THE WILD BOAR MANAGEMENT IN A PROVINCE OF THE CENTRAL ITALY

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Abstract: The province of Siena is inhabited by considerable Wild boar populations. The analysis of hunting data and agricultural damages in some different areas showed that damages were much more onerous in agricultural (vineyards especially) landscapes where, moreover, hunting is less intensively practised. It is evident that management actions have to be diversified in accordance with these differences.

Keywords: Wild boar, *Sus scrofa*, Suidae, Damages, Hunting.

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1. Introduction

A large Wild boar population of different origins occurs in the province of Siena, southern Tuscany. A local subspecies, *Sus scrofa majori* (De Beaux & Festa, 1927), was supposed to inhabit south-west Tuscany. Recent biometrical studies have questioned the validity of such a subspecies (Apollonio *et. al.*, 1988; Randi *et. al.*, 1989). Around 1950, the Wild boar was rare and only present in the south-west of Siena province (Maremma). In Tuscany, as elsewhere in Europe, the "wood-based economy" crisis, broken out between the '50s and '70s, allowed the demographic increase of the Wild boar (Saez-Royuela & Telleria, 1988). This development was accentuated by introductions of central-european Wild boar for hunting purposes (Erkinaro *et. al.*, 1982). Introductions were also made in the east of the province (Chianti and Chiana Valley). Presently, a western area where there are hybridized populations, a north-eastern area (Chianti) and a south-eastern area (Chiana Valley) where there are introduced populations only can be identified.

In Maremma, Wild boar hunting is an ancient tradition. It is practised by hunting teams using hound packs. The Wild boar population increase promoted an increase of hunting teams number. Only three teams were hunting in 1945, but in 1989 there were no fewer than 154 (about 5,000 hunters for each hunting day, Mazzoni della Stella, 1986). On average, more than 4,000 wild boars are killed every year in the province of Siena, over an area of 362,000 hectares.

Every year the Province of Siena Administration has to pay on average of 313,000 US $ for Wild boar agricultural damage. Since 1987 Wild boar hunting and management have been regulated following the guideline provided by the National Wildlife Institute (I.N.F.S.), (Spagnesi & Toso, 1991). The provincial territory has been divided in two areas: one where the Wild boar presence is compatible with local land management, and one where Wild boar presence encroaches human activities and has to be consequently limited. In 1988, in Monticiano territory, in the centre of the oldest Wild boar area, an "A.R.S." (Area a Regolamento Specifico, *i.e.* especially managed area) for advanced Wild boar management was established.

2. Methods

From the 1990-91 hunting season the Province of Siena Administration has aged wild boars shot by hunting teams to improve the knowledge of the local population structure. The Monticiano A.R.S. was selected as a testing area, and Merse Valley (south-west) and Chianti as control areas. The number of participating hunters and that of wild boars shot, as well as sex and weight of the latter were taken from hunting registers.

Age was determined by tooth eruption (Boitani & Mattei, 1991). Four age classes were established: the 1st class included 0 to 12 months old piglets; the 2nd class comprised 13 to 24 months old wild boars, the 3rd class included 25 to 36 months old wild boars and the 4th class included adults more than 36

months old. Hunted population densities have been expressed as killed Wild boar number per 100 hectares of hunting area. Agricultural damage has been estimated as indemnities paid by the Province of Siena Administration to farmers, expressed as a cost per hectare of agricultural and forest area and per killed Wild boar.
Correlations were evaluated by the Spearman rank correlation coefficient (rs) (Fowler & Cohen, 1993). Differences between population structures were tested through a contingency analysis (Daniel, 1978).

3. Results and discussion
The age of 2,870 killed wild boars was determined: from 1990 to 1993 in Monticiano area (n = 1,669), for the hunting season 1991-1992 in Merse Valley (n = 612) and in 1992-1993 hunting season in Chianti area (n = 589). The sex ratio in Monticiano was 1:0.8, whereas in Merse Valley it was 1:0.88 and in Chianti it was 1:1.03. The Monticiano population structure was not significantly different from that in Merse Valley (chi-square=7.25, df=3, not significant). However the female piglet age class differed in these populations (chi-square=5.16, df=1, $p<0.05$). The Monticiano population was significantly different from the Chianti population structure overall (chi-square=46.47, df=3, $p<0.01$), for the female piglet class (chi-square=13.64, df=1, $p<0.01$), for the adult female class (chi-square=22.21, df=1, $p<0.01$) and for the adult male class (chi-square=5.61, df=1, $p<0.05$). In Chianti the high proportion of female piglets (≤ 12 months old) may have been caused by clandestine releasing for hunting purposes: young females are sold for lower prices than young males and can be transported easily. The abnormally low proportion of adult males and females in Chianti is consistent with the recent artificial origin of this population (Tab.1).
Average damage differed between the various areas. In the western area, in the last three years, 1.1 US $ per hectare have been paid. At the same time, in Chianti 2.0 US $ per hectare, and in Chiana Valley 2.9 US $ per hectare have been paid. Similarly, in the western area the mean indemnity paid for each Wild boar killed was 28.0 US $, while in Chianti and in Chiana Valley was 83.0 US $ and 146.4 US $ respectively (Tab. 2). These data can be interpreted by looking at the ecological characteristics of each area. The western area has a large proportion of wood, a small proportion of herbaceous cultivations and grazing lands and, especially, a modest proportion of vineyards. On the contrary, in Chiana Valley, the agriculture is managed by industrial methods and it is based on cultivations of high economic value. In Chianti the wood percentage is the greatest, but there is the largest proportion of vineyards too (Tab. 2). The Wild boar is not causing considerable damage in the western area, while in Chianti and Chiana Valley it is in strong conflict with local agriculture (Meriggi & Sacchi, 1991). In particular, the indemnities extent has shown a direct, significant association with the local vineyard extension (rs=0.508, n=22, $p<0.01$). Environmental characteristics have a strategic importance (Casanova & Massei, 1986; Lescourret &

Table 1 - Age class and sex distribution (%) of wild boars shot in different study areas and years.

	Total number	female piglets	male piglets	female yearlings	male yearlings	female subadults	male subadults	female adults	male adults
Monticiano 1990/91	487	18%	19%	10%	20%	7%	9%	9%	8%
Monticiano 1991/92	413	10%	15%	18%	24%	10%	15%	4%	4%
Monticiano 1992/93	769	17%	23%	12%	17%	8%	9%	9%	5%
Merse Valley 1991/92	612	17%	16%	15%	22%	9%	13%	5%	3%
Chianti 1992/93	589	28%	24%	14%	17%	6%	6%	3%	2%

Table 2: Indemnities paid, land use and hunting parameters of the study areas in Siena province.

	Western area	Chianti	Chiana Valley
Indemnity US $/ha	1.1	2.0	2.9
Indemnity US $/killed Wild boar	28.0	83.0	146.4
Wood (%)	52.0	54.5	22.8
Vineyard (%)	4.7	13.9	5.7
Herbaceous cultivations and grazing land	41.9	29.0	62.9
Killed wild boars/100 ha	3.8	2.4	2.0
Foraging sites/hunting team	1.5	1.3	1.0

Genard, 1985). If the number of killed Wild boar per 100 ha is compared with damage refunding we can observe that higher damage is associated with lower numbers. In the last three years, on average, the greatest number of killed wild boars per 100 ha (3.8) has been actually observed in the western area, while lower numbers have been recorded in Chianti and Chiana Valley (2.4 and 2.0 respectively) (Tab. 2). Wild boar hunting in the western area is an ancient tradition and a sound organisation. The hunting teams have many members and many of them are engaged in Wild boar management. Each team of the western area hunts on average for 30 days, in one season, with an average participation of 36 hunters. The same hunters supply the Wild boar with large quantities of maize at the "right" season (summer) and in the "right" place (inside the wood, far from farmed fields). In Monticiano, where artificial feeding is carried out during the whole year, the damage prevention gets very good results: in the last three years, the mean indemnity per hectare has been just 0.2 US $, vs. an average indemnity of 1.1 US $ in the western area (Andrzejewski & Jezierski, 1978; Vassant & Breton, 1986; Vassant *et. al.*, 1987). In Chianti and Chiana Valley the situation is different: teams have a smaller number of members, a lower hunting day number, an insufficient interest in the territory management and allow the wild boars to eat freely at public expense (Tab. 2).

4. Conclusions

The Province of Siena Administration is taking steps towards a better Wild boar management, but it has still got a good deal to do. First of all it is necessary to diversify the management in the three areas. It is absurd to "persecute" the Wild boar everywhere, but it is as much absurd to bear it everywhere. It is first necessary, to oppose, always with the greatest severity, clandestine releasings (Lovari, 1991; Massei & Toso, 1993). Hunting areas need to be limited especially where wood and vineyard are contiguous. Culling should be increased everywhere, particularly in agricultural areas, to obtain a general density reduction. It may even be locally advisable to carry out control operations in protected areas. In this connection it is also important to evaluate carefully the establishment of protected areas. Artificial feeding must be regulated and addressed to the protection of agricultural areas only.

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Study area: Tuscany, Central Italy.

WILD BOAR MANAGEMENT IN AN AREA OF SOUTHERN TUSCANY (ITALY)

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Abstract: In the South-West of Tuscany (Maremma) the Wild boar is traditionally hunted. In order to improve the management of this important natural resource an "A.R.S." (especially managed area) was estabilished in 1988 and a study about the age and sex composition of the culled population was started.

Keywords: Wild boar, *Sus scrofa*, Suidae, Hunting.

IBEX J.M.E. 3:217-218

1. Introduction

In the area of Monticiano, southern Tuscany, Wild boar hunting is an ancient tradition (Mazzoni della Stella, 1986) and it is also an important part of the local culture and economy. In 1988 an "A.R.S." (Area a Regolamento Specifico, *i.e.* especially managed area) for advanced Wild boar management was established there. The A.R.S. agency has carried out a successful management of the Wild boar reserving to hunt an exclusive territory about 5,600 hectares large, while protected areas (within the A.R.S. or to it contiguous) are about 7,000 hectares large. Since 1990-91 hunting season, the wild boars killed in the A.R.S. were aged to improve the knowledge of the local population structure.

2. Methods

Age was determined by tooth eruption (Boitani & Mattei, 1991). Four age classes were established: the 1st class included 0 to 12 months old piglets, the 2nd class comprised 13 to 24 months old yearlings, the 3rd class included 25 to 36 months old individuals and the 4th class included adults more than 36 months old. The proportions of age classes between the different years were compared by a contingency analysis (Daniel, 1978).

3. Results

During three hunting seasons 1,669 culled wild boars were aged: 487 in 1990-91, 413 in 1991-92 and 769 in 1992-93. 67.77% of the wild boars killed had an age between 0 and 24 months (Tab. 1). The sex ratio was in favour of males in the first three age categories, while in the last age class it was in favour of females: on average, in the three years, the sex ratio of the population of killed animals was 1:0.80 (Tab. 2). Observed differences in the proportion of age categorie (Tab. 1), in the three hunting seasons, were highly significant (chi-square=52.57, df=6, $p<0.001$). However the observed difference in proportion of 1990-91 vs 1992-93 age ratios was not statistically significant (chi-square=2.99, df=3, n.s.), while those between 1990-91 and 1991-92 (chi-square=39.93, df=3, $p<0.001$) as well as between 1991-92 and 1992-93 (chi-square=39.31, df=3,

Table 1: Age classes distribution (%) of wild boars shot in A.R.S. Monticiano.

Hunting season	0-12 months	13-24 months	25-36 months	>36 months
1990/91	36.76%	29.98%	15.81%	17.45%
1991/92	25.91%	41.89%	24.21%	7.99%
1992/93	38.88%	29.52%	17.56%	14.04%
Mean	35.05%	32.72%	18.69%	13.54%

Table 2. Culled wild boars' sex ratio in the three successive hunting seasons and in the four age categories (A.R.S.)

Hunting season	M:F	Age category (months)	M:F (mean three years)
1990/91	1:0.78	0-12	1:0.78
1991/92	1:0.74	13-24	1:0.68
1992/93	1:0.86	25-36	1:0.78
Mean three years	1:0.80	>36	1:1.33

Table 3. Number of wild boars culled per 100 ha in A.R.S. Monticiano.

Hunting season	Number
1990/91	8.7
1991/92	7.4
1992/93	13.8
Mean three years	10.0

$p<0.001$) resulted highly significant. The number of wild boars killed per 100 ha in the hunting areas of Monticiano was always very high (Tab. 3).

4. Discussion

The rather small game-bag of 1991-92 may have been caused by an abundance of food. Therefore a lot of sows and piglets likely preferred to stay in the protected areas rather than going to the hunting areas. Apparently, many adult males stayed in protected areas because they were attracted by the presence of receptive females (hunting season and rutting season coincide). Conversely, most young males and young females, because of their greater mobility, visited the hunting areas. This hypothesis may explain the higher proportion of the 2nd age class in 1991-92 (41.9%) vs 1990-91 (30.0%) and vs 1992-93 (29.5%), as well as the smaller game-bag too.

5. Conclusions

The hunting of Wild boar is important to the local economy. The knowledge of relationships between game-bags and food abundance in both protected and hunted areas is advisable to improve the conservation and the management of this natural resource.

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MANAGEMENT ATTEMPTS OF WILD BOAR (Sus scrofa L.*): FIRST RESULTS AND OUTSTANDING RESEARCHES IN NORTHERN APENNINES (ITALY)*

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Abstract: Wild boar disappeared from Northern Apennines nearly in the middle of nineteenth century, during the period of greatest human density on hills and mountains. Its disappearance was mainly due to high competition from territory exploitation related to woody and agricultural activities. The species spread from south-eastern France to western Liguria causing damages to cultivations since 1926. In the province of Genoa, thanks to an hunting association logistic support and to the Provincial Administration financial help, beatings have been carried out for three years (1990, 1991 and 1992) on selected area for a total of 7,000 ha with the cooperation of more than 600 volunteers per year. This in order to recognize numerical and structural changes in the present population. The comparison between these data and the number of hunted animals in the same years evidenced that the density of population is unaffected by heavy hunting pressure.

Keywords: Wild boar, *Sus scrofa*, Suidae, Regional history, Population, Distribution, Hunting.

