



COMMENTARY

Response to Streby and Kramer: Additional considerations for explaining differences in return rates of geolocator-tagged and control Cerulean Warblers

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ABSTRACT

Our recent manuscript investigated geolocator-tagging effects on a small migratory warbler. Streby and Kramer (2017) suggest that a year effect may have been masked by our unequal sample sizes between years. They also argue that the difference in return rate between our geolocator-tagged and control birds was likely due to differences in harness styles used between years. We agree with their comment regarding the possibility that a year effect could have been masked by our unequal sample sizes. However, it is not possible to draw reliable conclusions from our data as to why we observed a reduced return rate for geolocator-tagged birds compared with color-banded controls, and attempts to do so are mere speculation. We also point out that both harness styles used in our study have been employed by a number of researchers who observed no reduced return rates for geolocator-tagged birds, including other species of parulid warbler. Researchers desiring to illuminate potential harness style effects on return rates should use large sample sizes of each harness type, in the same year, and search for all geolocator-tagged and control birds with equal effort.

Keywords: geolocator, effects, return, survival, harness

Respuesta a Streby y Kramer: Consideraciones adicionales para explicar las diferencias en las tasas de retorno de individuos de *Setophaga cerulea* marcados con geo-localizadores e individuos control

RESUMEN

Nuestro manuscrito reciente investigó los efectos de marcación con geo-localizadores en una curruca migratoria pequeña. Streby y Kramer (2017) sugieren que un efecto del año podría haber estado enmascarado por nuestros tamaños de muestreo desiguales entre años. Ellos también argumentan que la diferencia en la tasa de retorno entre las aves marcadas con geo-localizadores y las aves control se debió probablemente a diferencias en los estilos de los arneses usados entre años. Estamos de acuerdo con su comentario sobre la posibilidad de que un efecto del año podría haber estado enmascarado por nuestros tamaños de muestreo desiguales. Sin embargo, no es posible sacar conclusiones confiables a partir de nuestros datos sobre por qué observamos una tasa de retorno reducida para las aves marcadas con geo-localizadores en comparación con las aves control marcadas con anillos de colores, y los intentos de hacerlo son meras especulaciones. También señalamos que ambos estilos de arnés usados en nuestro estudio han sido empleados por numerosos investigadores quienes no observaron una reducción en las tasas de retorno para las aves marcadas con geo-localizadores, incluyendo otras especies de parúlidos. Los investigadores con intenciones de aportar sobre los efectos del estilo del arnés sobre las tasas de retorno deberían usar tamaños grandes de muestreo de cada estilo de arnés, en el mismo año y buscar todas las aves marcadas con geo-localizador y las aves control con un mismo esfuerzo.

Palabras clave: arnés, efectos, geo-localizador, retorno, supervivencia

In their commentary on “Mixed effects of geolocators on reproduction and survival of Cerulean Warblers, a canopy-dwelling, long-distance migrant” (Raybuck et al. 2017), Streby and Kramer (2017) suggest that our finding that Cerulean Warbler (*Setophaga cerulea*) annual return rates were lower for geolocator-tagged males than for banded

controls was related to a difference in the harness method used between the first and second years of our study. Although we agree that this is a possibility, we do not agree with all of the assertions made by Streby and Kramer (2017).

Of greatest concern to us is that Streby and Kramer (2017) claim that their method (described by Streby et al.

2015) of having a single contact point (i.e. a superglued knot) between the geolocator and the harness is superior to the continuous harness (i.e. the Φ method), which they suggest could have a number of negative consequences that could influence survival. The authors use a published study of Golden-winged Warblers (*Vermivora chrysoptera*; Peterson et al. 2015) and an unpublished study of Louisiana Waterthrushes (*Parkesia motacilla*) as 2 examples in which researchers found that geolocators attached using the Streby et al. (2015) harness attachment had no discernable impact on return rates. However, they fail to mention that a number of other researchers have reported undiminished return rates using the Φ method of geolocator harness attachment. For example, from published studies, Hallworth et al. (2015), who made harnesses by soldering the ends of Stretch Magic material (Pepperell Braiding Company, Pepperell, Massachusetts, USA) together, and Cooper et al. (2017), who made harnesses by crimping Stretch Magic material, deployed geolocators using the Φ harness method on Ovenbirds (*Seiurus aurocapilla*) and Kirtland's Warblers (*Setophaga kirtlandii*), respectively, and did not detect any negative effect of geolocators on return rates. These researchers also did not report skin and feather abrasions. In an unpublished study, Boves and colleagues also found a lack of impact on return rates of male Prothonotary Warblers (*Protonotaria citrea*) using the same harness method as Hallworth et al. (2015). In addition, although anecdotal, our sole returnee of 10 Cerulean Warblers tagged using the Φ method did not show any signs of the possible abrasion to the feathers and skin suggested by Streby and Kramer (2017), although we do agree that such abrasion can be caused by loose-fitting harnesses, regardless of design. In fact, in 2017, we recovered one Cerulean Warbler showing signs of abrasion (feather loss and redness of the skin around the thighs). This bird had carried its geolocator with a Streby et al. (2015) harness for 2 yr (it was not detected in 2016). After 2 yr of wear, the harness material had stretched to the point of being too loose. We have not found such abrasions on Cerulean Warblers that were recaptured after 1 yr, and we are only highlighting this observation to stress the importance of proper harness fit, regardless of design. Each bird that we released during our study was checked for harness fit and to ensure that the device could not freely move from side to side or rotate (harness too loose) or restrict movement of the legs (harness too tight).

