Health management in hatchery and grow-out mariculture

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Introduction

Mariculture has been steadily growing over the last few decades. To satisfy the increasing demand of local and export markets for fish and to control overexploitation of marine fish species, many countries are expanding mariculture activities. Disease is one of the most limiting factors in mariculture. Intensification of mariculture favours pathogens, which increase disease outbreaks. Diseases are broadly classified into infectious and non-infectious diseases. Infectious diseases are further divided into four groups based on the nature of the pathogen: viral, bacterial, parasitic, or fungal. Non-infectious diseases are divided into neoplastic diseases, genetic and environmentally induced diseases, and nutritional deficiency diseases. Sustainable aquaculture production can only occur when fish are healthy and free from disease. Fish disease management is a combination of preventing the onset of disease and measures to reduce losses from disease when it occurs. Fish cultured in floating cages become particularly susceptible to disease when various environmental parameters such as temperature, salinity, dissolved oxygen and suspended particles fluctuate suddenly or widely, or following rough , although often unavoidable, handling operation. Once conditions suitable for pathological changes develop, progress to disease in the warm water environment is rapid. Early detection of behavioural changes and clinical signs in the cultured animals are critical for proper diagnosis of the disease.

Disease rarely results from simple contact between the fish and a potential pathogen. Environmental problems, such as poor water quality, or other stressors often contribute to the outbreak of disease.

Fish health management

Fish health management is a term used in aquaculture to describe management practices which are designed to prevent fish disease. Once fish get sick it can be difficult to salvage them. Successful fish health management begins with prevention of disease rather than treatment. Prevention of fish disease is accomplished through good water quality management, nutrition, and sanitation. Without this foundation it is impossible to prevent outbreaks of opportunistic diseases. The fish is constantly bathed in potential pathogens, including bacteria, fungi, and parasites. Even use of sterilization technology (i.e., ultraviolet sterilizers, ozonation) does not eliminate all potential pathogens from the environment. Suboptimal water quality, poor nutrition, or immune system suppression are generally associated with stressful conditions which allow these potential pathogens to cause disease.

Predisposing factors

- Fish stocks living under stressful conditions are less able to defend against a pathogen and hence will become sick more readily. Fish that are well cared for generally do not become sick even in the presence of a pathogen. The most common error in fish husbandry is overstocking. This leads to problems such as:
- Fish to fish aggression
- Increased fish and feed wastes
- Ease of disease spread,
- Increased concentration of pathogens
- Resultant poor water quality

High fish density, stress, and ease of transmission increase susceptibility of the fish population

to diseases and parasites. In marine aquaculture, diseases present in wild fish can infect cultured fish and spread rapidly.

Types of fish diseases

There are two broad categories of disease that affect fish, infectious and non-infectious diseases. Infectious diseases are caused by pathogenic organisms present in the environment or carried by other fish. In contrast, non-infectious diseases are caused by environmental problems, nutritional deficiencies, or genetic anomalies; they are not contagious and usually cannot be cured by medications.

- Infectious diseases. Infectious diseases are broadly categorized as parasitic, bacterial, viral, or fungal diseases.

Common Diseases of Cobia (Rachycentron canadum)

S.No	Bacterial disease	Causative organism
1	Pasteurellosis	Photobacterium damsella sub sp pisicida
2	Streptococcosis	S. iniae
3	Vibriosis	V.anguillarum
4	Bacterial enteritis	V.alginolyticus
5	Mycobacterium infection	MY. Sp 2nd Aeromonas hydrophila
6	Viral disease Lymphocystis	Irido virus

Common Diseases of Pompano (Trachinotus blochii)

S.No	Disease	Causative agent
1	White spot disease	Ciliate protozoan, Cryptocaryon irritans
2	Cardiac myxosporidiosis	Myxosporidian protozoan, Henneguya sp.
3	Monogenetic trematode infestation	Bicotylophora trachinoti- gills Benedenia sp- body
4	Fatty degeneration	Dietary deficiency- protein
5	Parasitic dermatitis (infestation)	Sea lice (Calligus elongatus)
6	Amyloodiniosis	Amyloodinium ocellatum

Common diseases of marine ornamental fishes

S.No	Disease	Causative agent
1	Red pest	Gram negative bacteria
2	Fin Rot	Gram negative bacteria
3	Fish tuberculosis	Mycobacterium sps
4	External Gas Bubble disease	Various causes Commonly caused by excess gas in the system, brought about by super-saturation of gas in high pressure water mains

- Vibriosis is a bacterial disease causing significant losses of fish in marine fish farms. Cobia, Grouper, seabream, snapper and pompano species are affected. Vibriosis results in severe skin, muscle, fin, eye and internal organ damage of fish. Diagnosis of the disease requires bacteriological culture of kidney, spleen, skin or eye lesions.
- Non-infectious diseases: Non-infectious diseases can be broadly categorized as environmental, nutritional, or genetic.
- A hygienic fish culture environment is essential to the health and productivity of farming operations. The reasons for this include:
- Disease risks are increased in poor and polluted environments.
- Quality of the product depends on clean and healthy environments.

The culture environment incorporates the following components

- Physical farm infrastructure e.g. fish cages, floats, nets, and utensils.
- Water quality e.g. dissolved oxygen and microbial contamination.
- Seabed sediments e.g. solid wastes measured as carbon, nitrogen and phosphorus.
- Introduced chemicals e.g. antibiotics, metals and pesticides.

