



Gazelle Research



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Research on Gazelle Ecology in Masua Park

One of the most effective ways to conduct environmental education focusing on the importance of natural resources is to bring people directly into the field on frequent visits. In fact, this is a necessity for raising environmental awareness. In order to make such visits effective, a specific attraction in the area in question can be very helpful. The observation of gazelles in their natural habitats constitutes such an attraction. Gazelles are a wild but familiar species, whose large size makes them relatively easy to spot and observe. However, to make observations by visitors successful, not only must gazelle density be high, their ecology must also be studied in order to ascertain when and where to show them to visitors. Masua Park, with its location in a non-urban area and its mosaic of varied habitats, is a perfect place to fulfill environmental educational goals, although present gazelle density in the park is far too low for this purpose.

It has been assumed that a high number of jackals in the park and its surroundings is the main factor limiting gazelle density in the area. Predators of similar size to jackals are known to contribute significantly to the mortality of ungulates, both of neonates (fox preying on roe deer) as well as adults (coyotes preying on black-tailed/mule deer). However, predation by jackals on gazelles has so far not been studied. The potential influence of jackals on gazelle population dynamics is one of the main aims of this study. The other aim is the influence of various factors on numbers of gazelle seen and the duration of observations as a basis for future educational activities in the park. Finally, the study is expected to provide general information on gazelle ecology and thus contribute to sustainable management of the area.

Intensive gazelle observations began in June 2002. They were conducted from 10-14 permanent observation sites located in the park, soon after sunrise and just before sunset, for 60-90 minutes each time. Group size and structure, activity, observation duration, and habitat type were noted. Solitary individuals

were considered groups of n=1. The same data were recorded when jackals were observed (although this happened much less frequently). By the end of November 2002, 1088 gazelles in 564 groups were recorded. Average group size was relatively small (1.9 individuals), while average duration of observation was 8.9 min. During this period only 84 jackals were seen. Their mean group size was 1.4 individuals, observed on the average for 3 minutes. Total time spent on observations was 900 hours.

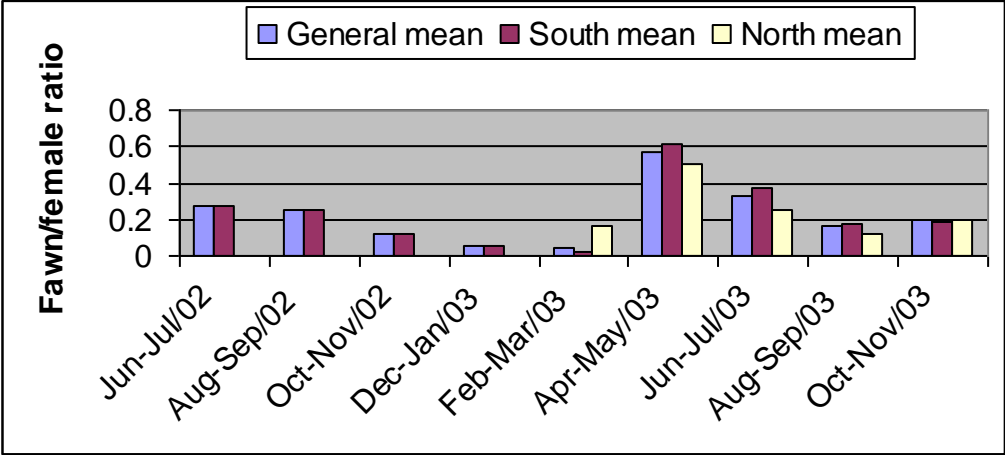


Fig. 1. Fawn/female ratio (number of fawns/100 females) in bimonthly periods.

