

# Large-scale spatial patterns of Canadian arctic Diptera: diversity, geography and history

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# Geographic Context



# Latitudinal Gradients



# Longitudinal Gradients

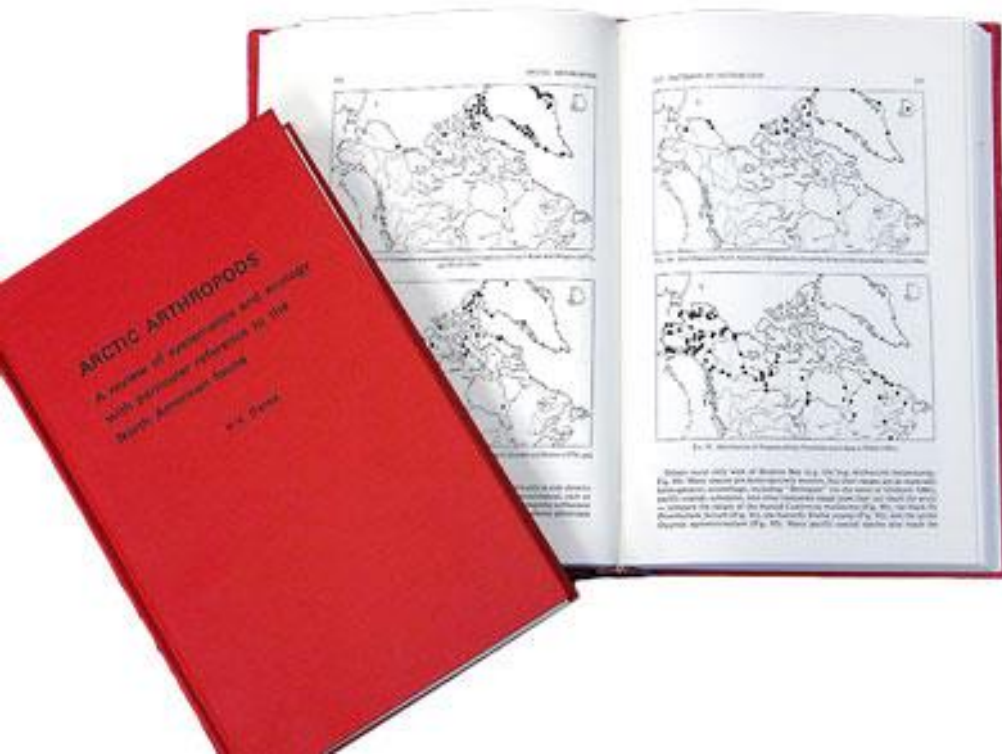
Beringia

Hudson Bay



# Arctic Arthropod Diversity

- “Conventional wisdom”
  - *Arctic Arthropods* (Danks, 1981)



- Depauperate fauna
- 2000 species above tree line in North America

# Arctic Ecological Diversity

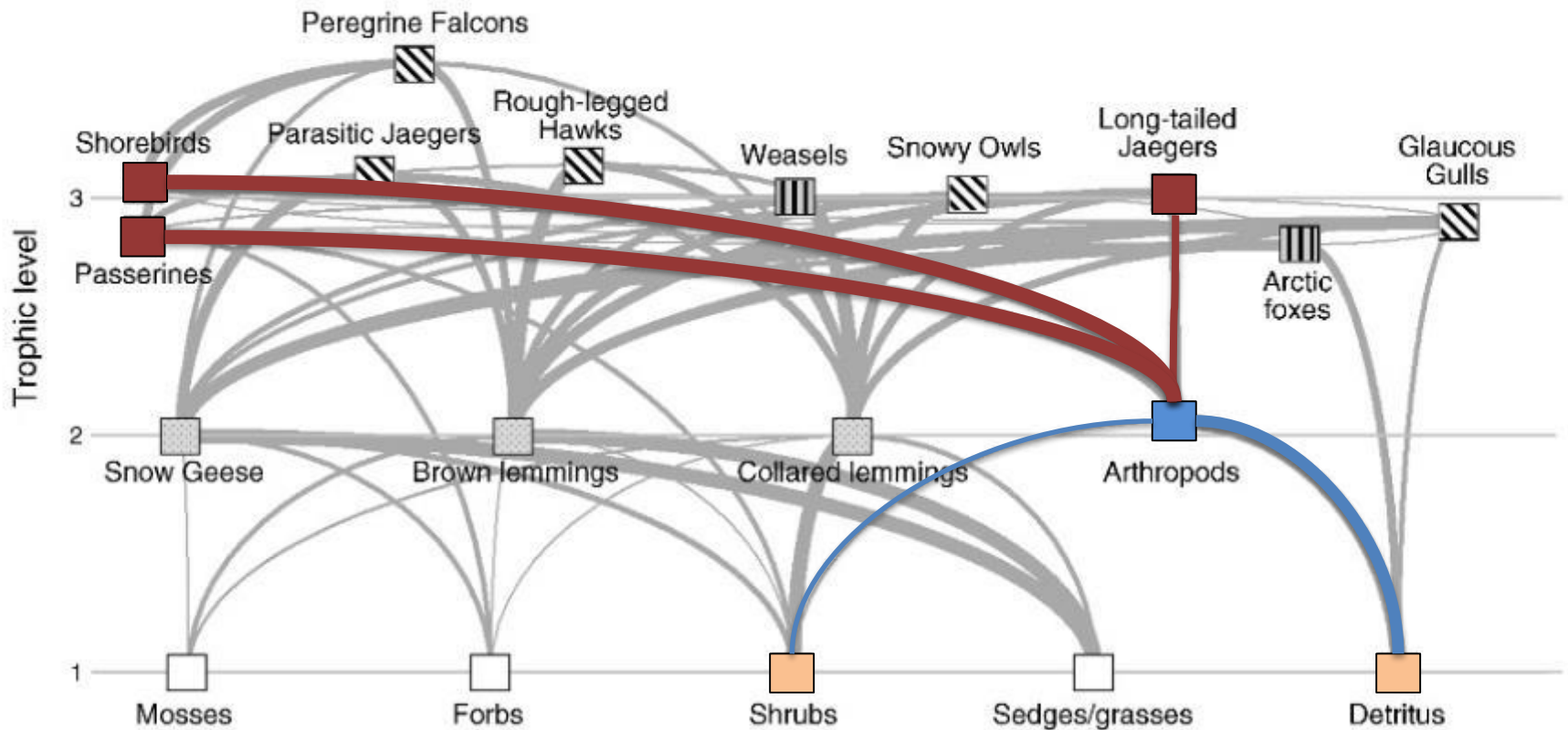
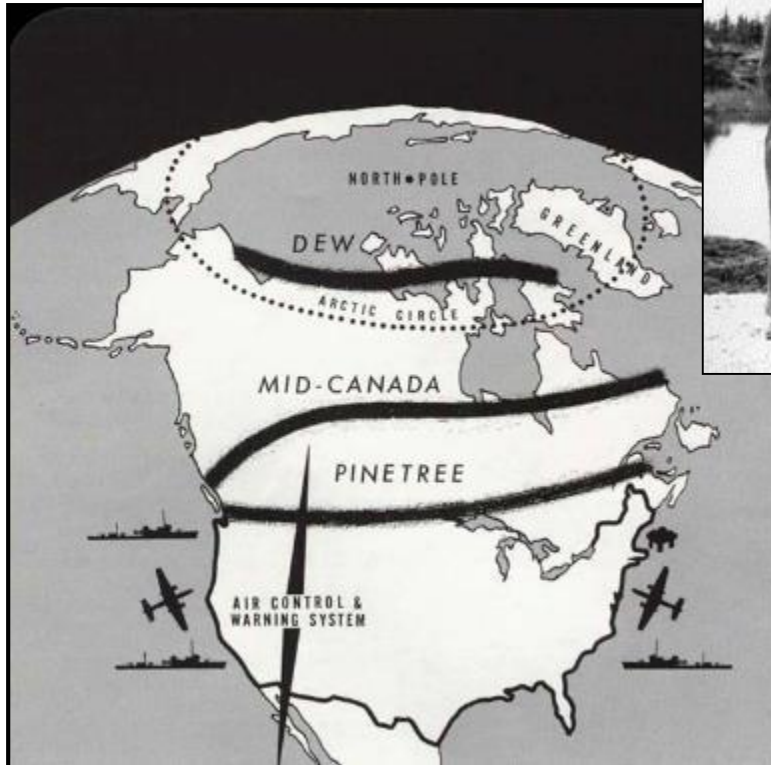