Husbandry practices:

- Removal of biofouling from net/pens.
- Cleaning of utensils and equipment used to handle fish or feed fish.
- Water quality testing and correction of poor water quality includes the following:
- Measurement of dissolved oxygen and water
- Maintaining optimal water quality parameters e.g. salinity, temperature, pH, ammonia, nitrite and nitrates.
- Regular assessment of bacterial load of Vibrio spp. in water
- Aeration to maintain optimal dissolved oxygen level
- Cleaning of the farm seabed and fallowing or rotation of sites
- Minimising organic pollution from fish wastes and feed wastes

Preventive measures

- Preventing the introduction of pathogens by proper quarantine procedures
- Maintenance of good water quality
- Avoidance or reduction of environmental stressors
- Adequate nutrition
- Isolation of cultured animals from feral stocks
- Regular immunization against major pathogens

Steps to solve a disease problem

- Determining that a problem exists.
- Identifying the cause of the disease or source of the distress
- Successfully curing the fish and eliminating the disease or cause of distress.

1) Cobia fingerlings affected with Vibriosis

Fig. 1. Eye: Bilateral exopthalmus

Fig.2. Stomach: Haemorrhagic gastritis

II) Histopathology

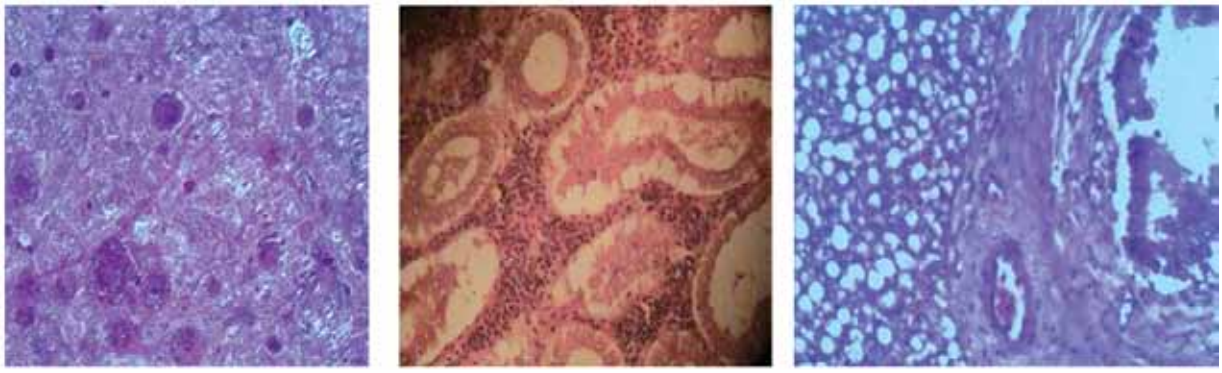

Fig.3 Spleen: Liquefactive necrosis H&E

Fig.4. Kidney : Acute tubular

Fig.5. Liver: Fatty degeneration-H&E

III) Genetic anomalies

Fig.6. Undeveloped upper maxilla

Fig. 7. Scoliosis- vertebral anomalies

IV) Pompano affected with sea lice (Calligus elongatus) infestation

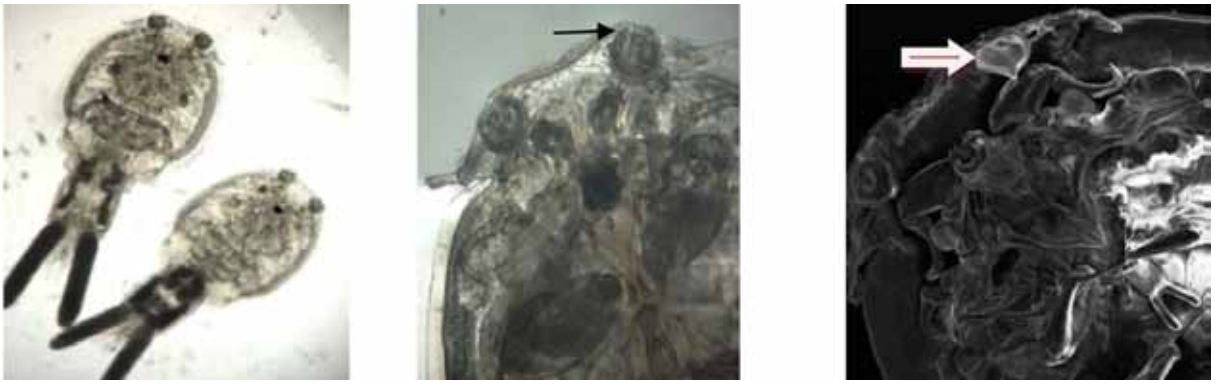

Fig.8. Caligus elongatus

Fig.9. SEM view presence of lunules (arrow)

V) Pompano parasitic infestation due to Amyloodinium. Ocellatum

Fig.10. A. ocellatum:Gill- Adult

Fig.11.Gill: Hypertrophy of the secondary lamellae H&E feeding stage-trophont

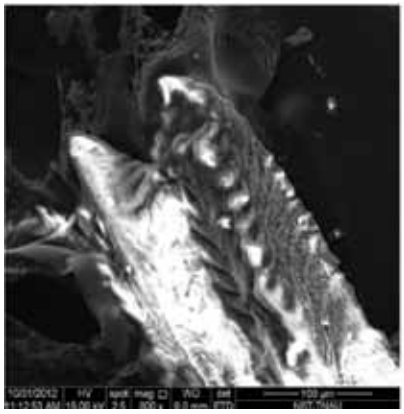

Fig.12. SEM Gill: Hypertrophy

Fig.13.Pompano: Tail tumour

Tail tumour :Papil lary cyst adenoma H&E