

Preliminary Observations on the Breeding of Ferrets in South Africa.

By G. N. Murray, Section of Zootechny, Onderstepoort.

In October, 1937, ferrets were imported into South Africa for the first time. No success was obtained in tracing any observations made on ferrets introduced into other parts of the southern hemisphere. The observations recorded should therefore in certain respects be taken to be applicable only to Onderstepoort, which is situated 28° 11' E. longitude and 25° 38' S. latitude. It is 4,000 feet above sea level and has a summer rainfall of 30 inches.

Before proceeding to describe the observations, it may be of interest to give a summary of the more recent observations made on the ferret, especially with regard to the influence of light on its sexual cycle.

Hammond and Marshall (1930) made detailed observations on the sexual cycle of the ferret by studying the different organs. They found that heat is prolonged in the ferret in the absence of coitus and that it may extend for 5 months. Like the rabbit, the ferret only ovulates after coitus. The recurrence of heat after pregnancy was found to vary according to whether or not the young were suckled. While suckling young the generative organs of one ferret killed 17 days after parturition were in a condition characteristic of anoestrus. Another ferret whose young were killed immediately after birth, began to come on heat 9 days later, the vulva being considerably swollen by the 16th day. Hammond and Marshall also found that for successful mating the female should be left until the maximum size of the vulva had been attained. This is reached about 2 to 3 weeks after the commencement of oestrus, when it is about 50 times the size of the anoestrous vulva.

Allanson (1932) again studied the reproductive cycle of the male ferret. She found that the weight of the testes for instance varied from 0.178 gm. in November to 2.062 gm. in April. From her histological studies she concluded that the male had a shorter period of quiescence than the female and a more extended reproductive season, since males were producing spermatozoa, which presumably would be capable of fertilizing the female at least 6 weeks before the female was ready for breeding. This, however, does not agree with Bissonnette's (1932) observations.

Bissonnette (1932) discovered that ferrets came into full oestrus in 38 to 64 days in mid-winter when illuminated by electric light. Normally ferrets are sexually active only from March to August in the northern hemisphere. Bissonnette stated that in ferrets the females were the ones more completely dependent

BREEDING OF FERRETS IN SOUTH AFRICA.

on light ration for their sexual cycles, while the males responded more slowly or less completely, and required additional treatment of some sort. He further stated that the accessory sex organs of males responded apparently completely and matings took place, but incompleteness of spermatogenic response rendered these matings sterile.

Bissonnette's work was confirmed by the work of Hill and Parkes (1933). They also showed that the anterior pituitary is linked with the sexual photoperiodicity since hypophysectomized animals were unaffected by artificial lighting and went into permanent anoestrus unless injected with pituitary extracts.

In a subsequent article, Hill and Parkes (1934) concluded from the results of their experiments that the almost total exclusion of light did not seriously affect the onset of the breeding season in the ferret, and they therefore suggested that the increasing length of daylight in spring was not a factor influencing the normal sexual periodicity of this species. Bissonnette (1935) suggested that the ferrets of Hill and Parkes were already well stimulated toward sexual activity when they started to expose their ferrets to reduced lighting.

Bissonnette (1935) took the result of his experiments, in which ferrets were exposed to different periods of lighting, to indicate that in female ferrets any inherent rhythm, or cycle, of sexual activity is modified either naturally or artificially by changes of the cycles of duration and intensity of the light to which they are exposed daily, and so made to correspond in phases with the seasons or changed there from. The rising illumination in spring and the failing one in late summer and autumn probably accelerated and retarded the sexual activity of the female ferret, or accelerated the onset of anoestrus in late summer and autumn.

Marshall and Bowden (1932, 1936) demonstrated that the light effect on ferrets began with the red radiation and extended throughout the visible to the near ultra-violet. The heat rays and the near infra-red were inactive. Marshall (1937) states that in the case of the ferret the ultra-violet irradiation has a far more extended effect upon the sexual organs than ordinary light rays and that this effect must be interpreted as one of hyperpituitarism.

With regard to the effect on the sexual cycle and breeding of animals taken from one to another hemisphere, Marshall (1936, 1937) discusses the observations made by different people. Ruminants usually breed in the autumn, and when they are taken from the northern to the southern hemisphere they fit in with their new surroundings in two years time.

