SADC REGIONAL PROGRAMME FOR RHINO CONSERVATION

RADIO-TRACKING COORDINATION

Raoul du Toit & Charles Mackie

Semester 2 Task 6.1-1.1

Semester 3 Task 6.1-1.2

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ABOUT the SADC Regional Programme for Rhino Conservation:

The Programme is funded by the Italian Ministry of Foreign Affairs, Directorate General for Development Cooperation (Project AID 5064).

The Programme is contracted to CESVI and implemented through a regional consortium which comprises:

- The Secretariat of the Southern Africa Development Community (SADC)
- IUCN-ROSA (The World Conservation Union - Regional Office for Southern Africa)
- The IUCN African Rhino Specialist Group
- WWF-SARPO - (World Wide Fund for Nature - Southern Africa Regional Programme Office)
- CESVI (Cooperazione e Sviluppo)

The ***Programme goal*** is to contribute to maintain viable and well distributed metapopulations of Southern African rhino taxa as flagship species for biodiversity conservation within the SADC region.

The ***Programme objective*** is to implement a pragmatic regional rhino strategy within the SADC region following the acquisition of sound information on, firstly, the constraints and opportunities for rhino conservation within each range state and secondly, the constraints and opportunities for rhino metapopulation management at the regional level.

DISCLAIMER

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REPORT ON WORKSHOP HELD AT MALILANGWE, 17 FEBRUARY 2001, TO DISCUSS RADIOCOLLARING OF RHINOS

Raoul du Toit

Present: C. Foggin, P. Morkel, M. Haupt, M. Kock, R. du Toit, J. Kriek, A. Lewis, P. Buss, W. Meltzer, J. Honeywill

Pupose: The workshop was held to take advantage of the gathering of relevant expertise at the annual Dangerous Drugs Course, in order to discuss aspects of rhino radiocollaring, including:

The problem -	the need for radiocollars; inadequacies of present designs; official policy on radiocollaring in Zimbabwe; lack of expertise and insufficient co-ordination; lack of resources.
Present designs -	neck collars with elasticised inserts; neck collars without elasticised inserts; horn implants; body implants; transmitter specifications (size, range, battery life, etc.).
New developments -	transmitter technology (satellite fixes, GPS, transponders); collar materials; implants.
What next?	things to be tried where? by whom? future co-ordination.

Rationale for ongoing trials of radiocollars

All participants agreed that radiocollaring is a crucial tool for rhino monitoring but has various problems that need to be ironed out – no one can yet claim to have produced a totally rhino-friendly and durable collar.

Experience with radiocollaring of rhinos

The meeting reviewed experience to date, with a slide show by M. Kock to illustrate some of the radiocollaring trials in Zimbabwe. The concept of a collar with an elasticised insert, in top central position on the neck, protected by a nylon sleeve (first suggested by P. Morkel) has been used extensively in the past, and still is. Another concept, introduced by B. O'Hara, is a steel cable in a hose to carry a transmitter that is encased in a lump of acrylic or fibreglass.

Problems have included the following:

There is a risk of pressure necrosis behind the ears, even with only slight pressure from the elasticised collars, and it was found necessary to fit them with a space of 2-3 fingers between the transmitter and the throat.

The neck circumference varies according to the position in which a drugged rhino is lying and the collar must be fitted with the neck in an elongated position. But if the neck muscles bulge when the revived rhino lifts its head with its own muscle power the collar may then be too tight.

The insert collars do not stay on rhinos as long as we need them to (although one is known to have stayed on for 19 months).

The length of the elastic insert is difficult to get right because if it is too short there is insufficient stretch but if it is too long the collar tends to fold over and may compress an ear.

It may be best for the insert to extend to just below the ear on each side. Any riveting or other join in the vicinity of the ears tends to cause abrasion of the ear bases.

The elastic materials lose elasticity over time, so the collars sag.

The rate at which rhinos shed their collars increases in the wet season, and their habit of mudwallowing adds to the risk of collars being shed.

Bulls tend to shed collars quicker than cows or subadults.

Bulky transmitters such as the most commonly used acrylic-encased Telonics model tend to bounce excessively as the rhino runs, adding to the risk of the collar slipping over an ear.

White rhinos are particularly difficult to radiocollar because their ears are further back, rather than being above the throat, so the collar has to bend behind the ear bases.

It is possible to follow-up a rhino after collaring to check from a helicopter if the collar is too loose or has flipped over an ear, but it is not easy to see if the collar is creating a lesion.

The sleeved cable design was shed too easily and created a potential snare around the rhino's neck, so is no longer used in Zimbabwe.

Any kind of rigid or semi-rigid collar is likely to damage the ears, even if it is specifically moulded to angle back from the jawbone to behind the ears. The collar <u>must</u> be soft/flexible on the sides and top.

