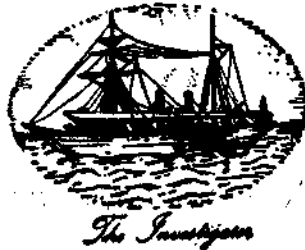


PROCEEDINGS OF THE SYMPOSIUM ON COASTAL AQUACULTURE

Held at Cochin
From January 12 to 18, 1980

PART 2 : MOLLUSCAN CULTURE

(Issued on 31st December 1983)



MARINE BIOLOGICAL ASSOCIATION OF INDIA

POST BOX NO. 1023, COCHIN 682011, INDIA

Price : Rs. 350.00

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SYMPOSIUM SERIES 6

Abbreviation

Proc. Symp. Coastal Aquaculture, Pt. 2

PRINTED IN INDIA BY K. G. JOHN AT THE DIOCESAN PRESS, MADRAS 7 AND PUBLISHED BY
E. G. SILAS ON BEHALF OF THE MARINE BIOLOGICAL ASSOCIATION OF INDIA, COCHIN-682 011.

OVER-VIEW OF FISH AND SHELLFISH DISEASES PROBLEM AND THEIR CONTROL IN MARICULTURE

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ABSTRACT

Culture practices of brackishwater prawns, marine fishes, mussels, oysters and crabs are rapidly expanding in India. Side by side with the advances in this line it is very essential to bestow our attention to identify and control any organism co-existing and affecting the cultured crop in any given area. In this context we may have to contend with, primarily, direct threats to productivity posed by the detrimental effects of cohabiting organisms belonging to three basic groups (a) competitors (b) predators and (c) disease and parasitism. Problems have manifested themselves in early mariculture ventures providing some insight into the potentially more serious problems that may be expected in large-scale mariculture. The premise that disease and parasite control must be assigned high priority in the development of mariculture is supported by examples all over the world. Documenting symptoms, isolating pathogens, and studying them, developing preventive and curative measures are all some of the works that are to be looked into in addition to studying disease vectors, environmental factors predisposing an organism to vulnerability or favour disease resistance.

Thus there is a strong case for starting fish pathology division to tackle the above problems in India where little work has been so far in progress on marine fish and shellfish diseases.

INTRODUCTION

FISH and shell fish culturists all over the world are quite often confronted with problems of large-scale mortality of the tended stock due to diseases, predation and ecological variations and environmental stress. Considerable work has been done in the developed countries in this realm. Sindermann (1970) has reviewed the work. Considering the voluminous literature on the incidence of fish diseases amongst fresh-water fishes and the marine fishes in the wild, very little information is available on the fishes and shellfishes subjected to marine farming. Southeast and East Asia is the world's main source of aquaculture products both for food and ornamental purposes. Even in this

region what little information on fish diseases that is available concerns the freshwater forms and there is a big gap to be filled up in respect of the diseases of marine fishes, molluscs and crustaceans. Due to the lack of knowledge and understanding of the effects of diseases in mariculture production in this region the industry goes on without the benefit of technical assistance in their control and treatment. This situation would continue for some more time. The effects of diseases are likely to be more and more felt due to intensification of aquaculture in many countries, including India where stress has been laid on mariculture. Raising of many species of marine teleosts, molluscs and crustaceans in brackishwater, estuarine and bay-water environment, has been satisfactorily developed and demonstrated. Even as we develop techniques of production it is imperative to evolve methods to solve problems

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posed by disease out-break, by documentation of different types of diseases, development of meliorative measures and eradication of causative agents by suitable techniques.

