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Joe E. Brooks[1], Mohammad Hafiz Khan[2], Ejaz Ahmad[3], Iftikhar Hussain[3] and Shahid Munir[3]

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1 Team Leader, DWRC, USAID Vertebrate Pest Control Project, NARC, Islamabad, Pakistan.
2 Assistant Professor, Department of Entomology, University of Agriculture, Faisalabad, Pakistan.
3 ~~Research~~ Program Specialist, ~~and~~ Scientific Officers ~~(respectively)~~, USAID Vertebrate Pest Control Project, NARC, Islamabad, Pakistan.

Govt. of Pakistan Vertebrate Pest Control Laboratory, NARC, Islamabad, Pakistan.

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ABSTRACT

A total of 273 wild boar (*Sus scrofa*) was collected by shooting from crop and non-crop areas in and around Faisalabad District, central Punjab, Pakistan between March 1987 and December 1988. We studied methods of aging wild boar by tooth eruption and eye lens weight. The breeding season was determined from 1) age at sexual maturity in males and females, 2) by observations of mating activity in the field, 3) by observations on visible pregnancy in adult females and 4) by back dating and forward dating the ages of fetuses. The breeding season began the last week of December 1987, when conceptions occurred, peaking in late January. Pregnant females were observed from late February until mid-June. No pregnancies were seen in July or August and only two in September. The peak months of births were April through August. Males and females were found to be sexually mature at 7 months and young females make a significant contribution (7 out of 30 pregnancies) to the breeding effort. Litter size for all females averaged 5.8±2.3, but was greater for older females (> 24 months) 6.6±2.2, and smaller, 4.8±2.2, for females <24 months. Males grow to significantly longer body lengths and body weights than do females. The largest male weighed 135 kg., the largest female, 85 kg. Females predominated in the collections, 100 females: 68.5 males. The animals of both sexes less than 12 months constituted 49.6% of the collection, while those 1 to 2 years were 25.2% and those older than 2 years were 25.2%. With the high breeding potential we observed, the wild boar of the Punjab croplands are capable of sustaining their numbers despite heavy predation by man. Large-scale population reduction at the strategic times in the population cycle may be the best method to reduce crop losses.

INTRODUCTION

The Eurasian wild boar, *Sus scrofa*, is distributed in a broad belt across North Africa, Europe, and Asia (Heptner et al. 1966). Thus, Pakistan is part of its ancestral range. Wild boars are found up to about 1000 m elevation in the upland areas of Pakistan and at lower elevations throughout Punjab, parts of the North West Frontier Province, and in Sind to the mouth of the Indus River (Roberts, 1977).

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1 Team Leader, DWRC, Vertebrate Pest Control Project, NARC, Islamabad, Pakistan
2 Assistant Professor, Department of Entomology, University of Agriculture, Faisalabad, Pakistan
3 Research Specialist and Scientific Officers (Respectively), Vertebrate Pest Control Project, NARC, Islamabad, Pakistan

The development of the irrigation canal system in Pakistan has increased the habitat for wild boars. Originally, they were restricted to riverain habitats which provided their life essentials: dense cover, abundant water and seclusion. They were preyed upon by tigers and wolves before man eliminated these predators. But as agriculture spread beyond the riverain zones in Punjab and Sind with the opening of the canals, a variety of suitable habitats for wild boars appeared in isolated patches all over the Indus plain (Beg and Khan, 1982). These new habitats brought wild boars into contact with croplands, where they now obtain much of their food.

In Pakistan, Roberts (1977) reported that wild boars damaged ripe sugarcane, potatoes, wheat (both newly sown and up to milk stage), and rice in the milky stage. Smiet et al. (1979) killed wild boars from riverain forests and found that they subsisted mainly on roots and tubers of *Scripus* spp. and *Cyperus* spp., while crops such as sugarcane, clover, and mustard were found only in a few stomachs. Khan (1982) analyzed the stomach contents of 48 wild boars killed in croplands around Faisalabad District and found that wheat and molasses scum were the most common items, followed by *Cyperus* spp. tubers, maize, sorghum, cotton, mesquite pods and leaves, sugarcane, and rice. Animal remains constituted a smaller part of the diet.

Shafi and Khokhar (1986) surveyed sugarcane fields in Sargodha and Sheikhupura Districts and found 35.4% damage to all stalks of Triton, a soft-rind, high sugar-content variety, while damage to the hard-rind varieties ranged from 6.7 to 8.3%. Brooks et al. (1989) have summarized the survey data on wild boar damage to several crops in Pakistan.

Some preliminary information of the biology of the wild boar in Pakistan has been reported in a few papers (Taber 1965; Roberts 1977; Smiet et al. 1979). Inayatullah (1973) and Beg and Khan (1982) presented data on wild boar distribution and habitats in Pakistan.

Wild boar is perhaps the second most important vertebrate pest, next to rats and mice, of crops in Pakistan. Yet there is little known about its basic biology in the Pakistan agro-ecosystem. Due to this general lack of basic knowledge and because there was a need to develop control methods and strategies to prevent crop damage by this species in order to increase crop yields, a cooperative study was undertaken with staff at the University of Agriculture, Faisalabad, on the biology, morphometrics, and food habits of wild boar.

METHODS AND MATERIALS

Information on size, reproduction, age determination and population structure was obtained from hunted animals taken in and around crop and non-crop areas in Faisalabad District and immediately adjacent areas in Sheikhupura, T.T. Singh and Jhang Districts between March 1987 and December 1988. Animals were

killed with shotgun, using rifled slugs or buckshot, and with the aid of dogs. Hunting was done both by day and at night with the aid of spotlights. Killed animals were weighed to the nearest kg by hanging by their hocks from a spring scale. Then a series of body measurements were obtained and recorded. These dimensions were taken as follows and are depicted in Figure 1:

a) HEAD AND BODY LENGTH - tip of snout to base of tail in a straight line.

b) TAIL LENGTH - base to distal end of vertebrae.

c) HIND FOOT LENGTH - proximal end of calcaneus to distal end of longest hoof.

d) EAR LENGTH - notch to distal end.

e) SHOULDER HEIGHT - from the proximal end of shoulder joint to distal end of longest hoof with forelimb positioned in a straight line.

f) SNOUT LENGTH - distal-most dorsal point of snout to a point equidistant between the eyes.

g) CRANIUM LENGTH - distal-most dorsal point of snout to the base of the skull (palpated with the finger).

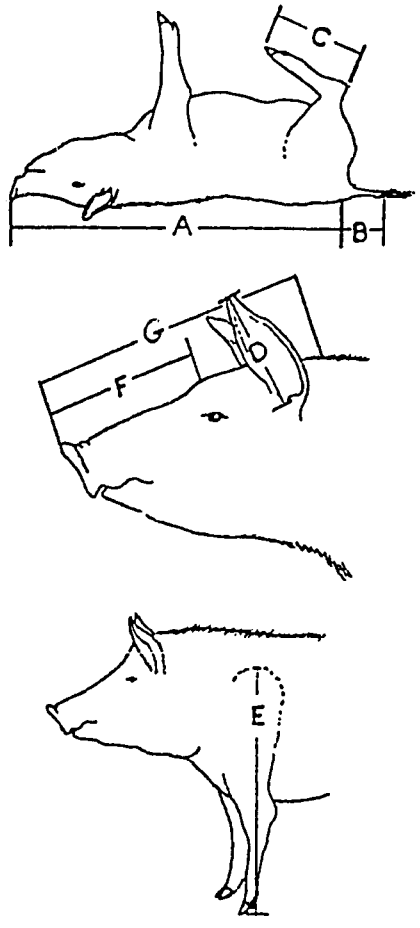

Fig. 1. Measurements taken.

The animal was then autopsied by making an abdominal incision from the sternum to the groin. The stomach was slit and a 50- to 100-ml sample of the contents was removed into 70% alcohol. The reproductive tracts of both males and females were removed and placed into 5% formalin. Embryos or fetuses were counted, weighed, and the crown-rump (CR) length of each was measured. Date of conception was estimated from mean embryo or fetus length using Henry's (1968), Kurnosov and Petrischev's (1977), and Petrischev's (1980) data. Ovaries were examined only for visible corpora lutea in the earlier stages of the study; later the number of sets of corpora lutea were determined (Cheatum 1949) and recorded. The testes were weighed, measured, and the epididymal tubules were examined for the presence or absence of visible, packed sperm. Periods of breeding and littering were determined by 1) dating observation of development of secondary sexual characteristics in males and females, 2) observing the occurrence of visible pregnancies in females, 3) back dating ages of fetuses to determine dates of conception, 4)

forward dating the ages of fetuses to determine the dates of parturition.

