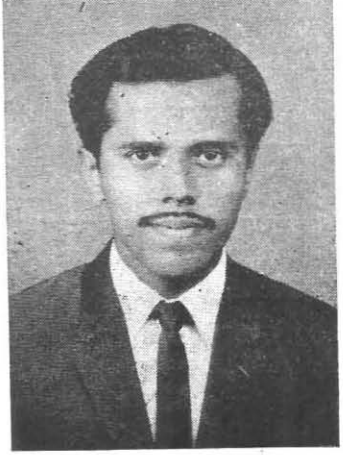
Diseases of Marine Fishes and Their Role in the Food-Chain



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INTRODUCTION

In their natural environments, fishes suffer from a variety of diseases. In India, very little consideration and less attention have been devoted on research to the possibility that man and fish may share disease-producing organisms in common or serve as vectors of each other's diseases. The need for much more research on fish as possible vectors of human infectious diseases is stressed here because of the increasing use of fish as human food, increasing contamination of the aquatic environment with human wastes and increasing direct contact between man and the aquatic environment.

AETIOLOGICAL FACTORS

The marine fish diseases constitute one of the important factors in regulating the populations in natural environment and in fish culture. While considering the aetiological factors responsible for marine fish diseases, the micro-organisms such as virus, bacteria, fungi and certain protozoa play an important role in the microbial diseases. Besides these, other parasites like leeches, tissue invading copepods, ectoparasitic copepods and isopods and helminth parasites are also playing an important part in causing fish diseases. Genetic and environmental factors are also responsible to a certain extent (Fig. 1).

Viruses

Viruses are best known in marine fishes as suspected or known aetiological agents of several neoplastic and hyperplastic diseases. Lymphocystis is probably the best known viral-disease of marine and fresh water fishes. Tumours or cancers in fishes have been well documented in the literature and some are reported to have relationship with human diseases, but very little is known from the Indian Waters.

Bacteria

Enough evidence is already available to prove that bacteria can be significant (primary or secondary invaders) causes of mortality in natural as well as captive population. Many of the bacteria normally present in the sea water or on

