TECHNIQUES

COLOUR-RINGS FOR VULTURES

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Introduction

At the Wildlife Management Symposium in June 1973, discussions were held which led to the formation of a Vulture Study Group. Dr. Mike Jarvis, Martin Johannsmeier, Peter Mundy and the writer were present, and Peter convinced the rest of us that colour-ringing of birds we handled would pay handsome dividends in terms of valuable data resulting from sightings of colour-ringed birds. At that time Peter was using the spiral colour-rings available from NUBRA, but I came away from the symposium with the idea of trying to use Darvic, a coloured PVC sheet that was said to be a superior material for making colour-rings (Coulson, 1963). I first called on Peter Milstein, who was making spring-tight rings for his Bald Ibis project (Zambatis & Milstein, in press). He was kind enough to describe his manufacturing process and also gave me some samples of the plastic. I then contacted the manufacturers of Darvic with a brilliant scheme that would involve their supplying us with material free of charge for scientific purposes - unfortunately they saw through the plot and I had to buy my own Darvic. After much experimentation with rusty pieces of pipe and old chisel-handles a prototype ring was produced which seemed suitable, and was first used on nestling Cape Vultures (Ledger & Mundy, 1973). A year later, and with the enthusiastic assistance of several members of the W.B.C. ringing group, we have perfected a process that enables us to produce Darvic rings in quantities. In the meantime, Richard Clark has also made spring-tight Darvic rings for his Sacred Ibis project. The purpose of this article is to give full details of our Darvic vulture ring.

Requirements

In any colour-ringing project, the rings should reasonably be expected to remain on the bird for the greater part of its lifetime, and the colours must remain true. The moment birds start losing their rings, or the colours change, the whole project becomes a waste of time since false combinations result when a ring is lost from a series, or if blue becomes black, for example. Colour-ringing has always been a problem in Africa, where the amount of sunshine and resultant ultra-violet radiation plays havoc with plastic, causing colours to change and the material to become brittle. Some years ago, Clive Hunter had the experience of starting a big project of colour-ringing Cape Sparrows, and realising after two years that he was wasting his time because the birds were losing their rings. In the case of long-lived birds with powerful beaks like vultures, the problems become much greater than they are for small passerines. Our oldest Cape Vulture so far has lived 14 years after ringing - it would indeed be a remarkable plastic that would survive the rigours of such a long time. It is rather doubtful that such a material exists, but we have taken steps to get some indication of the life we can expect from our rings, and these are mentioned below.

Material

"Darvic" is the registered trade mark of a range of sheet materials made from unplasticised polyvinyl chloride (PVC) by I.C.I.

Limited. To make the vulture rings we use the standard grade in six colours (red, white, blue, green, yellow, black), purchased in sheets of 1829 x 1219 x 1,5mm. Like other plastic products, the price of Darvic has soared as a result of the oil crisis. Darvic has an impressive record of chemical resistance, and details of tests performed with some 400 chemicals may be found in I.C.I.'s Technical Service Note D 106, which also gives much other information on the product. It is a thermoplastic substance which becomes soft when heated above 80°C. At this temperature Darvic can be moulded into various shapes, and if cooled in position, retains the shape of the mould. If the moulded product is heated above 80°C again, it will return to its original flat shape. (Here a word of caution to users of Darvic rings is appropriate - if rings are left on the ground in full midday sunshine, especially if they are in plastic bags, the temperature can rise to softening point and the rings become distorted through flattening. We have experienced this in the Kruger National Park and in Rhodesia (Mundy), and black is particularly vulnerable since it absorbs the solar radiation). Darvic can also be machined, sawed, drilled, turned, ground, pressed and engraved. It is quite extensively used in the signmaking industry, and laminated sheets are available for this purpose. With a black-white-black laminate, for example, the signwriter can engrave through the black layer until he hits white, so getting a very neat effect of white letters on a black background. Houston (1974) made vulture rings from yellow-black Darvic laminate which he engraved to get a black numeral on a yellow background. Darvic can be glued with special PVC cements, or by using the solvent Cyclohexanone. Glueing with these adhesives takes rather long, and Houstan (1974) had to bind his rings with wire until the cement had dried.