We do agree with Streby and Kramer (2017) that our small sample size in 2014 potentially could have masked a year effect. However, if such an effect did indeed exist, it could have been related to other factors, including not only variation in harness attachment methods, but also geolocator shape or our increased experience with geolocator deployment in 2015 compared with 2014. To argue that one of these factors is the definite cause of a difference in

proportional return rates between years is not testable using our data.

Interestingly, Hallworth et al. (2015) actually reported higher apparent survival for geolocator-tagged Ovenbirds ($n = 66$; 0.675 ± 0.060) compared with apparent survival of Ovenbirds without geolocators ($n = 148$; 0.549 ± 0.080). Results such as this bring up another, but possibly related, issue that may be worth consideration when interpreting the effects of geolocators on small passerines. In most cases, a comparison of controls and tagged birds is not the primary concern of these studies, and thus resighting efforts may be biased toward tagged individuals. This may be expected because of limited field time, restricted resources, and the greater scientific value associated with geolocator-tagged birds (vs. controls). This potential for bias in search effort, in our opinion, could hamper the interpretation of return rate comparisons of small, geolocator-tagged birds.

Finally, although we found that the year effect explained less variation in return rates than the geolocator ('group') effect in our study (see table 3 in Raybuck et al. 2017), we were encouraged by the seemingly improved return rate of tagged birds in 2016 compared with 2015. We are hopeful that we will not find strongly differing return rates between control and geolocator-tagged birds in 2018, as we have deployed 166 more geolocators (79 using the Streby et al. (2015) attachment and 87 using the Φ method) on Cerulean Warblers throughout their breeding range to increase our sample size and to obtain a fuller picture of Cerulean Warbler migration strategy and migratory connectivity. We will again compare return rates between color-banded controls and geolocator-tagged birds following the 2018 recapture season, and we recommend that all researchers conducting avian studies involving geolocators design their sampling to be able to compare return rates of tagged and control birds. We also recommend that researchers fully describe their attachment methods and attempt to put equal effort into resighting all birds.

LITERATURE CITED

- Cooper, N. W., M. T. Hallworth, and P. P. Marra (2017). Light-level geolocation reveals wintering distribution, migration routes, and primary stopover locations of an endangered long-distance migratory songbird. *Journal of Avian Biology* 48: 209–219.
- Hallworth, M. T., T. S. Sillett, S. L. Van Wilgenburg, K. A. Hobson, and P. P. Marra (2015). Migratory connectivity of a Neotropical migratory songbird revealed by archival light-level geolocators. *Ecological Applications* 25:336–347.
- Peterson, S. M., H. M. Streby, G. R. Kramer, J. A. Lehman, D. A. Buehler, and D. E. Andersen (2015). Geolocators on Golden-winged Warblers do not affect migratory ecology. *The Condor: Ornithological Applications* 117:256–261.

- Raybuck, D. W., J. L. Larkin, S. H. Stoleson, and T. J. Boves (2017). Mixed effects of geolocators on reproduction and survival of Cerulean Warblers, a canopy-dwelling, long-distance migrant. *The Condor: Ornithological Applications* 119:289–297.
- Streby, H. M., and G. R. Kramer (2017). Comment on “Mixed effects of geolocators on reproduction and survival of Cerulean Warblers, a canopy-dwelling, long-distance migrant”. *The Condor: Ornithological Applications* 119:848–851.
- Streby, H. M., T. L. McAllister, S. M. Peterson, G. R. Kramer, J. A. Lehman, and D. E. Andersen (2015). Minimizing marker mass and handling time when attaching radio-transmitters and geolocators to small songbirds. *The Condor: Ornithological Applications* 117:249–255.