IBEX J.M.E. 3:219-221

1. Introduction

In the study area (province of Genoa) the Wild boar has been present in historical age; it disappeared in the middle of nineteenth century, as a consequence of maximal expansion of human population and exploitation of natural resources for woody and agricultural activities in Apennines.

The reappearance of Wild boar since 1919, is probably due to a real invasion of the wild european subspecies, or form, spreading from southern France, where Wild boar populations were in a cycle of great numerical expansion (Balletto, 1977).

Toschi (1936) reported that in the provinces of Imperia and Savona, the density of the species reached such high levels that farmers required the suppression of the animals after the damages to cultivations they suffered. However, until 1961, the range occupied by Wild boar populations in Liguria was limited to Imperia province and to the western portion of Savona province.

In 1985 Liguria Region commissioned to the Institute of Zoology of the University of Genoa, a specific research on the presence of the Wild boar, on the wake of the contrasting reactions that the presence of this "new" faunistic population was provoking.

The local administrations, such as the Provincial Administration, identified the presence of the Wild boar with the troubles they were causing to farmers. As a consequence of the increasing complaints of the farmers, the local administration provided to increase the number of animals to be suppressed, always evaluating the density of the animals on the ground of the tracks and signals of presence left by the animals.

A preliminary phase consisted in the determination of the "form" of the wild boars present in the area, also taking into account that "voices" were run on the existence of non authorized restockings carried out by the hunters. Biometric and craniological analyses revealed that none of the animals (n>300, with >100 craniometric features) showed characteristics of recent cross-breeding with domestic pigs. Phenotypical characters presented a strong homogeneity (Marsan *et al.*, 1990).

The shortage of adult animals and the absence of old animals have also been verified. From the data obtained emerged the need for hunting planes on the ground of scientific censuses.

2. Methods

Quantitative data on Wild boar population were obtained in 1985, 1990, 1991 and 1992 by driving censuses with walking operators with dogs. These operators (volunteers) drived the animals towards a line of fixed observers.

We tried to make total count on the sampled territory by using 1 operator per hectare. March and April were the best periods regarding visibility (nacked trees), June-July allowed estimation of reproductive trends. Three categories of animals were distinguished: striped (supposed to be ≤ 5-6 months old), red (between 5-6 months and 1 year old) and black (over 1 year old).

3. Results

Annualy, six beatings with positive outcome have been carried out, with the participation of more then 500 people, and among them the provincial guards verified the correct course of the operations. In only two cases the lack of an adequate number of people impeded the correct course of the censuses.

In 1992 relative density resultant is about 1.4 Wild boar/km^2 against 1991 relative density of 1.7 Wild boar/km^2 (Tab. 1).

Apparently the suppression plan taking place during 1991-92 hunting season produced a numerical decrease of the population. This decrease would be counterbalanced by an increase of births: the difference between striped beasts and black beasts is significant (test χ^2 $p<0.01$) (Fig. 1). One of the regulation mechanisms known in Wild boar could account for this difference (e.g. restriction of reproduction due to density).

4. Conclusions

In this century, the only management of Wild boar has been in relation to the entity of damages to cultivations they caused; the more damages the wild boars cause to crops, the more hunting will follow, because the natural ecology of the habitat they occupy in the Apennines is limited by the absence or scarsity of big predators such as the wolf or the lynx.

Our proposals about hunting planning are the following:

1) Selected suppressions in at least two age classes based exclusively on the censuses.

2) Determination of the ranges of sex and age of the hunted animals. For determining the exact number of killed wild boars we propose the use of an irremovable mark, rather than only the declaration to the authority, often omitted.

3) Determination of the environmental situations that could increase Wild boar damages.

Table 1. Results about the censuses in 1991 and 1992.

Census 1991

Area	Surface (ha)	Wild boar (n)	Striped (n)	Red (n)	Black (n)
Sestri L.	1100	22	15	2	5
Propata	994	11	1	0	10
Masone	1050	23	4	1	18
Gattorna	875	5	0	0	5
Campomor.	881	25	3	7	15
Vobbia	1056	16	0	0	16
Total	5956	102	23	10	69

Census 1992

Area	Surface (ha)	Wild boar (n)	Striped (n)	Red (n)	Black (n)
Sestri L.	1100	21	15	0	6
Propata	994	21	12	0	9
Masone	1050	10	5	2	3
Gattorna	875	3	1	0	2
Campomor.	881	19	9	2	8
Vobbia	1056	8	0	3	5
Total	5956	82	42	7	33

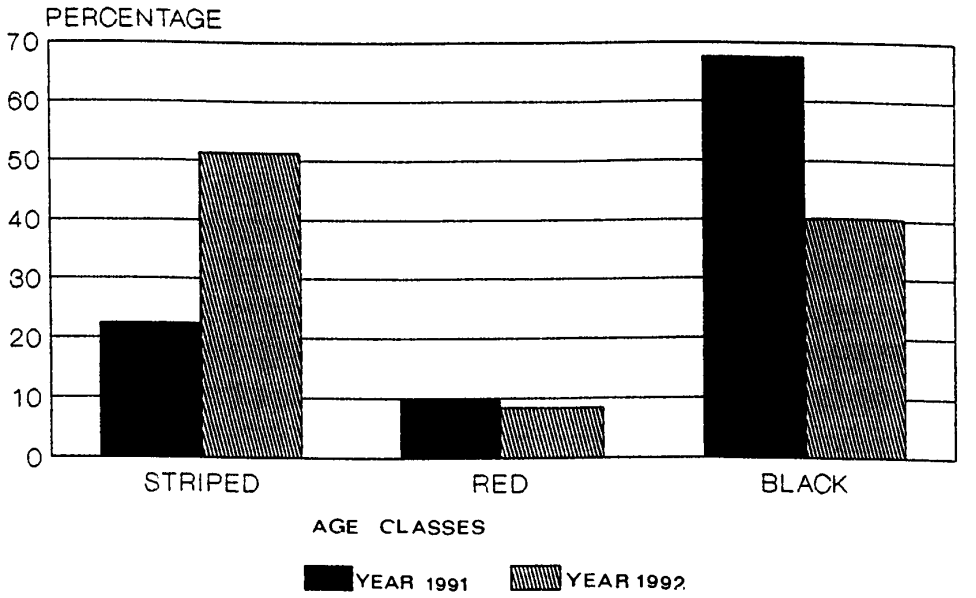

Figure 1: Comparison between two years of censuses (1991/1992) for different age classes.

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WILD BOAR POPULATION DYNAMICS AND MANAGEMENT IN HUNGARY

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Abstract: In this contribution population and harvest data as well as a simple harvest model are presented. The results show that the population growth was supported by the following elements: the harvest rate of Wild boar populations was always much lower than it is necessary to achieve a zero growth rate, *i.e.* to stabilize the population; hunting pressure on larger populations is inefficient, these populations are underharvested and surplus individuals can immigrate into the surrounding areas; during the last decades the afforested area of the country increased and this gave considerable additional habitat for Wild boar; the large-scale agriculture provided excellent habitat (large field size) and foraging opportunities for Wild boar. On the basis of the results the elements of an effective Wild boar management are also described.

Keywords: Wild boar, *Sus scrofa,* Suidae, Population dynamics, Management, Hunting, Harvest model.

IBEX J.M.E. 3:222-225

1. Introduction

Wild boar (*Sus scrofa*) is an important big game in Hungary. In spite of the continuously increasing harvest, the Wild boar population has been increasing during the last 30 years (Fig. 1). Although this population growth resulted in much more shooting opportunities for hunters, damages of Wild boar caused in agricultural crops and forest plantations are considered as intolerable. According to the official guidelines of the 70s' and 80s', the supportable population ranged from 8,000 to 16,000 indivi-

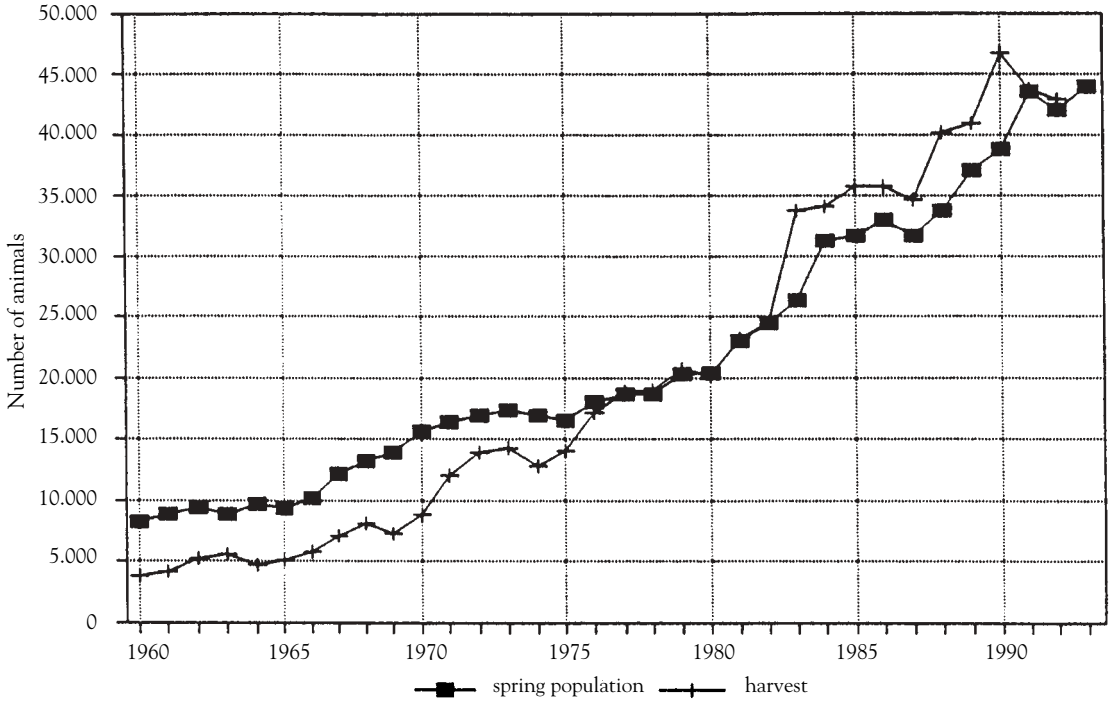

Figure 1 - Wild boar population dynamics (Reported spring population and harvest).

duals (Kõhalmy *et al.*, 1987). To achieve this goal hunting methods of Wild boar are very liberally determined (*e.g.*, night hunting with spotlights is allowed), and Wild boar can be shot all year.
This paper presents population and harvest data, and with a simple model under-harvest as a source of continuous population increase is evaluated.

2. Material and methods

Game management data (1969-1992) published by the Ministry of Agriculture were used for the analyses. These data include the reported spring population size and the number of wild boars shot during the same calendar year. The data are divided into management sectors: game management units managed by state enterprises [18% of Hungary: state forestries, state farms, military areas, etc.] and by hunting associations [82% of Hungary: ca. 700 units]. This allowed the separated analysis and comparison of hunting efficiency of the two groups.
The hunting efficiency was measured with harvest rates for each year (Harvest rate = harvest / spring population). The harvest rates were calculated for the two management sectors and from the country totals.
With a simple harvest model it is possible to calculate the harvest rate to stabilize the population size (zero population growth):

$$HR = \frac{P + P \cdot Fr \cdot R - P \cdot m - P}{P} = Fr \cdot R - m$$

where: HR = harvest rate, P = spring population, Fr = Proportion of reproducing females, R = number of piglets per female (reared until autumn), m = mortality rate.
Assuming 1:1 sex-ratio among the adults, 2.5-3.5 reared piglets/reproducing female and 5% natural mortality of the adults, the model suggests 1.1-1.6 harvest rate (110-160%) to keep the population size unchanged. This range is in accordance with the 100-150% harvest ratio given by other authors (Kõhalmy *et al, op. cit.*; Páll, 1982).

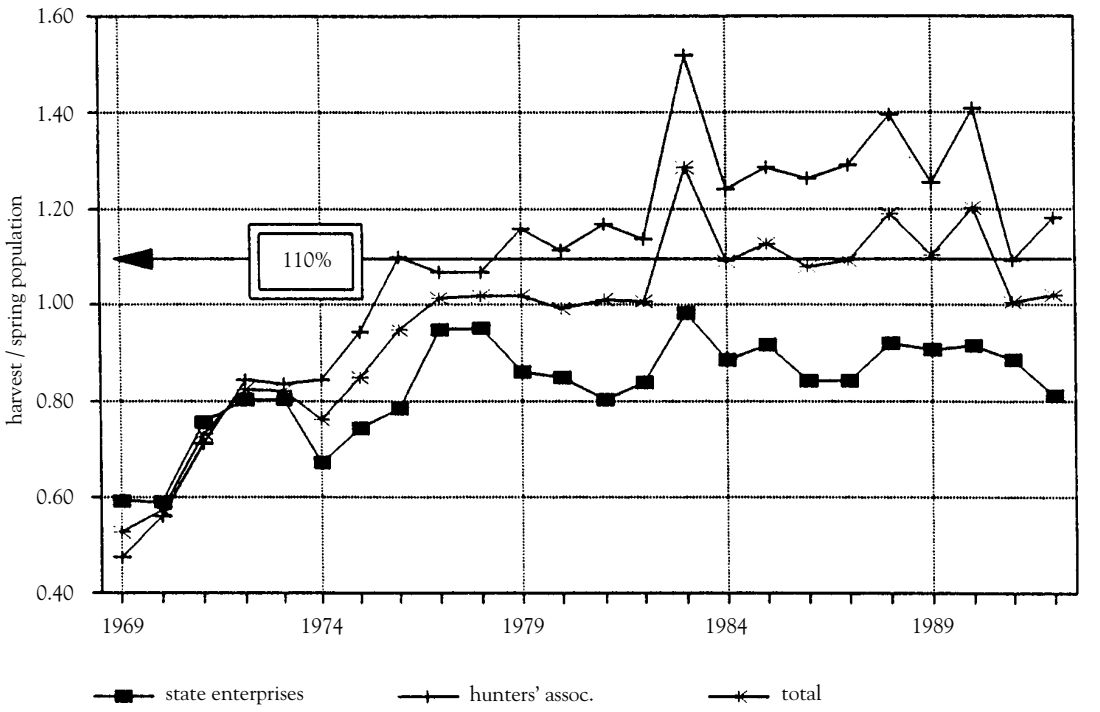

Figure 2 - Harvest rates of Wild boar in Hungary (1969-1992).

