Investigating relationships between contaminant bioaccumulation and movement behavior in the American alligator (*Alligator mississippiensis*)

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Abstract: Animal movement behavior provides insight into their ecological roles and organismal function. Anthropogenic disturbances, such as urbanization and habitat fragmentation are key drivers of variation in animal movement, but the effects of long-term exposures to environmental contaminants have yet to be examined. The long lifespans and predatory diets of crocodilians often lead to the bioaccumulation of persistent contaminants and confers a marked vulnerability to the attendant physiological effects resulting from elevated body burdens. In this study, we investigate the relationships between blood concentrations of mercury (Hg), a widespread contaminant with well characterized neurotoxicity, and movement patterns in free living, naturally exposed American alligators. We sampled alligators from two former nuclear cooling reservoirs that vary with respect to historical Hg contamination and placed GPS and accelerometer transmitters on male alligators from each reservoir (13 total). Data from July 2020 – March 2022 was analyzed using a generalized linear mixed model framework combined with AIC model selection to resolve the relationships linking alligator activity to meteorological conditions, reservoir, individual traits, blood Hg levels (mg/kg; wet weight), and season. The most parsimonious model included snout-vent-length, average daily temperature, humidity, wind speed, season, and blood Hg levels (AICc weight = 0.68, conditional R^2 = 0.90). Additionally, we found that when comparing activity between reservoirs, alligators from Par Pond ($\bar{x}$ = 1.72 mg/kg, ww) had significantly higher Hg levels than those on L Lake ($\bar{x}$ = 0.63 mg/kg, ww; $p < 0.001$), and the alligators on Par Pond were less active despite our tagged animals having the same size range, and same daily meteorological conditions, as those on L Lake. The findings presented here provide insight into the contributions of climatic factors and how the exposure of contaminants interact with individual traits to influence behavior.

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