Tropical ruminants when brought to temperate countries do not usually adjust themselves to the changing seasons because they do not have the capacity to respond to appropriate stimuli so as to undergo rut or oestrus at fixed times of the year. Outside of tropical areas the insectivores, carnivores, rodents and non-ruminating ungulates with very few exceptions breed in the spring or first half of the year in the northern hemisphere and in the spring or second half of the year in the southern hemisphere.

Imported Ferrets.—During October, 1937, a number of ferrets were imported into South Africa for the first time. They were sent to the National Zoological Gardens, Pretoria, before some were taken to Onderstepoort. The females came into oestrus shortly after their arrival. One female sent to Onderstepoort had a litter of 3 young the 19th February, 1938. Some of the females kept at the Zoological Gardens had litters before this date.

During December, 1937, another batch of ferrets (twenty) were sent directly to Onderstepoort. Some of these immediately showed oestrus and were subsequently served. On the 13th March, 1938, two females had litters of 7 each, and one had a litter of 5 on the 15th March. About a week later two more ferrets had litters. The rest of the females did not breed that season.

When the ferrets arrived they all had long coats, but by the end of March they had all lost their long hair and had short smooth coats.

Management.—The ferrets are kept in a large well ventilated room, 23 ft. by 15 ft., which is divided by a partition into $\frac{1}{3}$ and $\frac{2}{3}$. The floor is covered with wood shavings. During the anoestrus period all the males and females run together, but during the breeding season only one male remains with the females. The other males are put into individual cages. When a female shows oestrus she is put with one of the males in the cage. After that she is kept alone in a cage until the swelling of her vulva starts to go down, when she is again taken to the lot.

Pregnant females are taken to the individual cages about a week before they are due to litter down. The individual cages (34 ins. by 17 ins. by 13 ins.) are made of smooth galvanized sheet iron with two trays, 7 inches deep, each containing some wood shavings. The wet shavings are removed every day and clean shavings put in. These cages are kept on shelves in another room.

Young ferrets remained with their mothers for 6 to 8 weeks. This season (1940-41) the young were removed as soon as they started to eat, i.e. when they were about 5 weeks old. In the present cages the females usually take the young away from the tray where the milk and meat are given. The females also seemed to have rather little milk so that the young were stunted if they were not removed from their mothers. During the present season, none of the young which were removed from their mothers after their eyes had opened were lost. This takes place from the 4th to the 5th week after birth.

During the 1940-41 season, observations were made on the number of young born and weaned during the different months. When a pregnant female was brought to a cage, a card was attached to the cage and the following information recorded on it: Date when the litter was born and the number of young born; dates when any of the young died or were destroyed by the female; date and number of young weaned; date when the female started to show oestrus and date of service. A few females that did not show oestrus again during the season, remained for several months in the cages.

Feeding.—The ferrets were fed raw beef three times per week. Milk was given daily and brown bread was given in the milk on the 4 days that no beef was given. The ferrets were fed every morning after the cages had been cleaned.

The young ferrets that had just been weaned were given mice freshly killed instead of beef. This was continued for about a month. They received the milk and bread as well.

Detailed Observations on 11 Females and 3 Males.

To get an idea of the sexual cycle of the ferret under conditions obtaining at this Institute, 11 females and 3 males were put into individual cages during January, 1940. These ferrets were handled regularly once per week, but the cages were inspected every day. This was continued until April, 1941.

BREEDING OF FERRETS IN SOUTH AFRICA.

Females.—In some cases litters were taken away from their mothers immediately after birth, some were allowed to suckle for a short time and others about 8 weeks. We wanted to see how late in the season ferrets would still come on heat. Hammond and Marshall (1930) showed that a ferret can come on heat again immediately if her litter is taken away soon after birth.

A female (No. 3) of which a litter was weaned on the 18th March, 1940, commenced to show oestrus 8 days later (26.3.40). In order to investigate how late in the season she would remain in oestrus she was not put to the male. On the 29th April, 1940, the swelling of her vulva started to go down. With the exception of No. 6, no females of which the young were weaned after the 18th March, 1940, showed oestrus again that season.