The left or right ramus of the lower jaw was removed, tagged, and put into a plastic bag with a small amount of 5% formalin. Both eyes were removed and placed into 5% formalin. They remained in formalin for one month before the eye lenses were dissected out and dried.

Age Determination

Several methods have been used to determine the age of wild boars. Cabon (1959) concluded that the most objective method involved the use of a tooth eruption schedule for animals under 3 years of age, and tooth wear for older pigs. Matschke (1967) and Diong (1973) provided schedules for wild boar. Pine and Gerdes (1973) found the tooth eruption schedule developed by Matschke (1967) gave satisfactory results with wild pigs in Monterey County, California. Diong (1973) used the same eruption scheme on wild boar in Malaysia and found it satisfactory with only minor modification. We used a combination of Matschke's and Diong's schedule in deriving ages up to 26 months (Fig. 2) on the hunted specimens of wild boar (Appendix-1).

Fig. 2. Aging wild boar by tooth eruption.

Matschke (1963) and Sweeney et al. (1970) found eye lens weight to be of less value than tooth eruption as an age indicator. However, Sweeney et al. (1970) found a significant correlation between eye lens weight and the age of feral hogs, even when body weight failed as an indicator of age. Smiet et al. (1979) used eye lens weight to age a series of wild boar collected in the Indus delta of southern Pakistan. We collected eyes from the killed animals and these were fixed in 5% formalin for one month. Eye lenses were removed from the eyes, dried in an oven at 80°C for 72 hours or more and weighed to the nearest mg on a torsion and/or electronic balance immediately after removal from the oven.

Tooth eruption is basically completed at 26-plus months in the wild boar, so another method must be used to determine age beyond this date. Incisor teeth were removed and sent to the Denver Wildlife Research Center, Denver, Colorado, USA, for

sectioning and studies on presence and number of annular rings of dentine and cementum. This method has been used successfully in other ungulates (Gasaway et al. 1978, Haagerud 1978, Keiss 1969, Kerwin and Mitchell 1971, Lockard 1972, McCutcheon 1969, Thomas and Bandy 1973, and Turner 1977).

Barrett (1978) extented the tooth eruption method through the degree of eruption on M_3 as given by Matschke (1967) and the amount of cusp wear on M_3 as described by Cabon (1959). By using a detailed examination of the third molars, he was able to group animals roughly into yearly classes from 3 to 6 years. We have followed his scheme.

Stomach Contents

The stomach contents were sampled by removing an approximate 50 to 100 ml amount and putting this into 70% alcohol or 5% formalin. Attempts were made to include portions of the contents from both the upper and lower parts of the stomach. The contents were examined first under low power on the dissecting microscope.

Trapping

Portable panel, root-door traps were fabricated using the design of Fraser (1975). The trap door is angled inward with guards around the door stops (Fig. 3). The panels are joined together with two or three hose-clamps at each corner to form a square, 2 m on each side, and stabilized with two diagonal wires. Reinforcing iron rods are driven into the ground 40 to 50 cm and a projecting lip catches and holds the bottom sides of the trap securely in place.

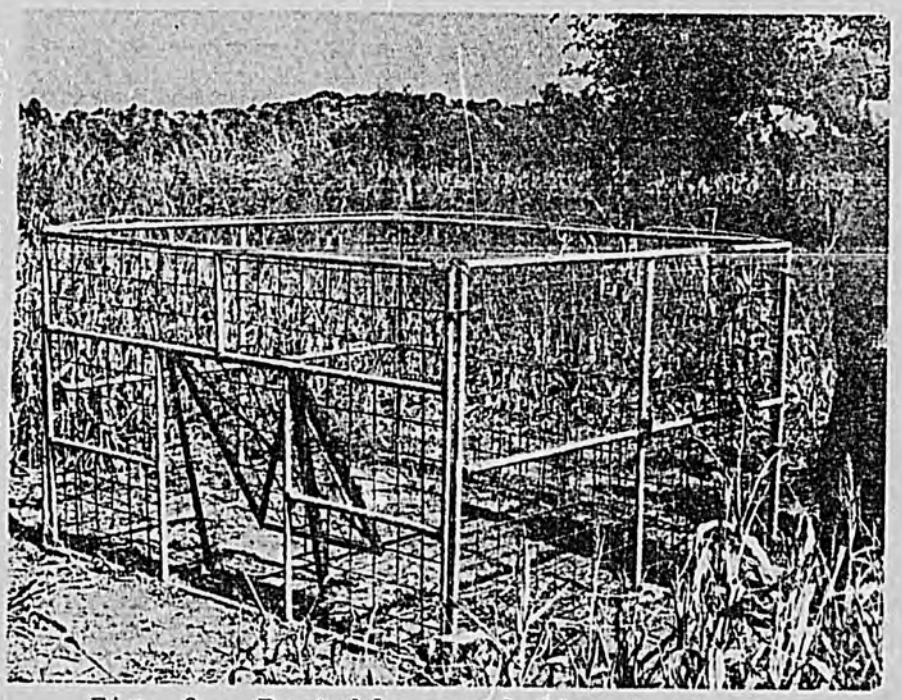

Fig. 3. Portable-panel live trap.

Traps were baited with maize or wheat dough balls with a small amount of molasses added. Captured animals were to be immobilized with a mixture of ketamine/xylazine administered with a 10 ml syringe on the end of a jab-stick.

FINDINGS

Aging Methods

Aging by Tooth Eruption

The tooth eruption scheme of Matschke's (1967) as modified by Diong (1973) fit the pattern seen in Pakistan wild boar almost exactly. Accordingly, we used it to obtain the estimated chronological ages of the collected specimens. The data are given in Appendix I and II, where all animals are listed in ascending order by age in months. All specimens having an erupted 3rd molar were estimated as 26-plus months of age and their incisors were pulled and submitted to the Denver Wildlife Research Center (DWRC) for sectioning and counting of annular rings. Using Barrett's (1978) method of 3rd molar eruption and cusp wear, animals more than 2 years old were classified into age groups from 3 to 6-plus years. Only one female and one male were estimated as being 6 years or older.

Age by Eye Lens

The eye lens weights plotted against the log of estimated age in months are shown graphically in Figs. 4 and 5, where they are plotted for each sex. There is an excellent fit of the regression lines to the age data, both for males (r = .9434) and for females (r = .9185). There may be a significant difference between the regressions due to sex. Thus it appears that eye lens weight, at least up to the estimated age of 26-plus months, can be used as a reliable age criterion in wild boar.

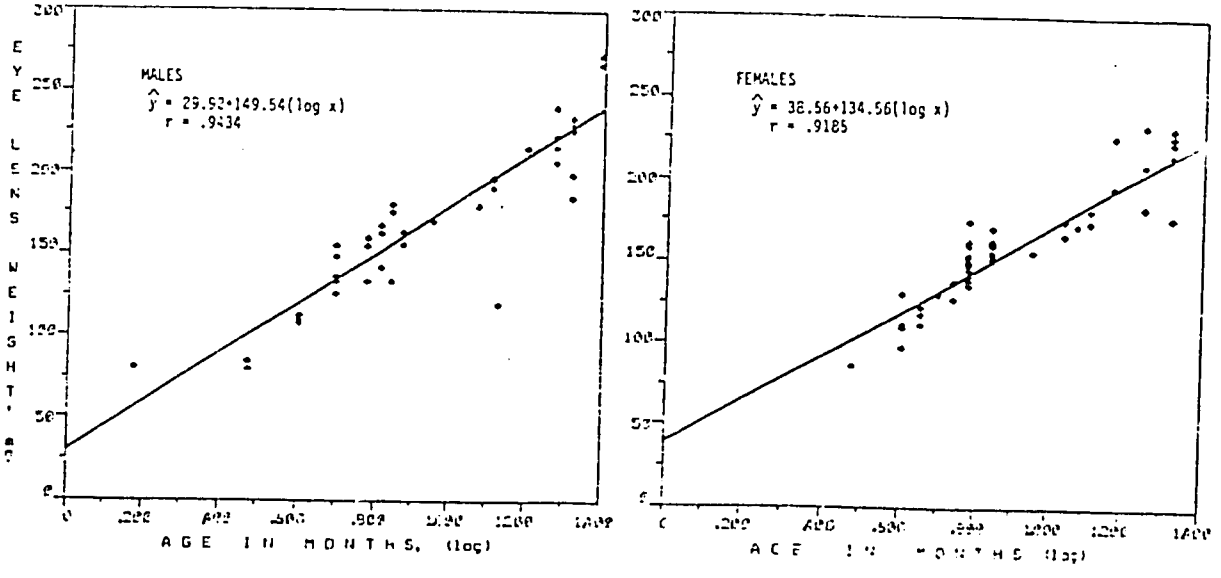

Fig. 4 and 5. Regression of eye lens weight on the log of age in months.

