

On the Term *Station* Used in Russian Ecological and Faunistic Literature

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Abstract—The history of the term *station* (in Russian, *statsiya*) in the Russian ecological and faunistic literature, interpretation of its meaning by different authors, and relationships between the terms *station*, *habitat*, *biotope*, and *ecological license* are discussed. It is suggested that *station* should be interpreted as the entire set of all external conditions affecting a population, which is observable as a part of physical space possessing certain properties.

Keywords: station, habitat, biotope, ecological license.

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The relationship between the characteristics of living systems and the environment in which they live is one of the most important ecological problems. When solving this problem, ecology inevitably interfaces with other branches of biology, such as morphology, physiology, and evolutionary theory. The “interfacial” nature of this issue especially exacerbates the problem of terminological discord, with ecologists, evolutionists, and physiologists all building their respective terminologies. Moreover, there is no agreement even between ecologists dealing with botanical and zoological objects (as well as between representatives of different schools of ecology). As a result, different authors use different terminologies in their theorizations. Often—and this seems to create the most difficult problems—the same word is used to mean different phenomena or concepts. This is the case, e.g., with the terms *biotope*, *station*, *ecological niche*, and *life form*.

Aiming at bringing order into the terminology used in Russian ecological publications, I suggest that several review articles should be published where some of the terms are considered from the viewpoints of the history of their use, their current meanings, and the possible unification of their usage. This study deals with the term *station* (in Russian, *statsiya*) widely used by Russian zoologists in ecological and ecofaunistic studies.

Apparently, Augustin P. de Candolle was the first to use this term (in the French form *station* and the Latin form *statio*) in the early 19th century in his book *Théorie élémentaire de la botanique* (Elementary Theory of Botany) to mean “lieu dans lequel un végétal croît naturellement, considéré, quant à sa nature physique, et non quant à sa position géographique (the place of natural growth of a plant, in terms of physical conditions rather than geographic coordinates) (de Candolle,

1813, p. 423). In addition, de Candolle suggested that the geographic location of a plant should be termed *habitation* or *patrie* in French and *habitat* or *patria* in Latin (literally, “dwelling” and “motherland,” respectively). According to de Candolle, e.g., the *station* of the rice is a marsh, and its *habitation* is India; examples of *stations* characteristic of plants are marine, bog, aboveground, and underground ones.

In the same 19th century, the eminent Russian naturalist Karl F. Roullier, a professor of Moscow University, introduced the terms *statio* and *habitat* into zoological terminology. In the division “Zoobiology” of the course of lectures developed by the year 1848 (which has been partly preserved in the form of fragments that Raikov (1955) later published as an appendix to his book), Roullier, when considering the consistent patterns of distribution or placement of animals over the earth, noted that one may differentiate between a physical location or place of occurrence (*statio*) and a geographic location or habitat (*habitat*). By both place of occurrence and habitat, Roullier meant “the relation of an animal to physical conditions” (Raikov, 1955, p. 499), which was direct in the former case and mediated by geographic coordinates in the latter case. When discussing the physical placement of animals, Roullier considered three media where animals live, namely water, air, and land (in modern language, soil), and the adaptation (both morphological and physiological) to these media of the respective three types of animals, namely aquatic, aerial, and terricolous. When speaking of the geographic placement of animals, Roullier noted that the geographic latitude and longitude largely determined the physical characteristics of the environment and that the difference between a place of occurrence and

a habitat was conventional, because “animals and physical conditions are the actors in both cases” (Raikov, 1955, p. 516). Note, however, that *statio* in that context actually meant the set of environmental conditions to which animals adapted.

Although Roullier did not make his course of lectures into a monograph, it has certainly had a considerable influence on Russian biologists, especially zoologists. According to Novikov (1960), Roullier coined the Russian scientific term *statsiya* (station), which is widely used by Russian zoologists today.

