Degrees of Extinction Risk in Farm Animal Populations

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Abstract. In the last time a sustained activity for defending the biodiversity in the nature has evolved. In order to classify the degree of extinction risk in natural biological populations (biological species) the number of adult animals was preferred.

The established degrees of risk are: in safety state \(>10000\) heads, in vulnerably state \(<10000 - 1000 >\) heads, species in danger \(<1000 -100 >\) heads, species in critical state \(<100\) heads. Same action has been extended to the biological populations in culture (breeds and lines or strains in animals, varieties or sorts in vegetable cultures, stems in microbiology) based on the same degrees of risk. But in farm animals the criterion and the degrees of risk admitted by FAO are not satisfactory because in natural biological populations closed reproduction is ensured by natural molecular and behavioural mechanisms, genetically controlled meanwhile in artificial populations reproduction is closed by men with artificial means (incarceration, territorial insulation, or registration books) being unprotected against crossbreeding.

The proposed degrees of risk for animal artificial populations are: active (with improvement program), in safety (big number, passive), vulnerable (with decreasing livestock), in danger (fast decreasing livestock or getting to \(100 – 1000\) heads and less than 6 families), in critical states (less than \(100\) heads and less than \(4\) active males), in construction or reconstruction (new or former existing populations). The difference concerning the means of closing reproduction in natural and artificial populations essentially modifies the way of estimating their state of extinction risk.

Keywords: biologic diversity, risk state, close reproduction.

INTRODUCTION

Officially the question of vulnerable biological populations in nature and culture in 1992 was launched. Then at Rio de Janeiro the Convention for Biological Diversity has been signed by the participant countries, including Romania. Up to now 188 states have signed the Convention that intents to protect nature against human invasion in ecosystems (6).

Fallowing the convention a large activity to evaluating the extinction risk of biological species in nature has been promoted. It has been considered that disappearance of biological species reduces the biological diversity and indicates damage of the environment and a lack of sustainability of the human social activities. So the goal of this activity became to discover species in danger and to impeach them to disappear by correcting the human activities (6).

As criterion of extinction risk of biological species the number of adult, able to reproduce, items was designed. So it was decided that species are in safety state disposing of more than \(10000\) individuals, vulnerable state disposing of \(<1000 – 10000 >\) individuals, in danger having \(<100 – 1000 >\) individuals and in critical state when the members of the species get under \(100\) individuals (1). This criterion is a very simple one and correct from biological point of view. It may be applied to animals and to vegetal species as well. When it was claimed to protect also the biological populations taken in culture the same criterion was...
recommended by FAO, the organization in charge to protect biodiversity in nature. Later objections to this official criterion and against the resulted classification of extinction risk degrees in farm animals have been addressed to FAO. The problem isn’t solved yet. The present paper tries to explain why it is not solved and to contribute to a better solution (1).

About biological diversity

Biological diversity is due to the diversity of genetic information. Genetic information is the kind of information able to command the reproduction of its own support. Concerning animals, in nature, there are three levels of biological diversity (5):

- Biological species level, determined by the genetic information species (species = sort of) existing in nature. It results in biodiversity.
- Organisms’ level, determined by genotype (all genes of one organism), existing inside each genetic information species. It results in variability.
- Cellular level, determined by the genomes (totality of active genes of haploid or diploid cells) existing in a body. It gives the tissues and organs functional specialization.

The same three levels of biological diversity are present in farm animals as well, but in farm animals the biodiversity is due to the number of breeds or lines inside the genetic information species instead of the number of biological species (2).

Why biodiversity in nature and in culture are different?

Animal biodiversity in nature is preserved by the stability of biological species. This fact is due to the closed reproduction of the members of one biological species ensured in superior animals by molecular and behavioral mechanisms genetically controlled in each species. Due to the closed reproduction the wild biological species are biological populations. Inside these populations the genotype variability is distribute in accordance with the laws of chance. (See Mendel’s laws) (4). The natural mechanisms of closed reproduction are keeping the order in nature. When natural selection, using the variability inside species, creates along generations, differences concerning the mechanisms of reproduction new species are borne. In nature each genetic species, identified by its mechanism of closed reproduction, has support its own biological species (4).

