SHORT COMMUNICATIONS, NOTES AND REPORTS

Comparing different types of patagial tags for use on vultures

Richard P. Reading[1,2,3*], Glyn Maude[1,2,3], Pete Hancock[2,3], David Kenny[1,3] and Rebecca Garbett[2,3]

[1] Denver Zoological Foundation, 2300 Steele Street, Denver, Colorado 80205 USA

[2] Kalahari Research and Conservation, Maun, Botswana.

[3] Raptors Botswana, Maun, Botswana.

*Corresponding author: rreading@denverzoo.org

Summary

Raptor research often requires identifying individuals. Researchers place patagial tags on raptors to facilitate such identification. Researchers in southern African use two main types of patagial tags: hard plastic ear tags originally designed for cattle and soft vinyl tags. We deployed both types of tags on vultures in Botswana. Based on our observations, we recommend using soft vinyl tags as they appear to be more aerodynamic and can be read from below when a raptor is soaring, as well as when the bird is perched. Cattle ear tags sometimes flutter when raptors fly and can only be read when the dorsal surface of the wing is visible.

http://dx.doi.org/10.4314/vulnew.v65i1.3

Introduction

Rapid declines of vulture populations throughout the Old World have generated concern and associated research on a variety of species. Today the IUCN (2013) considers five of the nine species occurring in southern Africa as Endangered, and two as Vulnerable. Even formerly

quite populous species, such as White-backed Vultures (*Gyps africanus*) are now considered Endangered. Other threatened species include the Endangered Cape Vulture (*Gyps coprotheres*), the Endangered Rüppell's Vulture (*Gyps rueppellii*), the Endangered Egyptian Vulture (*Neophron percnopterus*), the Vulnerable Lappet-faced Vulture (*Torgos tracheliotos*), the Vulnerable White-headed Vulture (*Trigonoceps occipitalis*), and the Endangered Hooded Vulture (*Necrosyrtes monachus*). We began studying vultures in Botswana in 2012 in response to the rapid declines of several species there. Two of us (RR and DK) also have been studying the ecology of Cinereous Vultures (*Aegypius monachus*) for over a decade in Mongolia and South Korea (Reading *et al.* 2005, 2010, Batbayar *et al.* 2008, Kenny *et al.* 2008, 2013). An important component of our (and other) studies of vultures involves applying patagial wing tags on relatively large numbers of birds to help assess movement patterns, establish core and home ranges, and assess population trends.

As part of our work in Botswana, we used two types of patagial wing tags: wing tags designed for California Condors (*Gymnogyps californianus*) (Wallace *et al.* 1980) and plastic cattle ear tags used widely throughout southern Africa (Birds of Prey Working Group 2006, Botha 2007). Here, we compare the two types of wing tags for use in vultures and other large avian species, especially raptors.

Methods

We conducted work throughout Botswana, but primarily in the western portion of the country, from 2012 to 2014. Capture sites included just east of Makgadikgadi National Park, Bokamotsu Ranch on the northwest border of the Central Kalahari Game Reserve (CKGR), Tuatona Lodge near Ghanzi, Grasslands Reserve between Ghanzi and the CKGR, Kalahari Rest Camp near Kang, Mpayathutlum Pan in Kalagadi Transfrontier Park, Molose Pan in Khutse Game Reserve, Santawani, and Big Pan and Deception Loop in the Central Kalahari Game Reserve (Figure 1). Although these sites varied considerably ecologically, they all lie within the Kalahari Region of Botswana.

