

# Capture of the White (Square-Lipped) Rhinoceros *Ceratotherium Simum Simum* (Burchell) with the Use of Drug Immobilization Technique

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## SUMMARY

The capture of the white (square-lipped) rhinoceros *ceratotherium simum simum* (Burchell) by the drug immobilization method is described. Details are given of the drug doses and the reactions of the twelve animals immobilized.

The value of this method of capture is discussed, especially in relation to the preservation of rhinoceros by moving from contested areas.

A method by which rhinoceros could be captured safely and inexpensively has been urgently required in Africa. The overall population of both black rhinoceros, *Diceros bicornis*, and the white (square-lipped) rhinoceros, *Ceratotherium Simum*, has been dwindling rapidly. Considerable numbers of these animals are poached annually, especially in areas outside the game reserves. Further losses are sustained when they come into conflict with expanding settlement. Many deaths could be prevented if rhinoceros on land required for clearing and development could be removed to game sanctuaries.

Black rhinoceros have been immobilized successfully by the use of gallamine triethiodide (Flaxedil)\* to rescue them from the islands of the Kariba Lake (1). This method of immobilization was not feasible when used on free-roaming rhinoceros in bush country (2).

As a result of laboratory experimentation, an immobilizing mixture was evolved that would put cattle down on their briskets for long periods of time, without destroying the righting reflexes and without

materially affecting respiration. As the action of the principal drug used was readily reversible, the state of immobilization could be terminated at any time by injection of the appropriate antidote. The wide margin of safety and lack of effect on essential body mechanisms such as respiration, commended its use for the capture of rhinoceros.

The purpose of this exercise was to test the possibility of using the drug immobilizing technique for the capture and subsequent relocation of the Southern white rhinoceros, *Ceratotherium Simum simum* (Burchell).

## Materials Used

The drug dose was delivered to the animal by means of a projectile syringe. (3) Syringes of 10 and 18 ccm. capacity were used, the latter being constructed for this particular purpose. The needles were two inches long with a barb near the base. A reinforcing piece affixed along the entire length of the needle and embedded into the nosepiece of the syringe gave the necessary support to the needle.

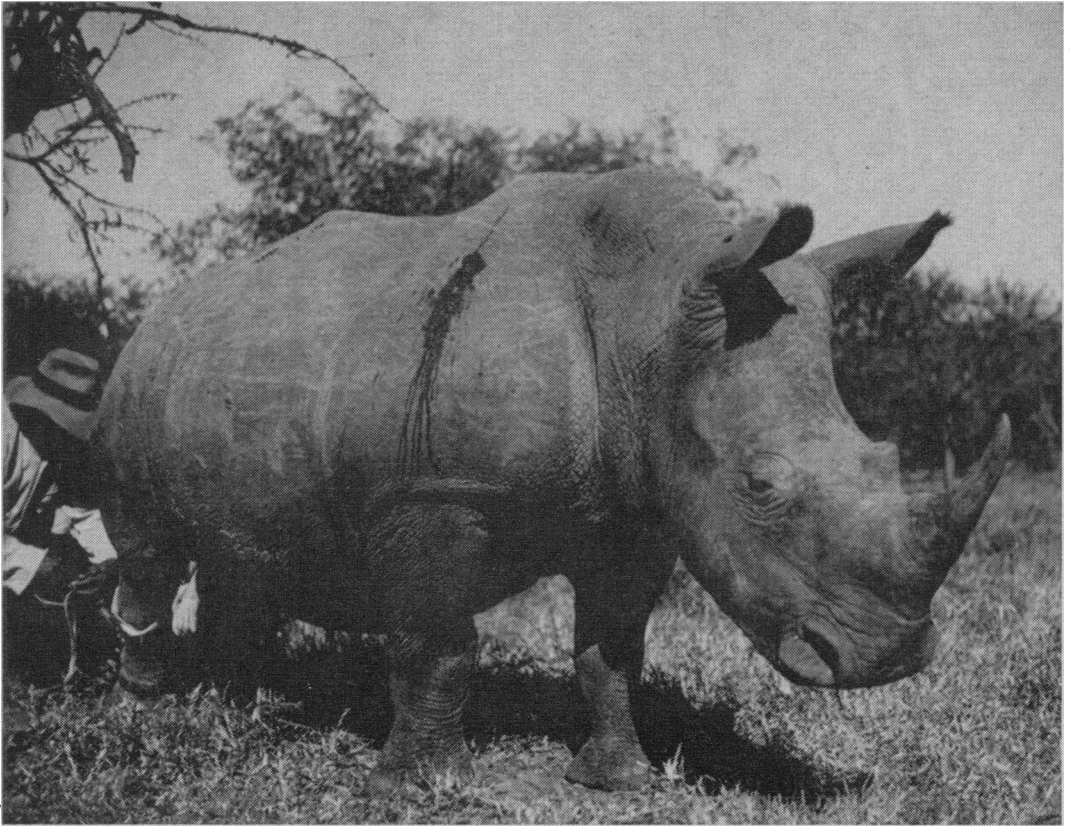
## Drugs used for Capture:

Five drugs were used to capture rhinoceros by immobilization and one for resuscitation. These were as follows:

- (i) diethylthiambutene hydrochloride (Themalon)\*\*
- (ii) morphine hydrochloride, B.P.
- (iii) 1-(1-phenylcyclohexyl) piperidine monohydrochloride (Sernyl)\*\*\*
- (iv) hyoscine hydrobromide, B.P.
- (v) chlorpromazine hydrochloride Largactil)\*\*\*\*

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\* May and Baker Ltd., Dagenham, England



White (square-lipped rhinoceros)

(vi) nalorphine hydrobromide (Lethidrone)\*

Three of the first four drugs were used in combination to form the immobilizing mixture, (see Table II) Nalorphine was used as an antagonist and antidote. Chlorpromazine was used as a tranquilizer during transportation after capture and, on one occasion it was used as an adjuvant to the immobilizing drug instead of phenylcyclohexyl piperidine.

The principal drugs, diethylthiambutene and morphine, are narcotics which are capable of 'fixing' the rhinoceros in a state of narcosis. In this state the animal is unable to run or walk in a self-determined direction, loses the sense of aggression and the ability to co-ordinate all but the simplest actions. There appears to be little sensation of pain and fear, but a sensitivity to noise. Breathing and other bodily functions appear to be almost unaffected. Righting reflexes are often maintained especially

under medium or light dosage. The animal is capable of recovering unaided at the optimal dosage. Both drugs are readily antagonized by nalorphine. Diethylthiambutene has considerable advantage over morphine in being readily soluble in high concentration (40%) at ordinary temperatures.

Phenylcyclohexyl piperidine monohydrochloride, in 2.5% solution, was used as a vehicle to dissolve the main drug and as a hypnotic to ensure a smooth induction of narcosis. Slightly higher doses than those used are desirable but limitations were set by the size of the syringe and the concentration in which this drug was supplied. A stronger solution enabling a final concentration of 5% to be used, would make it possible to use a somewhat higher dosage. Its quick absorption ensures a rapid onset of hypnosis and thus a reduction of the interval between injection and immobilization.

Hyoscine, a cerebral depressant, was used for its amnesic as well as its parasympatholytic properties. As such, it was an important constituent of the drug mixture.

\*\* Burroughs, Wellcome & Co. Ltd., London.

\*\*\* Parke, Davis & Co., Michigan.

\*\*\*\* May & Baker Ltd.

**Table I — The reaction of rhinoceros to injection and the time interval between injection and immobilization**

Animal No. and Sex	Estimated Weight (lbs)	Reaction to injection	Immobilization Time (minutes)	Antidote (Nalorphine)**	Recovery
1. F.	1,700	Slow Trot	15	400+600 mgm.	Delayed
2. M.	1,500	Fast Trot	8	400+600 "	Delayed
3. M.	4,500	Walk. 300 yds.	8	200+1300 "	Uneventful
4. M.	4,500	Ran	60	None	Rapid
5. M.	1,500	Ran	12	200+600 "	Slow
6. F.	2,700	Ran	20	200	Immediate
7. M.	2,700	Ran	15*	None+200 "	Immediate
8. M.	2,500	(needle broke) walked 200 yds	18	100+600 "	Immediate
9. F.	2,000	Ran	25	200+600 "	Immediate
10. M.	4,500	Ran	6	600+900 "	Slow
11. F.	2,500	Slow run	12*	200+600 "	Immediate
12. F.	3,000	Ran	25	100+600 "	Immediate

\*Standing

\*\*First dose to assist recovery; second dose prior to crating.

