

5.6. Demography of wild ungulate populations and disease prevalence

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Abstract

Population trends of ibex and wild boar in Sierra Nevada are presented. In the case of the Spanish ibex, the monitoring began in 1960, while for the wild boar, in 2002. The ibex in Sierra Nevada maintains the most numerous population and with the greatest genetic variability in the Iberian Peninsula. The population trend is positive, although for the last 20 years growth has slowed down. The wild boar presents stable populations as a result of population control, scarcity of food and probably reproductive diseases. Also, results related to the time course of infectious and parasitic diseases are examined in populations of ibex and wild boar. These results are of great interest, as wildlife are considered the main reservoir of more than 70% of all emerging diseases.

> Aims and methodology

The Spanish ibex and wild boar populations in Sierra Nevada have been monitored, and different pathogenic agents have been studied in both species. The density of the ibex population was estimated using linear transects. The census itineraries were based on the distribution of individuals sighted along the paths taken at random in the study area. The abundance estimate was based on a model related to density parameters to be calculated.

The observer, on detecting an animal, assumes that the probability of detection is a function of distance between them. Any continuous variable randomly distributed, such as the detection distance, is defined by a probability function $[f(x)]$. Sarcoptic mange was monitored by direct examination, calculating the proportion of diseased and healthy animals. Due to the ecological singularities of the wild boar and the extensive and continuous plant structure of

the refuge area, the battue method was used for estimating the population structure and density of this species in Sierra Nevada. The health status of the population was determined by epidemiological monitoring of different relevant pathological agents through serological tests and various epidemiological indices.

> Results

Spanish ibex

Population trend of the Spanish ibex in Sierra Nevada

Sierra Nevada harbours the most numerous population of Spanish ibex with the greatest genetic variability of the Iberian Peninsula. This population has grown in the last 40 years, from a density estimated in 1960 of 1.29 ind/km² to some 11.68 ind/km² estimated in 2012. Considering the results obtained during the demographic monitoring for the past 20 years,

the population can be considered somewhat stable with a slight increase.

The genetic structure of the population

In Sierra Nevada, 4 of the 6 alleles known for the MHC (major histocompatibility complex) has been described. It is well known that high levels of polymorphism can be related to greater defence capacity against pathogens, while populations that show a markedly homogeneous genetic composition may be more susceptible to parasitic diseases.

Sarcoptic mange

Evidence exists (historical texts, experimental infection and monitoring) that indicates the existence of individuals resistant to mange in the ibex population in Sierra Nevada. The capture and marking of different specimens affected by the disease has shown that the mean survival in Sierra Nevada exceeds 209 days, which is far greater than the 90 days estimated for this species in the Natural Park of Cazorla, Segura, and Las Villas [23].



Wild boar

Population trend of wild boar in Sierra Nevada

The presence of wild boar in Sierra Nevada is very recent, dating to no earlier than 1975. From recolonizations, the expansion was rapid, taking advantage of the enormous forested area. The mean annual density estimated in the refuge area (forested area and dense

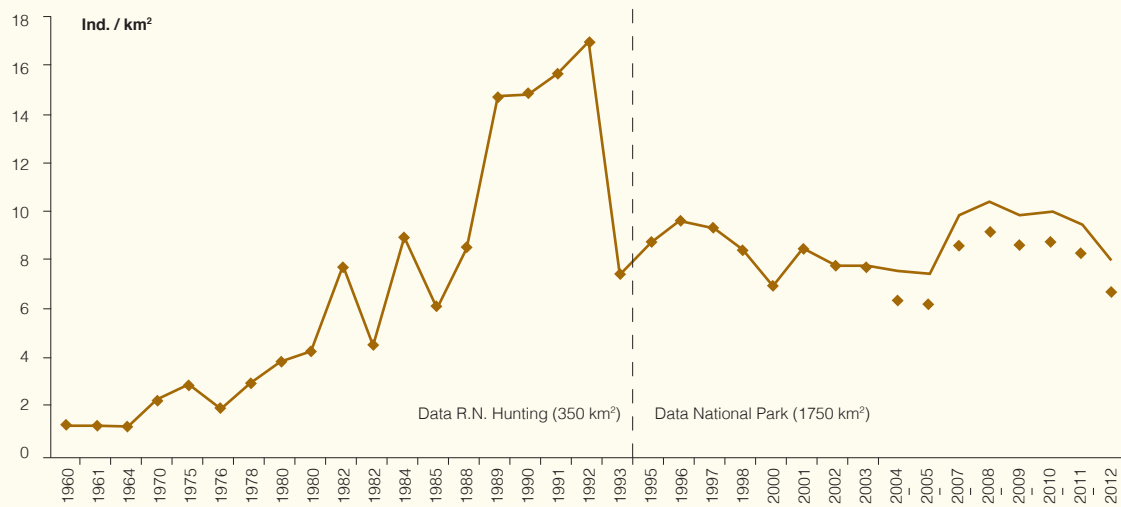
shrublands) is 8.5 ind./km², and for the entire protected natural area, 2.6 ind./km² [24]. These results indicate a population decline after the implementation of a management plan and subsequent stability that continues at present.

