

TERRESTRIAL VERTEBRATE SPECIES FROM THE THREE EDITIONS OF „THE RED BOOK OF THE REPUBLIC OF MOLDOVA”: LIMITING FACTORS AND PROTECTION MEASURES

Asea M. Timuş^{1,2,*}, Victoria Nistreanu²

¹ State Agrarian University of Moldova, Chisinau, Republic of Moldova

² Institute of Zoology, Academy of Sciences of Moldova, Chisinau, Republic of Moldova

Abstract

In the paper a short study history and analysis of 4 groups of terrestrial vertebrates (mammals, birds, reptiles and amphibians) from the four editions of „Red Book” are presented: 2 from soviet period (first edition of Moldavian SSR from 1978 and second edition of USSR from 1984) and 2 after the independence of the republic (second edition from 2001 and third one from 2015). The number of listed species in these editions are growing, in the third editions from 2015 being described 219 vertebrate animals, including 30 mammal species, 62 bird species, 9 reptile and 7 amphibian species. According to IUCN criteria the listed species are included in the following: vulnerable (VU) 45 species; endangered (EN) 20 species and critically endangered (CR) 43 species. The factors that provoked the species number decrease and the measures for preventing their disappearance are indicated for each species.

Keywords: Red Book, Republic of Moldova, terrestrial vertebrates

1. INTRODUCTION

The greatest richness of the Republic of Moldova has a natural origin: the forest and meadow, the soil and water, flora and fauna. In all the habitats there exists a valuable biodiversity from which the human population extracts agricultural, forestry, scientific, aesthetic, touristic, game and other assets, respectively gain economical and financial benefits. The most important factor that influence upon the natural resources is the anthropogenic one. Some elements of the millenary biological diversity on this territory, at least in the last hundred years, have begun to obtain special statutes: rare, vulnerable, endangered or disappeared species. However, in order to save the richness of flora and fauna, some legal measures (spontaneous or direct) have been taken over time, so the most well-known and important ones are presented in the paper.

Historical legislative sequences tending to protect the environment. The first "environmental" regulation with documentary evidence is known as the "Branîşte Law" dated from 1475, issued by the Prince Stefan cel Mare, who was not only the ruler of Moldova (1457-1504), but also a monopolist of local agricultural and forestry products, in particular: bee (wax and honey), fish (fish for trade and "majerit – tax for fish chariots") and tannery (skins and precious fur). In order to monopolize these products, the ruler banned by law and with precautionary measures and sanctions

the fishing, hunting, grazing and tree felling by the population for commercial purposes, without the consent of the owner.

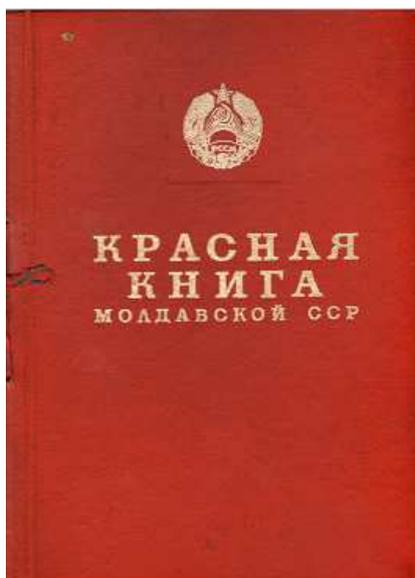
Although, according to modern concepts, the law did not approach the protection of the environment or some species of ecological or economic value, nevertheless by this law some "protected areas" were formed spontaneously and unplanned (Popescu, 2012). The Law of Braniste was taken over by other rulers, princes and emperors of countries and provinces, for example by Vlad Vintilă, who in 1523 issued "interdiction to the damage of nature"; Sigismund Bathory in 1588 "prohibited the hunting and cutting of forests from his estate in Alba Iulia"; Ștefan Tomșa in 1621 issued the "Law of Braniste in Popești"; Vasile Lupu wrote in 1646 the "Romanian Book of Learning"; Matthew Basarab in 1652 completed the law to warn that "no one should have any business, nor the forest cut, nor hunt, nor catch the fish"; Antioh Cantemir in 1706 drew up the "Focsani Convent that forbade the Wallachians to cut forests from Moldovian territory"; Gregory II Ghica in 1739 founded „the first regular forest service”; Dimitrie Cantemir made "Descriptio Moldavae" in 1751; Joseph II in 1786 adopted the first Romanian forest law or the Forest Code for Bucovina „Forest Order”; Alexandru Moruzi signed in 1794 the "Anaforaua for Codru, groves and meadows" and others.

