DEMOGRAPHIC PATTERNS OF A WILD BOAR (Sus scrofa L.*) POPULATION IN TUSCANY, ITALY*

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Abstract: 1253 wild boars, killed during seven hunting seasons between 1984 and 1991, were aged from tooth eruption and tooth wear. Annual age and sex pyramids were computed. The overall structure of the sample showed that 52% of the killed wild boars was 7-22 months old, while the sex ratio was slightly unbalanced in favour of males (1:0.85). The reproductive tracts of a portion of sows (73%) were analysed and corpora lutea and embryos were counted. The pre-natal sex ratio showed a preponderance of female fetuses (1:1.2). Further data on age-specific corpora lutea, embryos and piglets/female ratio were recorded for each year of the study. Figures from annual life and reproductive tables were used to evaluate age-specific mortality, survival, longevity, mean expectation of further life, reproduction and recruitment.

Keywords: Wild boar, *Sus scrofa*, Population dynamics, Life tables.

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1. Introduction

In recent years Wild boar populations have increased both their numbers and distribution in Italy. In spite of growing concern for their conflicts with human activities (damages to crops), detailed studies of their distributions, densities and population dynamics are still lacking. Here we present some aspects of a demographic survey of a Wild boar population, as drawn from hunting data. Boar hunting is carried out throughout Italy, though with different methods and efficiencies, and it is the major cause of mortality among (non-piglets) individuals during winter (Boitani *et al.*, in press).

2. Study area

The study was conducted in the 11,000 ha Commune of Monticiano (Siena, Tuscany), a widely wooded (86%) hilly area (300-400 m u.s.l.) including two main rivers: Merse and Farma. The climate is sub-mediterranean and average annual temperatures are 4.6°C in January and 24°C in July. Forest cover (oak, chestnut, maquis) is interrupted by a mosaic of a few fields (average 10%) of sunflower, corn and barley, and many untilled fields.

Ungulates are present with significant densities of Fallow-deer (*Dama dama*) and Roe-deer (*Capreolus capreolus*).

In the study area wild boars are hunted by seven specialised teams (bound hunting with posted shooters): hunting effort is high (average of 3 days a week for 3 months), rather constant year by year and uniformly distributed.

3. Methods

From 1984 to 1991 we collected the harvest data of two hunting teams, whose hunting areas occupy about 44% of Monticiano territory. 1,253 legally killed wild boars were analysed with regards to sex, age and weight (with the exception of piglets < 6 months old). Age was assessed on the basis of teeth eruption and wear, following Matschke (1967) and Boitani and Mattei (1992). 180 animals (14% of the sample), whose age was not determined because the skull was damaged, were classified on the basis of the weight-age relation worked out from 1,073 fully classified animals. Aged animals were initially divided into six classes for a preliminary demographic analysis (0-6, 7-12, 13-17, 18-22, 23-32 and >32 months old) and then reorganised into one year categories (0-1, 1-2, 2-3, 3-4, 4-5 and 5-6 years old) in order to compute life and reproductive tables. The last three age groups (3-6 years) were identified through the degree of wear of the tuberculate teeth and the length of upper and lower canine (Iff, 1978). 73% of all sows were examined for reproductive activity and dissected to count the corpora lutea and embryos (which were sexed). Birth dates were obtained from the age of the animals at death. In order to reduce the age assessment error, only the animals up to 24 months old were considered for birth distribution analyses. Age specific and annual parameters were used to investigate the harvest data: sex-ratios, age structures, weight-age relationships and reproductive parameters were computed. Age and reproductive tables were obtained following Pikula *et al.* (1985).

Table 1: Embryos, piglets, juveniles, adults and total (post-natal) annual sex ratio (M:F).

Year	Embrios	Piglets	Juveniles	Adults	Total
1984 - 85	1:1.6	1:1.67	1:0.54	1:0.88	1:0.96
1985 - 86	??	1:1.12	1:0.80	1:1.24	1:1.05
1986 - 87	1:0.8	1:0.57	1:0.53	1:1.30	1:0.72
1987 - 88	1:1.5	1:1.22	1:0.67	1:1.04	1:0.89
1988 - 89	1:1.2	1:1.31	1:0.52	1:0.73	1:0.83
1989 - 90	1:0.9	1:0.92	1:0.39	1:0.92	1:0.75
1990 - 91	1:1.4	1:1.37	1:0.46	1:0.85	1:0.79
MEAN	1:1.2	1:1.09	1:0.57	1:1.00	1:0.85

4. Results and discussion

During the 7-years period the number of sampled wild boars fluctuated between 109 (1988-89) and 239 (1985-86), showing opposite trends in adult (>2 years) and yearling (1-2 years) percentages: until 1987 the former decreased and the latter increased, whereas trend reversed after the 1988 minimum. Piglets' (7-12 months) harvest showed smooth changes with a peak in 1989-90 (Fig. 1).