Possible improvements in radiocollars

Some ideas on improved materials and designs were suggested as follows.

A more streamlined transmitter housing could be designed. For instance, a simple collar could be made of nylon seatbelting and the transmitter could be wrapped in the belting and covered with acrylic to form a housing that is bonded snugly to the collar. Acrylic does not bond well to smooth plastics such as are used for Telonics and Sirtrack collars, but strong bonding can be achieved with more fibrous machine belting or nylon weave.

Bone cement is stronger and lighter than acrylic but can't be digested with chemicals to easily remove the transmitter for refurbishment. The ideal may be to have an inner layer of acrylic around the transmitter with an outer layer of bone cement.

The concept of a very simple collar of soft but tough nylon seatbelting, with no elastic insert, might be worth trying especially if the transmitter can be made as small and light as possible.

A simple leather belt may be an alternative since the leather may deform to the shape needed to fit around the ears comfortably. But without ongoing treatment the leather may lose flexibity and crack as it is exposed to water and sun.

A smaller transmitter could be designed if a smaller battery pack is used. The participants agreed that the strength of transmission should not be reduced in order to prolong battery life. One Sirtrack design reduced the strength of transmission in order to achieve a five-year battery life but the signal range proved to be inadequate. A collar will not stay on for this long anyway so there is little point in sacrificing signal power. Participants agreed that a two-year battery life, with normal signal strength, is sufficient. Motion sensors can be used to reduce the frequency of signals when the animal is resting, or timer switches could be used so that the transmitter switches off for periods, with the aim of reducing the size of the battery that is needed to achieve a two-year life with standard signal strength.

M. Haupt gave his technical opinion that Telonics devices have proved to be the most reliable and can be made to fit within a 35x35x35mm housing while still achieving a 50-60km range along line-of-sight.

Signal transmission should ideally be optimised by tuning the antennae in the field, with an oscilloscope, when each collar is fitted. Although P. Morkel had found that the breakage of antennae often had less serious consequences for signal strength than theory would suggest, it is generally important to protect the antennae within the collar and to try to keep the ends of each at least 9cm apart, with a total spread of 50cm. If one of the antennae has to be reduced in length then it should be the "cold" one. If this is cut off then the end should be attached to a rivet so as to achieve contact with the rhino's skin.

The potential risk that very strong collars could strangle a rhino if snagged is small, since rhinos will almost always be able to break the object that is snagging them even if they can't break the collar. But this risk may be reduced by building in a link of pre-determined weakness. Timer releases (each about US$250?) might also be considered, along with remote control devices to disconnect the collar, but these would probably be too expensive and merely an added complication for most applications.

Ideally, collaring should be undertaken at the beginning of the dry season because of the increased rate of collar shedding in the wet season.

Ideally, collars should be attached while rhinos are in bomas and can be observed for 10-14 days to check that the collars are not creating lesions and are functioning properly.

The idea of administering long-acting tranquillizers to rhinos to reduce the likelihood that they will deliberately try to scrape off their collars before getting used to them was not endorsed by participants. In fact, observations of collared rhinos in bomas do not indicate that rhinos deliberately try to scrape off their collars. Rhinos seem to shed their collars in non-deliberate ways with individual behaviour, such as frequency of mud-wallowing, playing a big part.

A length of insert of 50-70 cm seems appropriate, with an ideal width of 35mm.

Implants

A. Lewis explained the current commercial interest within South Africa in radiotracking to be able to “find” special animals for tourists, a purpose for which invisible implant transmitters are most suitable. Various biotelemetry options are possible with these implant devices, such as temperature and blood flow monitoring. Surgical wax coatings create problems because they don’t allow the implants to adhere to tissues and therefore create permanent abcesses. Resin coatings can case reactions. Porous bone cement is effective, since good adhesion of fibrous tissue is achieved, and powdered antibiotics can be mixed in for slow release. Breast implant technology may also be relevant. Thermoplastic materials have potential. It may be possible to bolt transmitters to bones, such as an animal’s pelvis. For all these options, considerable experimentation on less valuable animals will be required to find the right materials. Subcutaneous implants in rhinos (away from pressure points) are a less risky option for experimentation than abdominal implants. Experimentation with dead rhinos, such as white rhinos shot by safari clients, is important to test the strength of signal that can be achieved.

Horn implants are useful in certain circumstances. P. Morkel intends to continue experimentation with horn implants, with colleagues such as B. Beauchamp in South Africa, and the possibility of some of this horn implant research also being done in Zimbabwe, with funding from the SADC Rhino Programme, must be considered. With experienced personnel, the time taken to fit horn implants can be as short as 10 minutes. With an adult rhino, a horn implant transmitter should function for at least 12 months. Placement of the transmitter in the rear horn, under a protective cap of dental acrylic or titanium, should be attempted since the rear horn is exposed to less wear than the front horn and also does not grow as quickly. Or the transmitter might be fitted in a mould that is secured in the saddle between the two horns.

