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THE BIRDSBESAFE® CAT COLLAR COVER:

Why Cats in New York Need It More Than Australian Cats to Decrease Songbird Mortality

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INTRODUCTION

Domestic cats are arguably the greatest anthropogenic threat to songbirds that currently exists, aside from habitat alteration and/or destruction (Loss et al. 2013). Although numerous campaigns have pushed for "cats indoors," many cat owners are unwilling or unable to keep their pet cats indoors (American Bird Conservancy 2015). In rural New York, where many people keep farm animals, there is also a sizable population of barn cats that are kept specifically as outdoor pets to keep barnyard mouse populations in check. Although some owners choose to ignore the carnage their cats are inflicting on local birdlife, many others do in fact care about the barn swallows, savannah sparrows, and bluebirds that their barn cats are killing, as well as the backyard warblers, grosbeaks and catbirds in villages and hamlets across the North Country and the Adirondacks.

Two recent studies on a relatively new cat collar device provide evidence that cat owners can in fact significantly decrease the number of birds that their cats are killing without affecting cat predation on barn rodents (Hall et al. 2015, Willson et al. 2015). The two studies, which were published within weeks of one another and which examined cat behavior on opposite ends of the globe, found varying levels of effectiveness in the use of the Birdsbesafe® cat collar cover (hereafter called BCC) as a device to decrease songbird mortality (Birdsbesafe® LLC). Here, I describe some of the main points of the two papers, one of which I co-authored, and I suggest a novel hypothesis that may explain the differences in results between the studies. These differences lead to important implications for North Country and Adirondack cat owners and suggest that the BCC will be more effective in northern regions of the mid-United States through Alaska and Canada than in lower latitude regions of the world such as Australia.

THE DEVICE

The BCC is a 2-inch wide cotton fabric tube that fits over a quick-release cat collar and pleats around the collar somewhat like a hair "scrunchie" or an Elizabethan collar (Figure 1). The premise of the BCC is that its bright colors and patterns, in hues of red, orange and yellow, may alert songbirds to the presence of an otherwise hidden, stalking cat. Songbirds have exceptional color vision with sensitivities across the color spectrum from ultraviolet through deep reds (Chen et al. 1986). This is called tetrachromatic vision, and it means that birds have higher sensitivities across at least four parts of the light spectrum than mammals; birds see colors that mammals are unable to differentiate. This ability sets birds apart from the limited visual spectrum used by most mammals, including humans. For example, humans cannot see in the ultraviolet part of the light spectrum (Hill and McGraw 2006). No scientific study had previously been carried out on the BCC's efficacy, although anecdotal evidence from cat owners who used the device noted sharp declines in their cat's success in hunting and catching birds (Birdsbesafe.com 2013).

HYPOTHESIS AND CONSERVATION IMPLICATIONS

Life histories are the "schedules" that organisms follow, based on natural selection, that dictate important adaptations for a population including lifespan, age at maturity, fecundity (number of young per reproductive bout), and size of offspring (Stearns 1992). For example, an albatross has a "slow" life history, meaning it lives a long time (over 40 years), takes a long time to reach sexual maturity (up to 10 years), has one nestling at a time, and invests an extraordinary amount time in that one offspring before breeding again. An American Redstart has a much "faster" life history: quick to breed, large clutch size (up to 5 eggs), and a short lifespan with an annual adult mortality of 50-60% (Sherry and Holmes 1997). There are important life history differences among similar-sized songbirds in the north-temperate zone compared to the equatorial regions. In general, songbirds that breed in higher latitudes have shorter lifespans, lay larger clutches, and have a shorter breeding season than lower latitude birds (Martin et al. 2000). I posit that the well-researched life history differences that exist between north-latitude and equatorial bird species are tied to direct conservation management implications.

These life history differences also correlate to physiological differences in relative testosterone increases in the breeding season in birds, with higher latitude birds exhibiting much higher increases in relative testosterone levels compared to baseline (non-breeding levels) (Hau et al. 2010, Hau et al. 2008, Goymann et al. 2004). The testosterone spike corresponds with a rush to acquire and defend territories, initiate nest-building, and raise young during the short breeding season. My suggestion here is that it also leads to relatively more distracted northern birds in comparison to their equatorial counterparts. The prediction is that northern birds may be more susceptible to predation during the breeding season and that avian life history theory has direct conservation management implications for devices like the BCC.