Sequences about ecological education. The first sequences about ecological education in the republic are mentioned in the communication of Eduard Miller, infectious physician and scientific secretary of the Society of Naturalists and natural science amateurs of Bessarabia, published as a scientific article in 1912 in the third volume of society (Miller, 1912). In that address, E. Miller presents a general situation of fauna and flora exposed to extermination on Earth due to the anthropogenic factor, with an emphasis on the species of animals and plants considered "monuments of nature" in the Russian Empire. Finally, the author propose **committee** to be set up in Bassarabia with the obligation to contribute to: 1) spreading the consciousness and nature-friendly attitude towards the masses of the population, especially the younger generations - by publishing brochures of popularization, founding of unions for the protection of birds, plants, areas, etc.; 2) improving current legislation and developing new lows, taking into account the above-mentioned purpose, and supporting them until their adoption as normative acts; 3) collection of funds for the creation of reserves, sectors with the status of "national parks". This proposal was accomplished much later, namely in 1930, when the first regulation for the protection of natural monuments in Romania was established - Law No. 213 of 1930.

IUCN Red List. The general environmental issue at the planet level has continued to be approached in various countries on all continents, and after the founding of the UN, the development of the concept of environmental and biodiversity protection and implementation in practice has taken a historical dimension. In 1963, through the IUCN, the "Red List" as international normative act was drafted and launched, where the primary inventory of the species of animals and plants requiring urgent conservation from all over the world was presented. This list was and still is, as mentioned by some authors, the best indicator of the state of world biodiversity (Popescu, 2012). A member of the IUCN was also the USSR and we consider that instantly Moldovian SSR too, which in 1978 hosted the 14th General Assembly of the IUCN, held in the city of Ashgabat (Turkmenistan).

2. RESULTS AND DISCUSSION

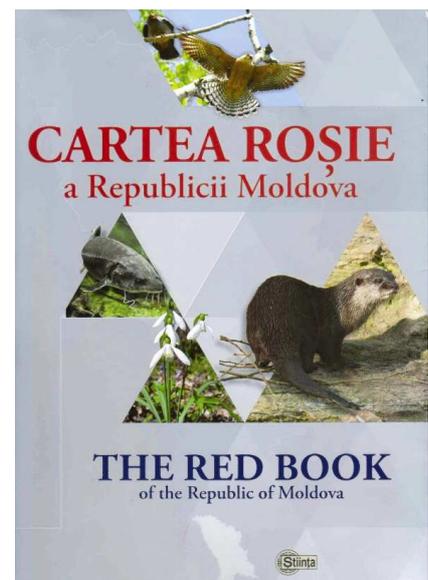
The Red Book of the USSR and Moldovan RSS. According to IUCN provisions, each member country was obliged to edit its own red lists of plant and animals species with the status provided in the general conceptions ratified by the member countries. The USSR respected this obligation and the first edition of the "Red Book of the USSR" (Krasnaya Kniga, 1978) was launched within the General Assembly of IUCN in Ashgabat. The Soviet republics were included in the international environmental and biodiversity policy, so in the Moldovan SSR it was developed and published in 1978 the first edition of the "Red Book" in Russian, which in 2018 will celebrate the 40th Anniversary of the appearance (Averin et al., 1978). The "Red Book of the USSR / Moldovan SSR" event (fig. 1) was publicized in all medium and superior educational institutions, including the Agricultural Technical College from Svetlîi vill., Ceadâr-Lunga district, while one of the authors was in the third year student (1979-1980). The media coverage of the "Red Book of the USSR and Moldovan SSR" was part of the political and ecological education of the youth, because they were edited on an international event and, which is equally important, under a state order.



Ist edition from 1978



IInd edition from 2001



III^d edition from 2015

Figure 1. Red Book of the Republic of Moldova

We assume that almost all the circulation of the first edition of the Red Book of the USSR from 1978 was distributed to the participants in the General Assembly of the IUCN in Ashgabat because there are no copies in the book libraries in the republic. As a proof can also be considered almost immediate re-editing of the second edition of the "Red Book of the USSR" (Bannikov and Darevskiy 1984; Banikov et al., 1984; Flint and Potapov, 1984).

