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**Aspects of the Population Dynamics of the Wild Pig
(*Sus scrofa* Linnaeus, 1758) in the Ruhuna National Park,
Sri Lanka**

(Mammalia, Suidae)

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Abstract

The wild pig (*Sus scrofa* L.) is a common resident of the Ruhuna National Park, in the dry zone of Sri Lanka. Between May 1978 and May 1980 the group size, group composition and birth of the wild pig showed pronounced seasonal variations. The group size is largest at the time of birth (towards the end of the wet season in April/May), whilst it is smallest in the wet season when the animals became scattered throughout the Park. Males are generally solitary except during the November/December (wet season) breeding period. Groups of two or more animals are generally matriarchal, consisting of females with their young or juvenile offspring. Birth is strictly seasonal and young wild pig are seen almost entirely in April and May only. The young and juvenile wild pig suffer about 75% mortality in the first year of life.

Introduction

The family Suidae is represented by a single species, *Sus scrofa* Linnaeus, 1758 in Sri Lanka. This wild pig has a wide geographical distribution in Europe, North America, Asia, Japan and the Malayan archipelago and has also become established in the United States (WALKER, 1964). In Sri Lanka, the subspecies *Sus scrofa cristatus* (Wagner, 1839), is commonly found throughout the island from the highest hills to the sea coast, although it is more numerous in the jungle areas of the low country than on the hills (PHILLIPS, 1935). In Sri Lanka, the species is closely allied to the European race, from which, according to LYDEKKER (1894), it could be distinguished by the presence of a crest or mane of long black bristles which run from the nape of the neck along the back, and by the complex structure and larger size of the last molar tooth in each jaw. In Sri Lanka, the wild pig has also a much thinner coat and lacks the under-fur.

The clearing of forests in Sri Lanka for the plantation of tea in the hill country, and rice in the low country, seems to have affected the wild pig least of all among the ungulates, perhaps owing to its omnivorous feeding habits and its remarkable ability to adapt to varied environmental conditions. According to PHILLIPS (1935), it is always the last of the large mammals to leave a district that is being opened up by man. This has posed a serious problem to farmers, especially those whose cultivations border forests and jungles, from where the animal comes in large numbers, raiding the cultivations and causing severe damage. Almost all the farmers regard it as a serious pest, perhaps second only to the elephant, in terms of the severity of the damage done to cultivated areas. Thus, wherever possible, this animal is shot by irate farmers. The kill is not difficult to dispose of as its meat is very palatable and eaten by all except of course the Moslems. However, the animal is protected in all the national parks and other nature reserves in the island.

For the wild pig in Sri Lanka, PHILLIPS (1935) provides a good general account of the animal, whilst detailed information on its ecology in the Wilpattu National Park is given by EISENBERG and LOCKHART (1972). PRATER (1934), GEE (1964), and KRISNAN (1972) provide data on the status of the wild pig in India. Seasonal activity patterns of the European wild pig were studied by BRIEDERMANN (1971), whilst KORMILITSYN and DULITSKY (1972) discuss the population dynamics of the animal in the Crimea. A good account of its social behaviour is given by GUNDLACH (1968), KURZ and MARCHINTON (1972) and HAFEZ et al., (1962). FRAZER (1968) discusses the animal's reproductive behaviour.

Unlike the population of wild pig resident in the Wilpattu National Park, that of the Ruhuna National Park has not previously been studied in detail, with the result that there is a paucity of information on this species in this Park. Hence, it was felt that a preliminary study should be carried out to gather information on the status of the population, its distribution in the Park, approximate numbers, impact on the habitat, and breeding pattern. Such information would help to design long-term management policies in the Park.

Study Area, its Climate, Vegetation and Soil

Observations on the wild pig in the Ruhuna National Park (Sri Lanka) were carried out in Block I. The exact description of the study area is given by BALASUBRAMANIAM, S. et al. (SPIXIANA 3, 2, 1980: 158, 159; Fig. 1, 2).

