POPULATION STUDIES ON GERBILS OF THE WESTERN DESERT OF EGYPT, WITH SPECIAL REFERENCE TO *Gerbillus andersoni* DE WINTON

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ABSTRACT: Population studies on the gerbil, Gerbillus andersoni, were carried out in Omayed in the Western Desert of Egypt during the period from July 1976 through August 1978 inclusive. Studies included determination of the sex ratio in the different age and weight groups, as well as seasonal changes in this ratio. The mean weight and age at the onset of maturity and the reproductive activity of both sexes were determined. The study also included seasonal changes in mean body weights of both sexes, those of the testes in relation to body weights, as well as changes in the length of the testis and of the cauda epididymis. Changes in the age structure of the population were also studied.

INTRODUCTION

Earlier investigations on Egyptian rodents were largely concerned with the anatomy, taxonomy, cytotaxonomy and distribution of various forms, while studies on rodent populations are lacking. This may be due partly to the many difficulties associated with field research in arid areas and partly to the scarcity of mammal communities in comparison with other communities in such areas.

The present study is the result of 26 months of field work (July 1976-August 1978 inclusive) carried out in Omayed, some 83 kilometers west of Alexandria and 10 kilometres to the south of the Mediterranean sea shore. It is part of the project of System Analysis of the Mediterranean Desert Ecosystem of Northern Egypt (SAMDENE), a joint project of EPA and the University of Alexandria. It has the objective of using available information as a guide in planning for the management of this ecosystem. The study area is an inland non-salty depression which will be included in one of the agricultural projects extending from the Nubaria to Alamein, 128 kilometers west of Alexandria. The present investigation will help in the study of the behavior of the gerbil towards future changes in the environment.

The study area was found to be inhabited by five different species of rodents representing the families Spalacidae, Dipodidae and Cricetidae. The rodents are:

1. The mole rat, Spalax ehrenbergi
2. The lesser Egyptian jerboa, Jaculus jaculus
3. The fat sand rat, Psammomys obesus
4. The lesser gerbil, Gerbillus gerbillus
5. Anderson's gerbil, Gerbillus andersoni

This latter species occurred in fair numbers which allowed the regular study of its population.

The common plant species in the area consisted of perennial herbs such as Asphodelus microcarpus, Plantago albicans and Atractylis cardus, as well as evergreen shrubs of Anabasis articulata and Thymelaea hirsuta. The perennial evergreen subshrubs were represented by Helianthemum lippi, Echiochilon fruticosum and Gymnocarpus decandrum.

During the period of study the maximum monthly average temperature ranged between 19.3°C in winter and 33.4°C in summer, while the minimum monthly average temperature ranged between 7.7°C and 22.7°C. The rainfall recorded in the winter of 1976-1977 was 84.5 mm; that of 1977-1978 was 55.2 mm.

MATERIAL AND METHOD

Semimonthly trapping of gerbils was carried out using live traps and the best results were obtained when traps were set under the shrubs of Thymelaea hirsuta. Traps were set about 5 p.m. and checked and collected in the early morning of the following day. The trapped animals were weighed in the field, transported alive to the lab where they were sacrificed. They were carefully measured and examined for their reproductive condition. A smear of the epididymis of the male was examined for the presence of spermatozoa. In females the general reproductive condition was recorded including the number of embryos, when present, and the condition of the mammary glands. Males were considered reproductively active if they showed scrotal testes and when active sperms were found in the cauda epididymis. Females were considered active if they were pregnant, lactating or in estrus, as determined by the condition of the vaginal orifice.

A scale has been developed to determine, with a fair degree of accuracy, the age of different individuals in the population. The scale depended on determining the wear of the grinding surface of the first two upper and lower molars, which resulted in different enamel patterns depending on the age of the individual gerbil (Wassif and Soliman 1978). Since this was done on cleaned and macerated skulls the method was further developed so that a print of the enamel in upper and lower molars of live gerbils can be made without sacrificing the animal.