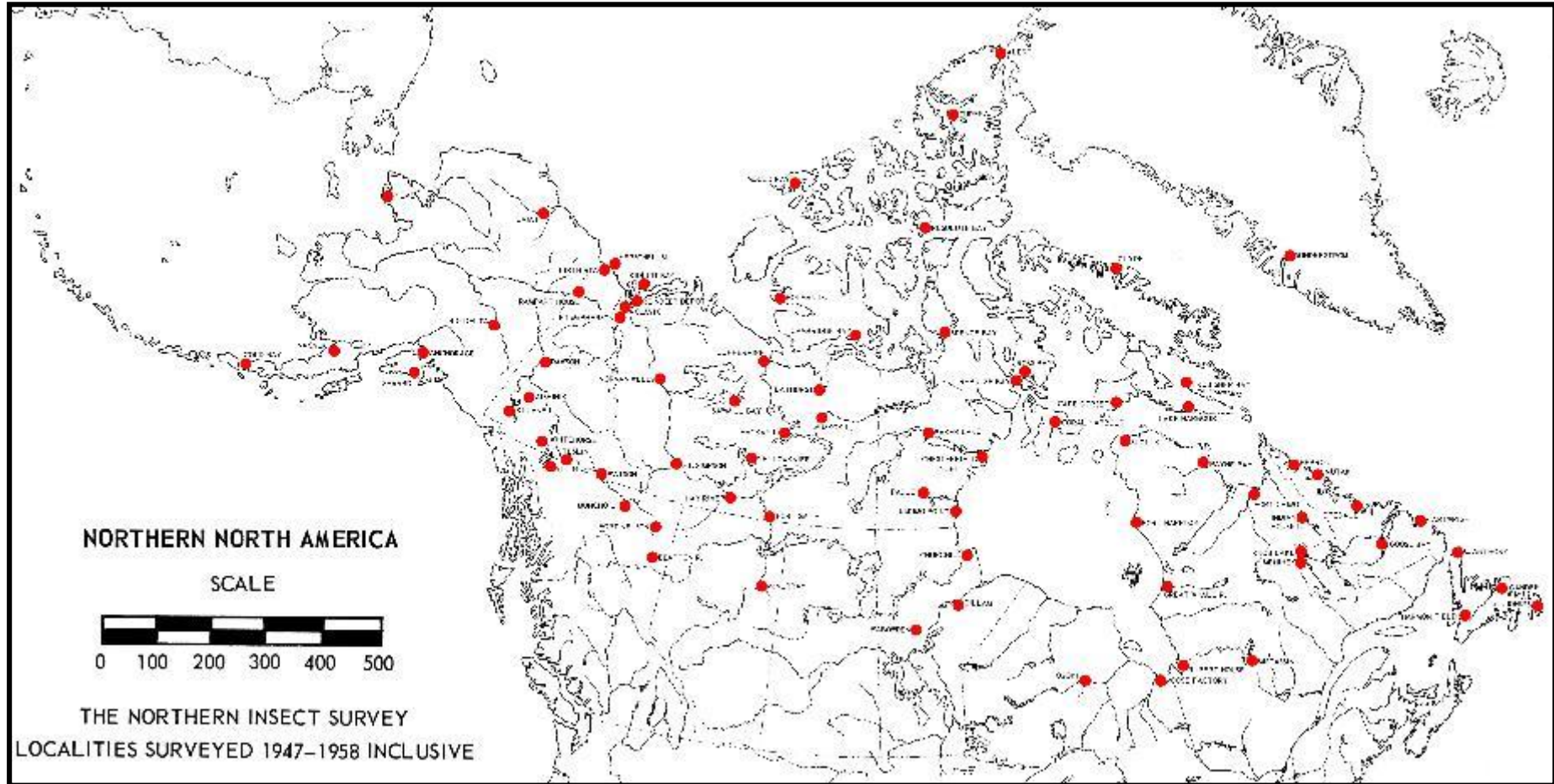
FIG. 1. Schematic representation of the tundra food web of Bylot Island, Nunavut, Canada, showing interactions among functional groups in 2008, a year of high lemming abundance. Line width is scaled to the relative importance of each group in the diet. Detritus includes marine subsidies.

# Northern Insect Survey (1947-1962)

- Military presence in the north after WW2 – DEW line
- Canadian biting fly survey, grew into broad inventory



# Northern Insect Survey Sites

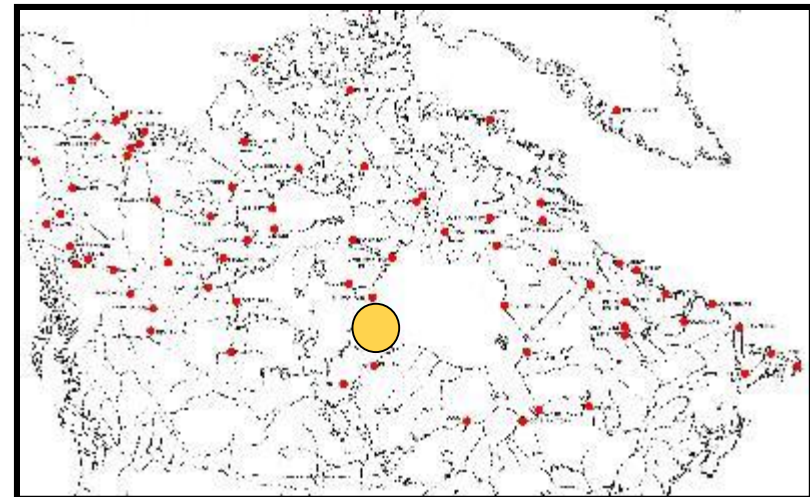


- 72 sampling sites, 2 million specimens collected, “dark data”

# Arctic Arthropod Diversity

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- Churchill, MB (one subarctic site)
- Inventory based on DNA barcodes & morphology
  - 198 Araneae (Blagoev et al. 2013)
  - 300 Coleoptera (Woodcock et al. 2013)
  - 1630 Hymenoptera (Stahlhut et al. 2013)
  - 1800 Diptera (Adamowicz et al, in prep.)
- High species turnover from site to site, especially in refugia



# Northern Biodiversity Program

Ecological structure of northern arthropods:  
adaptation to a changing environment

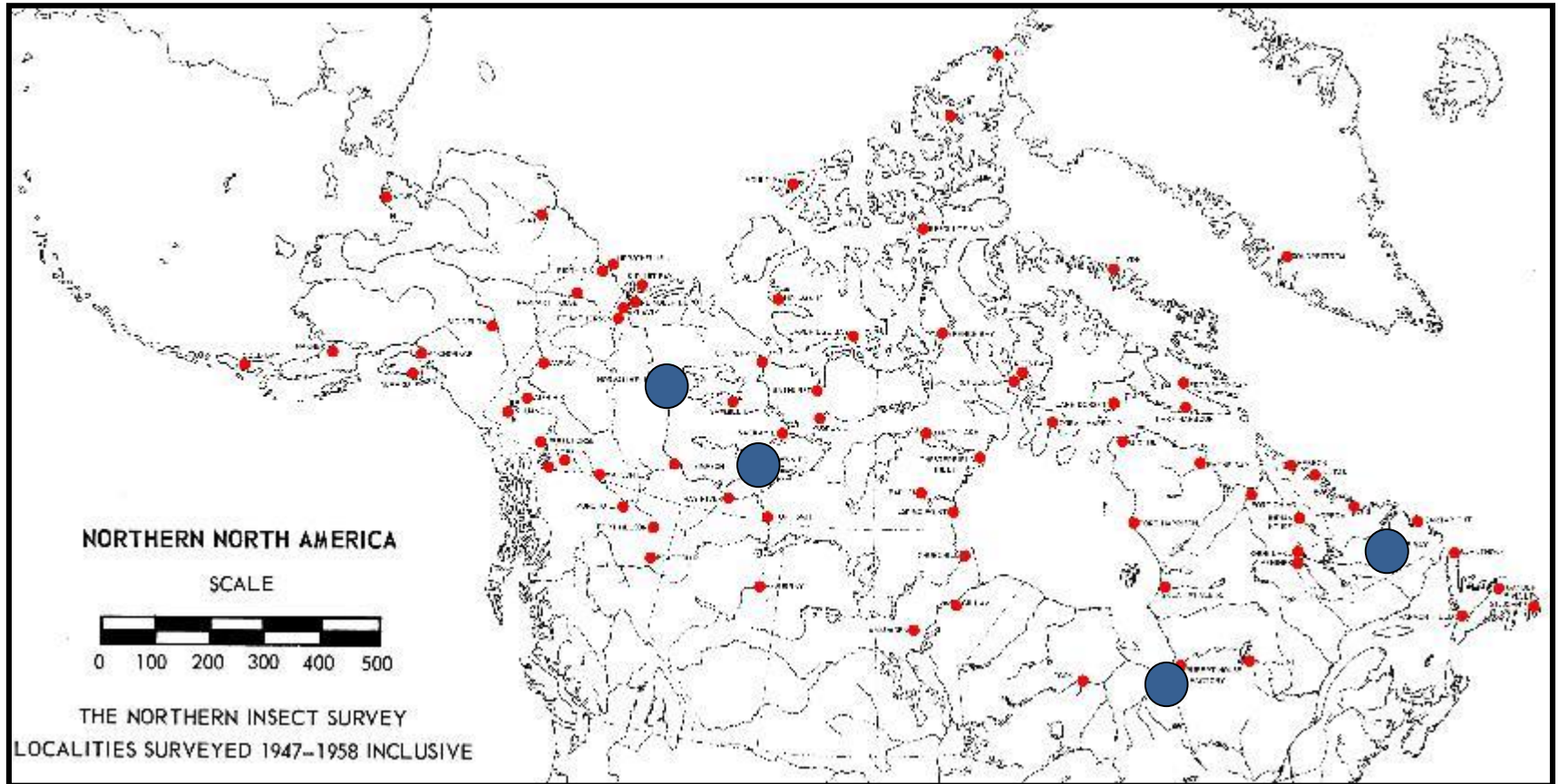


## Themes

1. **Diversity and ecological structure**
2. Ecological adaptation & community change
3. Evolutionary change and genetic diversity
4. Traditional knowledge, outreach, education