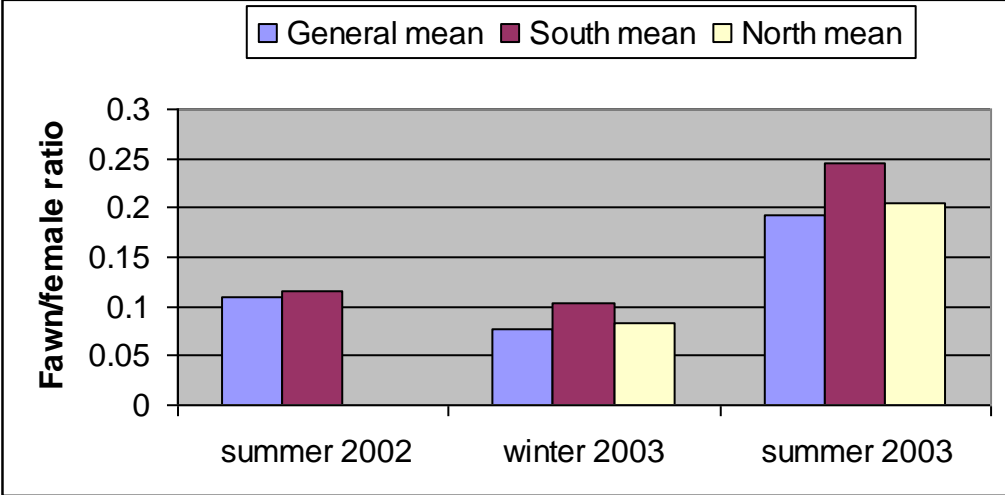


Fig. 2. Female/fawn ratio of gazelles in different seasons

Fawn/female ratio depended very much on the season (Fig. 1) and although the data are still preliminary, the maximum value was recorded in April-May 2003, when it reached nearly 60%. By the next bimonthly period it had dropped by about 25%. Subsequently, the decrease was much slower; the minimum ratio was recorded in the period December-March. Noteworthy was the fact that in summer 2003 the ratios tended to be, in general, twice as high as in the same season of 2002 (Fig. 2). The increase in the summer of 2003 may be related to the very wet winter 2002/2003. Due to high precipitation, vegetation in the park grew vigorously and provided the newborn gazelles with favorable shelter, in which it was relatively more difficult for jackals to find young gazelles. (The literature reports that shelter is an important factor affecting predation efficiency on ungulate neonates.) Another important result was the increase in the fawn/female ratio recorded in the northern part of the park in 2003 compared to the previous year, when fawns were not observed at all.

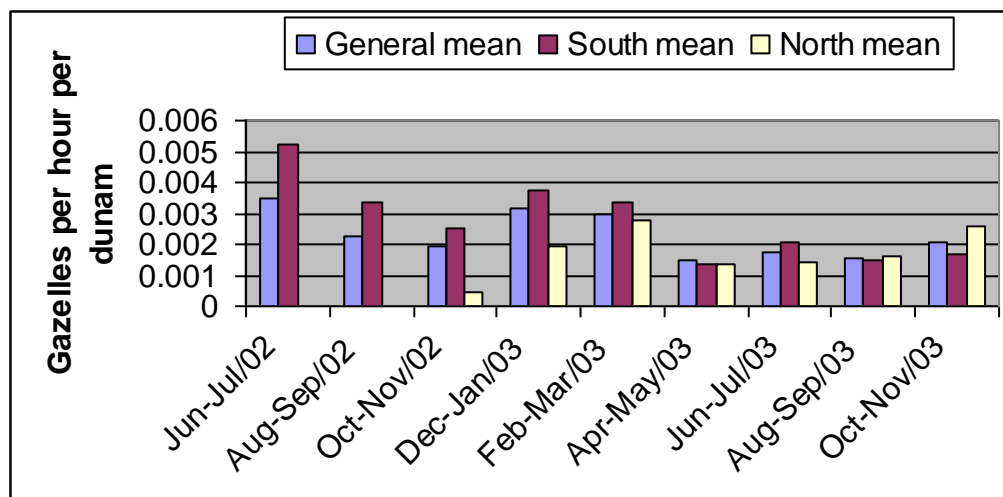


Fig. 3. Mean numbers of gazelles seen in different bimonthly periods of the study.

On the average, the highest number of gazelles was observed between June and July 2002 (Fig. 3). However, this was the initial period of the study, when data was collected in relatively few sites and therefore the results from this

period are not representative. The data from the other periods indicates that the gazelle observability was higher between December and March than in the other months. Gazelle observability in 2002 in the northern part of the park was lower than during the subsequent year.

Average number of gazelles observed in the morning seemed to be higher than that seen in the afternoon. This was especially clear in the southern part of the park (Fig. 4). However such an approach (when all observation points were considered) might be too general, since in most cases the observation sites were used either in morning or in afternoon due to sunlight direction and slope aspect. When the analysis was done using data from only two points, where both morning and evening observations were possible, the difference was confirmed and became even clearer (Fig. 5).