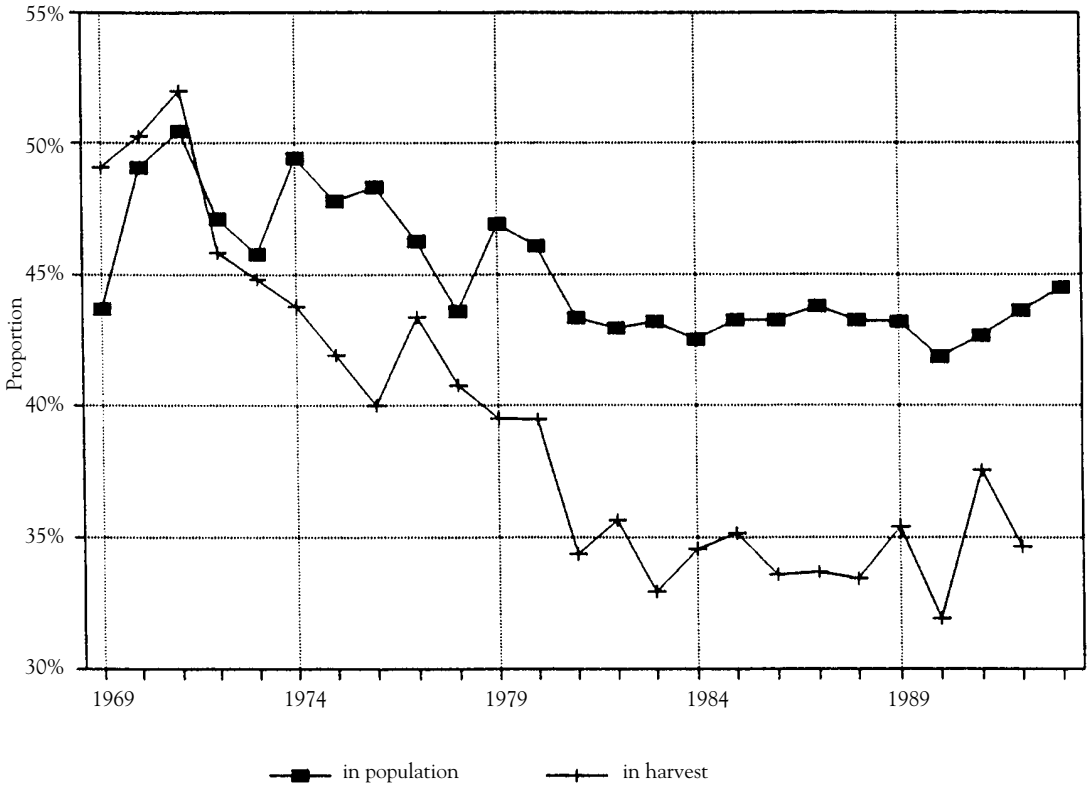

Figure 3 - Share of state enterprises.

3. Results

From 1969 to 1984 the harvest rate of Wild boar was increasing and since 1985 it is nearly stable. Since then, the harvest rate of Wild boar calculated from the country totals has reached the lowest value indicated by the model. On the other hand, there is a very great difference between the values of state enterprises and hunters' associations. In the areas managed by state enterprises the harvest rate was always much lower ($0.8 < HR < 1.0$), while in the other sector it ranged between 1.2 and 1.5 (Fig. 2).

This difference in hunting efficiency is very important if we consider that in the 70s' more than 50% and in the 80s' 40-45% of the spring population was reported in the area of state enterprises (Fig. 3). In the same time the share of state enterprise in the harvest declined from 50% under 35%. The disparity in the shares of state enterprises means that about half of the Wild boar population was under-harvested in the period investigated. This part of the Wild boar population could give a steady basis for continuous increase.

The effect of disproportionate harvest rates can be amplified by the geographical distribution of hunting areas managed by state enterprises (Fig. 4). These areas are dispersed and from the under-harvested Wild boar stocks surplus individuals can migrate into the neighbouring areas. It can be assumed that state areas (especially the state forest enterprises) are functioning as reservoirs of population increase.

4. Discussion

The results emphasize that the harvest rate of Wild boar populations was generally lower than that of necessary to stabilize the population. Much greater harvest rates should have been applied to initiate a population decline in order to reduce the Wild boar population to the desired size (Kõhalmy *et al.*, *op. cit.*).

During the last decades the afforested area of the country increased continuously, which provided significant new habitat for Wild boar. Additionally, the large-scale agriculture gave

Figure 4 - Distribution of hunting areas managed by state enterprises in Hungary.

excellent temporary habitat in summer and autumn and foraging opportunities for Wild boar (Csányi, 1989). Although habitat changes provided a sound basis of population dynamics, the relatively low harvest of Wild boar populations can be regarded as key element of the process.

The lower harvest rates in areas managed by state enterprises contributed to the continuous population increase by providing surplus animals. Because of the scattered pattern of these hunting districts, migrating individuals may constantly maintain numbers in areas where these animals are intensively hunted due to the great damage caused in agricultural crops. Paradoxically, energetic elimination of Wild boar results in areas becoming a special kind of "traps," which attract straying individuals from the surrounding areas (Andrzejewski & Jezierski, 1978).

A further analysis also revealed that there is a slight negative correlation between Wild boar density and harvest rate. The previously described effects of management differences can be intensified because large (dense) populations are also under-harvested and the same problems appear on smaller scales (Csányi, 1989).

It can be concluded that management of Wild boar populations requires the cooperation of neighbouring management units. In the future, the dilemmas of Wild boar management can be solved on larger-scales if in ecologically similar regions (game management regions) common strategies are applied in planning and control (Csányi, 1993).

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ESTIMATING SUSTAINABLE HARVESTS FOR WILD PIG POPULATIONS IN AUSTRALIA'S RANGELANDS

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Keywords: Wild pig, *Sus scrofa,* Suidae, Population management, Modelization.

IBEX J.M.E. 3:226

International demand for Wild pig meat has led to rapidly increasing harvests in Australia, particularly in the semi-arid rangelands which contain the highest density of pig populations. Overharvesting has occured in some areas, leading to uncertainty in the supply of Wild pig carcasses for export. Uncertainty of supply prompts Wild pig meat exporters to relocate harvesting operations to other areas, eliminating an important source of income to local game hunters and to the local economy. Regulated harvesting would stabilise hunter incomes and garantee consistent access to harvestable pigs, allowing demand and supply to be more closely matched. In order to regulate Wild pig harvests, sustainable yields must be estimated and used to set local or regional quotas.

Seasonal conditions in Australia's semi-arid rangelands are higly unpredictable. Rainfall has little seasonality and variation between years is typically high (>40%), leading to extreme variation in available pasture. Because wild pigs inhabiting the rangelands subsist on pasture, rates of change in their abundance are closely linked to its availability. Consequently, sustainable yields for pig populations in the rangelands cannot be accurately predicted using simple techniques (*i.e.* logistic-based harvesting models). We used an empirically derived stochastic population model to evaluate alternative harvesting schemes for wild pigs in rangelands habitats. The simulation model is based on an interactive plant-herbivore system comprising pasture, an unharvested population of kangaroos, and wild pigs. The model is used to examine how the maximum sustainable yield (MSY) of Wild pig populations in rangelands habitats varies with prevailing seasonal conditions, and how MSY can be tracked and predicted using environmental indicators. A series of simulations illustrating how a regulated harvest of wild pigs would operate has been also conducted.

WILD BOAR, TURKEY'S MOST SOUGHT-AFTER BIG GAME

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Keywords: Wild boar, *Sus scrofa,* Suidae, Distribution, Damages, Hunting.

IBEX J.M.E. 3:227

Since ancient times Wild boar (*Sus scrofa* L.) had the position of being the unique wild game of interest for the men living in Anatolia. Wild boar is currently the most popular big game hunted in Turkey. It is very similar to those living in Europe, Russia, Caucasia and Iran, and exists in huntable numbers in the forests of northern, southern and western Turkey (in fact almost everywhere except in open flat areas and in the high mountains).

The places where the Wild boar can be found in great numbers in Turkey are: Kirklareli-Demirköy, Tekirdag-Malkara, Istanbul-Sile, Yalova and Belgrat forests, Sakarya-Hendek, Karasu, Bolu-Düzce, Mudurnu, Mengen, Gerede, Zonguldak-Ulus, Yenice, Devrek, Bartin, Kastamonu-Tasköprü, Araç, Tosya, Daday, Azdavay, Sinop-Ayancik, Boyabat, Gerze, Samsun-Bafra, Carsamba, Tokat-Niksar, Ordu, Giresun, Trabzon, Artvin, Balikesir-Sindirgi, Bayramiç, Kepsut, Biga, Bursa-Orhaneli, Gemlik, Armutlu, Inegöl, Yenisehir, Afyon, Kütahya, Aydin, Mugla, Antalya, Mersin-Anamur and Karabu-cak forest areas.

Habitat selection of Wild boar changes depending upon the regional characteristics of the area. Sites of this animal in Turkey may be divided into three main zones which are influenced by the Black Sea, Mediterranean and semi-continental climates. Wild boars use the different habitats in relation to their availability in these regions. They prefer marshy areas, lake and stream edges mainly where woods have a dense understory, shrubs, and uncultivated lands within wooded areas used for feeding, bedding and resting.

In the Black Sea Region, Wild boar selects the coppices that are dominated by chestnut (*Castanea sativa*), and, further inland, pure or mixed oak stands. In winter, it can be found in mixed deciduous at low altitudes where the rooting activity is maximum. The most prefered micro-habitat types are those that can ensure food or shelter and include muddy places or water accumulations where it can take a mud-bath and get itself body scratched by rubbing itself against tree trunks.

Wild boars make great damage to corn, barley, wheat, potatoes, sugar beet, bean, leek, lucerne, meadow, grapevine, hazelnut when resources in natural habitat are not sufficient and especially with an increase of their populations. Damages are mainly done during summer - early autumn. In this period, these animals rarely come out into the open to feed during the day: night is the time when they roam and plunder the fields. About 20 to 30 years ago, the Wild boar could heavily affect the local economy in many areas where the villagers used to spend the night in small huts in the fields.

Hunting of Wild boar is free whole year in Turkey, because of its damages to agriculture. Control of this animal has been carried on by local people and agricultural organizations in companies that were promoted by the government.

As a natural consequence of disappearing of some wet lands and marshy areas, and destroying of some wooded and bushes areas for various causes, Wild boar has also become extinct in those places. Some populations especially in western parts of Turkey have recently decreased because of its flesh becoming valuable as an expert matter.

In next decennary, as demands for its flesh and hunting grows, it seems to be necessary to take measures for restricting hunting period and conserving it in some locations.

WILD BOAR (Sus scrofa L.*) HUNTING IN SOUTH-WESTERN PYRENEES (SPAIN): PRELIMINARY DATA*

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Abstract: We have elaborated from 144 hunting battues of the 1990-91 hunting season the approximate density of the population, its census and a description of the hunting activity. Minimal density was an average of 3.1 (SE 0.8) for every 100 ha of wooded surface. Hunting efficiency was 20%.

Keywords: Wild boar, *Sus scrofa,* Suidae, Population, Density, Europe.

IBEX J.M.E. 3:228-229

1. Introduction

The Wild boar is an autochthonous species in the study area (Western spanish Pyrenees) and has been present there for centuries. Since the late sixties its populations have increased and today it can be considered as abundant, with an important ecological, sociological and economic-environmental relevance.

The aim of this preliminary work is to present the first data of Wild boar abundance in the area, to determine its population structure and to describe the hunting activity in a given hunting season.

2. Material and methods

The study area was in the Western Aragonese Pyrenees, with 60,285 hectares. The territory comprises the National Hunting Reserve of Los Valles, managed by the Regional Wildlife Service, three shooting preserves, managed by local hunters and a non managed hunting area. Woods occupy approximately 33,000 ha and consist of the following species in order of importance: Scots pine (*Pinus sylvestris*), White oak (*Quercus humilis*), Beech (*Fagus sylvatica*), Fir (*Abies alba*) and Holm oak (*Quercus ilex*).

Other wild ungulates in the area are Roe deer (*Capreolus capreolus*) and Pyrenean chamois (*Rupicapra p. pyrenaica*). The only predator living in the area is the brown bear (*Ursus arctos*), with a relict population.

We have elaborated from 144 hunting battues inquiries, carried out during the 1990-91 hunting season by eight groups of hunters specialized in Wild boar hunting, the approximate density and census, a description of the hunting activity and the population structure. The age of the boars was determined using tooth eruption and wear, and weighing crystalline lenses from a sample of 38 individuals. Density estimates are based on the number of boars seen during the battues.

3. Results

3.1. Density and census

Habitat	Number of battues	Density (boars/100 ha)	Standard error
Holm oak	22	3.0	2.5
White oak	29	3.1	2.2
Scots pine	70	2.8	1.1
Beech	23	4.2	1.4
TOTAL	144	3.1	0.8

As wild boars occupy mainly wooded habitats, multiplying the average density by the wooded surface, the total census for the area would be approximately 1,023 boars.

3.2. Hunting activity

Hunting efficiency, that is the number of killed boars in comparison with the total boars seen, was 20% which agrees with similar studies. Hunting is carried out mainly in battues (91% of the killed boars), during weekends and holidays (83% of the battues), in December essentially (46% of the battues). The average number of hunters per battue was 12.4, dogs were 5.3 and the driving hunters were 2.7, on an average surface of 158 ha.

3.3. Sample structure

Age (years)	Males	Females	Sex-ratio	X^2	P level
0-1	7	4	1.75	0.81	0.36 NS
1-2	9	8	1.12	0.6	0.81 NS
>2	3	7	0.42	1.6	0.21 NS
TOTAL	19	19	1	0	1 NS

The structure of the sample shows a 1:1 sex-ratio. 74% of the examined animals were less than two years old.

4. Acknowledgements
This work has been entirely supported by the Aragonese Regional Government and is part of a long term investigation on Wild boar biology in mountain environments. We are thankful to all the hunters and rangers who helped us to gather the boars and filled up the battue inquiries.