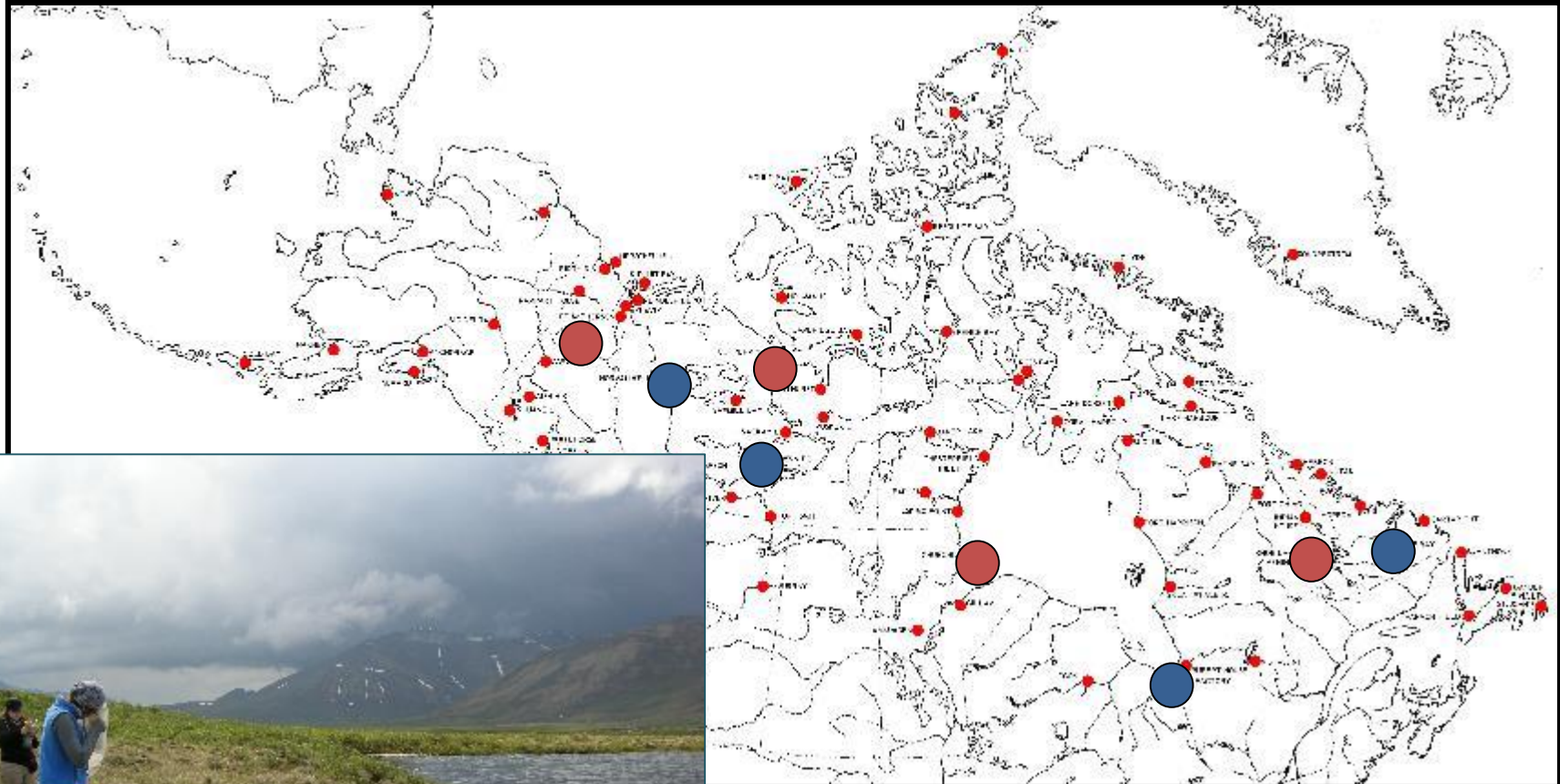


# NBP Study Sites (2010-2011)



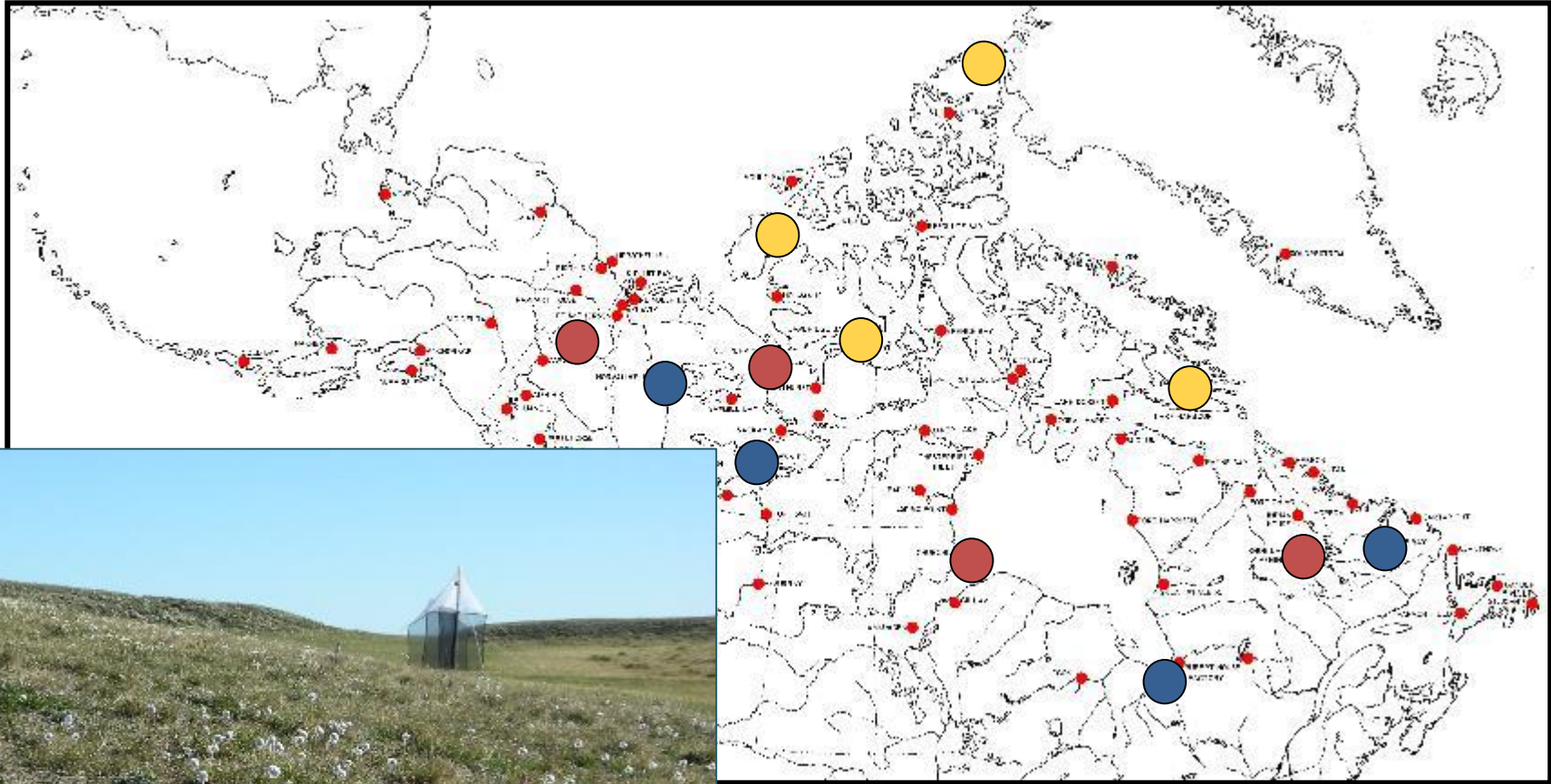
● - north boreal

# NBP Study Sites (2010-2011)



● - subarctic

# NBP Study Sites (2010-2011)



● - high arctic

# NBP Study Design & Taxa

- Standardized, replicated protocols, multiple trap types, wet and mesic habitats at each site
- Spiders
- EPTs
- Beetles
- Ichneumonidae
- Sawflies
- Biting flies
- Higher Diptera