In Russian biological literature, the Latin word *statio* originally took the form *stantsiya*¹. The famous Russian ornithologist M.A. Menzbir, a professor of Moscow University used this Russian variant of the word to mean “the entire set of external conditions determining the distribution of species” in his large monograph entitled *The Ornithological Geography of European Russia* [in Russian] (Menzbir, 1882, p. 7). In essence, Menzbir’s *stantsiya* was equivalent to Grinnell’s *ecological niche*, i.e., the “ultimate distributional unit within which each species is held by its structural and instinctive limitations” (Grinnell, 1928, p. 435). Later, A.P. Semenov-Tyan-Shanskii (cited from Filip’ev, 1924) suggested that, in the given sense, *stantsiya* should be replaced by *statsiya* in Russian², which was generally accepted in Russian zoological publications in the 20th century.

Afterwards, different authors used the term *station* in somewhat different senses. A station was often understood as a part of space occupied by living organisms and possessing certain properties. For example, Kashkarov and Stanchinskii (1929) described stations to be “determined by a combination of ecotopic elements (water and land, soil and vegetation) in the form of natural systems, the places where animals live” (p. 319). Regarding aquatic ecosystems, Filip’ev (1924) defined station as “an area of the sea bottom characterized by similar living conditions and, hence, a substantially similar population throughout it” (p. 2). In the collective monograph *The Animal World of the Soviet Union (Zhivotnyi mir SSSR [...])*, 1936, vol. 1), stations are considered to be “places of living that are characterized by strictly defined physical and biological conditions” (p. 736), without specifying who or what occupies some or another station (an individual animal, a population, a species, a biocenosis, etc.). More typically, however, Russian zoologists interpreted *station* as a set of conditions that a given biological species chooses for habitation, with the same species sometimes occupying different, not nec-

essarily similar, stations (these examples were numerous, so that Bei-Bienko (1930) summarized them to enunciate the “principle of change of stations” and extrapolated it to various groups of animals).

This relationship between the concepts of station and species had to be inevitably replaced by another one as the notions on the polytypic and ecological heterogeneity nature of species were developed in biology. The appearance and development of the notion on population as a natural intraspecific subdivision possessing the properties of an integrated system in both genetic and ecological terms, which took shape by the 1940s to 1950s (see Yablokov, 1987 for review) is considered to become an important prerequisite for this replacement. The notion on station as an attribute of a specific population rather than a whole species was gradually formed. An example of this interpretation of station can be found in a study by Beklemishev (1969), who defined station as “a part of environment inhabited by a population of a given species” (p. 7). Regarding more recent publication, this view is reflected, e.g., in Reimers’ (1990) ecological dictionary, where one of the meanings of the word *station* is “a population’s habitat” (p. 496).

Earlier, I put forward the concept on the use of two reference systems in ecological studies: a democentric system, where the spatial and temporal boundaries of a population or its natural subdivision are assumed to be the boundaries of the object of study, and a cenocentric system, where the spatial and temporal boundaries of an ecosystem or biocenosis are assumed to be the boundaries of the object (Ozerskii, 2009). Obviously, given this interpretation, the concept of station entirely fits the democentric reference system. The concept has two aspects: *autecological station*, which is the set of the values of ecological factors, and *topical station*, which is a part of the physical space (either continuous or represented by separate fragments). The autecological and topical stations are inseparably related to each other. External conditions, which are essentially a set of ecological factors that have assumed specific numerical values, are expressed in nature as a specific type of environment (including, e.g., a type of natural landscape), and a population occupies a specific area, thereby ensuring precise spatial boundaries of its station. This duality may also be seen in Menzbir’s (1882) study, where the “autecological” definition is followed by examples of different types landscapes, such as “a rocky area” (p. 240), “forests with glades and groves near meadows and arable fields” (p. 257), and “a desert with saxaul thickets” (p. 387) as stations of different species of birds.

This meaning of the word *station* can also be found in more recent ecological, biogeographical, and zoological studies. Note, however, that most of them considered topical stations. For example, in Petrov’s (2001) handbook of biogeography defines station as “a place ensuring all conditions necessary for a given species to live there” (p. 80) and differentiates between

¹ The Russian words *stantsiya* and *statsiya* may both be translated into English as *station*.

