

Arctic Wildlife Observatories Linking Vulnerable EcoSystems (ArcticWOLVES)

A study of the impact of climate
change on tundra wildlife

Gilles Gauthier



Overview of ArcticWOLVES

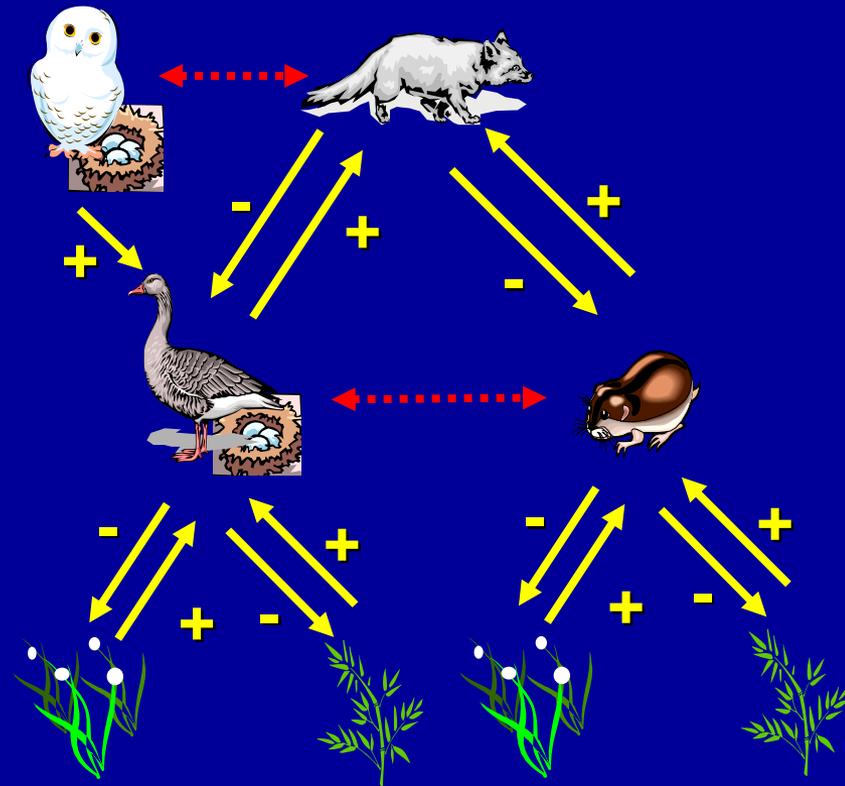
- ArcticWOLVES was developed for the International Polar Year
- The project integrates a circumpolar network of wildlife observatories in order to assess the current state of arctic terrestrial food webs over a large geographical range

