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THE SIGNIFICANCE OF ABIOTIC AND BIOTIC FACTORS
OF THE ENVIRONMENT DURING THE
ACCLIMATIZATION OF WATER ORGANISMS

by A. F. Karpevich

- USSR -

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THE SIGNIFICANCE OF ABIOTIC AND BIOTIC FACTORS
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- USSR -

Following is the translation of an article by A. F. Karpevich in the Russian-language publication K Voprosy Ekologii (Toward the Problem of Ecology), No 4, Moscow, 1963, pages 32-34.

The urgent problem of increasing the productivity of the reservoirs of the USSR through augmenting their reserves of valuable fish and other commercial resources can be resolved through a complex of measures, among which the significant ones are:

- a) extending the ranging areas of valuable species of fish, invertebrates, algae, etc, through their acclimatization or their transfer into new reservoirs;
- b) a directed formation of reservoir flora and fauna through the introduction at each stage of the nutritional process of new species capable of utilizing the reservoir's nutritive resources to the maximum;
- c) suppression of fish, invertebrates and water plants of small value through increasing the quantity of their consumers ("predatory density") and competitors.

Re-population of species and their acclimatization in new areas and reservoirs new for them is considered an ecological-physiological problem, based on the study of species demands on the medium and its adaptations. This problem's resolution has a practical objective.

Species acclimatization is a united process of mastering the new medium and adapting to it, but this process has what might be called two aspects and two stages: a) adaptation and survival of species individuals through all their developmental stages of their assimilation of new elements from the physico-chemical medium and biochemically appropriate food and b) adaptation, "shaping" of the species to new factors in the medium, its establishment in the new medium, quantitative development etc -- the creation of a niche in new conditions.

In the transfer of a species into an area or reservoir

not customary for the specie, the united individuals of the specie that first encounter and interact with the new medium. It is their survival that determines the future establishment of the form in the new area. Individual survival is only possible, however, if individuals can find those medium elements in the new conditions which will ensure a normal course of metabolic processes.

The elements necessary for nitrous, fatty, salt, and gaseous metabolism are oxygen, salt, water, biogenic elements in inorganic and organic substances (food) and others which we shall call assimilative, basic elements for the organism's interaction with the medium.

The presence or absence of any of these elements is, then, the determining factor in the possibility of survival.

Supportive, non-assimilable elements -- factors of the medium -- include all those not participating in the metabolic process but still stimulating or limiting its course, thus stimulating or limiting population growth, reproduction and growth of individuals, as well as everything that influences population dispersion within the areas limits and the quantitative development of the specie -- current, substrate, enemies, parasites, the presence of appropriate nutrition, etc. These medium elements might better be termed factors.

The species' life conditions -- its niche -- are defined, in our opinion, by the relation of the individuals to the assimilated medium elements and by the interaction of the population with non-assimilable, or supportive, factors of the abiotic and biotic medium. These last, particularly the biotic relations, are responsible for specie proliferation.

The survival of re-settled individuals is ensured when there exist favorable conditions within the physico-chemical medium and food capable of being assimilated in terms of its chemical composition. However, individual survival in a new medium, or even the individual's active selection of life conditions, does not determine the economic effect of acclimatization. This effect depends on the population's interactions with the medium's supportive factors and primarily on its biotic relations with the life forms already existing in the new reservoir.

The population's interactions with the medium are more complex than those of the individual. These interactions include not only physico-chemical conditions and physiologically appropriate food, but also the biotic relations of the resettled organism, primarily its food relations with other forms, the presence of appropriate food, its general reserves and the quantity necessary for one individual (when there is a lack of food, the resettled organism enters into competitive relations with other species), as well as enemies, predators,

parasites, etc.

Abiotic (temperature, etc) and biotic factors of the medium determine the rates of quantitative population growth within area limits or in areas of mass accumulation of individuals, moreover the quantitative proliferation of the population is often determined by its biotic relations in new conditions and, consequently, biotic relations often also determine the economic effect of acclimatization.

To secure successful acclimatization of a phenotypic character, a population is selected of a specie existing in ecological conditions similar to these of the reservoir to be settled.

Individuals of the acclimatized specie possess properties which may not appear to their full extent in the native reservoir, but on resettlement into new physico-chemical conditions properties hidden earlier can make their appearance. This is conditioned by the individuals surviving in conditions not habitual for the original population, and also leads to alternations in the resource qualities of the acclimatized organism.

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