Animals over 26 months of age were not fitted to the line since their age in years will be determined by annular rings in the sectioned incisors at DWRC. The eye lenses of 26 plus months

aged animals ranged from 220 to 300 mg in females and from 186 to 354.5 mg in males.

Morphometrics

The various body measurements of male and female wild boar are summarized by estimated dental age in Table 1. Males continue to grow to a heavier body weight and a longer body length than do females. This difference becomes especially obvious in animals over 2 years of age but is apparent even at the ages of 5 to 6 months. The difference is statistically significant in body weight only in the last two age groups (p = 0.02 and 0.001, respectively) and only in the oldest age group in the case of head and body length (p = 0.001).

Table 1. Morphometrics of Pakistan Wild Boar

Age (months)	Body weight kg	H.B.L. cm	Tail cm	Shoulder cm	Cranium cm
Males					
1-2 (4)	7.2± 1.9	53.0±10.7	9.0±1.7	28.8±5.9	16.1±2.4
2-4 (4)	11.7± 2.6	72.9± 3.3	13.4±2.0	42.2±2.7	22.5±1.7
5-6(13)	28.0±10.6	103.6±10.5	18.8±3.3	55.0±6.2	29.3±2.6
7-12(15)	39.4± 9.3	113.5± 7.4	19.3±2.6	63.4±3.8	33.4±2.6
13-18(9)	48.5±11.4	118.3± 7.2	20.9±1.6	66.1±4.7	35.4±2.5
19-24(11)	63.0±15.1	127.8±10.4	19.6±6.8	72.9±7.9	38.8±4.2
> 24(21)	97.7±15.5	145.0± 8.4	25.9±2.5	83.3±4.4	43.7±3.3
Females					
1-2 (2)	4.5± 3.5	45.0± 4.2	7.7±0.3	26.5±3.5	14.8±4.5
2-4 (5)	10.2± 2.2	69.1± 4.7	12.5±0.9	39.1±2.6	21.3±1.7
5-6(39)	26.4± 8.8	97.0±11.6	17.1±3.1	52.5±7.4	29.0±3.1
7-12(16)	33.0± 8.2	103.3± 6.0	17.8±2.6	57.9±4.3	30.4±2.0
13-18(11)	42.9± 9.4	111.5± 4.9	18.7±2.8	60.7±3.3	33.4±2.3
19-24 (9)	48.5±10.7	121.8± 6.7	21.7±2.7	63.5±3.9	36.0±2.2
> 24(29)	61.6±10.4	128.7± 6.9	23.1±3.0	68.5±3.8	38.3±3.5

Reproductive Activity

Age at Sexual Maturity

Both sexes come into breeding potential before they are one year old. Males were seen with visible tubules in the cauda epididymis (packed with mature sperm) as early as 4 to 5 months of age, but the onset of sexual maturity (the 50% point for visible tubules) was found to be 5 months. All animals over 8 months were positive for this criterion. The mean weights of testis for several age groups are given in Table 2.

Females, too, first began to ovulate at the age of 6 to 7 months, and the 50% point for this character was 6.5 months.

Thus, both sexes are capable of breeding in the next major breeding season following their birth, and the females, at least, make a minor contribution to the breeding effort. Actually, 7 out of 30 pregnant animals collected during 1987 and 1988 were born during the previous major breeding season.

Table 2. Mean weight of testis (without epididymis) in male wild boar of several ages.

Age (mos)	No. Examined	Testes weight (g)±S.D.	Range
4 - 6	9	14.1 ± 12.8	(3.1 - 45.3)
6 - 12	11	40.6 ± 30.5	(7.0 - 108.1)
12 - 18	10	68.2 ± 32.1	14.2 - 117.4
18 - 24	9	118.0 ± 51.6	27.5 - 180.0
> 24	17	142.5 ± 53.8	59.3 - 286.8

Mating Activity

The breeding season began in the last week of December 1987, as judged by dating back from the estimated age of the fetuses. Two pregnancies dated from late December, 16 in January, 6 in February and 3 in March. Mating activity was observed in the field on 10 January 1988.

Visible Pregnancies

The first pregnant females were collected on 22 February 1988. The peak littering effort was judged to be April and May, tapering off quickly in June (Fig. 6). A minor peak of pregnancies was seen again only in September.

Month of Birth

By dating back from the estimated age in months from tooth eruption, it was possible to estimate the month of birth. This is depicted graphically in Fig. 7. Of the

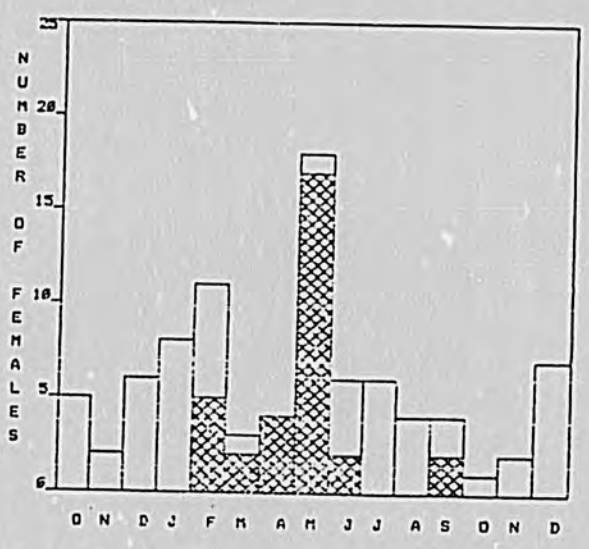

Fig. 6. Pregnancy in wild boar (cross-hatched) and total females examined (empty bars) in 1988.

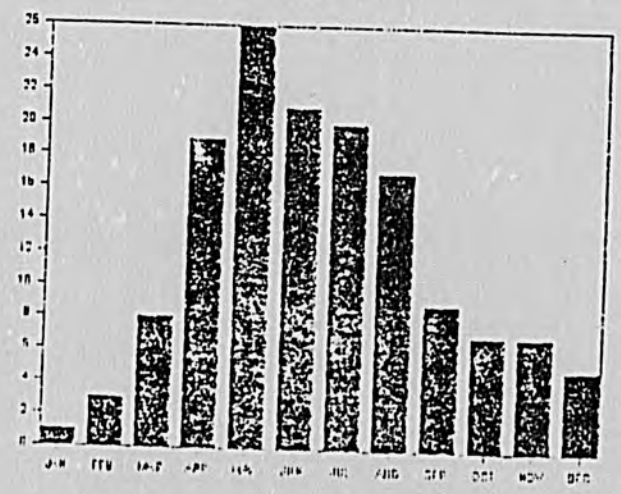

Fig. 7. Month of birth of dentition aged wild boar.

143 dated animals, 103 (72%) were estimated to have been born in the 5 months between April to August, with the peak occurring in May. Animals were born in every month of the year, however, with the least in January and February.

When the fetuses were dated (Henry 1968) and the estimated date of birth obtained, it was seen that 3 litters would have been born in April, 16 in May, and 8 in June.

Litter Size

The overall litter size was found to be 5.77±2.3 in a sample of 30. When the litter size was calculated for all females less than 24 months of age, it was found to be 4.77±2.2 (n=12), while in females older than 24 months, litter size averaged 6.53±2.1 (n=17). This supports the idea that older females have larger litters.

Reproductive Production by Age Groups

The proportion pregnant and litter size is given in Table 3, for young of-the-year, yearlings and females 2 years or older. Young-of-the-year, breeding for the first time, are more productive than yearlings, but much less than older females.

Table 3. Pregnancy and litter size by several age groups of females

Age (months)	Number Examined	Proportion Pregnant	Mean Litter Size (S.D.)	No. Young per Female
6 - 12	30	.233	5.29±2.5	1.23
13 - 24	32	.156	4.17±1.9	0.65
> 24	35	.486	6.53±2.1	3.17

Mammaries

The mean number of visible mammaries per female was 8.3±1.0 (n = 151), ranging from 3 to 10. Eight and 10 were the most frequently encountered. This is less than the number found in domestic breeds (Plum 1938; Smith et al. 1938) and less than the 11.9 to 12.6 observed by Barrett (1978) in feral hogs in California.