Health state of the population

The wild boar population in Sierra Nevada has a moderate and even low infection load in

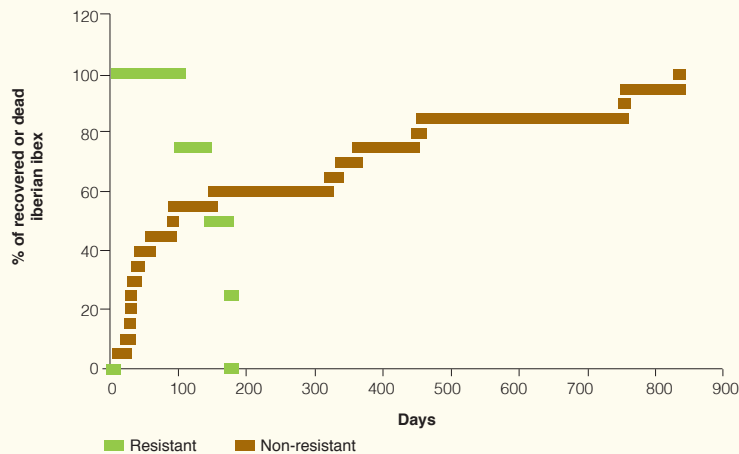
general. It was confirmed, however, that the low rates of pathogen circulation detected are sufficient for the existence of continuous active foci of infections in time and space [25].

Figure 1



Evolution of the Spanish ibex population in Sierra Nevada since 1960.

Figure 2



Survival rate of animals resistant and non-resistant to mange in the Spanish ibex population in Sierra Nevada.



Female ibex with kid.

► Discussion and conclusions

Spanish ibex

The trends of the Spanish ibex population in Sierra Nevada appear to be related to land-use changes and human depopulation. The climatic factors are not clearly involved in the results. The forecasts of global warming and the irregularity of the precipitation do not, either, signify a negative prediction for the population size, which will foreseeably continue to expand numerically, facilitating the connectivity between populations. Under these conditions, diseases (parasitic mainly) could increase in incidence, affecting the size and structure of the populations of these mountain ungulates. For example, in the Sierra Nevada population, prevalence of mange has been related to climate. Certain diseases are climate sensitive, influencing the frequency, distribution, and transmission vectors (fleas, ticks, mosquitoes, etc.). This can have an impact not only on human health but also on livestock and wildlife, particularly any threatened species, which can be pushed to extinction by stochastic events.

Wild fauna is considered the main reservoir of more than 70% of all emerging diseases. The interaction of these variables in a certain time and place could lead to the establishment of epidemiological scenarios propitious for the emergence and re-emergence of vectorial infectious and zoonotic diseases. These risks should be better known and they require new mechanisms of vigilance and prevention. For this, the Spanish ibex population is being intensely monitored, not only at the population level but also with respect to diseases that affect them, integrating the epidemiological vigilance with ecological, demographic, and reproductive aspects.

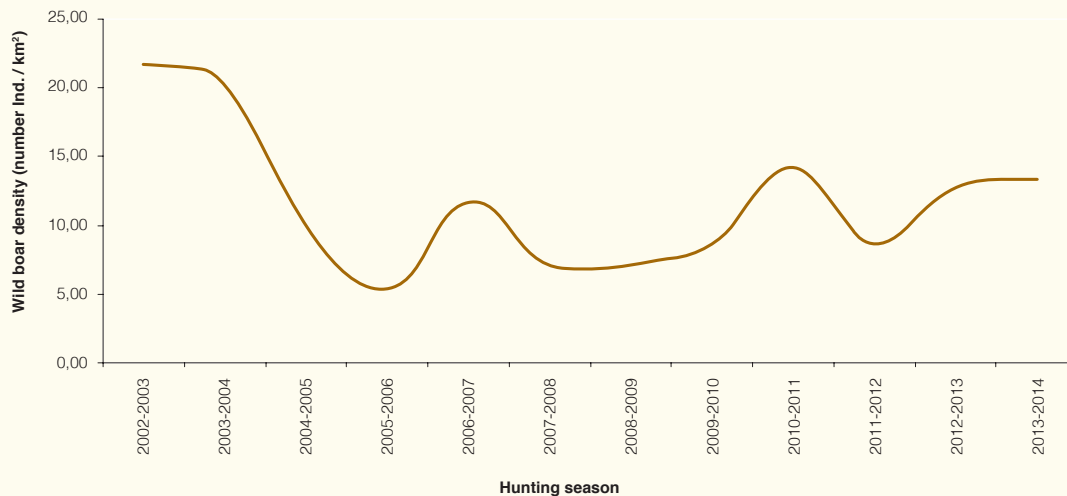
Wild boar

The low productivity of the population appears to be related to food scarcity or to reproductive diseases. In species such as wild boar, which shows great populational fluctuations according to available food, management measures based on mean calculations or estimations

prove less effective. The pressure exerted in the population controls and the low growth rate are considered sufficient elements to maintain admissible populational densities from the socioeconomic and environmental standpoint.

The heterogeneous distribution in space and time of the pathogens is probably determined by several factors that interact, such as the local density of the population, the behaviour of the species, the mode of transmission of each pathogen, population management, and environmental aspects including climatology. The natural reservoirs maintain pathogens in restricted geographic areas due to the characteristics of the ecosystems [26], the Marquesado and Alpujarra Alta (Granada province) having the highest concentrations of wild boar pathogens in Sierra Nevada.

Figure 3



Evolution of the wild boar population in Sierra Nevada over the last decade



Male Spanish ibex with a GPS-GSM collar.