In the second edition of the "Red Book of the USSR", flora and fauna was exposed according to the 5 categories proposed by IUCN, namely: 1) species threatened with extinction and their saving is impossible without special measures; 2) species with high population density, but with rapid

number declining; 3) rare species which are currently not threatened with extinction, but are in limited number or on limited territory and can quickly disappear with influence of natural or anthropogenic factors; 4) species whose biology is insufficiently studied, their numbers and state are of concern, but the lack of information does not allow them to be included in the previous categories; 5) species restored by rescue measures and their condition are not of concern but require permanent surveillance and are not intended to be used for economic purpose.

The first edition of the "Red Book of the Moldovian SSR" appeared after the approval by the Soviet of Ministers of Moldovian SSR, through decision no. 88 of March 29, 1976 "On the foundation of Book of rare and endangered animal and plant species from Moldovian SSR" (Averin et al., 1978). In this edition 55 species were presented: 29 species of vertebrate animals (17 birds, 8 mammal and 4 reptiles species) and 26 higher plants species (tab. 1). After a period of about 10 years the list of rare and disappearing bird species increased to more than 40 species (Ganea and Zubcov, 1989).

The Red Book of the Republic of Moldova. After the first edition there was a significant period until the subsequent publication of this type of book, after 22 years or in 2001 (coordinator for animals Munteanu, 2001). The initiative for reviewing and re-editing the second edition of the "Red Book of the Republic of Moldova" was proposed by the National Ecological Institute of the Republic of Moldova. The Institute elaborated the Concept of Strategy for Biodiversity Conservation, approved in 1997 by the Department of Environmental Protection of the Republic of Moldova. The strategy was approved by the Ministry of Environment and Territorial Development and implemented by the Institute of Zoology and Botanical Garden (Institute) of the Academy of Sciences of Moldova. These fundamental scientific research institutions have intensified the work of investigations with reference to the critically endangered, endangered and vulnerable plants and animal species to be listed in the Red Book of the Republic of Moldova, second edition. The plant and animal species have been included under the state's protection in accordance with the relevant legislation, such as: the protection of the environment; Law of the animal kingdom; Law of protected areas; regulation of rare, vulnerable and endangered species from the Red Book; principles of the UN Conference from Rio de Janeiro (Agenda XXI, 1992) and the provisions of the Conventions, of International agreements that consider as primordial necessity of all the world's states to achieve stability and ecological balance for the conservation of the existing genofond of local species.

In the second edition of the "Red Book of the Republic of Moldova" published in 2001 in Romanian, 242 species were described: 116 animal species (75 vertebrate species: 14 mammal, 39 bird, 8 reptile, 1 amphibian and 12 fish and one cyclostomata species; 41 invertebrate species: 37 insect, 3 mollusc and 1 crustacean species) and 126 plant species (81 angiosperm, 16 lichenophyta, 10 bryophyta, 9 pteridophyta, 9 mycophyta, 1 gymnosperm species). In this edition there were included 187 species more than in the first edition: plus 87 animal and 100 plant species (tab. 1).

Table 1. Species of terrestrial vertebrate animals from the Red Book of the Republic of Moldova

