

## Population dynamics and age structure of Mouflon in Nakhchivan autonomous republic of Azerbaijan

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### Abstract

In the period of 2018-2023, we conducted a study of the population structure of the Asian mouflon in the territory of the Nakhchivan Autonomous Republic. The average annual number of mouflon was 500 heads. The age structure of the species was represented by 173 males (34.6%), 140 females (28%), 116 cubs (23.2%), and 74 (14%) young animals. The average five-year number of pregnant females was 140, and the average five-year number of lambs was 116, and the ratio of the five-year average birth index was 82%. The average population density of Asian mouflon was 5 heads per 1000 hectares. The obtained results suggest that the organization of protection works in the area had a positive effect on the population of the species. Mouflon habitat, distribution areas, appearance and population size. A subspecies of *Ovis orientalis* Gmelin, 1774 (*Ovis orientalis gmelinii* Blyth, 1851) is distributed in the territory of Nakhchivan Autonomous Republic.

**Keywords:** Nakhchivan Autonomous Republic, *Ovis orientalis*, population density, age structure, birth, death, life expectancy

### Introduction

Taxonomic assessment. Species belonging to the genus *Ovis* in the world are the Arkhaly sheep (*Ovis ammon* Linn., 1758) living in Asia, the Snow sheep - *Ovis nivicola* Escholtz, 1829 living in the northeast of Russia, the Bighorn sheep - *Ovis canadensis* Shaw, 1824 living in North America, the Thin-horned sheep - *Ovis dalli* Nelson, 1884, the Mouflon sheep - *Ovis orientalis* Gmelin, 1774 and the Ural sheep - *Ovis vignei* Blyth, 1841 (Guliyev SM 2000) [3]. Asian mouflon (*Ovis orientalis* Gmelin, 1774) - distributed only in the South Caucasus. The distribution of Asian mouflon in Azerbaijan is limited to the territories of Nakhchivan MR. Currently, mouflons are found in small groups in the surrounding areas of Ardych mountain in Sharur district, Garagush mountain of Kangarli district, Gilanchay, Paragachay, Nasirvaz, Kotan, Ganza, Nus-Nus valleys of Ordubad, Alinchachay, Darelik, Ilandag, as well as Darelayaz and Zangezour ranges of Julfa district. Small populations were also observed in the territory of Sadark region (Mammadov AF. 2016a [5], 2016b [6], 2017; Red Data Book of the Republic of Azerbaijan 2023 [13]; Talibov TH *et al.* 2007, 2009) [17].

This area, one of the oldest places of human settlement, also played an important role in the domestication of wild species. In wild prairie sheep, as in domestic sheep, two mitochondria were found to be in the same group as one of the DNA haplotype groups. And this suggests that the mouflon is highly likely to be the ancestor of modern domestic sheep (Hiendleder, S. *et al.* 2022) [10].

Due to its richness and sensitivity of biological diversity, most areas of the Nakhchivan Autonomous Republic are included in one of the priority corridors of the Caucasus ecoregion. Apart from the Asian mouflon, other two-toed species such as *Capra aegagrus* Erxleben, 1777 and *Sus scrofa* Linnaeus, 1758 are also widely distributed here (Mammadov AF *et al.* 2019) [8].

The main objective of the study was to determine the age and sex structure, productivity, stocking, habitats and

distribution areas of the Asian mouflon population. The implementation of the census allowed to estimate the current range and population density of this subspecies with great reliability.

### Materials and methods

Materials for this work were collected during field expeditions. The research covered all seasons of 2019-2023. Basic materials on the ecology of mouflons were collected during 90-120 expedition days per year. A 1:100,000 topographic map was used to determine the distribution zones of animals within the autonomous republic. Animal counting was done visually. 10-22x50 binoculars, Canon Eos 600D camera, Canon with two different lenses - 75-300 mm and 18-55 mm, 1.4x Tampon teleconverter and Swarovski 20x60 telescope were used during observations. Altitudes and geographical coordinates were determined using a GPS navigator, based on the literature on the age difference of animals (Çanakçioğlu and Mol 1996 [2]; Turan 1987). To determine annual growth, number dynamics, sex-age composition and fertility index, we used generally accepted methods (Kuzyakin *et al.* 1990 [4]; Rusanov YaS. 1973 [14]; McDonald, L.L. 2000) [9]. Mathematical calculations were made using the measurement/point-based measurement method (Oğurlu 2001, 2003) [11, 12]. In order to specify the current numerical status of the species, the report data of the Ministry of Ecology and Natural Resources of Nakhchivan Autonomous Republic was also used.