Behavior

Habitat Where Collected

Wild boar were collected mainly from crop fields, mesquite and *Acacia* thickets, and grassy low-lying areas with rank growth of *Saccharum* and *Typha* spp. (Table 4). These are the areas in which they hide during the daylight hours for resting; breeding, etc. Grassy low-lying waste areas, sugarcane fields and

mesquite/acacia thickets account for 96% of the animals collected.

Table 4. Habitats where wild boar were taken in Faisalabad area

Habitat	Number collected		Total
	Males	Females	
Crop Fields:			
Sugarcane	51	70	121
Wheat	3	4	7
Maize	1	3	4
Cotton	0	1	1
Low-lying areas	64	72	136
Mesquite/Acacia thickets	12	24	36

Size of Groups

The mean number of animals per group was obtained from 85 field observations during the period June to December 1988. These data are summarized in Table 5. The mean number per group was found to be 5.24, generally one or more adult females with their young-of-the-year and an occasional yearling.

Table 5. Frequence of numbers of wild boar sighted singly or in groups

	Number or Group												
	1	2	3	4	5	6	7	8	9	10	11	12	>12
No. of sightings	16	8	19	2	10	1	15	0	4	0	4	0	5

Old males normally move singly but males up to the age of about 18 months move with the family. Wild pigs move in groups of 2 to 28. The largest group of 28 animals was observed on the Pakistan Air Force Base, Rasel-e-Wala, on the night of 21st August, 1988. This group included 2 males and 4 females with 22 piglets of varying ages.

Population Structure

Sex Ratio

It is difficult to draw any conclusions regarding the sex ratio from the hunted sample, since there was a conscious bias to try to collect more females for reproductive studies. The overall sex ratio (males:females) in the hunted collections was 100 males:146 females. When the sex ratio is examined by age

(Table 6), the males of 1 to 4 months are equal to the females in number. They then drop to only about a third of the sample at 5 to 12 months. The males again reappear as 48% of the sample from 13 to 24 months.

Table 6. Sex ratio by age groups in wild boar.

Age in months	Number of Males	Number of Females	Percent Males
1 - 4	13	13	50.0
5 - 12	31	65	32.3
13 - 24	30	32	48.4
> 24	26	36	41.9
Totals	100	146	40.6

Immatures vs. Adults

It appears from the aging studies of the hunted sample that 75.3% of the females and 74.0% of the males are less than 2 years of age. This may indicate that wild boar populations in Pakistan have a high rate of turnover, with limited life expectancy of individual members.

DISCUSSION

Aging Methods

Accurate aging methods are important for any vertebrate pest management program. It was found in this study that the tooth eruption schemes as given by Matschke (1967) and Diong (1973) were satisfactory for estimating ages of both sexes up to the time of eruption of the 3rd molar, or 26-plus months. Beyond that age, aging methods had to rely on degree of eruption of the 3rd molar, cusp wear, or on sectioning and staining of incisor teeth and counting of annular rings. The only difference noted in the eruption scheme was that the first molar generally erupts before premolar 1, the reverse of that seen in the European wild boar. It was easy to differentiate between the deciduous and permanent teeth on the cleaned jaws.

There is a problem with the use of tooth eruption, however, as pointed out by Sweeney et al. (1970). Estimating the age of wild boar by dentition tends to clump animals into established and often overlapping age classes. In many cases, the tooth eruption pattern places an animal in a zone of overlap, forcing a subjective decision in assigning the animal to a specific age class.

A second criterion of age is the use of the weight of the eye lens. If using known-age animals, this should provide a continuum of ages without the need for subjective assignments.

The weight of the eye lens gave a good correlation with estimated age by dentition in both sexes. The relationships between lens weight and age by incisor sectioning will have to await results from DWRC on this method.

Morphometrics

The wild boar from central Pakistan are smaller than their counterparts from the USSR (Kozlo 1968; Gunchak 1978), but larger than feral hogs from South Carolina or Tennessee, USA (Brisbin et al. 1977; Henry 1970). They also are larger than those reported by Smiet et al. (1979) from Thatta District in southern Pakistan. The largest male weighed 135 kg and the longest male measured 163 cm head and body length and stood 92 cm tall at the shoulder. The largest female weighed 85 kg and the longest female measured 143 cm in head and body length.

Males grow to a larger body weight and a longer body length than do females. In the oldest age group, males averaged 97.7 kg in body weight and 145 cm in head and body length against 61.6 kg in body weight for females and 128.7 cm in head and body length. The differences in weight and length were significant ($t = 9.31$ and 7.32, $p = .001$) in both cases.

Reproduction and Breeding Season

Age at Sexual Maturity

Both sexes are capable of breeding at about 7 months of age. The males were seen with sperm in the epididymis as early as 5 to 6 months, which is in general agreement with ages reported for domestic and European wild hogs (Henry 1966; Sweeney et al. 1979) and correlates well with the domestic male pig, which produces mature sperm at 6 months of age, but generally are not used for breeding before 9 months of age (Day 1962). Barrett (1978) found that feral boars about 6 months old in northern California, USA, often attempted to breed but because of their subordinance to the older boars and because of their small size relative to that of the adult sow, they were rarely successful.

The male reproductive tract of the wild boar has been little described, so some observations are given here. The testis of the mature boar is ellipsoidal in shape. It is enclosed in the scrotum against the caudo-medial surface of the thighs ventral to the anus. The scrotum does not hang as a pendulous sac but is generally tight against the body. The testis ranges in weight from 1.5 g in 2 to 4 month old males, up to 144 g in the mature boar. There is great variability between individuals of the same age groups; some animals of mature size had paired testis weights of only 59.3 to 85.8 g, while others ranged up to 286.8 g. Metzdorff (1940) gives the average weight of testis in the European wild boar in Germany as 116 g (6 animals), with a range of 38 to 266 g. Wood and Brenneman (1977) give a mean testis weight of 135.3 g (n = 9) for European wild boar in the USA and Johnson et al. (1982) reported mean testis weights of 151.7 g (n

= 26) for boars 21 to 26 months old and 174.6 g (n = 38) for boars more than 26 months. Our data are essentially in agreement with the above observations. It appears that the testis may increase in weight with the age of the animals, at least up to 3 years of age.

The epididymis is relatively large and prominent. The epididymal tubules are easily discerned with packed sperm in sexually mature animals. Even males as young as 5 to 6 months were easily seen with sperm packed into the cauda epididymis.

Females were found with corpora lutea in the ovaries as early as 6 to 7 months, and were ready to breed at 8 months. This agrees with data reported for the female European wild hog which reaches maturity at 7 months (Henry 1966), but in the feral hog was reported as 10 months (Sweeney et al. 1979). Pregnant young of the year females constituted 23 % of the visibly pregnant animals in 1988. They make a minor, but significant, contribution to the reproductive effort of the population.

In contrast, European wild boar generally first breed as yearlings (18 to 21 months) (Sludskii 1956; Haber 1959). In years of good mast (acorns) production, a small proportion of young females may breed at 8 to 10 months of age (Oloff 1951).

Breeding Season

The breeding season began in the last week of December 1987 as judged from fetus ages. Mating activity in the field was first seen on 10 January in 1988. Visible pregnancies were observed first in females collected on 22 February 1988. By back-dating fetus ages, the peak of conceptions were seen to have occurred in the last two weeks of January 1988.

Pregnant sows were seen in February through June 1988. Two sows were pregnant in September 1988 but none were seen in the other months. The major and most significant period of breeding activity is thus the winter and spring months from December through June.

Young can be born in every month of the year, but dating by age from tooth eruption, 72% of the animals were born during the five months from April to August. This is corroborated by aging the fetuses forward to parturition, when the peak of births would have occurred in May, with others born in April and June. There was a suggestion from the animals collected that there was a minor breeding period in the fall of 1987. In October 1987, six animals were taken weighing between 8.5 and 10.5 kg. Two of the animals were aged as 2 to 4 months old and two as 4 to 6 months. In December, three animals were shot weighing 7 to 8 kg and aged as between 2 to 5 months of age. These animals, as those in October, must have been born between August and October 1987.

The littering (farrowing) season in the European wild boar is given by Mauget (1982) as the spring and summer months in France and Germany and from January to September in Mauget's (1972) own studies in France. In the USA, the farrowing season is given for the wild boar as year-round by Conley et al. (1972), Johnson et al. (1982), and Singer and Ackerman (1981), whereas Pine and Gerdes (1973) observed it to be mainly from October to June in California. Springer (1977) reported it to be in January through April in feral pigs in Texas.