It may be possible to glue small transmitters to the tail hairs of a rhino, using Araldite cement and transmitters with relatively short battery life, as with elephant seals. A reception range of 35 km from an aircraft should be achievable.

Modern transponder technology linked with small GPS engines and cellphone cards, such as the “Digital Angel” system that is under development in the US, is likely to soon yield some devices that will be useful for rhino monitoring. R. du Toit is monitoring these developments, along with S. Osofsky of WWF-US..

Next steps related to the SADC Rhino Programme radiocollaring project

A small project is underway in Zimbabwe to try some new collar designs using locally available materials. It has become apparent that attempts to design better collars must include the repackaging of transmitter circuits and batteries in more streamlined housings. This work can be undertaken by M. Haupt in Pretoria, who can also seek a wider range of collar materials in South Africa. There is some funding from the SADC Rhino Programme to support ongoing research and R. du Toit and C. Foggin will liaise with M. Haupt to make a plan for this research-and-development of new collar designs. Other colleagues will be continuing with their own research-and-development, such as work on horn implants by B. Beauchamp and P. Morkel. Liaison can be maintained within a network of interested professionals by emailing.

Relevant addresses

This is an informal network, within which colleagues are urged to share ideas and experiences of relevance to rhino radiocollaring. This is not meant to be a complete list, nor one that confers any obligations on anybody, and the addition of any other names will be welcomed. Ongoing research is intended under the SADC Rhino Programme, for which R. du Toit can be a point of contact (also M. Haupt) so any ideas on specific designs or materials for testing would be appreciated. The findings of this research can be discussed within this network in due course.

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RADIO COLLAR RESEARCH AND DEVELOPMENT

Charles Mackie

Background

This consultancy was initiated as part of a larger SADC Regional Programme for rhino conservation through IUCN ROSA supervised by WWF SARPO. The specific objective was to develop and test better attachment methods for suspended transmitters on free ranging rhinos. To date, attachment of neck or suspended type collars, for the duration they are required to remain on rhinos (up to 2 years), has been problematic. The main problems encountered are summarized below:

- The shape of the rhino's neck tends to force the collar to sit on its ears or work forward over the ears causing abrasion or trauma.
- Too robust a collar, may ensnare the rhino in thick bush or man made obstacle.
- The collar may come off, either through ware or when wet and slippery can be forced off by the host.
- Variations in rhinos' physical condition and growth in young animals means that ideally the collar should have the ability to stretch or otherwise accommodate the range in neck circumference.
- Immobilized rhinos may recline awkwardly during immobilisation resulting in an "inflated" neck diameter and some expansion property is necessary to accommodate this.

Additional weak points and problems of suspension collars relating to materials and construction are listed as follows:

- Accumulation of mud in the folds and under the collar causes abrasion and injury.
- Elastic section (in elastic insert designs) breaks at the joint to the PVC section of collar.
- Collars ware through and fall off within 2 years.

With this in mind the ideal specifications for collar design were defined and as far as possible materials were sourced which fitted the following specifications.

- Thickness – as flat as possible but not more than 15 mms thick overall.
- Width- min 40 mms, max 70mms.
- Stretch- 5 to 10% with approx 30kg pull.
- Breaking strain - 200 kg.
- Overall length of 135-160cms

For elastic collar inserts a number of lengths were proposed and two lengths were made; one of medium length - 45cms and a long version of 60 cm. (These were specifications given by C. Foggin and there is some in clarity about the required or ideal lengths for insert sections. Hofmeyer (1999) recommended insert lengths of 15 cm).

Materials

It is self evident that most collars have been developed using materials that are readily available. A number of unsuccessful attempts were made to have materials or variations of materials made to specification. Almost any material can be made however, but only in large quantities, which, for the purposes of this work were unreasonable.

A number of samples of standard, easily obtainable materials are submitted and the sample numbers here refer to those on the samples submitted with this report.