### Results

A comparison of the distribution areas of mouflon in individual districts of Nakhchivan Autonomous Republic and their mountainous areas shows that according to the number of animals and the size of the population, the mountainous areas of Babek-Julfa district take the first place, and the Ordubad mountains take the second place. The territories of Sadarak-Sharur-Kangerli and Shahbuz districts come next (Fig 1).



**Fig 1:** Female mouflon and its distribution area in the autonomous republic

Looking at the table, we see that the largest number of mouflons was in 2023 (579 individuals). The lowest number of animals by year was in 2021 (400 heads) (table).

**Table 1:** The number of mouflons for the years 2019-2023

Observation	Sexual characteristics of observed individuals								Σ
	Age composition of a male individual				Female, labs and juveniles				
	2-4	5-9	>10	To	Female	Labs	Juveniles	To	
2019	64	78	43	185	113	96	83	292	477
2020	76	33	67	176	186	133	68	387	563
2021	46	93	26	165	93	86	56	235	400
2022	65	88	57	210	111	98	66	275	485
2023	36	63	26	125	196	165	93	454	579
Total	287	355	219	861	699	578	366	1643	2504

Looking at the age composition of male individuals by year, the highest indicator in the 2-4 age group is 76 in 2020, and the lowest is 36 in 2023; Among the 5-9 age group, the highest indicator is 93 in 2021, the lowest number is 33 in

2020; In the age group of 10 years and older, the highest number of individuals was 67 in 2020, and the lowest number was 26 in 2023 (Fig. 1).

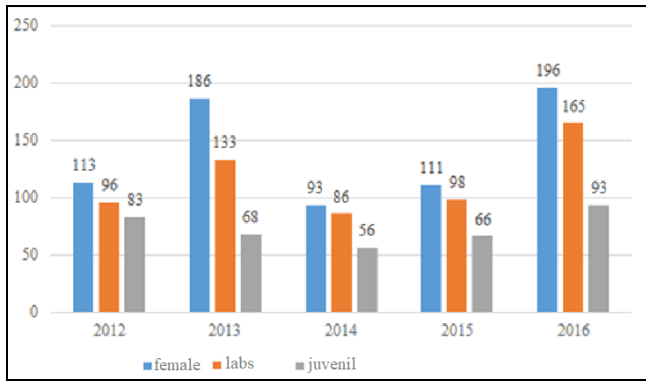


Fig 1: Number of mouflon sheep by years and age composition

Looking at the dynamics of the number of females, labs and juvenil individuals of the species over the years, the largest number of females was 196 in 2023. The lowest number was recorded in 2021, 93 heads.

The number of lambs born was 165 in 2023, and the least number was 96 in 2019. Looking at the dynamics of the number of juvenils by year, the highest number was 93 in 2021, and the lowest number was 56 in 2021 (Fig. 2).

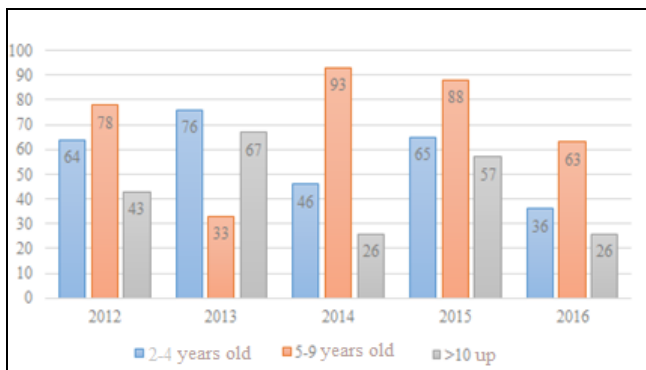


Fig 2: Mouflon sheep's teeth, cubs and young individuals number by years

Mouflon hatching percentage by year was 85% in 2019, 71.5% in 2020, 92.5% in 2021, 88.3% in 2022, and 84.2% in 2023.