The litter of No. 6 was weaned on the 6th April, 1940, but her vulva only commenced to swell much later and was fully swollen on the 3rd May, 1940. No male was interested in her at that time. Her vulva remained swollen during part of the winter until the 2nd July, 1940, when she was served. On the 10th August she appeared pregnant. A dark discharge was coming from the vulva. Three days later this dark discharge was still seen but then the female did not appear pregnant any more. It therefore seems very likely that she must have aborted and eaten all the foetuses, which probably were dead, since ordinarily no bloody discharge comes out of the vulva before a litter is born.

Females of which the litters were taken away immediately after birth or destroyed by the females, showed the same tendency, i.e. to show oestrus shortly afterwards, as when litters were suckled before being taken away. On the 7th March, 1940, a female (No. 10) had a litter of 2 which was removed on the 9th March. Six days later her vulva started to swell. She was served on the 29th March. On the 24th April she appeared to be pregnant, but 5 days later she did not appear pregnant any more.

On the 16th March No. 11 had a litter which she destroyed on the 19th March. She did not show oestrus again that season.

According to Hammond and Marshall (1930) the time taken by the vulva to swell to its maximum size takes 2 to 3 weeks. Females will, however, take the male much sooner and will be fertilized. No. 4, for instance, had a litter of 9 on the 25th January, 1940, the young of which were all dead. On the 29th January, her vulva started to swell and she was served on the 31st January. The subsequent litter had only 3 young. About the same is the case with No. 2. She was served 9 days after her litter was born and 6 days after all her young were destroyed. She also had a litter of only 3. No. 7 was served 15 days after the birth of her litter or 13 days after all the young were dead. Her subsequent litter had 4 young. No. 9 was served 14 days after her litter was weaned but she did not give birth to any young. It will be seen that Nos. 4, 7 and 9 each had 9 young per litter in the first case but 2, 4 and 7 had only 3, 3 and 4 respectively the second time. It would therefore appear that a female may become pregnant when served before she is completely "on heat" or in oestrus, but that there are only a few ripe follicles at that time, hence the litters that are only half the average size or a third of the previous litters of the same females.

According to these results it would appear that females may be stimulated to show oestrus, when the light is decreasing, by taking away the young immediately after birth or when they have suckled as long as 8 weeks. Whether the condition of a female after suckling her young has an influence, was not

1940.

No.	January.	February.	March.	Apr'l.	May.	June.	July.
1	10th; Litter born	29th; weaned 3	9th; vulva swelling. 11th; first male not interested 12th; another male served her	10th; appears pregnant 24th; does not appear pregnant	—	—	15th; vulva swelling 27th; served by young male
2	16th; litter of 3. 19th; all dead. 22nd; vulva swollen. 23rd; served.	—	5th; litter of 4. 20th; all young dead.	—	—	—	—
3	18th; litter of 11.	—	18th; weaned 6. 26th; vulva swelling.	24th; male not interested. 29th; swelling going down.	—	—	—
4	25th; litter of 9, all dead. 29th; vulva swelling. 31st; served.	—	12th; litter of 3.	26th; weaned 2.	—	—	—
5	31st; litter born.	—	—	2nd; weaned 5.	—	—	—
6	—	14th; litter of 8.	—	6th; weaned 4.	3rd; vulva swollen. No male interested.	Vulva swollen.	2nd; served by young male.
7	—	25th; litter of 3. 27th; Remaining 2 taken away.	6th; vulva swelling. 8th; served.	19th; Dark discharge. No foetuses could be felt.	—	—	—
8	—	27th; litter of 6.	—	26th; weaned 4.	—	—	—
9	—	—	5th; litter of 7.	—	23rd; weaned 3.	—	—
10	25th; served.	—	7th; litter of 2. 9th; young taken away. 15th; vulva swelling. 29th; served.	24th; appears pregnant. 29th; does not appear pregnant.	—	—	—
11	—	5th; served.	16th; litter of 4. 19th; all dead.	—	—	—	—

TABLE 1.

Females kept in Individual Cages.