*Drug used during Translocation:*

The five animals moved were given varying doses of chlorpromazine. This tranquilizer drug had proved most successful in alleviating apprehension, preventing struggling during transportation, inducing rapid acquiescence to capture conditions, and to early acceptance of food and drink. It has previously been used during translocation of antelope, giraffe and black rhinoceros.

During this exercise, it became plain that heavy doses of tranquilizers were necessary if an animal was to be crated immediately on capture. Also, the immobilizing drug should be partially or completely antagonized and its action substituted by that of a tranquilizer. Whereas

the animal under the influence of opiates is extraordinarily tractable under most conditions, the bulls in particular will fight if confronted with a solid obstacle in the path of advance. A dose of chlorpromazine of approximately 0.25 mg. per pound body weight, in addition to what has already been given in the immobilizing dose, will prevent this tendency and induce the animal to lie down in the crate. This is of particular advantage when the truck has to cover rough country such as stream beds before it reaches the main track. There appears to be no disadvantage to administering chlorpromazine in addition to phenylcyclohexyl piperidine when this drug has been incorporated in the immobilizing dose.

**Table II — The type of drug mixture used for immobilization and the dosage administered. The nalorphine (antidote) in the right-hand column is injected by hand. The drugs listed in the other columns are mixed in the same projectile syringe.**

Animal No. and Sex	Hypnotic*	Amount (mgm.)	Narcotic	Amount (mgm.)	Hyoscine (mgm.)	Nalorphine Injected (mgm.)
1. F.	Sernyl	350	Morphine	1,250	150	1,000
2. M.	Sernyl	350	Morphine	1,250	150	1,000
3. M.	Sernyl	350	Morphine	1,250	100	1,500
4. M.	Sernyl	175	Morphine	500	60	None
5. M.	Sernyl	200	Morphine	700	60	800
6. F.	Sernyl	200	Diethylthiambutene	3,000	60	200**
7. M.	Sernyl	200	Diethylthiambutene	3,000	60	200
8. M.	Sernyl	240	Morphine	830	80	700
9. F.	Sernyl	240	Diethylthiambutene	2,000	50	800
10. M.	Sernyl	350	Morphine	1,250	150	1,500
11. F.	Sernyl	175	Morphine	625	60	800
12. F.	Chlorpromazine	500	Morphine	500	60	700

\*All those moved (Nos. 6, 7, 8, 11 and 12) were given more chlorpromazine.

\*\*Another 200-300 mgm. nalorphine given on arrival at release point after journey.

## Results

The results of the drug immobilization of twelve rhinoceros are given in detail in Tables I and II and in the review of the individual cases given below. All the rhinoceros that were injected properly became immobilized, showing that there is a wide lower margin besides the upper margin of tolerance. Where they failed to go down there was, in every case, a reason, such as the syringe falling out almost immediately, or, in a few cases, the syringe striking a rib. All the twelve rhinoceros immobilized recovered. The preponderance of these were taken outside of a game reserve.