When animal biological species entered in culture, breeders introduced artificial selection instead of natural selection. In order to maintain the traits induced by artificial selection they had to close the reproduction with selected animals. So they created artificial mechanisms of closed reproduction. Such mechanisms are incarceration (using chains or cages), territorial insulation (as is given by states’ boundaries) and studbooks, herdbooks, or flockbooks (the names differ with the genetic species).Using mechanism of closed reproduction breeders obtained animal artificial populations called breeds or lines (if smaller and dedicated to crossbreeding) (4). So the biodiversity in farms animals is giving by the number of genetic species and the number of breeds and lines. In some cases, as cattle for instance, the wild biological species disappeared but the genetically determined mechanism of closed reproduction are still acting what means the genetic species still exists. Genetic species of farm animals are not populations.

Natural biological species are maintained by natural mechanisms, of genetic nature, able to close reproduction and are sustainable populations. Breeds and lines are maintained by artificial mechanisms of closed reproduction controlled by men. If the artificial mechanism doesn’t act crosses in between populations inside genetic species became possible and the biodiversity is lost. Also if breeders lose their interest in a breed or line, which is not
reproduced more disappears. So animal farms populations are in danger of extinction if they don’t present any interest for the breeders and disappear by crossing (4).

In wild biological species the criterion of number of adult animals in appreciating the risk of its extinction is a good one since the genetically closed reproduction suppose as a cause of population extinction the effects of the inbreeding. Inbreeding acts in animal artificial populations in the same way and the number criterion in appreciating their extinction risk schooled not be excluded (5).

**New opinions concerning criteria and degrees of risk in farm animal populations**

The idea of the extinction risk is now extended to the artificial populations of genetic species in culture (strains in microbiology, sorts and varieties in vegetables and breeds and lines in farm animals) as well (7). Doesn’t matter the numeric criterion mentioned above was accepted by FAO, the word organization in charge with the watch of natural and artificial populations at risk, requirements for more criteria of classifying the degree at risk in artificial populations have been claimed. Criteria and degrees of extinction risk in farm animal population things aren’t satisfactory. FAO already accepted as a new criterion the speed of decrease of number in artificial populations (7). That is not enough. The fact that genetic identity of artificial populations is not protected by natural mechanism of closed reproduction is ignored. Also is ignored the existing relation between animal industry and market requirements which are changeable. Crossbreeding is a permanent danger for the farm animals’ biodiversity.

Paying attention to the farm animal populations characteristics and choosing among different proposals by authors implicated in this problem, as criteria of gradation the risk states in artificial populations has to be proposed (4) (7):

- The contribution of each artificial population (breed or line) to the market consistency. That is expressed in its genetic grading up improvement program, which could be good or wrong;
  - The increasing or declining trend of livestock of the population;
  - The number of adult females;
  - The number of families of male genitors to which they are pertaining to,
  - Inbreeding coefficient or the rhythm of consanguinity.

Based on these criteria the next classes of risk states have to be identified:

- Active populations, which are efficiently producing for market, have a closed reproduction based on registering books and are submitted to a good improvement program;
- Safe populations, having economic utility, a grate not decreasing livestock, are in closed reproduction by territorial insulation and are in passive state having no improvement program;
- Vulnerable populations, having uncertain relations on the market, have a slowly decreasing livestock, doesn’t matter if they have or not improvement program;
- Populations in danger, with a fast decrease of their livestock, have less than 6 male genitors’ families got to 100 – 1000 adult female stock;
- Populations in critical state having less than 100 adult females and less than 4 active males;
- Population in construction as new ones or in reconstruction after extinction, by identifying needed individuals and building up the required family structure.