Ribbons of filter paper 2-3 mm wide were immersed several times in a mixture of molten beeswax and paraffin wax and then left to dry. If such a ribbon is introduced into the mouth of the gerbil and the two jaws are allowed to press against it, a print of the enamel pattern in both upper and lower molars can be obtained. The print is then examined under a binocular microscope to determine the degree of erosion of the teeth and consequently the age of that particular gerbil.

RESULTS

Sex Ratio

The sex ratio in the various weight groups (Fig. 1A) indicates that males dominate low and high weight groups (66% in individuals weighing up to 15 gm and 100% in individuals weighing more than 30 gm). In the different age groups (Fig. 1B) males dominate individuals up to 20 months old. They form a low percentage in individuals ranging in age between 21 and 24 months.

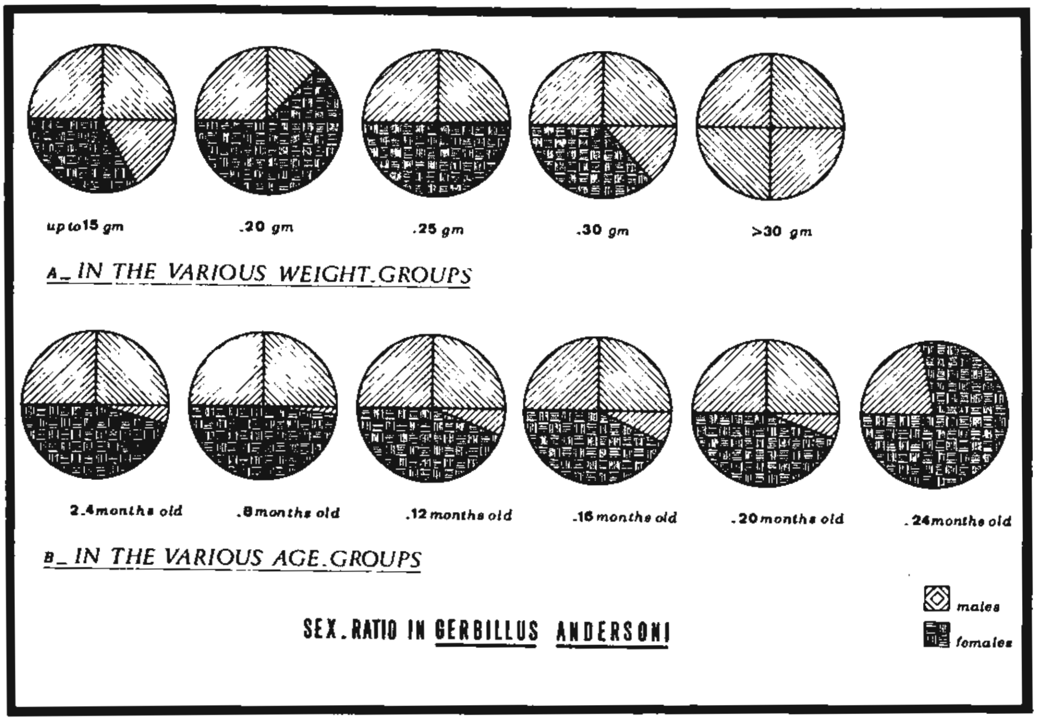


Fig. 1.

The percentage of males in the total number collected was 52.9% (196 males out of a total of 370 gerbil). No marked seasonal changes in the sex ratio were observed.

Maturity

Males below 20 gm body weight were found to be reproductively inactive. Only 8% of males having 20 gm body weight were reproductively active. This percentage progressively increases with increasing body weight up to 32 gm. From this weight onwards all males become reproductively active.

The youngest male that showed signs of sexual activity was 5.5 months old. The main breeding stock was formed of males ranging in age between 8 and 17 months. Males, whether born early or late in a given breeding season, all become sexually mature at the beginning of the next breeding season at a mean age of about 10 months.