Fig. 1 shows the average climatic data for Ruhuna National Park. Other data to the climate and vegetation are recorded in the publication mentioned above.

The soil of the Ruhuna National Park is predominantly of the reddish-brown type. Patches of loose sandy soil are common in the eastern border of the Park while, the north is composed chiefly of clayey soil. MUELLER-DOMBOIS (1972) characterized the dominant clay as being kaolinite, which becomes hard in the drought and later impedes drainage. In the absence of rapid percolation through the soil, rain water gets collected in the lower reaches of the Park in the so-called villus.

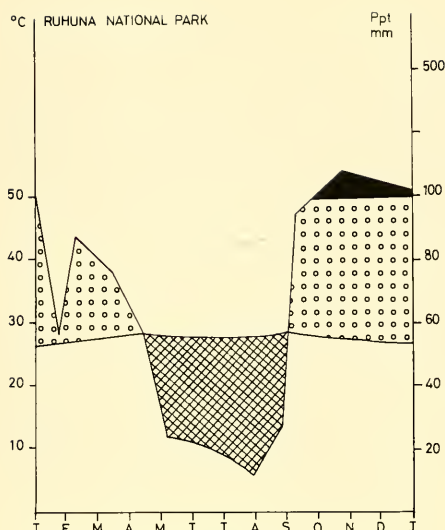


Fig. 1 Average climatic data for Ruhuna National Park. Temperature curve: monthly mean values (°C). Rainfall curve: monthly mean values of precipitation (Ppt.) in mm. Rainfall exceeding 100 mm is shown in black. Wherever the Rainfall curve undercuts the temperature curve, a significant drought period is indicated by cross-hatched lines. The abscissa indicates the months through the year from January to January with July in the center (After MUELLER-DOMBOIS, 1968). – Durchschnittliche Klimawerte für den Ruhuna Nationalpark. Temperaturkurve: Monatliche Mittelwerte (°C). Niederschlagskurve: Monatliche Mittelwerte (mm). Der Niederschlag über 100 mm ist schwarz dargestellt. Wo die Niederschlagskurve unter die Temperaturkurve sinkt (Gitternetz) wird eine signifikante Trockenperiode angezeigt. Die Abszisse gibt die Monate von Januar bis Januar an (nach MUELLER-DOMBOIS, 1968).

Materials and Methods

A number of ecological events such as the onset of breeding, time of parturition, pattern of dispersal, and extent of habitat utilization, are closely tied up with the onset of rains, intensity of ambient temperature, and duration of drought, in the tropics. Thus, in order to assess the effects of the varying climatic regimes on the population of wild pig in the Park, counts of the animals were made seasonally from May 1978 to May 1980 (Table 1). The whole area of the Park was surveyed along jeep tracks to include the various habitats such as riverine forests, forests, scrub, grassland, and also the numerous water holes or villus around which much of the wild pig activity was centred. All counts were made between 06.00 and 18.30 h, from a Jeep, with the help of a pair of 8×40 binoculars. At every count, the wild pig observed were classified according to sex and age, and their activity was recorded.

For the purpose of censusing the wild pig, four categories, based on the classification of EISENBERG and LOCKHART (1972), were employed. They are: - (1) adult males, (2) adult females, (3) juveniles and (4) striped young.

Table 1. Seasonal changes in population structure, composition and group size in wild pig (*Sus scrofa*) in the Ruhuna National Park, Sri Lanka.

month	year	season	ad.♂♂	ad.♀♀	juv.	young	classified	unclassified	total	number of groups	largest group	average group size
May	1978	wet	11	34	0	44	89	0	89	6	22	14.8
Jul	1978	dry	15	52	25	0	92	0	92	13	14	7.1
Dec	1978	wet	14	20	10	0	44	55	99	29	14	3.4
Feb	1979	dry	2	5	13	0	20	0	20	5	9	4.0
April	1979	wet	9	28	6	19	62	0	62	17	18	3.7
Jul	1979	dry	11	22	16	1	50	52	102	23	40	4.4
Nov	1979	wet	7	10	5	0	22	0	22	11	10	2.0
May	1980	wet	12	52	22	40	126	0	126	24	21	5.5
			81	223	97	104	505	107	612	128	--	4.8

ad.♂♂ = adult males; ad.♀♀ = adult females; juv. = juveniles.

