ADAPTATIONS OF THE IMMOBILIZING TECHNIQUE TO THE CAPTURE, MARKING AND TRANSLOCATION OF GAME ANIMALS IN THE KRUGER NATIONAL PARK.

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Introduction.

During recent years a number of scientists, game wardens and trappers have conducted research on the immobilization of game by means of a dart-syringe containing paralysing or hypnotic drugs. This is a completely new field of research for the Veterinarian, the Zoologist and the Nature Conservator, but its value and importance in nature conservation today cannot be over-estimated. It will enable the scientist and nature lover to study the migration of game by marking suitable individuals, fascilitate the transport and re-introduction of game into areas where they have become extinct, and make possible veterinary research without the shooting of game.

The Department of Nature Conservation of the National Parks Board of Trustees have also recently initiated research on the immobilization and transportation of game. It is our intention in this paper, to provide a brief resumé of the results achieved so far.

Work was commenced on the blue wildebeest *(Gorgon taurinus taurinus* Burchell) for the object of migratory studies, the impala *(Aepyceros melampus melampus* Lichtenstein) for physiological observations and diagnostic purposes in diseases like Foot and Mouth Disease, and in the case of the hippopotamus (*Hippopotamus amphibius capensis* Linnaeus) for re-introduction to the Eastern Cape.

Method of Drug Administration.

Initial experiments were conducted with the CO_2-gas operated gun from America, but it was soon abandoned on account of its short range and inaccuracy associated with the changing temperatures. It was at this stage that

the crossbow was introduced — a weapon constructed by Mr. G. L. van Rooyen of Greytown, Natal. The dart-syringes used with this crossbow were designed by Mr. van Rooyen, and are of two types. In the first type the drug is ejected through a hypodermic needle by a mechanical spring, which pushes the plunger forward as soon as a thin metal disc is punctured behind the needle by a firing-pin on impact. In the second type the plunger is propelled by gas formation at the rear end of the dart, due to a mixture of two liquids. On impact both syringes gave eminently satisfactory results, although we prefer the latter type. We find the new Cap-Chur pistol most useful, however, for injections given at short range.

The Van Rooyen crossbow is very accurate at ranges from 30-75 yards, which is more than adequate under our conditions.

On thin-skinned animals ordinary hypodermic needles were used, but for use on thick-skinned animals like the hippopotamus, a special type of needle was found necessary. The tip of the needle is sealed off and tapers to a sharp point, while a number of small apertures are drilled into the distal portion of the shaft. With this needle the possibility of blockage is eliminated as no plug is cut as the needle pierces the skin. The drug is forced through the openings in the distal part of the shaft, into the muscular tissue and is delivered into a larger area of tissue than is the case with conventional needles.

Drugs :

Experiments were conducted on the following drugs :

(a) *Nicotine Sallicylate.*

This drug was administered to impala but on account of its danger to the operator and its severe convulsive action in the patient, it was soon discarded and is in our opinion not suitable for this type of work.

(b) *"Scoline" (Succinyl Choline Chloride) Allan-Hanbury.*

A muscle relaxtant acting by persistant depolarisation of the motor end plates. There is no specific antidote for this drug.

(c) *"Flaxedil" (Gallamine triethiodide) May Baker.*

This is also a muscle relaxtant which blocks impulses at the neuro-muscular junction. Neostigmine or Prostigmine is a specific antidote.

(d) *Morphine hydrochloride :*

A hypnotic which causes depression of the central nervous system. Nalorphine hydrobromide is a reliable antidote.

(e) *Chlorpromazine* and *Perphenazine* were used as tranquilizers.

Experimental Animals.

(i) *Blue Wildebeest :*

At the onset of our experiments on the immobilization of wildebeest no reference could be found in the literature regarding the optimum dosage rates of Scoline or Flaxedil for these animals.

Workers like Harthoorn et al (1960) reported that they were difficult patients and this became abundantly clear to us when Scoline was injected into them. As shown in the table a total of 15 wildebeest were shot with darts containing Scoline. Six cases resulted in the death of the animal involved, two animals could not be found subsequently and seven were successfully immobilized.

TABLE I

Succinyl Choline Chloride administered to Wildebeest by means of the Crossbow and Projectile Syringe.