DAMAGES CAUSED TO CROPS BY WILD BOARS (S. scrofa meridionalis) IN SARDINIA (ITALY)

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Abstract: In Sardinia wild boars *(Sus scrofa)* are originally present with an endemic subspecies, *S. scrofa meridionalis*. It is distinguished by its smaller size and by a taller and larger head in comparision with the one of the typical form. In the Island, starting from the sixties, many exemplars of the subspecies *Sus scrofa scrofa* (central European Wild boar) have been introduced with a hunting purpose. They have spread in a great part of Sardinia and they have cast out the endemic subspecies to a few areas (central Sardinia, Ogliastra, Sulcis, Iglesiente). We should consider the fact that in Sardinia wild boars have always had the chance to interbreed with great facility with domestic pigs, owing to the large diffusion of pig rearing in the wild state. We haven't any exact and reliable data on the distribution and density of the Wild boar in Sardinia. The only information we get is from the examination of the shootings during the hunting season. The introduction of central European exemplars and the possibility of interbreeding with domestic pigs may have influenced the prolificacy and have favoured in many circumstances the numerical development of the population of wild animals. Wild boars are a omnivorous species, they feed mainly on the fruits of woods (acorns, chestnuts, hazelnuts), roots, tubers, bulbs and larvas of insects, corns, carrot, potato, sugar beet and vineyards. They often cause damage to crops. Even in Sardinia several cases of damage caused by wild boars in farming area are reported to the Regional Department of the Defence of Environment. This Department is responsible for the evaluation of the damages and the possible refund for farmers. In this poster the data of the damages claimed in a three year period, from 1990 to 1992, are examined. Particular attention is paid to the geographical distribution of the damage and to the kind of crops.

Keywords: Wild boar, *Sus scrofa meridionalis*, Suidae, Damage increase.

IBEX J.M.E. 3:230-235

1. Introduction

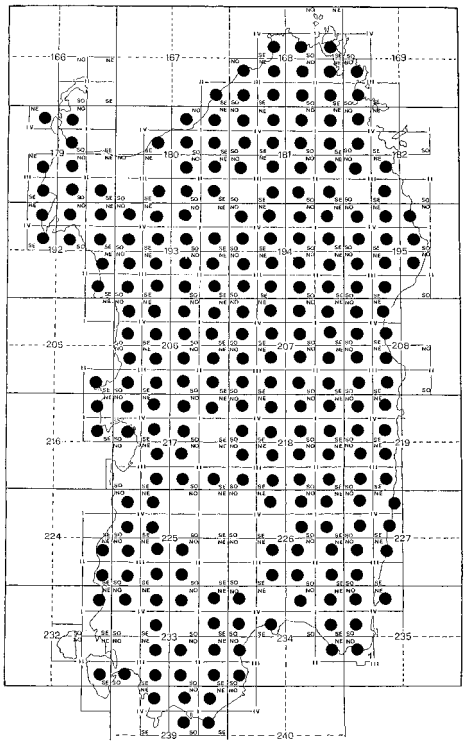
Wild boars in Sardinia are present at first with the subspecies *Sus scrofa meridionalis* Major, 1883, characterised by small size and by a thin and long muzzle. Sardinian wild boars probably originate from pigs gone wild. The species is largely distributed (Fig. 1) almost all over the regional territory and in particular in areas with vegetation characterised by mediterranean brushwood and wood of evergreen broadleaf plants (ilex, corkoak and *Quercus pubescens*). In Sardinia there are no certain data on the real distribution and density of populations and we lack information on bioethology and the use of habitat.

In the last decades (1960-1990) wild boars belonging to the central European subspecies (*S. scrofa scrofa*) and to the Maremma one (*S. scrofa majori*) have been introduced in different areas of the region (Gallura, Nurra, Sant'Antioco, etc.), with the only aim of repopulation for hunting purposes.

These introductions have certainly caused genetic contamination of pre-existing populations and in some cases a population increase which has contributed to the reduction of food availability and to the spreading of the species even in areas never frequented before.

Wild boar is an omnivorous species and feeds, also in Sardinia, predominantly on fruits of woods (acorns, berries, chestnuts and hazelnuts etc.) and on roots, tubers, bulbs, larvas of insects and other invertebrates it searches for with its limbs and muzzle. Under certain conditions (high density, excessive presence of man in woods, reduction of natural food resources owing to fires, drought etc., repopulation and unfit introductions) wild boars may frequent, in order to feed, even farming areas causing damages which might be of a certain importance.

In this poster the data of the damage claimed in a three years period, from 1990 to 1992, are examined. Particular attention is paid to the geographical distribution of the damage and to the type of crops.



● Presence

Figure 1 - Wild boar distribution in Sardinia (1992).

2. Methods

The data concerning damages to crops caused by wild boars in Sardinia in the years 1990, 1991 and 1992 have been processed.

The data come from the surveys and the assessments of damages made by technical offices of the hunting Provincial Committees of Sassari, Nuoro, Oristano and Cagliari. These offices, bodies of the Regional Committee for the Defence of Environment, are in charge of evaluating the claims of damages caused by wild fauna sent by farmers. It is important to underline that the rules concerning the indemnity of damages are not very well known by farmers who don't often claim damages when they are of a small extent. For this reason the occurrence as it appears from the analysis of the data is to be considered understated.

3. Results

We learn from the analysis of the data that in Sardinia in the years 1990 - 1992 the crops more frequently and more largely damaged by wild boars are grasslands (clover, lucern, etc.), cereal fields (maize, wheat, barley), vineyards and pastures. Vegetable gardens are much less affected.

In tables 1, 2 and 3 the data concerning the damaged surfaces, in hectares, corresponding to the four provinces and to the whole territory of Sardinia are reproduced.

In figures 2, 3 and 4 the percentages of damaged surfaces for the different crops for each year are reproduced.

In figure 5 the variation of damaged surfaces in the years 1990 - 1992 for each crop is presented.

As regards the survey of the kind of damages caused by wild boars it has been observed a direct impact on the crops with use of produce and an indirect impact with trample and digging of the ground.

In table 4 the consequences on the main crops are presented.

4. Regulations

4.1. Present regional regulations (Regional Law 28.4.1978 n.32)

The autonomous region of Sardinia, which is

Tab. 1: Characterization of the damaged surfaces - Year 1990.

CROPS	Damaged surfaces (ha)				
	SASSARI	NUORO	ORISTANO	CAGLIARI	SARDINIA
vineyard	101	40	8	15	**164**
wheat	—	—	8	32	**40**
barley	—	—	35	5	**40**
grassland	—	10	29	35	**74**
maize	70	—	7	—	**77**
vegetables	10	—	7	—	**17**
pasture	—	—	44	—	**44**
TOTAL	181	50	138	87	**456**

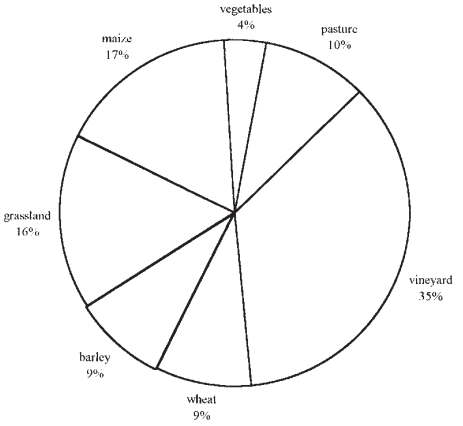


Figure 2. - Proportion of various crops in total damaged surface - Sardinia, year 1990

the sole responsible as regards hunting, following the state law of 27th December 1977, has issued the regional law 32 of 28th April 1978. It deals with "Rules on the protection of fauna and hunting in Sardinia" and confirms article 1 which states that "Wild fauna is an environmental possession of the Region and therefore it is safeguarded and protected in the interest of national community". For this reason the Regional Administration has planned for the safeguard and protection of crops, art. 55 of above mentioned regional law *32/78* that "adequate reparation is granted for the damage of crops contiguous or inside permanent oases of faunal protection and capture and areas of repopulation and capture".
This article was then modified by art. 47 of regional law *31/83* which states: "The Regional Administration grants adequate compensation to breeders and farmers for damages caused to cattle and crops by game or by the handling of permanent oases of faunal protection and of areas of repopulation and capture". This last rule enlarges the possibility of granting indemnities for damages caused by wild fauna both to crops and to cattle even if they are not inside permanent oases of faunal protection and/or areas of repopulation and capture.
It is important to underline however that adequate indemnity means "ristoro patrimoniale" (property relief) and certainly not a complete compensation.

4.2. Adjustment of regional regulations to law *157/92*.

The Regional Administration with the bill 188 of 16th February 1993 still before the regional committee which will soon introduce it to the Regional Council for approval has incorporated the innovative aspects set by the state law 157/92 and in particular the principle of the link hunter-territory-crops.
The title II heading IV of the above mentioned bill concerns the protection of crops, cattle and

Tab. 2: Characterization of the damaged surfaces - Year 1991.

CROPS	Damaged surfaces (ha)				
	SASSARI	NUORO	ORISTANO	CAGLIARI	SARDINIA
vineyard	83	60	—	15	**158**
wheat	—	20	5	37	**62**
barley	40	—	—	10	**50**
grassland	50	10	82	45	**187**
maize	100	—	—	—	**100**
vegetables	15	—	5	—	**20**
pasture	—	—	83	—	**83**
TOTAL	288	90	175	107	**660**

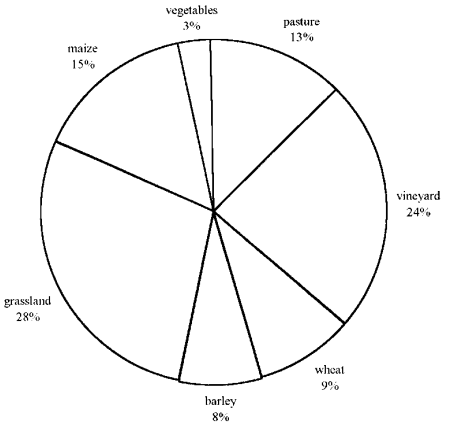


Figure 3 - Proportion of various crops in total damaged surface - Sardinia, year 1991

fish production. This protection is to be agreed on by hunters and farmers concerning hunting in private property. Landowners and landholders must be paid a subsidy in exchange for hunting and in addition can claim compensation for the damage caused to crops and works by hunting and by wild fauna. Competence in this field is divided among the different subjects in charge of the management of the Institutions fixed by law. However the Regional Administration must pay for the damages caused in permanent oases of faunal protection and capture, in temporary areas of repopulation and capture and in public areas of game breeding for study and repopulation.

5. Final considerations and suggestions

From the analysis of the data of the present survey it is possible to make some general considerations and suggestions:

1. At present we haven't got enough scientific information on food liking, ethology and the dynamics of Wild boar populations in Sardinia. Consequently, also the analysis of the occurrence of damages is objectively more difficult, so it would be necessary to start also in Sardinia researches on the biology and ecology of this species.

2. Available data on the distribution and extent of damages caused by wild boars to crops are not enough yet and they don't allow us to define a complete outline of the occurrence. A deeper research on the matter all over the regional territory is to be hoped along with the beginning of specific surveys on sample areas according to their different environmental characteristics (altitude, vegetation, type of crops).

3. As regards the analysis of damages caused by wild boars it is possible to state that the occurrence concerns mainly hill pastures and grasslands next to woodlands of small or medium extent. In these areas wild boars, by "ploughing"

Tab. 3: Characterization of the damaged surfaces - Year 1992.

CROPS	Damaged surfaces (ha)				
	SASSARI	NUORO	ORISTANO	CAGLIARI	SARDINIA
vineyard	70	70	3	15	**158**
wheat	—	20	—	43	**63**
barley	—	—	—	10	**10**
grassland	70	20	58	115	**263**
maize	197	—	3	—	**200**
vegetables	20	—	4	—	**24**
pasture	—	—	125	—	**125**
orchard	—	5	—	—	**5**
TOTAL	357	115	193	183	**848**

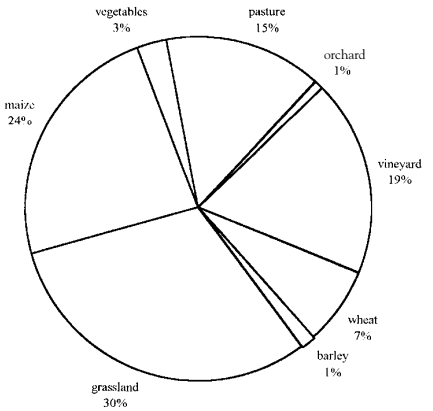


Figure 4 - Proportion of various crops in total damaged surface - Sardinia, year 1992

the ground, make the surface unusable for the traditional practise of domestic animal breeding (sheep and cattle) in the wild or half -wild state. In some cases relevant damages are caused.

Where there are large woodlands (Nuorese, Sarrabus, Sulcis-Iglesiente) the number of claims for damages caused by wild boars is smaller.

The occurrence of damages also concerns, in some parts of Sardinia, farming areas with intensive cultivations such as vegetables or vineyards where these crops are next to woodlands or mediterranean bushlands (Algherese, Sassarese and Logudoro).

It is to be underlined that from 1990 to 1992 there was an increasing diffusion of the occurrence: 21 comunal territories affected in 1990 with a total amount of damaged surface of 456 ha; 28 in 1991 with 660 ha damaged and 38 in 1992 with 848 ha (Fig. 6). The number of claims for damages caused by wild boars also increased.

At present it is not possible to decide whether the above mentioned increase originates from a real growth and territorial diffusion of the Wild boar populations, from modifications of the natural environment of the species or (more probable) is a consequence of an increasing and more widespread knowledge of the regulations concerning claims for damages caused by wild fauna. A lot of farmers are likely to suppose that damage compensation can provide a new possibility of supplementing their farming income.