The overall sex ratio was slightly unbalanced in favour of males (1:0.85). Similar results were also found by Boisaubert *et al.* (1987), Durio *et al.* (1992) and by Massei and Tonini (1991). Opposite to great fluctuations among piglets, a constant tendency for yearling males to be more numerous than females was maintained (Tab.1). Lack of information about natal and post-natal sex-ratios did not allow a comparison with embryo trends: males and females may suffer different kinds of mortality during this period. Average pre-natal sex-ratio was fairly balanced (1:1.2), ranging from 1:1.6 in 1984-85 to 1:0.8 in 1986-87.

The age distribution indicated a relatively young population: 70% of the killed animals was 6 to 24 months old. However, the living population was probably even younger (x =

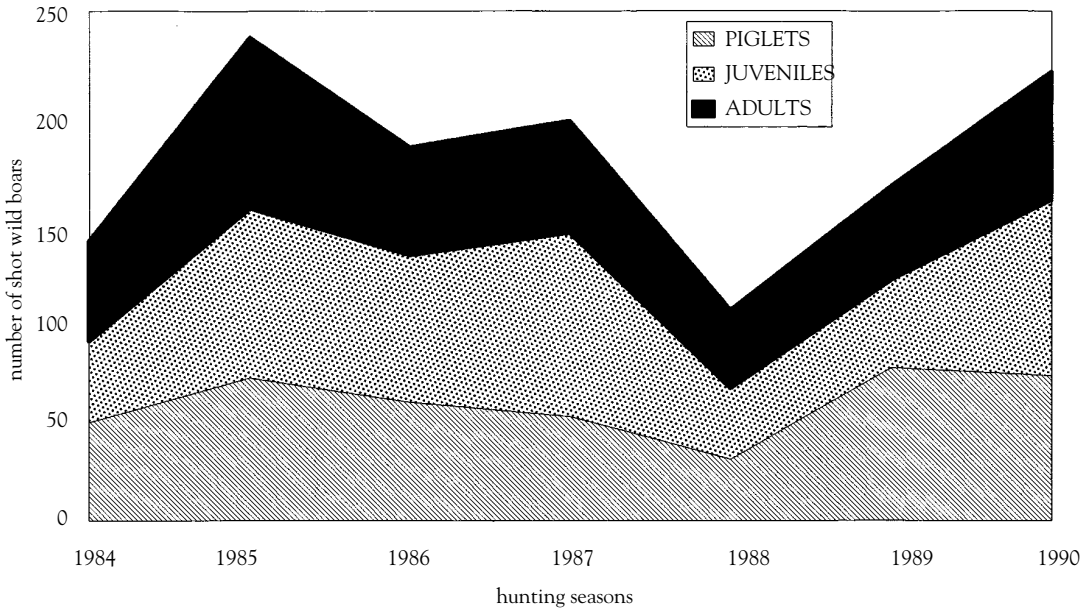


Figure 1 - Harvest trend and age classes of hunted wild boars.

2.25 years), as the piglets were only seldom hunted because of tradition and difficulty of finding them. Durio *et al.* (*op. cit.*) in Italy and Vassant *et al.* (1988) in France described similar situations. High rates of reproduction and of adult mortality are among the causes of the particular age structure. With the exception of 2-3 years old animals, wild boars tended to decrease in number with increasing age. The stronger annual fluctuations were found in 3-4 years old age-class, while younger than 2 years old individuals showed two peaks (1985-86 and 1989-90), probably due to an increased reproductive success. In the 1988-89 season the harvest was very poor. A decrease in number of living wild boars may have been the cause, while the abundance of piglets and yearlings (strong reproductive effort) during the following season was also the consequence.

80% of sampled wild boars weighed 20-80 kg, without significant differences between sexes. As noted also by Klein (1984), weight gain was fast up to about 2 years, when both sexes reached about 45 kg (males = 47.4 kg; females = 43.3 kg), while during the third year only males increased their weights at similar rate up to 60 kg (Tab. 2).

Table 2: Mean weight and standard error (SE) for age and sex classes.