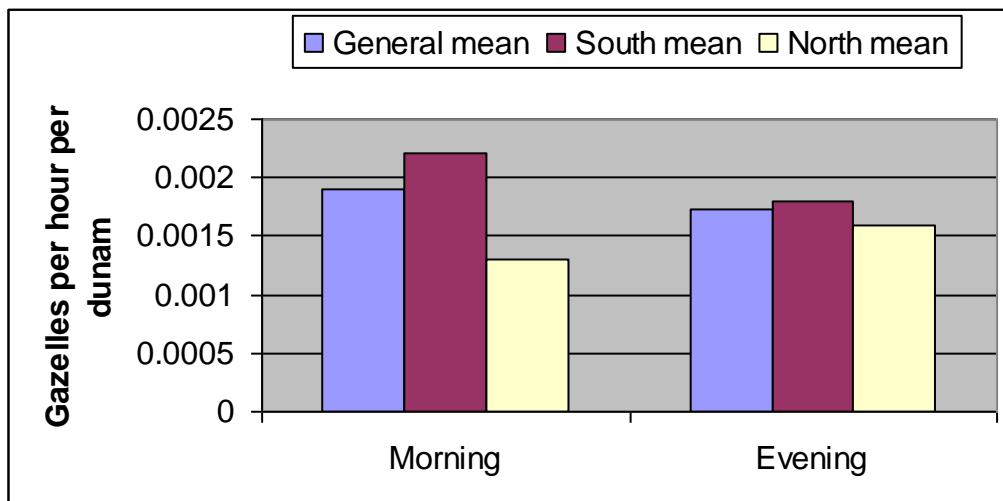


Fig. 4. Gazelle observability in morning and in evening

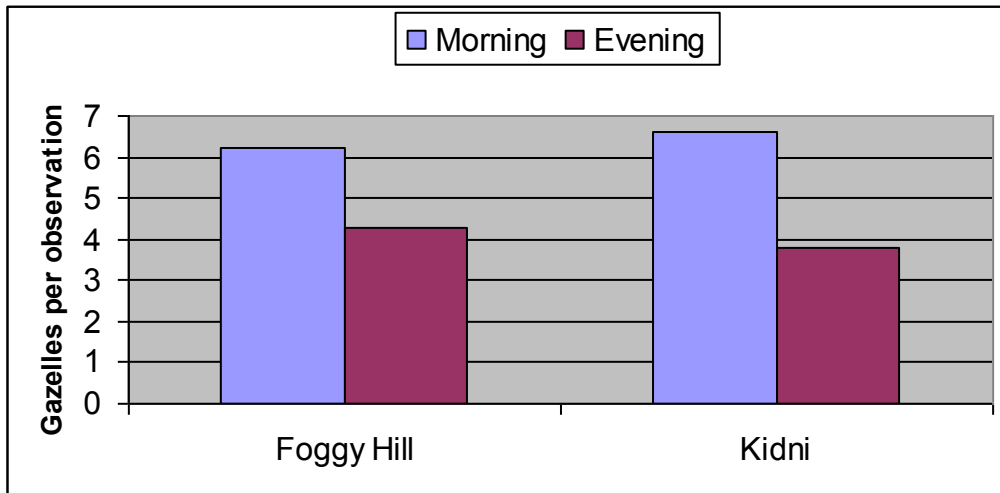


Fig. 5. Morning and evening gazelle observability in the two sites where gazelles were observed in both periods of day

Number of gazelles seen from a given observation point was positively correlated with the total area, which could be covered by observation (Fig. 6). Differences in size among the areas was due mainly to topographical characteristics. It can also be seen (for the 2003 data) that the number of gazelles observed in winter was higher than that seen in summer (Fig. 6).

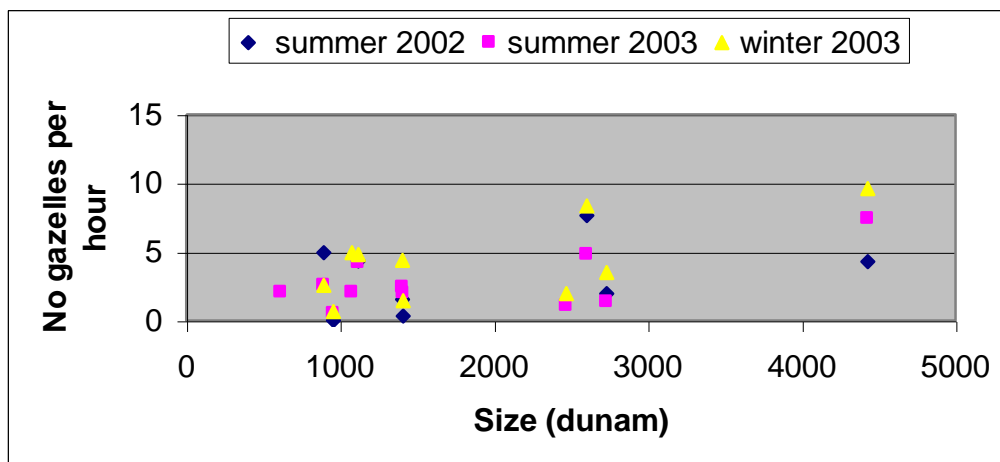


Fig. 6. Relation between the size of area covered by observation from the observation points and the number of gazelles seen

Mean duration of gazelle observation, i.e. the time between which a given group was noticed until it disappeared, primarily depended on the season. Maximum duration of observation was recorded in February, while that between September and December tended to be the shortest. In most months, males were seen on the average for shorter periods of time than females (Fig. 7). Observation duration depended on habitat type; in general it was higher in agricultural fields and open grassy areas than in the closed habitats (Fig. 8). During almost every month, bush (maquis) was the habitat of lowest duration of gazelle observation.

