

A population study of the wild pig (*Sus scrofa*) in Ruhuna National Park, Sri Lanka

Padma K. de Silva¹, Charles Santiapillai¹ and Sarath Dissanayake²

Abstract

The wild pig population of the Ruhuna National Park-Block I (RNP), which has an extent of 140 km², was surveyed seasonally over two years. The study indicates that the minimum crude density of the wild pig (including juveniles and young) is 0.71 km⁻² and that the number of pigs is gradually increasing after the catastrophic mass mortality due to an outbreak of "swine flu" in 1989. The crude density of the wild pig population in RNP excluding juveniles and young is 0.40 km⁻². The observed crude density is much higher than that estimated for the Wilpattu National Park in 1968/69. More wild pigs were encountered near waterholes and grasslands than in the forest.

There is an apparent predominance of females over males by a factor of 1.4. This may be due to males, as they mature, leaving sounders and moving into other areas.

Diurnal activity is mainly concentrated over the early morning and early evening hours, although wild pigs may be encountered at any time of the day. During the day they mainly forage, digging for roots in the vicinity of water holes and also feeding on carcasses of herbivores such as buffalo, deer and sambar.

The breeding appears to take place throughout the year except during the drought period of June to August. Enhanced breeding was observed from September to March, during the major rainy period and subsequent months.

KEYWORDS: Wild pig, *Sus*, Artiodactyla, population dynamics, reproduction, Sri Lanka, tropical.

Introduction

The wild pig *Sus scrofa* Linnaeus, 1758 is widely distributed in NE Africa, Europe and most of Asia. Of the several subspecies, *S. scrofa cristatus* Wagner is found in Sri Lanka, India, Pakistan, Nepal and much of SE Asia. The subspecies is found throughout Sri Lanka (except the Jaffna peninsula) from sea level to the highest elevations (2,200 m). It is quite common and is found in any locality where there is a patch of forest or grassland of more than a few hectares. It often raids cultivations such as potatoes, manioc and sweet potatoes and is considered a pest by the farmers. In agricultural areas it is nocturnal and is therefore difficult to observe; but in protected areas it is frequently seen in daytime as well.

¹Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka.

²Department of Wildlife Conservation, Wildlife Training Centre, Giritale, Sri Lanka.

Being an omnivore readily turning into a scavenger, it finds sustenance easily throughout the year and plays an important role in the tropical forest and grassland ecosystems. Its prolific breeding habits help it to colonize new areas rapidly.

The wild pig of Sri Lanka has been studied in two areas (i) in the Wilpattu National Park during 1968/69 by Eisenberg & Lockhart (1972) and (ii) in Ruhuna National Park (RNP) during 1978/80 and 1980/82 by Santiapillai & Chambers (1980) and Ashby & Santiapillai (1991), respectively. Subsequent to these studies, the wild pig population in RNP was decimated in 1989 by an outbreak of "swine flu" (B.V.R. Jayaratne, Deputy Park Warden, RNP, pers. comm.). The present study was therefore carried out to reassess the status of the wild pig population in RNP.

Materials and methods

Study area. Ruhuna National Park (RNP) is one of a complex of adjacent reserves which is situated in the south-eastern lowland dry zone of the country. The entire complex, which covers an area of about 1,500 km², is the largest protected area of the country, which has an area of about 65,500 km². This contiguous protected area including RNP is divided into two national parks, three sanctuaries and one strict nature reserve, and the RNP itself is divided into several blocks. The present study was carried out in Block I of Ruhuna National Park which has an extent of 140 km².

The vegetation of the RNP is composed mainly of scrub forest and grasslands. A few natural waterholes and several small, man-made reservoirs are found scattered within the park. The two rivers, Menik and Kumbukkan, and a number of streams, which are mostly seasonal, drain the area.

The study area receives a highly seasonal rainfall of about 900 mm per annum, although this had varied from 536 mm to 1191 mm during the last twenty years. The major rainy period in RNP is from October to December followed by a major drought period from June to August. During this drought period most of the smaller waterholes dry up completely. The monthly mean temperature in the area varies between 26°C and 29°C (Müeller-Dombois, 1968).