The weight at which 50% of females are in a state of reproductive activity is 27 gm, which is 90% of the maximum weight recorded for females (30 gm). Below 20 gm none of the females was reproductively active. Females do not attain sexual maturity before being 9 months old.

Allanson (1968) stated that males of Tatera afra inhabiting Cape Province in South Africa reach maturity in the same season in which they were born. This is also the case in Clethrionomys glareolus skomerensis in Britain (Coutts and Rowlands 1969).

Reproductive Cycle

The reproductive cycle of males (Figs. 2 and 3) shows one peak of sexual activity per year, extending through the winter and spring months. During this peak (January - March 1977, January - April 1978) the male population consisted exclusively of sexually active males. On the other hand, males passed through a short period of sexual quiescence during the autumn (September - October 1976 and October 1977). During this period males were completely sexually inactive. Between the two opposite peaks there was a gradual change in the percentage of sexually active males.

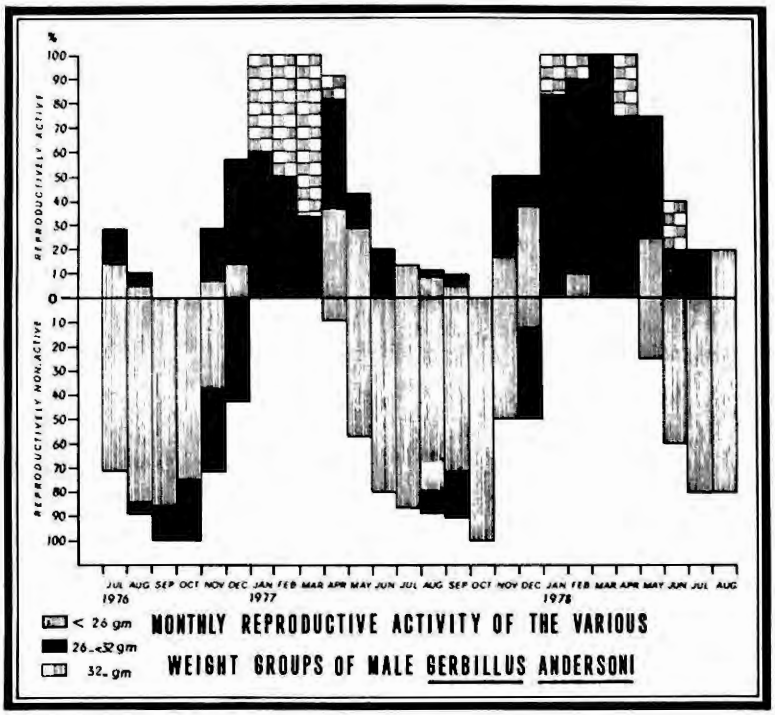


Fig. 2.