It may also be mentioned here that transport of live fish seed and ornamental fishes is also a source of spreading disease from one country to another. The world trade in ornamental fish is worth \$ 4000 million a year. Efforts have been made by agencies like International Office of Epizootics (OIE) American Fisheries Society, World Health Organisation (WHO) to prevent spread of communicable disease through fish transport from one geographical area to another. Quarantine measures and regulations have been suggested by FAO (Report of FAO, 1977; Zenny, 1978) to tackle problems arising out of these. In India, except for inland fish seed transport, marine systems have not so far resorted to transport of seeds from one part of the coast to another (In recent years there has been some movement for prawn seed). Adherence to the measures and principles laid down in quarantine regulations would prevent the possibility of disease transmission from one area where particular disease may be prevalent to another area where such a possibility did not exist before.

Intensive and efficient culture of any animal requires crowding or stocking them more densely than in nature. Under these conditions there are more vulnerable to disease and fall prey to many types of diseases, directly and indirectly, reaching catastrophic proportions at times (Bardach *et al.*, 1972; Huet, 1972). This imposes the demand for knowledge about the nature and control of diseases. In an unenclosed environment the problems of culturists are of still greater magnitude.

In order to highlight the extensive damage done by various disease causing agents, the present paper reviews some of the commonly known significant diseases amongst fishes and shellfishes. Broadly, the diseases may be

classified as infectious, parasitic, noncommunicable and of unknown etiology. Parasitic infestation may be endoparasitic or ectoparasitic. Infectious diseases are caused by viruses, bacteria and fungi and less frequently by algae; other causes of debilitation and mortality include deficiencies, wounds, poisons, environmental factors such as temperature, salinity and predation.

In all the above cases the symptoms are documented, causative agents identified, pathogens isolated and studied and curative and preventive measures are sought through experimentation. By developing control in these areas it may be possible to keep down the incidence of disease and parasitism in cultures to levels at or below the rate of occurrence in the natural environment, or more to the point, to levels acceptable to a viable mariculture. The diagnosis and treatment of fish diseases have reached the highest levels of sophistication in the culture of temperate freshwater fishes. Bauer *et al.* (1973) have given an exhaustive list of literature on diseases of pond fishes. Si dermann (1966) has given a very valuable, up to date review of the diseases amongst marine fishes.

Microbial diseases

Microbial diseases are those of viral, bacterial, fungal and protozoal etiology. All these tend to destroy the tissues of the host and multiply within the host. The pathology depends on virulence of dose, resistance of individuals, infective dose, environmental variables and host nutrition. The effect may be from chronic to acute affliction leading to mortality in several cases.

Viruses

Viruses and known etiological agents for neoplastic, hyperplastic and hypertrophic diseases. Lymphocystis diseases and certain Papillomas are known to be of viral origin. Chronic fibro-epithelial tumor or 'Cauliflower disease',

white, raised patches on skin called 'Fish-pox' are often caused by viral infection. *Baculovirus* are known to infect the hepatopancreas of blue crabs apparently not causing overt diseases in the host. RLV (Reolike Virus) causes fatal mortality due to neurological damage. HLC (Herpeslike Virus) also causes fatalities after 40 days due to massive destruction of hemocytes. CBV (Picornalike virus) bring about death because of its predilection for epidermal tissues. The above diseases are mostly in crabs in culture system than in the wild state (Johnson, 1978). Farley (1978) reports Virus and Virus like lesions of groups pedoirdae, papoviridae, herpetoviridae, iridoviridae, togaviridae, retroviridae and reoviridae in 13 species of molluscs.

Bacterial diseases

Reports of bacterial epizooties in marine fishes are infrequent according to Sinderman (1966) due to lack of observation or inadequate examination rather than lack of occurrence. 'Red disease' due to *Vibrio anguillarum* and *Pseudomonas (Aeromonas) punctata* leads to mortality. Bacterial dermatitis accompanied by ulcerations and fin-rot due to *Pseudomonas* sp. is also common. *Mycobacterium* spp. are known to cause spontaneous tuberculosis. *Mycobacterium* and *Chondrococcus columnaris* are known to infect gills, fins and skin. Many of these bacteria normally present in sea water or on the surface of the fish invade and cause pathological effects if fish are injured or subjected to severe environmental stress.

