Global warming link to amphibian declines in doubt

November 12 2008

Evidence that global warming is causing the worldwide declines of amphibians may not be as conclusive as previously thought, according to biologists. The findings, which contradict two widely held views, could help reveal what is killing the frogs and toads and aid in their conservation.

"We are currently in the midst of a sixth mass extinction event," said Peter Hudson, the Willaman professor of biology at Penn State and co-author of the research study. "And amphibians are bearing the brunt of the problem."

Studies suggest that more than 32 percent of amphibian species are threatened and more than 43 percent face a steep decline in numbers.

Much of the massive declines associated with amphibians appear to be centered in places such as Central America and Australia, said Hudson. "It appears to be linked to a chytrid fungus -- Batrachochytrium dendrobatidis (Bd) -- which we did not know affected frogs," he added.

There are currently two theories on the extinctions. The first -- chytrid-thermal-optimum hypothesis -- suggests that the declines were triggered by global warming which pushed daytime and nighttime temperatures to converge to levels that are optimal for the growth of the chytrid fungus.

But according to a second theory -- spatiotemporal-spread hypothesis -- amphibian declines were simply driven by the introduction and

subsequent spread of the fungus from certain locations.

"Our models suggest that both these theories are slightly wrong," added Hudson, director of the Huck Institutes of the Life Sciences at Penn State. "Neither of them fit available data."

While the researchers do not completely discount the role of global warming in amphibian declines, they believe that evidence linking it with the declines is weak.

"There is indeed a positive, multi-decade correlation between amphibian extinctions in Latin America and air temperature in the tropics," said Jason Rohr, lead author and assistant professor of biology at University of South Florida. "But this relationship should not necessarily be interpreted as causal."

Rohr and his University of South Florida colleagues Thomas R. Raffel and John M. Romansic, both faculty associates, along with Hudson and Hamish McCallum, professor of wildlife research, University of Tasmania, tested the competing theories by re-analyzing the same data used in conceiving the two ideas.

The team's findings were published in a recent issue of the Proceedings of the National Academy of Sciences. The work is funded by the National Science Foundation.

The scientists checked the first hypothesis to see whether climatic factors such as the percentage of cloud cover, narrowing difference between the lowest average daily temperature and the highest average daily temperature, and the predicted growth rate of the fungus under certain temperatures, could accurately predict extinctions.

Their statistical analysis revealed no such narrowing of temperature

spans in the 1980s, when extinctions were increasing. When the difference in average daily temperatures did narrow in the 1990s, amphibian extinctions were decreasing.

Further, while the chytrid-thermal-optimum hypothesis showed high elevations as having the highest proportion of amphibian declines and the second highest proportion of amphibian extinctions, statistical analysis showed that growth rates for the fungus and cloud cover to be lowest at the highest elevation.

"While there is evidence to suggest that the chytrid fungus is killing the frogs, further research is needed before we can conclude that climate change is accelerating the spread," said Rohr, who previously was a researcher with Penn State's Center for Infectious Disease Dynamics.

A separate statistical analysis of the spread hypothesis also indicated inconsistencies between the year of amphibian declines, and the sites from where the fungus might have been introduced.

"Almost all of our findings are contrary to the predictions of the chytrid-thermal-optimum hypothesis," said Hudson.

The researchers say their findings show the pitfalls of drawing conclusions from multi-decadal correlations between climatic factors and extinctions, and underscores the need for molecular data on the fungus to understand from where and how it spread.

"We are facing a cataclysmic global decline in amphibians, caused primarily by the effect of a fungus that was historically not important, but the emergence of which might be associated with climate change, along with the use of herbicides and pesticides," Hudson explained. "The bottom line is that there doesn't seem to be one single explanation for the massive amphibian declines. It could be a mix of other factors."

Source: Penn State