The overall litter size averaged almost 5.8 per pregnant female, but significant ($p = .05$) differences exist between females less than 2 years and older females in size of litter. This litter size, if coupled with good survival of young, could lead to rapid population growth.

Henry (1966) reported that the European wild boar in the USA has an average litter size of 4.8. Sweeney et al. (1979) found that in the feral hog it ran 7.0, which is larger than the European wild hog. Mauget (1972) reported a litter size of 4.6 in European wild boar from France, while Aumaitre et al. (1982) found it to be 4.5. Stubbe and Stubbe (1977) in the German Democratic Republic found it averaged 5.3. Feral hogs in the USA ran 5.6 (Barnett 1978) and 6.2 (Hagen and Kephart 1980)

Population Structure

The sex ratio of 100 males to 146 females may be fairly close to the actual. While there was a deliberate attempt to collect females during the period February through June for pregnancy studies, in actual fact almost every animal seen was shot at, without regard for sex. The collection of very young animals, up to 12 months, could not have been discriminated as to sex before shooting, and in fact the sex ratios are probably close to the actual sex ratios in the wild.

The disappearance of the young males, 5 to 12 months of age, as shown in the collections, may be due to competition and intraspecific strife exerted on them by the mature males. This is only speculation at this point and needs to be verified by field observations and/or recovery of killed young males in the field.

Wild boar in the Faisalabad area frequent mainly three major habitat types in which they hide during the day and/or forage at night; sugarcane fields, low-lying areas containing dense growths of *Saccharum* species or *Typha* species, and thickets of mesquite/acacia. Ninety six percent of the animals collected were taken from these three habitats. In the period when all sugarcane and wheat fields have been harvested, roughly from May until August, and until maize, sorghum and sugarcane grow tall enough to provide shelter and hiding places, the wild boar retreat to the dense growths of *Saccharum* and *Typha* or into mesquite/acacia thickets if water is available nearby. This may

be the critical period for the animals during the annual cycle. It also coincides, in part, with the main farrowing period.

Other researchers have found that post-natal mortality of young in feral hogs and wild boar may run from 36% (Singer et al. 1978) to over 50% (Baber and Coblentz 1986, Coblentz and Baber 1987). We believe that the same probably pertains to wild boar populations in Pakistan since the main farrowing period coincides with a time of scarcity of crops in the fields in which to hide or to utilize as food.

Research Needs

The young age at which sexual maturity in both sexes takes place, the year-round breeding capabilities, the relatively large litter sizes, and the possibility of two litters per year indicate an animal with a high reproductive potential. Wood and Barnett (1979) stated that wild pigs are "the most prolific large mammal in the U.S." The high reproductive potential, accompanied by high mobility (wild boar are capable of wide nightly movements in search of food) and a lack of effective control techniques, makes this animal a formidable pest species in the Pakistan agroecosystem.

A comprehensive programme of basic research on its biology, combined with evaluation of candidate toxicants, baits and bait delivery systems, leading to development of control strategies and methods, is sorely needed. In a study of feral pigs on Isla Santiago, Galapagos Islands, Coblentz and Baber (1987) concluded, based upon cost and efficiency, that poisoning was the best method of control. Cost of removal per pig by poisoning was estimated at about eleven times cheaper than shooting, the second most efficient control method. Our researches are directed to this end.

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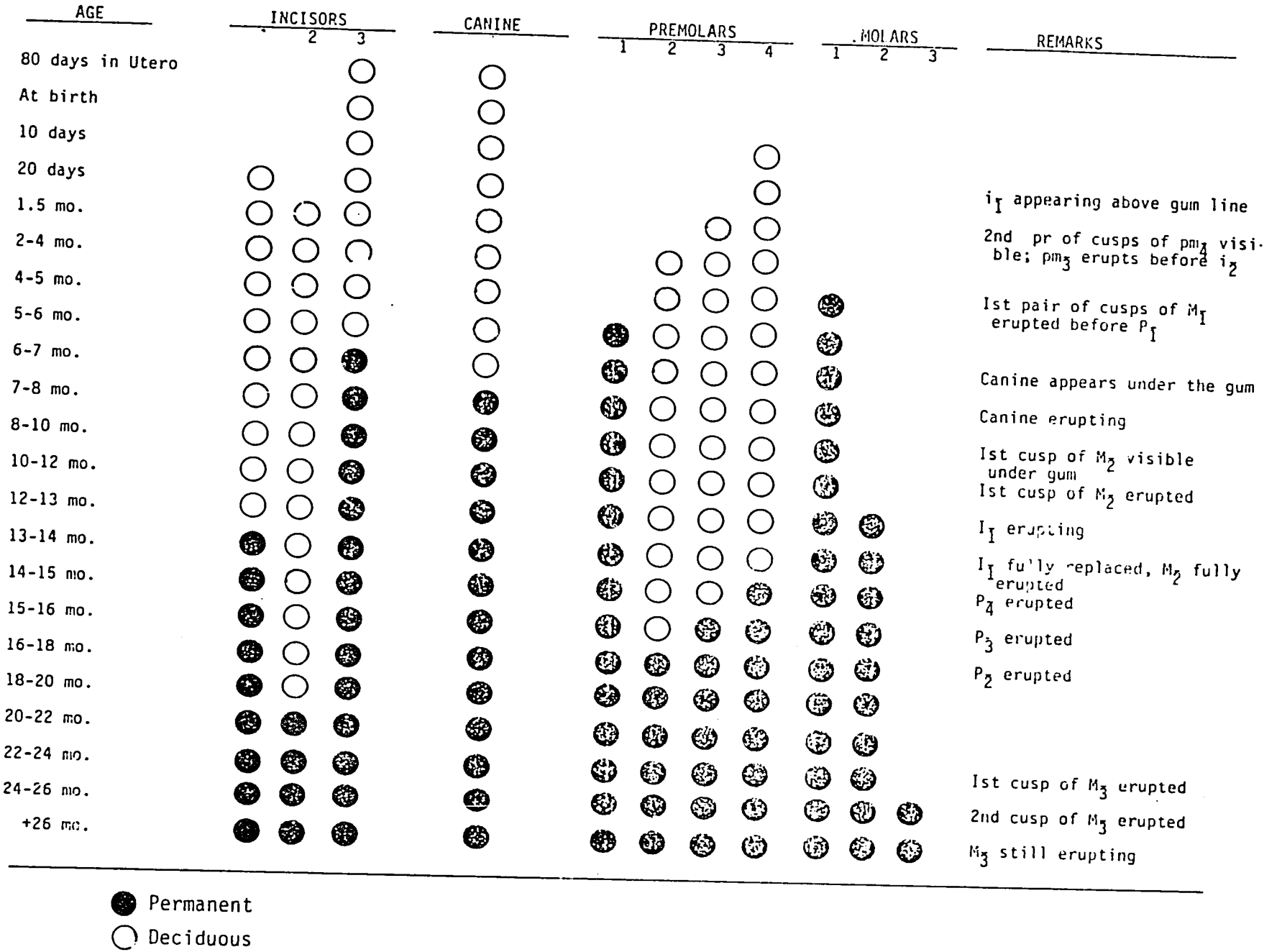
AGE
INCISORS
1 2 3
CANINE
PREMOLARS
1 2 3 4
MOLARS
1 2 3
REMARKS
80 days in Utero
At birth
10 days
20 days
1.5 mo.
2-4 mo.
4-5 mo.
5-6 mo.
6-7 mo.
7-8 mo.
8-10 mo.
10-12 mo.
12-13 mo.
13-14 mo.
14-15 mo.
15-16 mo.
16-18 mo.
18-20 mo.
20-22 mo.
22-24 mo.
24-26 mo.
+26 mo.
i_I appearing above gum line
2nd pr of cusps of pm_4 visible; pm_3 erupts before i_2
Ist pair of cusps of M_I erupted before P_I
Canine appears under the gum
Canine erupting
Ist cusp of M_2 visible under gum
Ist cusp of M_2 erupted
I_I erupting
I_I fully replaced, M_2 fully erupted
P_4 erupted
P_3 erupted
P_2 erupted
Ist cusp of M_3 erupted
2nd cusp of M_3 erupted
M_3 still erupting
Permanent
Deciduous

