

## Golden jackal (*Canis aureus* Linnaeus, 1758) and Red fox (*Vulpes vulpes* Linnaeus, 1758) population dynamics in Sarnena Sredna Gora Mts., Bulgaria based on hunting statistics

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**Abstract.** Golden jackal (*Canis aureus* Linnaeus, 1758) and Red fox (*Vulpes vulpes* Linnaeus, 1758) are the most common medium-sized canid species in Bulgaria. Annual harvest hunting data base for 2009-2019 was used as a method for assessing changes in their population trends. The study area covers approximately 100,000 ha comprising the areas of State Forestry Stara Zagora, State Forestry Kazanlak, State Forestry Maglzh and State Forestry Chirpan (Bulgaria). The hunting bag data for jackals and foxes varied considerably during the study period, ranging from 340 to 899 specimens for the jackals, and from 143 to 299 for the foxes, respectively. It can be concluded that the dynamics in the number of the Golden jackal and the Red fox in the region of Sarnena Sredna Gora Mts. and its adjacent territories was of different intensity over the years and proceeded independently.

**Key words:** hunting bag, abundance, predators.

### Introduction

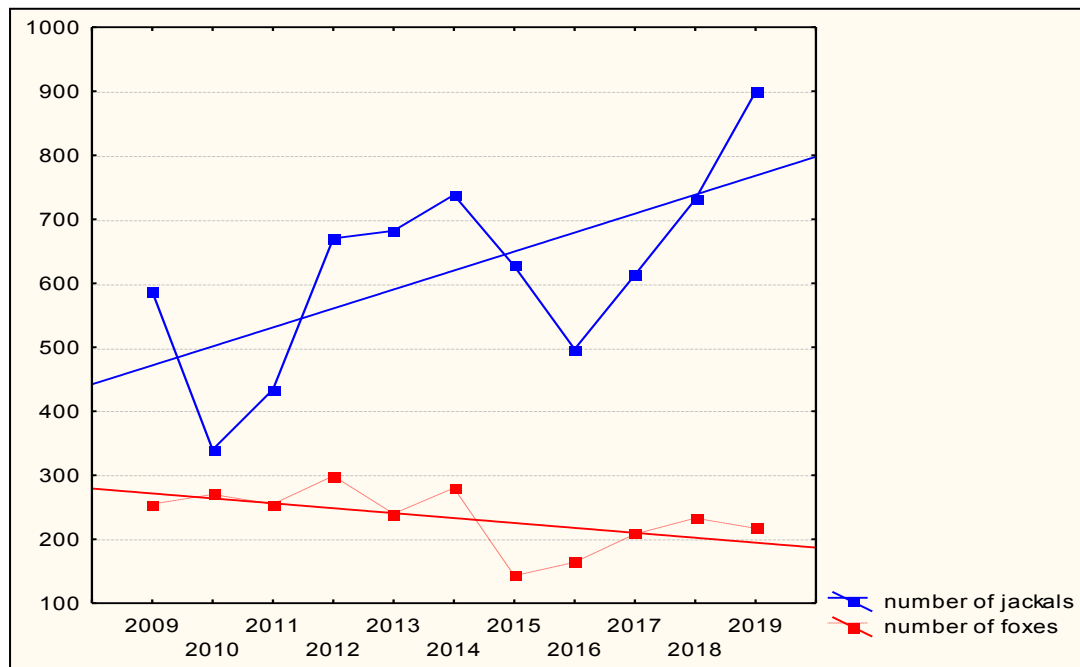
Golden jackal (*Canis aureus* Linnaeus, 1758) and Red fox (*Vulpes vulpes* Linnaeus, 1758) are the most common medium sized canid species in Bulgaria. The fox is widely spread from the seacoast to the subalpine zone, and the jackal inhabits primarily the low and semi-mountainous areas avoiding high altitudes (Popov & Sedefchev 2003). Hunting practice provides raw data for statistics, biological samples, animal carcasses, as well as non-invasive sampling and observations of species (Cretois *et al.* 2020). Management measures for the conservation or population control of species in England are based on accurate methods of reporting their distribution and abundance, implemented through the National Gamebag Census (Whitlock *et al.* 2003). Hunting is one of the reliable methods for the census of the foxes (Beltran *et al.* 1991). Although some authors argue on the accuracy derived from shooting data (Smedshaug *et al.* 1999, Sadlier *et al.* 2004), others use them to assess the number, density and development trends of jackal and fox populations (for Romania - Banea *et al.* 2012, for Slovakia - Guimaraes *et al.* 2019, for Greece - Giannatos 2004 and for Hungary - Toth *et al.* 2009). In Bulgaria, the fox and the jackal are a hunting source according to the Law for hunting and protection of the game (SG 2000). The changes in the numbers of the two species are of particular interest, as they are related to the numbers of the other hunted species. The correlation between the number of the smaller predator and that of the larger one is still discussable, provoking the investigation of jackal and fox populations dynamics in the Sarnena Sredna gora Mts. and its adjacent areas.

## Material and Methods

According to Krofel *et al.* (2017) hunting bags data for competing species needs to be collected and analyzed at a finer spatial scales, for their spatial segregation could be very narrow, as in the case with jackal and wolf in some regions. The study area represents homogeneous, semi-mountainous hilly terrain, covered by forest and shrub vegetation providing suitable habitat for jackals and foxes. It is a part of Sarnena Sredna Gora Mts. with its adjacent areas. The area covers approximately 100,000 ha comprising the territories of State Forestry Stara Zagora, State Forestry Kazanlak, State Forestry Maglizh and State Forestry Chirpan. Annual harvest hunting data base for 2009-2019 was used as a method for assessing changes in population trends. Statistical data processing was performed by Statistica 6 Stat. Software.

## Results and Discussion

The hunting bag data for jackals and foxes varied greatly during the study period, with values for jackals ranging from 340 to 899 specimens, and for foxes from 143 to 299, respectively.



**Fig. 1.** Golden jackal (*Canis aureus* L.) and Red fox (*Vulpes vulpes* L.) population dynamics trends in Sarnena Sredna Gora Mts., Bulgaria, for a period of 11 years based on the analysis of the hunting data base (number of shot individuals)

On average, 620 jackals and 233 foxes were shot each year throughout the study area. Assuming that the success of hunting for both species was the same, it turns out that the jackals were significantly more (2.66 times) compared to foxes. The number of jackals varied more over the years (SD=154.84 and Vc=24.98) compared to that of the foxes (SD=47.64 and Vc=20.44). It can be concluded that the jackal population was more unstable than that of the fox, with two strong declines in 2010 and 2016 (Fig. 1). The fox population was more stable, with one significant decline in 2015. After this period until now, both predators have seen a simultaneous increase in numbers. In accordance with assumption of Banea *et al.* (2018), the jackal does not exert a decreasing effect on fox numbers, just as in Romania, Serbia and Hungary. Following the median, built on the basis of statistical values, it can be summarized that the jackal population was rising, while that of the fox was decreasing in the study area for the period of 2009-2019 (Fig. 1). The sharp

increase in the number of jackals in Bulgaria began from 2003 to 2009, as reported in a larger scale study (Stoyanov 2012). It can be summarized that the dynamics in the number of the Golden jackal and the Red fox in the region of Sarnena Sredna Gora Mts. with its adjacent territories was being of different intensity over the years and was proceeding independently.

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