Signs of the Seasons:
A New England Phenology Program

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NH Sea Grant/UNH Cooperative Extension
Water, Weather, Climate and Community Workshop VII
23 July 2013
**Phenology** is the study of seasonal biological events observed in plants, animals, or microbes.
Climate influences the **phenology** of biological processes that affect our daily lives.
“Phenology... is perhaps the simplest process in which to track changes in the ecology of species in response to climate change.” – IPCC 2007
Collecting phenological data: hands-on empirical observations

Examples:
• First flowering date
• Timing of animal emergences
• Dates when babies are observed or fledge
• Arrival dates of migratory animals
Early phenological observations from Thoreau’s journals

“I saw this morning for the first time the bobolink, gold robin [most likely a northern oriole], and kingbird.” *May 10, 1853*

- Thoreau made **daily** observations about plants animals every spring from **1851-1858**

- The **phenological data** in Thoreau’s journals provided the foundation for ongoing long-term studies of phenology!

Long term data show that, in the northern hemisphere, co-occurring species are flowering earlier in the spring than they did 100 – 150 years ago.
Phenological Responses to Climate Change

- Changes in the **timing of spring activity** have been observed in several species
- But the **magnitude** of phenological response depends on type of organism

Phenological responses to climate change

Earlier “leaf-out” at Lowell Cemetery in Lowell, Massachusetts

Miller-Rushing et al. 2006. American J. Botany
Key Goal: To understand how plants, animals, and landscapes respond to environmental variation and climate change

- A national biological science and monitoring program
- A national phenological data management system
- Standard protocols for plants, animals, landscapes
Go to [www.usanpn.org](http://www.usanpn.org)
- 300+ plant species
- 160+ animal species
- Core protocols
Signs of the Seasons

A partnership between:
Signs of the Seasons
Focal species

- American eel, *Anguilla rostrata*
- Eastern white pine, *Pinus strobus*
- Common reed, *Phragmites australis*
Protocols for 143 animal species in NH

<table>
<thead>
<tr>
<th>Do you see/heard...</th>
<th>Date:</th>
<th>Time:</th>
<th>Date:</th>
<th>Time:</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active individuals</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Feeding</td>
<td>y n ?</td>
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<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Fruit/seed consumption</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Insect consumption</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Calls or song</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Singing males</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<tr>
<td>Nest building</td>
<td>y n ?</td>
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<td>y n ?</td>
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<td>y n ?</td>
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<tr>
<td>Dead individuals</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
<td>y n ?</td>
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<td>y n ?</td>
</tr>
<tr>
<td>Individuals at a feeding station</td>
<td>y n ?</td>
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<td>y n ?</td>
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<td>y n ?</td>
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</tbody>
</table>

Comments:
Opportunities

Signs of the Seasons
Backyard Phenology Monitoring Training

30 July 2013
Great Bay Discovery Center
9-11:30am
Opportunities

Phenology Monitoring at NH Audubon Wildlife Sanctuaries

Deering Wildlife Sanctuary in Deering

Ponemah Bog Sanctuary in Amherst

Silk Farm Sanctuary in Concord
Extra slides
Phenological Mismatch

Stenseth N C, and Mysterud A PNAS 2002;99:13379-13381