Determining the Role of Competition in Structuring Population Distributions:

Case study of stream fish in Oklahoma

Winston, M.R. 1995. Co-occurrence of morphologically similar species of stream fishes. The American Naturalist 145:527-545.

Complete Competitors Cannot Coexist…

- Partitioning of resources
  - Food
  - Temporal
  - Space (habitat)
- Space Partitioning Leads to Complementary Distributions
  - Sympatric
  - Allopatric
  - Parapatric

Distributions of Stream Fish in Red River

- Anecdotal observations of parapatric distributions among 27 species of morphologically similar minnows, shiners, and chubs
- Wanted to know the mechanism (e.g., interspecific competition) for assembly

Reasons/Mechanisms for Parapatric Distributions

- Historical
  - Species are adapted to different environments
  - Genetic mechanisms maintain boundaries
- Ecological
  - Ecotones
  - Predation
  - Disease and parasites
  - Interspecific competition

Approach

- Genetic Mechanisms
  - Used phylogeny
  - Predictions:
    - » More distantly related species should show more random distributions (i.e., more overlap)
    - » Less likely to have parapatric distributions
  - If distantly related species show parapatric distributions then suggests an ecological mechanism

Approach

- Ecological Mechanisms
  - Used morphology
  - Predictions:
    - » Morphologically similar species would have parapatric distributions more than dissimilar species
  - If morphologically similar species showed parapatric distributions then suggests an ecological mechanism

Results

- Genetic Mechanism
  - Phylogeny failed to explain (i.e., distantly related species still showed some complementary distributions
- Ecological Mechanism
  - Morphologically similar species co-occurred less than morphologically less similar species
  - Suggests an ecological mechanism

Ecological, however…

- Ecotones?
- Predation?
- Disease and Parasitism?
- Interspecific Competition?

Ecotone?

- Ecotones bound the distribution of species adapted for particular habitats
- If assume morphologically similar species are adapted to similar habitats then expect similar species to co-occur
- This was not the case

Predation?

- Assume picivores should prey on morphologically similar species
- If one species was excluded from an area due to predation, then other morphologically similar species should be excluded as well
  - Not the case
- Additionally, picivore ranges were usually much larger and overlapped many parapatric distributions

Parasites and Disease?

- ?????
- Used other studies to suggest might or might not be the case

Interspecific Competition

- Assume that if morphology reflects resource use and if *resources are limiting*, then expect competitive pressure to result in parapatric distributions
- Found morphologically similar species showed parapatric distribuitons

Conclusions

- Interspecific competition, as the mechanism for parapatric distributions, was consistent with predictions
- If an observational approach is used, care must be taken to examine all possible explanations