Life history theory suggests that northern latitude breeding songbirds may regularly be caught and killed by domestic cats at a higher rate than lower latitude passerines. If this is the case, it would explain the wide difference in effectiveness of the BCC that was observed across the two recent studies in northern New York and Australia. It would also explain the results we found for northern New York birds in the spring breeding season, when testosterone levels are high, versus our results during the fall (post-breeding) season, which closely match results from Australia. These major life history differences in birds also imply that northern latitude areas are the locations where the BCCs should be most effective.

METHODOLOGY OF THE STUDIES

Each of the studies was a test of the BCC and its effect on predation using a large sample size of domestic cats wearing the collar cover compared with the same cat groups not wearing the collar cover. Both studies focused on cats with a history of animal predation and excluded cats from the study that were not known hunters. Each study asked cat owners to collect and freeze any prey item that cats delivered to the house for identification. While each study examined predation on mammals as well as birds, I will focus on birds. Results for mammals in each study suggested that the BCCs were not effective at reducing mammal predation, likely because most mammal prey do not have color vision (Jacobs 2009).

The New York study

My co-authors and I (Willson et al. 2015) carried out two seasonal trials. The first took place in September-November 2013 and the second in April-June 2014, both at 46° N latitude. In the fall, we had 54 cats from 26 households participate in a 12-week trial. Cats were divided into two groups, and the groups alternated wearing BCCs for two weeks followed by two weeks with no collar cover. This method insured against any differences across treatments due to weather or seasonal change over the course of the trial. During the "off" weeks, owners removed both the Birdsbesafe® collar and the interior quick-release collar so that the test was against fully collarless cats. All prey items were frozen, marked as coming from cats with or without collars, and identified to species by our research team. In the spring, another 12-week trial was run exactly as the first but with a subset of 19 cats from 10 households that participated in the fall study. The lower number reflects some owners wishing to not participate in a second trial, as well as owners away for the summer months.

The Australia study

Hall et al. (2015) carried out two annual trials of cats wearing the BCC against collarless cats in Perth, Western Australia (32° S latitude). The first year's trial ran for six weeks during austral spring and summer from October 2012 through February 2013, and the second year's trial again ran for six weeks, from October 2013 through January 2014. The first trial involved 53 cats from 39 households over a period of six weeks. Half of the cat participants wore BCCs for the first three weeks, followed by three weeks without BCCs. The other half began with

no BCCs for three weeks, followed by three weeks wearing the BCCs. Three different colors of the BCC were tested against each other. Analyses were done at the level of household so sample size in this year was 39 households. In the second year of testing, 61 cats from 43 households completed the trial, with the same division across two groups of cats over six weeks. Only the most effective color of BCC from year one was tested again in year two. The analyses were broken down across birds, mammals, and reptiles, as well as animals with good color vision (birds and reptiles) vs. those without (mammals).

RESULTS

Because the New York and Australia trials were of different lengths, it is easiest to compare them if we examine the magnitude change across trials for each study when cats were wearing the BCC versus when they were collarless. In the spring New York trial, which lasted 12 weeks, cat predation on birds averaged 19 times higher when cats were not wearing the BCC. In fact, total spring bird predation with 19 cats over six weeks totaled only one bird when cats wore the BCC. In the fall, cat predation on birds was still significantly decreased, with cats killing 3.4 times more birds when not wearing BCCs (Figure 2).

In Australia, the BCC was deemed most effective in year 1; the authors found that cats brought home 28% of total birds while wearing the BCC, while in year 2 they brought home 40% of birds in that same period with the BCC. Combined, cats brought home an average of 34% of bird prey while wearing the BCC. In summary, Australian cats reduced the number of birds brought home by an average of 1.5 to 2.5 times while wearing the BCC (Hall et al. 2015).