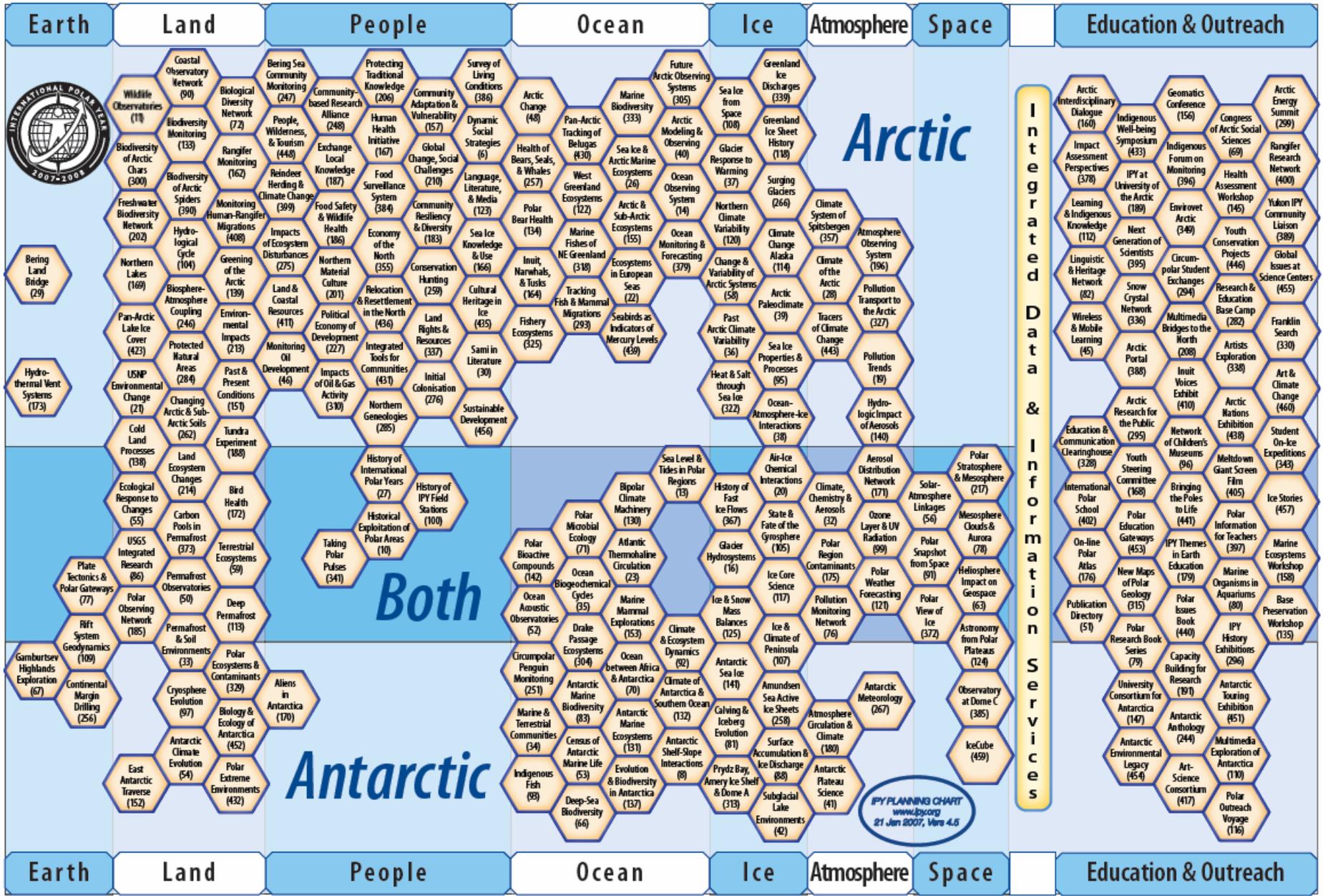


Overview of ArcticWOLVES

Major aims:

- Determine the relative importance of bottom-up (resources) and top-down (predators) forces in structuring arctic food webs
- How climate affects wildlife species and trophic linkages
- Provide baseline information to evaluate current and future population trends for several wildlife species





Bering Land Bridge (29)

Hydro-thermal Vent Systems (173)

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Political Economy of Development (227)

Impacts of Oil & Gas Activity (310)

Community Adaptation & Vulnerability (157)

Global Change, Social Challenges (210)

Community Resiliency & Diversity (183)

Conservation Hunting (259)

Land Rights & Resources (337)

Initial Colonisation (276)

Northern Geneologies (285)

Relocation & Resettlement in the North (436)

Integrated Tools for Communities (431)

Northern Geneologies (285)

History of International Polar Years (27)

History of IPY Field Stations (100)

Historical Exploitation of Polar Areas (10)

Taking Polar Pulses (341)

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Bipolar Climate Machinery (130)

Polar Microbial Ecology (71)

Ocean Acoustic Observatories (52)

Circumpolar Penguin Monitoring (251)

Marine & Terrestrial Communities (34)

Indigenous Fish (98)

Deep-Sea Biodiversity (66)