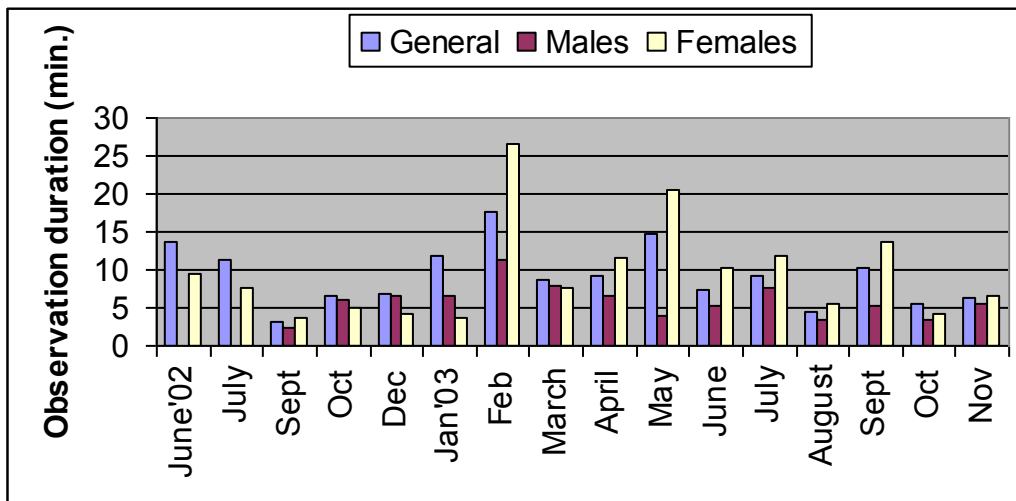


Fig. 7. Monthly changes in average duration of gazelle observation

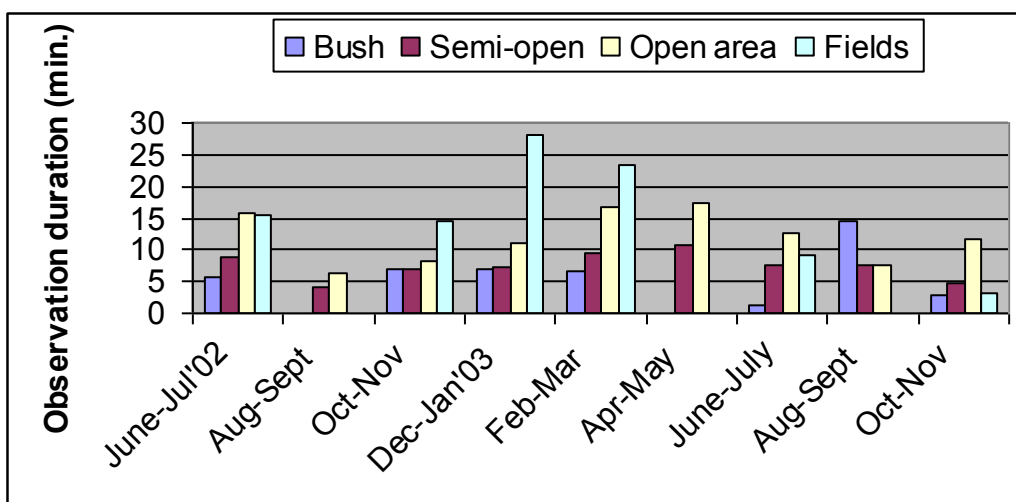


Fig. 8. Average duration of gazelle observation in bimonthly periods depending on habitat type

Observation duration was higher in winter than in both summers (Fig. 9). This was the case mostly for female observation duration; male observation duration varied very little between the seasons. Although average time of female observation in the summer of 2002 was similar to that of males, both in winter and in summer of 2003, on the average females were observed for longer periods of time than were males (Fig. 9). In all the three seasons, duration of gazelle observations was longer in open grassy habitats than were durations in either maquis or open maquis (Fig. 10). In the case of cultivated fields the situation was more complex. In the summer 2002 and the winter of 2002/2003, fields were the habitat of longest observation duration, but in summer 2003, gazelles were seen for shorter time periods in the fields than in open areas. Although this aspect was not studied, seasonal differences in observation time of gazelles may have depended on the crops cultivated in the fields.