No.	Sex	Total Scoline in mgm.	Est. bodyweight in lbs.	*Actual bodyweight in lbs.	Time to collapse in minutes	Time to recover in minutes	Time died after injection in minutes	Dose mgm./lb.
1	Young ♀	75		369	2½		20	.203
2	Adult ♂	80		513	2½		15	.155
3	Adult ♂	37.5		516	5		23	.126
4	Adult ♂	35		621	6		25	.056
5	Adult ♂	30	530		?		17	.056
6	Adult ♀	30	550		11	30		.054
7	Adult ♂	30	520		—	—	—	.057
8	Young ♀	10		294	4½	45		.034
9	Young ♀	10		294	4½	26		.034
10	Adult ♂	32.5	650		23½	40		.05
11	Adult ♀	25	500		8	—	25	.05
12	Adult ♂	20		556	5½	30		.035
13	Adult ♂	20	560		9	35		.035
14	Adult ♂	20	560		10	30		.035
15	Adult ♂	20	570		—	—	—	.035

* These animals were actually weighed in the field by means of a portable platform scale.

Of the seven animals that were immobilized and recovered successfully, two had had an overdose (No. 6 & 10), but for some reason unknown to us, they did not absorb the full dose injected into them. It is essential to use barbed needles otherwise the animal may shake the syringe free before the full dose is injected.

A post mortem examination was conducted on the animals that had died and revealed excessive pulmonary oedema and regurgitation of rumenal contents. The addition of atropin (4 mgm/100 lb.) helped to counteract the pulmonary oedema and the marked salivation. It is also important to keep the animal on its brisket and to lift the fore-quarters. This prevents bloat, inhalation of rumen contents and relieves the pressure of the rumen on the partially affected diaphragm, thereby fascillitating respiration.

The effective dose of Scoline seems to be in the region of .034—.035

mgm/lb. Since our initial attempts with Scoline on the wildebeest, Talbot and Lamprey (1961) reported on similar experiments on wildebeest in East Africa.

The effective dosage rates used by them seem to be slightly lower than our own. It seems possible that quite a number of factors may be responsible for this variation, such as physical state of the animal, nutritional states, difference in syringe mechanisms etc.

(ii) *Impala :*

Impala were successfully immobilized with Scoline at a dosage rate of .16 mgm/lb. —the same as for Uganda Kob, (Harthoorn et al 1960). The impala seems to tolerate the drug much better than the wildebeest.

Flaxedil was also used on this species, and appeared to be quite safe. Out of a total of 7 impala, the dosage rates varied from 60 mgm—150 mgm in the adult ram, without any casualties arising. The antidote, Prostigmine, had to be administered in a total dose of 150 mgm. With Prostigmine given intravenously (1 mgm/100 lb.) the animals recovered completely within $2\frac{1}{2}$ minutes. The enzyme "Hyalase" was added to each dose of Flaxedil, and the time before paralysis set in varied from $6\frac{1}{2}$ to 16 minutes. Without the antidote the animals remained paralysed for a period of 45-72 minutes. One animal was given 'Trilafon' (Perphenazine) as a tranquilizer after it went down, and remained immobile for 3 hours.

Marking of Animals :

We employed various methods for marking the horns of impala so that they could be identified at a later date. We started off by fitting coloured plastic tubing around the horns, but it did not last very long before it was rubbed off. In other cases we wrapped several layers of coloured plastic adhesive tape around the horns and also sprayed the horns of some with 'Aerolac' spray paint. The paint lasted for 2-3 months and then started to wear off. The plastic adhesive tape holds the highest promise as a marking device. After a period of 8 months, it is still clearly visible and the animal can be recognised at a considerable distance.

(iii) *Hippopotamus :*

Both Flaxedil and Scoline were used in our attempts to capture live hippopotami for Addo National Park, but without satisfactory results. One animal was successfully immobilized with Scoline but died in transit whilst it was moved to a camp at Skukuza. The main objection to the use of Scoline is that it is very difficult to judge the correct weight of such a large animal in the water, and with a drug where the safety margin is so narrow, it is extremely difficult to calculate an effective but safe dose. Harthoorn succeeded in immobilizing hippopotami with Scoline as well as with Flaxedil. At the time of our first abortive attempts to immobilize hippopotami, the capacities of our syringes were too small to carry sufficient Flaxedil to affect an animal of round about 1000 lbs. bodyweight. We were also of the opinion that a paralysing

drug is dangerous to use on animals in deep water. We then resorted to a mixture of drugs which were used with considerable success by Harthoorn and Natal Parks officials for immobilizing and capturing White Rhinoceros. The mixture consists of 0.5 gm Morphine hydrochloride, 50 mgm Hyoscine hydrobromide and 250 mgm Chlorpromazine per 1000 lb. bodyweight. Mr. Van Rooyen supplied us with special 5 and 10 cc. capacity syringes, because the total volume of this mixture is also about 5 cc. for a 1000 lb. animal. With this mixture we succeeded in capturing four hippo, an adult male and female and a young bull and heifer. The adult male subsequently escaped from captivity at Skukuza, much to our chagrin.