Manufacturing Process

To make vulture rings of 24mm internal diameter we first cut 90mm wide strips off the big sheet with a tungsten-carbide-tipped circular saw. The strips are marked at 12mm intervals and cut on a guillotine to give a rectangular piece of Darvic 90 x 12 x 1,5mm (fig.1.). This strip is trimmed with a modified 16mm bell-punch mounted in a hand-vice to round the corners (fig.2). The finished strip is dropped into boiling water, and when soft is folded (fig.3) and transferred to the die (fig.4). The die and strip are returned to the water for further warming, then the mandrel is forced into the die (fig.5) to give the ring its exact shape (fig.6). The ring is allowed to cool below softening temperature before ejecting it from the die. Our Mark 1 die (fig.7) requires that the ring be ejected by pushing on the projecting tab, while the more sophisticated Mark 2 (fig.8) has a sliding inner section that automatically ejects the ring. Dies and mandrels (fig.9) are machined from mild steel, then "blued" by heat treatment to resist corrosion. The ring is finished off by punching a 2mm hole through the tab with a modified leather punch. Locking the ring onto the bird's leg is achieved by passing a No.14 bifurcated rivet through the tab and flattening the arms with a pair of modified pliers (fig.10). The rivets are steel, and are available with either copper- or nickel-plating against corrosion.

Using the ring

The ring is simply stretched open and slipped onto the tarsus. A rivet is pushed through the holes in the tabs (fig.11). The V-shaped nose of the modified pliers is forced between the arms of the rivet to open them (fig.12), then the pliers are turned parallel to the tarsus and the two halves of the rivet pressed flat (fig.13). It is essential that the rivet be closed very firmly so that it is al-

most embedded in the Darvic and no lateral movement of the locked tab can take place.

Evaluation

We are satisfied with the performance of the new ring so far, but will continue to modify and test it in the light of new developments. One of our first targets has been to evaluate whether the Darvic ring has any advantages over the spiral rings Peter Mundy was using. These rings are made of Xylonite, a celluloid material, and Peter was cementing them tightly closed with the solvent Acetone before releasing the birds. Through the good offices of Manfred Schmitt it was possible to send a set each of the Darvic and Xylonite rings to the S.A.Bureau of Standards to test them for colour-fastness. It would take a lot of space to describe the test method (S.A.B.S. No.405) but in brief, the rings were exposed to the ultra-violet light from a Xenon lamp until a distinct colour-change took place. The standards used for comparison were numbered from 1 to 8, No.1 being of very low light fastness, each standard being about twice as light-fast as the one below it. The test was run for 154 hours before severe colour-changes took place in some of the Xylonite rings, and then each of the rings was assigned a rating of colour-fastness. All the Darvic rings were rated at 7, as were yellow, black, orange and green Xylonite rings. The red and blue Xylonite rings were rated 6 the purple as 4-5 and white as 3-4 (copies of the test report are available to interested persons on request). This test convinced us that Darvic is superior to Xylonite in terms of colour-fastness to U.V. light, but how can one predict the time it will take to fade a ring on a vulture's leg? This is clearly impossible. Apart from the fact that the rings are in shade when the bird is flying or perched, they will be immersed in water when it bathes, be exposed to all manner of organic chemicals when the vulture stomps around in the putrid remains of dead animals, and be sand-blasted during takeoff and landing. Furthermore, because the ring can rotate and is held (when not flying) in a nearly vertical axis, the total exposure to U.V. light will be a fraction of that in the test-chambers of the S.A.B.S. The manufacturers and users of Darvic do not recommend it for outdoor use in tropical climates because they say the colours start to be affected after about a year. Nobody can duplicate the conditions prevailing on a vulture's leg, and only time will give us these answers. Looking for other possible defects we must inquire whether Darvic is likely to become brittle with age - we don't know at this stage, but certainly it seems to be a strong material several times thicker than the Xylonite, and we do not think the ring itself can be broken by a vulture. The other possible weak point is the locking mechanism. There are some remarkable modern adhesives on the market (like one I spilled on my fingers and had to cut the skin to separate them), but they are exceedingly expensive and we have no idea on how they would stand up to life on a vulture's leg. The bifurcated steel rivet is the best locking device we can find at present. Provided the rivet is properly closed, the ring cannot be opened except by breaking it. We noticed fairly severe corrosion of some rings taken from dead Cape Vultures under their nesting cliffs, but this is no true indication because the corpses are soaked by water running from the base of the cliffs, and again we have no idea of how long the rivet will last on the living bird. Dr.Clive Elliott very kindly visited the bifurcated rivet factory in England and brought back samples of aluminium rivets for us to test - unfortunately they are so soft that the rings can easily be opened by hand. We have also tried aluminium "pop-rivets", but found that the force required to shear the internal pin is sometimes so great that the whole rivet is dragged