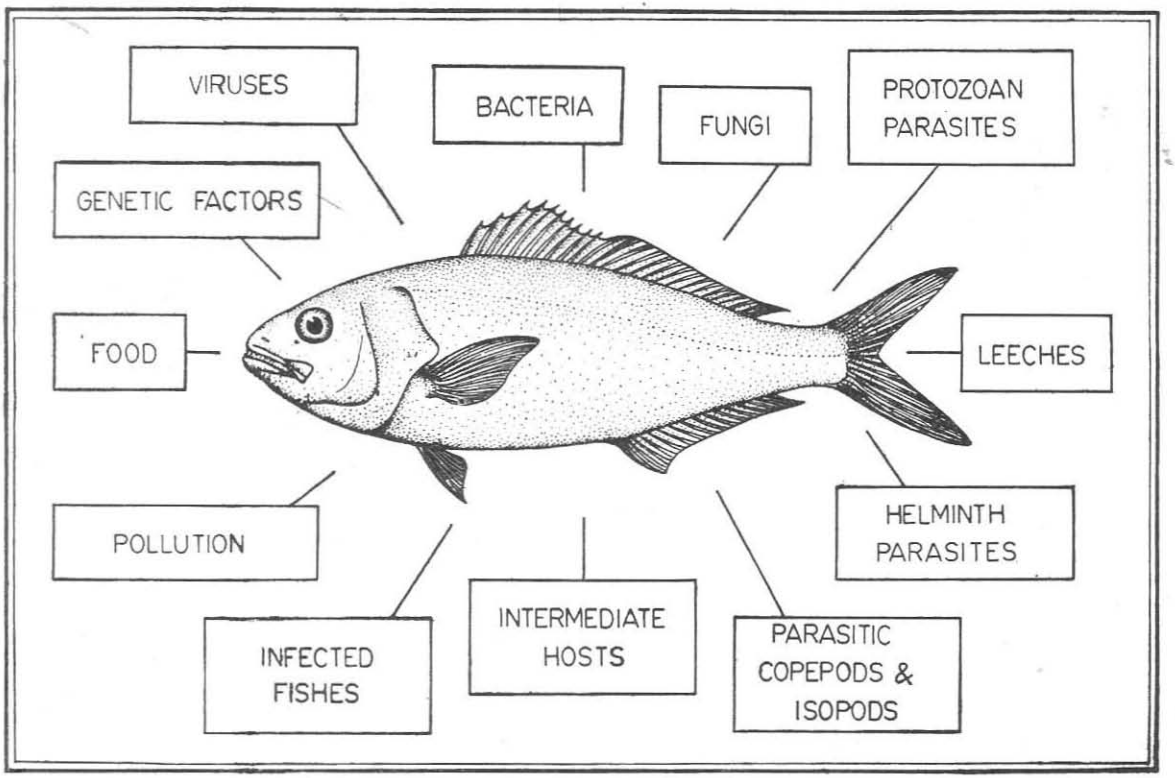

Fig. 1. *Aetiological factors of marine fish diseases*

the surface of fish can invade and cause pathological effects if fish are injured or subjected to other severe environmental stresses. Bacterial dermatitis, sometimes accompanied by ulcerations and fin-rot have very often been reported and few cases of tuberculous lesions caused by acid-fast bacilli have also been reported in halibut, cod and plaice. Tuberculosis in fish is characterised by pronounced pathological changes affecting the liver. kidney, spleen and reproductive organs. The other diseases are "Eye disease", characterised by initial destruction of the eyes and "Boil disease" characterised by muscle abscesses. Myxobacterial disease is caused by the bacterial infection on skin, gills and fins.

Fungi

Fungus infection generally occurs in injured parts and is a secondary result of the injury. When the infection is severe on gills, mortality of fishes takes place due to obstruction of respiratory activity One of the most serious fungus pathogens of fishes (marine and fresh water) is *Ichthyophonus* affecting the heart, viscera and lateral somatic muscles. Chronic infections are characterised by cell infiltrations, progressive connective tissue encapsulation of spores and accumulation of melanophores.

Protozoa

Sporozoa are among the best known and most serious pathogens of marine fishes, although representatives of other

protozoan groups such as haemoflagellates and ciliates have been studied. The flesh of clupeoid fishes is often parasitized by sporozoans. Myxosporidia and microsporidia cause severe damage to the nerves and muscle tissues of the different organs of fish. Widely distributed are *Ceratomyxa*, *Myxidium*, *Sphaeromyxa*, *Leptotheca* and *Chloromyxum*. Among coccidia, *Eimeria* invades many fishes (clupeoids, carangids and elasmobranchs) affecting the liver. Among the haemoflagellates, *Trypanosoma* occurs in marine fishes in many parts of the world and about 45 species have been described so far. They are transmitted by leeches in the digestive tract, where they undergo massive reproduction. Whether they are harmful to fishes as well as man is still not free from doubt.

Helminth Parasites

Helminth parasites are very common in marine fishes, out of which some are pathogenic for man. They include trematodes, cestodes and nematodes. They require two or three hosts to complete their life cycle.

Trematodes

Marine teleosts serve as intermediate hosts for many trematodes, particularly those whose difinitive hosts are shore-inhabiting or fish eating birds or mammals. An excellant example is the trematode *Cryptocotyle lingua* (Creplin) whose life cycle (in the Western North Atlantic) involves the periwinkle *Littorina littorea*, the Atlantic herring *Clupea harengus* and the sea-gull *Larus argentatus* Pontoppidan. The cercariae of *Cryptocotyle* invade and encyst in the fins and integument of herring and a number of other inshore clupeoid fishes causing the formation of conspicuous pigmented cysts or "black spots" (Sindermann, 1966).

Another digenetic trematode is *Nanophyetus salmincola* which requires three hosts for completion of its life cycle. The first intermediate host is the pleurocerid snail *Oxytrema silicula* found in North Western California. The parasite develops in the snail. The next intermediate hosts are salmonid and some non-salmonid fishes and the Pacific giant salamander in which the parasitic cercariae encyst as metacercariae. The definitive hosts are birds and mammals that acquire the trematodes by eating the infected fish. Another larval fluke *Stephanostomum baccatum* (Nicoll) occurs in a number of marine fishes, particularly flat fishes (Wolfgang, 1954). The life cycle involves gastropods of the family Buccinidae, the winter flounder and other pleuronectids and the sea-raven *Hemitripterus americanus* (Gmelin).