Although the number of female sheep was the least in 2019, the highest percentage of lambs was this year (113:96; 92.5%). Despite the highest number of females in 2023 (196:165 head) and 2020 (186:133 head), the percentage of cubs was at the lowest level (2020, 71%; 2016, 84%).



Pict 2: Mouflons with their labs

**Migration**

Two forms of migration are observed in mouflons, horizontal, which is related to changing pastures during the day, moving to night and drinking places, and vertical migrations related to the second season. Vertical migration is more typical. Since the winters in this area are very harsh, mouflons gather from the upper zones to the southern areas of the foothills and spend the winter. In spring and summer, they climb to the upper zones.

Daily and seasonal activity. Mouflons are active in two phases during the summer. This activity occurs in the morning and evening hours. Animals rest from 10-11 to 17-18. Seasonally, the most activity is autumn, followed by winter and spring. The least activity is observed in summer.

**Nutrition**

No specific research work has been carried out on the nutrition and diet of Asian mouflon. In connection with this issue, the information provided on the feeding of mouflons in the territory of Armenia is of a general nature. Mouflons in Azerbaijan use 71 types of plants belonging to 23 families. In spring, herbaceous plants occupy the main place in their diet. In the summer, there is a wide selection of fodder plants in terms of quantity and quality. In the autumn months, the mouflon's diet becomes relatively weak. When a thick snow cover falls, animals can dig through the snow and tear the fodder plants from the frozen mass with great difficulty.

**Reproduction**

Mating between mouflons in the Lesser Caucasus started from the end of November until the beginning of January. Sheep of mating age males and females live in herds of 10, 15 or 20 together. In the spring, when birth is approaching, males separate from the herd by dividing into small groups of twos, threes or threes (Red Data Book of the Republic of Azerbaijan 2023) [13].

Lambs were born from the end of April to the end of May. A ewe sometimes gives birth to two lambs. Lambs move immediately after birth. A few days after birth, they are mobile enough to follow their mother. The sex and age composition of mouflons for the study period is given in the table below.

Flock formation and herd coefficient. Depending on the seasons of the year, the size of mouflon herds varies. Towards the end of autumn, the herds get bigger. Although the mating period is over, the autumn flocks do not change in size until the spring. The herd coefficient of Asian mouflon in Azerbaijan is 8.9 heads on the total area (on average).

**Enemies, diseases, parasites and food partners**

Mouflon's enemies are mainly large wild predatory mammals (wolf, brown bear, leopard, birds of prey). The most dangerous and terrible of the negative factors is broconerism. Diseases and parasites of mouflons are the same as domestic sheep (pasteurellosis, pleuropneumonia, paratyphoid, necrobacillosis, etc.). 20-21 types of parasitic worms and 2 types of ectoparasites - ticks were found in mouflons (Asadov, 1960 d) [1]. The main anthropogenic factor preventing the increase in the number of mouflons is the encroachment of their pastures by domestic animals (sheep, goats, cattle).

Studies of wild animal populations, whose number is decreasing or in danger of extinction, have been carried out for 50 years in the autonomous republic. Especially with the adoption of the CITES Convention, the interest in endangered species has increased, and serious measures are being taken to restore these species (Shackleton DM. 1968) [15].

Wild animals are the main part of biological diversity in our country. Among these species, herbivorous mammals have an important importance in terms of ecosystem sustainability. In the last 50-60 years, most wild animals in our country have faced the threat of extinction due to habitat degradation, illegal hunting and other reasons. In this regard, a number of protective measures have been developed.

