

PARASITE INFESTATION OF FISHES AND SEA PRODUCTS

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Summary

This chapter examines interrelations between parasites and their freshwater and marine fish hosts. In natural water bodies, parasites occur mainly in relatively small quantities and exert impacts that do not normally lead to fish deaths. This chapter presents the main forms of pathogenic parasitic influence upon host organisms. As a rule, outbreaks of parasites of hydrobionts are connected with anthropogenic activity causing disturbance to "host-parasite" equilibrium. Distinction is made between the epizootically and optionally significant species of parasites found in aquaculture. A number of measures have been developed for elimination of parasites after outbreaks in fish farms. Particular attention is paid to helminth infestations of humans and other warm-blooded animals as a result of eating infected fish and shellfish.

1. Introduction

Parasitism is a widespread phenomenon among freshwater and marine animals. To date, not more than 25% of the species of parasites actually existing have been described. At present, 15 000 species of parasites have been recorded from marine ecosystems. About 200 species of food fish have been recorded in the Atlantic Ocean, the Mediterranean Sea and the Azov-Black Sea basin, and there are about 100 species of Far Eastern salmonid fishes. The latest summary of parasites of freshwater fishes of the former USSR includes about 2000 species. In consumable bivalve mollusks there are about 50 species of parasites, and more than 30 species in the Crustaceans.

Evolution and development of the present-day parasitofauna of hydrobionts proceeded under influence of the geoclimatic phases and multiple marine transgressions and regressions beginning with the preboreal to the subatlantic period. Evolution of parasite-host systems began more than 10 000 years ago and, proceeding concurrently on the principle of inter-influence, it is directed at conservation of both host and parasite.

Regulation of parasite numbers in a water body is performed through multiple

individual host-parasite relations which are independent of one other. In each water body, this results in formation of individual populations of parasites in each individual populations of hydrobionts, i.e. fishes, mollusks, crabs.

2. Parasitology of marine and fresh waters

The parasite fauna of marine fishes and invertebrates is the most diverse and is characterized by high biomass. This is to a large extent connected with the huge numbers of helminths and parasitic copepods. The infestation rate of fishes in lakes and ponds is higher than in rivers, though the number of parasite species in rivers is generally larger. Accumulation of parasites and their invasion stages (spores, eggs) proceeds faster in ponds than in rivers due to the low flow of ponds and the large number of potential hosts for the parasites.

Trophic status and feeding habits of fish also exert direct and indirect influences on the parasite fauna. The presence of a planktonic and benthic community provides intermediate hosts for helminths, and promotes fish infestation by these parasites. In this connection, the parasite fauna of predatory and other fishes, planktivores and benthophages are significantly different.

Information concerning parasites has been extensively used in biological investigations of Far-Eastern salmonids, including their migrations, and identification of local stocks. Such understanding is of great importance for commercial fisheries. Localization of parasites is very various (diverse). They have adaptations for life in all organs and tissues of hydrobionts, including the blood, nerve and bony tissues. Their impact on the organism is varied and depends on a number of conditions: the species of host, its morphological characteristics, virulence, localization, and the immuno-physiological state of the host. The influence can be local, general or mixed.

Local impact involves damage to individual organs and tissues, such as for example, branchial apparatus, skin, musculature, skeleton, and internal and sense organs. Attachment of helminths or entomostracans on the gills can cause their destruction. The fish may die as a result of disturbance of the gill breathing function. Injuries to internal organs can be different. The larval forms of some trematodes, cestodes and threadworms can cause severe damage.

The general influence of parasites on their hosts can be summarized as follows.

1. Retardation of the growth of infected fish; reduction of weight and fat content resulting from the fact that the parasite is removing some of the nutrients from the host. The growth rate of carp (*Cyprinus carpio*) and total fish productivity of the fish-growing ponds where botryocephalosis was recorded may be reduced down to 20%. The fat content in bream (*Abramis*), roach (*Rutilus rutilus*), and silver bream (*Blicea bjoerkna*) infested by the parasite *Ligula sp.*, decreases host size by 40%.
2. Disturbance of metabolism and hematological changes take place in fish mainly as a result of the toxic effects of their parasites. Infection by blood parasites, i.e. cryptobias and trypanosomes, results in destruction of the cell elements of blood and in anemia. Significant mechanical damage to the gastro-intestinal tract is observed

in salmonids parasitized by proboscis nematodes (*Acanthocephala*), and metacercarias of trematodes, being localized in the fish eyes, cause the parasitary cataract and blindness of young sturgeon (*Acipenseridae*), silver carp (*Hypophthalmichthys molitrix*) and trout (*Salmo spp.*). Toxic impacts on fish are also exerted by ingress of metabolic products of the parasite or secretions from its toxic glands, these can affect the immune system and general homeostasis of the host.

3. Influence on reproduction and consequently on size of fish populations as a result of injuries to sex glands and disturbances of reproductive function. Parasitic infestation by *Amphilina foliacea* and *Polypodium hydriforme* in sturgeons depress the reproductive ability and can cause atrophy of the sex glands. Obviously, such influences on the reproductive system decrease host population size. Also, cases of mass death of fishes are known in natural water bodies when the fishes are affected by different parasites, for example Aral barbell sturgeon (*Acipenser nudiventris*) by *Nichia*, tench (*Tinca tinca*) by *Eergasilus*, perch (*Perca*) by *Ttrienophorus*, etc. However, even when the numbers are high, the parasites rarely cause death of commercial sea fishes, but they can alter biochemical and organoleptic characteristics and this can adversely affect their marketable characteristics, i.e. appearance, texture and taste of meat and other tissues. For example, when many food fishes from the Atlantic or the Pacific are infected with *Pennela elegans*, a thick connecting capsule like a cartilage is formed within the musculature around the head end of the parasite, and presence of nematode larvae in the liver of cod (*Gadus morrhua*) often cause rejection of these valuable products. These changes are readily revealed by microscopic, histological, biochemical, or organoleptic methods, but quantification of such changes, i.e. the level of parasitic infection, remains a very important practical problem.

In natural fresh water bodies the parasites occur in relatively small quantities and exert comparatively minor influence on the fish, seldom causing death. Sudden outbreaks are usually related to anthropogenic activity resulting in disturbance of the parasite-host balance. This is usually connected with reduction of the host resistance. Using experience from around the world it is now possible to distinguish among the parasites those species which are epizootically, epidemiologically, and optionally (conditionally pathogenic) significant .

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Biographical Sketch

Nina A. Golovina has a DSc in Biology. She is the author of three patents, two monographs, a textbook "Ichthyopathology", and about 140 scientific papers. Her scientific interests include problems of fish protection, general ichthyopathology, physiology, cell factors of immunity, etc. She is an active participant in international scientific conferences and symposia.