Sources of supply

Sample 1. Blue polyurethane layflat chemical hose – HT-LFM040 40mm.
Sample 2. Black sponge rubber strip –RU-SP10x60

Source: Universal Rubber and Hose Harare Pvt. Ltd.
81 Belvedere Road,
Box 4647,
Harare.
Tel 263-4-737542
Fax 263-4-720465

Cost: 1 Z$ 326.98 US$3.44/m
2 Z$ 134.49 US$1.41/m

Sample 3. Braided upholstery elastic (Grade II). Available as grade I (weakest), II, III (strongest)

Source: Paramount Elastics & Tapes Manufacturing Co Pvt Ltd
Leyland Road,
Ardbennie,
Harare.
Tel 263-4-620720,620729,666921
Fax 263-4-666922

Cost: Z$17.95/m US$ 0.19cents/m

Sample 4. Bungi Latex rubber strap (plied 9 and 4 times in sample)

Source: Unknown manufacturer, supplied by Mr Ash Palmer, Victoria Falls
Tel 011-407696

Collar development

In large part this consultancy referred to recent practise and experimentation by local practitioners; Messers Du Toit, Brett and Foggin and the consultant's previous experience in radio telemetry, in particular elephant and rhino in the early years of development of telemetry in Chizarira National Park.

Major references were Du Toit (1996) and Hofmeyer (1999).

The terms of reference requested experimentation along two lines and as far as possible these were followed and referred to as Elastic insert section and Radial expansion.

1. Elastic insert – Figure 1

The elastic insert section was made using No II grade elastic (sample 3) from Paramount Elastics (No III grade was not available except to order in large quantities), using 6 and 8 layers of elastic, stitched into PVC belt ends of the MMKC transmitter collar. At the joint with the PVC insert an extra fold of elastic was used as protection to the joint. Three prototypes were made using different protective web sheaths, which were stitched by Johnson's Saddlery in Harare. One of the sheaths was using sample 1 while the others were taken from other collar prototypes obtained locally. Sample 5 is the best example of sheathing material, which can supplied locally by paramount Garments. In order to avoid "nest" sites for mud aggregations on the underside of the sheath, the sheath was allowed to slide with an overlap. No stitching was made through the sheath to allow the elastic to stretch.

2. Radial expansion – Figure 2

This concept is intended to obviate the problem of inflated neck diameter during immobilization.

Figure 2 shows the principle and design of the collar, which is made of blue chemical layflat hose (sample 1), containing a strip of 10mm thick rubber sponge. This was made by the consultant but not tested before premature termination of the contract. An insert section 60 cms long, containing double thickness rubber sponge (2 pieces10mm thick) was made along the same lines, to sit around the upper neck section with the transmitter (Telonics 555 type) suspended below.

A further line of experimentation was investigated. This was with Proplastics, Spurn Road, Ardbennie, Box CY 2525, Causeway. The concept was to encase the transmitter in a hard polypropolene encasement blended into a softer polyurethane or sponge inner section possibly joined with in situ electro bonding to fuse the ends. This seems a novel idea but the plastics engineer was only to become available in March 2001.

Contacts and communications

The following other persons were contacted in the course of this consultancy:

Kevin Lay
Mark Atkinson
Ash Palmer Shearwater Adventures
Derek Pitfield MD Proplastics Ltd

Only one of them provided new materials or innovative ideas regarding materials. Otherwise materials with promise were sourced locally by the consultant.

The following local experts in Rhino Conservation and Management were contacted: R. du Toit WWF SARPO, R. Brett IUCN ROSA, C. Foggin DVS

Discussion

Little can be said about the prototypes until they can be tested on rhinos. Nevertheless the following discussion applies.

Elastic insert

The elastic insert principle appears to be simple to achieve. The question of how resistant to wear this can be made without the sheath chafing, or accumulations of mud on the underside of the sheath wearing the rhinos' neck, still remains. Elastic also tends to loose its elasticity with ware and time. Latex rubber however is very resilient and soft.

The plied latex bungee section, one of 4 ply and 1 of 9 ply, is soft and offers the ideal stretch property. Four ply appears to give ideal elasticity and strength. This has not been developed further but if encased in suitable material may be useful as an elastic insert. Again the resistance to ware inside a sheath needs to be tested. Its joint to any other part of an insert will also have to be developed but if used with the lightweight Telonics 555 transmitter this is not a factor. The elastic insert protected by the blue layflat hose appears to have promise except that there is potential for the problem of mud accumulation. This can perhaps be overcome by moulding the hose with heat once the section has been made to remove the folds and uneven sections.

Radial expansion

The collar with the blue layflat hose carrying the Telonics 555 transmitter with or without the sponge rubber within, also appears to have potential, because for one, it is light and with a 10mm sponge within does not have prominent folds on the inside. A version with two plies of sponge (20mm) has not been tried but it is thought to have similar properties. It ability however, to compress and therefore expand after attachment to the rhino appears to be very small. Latex bungee strips also have some radial expansion property because while it is stretched it also flattens marginally, which with its stretch and soft properties has potential.

The prototypes or variants of collars produced in this work appear to be an improvement on existing collars and some of them may be quite successful. Only testing on free ranging rhinos will allude to this.