Gaffkemia is a fatal disease causing heavy mortality among lobsters. The causative agent is *Aeromonas viridans* var *homari* (Stewart, 1978). An anaerobic bacteria *Eubacterium tarantellus* if present in the C.N.S. of fishes might be a possible disease agent (Udey, 1978).

Fungi

It is stated by Sindermann (1966) that with the single exception of *Ichthyophonus hofei* fungal diseases of marine fishes are almost

unknown. The infection often results in necrosis and mortality of the invaded stock.

Protozoa

Sporozoa and cindospora are among the best known serious pathogens of marine fishes. In addition hemo-flagellates and ciliates are also known to affect the fish stock. Coccidia, myxosporidea and microsporidea bring out severe effects on hosts causing nerve and muscle degeneration and Castration. *Eimeria* spp. and haemogregarines have been studied in detail among Coccidia. Diseases caused by myxosporidea are common among marine fishes (also freshwater fishes). The afflicted fishes show wormy or mushy or jellied condition or milkiness. Those afflicted in the gall bladders show enlargement and discolouration of the organ. Myxosporidea infection in somatic muscles cause extensive damage. *Hannenuya salminicola* invading the flesh causes white cysts formation called 'tapioca disease'. Gill invading myxosporidea are not of any serious consequences to marine fishes. *Myxosolus* sp. and *Myxosoma* spp. affliction do not appear to result in mortality although they cause hypertrophy and 'whirling disease' respectively. Several serious diseases result from microsporidian invasion. *Glugea* spp. are known to produce visceral involvement preventing reproductive activities. Some destroy digestive tract and impair metabolic functions. Occasionally the host dies where infection is serious. Another microsporidea *Nosema* sp. produce tumor like cysts in the C.N.S. in the host. *Pleistiphora* sp. produces intramuscular cysts reducing the marketability the fish because of the bulges noticed on the host. Among microsporidians *Ameson* sp., *Chapmanium* sp., *Agmasoma* sp. and *Indosporus* sp. have all been reported as parasitic on prawns and crabs (Sprague, 1978). Sprague (1978) also reports *Paramoeba pernicioso* causing serious mortality among molluscs.

Parasitic diseases

Diseases considered under this are those caused by helminths (trematodes, cestodes, nematodes, acanthocephalans) and parasitic copepods. These are non-multiplicative in the host after invasion. Helminths, as larval infection, are of great significance. Adults occur in digestive tracts but the larvae are found in the viscera. Growth retardation, tissue disruption, metabolic disturbances and mortality of hosts in serious infestations are characteristic of the helminth invasion of the host.

Digenetic trematodes occur in digestive tracts and the migrating cercariae and metacercariae of these encyst beneath the body of fish hosts as pigmented cysts-as 'black spots'. At times larval fishes infested by these die. Adult digenetic trematodes, do not cause serious disease. Monogenetic trematodes parasitic on gills and body surfaces many become serious depending on optimum conditions. *Benedenia* and *Axine* infestation are also known leading to ematiation and making the fish vulnerable to bacterial dermatitis. *Echinostephanus* sp. and *Tormopsolus* infest intestine. In natural conditions they are less of a serious threat. *Gyrodactylus* spp. cause mortality. Adult cestodes are also not uncommon and are harmful to digestive tract but the larval stages are the most dangerous. Nematode larvae infesting the flesh and viscera reduce the commercial value of the hosts. Effects of *Parrocaecum* spp. and *Contraecum* sp. *Cucullanelus* sp. and *Eustoma* sp. have been reported. The 'spiny-headed' acanthocephalans are represented as adults and larvae in marine fishes. *Echinorhynchus* sp. *Telosentis* sp. *Pamphorhynchus* sp. are reported from them.