# Diptera Collaborators



Meagan Blair



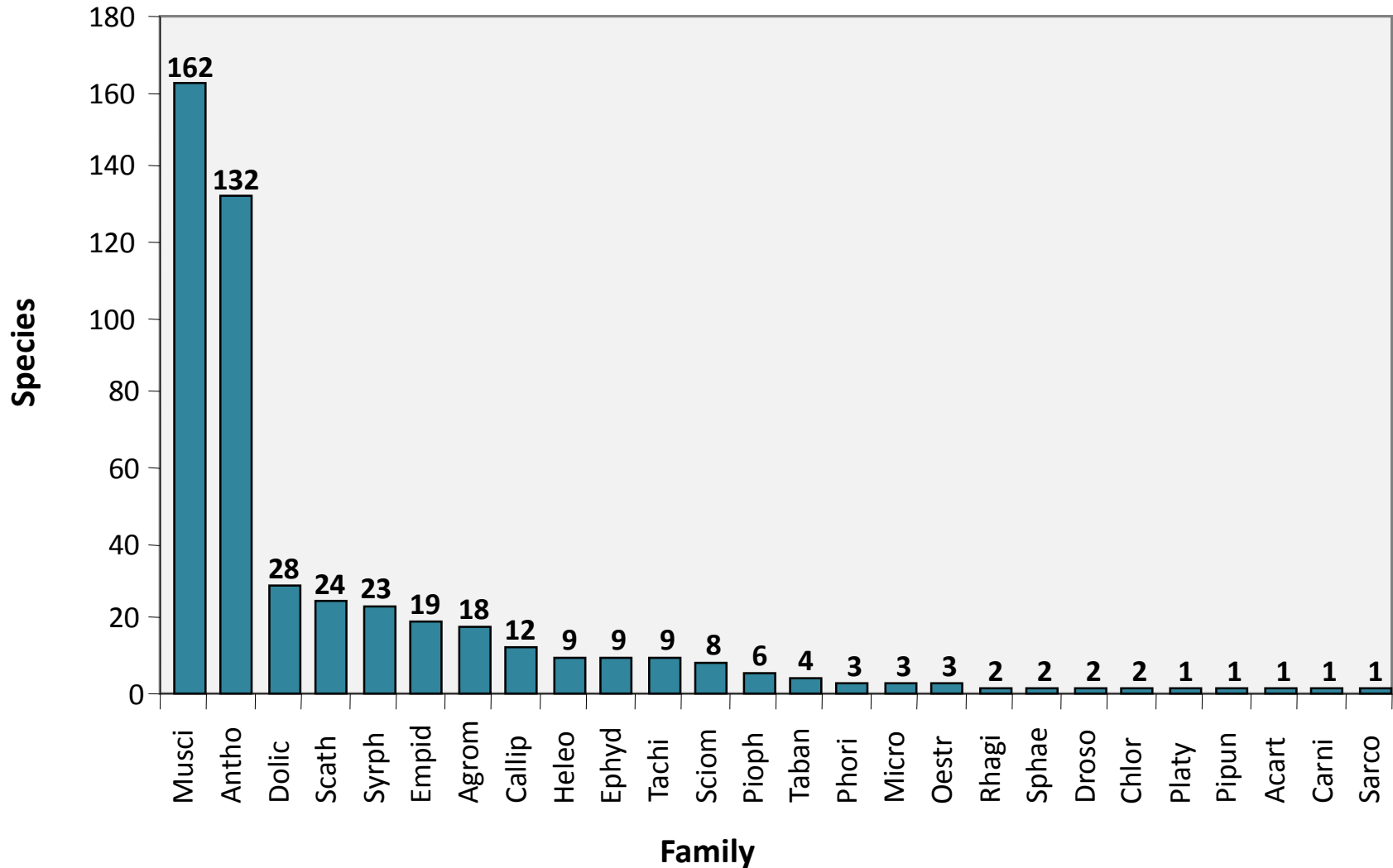
Anna Solecki



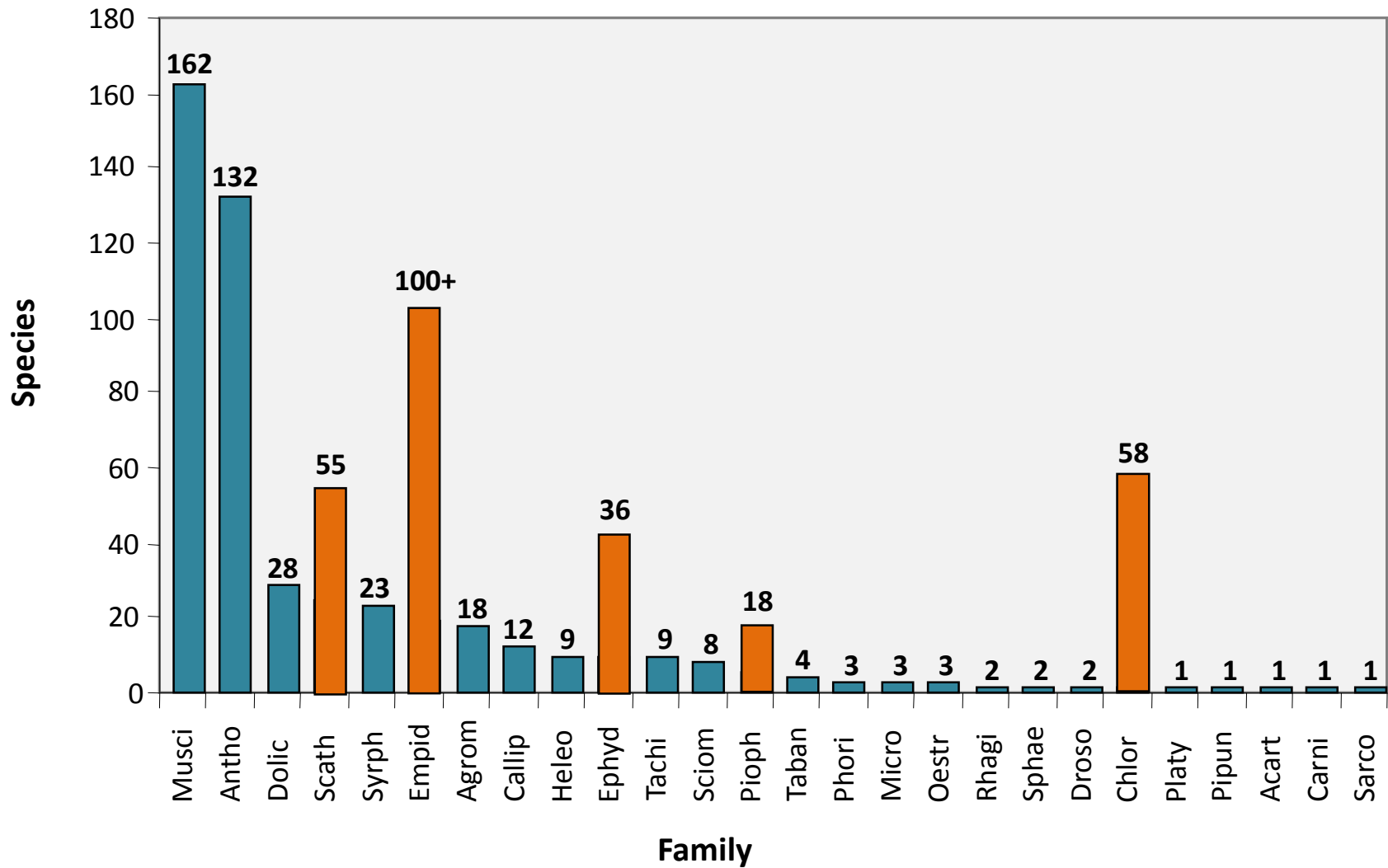
Élodie Vajda

Sabrina Rochefort

# Arctic Higher Diptera (Danks 1981)

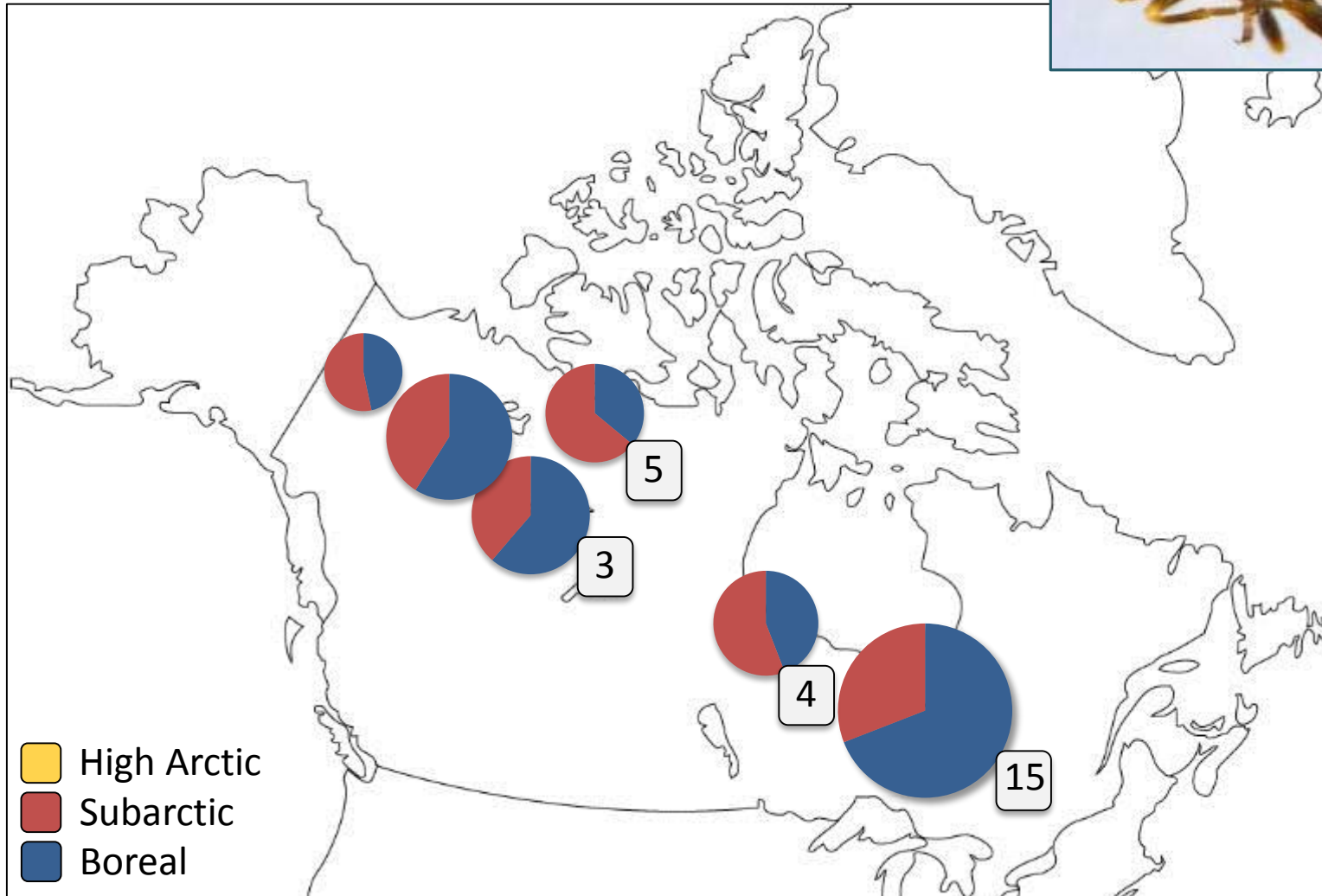


# Increasing Diversity



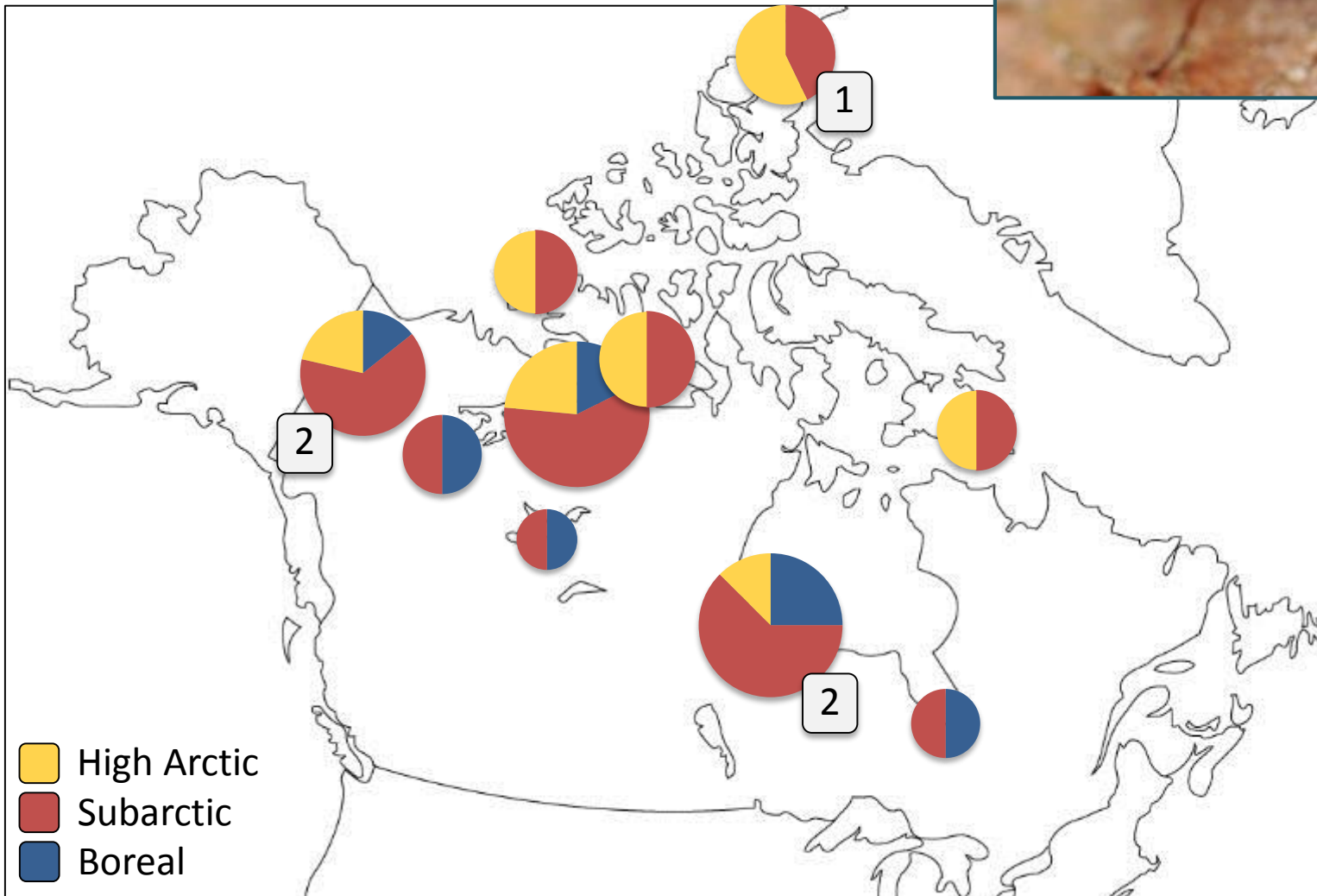
# Chloropidae

58 species (30% new species)