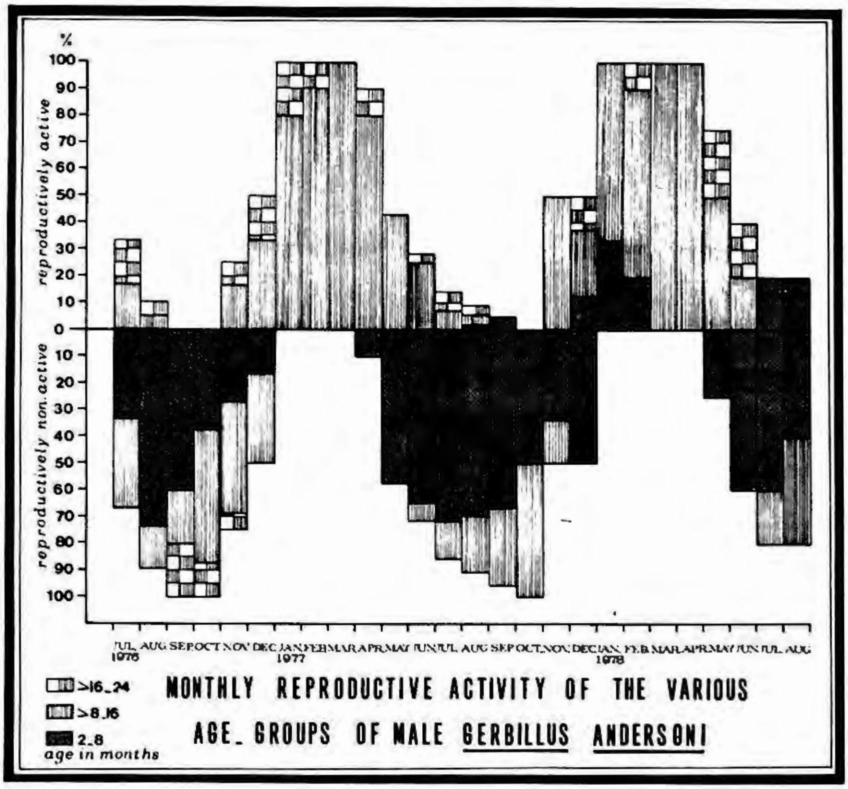


Fig. 3.

Females also show one peak of reproductive activity per year (Figs. 4 and 5) during winter and spring months. (January - May 1977, February - May 1978). During such months sexually active females formed varying proportions of the female population.

When the reproductive cycle of males is compared with that of females, it becomes evident that the breeding season of males is longer than that of females. Males also have a higher percentage of reproductively active individuals than females at any given month of the year. It is also clear that a high percentage of reproductively active males were above 30 gm body weight, whereas females never exceed 30 gm body weight.

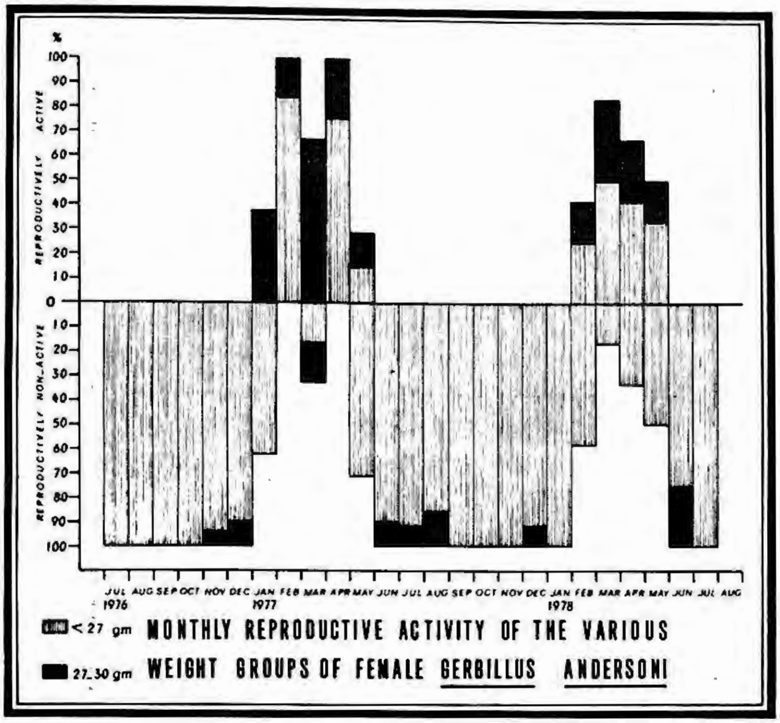


Fig. 4.