Appendix-II

MORPHOMETRICS OF PAKISTAN MALE WILD BOAR

A.NO.	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Eye Lens Wt. (mg)	Testes Wt.(gm)	Tubules Visible
211	2.0	44.0	7.2	25.0	13.0	11.5	5.0				
21	2.0	40.0	6.1	21.3	13.2	7.5	5.0			-	-
32	8.5	70.5	12.5	30.0	21.5	17.1	7.3			-	-
24	12.0	72.0	14.0	43.0	22.0	13.3	8.0			-	-
30	10.4	75.2	12.5	41.8	23.7	18.9	8.2			-	-
2	21.0	95.7	16.6	46.5	26.8	21.2	8.3			-	-
4	17.0	95.7	17.0	48.5	24.3	20.1	8.5			-	-
6	17.5	95.3	15.5	46.9	24.5	19.4	8.1			-	-
5	17.5	97.2	17.0	45.5	23.5	20.6	8.2			-	-
22	55.5	115.0	22.0	61.3	37.0	29.0	13.0			-	-
187	6.0	45.0	8.0	28.0	17.0	12.0	5.3	1		-	-
186	5.0	43.0	8.4	23.0	15.0	13.0	5.0	1		-	-
188	7.0	49.0	8.0	27.0	13.5	12.0	5.0	1		-	-
233	14.0	71.0	12.0	36.5	20.0	17.0	7.0	1	72		
203	10.0	69.0	11.5	37.0	19.0	16.5	6.5	1.5	80	2.3	-
234	17.0	18.0	13.2	40.0	22.0	19.0	8.5	2-4	76.5		
93	9.0	70.0	11.6	40.0	21.0	18.0	8.0	2-4	84	2.0	-
92	10.0	70.5	12.0	40.0	21.0	19.0	8.5	2-4	79	-	-
237	16.0	72.0	13.0	41.0	22.0	16.5	7.5	2-4	73		
197	14.0	74.0	16.0	45.5	24.0	21.5	7.0	2-4	166.5(?)	-	-
199	14.0	77.0	14.0	43.2	24.0	19.0	6.5	2-4	55	-	+
238	16.0	78.0	13.5	33.0	22.0	18.5	8.0	2-4	71		
219	14.0	74.0	13.0	42.0	21.5	17.0	8.0	4	112		
212	15.0	82.0	13.0	45.0	24.0	20.0	8.5	4-5	110.0	3.1	+
251	17.0	83.0	15.0	29.0	24.0	19.0	8.5	4-5	115		
210	12.0	84.0	13.0	50.0	25.5	21.5	9.0	4-5	107.5	3.6	+
255	26.0	96.0	13.0	45.0	28.0	22.0	9.0	4-5			
102	30.0	107.0	20.0	69.0	31.0	25.0	11.0	4-5	135	12.0	+
246	22.0	91.0	16.0	41.2	26.0	22.0	9.0	5			
256	30.0	95.0	17.0	53.0	26.0	23.0	9.5	5-6			
98	29.0	98.0	17.0	54.0	28.0	25.0	10.0	5-6	148	11.2	+
134	26.0	104.0	17.0	57.0	29.0	25.0	10.0	5-6	155	12.1	+
9	25.5	104.5	15.0	49.8	28.0	23.0	9.4	5-6	120	-	+
45	21.0	113.0	13.0	51.0	27.3	22.3	9.3	5-6	133	5.5	+
132	26.0	100.0	17.5	55.0	31.5	25.0	11.0	6	133	45.3	+
42	40.0	106.0	21.5	54.5	31.3	31.0	10.4	6	155	14.0	+
61	35.0	113.0	18.0	61.0	33.0	25.3	11.3	6	159	18.4	+
265	45.0	115.0	24.5	60.0	32.0	23.0	11.0	6	167.5		
68	29.0	102.0	22.0	50.3	31.3	27.0	10.3	6-7	142	7.0	+
259	60.0	104.0	20.5	60.0	31.0	27.0	10.0	6-7	151.0		
81	25.0	113.0	19.0	61.0	30.0	25.0	11.0	6-7	162	38.1	+
87	40.0	115.0	18.0	57.0	30.5	26.0	11.0	6-7	157	35.3	+
266	44.0	119.0	20.0	63.0	32.0	28.0	11.0	6-7	169.5		
72	27.0	102.0	18.3	57.3	29.3	24.3	10.3	7		8.0	+
113	35.0	104.0	21.2	64.0	31.0	26.0	10.0	7	133.5	70.3	+
88	35.0	108.0	20.0	60.0	32.0	27.0	11.4	7	182	20.5	-
245	20.0	95.0	15.0	54.0	27.0	24.0	9.0	7-8	175.5		
127	31.0	106.5	17.0	56.0	31.0	24.4	10.4	7-8	165.5	50.2	-

A.NO.	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Eye Lens Wt. (mg)	Testes Wt. (gm)	Tubules Visible
60	30.0	107.0	17.3	60.0	33.3	27.0	12.0	7-8		31.4	+
14	34.0	109.6	15.2	62.0	32.2	27.0	11.0	7-8		-	-
80	35.0	112.0	16.3	60.0	32.6	26.0	10.8	7-8	155	15.7	-
147	40.0	115.0	20.0	63.0	34.0	27.4	14.4	8-10	170	60.3	+
101	55.0	121.0	22.0	70.0	36.0	29.0	13.0	8-10		109.1	+
158	50.0	128.0	23.0	66.0	36.0	29.0	13.0	12		-	-
175	41.5	114.0	20.0	67.0	34.0	23.0	12.0	12-13	136.5	50.6	+
13	37.0	116.2	15.5	62.4	35.2	26.5	9.7	12-13		-	-
132	36.0	119.0	21.0	68.0	37.0	29.0	11.3	12-13		-	-
151	47.0	119.0	20.0	67.0	35.5	28.0	12.0	12-13	178	117.4	+
173	49.0	122.0	23.0	65.0	36.5	28.0	11.5	12-13	180	49.3	+
125	35.0	112.0	18.0	62.0	34.0	28.0	11.0	13		62.7	+
152	42.0	115.0	21.5	63.0	34.0	29.0	12.0	13	190	42.2	+
174	31.0	105.0	22.0	59.0	32.0	25.0	11.0	13-14	199	14.2	-
149	45.0	120.0	23.0	64.0	35.5	28.0	12.0	13-14		75.2	+
180	55.0	122.0	20.0	63.0	35.0	25.0	12.0	14-15	187.5	-	-
162	60.0	129.0	22.5	72.0	35.3	30.0	12.0	14-15		89.2	+
148	45.0	120.0	21.5	69.0	34.0	28.6	12.0	15-16		66.4	+
191	52.0	117.0	22.0	66.0	36.0	26.0	12.0	16	208		
164	64.0	124.0	20.0	73.0	40.0	29.0	12.4	16	215	114.2	+
29	58.5	116.0	20.0	65.0	39.0	28.3	12.2	16-18		-	-
83	59.0	117.0	22.0	65.0	36.0	28.0	12.0	18-20	200	-	-
220	42.0	120.0	22.0	63.0	33.0	25.0	10.5	18-20	113		
102	37.0	123.0	19.4	62.0	33.0	30.0	12.0	18-20	222.0	132.0	+
99	85.0	133.0	26.0	85.0	40.5	29.3	13.0	18-20	216	116.6	+
53	75.0	141.0	21.0	74.0	41.0	31.0	13.0	18-20	240	143.7	+
223	61.0	121.0	21.0	70.0	37.0	23.5	13.0	20-21	229		
94	63.0	123.0	22.0	70.0	35.0	27.0	12.0	20-22	199	151.0	+
202	57.0	127.0	22.2	71.0	38.0	28.0	12.0	20-22	226	57.1	+
77	46.0	129.0	22.0	72.0	33.0	29.3	12.0	20-22	234	168.9	-
261	70.0	132.0	23.0	71.0	35.0	28.0	12.0	20-22	228.0		
263	70.0	133.0	23.5	62.0	39.0	23.0	13.0	20-22	242.0		
225	74.0	134.0	22.0	78.0	39.0	27.5	12.0	20-22	185		
120	65.0	135.0	25.0	73.0	40.0	31.0	12.0	20-22		121.9	+
154	47.0	123.0	21.0	63.0	39.0	29.0	13.0	22-24	189.5	88.9	+
185	38.0	107.0	19.0	59.0	31.5	27.0	11.0	24	~~170~~	27.5	+
167	90.0	148.0	25.0	84.0	42.0	31.0	14.0	24-26		133.7	+
163	71.0	137.0	28.0	78.0	41.0	29.0	13.7	26-30	257	125.9	+
214	90.0	141.0	28.0	81.0	41.0	30.5	13.0	26-30	272.5	85.8	+
268	82.0	142.0	24.5	71.0	40.0	28.0	12.5	26-30	257.0		
18	77.0	143.0	15.0	82.0	48.4	32.0	14.0	26-30			
143	95.0	144.0	26.0	75.0	42.5	28.0	12.4	26-30		124.0	+
264	102.0	149.0	27.5	86.0	39.0	30.0	13.5	26-30	254.5		
135	97.0	150.0	29.0	87.0	45.0	29.0	14.0	26-30	222	152.3	+
155	69.0	131.0	23.0	73.0	39.0	29.0	12.0	30-35	251	156.5	+
10	85.0	133.4	23.5	81.5	44.5	27.3	13.7	30-36	260		
79	34.0	135.0	24.7	85.0	44.5	30.0	14.0	30-36	325	-	-
36	95.0	138.0	23.0	81.3	42.3	28.0	15.0	30-35		68.0	+
50	135.0	153.5	28.0	98.0	47.0	31.3	14.0	30-35	253.5	143.3	+

