

Population structure of the wild boar (*Sus scrofa*) in two Mediterranean habitats in the western Iberian Peninsula

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Abstract. Wild boar population structure was studied in two well-preserved forests of western Iberian Peninsula, one located in a typically Mediterranean zone (vegetation mainly holm oak *Quercus ilex* and various tall-shrubs species), and the other in a more Atlantic area (mainly oak *Q. pyrenica* but with abundant cork oak *Q. suber* in some places). Data were collected during hunts in *monterías*' area between the 1994/95 and 2000/2001 hunting seasons (October to February). 972 hunted wild boars were sexed and aged in the field, using growth patterns and tooth attrition. The mean age of hunted wild boars differed in the two zones. 2.11 years old in holm oak forest, and 1.78 years old in oak forest. This difference may result from shrub cover density and its effect on hunting dog, efficiency in rooting out wild boar. However, mean age was similar other zones of Europe. Proportionately more females were taken than males demonstrate the usefulness of Mediterranean hunting in contributing to management and conservation.

Key word: oak forest, holm oak forest, age, sex-ratio, hunting

Introduction

The wild boar (*Sus scrofa*) has been expanding its distributions in recent years, probably facilitated by its feeding (Venero 1984, Groot Bruinderink et al. 1994) and reproductive biology (Fernández-Llario & Carranza 2000). In fact, the wild boar can reach very high densities in many places where they are established (Fernández-Llario 1996, Rosell 1998), a sample of this tendency being the new populations located in America (Berrutti et al. 1998, Gipson et al. 1998, Waithman et al. 1999) or Oceania (Dzieciolowski & Clarke 1989, Anderson & Stone 1993). In Europe, where the species is native, this behaviour has been observed for longer, and the Iberian Peninsula is a good example of what can be seen on a large scale in the rest of the continent (Tellería & Sáez-Royuela 1985, Abaigar 1990, Lerános & Castián 1996, Rosell 1998). This tendency to increase population has motivated the wild boar to be currently considered by several sectors as a harmful species to agriculture (especially farming) interests and sometimes to livestock (Genov 1981, Dardailon 1986, Cargnelutti et al. 1990). Furthermore, several researchers indicate that the wild boar can influence native fauna and flora (Howe et al. 1981).

The wild boar remains an important hunting species, being essential to areas with hunting traditions. Therefore, it is necessary to look into the management of wild boar populations, and hence maintain the scarce well-preserved forest. With reference to this issue, in the Iberian Peninsula there is an imbalance in the information on wild boar biology between the Northern (see Sáez-Royuela 1987, Lerános & Castián 1996, Rosell 1998) and south parts of the peninsula. These areas have different ecological characteristics and therefore

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results and management practices from one area cannot be readily applied to the others. Therefore, it is indispensable to investigate the wild boar biology in these areas and to provide information to land managers, especially when several endangered species, such as the Iberian lynx (*Lynx pardina*) and the Imperial eagle (*Aquila adalberti*) (Rodríguez & Delibes 1990, Díaz ASENSIO & Tellería 1996) still survive in the peninsula.

Here, we will analyse the wild boar population structure within these well-preserved ecosystems. We look into results obtained over hunting in two different areas in southwestern Spain. These areas present important ecological differences, but both are Mediterranean areas. We also examine the possible influence of the 'montería' hunting system, which is traditional in these zones.

Study Area, Material and Methods

Our data were gathered at Monfragüe and Las Villuercas, areas near one another in western Spain, but with remarkable differences in vegetation and other environmental characteristics (Fig. 1). Monfragüe is located in the centre of the Cáceres province, presents hill ranges not more than 650 m high, land is dominated by holm oak (*Quercus ilex*) with *Cistus ladanifer*, *Arbutus unedo* and *Phillyrea angustifolia* also present. Rainfall is seasonal, which causes summers to be dry and harsh, whereas the winters are cold and rainy (B uy o l o et al. 1998, P u l i d o 1999). The land is divided into great privately owned estates dedicated mainly to big game hunting. The presence of Iberian lynx and Imperial eagle are indicative of a high level of conservation. There are high densities of red deer (*Cervus elaphus*), which in some estates can surpass 40 per square kilometre. Other species have recently been introduced like fallow deer (*Dama dama*) or moufflon (*Ovis ammon*) (C a r r a n z a 1998).