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Greenland Ice Discharges (339)

Greenland Ice Sheet History (118)

Surging Glaciers (266)

Climate System of Spitsbergen (357)

Climate Change Alaska (114)

Climate of the Arctic (28)

Arctic Paleoclimate (39)

Sea Ice Properties & Processes (95)

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Solar-Atmosphere Linkages (56)

Polar Snapshot from Space (91)

Polar View of Ice (372)

Astronomy from Polar Plateaus (124)

Observatory at Dome C (385)

IceCube (459)

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Ice & Snow Mass Balances (125)

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Originality of ArcticWOLVES

- Study a large array of key wildlife species



Originality of ArcticWOLVES

- Study the INTERACTIONS between these species
 - Predator-prey
 - Herbivore-plant
- Have spatial replicates over a large latitudinal and longitudinal gradient
- Use standard protocols across all sites

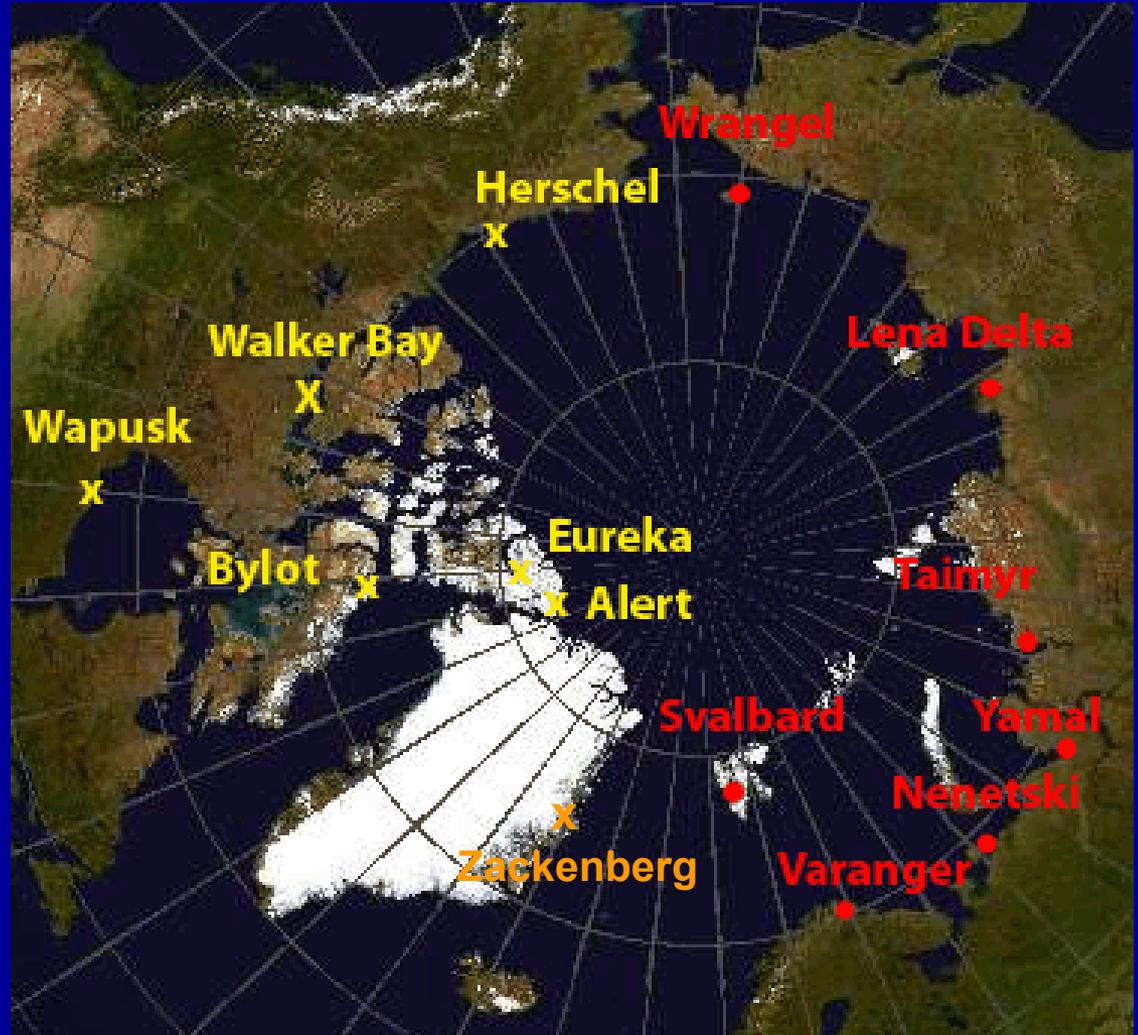


International scope

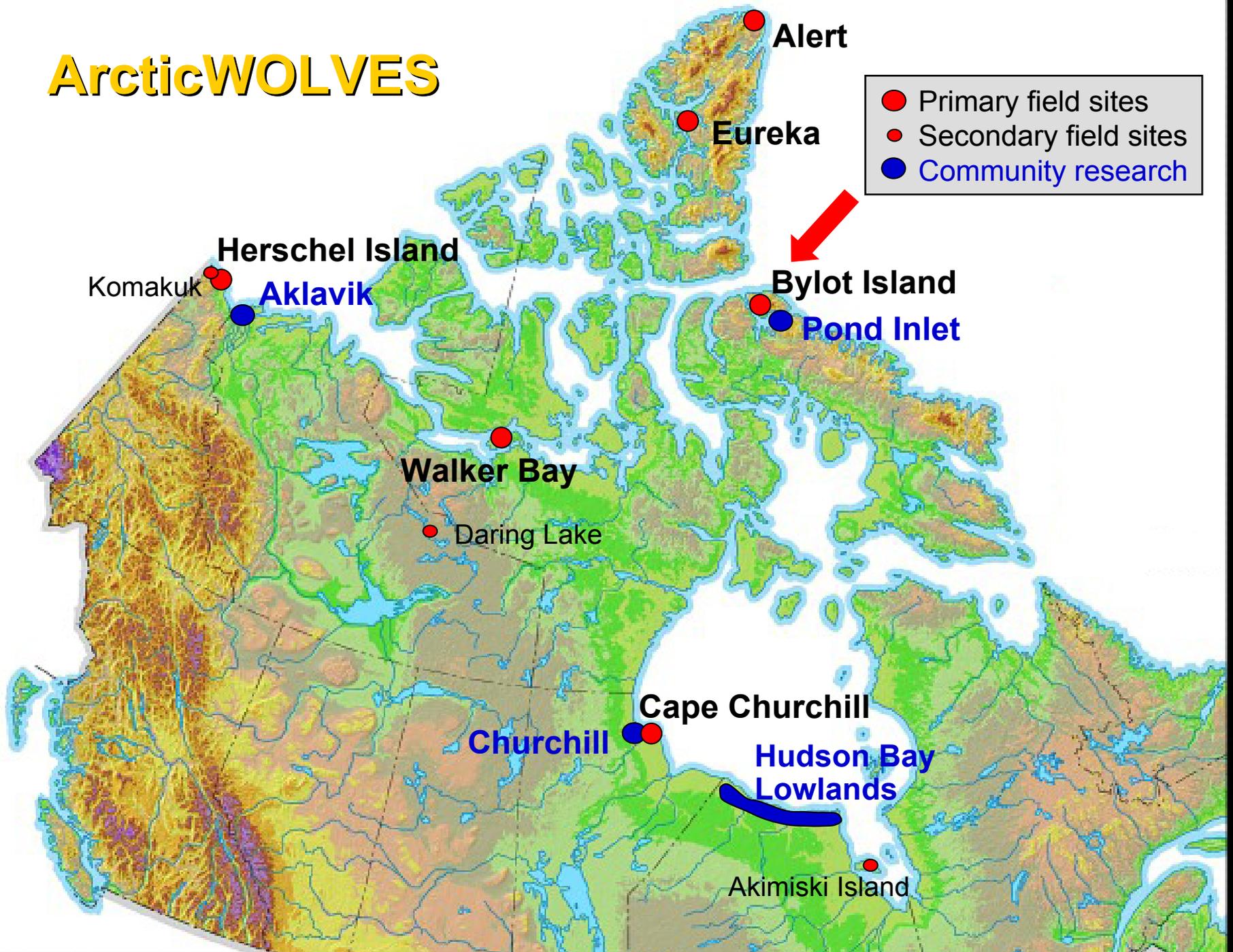
- The project currently involves more than 40 researchers from 9 countries:
 - Canada, USA, Norway, Sweden, Denmark, Netherlands, Finland, Russia and UK
- Closely linked to several other IPY projects
 - Bird Health (Netherlands)
 - Arctic Predators (Norway-Russia)
- Over 14 field sites in the circumpolar world
- In Canada:
 - 12 principal investigators
 - Over 20 scientific and northern collaborators
 - 6 primary field sites