Cestodes

Larval tape worms have been reported frequently in the viscera and flesh of marine and estuarine fishes. The larval stages are of greatest concern to man. The difinitive hosts of many of these parasites are elasmobranchs (Williams, 1958), bill fishes or fish eating birds and mammals.

Nematodes

Nematodes or round worms have long been known to parasitize marine fishes and are found throughout the seas of the world. Most of our informations concerning the adverse effects of nematodes on marine fishes are related to members of the family Anisakidae. They are mostly embedded in the intestinal wall, liver and ovary apparently

causing erosion of tissues. The larval stages cause more damage to the hosts than the adults.

Other parasites

Besides these, leeches, tissue invading copepods, ectoparasitic copepods and isopods are also common in marine fishes. As parasites, these organisms are important to fish in two ways. They can either act as intermediate hosts for other parasites harmful to fishes or they can parasitize the fishes directly. Marine fishes are parasitized by a variety of copepods of which several members of the families Lernaeopodidae, Pennellidae, Caligidae and Sphyriidae are particularly injurious to the hosts. Usually the adult females become highly modified and penetrate the flesh, often causing extensive ulceration. They affect gills, muscles, heart and mouth of fishes like elasmobranchs, pomfrets, sea-pikes, barracudas, tuna, kalava and certain clupeoids.

Food

Fishes with highly specific diet tend to have a limited number of parasites and fishes feeding on a more generalised diet (bottom feeders and plankton feeders) expose proportionately greater diversity of parasites. Epipelagic fishes and mid water fishes feed upon a wide variety of planktonic invertebrates, many of which are known to serve as intermediate hosts and many carnivorous fishes predating on the infected fishes are also ultimately affected by the disease.

Genetic and environmental factors

It is presumed that genetic overlap or predisposition may also affect the populations of certain species as a whole. Although there is insufficient evidence to be certain whether certain neoplastic diseases are the result of pollution of the surrounding environment, it is likely that human activities such as dumping of toxic wastes of chemical and other factories and sewages of cities into the sea, and biological factors like excessive growth of phytoplankton and sea weeds may increase the susceptibility of fish population to the aetiological agents as well as enhance the environment to the benefit of the aetiological agents like viruses, bacteria and parasites. Trauma may also be another important factor. Once the epidermis is damaged by stones, rocks or predators, oncogenic viruses and parasites present in the surrounding environment have direct access to the fish.

ROLE OF PARASITES AND DISEASED FISHES IN THE MARINE FOOD-CHAIN

Parasites play an important role in marine fish diseases. In the marine environment, epipelagic fishes like tuna, bill fishes, mackerels, sardines and other clupeoid fishes harbour adult parasites whose eggs and young are released into the water where they then invade or are ingested by zooplankton and certain fishes. These infected zooplankton may be eaten by epipelagic fishes and other carnivores and they are in turn preyed upon by other fishes, marine mammals, oceanic birds and man (Fig. 2). Mesopelagic fishes (e.g. myctophids, gonostomatids etc.) during their upward vertical migration (in the night) also feed on the infected zooplankton and they are in turn preyed upon by certain epipelagic and mesopelagic fishes. During their downward migration, they may be eaten by other mesopelagic and bathypelagic