² Unfortunately, I.N. Filip’ev did not specify in which work by Semenov-Tyan-Shanskii this correction was suggested. Anyway, he had already used it in a study on the taxonomic boundaries of a biological species and its subdivisions (Semenov-Tyan-Shanskii, 1910).

potential stations (which have not been populated by the given species for some or other reasons but are suitable for it) and actual stations or habitats. The spatial scales of stations may be varied depending on the purpose of the study. In the same publication, Petrov notes that the term *station* has a broad sense and gives examples of stations that include both living media (the terrestrial, aquatic, and aerial media) and “more fractional subdivisions related to roughness of the terrain, characteristics of soils/grounds, etc., even to the degree of bog hummocks, isolated boulders, organisms that serve as stations for other organisms forming symbioses with or parasitizing on them, etc.” (pp. 80–82). This variety of scales in interpreting the term *station* occurs even in studies on closely related subjects, e.g., studies on the ecology of forest insects. For example, Rozhkov (1981) mentions old-growth larch forests, i.e., forest biocenoses, as a typical station of the beetle *Xylotrechus altaicus* (Geb.), whereas Kataev (1983) interprets a station of a herbivorous insect as the site on the plant surface, within its organs, or in the soil where the insect lives.

There is one more interpretation of the term *station* in Russian literature. For example, Naumov (1955) defined station as a part of a habitat used “either during a limited period (one or several seasons or a specific time of the day) or for a specific and also limited purpose (feeding, reproduction, surviving through dangerous situations, etc.)” (p. 47). Regarding the most recent publications, Artamonov’s (2005) study may be cited, where the author defined station “as one of several (a limited number) of variants of the incorporation of a population into the space of a specific biotope” (p. 82) and suggested that five types of stations should be distinguished for flies of the families Calliphoridae and Sarcophagidae, with the types of stations corresponding to different types of activities at different developmental stages of these insects (larval and imaginal feeding, reproduction, the pupal diapause, and survival under adverse conditions). The same interpretation of station, as one of several possible, is presented in Petrov’s (2001) book cited above, Dedyu’s (1990) ecological encyclopedia, and Reimers’ (1990) ecological dictionary.

It should be noted regarding this use of the term *station* that it is only possible if another term is consistently used to mean the entire set of external conditions affecting a population. In ecological and faunistic studies, including Russian ones, the term *biotope* is widely used to mean the types of ecosystems populated by a given species (or its population). Obviously, in this sense, the term approximately corresponds to the “topical component” of Menzbir’s “station.” However, it seems extremely undesirable to use the term *biotope* in this sense.

The history of this term is as follows. Originally, the German zoologist F. Dahl (1903) introduced the term *Zootop* (*zootope*, which literally means an animal’s place of habitation) for the “types of land and water”

(“Geländearten und Gewässerarten,” p. 454) as places where a researcher collects animals. In one of his later studies, Dahl (1908) generalized *zootope* to *biotope*, a place of habitation of any living organism, including a plant. Dahl strictly differentiated between the terms *biotope* and *biocenoses* and contrasted them with each other: “einerseits ‘Gelände- und Gewässerarten’ (‘Zootope’) und andererseits ‘Biocönosen’” (on the one hand, “types of land and water” (“zootopes”); on the other hand, “biocenoses”) (Dahl, 1908, pp. 350–351). It is important that this interpretation of a biotope makes it difficult to consider plants or any other living organisms in it, because they are included in a biocenosis. Finally, in the 1940s, Sukachev (1954) formulated the concept of biogeocenosis as a system comprising a biotope and a biocenosis. This meant, among other things, an ultimate formation of the concept of biotope as “the inanimate component of an ecosystem”) and, hence, its confinement to the cenocentric reference system.