A.NO.	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Eye Lens Wt. (mg)	Testes Wt. (gm)	Tubules Visible
49	108.0	155.0	26.0	78.3	54.3	30.0	16.0	36+		110.6	+
78	95.0	139.0	24.0	86.4	42.5	29.5	13.5	48+		139.1	+
224	113.0	147.0	26.0	86.0	44.0	27.5	13.0	48+	334		
100	106.0	150.0	28.0	88.0	45.0	31.0	14.0	48+	305	-	+
176	95.0	153.0	27.0	84.0	45.0	29.0	15.0	43+	324	114.5	+
91	89.0	144.0	20.0	82.0	43.5	28.0	14.5	60+	332.5	184.7	+
230	120.0	145.0	20.0	83.0	44.0	28.0	13.5	60+	335		
145	90.0	145.0	27.0	80.0	42.0	31.5	15.0	60+	186	165.3	+
90	110.0	147.0	28.0	88.0	45.5	30.5	15.0	60+		235.3	+
62	115.0	150.0	26.3	83.3	43.0	31.0	14.0	60+		173.9	+
43	115.3	153.0	21.0	87.3	40.3	31.0	15.0	60+		119.8	+
95	118.0	153.0	23.0	92.0	43.0	32.0	14.0	60+	349	-	-
216	90.0	135.0	25.0	82.0	41.0	28.0	12.5	72+	354.5	50.3	+

Appendix-III

MORPHOMETRICS OF PAKISTAN FEMALE WILD BOAR

A.No	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranius Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Preg.	Litter size	Eye Lense Wt. (mg)
204	2.0	44.0	8.2	24.0	13.5	12.0	4.5				
1	16.0	91.5	13.7	42.0	24.0	19.9	7.3				
3	16.5	93.3	16.5	48.5	21.3	19.5	7.7				
38	20.0	94.0	-	53.0	23.3	22.3	11.0				
7	17.3	94.0	15.3	45.5	23.3	19.6	8.0				
25	21.0	102.0	17.0	52.0	34.0	24.3	10.0				
118	35.0	108.0	18.3	64.0	28.4	26.0	10.4		Preg.	6	
23	42.5	111.3	18.0	53.0	33.0	25.0	11.0				
36	23.0	113.0	18.0	63.0	35.0	27.3	10.0				
27	53.0	122.0	21.0	67.3	33.3	27.0	11.3				
28	50.5	124.0	21.0	69.5	33.2	25.0	12.0				
116	2.0	42.0	7.5	24.0	11.5	11.5	5.0	1			
195	7.0	48.0	9.0	29.0	18.0	14.0	6.0	1.5			62
52	7.0	65.0	12.0	35.0	20.0	17.3	6.3	2-4			
190	11.0	55.0	14.0	33.0	19.0	17.0	7.0	2-4			86
33	10.3	59.0	11.7	38.9	22.0	17.9	7.9	2-4			
242	15.0	70.0	11.0	39.0	21.0	16.5	5.0	2-4			88
235	13.0	71.0	12.2	38.0	18.0	18.0	8.0	2-4			70
34	10.0	71.6	12.0	33.6	23.2	17.6	8.2	2-4			
193	13.0	76.0	13.0	43.0	22.3	19.0	8.0	2-4			80
241	15.0	78.0	13.5	41.0	22.0	18.0	8.0	2-4			
243	13.3	81.0	13.2	39.5	22.0	19.0	8.0	2-4			90.5
221	17.0	75.0	15.0	42.0	27.0	18.5	8.0	4			111
222	18.0	79.0	14.5	42.2	26.0	19.0	8.5	4			110
40	7.5	69.0	12.0	30.0	24.0	16.5	6.0	4-5			130
51	8.0	73.0	15.0	38.0	22.0	19.0	7.3	4-5			105
227	16.0	80.0	16.2	45.0	22.0	21.2	9.0	4-5			122
75	17.0	82.0	12.0	48.0	25.0	21.3	9.0	4-5			130
226	18.0	84.0	16.5	45.0	25.0	21.0	9.5	4-5			138
119	18.0	84.0	12.5	44.0	24.0	20.0	9.0	4-5			
205	19.0	87.0	16.0	49.0	26.0	21.0	9.0	4-5			111
254	21.0	88.0	14.0	49.0	25.0	20.0	9.0	4-5			120
231	15.0	88.0	13.5	49.0	20.0	21.0	9.5	4-5			122.5
39	9.0	70.0	13.0	32.0	25.0	17.0	6.3	4-5			97
11	27.5	93.4	13.3	18.7	31.0	24.5	9.8	4-6			
64	8.0	72.3	13.0	43.0	23.3	19.3	9.0	5			
8	13.7	85.3	18.2	48.6	29.4	21.2	9.3	5-6			138
248	25.0	86.0	14.5	51.0	26.0	22.0	9.5	5-6			144.5
257	21.0	90.0	16.5	49.0	27.0	21.0	9.0	5-6			
252	23.0	91.0	15.5	45.0	28.0	21.0	9.0	5-6			205.0
121	26.0	93.0	13.0	54.5	27.2	23.0	10.5	5-6			127
245	30.0	94.0	15.0	51.0	26.0	21.5	10.0	5-6			123.5
250	25.0	95.0	15.5	50.0	27.5	22.0	9.0	5-6			135.5
46	22.0	95.3	12.0	53.3	27.3	20.3	9.0	5-6			127
12	20.0	97.7	16.2	52.6	27.0	22.4	10.3	5-6			148
57	25.0	98.2	19.5	56.7	31.5	23.1	9.0	5-6			174
105	28.0	99.0	15.0	50.0	30.5	24.3	10.5	5-6			140