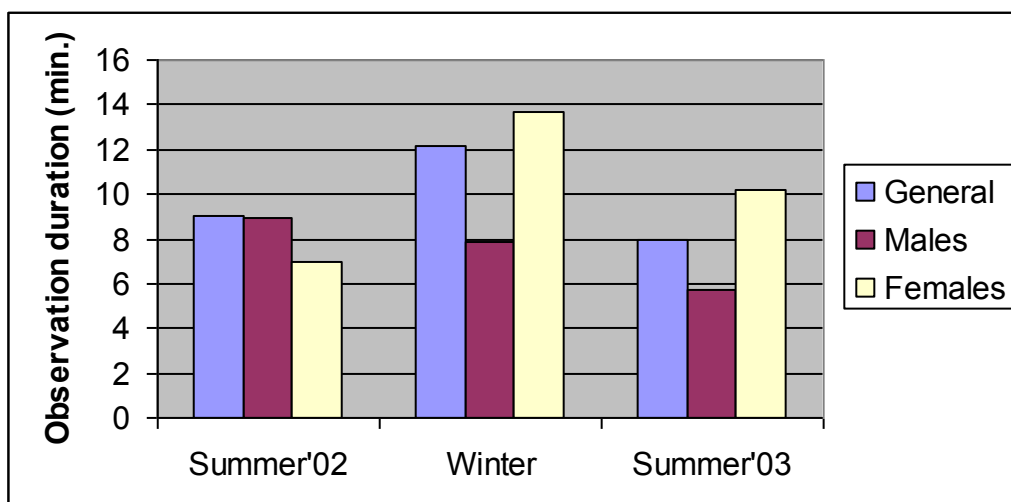


Fig. 9. Influence of the season on gazelle observation duration

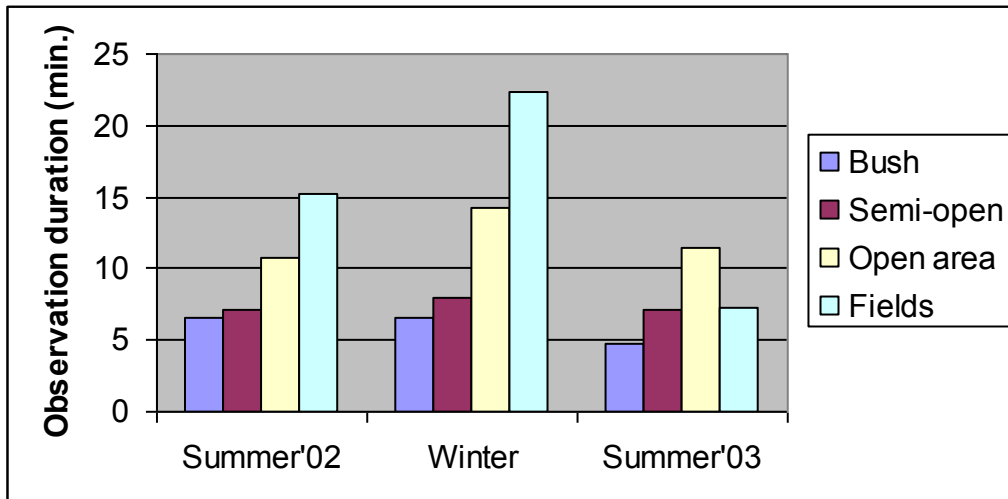


Fig. 10. Observation duration of gazelles in different habitats

Observation duration was also influenced by time of day, although the relation depended on the season. In winter, observation duration was similar in mornings and evenings, while in both summers the average duration of morning observation tended to be longer than that in the afternoon (Fig. 11).