It is our opinion that in order to deal with the problem of damages caused by wild boars it is necessary to start a handling of this ungulate that should not only consider the possibility of granting compensations but also allows in the different environmental situations to evaluate the occurrence scientifically and supply farmers with technical information on:

- preventive measures (repulsive forces, fences, complementary food supplies, etc);

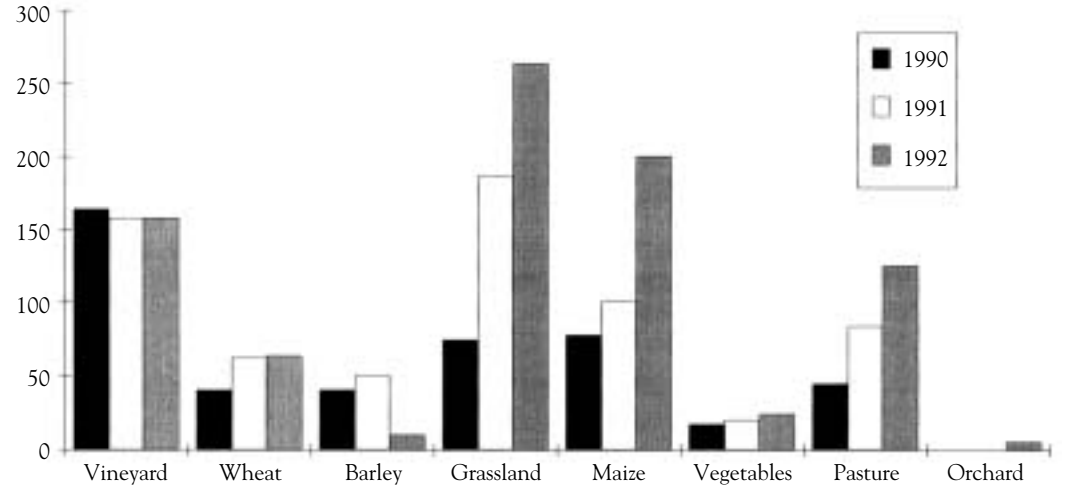


Figure 5 - Damaged surfaces (ha) for various crop types, from 1990 to 1992.

Tab 4: Consequences of damages caused by wild boars on different crops.

VINEYARD	Breaking off of plants and breakage of stalks, damage of bunches with crushing of grapes and getting sour of bunches as a consequence.
WHEAT and BARLEY	Flattening of plants and difficulty of mechanical harvesting as a consequence.
GRASSLAND and PASTURE	Breaking of turf with possible erosion in a sloping ground.
MAIZE	Breaking off of plants which makes it difficult mechanical harvesting of cobs. Cobs are often damaged.
VEGETABLES	Trample and smearing.

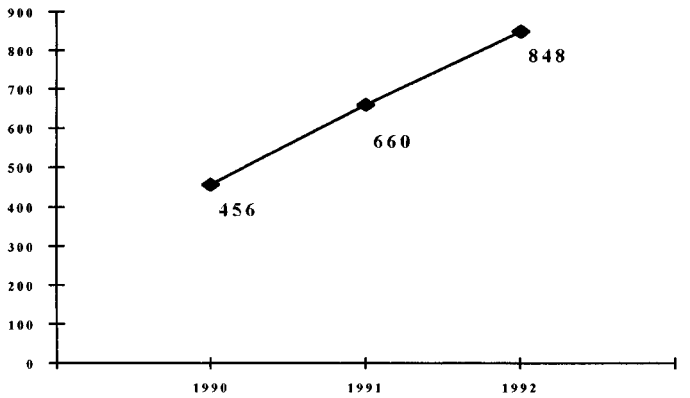


Figure 6 - Increase of registered damaged surfaces (ha) from 1990 to 1992.

- population control (capture and hunting plans);
- strict evaluation of damages and consequent total compensation.

6. Acknowledgements
We would like to thank Mr Salvatore Pruneddu for translating this poster into English.

THE WILD BOAR'S IMPACT ON AGRICULTURE IN PIEDMONT (ITALY): A STUDY ON ADMINISTRATIVE REPORTS

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Abstract: The damages caused by Wild boar in Piedmont region (NW Italy) in the period 1986-1990 are presented. An analysis was performed on the data from Cuneo Province. This area represents well most ecological and agricultural landscapes of the region.

Keywords: Wild boar, *Sus scrofa*, Suidae, Damages.

IBEX J.M.E. 3:236

1. Introduction

The economical impact of the Wild boar have reached, in these last years, such an extent that the local administrations were led to develop management plans. In Piedmont, since 1986, the Provinces refund farmers for crop damages caused by game.

In this paper a general picture of the situation in the six piedmontese provinces is first given, the data of Cuneo Province are then analysed for the five-year period 1986-1990.

Table 1: Anova two ways test. Values for independent variables - Class Level Information.

Class	Levels	Values
CROP	9	Other Chestnut Cereals Orchard Corn Maize Vegetables Potatoes Grasslands
Year	5	86 87 88 89 90

Numbers of observations in data set = 3898

2. Material and methods

The data are drawn from the appraisals filled by the experts appointed by the provincial administrations. A total of 3898 reports from Cuneo Province were analysed and data on crop type, damaged surface (in m^2), month of occurrence, location and altitude were recorded.

The statistic test used is the ANOVA two ways test with interaction. Means were compared by the Ryan-Einot-Gabriel-Welsch multiple range test that defends against first type error. The software used was the SAS.

3. Results and conclusion

Among the six provinces, Cuneo and Torino are those that suffered the heavier Wild boar impact. This must be related to the species' range. On the whole a decrease, both in numbers of requests and in amount of refunds, has been shown.

The analysis of variance of the damaged surfaces by year and by crop type (Tab.1), demonstrated that highly significant differences exist between the years ($F=4.92$, $df=4$, $p=0.0006$) and between crop types ($F=2.69$, $df=8$, $p=0.006$).

The comparison test of the averages indicates that 1987 was the year of maximum damage (Tab. 2).

The comparison test of crop type indicates that the Wild boar choice did not change along the years and this underlines the opportunism of the species that can optimise the exploitation of the environmental resources.

Table 2: Ryan-Einot-Gabriel-Welsch Multiple Range Test for variable: "Damaged Surface" - Means with the same letter are not significantly different. Note: This test controls the type I experimentwise error rate.

Grouping	Mean	N	Years
A	35230	641	1987
B	15440	1547	1990
B	6746	414	1986
B	5097	607	1989
B	1022	340	1988

It is noteworthy that the high variability of the data influenced the interpretation of the results. This is due to the fact that the parameter "damaged surface" actually states, in most cases, the loss estimated by the farmer rather than objective damage caused by the animals. In order to allow optimisation of the administrative intervention on the damages caused by game, it is desirable to better separate the loss suffered by the farmers from the damages caused by the animals.

WILD BOAR (Sus scrofa) CONTROL IN REGIONAL PARK "LA MANDRIA" (PIEDMONT, NW ITALY)

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Abstract: The authors discuss the effects on population structure (sexes, age classes) and the effectiveness of two different methods of population control to which wild boars of the Regional Park "La Mandria" were subjected during a period of five years.

Keywords: Wild boar, *Sus scrofa,* Suidae, Damages, Control, Sex ratio, Age classes.

IBEX J.M.E. 3: 237-240

1. Introduction

In order to limit crop damages caused by wild boars living in the Regional Park "La Mandria" two different methods of population control were employed: shooting individuals caught in cage traps and direct shooting from high seats. The purpose of this study was to assess the management effectiveness of the two techniques and their impact on different age classes and sexes. Data concern the period from 1 Dec. 1988 to 30 Nov. 1993.

2. Study area

The Regional Park "La Mandria" (258-402 m u.s.l.) stretches for 6,541 ha, mainly occupied by grazing meadows, cereal fields and deciduous forests (27% of the surface) (Fig. 1).

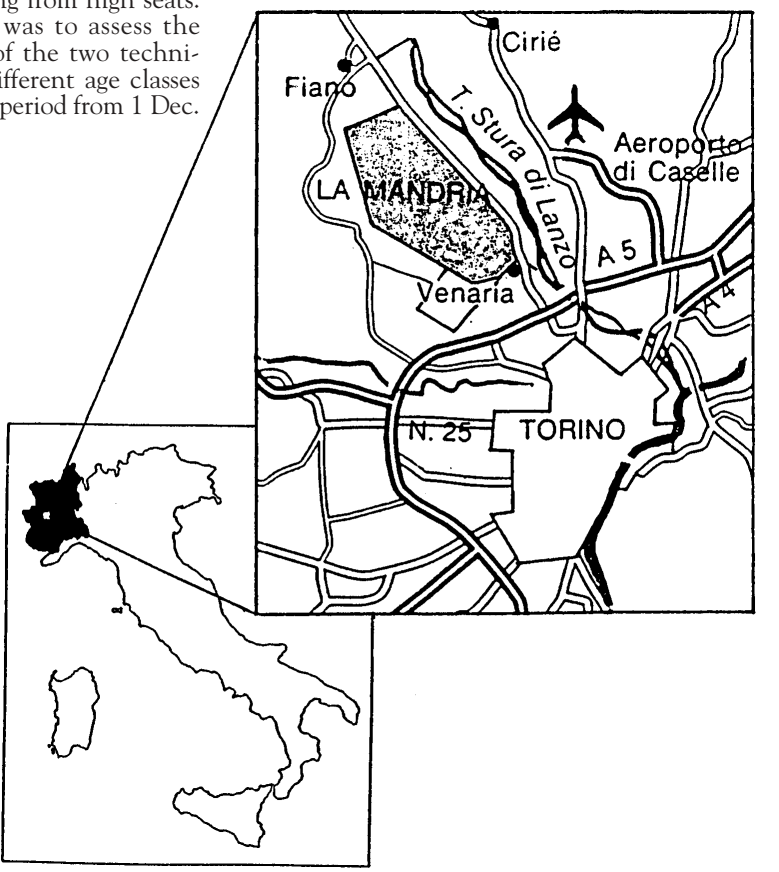

Figure 1 - Study area.

The central area of the Park is more suitable for wild boars, being lesser anthropized and thanks to its more extensive forestal cover; it is enclosed by a wall that does not represent a barrier to the species, which can move along the several water courses which cross it.

3. Material and methods

Eight movable cage traps were employed, baited with maize grains and placed in the central area of the Park. Traps were operated weekly for 5 days and checked each morning by an operator. Captured animals were killed directly within the cage, except for individuals younger than 4 months which were freed and are not considered in the present study.

Assuming a trap night (TN) to be 1 trap operated for 24 hours, capture rates are expressed as the number of caught and killed wild boars/100 TN.

Other wild boars were killed directly shooting with carbine from permanent high seats or temporary seats (lean-to type). To this purpose individuals were driven by moving operators also aiming to the selective control of Red deer and Fallow deer. The number of daily employed operators varied from 7 to 30; dogs were not employed.

Individual age was determined on the basis of the dentition analysis following the criteria proposed by Iff (1978) and Boitani and Mattei (1991).

The incidence of the two culling methods on different age classes and sexes was tested by χ^2 analyses for independent samples.

4. Results and discussion

On the whole, 486 individuals were culled, 67.3% were shot in capture traps and 32.7% shot from high seats (Tab. 1).

Individual shooting within cages has not inhibited further captures, 14% of which took place during the 48 hours following the shooting. The number of individuals shot in a trap varied from 1 to 11 per capture, with a mean of 1.68; multiple captures were 29.3% of the all cases.

The period with more captures was from May to September (Fig. 2).

The overall sample of culled individuals shows a sex ratio of 1: 1.31. The incidence on the sexes of the two methods employed does not significantly differ ($\chi^2 = 0.298$, d.f. = 1, $p>0.5$). On the contrary, the two methods significantly differ regarding to the different age classes cull ($\chi^2 = 104.514$, d.f. = 4, $p<0.001$), which is proportionally bigger on 4-6 months individuals with trapping (Fig. 3). There is undoubtedly a selection in favour of the killing of individuals older than 1 year in the high seat shooting, due to the fact that among an animal herd the culler tends to choose the bigger individual. Since we do not really know the population structure, it is not possible to check if the opposite selection exists employing traps, as noticed by other authors (Mauget, 1980; Douaud, 1983; Spitz *et al.*, 1984; Boisaubert & Klein, 1984; Gaillard *et al.*, 1987; Jullien *et al.*, 1993).

The trapping success has progressively reduced from 1989 to 1993 (Fig. 4). The exceptional acorn production during the autumn 1993 may have influenced the last figure, which is particularly low; several authors notice that a high food availability in the environment interferes negatively with the captures (Vassant *et al.*, 1993).

However, the trend on the whole denoted by the index shows how, in spite of the possible immigration, the killing has determined a progressive decrease in the number of wild boars in the area.

Table 1: Number of wild boars killed within the cages (C) and by shooting from high seats (HS) for each year.

Years	Days***	WILD BOARS		
		C	HS	Total
1989 *	98	63	19	82
1990	185	116	55	171
1991	165	61	54	115
1992	195	59	14	73
1993 **	195	28	17	45
		327	159	486

* Data relevant to December 1988 are included.

** Data until 30/11/1993.

*** Number of operating days. Trapping and high seat shooting were carried out during the same days each year.

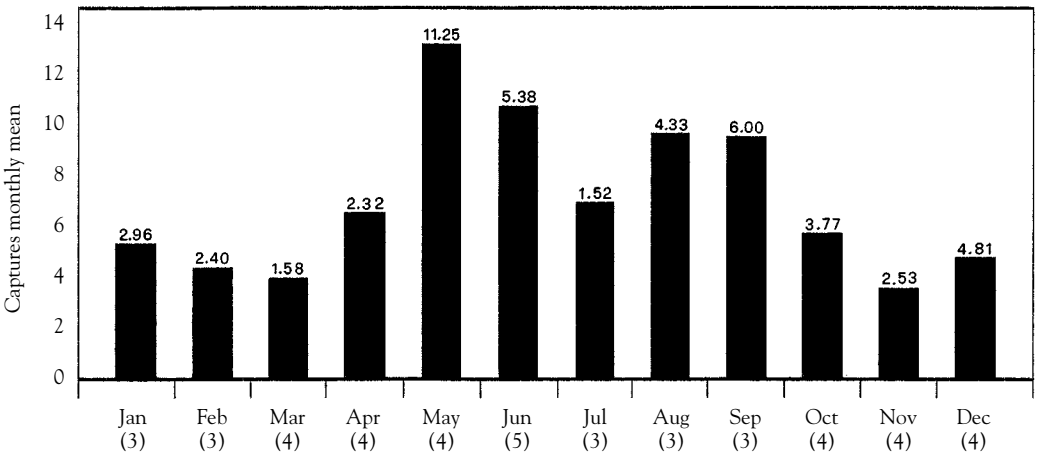

Figure 2. Captures monthly mean. Values above the bars indicate SE, values in parentheses indicate the number of months (between 1988 and 1993) in the sample.