Las Villuercas consists of mountain ranges of greater altitude (up to 1601 m). Dominant are oak (*Quercus pyrenaica*) and cork oak (*Quercus suber*) and *Erica* ssp. and *Arbustus unedo* are the main shrubs. The climate, soil character and use land in these mountain ranges results in high botanical diversity. The summers are milder than in Monfragüe, as well as there being greater precipitation in winter, snow being common. The land is partly



Fig. 1. Iberian Peninsula, Extremadura and area of study.

cultivated with species such as chestnut (*Castanea sativa*), the rest being dedicated to pastures or covered with native vegetation. Fauna, the same as in the other area studied, is very diverse. The Iberian lynx and Imperial eagle are also present. In the same way, red deer densities are also very high as well as an important roe deer population (*Capreolus capreolus*) (Mateos - Quesada 1998). In both Monfragüe and Las Villuercas, the wolf (*Canis lupus*) became extinct in the 1960s.

Data was collected during the hunting, 'monterías', from October to February (in some analysis, we will take as a reference annual seasons, being Autumn: October, November and December and Winter: January and February), a hunting technique exclusive to this peninsular area, which is based on hunting in an area where wild boars are hidden. The hunting area is on average 550 hectares. Various hunters, approximately 40, armed and located in fixed points, wait for the arrival of the wild boars that are moved from their places of rest by dogs led by a person.

The possibility of using hunted wild boars to draw conclusions concerning their biology and management is useful since hunted animals represent more than 30% of the population (Sáez - Royuela & Tellería 1988) and they are selected at random.

Once the hunt had concluded, each hunted wild boar was sexed, measured (from snout to tail) and aged according to growth patterns and tooth attrition described for this species (Dub 1952, Iff 1978). Because of our hunting laws, it was prohibited to shoot individuals younger than 1 year, as well as females followed by piglets. We studied the possible differences, which could be established as far as age and proportion of sex of the hunted individuals. Parametric variable test were used throughout since they did not differ from normality after the Kolomogorov-Smirnov Normality Test. Referring to the statistics applied, to determine possible variations between males and females, we used a Impaired Student test. The differences among months and zones was analysed by a Chi-square test. Analyses were performed using the *Statistica 5.1* package. The population pyramids were made to thank a specific software programmed by Pedro Fernández-Toledo.

Results

In total 972 wild boars were hunted in 47 *monterías* over 7 hunting seasons (from October to February) between 1994–95 and 2000–2001. The number of wild boars analysed in Villuercas was 588, whereas in Monfragüe it was 384.

The number of males hunted was 436 (42.7%) was significantly lower ($\chi^2 = 7.39$, $P = 0.01$) than that of females 536 (52.6%), with 47 (4.61%) of indeterminate sex. The same pattern was observed when χ^2 we analysed the sites separately: Villuercas, males 263 (44.73%), females 325 (55.27%), $\chi^2 = 4.57$, $P = 0.03$; Monfragüe, males 173 (45.05%) and females 211 (54.95%) $\chi^2 = 6.36$, $P = 0.01$). There are not differences between the study zones ($\chi^2 = 0.009$, $P = 0.920$).

Sex-ratio did not differ over the 7 years of study ($\chi^2 = 7.55$, $P = 0.272$), nor based on the annual season (autumn and winter) in which the hunting was carried out ($\chi^2 = 0.284$, $p = 0.594$).

Mean age was 1.93 (± 1.07 , $n = 815$) years old. We observed significant differences when we analyse both habitats (Impaired Students $t = -4.48$, $df = 812$, $P = 0.001$). So, in Villuercas, wild boars were 1.78 (± 0.95 , $n = 468$) years old whereas in Monfragüe mean age was 2.11 (± 1.14 , $n = 346$). In the same way, we found seasonal differences in wild boar age based on season (autumn: 1.82 ± 1.01 , $n = 457$ and winter: 2.04 ± 1.07 , $n = 342$, Impaired Students $t = -2.84$, $df = 797$, $P = 0.003$). However, mean age did not differ between sexes within the study areas (Villuercas: males 1.78 ± 0.94 , $n = 204$ and females 1.77 ± 0.96 , $n = 346$,