ArcticWOLVES network

- Sites were selected based on:
 - History of wildlife related studies
 - Infrastructure available
 - Long-term commitment of key researchers



ArcticWOLVES



Themes of ArcticWOLVES

- Trophic dynamics of Arctic food webs
 - A dominant view is that resource abundance controls Arctic terrestrial food webs
 - Our hypothesis is that top-down processes driven by predators may be the primary forces structuring arctic communities



Themes of ArcticWOLVES

- Impacts of climate change on terrestrial animal biodiversity
 - Measure the abundance, distribution, and phenology of reproduction of several wildlife species to build a spatially-explicit database
 - Assess recent changes in wildlife abundance and use by northern people in relation to climatic change
 - Conduct field experiments to measure the effects of key climatic events on herbivores
 - Combine western science with traditional knowledge

Study of trophic dynamic

Approach 1

Intensive studies/ manipulations on key species

- Grazing impact
- Habitat use
- Numerical response
- Functional response
- Demography
- Movements

Selected sites

Primary production

Herbivores

- Geese
- Lemmings/voles
- Muskox
- Other spp

Mammalian predators

- Arctic/red foxes
- Weasels
- Other spp

Insects

Insectivores

- Shorebirds
- Other spp

Avian predators

- Snowy owl
- Jaegers
- Gulls
- Rough-l. hawk
- Raven
- Falcons
- Other spp

Approach 2

Extensive
monitoring
(all species)