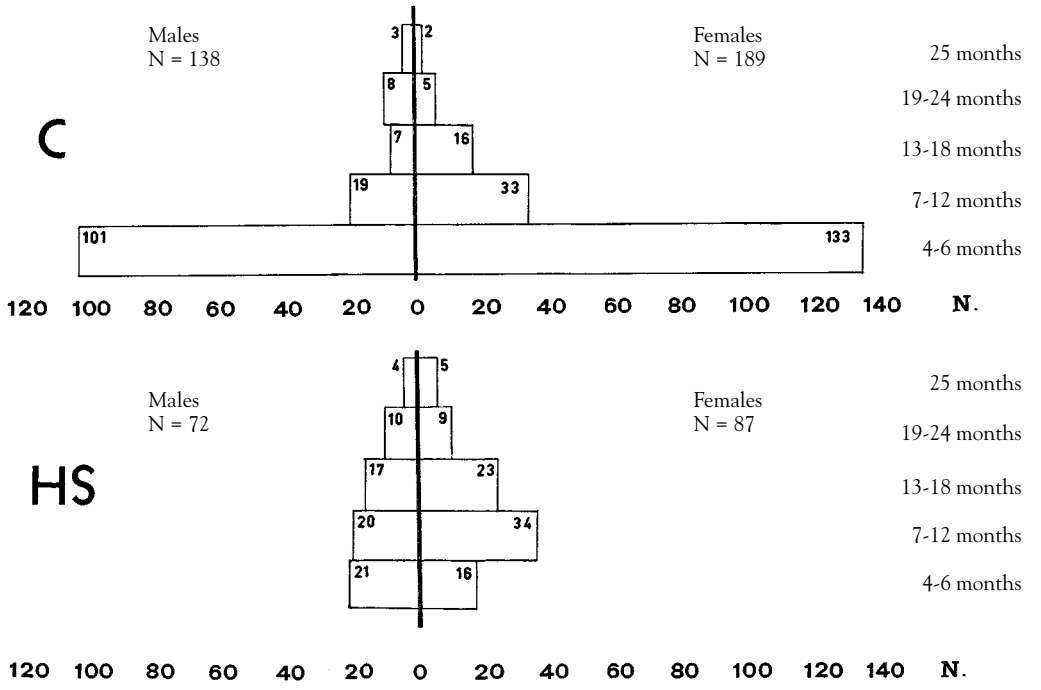

Figure 3 - Age class distribution in the two samples: (C) captured, (HS) shot from high seats.

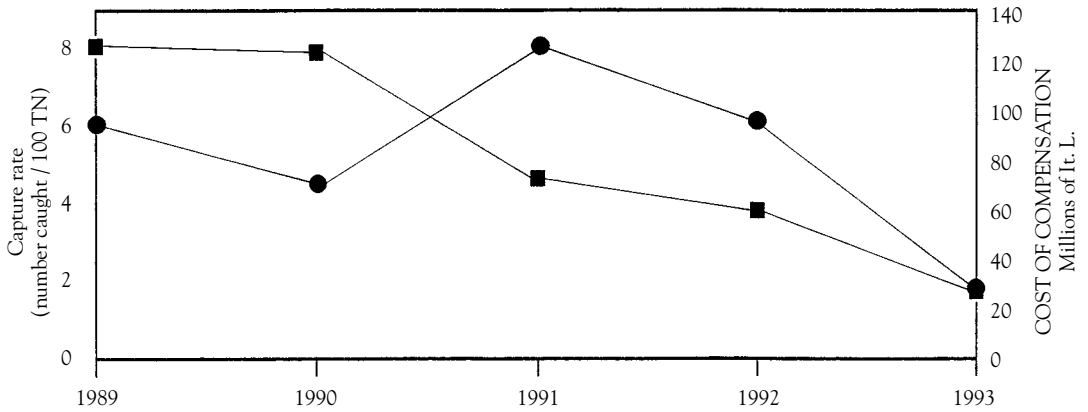

Figure 4 - Trapping success rates of wild boars and allocation of money to refund crop damages.

Since 1992, also the damages caused by the species to crops are sensibly decreased, as shown by the expense course for the compensations.
The killed Wild boar selling has covered the 21% of the total costs of compensations for damages for the whole period.
Between the two methods employed, the one based on trapping has proved the most profitable. Besides the better results in harvesting the population:
a) it has requested a minimum employment of means and men;
b) the straight and immediate animal culling has been assured avoiding wild boars' wounding risks linked to the hunting methods;
c) in the weapon employment, the maximum safety has been obtained both for the operators and for the public;

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NEW TECHNIQUES FOR AN OLD PROBLEM - RECENT ADVANCES IN FERAL PIG CONTROL IN AUSTRALIA

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Abstract: Feral pigs *(Sus scrofa)* are a major agricultural and environmental pest in Australia and pose a serious threat to the livestock industries through their potential role in spreading exotic diseases, such as foot and mouth disease. General methods of control used, such as 1080- poisoning, trapping and hunting, often do not provide the required reductions in population densities necessary to reduce impacts to acceptable levels or provide a high probability of potential success in eradicating outbreaks of exotic diseases in pigs. New techniques and strategies are discussed, such as shooting or poison-baiting from helicopters, and the use of anti-coagulant poisons, "Judas pigs" and oestrus sows, which can overcome these problems, and in some cases, result in the eradication of pigs or their temporary reduction to zero densities in some areas.

Keywords: Feral pig, *Sus scrofa,* Suidae, Health, Pest control, Populations.

IBEX J.M.E. 3:241-244

1. Introduction

Feral pigs (*Sus scrofa*) are a major pest in Australia because of their impact on agriculture and the environment. They also have an actual and potential role as hosts or vectors of a number of endemic and exotic diseases and parasites, particularly foot and mouth disease (FMD), which, if it occurred in Australia, could have disastrous effects on the rural economy.

The extent to which feral pig populations in different parts of Australia need to be reduced to prevent or eliminate such impacts (*i.e.* to achieve threshold densities) is not known precisely. However, as a rough guide, control programs probably need to reduce pig populations by at least 70% annually to keep their numbers below pre-control levels (Giles, 1980). This is because of the pigs' potential high reproduction rate. Giles (*op cit*), for example, recorded a natural rate of increase of 0.71 per year for a feral pig population not subject to control measures in western New South Wales following a period of seasonal abundance, while Hone and Pedersen (1980) and Saunders (in press) recorded average rates of increase in pig populations in the same region of 0.57-1.34 per year after control campaigns had removed 58-80% of the populations.

Threshold densities for eradication of potential outbreaks of FMD amongst feral pigs in the western floodplains of New South Wales and the hill country of southeastern New South Wales are approximately 2.3-14/km^2 and 0.03-0.04/km^2, respectively (Pech & Hone, 1988; Pech & McIlroy, 1990). In such cases, very high culling rates (>95%) would be required for rapid eradication of the outbreaks (e.g. < 21 days). Lower culling rates could be effective if a longer outbreak was acceptable.

Traditional methods of control, such as trapping, poisoning with phosphorous or 1080 (sodium monofluoroacetate), and hunting, with or without dogs, do not always provide the reductions in population numbers required to prevent or eliminate the adverse impacts of feral pigs (Hone & Pedersen, *op.cit*; Hone, 1983; McIlroy & Saillard, 1989; Saunders *et al.,* in press). There are also concerns about user safety, bait shyness and the humaneness of both poisons and their impact on non-target animals (McIlroy, 1983; Choquenot *et al.*, 1990). This paper reviews recent improvements to these methods and new techniques and strategies that are being developed to enhance feral pig control in Australia.

2. Use of helicopters for shooting and poisoning campaigns

Shooting feral pigs from helicopters has become a popular control technique in Australia since the early to mid 1980's. Its main advantages are that it is a species specific method and more humane than most other control methods, it produces results equal to poisoning programs, it is labour efficient and more than

competitive on a cost per pig basis compared with other control methods, it can provide a quick reduction of pig numbers over a wide area, including areas such as wetlands and other terrain where access on the ground can be difficult, and it is not affected by seasonal conditions (Korn, 1986). Saunders (*op.cit*) evaluated the technique in the southern Macquarie Marshes in New South Wales over two consecutive years. An 80% population reduction was achieved in the first year, followed by a 65% reduction in the second year, after the population had recovered to 77% of its first year level during the intervening 12 months. While annual use of the technique may not achieve the required reduction of feral pig populations to below the threshold densities for establishment of exotic diseases, or provide long-term protection of agricultural or conservation values, it is useful for short-term protection of other susceptible enterprises such as crops or sheep flocks during lambing (Saunders, *op. cit.*). Ultimately, its use for effective long-term control may require consideration of marginal benefit curves and its integration with either commercial harvesting or other control methods.

Helicopters can also be very useful for aerial distribution of poison baits to areas that are not readily accessible on foot or by vehicles. For example, McIlroy and Saillard (*op.cit.*) found that conventional control programs against pigs in Namadgi National Park, southeastern Australia, during spring were not always effective (e.g. only 0 - 30% population reductions) because many of the pigs moved away from the valley floors, where they had largely overwintered, to more remote areas where there were no access tracks for trail-baiting and other control methods such as trapping. However, when a helicopter was used to distribute bait to remote grassy clearings in the forest, ridge tops and other similar sites, an 86% reduction in pig numbers was achieved in less than 3 weeks (McIlroy, unpubl. data).

3. Use of dogs for hunting

Shooting, or hunting, with or without dogs, is a long-established method of control for feral pigs in Australia. It can take three forms:

- Shooting by landholders, generally on an opportunistic basis, but occasionally as part of coordinated shooting drives.
- Commercial harvesting for export of Wild boar meat. This industry, which began in 1980, is now worth from $10-18 million per annum, depending upon fluctuating market prices.
- Recreational hunting. The feral pig is regarded as the most important game animal in Australia and shooting, bow hunting and dogging are popular pastimes for many amateur hunters.

The effectiveness of shooting or hunting on the ground as a control technique for feral pigs in Australia has not been objectively evaluated, but is generally considered to play an insignificant role in reducing damage except where it is intensively conducted on small accessible properties (Hone, 1984). McIlroy and Saillard (*op.cit.*) monitored the effectiveness of hunting feral pigs with dogs and concluded that the technique was not as effective for the large scale reduction of pig populations as poisoning. However, it could be useful for obtaining samples of pigs for monitoring prevalence of disease during the first few days of an exotic disease outbreak, and for killing pigs that survived other control methods. Its overall effectiveness could be further enhanced by the adoption of recent improvements in the use of dogs for pig control developed in New Zealand. These include the use of "elite" types of dogs with specialist skills, such as long-range finding and bailing abilities, holding abilities, and independent targeting (in which each dog targets a different pig), and the use of radio collars on the dogs to enable hunters to locate bailed pigs more quickly or locate lost dogs (C. Clarke, *pers. comm.*). Clarke found that using radio collars on long-range finders increased kill rates by 31% and using independent target dogs increased kill rates by 66%.

4. Use of anticoagulant poisons

Recent research has indicated that anticoagulants, particularly warfarin, are potential alternatives to 1080 and phosphorous for poisoning feral pigs (McIlroy, *op.cit.*; Hone & Kleba, 1984). Warfarin is acceptable and highly toxic to feral pigs and its slow mode of action precludes many of the problems, particularly bait shyness, associated with the other poisons. Warfarin also has an antidote (Vitamin K1) for cases of accidental poisoning.

McIlroy *et al.* (1989) and Saunders *et al.* (1990) evaluated warfarin as an agent for pig control and reported population reductions of 94% and 99%, respectively, in two hill country areas of southeastern New South Wales. Choquenot *et al.* (1990) obtained only a 61% reduction in the semi-arid rangelands of New South Wales, but suggested that abundant

alternative food after heavy rain may have depressed bait consumption.

5. Use of oestrus-induced sows to enhance trapping

There is some evidence that poisoning and trapping programs preferentially remove sows, leaving a preponderance of boars in residual populations (Choquenot *et al.*, 1993). These boars are more likely to prey on lambs than sows and more readily spread diseases because they range over greater distances (Pavlov & Hone, 1982; McIlroy *et al., op. cit.*). Limited field trials have shown that sows, artificially induced into oestrus by abortion, followed by treatment with a serum gonadotrophin preparation, preferentially attract more pigs (particularly boars) to traps in which they are placed than traps containing anoestrous sows or bait alone (McIlroy, unpubl. data). Choquenot *et al.* (1993), however, found that using oestrous sows in traps, after a conventional trapping session had removed 83% of the pre-existing population, did not result in the capture of any further pigs.

6. Judas pigs

This technique takes advantage of the gregarious nature of pigs and involves fitting radio transmitters to captured pigs and radio-locating them after release to disclose the whereabouts of other pigs in an area. McIlroy (unpubl. data) first tested the technique in 1989, using sows and immature pigs captured near an area where 84% of the pigs previously present had been killed by a warfarin-poisoning campaign. These trials were generally unsuccessful; the released pigs mostly either established new home ranges on their own or began moving back towards their capture site. Trials with sows captured earlier within the poisoned area, however, were very successful, with individuals joining other survivors in the area within 1-7 days of release and from distances of up to 8 km away. The method has since been successfully used in the Northern Territory and in New Zealand. In the Northern Territory the Conservation Commission used two sows that they caught on Undoolya Station near Alice Springs as "Judas pigs" and on 13 subsequent occasions shot all pigs associated with them from a helicopter, eradicating a colony of 47 feral pigs (Bryan, *pers. comm.*). Landcare authorities in New Zealand have had similar success with the technique, using dogs and ground-based shooting (Clarke, *pers. comm.*).

7. Conclusion

The improvements on current methods and the new techniques and strategies described in this paper are not likely to replace traditional methods for feral pig control in Australia. However, in many cases they could enhance the effectiveness of control programs, particularly where intensive management of pigs is required with minimal impact on non-target animals.

