

Trends in insect body sizes are influenced by multiple factors that also change over time

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Highlights

- *Tanytarsus gracilentus* body sizes decreased between 1979 and 2015 at Lake Mývatn, but this negative trend was not significant.
- During the same time, their abundance decreased.
- *T. gracilentus* were larger when food conditions were favorable (high $\delta^{13}\text{C}$), water temperatures were cooler, and the population was smaller.
- The magnitude of these effect sizes were similar, suggesting that changes in abundance could offset warming temperatures.

Background

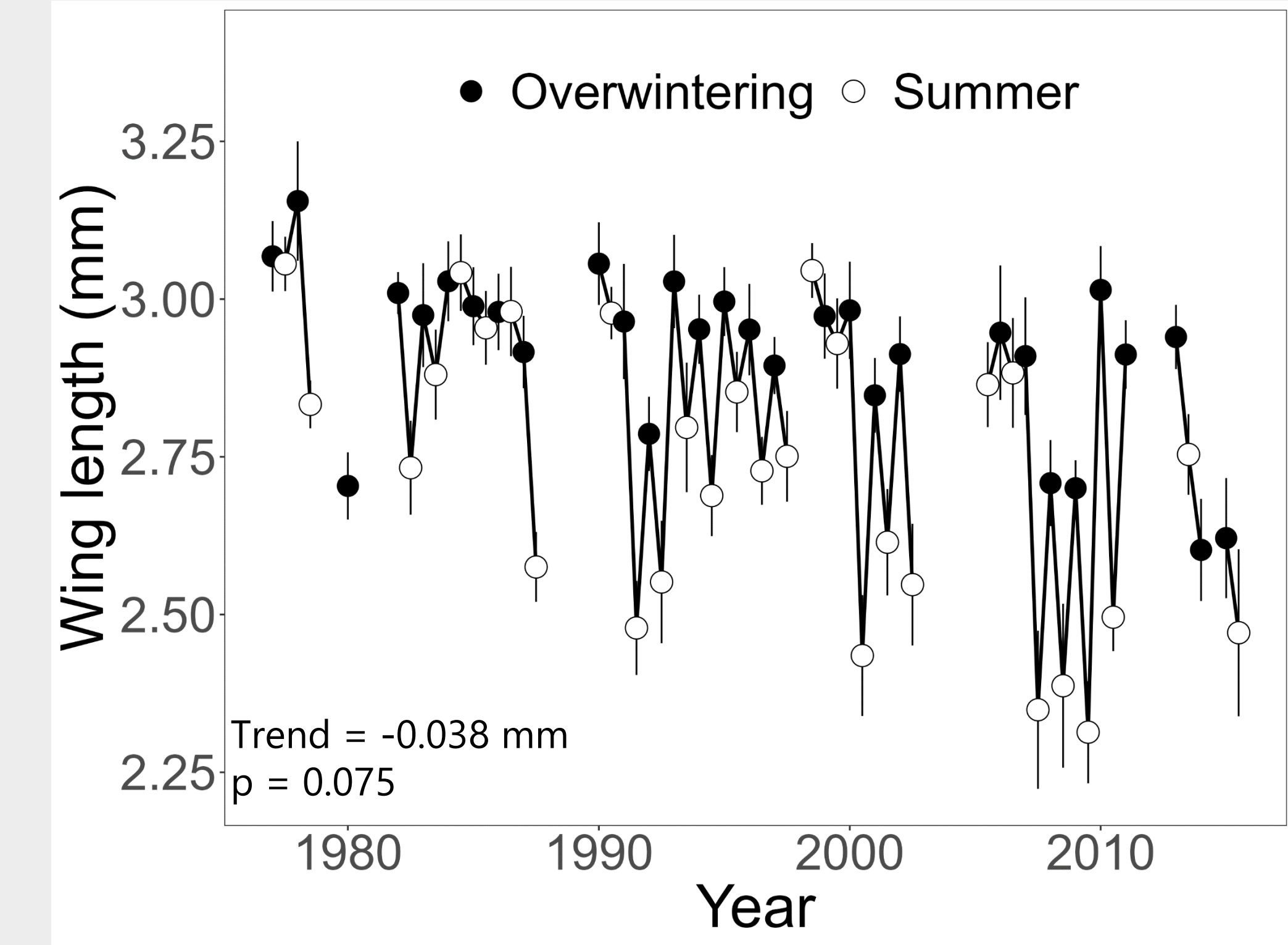
The temperature-size rule predicts that warmer temperatures result in smaller ectotherms at maturity. Given widespread climate warming, insects are expected to decrease in size. Evidence for shrinking insect body sizes over time is mixed, but most studies lack data on other factors that may contribute to variation in body sizes at maturity.