Three physiognomic categories of vegetation, viz. the forest characterized by a crown biomass of at least 20% above 5 m height, the scrub with less than 20% of crown biomass above 5 m, and the grassland or plains could be recognized in the area (Müeller-Dombois, 1972). The major species of trees and other plants in RNP are given by Balasubramaniam et al., (1980). The coastal region in Block I (Fig. 1) is characterized by numerous waterholes (and a few reservoirs) surrounded by grassy plains, whereas the inner region consists mainly of scrub with scattered small patches of grassland; taller forest is found along the banks of the rivers.

Methods

The study was carried out in RNP-Block I (Fig. 1) from 1991 to 1993, during which period the wild pig population was studied on eight months in both the dry and the wet seasons. During each study month, the population was surveyed for at least one week by traversing various parts of Block I. Since much of

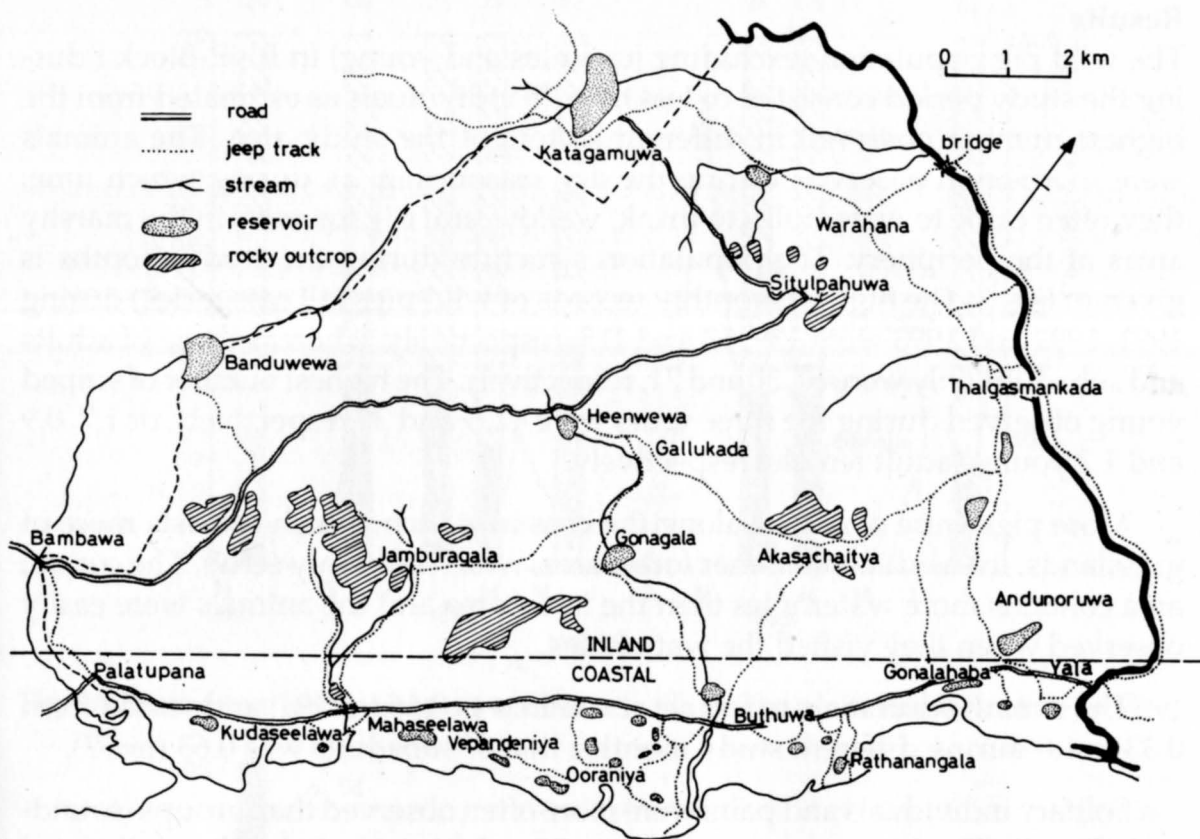


Fig. 1. Map of Ruhuna National Park - Block I, showing waterholes (stippled), rocky outcrops (hatched) and road network. Coastal and inner regions as distinguished in the present study are indicated.

