Journal of Avian Biology

JAV-01656
Ma, Y., Branfireun, B. A., Hobson, K. A. and Guglielmo, C. G. 2018. Evidence of negative seasonal carry-over effects of breeding ground mercury exposure on survival of migratory songbirds. – J. Avian Biol. doi: 10.1111/jav.01656

Supplementary material

Appendix 1

Materials and Methods

Probable breeding sites for Blackpoll Warbler. A likelihood-based assignment technique (Hobson et al. 2009, Wunder 2010, Van Wilgenburg and Hobson 2011) was applied to assign molt origins. We created a map (isoscape) of predicted δ^2H in feathers ($\delta^2H_{f;}$) by applying algorithms presented in Hobson et al. (2012) to rescale the precipitation amount-weighted growing season δ^2H in precipitation (δ^2H_p) map of Bowen et al. (2005) into equivalent feather values. Specifically, we applied the regression equation $\delta^2H_f = -17.57 + 0.95\ \delta^2H_p$, based on data collected from multiple species of Neotropical migratory birds, to rescale the feather isoscape, and used a spatial "mask" operation to extract only those areas of the continent falling exclusively within the species' breeding range based on a digital breeding-range map (BirdLife International and NatureServe 2011). A variance estimates of 14.4 ‰ was assumed from the residuals of the precipitation-to-feather calibration (Hobson et al. 2012).

Result and Discussion

Probable breeding sites for Blackpoll Warbler. Figure S1 indicates that both the autumn and spring cohorts of Blackpoll Warbler originated from the same general area of northwestern Canada. This strengthened our hypothesis that Hg exposure was linked to reduced survival in the same general group of individuals sampled. We also note, based on ebird animations (http://ebird.org/content/ebird/occurrence/blackpoll-warbler/), that our sampling site (Long Point Bird Observatory, a labeled star in Figure S1) most likely samples birds moving in an east to west direction in autumn and a northwestern movement in spring consistent with birds originating in the west as predicted by the isotope data. In short, we have provided good evidence that the spring and autumn cohorts were effectively sampling the same source population and that there is no reason to expect differential exposure to Hg on the breeding grounds driving the patterns we see.

Age effects. Age class explained variation in feather [Hg] of Ruby-crowned Kinglet and White-throated Sparrow, and there was a trend towards statistical significance in the Swainson's Thrush (Table 1, main text). However, age affected Hg in different ways (Figure S1). Adult Ruby-crowned Kinglets had 1.7 times higher feather [Hg] than juveniles. This can be explained if Ruby-crowned Kinglet adults feed on higher trophic level, and hence higher Hg prey (e.g. spiders, pseudo-scorpions) than younger birds (e.g. caterpillars, larvae) (Swanson 2008) or if there is a strong Hg accumulation in their body pools in adults. In contrast to this exclusively insectivorous species, juveniles had higher feather [Hg] than adults in the two omnivorous species. Specifically, juvenile White-throated Sparrow feather [Hg] was 2.3 times greater than in adults, and tended to be 1.4 times greater in juvenile Swainson's Thrush than adults. This could be explained by a more plant-based diet (e.g. fruit and seeds) of adults (Mack and Wang 2008, Falls and Kopachena 2010). Warner et al.(2012) suggested that compared to adults, the young of Tidal Marsh Sparrows (Coastal Plain Swamp Sparrow, *Melospiza georgiana nigrescens*, and Seaside Sparrows *Ammodramous maritimus*) have a higher protein (insectivorous) diet which may at least partially explain the higher [Hg] in juveniles. In terms of migration distance, Ruby-crowned Kinglets migrate short distances in most cases, experiencing a less taxing migration period, while White-throated Sparrows migrate short-to medium distances, and Swainson's Thrushes are long-distance migrants. Thus, feather [Hg] did not change seasonally in these three species possibly due to diet structure or migration distance.

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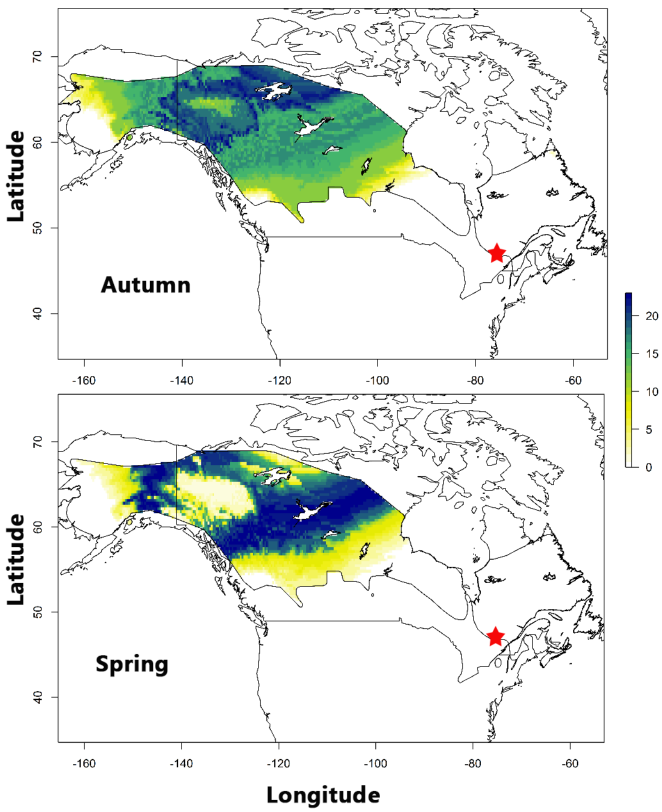

Figure A1. Probable breeding origins of Blackpoll Warbler sampled during migration in autumn and the following spring at the Long Point Bird Observatory (LPBO, indicated by the star). Assignment based on tail feather deuterium values (see text). Color legend refers to number of individuals assigned to each pixel.

