

“Medžiojamųjų gyvūnų etologija” [*The Ethology of Game Animals*] by Olgirda Belova. 2001. Lithuanian Forest Research Institute. Kaunas: *Lututė*, 280 p., illus., bibliogr., in Lithuanian, summary Engl. ISBN 9955-452-48-X

The subject of the behaviour of animals, its biological causality and the regularities of animal responses to the irritants such as *The Ethology*, has grown considerably and is developed further. The main problems came to light are: how to create favourable conditions for implementing all behavioural programmes of animals, how to improve the relationship between a human being and animals according to the status of animals and their possible benefit or damage, to strive for the conservation of the biodiversity of our environment, to co-ordinate the human economic activities with the environment protection.

Wide range of subjects concerning these problems are analysed and presented in a readably and scientifically acceptable way in the monograph *“The Ethology of Game Animals”* by Olgirda Belova. Using the results of the own research work as well as much information of the up to date and prior literary sources, which already became classical ethological and eco-

logical subjects, O. Belova provides the comprehensive and lucid answers to the questions of animal behaviour.

This well-written book splits into four main chapters such as *The Theoretical Backgrounds of the Ethology of Game Animals*, *The Outline of Animal Social Ethology*, *The Adaptations of Animal Behaviour* and *The Applied Ethology and Ethological Research and Their Significance to the Forestry, Game management and Environment Conservation*. Each chapter consists of a number of paragraphs revealing the subjects of the game animal behaviour. The first chapter of the book is divided into three paragraphs. Succinctly, the attention was focused, and connections, contact points and differences between zoopsichology and ethology as well as the essence, display and constituent parts of behaviour were revealed. The knowledge of animal behaviour allows us to understand the laws of nature, which could help perceive the ways of the life of animals, also foresee the activities of animals and ascertain abilities of the survival and breeding under certain conditions as well as manage the number of their populations. The continuation of genus is the impetus of life because an animal has to survive and leave offspring. That is possible only by the communicative relations of animals with the environment and by the combination of their activities

with one another. Images of certain objects and events leave in the brain of animals while they respond to the externality. An image is the regulator of animals' behaviour. That is the reflection of either that already has happened and that will happen later on. The image stimulates an animal to search around the equivalent or to avoid it. This feature is called *anticipation* or the ability to look forward to the course of events. The elements of the visual and activity thinking are characteristic of animals while the mental decision and abstract thinking are not typical of them. Animals are thinking while they act or by the comparison and relation of images of the current situation with the earlier images that have stamped in their memory. The animal behaviour is considered to be one of the most significant adaptation systems. An animal organism could survive only through the maintenance of the equilibrium with externality and corresponding response to environmental irritators by reflexes. All adaptation systems of animals create conditions for the survival, and existence of animals, their group or population under the conditions of certain abundance. That is why the knowledge of behaviour not only of an individual but also the whole population or synecological level is important for the control of populations as well as for the conservation of species diversity both in the forest and game management, and for the environment protection.

The author of the monograph has analysed and revealed the range of the main and secondary methods for the behavioural studies. The knowledge of the behaviour creates conditions for the definition of relations between animal behaviour and processes that are going on in animal's organism and around it, and which occur before certain behaviour will be displayed, or accompany it or is the consequence of this behaviour. The author shows the essence of the causal analysis, and underlines that there is not unified scheme for this analysis. The methods were used in practice by the author as well as the newest methods for studies of the animal behaviour are explained and determined. The main constituent parts of animal behaviour are specified. The urge or inducement of the behaviour is its incentive, which corresponds with a need of organism, and this need determines the direction of animal's behaviour that is a response or reaction. Thus, the preparative stage is "switched" on, for example, while the deer *Cervus elaphus* (L.) feels the hunger. At that time the animal is searching for the food source. Patterns and the essence of the inducement and important biological motivations, which are led by different types of emotions, and the variety of behavioural deviations of the different game species and other wildlife are presented and specified. Forms

and types of the individual and social behaviour of game species, which are typical of the Lithuanian fauna, are specified and analysed. The author specified the main incentives of a behavioural form, and the structure of each behavioural form and its constituent parts on the ground of behavioural patterns of different wildlife species (*i.e.*, hares *Leporidae*, deer *Cervidae*, weasels *Mustelidae*, red fox *Vulpes vulpes* (L.), wolf *Canis lupus* (L.), lynx *Felis lynx* (L.), racoon dog *Nyctereutes procyonoides* (Gray.), squirrel *Sciurus vulgaris* (L.), *etc.*). The means, how to identify the behavioural act, are shown. All elements of the play behaviour are displayed, when there is no need to behave somehow differently, when there are no problems of the survival or danger of near predators. Patterns of the play behaviour of wildlife show the significant role of this behaviour form for the further existence of the animal.