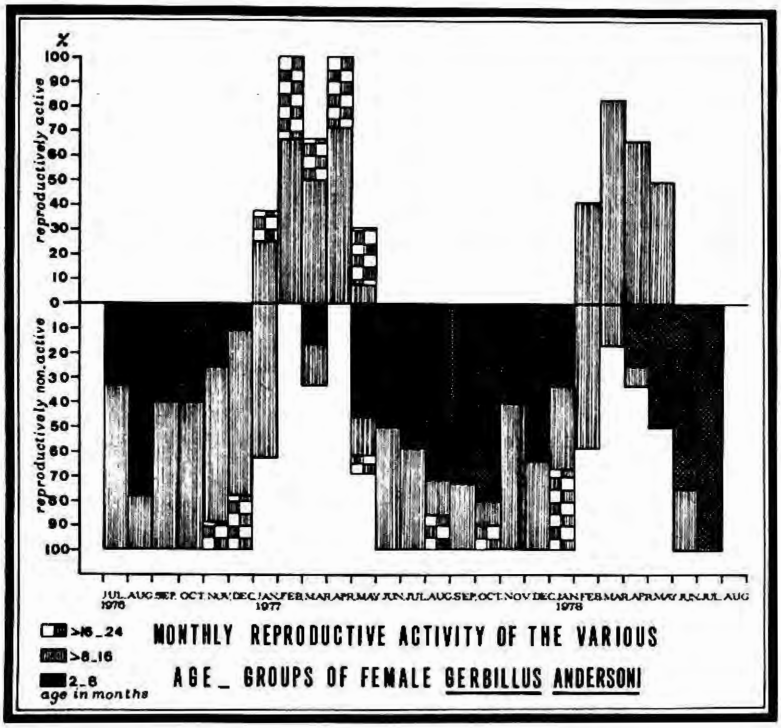


Fig. 5.

Monthly and Age Changes in the Reproductive Organs of Males

1. Testis length -- The mean length of the testis was calculated monthly for 3 age groups, namely subadults (up to 8 months), adults (more than 8 months and up to 16 months) and old adults (more than 16 and up to 24 months). The mean length of the testis in the different age groups showed clear seasonal changes. It increased in length towards months of highest sexual activity.

2. Cauda epididymis length -- The seasonal changes in the length of the cauda epididymis greatly resemble those of the testis, both having a peak of maximum length synchronizing with the peak of highest reproductive activity in males (Fig. 6).

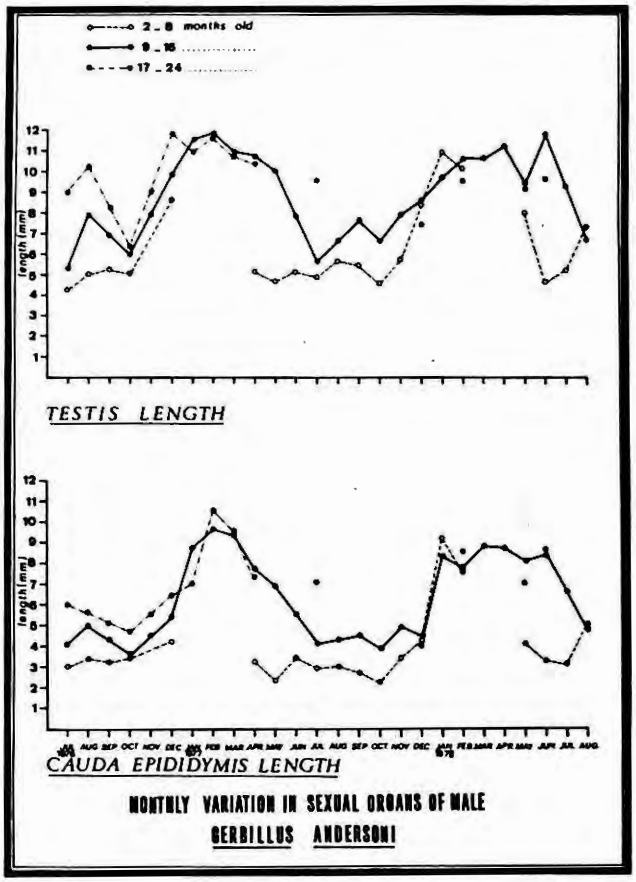


Fig. 6.