- Primary production
- Abundance
- Breeding activity
- Diet

All sites

Spatial replicates

HER

WB

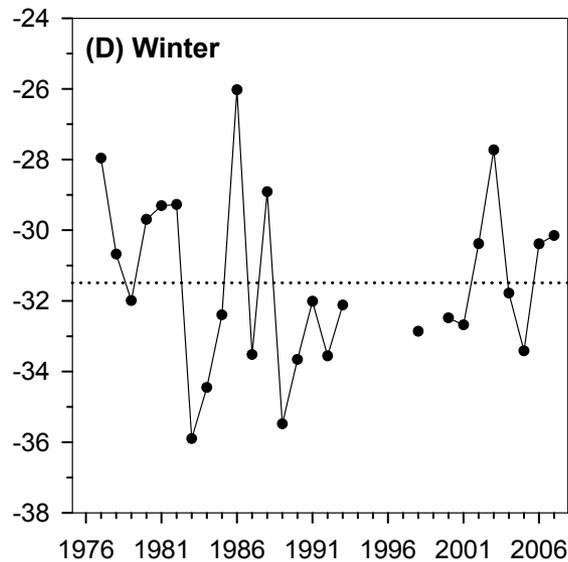
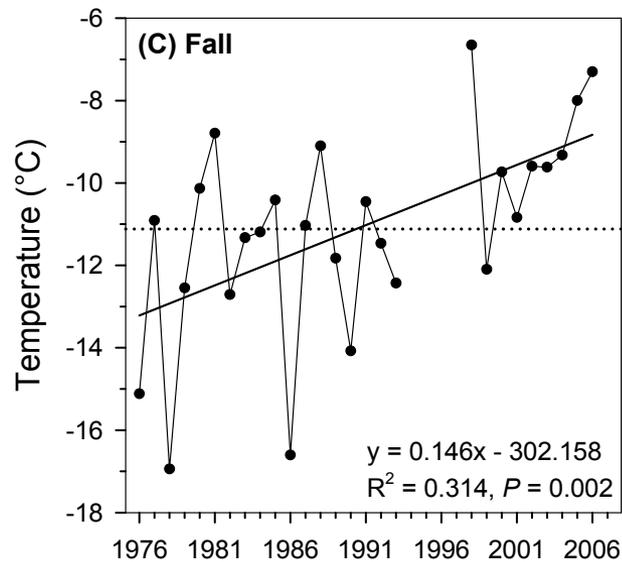
