

# Biodiversity and Climate Change: What do Frogs Have to Say About It?



**QUILLS**  
Queen's University Indigenous  
Land-Based Learning STEM

## A Study Summary

Climate change is causing unpredictable weather patterns, as well as shifts in the timing of seasons. This is a cause for concern, as many species use timing, hours of daylight, and temperatures as signals, or cues for development and behavioural strategies.

These types of signals are called "environmental cues", which means that a factor within the environment (temperature, weather, light, precipitation, etc.) will cause species to act a certain way.

Frogs use temperature and associated seasonal changes in the environment as cues to emerge from brumation (hibernation) and to start breeding. Amphibian species are sensitive to changes in their environment. Particularly their moist skin type and the fact that they require both aquatic and terrestrial environments for their development and reproductive stages makes them sensitive. Additionally, they are ectotherms meaning they cannot make their own body heat like humans. These factors make them extra sensitive to environmental changes that can come from climate change within these two environment types.



Not all species, however, respond similarly to the same environmental changes. Therefore, these researchers were interested in how 2 certain reproductive behaviours change with climate change in frogs; when they come out of their brumation, or as the researchers say "timing of emergence", and the time at which they begin to do their mating calls. The scientists used a database of existing research to examine the changes of these two behaviours of 8 different frogs located in Southeastern, Ontario:



American Toad ( <i>Anaxyrus americanus</i> )	Chorus Frog ( <i>Pseudacris</i> sp.)	American Bullfrog ( <i>Rana catesbeiana</i> )	Gray Tree Frog ( <i>Hyla versicolor</i> )
Northern Leopard Frog ( <i>Lithobates pipiens</i> )	Wood Frog ( <i>Lithobates sylvaticus</i> )	Spring Peeper ( <i>Pseudacris crucifer</i> )	Green Frog ( <i>Rana clamitans</i> )

In their study, they found that through 40 years (between 1970 and 2010), the average temperatures of the months in spring increased. For example, March temperatures increased by 2.8°C over 40 years, and April temperatures increased by 2.4°C over 40 years. The chart below depicts whether or not the behaviour of these 8 frogs changed or not, determined from the study.

Species of Frog	Timing of Emergence	Any Significant Changes over 40 Years?	Beginning of Calling	Any Significant Changes over 40 Years?
American Toad	April	No	April	Yes
American Bullfrog	May	No	June	No
Northern Leopard Frog	April	Yes	April	Yes
Chorus Frog	April	No	April	No
Wood Frog	April	No	April	Yes (Borderline)
Spring Peeper	April	No	April	No
Gray Tree Frog	May	No	May	No
Green Frog	April	No	June	No

These frogs began calling 19.2 days earlier over a 40 year period.

These frogs emerged 22 days earlier, and also began calling 37.2 days earlier, over a 40 year period.

These frogs began calling 19.2 days earlier over a 40 year period.

Therefore, some frogs are changing the way they behave in response to changes from the climate crisis. American toads and Wood frogs begin their mating calls about 19 days earlier than they did 40 years ago. Northern Leopard frogs come out of brumation about 22 days earlier, and begin their mating calls about 37 days earlier than they did 40 years ago.

Changing behaviours can affect their offspring, and it can also change the balance of ecosystems, in regard to predation and competition. This information contributes to our knowledge of how species will continue responding to future pressures, and what impacts their differing behaviours may be.

Klaus and Loughheed (2013) state that although some frogs are changing their behaviours in response to warmer temperatures, this does not mean that all frogs will do the same. Therefore, if this study tells us that not all species will react the same way to changes in the environment, then we might need to continue researching how other species are responding, so that we know how to help protect them.

Study: Klaus, S. P., & Loughheed, S. C. (2013). Changes in breeding phenology of eastern Ontario frogs over four decades. *Ecology and Evolution*, 3(4), 835-845.