| No | Order | Family | Species | USSR | MSSR | Republic of Moldova | | Status |
|---|-------------------------------|--------------------------|---|--------------------------------------|---------------------------------|---------------------|----------------|----------|
| | | | | 1984 | 1978 | 2001 | 2015 | |
| Class Amphibia – 13 species registered in the republic | | | | | | | | |
| 1. | Eucaudata (Anura) | Pelobatidae | <i>Pelobates fuscus</i> L., 1758 | - | - | + | + | CR |
| 2. | | Bufo | <i>Bufo bufo</i> L., 1768 | - | - | - | + | VU |
| 3. | | Discoglossidae | <i>Bombina bombina</i> L., 1761 | - | - | - | + | VU |
| 4. | | | <i>B. variegata</i> L., 1758 | - | - | - | + | EN |
| 5. | | Hylidae | <i>Hyla arborea</i> L., 1758 | - | - | - | + | VU |
| 6. | | Ranidae | <i>Rana dalmatina</i> Bonaparte, 1840 | - | - | - | + | VU |
| 7. | | | <i>R. temporaria</i> L., 1758 | - | - | - | + | VU |
| Total | 1 | 5 | 5 genera / 7 species | 0 | 0 | 1 | 7 (54%) | - |
| Class Reptilia – 14 species registered in the republic | | | | | | | | |
| 8. | Squamata | Lacertidae | <i>Eremias arguta</i> Pallas, 1773 | - | - | + | + | CR |
| 9. | | | <i>Podarcis taurica</i> Pallas, 1814 | - | - | - | + | EN |
| 10. | | Colubridae | <i>Zamenis longissimus</i> Laurenti, 1768 | + | + | + | + | EN |
| 11. | | | <i>Elaphe quatuorlineata</i> Lacépède, 1789 | - | - | + | + | CR |
| 12. | | | <i>Coluber jugularis</i> L., 1758 | - | + | + | - | - |
| 13. | | | <i>C. caspius</i> L., 1758 | - | - | - | + | EN |
| 14. | | | <i>Coronella austriaca</i> Laurenti, 1768 | - | + | + | + | EN |
| 15. | | | Viperidae | <i>Vipera ursini</i> Bonaparte, 1835 | - | - | + | + |
| 16. | | <i>V. berus</i> L., 1758 | | - | - | + | + | EN |
| 17. | | Testudina | Emididae | <i>Emys orbicularis</i> L., 1758 | - | + | + | + |
| Total | 2 | 4 | 8 genera / 10 species | 1 | 4 | 8 | 9 (64%) | - |
| Class Aves – 285 species registered in the republic | | | | | | | | |
| 18. | Suliformes | Phalacrocoracidae | <i>Phalacrocorax pygmeus</i> Pallas, 1773 | - | - | + | + | CR |
| 19. | Pelecaniformes | Ardeidae | <i>Ardeola ralloides</i> Scopoli, 1769 | - | - | + | + | EN |
| 20. | | | <i>Egretta alba</i> L., 1758 | - | + | + | + | EN |
| 21. | | | <i>Ardea purpurea</i> L., 1766 | - | - | - | + | VU |
| 22. | | | <i>Botaurus stellaris</i> L., 1758 | - | - | - | + | VU |
| 23. | | Pelecanidae | <i>Pelecanus onocrotalus</i> L., 1758 | - | - | + | + | EN |
| 24. | | | <i>P. crispus</i> Bruch, 1832 | - | - | + | + | CR |
| 25. | | Threskiornithidae | <i>Plegadis falcinellus</i> L., 1766 | - | - | + | + | CR |
| 26. | | | <i>Platalea leucorodia</i> L., 1758 | - | - | + | + | CR |
| 27. | Ciconiformes | Ciconiidae | <i>Ciconia nigra</i> L., 1758 | - | - | + | + | CR |
| 28. | | | <i>C. ciconia</i> L., 1758 | - | - | - | + | VU |
| 29. | Anseriformes | Anatidae | <i>Cygnus olor</i> Gmelin, 1789 | - | + | + | + | VU |
| 30. | | | <i>C. cygnus</i> L., 1758 | - | + | + | + | VU |
| 31. | | | <i>Aythya nyroca</i> Guld, 1770 | - | - | + | + | CR |
| 32. | | | <i>Anser erythropus</i> L., 1758 | - | - | - | + | VU |
| 33. | | | <i>Branta ruficollis</i> Pallas, 1769 | - | - | - | + | VU |
| 34. | | | <i>Netta rufina</i> Pallas, 1773 | - | - | - | + | VU |
| 35. | | | <i>Oxyura leucocephala</i> Scopoli, 1769 | - | - | - | + | CR |
| 36. | | | <i>Tadorna tadorna</i> L., 1758 | - | - | - | + | VU |
| 37. | | | <i>T. ferruginea</i> Pallas, 1764 | - | - | - | + | VU |
| 38. | | | Accipitriformes (Falconiformes) | Accipitridae | <i>Pernis apivorus</i> L., 1758 | - | + | + |
| 39. | <i>Milvus milvus</i> L., 1758 | - | | | - | + | + | CR |
| 40. | <i>M. migrans</i> L., 1758 | - | | | - | - | + | VU |

| | | | | | | | | |
|---|------------------------------------|------------------|---|----------|-----------|-----------|--------------------------|----------|
| 41. | | | <i>Haliaeetus albicilla</i> L., 1758 | + | + | + | + | CR |
| 42. | | | <i>Neophron percnopterus</i> L., 1758 | - | + | + | + | CR |
| 43. | | | <i>Circaetus gallicus</i> Gmelin, 1788 | + | + | + | + | CR |
| 44. | | | <i>Circus cyaneus</i> L., 1766 | - | - | + | + | CR |
| 45. | | | <i>C. macrourus</i> Gmelin, 1771 | - | - | + | + | CR |
| 46. | | | <i>C. pygargus</i> L., 1758 | - | - | + | + | CR |
| 47. | | | <i>Aquila pomarina</i> Brehm, 1831 | - | + | + | + | CR |
| 48. | | | <i>A. clanga</i> Pallas, 1811 | - | + | + | + | CR |
| 49. | | | <i>A. heliaca</i> Savigny, 1809 | + | + | + | + | CR |
| 50. | | | <i>A. rapax</i> Temminck, 1828 | + | + | + | + | CR |
| 51. | | | <i>A. chrysaetos</i> L., 1758 | + | + | + | + | CR |
| 52. | | | <i>Hieraaetus pennatus</i> Gmelin, 1778 | - | + | + | + | CR |
| 53. | | Pandionidae | <i>Pandion haliaetus</i> L., 1758 | + | + | + | + | CR |
| 54. | | Falconidae | <i>Falco naumanni</i> Fleischer, 1818 | - | - | + | + | CR |
| 55. | | | <i>F. cherrug</i> Gray, 1834 | + | + | + | + | CR |
| 56. | | | <i>F. peregrines</i> Tunstal, 1771 | - | - | - | + | CR |
| 57. | | | <i>F. vespertinus</i> L., 1766 | - | - | - | + | VU |
| 58. | | Rallidae | <i>Tetrax tetrax</i> L., 1758 | - | - | + | - | - |
| 59. | | | <i>Porzana porzana</i> L., 1766 | - | - | - | + | VU |
| 60. | Gruiformes (Otidiformes) | | <i>P.pusila</i> Palla, 1776 | - | - | - | + | VU |
| 61. | | | <i>P. parva</i> Scopoli, 1769 | - | - | - | + | VU |
| 62. | | | <i>Crex crex</i> L., 1758 | - | - | + | + | EN |
| 63. | | Otididae | <i>Otis tarda</i> L., 1758 | - | + | + | + | CR |
| 64. | | Recurvirostridae | <i>Recurvirostra avosetta</i> L., 1758 | - | - | - | + | VU |
| 65. | | | <i>R. himantopus</i> L., 1758 | - | - | - | + | VU |
| 66. | Charadriiformes | Haematopodidae | <i>Haematopus ostralegus</i> L., 1758 | - | - | - | + | VU |
| 67. | | Glareolidae | <i>Glareola pratincta</i> L., 1766 | - | - | - | + | VU |
| 68. | | Scolopacidae | <i>Gallinago media</i> Latham, 1787 | - | - | - | + | VU |
| 69. | Columbiformes | Columbidae | <i>Columba oenas</i> L., 1758 | - | - | + | + | CR |
| 70. | | Tytonidae | <i>Tyto alba</i> Scopoli, 1769 | - | - | + | + | VU |
| 71. | Strigiformes | Strigidae | <i>Bubo bubo</i> L., 1758 | - | + | + | + | CR |
| 72. | | | <i>Asio flammeus</i> Pontoppidan, 1763 | - | - | + | + | CR |
| 73. | Coraciiformes | Coraciidae | <i>Coracias garrulous</i> L., 1758 | - | - | - | + | VU |
| 74. | Piciformes | Picidae | <i>Picus viridis</i> L., 1758 | - | - | + | + | EN |
| 75. | | | <i>Dryocopus martius</i> L., 1758 | - | - | + | + | EN |
| 76. | | | <i>D. medius</i> L., 1758 | - | - | - | + | VU |
| 77. | Paseriformes | Turdidae | <i>Monticola saxatilis</i> L., 1766 | - | - | + | + | CR |
| 78. | | Muscicapidae | <i>Ficedula hypoleuca</i> Pallas, 1764 | - | - | - | + | VU |
| 79. | | | <i>Luscinia svecica</i> L., 1758 | - | - | - | + | EN |
| 80. | | Fringillidae | <i>Serinus serinus</i> L., 1758 | - | - | + | - | - |
| 81. | | Alaudidae | <i>Melanocorypha calandra</i> L., 1766 | - | - | - | + | VU |
| Total | 12 | 24 | 46 genera / 64 species | 7 | 17 | 39 | 2 (22%) | - |
| Clasa Mammalia – 74 species registered in the republic | | | | | | | | |
| 82. | Insectivora | Soricidae | <i>Crociodura leucodon</i> Hermann, 1780 | - | - | + | + | VU |
| 83. | | | <i>Neomys anomalus</i> Cabrera, 1907 | - | - | - | + | EN |
| 84. | | | <i>N. fodiens</i> Pennant, 1771 | - | - | - | + | CR |
| 85. | Chiroptera | Rhinolophidae | <i>Rhinolophus ferrumequinum</i> Schreber, 1774 | - | + | + | + | CR |
| 86. | | | <i>Rh. hipposideros</i> Bechshtein, 1800 | - | - | - | + | EN |
| 87. | | Vespertilionidae | <i>Barbastella barbastellus</i> Schreber, 1774 | - | - | + | + | CR |