through the hole in the tab, damaging the ring beyond redemption. To evaluate the performance of the ring over the next few years, a three-point plan has been adopted:

1. A full set of rings closed with both copper- and nickel-plated rivets has been suspended at an angle of about 30° from the vertical on a water-tower in the Transvaal. The rings are exposed to sun throughout the day and to all prevailing weather conditions. The date of commencing this natural weathering test coincides with our first use of Darvic rings on the Cape Vulture. The rings are inspected regularly, and when the time comes that we can see colour-changes or find that there is so much corrosion of the rivets that they are no longer effective, we will know it is time to consider that similar deterioration has taken place in the rings on the living birds. Every year we plan to add another string of rings to the water-tower, and in time this should give us some idea of what to expect. (Incidentally, I would recommend this simple weathering test procedure to everybody who does a colour-ringing study).

2. Dr.Mike Jarvis and Peter Mundy both have vultures in captivity wearing Darvic rings. With their kind collaboration we will get some idea of how the bird itself can affect the life of the rings by biting or pulling at them.

3. It has been arranged that all colour-rings from recovered vultures will be returned to us for evaluation. As time goes by we will have a series of rings taken from birds after a known time in the wilds, and only then will we be able to give a full report on the life-expectancy of our Darvic vulture ring.

In the mean time, Peter Mundy has had the chilling experience of discovering that vultures which he has caught with so much effort and personal risk have been losing their Xylonite rings. I am grateful for the following report he has compiled for this article:

"I have stopped using Xylonite spiral rings in favour of Darvic rings. I recaptured 4 Whitebacked Vultures and resighted 3 others, each of which had lost all of their three rings. I resighted two Hooded Vultures which had lost one or both colour-rings. My captive Whiteheaded Vulture, in an aviary at the University of Rhodesia, has lost a colour-ring about 15 months after I ringed it, and the upper colour-ring on a captive Whitebacked Vulture has worked its way down over the lower ring so as to obscure it completely. The colours of the Xylonite rings have remained true - up to 9 months so far in the field and about 18 months on a captive bird. However, the spectral purity of the colours leaves something to be desired - green and blue, and orange and yellow are very easily confused. Every spiral ring was stuck with Acetone. I think the vultures may have worked away at the ring, broken the seal and then pulled at the outer end as if pulling on a strip of meat. The ring is therefore simply unrolled from the tarsus. I have changed to the Darvic rings, before they have been in use long enough for a full evaluation, for the following reasons:

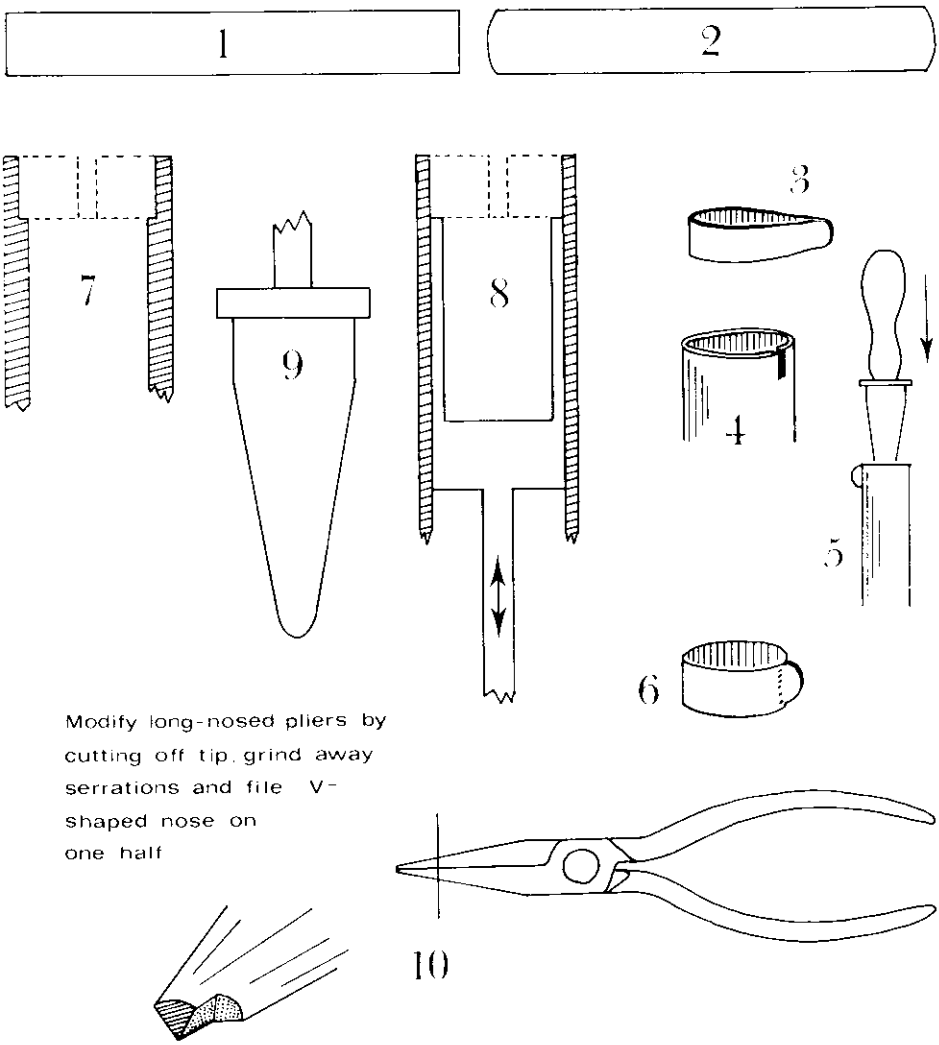
(i) The ring has a tab, so one cannot slip over the other

(ii) Darvic seems less brittle than Xylonite

(iii) Locking the ring properly with a rivet should make it 'vulture-proof'

(iv) The six colours are very bright and clear.

The disadvantage of the time taken to fix on a Darvic ring is a minor one compared to the advantages listed above."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Modify long-nosed pliers by cutting off tip, grind away serrations and file V-shaped nose on one half
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Availability

The W.B.C. put its new colour-ring design to the NUBRA Technical Subcommittee. The design was approved and the Unit will be stocking supplies of the 24.0mm vulture ring. The Unit will also be investigating the possibility of obtaining other colour-ring sizes in Darvic and it is likely that 16.0mm and possibly 10.0mm rings will be available. For the six available colours, the price is likely to be around R5 per 100 for 24.0mm and R4 per 100 for 16.0mm rings. Enquiries should be directed to the writer or to NUBRA.

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It is a pleasure to acknowledge the assistance of many W.B.C. ringers whose imaginative minds and varied skills have made the Darvic ring possible: Richard Sadler, Mike Fagan and Paul Whitehouse did the necessary machining work, Frank von Maltitz designed and supplied the trimming device and also cuts the sheets, while Manfred Schmitt is especially thanked for arranging the weathering test and for designing the Mark 2 die. Several others are acknowledged for spending their free hours making rings, and Peter Mundy (University of Rhodesia) has kindly provided information on his experience with colour-rings on vultures in the field.

References

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A NEW DESIGN OF PLIERS FOR REMOVING BADLY FITTED RINGS

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In the British Trust for Ornithology publication "Ringers Bulletin" Vol.4 No.3 dated July 1973, Mr. J.Ely wrote an article on a design of pliers to remove badly fitted rings. It occurred to me that Mr.Ely's design was both cumbersome and almost impossible to use when working single-handed (as is the case on my ringing excursions). Accordingly I asked Mr.R.Klomfass, Senior Technical Officer at the Human Anatomy Department, University of the Witwatersrand, if he could design a more practical set of pliers. He then made what I consider to be a very useful addition to my ringing equipment.

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