G. N. MURRAY

		1941.						
August.	September.	October.	November.	December.	January.	February.	March.	
—	6th; litter of 5.	25th; only 2 young left; weaned them.	—	21st; vulva swollen; served.	—	22nd; not pregnant.	—	
29th; vulva swelling.	7th; served.	19th; litter of 5. 22nd; all dead. 24th; vulva swelling. 28th; served.	—	9th; litter of 3. 14th; all dead.	—	—	—	
17th; vulva swelling. 30th; served.	30th; does not appear pregnant.	—	—	7th; vulva swelling. 14th; served.	26th; litter of 4.	—	3rd; weaned 3. 13th; vulva swelling. 26th; with male.	
—	30th; vulva swelling.	10th; served.	22nd; litter of 6, female dying.	—	—	—	—	
—	17th; vulva swelling. 23rd; served.	—	5th; litter of 10.	8th; all dead. 2nd; vulva swollen. 28th; served.	—	8th; litter of 5. 14th; all dead.	—	
10th; pregnant, bloody discharge. 13th; bloody discharge; not pregnant.	30th; vulva swelling.	10th; served.	22nd; litter of 5.	25th; all dead.	27th; vulva swelling.	7th; served.	—	
—	14th; vulva swelling. 23rd; served.	—	4th; litter of 9. 6th; all dead. 16th; vulva swollen. 19th; served.	—	1st; litter of 4. 27th; 2 dead.	11th; weaned 1.	—	
—	—	17th; vulva swelling. 25th; served.	—	6th; litter of 8.	9th; weaned 3. 18th; vulva swelling. 27th; served.	—	—	
23rd; vulva swelling.	14th; served.	26th; litter of 8.	14th; 2 young dead. 30th; weaned 3.	14th; vulva swollen; served.	27th; vulva swelling.	7th; served.	—	
—	23rd; vulva swelling.	4th; served.	14th; not pregnant.	7th; vulva swollen; served.	18th; litter of 3.	11th; all dead.	—	
—	7th; vulva swelling. 14th; served.	26th; litter of 10. 28th; all dead.	4th; vulva swollen; served.	Female escaped and got mixed with the lot.	—	—	—	

determined. Female No. 3, that showed oestrus at the end of March, had reared six young and was in a fairly lean condition. This stimulus is apparently not enough in all cases, even quite early in the season. Female No. 2 for instance, had a litter on the 9th December, 1940, which she destroyed 5 days later. She did not show oestrus again during the 1940-41 season. There were two females from the lot that did not show oestrus again after they had destroyed their young in December.

During the 1939-40 season fertile matings occurred up to the 5th February. No litters were obtained from females served during the beginning of March, although two females may have been pregnant and aborted. During the 1940-41 season the last litter was obtained on the 10th March, the young of which were all destroyed. This female was therefore served about the 28th January. It appears probable that it depends on the male how late in the season a fertile service will be possible. From our observations, old males do not take notice of females in oestrus much earlier in the season than young males. This, therefore, agrees with Bissonnette's (1932) observations that the male had a shorter breeding period than the female. With regard to the females, age and condition may cause the variation we have noticed.

Males.—In Table 1 it will be seen that in 1940 the last litter was obtained on the 16th March. During that season the oldest male, born in the beginning of 1938, served a female on the 8th March but on the 11th he would not serve another female. A young male served this female. A young male still served a female the 29th March. No young were obtained from this service, although the female appeared pregnant 4 weeks after she was served.

During the 1940-41 season, six males were kept in individual cages and one with the females in the large room. On the 22nd February, 1941, 4 of the 6 males in the cages had very small testes, smaller than peas. These 4 males were not interested in females on heat. The other two males in the cages had larger testes and were still interested in the females on heat and served them. The male running with the females had the largest testes.

The earliest that a male served a female in the season was on the 2nd July, 1940. This was a young male of the 1939-40 season. At that time none of the old males were interested in the females. Their testes were then still quite small. The female (No. 6) that was served on the 2nd July did not produce a litter although she appeared to be pregnant on the 10th August. Both the male and female therefore appeared to have been fertile as early as the beginning of July. A female (No. 1) served by the same male on the 27th July, produced a litter.

On the 29th June, i.e. only a week after the days had commenced getting longer, the testes of the young males born during the 1939-40 season, were about 3 to 4 times larger than those of the old males. Towards the middle of July it was noticed that the testes of the old males had commenced to increase in size and towards the end of the month were well developed.

If female No. 6 is not taken into consideration—as she was in oestrus since the previous breeding season—then the first female that showed oestrus was No. 1 on the 15th July. By that time young males were already fertile. From this it would appear that if young males are considered, then they are fertile as early in the season as the females. The old males however appear to be about a month slower.