Block I could be traversed using its extensive network of roads (Fig. 1), the survey covered a diversity of habitats such as forest, scrub, grassland and water holes.

At every sighting of the wild pig the number and, whenever possible, the composition of the groups and the behaviour of their members were noted. For the purpose of censusing four categories, namely, adult, subadult, juvenile and young were recognized following Eisenberg & Lockhart (1972). Only the very small animals in which the striped pattern could be discerned were categorised as young while those in which the stripes had disappeared were categorised as juveniles. Subadults were identified by their smaller size in comparison to that of the adults. Both subadult and adult male categories could be easily identified by their prominent scrotum. However, sex of the juveniles and young could not be ascertained with any certainty at all times. In the instances in which the sex of the subadults and adults was uncertain or the groups could not be properly classified, the individuals were taken as 'unsexed' or 'unclassified', respectively.

In estimating the crude density, care was taken to eliminate repeat observations in each monthly survey. However, all observations were taken into account in estimating the frequencies at different times of the day. In estimating the number of individuals observed at different hours, the numbers observed at these hours were converted to a unit time basis in order to eliminate the inaccuracies due to surveys covering different lengths of time at different hours of the day.

Results

The wild pig population (excluding juveniles and young) in RNP-Block I during the study period consisted of less than 75 individuals as estimated from the highest number observed in different sectors of the study area. The animals were more often observed during the dry season (Fig. 2), during which time, they often came to waterholes to drink, wallow, and dig for roots in the marshy areas at the periphery. The population structure during the study months is given in Fig. 2. The highest monthly records of wild pigs (all categories) during 1991, 1992 and 1993 were 139, 53 and 115, respectively, whereas those of adults and subadults only were 67, 30 and 71, respectively. The highest number of striped young observed during the three years were 42, 9 and 37 respectively, or 1.7, 0.9 and 1.2 young/adult female, respectively.

More pigs were observed along the coastal stretch, which consists more of grasslands, than within the inner forest area, which is mainly scrub. The coastal area contains more waterholes than the inner area and the animals were easily observed when they visited the waterholes.

The overall adult male to female sex ratio was 0.66 ($n=191$) and varied from 0.33 to 1.0 during different study months; that of subadults was 0.63 ($n=57$).

Solitary individuals and pairs were more often observed than groups (sounders) (Fig. 3). The largest group size was 26, which included 18 juveniles and young. Sounders with 7 to 17 individuals were more frequent. The highest number of adults and subadults observed in a sounder was 19, with 10 adults and 9 subadults but no juveniles or young. Solitary individuals were observed on 39 occasions and solitary males on 35 occasions. Of all the adult males and females observed, about 64% and 3% respectively were solitary individuals. The observed solitary females were old individuals. Sounders were more often observed in the vicinity of waterholes whereas single individuals were observed in similar frequencies in any part of the park. Pairs were observed 15 times; of these, 33% were of two adult males together; 13% were of two adult females together; and 13% were of adult male-adult female pairs.

The average size of a sounder was 12.1 and the average number of adult males and adult females per sounder were 1.3 and 3.7, respectively.

Because of the short duration and the high mortality of the young and juvenile stages (see Discussion), fluctuations in the population could be more reliably given with reference to the adults and subadults. In 1991, 1992 and 1993 the highest number of adults and subadults observed per month was 67, 30 and 71, respectively. Wild pigs are said to display periodic activity both during day and night, although the daytime activity predominates (Eisenberg & Lockhart, 1972), at least in protected areas. They could be observed during any hour of the day in RNP (Fig. 4). However, it appears that there are two activity peaks during daytime, one in the morning until about 0900 hours and one in the evening after 1500 hours. During the day their main activity (over 90% of the time as observed in the present study) was foraging, often digging in the muddy littoral of the waterholes and sometimes feeding on carcasses of dead animals such as buffalo and deer. Drinking and wallowing in the mud are the other major activities observed during the daytime. The activity peaks seen between 1000 and 1500