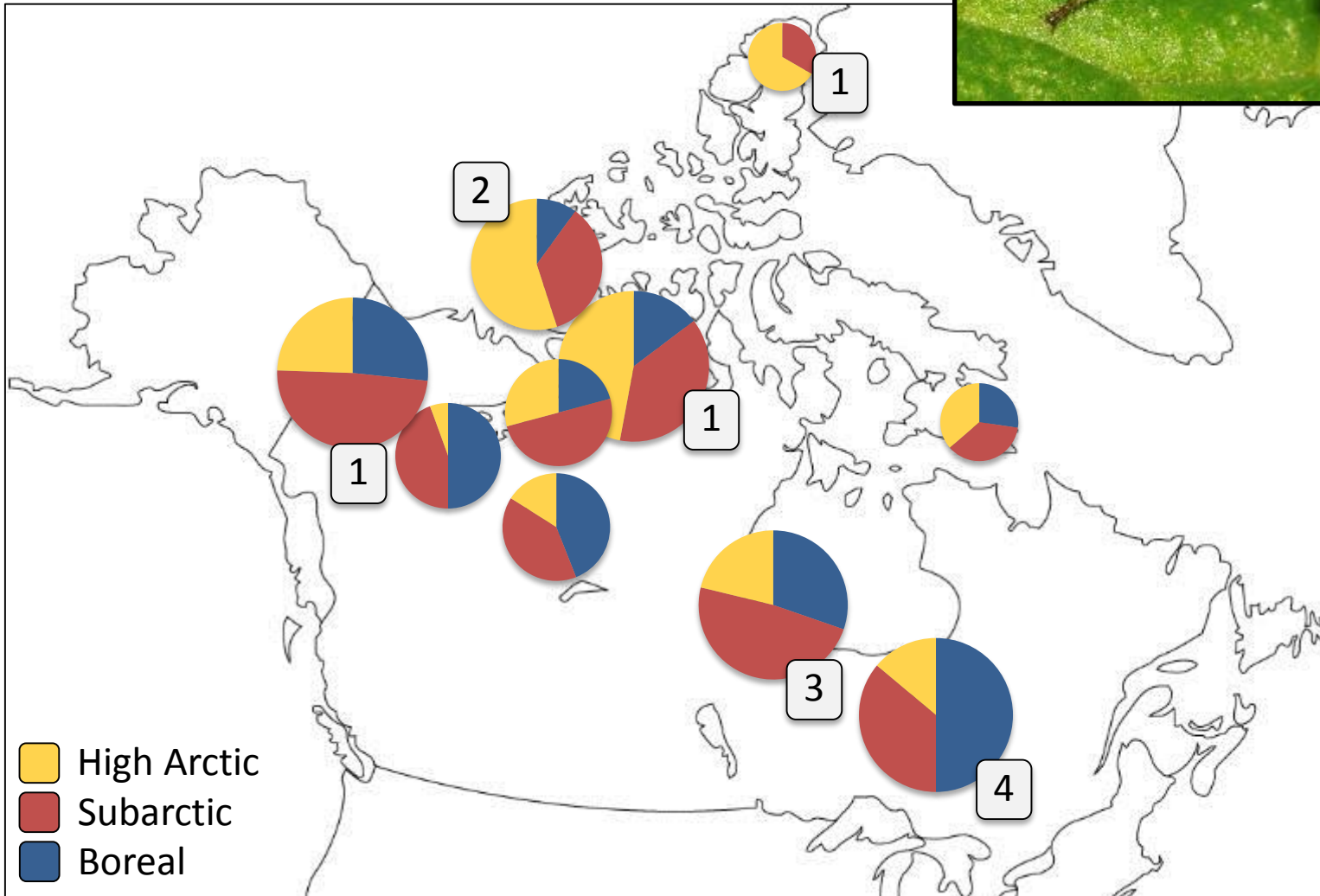
# Piophilidae

18 species, northern family



# Scathophagidae

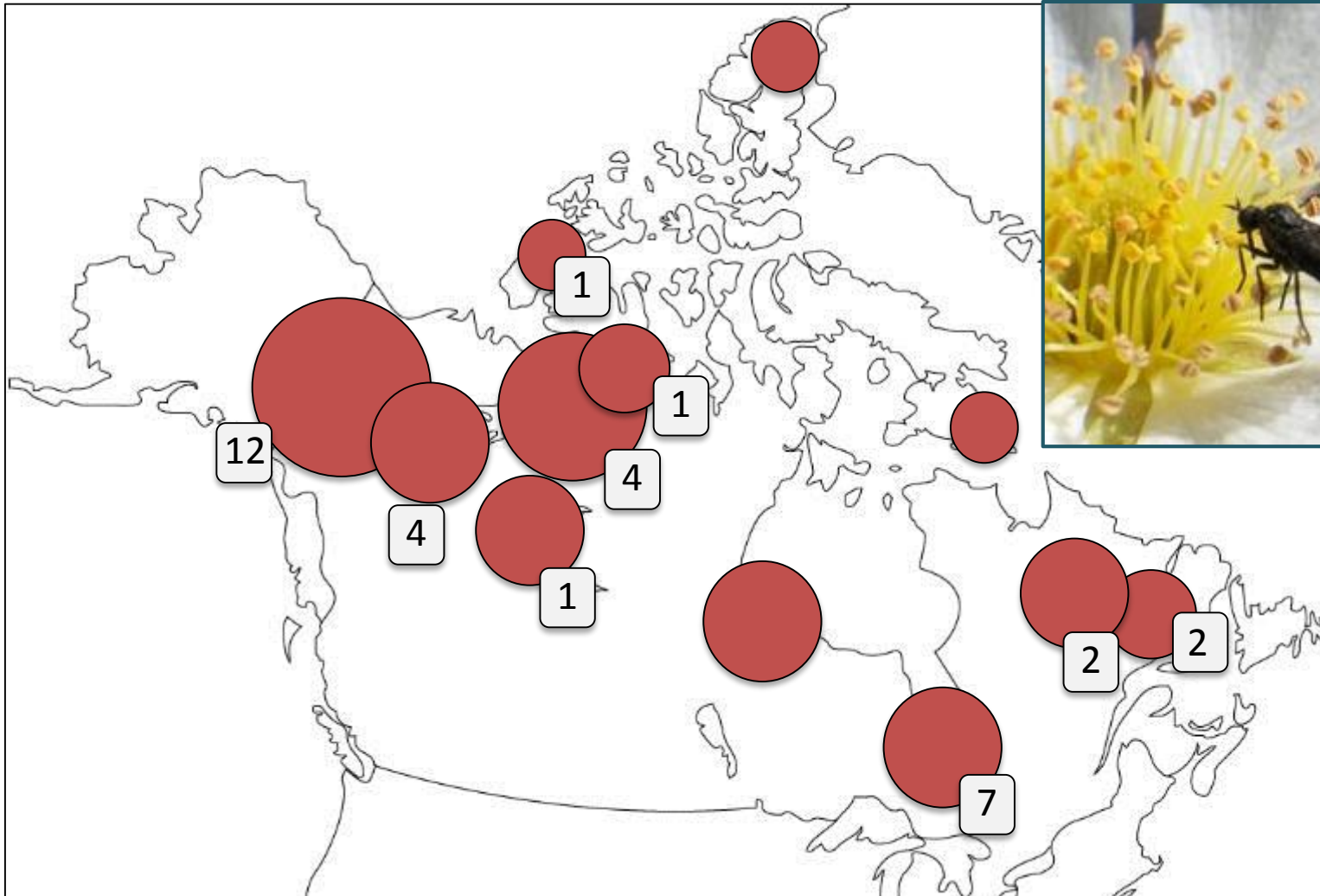
55 species, change at tree line



# High Diversity - Empididae

*Rhamphomyia*

80+ species; predators, flower visitors



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# Ecological Diversity

- Higher species richness ~ higher trophic diversity
- Chloropidae
- Two species in Danks (1981), both phytophagous