Changes in the length of the cauda epididymis are more closely correlated with the peak of sexual activity in males than are changes in the length of the testis. The cauda epididymis shows sharp increase and decrease in length before and after this peak, respectively, while changes in the testis are gentle. The changes in the length of the cauda epididymis thus reflect more accurately the changes in the reproductive status of males.

3. Testis weight -- The monthly mean weight of the paired testes showed clear seasonal changes (Fig. 7), correlated with the sexual activity in males. The testes weight, when expressed as percentage of body weight, also shows the same changes. Changes in testes weight are relatively larger than changes in body weight. The maximum testis weight is 12 times its minimum weight in the same age group; the corresponding figure for the body weight is 1.8. Monthly changes in male reproductive organs in desert rodents were reported upon by Balda et al. (1973).

Seasonal Fluctuations in Body Weight

Fluctuations in body weight are treated through two different approaches: The first approach deals with the changes of absolute values of mean body weights in grams of individuals belonging to various ages of both sexes. The second approach deals with seasonal changes in abundance of individuals belonging to various weight groups of both sexes.

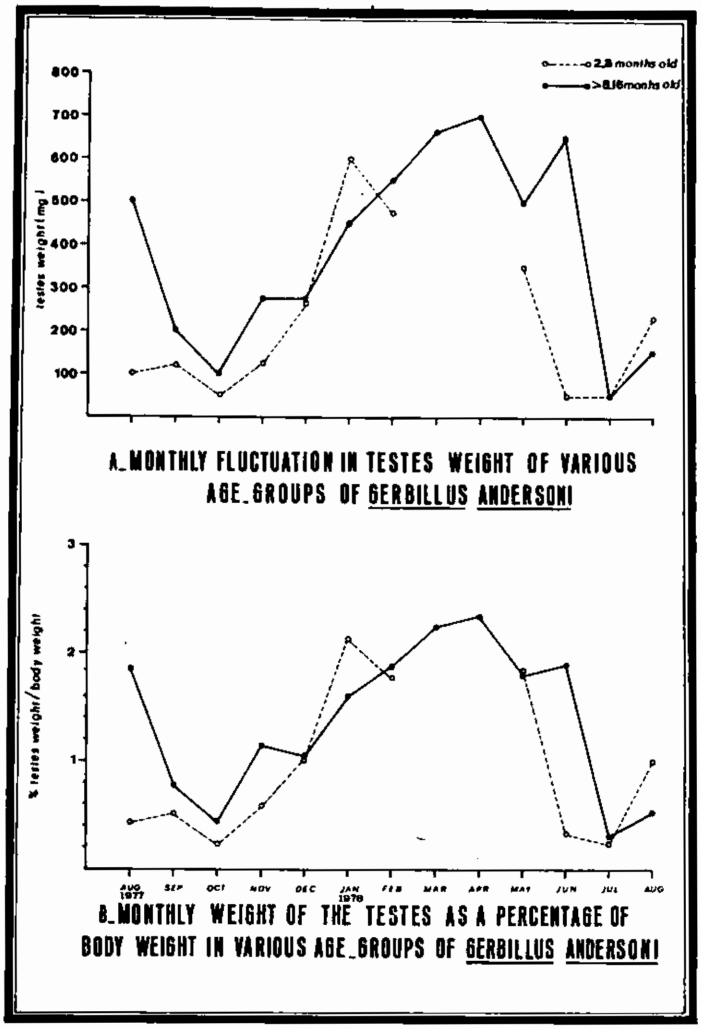
The mean body weight of various age groups of both sexes showed an increase towards months of the breeding season. Males were usually heavier than females of the same age group during any given month.

The distribution of various weight groups of both sexes shows clear seasonal fluctuations which reflect the reproductive cycle of each. Individuals of low weight groups made their first appearance three months after the beginning of the breeding season. This suggests that young do not enter traps before they are two months old.