| | | | | | | | | |
|--------------|------------------|--|--|----------|----------|-----------|---------------------|----------------|
| 88. | | | <i>Myotis bechsteinii</i> Kuhl, 1817 | - | - | + | + | CR |
| 89. | | | <i>M. blythii</i> Tomes, 1857 | - | - | - | + | VU |
| 90. | | | <i>M. dasynceme</i> Boie, 1825 | - | - | - | + | EN |
| 91. | | | <i>M. daubentonii</i> Kuhl, 1817 | - | - | - | + | VU |
| 92. | | | <i>M. myotis</i> Borkhausen, 1797 | - | - | - | + | CR |
| 93. | | | <i>M. mystacinus</i> Kuhl, 1819 | - | - | - | + | VU |
| 94. | | | <i>M. nattereri</i> Kuhl, 1817 | - | - | + | + | CR |
| 95. | | | <i>Nyctalus lasiopterus</i> Schreber, 1780 | + | + | + | + | CR |
| 96. | | | <i>Pipistrellus kuhlii</i> Kuhl, 1819 | - | - | - | + | VU |
| 97. | | | <i>P. nathusii</i> Keyserling et Blasius, 1839 | - | - | - | + | EN |
| 98. | | | <i>Plecotus auritus</i> L., 1758 | - | - | - | + | EN |
| 99. | | | <i>P. austriacus</i> Fischer, 1829 | - | - | - | + | VU |
| 100. | | | <i>Vespertilio murinus</i> L., 1758 | - | - | + | + | CR |
| 101. | Rodentia | Sciuridae | <i>Spermophilus citellus</i> L., 1766 | - | - | + | + | VU |
| 102. | | | <i>S. suslicus</i> Guldenstaedt, 1770 | - | - | - | + | VU |
| 103. | | Gliridae | <i>Myoxus glis</i> L., 1766 | - | - | - | + | VU |
| 104. | | Cricetidae | <i>Cricetus cricetus</i> L., 1758 | - | - | - | + | VU |
| 105. | | Muridae | <i>Micromys minutes</i> Pallas, 1771 | - | - | - | + | VU |
| 106. | Carnivora | Mustelidae | <i>Martes martes</i> L., 1758 | - | + | + | + | VU |
| 107. | | | <i>Mustela erminea</i> L., 1758 | - | + | + | + | VU |
| 108. | | | <i>M. lutreola</i> L., 1758 | - | + | + | + | CR |
| 109. | | | <i>M. eversmanni</i> Lesson, 1827 | - | + | + | + | CR |
| 110. | | <i>Lutra lutra</i> L., 1758 | - | + | + | + | VU | |
| 111. | Felidae | <i>Felis silvestris</i> Schreber, 1777 | - | + | + | + | VU | |
| Total | 4 | 9 | 16 genera / 30 species | 1 | 8 | 14 | 30 (40 %) | VU-45 |
| In total | 17 orders | 25 families | 48 genera | 9 | 29 | 62 | 108 | CR-43 EN-20 |

Note: VU – Vulnerable; EN – Endangered; CR – Critically endangered (according to criteria from the IIIrd edition of „Red Book of the Republic of Moldova”).

According to the Strategic Plan for the Conservation of Global Biodiversity for 2011-2020, approved at the 10th Conference of the Parties to the UN Convention on Biological Diversity (CBD), to which the Republic of Moldova is a member, in 2015 was published the third edition of the "Red Book of the Republic of Moldova".

In the third edition of the "Red Book of the Republic of Moldova" (fig. 1), published in 2015 in Romanian and English, 427 species were described: 219 animal species (134 vertebrate species: 30 mammals, 62 birds, 9 amphibians, 9 reptiles, 23 fish and one cyclostomata species; 85 invertebrate species: 80 insects, 3 mollusks, one crustacean and one collembolan species) and 208 plant species (150 angiosperm, 14 pteridophyta, 14 basidiomycota, 14 ascomycota, 8 algae, 7 bryophyta, 1 gymnosperm species) (coordinator for animals Toderaş, 2015). In the third edition there are included 185 species more than in the second edition (103 animals and 82 plants) and 372 species more than in the first edition (190 animals and 182 plants) (tab. 1).