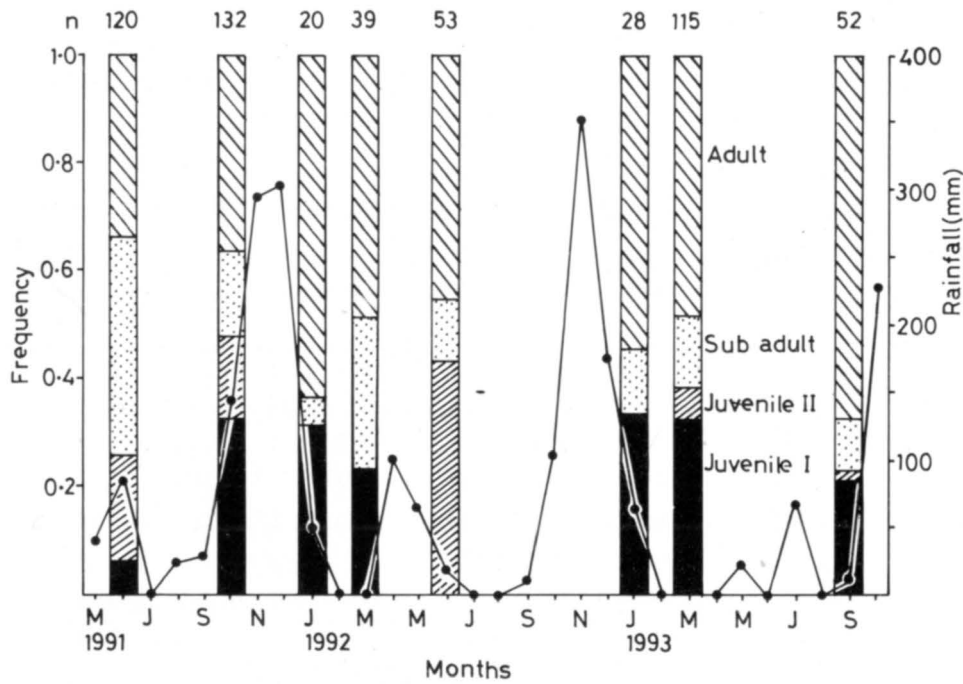


Fig. 2. The structure of the wild pig population in the study area during the survey months.

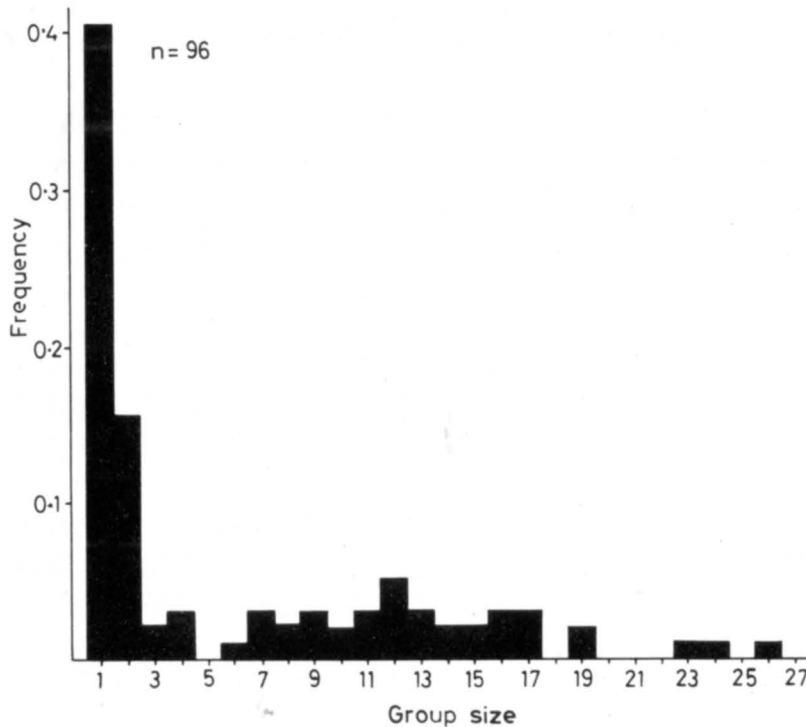


Fig. 3. Group structure of the wild pig in Ruhuna National Park.

hours are mainly due to animals visiting waterholes during the dry season. Table 1, which shows the number of individuals observed per hour during the study months between 1000 and 1500 hours, indicates that the numbers observed during these hours from the onset of rains until the scrub and grassland begin to dry up (usually October to March) were low compared to those during the drier months (usually April to August).