Since no male was reared from those born in September, it could not be observed whether young males would show any development of their sexual organs towards the end of the season. However, it is intended making further studies on males and females born during the different months.

It has already been mentioned that Allanson (1934) concluded that the male ferret had a shorter period of quiescence than the female and a more extended reproductive season. Bissonnette (1932) on the other hand stated that the females responded completely to light rations while the males responded more slowly or less completely. Our observations agree with Bissonnette's with regard to the old males. Young males may respond as early as the females to increased light but the indications are that they may stop breeding earlier than the females.

An interesting point mentioned by Bissonnette (1932) is that in birds again the males apparently respond to similar light treatment somewhat more quickly and just as completely as the females. He then mentions Dr. Hammond's interesting suggestion. In birds, the male and in mammals, the female, are homozygous for sex and homogametic, and these are the sexes in these classes that are most susceptible to light ration changes and changes in anterior lobe hypophysis hormone, balance or concentration, while the heterozygous heterogametic sexes are less susceptible.

Gestation Period.—In Table 1 there are 20 complete gestation periods. The length of the gestation period varied from 40 to 44 days, the average being 42 days. Of the 20 gestation periods 11 were 42 days; 1, 40 days; 2, 41 days; 3, 43 days. This is about the same as found by Hammond and Marshall (1930). They, however, had no gestation periods of 40 and 44 days.

Breeding Results of the 1940-41 Season.

Towards the end of 1939 it was noticed how few of the females reared their young. It was thought that the cages in use at that time had something to do with it. During January, 1940, the pregnant females were put into new cages. During the next breeding season (1940-41) a record was kept of every pregnant female that was put into an individual cage. The date when a litter was born and all subsequent observations until the female was served again, were recorded on cards fixed to each cage.

The following are the observations made on every female from September to March:—

LITTERS BORN DURING THE DIFFERENT MONTHS.

September.

None Reared.

27/9/40 litter of 5; 2/11/40 all dead.

27/9/40 litter of 8; 4/11 all dead; 6/1 vulva swelling; 9/11 served.

Reared.

6/9/40 litter of 5; 25/10 2 left weaned; 21/12 vulva swollen, served.

October.

None Reared.

- 7/10/40 litter of 6; 14/10 all dead; 15/10 vulva swelling; 19/10 served.
 14/10/40 litter of 8; 17/10 1 left; 19/10 all dead; vulva swelling; 24/10 served.
 19/10/40 litter of 5; 13/11 all dead; 18/11 vulva swelling; 23/11 served.
 19/10/40 litter of 5; 22/10 all dead; 24/10 vulva swelling; 28/10 served.
 19/10/40 litter of 5; 18/11 2 left; 19/11 all dead; 23/11 vulva swelling; 4/12 served.
 25/10/40 litter of 7; 28/10 all dead; 4/11 vulva swelling; 16/11 served.
 26/10/40 litter of 10; 28/10 all dead; 4/11 vulva swollen.

Reared.

- 26/10/40 litter of 8; 14/11 2 dead; 30/11 weaned 3; 14/12 vulva swollen, served.

November.

None Reared.

- 2/11/40 litter of 4; 4/11 all dead; 6/11 vulva swelling; 9/11 served.
 2/11/40 litter of 7; 4/11 all dead; vulva swelling; 9/11 served.
 4/11/40 litter of 9; 6/11 all dead; 16/11 vulva swollen; 19/11 served.
 5/11/40 litter of 10; 8/12 all dead; 21/12 vulva swollen; 28/12 served.
 11/11/40 litter of 7; 17/12 all dead; 11/1/41 served.
 13/11/40 litter of 8; 16/11 all dead; 20/11 vulva swelling; 23/11 served.
 13/11/40 litter of 7; 16/11 1 left; 18/11 all dead; 30/11 served.
 18/11/40 litter of 3; all dead; 23/11 vulva swelling; 30/11 served.
 19/11/40 litter of 4; 20/11 all dead; 30/11 served.
 22/11/40 litter of 6; 23/11 all dead; 30/11 served.
 22/11/40 litter of 5; 25/12 all dead; 27/1/41 vulva swelling; 7/2 served.
 22/11/40 litter of 5; 26/12 all dead; 7/1/41 vulva swelling; 11/1 served.
 26/11/40 litter of 7; 17/12 all dead; vulva swollen, served.
 29/11/40 litter of 1; 30/11 all dead; 17/12 served.

