An overview of amphibian phenology

What is phenology?

"Phenology" is derived from the Greek word *phaino*, meaning to show or appear. Phenology refers to recurring, seasonal, plant and animal life cycle stages, such as leafing and flowering, maturation of agricultural plants, emergence of insects, and migration of birds. It is also the study of these plant and animal life cycle stages, especially their timing and relationships with weather and climate. Naturalists, farmers and gardeners, herbalists and hunters have always been attuned to these seasonal changes, and so there is much country lore about annual cycles and co-occurrences. In some European countries, the national weather service collects citizen reports on phenological data about common species, and these data are used in advising farmers about when to plant and harvest. Records of these data have provided important evidence about changes in climate in New England and around the world, and have other scientific value, as well.

This Brief provides basic background about key seasonal changes that are studied ("phenophases") in amphibians; other Briefs detail specific methods for data collection.[1]

Amphibian phenophases

Here are some observations that are made of amphibian phenology:

Individuals active — frogs, toads, or salamanders seen moving across the landscape, or active in the water.

Calling. Male frogs and toads call to attract females to their mating areas. Most distinctive spring calls in New England are those of wood frogs, spring peepers, American toads, and grey tree frogs. Recordings of these calls can be found easily on the Web.

Mating. Individuals or groups gathered in water to mate; males grasping females.

Egg masses or young visible.

Juveniles moving on the land - "miniature" toads or frogs actively moving across lawns, roads, etc.

What does it mean? How does phenology tell us about climate?

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[1] and see USA-NPN National Coordinating Office. 2012. U*SA-NPN Plant and animal phenophase definitions*. USA-NPN Technical Series 2012-004. www.usanpn.org.

Phenological events are triggered by environmental cues taking place during the year. Thus, one year's observations are interesting, but don't tell us about trends.

Scientists and citizen-observers have reported some amphibian responses to climate change. Leopard frogs, gray tree frogs, and American toads have all begun singing much earlier (up to 3 weeks earlier) than they did in years past. Some species may find their habitats invaded by southern species of fish or other predators that move north as temperatures warm.

Beyond that, there are some species that are able to adjust their behavior to match the change in climate, and some that cannot. For some amphibians, changes in precipitation patterns may mean that, for example, vernal pools may not last as long as is best for reproductive success; or extended periods of drought between torrential downpours may alter the quality of frog or salamander habitat. Linkages between frog phenology and that of their prey insects may also change. There is still much to be learned about amphibian ecology in a changing climate. You can help!