Parasitic copepods

Several species of ectoparasitic copepods *Caligus* and *Lernaeopoda* on gills, buccal cavity

and fins are known. Members of *Lernaeoceriidae*, *Penellidae* and *Sphyrriidae* families are known to be particularly serious to the host. *Lernaescera* spp. are parasitic on gill region and heart which causes loss in weight, anaemia of fish which kills the host. *Sphyrion* sp. causes ulceration and death. *Lernaecenicus* sp. (Pavillon) is another parasite of less consequence. *Panella* sp. causes cysts in the tissues.

Protozoan, helminth and copepod parasitisms of fishes although not often direct cause of death, can act to weaken the host and help the entry of secondary invaders leading to mortality on large-scale. The fishes so infested often fall prey to predators because of their inability to escape. Environmental variations also kill them on account of lack of resistance.

Dinoflagellates also cause diseases. The gill parasite *Amylodinium* sp. causes velvet disease leading to mortality. *Haematodinium* spp. is parasitic on crabs (Sawyer and Maclean, 1978).

A ciliate parasite *Cryptocaryon* sp. causes 'white spot disease' on gills and epidermis. Several ciliates *Anbiphyra*, *Epistylis*, *Chilonodella* and *Trichodina* can cause mortality under certain conditions (Rogers, 1978). The flagellate *Costia* and *Bodomonas* can cause mortality, although easily controllable in early stages.

Two algae *Leucosphaera* and *Thallambella* are responsible for epizootics and mortalities in many fishes.

Diseases among molluscs, lobsters and prawns

Examples of epizootic disease and parasitism have occurred in cultivated molluscs. An important factor in the diseases of cultured shellfish population is the introduction and spread of pathogens through the transfer of seed stock to growing areas especially in oysters. In Europe the effects and spread of *Mytilicola intestinalis*, a parasite invading

cultured mussel stocks, has been documented from very early years. In Japan, evidence of disease in oysters, both bottom grown and suspended stocks, has been documented. On the west coast of U.S., three diseases are known in oysters—a parasitic copepod (*Mytilicola orientalis*), bacterial and an amoeboid organism. On the east coast of U.S. four diseases predominate—*Dermocystidium marinum*, a fungal attack, Malpeque Bay disease in Canada, Sea-side disease (haplosporidian disease by *Minchinia costalis*). Mass mortality of bivalve larvae by gram negative bacilli *Vibrio* and *Aeromonas* sp. has been recorded. Other epizootics is caused by *Strotopodium zoophorum* a fungus killing the larvae and juveniles.

In the case of lobsters pathogens like *Pythium* affect the stock. Mycosis is caused by *Aphanomyces* sp. in European freshwater cray fish (Brown spot disease). Amongst prawns cultured in brackishwater masses chondrococcus infection (*Flexibactor* sp.), Haemorrhagic septicaemia by *Pseudomonas*, vibriosis by *Vibrio anguillarum*, enteric bacterial infection by *Escheriella coli* and soft shell infection (unknown reason) have been reported in India (Mahadevan *et al.*, 1978).

REMARKS

The review does not detail the disease noticed amongst freshwater fishes cultured in India. Because of the enormity of marine ecosystem, disease problems are also varied and many. Continuity of observations on diseases to document the diseases is essential. Delmendo (1978) gives a list of diseases documented in the Indo-Pacific region. Amlacher (1970) quoted by Delmendo (1978) has given a detailed account of treatment procedures of certain known diseases. A comparative statement of disease agents and prevalence in Southeast Asian countries is found in a recent publication of the International Development Research Centre, Canada, summarising the outcome of a workshop on fish disease held in Indonesia in 1978. Developing countries should strengthen their capabilities in controlling fish diseases. Diagnosis and treatment of fish requires specialized training and equipment. Manpower to provide this should also be developed.

Our present knowledge of marine fish diseases is rudimentary and needs to be strengthened in the years ahead. Already a start has been made by the Central Marine Fisheries Research Institute in 1976 to investigate the diseases common among the prawns, mussels oysters and eels.

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