Age Structure

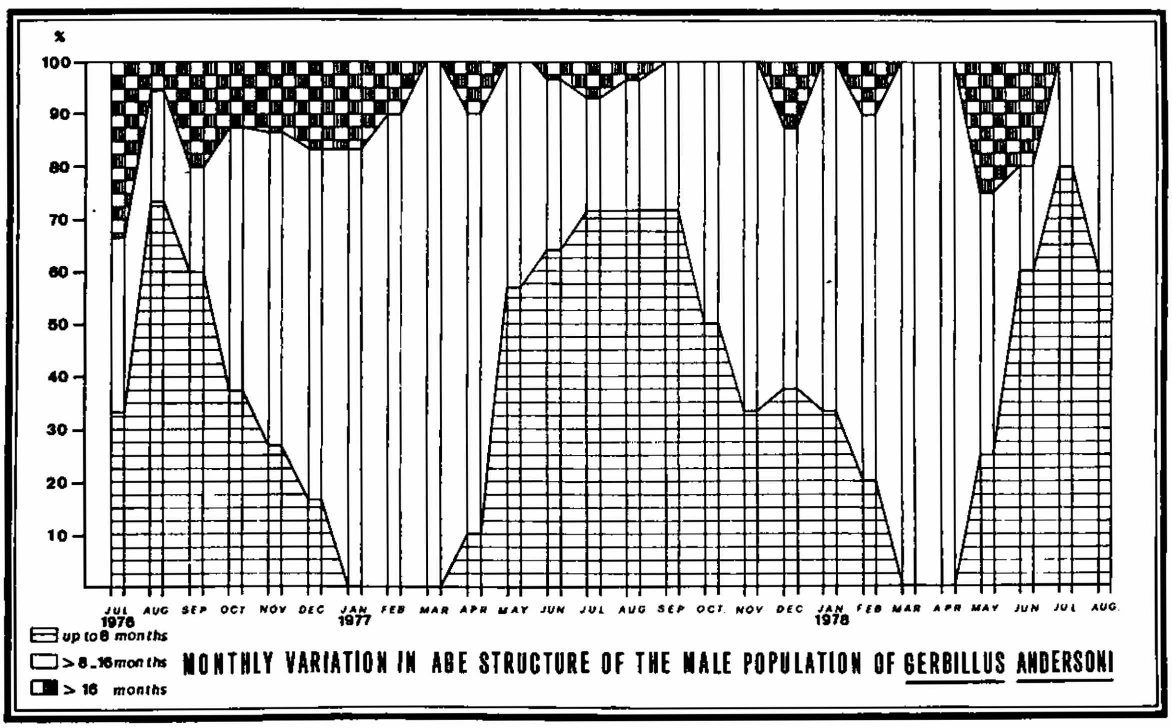
The population is classified into three age groups on the basis of the degree of erosion of the grinding surface of upper and lower molars in different individuals (Wassif and Soliman 1978). The age groups are: subadults (2-8 months), adults (more than 8 months and up to 16 months) and old adults (more than 16 months and up to 24 months).

The first and second age groups (Figs. 8 and 9) showed clear contrasting monthly changes. The first group disappeared during the first three months of the breeding season, though they were actually



2-8 months old
>8-16 months old
testes weight (mg)
800
700
600
500
400
300
200
100
A. MONTHLY FLUCTUATION IN TESTES WEIGHT OF VARIOUS AGE GROUPS OF GERBILLUS ANDERSONI
% testes weight/body weight
3
2
1
AUG 1977
SEP
OCT
NOV
DEC
JAN 1978
FEB
MAR
APR
MAY
JUN
JUL
AUG
B. MONTHLY WEIGHT OF THE TESTES AS A PERCENTAGE OF BODY WEIGHT IN VARIOUS AGE GROUPS OF GERBILLUS ANDERSONI

Fig. 7.