Results

Fig. 2 represents the frequency of groups encountered in the Park, based on a total of 505 classified animals observed in 117 groups. Table 1 summarizes the seasonal changes in population structure, composition and group size in the wild pig. The age and sex ratio of the population according to seasons is given in Table 2.

Discussion

Social groupings

During the period of study, a total of 612 animals in 128 groups were recorded, of which 505 animals in 117 groups were classified according to age and sex (Fig. 2). Of the 117 groups, 59 consisted only of solitary animals, of which 45 represented adult males, while 14 were adult females. The next most frequently observed grouping in the Park was that of two individuals, and this was followed by the groups of three and nine individuals representing. The largest group size encountered in the Park, was of 40 animals (Table 1).

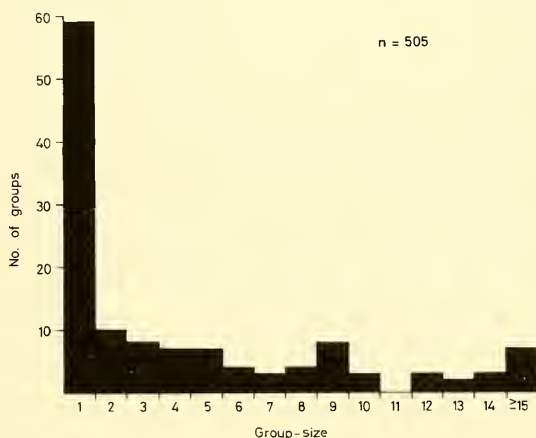


Fig. 2 Frequency diagram indicating the group size for the wild pig (*Sus scrofa*) in the Ruhuna National Park, Sri Lanka. – Häufigkeitsdiagramm für die Gruppengröße beim Wildschwein (*Sus scrofa*) im Ruhuna Nationalpark, Sri Lanka.

It thus appears clear that the adult males lead a solitary life for the most part. The most cohesive social unit in the Park seems to be what EISENBERG and LOCKHART (1972) categorize as "sounders" which are composed of four to eight adult females and their young. These units are essentially matriarchal in nature, and could be seen moving, feeding, wallowing and resting together. The entry of an adult male into such units during the breeding season, would result in the expulsion of the subadult males.

Table 2. Seasonal changes in age-structure and sex-ratio in the wild pig (*Sus scrofa*) in the Ruhuna National Park, Sri Lanka.

season	month	year	boars	: 100 sows	: juveniles	: young
wet	May	1978	32.35	100	0	129.41
dry	Jul	1978	28.85	100	48.08	0
wet	Dec	1978	70.00	100	50.00	0
dry	Feb	1979	40.00	100	260.00	0
wet	April	1979	32.14	100	21.42	67.86
dry	Jul	1979	50.00	100	72.64	4.55
wet	Nov	1979	70.00	100	50.00	0
wet	May	1980	23.08	100	42.31	76.92

Population structure

From Tables 1 and 2, it appears that the number of adult females in the population is always greater than that of the adult males, irrespective of the season. In most mammals however, there is parity between the sexes at birth (MITCHELL et al., 1977). A number of factors may be responsible for the difference in the adult sex-ratio in the wild pig. The sex-ratio of pigs at birth seems to be 49.54% males for a large series of records (ASDELL, 1964) which is almost 1:1. The disproportion of the adult sex-ratio could therefore be due to selective mortality in the early stages of their life. ASDELL (1964) reports that the stillborn pigs have a much higher ratio of males than females. EISENBERG and LOCKHART (1972) found mortality to be about 50% among the young ones, within their first month of life. Mortality differential of the sexes in the Park through predation could be an important factor for the sex-ratio difference. The wild pig, especially in its juvenile stage, is highly vulnerable to attacks by the leopard (*Panthera pardus*) and the marsh crocodile (*Crocodylus palustris*). Although a fully adult male wild pig is a formidable opponent to the leopard, the younger stages are preyed upon by the latter especially when either a young or a juvenile has strayed out of the sounder. Most often, it is the juvenile or sub-adult males that tend to wander away from such social units and are preyed upon by leopard and crocodile. Hence the males could be expected to suffer a higher predation rate than the females.