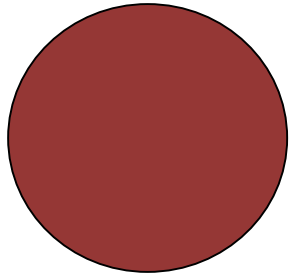


Stem-borer

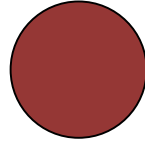


Seed feeder

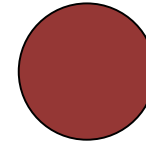
# Chloropidae - Ecological Diversity



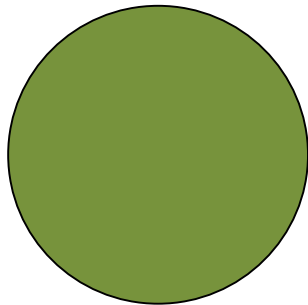
Homoptera predators



Insect egg predators



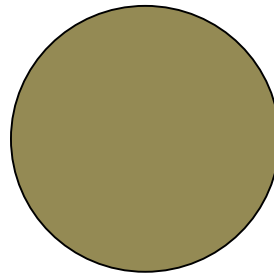
Spider egg predators



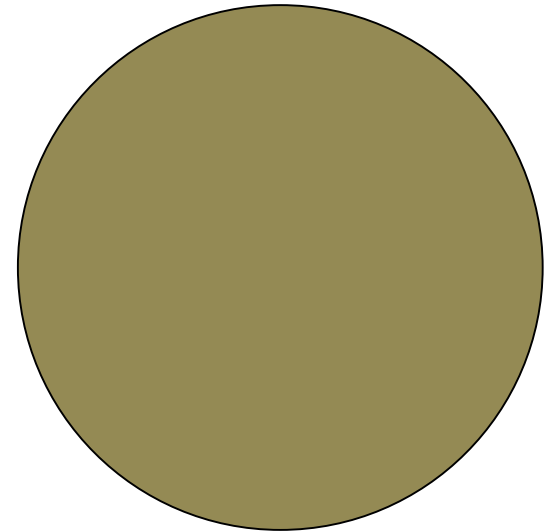
Stem-borers



Seed feeders

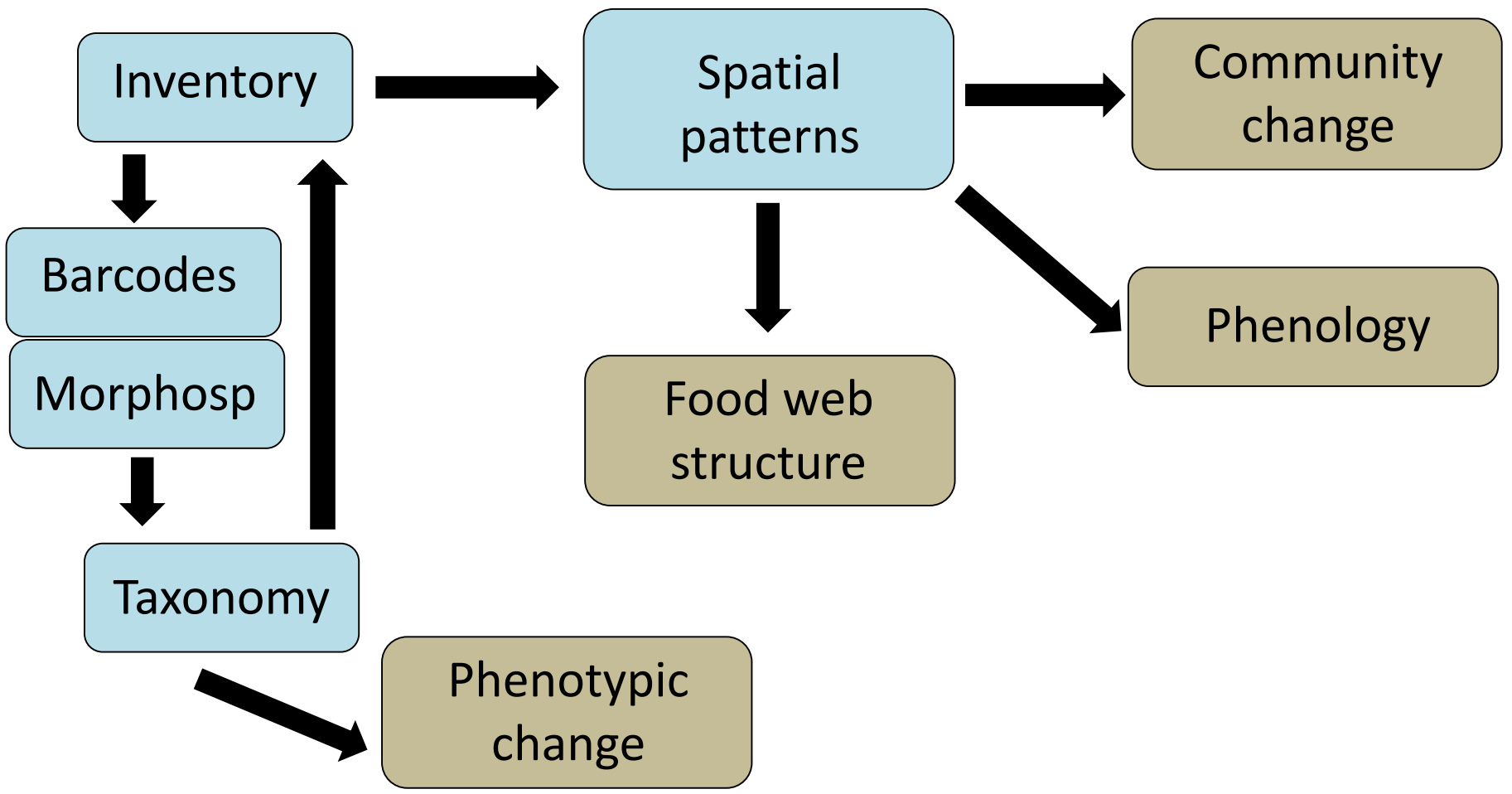


Saprophagous –  
dead arthropods

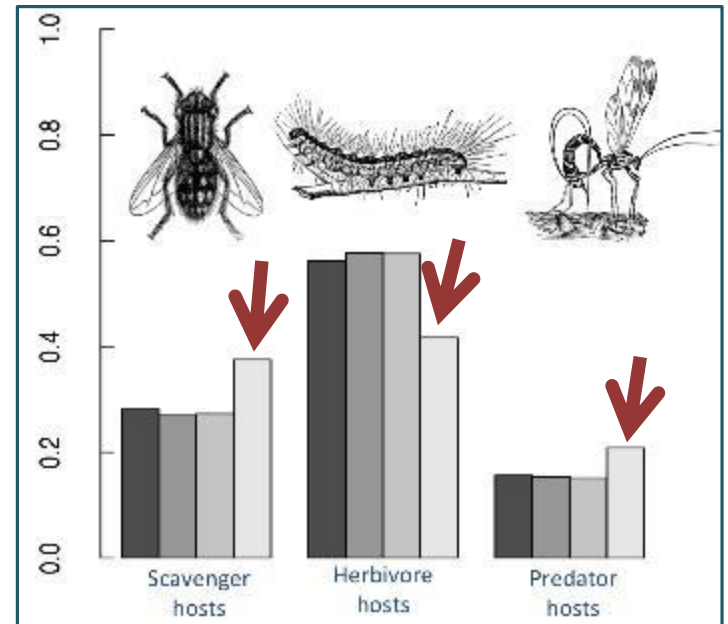
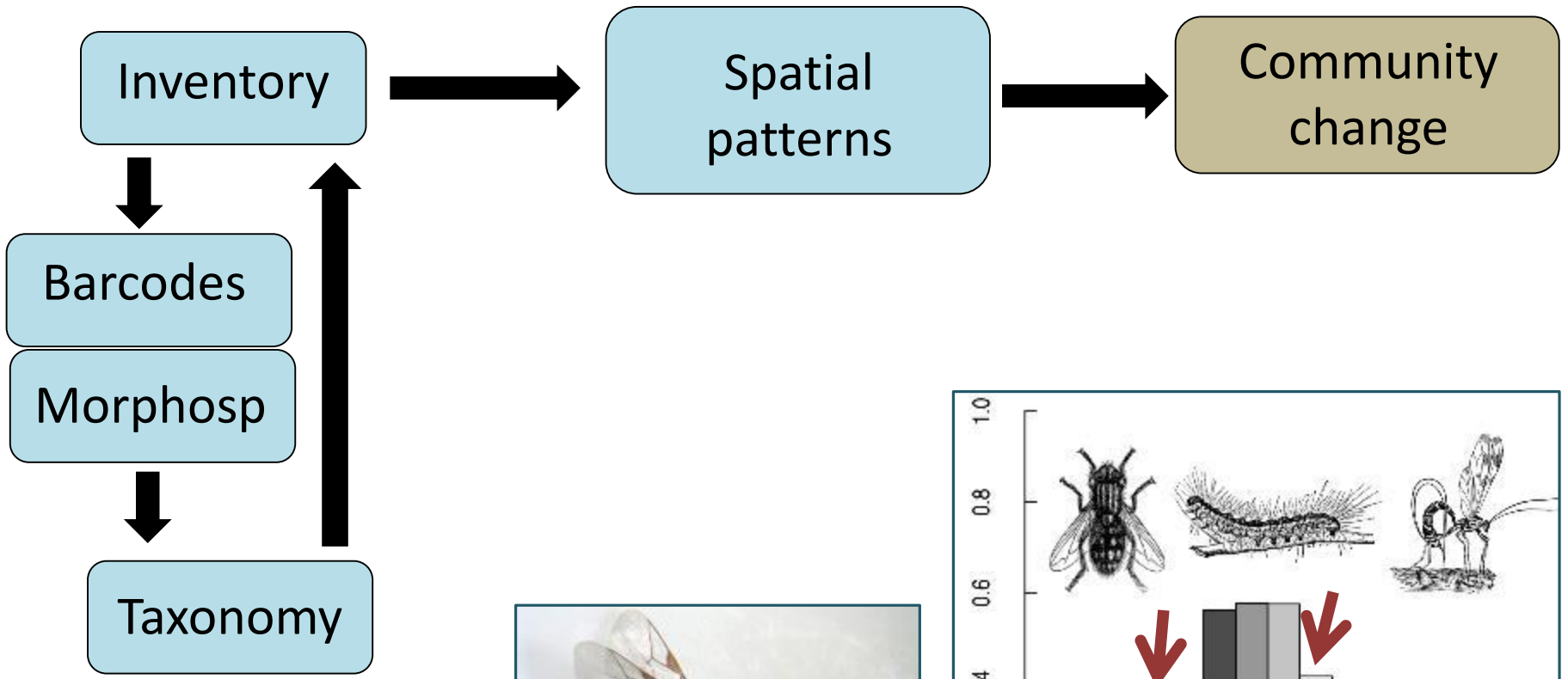


Saprophagous - plants

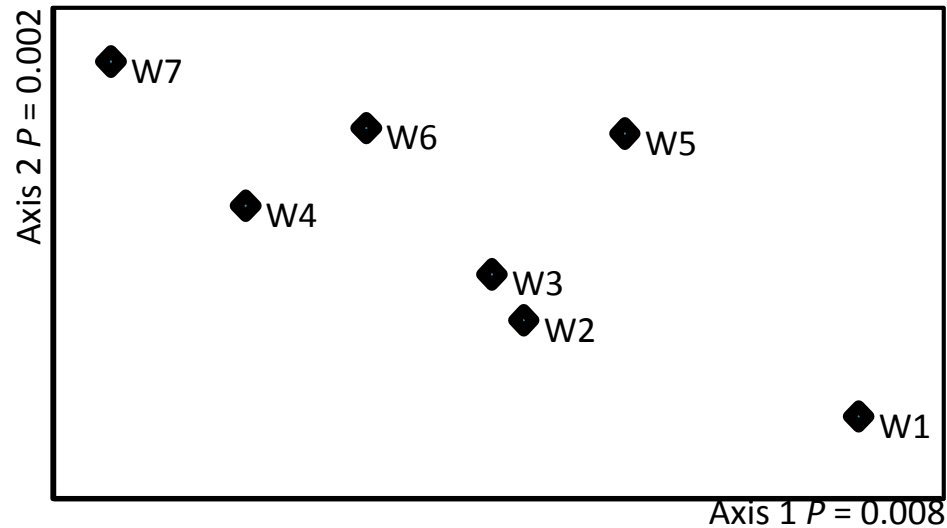
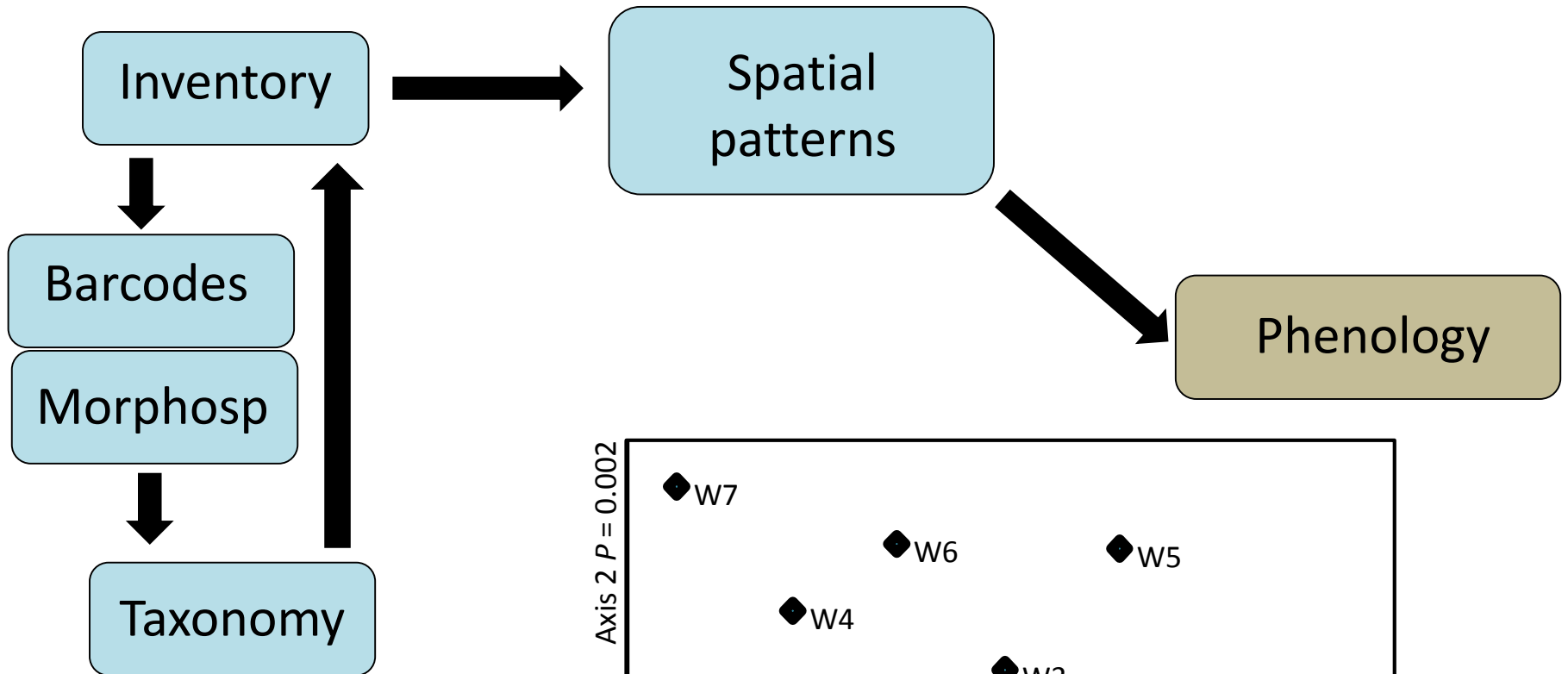
# Building on Baseline Data