In the monograph, the main types of animal's individual and social behaviour are specified. The formation process of the behaviour was discovered by the author, and the development of the behaviour of some game species (*viz.* *Lepus europaeus* Pallas, *Capreolus capreolus* L.) was specified comprehensively and lucidly. These are the forms and types of the individual behaviour. The biological adaptation of animals depends not only on their abilities to survive but also on the ability to continue their genus. The role of the conflict for a display of animal sexual behaviour is determined. By way of an illustration, the sexual behaviour of some game species is specified (*viz.* European hare, red fox, wolf, squirrel, deer and wild boar). The outset of the mating is different. It depends on the internal readiness, feeding, external temperature, inclemency of weather; precipitation while the significant releaser of the sexual behaviour is a photoperiod. The main mating systems and their display as promiscuity, polyandry and polygyny are determined. The author specified the maternal behaviour including the introduction of the maternity, the period of the main intercourse and parting. The contacts between a mother and juveniles are kept on the ground of the initiative of mother within the period of main intercourse. The author also noticed that this period could be divided into the three stages such as "approaching of female", "mutual approaching" and "approaching of juveniles". The phenomenon of the *allopARENTAL* behaviour, altruism and mutual altruism is described and its role for the survival of juveniles is shown. The author shows that a disturbance of the comfort behaviour causes a stress status, the background of which is the unsatisfying of a need. The defensive behaviour involves the animal's efforts to survive within the collision with adversaries and com-

petitors. The preconditions of the ability to distinguish a danger are an individual experience and imitation of elder conspecific animals. These preconditions form a degree of animal fear. The patterns of animal responses have been indicated on the grounds of analysis of the behaviour of so-called problematic game species. The author underlined that the knowledge of a tactics of animal response to the dangerous situation is the precondition of control and management of the wildlife populations.

The social behaviour as behaviour of individuals is the basis of the social organisation of a population, and is based on the direct and indirect interactions between animals and birds. The main fundamentals of social communities are determined in the monograph. The levels of animals' interactions and contacts, the essence of hierarchical rank and hierarchy, *i.e.* a system of grades of a status ranked one above the other, the process of its formation; costs and benefits of being dominant or subdominant, occurrences of the dominance and subordination and conformation behaviour as well as the main concepts and criteria for the identification of **organized communities**, occurrences and principles of **the territoriality** and its links with the dominance, the ambiguities and differences between territoriality and home range as well as the occurrence of the leadership and the main features of the different types of leaders are indicated. The basis of the agonistic behaviour is all animal interactions related to the incompatibility, collision, and conflict. These occur through the intolerance and enmity of one individual to the other. The phenomenon of aggression and reasons for its occurrence in the behaviour of game species as well as patterns of the interspecific and intraspecific aggression of different wildlife species are revealed, and a role of the aggression for the survival and existence of animals is determined. The main factors causing the competition are ascertained. The competitive behaviour is based on asymmetric interactions and it is displayed because of the cost of resources, and through the ability of an animal to fight or keep reserves for itself. However, the asymmetry could be untied neither with the cost of resources nor with the ability to fight. In this case one of the competitors could be a master of the territory. Animals must ascertain their abilities themselves and the significance of a victory before they take up a struggle or display competitive actions. The author revealed that this is the result of the adaptation of animals. The main objects of the competition and other categories of interactions have been determined.

The author has determined the essence of the ontogenesis of behaviour. The main occurrences of the formation of behaviour are post-natal period, early