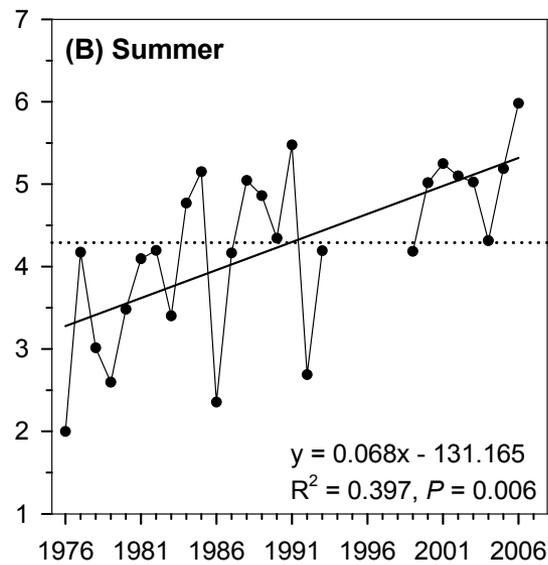
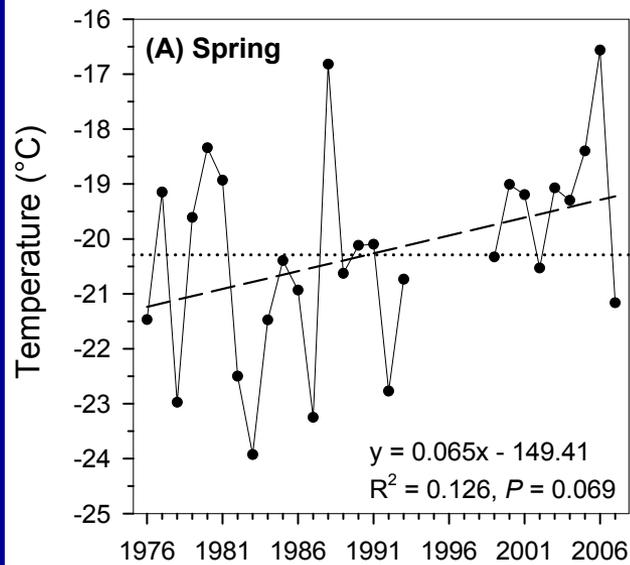
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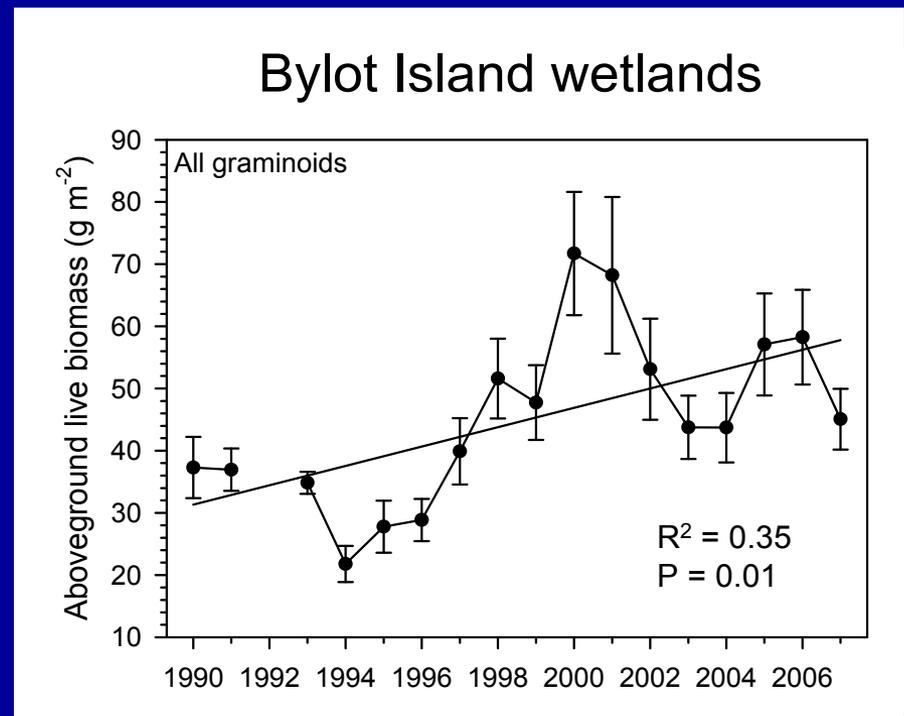
ALE