Reared.

- 9/11/40 litter of 5; 17/12 1 left weaned; 7/1/41 served.
 27/11/40 litter of 9; 7/1/41 weaned 3; 18/1 vulva swelling; 23/1 served.
 28/11/40 litter of 8; 7/1/41 weaned 1; 18/1 vulva swelling; 23/1 served.

December.

None Reared.

- 2/12/40 litter of 8; 7/12 all dead; 17/12 served;
 3/12/40 litter of 5; 7/12 all dead; 27/1/41 vulva swollen, served.
 9/12/40 litter of 3; 14/12 all dead.
 17/12/40 litter of 7; 16/1/41 all dead; 22/2 vulva swelling.
 28/12/40 litter of 5; 29/1/41 all dead.

Reared.

- 2/12/40 litter of 7; 16/1/41 weaned 3; 27/1 vulva swelling; 1/2 served.
 3/12/40 litter of 9; 9/1/41 weaned 3; 27/1 vulva swollen; served.

BREEDING OF FERRETS IN SOUTH AFRICA.

6/12/40 litter of 8; 9/1/41 weaned 3; 18/1 vulva swelling; 27/1 served.
10/12/40 litter of 8; 7/1/41 2 dead; 16/1 weaned 6; 21/1 vulva swelling;
7/2 served.
20/12/40 litter of 6; 25/1/41 weaned 3; 3/2 vulva swelling; 7/2 served.
21/12/40 litter of 5; 25/1/41 weaned 4; 7/2 vulva swelling; 14/2 served.

January.

None Reared.

2/1/41 litter of 9; 29/1 all dead; 7/2 vulva swelling; 14/2 served.
4/1/41 litter of 2; 7/1 all dead; 11/1 vulva swelling; 16/1 served.
10/1/41 litter of 5; 12/1 all dead; 18/1 vulva swelling; 23/1 served.
10/1/41 litter of 6; 12/1 all dead; 18/1 vulva swollen; served.
10/1/41 litter of 4; 21/1 1 dead; 23/1 1 left; 27/1 all dead; vulva
swollen; served.
15/1/41 litter of 5; 14/2 all dead.
16/1/41 litter of 3; 18/1 all dead; 28/1 1 dead; 22/1 all dead.
18/1/41 litter of 3; 11/2 all dead.
27/1/41 litter of 8; 29/1 1 left; 31/1 all dead; 7/2 vulva swollen; put
with male on 14/2, 22/2 and 27/2.
27/1/41 litter of 8; 31/1 all dead;

Reared.

2/1/41 litter of 4; 27/1 2 dead; 11/2 weaned 1.
4/1/41 litter of 3; 11/2 weaned 3; 13/3 vulva swelling; 20/3 swelling
going down.
4/1/41 litter of 6; 11/2 weaned 3.
4/1/41 litter of 7; 11/2 weaned 5; 1/3 vulva swollen; 12/3 served.
4/1/41 litter of 5; 11/2 weaned 3.
27/1/41 litter of 4; 3/3 weaned 3.

February.

None Reared.

8/2/41 litter of 5; 14/2 all dead.
13/2/41 litter of 5; 14/2 all dead.
21/2/41 litter of 7; 10/3 all dead.

Reared.

22/2/41 litter of 5; 29/3 weaned 5.
23/2/41 litter of 3; 31/3 weaned 3.
27/2/41 litter of 5; 14/4 weaned 3.

March.

None Reared.

4/3/41 litter of 1; 6/3 young dead.
6/3/41 litter of 5; 8/3 all dead.
10/3/41 litter of 5; 13/3 all dead.

A summary of these observations are given in Table 2.

TABLE 2.

Number of Young Born and Reared during Different Months.

	None Reared.		Reared.		
	Number Litters.	Number Born.	Number Litters.	Number Born.	Number Weaned.
September.....	2	13	1	5	2
October.....	7	46	1	8	3
November.....	14	83	3	22	5
December.....	5	28	6	43	22
January.....	10	53	6	29	18
February.....	3	17	3	13	11
March.....	3	11	0	0	0

From the above table it can be seen that up to the end of November, 28 litters with 177 young were produced but only 10 young were weaned. From December there was an improvement. This is therefore the same experience as we had in 1939. The young may be destroyed by the female or they just die. The females did not appear to have milk. Some of these young ferrets that died were examined for anything abnormal. Bacteriological tests were also made but nothing abnormal nor any infection was found to be present.