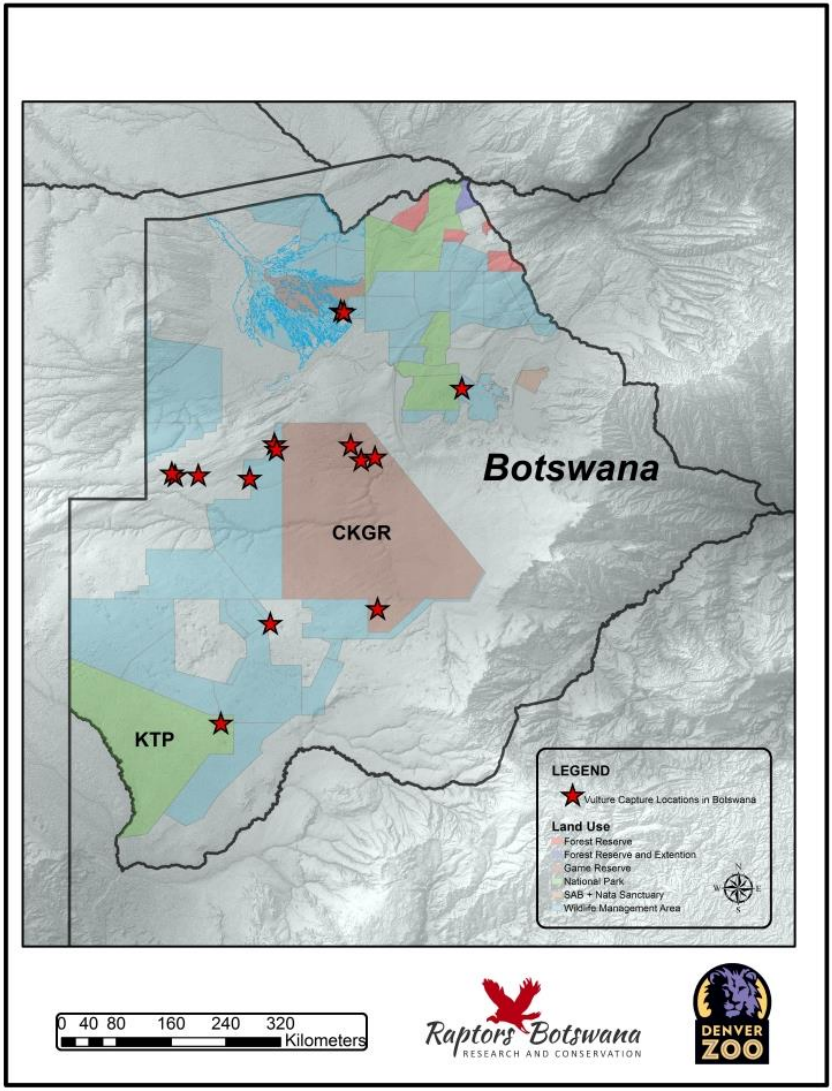

Figure 1. Vulture capture sites in Botswana.

We captured White-backed Vultures (WBVs), White-headed Vultures (WHVs), Lappet-faced Vultures (LFVs), Hooded Vultures (HVs), and Marabou Storks (*Leptoptilos crumeniferus*) on bait (i.e. animal carcasses) using a compressed-air canon net (Netblaster, WCS NetBlaster™, Wildlife Control Supplies, East Granby, CT 06026, USA). We released non-target species (Pied and Cape Crows, *Corvus albus* and *C. capensis*, respectively) immediately.

We extracted, manually restrained, and hooded birds to minimise stress. Once restrained, we collected blood and, from some birds, feather samples, and placed unique identification on each bird. We obtained metal leg bands from Porzana Limited (Unit 1A, The Applestore, Woodhouse Lane, Icklesham, E. Sussex, TN36 4BJ, United Kingdom), purchased plastic cattle ear tags from the Birds of Prey Working Group (2006), and constructed vinyl patagial wing tags (Vinyl: Gallagher Tent & Awning, 809 Plaenert Dr., Madison, Wisconsin 53713, US; paint: black nadzar vinyl ink, Regional Supply Inc., 3571 S. 300 West, Salt Lake City, Utah 84115, USA) following Wallace *et al.* (1980) for California Condors. The vinyl tags had 5 cm characters while characters on the ear tags were 2.5 cm. We used off-the-shelf, blank livestock ear tag components to attach both types of tags; female blank tags with studs for our vinyl tags and just studs for the cattle tags (Allflex®,Nasco, 4825 Stoddard Rd., Modesto, California 95352, USA) (Kenny *et al.* 2008). We used different sizes of vinyl tags for different species (i.e. smaller tags for smaller species). We placed only vinyl wing tags on LFVs, HVs, and WHVs, only cattle ear tags on Marabou Storks, and a mix of cattle ear tags and vinyl tags on WBVs. We had each leg band inscribed with "Botswana vulturestudy@gmail.com" followed by a unique number. For LFVs, HVs, WHVs and some WBVs, we collected morphometric measurements, and for a few birds (n = 10 LFVs, 3 WHVs, 2 HVs, and 1 WBV), attached solar-powered GPS/satellite telemetry (PTTs) units. We attached the 45 g (HVs and 1 WHV) or 70 g (LFVs, WHVs, and WBVs) PTTs using Teflon coated straps (Bally Ribbon Mills, Bally, Pennsylvania 19503, USA) and crimped metal ferrules in a modified backpack design (Buehler *et al.* 1995)

that we tested on captive zoo animals at Denver Zoo (Denver, Colorado, USA) first (to test for adverse effects). We cut foam rubber from mouse pads and glued two to three pads on the bottom of the tracking units to raise them above feather level (about 1 cm).