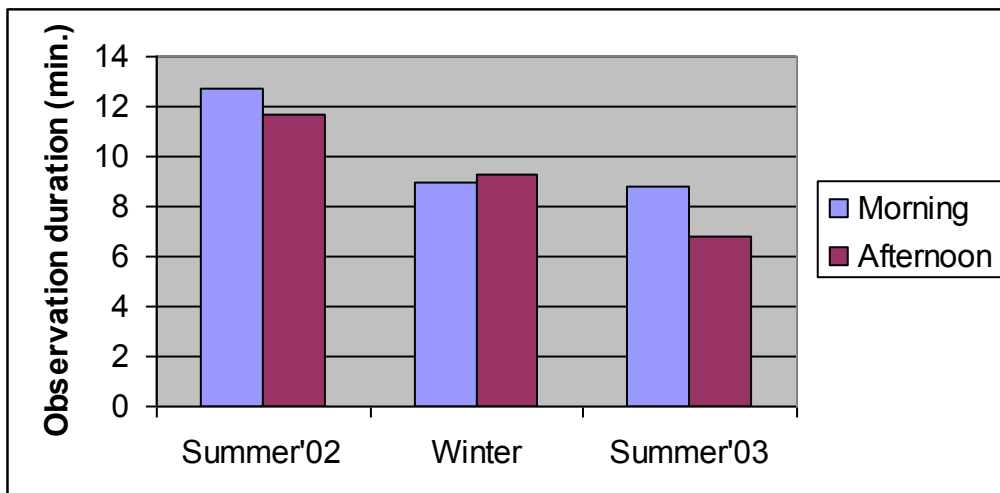


Fig. 11. Observation duration of gazelles in different periods of day

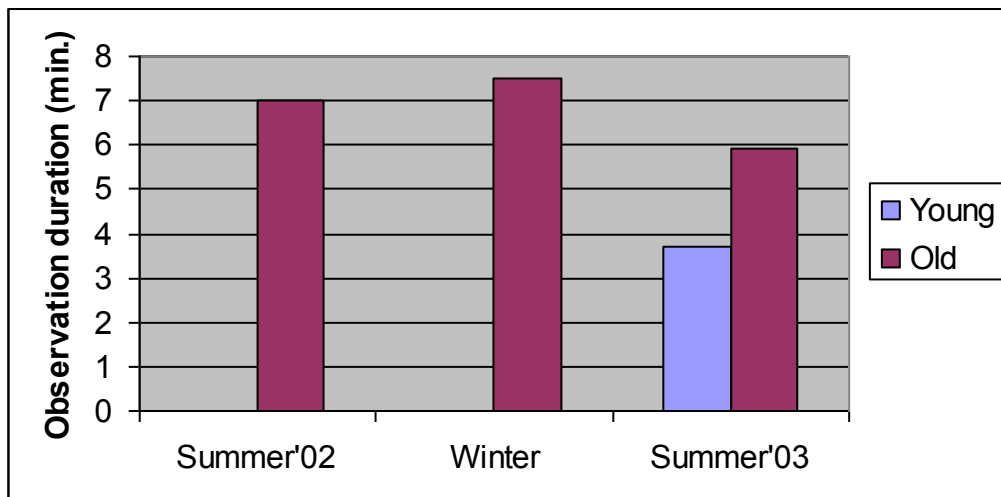


Fig. 12. Observation duration of male gazelles depending on their age

Although sample size precluded comparisons for summer 2002 and winter 2002/2003, in the summer of 2003, older males were observed on the average for longer time periods than younger males. (Fig. 12). The difference in observation time between females with and without fawns, and the groups with fawns, was also interesting. Females with fawns were seen on the average for longer times than those without fawns (Fig. 13). This happened in all the seasons, but was especially apparent in the summer of 2003. This may have important practical significance related to jackal population management: if jackal population management in the future leads to higher fawn/female ratio, gazelles will be not only more likely to be seen, but also the average time of their observation will increase.

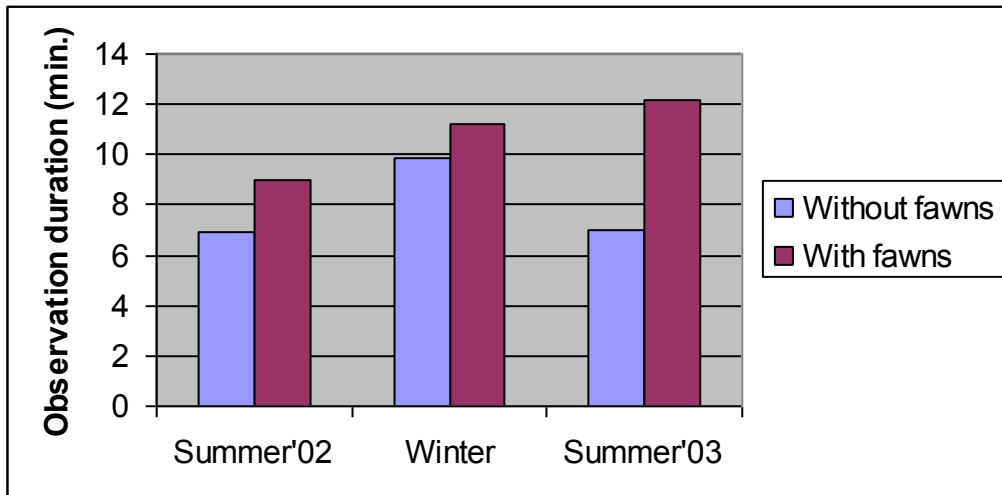


Fig. 13. Observation duration of female gazelles with and without fawns.

Gazelle activity was another factor affecting observation duration. The longest time of observation was recorded in grazing individuals (Fig. 14). All the other activity types were associated with at least half the observation duration. It is quite logical that walking and especially running gazelles had the shortest average time of observation.

Among the observed gazelles, in general, grazing and walking behavior dominated. (In sum, both activity types were exhibited in about 50% of the gazelles seen.) (Fig.15). Another notable portion (17.5%) of the gazelles were seen when grazing and walking at the same time. The activity pattern showed some changes between the seasons, with the most important

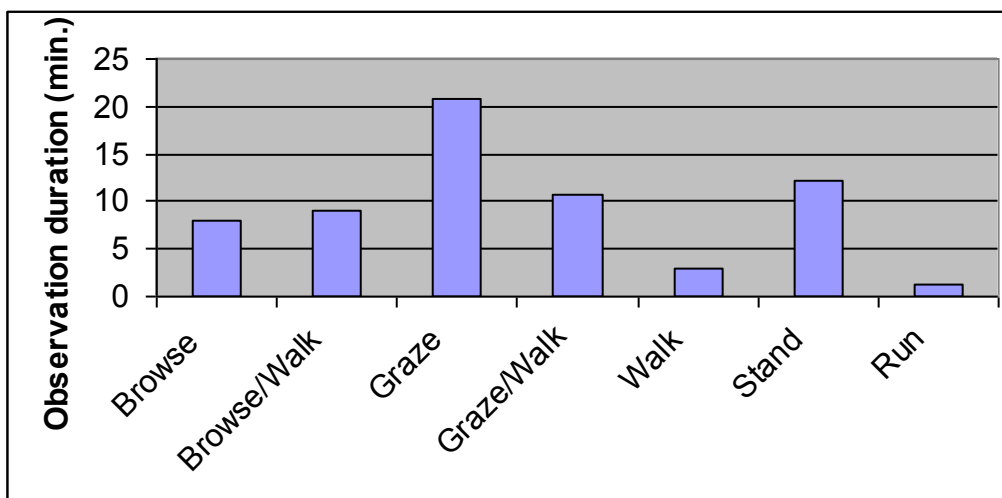


Fig. 14. Observation duration of gazelles depending on the kind of activity

change regarding feeding behavior. In winter, no gazelles were observed browsing, while grazing, and grazing and walking, were exhibited in nearly 60% of the gazelles. In summer, 13% of the gazelles were seen browsing and browsing/walking, while fewer fed on grasses. This is in accordance with what is known about gazelle ecology: in winter grasses constitute a major component of gazelle diet while in summer a large part of their food requirements are met by browsing.