Those females that destroyed all their young before the end of November, were earclipped. Later in the season some of the marked females reared their litters. There was no change made with regard to the feeding and management of the ferrets. Of the 50 females, some were born the previous season and the others a year earlier.

It would therefore appear that the season has an adverse effect on the rearing of the young, especially if one bears in mind that the poor results were obtained during two successive years, and that there was an improvement in December.

Another proof of the adverse seasonal effect are our results (1941) with rats. Our results show that those rats born during October, November and December showed the lowest survival rate than at any other time of the year. The young that survived were the lightest at all ages up to 20 weeks, after which age they were not weighed any more. This question was also discussed with regard to the experience with sheep.

For a final proof of the environmental influence, some of the ferrets should be kept in a room where temperature, humidity and light can be controlled. Such results can then be compared with those obtained under the old system of breeding. By exposing the ferrets to increased lighting during the time when they are in anoestrus, there may be a possibility of inducing them to breed during a time of the year that is more favourable.

SUMMARY AND CONCLUSIONS.

The ferret fits in immediately with its new environment as regards its sexual cycle, when taken from the northern to the southern hemisphere. The animals that were in anoestrus in England started breeding shortly after they arrived in South Africa—the last litters being born the 22nd March, 1938.

Females may be stimulated to show oestrus, even where the light is decreasing, after the birth of a litter or after they have suckled their young for some time. A female may even remain in oestrus throughout the winter. There is, however, a big variation in the reaction of different females. Some females that had litters during December did not show oestrus again during that season while other females still came on heat as late as the end of April after their young had been weaned.

Fertile matings appeared to occur only until the end of January or the first week in February. A few matings occurred after this date, but no young were produced. The earliest that a litter has been produced is the 6th September. This female was served on the 27th July, 1940, so that litters have been obtained from September to March inclusive. The breeding season at Onderstepoort, therefore, appears to be about 1 to 2 months longer than in Europe.

Young males, born during the previous season, will copulate and are fertile about a month earlier than older males. When females commence to come on heat toward the middle of July, only young males will serve them.

The average litter size of those in which one and more have been reared is 6.0 young per litter and 5.7 in those litters of which all the young were destroyed. If females are served immediately after their vulvas start to swell, then the average litter size is only 3, which is half the normal. The average litter size of the previous litters of these females was 9, so that early service can reduce the litter size to half or a third the normal size.

Up to the end of November only 10 young out of 177 were reared. From December there was an improvement. It appears that the months September, October and November have an adverse influence on the mothers and probably on the young as well. This is substantiated by the results obtained with rats over a period of 4 years. During this time of the year the survival rate is the lowest and those that did survive grew at a slower rate and did not reach the same mature weights as those born during the favourable time of the year.

Experience during the last two years indicates that there is very little advantage in breeding ferrets before November, although they commence to come on heat 3 months earlier. Rats born during June and July have done very well. Therefore it is intended to try out the practicability of electric lighting for large scale breeding and probably injecting only the males with pregnant mare serum after they had been exposed to the extra light for some time.

REFERENCES.

- ALLANSON, M. (1932). The reproductive processes of certain mammals. III. The reproductive cycle of the male ferret. *Proc. Roy. Soc., B*, Vol. 110, pp. 295-312.
- ALLANSON, M., ROWLANDS, I. W., AND PARKES, A. S. (1934). Induction of fertility and pregnancy in the anoestrus ferret. *Proc. Roy. Soc., B*, Vol. 115, pp. 410-421.
- BISSONNETTE, T. H. (1932). Modification of mammalian sexual cycles; reactions of ferrets (*Putorius vulgaris*) of both sexes to electric light added after dark in November and December. *Proc. Roy. Soc., B*, Vol. 110, pp. 322-336.
- BISSONNETTE, T. H. (1935). Modification of mammalian sexual cycles IV. Delays of oestrus and induction of anoestrus in female ferrets by reduction of intensity and duration of daily light periods in the normal oestrous season. *J. Exp. Biol.*, Vol. 12, pp. 315-320.