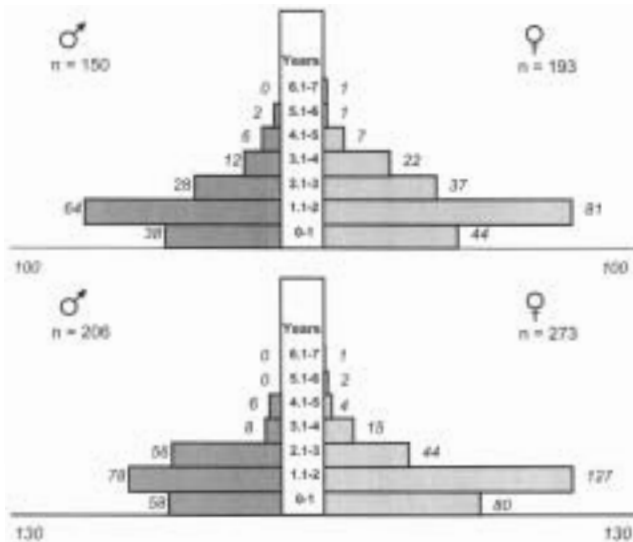


Fig. 2. Population pyramids of Villuercas (below; n = 479) and Monfragüe (above; n = 343).

Impaired Students $t = 0.29$, $df = 466$, $P = 0.766$. Monfragüe: males 2.05 ± 1.10 , $n = 150$ and females 2.14 ± 1.15 , $n = 193$, Impaired Students $t = -0.81$, $df = 341$, $P = 0.420$.

By age-class and sex, most of the hunted wild boars are under 3 years old (Fig. 2), and in particular females under 2 years old.

Discussion

The population structure of the wild boar in this area of the Iberian Peninsula presents many similarities with others described in northern Spain and in rest of Europe (Briedermann 1971, Conley et al. 1972, Stubbe & Stubbe 1977, Andrzejewski & Jezierski 1978, Baettig 1982, Abaigar 1990, Fernández-Llario 1996), with a higher proportion of females. Nonetheless in the northern Iberian Peninsula, the proportion of males and females is similar (Sáez-Royuela 1987, Herrero 1996, Rosell 1998).

In our study area, this greater presence of females could be because of our hunting laws, which prohibits hunting adult females followed by piglets or if they show an evident gestation. Furthermore, we are in agreement with Spitz (1989), who indicates that the oldest males are more difficult to hunt, because of their experience, which could also explain why this sort of individuals survive even in places where other shooting techniques are applied (Sáez-Royuela 1987, Rosell 1998, Andrzejewski & Jezierski 1978).

The low overall mean suggests elevated hunting pressure in our study areas. But the lower mean age observed in the oak forest could result from differences in hunting efficiency rather than population differences. In Monfragüe's holm oak forests, the thickness of the shrub-like cover provides more places for the wild boar to hide from the hunting dogs (Caley & Ottley 1995). In oak forests, there is a lower bush density, which renders wild boar more susceptible to hunters.

However, the overall mean age obtained was similar to other populations free of hunting pressure. For example, in the Doñana National Park, the mean age of wild boar is 1.80 years old (Fernández-Llario 1996). This low mean age is fundamentally due to the

ample representation of younger individuals (1.5 years old), a situation that is repeated in other European natural zones (Dardillon 1988). But even in lands where there is a high hunting pressure, this average age can be greater than in the holm oak forest population (Monfragüe). The overall mean age observed in other European populations does not differ substantially from these of Iberian peninsula (Jeziński 1977, Kratochvíl et al. 1986) or from the feral pig population introduced elsewhere in the world (Dzieciolowski & Clarke 1989). Thus, regardless of hunting techniques, the mean age of wild boar does not differ substantially from one population to another.

The most notable discrepancy exists in the proportion of young males and females, with a dominance of young females. It could be interpreted as a consequence of wild boar biology (Spitz 1989), as young males may encounter greater mortality when they leave the family group. Higher mortality in youngest males may also be related to their rapid growth rate (Gillard et al. 1992).

Finally, in this type of work in which culled animals are analysed, it is always necessary to remember the possible particularities of the hunting modality. In our case, *montería* is considered as a correct method to value diverse aspects of wild boar biology (Fernández-Llario & Mateos-Quesada 1998), and among them, its population structure. Thus, the prohibition to shoot animals under six months and females followed by piglets, as we have already indicated above, means that the base of our pyramid cannot be calculated with the degree of reliability that it would be desirable, and that it can be established in works in which there is no selective hunting or they are made on alive animals (Milkowski & Wojcik 1984). However, we believe that these conditions must not affect the plausibility of these findings and, therefore the *montería* results may be used to provide information to land managers and a better understanding of this part of the wild boar's biology.

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