It can be seen that in the third edition from 2015 108 species of terrestrial vertebrates are included: mammals – 30, birds – 62, reptiles – 9, amphibians – 7. Compared to the first two editions of the Red Book of the Republic Moldova, the species number is increasing as follows: Mammals with 16

species versus second and 22 with first edition; Birds with 23 species compared to the second edition and 45 with the first; Reptiles with 1 species compared to the second edition and 5 with the first; Amphibians with 6 species more than in the second edition. As to the statuses of these species – vulnerable (VU), endangered (EN) and critically endangered (CR) – we mention that there are 45 VU, 43 CR and 20 EN species. Among the classes the species are listed as follows: Mammals 15 VU, 5 EN and 10 CR; Birds 25 VU, 8 EN and 29 CR; Reptiles 0 VU, 6 EN and 3 CR; amphibians 5 VU, 1 EN and 1 CR.

When making a comparison of all terrestrial vertebrate species registered in the Republic of Moldova with those included in the "Red Book" the ratio of protected species can be revealed: Mammals – total 74 species, 30 of which are under protection, representing 40%; Birds – in total 285 species, of which 62 are under protection or 22%; Reptiles – in total 14 species, of which 9 are under protection, respectively 64%; Amphibians – in total 13 species, 7 of which are protected, representing 54%.

The main **factors** that reduce the number of terrestrial vertebrate animal populations are:

1) **anthropogenic** – destruction of forest, aquatic, rocky, meadow habitats and of forest protection belts, deforestation and cutting of hollow old trees, forest landscaping, grazing, soil pollution, extensive agriculture and excessive use of pesticides (control of pest insects and rodents), disturbing the hibernation and breeding habitats (bird nests, bat roosts, animal burrows), capture of attractive individuals due to lack of ecological education, unorganized tourism, hostile attitude towards some animals (bats, reptiles, amphibians, some micromammals), lack of migration corridors, poaching and accidental hunting, campaigns for the destruction of the ichthyophagous birds, of mammals considered harmful (ground squirrel species, otter), burning of reed, stubble and fallow ground, construction of dams, appearance of wind turbines, collision with the high-voltage grid, road traffic killing (martens, snakes, frogs);

2) **biological** – increasing of some predator species number (fox), of stray dog number that can be met even in wild environment, of invasive species (golden jackal) that are concurrent for native species, decreasing of prey species that serve as food resources for carnivorous mammals, prey birds, snakes etc., climatic conditions fluctuation toward aridization, local flooding, reduction of nesting places for terrestrial and aquatic species, hybridization, interspecific competition.

The **measures** for the protection of mammals with special status in the Republic of Moldova are: monitoring the status of the populations; protection of hibernation and reproduction habitats; organizing micro-reservations for breeding; conservation of natural habitats, especially of meadows and steppes; prohibition of forest management; interdiction of cutting secular and hollow trees; reducing pesticide use in agriculture and forestry; regulating the grazing in areas with vulnerable and endangered populations; creating artificial conditions for shelter; ecological education of population; cultivating alfalfa on hats; banning the burning of stubble and reed; fight against poaching by applying the legislation in force, etc.

The **measures** for the protection of birds with special status in the Republic of Moldova are: protection of colonies through prohibition of cutting of massive trees from the secular forests, especially during the breeding season; restoration of aquatic habitats, especially those with

abundant fish resources; the elimination of fishing nets; fight against poaching, especially of raptors, by applying the legislation in force; prohibiting the burning of the reeds and the brood; preventing the chemical pollution of water; reducing the disturbance generated by spontaneous agricultural and touristic activities; installation of sound signals on high voltage electrical networks; organizing platforms, straw sites and artificial nests for breeding; creating snake farms (for *Circaetus gallicus* Gmelin, 1788); prohibition of the destruction of ground squirrel colonies (considered pests of plants) from the breeding sectors of the Saker falcon (*Falco cherrug* J.E. Gray, 1834) and of the ravens; reproduction in farms with subsequent releasing in wild habitats (*Falco naumanni* Fleischer, 1818); installation of nest protection indicators during agricultural works (*Asio flammeus* Pontoppidan, 1763).

Protection **measures** for reptiles and amphibians with special status: creation of new protected areas; reducing the pollution of aquatic basins; protection of breeding sites; grassland regulation; restoration and repopulation of steppe sectors, potential for survival of the species *Vipera ursini* Bonaparte, 1835; protection of the Prut and Nistru meadows; education of the human population through the dissemination of ecological knowledge.

