INDIA'S RHINO RE-INTRODUCTION PROGRAMME

सत्यमेव जयते

DEPARTMENT OF ENVIRONMENT
GOVERNMENT OF INDIA

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Produced By Department of Environment, Government of India and
Printed at United Printing Press, 69, Najafgarh Road Industrial Area,
New Delhi-110015 Tel. : 539938

उप मंत्री
पर्यावरण
भारत
नई दिल्ली-110011
DEPUTY MINISTER
ENVIRONMENT
INDIA
NEW DELHI-110011

May 26,1984.

FOREWORD

I am indeed happy that this publication on India's Rhino Reintroduction Programme is being brought out at this stage to explain the background and raison d'etre of the whole operation. This is a major step in the field of wildlife management for the region as a whole. An operation of this nature and magnitude has not been undertaken earlier in this region. I am glad that this comes so soon after the adoption of the National Wildlife Action Plan by the Government of India. A lot of imagination, initiative and coordination has gone into the total effort and I am particularly grateful to the Governments of Assam and Uttar Pradesh for the spirit of cooperation displayed by them. The foresight and goodwill shown by the Chief Minister of Assam deserves special mention.

The authors of this publication have been directly involved in the whole operation and have shown what commitment, diligence and tact can achieve. I hope this publication will be of interest to all those who care for this subject.

(Digvijay Singh)

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What is Re-introduction ?

A recent position statement[1] prepared by the IUCN* Species Survival Commission defines 'Re-introduction' as "the international movement of an organism into a part of its native range from which it has disappeared or become extinct in historic times as a result of human activities". The statement goes on to lay down the following five criteria for this purpose :—

(1) Reintroduction is the release of animals or plants of a species into an area in which it was indigenous before extermination by human activities, re-introductions are particularly useful where a species has become extinct due to human persecution, over-collecting, over harvesting or habitat deterioration.

(2) Re-introductions should only take place where the original causes of extinction have been removed or are in the process of being dealt with.

(3) Re-introductions should only take place where the habitat requirements of the species are satisfied. This means that where a species to be re-introduced became extinct in an area because of habitat change, or where significant deterioration

*International Union for Conservation of Nature and Natural Resources (IUCN) established in 1948, is a union of sovereign states, Government agencies and non-governmental organisations concerned with the initiation and promotion of scientifically based action directed towards the conservation and sustainable use of nature and natural resources. Partner of the World Wildlife Fund—International at the World Conservation Centre situated at Gland (Switzerland), IUCN is perhaps the largest scientific and technical non-governmental, international conservation organisation in the world today.

has occurred in the habitat since the extinction, the species should not be re-introduced unless measures have been taken to reconstitute the habitat to a state suitable for the species.

(4) The basic programme for re-introduction should consist of :

— a feasibility study,

— a preparation phase,

— release phase,

— follow-up phase.

a) Study of the ecology of the species should re-assess the relationship the species had with the habitat into which the re-introduction is to take place, and assess the extent that the habitat has changed since the extinction of the species. The change in the species should also be taken into account if they have been captive-bred or cultivated, and allowance made for any changes liable to affect the ability of the animal or plant to re-adapt to its traditional habitat.

b) The attitudes of local people must be taken into account. If the re-introduction of a species that was persecuted over-hunted or over-collected is proposed, an education and interpretive programme or other inducement should be used to improve their attitude to the introduction, if it is unfavourable, before re-introduction takes place.

(5) The animals or plants involved in the re-introduction must be of the closest availablerace or type to the original stock and preferably be the same race as that previously occurring in the area."

The most important difference between 'Introduction' and 'Reintroduction' of a species is that 'reintroduction' has to relate to the former range of the species. This has to be kept in mind when considering India's rhino re-introduction programme.

What then was the former range of the Indian rhino ?

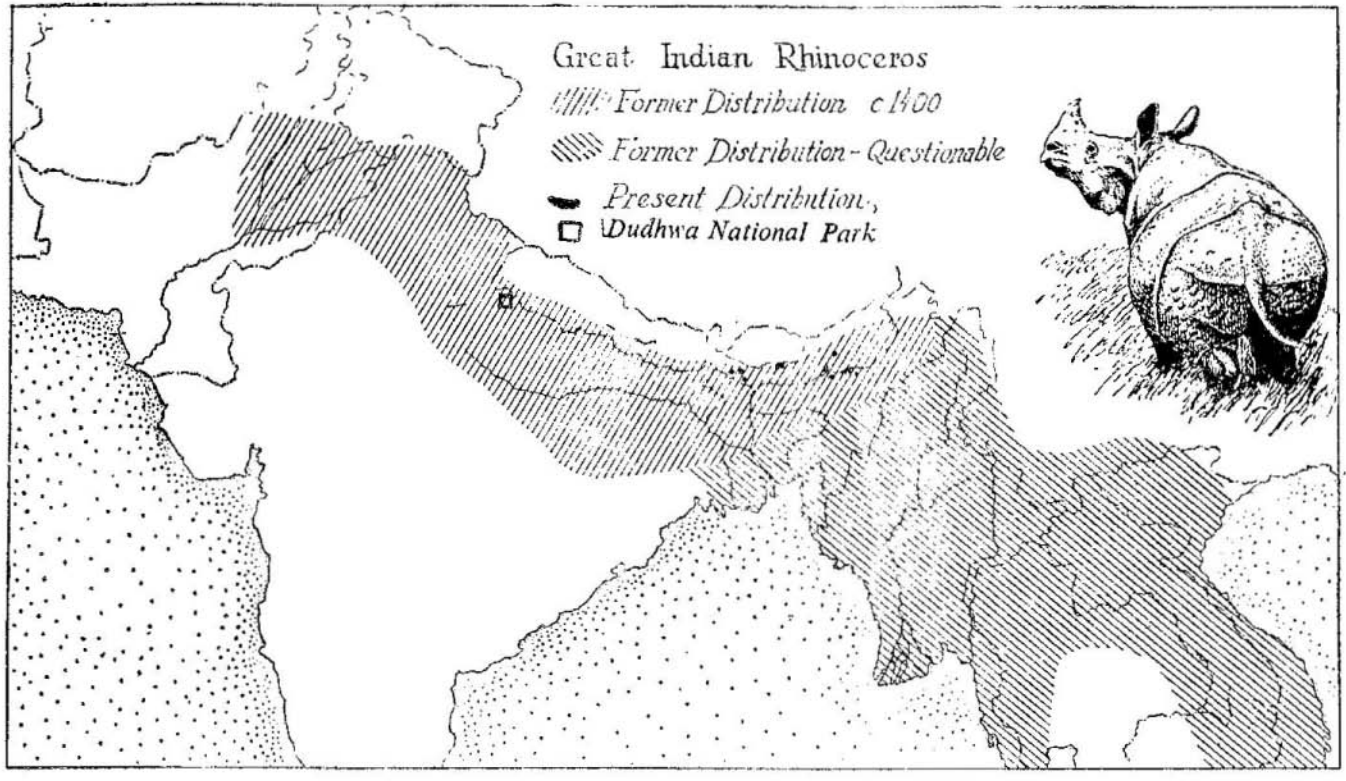
Former Range of Indian Rhino :

> "The rhinoceros.....is a large animal equal in bulk to perhaps three buffaloes .....It is more ferocious than elephant and cannot be made obedient and submissive. There are *masses of it* in the Peshawar and Hashnagar jungles, so too between the Sind river and the jungles of the Bhira country. Masses there are also on the banks of the Saru river in Hindustan. Some were killed in Peshawar and Hashnagar jungles in our wars on Hindustan".[2]

This is how Babur, the founder of the Mughal Empire in India at the beginning of the sixteenth century, described this second largest land animal alive. His famous memoirs, the Baburnamah carries several graphic accounts of rhino hunting as far west as Peshawar and near the Khyber Pass. The Mongol invader, Timurlane, also hunted many Indian rhinos on the frontier of Kashmir around 1398 A.D. Going back about 5000 years, it seems that rhinos were so numerous and conspicuous then in India that they were displayed on special seals made during the Indus Valley Civilization. Some of these seals found at Mohenjodaro (now in West Pakistan) can be seen in the National Museum at New Delhi.

Babur was obviously referring to the Greater One-Horned Rhino (*Rhinoceros unicornis*), the largest and most well known of the three Asiatic species of rhino, now found only in parts of India and Nepal. The other two Asiatic species were also found on the Indian sub-continent until perhaps the beginning of the nineteenth century. However, it is only the Greater One-Horned Rhino, popularly known as the Indian rhino, which has survived the struggle for existence on the sub-continent, though in greatly reduced numbers.

The former range of the Indian rhino was all along the foothills of the Himalayas, particularly the Terai region and the valleys of the rivers Indus, Ganges and Brahamaputra. During the last two hundred years or so, hunting and poaching for sport, horn or hide as well as large scale habitat conversion to agriculture and tea plantations has caused a drastic reduction in the population of the species and now only about 1500 Indian rhino survive in parts of India (about 1200) and Nepal (about 300). Most of the population in Nepal is in the Chitwan National Park, where Andrew Laurie carried out his studies on the ecology of the species (1978)[3]. In India, almost the entire population is in Assam, where the Kaziranga



Map Showing location of Dudhwa National Park.

National Park is the main stronghold with about 1000 estimated; the last count done in 1978 gave a total of 960 animals. The Assam authorities are currently carrying out another count the result of which would be known in due course. However, preliminary indications are that there has been no reduction in rhino population at Kaziranga.

A map giving an idea of the former and present distribution of the Indian rhino is given below :

IUCN/SSC Asian Rhino Specialist Group :

In August, 1979, the Asian Rhino Specialist Group of the IUCN Survival Service Commission (now called the Species Survival Commission) met in Bangkok "to analyse the situation with regard to the three Asian rhino species and to work out action proposals in order to ensure for these species the survival of as many viable population units as possible in suitable areas".[4] As far as the Indian rhino is concerned, the Specialist Group came to the following conclusions:

The Great Indian rhinoceros

The population of this species exceeds 1100, perhaps even 1500 individuals. These animals form two larger and at least six small population units, which presently all thrive due to efficient protection.

The largest unit inhabits the Kaziranga National Park, an area of about 550 sq kms. In Kaziranga, population pressure only has grown high and, as a consequence, also damage done by rhinos to the rice fields bordering the park. On the other hand, the situation of most of population units shows certain risks apart from poaching:

— contact between domestic buffaloes and rhinos and its consequences in the case of epidemic outbreak,

— loss of living space as a consequence of erosion during seasonal flooding,

— loss of food resources due to the spreading of the exotic plants *Eichhornia grassipes* and *Mikania scandens*.

The following efforts therefore are important :

1. To monitor all local population units and to study the consequences of flooding and the impact of *Eichhornia* and *Mikania*.

2. To identify new areas suitable to harbour additional population units of the rhino and to establish such units by translocating rhinos from over-populated areas. This will at the same time reduce friction between rhinos and people, and broaden the basis for the species survival.."

Elaborating the last point, the Specialist Group, headed by Prof. R. Schenkel of the University of Basel (Switzerland), felt that the selection of suitable areas for establishing additional population units of the species should be preferably in the rhino's former distribution range. Its further advice was that "in the preparatory phase, areas in question must be studied as to their habitat; the governments involved must decide on legal and actual protection and give their consent to rhino translocation; the rhinos to be captured and translocated have to be selected. Then capturing, translocation and release procedures will follow and finally monitoring of the translocated rhinos. As Kaziranga is already now overcrowded, a pilot action is urgent to relieve Kaziranga and to acquire experience in translocation. Translocation necessitates a specialized unit, of which the pilot action would be the first effort."

The following interesting remarks on the biology of the Indian rhino, included in the report of the Specialist Group, are also worth quoting :—

Biology of Indian Rhino :

Remarks on Biology:

These remarks are restricted to the main characteristics in which this species differs from the two other Asian rhino species :

—The Indian rhino lives in comparatively open country.

—It is to a large extent a grazier.

—It is a comparatively social rhino species.

—In a suitable habitat, it can reach a rather high population density (e.g. Kaziranga, appr. 1 rhino/0.6 sq km).

— Its individual home range under stable living conditions is much smaller than in the other Asian rhino species, yet seasonal or irregular changes of its living space (e.g. flooding or drought) can force migration upon the animal.

— It lies for hours submerged in shallow water or in narrow wallows.

— Defecation again and again at the same spot results in the formation of large dung heaps.

— Females on heat not only release urine at short intervals, but also utter a typical rutting call.

Rhino Sub-Committee Appointed:

Shortly after the meeting of the Asian Rhino Specialist Group, the Wildlife Status Evaluation Committee of the Indian Board for Wildlife* met in New Delhi on 5th November, 1979, and appointed a sub-committee to consider and recommend alternative areas for the translocation of some rhinos from Kaziranga National Park in Assam, where reduction of rhino population was necessary according to the Chief Conservator of Forests, Assam Relevant extracts of the minutes are given in *Annexure I.*

FEASIBILITY PHASE

Ecological Requirements of Potential Area:

The Rhino Sub-Committee got down to business straightaway. First and foremost, it considered the ecological requirements of potential areas for the re-introduction of Indian rhinoceros and established[5] the following main criteria :

**The Indian Board for Wild Life* is the apex advisory body to the Government of India in the field of wildlife conservation. The Board was first set up in 1952. Since 1980, the Board is headed by Prime Minister Smt. Indira Gandhi. The Union Minister of Agriculture and the Union Deputy Minister of Environment are the Vice-Chairmen. The other members are officials, representatives of leading non-governmental organisations and eminent naturalists, ecologists and environmentalists. The Board has a Standing Committee (also headed by the Prime Minister) and three Expert Committees on Flora, Zoos and Birds.

(i) Diversity of habitat, including flooded grassland with a variety of food plants.

(ii) Ample shade and water for wallowing (and drinking), especially in the hot season.

(iii) Protection from all forms of human disturbance and harrasment, including pollution, poaching and the introduction of disease via domestic stock. It is equally important that conflict with cultivation adjacent to areas of re-introduction be avoided, especially in view of rhino's liking for crops such as paddy and sugarcane.

Prof. Schenkel's Views :

The Chairman of the Sub-Committee, Dr. J. B. Sale*, got in touch immediately with Prof. R. Schenkel Chairman of the IUCN/SSC Asian Rhino Specialist Group, who was luckily on a visit to India. Prof. Schenkel visited Assam and in his note[6] dated the 4th January, 1980, to the Chairman of the Rhino Sub-Committee confirmed that "from the point of view of species conservation it would be highly desirable to create more local rhino populations in suitable, well protected areas. This has been proposed by the Asian Rhino Specialist Group, of which Mr. Lahan from Assam is a member. All the authorities in Assam responsible for rhino conservation specially also the Chief Conservator of Forests, Mr. Goswami, support the idea." He further suggested that "it should be possible to specially select those rhinos for translocation, which have been in small pockets in permanent conflict with man and are extremely difficult to protect."

In a subsequent report sent to the Director (Wildlife), Government of India, Prof. Schenkel stated that "Dudhwa is the area most suitable for establishing a new local population of Indian rhinoceros. The area is protected, large enough and contains suitable habitat". Prof. Schenkel's full report on Dudhwa is given in *Annexure II*.

**Dr John Benjamin Sale* from U.K. is F.A.O. Specialist in Wildlife Management presently the Chief Technical Advisor to the Wildlife Institute of India. He has more than 25 years experience in Africa and Asia on Wildlife research and management and has specialised in drug immobilisation, radio-tracking and aerial census of large mammals.