Methods

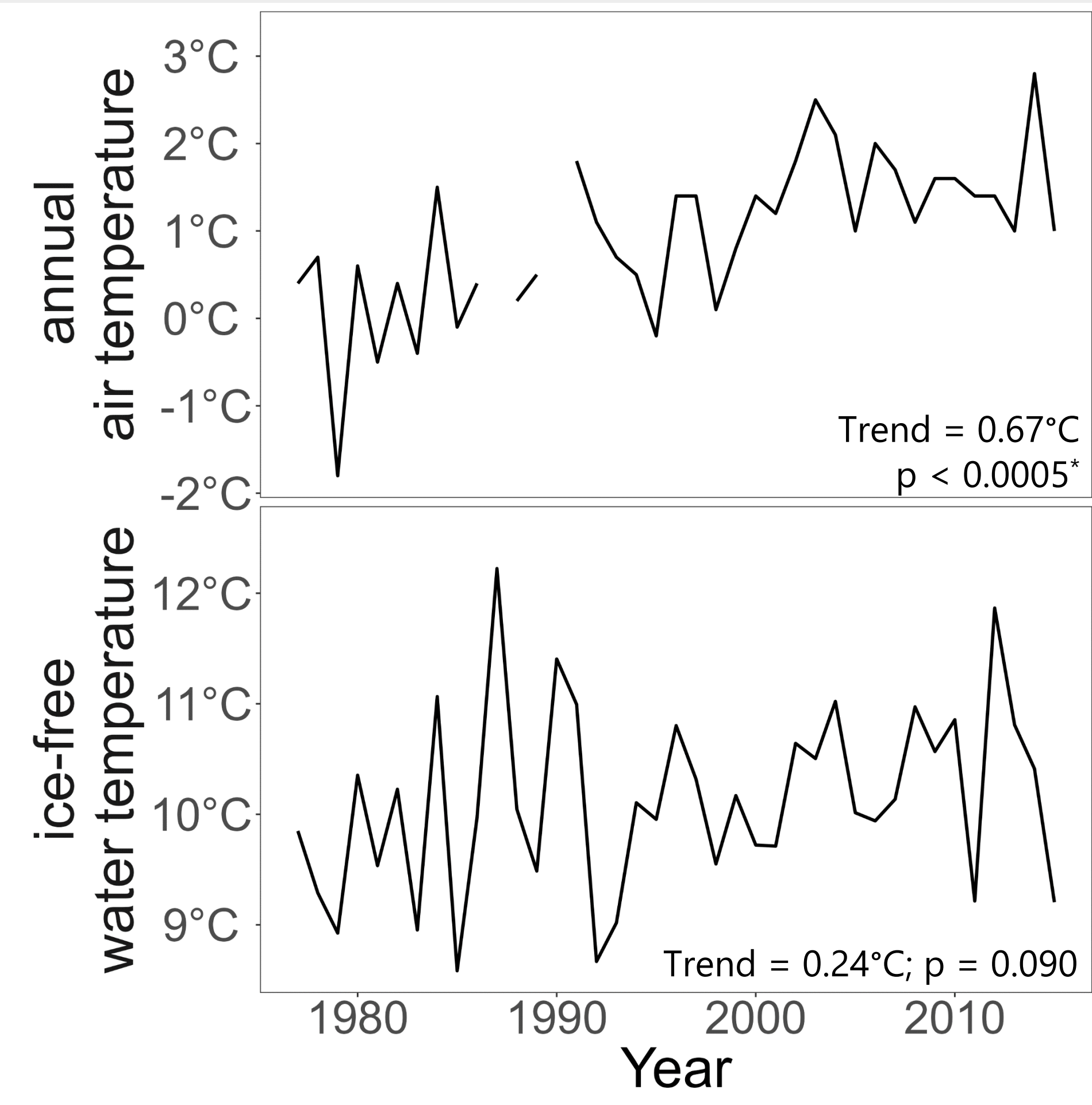
We measured wing lengths and carbon stable isotopes of adult *Tanytarsus gracilentus* (Diptera: Chironomidae) collected during population monitoring from Lake Mývatn, Iceland between 1979 and 2015. Water temperature over the study period was measured using thermocouples in the lake's outlet and air temperatures were provided by the Icelandic Meteorological Office. We fit state-space models to evaluate trends in all variables and to assess how body size was associated with changes in the predictor variables. We assessed significance using bootstrapped likelihood ratio tests.

Midge wing length have decreased, but not significantly so.