- HAMMOND, J., AND MARSHALL, F. H. A. (1930). Oestrus and pseudo-pregnancy in the ferret. *Proc. Roy. Soc., B*, Vol. 105, pp.609-630.
- HILL, M., AND PARKES, A. S. (1933). Studies on the hypophysectomized ferret. Effect of hypophysectomy on the response of the female ferret to additional illumination during anoestrus. *Proc. Roy. Soc., B*, Vol. 113, pp. 537-540.
- HILL, M., AND PARKES, A. S. (1934). Effect of absence of light on the breeding season of the ferret. *Proc. Roy. Soc., B*, Vol. 115, pp. 14-17.
- MARSHALL, F. H. A. (1936). Sexual periodicity and the causes which determine it. *Phil. Trans. Roy. Soc., B*, Vol. 226, pp. 423-456.
- MARSHALL, F. H. A. (1937). On the change over in the oestrous cycle in animals after transference across the equator, with further observations on the incidence of the breeding seasons and the factors controlling sexual periodicity. *Proc. Roy. Soc., B*, Vol. 122, pp. 413-428.
- MARSHALL, F. H. A., AND BOWDEN, F. P. (1934). The effect of irradiation with different wavelengths on the oestrous cycle of the ferret, with remarks on the factors controlling sexual periodicity. *J. Exp. Biol.*, Vol. 11, pp. 409-422.
- MARSHALL, F. H. A., AND BOWDEN, F. P. (1936). The further effects of irradiation on the oestrous cycle of the ferret. *J. Exp. Biol.*, Vol. 13, pp. 383-386.
- MURRAY, G. N. (1941). Growth of the albino rat, with special reference to the influence of environment. *Onderstepoort J.*, Vol. 16, pp. 331-539.

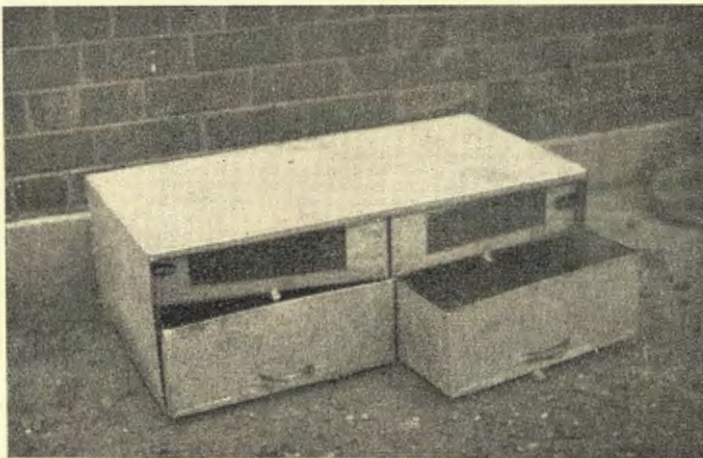


Fig. 1.--Individual Cage.

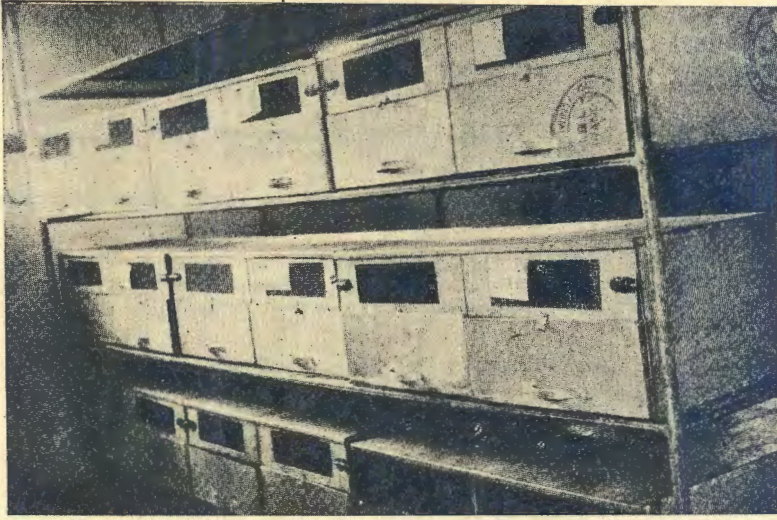


Fig. 2.—Cages on shelves.