The term *habitat* is another widely used synonym of *topical station* in Russian zoological literature. However, although the use of the word *habitat* in this sense is widely accepted, it is not the best choice. First, it did not correspond to the original meaning of this term, i.e. the one that Roullier assigned to it. Second, which is likely to be even more important, the term *habitat* has acquired too many different meanings. This was not so until recent time. In the mid-20th century, it was quite reasonable to interpret habitat as “a set of ecological conditions necessary for completing the entire biological life cycle of a species” (Minin, 1936, p. 66) and contrast it with biotope as a cenocentric subdivision of the arena of life. Many researchers, e.g., Kashkarov (1938, 1945), Novikov (1949), K.V. Arnol’di and L.V. Arnol’di (1963), and, speaking of foreign ecologists, Uvardy (1959), adhered to this approach. However, the translators of English sources, including classical reviews and handbooks on ecology (e.g., MacFadyen, 1965; Odum, 1975, 1986; Begon et al., 1989) made it a common practice to translate the English word *habitat* as the same Russian word³ irrespective of whether the environment in which a species lives (the *station*) or the inanimate component of an ecosystem (the *biotope*) was meant. Therefore, at present, the use of the democentric term *station* (always meaning the entire system of both abiotic and biotic conditions under which a species, population, or part of a population exists) in all these cases gives rise to less confusion than the use of the term *habitat* in the same sense.

Not only does the term *station* largely overlap semantically with the term *habitat*, but it also has much in common with some interpretations of the term *ecological license*. Like the term *habitat*, the term *ecological license* has several meanings. It was coined

³ *Mestoobitanie*; throughout this text, the Russian *mestoobitanie* is translated as *habitat*.

by the German zoologist K. Günther (1949) and originally meant the possibility of or "permission" for existence of an individual provided by environmental conditions allowing the survival of carriers of the characters that have resulted from new mutations and have no selective value. Later, however, Ya.I. Starobogatov and V.F. Levchenko, not knowing about earlier publications where the term had already been used, introduced it to scientific language again (Levchenko, personal communication). The new meaning of the term *ecological license* was the set of conditions in an ecosystem owing to which a population already existing or emerging there has or obtains (1) a specific position in space and time, (2) a specific position in the gradient of environmental factors, and (3) a specific role in the flows of matter, energy, and information (Levchenko, 2004; Starobogatov and Levchenko, 2005). This definition of ecological license considerably differs from the original one. Günther speaks about the preexisting correspondence of the environmental conditions to the demands of an individual with a new phenotype; Levchenko and Starobogatov, about a set of environmental conditions irrespective of the actual demands of living organisms. It is obvious that, according to the later interpretation, an ecological license closely resembles a station in its autecological aspect; in the case of the ecological license of a population, the meanings of these terms are practically identical. In such cases, apparently, the term *ecological license* may be replaced with a less ambiguous term *station* (or *autecological station*) without loss of meaning⁴.

Thus, in the current Russian terminology, there are several terms for the environment in which a population lives: *station*, *ecological license*, *biotope*, and *habitat*. Only the first two of them entirely fit the democentric reference system and unambiguously cover the entire set of environmental factors, both abiotic and biotic, interacting with the population. Of these, the term *station* seems to be less ambiguous and, hence, more preferable than the term *ecological license*. I think that it would be reasonable to settle on the following definition of *station*: A station is the entire set of external conditions affecting a given population, which is outwardly expressed as a part of the physical space (either continuous or fragmented) with specific properties that is occupied by the population. Regarding the interpretation of a station as a part of a habitat (e.g., Naumov's interpretation), it would be suitable, in the general case, to use the expression *partial station*. Note that the terms for some specific variants of partial stations (such as *feeding*, *reproduction*, and *survival stations*) are also widely used in Russian scientific literature, and those for other variants may be intro-

duced when necessary without causing terminological confusion.

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⁴ The term *ecological license* has meanings other than these two ones. For example, *license* may mean a combination of the values of ecological factors that is not used by any living organism (an "unoccupied ecological space") (Kiselev, 2004a, 2004b).

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