The technique employed for immobilizing and capturing hippopotami was briefly as follows :

One of us (U. de V. P.) who did the shooting with the crossbow, usually stalked up to the hippos, where they lie dozing out of the water on a sandbank, to a distance of 50-60 yards. A suitable animal was selected and the projectile containing the drug fired into it. This procedure is most profitably reserved for the winter months, and then during the early hours of the morning when the water is cold. The hippo's sense of hearing is, however, very acute and one has to be extremely careful in approaching them.

During the warm months they are hardly ever found out of the water. We therefore had to drive them, by means of a net across the river, to shallow water so as to expose at least part of the body before shooting.

After the drug mixture had been administered, it took about 30 minutes before the first signs of reaction could be noticed. The stricken animal usually gave notice of the drug taking effect by emitting a peculiar grunting noise. The onset of the reaction is very slow and it was only possible to handle the animal after $1\frac{1}{2}$ to 2 hours had elapsed. The drugged animal was then separated from the others and hauled out with the net onto the river bank. As a precautionary measure Nalorphine hydrobromide was administered in the requisite dose, and the animal was then crated, loaded onto a lorry and moved to a small camp.

Transportation of the animals :

The whole object of our attempts to capture hippopotami alive centered on the re-introduction of these animals to the Addo National Park in the Eastern Cape, in which area the last hippo was shot close on 100 years ago. (The last surviving hippopotami disappeared from the Eastern Cape round about 1895). We, therefore, had to transport the animals by road to the Addo National Park, a distance of over a thousand miles, and release them in the Caesar's Dam.

After the animals were caught in the Letaba and Olifants Rivers, they were moved by road over a distance of 100 miles to our headquarters at

Skukuza. There they were kept and fed in small camps provided with pools in which they could wallow.

We found that after the animal had received the injection of Nalorphine hydrobromide, it was able to rise to its feet and could be pushed into the crate. About 15 minutes after the reaction to the Nalorphine they fall into a deep sleep that lasted for the best part of 12 hours, and we had no difficulty in the transportation from the river to the camps. When they woke up, they were perfectly normal, went into the water and took their food regularly during night time.

At the time of transportation from Skukuza in the Kruger National Park to Caesar's Dam in the Addo Park, two of the hippo had been in the camps for a month and the other one (the heifer) for 3 days. The journey lasted 44 hours and the two hippo that were in captivity for a month travelled without any trouble at all. The little heifer was a bit restless, but after the administering of a tranquilizer (Perphenazine) she also settled down surprisingly well. Each animal received a shower of water at frequent intervals, and they were fed and watered regularly on the road. Their respiration became accelarated and they yawned when the convoy crossed the Highveld — propably as a result of the lowered atmospheric pressure — but soon came back to normal as we approached Pretoria.

As a precautionary measure the animals were treated with Hydrocortisone and antibiotics to counteract possible stress and secondary infection. Although it was a long and tiring journey, the three hippos reached and settled down in their new home without any ill effects.

Resumé.

Initial experiments conducted in the Kruger National Park on the immobilization, marking and translocation of wild animals are described. The equipment and techniques employed are expounded and dosage rates for various drugs used on blue wildebeest, impala and hippopotami are provided. The successful translocation of three hippopotami from the Kruger National Park to the Addo National Park in the Eastern Cape (over a distance of 1000 miles) during November 1961, receives specific mention.