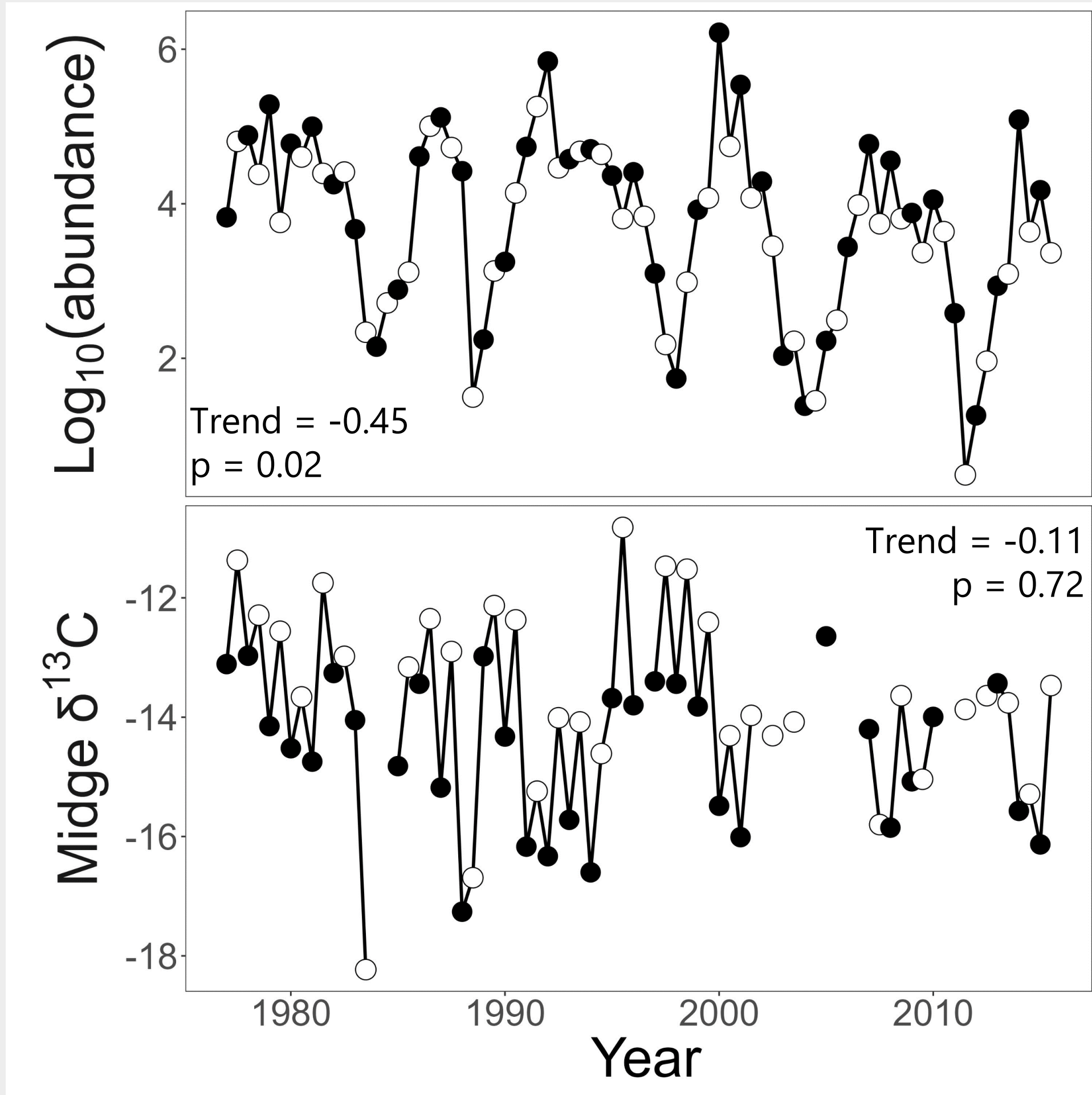


Trend reported per decade

Air temperatures increased, but the water temperatures have increased more slowly.



Midge abundances have decreased, and there is no evidence that $\delta^{13}\text{C}$ shows a trend.



Water temperature, abundance, $\delta^{13}\text{C}$, and cohort all contribute to variation in body size

	Term	Estimate	p-value
	AR(1) term	-0.036	-
	AR(2) term	0.300	-
	process error	0.108	-
	emerging in summer cohort	-0.24	0.004
	water temp.	-0.056	0.010
	abundance	-0.066	0.007
	$\delta^{13}\text{C}$	0.052	0.013
	trend	-0.032	0.078

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See the paper here:

