REVIEWS

A review of colour-marking techniques used on vultures in southern Africa

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Summary

This document aims to provide the background to and motivation for the decision by the Birds of Prey Working Group of South Africa to implement the use of patagial tags for the colour-marking of vultures, under the auspices of the Sasol Vulture Monitoring Project. Information is provided on the reasons for the review of colour-marking before 2006 and the various alternative options considered and tested during 2005.

Introduction

With the amalgamation of the Vulture Study Group (VSG) into the Birds of Prey Working Group (BoPWG) of the Endangered Wildlife Trust (EWT) in 2004, responsibility for the management of vulture colour-marking activities under the auspices of the Sasol Vulture Monitoring Project was deferred to BoPWG. It was evident that the functioning of the database and distribution and use of colour rings to participants in vulture colour-marking in southern Africa at that time needed an in-depth review and update, in particular the following aspects: (1) the company that held the mould and was responsible for the production of the colour rings and spacers used in the colour-marking of vultures had changed ownership, resulting in the mould becoming mislaid (a new mould would have to be forged at considerable cost to continue production and supply of rings), (2) the database was in serious need of updating and not all data of colour-ringed birds had been captured, (3) issue and control of colour-combinations to participants had become disorganized and it was evident that several ringers were creating their own permutations, leading to the duplication of the use of combinations in several instances, (3) colour-ringing was done in some areas by individuals not qualified and registered as ringers and by others not following a standard protocol and birds were being ringed and released without minimum biometric data required by SAFRING being collected and submitted, (4) there was a substantial back-log in the submission of ringing data to SAFRING and BoPWG by some ringers, (5) there were numerous doubts and complaints about the durability, colour-fastness and visibility of the colour rings in the field and (6) re-sightings and recoveries over more than 30 years of colour-ringing of 7,000+ vultures in southern Africa had yielded a return of less than 10% (S.E. Piper pers. comm.)

BoPWG hosted a Raptor Ringing

Workshop that preceded its Annual General Meeting at the Magalies Conference Centre in the North West Province during March 2005. This workshop was attended by more than 40 people from across southern Africa, all interested and involved in the ringing and colour-marking of raptors. At the workshop the challenges and various options with regard to vulture colour-marking were discussed in detail. Delegates agreed to the suspension of vulture colour-marking activities under the auspices of the Sasol Vulture Monitoring Project during the 2005 ringing season, while a detailed assessment of available methods was conducted by BoPWG over a period of 12 months. Findings were to be collated and a recommendation made as to the most viable option for use in the colour-marking of vultures in southern Africa in the future. The following aspects were to be used as important guidelines in the assessment process: (1) the proposed system should be simple, user-friendly and facilitate consistent implementation across southern Africa, (2) the welfare of the birds should be of paramount importance at all times and should not inhibit their normal life cycle and behaviour, (3) the marking method to be used must have a proven track record of durability and resistance to discolouration, and should prevent removal thereof by the bird itself, (4) the system should be cost-effective and affordable, (5) it should facilitate an optimal rate of return with regard to re-sighting and recovery, and (6) the system should be effectively managed and coordinated.

Colour-marking methods investigated

Plastic rings

This refers to the method of colour-marking used on vultures under the auspices of the Sasol Vulture Monitoring Project until 2005. The method consists of the fitting of a combination of five plastic rings together with a metal ring provided by SAFRING to both legs of the bird in various colour combinations (three plastic rings on the one leg and two plastic rings with the metal ring on the other).

As mentioned above, the mould for these rings was lost when the company responsible for the manufacture thereof changed hands and a new mould would have had to be made should this option be decided on. A meeting was held with a plastics moulding company in Johannesburg, De Sa Industries, who provided the best quote for this option. A new mould would cost R18,000.00 to produce and would require 6-8 weeks to manufacture before rings could be produced. Individual rings could be produced at R0.56 per ring and R0.52 per ring spacer. A complete combination of colour rings for a single bird would thus amount to R3.83, excluding the cost of the metal SAFRING ring. According to De Sa Industries, an unlimited range of colours could be produced, which would offer a wide range of possible colour combinations.

The confusion and challenges faced in keeping the database for this method up to date has been mentioned above. In consultation with a number of participants and judging from evidence gathered

during observations of ringed birds at vulture restaurants and in captivity at the De Wildt Vulture Unit, this method has proved to have numerous limitations and shortcomings which considerably reduce its viability for future use. These are: (1) discolouration was evident in several cases and prevalent in certain colours when rings were removed after 2-3 years of having been fitted, (2) individual rings are seemingly easily loosened and removed by the birds themselves which renders combinations useless, (3) hypo- and hyper-keratosis on the leg areas in contact with plastic rings were evident in all captive birds examined (P. Bartells, pers. comm.), and (4) the visibility of rings was easily compromised by dirt, when birds were perched and the legs were covered by plumage from the underparts of the bird or when birds were on the ground in areas of taller grass.

"Canadian" PVC rings

A range of these rings, manufactured by Haggie in the USA and ProTouch in Canada, has been used with good results in species such as cranes, storks and waders (birds with proportionally longer tarsi than vultures) in southern Africa in the past. James Wakelin from KwaZulu-Natal Wildlife was the first to fit these rings vulture nestlings in southern Africa. He ringed 27 vulture nestlings in the Phongolo- and Mkuze Game Reserves in Zululand in 2004 (Wakelin 2004, 2005).

These rings consist of a hard, durable PVC plastic that can be engraved with a specific number/code for individual birds. Due to the hardness of the plastic, rings should preferably be warmed prior to fitting as they can be difficult to open. A range of ten colours is available and the colour of the engraved lettering can be made available in white, black or transparent lettering. Based on the total cost for 40 rings ordered for use on the vultures in Zululand in 2004, a single PVC ring costs R41.50. This excludes the cost of a SAFRING metal ring.

At the Raptor Ringing Workshop in 2005, a number of concerns were raised around the potential impacts on vultures and the effectiveness of the use of these rings. Part of the focus of the assessment process was to investigate these and provide feedback in this regard. Some of the findings related to this method were as follows: (1) The 60 mm PVC rings that were fitted to nestlings in Zululand covered the entire tarsus of both Lappet-faced Vultures ***Torgos tracheliotos*** and African White-backed Vultures ***Gyps africanus***. Concerns were raised that limited movement of the ring could in the longer term lead to restricted blood flow to the leg and foot of a ringed bird. Evidence of this was found on a bird at the Rare and Endangered Species Trust (REST) in Namibia fitted with such a ring, that showed marked chafing and swelling when the ring was removed (M. Diekmann, pers. comm.). (2) A further concern was that waste material could accumulate between the ring and the leg and in the longer term increase the risk of bacterial infection in this area. (3) Concerns around the length of the rings were investigated by fitting 25 Cape Vultures ***Gyps coprotheres*** at the De Wildt Vulture Unit with PVC rings of varying

lengths (60 mm, 55 mm, 50 mm, 45 mm and 40 mm) during early December 2005 (Figure 1). Hypo-keratosis was noted on birds wearing the 55 mm and 60 mm PVC rings within two months of them being fitted. These tests will continue to assess potential impacts over a full 12 month period. (4) Shorter length PVC rings in some birds seem to become stuck some way up the tarsus, i.e. the ring does not rest on the bird's "foot". This could in the longer term lead to a restriction in blood flow or other effects on the leg to which the ring has been fitted. (5) Similar to the use of other plastic rings on the tarsi of vultures, the visibility of rings can be compromised by dirt, when birds are perched and the legs are covered by plumage from the under-parts of the bird or when birds are on the ground in areas of taller grass. To date it had not been possible to access re-sighting data of birds in Zululand. Two dead birds were, however, recovered that had been fitted with these rings.

Figure 1. Fitting of shorter lengths PVC rings at De Wildt Vulture Unit, December 2005.

Darvic rings

Darvic rings are similar in nature to Haggie PVC rings and are manufactured from the same type of material. These rings were used successfully on captive vultures during work related to the Asian Vulture Crisis (J. Parry-Jones pers. comm.). The cost of these is similar to the Haggie rings, but the rings come in a more limited range of colours and sizes, limiting their suitability for use on vultures. The same concerns regarding the physical effects of the rings on the bird's leg were expressed, but not tested as part of the assessment.

Similar concerns to the other two leg-fitted colour-marking systems with regard to visibility in the field are relevant here and it can be assumed that the same limitations will be experienced in this regard.

Patagial tagging

Although patagial tagging has been used widely in the colour-marking of birds (Hewitt & Austin-Smith 1966, Kochert 1972, Southern 1971, Wallace ***et al.*** 1980, Kemp 1992, Charaloumbos 2002), this option was initially viewed as the least likely option to be considered for use in southern African vultures. The following concerns were raised and needed to be addressed if this option was to be followed at all: (1) the method is intrusive and could harm birds if not applied with due planning, care and consideration, (2) birds might harm themselves by trying to dislodge the tag/s from their wings, (3) African vultures are considered to be more aggressive and birds might be harmed by other vultures at a carcass due to the tag on the wing being pulled and tugged on, (4) the tags will negatively

affect the birds' ability to get off the ground, gain height and fly effectively, (5) the size of the tag decided on for use might be too large for smaller species of vulture, (6) tagged nestlings might be abandoned by their parents, (7) tags could interfere with the reproductive ability of birds, (8) members of the public, e.g. tourists and photographers, might react negatively to large numbers of vultures being observed with plastic tags on their wings, and (9) the rate of re-sighting and recovery of tagged birds will not significantly improve, compared to other methods of colour-marking.

In attempting to address these concerns, it was decided to consult the relevant literature and individuals who have applied this method before and to also implement controlled trials testing this method on captive and wild birds under controlled circumstances, observing and recording the reaction of birds individually and among each other after tagging. In instances where birds were tagged, regular veterinary inspections of such birds were to be done where possible to establish whether the tags and areas where perforation occurred were negatively affected in any way. Any sign of adverse effects on tagged birds would lead to an immediate suspension of trials and the removal of tags from birds where possible. The process followed is presented below.

Literature review

The assessment process on the use of patagial tags was initiated in May 2005 with a study of available literature on this method to establish details related to suitable materials, areas and process of application and applicability of the method on large scavenging birds (Hewitt & Austin-Smith 1966, Kochert 1972, Nesbitt 1979, Wallace ***et al.*** 1980).

Tag materials and supply

Information on the most suitable, durable and safe material used in the production of patagial tags was sought from a number of individuals with previous experience in the use thereof for the colour marking of birds and mammals. Alan Kemp and Patrick Benson provided valuable insights into the materials that they found most suitable when colour-marking large birds in the Kruger National Park during the 1980s. Angus Anthony, a VSG-member of long standing who has been involved in the ringing of vultures around Kimberley for a number of years, also provided valuable information and suggestions, especially in view of his years of experience in the use of tags in the management of large herds of cattle. Maria and Jörg Diekmann provided similar inputs from their experiences in cattle-ranching in Namibia. Tim Osborne provided additional advice in view of his experience in the marking of Kori Bustards ***Ardeotis kori*** in Etosha National Park and also assisted in providing contact details for the manufacturers of Allflex® tags.

From the information gathered, it was evident that the best option for use on vultures would be tags similar to those used on cattle and other livestock worldwide. These tags have a proven track record of durability, colour-fastness and ease of use. Contact was made with

a reliable supplier of tags based in South Africa through Angus Anthony. Axxon (Pty) Ltd. provides a range of tags from a number of international manufacturers to livestock farming suppliers (e.g. farmers' co-operatives) across southern Africa and is able to provide tags and tag applicators according to specification at competitive prices.

Determining and monitoring areas on the wing suitable for application

Several references consulted (e.g. Hewitt & Austin-Smith 1966, Southern 1971, Kochert 1972, Wallace ***et al.*** 1980) consulted provided accurate guidelines with regard to the appropriate site on a birds' wing where patagial tags should be applied. The tag should be attached one third of the way from the bend in the fold towards the outside of the wing and no less than 25 mm from the leading edge of the flap. Before a tag is applied, the area should also be inspected visually to ensure that there are no veins, tendons or others structures in the area that could be damaged.

As an added measure, Zephné Bernitz, a qualified veterinarian and member of the BoPWG Advisory Committee, dissected the wings of a number of dead birds of various species to inspect the relevant area and to ensure that no structures vital to the birds' mobility, blood supply or nervous system would be affected by the fitting of a patagial tag. In all species inspected, no such structures were found in the intended area of application.

Areas of application were disinfected properly prior to the tag being fitted and the tag components as well as the tag applicator were first submerged in a disinfectant solution to minimize the risk of infection. None of the perforations in captive and wild birds that were inspected for as long as seven months after application, and to the present, have shown any signs of infection, swelling or enlarging after application of the tags (P. Bartels pers. comm..). Ten captive birds at the De Wildt Vulture Unit initially fitted with smaller tags in May 2005 also facilitated detailed inspection of the perforations after these tags were removed, to be replaced by tags of a larger size in November 2005. Again none of the above signs of potential negative impact was evident in these.

Patagial tag size

Initial tests on captive birds at the De Wildt Vulture Unit and at REST in Namibia using smaller "hog tags" (Figure 2) normally used on smaller livestock such as pigs, goats and sheep did not provide satisfactory results as birds tended to preen their wing coverts to extend over the tags. This made the alpha-numeric coding on the tags difficult to read. The lettering on this size tag was also quite small and difficult to read from a distance.

Subsequent tests with the larger "cattle tags" (71 mm wide x 66 mm long with a "neck" of 18 mm wide x 30 mm long) proved adequate for use on vultures, with optimal visibility being afforded by the neck which extended the printed surface of the tag beyond the reach of the wing coverts. The larger size of the tag also facilitated the use of a larger letter

size in the alpha-numeric code. This size tag has been fitted to Cape Griffon, African White-backed, Lappet-faced and Hooded ***Necrosyrtes monachus*** vultures over the last 12 months with no apparent effect on the birds' ability to get airborne, fly, soar and land.

Figure 2. "Hog tag" fitted to a vulture at the De Wildt Vulture Unit (Photograph: Kerri Wolter).

Sequence of testing of tags

Due to the intrusive nature of the method of application, it was decided to first fit tags to captive birds and then, providing that no negative impacts were observed on birds fitted, to expand testing to wild birds in the nest and, if possible, to free-flying wild birds. As part of the assessment, birds were tagged as follows:

Birds in captivity

Twelve birds (Cape Griffons and African White-backed Vultures) were fitted with "hog tags" at the De Wildt Vulture Unit and at REST in May 2005. Birds showed no ill effects from the tagging process and were not once observed attempting to remove tags fitted themselves. Neither was any attempt witnessed of birds trying to dislodge tags from each other's wings, even during feeding. Findings of inspections on the perforations and the replacement of the "hog tags" with "cattle tags" have been discussed above. Since September 2005, another 40+ vultures at the De Wildt Vulture Unit were fitted with the larger tags and none of the birds have shown any negative reaction to the tags. Some of these birds have subsequently been released after rehabilitation and have contributed valuable information on the movement of birds post-release as part of a cellphone-tracking project run by the De Wildt Vulture Unit and BoPWG.

Vulture pulli

After the findings of the effect of tagging on vultures in captivity were known, it was decided to tag and monitor a small number of nestlings in the Kalahari to determine what the impact of tagging would be on the chicks and their parents. In August 2005, Abrie Maritz and André Botha fitted four African White-backed Vulture nestlings with bright blue patagial tags, after which they were returned to the nest (Figure 3). Parent birds returned to the nest within about 45 minutes and proceeded to feed the nestlings, with no apparent reaction to the tag on their nestling. Abrie Maritz conducted follow-up visits until the chicks fledged and observed no apparent discomfort of the tag to the nestlings or abandonment of nests by the parents. During September and October 2005, he proceeded to tag a further 65 nestlings in the Vanzylsrus

area of the Northern Cape.

Mark Anderson, Angus Anthony and their team ringed and tagged an additional 43 African White-backed Vulture nestlings at Dronfield near Kimberley in October and November 2005 (Anderson 2005). Their findings on the reaction of nestlings and their parents to tagging were identical to those at the Vanzylrus colony. One of the tagged nestlings was recovered after a suspected poisoning incident near Kimberley about five months after tagging. The tag and area on the wing where it had been inserted was inspected and found to be in good condition with no indications of attempted removal, infection or other negative impacts of its application. The bird was also found to be in good physical condition and was released after rehabilitation.

Figure 3. One of the first African White-backed Vulture nestlings tagged in the Kalahari as part of the assessment (Photograph: Neels Jackson).

Wild, free-flying vultures

A serious poisoning incident near Hoedspruit in the Limpopo Province on 15 October 2005 resulted in the death of 31 vultures. Another 17 birds (one Hooded Vulture and 16 African White-backed Vultures) could, however, be saved and rehabilitated prior to being released back into the wild from the Moholoholo Rehabilitation Centre (Figure 4). This provided the opportunity to test patagial tagging on wild, free-flying vultures as part of our assessment of this method. All 17 birds were fitted with tags at Moholoholo on 4 November 2005, after which the birds were released at the centre's vulture restaurant.

Figure 4. Hooded Vulture being fitted with a patagial tag at the Moholoholo Rehabilitation Centre prior to release.

Due to a concerted awareness campaign and good public participation, we have received almost 90 reports of re-sightings of tagged birds from across the Lowveld (eastern South Africa) to date. Twelve of the seventeen birds have been re-sighted since release with very interesting movement data having been collected from these re-sightings. This amounts to a re-sighting rate of almost

71% from a relatively small sample of birds, but provides substantial proof of the value of using this method to colour-mark vultures. All birds re-sighted were reported to be in good condition.

Presentation of findings and decisions taken at BoPWG AGM, March 2006

The findings of the assessment of vulture colour-marking methods were conveyed to the plenary at the BoPWG Annual General Meeting on 14 March 2006. The recommendation that patagial tagging be accepted as the preferred method for the colour-marking of vultures in southern Africa was ratified. As part of this process, delegates were asked to provide input and decide on a number of aspects related to the method. The following recommendations were received and incorporated into the BoPWG's colour-marking protocol for vultures: (1) Patagial tags will be fitted to both wings of a vulture. The usual metal ring from SAFRING will be put on one tarsus of the bird. (2) Tags will be attached only on the dorsal side of the wing as tags fitted to the ventral side could possibly affect flight. (3) A leather punch should be used to perforate the skin on the wing flap prior to the tag being applied. This will prevent pinching and stretching of the skin during application. (4) A single colour tag will be used across all regions where tagging will be done. A new colour tag will be issued only once a particular project's alpha-numeric code sequence (001-999) has been completed. (5) Each area/project where vultures will be tagged, will be awarded a unique alphabetical code. (6) Codes and other wording will be laser-burnt onto tags. The alpha-numeric codes will also be enhanced by using special marking pens to improve readability in the field. (7) All re-sightings and recoveries will be channeled through SAFRING. (8) BoPWG will be responsible for the administration of the colour-marking scheme as well as the acquisition and distribution of tags and tagging equipment to the relevant participants. (9) Tags will be issued according to a needs-assessment done by participants at the commencement of the ringing/tagging season. No tags will be issued unless all relevant ringing data have been submitted to SAFRING and BoPWG. (8) The implementation of patagial tagging must be accompanied by a concerted public-awareness effort to ensure optimal reporting of re-sighted and recovered colour-marked vultures throughout the region. (9) A detailed colour-marking protocol has been compiled and distributed to interested parties for comment following the approval and recommendations received at the BoPWG AGM. It is expected that the final draft of the protocol will be available by the end of April 2006.

Conclusion

The assessment of vulture colour-marking methods for use on vultures in southern Africa has been an interesting process that provided the BoPWG with the opportunity to find the best practical option that would result in the use of a safe marking method applicable to all species of vultures occurring in southern Africa. It is believed that the

decision to use patagial tagging in future will facilitate the implementation of an effective method that will ensure optimal results with regards to re-sighting and recovery of colour-marked birds (Figure 5).

Figure 5. Tagged African White-backed Vulture photographed at a vulture restaurant almost three months after release from Moholoholo. The full crop is a good indication that the bird is doing well and is not inhibited by the tag when competing for food.

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Postscript

Since writing the article, a number of developments and adjustments with regards to the tagging protocol have been agreed upon. The use of a leather punch to make guide holes prior to tagging has been abandoned due to the tissue damage caused by the use thereof. The edges of the tags must also be cut off prior to fitting to prevent preening birds getting a firm hold of them in their beaks and pulling the indentations along them.

The number of vultures tagged during 2006 and early-2007 now stand at 615 and the total number of reported re-sightings of these birds on the database exceeds 600. Significant movements have been recorded, but details of these will be provided in a future article in ***Vulture News***. An active media and public awareness campaign has accompanied the implementation of this project and an excellent response has been received received, especially from the Lowveld of South Africa where many reports were received from tourists and ranger staff from private nature reserves and the Kruger National Park. Participants in this programme are also encouraged to initiate concerted re-sighting efforts at vulture restaurants and to report all sightings of tagged birds.

Tagging has also been implemented for African Fish-eagle ***Halieetus vocifer*** nestlings at two study sites (the Breede River in the Western Cape and the Vaal and Orange Rivers in the Northern Cape). Marabou Storks ***Leptoptilos cumeniferus*** have been tagged at REST in Namibia, in Swaziland and at the Moholoholo Rehabilitation Centre. Secretarybirds ***Sagittarius serpentarius*** could also soon be included in this initiative.

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