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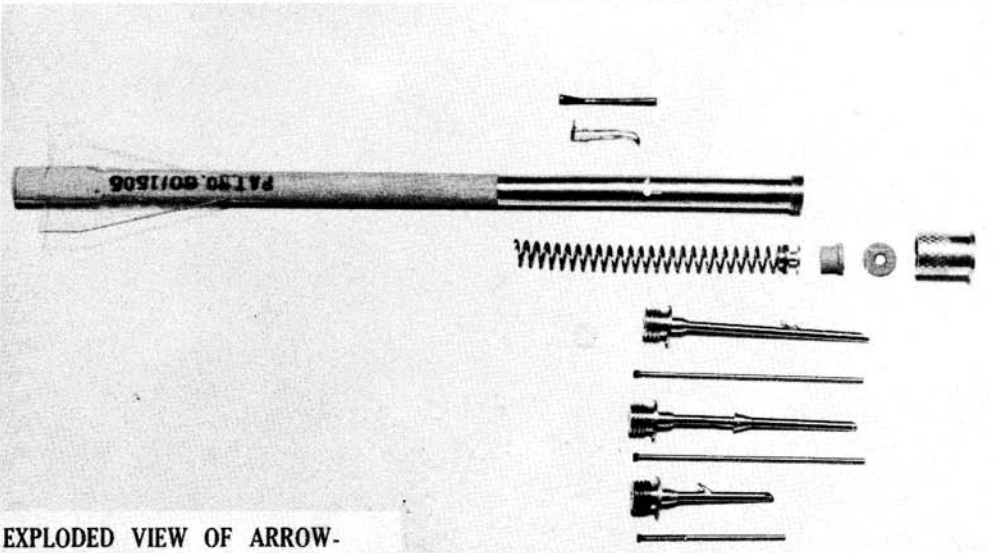
GETTING EQUIPMENT READY
Photo: R. TIBBS



EXPLODED VIEW OF ARROW-SYRINGE AND 3 DIFFERENT NEEDLES Photo: R. TIBBS.

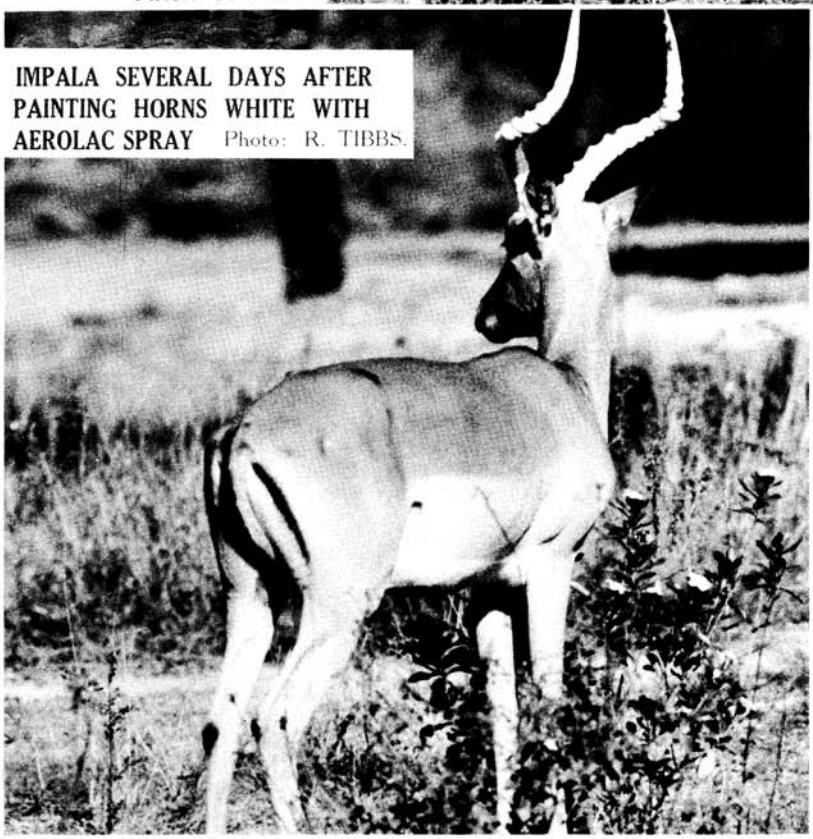
CROSSBOW IN THE PROCESS OF BEING COCKED

Photo: R. TIBBS.