experience, imprinting and sensible phase, learning, development of adaptations and socialisation, when an animal adopts the experience of conspecific animals and reproduces it in its behaviour. Adults usually hardly adapt themselves under the unusual conditions in the new environment (e.g., when they have been moved from usual environment to other localities). The behaviour is goal seeking and correct, when animals find themselves in the similar environment, where the incentives are known from the early lifetime based on early experience. The new habits develop slowly provided that the previous behavioural elements help them survive in a changed environment. The mistakes have been made before now in Lithuania (e.g. the adult hares were transferred to the new localities for the replenishing of local populations, however, residents have suffered from predators, and supplanted by indigenes) because the mentioned occurrence has not been taken into consideration. There is noticed in the monograph that the knowledge of the development of behaviour helps ones understand and, in case of necessity, change and foresee some behavioural acts, which are harmful for human activity or health, and help us solve problems of the survival of juveniles and maintain a sustainable population. The main stages of the development of game behaviour have been distinguished and analysed. Patterns of the formation of behaviour are revealed on the grounds of comprehensive studies of some game species, e.g. the brown hare. The author indicated that the development of behaviour is greatly influenced by the presence of the conspecific animals, both adults and juveniles. Within the first stage the sense of a fear is characteristic of *Leporidae* among the whole complex of behavioural acts. The growth of association index is specified. The author showed the possibility of the imprinting during the certain sensitive phase; however, it is relieved as soon as certain incentives have displayed. The importance of the learning is specified and the role of an experience and imitation for animals is underlined by an analysis of behaviour of certain game species. Certain patterns of the storing up knowledge are also analysed. The author emphasized that the peculiarities of the population behaviour could be given to further generations by traditions, or it is signal heredity genetically. The second and third patterns of the storing up knowledge bound up with facultative learning, which is possible in any period of life. Therefore, the suckling attitude even could be changed and unusual, for instance, some fawns could suck on the hinder part squeezed between female's hind legs. During the seeking for food, juveniles could find new food and test it as adults usually have done. The additional incentives stimulate the prevalence of facultative learn-

ing. It is shown that the rapid facultative behaviour is characteristic of self-dependent animals, i.e. which are single or separately from the conspecific animals in a group. Eventually, the behaviour of animals gains an adaptive character and becomes more efficient. The author shows that the changes caused by the processes of animal's growth and pubescence could be separate from the changes induced by learning some criteria. The main forms of learning have been analysed, and their importance for game specified.

The second chapter, consisting of three main paragraphs, determined the essence of the social ethology. The author described that there are no absolutely single and social animals. They still meet in the breeding season or accidentally even if they usually stand apart from other animals of the same species. Hence, the terms "social living" or "loneliness" are rather tendencies to live alone or in a group, for instance, pattern of the individualism is characteristic of hares, however, they usually meet in feeding places, within the breeding season, females associate with juveniles, and juveniles intercommunicate one another and associate with female. It is emphasized in the monograph that the impact of the human factor combined with its natural fluctuation, and further habitat alteration caused changes not only in a population, distribution, and range of the tolerance of animals to limiting factors but also changed the social structure of populations. The basis of a population is the social intercourse of individuals because a population is the social, or social demographic system. The author has revealed connections between the indices of wildlife population and animal's behavior. A phenomenon of the sociality of animals has also been determined. The new standpoint on the Sociobiology and Socioethology, and Applied Ethology is explained as well as the basic principles and main problems of the social ethology and sociobiology have been specified. The genetic adaptation, group selection, kin selection, inclusive fitness, survival of the fittest, the phenomenon of altruism, alloparental care, peculiarities of a cooperation, competition, dominance system, social spacing, parental care, parental benefits and influence on a progeny, occurrence of conflicts between different categories of animals are explained on the grounds of patterns of various game species. The social structure of wildlife populations and factors, which predetermine its formation and existence, have been specified. The author indicated a compromise between the propensity for loneliness, when we can see an individual as any physically distinct animal or bird, and propensity for the intercourse, which could continue shortly or be more prolonged, that is why more or less stable communities of different size are forming. In the same course, animals or birds strive to keep

certain distances from each other within a community. Through the social demographic composition of a population, the social structure influences the spatial distribution of animals depending on the carrying capacity of a territory. Wildlife communities are a basis of the social structure of their populations. The author noticed that this phenomenon in forest ecosystems and surroundings is of great importance. On the other hand, a formation of wildlife communities causes the realization of the main functions of a population. The main factors determined the distribution and separation of one individual from the others, and factors uniting animals in communities are determined on the ground of specific patterns of the social behaviour and social organization of game and other wildlife species (squirrels *Squiridae*, weasels *Mustelidae*, wolves *Canidae* and deer *Cervidae* etc.). The role of territoriality as a density dependent factor is explained, and, at the same time, the role of the food supply, weather conditions, habitat features, abundance of predators and competitors, and other abiotic and biotic factors is specified. These factors could influence the ability of population striving the biologically optimal density as well as the display of territoriality. The author has revealed the conditions when the territoriality prevails. She emphasized that the territoriality prevails when the density of population is low, while the hierarchy prevails and display of dominance take place, when the density is high. The striking example of this occurrence was shown. Specific properties, functions and differences between territory and home range, costs and benefits of the territoriality of animals and birds are specified on the grounds of the analysis of well known game species. The author has specified the links with the optimisation of the behaviour while we understand the optimal behaviour as the behaviour tends to maximize the inclusive fitness and results in the greater differences between costs and benefits and becomes more adaptive. All examples and the analysis show that the territoriality is not stable species-specific feature. The wildlife spatial interactions have been specified and explained. The author has shown that it is possible to determine and describe the spatial interactions by the ecology of animals, possible types of bonds, forming of communities and their existence. The classification of breeding interactions is presented in the monograph. Mostly characteristic determinants influenced the display of a certain type of breeding interactions as well as the possibilities to realize these interactions of various game species are expounded. The result of the relationship between opposite forces like integrated and disintegrated interactions is social communities of animals and birds. The true community is more than one mated pair or a mother with juveniles. Occurrences of