Field Trials in Assam :

With a view to establish appropriate capture, handling and translocation techniques and to train personnel in such an operation, field trials were carried out in Assam between 17th January and 12th February, 1980 by Dr. J. B. Sale and Dr. M.H. Woodford (Consultant Wildlife Veterinarian) with the help and full cooperation of the Assam authorities. Five rhinos were successfully immobilised and four of these were transferred to holding sites specially set up for this purpose. These trials successfully demonstrated the usefulness of the drug immobilisation technique in the capture of Indian rhinos. Capture and transport procedures (upto the holding stage) were also developed and some training was imparted to field personnel and veterinarians. A full report on this trial operation was published on 5th March, 1980, and is given in *Annexure III.*

Suitability of Dudhwa assessed :

Vegetation Survey :

Meanwhile, the Rhino Sub-Committee visited Dudhwa to assess its auitability as a re-introduction site. A team of the Botanical Survey of led by Dr. P.K. Hajra was also commissioned to carry out a detailed survey of the vegetation of Dudhwa in relation to its rhino feeding ecology. This detailed study clearly established a number of floral elements common to Dudhwa (U. P.) and Kaziranga Manas (Assam), both of which are excellent rhino habitats. A list of 14 plants (including grasses) eaten by rhinos in Assam were located in Dudhwa. The report published by the Botanical Survey of India is given in *Annexure IV.*

Report of Rhino Sub-Committee :

On the basis of the vegetation survey and other relevant factors, the Rhino Sub-Committee came to the unanimous conclusion that "Dudhwa National Park contains suitable habitat for a population of Indian rhinoceros"[7]. In its report submitted to the Director (Wildlife), Government of India, in July, 1981, the Sub-Committee noted that the Indian rhino were present in this area until the 1870's; the last record being of one shot in Pilibhit District in 1878 (Hewitt, 1938). Relevant extracts from the report of the Sub-Committee with regard to Dudhwa National Park are included in *Annexure V.*.

Dudhwa History

Here, it may be pertinent to mention that the history of the forests of Dudhwa National Park in the Lakhimpur Kheri District of Uttar Pradesh dates back to the second half of the 19th century when these private forests were taken over by the Government and reserved under an Act passed in 1879[8]. These forests were subsequently declared as 'Reserved Forests' under the Indian Forest Act in January, 1937. The first working plan was prepared in the year 1886, which led to some protection to the wildlife habitats. However, on account of the shooting rules and heavy grazing pressures, the status of the forests as well as the wildlife contained therein deteriorated. It was ultimately in 1958 that a sanctuary for swamp deer was constituted in the area. It was called the Sonaripur Sanctuary extending over an area of only 15,766 acres. The area of the sanctuary was extended in 1968 to cover 212 sq. kms. and it was declared as the Dudhwa Sanctuary. The protection measures undertaken in the sanctuary proved beneficial to the swamp deer as well as the other wildlife species and recognising the ecological importance of these forests, the Government of Uttar Pradesh notified an area of 490 sq. kms. under the Wildlife (Protection) Act, 1972, as the Dudhwa National Park, which came into existence on 1st February, 1977. An area of about 123 sq.kms. acts as the buffer zone to the national park, which thus has a total area of about 613 sq.kms. The national park consists of some of the best Sal (*Shorea robusta*) forests in the country interspersed with grass meadow, ponds, lakes and other perennial sources of water. The suitability of such a habitat for wildlife is reflected in the diversity of the fauna and flora in the area.

It is worthy of note that the Rhino Sub-Committee recommended a number of measures to be taken prior to any re-introduction of rhinos in Dudhwa. Most of these related to better management through improved protection and enforcement as well as provision of special staff and equipment and the construction of a trench-cum-fence all round the area selected for the release of rhinos. Accordingly, the matter was taken up at once with the Government of Uttar Pradesh, which was urged to initiate necessary action as early as possible.

IBWL Standing Committee endorses recommendations of Rhino Sub-Committee :

On 19th August, 1981, the Standing Committee of the Indian Board for Wild Life met again at New Delhi under the chairmanship of the Prime

Minister. The report of the Rhino Sub-Committee was placed before the Committee which approved the recommendations contained therein and desired that further action should be taken early.

A Project Implementation Committee headed by the Director (Wildlife), Government of India, was then set up. Meanwhile, the IUCN and WWF-International expressed full support for the project, specially in the context of 1982 being 'The Year of the Rhino'.

PREPARATORY PHASE:

Then followed the preparatory phase spanning the whole of the open season of 1981-82, during which the U.P. authorities took action on the recommendations of the Rhino Sub-Committee. A special trench 3m x 2m × 1.5m was made around the area selected for the release of the rhinos. Subsequently in 1983, this was reinforced by an electric fence devised under the expert guidance of F.A.O. Consultant Robert Piesse from Australia, over an area of about 19 sq kms inside which the rhinos were to be released. This electric fence is far more economical having cost only about Rs. 4,500/- per km., as compared to a trench costing between Rs. 50,000/- to Rs. 75,000/- per 7m. depending on the terrain.

Negotiations with Assam :

While preparations were afoot at Dudhwa the Government of Assam expressed some reservations about the project and called for a closer look at some of the recommendations of the Rhino Sub-Committee. Hence, discussions were arranged between the members of the Rhino Sub-Committee and the representatives of the Assam Government. The Sub-Committee visited Assam and held discussions at Kaziranga and Manas from 6 to 9 December, 1982. This was followed by a visit to Dudhwa on 28th-29th April, 1983, when a team of four experts from Assam also participated to assess the suitability of Dudhwa for the proposed rhino reintroduction. This was followed by meetings at officials' level and then a series of meetings between the Forest Ministers of U.P. and Assam with the Union Deputy Minister of Environment at Delhi and Gauhati during September—October, 1983. Meanwhile, the Standing Committee of the Indian Board for Wildlife met at New Delhi on 13th September, 1983, under the chairmanship of the Prime Minister and strongly endorsed the need for urgent action in the matter, specially in the context of increased incidence of poaching of rhinos in Assam. The Chief Minister of Assam was then approached in this regard. He took

keen interest and finally, after a meeting with the Union Deputy Ministes of Environment at Gauhati on 8-9 October, the Chief Minister gave his approval for making available six rhinos for experimental reintroduction in Dudhwa National Park.

CAPTURE, TRANSLOCATION AND RELEASE OPERATIONS—

Selection Of Capture Area :

Hectic activity followed hereafter. The Government of Assam agreed to provide necessary facilities for the capture and transport of the rhinos inside the State. Pobitara Sanctuary and the surrounding area of Nowgong Forest Division, about 60 kms. from Gauhati, were selected for the capture operation.

A capture team consisting of selected personnel of Assam and U.P. Wildlife Organisations left for the selected area in the first week of March, 1984. The team was led by Dr. J.B. Sale and assisted by two veterinarians, one each from U.P. and Assam.

Between 15th and 21st March, 1984, five rhinos (1 adult, 1 subadult male + 2 adult, 1 subadult female) were captured and placed in the holding stockades, Four of them were nuisance animals living permanently in cultivation. All were captured by darting, using doses of between 1.0 and 2.0 ml Jmmobilon (etorphine and acepromazine mixture, Recketts, U.K.) which was reversed by Revivon (diprenorphine). Three of the rhinos were walked directly into a crate placed immediately in front of them, by administering a small dose of Revivon and guiding them forwards with ropes as resultant recovery from immobilisation took place. The other two had to be transported about 1.5 km. from capture site to crate on a sledge. They were revived after the sledge bearing them had been inserted into the crate. All animals, except one female, quickly settled in the stockades and were eating well after a couple of days.

Transportation :

After about eight days, the five rhinos were re-crated for shipment to Dudhwa and taken by truck to Gauhati airport on the morning of 30th March, 1984. Here they were loaded onto an Aeroflot IL 76 cargo aircraft specially chartered for the operation. The charter was arranged

through the Indian Airlines with necessary clearances from the Directorate General of Civil Aviation. Initial plans to airlift the rhinos from Gauhati to Lucknow or Bareilly could not materialise as the airfields at both these places were not found suitable to take this large and versatile aircraft. The cargo-hold of IL-76, with length of over 25 metres and capacity of over 30 tonnes, is very suited for carrying the rhino crates made to the specifications prescribed by Sale and Woodford (1980) and conforming to the I.A.T.A. regulations for live animal transportation. The aircraft has four overhead wire-rope electric cranes, each of 2.5 tonnes capacity, which are very useful for picking up the crated rhinos directly from the trucks onto the aircraft. The crates were lashed on to individual palletes and held firmly in place during the flight, which hopefully made the journey less strenuous for the rhinos. Three of the animals were given pre-flight sedation (between 10 and 20 ml azaperone) and all behaved well during the 2 1/2 hours flight to New Delhi. After food and water at Delhi (Palam) airport, the crated animal embarked on an 18 hour truck journey to Dudhwa National Park. Immediately on arrival (at night), they were released into individual stockades, where they were cared for by a U.P. team (including veterinarians) who had received special training in Assam during previous months. Freshly cut local grasses were readily consumed.

Release:

After three weeks at Dudhwa, the group (apart from a pregnant famale who resisted captivity and died following a stressful abortion) was deemed fit for release and three of the animals were let out into the specially fenced area on 20th April, 1984. The large bull was held back until the others had settled down and released after radio-collaring some days later.

Early indications are that the rhinos are settling well into the new environment, which has abundant green grasses, shade and water to supply the animals' needs during the forthcoming summer period. The movements of each animal are being monitored daily by a special team set up for this purpose. The release area is under intensive watch and ward under the overall supervision of the Director, Dudhwa National Park. The electric fence has been adequately strengthened and its efficacy as a wildlife proof barrier is under test. The need for constant vigil cannot be over-emphasised however.

The reintroduction operation has evoked considerable interest in the area as outside. The reactions of the local population have so far been

favourable. What happens if and when any of the rhinos stray into the cultivated areas, which would happen sooner or later, remains to be seen. An education and interpretative programme is being mounted for this purpose.

FUTURE PLANS :

Further Releases

Further release of rhinos in Dudhwa will be planned based on the experience with these initial animals. The release of 20-30 animals over a 5 years period is planned to establish a viable breeding population. In this context, the possibility of infusing new blood by getting a few animals of the same species from Nepal is worth exploring. The selected area of about 90 sq. km is considered suitable to accommodate upto 90-100 animals, based on the estimate that a density of 1 rhino per sq km. is quite reasonable.

Research Project :

The rhino reintroduction programme does not end with the translocation and release of a few rhinos in Dudhwa. It is, in fact, the take-off point for the development of an integrated conservation and management programme for the Great Indian Rhinoceros in the country. For this purpose, a Research Project has also been drawn up. The main aim of the research project is to provide objective scientific data as the basis for improved management of the species in India, which will in turn have great significance for the region as a whole. This would include :—

1. Upto-date information on the numbers, distribution and conservation status, of all existing populations in Assam and West Bengal.

2. A detailed study of the ecology of the Kaziranga population and comparison with other populations with particular reference to density, distribution in relation to habitat types, and food supply, local movements, natality, mortality, incidence of disease.

3. The intra-specific behaviour of rhinos, especially adult males, should be monitored and comparison of such social behaviour as male-male fights be made between high and low density populations. Any harmful effects of high density on social behaviour should be described and quantified.

4. A study of the reproductive performance of the Jaldapara and Gorumara rhinos in West Bengal in the light of reported lowered fecundity of these populations.

5. The effect of high rhino density on other species of herbivores should also be studied, e.g. competition at water holes, loss of food supply and competition for shade.

6. An evaluation of possible protected areas for re-introduction within the species' former geographical range (i.e. Assam, West Bengal, Bihar and Uttar Pradesh) paying particular attention to ecological suitability and the quality of protection which could be afforded.

7. Monitoring of the ecology and behaviour of any reintroduced groups, in order to evaluate reintroduction as a management tool in relation to the conservation of Indian rhino.

The research projects will be funded by the Central Department of Environment, while the Wildlife Institute of India will be the nodal agency for its implementation. The project is initially proposed for a period of three years, but would be reviewed after two years to consider the necessity of a further extension. The project headquarters is proposed at Kaziranga National Park in Assam and will cover all existing and potential rhino habitats including Dudhwa, which is the first new home of the Indian rhino. The project report is given in *Annexure VI.*

Viewed in its proper perspective, the return of the rhinos to Dudhwa is an excellent example of Centre-State relations as well as a tribute to the initiative of the Government of India and the spirit of cooperation displayed by the Governments of Assam and Uttar Pradesh. It is also a giant step forward in implementing the recently adopted National Wildlife Action Plan* and should pave the way for more initiatives in the field of wildlife management in India as well as in the region as a whole. No doubt, the ultimate success of the experiment would depend on proper follow-up based on sound scientific inputs, support of concerned governments and the involvement of the local people.

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* The National Wildlife Action Plan is a prospectus of action to be taken in the field of wildlife conservation in India in the coming years. It was adopted by the Government of India in October, 1983. Among the 10 components of the Action Plan is the 'Rehabilitation of Endangered and Threatened species', which includes projects on restoration and reintryduetion of such species in selected areas of their former place of distribution.

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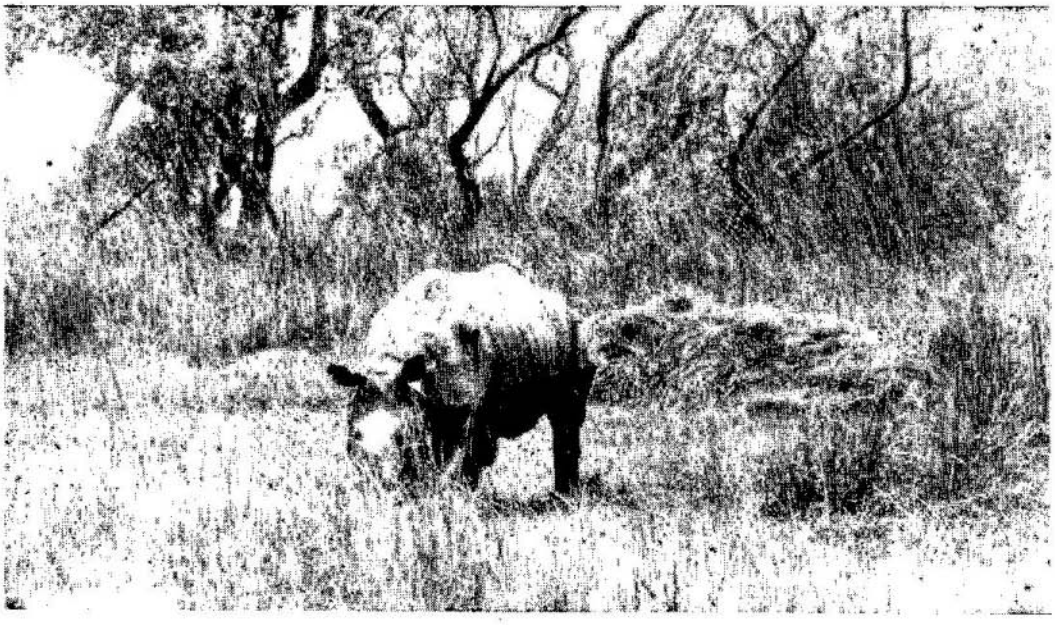
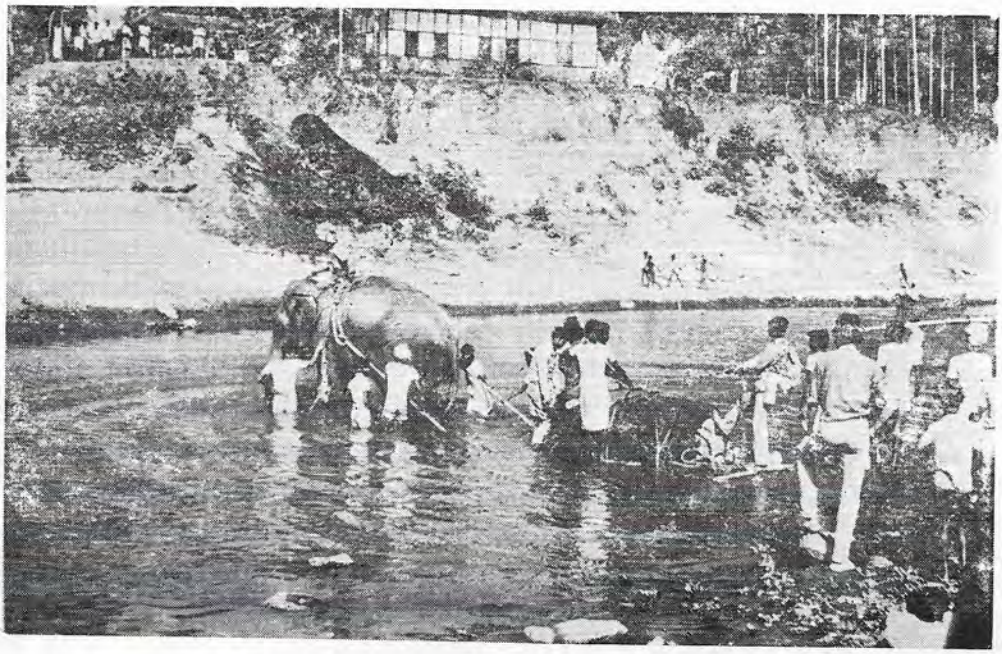


A released Rhino in its new surroundings at Dudhwa National Park.