### Review of Cases:

- No.1 The dosage given was far higher than necessary for immobilization. The amount of antidote given was initially far too low, and the full dose was not given till about six hours after partial recovery. The amount of hypnotic tranquilizer given was too larger for the size of the animal and, acting together with the other drugs, induced a state of fairly deep narcosis.
- No.2 This animal was only taken due to over estimation of its weight. Here also, the double size syringe used incorporated too much hypnotic. The doses of both the tranquilizer and the narcotic drug were greatly in excess of that later shown to be necessary for the weight of animal and were, in fact, the identical doses that immobilized a fully grown bull in eight minutes.
- No.3 From its measurements and the known weight of a bull, this animal must have weighed about 4,500 lbs. The speed (8 minutes) with which it became immobile was remarkable and confirmed the impression gained from Nos. 1 and 2, that the dosage rate per pound could be greatly decreased. The dose was identical to that used for Nos. 1 and 2.
- No.4 This bull was approximately the same weight as No.3. Due to inexperience and difficult country, the weight was judged at 2,000 lbs., only a fifth of the dose administered to Nos.1-3 was given. This animal was ataxic and disinclined to move after forty minutes and went down in one and a half hours, remaining down sufficiently long to be ear-tagged.
- No.5 Body weight was over-estimated as this animal probably only weighed 1,500 lbs., although estimated to weigh 2,000 lbs. He remained very sleepy in spite of antidote and was disinclined to walk. Left for two hours and on our return was seen walking with a cow.
- No.6 This animal was almost immobilized in twenty minutes and on its brisket in twenty five. An antidote was probably unnecessary and after the administration of a small amount only, the animal rose and started to walk off. A tranquilizer had to be given in quantity as the arrival of the crate was delayed.
- No.7 This bull did not go down at first but was found pushing hard against a bush, and remained in that position, sweating profusely, for more than half an hour. On being pulled away from the bush the animal lay down, and was later crated without difficulty.
- No.8 Here again, an optimum light dosage rate was employed. After a very small amount of nalorphine (100 mg.) the animal rose and had to be 'amused' for nearly two hours till the crate arrived. Ear tags placed while the animal was standing induced no reaction whatever, and the bull walked into his crate with virtually no coercion.
- No.9 This young cow was led for 300 yards out of a stream bed by the horn, after the administration of 200 mg. antidote. It proved possible to lead the animal exactly where required and without difficulty. Ear tags, penicillin, more tranquilizer and a final dose of antidote were administered while the animal was standing.
- No.10 No.10 was a mature bull which went down in fifteen minutes after a full dose. He was too large to transport with current equipment and was released. This bull died later from a fall from a cliff and illustrates a hazard that faces all animals that are released after immobilization, i.e. death from predation or misadventure before all faculties are fully recovered.
- No.11 This half-grown cow did not go

**Table III — A comparison of the immobilizing dosage rates, per pound body weight, for various animals captured**

Rate of dosage	Sernyl	Morphine (or) Diethylthiambutene	Hyoscine (mgm. per 100 lb.)	Time for Immob. in minutes	Ref. to Animal No.
LOW	0.04	0.11	1.3	About 60	No. 4
LOW	0.07	1.11	2.2	20 + 15	Nos. 6 & 7
MEDIUM	0.13	0.47	4.0	12	No. 5
HIGH	0.23	0.83	1.0	8	No. 2

down but was found standing after a short run of 1½ miles, and after twelve minutes. The syringe was removed from the shoulder while the animal was standing followed by the administration of tranquilizer and of antidote. Later it was possible to lead this cow to a better stretch of ground to facilitate crating.

No.12 This three-quarter grown female rose immediately on being given antidote and set off for thick bush. The hind legs were hobbled to prevent escape and more tranquilizer was administered before crating.

## Discussion

The doses administered varied widely, as it was necessary not only to test the effectiveness of the immobilizing drug mixture, and to know its degree of safety, but to estimate the upper and lower dosage limits, (See Table III) We thus determined the feasibility of this method for the capture of numbers of rhinoceros by game rangers who have no specialized knowledge of pharmacology or physiology.

Definite recommendations as regards dosage rates cannot be made on the basis of twelve animals, especially as two immobilizing drugs were used in the mixtures. The results indicate, however, that with any of the combinations used, the safety margin is wide, and that much greater latitude exists than with the use of muscle relaxants in other species, such as gallamine triethiodide in black rhinoceros, (2).