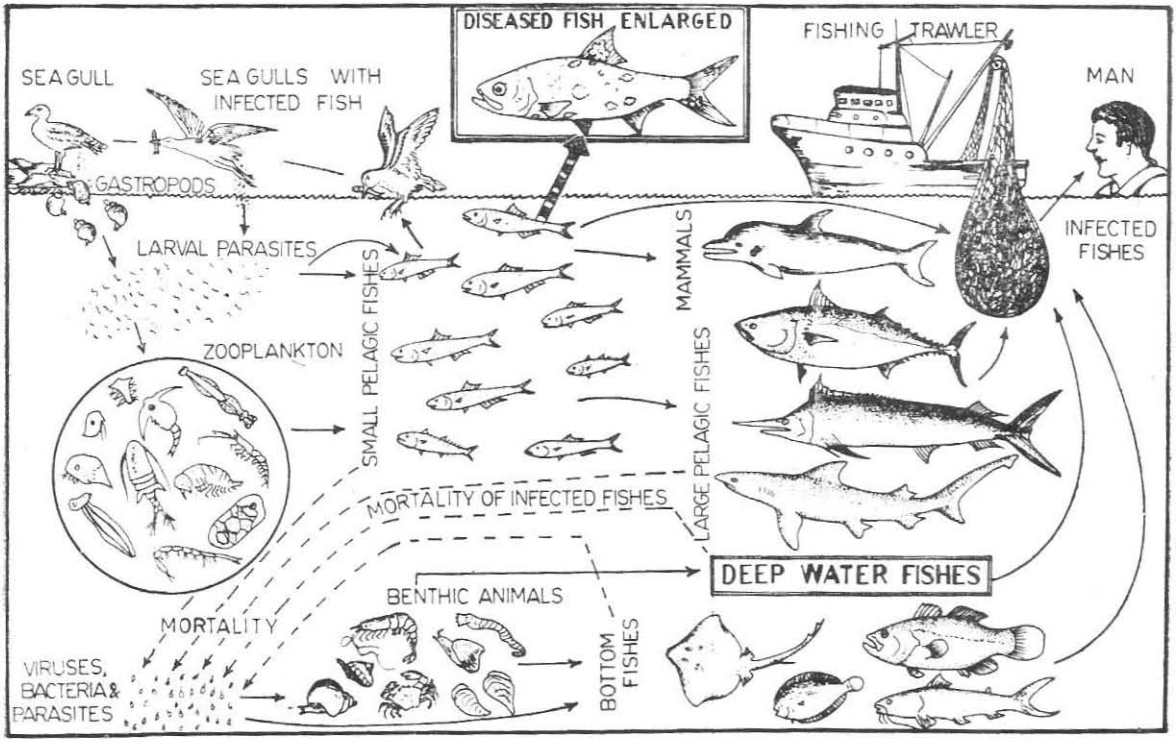

Fig. 2. *The role of parasites and diseased fishes in the Food-chain*

fishes. The infected bathypelagic fishes may serve to transport these larval parasites to bottom dwelling fishes. These larval parasites utilise the aquatic invertebrates like gastropods and crustaceans and they are preyed upon by the bottom fishes, Death and decay of the infected organisms at all stages may also enhance the environment to the benefit of aetiological agents. It is also likely that certain diseases and parasites common to one geographic area might be spread to the other habitats by the hosts of cosmopolitan distribution.

RELATIONSHIP OF FISH DISEASES TO HUMAN DISEASES

An inescapable aspect of any discussion of fish diseases is their possible relationship to human disease. Among the human illnesses associated with infectious agents of marine fish origin are severe inflamations of superficial wound among fish handlers due to the bacteria or viral attack. A human pathogen *Erysipelothrix rhusiopathiae* commonly found in marine and fresh water fish causes cutaneous infection in wounds or abrasions of humans touching the infected fish. This disease is known as "Fish Rose", often considered as the occupational disease of fish handlers.

Although human bacterial pathogens do not cause disease in fish, some human pathogens survive and multiply in the gut, mucous and tissues of fish and thus render the fish a potential vector

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of human diseases. Fishes serve as vectors of several infectious diseases. Among the bacterial pathogens, *Mycobacterium fortuitum* has been isolated from fish and human lesions (Nigrelli & Vogel, 1963). Larval trematodes infective to man are reported to occur in the flesh of mullets, *Mugil cephalus* and *M. japonicus* and larval tape worms of *Diplogonoporus grandis* (Blanchard) infective to man have been reported in marine fishes of Japan. Fishes are supposed to be the important vectors of cholara and Typhoid fever in many parts of the world. Russian workers claim that Cholara vibrios grow actively in the gastro-intestinal tract of fish and are distributed by fish over great distances.

As long as raw marine products from inshore waters are eaten by humans, the possibility of disease transmission must be recognised. Recent studies in Japan have implicated the ingestion of raw marine fishes in summer outbreaks of human gastro-intestinal diseases. Eosinophilia has long been associated with many helminth infestations and ingestion of raw fish, dried or improperly cooked fish has recently become a suspected route of transmission in outbreaks of human eosinophilic diseases. It is suggested that the practice of proper cooking of seafood may be the chief factor in limiting the fish-borne human diseases.