Age Classes (months)	Mean weight of Males (kg) [S.E.]	Mean weight of Females (kg) [S.E.]
1 (5-6)	19 [7.3]	18 [7.1]
2 (7-12)	18.7 [7.5]	20.5 [7.5]
3 (13-17)	30.8 [10.2]	30.5 [12.3]
4 (18-22)	47.4 [10.5]	43.3 [9.4]
5 (23-32)	59.5 [14.5]	47.9 [6.5]
6 (>32)	72 [18]	56.2 [12]

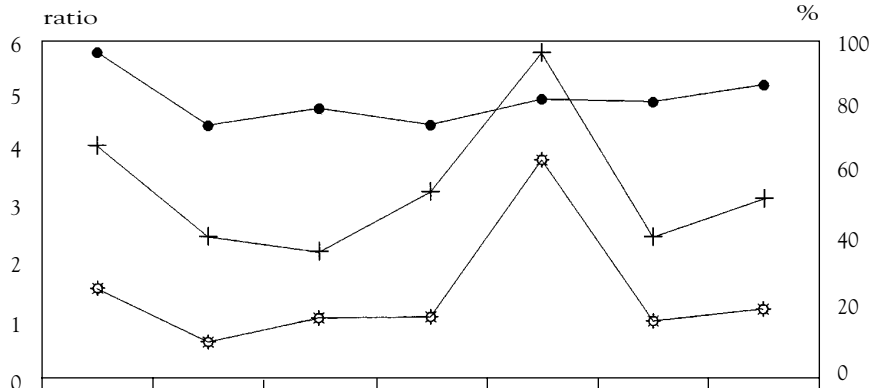
A positive relation between mean weight and mean age was found (r = 0.97977, age classes for males = 6; r = 0.98786, age classes for females = 6). Mean weight of 0.5-1 and 1-2 years old age classes had maximum annual fluctuations of 10 kg for both sexes and groups (p>0). Stronger variations during middle seasons were probably due to different trophic conditions.

The intensity of reproduction output was not equal in different study years. Great reproductive effort was evident in 1984 and 1988, when the percentages of pregnant sows, the fertilisation rates and (in 1984 only) the numbers of embryos per female reached a peak (Fig. 2). The mean number of piglets (*i.e.*, embryos) per litter was 4.95 (± 0.42) with no significant differences among years except in 1984-85 (5.8 piglets per litter). A correlation between mean number of foetuses and sow weight classes was found (y = 2.7487 + 0.6473 x; r = 0.5481, n = 5); however the relation did not hold true for piglet and female age classes (sizes only depended upon mothers' physical conditions). Also, the percentage of pregnant females was correlated with weight. Ovulation rate averaged 2.09 (± 0.93), and 2.83 (±1.03) when only females older than 1 year were considered, with strong annual fluctuations. Positive correlations were found between female weight gain and numbers of piglets per litter and between age and percentage of pregnant sows: these results are confirmed by Saez-Royuela (1987) in Spain and by Mauget (1980) and Gerard *et al.* (1991) in France.

Mean reproduction index was 0.74, *i.e.* 0.74 piglets born per each individual of the living population (similar values were obtained by Kratochvil *et al.*, 1986); the same index was 3 for females older than 1 year, and 5.14 for females older than 2 years.

Births occurred during whole year, but 50% were within the period between April and May (Fig. 3). This pattern agrees with a winter mating season as found by Mauget *et al.* (1984) and by Durio *et al.* (*op. cit.*). In our study, on a monthly basis, 1 peak (April-May) and two lows (February and October) could be identified: this might be explained by the killing of pregnant females during the harvest, the sexual cycle of this species and the summer anoestrus respectively (Durio *et. al.*, *op. cit.*; Mauget *et al.*, *op. cit.*). A second peak, though less obvious, was present in December-January, most probably due to the different environmental conditions. Compared with Mauget's study (*op. cit.*) the sampled population showed a delay of few months in birth distribution, probably owing to different climatic and environmental conditions.

The time specific life table suggests (Fig. 4) that mortality rates for both sexes were highest during the second year of life. However, neonatal mortality was not included in the first year mortality rate. The lowest age-specific mortalities and the greatest mean expectations of further life were found in 2-3 years old animals for both sexes. Life expectancy was slightly higher for females than for males throughout life. The higher nutritional requirements of lactating sows and growing juveniles may be



		84-85	85-86	86-87	87-88	88-89	89-90	90-91
% pregnant sows	☼	26.7	10.8	17.9	18.1	64.5	16.7	20.4
fertilization rate (%)	+	69	41.9	37.4	55.1	96.1	41.5	52.9
embryos/females	●	5.8	4.5	4.8	4.5	4,95	4.9	5.2

Figure 2 - Reproduction parameters of the sampled population.