Young were observed in all months of the survey except in June 1992 (Fig. 2). High percentages of young were observed from September to March and a low percentage was observed in June. These observations indicate that breeding occurs during most months except probably during the drought period of June to August.

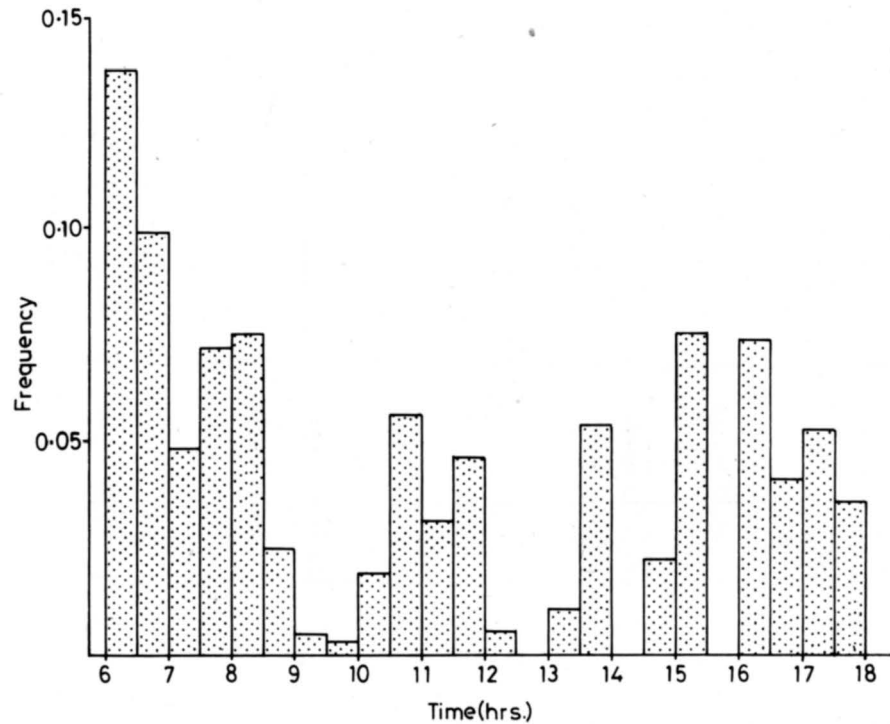


Fig. 4. Diurnal activity pattern of the wild pig in Ruhuna National Park.

The adults appear to be immune to predation because of their large size and aggressiveness. The major predator of the smaller pigs in RNP may be the leopard (*Panthera pardus*), but the swamp crocodile (*Crocodylus palustris*), and the python (*Python molurus*) may also prey on them.

Discussion

The observed average crude density of 0.71 km^{-2} of the wild pig (including young and juveniles) in RNP Block 1 for 1991-93 period was the minimum density since some individuals may not have been observed during the study. The highest numbers of adults observed during 1978-80 period (Data from Santiapillai & Chambers, 1980) and 1991 to 1993 (present work) (Table 2) indicate that the adult+subadult population was less during the latter period than during the former period. The average crude density of adults during the 1978-80 period was 0.40 km^{-2} and that during the 1991-93 period was 0.30 km^{-2} . Since the population was reduced drastically in 1989 by the outbreak of "swine flu", it may be that the population has not yet recovered fully. This view is strengthened by the absence of very large adults in the population.