the group effect and mass effect can display, when animals have gathered together in communities. The essence of these phenomena is determined. Gathered animals get some benefits and losses of the being as members of communities. Costs and benefits of the communal life of animals and birds as well as the main determinants affecting gathering of individuals in social units are specified.

The author analysed the different classifications of social units of wildlife, or their societies, *i.e.* groups of individuals belonging to the same species and organized in a cooperative way, such as classifications by the origin of a society, by the character of contact or by the degree of their stability *etc.* Societies classified by their stability are the following: aggregation, or accidental communities; temporal communities; and stable communities that could be growing or open, and stable or closed. The author lucidly and succinctly specified mentioned societies, their formation and functioning. The different levels, from zero to the second level of integration of the social structure of wildlife populations have been analysed and specified on the grounds of specific patterns of a social structure of communities of game species including social units of different levels of the integration, main interactions, bonds and contacts within all social units of *Carnivora*, *Rodentia*, *Lagomorpha*, *Artiodactyla* and also birds.

The third chapter, containing two main paragraphs, specified the animal adaptations and their development. The social system of certain wildlife species as the greatest common interspecific relations and the adaptation of animals and birds to human factors as well as the interaction man – wildlife have been determined. The development of the generalization, differentiation and display of ambivalent behaviour while animals adapt to the environment have been specified. Adaptations are important for the animal survival and for relations of animals and men with each other and with their environment. The essence of these subjects and their importance for the knowledge of animal behaviour, the main tasks of the applied ethology, the possibilities and foreseeing course of the animal behaviour and importance of the behavioural research in game management and nature protection have been revealed. The author emphasized that humans are re-making the environment and transforming the habitats of wildlife to suit their own ideas and strive to attain their objects, which often are inadequate to the natural needs of wildlife. It is specified that the natural relationship between wildlife and other components of their environment has changed essentially because of the multiple persistent acting and changeable factors which are closely connected with a human activity (e.g. forest management, hunting, recreation *etc.*). At the

same time, the species-specific properties of animals are transformed such as reaction norms, parameters of ecological niches, interactions *etc.* All together affect the sustainability, diversity of an environment as well as the results of human activity.

In the fourth paragraph, the author, apparently, specified the Applied Ethology and revealed the importance of the ethological research in the forestry, game management and environment conservation. The Applied Ethology investigates the problems that are significant for the game management and environment protection as well as for other areas of human life related to wildlife. The main problems of the Applied Ethology have been solved, are abilities of animals and birds to adapt themselves a) at the level of an individual such as a species-specific reaction norms, and b) at the level of a community such as the intrinsic structure of wildlife populations and ecological niches. The issues of the Applied Ethology would be resolved at three levels of the assessment of biological diversity while the underlining of the relationship between individuals, their societies, populations and species with their abilities to adapt to an environment is needed. The main criteria of the control of a status of wildlife species and their habitats in a context of biodiversity conservation have been determined.

The author worked out the original model and the process of prognosis of wildlife behaviour and how to foresee the wildlife behaviour by the perception, and behavioural motivation under certain conditions. The main data needed for the analysis and further prognosis of an animal's behaviour have been specified. Changes of dominance of the certain need and the interaction between animals and their environment are analysed. The direct connection of this situation with the problem "forest - herbivores" is revealed and the methods of managing wildlife behaviour are proposed and explained. The author revealed that the knowledge of the behaviour of wildlife enables to avoid the undesirable environmental occurrences and accidents or, on the other hand, the overpopulation and strong damage caused by animals to forests and other environment as well as other occurrences, which would destroy the environmental equilibrium.

The book is important contribution to science and will fill up the gap in the literature on wildlife behaviour. It is up to date, useful and relevant to the needs of game managers, foresters, students of biomedical sciences, and for those who working to protect and tend the fauna and environment and are interested in the animal behaviour.

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