Compared to the classification proposed by FAO (1), that is common for natural and artificial biological populations there are some major differences able to approach the risk state classification criteria for artificial population to the closed reproduction peculiarities of
populations in culture. It must be said once more that the biological populations don’t exist without closed reproduction. This is the reason why among the criteria determining the level of risk of extinction of populations in culture existence of improvement (grading up programs) that doesn’t admit infusion of genes from other population was included. Par consequence the Pinzgauer cattle breed in Romania and also the Carpathian Indigenous Buffalo breed, both of them being subject of conservation by DAGENE organization acting in the Danube region (2), could be included in the group of populations in safety but not in the group of active populations because they don’t dispose of the needed herdbook of the grading up improvement programs. Out of that it results these two populations could be neglected and their vulnerability to increase in the future (3).

A second main difference is the one that FAO doesn’t mention as vulnerable populations the ones whose livestock decreases very fast, although that could easily happens, by crossing, even when the initial number of individuals in population was very big. So was the case of Merino sheep in Romania. After 1990 when the wool market failed down and merino sheep were crossed to the thick wool rams the Merino sheep in Romania got down from 40% up to quite nothing (3). Now there are up to 5 flocks of different Merino types. Each of them is in danger because of the low number of individuals. Many thin wool sheep population have disappeared.

Same thing happened 66 – 70 years ago with the Steep Gray Cattle which was replaced with European dual purpose breeds. If that time the local Steep Gray Cattle was in safety judging on its livestock, now it is in critical state and trails to rebuild it are in course (3).

**Peculiar cases**

In Romania after 1990 privatization of the Artificial Insemination Centers as commercial enterprises (instead of breeders’ cooperatives) and the dispersion of dairy cow livestock, determined a tremendous decrease of cattle biodiversity. Now in Romania there are only commercial animals most of them crosses of unknown origin. Reproduction is ensured mostly with occasional bulls and for artificial insemination imported semen is used (4).

The swine biodiversity was lost too. Before 1990 there were in Romania 6 research stations each of them selecting two or three breeds as Landrace, Large White, Durok or Hampshire. In the research Institute a very good, competitive paternal breed was created. All of them were privatized. The new owners because of lack of knowledge destroyed these values. Together with the breeds’ failure all the research activity was stopped. Very few is known now about two valuable local breeds, Mangalitsa having a very tasty thick layer of fat which is able for outdoor housing and Basna breed disposing of small precocious animals able to farrow before 1 year of age. Some pigs were imported with no good for biodiversity because they are commercial animals to be slaughtered (3).

In sheep the old local breeds used in a pastoral system are in safety but the modern breeds are in danger. All the modern breeds have less than 1000 heads of livestock. The only one active population is the pelts producing Karakul breed.

By tradition in horse breeding the studbook of each breed is maintained but the number of pedigree animals is very small, around 100 heads. All horse populations are in danger (3).

Concerning birds a big lost was the dissipation of a great collection of poultry breeds and of other species.

There are some funds allocated by the government for the animal biodiversity conservation, but it is a misunderstanding in using these funds. In totality these funds are used
for populations in danger or in critical state. At the same time no coordinated action is promoted to preserve genetic values as deep frozen semen, embryos or tissues.

CONCLUSIONS

Concerning the actual Breed at Risk Criteria officially accepted by FAO are strong objection. The number of individuals in the livestock of one breed is not able to guarantee the existence safety of one breed.

New criteria for estimating the risk of artificial population extinction would be the potential of a breed to satisfy market requirements, which is the best argument for a breed sustainability, and the speed of the livestock decreasing.

As degrees of risk in farm animals population are proposed:
- Active populations, which are efficiently producing for market, have a closed reproduction based on registering books and are submitted to a good improvement program;
- Safe populations, having economic utility, a grate not decreasing livestock, are in closed reproduction by territorial insulation and are in passive state having no improvement program;
- Vulnerable populations, having uncertain relations on the market, have a slowly decreasing livestock, doesn’t matter if they have or not improvement program;
- Populations in danger, with a fast decrease of their livestock, have less than 6 male genitors’ families got to 100 – 1000 adult female stock;
- Populations in critical state having less than 100 adult females and less than 4 active males;
- Population in construction as new ones or in reconstruction after extinction, by identifying needed individuals and building up the required family structure.

It must be said that animal farm biodiversity can’t exist without closed reproduction of artificial biological populations.

Conservation of breeds must include also sustainable breeds by keeping them as active breeds under selection pressure.

REFERENCES