Studies on the black-tailed deer in California by TABER and DASMANN (1954) seem to suggest that a disproportionate mortality of the fawns, in favour of the males, was also brought about by starvation or other causes. FLOOK (1970) observed appreciable higher mortality in yearling males than in females, and also a lower maximum age in adult males than in adult females, in the case of wapiti.

In the wild pig, the discrepancy in the adult sex-ratio may also be related to the differences in behaviour patterns of adult males and females. As seen in Fig. 2, the adult males predominantly function as loners throughout most of their lives, while the females are associated with their young into "sounder" groups. Adult males enter such groups only during the breeding season. Hence, during the non-breeding season, when males are dispersed and are more difficult to see, the observed adult sex-ratio will always be greatly in favour of females. Besides, the wild pig being polygynous, in such cases, the "natural" adult sex-ratio is unlikely to be parity (MITCHELL et al., 1977).

Group size

From Table 1 it appears that group size varies in three ways. The largest groups are seen in the wet season months of May 1978 and 1980. This is due to the large numbers of young present at this time. The next highest group sizes are found in the dry season counts. The smallest group sizes are seen during the wet season months.

Group size could be influenced by a number of factors. In general, animals living on open plains are found to occur in larger groups than those living in forested areas (DAS-MANN and TABER, 1956; PEEK et al., 1974; FRANKLIN et al., 1975). But the wild pig is an omnivore, and it utilizes both the open grasslands and the forested areas. During the wet season, with the onset of the rains and lowering of the ambient temperature, the animal moves about in small groups and its range is fairly extensive, being found to be distributed throughout the Park in a variety of habitats such as grassland, scrub and forest. This is because of the ready availability of suitable forage. As such resources are available, and also as this availability is spread throughout the Park, the animal moves about in smaller groups, thereby reducing any intraspecific competition. A similar pattern was observed in the case of the European red deer (*Cervus elaphus*) on the Island of Rhum by LOWE (1969) where group size of the deer was found to be associated with a well-dispersed pattern of shelter and preferred vegetation.

In the Park, the wild pig was observed to feed heavily on the duckweed (*Monochorea vaginalis*) which is found well distributed throughout the Park near the water holes, in the wet season. But with the onset of the drought, a number of water-holes begin to dry up, and the vegetation around such places becomes heavily grazed. As the drought proceeds, the vegetation also become low in nutritive value. It is during such times, when the animals are forced to search for alternative food sources, that they are seen to move about in larger groups, over the much small remaining areas of suitable vegetation. Groups of pigs could be seen uprooting plants, and feeding on underground tubers which are rich sources of protein. The preferred food items during the drought seems to be underground rhizomes, such as *Cyperus rotundus*, which are a common component of the coastal grassland vegetation.

In addition to the mixed groups, those consisting entirely of adult females were observed on 14 occasions in a total of 117 observations. It is however not known what factors lead to the isolation of such single females. More than the boars, it is the sows that require a high plane of nutrition, especially in times of pregnancy, parturition and weaning. Hence, differences between boars and sows, in their pattern of habitat utilization, could reflect long-term evolutionary strategies.

Crude density and biomass

The basis of all wildlife management in a Park is an understanding of the population density and dynamics of the animals in the Park. Estimates of density for the contemporary population of wild pig are not available. Thus, an attempt was made to get an idea of the numerical abundance of the animal, from the visual counts made throughout the study period.