IMPALA HIT IN HINDQUARTERS, SHOWING ARROW IN POSITION

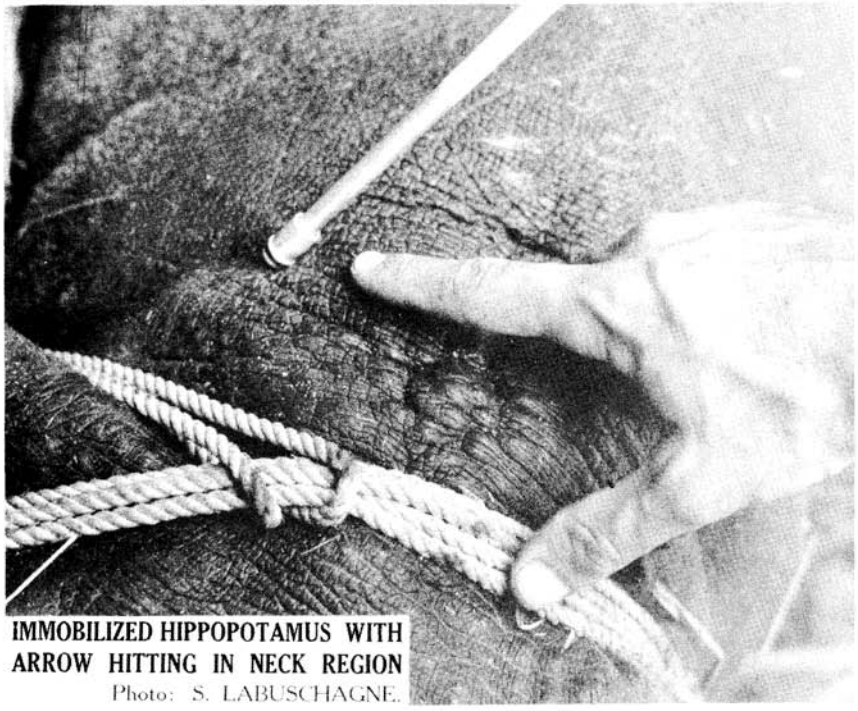
Photo: R. TIBBS.

IMMOBILIZED IMPALA MARKED WITH YELLOW PLASTIC TUBING ROUND ONE HORN
Photo: R. TIBBS.

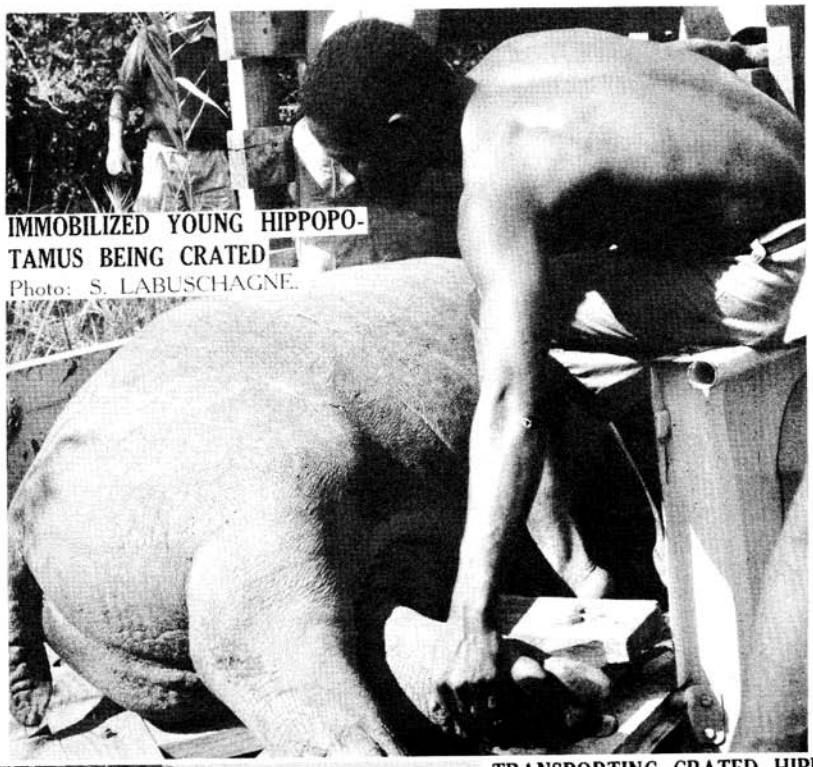


IMPALA SEVERAL DAYS AFTER PAINTING HORNS WHITE WITH AEROLAC SPRAY Photo: R. TIBBS.

HIPPO BEING REMOVED FROM RIVER Photo: R. TIBBS.