The lower density observed in 1992 need not necessarily have been caused by population decline alone. 1992 was an exceptionally dry year. In comparison

Table 1. The frequencies of individuals observed per hour during the study months between 1000 and 1500 hours

Year	1991		1992		1993		
Month	Oct	Jan	Mar	Jun	Jan	Mar	Sep
Number hr^{-1}	0.12	0.05	0.15	0.32	0.08	0.18	0.15

to 399 mm of rain received between January and September in 1991 (drier period), only 240 mm of rain fell during the same period in 1992. Also, while there was only one month (July) in which there was no rain in 1991, there were four dry months (February, March, July and August) in 1992. Most of the smaller waterholes became dry very early in the drought in 1992, the days were very hot, and there was little water available in RNP. In fact, many buffaloes died during this drought. However, there was no evidence of mass dying of wild pigs. It may be that some wild pigs did not come out of the forest shade until late evening and night, and were thus missed during the surveys. As a result, the population may have been under-estimated.

The average crude density of all categories of wild pig in RNP (taking the highest number observed during a study season as the minimum density) was 0.78 km⁻² during the period 1978 to 1980 (Santiapillai & Chambers, 1980) and 0.71 km⁻² during the period 1991 to 1993. In comparison to this, the crude density of all categories of wild pig in Wilpattu National Park (WNP) during 1968/69 was 0.30 km⁻² (Eisenberg & Lockhart, 1972). The vegetation of the two national parks is somewhat different (Eisenberg & Lockhart, 1972; Müller-Dombois, 1972; Balasubramaniam, et al., 1980) and, more importantly, the crude densities of other herbivores and carnivores are also much lower in the WNP in comparison to those in the RNP (Eisenberg & Lockhart, 1972; Santiapillai, et al., 1982; Ashby & Santiapillai, 1983, 1986; de Silva, 1992), which indicates that the habitat in the latter is much more diverse. Although WNP contains a few large permanent waterholes, RNP contains many small, shallow, temporary waterholes in addition to a few large permanent waterholes. These small waterholes are the preferred habitat of the wild pigs for digging up roots in the littoral and for wallowing. Also, the higher densities of other herbivores provide relatively higher amounts of carrion for feeding. Thus, RNP-Block I, especially the coastal zone which contains many waterholes and grasslands scrub, offers a very suitable habitat for the wild pig.

Eisenberg & Lockhart (1972) also point out that wild pigs tend to collect and concentrate their activity in the vicinity of waterholes, especially during the dry season, as the pigs are definitely dependent on water for drinking and wallowing. They also observed a great deal of activity of wild pigs in the vicinity of waterholes and in open scrub country but vastly reduced activity in forested areas.

As they mature the males leave their original sounders and tend to remain solitary except for mating. The maturing males leaving the original sounders

Table 2. Number and crude density of adults+subadults during the years indicated. (Data for 1978-80 from Santiapillai & Chambers, 1980).

Year	1978	1979	1980	1991	1992	1993
No. of adults + subadults	67	37	64	47	21	56
Crude density (km ⁻²) (adults+subadults)	0.48	0.26	0.48	0.34	0.15	0.40

and later rejoining other sounders for mating purposes reduce the chances of inbreeding and also allow a single male to mate with several females. It may also be that the new adult males, although sexually mature, have to wait for several years before they could successfully compete with the older males for mating with the females. The average number of adult males per sounder was 1.3, which indicates that there is usually not more than one or two adult males per sounder at a time. The presence of a few old solitary females probably indicate that the old females either leave the sounders on their own or that they are rejected by the sounders. Eisenberg & Lockhart (1972) found that females become solitary when they give birth. Such solitary females are said to build "nests" with a diameter of about 1 m and a height of about 25 cm with twigs and leaves for settling down (B.V.R. Jayaratne, pers. comm.). However, such solitary females or "nests" were not observed during the present study.

Although the male to female sex ratio of adults is biased in favour of the females, the mortality rates of both adult males and adult females of RNP appear to be similar as indicated by the life expectancy studies by Ashby & Santiapillai (1986). There is also no reason to assume differential growth rates at least up to the adult stage. The probable explanation for the adult females substantially outnumbering adult males is that the males, as they mature, leave the sounders and move into other areas, especially the forest areas, in which observations are more difficult. They may also come under greater poaching pressure as they move towards the periphery of the reserve.