From Table III it can be seen that the difference between the highest and lowest dosage of morphine is nearly eightfold. To this difference should be added a nearly sixfold increase in the hypnotic. This is a far wider margin of safety than is necessary to cover mistakes in judging weight, even in rhinoceros which have proved particularly difficult to assess accurately. Us-

ing a medium dosage rate (Table III) it is only necessary to distinguish between half-grown calves, immature and mature animals. In fact, a fully mature animal and a small calf can be confused without causing fatality. As examples: No.2 when estimated weight was 1,500 lbs., and No.3 estimated weight 4,500 lbs., received the same high dosage rate that immobilized the latter in eight minutes.

After rising, the animals are curiously tractable. Half-grown animals have been led by the horn for several hundred yards. Projectile syringes have been removed from the unrestrained and standing animal. (Ear tags have been placed when the rhinoceros was standing and unroped; measurements have been taken; penicillin, tick-grease and tranquilizer have been administered.) The rhinoceros that were crated, walked into their crates with very little coercion.

As the action of the main drugs (morphine and diethylthiambutene) can be reversed by the use of an antidote, the ensuing rapid recovery prevents the self-inflicted damage that is reported to be a marked feature of the prolonged recovery phase from immobilization with soporific or anaesthetic drugs. By judicious injection of nalorphine, the main immobilizing drug can be antagonized and then replaced with tranquilizer, which is injected when the antidote is seen to take effect.

The rhinoceros may be caught while causing them little distress, and moved at once for more than a hundred miles. One cow rhinoceros, on arrival at its destination only six hours after capture, refused to leave the trucks, crate and personnel and could be left behind only by rapid driving. The attitude of the animals suggests that the experience is not unduly frightening to them.

The bad bruising which was a marked feature of the capture of white rhinoceros by conventional roping seems to be largely

avoided using this drug-immobilization method.

It would appear that the capture of white rhinoceros by the drug method has the advantage of gentleness to the animal concerned and, from the point of view of the captors, a reduction in expense by allowing the use of lighter material for capture and transport. A considerable reduction in costs is also achieved by obviating the period of captivity normally necessary for taming before the rhinoceros can be crated for transport.

It is expected that the same drugs as used on the white rhinoceros will be equally suitable for other species of the same family. Since writing, a black rhinoceros *diceros bicornis bicornis* (Linnaeus) has been successfully caught by the same method and the use of one of the drug combinations discussed in this paper.

### Conclusions

On the results obtained with the use of the three drug combinations on twelve rhinoceros, only tentative conclusions may be reached. These are as follows:

- (a) All three mixtures of drug can be safely used for the immobilization for capture of the white (square-lipped) rhinoceros.
- (b) Diethylthiambutene appears to have the advantage over morphine of being more soluble, less toxic and possessing an action which is more easily reversed.
- (c) Mortality from immobilization by the methods described should be restricted to animals that fall into precipitous places or possibly water. The mortality suffered in this way should be low. The chances of a fall of this nature should be less than from methods involving chasing.
- (d) The expense involved in moving small numbers of rhinoceros by this method is less than if professional trappers are employed. With small numbers, the cost of moving is commensurate with those of normal vehicle running rates. The cost is then restricted to the drug expended and lost, or damage syringes. Capture gun equipment should, in any case, be a stock-in-trade of every game reserve, to assist animals that are snared or otherwise in difficulty.

- (e) The demeanour of the animals caught clearly indicate that very little distress was experienced. The injection itself only caused alarm if the shooter was seen or winded. Catching rhinoceros by the method described seemed to avoid both fear and rage, as well as the damage incurred as a result.
- (f) Damage to the animals is usually negligible. There are no rope galls or deep bruising. The hole left by the needle need not cause concern, especially if it is covered with ointment and penicillin is administered. The drug technique permits immediate crating which must be less painful and damaging than being transported, tied, and lying on the side.
- (g) This method of catching rhinoceros should contribute materially to saving those animals that come in conflict with human interests. It should be within the means of every game park to stock the equipment and drugs required to capture and transport rhinoceros when necessary. The flexibility of dosage of the drugs mentioned should permit their use by Wardens and Rangers without involving extensive knowledge of pharmacology or dosages.

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