══════ RESEARCH NOTES ══════
══════ НАУЧНЫЕ ЗАМЕТКИ ══════

LONG-TERM COMPLEX MONITORING OF HORSE POPULATIONS: ITS ADVANTAGES AND PROBLEMS

Natalia N. Spasskaya

Lomonosov Moscow State University, Russia
e-mail: equusnns@mail.ru

Complex monitoring of a feral horse population (Rostovsky State Nature Biosphere Reserve, Russia) started in 2006. Its main goal was to assess the state of the group and to forecast its future prospects. The monitoring was based on the so called biographical method. The long-term and comprehensive studies allowed uncovering some phenomena that were not evident through short-term observations, namely a persistent high mortality rate of the young stock; constant presence of groups of mares that did not breed (or had low reproductive status); delayed reaction of the population to a disturbance of its social structure, and others. It is stressed that such long-term complex monitoring should be implemented in any reintroduction projects.

In recent decades, great significance has been attributed to long-term studies of conservation ecology and ethology that are based on individual identification of animals (Clutton-Brock & Sheldon, 2010). However, there are not many such projects in the world in general, so they are far rarer for horses. In most cases, such a long-term monitoring considers mainly demographic aspects, while additional issues are investigated only for short periods.

The population of the feral horse (*Equus caballus caballus* Linnaeus, 1758) inhabiting an isolated local territory in the Rostovsky State Nature Biosphere Reserve is the only such large and long-standing group in Russia (Spasskaya, 2008). The long-term island isolation, the small size of the island, and the protective regime make the population a good model for research of a complex of demographic, ethological and microevolutionary processes. Monitoring of the population started in 2006. Its main goal was to assess the state of the group and to forecast its future prospects (Spasskaya & Scherbakova, 2006). One of the practical tasks of the work carried out was, among others, to elaborate the methodology for conducting a long-term comprehensive monitoring, which can be applied in the implementation of reintroduction projects of ungulates, first of all of the Przewalski's horse (*Equus c. przewalskii* Poliakov, 1881).

Our monitoring of the Rostov feral horse population was based on an initial stage of the biographical method. An indispensable condition of the work was the individual identification of the horses by a complex of characters: gender, age, general colour pattern, colour marks (both inherited and acquired). The surveys were carried out two or three times each year: we registered newborn and absent (dead and captured) animals, individuals belonging to particular social groups, their transitions from one group to another, decay of existing and formation of new groups. For a part of the animals born in 2006–2009 and for all animals born in 2010 and later, parents and more or less accurate dates of birth are known. We regularly explored the island in search for the remains of dead animals. For each of the latter, geographical coordinates of their locations are determined using GPS receiver, its gender and age are determined, the presence or absence of injuries are registered, and developmental features (including dental anomalies) are detected. After clearing of the skeleton from soft tissues, measurements of the skull and limb bones of adults (over 5 years old) are taken for further evaluation of their size and exterior features.

All the obtained data are entered into several electronic databases. The «Card index» database contains information about each individual: its gender, date of its birth and eventual death, description of its phenotype (colour, markings), its parents, and duration of its membership in different social groups. It is supplemented by a photographic dataset with images taken of each animal in full face at the age of 1 month, 0.5 years, 1 year, 5 years. Each individual receives a unique alphanumeric num-

ber for its identification in different databases. The «Demography» database fixes the size and gender structure of each social group and, accordingly, of the entire population. In the «Reproduction» database, for each mare, the time of her entry into the breeding period and the frequency of the chaff are marked. The «Mortality» database contains a list of the registered dead animals with indication of their geographical coordinates, sex, age, measurements of their skulls and limb bones, and a comparison of these remains with the particular individuals from the «Card index» database. The data contained in these main tables can be sorted and summarised according to any query.

A collection of biological material from particular individuals (wool, tissues, feces) for genetic, biochemical, microbiological research was formed, and it is constantly supplemented.

The complex monitoring conducted and the accumulated data and biological material allow revealling:

– trends in the genetic drift, both directly in the genotype and indirectly reflected in changes in the manifestations of the colour patterns and dental anomalies;

– directions in the exterior changes;

– dynamics of the demographic parameters of the population and the reproductive potential of individuals

– dynamics of the population social structure.

Some preliminary results of research of the Rostov feral horse population have already been published (Spasskaya & Scherbakova, 2006; Spasskaya, 2009, 2014; Spasskaya et al., 2010a,b; Ransom et al., 2016). Knowledge of established relationship between individuals in the population allows a more detailed analysis of behavioural patterns, biochemical and microbiological processes. Research in these areas is either already underway or has recently begun.

Long-term and comprehensive studies allow catching also some phenomena that are not evident during short-term observations, for example:

– a persistent high mortality rate of the young stock (up to 30% even in the years of favourable climatic conditions)

– constant presence of groups of mares that do not breed (about 8% of adult mares) or have low reproductive status (about 14%)

– a delayed reaction of the population to a disturbance of its social structure, which involves an increase in the proportion of breeding young mares, an increase in the birth rate, formation of breeding groups by bachelors at an earlier age.

During the implementation of our research project, a significant number of new issues appeared, the answers to which are not available yet: what is the trigger mechanism for the emergence of social groups of mixed type (e.g., multi-male ones) in the population; which mechanisms ensure stability of the social structure of the population; how and why coalitions of several social groups arise, etc. It should be emphasised once again that, due to a certain inertia of the population's reaction, it is impossible to get answers to a number of them during short 3-year periods adopted for implementation of the standard grant-supported projects.