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### References

- Asadov SM. Helminth fauna of ruminants of the USSR and its ecological-geographical analysis. Baku: Publ. of the Academy of Sciences of the Azerbaijan USSR, series Biol. and 1973№1,1960, 48–51.
- Çanakçioğlu H, Mol T. Wild Animals Information. Istanbul: Istanbul University Faculty of Forestry Publication,1996:440:550.
- Guliyev SM. Aziatskii muflon *Ovis orientalis* Gmelin [Asiatic mouflon *Ovis orientalis* Gmelin]. In: Gadjiyev DB, Rakhmatulina IK, editors. *Zhivotnyi mir Azerbajana* [Animal life of Azerbaijan: Vertebrates]. Elm,2000:3:613–6.
- Kuzyakin VA, Chelintsev NG, Lomanov IK. Metodicheskiye ukazaniya po organizatsii, provedeniyu i obrabotke dannykh zimmego marshrutnogo ucheta okhotnich'ikh zhivotnykh v RSFSR (s algoritmami rascheta chislennosti). Moscow, 1990. Russian.
- Mammadov AF. Fauna of Nakhchivan Autonomous Republic. News of the Nakhchivan Branch of the National Academy of Sciences of Azerbaijan. A series of natural and technical sciences,2016:12(13):205–18. Azerbaijani.
- Mammadov AF. Fauna of small in number terrestrial vertebrates of the Nakhchivan Autonomous Republic. News of the Nakhchivan Branch of the National Academy of Sciences of Azerbaijan. A series of natural and technical sciences,2016:13(4):225–34. Azerbaijani.
- Mammadov AF. The origin and phylogenetic branching of mammalian fauna (Mammalia), distributed in the Nakhchivan Autonomous Republic. News of the Nakhchivan Branch of the National Academy of Sciences of Azerbaijan. A series of natural and technical sciences,2017:13(4):190–8. Azerbaijani.
- Mammadov AF, Bayramov AB. Population structure of Bezoar goat in Nakhchivan Autonomous Republic of Azerbaijan. *Acta Biologica Sibirica*,2019:5(4):175–9.
- McDonald LL. Quantitative methods in wildlife monitoring. In: Workshop Wildlife Monitoring - Recent Developments in Techniques and Applications. Swiss Federal Institute, 2000.
- Hiendleder S, *et al.* Molecular analysis of wild and domestic sheep questions current nomenclature and provides evidence for domestication from two different subspecies. *Proc R Soc Lond B Biol Sci*,2022:269:893–904.
- Oğurlu I, Başkaya Ş. Studies in wildlife-inventory and inventory determination. Istanbul: Istanbul University, 2001. Turkish.
- Oğurlu I. Inventor at wildlife. Ankara: Republic of Turkey Ministry of Environment and Forestry Nature Conservation and National Parks, Directorate of Hunting and Wildlife, 2003. Turkish.
- Red Data Book of the Republic of Azerbaijan. Fauna. Second Edition. Baku, 2023. Azerbaijani.
- Rusanov YS. Uchet chislennosti zhivotnykh metodom povtornogo oklada. *Metody ucheta okhotnich'ikh zhivotnykh v lesnoy zone. Trudy Okskogo Gosudarstvennogo Zapovednika*,1973:9:62–8. Russian.
- Shackleton DM. Wild sheep and goats and their relatives: Status survey and conservation action plan. IUCN/SSC Caprinae Specialist Group. Grand, Switzerland: IUCN, 1997.
- Talybov TH, Weinberg RI, Mamedov IB. The conservation strategy of the Asian mouflon and bezoar goat in Azerbaijan. Nakhchivan, 2007. Azerbaijani.
- Talibov TH, Weinberg PI, Mammadov IB. Conservation strategy of the Asiatic Mouflon (*Ovis [orientalis] gmelini* Blyth) and the Bezoar Goat (*Capra aegagrus* Erxleben) in Azerbaijan. In: Zazanashvili N, Mallon D, editors. Status and Protection of Globally Threatened Species in the Caucasus. CEPF Biodiversity Investments in the Caucasus Hotspot 2004-2009. Tbilisi: CEPF, WWF, 2009, 46–52.