The staff of scientific researchers that participated at the elaboration of the Red Book of Moldova was represented by: Ist edition from 1978 (without specification) – Averin Iu.V., Ganea I.M., Lozan M.I. and Tofan V.E.; IInd edition from 2001 – Averin Iurii (one mammal species and 8 bird species), Corcimari Nicolae (3 mammal and 5 reptile species), Andreev Sergiu (6 bat species), Ganea Ion (8 bird and 2 reptile species), Munteanu Andrei (4 mammal and 8 bird species), Uspenschi Gherasim (one mammal and 4 bird species), Zubcov Nicolae (11 bird species), Țurcan Vladimir (one reptile species), Cozari Tudor (one amphibian species); IIIrd edition from 2015 – Nistoreanu Victoria (16 mammal species), Andreev Sergiu (12 mammal species), Savin Anatolie (10 mammal species), Larion Alina (one mammal species), Munteanu Andrei (4 mammal and 17 bird species), Cojan Constantin (8 bird species), Sochircă Natalia (5 bird species), Bogdea Larisa (6 bird species), Zubcov Nicolae (17 bird species), Jurminschi Serghei (9 bird species), Țurcan Vladimir (9 reptile species), Cozari Tudor (7 amphibian species).

3. CONCLUSIONS

The terrestrial vertebrate fauna of the Republic of Moldova continues to be exposed to the various limitative factors, among which the anthropogenic ones dominate. Due to these influences, the number of species included in the "Red Book of the Republic of Moldova" increases with each edition, namely: in 1978 - 29 species, in 2001 - 62 species and in 2015 - 108 species. The factors that provoke the assignment rarity criteria (VU, EN, CR) and measures to prevent the decreasing or disappearance of mammal, bird, reptile and amphibian species are stipulated for each species, so they are only to be implemented.

4. REFERENCES

- Averin, I.V., Ganea, I.M., Lozan, M.I., Tofan, B.E. (1978). Opisanie vidov jivotnyh iz Krasnoi Knighi Moldavskoi SSR. V kn.: Redkie i nahodeasheisea pod ugrozoi ischeznovenia vidov jivotnyh I rastenii Moldavskoi SSR. Ordena Drujby narodov izdatelstvo „Cartea Moldovenească”, Kishinev, 1-56.

- Bannikov, A.G., Darevskiy, I.S. (1984). Amfibii i reptilii. V kn.: Krasnaia kniga SSSR: Redkie i nahodeasheisea pod ugrozoi isceznovenia vidov jivotnyh I rastenii. Tom 1, 2-e izd. Moskva. Lesnaia promyshlenosti, 171-201.
- Bannikov, A.G., Sokolov, V.E. I drugie (1984). Mlekopitaiusheisea. V kn.: Krasnaia kniga SSSR: Redkie i nahodeasheisea pod ugrozoi isceznovenia vidov jivotnyh I rastenii. Tom 1, 2-e izd. Moskva. Lesnaia promyshlenosti, 9-97.
- Flint, B.E., Potapov, R.L. (1984). Ptitsy. V kn.: Krasnaia kniga SSSR: Redkie i nahodeasheisea pod ugrozoi isceznovenia vidov jivotnyh I rastenii. Tom 1, 2-e izd. Moskva. Lesnaia promyshlenosti, 98-170.
- Ganea, I.M., Zubkov N.I. (1989). Redkie i iscezaiushie vidy ptits Moldavii. Kishinev „□tiin□a”, 150 s.
- Krasnaia kniga SSSR (1978). Redkie i nahodeasheisea pod ugrozoi isceznovenia vidov jivotnyh I rastenii (https://ru.wikipedia.org/wiki-Красная_книга_СССР, vizitat în 01-22 mai 2017)
- Miller, Eduard (1911-1912). Obi ohrane paniatnikov prirody. Trudy Besarabskogo Obshestva estestvoispătatelei. III, 181-205.
- Munteanu, Andrei (2001). Partea a II-a Animale (redactor științific-coordonator). În: „Cartea Roșie a Republicii Moldova”, ediția a II-a. Chișinău, Știința, 147-287.
- Popescu, Gh. Cristian (2015). Dreptul mediului și politici de mediu. Editura „Semne”, București, 2012, 390 pp.
- Toderaș, Ion (2015). Partea a II-a Animale (autor-coordonator). În: „Cartea Roșie a Republicii Moldova”, ediția a III-a. Chișinău, Știința, 233-490.