

## 6.6. Organization of the Population

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In the section on structure and organization of the population, symptoms of the organization of bank vole populations are presented. When describing the elements of population organization (spatial distribution, sex ratio, age structure, etc.), I indicated that different elements of population organization have an effect on the size of this population. This is understandable because each individual lives in the environment which comprises abiotic factors, the ecosystem and the population itself (Fig. 6.15). Thus, the bank vole population is a part

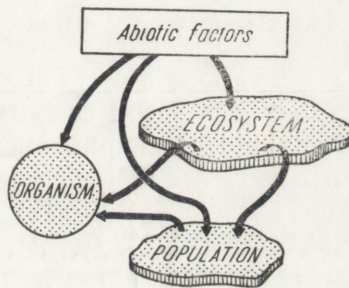


Fig. 6.15. Individual organisms are influenced by the abiotic environment, bio-coenosis and population; the character of the population depends on the ecosystem and climatic factors (after Petruszewicz, 1978).

of the habitat of each individual member of this population, the population being something more than the sum of individuals of a given species. Due to relationships and interactions among conspecifics living in the same area, a certain system is created as a whole, that is, the population.

To explain what the concept of population wholeness means, I must refer the reader to the controversy between the advocates of the holistic and reductionistic approach to biological studies. Reductionists say that all living processes can be explained by reducing them to the molecular level, thus through physical and chemical processes. Holists (for a detailed discussion see Dobzhansky, 1961; Jacob, 1973; Urbanek, 1973; Kunicki-Goldfinger, 1976; after Petruszewicz, 1978) argue that there are qualitatively different levels of biological processes (Fig. 6.16) and the properties of a higher level cannot be totally explained on the basis of even a complete knowledge of the lower levels.

According to the holistic approach, and this whole monograph is written from this point of view, even a complete knowledge of individual organisms cannot explain all the properties of life at the population level. Interrelationships, interactions of different kinds form from the population an integron: an integrated system. Not all properties of this integron can be explained by properties of individual animals. They are the product of interactions among individuals and between individuals and their habitat. The integron (system in cybernetic terminology), that is, population in this case, influences, in turn, population members, as already indicated when particular elements of population organization were discussed. The effect of population on individual animals is no longer questioned. Now I am going to show some general features of the population as a system.

#### 6.6.1. Organization is a Unity

I have already discussed various aspects of population organization, such as the organization of life in space, age structure, sex ratio, social structure, etc. This was a kind of simplification, which is useful for

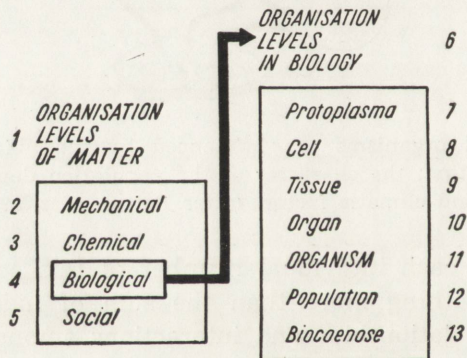


Fig. 6.16. Organization levels in biology (after Petruszewicz, 1978).

description and sometimes necessary in the process of research. In the process of investigation it is convenient and sometimes necessary to distinguish various aspects of population organization. It is impossible to study everything at one time. It should be remembered, however, that population is a unity, a whole. Particular manifestations of organization are interdependent and interrelated. One aspect of organization influences another one and also depends on it. All elements of population organization, whether sex ratio, age structure, or genetic structure, are realized in space. All aspects of organization operate on a definite



number of individuals, they depend either on the total number of individuals in the population, or on the number of individuals in the closest vicinity, that is on density. The probability that a certain symptom of life will always reveal itself depends on the number of individuals and on their distribution in the habitat. In turn, the character and frequency of the occurrence of a certain aspect of life influences the distribution and survival of different individuals, accounting for the development of a specific sex ratio, age structure, or genetic and morphological structures. As a result, the elements of population organization are interdependent, organization works as the resultant, as a whole.

Obviously, this does not contradict the fact that the importance of particular aspects of organization to population functioning and its future fates can vary.

#### 6.6.2. Diversity and Inequality of Population Elements

Describing the elements of population organization, emphasis on the diversity of individuals or their groups is being put. It seems that as a rule the effect of organization on population numbers, or, more precisely, the mechanism of this effect creates different conditions for various population components (individual animals or certain categories of individuals), and gives them different chances. This seems to be a common and general regularity in the functioning of each population. It also seems that the basic regulatory mechanism of the effect of population organization on its numbers does not go through a simple increase in mortality or reproduction, or probability of the survival of all individuals, but just through creating different chances for individuals of different categories with respect to population organization, such as migrant — resident, dominant — subdominant, a member of the group — not a member, individuals in aggregations — individuals beyond aggregations, etc. Inequality, or simply diversity of population members is a basis for population organization.

#### 6.6.3. Relative Persistency of Population Organization

The ecological organization of the population can have a certain inertia, the ability to persist for some time. Each "population curve" provides an indication of this. Let us assume that in an overcrowded population, say at the highest point between *A* and *B* in Figure 6.17, population organization enhances mortality, reduces reproduction and the survival of newborn. Then the population declines. Also the following situation is possible: the symptoms of overcrowding can occur

at a lower density than that in the "valley" of the curve of population dynamics, say at the point *C* as compared with *E* in Figure 6.17, and the population numbers decline. Time point *B* indicates on the descending line the state (density *N*) at which at point *A* numbers increased.

The property of population organization due to which it can persist unchanged is extremely important. If the organization directly and without delay changed in response to environmental effects, it would be merely the instrument of adaptation. It would not be possible to

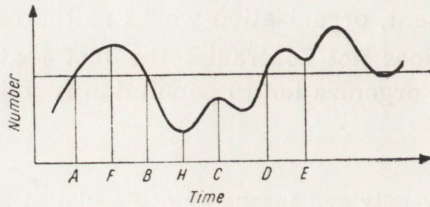


Fig. 6.17. A hypothetical curve of population dynamics. At the same density there is an increase at points *A* and *D*, and a decrease at *B*. Symptoms of overcrowding can occur even at *C*, where the density is lower than in the "valley" *E* (after Petruszewicz, 1968).

figure out the mechanism of modifying these environmental influences by population organization. Population organization develops under certain external ecological conditions (environment and biocoenosis), the action of which can be modified by the previously established organization, and is created by the ecological situation in the preceding period. Due to this relative inertia, population organization can be not only the mechanism of adaptation but also it can modify environmental effects, and in this way influence processes determining changes in numbers.