From Table 1, except for the low counts of February 1979 and November 1979, the total numbers of animals counted (without repetition) were as follows: - 89 (May 1978), 92 (July 1978), 99 (December 1978), 62 (April 1979), 102 (July 1979), and 126 (May 1980). This gives an average of 95 animals. Thus on the basis of this average value of 95 animals in Block I, whose area is 140 km², the minimum crude (overall) density of the wild pig in Ruhuna National Park is estimated to be 0.68 per km². This value of crude density is more than double that calculated by EISENBERG and LOCKHART (1972) for the wild pig population in Wilpattu National Park. The crude density of the wild pig in the Kanha National Park, India, was found to be 0.46 per km² (SCHALLER, 1967). During the drought concentration, in Wilpattu National Park, the crude density may reach values as high as 1.16 per km² (EISENBERG and LOCKHART, 1972). Thus it appears that the smaller Block I of the Ruhuna National Park, whose area is only 140 km², supports a more dense population of wild pig than the larger Wilpattu National Park, whose area is 580 km². The estimate of 0.68 wild pig per km² is likely to be an underestimate of the true density, as not all areas of Block I are visible from the roads. It is not possible yet to estimate by how much our value is too little.

According to SCHALLER (1967), the number of individuals of each ungulate species per unit area, multiplied by their weight, provides an estimate of the biomass supported by a certain habitat, which is a useful index for determining ultimately the optimum carrying capacity of the range. In the calculation of biomass, the wild pig poses a problem, as its groups reflect unequal sex ratios and size composition (Table. 2). Thus biomass calculation should be based strictly on the actual composition of the population. However, in the absence of data on the average weights of young and juveniles, it was decided to adopt the average weight that was employed by EISENBERG and LOCKHART (1972) in their calculation of biomass values. This would also enable a comparison to be made between the biomass of the wild pig in the two National Parks. The average weight of the wild pig, taken as 27 kg would yield a biomass of 18.4 kg per km², which is more than twice that (8.1 kg per km²) for Wilpattu population.

Seasonality of birth

Striped young were observed in the Park almost entirely during April and May only. But for the one striped young that was recorded in the dry season month of July 1979 the birth of the young therefore coincides with the short wet-season in Ruhuna. The wild pig is therefore a seasonal breeder. Peaks of juveniles were seen about two months after those of the young (Table 2).

The gestation period of the wild pig in Sri Lanka is given as four months (PHILLIPS, 1935, EISENBERG and LOCKHART, 1972) and as from 112 to 115 days by WALKER (1964). The sows are in heat about every 21 days, and this usually lasts about 2 or 3 days. Sows reach sexual maturity in about a year and a half (WALKER, 1964).

On the basis of the high percentage of striped young in the months of April and May, and the extent of the gestation period being four months, it would appear that breeding reaches a peak during the wet season months of November and December. Thus there seems to be a correlation between breeding in wild pig, and the onset of the rains. It is at this time of the year that the ratio of males to females reaches the highest (Table 2). This in turn indicates that the solitary males join the female/juvenile groups or sounders in November/December for breeding purposes. After breeding, they leave such groups and resume their solitary lives. Published work on breeding and recruitment in ungulates in temperate habitats almost invariably underlines the coincidence of parturition with availability of green forage (McCABE and LEOPOLD, 1951, TALBOT and TALBOT, 1963). Such a correlation between the birth peak and the duration of the rains, during which time there is an abundance of the preferred forage items, was also observed for spotted deer (*Axis axis*), water buffalo (*Bubalus bubalis*) and wild pig (*Sus scrofa*) in Wilpattu National Park (EISENBERG and LOCKHART, 1972) and for the water buffalo in the Ruhuna National Park (SANTIAPIILLAI and CHAMBERS, in preparation).