Eisenberg & Lockhart (1972) were of the opinion that the young stage lasts for about 3 months and that the adults are more than 2 years old. During the present study, the subadults appeared to be more than 6 months old which suggests that the juvenile stage lasts from 3 to 6 months. Mortality of young could be over 50% within the first month of birth and remains relatively high up to about the subadult stage (Eisenberg & Lockhart, 1972). In RNP, Ashby & Santiapillai (1991) concluded that only about 12% of the young born at any time survive to one year of age.

The diurnal activity rhythm of the wild pig in RNP is similar to that observed in WNP by Eisenberg & Lockhart (1972). These authors found that the activity concentrates in the early morning and early evening hours with pigs resting in the shade in the forest during the hot mid-day and afternoon hours. However, the pigs become active in the mid-day and afternoon hours if sufficient cloud cover is present, especially during the dry season. Observations made during the present study agree with this.

Breeding of the wild pig in RNP probably takes place during most months, if not all. However, there appears to be an enhancement of breeding from about September to March, from the onset to a few months following the major rainy period. This is advantageous since, during this period, the waterholes are full, the scrub and grasslands sprout new growth, and the earth is easy to dig. There seems to be less breeding during the drought months of June, July and August. In WNP too, breeding was observed in the rainy season of October to December and again from February to April (Eisenberg & Lockhart, 1972). However, in RNP, there was high rate of breeding, as indicated by the presence of striped young in January as well. The gestation period of wild pigs is about 4 months

(Walker, 1964; Eisenberg & Lockhart, 1972). The sows come into heat every 21 days and remain in heat for 2 to 3 days. Synchronization of the oestrous cycle in the adult females of the same sounder has been reported (Eisenberg & Lockhart, 1972). The sows probably breed two to three times per year (Phillips, 1984).

In Sri Lanka, the litter size of wild pigs ranges from 4 to 6 (Phillips, 1984), and this is apparently true for the WNP population as well (Eisenberg & Lockhart, 1972). Table 3 gives the frequency of the number of young in the sounders. The most frequent numbers were 7 and 8 young per sounder while 11 and 13 young per sounder were next most common. Considering the high mortalities at this stage, it appears that in a sounder, 1 to 3 sows have litters simultaneously and that each litter consists of 4 to 6 young. It was also observed that the average number of adult females per sounder is 3.7.

The predators of the wild pig are usually effective only on the young and juveniles. Even during these vulnerable stages, the adults in the sounder protect the young from predators. Santiapillai et al. (1982) estimated that there are about 25 leopards (*Panthera pardus*) in RNP-Block I (a density of 0.18 km⁻²), although de Silva & Jayaratne (1994) estimated that there are only about 16 adult leopards in Block I (a density of 0.11 km⁻²). In any event, the major prey species of the leopard appear to be the spotted deer (*Axis axis*), sambar (*Cervus unicolor*) and grey langur (*Semnopithecus priam* = *Presbytis entellus*). The crocodiles may be important predators of the young and juveniles when they visit waterholes.

The wild pig population in RNP appears to be vulnerable to disease carried by domestic pigs. In January 1993, two adult female domestic pigs were seen with a wild pig sounder. These pigs had escaped from a nearby village into the reserve. Such pigs could carry dangerous parasites and diseases to which the previously unexposed wild pigs are susceptible. Hence, it is important to protect the wild pig population of the park from such intrusions from the outside. The 1989 "swine flu" epidemic was said to have been caused by pigs eating contaminated refuse.

Wild pigs, despite their prolific breeding potential can be extirpated from areas rapidly by increased poaching pressure. Wild pigs disappeared from many regions in Bulgaria during the World War I (1912-1918) due to increased hunting pressure (Randi et al., 1992).

Habitat fragmentation is another threat to the wild pigs in Sri Lanka. Human inhabited areas can constitute effective barrier to wild pig dispersal and colonization of new habitats.

Wild pig however can respond to better management practices that involve a limitation of hunting, restocking of wild pig into depleted areas, and improvement of habitat conditions following farmers' abandonment of their rural areas.