Seasonal climatic trend Bylot Island



Primary production

- Sampling of plant biomass to measure primary production at all sites
- Some sites have a history of plant production monitoring



Plant-herbivore interactions

- Goose/plant interaction - Robert Jefferies
 - Comparative response of vascular plants to goose defoliation across sites and habitats
 - Evaluation of habitat degradation caused by goose grazing using exclosures
- Lemming/plant interaction
 - Lemming exclosures also set up at a few sites



Shorebirds

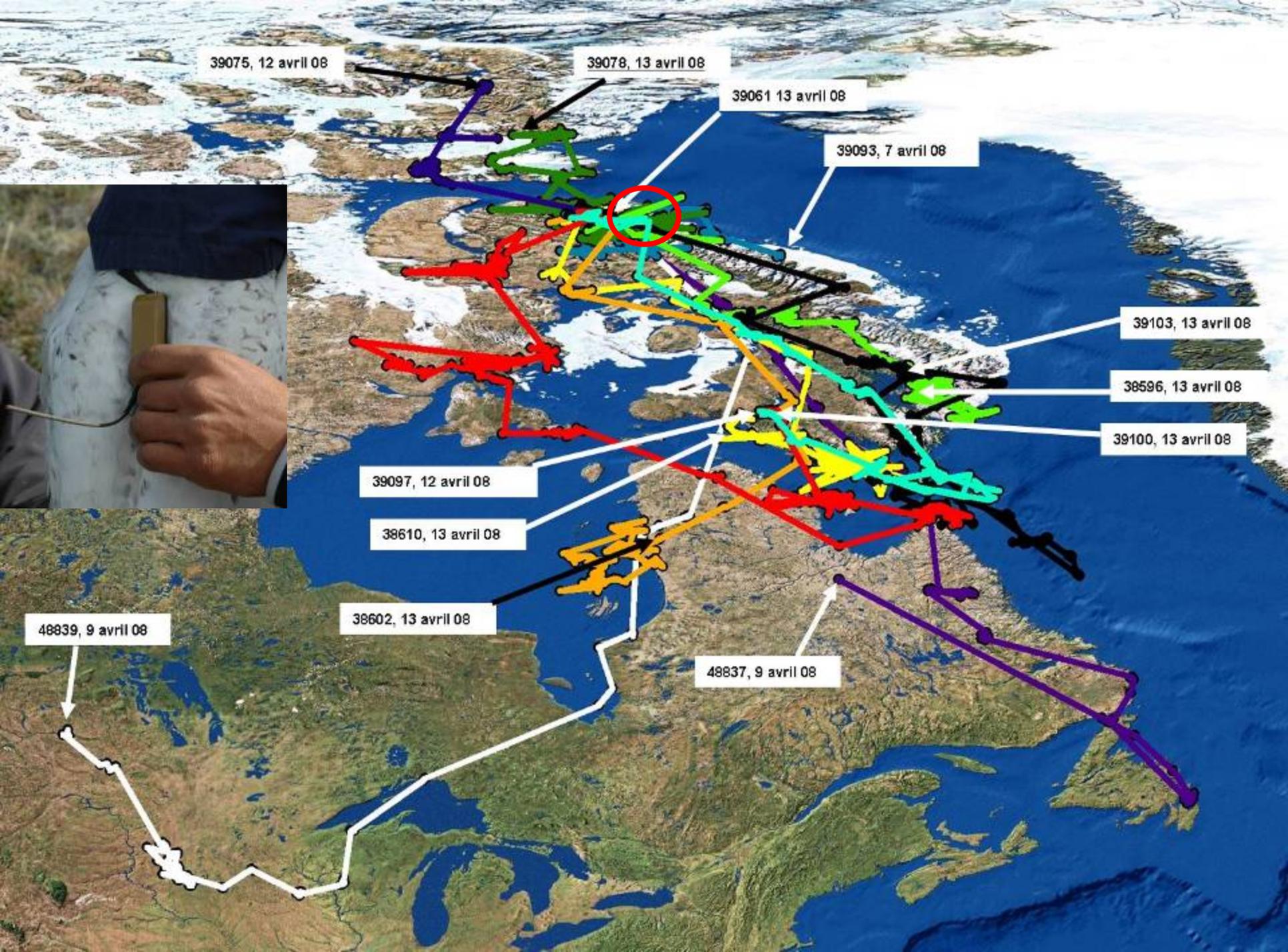
- Project led by Joel Bêty and Guy Morrison
- Impact of predation on reproductive success
 - Measure of nesting density
 - Measure of reproductive success (pre-hatch and post-hatch)
 - Experiments on predation pressure with artificial nests
- Role of food (insects) in reproduction
 - Sampling of seasonal abundance of insects



Avian predators

- Project led by Gilles Gauthier
- Emphasis on raptors (snowy owl and RL hawk), jaegers, gulls
- Numerical response to variations in lemming abundance
 - Nest abundance and reproductive success
 - Tracking of owl and jaeger movements with satellite transmitters
- Functional response to variations in lemming abundance
 - Diet studies (pellets, isotopic analyses of blood samples)
 - Prey delivery rates at nest (observations and cameras)





Arctic/red foxes studies

- Project led by Dominique Berteaux
 - Foraging strategies, habitat use and reproductive success of arctic foxes
 - Impact of expanding red foxes on arctic foxes populations



Lemming studies

- Lemming-climate studies - Don Reid & Charles Krebs
 - Study of lemming abundance and demography (snap-traps and live-trapping) – June to August
 - Winter habitat use and demography based on winter nests
 - Snow-fence experiment to study effect of winter climate on lemming demography
- Lemming-habitat studies - Doug Morris
 - Habitat use and predation risk



Small mammal snow fence



Trophic dynamics

- Ecosystem modelling - Charles Krebs
 - Modelling the strength of bottom-up vs top-down interactions in the tundra ecosystem