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WILD BOAR FARMING IN THE UNITED KINGDOM

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Abstract: The European Wild boar *(Sus scrofa scrofa)* has not existed in the wild in the UK for 300 years, even then it was confined to estates; it seems that the truely free living animal became extinct in the mediaeval period. Until 12 years ago the Wild boar in the UK was present only in zoos. However since 1981 there has been a steady increase in entrepreneurs establishing Wild boar farms for meat, these have usually been a secondary enterprise to other forms of farming including deer farming. The initial stock for Wild boar farming arose from zoos and was therefore very limited. In September 1989 the British Wild boar Association (BWBA) was founded to promote the commercial development, welfare and understanding of husbanded Wild boar in the UK, involving a system of registration of purebred animals. Guidelines for the welfare of farmed Wild boar have been produced by the Farm Animal Welfare Council in collaboration with BWBA. The guidelines offer advice on general principles of management of farmed Wild boar having regard for their behavioural needs; an essential welfare principle is that Wild boar should be farmed as extensively as possible. Other sections in the Guidelines are concerned with specific aspects such as handling, introduction of new stock, stocking rates, accomodation, fencing, feed and water, field slaughter and the use of dart guns. During the last six years Wild boar farming has expanded due to imports of purebred animals from Denmark and Sweden. There are currently about 35 members of BWBA including 25 farmers, about 65% of which have registered herds. Herds size ranges from less than 5 animals to over 60. The diet consists of commercial pig food plus vegetable supplements and usually one litter averaging 5 young is produced per sow per year, overall this leads to the production of around 1500 purebred carcasses a year for the exclusive meat market in the UK. There is considerable scope for research not yet undertaken to optimize husbandry methods, production and meat quality and to explore the potential of Wild boar in breeding programmes with domestic pigs to produce specialist pork products.

Keywords: Wild boar, *Sus scrofa,* Suidae, Husbandry, Purebreeding, Europe.

IBEX J.M.E. 3:245-248

1. Introduction

By contrast with most European countries, the European Wild boar (*Sus scrofa scrofa*) has not existed in the wild in the UK for 700 years. The last record of free-living Wild boar, is the dozen animals ordered to be killed by Henry III in the Forest of Dean for a friend (Rackham, 1993). Before this time after the Norman Conquest in 1066, William I instigated the formation of royal estates so that the large game deer and Wild boar were readily available for hunting. After the extinction of free-living Wild boar in the 13th century, the animal existed only in the royal parks until hunted to extinction in the 17th century. A major factor from the 13th century onwards which led to the demise of the Wild boar, was the loss of woodland to agriculture so that today less than 8% of Britain's land area is covered by trees. The absence of Wild boar in Britain for over 300 years except for a few in zoos, has resulted in the British public being unfamiliar with the animal and the merits of its meat. However just over a decade ago this situation began to change when a few people with experience of hunting and eating Wild boar in Continental Europe, started to farm the animal in Britain thereby introducing an alternative agricultural enterprise to the country and an opportunity to study a genetically wild animal in a husbanded environment. The aims of this communication are to provide an overview of the progress of Wild boar farming in the UK.

2. Aspects of Wild boar farming

2.1. Legislation

In 1984 the Dangerous Wild Animals Act (DWAA) was amended to include Wild boar. This meant that anyone wishing to keep Wild boar outside a zoo had to be granted a licence under the DWAA. The licence is issued with the approval of the environmental health office of the local authority following an inspection (involving a veterinary surgeon) of the site and payment of a fee around £100. Conditions of the licence are that the animals must be contained by adequate fencing and that they are husbanded with due regard for their welfare. If an animal escapes, it is entering the wild which is illegal under the Wildlife and Countryside Act, 1981, and therefore it must be culled or preferably sedated

with a dart gun for return to the owner. All other legislation dealing with husbandry, health, transport, slaughter and meat hygiene is the same as for the domestic pig.

2.2. The role of the British Wild boar Association (BWBA)

Before dealing with the progress of Wild boar farming in the UK, it is appropriate to outline the role of this Association in promoting Wild boar farming. In 1989 BWBA was formed following an awareness by the author that a representative organisation for all interested in Wild boar in Britain was needed particularly to address some of the problems which had arisen with farming the animal. The primary aims of the Association are: (a) to encourage the commercial development, welfare and understanding of husbanded Wild boar in Britain, (b) to operate a registration scheme for purebred Wild boar (BWBA members only entitled to register) in order to promote the pure breeding and marketing of Wild boar and (c) to organize meetings, publications and other activities to promote the Association and Wild boar in Britain. With reference to the first aim, animal welfare is a highly topical and emotional issue in the UK particularly in relation to farming a wild animal where there is most concern about restricting an animals natural behaviours.

The Farm Animal Welfare Council supported by the Ministry of Agriculture, Fisheries & Food (MAFF), have approached BWBA to produce guidelines for the welfare of farmed Wild boar. Probably the most important aim of BWBA is the second dealing with the pure-breeding and marketing of Wild boar. A major concern is the crossing of wild boars with domestic sows (usually rare breeds like the Tamworth) to increase litter size and growth rates of progeny, and selling the meat at a premium as "Wild boar". Those familiar with the distinctive qualities of the meat from purebred Wild boar were the first to realize that the hybrid product was often indistinguishable from pork, this was soon followed by a similar response from uninformed consumers. This together with the importation of inferior Australian feral pig meat was blighting the UK Wild boar market. Individual BWBA members expressed their concern about these matters to MAFF which has subsequently with trading standards officers, given their support to identifying sources of misrepresented Wild boar meat. The registration scheme adopted by BWBA and supported by the majority of its members, is making a significant contribution to the propagation of purebred Wild boar since the Association only promotes producers of purebred animals. Eligibility for registration depends on the origin of the animal and phenotypic characteristics conforming to a typical Wild boar as seen on a herd inspection. Only breeding animals are registered. BWBA's third aim of publicity and promotion has led to the presence of Wild boar at major agricultural shows and articles in newspapers and magazines, radio and television have also provided good coverage of the farmed animal. In 1992-93 of the 36 BWBA members, 25 were farmers with about 65% holding registered stock involving 2-60 sows (Fig. 1). However it is likely that there maybe a further 15 Wild boar farmers who are not members of BWBA.

3. Types of farm

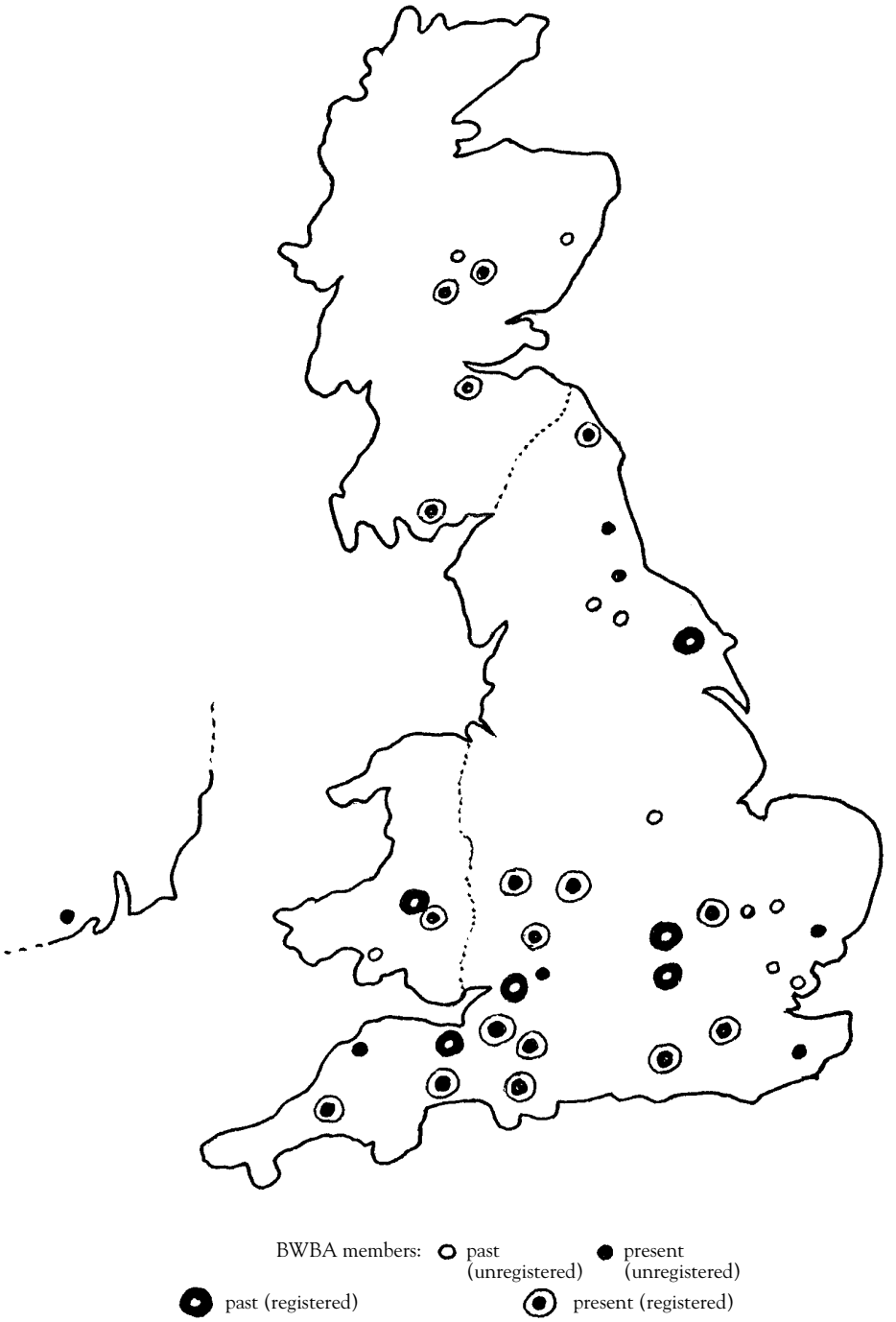
The first Wild boar farm was started in 1981 with surplus animals from London Zoo. Farms a decade ago consisted of mixed semi-intensive/extensive systems (Booth *et al.*, 1988). The breeding males were often confined to high security pens whereas sows were housed either in a straw covered pen or allowed the greater freedom of a paddock with an ark. As today, the use of woodland was a minor occurrence with pastureland predominating. Now extensive systems are the norm with large paddocks (over 1 hectare each) for a family herd *i.e.* a boar with up to 10 sows, dry sows and weaner/growers, rotated to new paddocks after 1 year.

4. Stock

With the awareness that distinctive Wild boar meat only arises from purebred animals, the small number of zoo animals available were insufficient to expand the industry. From about 1987, wild boars were imported first from estates in Denmark where the animals were of German origin, and secondly from an estate in Sweden where the animals were large and of East European origin. Denmark, Sweden and Britain have a similar high health status for pigs, a factor important to the importation of Wild boar or pigs from continental Europe to the UK.

5. Feed

Most Wild boar farms feed a combination of commercial food and forage vegetables. Where extensive pastureland prevails, the need for commercial cereal based food is minimal



Past: no longer BWBA members. — Present: BWBA members in 1992-1993. — Registered: purebred breeding stock registered with BWBA — Unregistered: stock not registered with BWBA.

Figure 1 - Distribution of wild boar farms in the UK.

except for lactating sows. Due to the relatively high numbers of animals being farmed per unit area of land, any woodland involved only supplies supplements of a variety of natural food sources. Creep feed is not usually given but the few farmers trying for 2 litters a year and therefore weaning at 8-10 weeks sometimes provide a "creep boost".

6. Production

The majority of Wild boar farmers seem content with the one litter averaging 5 young per sow per year normally produced in the spring. This allows for a maximum "weaning off" period between 12-16 weeks, evolved in nature to provide healthy, strong growers by the onset of winter. It has yet to be demonstrated whether the constant availability of food and other comforts in the farmed environment, supports the production of 2 litters a year more readily than in the wild.

7. Slaughter

Animals destined for slaughter are mostly surplus males which reach a slaughter weight of 50 kg upwards from 12 months of age. However some of the animals of East European origin reach slaughter weight at 9-10 months of age. As wild boars do not exist in the wild in the UK they are classified as pig for meat production purposes and therefore they have been routinely slaughtered in abattoirs. It is now realized that this is often a hazardous procedure with welfare deficits for animals and handlers. Shooting on the farm, a common practice with farmed deer, is considered the most desirable slaughter method for farmed Wild boar and this has been approved by MAFF that provided the carcasses to be subsequently dealt with according to approved CEE regulations.

8. Marketing

As few Wild boar farmers have facilities for butchering the meat under approved CEE regulations, they are happy to sell whole carcases for £ 4 - £ 6 / kg to chefs in hotels, restaurants and to local butchers. Those with butchering facilities are often also deer farmers and therefore provide cuts of meat and products for wholesale, farm shop or other retail outlets. Prices for Wild boar and farmed deer are comparable being up to one third above carcase prices for the prime cuts of saddle and haunch. Although some supermarkets have shown an interest in selling Wild boar meat, the current production of only 1,500-2,000 animals from 300 registered sows would be insufficient to allow for an increase in breeding herds, maintain supplies to regular customers and supply supermarkets particularly when the latter will only offer a minimum price for carcasses.

9. Conclusions and the future

With Wild boar farming being a new alternative agricultural enterprise in the UK, there is considerable scope and need for establishing appropriate regulations with regard to husbandry, slaughter and marketing of farmed Wild boar and meat. Such requirements must involve the legal, agricultural, marketing, veterinary and scientific professions to provide appropriate information as a basis for a forward thinking Wild boar industry and related industries. The following summarizes some of the wide ranging topics needing attention in relation to Wild boar farming: (a) finalization of a code of practice for husbandry, (b) morphometric or other objective data required as a possible practical means of identifying a purebred Wild boar, (c) quality control of meat production, *i.e.* selective breeding/husbandry/carcass evaluation - to what extent can we, or should we apply modern technologies of farm animal production to Wild boar farming, (d) continued education of the public about Wild boar, (e) value of Wild boar to woodland ecology *i.e.* removal of excess plants such as bracken and rhododendrons, animal pests and increasing soil fertility, (f) possible benefit of Wild boar genes for pork production (*i.e.* hardiness, meat quality as currently produced in the 'wild blue', a Wild boar cross outdoor domestic sow) and (g) the value of an increased understanding of the genetics, physiology and behaviour of Wild boar not only for our appreciation of this splendid animal but also of its cousin the domestic pig.