Long-term studies accumulate information for a further analysis of microevolutionary processes, including those involving agent-oriented models that give more realistic results and have become increasingly popular in recent ecological studies (see Goltsman et al., 2018).

With the evident merits of long-term comprehensive monitoring research, certain technical and organisational difficulties have become quite evident. These include the maintenance of methodological integrity and continuity in research, the search for funding (because such monitoring studies are not supported by grant projects), as well as the probability of disappearance of the studied group of animals.

However, the attitude towards reintroduction projects and the situation with them should be fundamentally different. Since each of these projects is a unique event, they must be obligatory accompanied not only by comprehensive monitoring of animal populations, but also by long-term studies of the dynamics of relevant natural communities. Only in this case, one would be able to collect the data necessary both for the analysis of the project implementation process and for predicting its further development. In particular, when discussing measures for reintroduction of the Przewalski's horse (Rozhnov et al., 2010), a complex scientific monitoring was suggested. However, in the «Pre-Ural Steppe» monitoring was carried out in 2015–2018 mainly for veterinary and biotechnical purposes (Program, 2018). Considering the above, the future plans should take into account the necessity of a more comprehensive study in this area.

References

Clutton-Brock T., Sheldon B.C. 2010. Individuals and populations: the role of long-term, individual-based studies of animal in ecology and evolutionary biology. *Trends in Ecology and Evolutionary Biology* 25(10): 562–573. DOI: 10.1016/j.tree.2010.08.002

Goltsman M.E., Sushko E.D., Doronina L.O., Kruchenkova E.P. 2018. An individual-based model of the population dynamics of the Arctic fox (*Vulpes lagopus semenovi*) on Mednyi Island, Commander Islands, North Pacific. *Zoologicheskii Zhurnal* 97(11): 1400–1417. DOI: 10.1134/S0044513418110041 [In Russian]

Program on creating the semi-captive population of Przhewalski's horses in the Orenburg State Nature Reserve 2015–2018. Orenburg. 51 p.

Ransom J.I., Lagos L., Hrabar H., Nowzari H., Usukhjargal D., Spasskaya N. 2016. Wild and feral Equid population dynamics. In: J.I. Ransom, P. Kaczensky (Eds.): *Wild Equids: Ecology, Management and Conservation*. Baltimore: Johns Hopkins University Press. P. 68–83.

Rozhnov V.V., Spasskaya N.N., Chibilev A.A., Levukin S.V., Orlov V.N., Paklina N.V., Pozdnyakova M.K., Petrischev B.I. 2010. *The Program on reintroduction of the Przewalskii horse in the Orenburgskaya Oblast (Sothern Ural Region Region, Russian Federation)*. Moscow: Russian Academy of Sciences, Ministry of Natural Resources and Ecology. 32 p.

Spasskaya N.N. 2008. Feral horses are not strangers in the steppe. *Steppe Bulletin* 25: 52–56. [In Russian]

Spasskaya N.N. 2009. Spatial structure of feral horse populations: analysis of factors affecting home range size. *Zoologicheskii Zhurnal* 88(5): 629–636. [In Russian]

Spasskaya N. 2014. Inherited dental anomalies in the horse (Equidae, *Equus caballus*). *Russian Journal of Theriology* 13(1): 17–26. DOI: 10.15298/rusjtheriol.13.1.03 [In Russian]

Spasskaya N.N., Scherbakova N.V. 2006. Population of the feral horses on Vodnyi Island in Rostovsky State Nature Reserve (result of investigations 2006). *Problems of Steppe Science* 6: 64–69. [In Russian]

Spasskaya N.N., Ermilina Ju.A., Mahotkina K.A., Svinarenko A.E. 2010a. Phenotypic characteristic isolate population of the feral horse on Vodnyi Island (Rostov Region). *Bulletin of Moscow Society of Naturalists. Biological Series* 110(6): 15–23. [In Russian]

Spasskaya N.N., Scherbakova N.V., Ermilina Ju.A., Mahotkina K.A., Pchelkina D.S., Svinarenko A.E. 2010b. Results of complex monitoring of population of the feral horses of the Vodnyi island in the Rostovskiy State Nature Biosphere Reserve. *Proceedings of the Rostovskiy State Nature Biosphere Reserve* 4: 197–211. [In Russian]

ДОЛГОСРОЧНЫЙ КОМПЛЕКСНЫЙ МОНИТОРИНГ ПОПУЛЯЦИЙ ЛОШАДЕЙ: ЕГО ПРЕИМУЩЕСТВА И ПРОБЛЕМЫ

Н. Н. Спасская

Московский государственный университет имени М.В. Ломоносова, Россия
e-mail: equusnns@mail.ru

Комплексный мониторинг популяции одичавших лошадей (Государственный природный биосферный заповедник «Ростовский», Россия) был начат в 2006 г. Его основной целью было оценить состояние группировки и спрогнозировать ее дальнейшие перспективы. С самого начала он основывался на так называемом биографическом методе. Долгосрочные и всесторонние исследования позволили выявить некоторые явления, которые не были очевидны из краткосрочных наблюдений, а именно: постоянный высокий уровень смертности молодняка; постоянное присутствие групп кобыл, которые не размножались (или имели низкий репродуктивный статус); замедленную реакцию популяции на нарушение социальной структуры и др. Подчеркивается, что подобный долгосрочный комплексный мониторинг должен быть реализован в любых проектах реинтродукции.

Ключевые слова: биографический метод, многолетние исследования, мониторинг, одичавшие лошади, Россия, Ростовская область