WHY THE DIFFERENCE IN EFFECTIVENESS OF THE BIRDSBESAFE® COLLAR COVER?

The Australian trials were completed during the nesting season for "down under" birds. It is therefore a good comparison with the New York spring trial. If we assume that the BCC should work equally well for all birds at mitigating predation by cats, we would expect similar results in trials with robust sample sizes. The fact that they were not equal and that the New York trial was in fact almost eight times more successful at keeping cats from killing birds (in comparison to the average kill rate for each trial with no collar) supports my hypothesis for a link between avian physiology and conservation management.

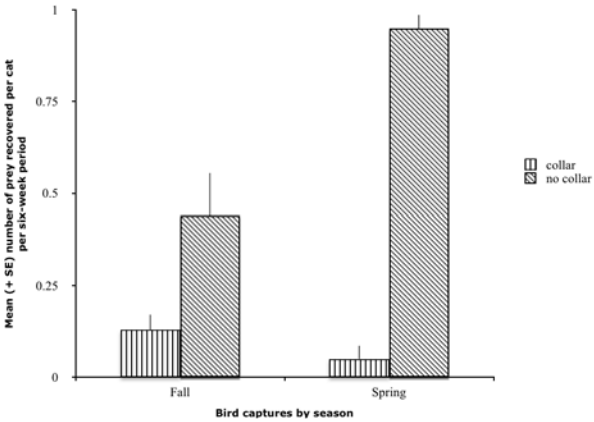
Studies by Hau and colleagues (Hau et al. 2010, Hau et al. 2008, Hau 2007, Wikelski et al. 2003) have examined the roles of the hormones corticosterone and testosterone in different life-history strategies of birds. Hau et al. (2010) predicted and found strong evidence that peak testosterone during the breeding season was higher in short-lived bird species with high courtship and breeding effort in comparison to longer-lived birds that display lower mating effort. The comparison used birds from a northern USA temperate site (42° N latitude) and tropical birds from the Republic of Panama (9° N latitude). The authors suggest that these hormones modulate life history responses to the environment with testosterone relating to

mating success. Thus, short-lived, temperate passerine birds elevate testosterone levels higher in their short breeding season when there is an all-or-nothing approach to raising young. Since temperate passerine birds typically have adult annual survivorship rates of only 50% (Sillett and Holmes 2002), just one out of two adults will have another chance to breed again in the future. Therefore, temperate birds have evolved a life history that pushes for larger clutch size and more attentiveness at the nest when compared to tropical counterparts (Ghalambour and Martin 2001).

So how does all of this relate to an anti-predator device like the Birdsbesafe® cat collar cover? Our north temperate birds act more like tropical and lower latitude birds only once they have completed breeding; they relax. Under this hypothesis, we would never expect the spectacular difference in effectiveness of the CC found in our New York study for lower latitude birds, because they are not as distracted by surging levels of testosterone. They are more vigilant and better at noticing cats creeping up on them, even in the breeding season. What this suggests for owners of cats in the Adirondack region, the northeastern United States, and really anywhere at higher latitudes is that these regions are the places where this anti-predator device will be most useful. Specifically, for owners who choose to use it, it is critical to use the device in the passerine breeding season from mid-spring through mid-summer. As northeast songbirds continue to decline due to a myriad of affronts including habitat alteration, climate change, window, building and wind-turbine strikes, as well as domestic cat predation, bird lovers who are also cat lovers with outside cats need to understand they have a responsibility to their backyard birds. Of course it is best to keep domestic cats inside (see American Bird Conservancy 2015), but if circumstances do not allow this, the Birdsbesafe® cat collar cover is a very effective alternative for decreasing songbird predation.

Figure 1: *The author's cat models the Birdsbesafe® cat collar cover.*

Figure 2: *Birdsbesafe® cat collar covers reduced the number of depredated birds recovered from individual cats by three to up to 19 times across two seasonal New York trials. Use of collar cover versus no collar was statistically significantly different each season (randomization test, $p < 0.05$). Figure displays each seasonal 12-week trial broken into the total time wearing versus not wearing collar cover (six week periods).*



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