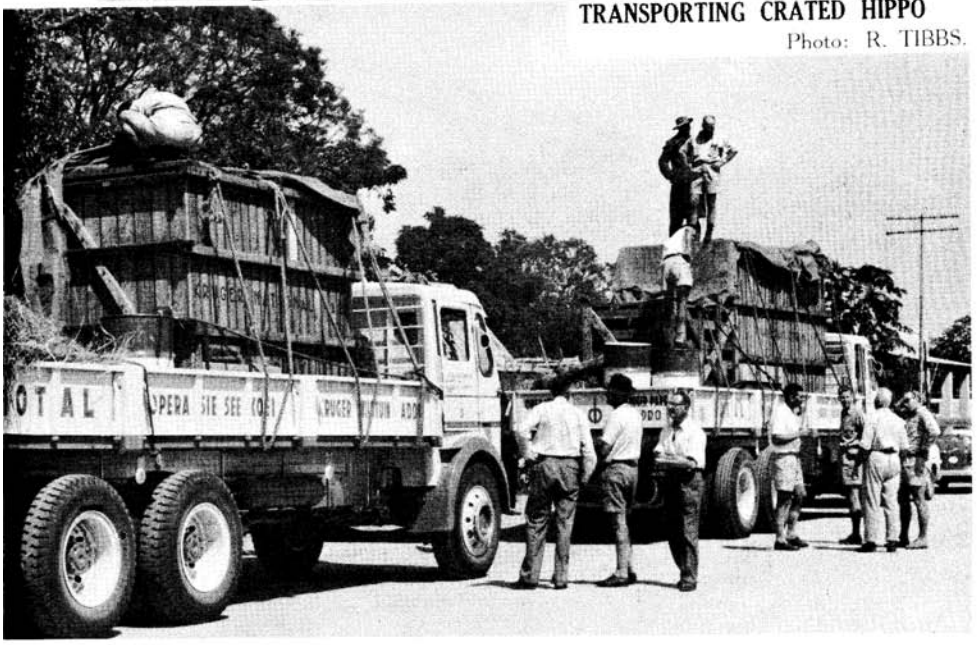


IMMOBILIZED HIPPOPOTAMUS WITH ARROW HITTING IN NECK REGION
Photo: S. LABUSCHAGNE.



IMMOBILIZED YOUNG HIPPOPOTAMUS BEING CRATED

Photo: S. LABUSCHAGNE.



TRANSPORTING CRATED HIPPO

Photo: R. TIBBS.

UNLOADING HIPPO AT ADDO ELEPHANT NATIONAL PARK

Photo: R. TIBBS

RELEASED AT HER NEW HOME

Photo: R. TIBBS.

REFERENCES

1. Beuchner, H. K., Harthoorn, A. M. & Lock, J. A. (1960). Immobilizing Uganda Kob with Succinyl choline chloride. Canadian Journ. of Comp. Med. Vol. 24 No. 11.
2. Beuchner, H. K., Harthoorn, A. M. & Lock, J. A. (1960). The immobilization of African Animals in the field, with special reference to their transfer to other areas. (U.S. Translocation). Proc. Zool. Soc. Lond. Vol. 135, Part 2, page 261.
3. Beuchner, H. K., Harthoorn, A. M. & Lock, J. A. (1960). Recent Advances in field immobilization of large mammals with drugs. Trans. 25th North American Wildlife Conference.
4. Beuchner, H. K., Harthoorn, A. M. & Lock, J. A. (1960). Control of African Wild Animals. Nature, Vol. 185, No. 4705, page 47.
5. Carter, B. (1961). Progress in drugging technique. Wild Life. Vol. 2. No. 4, page 9.
6. Grzimek, M. & B. (1960). A Study of the game of the Serengeti plains. Zeitschrift für Säugetierkunde. Band 25.
7. Harthoorn, A. M., Lock, J. A. and MacKeand, J. (1960). Translocation of Wild Animals as a means of Game Control. Nature, Vol. 187, No. 4736, page 518.
8. Page, J. (1960). Personal communications.
9. Player, I. (1961). Personal communications.
10. Talbot, L. A. and Lamprey, H. F. (1961). Immobilization of free-ranging East African Ungulates with Succinyl choline chloride. The Journ. of Wildlife Management Vol. 25, No. 3. page 303.
11. Van Rooyen, G. L. (1961). Personal communications.