%
100
90
80
70
60
50
40
30
20
10
JUL 1976
AUG
SEP
OCT
NOV
DEC
JAN 1977
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 1978
FEB
MAR
APR
MAY
JUN
JUL
AUG
up to 8 months
> 8-16 months
> 16 months
MONTHLY VARIATION IN AGE STRUCTURE OF THE MALE POPULATION OF GERBILLUS ANDERSONI

Fig. 8.

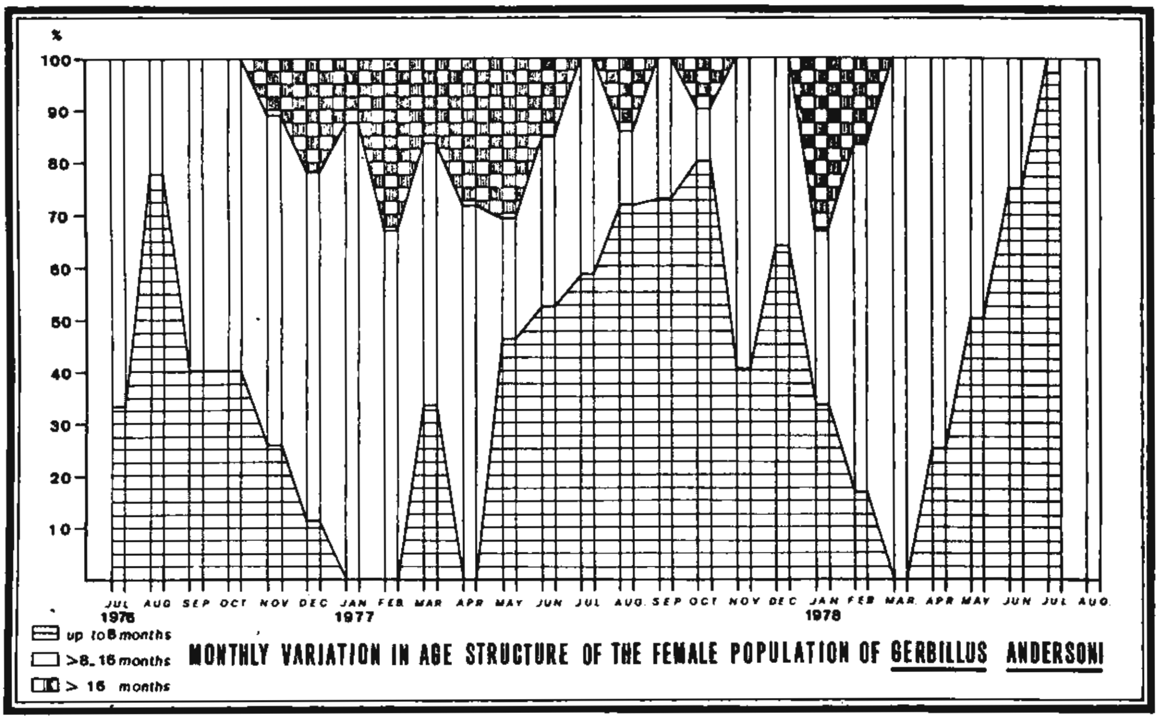


Fig. 9.

present in the population. The second age group showed a maximum occurrence during the breeding season, while the third age group formed low percentages throughout the whole period of study. This indicates that gerbils rarely exceed 16 months old and that most adults disappear after the end of the breeding season following that in which they were born. The low percentage of old adults in the second year of study could be attributed to the continuous trapping which provided narrow chances to individual gerbils to grow older and exceed 16 months of age without being trapped. Continuous trapping, therefore, affects the age structure of the population.

Impact on Vegetation

The impact of Gerbillus andersoni on the vegetation of the area has been studied by Wassif and Soliman (1978). The animal feeds largely on the seeds of the evergreen shrub of Thymelaea hirsuta, a dominant plant of the area in which seed shedding coincides with the breeding season of the gerbil.

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