In Ruhuna National Park, the most favourable period of the year, as far as availability of highly nutritious forage is concerned, would be during the long rainy season from October to May. It is precisely then that both breeding and parturition in the wild pig takes place. The wild pig, unlike the spotted deer or water buffalo, is not a ruminant. Like the elephant, it relies on feeding on large amounts of low-quality forage rather than on small amounts of highly nutritious forage as do the ruminants in general (BELL, 1971). While the ruminants are very selective in their food preferences, the non-ruminants are less discriminating in this respect.

Being an omnivore helps the wild pig to adopt the strategy of utilizing large quantities of low quality food items. Thus, the period of drought which is critical to several other ungulates, especially the ruminants, seems to affect the wild pig least of all, so that it is able to incorporate even dead animal matter into its range of food items. But its predominant food still consists of plants. During the rainy season, the above-ground components of plants are abundant, and the animal feeds on leaves, fruits, and the succulent stems of water plants. It is during such a period that there is a peak of birth in the wild pig population. A number of females come into oestrus synchronously. The last three months in the development of the foetus in ungulates is critically associated with the amount of forage available to the females. According to WALLACE (1945), the foetus grows very rapidly during these months, and it is then that the pregnant females are in need of a high plane of nutrition. In the case of the wild pig, both forest scrub and grassland seem to provide the required forage to the sows.

The litter size is given as 4 (CLARK, 1901) or it varies between 4 and 6 (PHILLIPS, 1935). The seasonality of birth and breeding in the wild pig has evolved through responses to abiotic as well as biotic factors. The chief environmental factors that seem to trigger the onset of breeding are the drop in the ambient temperature, and the onset of the rains. The prolonged rainy season thus ensures the availability of an adequate supply of forage essential to the growth of the foetus via the mother, and the production of milk during the period of lactation and weaning.

Mortality in the wild pig

The birth of wild pig is strictly seasonal, with large peaks of striped young observed in either April or May in 1978, 1979 and 1980 (Table 1). After 6 to 8 weeks, the stripes are lost and the young pigs enter the juvenile phase, which lasts for about a year. During this time, from birth to about 12 months, there is a marked decrease in the numbers observed and this is probably due to mortality in these two age classes. Thus the 44 young seen in May 1978 declined to 13 juveniles in February 1979 – a decrease of about 70%. Similarly, the 19 young seen in April 1979 declined to 5 juveniles in November 1979 – nearly a 75% decrease. If there is an equal likelihood of observing young and juveniles at these times of the year, then the decrease will reflect the mortalities suffered by the immature wild pig. Thus it seems that in the years of study there was about a 70–75% mortality in the young and juvenile stages.

The numbers of observed wild pig of all classes are at their lowest in February and November 1979 (Table 1). These low numbers are probably due to a combination of three factors: -the mortality of young and juveniles referred to above, the dispersal of wild pig over Block I during the rainy season, and adult mortality. Further detailed studies are required to estimate the relative importance of each of these factors.

Zusammenfassung

Untersuchungen zur Populationsdynamik des Wildschweins
(*Sus scrofa* Linnaeus, 1758) im Ruhuna Nationalpark, Sri Lanka.

Das Wildschwein (*Sus scrofa* L.) tritt im Ruhuna Nationalpark, in der Trockenzone von Sri Lanka, verbreitet auf. Zwischen Mai 1978 und Mai 1980 zeigte die Gruppengröße, Gruppenzusammensetzung und das Absetzen der Jungen ausgesprochen jahreszeitliche Schwankungen. Die Gruppe ist am größten zur Wurfzeit (gegen Ende der Regenzeit im April/Mai), am kleinsten in der Regenzeit, wenn die Tiere über den Park zerstreut sind. Die Eber sind gewöhnlich Einzelgänger, außer während der Tragzeit im November/Dezember (Regenzeit). Gruppen von zwei oder mehr Tieren sind im allgemeinen Weibchen mit ihren jungen oder halbwüchsigen Nachkommen. Das Werfen ist streng an die Jahreszeit gebunden und junge Wildschweine wurden beinahe ausschließlich im April und Mai beobachtet. Die Mortalität im ersten Lebensjahr beträgt etwa 75%.

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