Table 3. The frequency of different numbers of striped young in sounders.

No. of Young	3	4	5	6	7	8	9	10	11	12	13
No. of Sounders	1	1	0	1	3	4	1	1	2	0	2

Acknowledgements

We wish to thank the Director and other officials of the Department of Wildlife Conservation, especially B.A. Muthubanda (Park Warden, RNP), for their valuable help during the course of this work. We are very grateful to John F. Eisenberg of the Florida Museum of Natural History, for suggesting valuable improvements. Thanks are also due to T.S.B. Alagoda of Department of Zoology, University of Peradeniya, for drawing the figures. This work was made possible by the Research Grant No. 4102.19/Sri Lanka of the WWF International, Switzerland.

References

- Ashby, K.R. & C. Santiapillai. 1983. The ecology of free-living water buffalo (*Bubalus bubalis* L.) in Sri Lanka with particular reference of Ruhuna National Park. *Tigerpaper*, 10: 20-26.
- Ashby, K.R. & C. Santiapillai. 1986. The life expectancy of wild artiodactyl herbivores, water buffalo (*Bubalus bubalis*), sambar (*Cervus unicolor*), spotted deer (*Axis axis*) and wild pig (*Sus scrofa*), in Ruhuna National Park, Sri Lanka, and the consequences for management. *Tigerpaper*, 13: 1-7.
- Ashby, K.R. & C. Santiapillai. 1991. Population age structure of the wild pig *Sus scrofa* in Ruhuna National Park, Sri Lanka, in Bobek, B., Perzanowski, K. & W. Regelin (eds.), *Global trends in wildlife management*. Trans. 18th IUGB Congress, Krakow, 1987. Swiat Press, Krakow-Warszawa.
- Balasubramaniam, S., Santiapillai, C. & M.R. Chambers. 1980. Seasonal shifts in the pattern of habitat utilization by the spotted deer (*Axis axis* Erxleben, 1777) in the Ruhuna National Park, Sri Lanka. *Spixiana*, 3: 157-166.
- de Silva, M. & B.V.R. Jayaratne. 1994. Aspects of the population ecology of the leopard, *Panthera pardus*, in Ruhuna National Park, Sri Lanka. *J. S. Asian nat. Hist.*, 1: 3-13.
- de Silva, P.K. 1992. Status of large mammals of Ruhuna National Park (Block I) of Sri Lanka, with special reference to elephant, water buffalo, spotted deer and wild pig. Interim Report of Project No. 4102.19/Sri Lanka, WWF International, Gland, Switzerland. 30 pp (mimeo).
- Eisenberg, J.F. & M. Lockhart. 1972. An ecological reconnaissance of Wilpattu National Park, Ceylon. *Smithsonian Contr. Zool.*, 101: 1-118.
- Müeller-Dombois, D. 1968. Ecogeographic analysis of a climate map of Ceylon with particular reference to vegetation. *Ceylon Forester*, 8: 39-58.
- Müeller-Dombois, D. 1972. Crown distortion and elephant distribution in the woody vegetation of Ruhuna National Park, Ceylon. *Ecology*, 53: 208-226.
- Phillips, W.W.A. 1984. *Manual of the mammals of Sri Lanka*. 2nd (rev.) ed., Wildlife & Nature Protection Society of Sri Lanka, Colombo. 389+xxxv pp.
- Randi, E., Massei, G. & P. Grnov. 1992. Allozyme variability in Bulgarian wild boar populations. *Acta Theriologica*, 37: 271-278.
- Santiapillai, C. & M.R. Chambers. 1980. Aspects of the population dynamics of the wild pig (*Sus scrofa* L., 1758) in the Ruhuna National Park, Sri Lanka. *Spixiana*, 3: 239-250.
- Santiapillai, C., Chambers, M.R. & N. Ishwaran. 1982. The leopard *Panthera pardus fusca* (Meyer 1794) in the Ruhuna National Park, Sri Lanka, and observations relevant to its conservation. *Biol. Conserv.*, 21: 5-14.
- Walker, E.P. 1991. *Mammals of the World*. Johns Hopkins Press, Baltimore. 1629 pp.