# Long-term Community Change

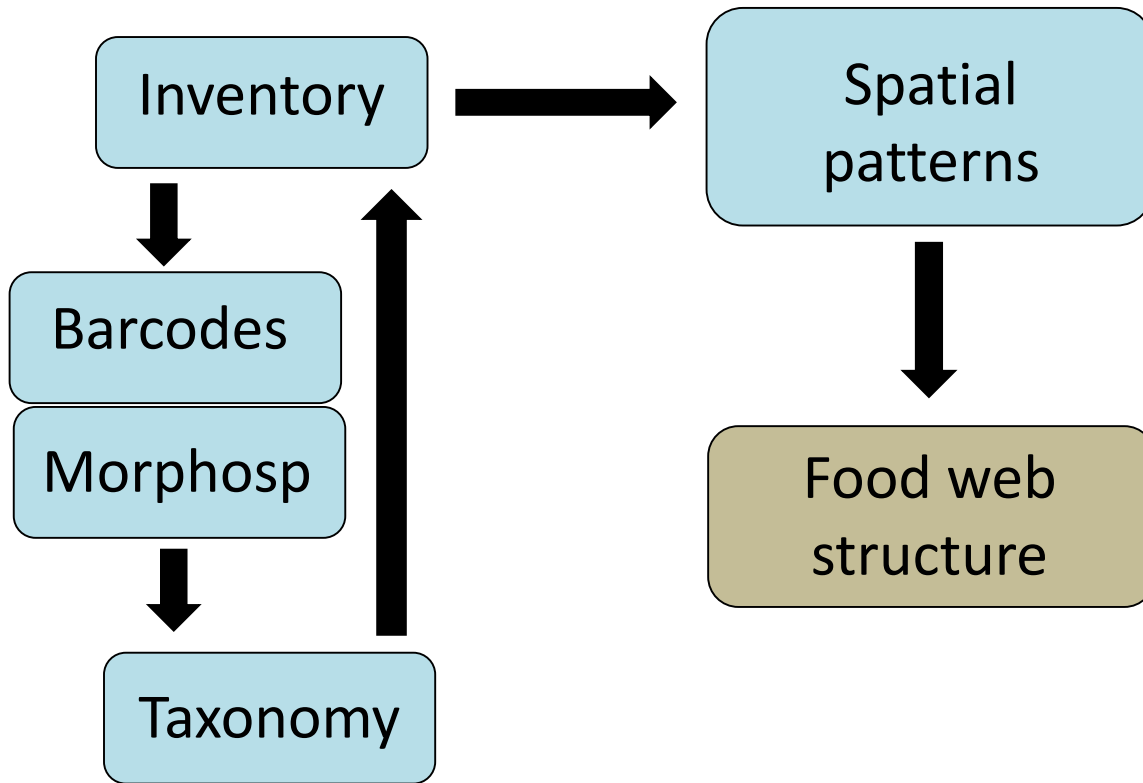


# Assessing Phenology

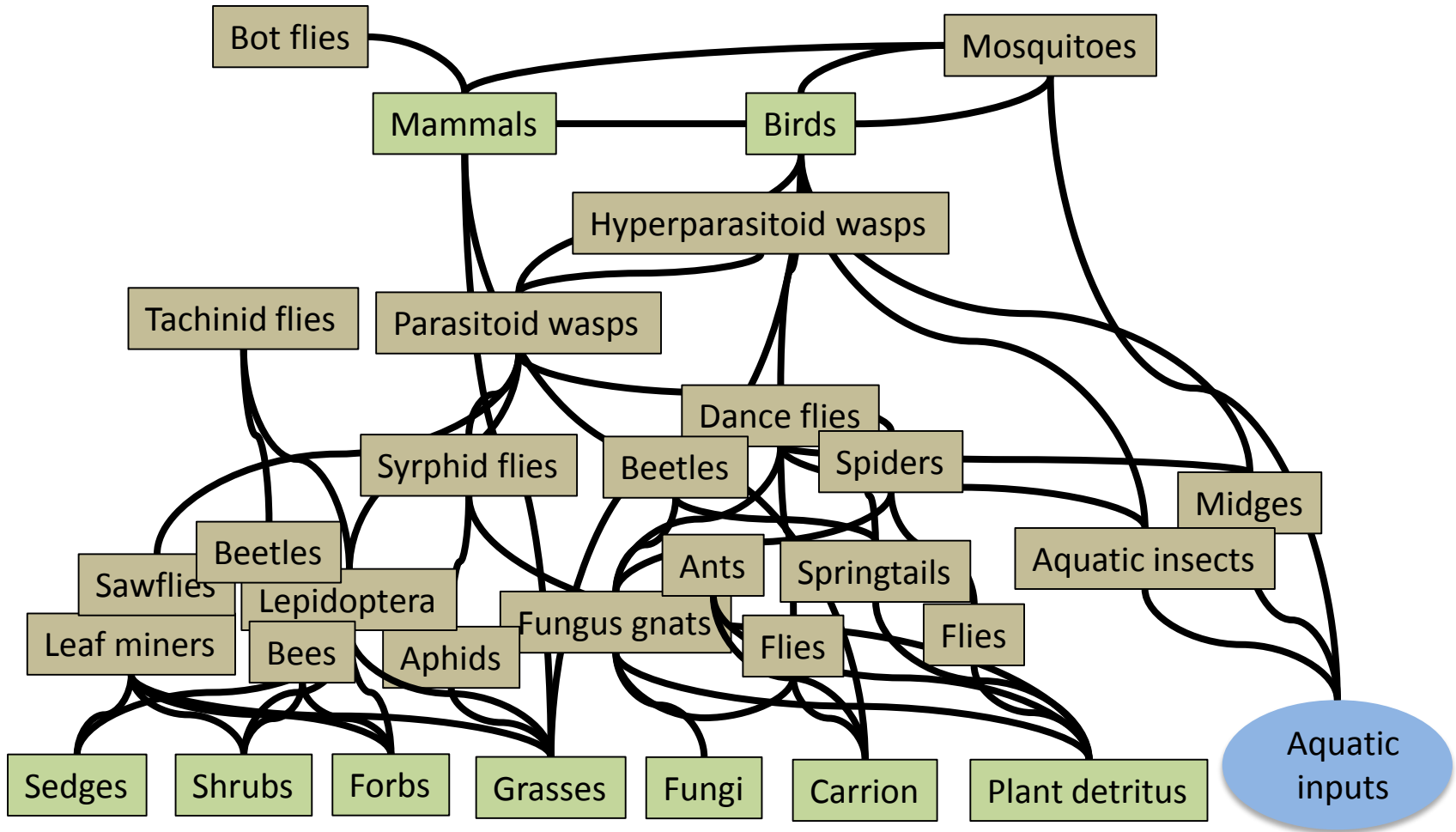


Weekly turnover of Diptera community at Kugluktuk, NU  
(Solecki *et al.* in prep.)

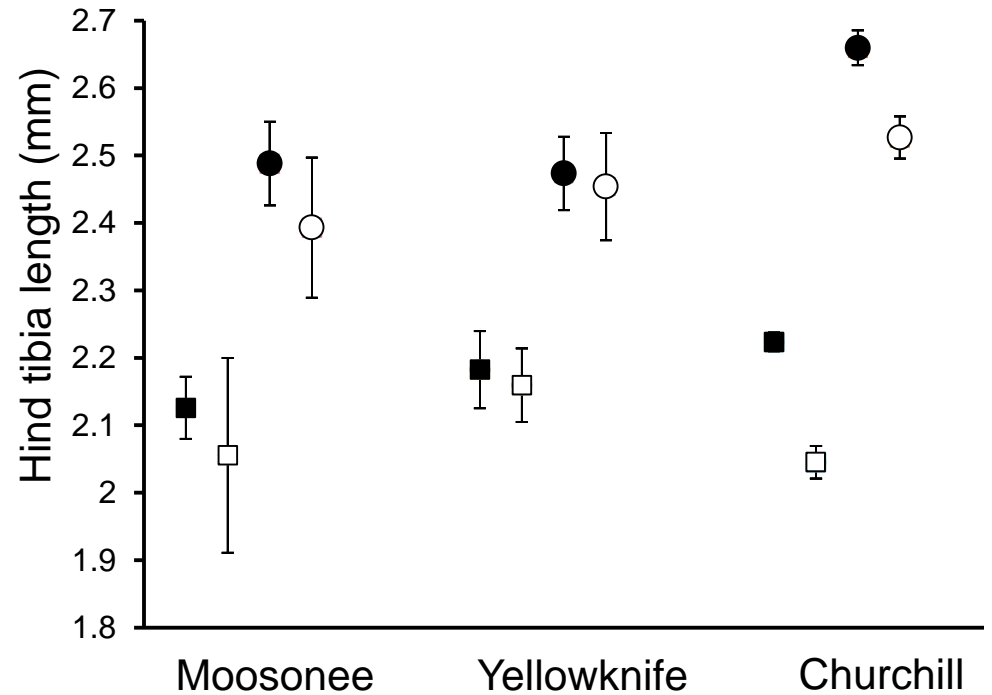
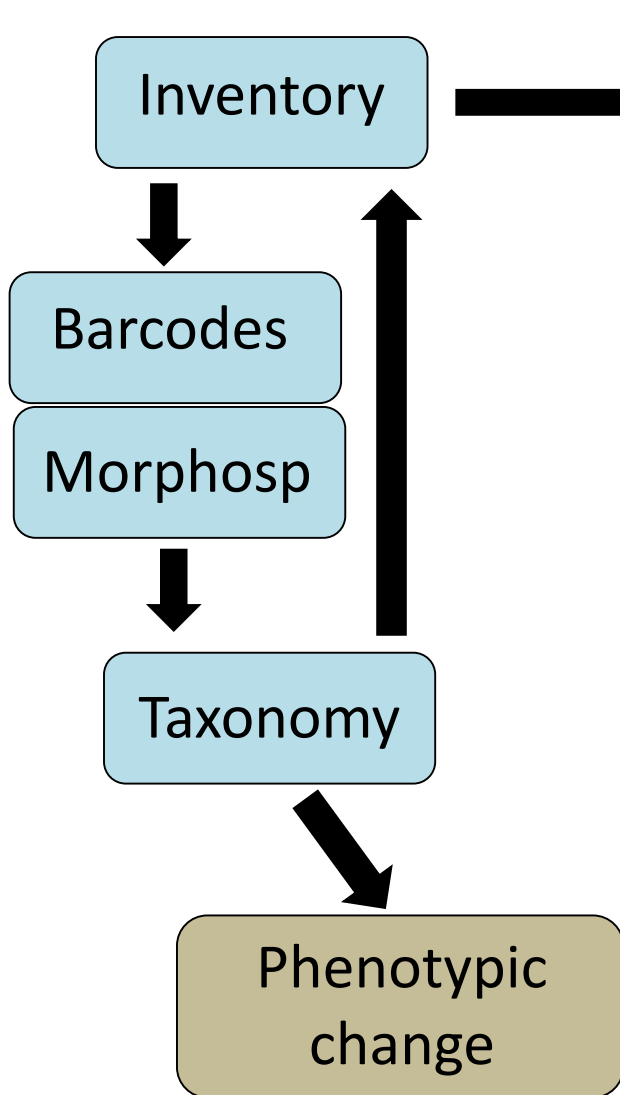
# Food Web Structure



# Food Web Structure?



# Phenotypic Change



50-year body size reduction in *Scathophaga furcata*  
Wheeler *et al.* in prep.



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**McGill**



**NSERC  
CRSNG**



- NT, NU, YT governments
- Parks Canada
- Northern HTOs, resource boards, communities