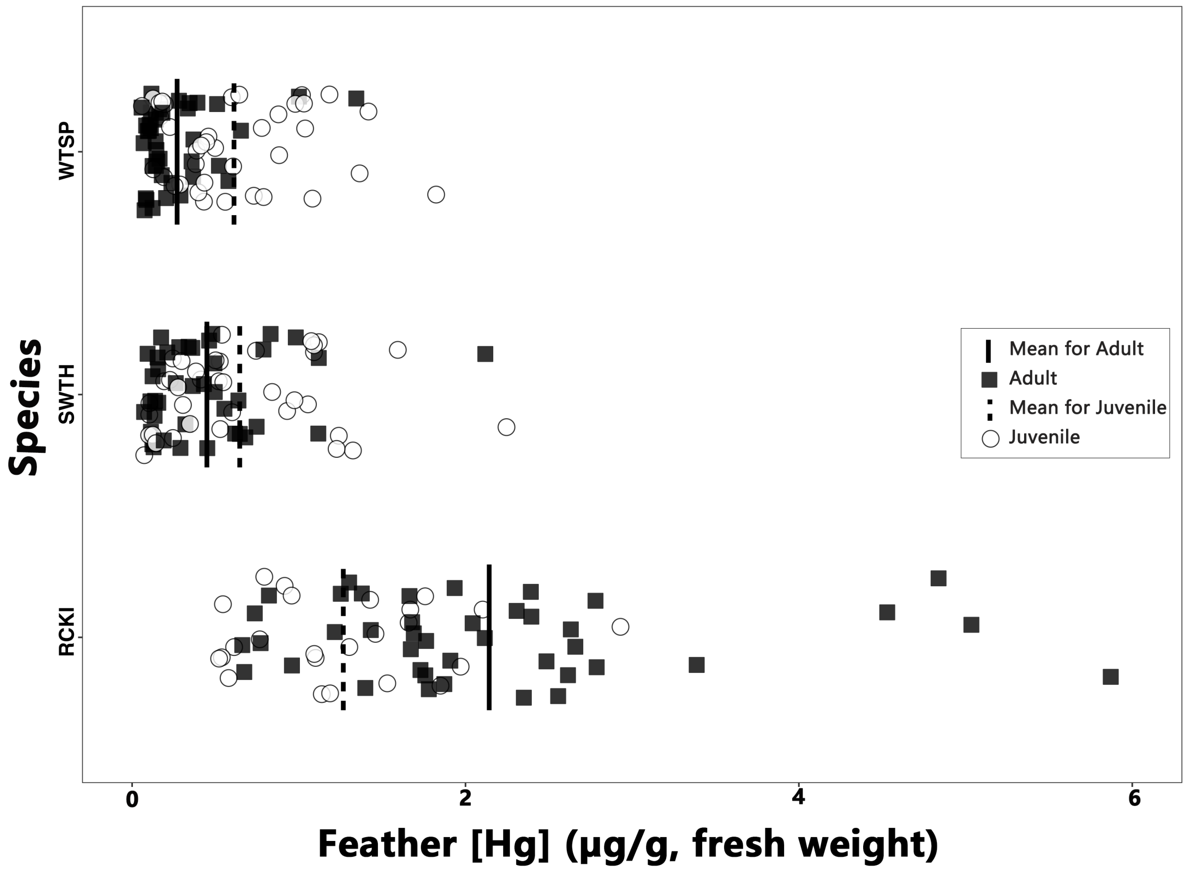

Figure A2. The distribution of feather [Hg] (µg/g, fresh weight) in Ruby-crowned Kinglet (RCKI), White-throated Sparrow (WTSP), and Swainson's Thrush (SWTH). Birds were captured by mist nets in autumn 2014 (September and October) and spring 2015 (April - June), at Long Point Bird Observatory (LPBO, 42°34' 58" N, 80°23'53" W), Ontario, Canada. Black squares represent adults while white circles represent juveniles. The solid line indicates mean [Hg] of adults and the dashed line indicates mean [Hg] of juveniles. Mean [Hg] of adult Ruby-crowned Kinglet was 2.14 ± 1.18 µg/g and of juveniles was 1.27 ± 0.60 µg/g. Mean [Hg] of adult White-throated Sparrow was 0.27 ± 0.26 µg/g and of juveniles was 0.61± 0.42 µg/g. Mean [Hg] of adult Swainson's Thrush was 0.49 ± 0.40 µg/g and of juveniles was 0.65 ± 0.50 µg/g.