

Limited movement of a hybrid zone in relation to regional variation in magnitude of climate change

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Abstract

Hybrid zones can provide clear documentation of range shifts in response to climate change and identify loci important to reproductive isolation. Using a deep temporal (36-38 years) comparison of the black-capped (*Poecile atricapillus*) and Carolina (*P. carolinensis*) chickadee hybrid zone, we investigated movement of the under-sampled western portion of the zone (western Missouri) as well as investigating whether loci and pathways underpinning reproductive isolation were similar to those from the eastern portion of the hybrid zone. Using 92 birds sampled along the hybrid zone transect in 2016, 68 birds sampled between 1978 and 1980, and 5 additional reference birds sampled from outside the hybrid zone, we generated 11,669 SNPs via ddRADseq. We used these SNPs to interpolate spatially and assess the movement of the hybrid zone interface through time, and to assess variation in introgression among loci. We demonstrate that the interface has moved approximately 5-8 km to the northwest over the last 36-38 years, i.e., at only one-fifth the rate at which the eastern portion of the hybrid zone (e.g. Pennsylvania, Ohio) has moved. Temperature trends across the last 38 years reveal that eastern areas have warmed 50% more than western areas in terms of annual mean temperature, possibly providing an explanation for the slower movement of the hybrid zone in Missouri. Using genomic cline analyses, we detected four genes that showed restricted introgression in both Missouri and Pennsylvania, including *Pnoc*, a gene involved in metabolism, learning and memory, concordant with previous physiological and behavioral findings on hybrids and the parental species.

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