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RECENT PROSPERITY OF WILD BOAR COMMERCIALIZATION IN JAPAN

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Keywords: Wild boar, *Sus scrofa leucomystax,* Suidae, Hunting, Meat, Asia.

IBEX J.M.E. 3:249

Trading and hunting of Japanese Wild boar (*Sus scrofa leucomystax*) in the 20th century were studied by questionnairs to 419 hunter groups of 34 prefectures with Wild boar. Before World War 2, Wild boar was not popular game animal and traded in several restricted prefectures. However, after the high economic growth period since 1960, Wild boar meat has become popular especially in tourist resorts. At present, 49% hunter groups trade the animals with various dealers (Fig. 1) and the big market channels have developed all over Japan; they consist of retail stores in every prefecture, whole sale stores and brokers in 70% prefectures (Fig. 2). Increasing demand lifted up the commercial value to more than 1,000 U.S.$ per animal. This situation has stimulated a rise in number of Wild boar hunters and improved the hunting methods. At present 57% of hunter groups use wired leg traps. This method has never been popular because it needs troublesome labor for patrolling traps. However, extension of roads in montane areas and spread of radio telemetry have improved this methods easy and effective; single hunters can harvest many wild boars from broad areas. This method is also prefered by dealers, because it does not damage animal body but only one leg. As the Japanese game law set up no limit and no control of the Wild boar trade, this species may be decreased rapidly in near future by strong hunting pressure caused by recent increasing demand.

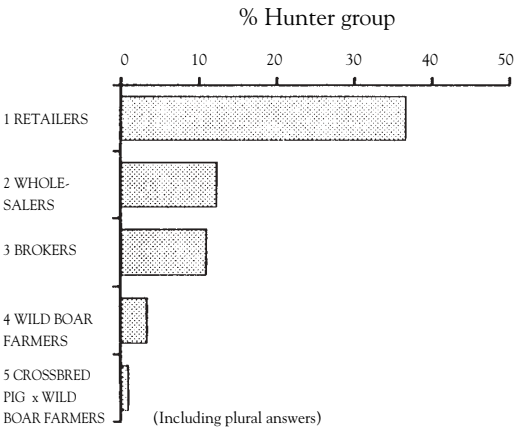

Figure 1 - Dealers with which hunter groups trade harvested wild boars in Japan.

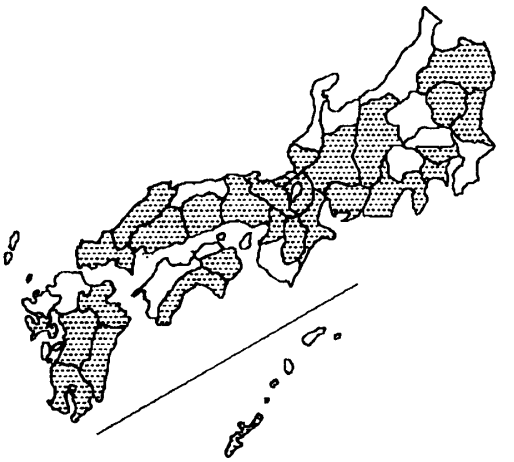

Figure 2 - Present distribution of prefectures with wholesale stores or brokers in Japan.

PRESENT STATUS OF FERAL CROSSBRED OF PIG x WILD BOAR IN JAPAN

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Keywords: Wild boar, Pig, *Sus scrofa leucomystax*, Suidae, Breeding, Feralization, Damages, Management, Asia.

IBEX J.M.E. 3:250

To investigate the present status of farming and feralization of the crossbred of pig x Wild boar, a questionnaire survey to the livestock departments of prefectural governments and 679 hunter groups of 47 prefectures in Japan was conducted.

The crossbred farms were established only in 10 prefectures around 1960 and spread into 29 prefectures (Fig.1). The increase of crossbred farms has been facilitated by the recent rise in popularity and high commercial value of the Wild boar meat especially in tourist resorts. The crossbred boar x pig has many merits such as increase of litter size, growth rate and survival rate. The feralization has occurred simultaneously with spread of the farms. Until now, the feral crossbred has been found and caught in 36 prefectures (77%) (Fig. 2) and they still inhabit in 24 prefectures (51%). These feral animals have damaged agricultural crops and plantations, but no prefecture has regulation laws of the crossbred farm management and the control of these feral animals. Moreover hunter's attitude complicated this troublesome situation; 45% hunter groups wish to exterminate the feral crossbred, while 23% favor them as game. Further, some hunter groups release them to field. A strong legal regulation of crossbred farm management should be provided to avoid these problems.

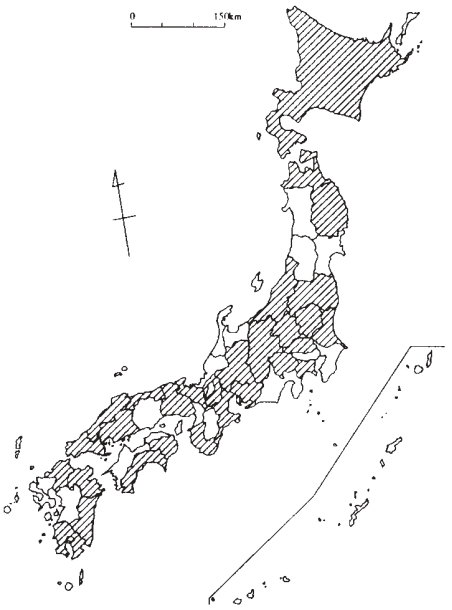

Figure 1 - Present distribution of crossbred farms.

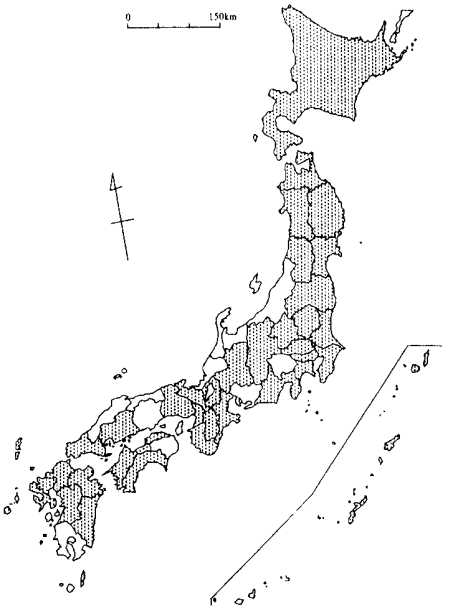

Figure 2 - Distribution of prefectures where feral crossbreds have escaped.

ANCIENT DOMESTIC PIGS IN THE URALS (RUSSIA)

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Abstract: The authors have studied pig bone remains of late Bronze age (first apparition of pig in the Urals) and Iron age in the South and Middle Urals. They analyze the composition of these remains (type of bones, age of the animals) and compare some characters of the mandible for different sites and for the two ages.

Keywords: Domestic pig, *Sus scrofa,* Suidae, Eurasia, Archaeological bone remains, Mandible, Bronze age, Iron age.

IBEX J.M.E. 3:251-253

The work is based on the literature (Tsalkin, 1972; Petrenko, 1984) and on the original data on the composition of bone remains from archaeological sites. The area of the Wild boar in the Holocene was the southern taiga zone, mixed forests, forest steppe, the north of the steppe zone in the western and eastern regions of the Urals.
In the settlements of the Neolithic, Bronze, Iron and Middle ages bones of the Wild boar account for less than 1% from the bones of wild species. This evidences a poor hunting pressure on the Wild boar populations in the Urals in ancient times. In the 19th century A.C.[1] Wild boar hunting increased sharply and in the 20th century A.C. the species was exterminated. Presently its area has been recovered as a result of reacclimatization.

Remains of the domestic pig have been studied from archaeological sites in the western regions of the Middle Urals (late Bronze age - 3 sites; Iron age - 32 sites), from the western regions of the South Urals (late Bronze age - 30 sites, Iron age - 12 sites) and from the eastern regions of the South Urals (late Bronze age - 10 sites). Totally about 5,000 bones of the pig were studied. They were found in settlements and sacrificial complexes.
The pig first appeared in the South Urals in the beginning of the late Bronze age (18-17th cent. B.C.[2]) together with the people of the Abashevo culture from the Middle Volga regions. In the middle of the late Bronze age the population of the western regions of the Middle Urals began breeding the pig. Since then up to the Middle ages the pig was bred by the whole population of the Ural western regions, from the southern taiga zone to the forest steppe zone. In the Ural eastern regions the pig was bred only by the population of the Syntashta, Petrovka (18-16th cent. B.C.) and Cherkaskal (14-13th cent. B.C.) cultures in the South Urals. In the settlements of the late Bronze age in the Ural western regions the pig bones average 5.5% in the forest - steppe zone, 9.6% in the broad-leaved forests, 12.3% in the mixed forests, 4.0% in the steppe zone. In the settlements of the late Bronze age in the eastern regions of the South Urals (in the steppe zone) the pig bones average 1.3%.
In the settlements of the Iron age in the Ural western regions they account in the southern taiga zone for 4.9%, in the mixed forests for 26.7%, in the broad-leaved forests for 35.4%. Thus, in comparison with the late Bronze age the role of the pig in the economics of the population of the Ural western regions is much greater in the Iron age. One of the reasons for that was the extensive development of agriculture in the Iron age. The most favourable natural zones for the pig breeding were the zones of mixed and broad-leaved forests.
In the settlements of the late Bronze age in the western regions of the South Urals skull bones

[1] A.C.: After Christ.
[2] B.C.: Before Christ.

make up 43.0% of the pig remains, postcranial skeleton bones 57.0%. In the settlements of the Iron age in the same region skull bones account for 43.6%, postcranial skeleton bones for 56.4%. In the settlements of the Iron age in the western regions of the Middle Urals skull bones make up 27.7%, postcranial skeleton bones 72.3%. Similar composition of the skeleton elements and killing age (Tab. 1) are indicative of the similar means of the pig usage by the people of the western Ural regions in the Bronze and Iron ages.

We studied variability of mandible sizes in 4 samples: two, from the western and eastern regions of the South Urals, refered to the Bronze age; two, from the western regions of the South and Middle Urals, refered to the Iron age. In each sample the variability was studied in two groups of different ontogenetic age: from 3.5-5 months to 10-12 months (M_2 has not cut) and from 10-12 to 17-22 months (M_3 has not cut). We analyzed the following characters (1st and 2nd age groups): i- diastem length (dC- dP_2 or C - P_2); ii- premolar length (dP_2 - dP_4 or P_2 - P_4); iii - dP_4 - M1 length (first age group) or M_1 - M_2 length (2nd age group); iv - diastem height (up to dP_2 or P_2); v- mandible body thickness under M_1.

It was found that mandible sizes of the same ontogenetic age and from the same chronological period but different territories did not differ in the studied characters, therefore we combined them in two chronological samples: late Bronze age and Iron age. Comparison of mandible sizes of the first age group (M_2 uncut) showed that pigs of the Iron age had a shorter diastem and less body thickness (Tab. 2).

In the second age group these differences remained, besides there appeared distinctions in the molar lengths and M_3 sizes (Tab. 2).

During the transition from the Bronze to the Iron age M_3 had a decreased correlation ratio (from 0.55 to 0.05) and altered regression coefficients: for the late Bronze age y = 5.88 + 0.296x; for the Iron age y = 14.24 + 0.05x.

Thus, pigs of the Iron age compared to the pigs of the Bronze age had shorter snouts and M_3 and thinner mandibles, wich was connected with the changes in the mandible growth process.

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Table 1: Age composition of killed animals from the settlements in the Ural western regions.

Age (months)	Late Bronze age South Urals		Iron age South Urals		Iron age Middle Urals	
	N		N		N	
up to 3.5	5	3.0%	0	-	0	-
from 3.5-5 to 10-12	51	30.5%	43	37.7%	20	28.6%
from 10-12 to17-22	79	47.3%	59	51.8%	40	57.1%
over 22	32	19.2%	12	10.5%	10	14.3%

Table 2. Mandible and M_3 sizes in the pigs of the Urals.

Characters*	N	Min. - Max.	M ± m	SD
	Late Bronze age		(First age group, M_2 uncut)	
i	18	14.0 - 25.0	19.16 ± 0.79	3.34
ii	28	34.8 - 44.0	38.94 ± 0.34	1.82
iii	40	30.4 - 39.0	35.09 ± 0.32	2.00
iv	21	27.1 - 35.0	31.68 ± 0.55	2.52
v	21	16.9 - 23.0	20.12 ± 0.32	1.45
	Late Bronze age		(Second age group, M_3 uncut)	
i	23	22.0 - 39.4	27.78 ± 0.86	4.11
ii	22	36.5 - 43.6	40.13 ± 0.35	1.65
iii	73	34.0 - 42.8	38.41 ± 0.23	1.96
iv	14	35.2 - 50.4	43.52 ± 1.09	4.08
v	32	23.1 - 30.3	26.10 ± 0.34	1.93
M_3 length	19	34.6 - 42.6	38.48 ± 0.52	2.27
M_3 width	18	13.8 - 19.0	17.26 ± 0.30	1.25
	Iron age		(First age group, M_2 uncut)	
i	33	12.0 - 22.1	16.80 ± 0.41	2.33
ii	58	36.5 - 42.1	39.44 ± 0.20	1.49
iii	80	31.4 - 38.6	35.11 ± 0.15	1.35
iv	44	27.4 - 35.0	31.01 ± 0.32	2.14
v	41	16.9 - 20.8	18.55 ± 0.17	1.07
	Iron age		(Second age group, M_3 uncut)	
i	27	15.5 - 27.6	21.71 ± 0.59	3.09
ii	28	38.3 - 44.0	40.80 ± 0.33	1.74
iii	75	32.3 - 40.0	37.14 ± 0.19	1.65
iv	14	35.5 - 47.2	40.56 ± 0.98	3.65
v	41	21.1 - 30.3	24.30 ± 0.30	1.91
M_3 length	18	30.5 - 38.6	34.66 ± 0.49	2.08
M_3 width	16	14.3 - 17.1	15.91 ± 0.21	0.85

*Description of characters is given in the text.