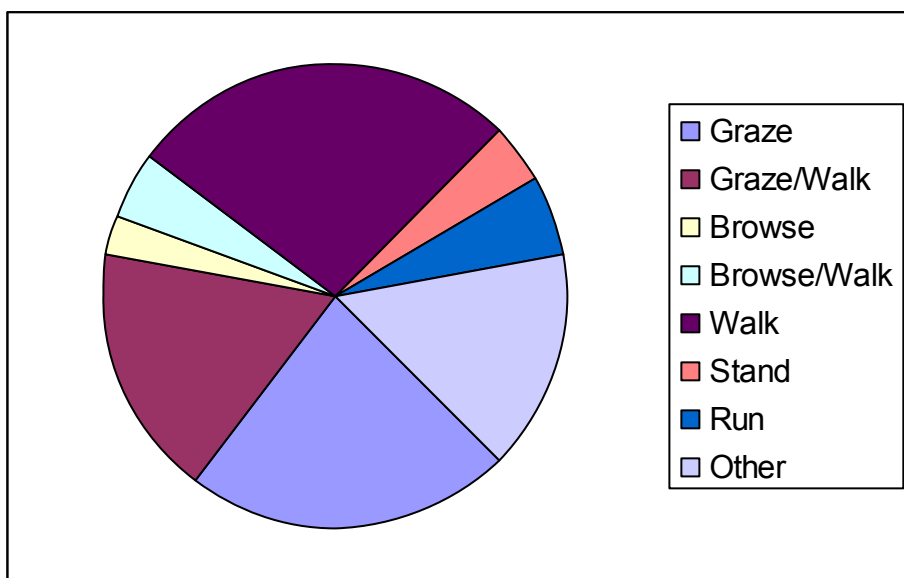


Fig. 15. General activity pattern of gazelles in Masua Park

In general, all-female groups of gazelles were most numerous (Fig. 17). Least numerous were groups containing both sexes. The percentage of male gazelle groups changed little throughout the year.

When the percentage of individuals in different kinds of groups was considered, the picture was a bit different (Fig. 18). Generally, the percentage of individuals in mixed groups was much higher than the percentage of the individuals in their own sex group, which suggests that the size of mixed groups was rather large. The percentage of individuals in mixed groups reached its peak in December-January, during the rutting season and decreased soon after.

A decreasing percentage of individuals in mixed groups was accompanied by an increasing percentage of individuals in female groups, with its peak between April and July. This is the period when females separate from the groups to give birth and then remain single around the area where their fawns are hidden.