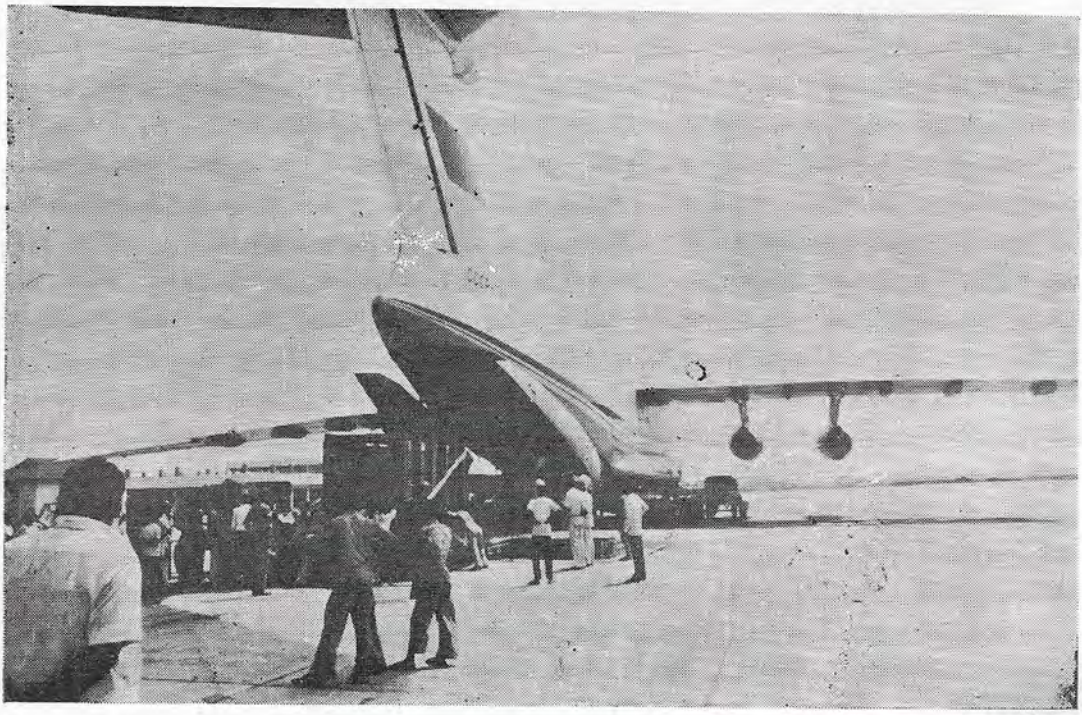
The three-strand electric fence which formed the paddock around the stockades.



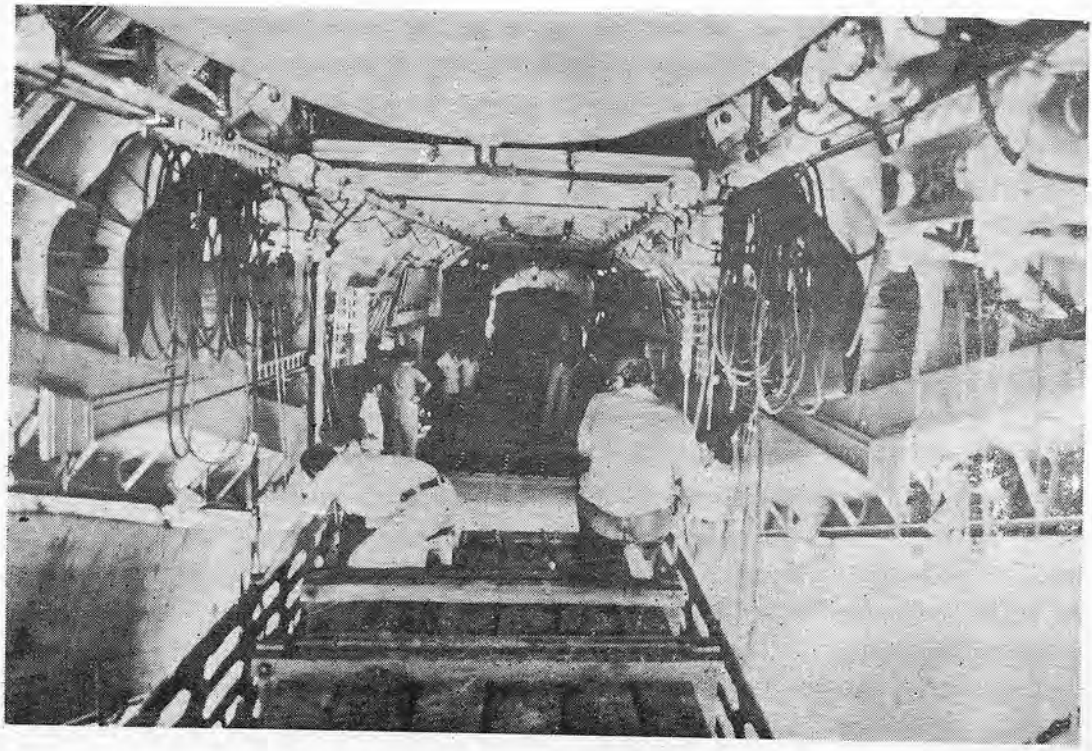
An immobilised Rhino on a sledge is pulled across a river by an elephant. The Head of the Rhino is held up by several people to prevent drowning.

A crate containing a newly captured Rhino is off-loaded from the truck for loading into the aircraft.

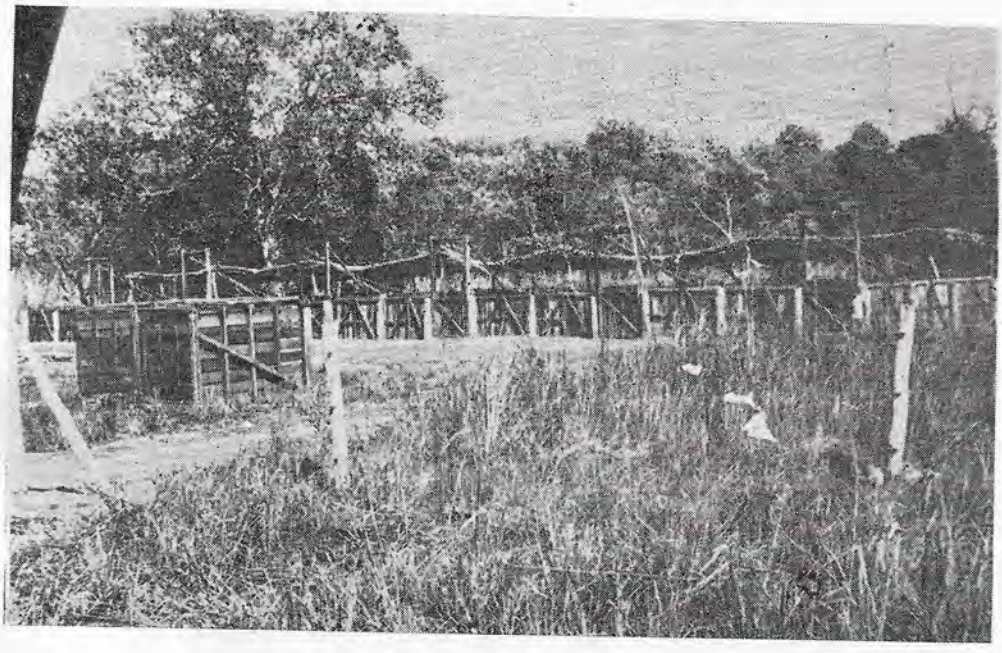
Loading the crates containing Rhinos into the Russian Aircraft at Gauhati Airport prior to the two hour flight to Delhi.



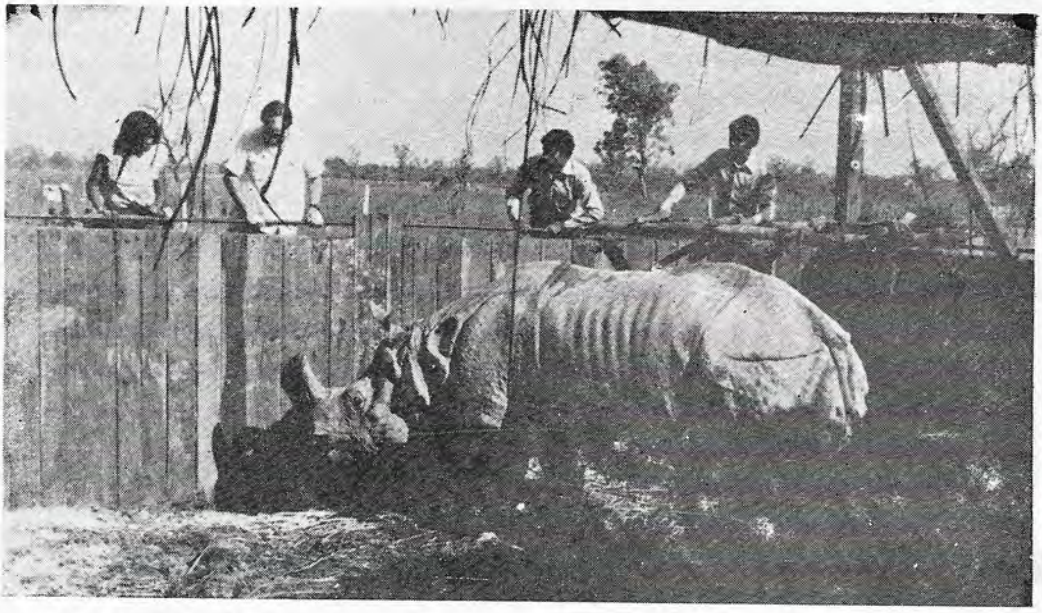
A view of the loading operation.



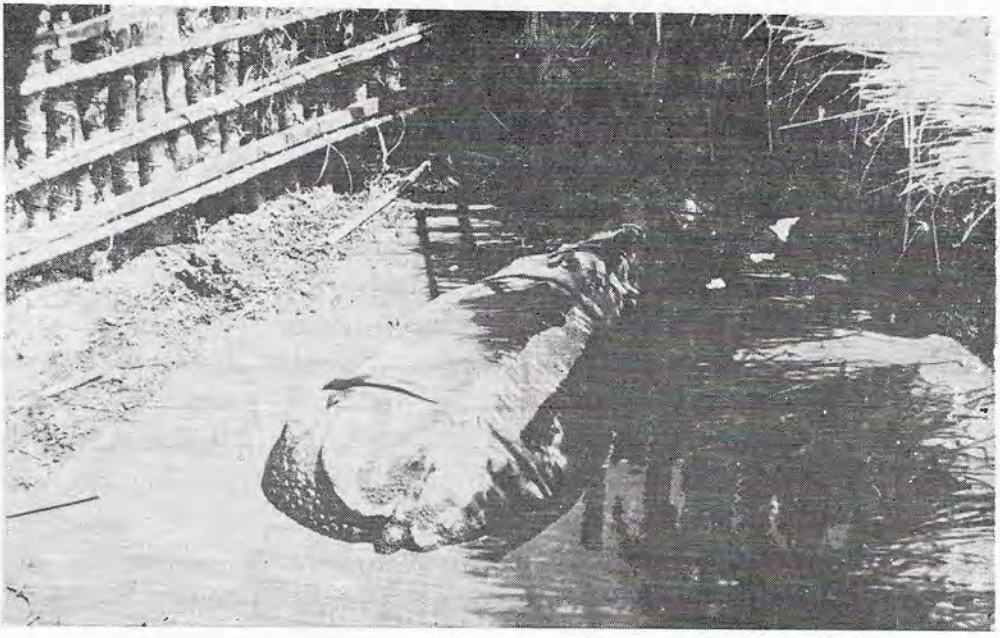
The interior of the Aeroflot IL-76 Aircraft.



A general view of the holding stockades at Dudhwa National Park, to which the Rhinos were transferred. In the foreground can be seen the three-strand electric fence around the stockades.

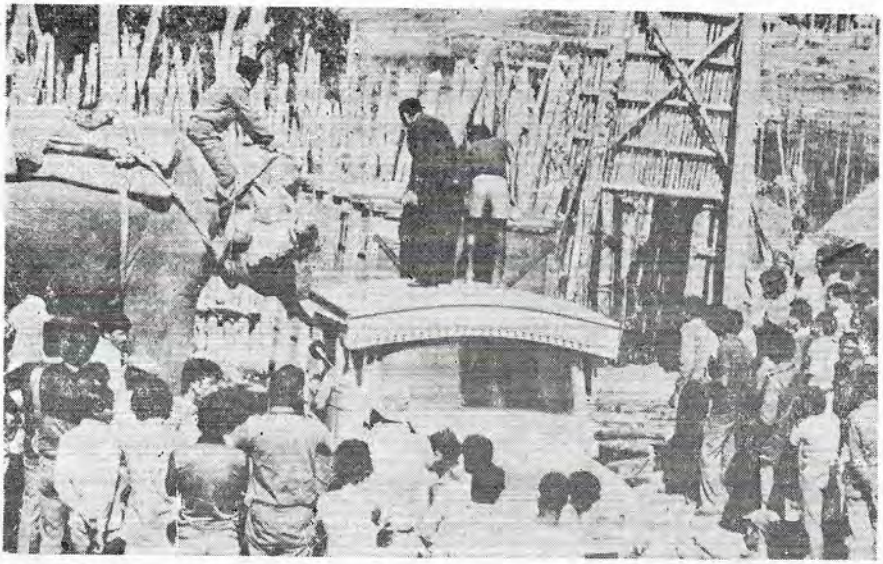


An adult Rhinos in the Dudhwa stockade. The animals were kept in the stockades for a minimum of 3 weeks prior to release.



A Rhino relaxes in a wallow within the holding stockade at Dudhwa.

Elephants manoeuvre sledge into position ready for transfer of the immobilised rhino to the crate.



Elephant pushing loaded crate off the truck which is in a ramp. A traditional stockade can be seen in the background.

Minutes of the first meeting of the Wild Life Status Evaluation Committee of the Indian Board for Wild Life held on 5.11.79 at Krishi Bhawan, New Delhi

AGENDA ITEM No. 1

Translocation of Rhinoceros from Kaziranga National Park

After the opening remarks, the Chairman introduced the first item of agenda regarding Translocation of Rhinoceros from Kaziranga National Park.

According to the Chief Conservator of Forests, the population of Rhinoceros in Kaziranga, as estimated by the local staff was 400 in 1962, and 960 at present. In addition to this, there are 400 to 500 Rhinos in areas like Manas and isolated pockets outside the Government Forests. The CCF Assam considered that the rhino numbers would soon be beyond the carrying capacity of Kaziranga National Park and systematic reduction of population by translocation was essential.

(a) *Identification and assessment of alternative habitat of the rhinoceros*

Possible alternative habitat suggested were Dudhwa National Park (U.P.) Jaldapara, (W.B.) Champaran (Bihar) Intanki in Nagaland and Lalighabri sanctuary of Arunachal Pradesh. In case of Jaldapara, there was a decline in population of Rhinos from 45 in 1972 to 23 in 1975 and 19 in 1979. Since the precise factors for the decline are not known, the committee decided against introducing any new populations in this area.