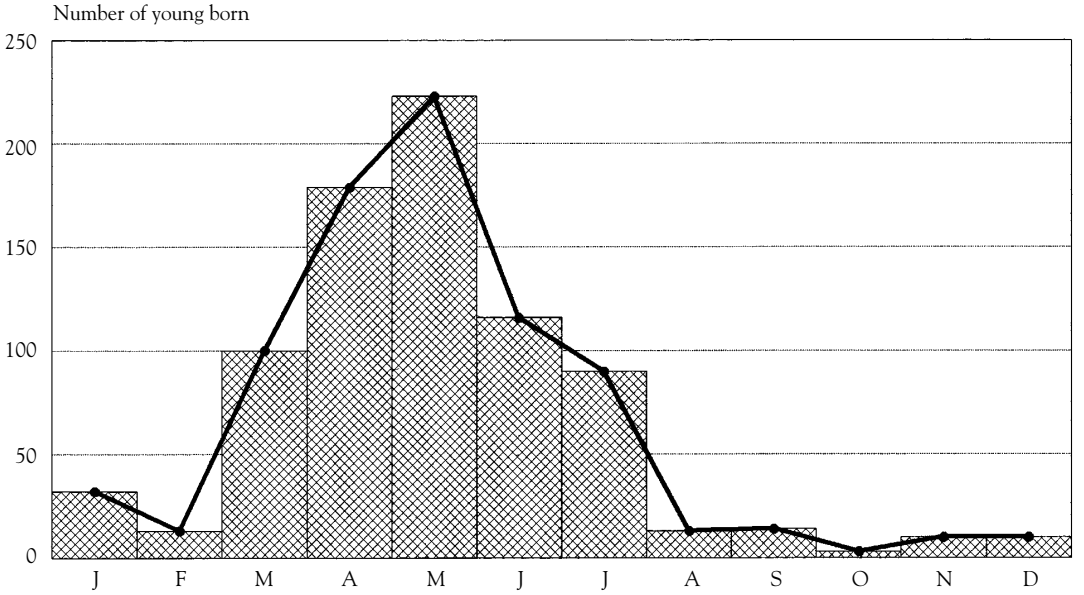


Figure 3 - Birth distribution of the sampled population (n=803).

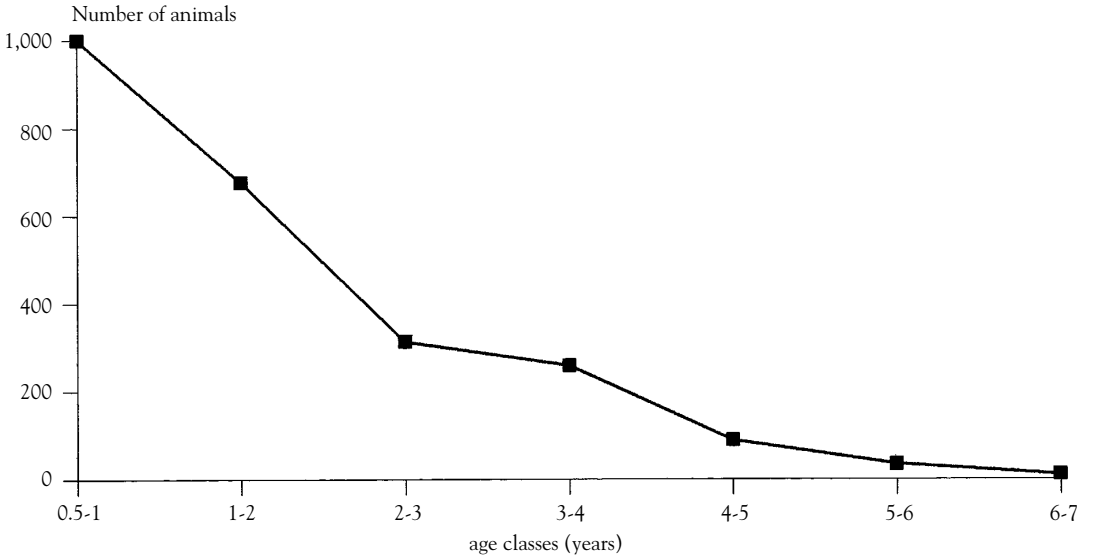


Figure 4 - Survivorship (1000lx) curve for the whole sample.

the causes of an increased vulnerability of these groups to natural as well as to hunting mortality.

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