A.No	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Preg.	Litter size	Eye Lense Wt. (mg)
41	32.0	100.0	12.7	54.0	27.5	24.5	10.0	5-6			150
85	26.0	102.0	16.0	49.5	33.6	21.4	12.0	5-6			150
71	25.0	103.0	18.0	54.0	30.0	24.3	10.0	5-6			148
86	34.0	105.0	14.4	60.3	29.0	26.0	11.0	5-6			153
256	25.0	87.0	16.0	49.0	25.0	21.0	9.0	6			
15	28.5	96.0	13.7	57.0	29.0	25.5	11.7	6			
104	27.0	98.0	18.0	55.6	23.3	24.0	10.0	6			139
69	26.0	99.3	21.3	50.3	29.0	24.3	10.0	6			136
123	27.0	100.0	17.0	53.0	32.0	23.2	10.0	6			
74	30.0	102.0	14.5	56.3	31.0	19.3	11.3	6			153
73	27.0	104.3	19.0	51.0	29.0	23.3	10.3	6			145
34	40.0	113.0	19.0	61.0	35.0	27.4	13.4	6			163.5
122	25.0	95.0	17.3	53.0	29.0	22.0	11.5	6-7			151
70	22.0	97.0	14.0	52.3	26.3	22.3	9.3	6-7			162
183	24.0	98.0	19.0	52.0	28.2	24.0	11.4	6-7			~~150~~ 161
55	30.0	98.3	21.0	50.0	23.0	23.3	10.0	6-7			150
16	30.1	101.0	13.2	58.5	30.0	25.0	12.0	6-7			
114	32.0	103.0	19.0	58.0	29.0	24.0	10.4	6-7			142
122	27.0	103.0	19.0	55.0	32.0	24.0	11.0	6-7			160
159	40.0	104.0	18.0	59.0	30.0	24.0	10.5	6-7			
252	34.0	104.0	21.5	57.0	30.0	21.0	10.2	6-7			141
111	35.0	107.0	21.0	63.0	32.0	26.4	11.0	6-7	Preg.	4	161.5
244	41.0	108.0	21.0	58.0	28.0	24.5	12.0	6-7			151
172	35.0	108.0	22.0	57.0	32.5	25.0	11.0	6-7			
59	29.0	108.3	20.0	54.0	30.0	25.3	11.3	6-7			162.5
112	36.0	109.0	22.0	57.0	32.0	24.0	11.4	6-7	Preg.	6	161.0
76	36.0	114.3	15.3	58.0	34.3	26.3	11.3	6-7			156.5
82	42.0	118.0	21.2	64.0	36.0	29.0	13.0	6-7			155.5
97	40.0	110.0	22.0	62.0	32.0	26.0	10.5	5.5			162
159	45.0	106.0	11.0	55.0	28.0	23.5	11.0	7	Preg. +	1	152.0
58	30.0	106.3	16.0	56.3	30.0	25.3	11.0	7			160.5
110	35.0	106.4	21.4	55.0	31.5	25.3	11.0	7	Preg.	5	171.0
178	31.0	109.0	17.5	59.0	33.0	25.0	11.0	7			
161	41.0	98.0	17.0	57.7	30.5	24.0	9.5	7-8	Preg. +	9	
150	36.0	103.0	17.0	69.0	32.0	25.0	11.5	8-10	Preg.	7	157
142	23.0	91.0	14.0	52.0	29.5	23.0	10.0	10			
153	21.0	95.0	17.0	52.0	29.5	23.5	10.5	10-12			251
124	22.0	97.0	20.0	56.0	30.0	24.4	9.0	10-12			175
130	22.0	98.0	18.0	59.0	28.0	24.0	10.0	10-12			
170	30.0	99.0	17.0	58.0	30.0	25.0	11.0	10-12			
89	31.0	106.0	19.0	54.0	31.0	25.0	11.3	10-12			167
140	34.0	107.0	18.3	60.0	31.3	25.0	11.0	12	Preg	5	172.5
169	40.0	105.0	20.0	56.0	31.5	25.0	11.0	12-13			
213	45.0	106.0	21.0	61.0	26.0	26.0	11.0	12-13			174.5
156	42.0	112.0	19.0	64.0	34.0	25.0	11.0	12-13	Preg.	6	
137	30.0	104.0	12.0	52.0	31.3	25.0	11.0	13	Preg. +	4	174.5
181	39.0	109.0	19.0	61.0	33.0	24.5	12.2	13			195
141	35.0	109.0	18.5	61.5	32.0	27.0	11.0	13	Preg.	1	182
236	50.0	115.0	19.0	64.0	32.2	25.5	11.0	13			192

A.No	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Preg.	Litter size	Eye Lense Wt. (mg)
177	55.0	106.0	17.0	54.0	32.0	25.0	10.5	13-14	Preg.	5	
179	28.0	108.0	15.0	57.0	31.0	26.0	11.0	14-15			
65	53.0	114.8	21.0	63.5	33.4	26.1	11.3	14-16			220.5
194	29.0	111.0	21.0	58.0	33.0	26.0	11.0	15-16			~~227~~
66	49.5	111.1	20.9	62.0	36.0	25.0	11.1	15-16			
184	43.0	113.0	20.0	61.0	35.0	27.0	12.0	15-16			258
115	40.0	114.0	20.0	63.0	30.0	27.0	11.4	15-16			195
201	36.0	144.0	20.0	53.0	33.0	25.0	10.0	15-16			
87	51.0	117.0	20.3	61.0	37.0	24.5	11.5	16-18			
106	50.0	120.4	21.0	67.0	37.0	27.0	13.0	16-18	Preg.	3	234
196	43.0	121.0	21.0	64.0	37.0	23.0	12.0	16-18			209
19	32.5	111.0	20.2	57.8	35.0	24.8	11.1	18-20			184
192	41.0	114.0	20.0	62.0	31.5	27.0	11.0	18-20			235
31	35.3	115.3	19.5	59.5	32.3	25.8	10.7	18-20			
47	-	116.0	21.3	60.0	33.3	25.0	11.3	18-20			
205	60.0	127.0	22.0	67.0	36.0	28.0	13.0	18-20			210
193	38.0	112.0	22.0	59.0	34.0	25.0	11.2	20-22			217
253	47.0	117.0	27.0	63.0	35.0	26.5	13.0	20-22			192
203	45.0	118.0	25.0	68.0	39.0	27.0	12.0	20-22			227
229	45.0	119.0	24.0	61.0	36.0	25.0	13.0	20-22			232
217	52.0	122.0	21.0	62.0	36.0	26.5	12.5	20-22			223
226	56.0	123.0	22.5	63.5	34.0	25.5	12.0	20-22			177.5
247	45.0	123.0	23.0	67.0	36.0	27.0	11.5	20-22			224.0
100	50.0	124.0	20.0	63.0	35.0	26.0	11.4	20-22			215.5
267	74.0	133.0	22.5	71.0	38.0	28.0	13.5	20-22			251.0
218	45.0	118.0	21.0	68.0	33.0	26.0	11.0	24-26			223
232	56.0	121.0	22.0	63.0	36.5	27.0	12.0	26-30			260
189	48.0	121.0	30.0	67.0	39.0	25.0	11.0	26-30			227
135	65.0	121.0	24.0	67.0	37.0	28.0	13.0	26-30	Preg	5	
129	56.0	122.0	22.0	69.0	37.0	23.0	13.0	26-30	Preg.	2	251
109	56.0	124.0	24.0	66.0	36.0	26.0	12.0	26-30	Preg.	6	
165	60.0	125.0	20.0	62.0	36.0	26.0	12.0	26-30	Preg.	7	255
125	58.0	125.5	22.4	67.0	39.0	27.0	12.7	26-30	Preg.	6	
240	60.0	126.0	22.5	70.0	36.0	25.0	12.5	26-30			270
128	56.0	126.0	22.3	63.0	37.0	28.0	13.0	26-30	Preg.	7	249
131	66.0	128.0	25.0	65.0	39.0	28.0	12.5	26-30	Preg.	6	
207	60.0	128.0	22.0	68.0	28.0	26.5	13.0	26-30			
35	47.0	132.0	-	67.0	38.0	25.5	12.3	26-30			
166	71.0	134.0	18.0	66.0	38.0	27.0	13.0	26-30	Preg.	6	232
17	76.0	138.0	25.0	70.0	40.0	30.0	15.0	26-30	Preg.	10	
37	-	-	-	-	-	-	-	30-36			
160	50.0	121.0	19.5	68.0	39.0	28.2	12.3	30-36	Preg.	9	
54	60.0	124.3	21.0	60.0	33.3	27.0	12.3	30-36			268.5
215	55.0	126.0	23.0	69.0	33.0	28.0	12.5	30-36			274
239	55.0	128.0	22.0	63.0	38.0	25.5	14.0	30-36			285.5
96	62.0	128.0	23.0	72.0	40.0	29.0	13.0	30-36			252
157	69.0	130.0	26.0	76.0	39.0	28.0	14.0	30-36	Preg.	8	277
144	73.0	131.0	24.0	70.0	33.0	29.0	12.0	30-36	Preg.	6	

A.No	Body Wt. (kg)	HBL (cm)	Tail Length (cm)	Shoulder Length (cm)	Cranium Length (cm)	Hind Foot Length (cm)	Ear Length (cm)	Age (mo)	Preg.	Litter size	Eye Lense Wt. (mg)
260	65.0	136.0	24.0	67.0	40.0	27.0	11.5	30-36			288
44	56.0	140.0	14.0	64.0	30.0	26.0	11.3	30-36			
107	52.0	127.0	25.0	67.0	41.0	29.0	13.4	36+			277
56	62.0	132.5	24.2	72.5	44.0	26.7	12.5	36+			
20	55.0	117.0	23.5	71.0	41.0	27.0	18.2	48+	Preg.	6	
206	50.0	124.0	23.0	66.0	37.0	25.0	11.5	48+			
138	69.0	130.0	24.0	70.0	37.0	26.0	12.0	48+	Preg.	2	277
139	69.0	135.0	26.3	78.0	42.0	23.0	13.0	48+	Preg.	6	278
48	70.0	140.0	25.3	66.3	43.3	25.3	13.0	48+			220
200	70.0	143.0	24.0	67.0	43.0	26.0	13.0	48+			317
63	46.0	130.3	22.3	69.0	37.3	23.0	13.3	60+			300
117	82.0	138.0	26.4	75.0	40.5	32.0	14.0	60+	Preg.	8	
146	85.0	132.0	25.0	69.0	40.0	28.0	14.0	72+	Preg.	9	