On a trial basis, it was decided that Dudhwa be selected first as an alternate habitat.

The committee felt that it was essential to carry out a comprehensive ecological study of the alternative habitats suggested, through a sub-committee, as a long time measure. The Committee decided to set up a sub-committee for the ecological assessment of the habitats consisting of the following members.

1. Dr. J.B. Sale (Chairman) — FAO Expert Central Crocodile Breeding & Management Training Institute, Hyderabad.
2. Chief Conservator of Forests, Assam.
3. Director, Botanical Survey of India or his nominee.
4. Director, Zoological Survey of India or his nominee.
5. Shri V.B. Singh, Chief Wild Life Warden, Uttar Pradesh.
6. Shri Duleep Mathai, World Wild Life Fund, India.
7. Dr. J.H. Desai, Delhi Zoological Park, Delhi,

Terms of reference:

1. The sub-committee will make datailed studies on the ecological conditions of the areas where animals are to be introduced and suggest the suitability.
2. The sub-committee will also conduct population studies in the existing National Parks where population exceeds the carrying capacity and suggest suitable measures.
3. The sub-committee will also study the reaction of local species with reference to the introduction of a new species.
4. The sub-committee may co-opt any experts in the field that it considers useful and necessary.

(*b*) *Approximate numbers that might be translocated in phases to different suitable habitats.*

The Committee was of opinion that a minimum number of 10 Rhinoceros may be translocated to Dudhwa National Park on an experimental basis, and further translocation to other areas will be based on the studies of the introduction and the possible interaction with local species of

fauna. It was also suggested that a detailed report about the flora of Dudhwa National Park may be prepared by the Botanical Survey of India.

(c) *What proportion of rhinos may be captured for sale to Zoological Parks within and outside the country, based on applications received and keeping in view captive breeding to wider genetic base.*

It was brought to the notice of the committee that there was great demand for Rhinoceros from the Zoological gardens within India as well as foreign countries:

The Committee felt that export of rhinoceros should not be permitted in view of the provisions of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The Committee was of view that a limited number of animals may be spared for Zoological gardens within India, as may be decided by the sub-committee constituted above, strictly on merits of each case.

(d) *To consider proposal of the Central Crocodile Breeding Management and Research Institute for organising translocation of rhinos with a view to imparting training in tranquilising and translocation and conducting the operations as safely and scientifically as possible in cooperation with the Chief Wildlife Wardens of the State concerned.*

Dr. J.B. Sale of the Central Crocodile Breeding Management and Training Institute, Hyderabad, has sent a proposal for operations of Rhinoceros translocation during the current season. The trainees in Crocodile Breeding Management and Trnining Institute, Hyderabad will be able to take part in such operations and will enable the trainees in Central Crocodile Breeding Management and Training Institute receive training in translocation. In addition to this, local help from the Assam Forest Department will also be necessary for the successful completion of the operations. The Committee decided that the Rhinoceros from isolated areas outside the National Park can be translocated first on experimental basis to the Dudhwa National Park.

(e) *To consider proposal received from Mr. Andrew Laurie for prior ecological studies of area where rhinos might be introduced.*

In view of the decision taken by the committee to constitute a sub-committee proposed in (*a*) above, it was left to their discretion whether or not to utilise the service of Mr. Andrew Laurie for carrying out ecological studies of possible rhino habitats, and to report to the Wild Life Status Evaluation Committee if his services are needed.

(*f*) *Administrative arrangements and time schedule for the translocation operations as suggested by Dr. J.B. Sale, FAO Advisor of the Central Crocodile Breeding and Management Institute.*

It was decided that the sub-committee constituted under the Chairmanship of Dr. J.B. Sale will work out the schedule for the operations in consultation with the State Govts of Assam and Uttar Pradesh.

Annexure II

Report on the suitability of Dudhwa National Park U.P. as potential site for re-introduction of the Indian Rhinoceros

By
Prof. Dr. R. Schenkel
Chairman Asian Rhino Specialist Group
of SSC/IUCN

1. Introduction

Informed conservationists generally agree that an endangered spccies whose habitat type has by human impact been reduced and split up into separated "islands", should live in as many of those islands as possible. This reduces the risk of its extinction.

This applies also to the great Indian rhinoceros. Some decades ago the few survivors of the species lived in Kaziranga and near Chitwan Nepal. Devoted efforts to protect these animals were extremely successful especially with the Kaziranga population which has multiplied many times within the last 40 Years. Within the new national park, population pressure is high and during recent years emigration of a population surplus has been observed. These animals have spread up and down and across the Brahmaputra Valley. However, most areas into which the rhinos move are used for agriculture and the invading animals are not compatible with it . There is not much choice but :

— to destroy them;

— to capture them and to transfer them to zoos;

— to translocate them to protected areas.

From the point of view of conservation, only the latter mentioned possibility is satisfactory, and then only if the probability is high that the animals can thrive in the new area.

2. Identification of areas for translocation of Indian rhinos

One requirement of such an area is that it must be efficiently protected. Of equal importance is habitat suitability. Translocation to an

area which already harbours a local rhino population is of little value. Under stable conditions the size of such a population depends on the living conditions provided by the area. As the introduction of individuals does not improve these conditions, it will not result in the lasting growth of the population. At best a small local population might profit as a gene pool from the importation of individuals not originating from the same local strain.

In fact it once has been suggested to translocate rhinos from Kaziranga to Manas, but such an effort would not be effective for the above reason. The most beneficial solution would be to create new population units in areas which :

— are—or can be—efficiently protected;

— provide suitable habitat throughout the year;

— are large enough to harbour viable population units;

— are not yet inhabited by rhinos.

3. Dudhwa National Park, U. P.

Repeatedly, Dudhwa Nationl Park has been proposed as a possible place to establish a new local rhino population. The Rhino Sub-Committee (Chairman Dr. J. B. Sale) of the Wildlife Status Evaluation Committee of India has worked out a detailed proposal, dated 21. 7. 1980. L- and R. Schenkel visited Dudhwa National Park at the end of December 1980/beginning January 1981 in order to obtain some first hand information on the habitat and the management of the Park. In a general way we can confirm the information summarized by the Rhino Sub-Committee in their report dated 21. 7. 1980. The following statements can also be made.

(*a*) *Size and habitat*

The whole park area is 490 km², approximately half the size of Kaziranga. Large parts of the park are characterised by rhino habitat similar to that of Kaziranga. Until about 1870 the area was inhabited by rhinos, but they were finally eradicated by hunting.

Although the percentage of forest in the area is higher than in Kaziranga, savannah marsh land vegetation is abundant and a number of "nallas" and "this" (ponds), as well as the Suheli river which forms the south-western border of the park, provide permanent water.

The lower, marshy areas are seasonally flooded. However, in times of flood the rhinos find refuge areas on higher ground inside the park. On the basis of habitat exaluation the Sub-committee has identified three areas within the park where rhinos could preferably be released. The choice of the area will be especially important during the early period after the rhino release. During this stage, disturbance of the animals should be avoided as much as possible. Once a new population unit is growing, parts of it will tend to progressively colonize the neighbouring suitable areas.

(b) Relation to man

At present, the park appears well protected and illegal hunting does not seem to play a major role. However, the introduction of rhinos into the park might lead to conflict between the rhinos and the human population of the surrounding area because:

- until now villagers were allowed to cut thatching grass in the park, mainly in December, and also to collect firewood.
- Individual rhinos might tend to move out of the park into cultivated land.

Before rhinos are translocated to Dudhwa, measures should be taken to minimize future conflict between rhinos and man.

4. Conclusions

Dudhwa is the area most suitable for establishing a new local population of Indian rhinoceros. The area is protected, large enough and contains suitable habitat.

However, measures to minimize conflict between rhinos and man are essential. In this context two problems have to be resolved:

- either the exploitation of resources provided by the park, which traditionally was permitted, will have to be strictly organised and controlled, or such exploitation will have to be stopped and the resources provided by alternative measures.

- Measures must be taken to prevent rhinos (and elephants) from moving into cultivated land outside the park.

Plans to cope with these problems have been developed. In particular, a trench-cum fence system to prevent rhinos from leaving the park

across the Suheli river or in an eastern direction has been designed and budgeted. Undoubtedly such a system would have to be permanently kept under control and maintained. A solid track will have to permit access to the trench-cum-fence in its entire extension (the suitability of high voltage electric fencing as demonstrated at the recent elephant workshop of India could also be explored - Ed.). It will also be necessary to resolve the problem of the "dacoits", who at present live partially in the park, partially in its immediate vicinity.

We do not doubt that all these problems can be resolved, but we want to emphasize that they must be resolved so that translocation does not run a high risk of failing.

We would like to mention one more aspect, construction and maintenance of the trench-cum-fence system would provide the possibility of employing workers of the villages around the park. This might contribute to create a positive relation between people and park.

5. Recommendations

We support the recommendations of the Rhino Sub-Committee dated 21.7.80. Introduction of rhinos into Dudhwa National Park, U.P. is a highly desirable measure in the interests of rhino conservation. However, we want to stress that quite a number of important steps have to be taken to assure the lasting success of the rhino translocation.

Preliminary Report on Drug Immobilisation and Transport of the Great Indian Rhinoceros

By

Dr. J. B. Sale,
FAO Expert
and Dr. M. H. Woodford,
FAO Consultant

1. INTRODUCTION

1.1 Distribution and status of the Great Indian Rhinoceros

Formerly the distribution of the Great Indian rhinoceros (*Rhinoceros unicornis*) extended across the foothills of the Himalayas and the plains of the Indus, Ganges and Brahmaputra rivers from the Hindu Kush in the West to the Burmese border in the East. Its southern limits seem somewhat uncertain but presumably it did not extend into the drier areas. Today only a few isolated pockets of the species remain, its former range having been enormously reduced due to the spread of human activities that conflict with the rhino's way of life, including cultivation of its natural habitat and hunting. These localised populations occur in the Brahmaputra valley of Assam, West Bengal and the Chitawan region of the Nepalese terai. Most of these animals are in protected areas such as sanctuaries and national parks and overall numbers have greatly increased since the turn of the century when Kaziranga had only a dozen animals. While the status of the Great Indian rhino has undoubtedly improved, its future is not yet absolutely guaranteed and it is currently on the I.U.C.N. 'endangered' list.

The present total for the species is approximately 1,500 animals, of which 1,000 are in Kaziranga National Park in Assam and 300 are in Nepal. Of the remaining 200, most are scattered throughout Assam, both in sanctuaries and elsewhere, and there are about 30 in two small sanctuaries in northern Bengal.

1.2 The need for capture trials

Two recent studies (Patar, 1977 ; Laurie, 1978) have revealed many details of the basic ecology of the Great Indian rhinoceros, forming useful background for the planning of future management strategy. There is growing recognition within India and internationally that this should include the re-introduction of rhinos from Kaziranga into well protected areas of suitable habitat of the species' former geographical range. Such translocations necessitate the capture and transport of number of rhinos, over a period of several years. In this context the Government of India requested F.A.O. advice on techniques of rhino translocation.

The traditional methods of capturing rhinos in Assam is a pit method, whereby unwary rhinos fall into a camouflaged pit dug in one of their regular paths. Bodily damage to the animals sometimes results and great stress is experienced during subsequent handling and transfer to the holding stockade. Furthermore, the method is unselective. In Africa, drug immobilisation has been used very successfully on both the Black rhinoceros (Jones, 1966; King, 1969) and the White rhino, (Harthoorn & Player, 1963 ; Player, 1967). Drug doses and handling procedure are now well established for both species (Harthoorn, 1976 ; Keep, 1971 ; Young, 1973). However, there was only very limited experience of chemical capture with the Great Indian species, one case of which was with a zoo animal probably requiring a lower dose than individuals in the wild (Young, *op. cit.* ; Laurie, 1979). Thus it was felt that there was an urgent need to establish procedure for the series of translocations envisaged within India.

In view of the fact that the Great Indian rhino is an 'endangered' species, it was felt prudent that the assistance of a wildlife veterinarian, experienced in chemical capture, should be sought for this initial trial. Accordingly the services of Dr. M.H. Woodford were arranged on a consultancy basis for the period 4 January to 14 February 1980. In addition to the technical inputs of the consultancy, there was an instructional component, whereby capture and translocation methodology would be demonstrated to Government wildlife personnel. The terms of reference of the consultancy, which should be seen in the above context, included the following :

- Advise and assist the Government with its plans for wild animal capture and translocation.
- Advise on appropriate methods and techniques to be adopted for the capture and translocation of wild animal species as

required by the Government and to demonstrate these to various Government counterpart personnel and to trainees of the Central Crocodile Breeding and Management Training Institute, Hyderabad.

— Give a course of lectures on wild animal capture and translocation and on wildlife diseases to the trainees of the Central Crocodile Breeding and Management Training Institute, Hyderabad.

2. OBJECTIVES

The objectives of the capture trials may be stated as follows :

2.1 In the light of the intention of the Government of India to carry out translocation of the Great Indian rhinoceros, involving reintroduction to protected portions of its former habitat, the trials should establish the parameters of a sound capture and translocation method using drug immobilisation and including ;

(i) the best mode of approach to the candidate for capture,

(ii) an appropriate delivery system, preferred range sites for 'darting',

(iii) a suitable drug and its safe dosage limits for (a) immobilisation and (b) revival,

(iv) procedure for safe transport from immobilisation site to an enclosure where rhinos would be held pending transfer to the site of reintroduction,

(v) suitable medications to be used for treatment of immobilised rhinos,

(vi) provision of training in these procedures to Government personnel, including the current course of trainees (Assistant Conservators of Forests and Range Officers) at the Central Crocodile Breeding and Management Training Institute, Hyderabad and officers of the Government of Assam.

Trial capture operations based on these objectives were carried out by the authors at two locations in Assam between 17 January and 10 February, 1980.

3. TRIAL LOCATIONS

During a preliminary visit to Assam in November 1979, Dr. J.B. Sale visited a number of possible sites for the trials. Since the removal (to sanctuaries) of several small isolated groups of rhinosin agricultural areas was under consideration, it was decided to start the capture trial at one such site. This was at Kurua, some 50 km from Gauhati, on the northern bank of the Brahmaputra river. The rhinos, thought to number about ten, live in a series of rocky hills covered with thick secondary jungle and surrounded by paddy fields and sugarcane. The plan was to transport any animals captured to holding accommodation at Gauhati Zoo and also, if needed, to stockades to be constructed in a forest area outside of Gauhati.

A second phase of the trials was carried out in the open grasslands adjoining Kaziranga National Park, providing completely different conditions from the first site. The second candidate for darting had to be 'herded' to the capture area from tall grassland, where capture would have been impossible. On immobilisation, rhinos were transported over a distance of 3-4 km to stockades, constructed from sal poles in the traditional manner.

4. METHODS & EQUIPMENT

Specifications of suitable equipment for rhino immobilisation and transport are given in Appendix A.

4.1 **Location of rhinos for 'darting'**

At Kurua initial attempts were made on foot to locate rhinos that were proceeding to or returning from crop raiding away from the hills at dusk and dawn. However, in spite of various times being tried, no contact with the rhinos was made and it was concluded that raiding forays were confined to the dead of night, which is unsuitable for darting.

Consequently, it was decided to comb the jungle-covered hills during daytime, for rhino lairs and riding elephants were assembled for this operation (Plate Ia). When flushed from cover, the rhino usually ran a short distance along one of its own well-worn tracks to an adjacent thicket, where it took shelter. After a series of these alternating searches and 'chases', the rhino eventually stopped in a position where a suitable part of its anatomy was exposed for long enough to aim and fire the syringe projectile from the safety of an elephant's back. The report of

the rifle and the impact of the projectile usually produced no more than a further short run into cover. Provided the animal was not harassed for 10 minutes or so while the drug took effect, no further attempt to escape was made.

