Climate System – Social System Interactions in the Northern Atlantic

North Atlantic Arc project – NAArc
NSF Arctic Social Sciences and ARCSS
Physical system change

Physical/social interactions affect biological system

Biological system change

Biological changes affect humans

Influences, feedbacks and interactions among systems

Human activities

Biological changes affect humans
Three case studies

- Major changes have affected fisheries across the Northern Atlantic.
- Interactions between physical, biological and human systems.
- Despite local differences, strong patterns emerge.
- Such patterns provide “empirical models” of human response to large environmental change.
Siglufjörður, North Iceland

Traditional 1965—66

After Vilhjálmsson 1997
“The herring years were special, indescribable. And they will never come again.”
Siglufjörður resident
Figure 9: Siglufjörður harbor in March 2003. The herring docks and international fleet are gone; remaining factories process capelin or shrimp. At center is a shrimp-freezing trawler. Lawrence Hamilton photo.
Late-1960s herring collapse coincided with arrival of an Arctic-origin Great Salinity Anomaly - GSA’70s
Biomass, catch and mortality, 1950–2000

Herring biomass was declining from overfishing before GSA’70s
Population of Siglufjörður, 1890–2000

Siglufjörður population declined as N Iceland herring declined and the fishery needed less labor.
Faroe Islands, Northeast Atlantic

Iceland
United Kingdom
Denmark
Norway
FAROE ISLANDS
Torshavn
North Atlantic Ocean
Norwegian Sea
Faroese landings of demersal fish from home waters, 1961-2000

Fisheries crisis ca. 1985-95. Overfishing plus physical change (GSA’80s?).
Faroe Islands total population 1970-2000

Faroes population 13% lower than pre-crisis trend
Faroe Islands cod catch and net migration 1980-2000

Net migration follows cod catches, with lag of 1-2 years, 1982-96
Net migration by sex and age group, crisis years 1989-95

Newfoundland, showing Northern Peninsula and northern Gulf of St. Lawrence
“Winners and losers” from ecological change:
Landings value in 3 regions, 1986-98
Integrating time series across disciplines: Newfoundland’s Northern Peninsula and the northern Gulf of St. Lawrence
General patterns

- Dramatic spikes followed by steep declines often characterize modern fisheries.
- Declines reflect interaction between fishing pressure and climate.
- Long-lived species have adapted to decadal-scale climatic variations.
- Fisheries remove predators and larger fish, leaving less robust ecosystems behind.
- Invertebrates become more abundant.
- Outmigration reshapes human populations, and affects prospects for sustainable development.
Small places see outmigration and demographic change.

- Net migration is a sensitive indicator.
- Young adults first to leave.
- Older, less educated population remains.
- Transfer-payment dependency grows.
- Regional centers expand.
Social factors influence the differential outcomes among people and places.

- Economic diversification is a difficult goal.
- New fisheries risk depletion, like the old.
- **Tourism is “Plan B” everywhere.**
- Government investments are vital, but often fail.
- Some communities are more cohesive, effective than others.
THE END