




Presentation given at:
**20 Years of ECN
 Research & Monitoring**
 12-13 May 2014
 Lancaster

Blaise Martay

British Trust for Ornithology

Are upland Lepidoptera communities more sensitive to impacts of climate change than lowland communities?

Event organized by  **Centre for Ecology & Hydrology** and supported by ECN's sponsors and research partners
NATURAL ENVIRONMENT RESEARCH COUNCIL

Sponsors:



Research partners:



Note: This presentation may differ slightly from that given at the symposium



Are upland Lepidoptera communities more sensitive to impacts of climate change than lowland communities?

Blaise Martay
James Pearce-Higgins
Don Monteith



Climate change impacts

Abiotic: thermal tolerance, extreme events
Biotic: food availability, competitors, predators, parasites

Survival, reproduction & adaptation

Population abundance

Community change

Climate change impacts

1. Which communities will be most impacted?
2. What mechanisms are driving changes?

Approach

- Identify species response to temperature from national population indices

[species temperature response = STR]

- Examine variation in mean individual STR across ECN sites and over time.

[community temperature response = CTR]

- Examine factors influencing CTR to explore mechanisms

Questions

Which communities will be most impacted?

- Climate or habitat?
- Uplands and Lowlands?

Mechanism for climate-driven change:

Abiotic

- **Extremes:**
 - Winter in cold sites?
 - summer in warm sites?
- **Thermal tolerance:** Is butterfly community change greater on cold sites?

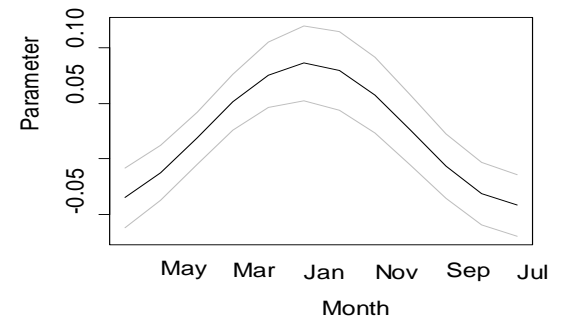
Biotic

- **Inter-specific competition:** Less change where species all reacting similarly?
- **Intra-specific competition (food availability):** ?
- **Predators and parasites:** ?

Methods

Identifying species temperature response

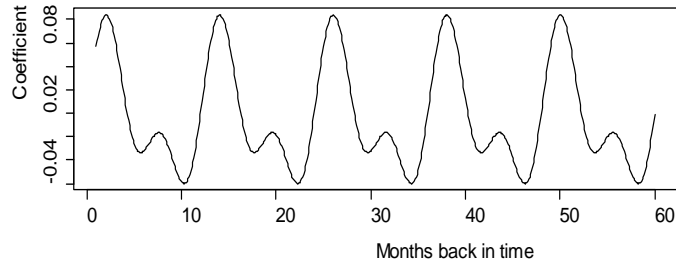
- Population = $\text{pop}_{\text{year}-1}$ + year + temperature of each month for previous ten years
- Assume response to temperature in adjacent months will be correlated:
 - Seasonal pattern in response
 - Decay in impact



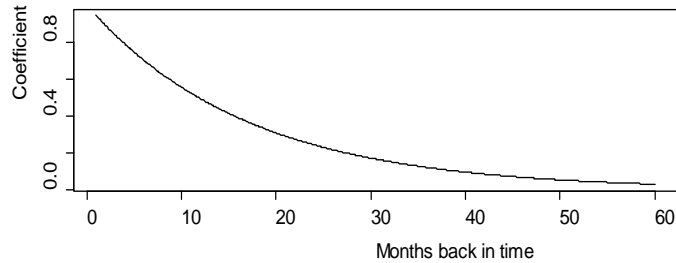
Methods

Identifying species temperature response

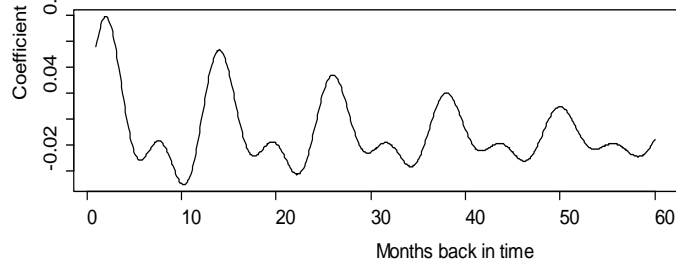
(a) Two repeating cycles per year



(b) Exponential decay

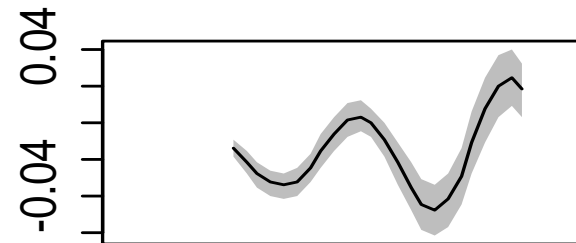


(c) Combined, a damped seasonal pattern



Mean temperatu

Adonis Blue



Season

Results

- Graph showing annual mean temperature through time,
- the positive relationship between temperature and mean moth CTR,
- No relationship between butterfly CTR and mean annual temperature

Community temperature response

Moths = climate

Butterflies = land-use?

Graph showing moth CTR at sites was determined by mean site temperature and increased over time. Butterfly CTR was determined by whether the sites was upland or lowland site but temperature did not influence CTR with those groups. Butterfly CTR did not increase over time.

Moths

On most sites CTR was driven by winter temperatures. On cold upland sites CTR was driven by summer temperatures

Butterflies

- Butterfly winter CTR increased over time while summer CTR decreased

What this means

No clear difference between uplands and lowlands

Moths:

- Clear climate signal
- Driven by biotic interactions?
 - Increase in winter parasitism and predation?

Butterflies:

- Mainly land-use?
- Why different from moths?
- Specialists and generalists?

Thank you