The efficiency of this method or rhino 'stalking' improved once the elephants and their mahouts get used to encountering rhinos in thick cover, sometimes at close quarters. Initially the elephants were nervous and sometimes turned and bolted, especially when faced by a rhino charge. This could prove dangerous, as for example, when all three riders of one bolting elephant were removed by thorny branches observed that a nervous elephant could quickly be transformed into a reliable, efficient animal in the firm hands of an experienced and fearless mahout.

The most useful hunting technique proved to involve two or three elephants. Once a rhino was located in cover, the team member performing the darting positioned his elephant beyond it, while the other (one or two) elephants were used to attempt to drive the rhino into the open towards the waiting 'darter'. Greatest difficulty was experienced while attempting to capture a sub-adult (595 kg), which first had to be separated from its aggressive mother so that she would not interfere with operations once the younger animal was immobilised.

In the open terrain at Kaziranga it proved possible to approach rhinos standing in the open, since these animals are used to being approached by tourists on elephant back. Six to eight elephants were available so that it was possible to 'hold' the target rhino in a circle of elephants, while the elephant bearing the darter slowly moved in until he was close enough for a shot.

If no suitable animal was available in the short grassland, it was necessary to locate one in adjacent swamp and attempt to drive it into the 'darting area', sufficiently away from thick cover to prevent losing it between darting and onset of immobility. To locate an animal in the swamps the elephants were walked abreast in a long line, combing likely patches of tall grassland. Once a suitable individual was identified, the elephants were formed into a large semi-circle behind it in an attempt to herd it slowly in the desired direction. Great care was needed when open ground was approached as the rhino, feeling exposed, frequently tried to rush back into the cover of the tall grasses. However, with a little practice by the mahouts, it proved possible to drive rhinos into a suitable open area for

immobilisation and to hold them there during and after the delivery of the dart (Plate Ib). Clearly, in the Kaziranga conditions the greater number of riding elephants available was a distinct advantage and ideally eight to ten could be usefully employed in this type of operation.

Apart from their value in locating and herding target rhinos, the elephant proved an ideal 'darting platform'. The height of the elephant's back affords a good view and allows a descending shot into the target areas of the rhino's anatomy (see below). When the elephant is standing still it provides a firm, vibration-free seat from which to take careful aim with the dart gun. Their equal versatility in thick jungle, on steep slopes or in deep swamps makes elephants the ideal 'vehicle' for approaching rhino during capture using the drug darting method.

4.2 Delivery system, syringe and target sites

The anatomy of the animal must be considered when selecting a delivery system, appropriate syringe and injection site for darting the Great Indian rhinoceros. Most of the body is covered by a thick hide consisting of epidermis, vascular epidermis and fibrous subcutis (King, 1969). The epidermis is heavily keratinised into numerous domed tubercles, particularly on the thigh and lower shoulder. Sections of this 'armour' are joined by heavy folds of loose skin, where the thickness is doubled. Furthermore, there are ribs just below the skin along the entire flank of the animal, as the rhino has ribs protecting its abdomen as well as the thorax.

Delivery system and range

The equipment used for darting was the 'Dist-Inject' Model 50 rifle which fires a metal syringe projectile propelled by a .22 blank cartridge (Peter Ott & Co , Basel, Switzerland).

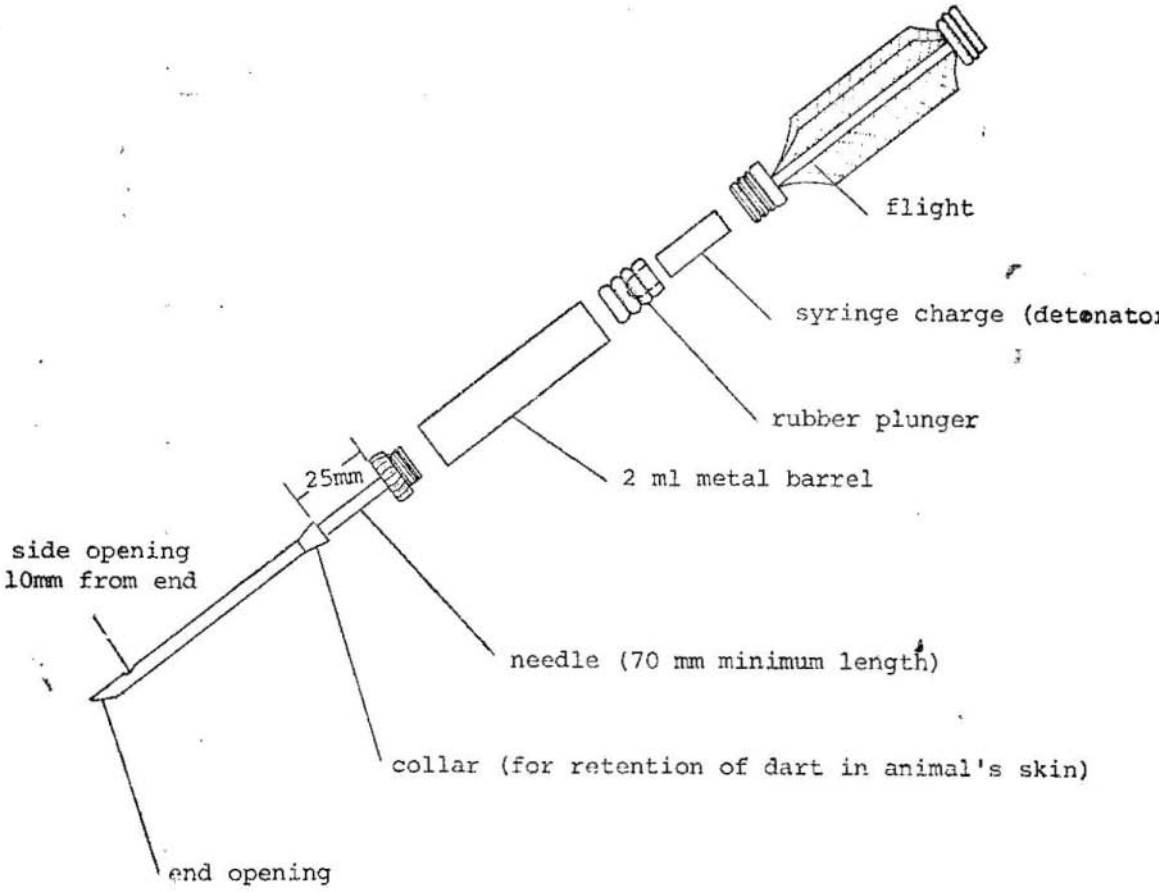
The Dist-Inject system allows accurate aiming by means of an adjustable back sight, set according to a combination of values for projectile weight and distance to the target. Similarly, .22 blanks of various powers are available and appropriate propelling power is selected according to the same combination of projectile weight and range values. A propellent cartridge of too high a power for the actual range is liable to cause the projectile to bounce off on impact, with a thick skinned species such as rhino. The most satisfactory range was found to be 30 to 40 m for which the 'white' blanks of the correct propellent when using a 2 ml syringe barrel. In most cases, with careful manoeuvring, it was possible to achieve this range on elephant back.

side
10mm

It proved essential to clean the barrel of the rifle, with the brass wire brush provided, after every shot. Failure to do this results in fouling of the bore to the extent that the dart may fail to emerge from the barrel, especially when using blanks of the lowest power.

Syringe projectile ('dart')

The syringe used has aluminium alloy barrel. It is preferable with the Indian rhino to use a system employing metal rather than plastic syringe barrels. The impact with such a hard inflexible skin could shatter a plastic syringe, particularly if the range happened to be rather short for the power of propellent used or the plastic brittle, due to age of the syringe.



Recommended type of 'dart' for delivering etorphine to rhino

The precision flight stabilizer of the Dist-Inject equipment assists in accurate placement of the projectile on the target site (see below).

It was decided in these trials to standardize projectile weight (and therefore trajectory characteristics) by using a 2 ml capacity syringe, irrespective of the quantity of drug loaded and always topping up completely with sterile water. The syringe is loaded from the front, after unscrewing the nozzle bearing the needle. This type of syringe is easy to load and there is little danger of spillage.

Syringe activation in the Dist-Inject system is by means of a detonator in the rear of the plunger which explodes on impact with the animal (providing an audible indication of successful injection). Accidental activation is impossible—an important consideration when a drug highly toxic to man is being used. The type of syringe which is activated by pumping compressed air behind the plunger after loading is not advisable for dangerous drugs such as M. 99. Inadvertent displacement of the sliding collar over the needle opening, after pressurization, results in the drug being squirred out under high pressure possibly entering the eyes or mouth of the operator or assistants.

Needles

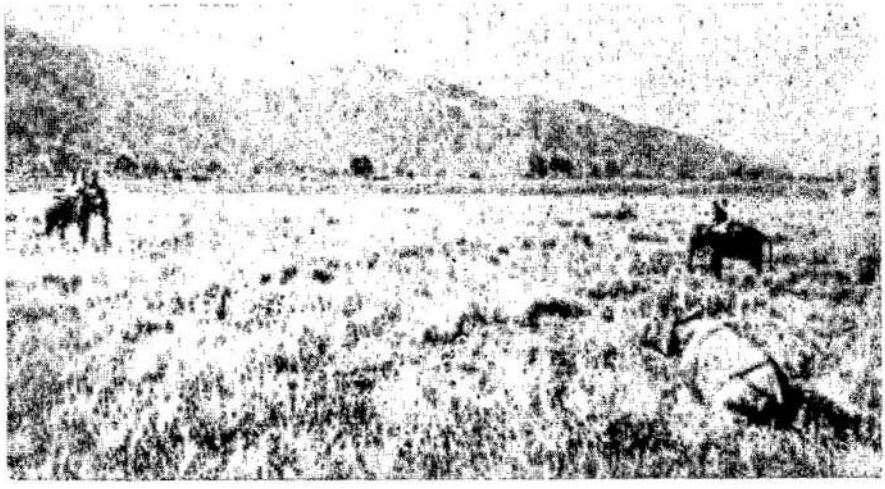
Needle length and strength are critical factors with rhinoceros darting. The NM6 needle, the longest supplied by Peter Ott, proved the most satisfactory and has the following features :

(a) It has an outside diameter of 2 mm and is 63 mm long. Slow induction and incomplete imobilisation caused some doubt as to the adequacy of this length and it is recommended that a 70 mm long needle, strengthened at the base to prevent snapping off on impact but of otherwise similar design, be tried on the Indian rhino.

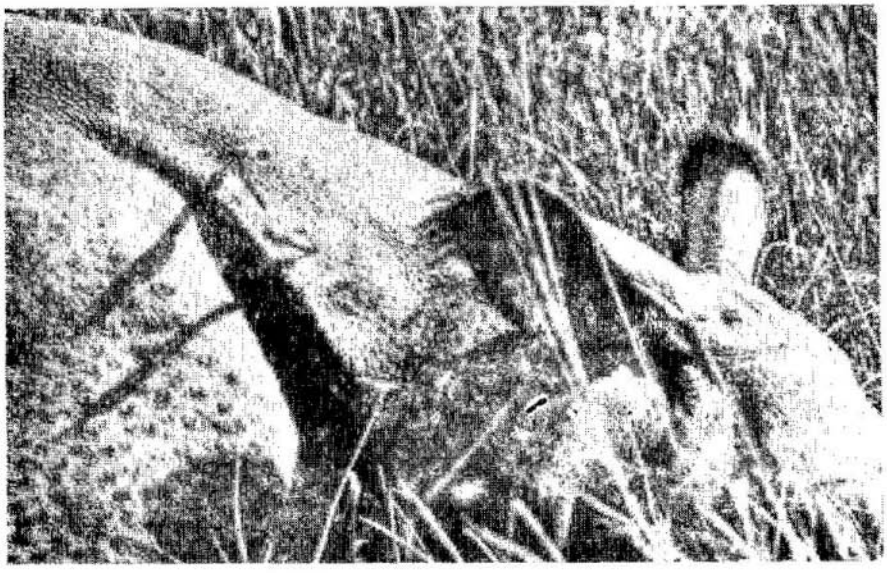
(b) In addition to the normal terminal opening, the NM6 needle has a side opening 10 mm back from the tip. This allows injection to be achieved, even if the terminal opening is blocked by 'coring' as the needle enters the skin ; a common occurance in rhinoceros darting.

(c) There is a collar 25 mm back from the tip, which, providing proper penetration was achieved, kept the dart in place until removed manually following immobilisation. A better position

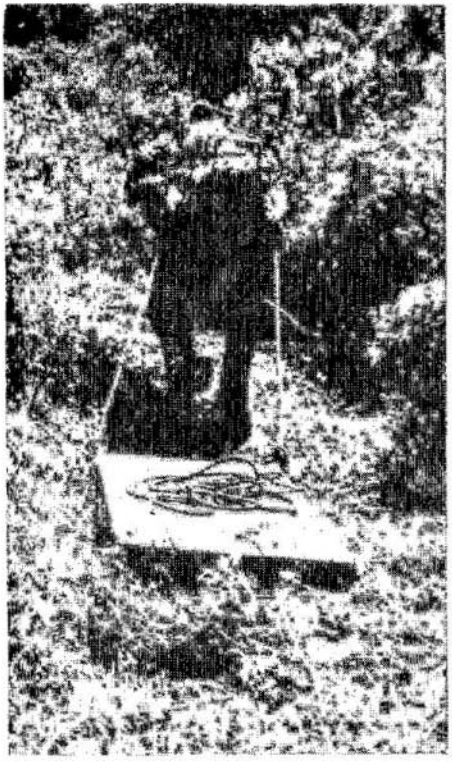
Elephants provide an ideal platform for darting rhinos in thick jungle.



Rhino at moment of 'going down' in open grassland. Elephants surround the Rhino preventing escape while the drug takes effect.



Preferred site for the dart is the upper part of the neck, above the fold. This animal received a second dart to 'top-up' the initial dose. Dart on right is in best position; left dart is too high and too far back from head.



Once a rhino is immobilised the sledge is movad up via a path hastily cut through the jungle.

for the collar would be 25 mm from the base of the needle, as this would avoid the risk of damaging delicate tissues deep below the skin.

Target site

Careful choice of target site on the animal's body is critical when darting the Great Indian rhino (Figure 1). First choice is the upper third of the neck above the fold, which has relatively thin skin and is resilient due to underlying muscle (Plate Ic). When using this site great care must be exercised in order to ensure that the dart does not accidentally hit the head. The site should not be used by unskilled marksmen. The upper anterior portion of the shoulder is also a possible site. At the rear end of the animal the only suitable site is the upper part of the rump, above the horizontal fold separating it from the thigh. However, in older animals the skin can be quite thick and kerotinised in this area which also suffers the disadvantage of a sloping presentation, making a 90° hit difficult unless the dart is fired from a tall elephant particularly close to the rhino.

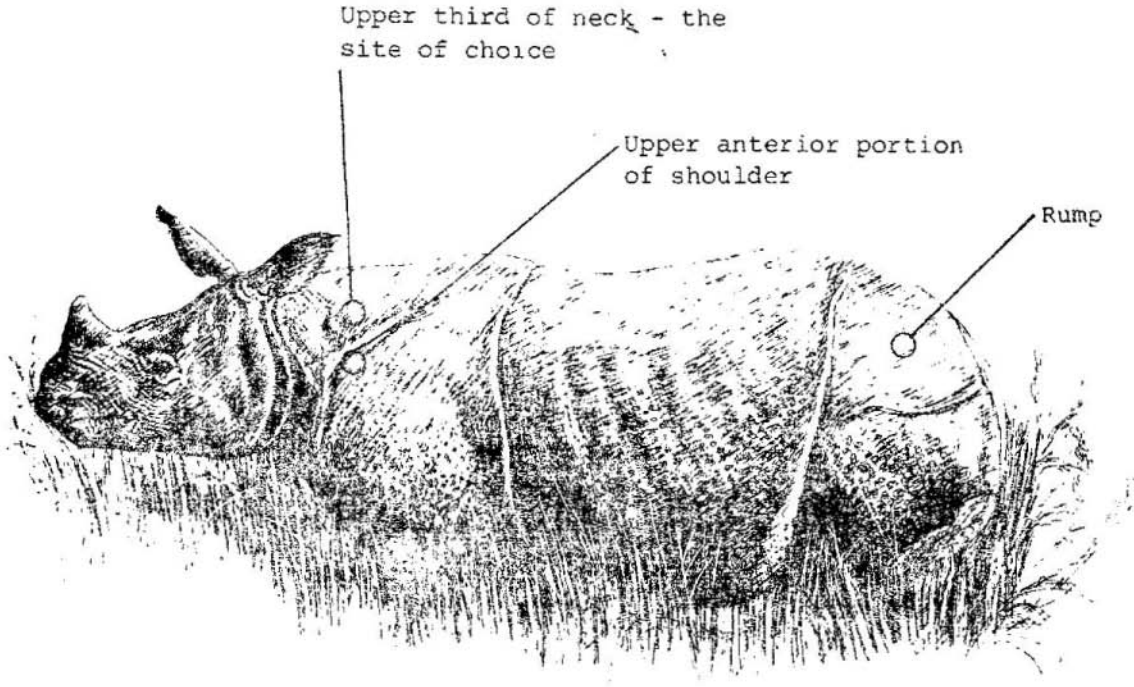


Fig. 1. Target sites for darting the Great Indian rhinoceros

Veins in the back of the ear pinna were confirmed as the best site for intravenous (manual) injection of Revivon (Harthoorn, 1976). However, on one occasion the position of the animal in the crate made the ears inaccessible and an intra-muscular injection in the rump proved a satisfactory alrernative (Case 4 Table 1).

4.3 Drugs used for immobilisation

The drug combination was Immobilon L.A. (Reckitt and Colman Pharmaceutical Division, Hull, England). This consists of etorphine hydrochloride 2.45 mg and acepromezine maleate B. Vet C 10 mg in each ml. The drug was delivered by the syringe projectile intramuscularly as far as possible. The effects of Immobilon were reversed by the intravenous injection of an equal quantity of Revivon L.A. containing diprenorphine hydrochloride 3 mg per ml.

One advantage of etorphine is that being extremely potent (10,000 times the potency of morphine) only small quantities are required. This makes particularly suitable for delivery by a syringe projectile system, where a lighter 'dart' has more stable flight characteristics than a heavier one, assisting accurate placement at the target site. The case with which the effects of etorphine can be reversed using diprenorphine is another reason for the choice of this drug. A further feature is that it has a wide safety margin, reducing the possibility of overdosage.

Immobilon L.A. is extremely dangerous if accidentally injected into humans or even absorbed through the skin and great care must be exercised in its use. The best antidote in cases of accidental administration to man is Narcan (Winthrop Laboratories, Surbiton, U.K.) which is naloxone hydrochloride 0.4 mg/ml. A 'human kit' containing vials of this drug and a suitable syringe for injection was carried at all times in the field. One serious problem with the use of etorphine in India is that neither of the human antidotes are available in the country (the second choice antidote is Lethidrone). It is therefore vitally important that Narcan or Lethidrone be imported along with Immobilon, the use of which should not be contemplated under any circumstances unless one of the human antidotes is to hand.

4.4. Transport procedure

The removal of a very heavy animal such as rhino from the site of immobilisation to the holding enclosure presents some of the greatest

Table 1

Summary of five immobilisations carried out during the trials

Passage of time (in minutes) is shown cumulatively throughout an operation, commencing with the actual time when the first 'dart' penetrated the rhino, i.e. zero minutes

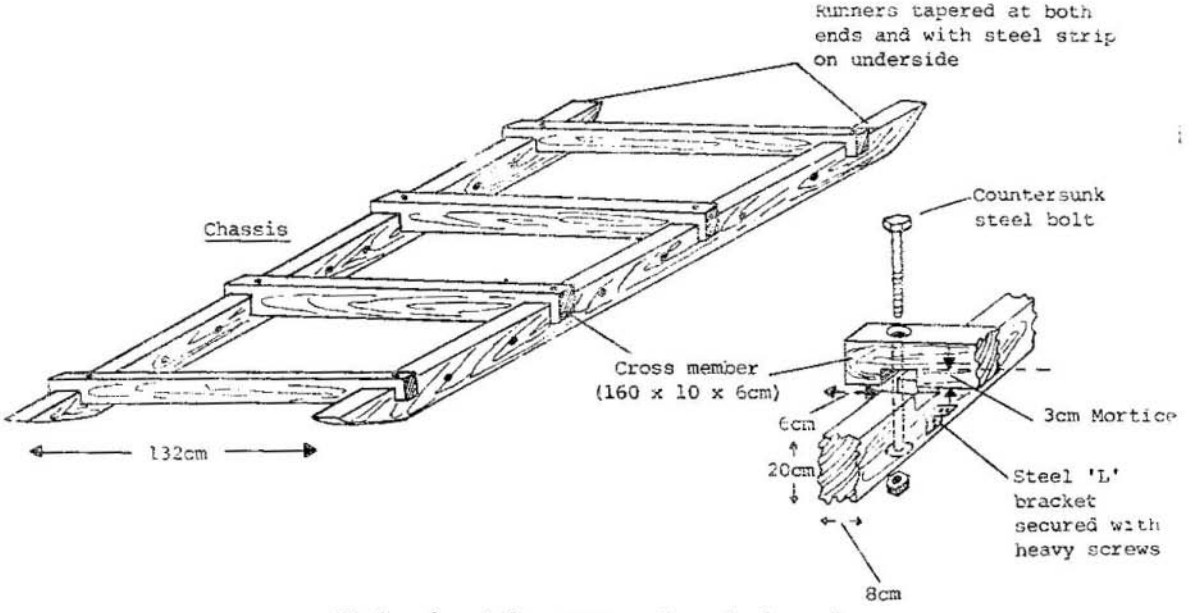
	Case 1	Case 2	Case 3	Case 4	Case 5
DATE	24.1.1980	25.1.1980	27.1.1980	8.2.1980	9.2.1980
SITE	Kurua	Kurua	Kurua	Kaziranga	Kaziranga
HABITAT	Wooded hillside	Wooded hillside	Wooded flat ground	Short grassland	Short grassland
SEX	Male	Male	Male	Male	Male
WEIGHT	1,300kg (est.)	2,500kg (est.)	995kg (weighed)	1,800kg (est.)	1,000kg (est.)
IMMOBILISATION (Immobilon)	0.6ml/shoulder (Hidden) ±13 min: Down Disturbed by people ±30 min: Ran 500m into open and lay down. ±45 min: 0.4ml/ rump. Immobilised Total Dose:1.0ml (2.45mg etorphine)	0.8ml/rump (Hidden) ±12 min: Down Immobilised ±120 min: Standing, incoordinate walking. Non-aggressive. Attempts to lead/ drive into crate failed. ±150 min:0.3ml Revivon i.v./ear. ±160 min:Ranoff dragging rope. ±170 min:0.5ml/ rump. Standing. ±190 min: Down. Rope removed. Total Dose:1.3ml (3.2mg etorphine) N.B. Not loaded	0.66ml/shoulder (partly hidden) Staggering. Incoordinate but mobile. ±60 min: 0.5ml/ shoulder. Walking, incoordinate, standing. ±120 min: 0.5ml/ rump. Down. ±133min:Immobilised. Total Dose:1.66ml (4.1mg etorphine)	0.5ml/neck Ran 200m. Swaying 12 min: Down (disturbed) 15 min:Walking 22 min: Down, alert.0.5ml/neck. 32min:Immobilised Total Dose:1.0ml (2.45mg etorphine)	1.0ml/high on shoulder Ran 400m. 6 min:Staggering 14 min: Down 24 min:Immobilised Total dose: 1.0ml (2.45mg etorphine)
LOADING/ TRANSPORT	Loaded directly into crate (on truck) by labour, using sledge as a ramp.		Dragged 100m on sledge by elephants to crate (on truck dug into ground). Loaded into crate by elephants and labour.	Towed ±1 km on sledge by tractor to crate (on truck dug into ground). Loaded by elephants and labour. Rhino beginning to revive.	Towed ±1 km on sledge by Land Rover to truck (dug into ground). Sledge loaded directly onto truck (by elephants).
REVIVAL (Revivon)	In Crate. 160 min: 1.0 ml (3.0 mg diprenorphine) i.v./ear. ±162 min:Revived	In Forest. 200 min: 1.0 ml (3.0 mg diprenorphine) i.v./ear. ±206 min:Revived Moved off.	In Crate. ±180 min: 1.7 ml (5.0 mg diprenorphine) i.v./ear. ±182 min:Revived	In Crate. ±100 min: 2.0 ml (6.0 mg diprenorphine) i.m./rump. 110 min:Revived	In Stockade. 86 min: 1.0 ml (3.0 mg diprenorphine) i.v./ear. 88 min:Revived
FINAL LOCATION	Crate unloaded by crane and rhino released into pen at Gauhati Zoo.	Animal released in forest due to inability to load into crate.	Crate unloaded by crane and rhino released into pen at Gauhati Zoo.	Crate unloaded from truck (dug into ground) by elephant and rhino released into stockade at Kaziranga 155 min after darting.	Sledge unloaded from truck (dug into ground) by labour and pulled to door of stockade. Rhino pulled from sledge and into stockade. Release 88 min after darting.

problems of capture operation. In particular, the immobilisation imparted to the animal by the drug begins to wear off after 1½ to 2 hours, which can seriously impede the loading operation if not completed by this time. In any case, it should always be the aim to keep the animal immobilised in a recumbent position for as short a time as possible, making speed of loading a critical factor to the success of the operation.

Unless the animal can be transferred to the holding pen well within the natural recovery time, it is necessary to load it into a crate near the immobilisation site and transport it in this (in revived state), on a truck, to the holding area. In South Africa it proved possible to walk White rhinos into a crate while in semi-conscious state, shortly after the administration of the antidote (Keep, 1971). The first rhino in the present trial was loaded directly into the crate while fully immobilised, using a ramp and the assistance of two elephants.

Sledge

It is often impossible to get a truck to the immobilisation site due to steep slopes, uneven or swampy ground or thick jungle. In such cases an interim transport phase is necessary wherein the still immobilised rhino is moved from its resting place to the waiting crate and truck from 50 m to 2 km away. For this initial journey the rhino is placed on a sledge (King 1969) which is then pulled by elephants or a vehicle to the site where the animal will be transferred to a Crate.

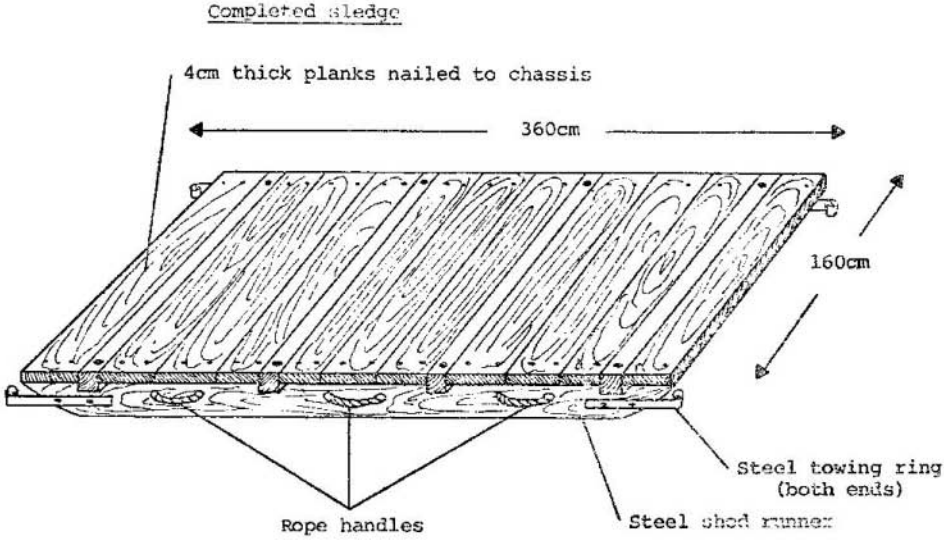


Timber for sledge, crate and stockade - sal

The sledge should be very strongly constructed (Appendix A) as the weight of a 1 to 2 tonne rhino places enormous strains on the structure as it is dragged over rough terrain. It should have sufficient clearance (14 cm) to avoid smaller boulders and stumps and yet be low enough (24 cm) to facilitate loading of the rhino onto it. Length should be slightly longer than a large rhino and 360 cm was found to be satisfactory. Width of the sledge should be such as to comfortably accommodate a rhino lying on its side (and also be capable of being inserted into the crate to facilitate loading—see below) and 160 cm was found satisfactory. Strong towing hooks should be fixed at both ends of the sledge to enable it to be pulled in either direction, which is important when manoeuvring it into position. Runners should likewise be tapered at both ends and steel shod to reduce drag and damage by stones. Handles on both sides of the sledge facilitate shifting it into position alongside the rhino by hand and also provide anchorages for ropes used to secure the rhino to the sledge when loaded. Nylon ropes should not be used for this purpose as they may cause 'burns' on the skin.

Loading Sledge

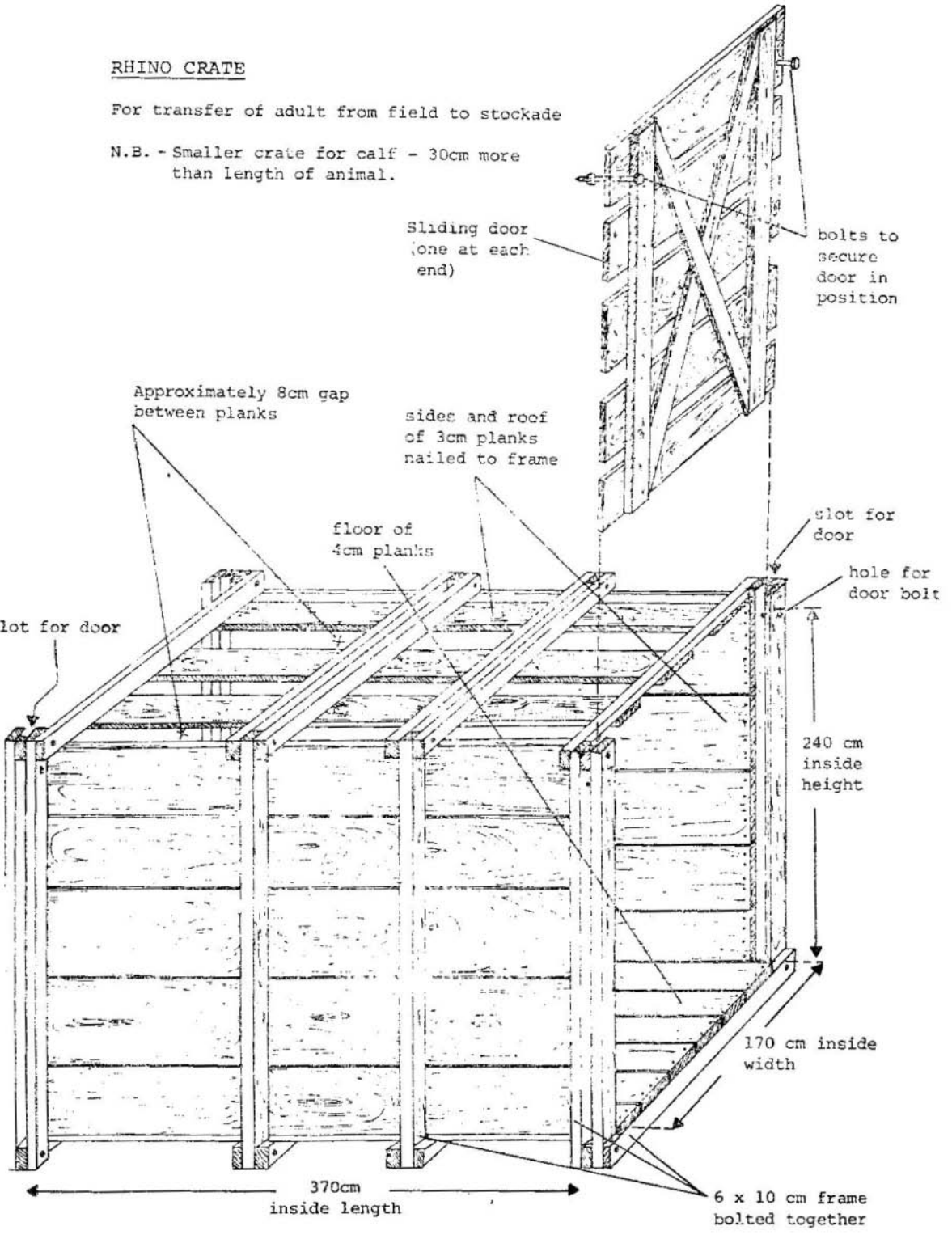
As soon as full immobilisation is confirmed, the sledge is brought into position (Plate IIa) beside the back of the recumbent rhino, whose legs are roped together as a precaution against partial revival and attempts to gain its feet during handling. A disciplined and experienced team of 15 men is required to manoeuvre the rhino on to the sledge. In these trials a smaller animal (995 kg) was lifted onto the sledge, with valuable assis-



RHINO CRATE

For transfer of adult from field to stockade

N.B. - Smaller crate for calf - 30cm more than length of animal.



tance from two elephants who placed their tusks under the rhino's body in a lifting-cum-pushing action. Two others were carefully rolled onto the sledge by men alone (Carter, King, 1979), which proved a much easier method.

Great care must be taken with the rhino's head which should be held out in a natural position by a couple of men while loading takes place. Kinking of the neck may impede breathing and/or circulation to the head. The eyes, which are open, should be constantly covered with a cloth or clean gunny bag to prevent damage by dust or bright sunlight throughout the time the rhino is immobilised.

Once the rhino is in a natural position on its side on the sledge, it should be secured by ropes passing transversely across its body and tied to the handles of the runners.

Elephants are the best power source for dragging the sledge in dense jungles or over extremely uneven ground (Plate IIa). On flat, fairly even ground at Kaziranga it was found that a tractor or jeep (Land Rover, in lowest gear and four-wheel drive) was adequate for towing the sledge to the crate loading site.

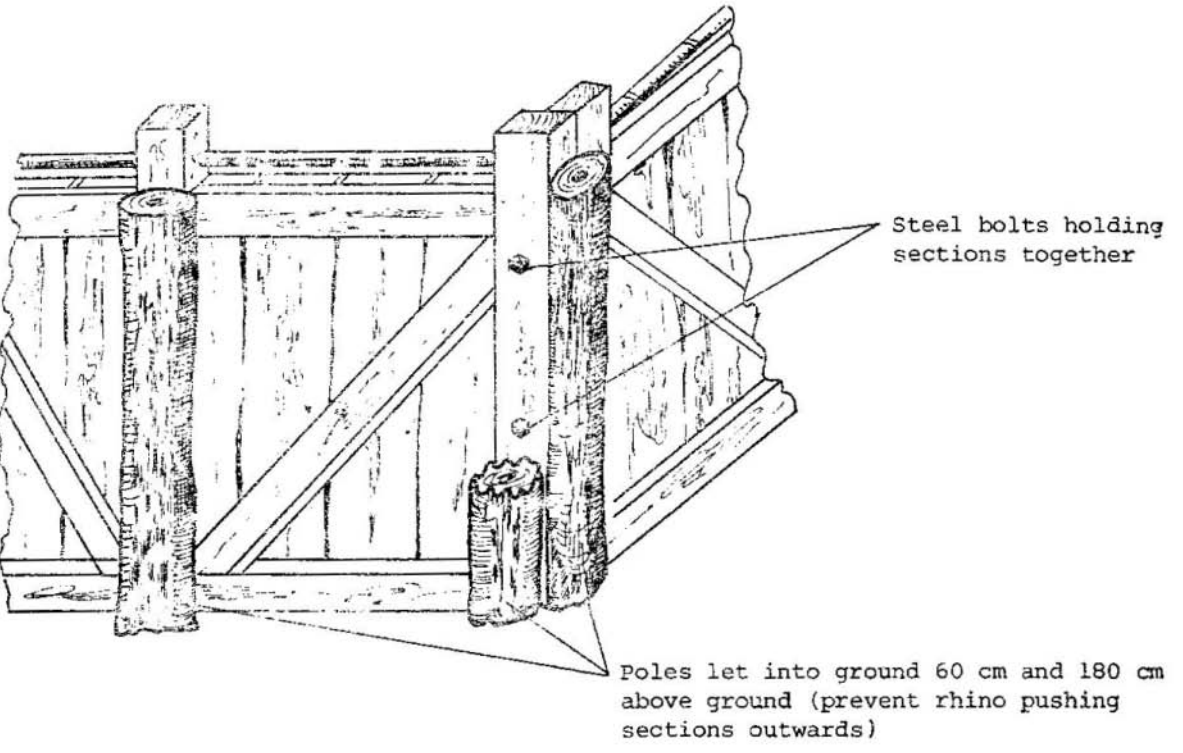
Crate

The crate should be extremely robust construction (Appendix A) as a rhino makes persistent attempts to destroy it after revival. Internal dimensions recommended are 370 cm long, 170 cm wide and 240 cm high. Side timbers should be planed smooth to prevent them from scratching the rhino, as it is jolted around during travel. It should have a drop door in runners at both ends, allowing manipulation of the rhino in the crate from the front or back and enabling it to exit from the crate forwards, on arrival at its destination.

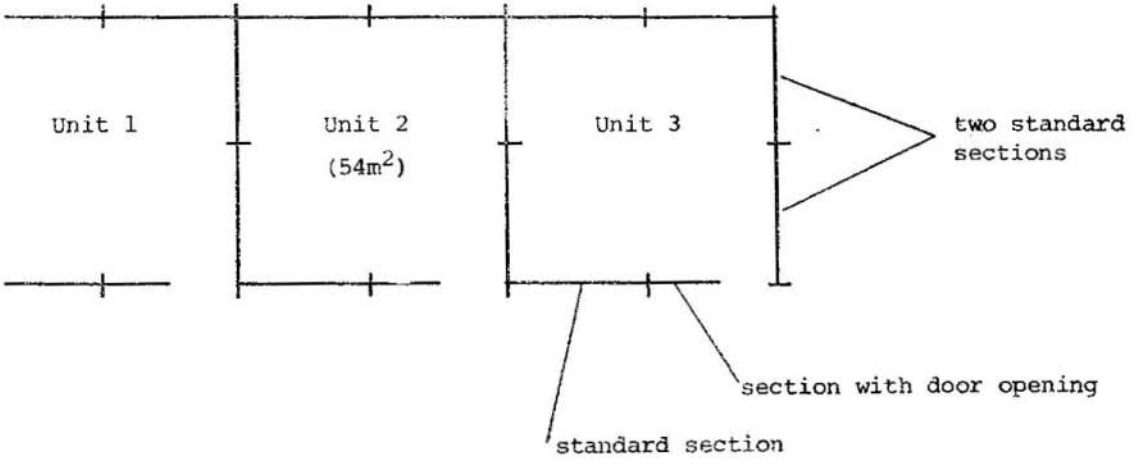
Loading crate

Because of the impossibility of lifting a loaded crate onto a truck in the field, it is necessary to load the rhino into the crate while it is roped to the truck. In order to facilitate this difficult operation it is desirable to lower the rear of the truck into the ground to bring the floor of the crate to a level near that of the sledge (Figure 2).

If it is impossible to dig a ramp into the ground, it is necessary to have a short wooden ramp available to bridge the gap between the sledge and the crate. As nearly as possible, sledge and crate should be horizontal



Formation of sections into units



and the sledge should be correctly aligned with the crate to facilitate loading of the rhino (Plate IIb).

After untying the ropes attaching the rhino to the sledge, it should be lifted/pushed forward into the crate. This is an extremely difficult task for men alone and tuskers proved invaluable in assisting with it. While the rhino's held up by two men, one elephant pushes/lifts the body behind the forelegs, while the second elephant pushes/lifts the rump. It is essential that they work in unison in providing slow, steady push, rather than sudden jerky movements which might injure the rhino. A pair of large, well trained and controlled tuskers can execute this task with great skill, without the risk of damage to the immobilised rhino.

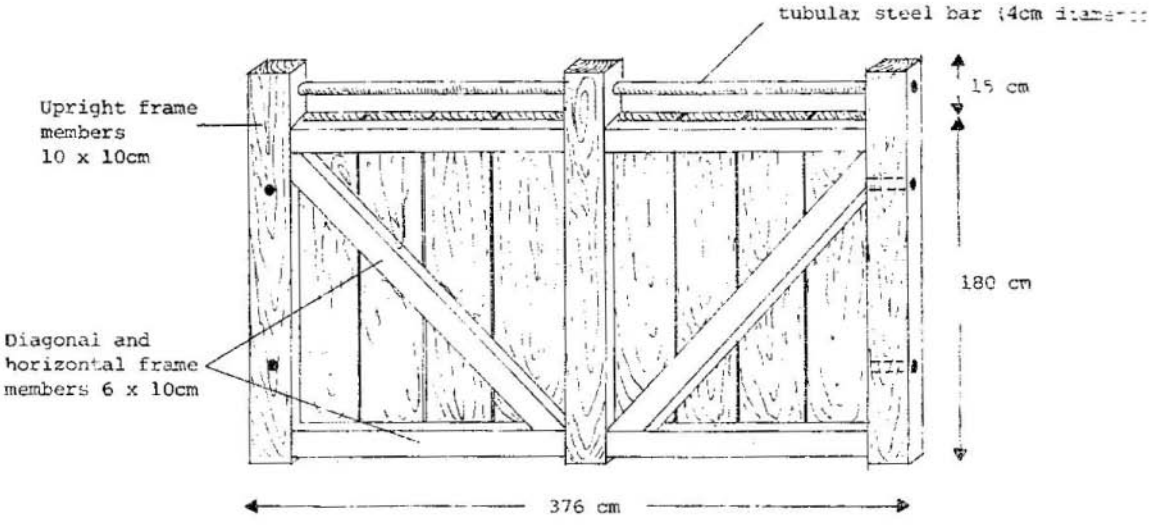
Once the rhino is safely in the crate, its legs can be untied and the Revivon injection administered. The crate door(s) should then be quickly closed and secured with bolts in anticipation of the animal reviving within several minutes of the Revivon injection.

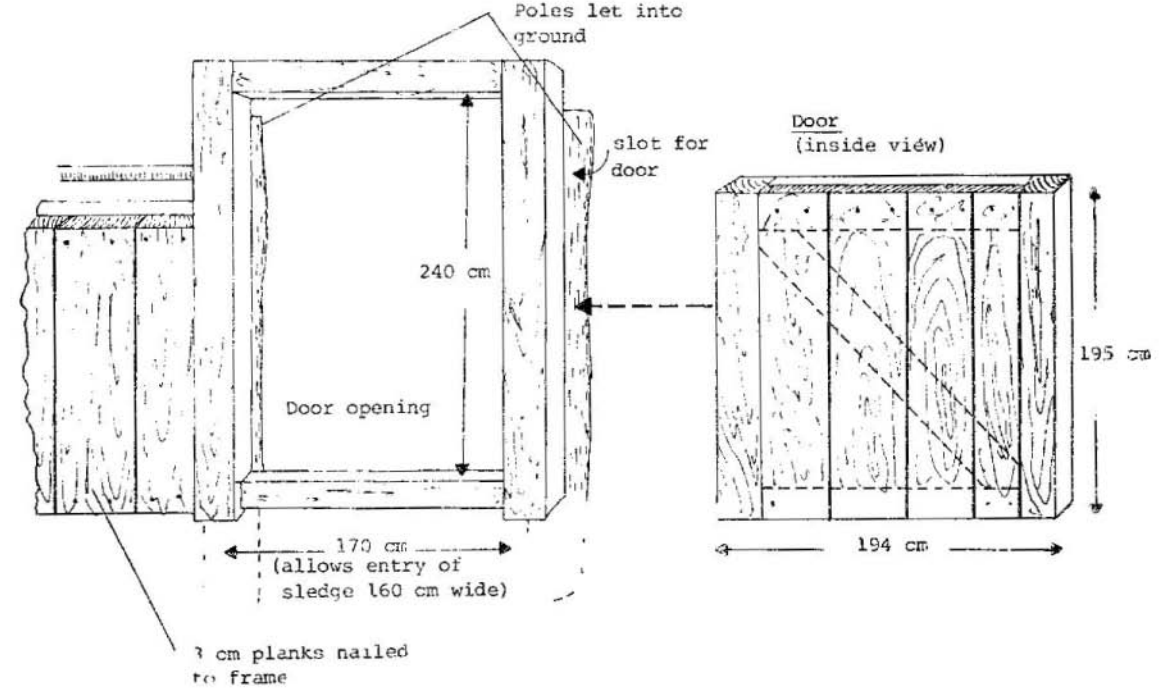
A great improvement on the above transfer procedure from sledge to crate would be to winch the sledge (with the rhino still on it) into the crate and bolt it firmly to the crate floor during transport. (Alternatively, the sledge could be carefully removed, under the sliding door, using a winch or elephant, once the rhino was on its feet.) This procedure would eliminate the difficult transfer of the rhino from the sledge into the crate. It necessitates the sledge being so designed as to fit into the crate and dimensions above have allowed for this. A winch should be fitted behind the cob of the truck to pull the loaded sledge (up a wooden ramp where necessary) into the crate. In the absence of a winch, elephants or cable through the crate and round a pulley behind the truck cab and out again. Alternatively, the loaded sledge could be pushed into the crate.

Unloading crate

The crate containing the rhino is best removed from the truck by using a crane. If a crane is not available, a ramp may be dug into the ground (Figure 2) near to the door of the holding accommodation. After the truck has been reversed into the ramp, men or elephants (Plate IIc) may be used to push the crate from the truck to the door of the holding pen using poles as rollers.

Once the front door of the crate is aligned to the door of the pen, both these doors should be opened and the rhino allowed to walk (down on earth ramp) out of the crate on its own, even if this takes time. As soon as the rhino is in the pen, the pen should be closed and the crate removed or reloaded onto the truck for a further operation.


tubular steel bar (4cm diameter)
Upright frame members 10 x 10cm
Diagonal and horizontal frame members 6 x 10cm
15 cm
180 cm
376 cm


Poles let into ground
slot for door
Door (inside view)
240 cm
Door opening
195 cm
170 cm
(allows entry of sledge 160 cm wide)
194 cm
3 cm planks nailed to frame

In cases where the holding accommodation is close to the immobilisation site, the sledge can be used to transport the rhino over the whole distance between these two points, eliminating the difficult crating operation. It is essential that the rhino be securely tied to the sledge, which can either be transported on the truck or pulled over the ground to the holding site where conditions permit.

4.5. Holding strategy and accommodation

Strategy

Ideally, captured rhinos should be held for 1 to 3 weeks in accommodation near to the capture site before being transported over a long distance in a crate. This reduces the stress of early captivity by allowing the animals relatively familiar surroundings and normal diet collected from their home range. Should holding near the home range not be possible, central facilities may be provided. Whenever possible, this should be at a forest site away from human and other disturbances and where plenty of fodder and water is available. The alternative is a zoo enclosure but the unfamiliar noises, smells and sights of a zoo may disturb the animal and detract from its acceptance of (temporary) captivity.

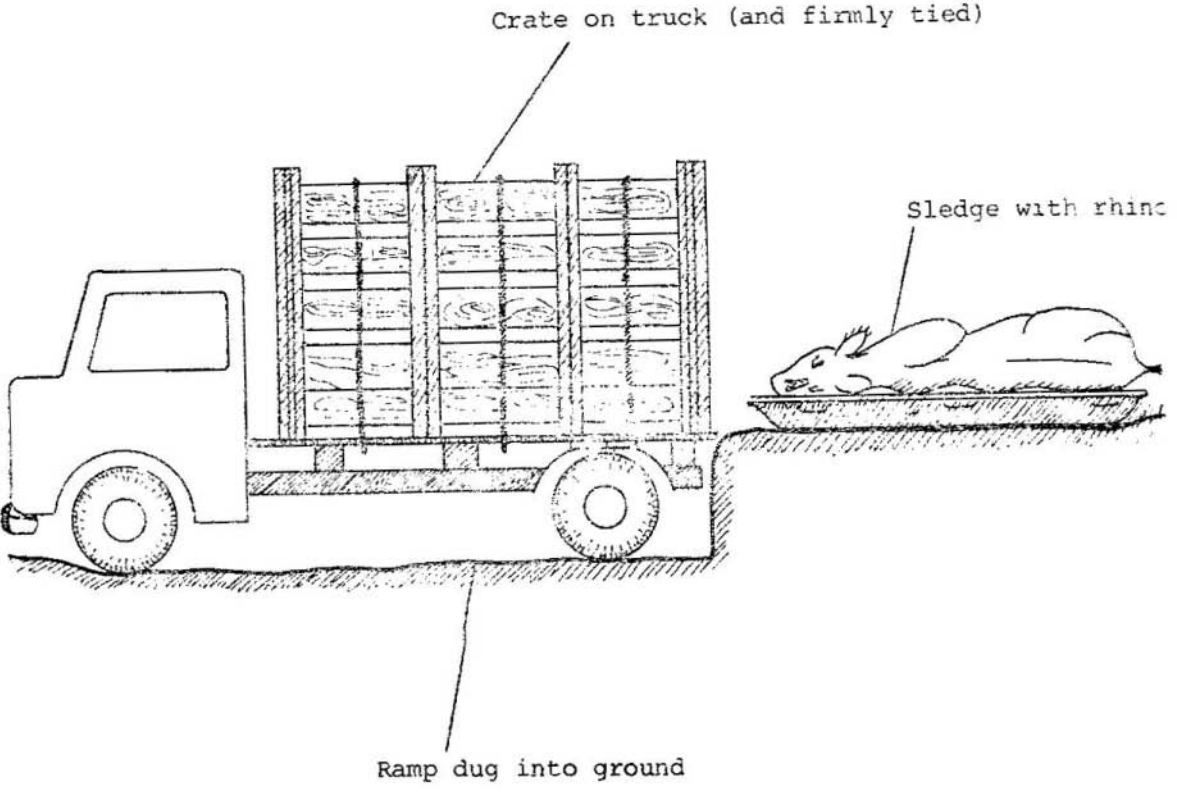
After a period of quietening down subsequent to capture, the animals can be moved, possibly over a long distance, to their ultimate new location. Here they should be held for a longer period (approximately 2 months) to allow them to gain familiarity with local food, water, sounds, smells, and climate before release into the wild.

Holding accommodation

Two types of holding enclosures were utilised in the present trials and a third type awaits testing under Indian conditions.

At Kaziranga traditional stockades were used made from vertical sal poles side-by-side, let into the ground and tightly bound together horizontally at several levels. The poles were of minimum 250 cm height above ground level. The stockades were constructed on the edge of a stream in such a manner that part of the stream provided a large wallow. The door was of the vertically sliding type, raised by a stout rope, passing over a gantry above the doorway. The dimensions of these stockades were approximately 20m × 12m which was adequate as a temporary holding area.

The first two animals captured were placed in spare rhinoceros accommodation at Gauhati Zoo, which consisted of rhino stable (house) attached to which was a walled exercise yard. A 200 cm high wall is essential for rhinoceros, as well as shade and a wallow.



For repeated capture and release operations in different locations the merits of a more portable stockade design are worth considering (Appendix A). A set of timber sections is constructed which can be used to erect stockades of various ground areas, at any given site and then dismantled, transported and re-erected elsewhere. The completely smooth and opaque walls eliminate the tendency of rhinos to try and prize their way out between the poles of traditional stockades, which has some times resulted in a broken horn or damage to the newly captured animal. Furthermore, rhinos settle down more quickly in a solid-walled stockade, preventing visual disturbance from outside (Harthoorn, 1976). If traditional stockades are used, cracks between the vertical poles should be stuffed with grass initially to give the appearance of a completely solid wall.

4.6 Medication carried/used

In addition to the immobilising drug and its animal and human antidotes, it is essential to carry a small number of medications for routine and emergency treatment of the captured rhinos. The following or local equivalent are recommended:

(i) Orbenin intramammary suspension (Beecham Animal Health, Brentford, U.K.) is a convenient semi-synthetic penicillin in a disposable syringe, containing 500 mg cloxacillin benzathine B.Vet.C. It was used for routine dressing of dart punctures and any minor injuries sustained by the rhino during handling.

(ii) Terramycin/L.A. Injectable Solution (Pfizer Ltd., Sandwich, U.K.) Each rhino captured received 40 ml i/m of this long acting formulation of oxytetracycline, as a general precaution against infection.

(iii) Concentrated Tetanus Antitoxin (wellcome Foundation Ltd., Crewe, U.K.). Each rhino received 2,500 IU s/c as a routine precaution.

(iv) Dexafort (Intervet Laboratories Ltd., Cambridge, U.K.). Each ml contains dexamethasone as phenylpropionate 2 mg and dexamethasone as sodium phosphate 1 mg. This drug exhibits potent gluconeogenic and anti-shock properties and was carried in case of acute shock symptoms following capture, such as circulatory failure.

(v) Parentrovite Multidose Injection (Beecham Animal Health, Brentford, U.K.) is a concentrated preparation of the B-complex vitamins together with vitamin C. It was carried for use in case of shock or stress due to prolonged recovery from the effects of immobilisation.

5. RESULTS

Five male animals were successfully immobilised during the trials, three at Karua and two at Kaziranga ; four of which were transferred to holding accommodation. The lack of females in the sample was not planned and reflects their greater elusiveness as well as the difficulty of distinguishing the sex of young adult rhinos in the field. Essential details of the five immobilisations are given in Table 1. Total doses of Immobilon administered ranged from 1.0 to 1.66 ml (2.45 to 4.1 mg etorphine) and of Revivon from 1.0 to 2.0 ml (3 to 6 mg diprenorphine). Complete revival was rapidly achieved in all cases and no significant side effects of immobilisation were observed. No medical problems were experienced and there were no casualties. Comments on problems that were encountered are given below, together with a statement on training achieved.

5.1 Problems encountered

A number of 'bounce-offs' of the projectile on impact with the rhino's skin were experienced. Several were perhaps due to using too powerful a charge for the range. Another cause was probably too great an angle between line of flight of the projectile and the rhino's skin on impact. It is essential to have a 90° angle of impact to guarantee proper penetration of the dart. Undoubtedly the heavy keratinisation of the rhino's skin was the major contributory factor in causing failure of needle penetration. The only way to avoid this problem is to strictly limit shots to the target areas indicated in Figure 1. This, of course, demands a high standard of marksmanship in the person operating the dart gun.

Slow and/or inadequate induction of immobilisation was common and four out of five rhinos had to be given a 'topping-up' dose of Immobilon (by re-darting) before adequate immobilisation was achieved. The causative factor may have been inadequate needle length, resulting in subcutaneous delivery of the drug, rather than intramuscular delivery essential for rapid and complete immobilisation (see. 4 2). However, the only animal that did not have to be topped-up (case 5) received the highest initial dose (1.0 ml) and it may be that, due to excessive caution, too low an initial dosage for a fresh species, which is also on the 'endangered' list, great care should be exercised to avoid an overdose. The only published dose of etorphine for the species is 0.001 mg/kg (Harthoorn, 1976). The mean initial dose in the present trials is 0.0013 mg/kg, while the mean total dose is 0.0022 mg/kg, more than twice the published figure. However, it should be borne in mind that the published cause was a zoo animal. A practical difficulty in dose calculation arises from the fact that in the field one frequently has to estimate the weight of an animal which is partly hidden by vegetation.

Case 2, the largest of rhinos in the series, partially recovered after 120 minutes, due to the unduly long time taken with loading arrangements (much jungle clearing was necessary in order to get the sledge to the animal and the labour failed to lift him onto the sledge). The standing rhino was in a non-aggressive, uncoordinated state and after attaching a neck rope, he was led 100 m to the truck with some difficulty but could not be persuaded to walk up the rather steep ramp to the crate. A small dose (0.3 ml) of Revivon was administered i/v in an attempt to improve coordination but the animal ran off dragging two neck ropes and had to be reimmobilised in order to remove these. Had there been time to dig the truck into the ground to reduce the angle of the ramp up to the crate, it might have been possible to walk this large animal into the crate.

The failure to load the Case 2 animal underscores the need for a well disciplined labour force, welded into a coordinated team. Undoubtedly repeated experience of such an operation by the labourers would help in the task of loading a large rhino. It is significant that the much smaller but well disciplined force of 13 trainees from the Central Crocodile Breeding and Management Training Institute had no difficulty in loading the two Kaziranga rhinos onto the sledge, although these were smaller than the Case 2 male and rolling rather than lifting the rhino was employed.

At Karua, a problem which had not been anticipated was large crowds of spectators (numbering up to 1000) which severely hampered the operations and increased the element of danger.

In all cases except 4, an interavenous dose of Revivon of equal volume to Immobilon received, produced rapid revival (mean 3 minutes, range 2-6 minutes). Case 4 was given an intra-muscular injection in the rump (due to inaccessability of its ears) of twice the Immobilon volume, in order to counteract the slower drug dispersal by this route. Even so, revival was slower (10 minutes) than in other animals, demonstrating the value of the intravenous route.

Communication between members of the team was sometimes a problem, both during the 'stalking' operation when elephants become widely separated and during loading when several separate aspects (positioning of truck, cutting track for sledge, care of immobilised animal etc.) needed careful coordination. The availability of 'walkie-talkie' radio would have greately helped in overcoming this difficulty and its use is recommended in future operations, as is standard practice in other countries.

5.2 Training achieved

Training in various aspects of drug capture and translocation was imparted to a total of twelve senior officers and thirteen trainees (Assistant Conservators of Forests/Range Officers level) as follows :

(a) Lectures on wild animal capture and translocation, given by Dr. M.H. Woodford at Central Crocodile Breeding and Management Training Institute, Hyderabad, were attended by all trainees of the 1979/1980 Course, the Assistant Instructor at the Insitute and three Government veterinarians engaged in wildlife work.

(b) The Veterinary Officer at Gauhati Zoo assisted Dr. M.H. Woodford in veterinary aspects of the operations at Karua, including drug preparation and loading of the projectile ; care

medication of the rhino during and after immobilisation. The District Veterinary Officer, Bokakhat similarly participated in the Kaziranga operations.

(c) The Senior Wild Life Warden, Assam Forest Department, fully participated in all aspects of operations at both sites. In consultation with FAO personnel, he was responsible for all logistic arrangements such as location of rhinos, transport, elephants, labour and liaison with local authorities. He was ably assisted by the Divisional Forest Officer, Bokakhat and Range Officer, Kaziranga, both of whom fully participated in operations there.

(d) The Divisional Forest Officer in charge of Gauhati Zoo and his Chief Engineer built (and later modified) the sledge and crate used, arranged appropriate holding accommodation in the zoo, supervised unloading of the crate and care of the rhino after unloading. The Divisional Forest Officer, South Kamrup Division designed and supervised the construction of traditional stockades.

(e) The Assistant Instructor and all trainees of the Central Crocodile Breeding and Management Training Institute participated in the Kaziranga captures, as part of a training tour, involving field exercises and a study of management in Kaziranga National Park. Care and handling of drugs (including human antidote) and delivery equipment was demonstrated ; a number participated in actual stalking and darting operations on elephant back and all took part in handling and loading of immobilised rhino and in the transfer of both the immobilised and revived animal into the stockades. The administration of Revivon and various medications and after-care were demonstrated.

6. CONCLUSIONS

All major objectives (see Section 2) of the trials were fulfilled and conclusions may be summarised as follows :

6.1 The usefulness of the drug immobilisation technique in the capture of the Great Indian rhinoceros was successfully demonstrated without casualities. Although certain details require further experimentation, there is little doubt that the technique can be used humanly and with complete safety on this species, provided proper precautions are exercised. In particular it should be noted that :

(a) Etorphine is a suitable immobilising agent and a dose of up to 0.0025 mg/kg appears to be safe for the species. It is highly toxic to man and should never be used in the absence of a specific human antidote. Strict regulations govern the importation of this narcotic drug into India.

(b) The delivery system should be one which minimizes the possibility of drug spillage and enables precise placing of the 'dart' on one of the limited target sites on the rhino. A long needle is essential.

(c) Diprenorphine is a suitable antidote and effects rapid and complete recovery, particularly when administered via the i/v route.

6.2 Capture and transport procedures were developed (as far as the holding stage). The use of well trained elephants, in the hands of experienced mahouts, proved vital to both 'darting' and loading procedures. The experience gained allows improvement in the design of equipment and a plan of operation, so as to reduce the time needed for the capture and transfer of a rhino to the holding pen. Basically, the approach involving the use of a sledge (and crate when necessary) proved to be a suitable one for the Great Indian rhinoceros in both types of habitat (forested hill side and grass covered, flat terrain).

6.3 A number of wildlife officers and 2 veterinarians in the service of the Assam Government and 13 trainees of Central Crocodile Breeding and Management Training Institute participated in the operations.

6.4 Further development and training in the capture and translocation of the rhinoceros is necessary. A fully competent capture team, incorporating all levels of capture and handling expertise, should be trained up if immobilisation and translocation is to play an important role in rhinoceros management in India. Such a team should include a Team Leader (Deputy Conservator of Forests with wildlife training prior to selection) ; and Assistant Leader (Assistant Conservator of Forests with wildlife training) ; Wildlife Veterinarian ; Veterinary Assistant and a Chief Field Technician (Range Officer with wildlife training). Only a professionally trained person, normally the veterinarian, should be involved in the handling of the potent drugs used in immobilisation. Several members of the team should be fully conversant with emergency procedure following accidental administration of a drug to a human subject. The handling of an endangered species such as the Great Indian rhinoceros, should only be

entrusted to a carefully trained, experienced capture team all of whom should have a background of training and experience in wildlife work, before selection for specialised training in the capture team).

6.5 Important aspects of rhino translocation yet to be tried and developed are long-distance transportation and the release of animals at new locations.

7. ACKNOWLEDGEMENTS

Many people assisted in the planning and execution of the capture trials. Administrative arrangements prior to operations were assisted by Dr. A.S. Alwan, FAO Representative in India ; Mr. N.D. Jayal, Joint Secretary (F & WL), Government of India ; Mr. S.P. Hazarika, Forest Secretary, Government of Assam ; Mr. M.M. Islam, Chief Conservator of Forests and Chief Wildlife Warden, Assam Forest Department and Dr. H.R. Bustard then FAO Consultant and currently Chief Technical Adviser of IND/74/046 Crocodile Breeding and Management. This work was carried out through the Central Crocodile Breeding and Management Training Institute and the cooperation of the Director, Mr. Pushp Kumar, is acknowledged. Practical help in making equipment and field operations was afforded by Mr. A. Gohain, Senior Wildlife Warden, Assam Fores Department ; Mr. Hazarika, Divisional Forest Officer incharge of Gauhati Zoo ; Mr. Verghese, Chief Engineer at Gauhati Zoo ; Dr. M. Barua, Veterinary Officer Gauhati Zoo ; Mr R.M. Sonowal, Forest Range Officer in charge of Kaziranga National Park and Mr. K. C. Patar, Divisional Forest Officer, South Kamrup Division. To all these persons we extend our grateful thanks for help rendered, without which the capture trials could not have been mounted. Dr H.R. Bustard and Mr. Pushp Kumar read and commented on the manuscript and Mr. Joseph J. Karoor provided several of the plates and their contribution is acknowledged

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