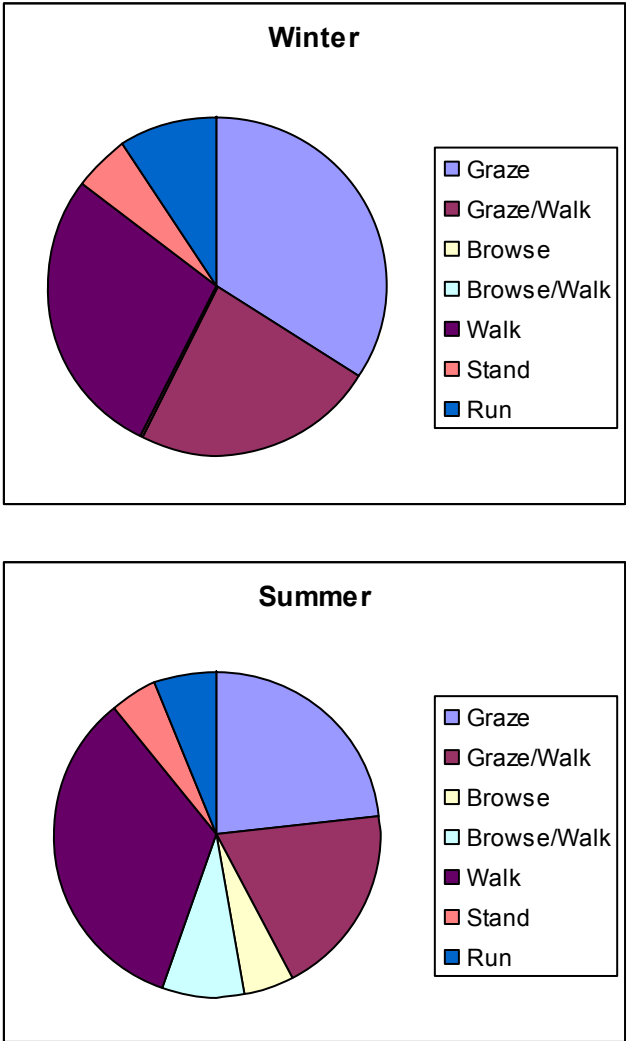


Fig. 16. Comparison of gazelle activity in winter and summer

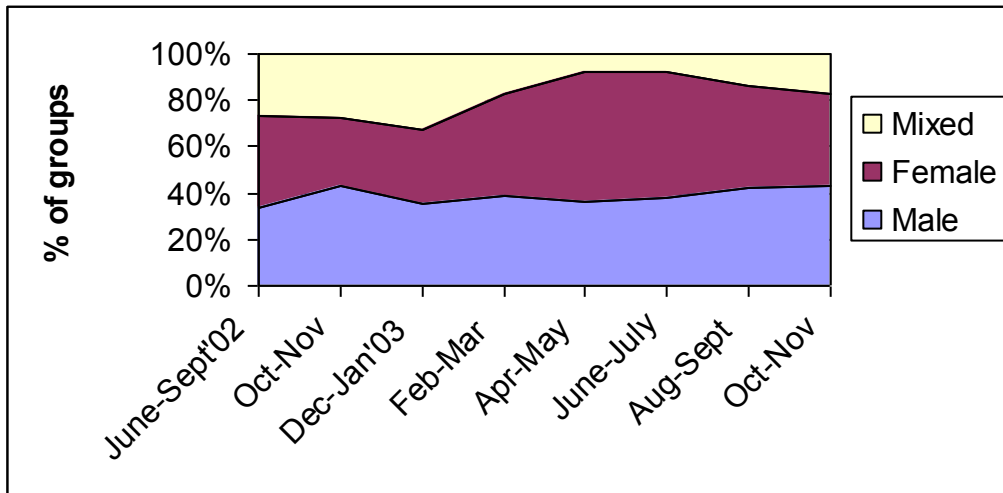


Fig. 17. Changes in proportion of gazelle groups of various kinds

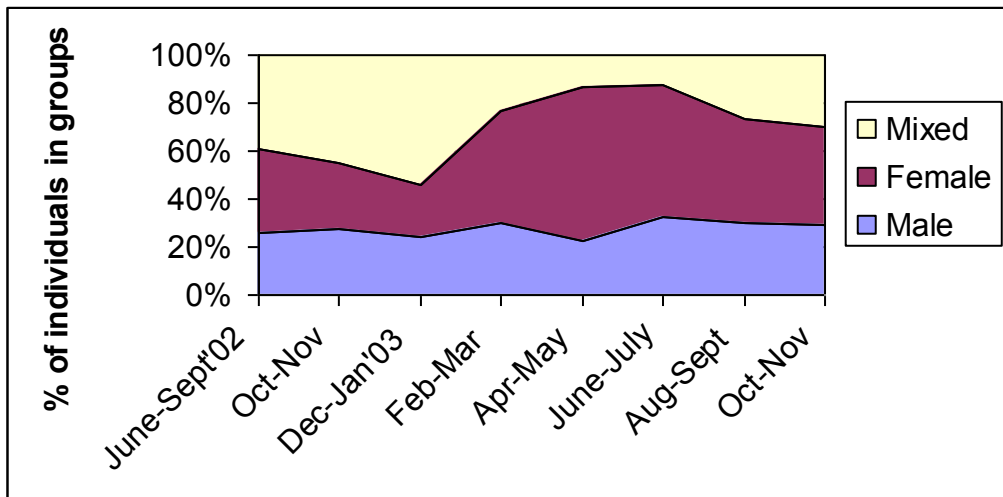


Fig. 18. Changes in proportion of individuals in various kinds of gazelle groups

Conclusions

Although in general, gazelle fawn/female ratio is low in the park, the value seems to vary remarkably between years. Among other influences weather probably affects the fluctuations. The influence of weather is rather indirect, i.e. it modifies jackal predation on neonates through, for instance, changes in cover conditions. If weather can modify vegetation density and, in consequence,

young gazelle can avoid jackal predation, it is very possible that grazing by domestic animals (cattle, sheep, goats) can have very the same effect. Intensive winter grazing might be most influential here because it acts to reduce the security provided by ground cover for gazelles during calving season. Evidence of this can be seen in the present study. During the winter 2002/03 no cattle grazed on the Noam Ohana range in the northern part of the park, where in recent previous years, grazing had been intense, and only in 2003 were gazelle fawns seen there. Similarly, gazelle observability in the north of the park was higher in 2003 than in the previous year. These findings suggest that intensive grazing may negatively affect also the number of gazelles observed. However, this issue must be studied more for full confirmation. Low mean jackal group size suggests that predation of jackals on adult gazelles does not significantly limit the gazelle population.

Winter is a better period in which to observe gazelles than summer. This is true not only in terms of the number of gazelles seen, but also in terms of duration of observations, which is higher in winter than in summer. In general, the number of gazelles observed in the morning was higher, making morning the best time of day to see gazelles. However, especially in winter, observation duration did not significantly depend on time of day. In terms of season of the year, the best months to see them are April and especially May. Males are observed with similar probability throughout the year and the duration of their observation depends less on the season than is the case for females.

Observation sites should have long-range visibility and consist mainly of open grassy areas. It is recommended that these be areas where scarce shrubs abound, so that gazelles will visit them in summer, when many still graze, but browsing constitutes a large part of their activity. Open maquis is also a good habitat for summer observations. Cultivated fields, if rather small, are also conducive to gazelle observation, but frequent presence of farm workers will cause the gazelles to avoid them.