We observed tagged birds after release with binoculars and took photographs to assess legibility and performance of patagial tags.

Results

We applied bilateral patagial tags of both types to 278 White-backed Vultures (n = 114 vinyl tags and 164 cattle ear tags) and vinyl tags to 14 Lappet-faced Vultures, three White-headed Vultures, two Hooded Vultures, and seven Marabou Storks in several areas of Botswana. Upon release, the plastic cattle tags lifted off the surface of the wings as the birds flew away, bouncing off the upper surface of the wing (Figure 2). Alternatively, the more flexible vinyl wing tags appeared more aerodynamic, more closely adhering to the upper and lower wing surface (Figure 3).

We observed our previously tagged birds at several capture sites. Because the plastic cattle tags only appear on the upper surface of the birds' wings, we could not discern if birds flying above us had wing tags or not. We could easily see wing tags on birds standing on the ground, but had difficulty reading them at distances of more than about 0.5 km. We more easily observed both tags and numbers on birds with vinyl wing tags. Because the vinyl tags appear both above and below the wings and because the tags have larger numbers, we could more easily determine both if a bird had a wing tag and what identification number appeared on that tag. We could only see the cattle tags from the dorsal surface of the vultures' wings, generally while the birds were on the ground.

Figure 2. Illustration of cattle ear tags on White-backed Vultures (*Gyps africanus*) tagged in Botswana. Note how the tags lift off the wings in flight.

Figure 3. Illustration of wing tags developed for California Condors (*Gymnogyps californianus*) on White-backed Vultures (*Gyps africanus*) (top), Lappet-faced Vultures (*Torgos tracheliotos*) (middle), and White-headed Vultures (*Trigonoceps occipitalis*) (bottom) tagged in Botswana. Note how the tags lie flat on the wings in flight.

Discussion

We found that the vinyl wing tags developed for California condors (Wallace *et al.* 1980), but widely used for other species as well (e.g. Batbayar *et al.* 2008, Kenny *et al.* 2008, Reading *et al.* 2010), are superior to plastic cattle ear tags used as patagial wing tags (Botha 2007). Maximum visibility and readability is the goal when placing patagial tags on birds. Vinyl tags proved more aerodynamic and easier to read at a distance and while birds were soaring than the plastic cattle tags. Sweeney *et al.* (1985) report similar problems in viewing cattle tags for Turkey Vultures (*Cathartes aura*) and Black Vultures (*Coragyps atratus*) in flight. In addition, Buckley (1998) found that the numbers on cattle ear tags faded over time, rendering them difficult to read. For quick and accurate observations, even with binoculars, patagial tag size and redundancy is critical. Patagial vinyl tags worked well in Asia with Cinereous Vultures, with re-sightings from six countries, although some birds lost a tag off one wing (Batbayar *et al.* 2008, Kenny *et al.* 2008). Vinyl tags permit construction of different sized tags for different sized birds. We therefore recommend that researchers studying large birds, particularly raptors in southern Africa and elsewhere, consider using vinyl wing tags and apply them to both wings.

Researchers use patagial tags to mark a wide variety of bird species for individual identification. Some studies have found adverse effects from patagial tags on bird survival (Zuberogoitia *et al.* 2012), behaviour (Brua 1998), and nesting success (Trefry *et al.* 2013), but studies on other species (Martin and Major 2010), including New and Old World vultures, found no measureable impacts on these larger birds (Wallace *et al.* 1980, Sweeny *et al.* 1985). Botha (2007) discusses a number of concerns initially raised by southern African vulture researchers about the use of patagial tags, but subsequent captive and wild studies concluded those fears to be unfounded.

Acknowledgements

Many people helped make this work possible. We especially thank Ralph Bousfield, James Bradley, Kyle Burks, Thanki David, Tony DeNicola, Vickie DeNicola, Hanri

Ehlers, Laurie Glabreath, Jane Horgan, Mmoloki Keiteretse, Lauren McCain, Mosepeli, Kate Reading, Anton van Schalkwyk, Katie Schoelzel, and the Cheetah Conservation Botswana volunteers for their help. BirdLife Botswana, the Denver Zoological Foundation, Kalahari Conservation and Research, Kanabo Conservation Link, and Raptors Botswana provided financial support. We thank Bokamotsu Ranch, Grasslands Reserve, Kalahari Rest Lodge, Jack's Camp, and Tautona Lodge for letting us trap vultures on their properties or concessions and the Botswana Department of Wildlife and National Parks for their support of our work.

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