ECONOMIC EFFECTS

It is generally accepted that apart from the physical factors such as oxygen, temperature, salinity and food supply, effects of diseases may also be a significant factor for controlling the fish population. Mortality by diseases is considerable although most likely death is associated with such factors as inability to feed, to escape from predators, bacterial infection and an increased susceptibility to environmental changes.

Heavy infestation of parasites leads to inhibition of growth, reduction of the host's reproductive potential and its commercial value. Liver fat content and oil yield may also be seriously reduced by parasitization. Thus the fish disease may have direct effects such as reduction of fish population, loss in weight of individuals, reduction in the quality of fish as food and rejection by consumers and subsequent loss of interest in fishery products and indirect effects such as survival of other species in the marine food-chain.

DISEASE CONTROL

It would be very helpful if a system of fish inspection and parasitic identification could be set up in each state and country to discover dangerous parasites and other causes for the fish diseases. Exports and imports of live and frozen fishes should be examined for pathogens. Some states in the U.S.A. are developing diagnostic services and the Bureau of Sports Fisheries and Wild-life provides identification assistance through a regionalized system of Fishery Biologists. The Export Inspection Agencies in India are also playing

a vital role in this aspect. The fish disease committee of the American Fisheries Society is also working on this problem. However more services are needed. We should urge increased inspection of exports and imports and the confiscation of fish carrying serious parasites.

CONCLUSION

It seems logical that whatever unexplained catastrophic declines in the fishery have occured, disease must be strongly suspected. One of the greatest needs is for continuity of observations so that changes in prevalence of diseases can be documented and thereby a good deal of information could be acquired on the diseases and their role in the marine economy. As with other marine problems, it is likely that greatest advances will be made with experimental studies in the circumscribed bodies of water such as aquaria, salt ponds and artificially restricted estuaries and other arms of the Sea. The role of viruses and bacteria in marine fish population is another aspect of research deserving greater attention.

REFERENCES

Nigrelli, R. F., and H. Vogel. 1963. *Zoologica. 48:* 131-144.

Sindermann, C. J. 1966. *Adv. mar. Biol. 4:* 1-89.

Williams, H. H. 1958. *Ann. Mag. nat. Hist.*, Ser. *13 (1):* 113-136.

Wolfgang, R. W. 1954. *J. Fish. Res. Bd. Can. 11:* 963-987.

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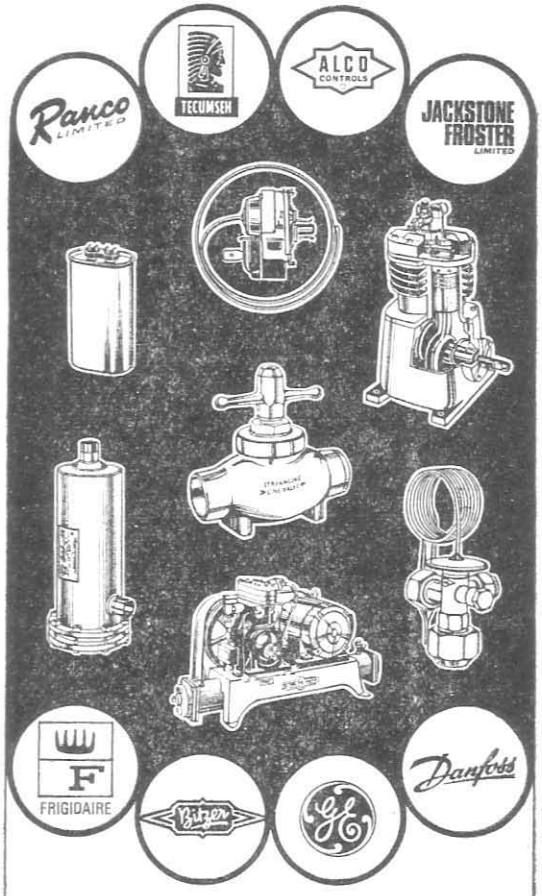

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