MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Integrating invasive species management across space and time: opportunities and challenges in the Arctic

Brooks A. Kaiser

University of Southern Denmark

The Arctic Biodiversity Congress:

Trondheim, Norway, December 2-4, 2014

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

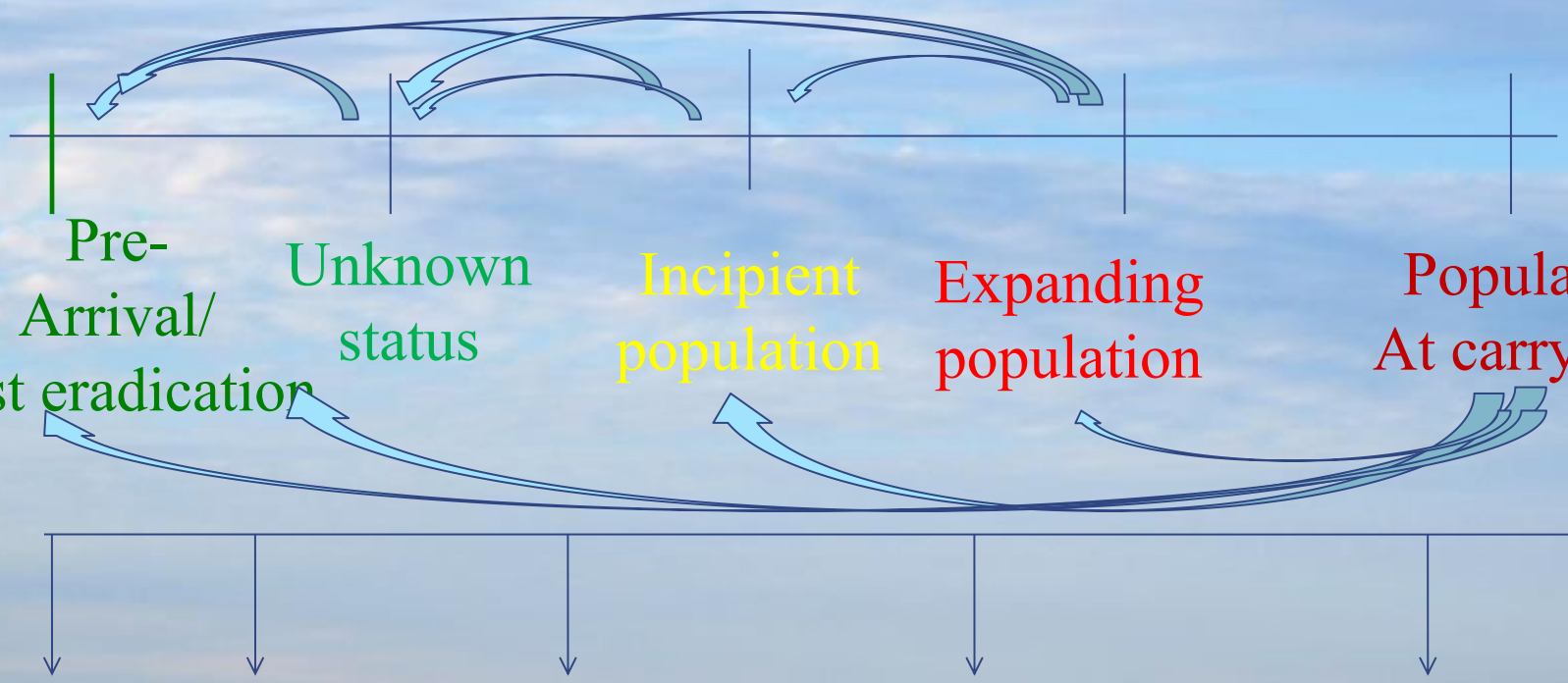
Management overview of invasive species

Most species wrt Arctic(?)

RKC in Iceland

Snow Crab, Barents

Red King Crab, Barents



MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Invasive Species Management Challenges

- Predicting where and when to target resources to fight damages from invasions
  - Ecological complexities
  - Economic incentives
  - Governance gaps
  - Uncertainties and information

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Arctic invasion and human behavior

Accidental introductions

Intentional introductions

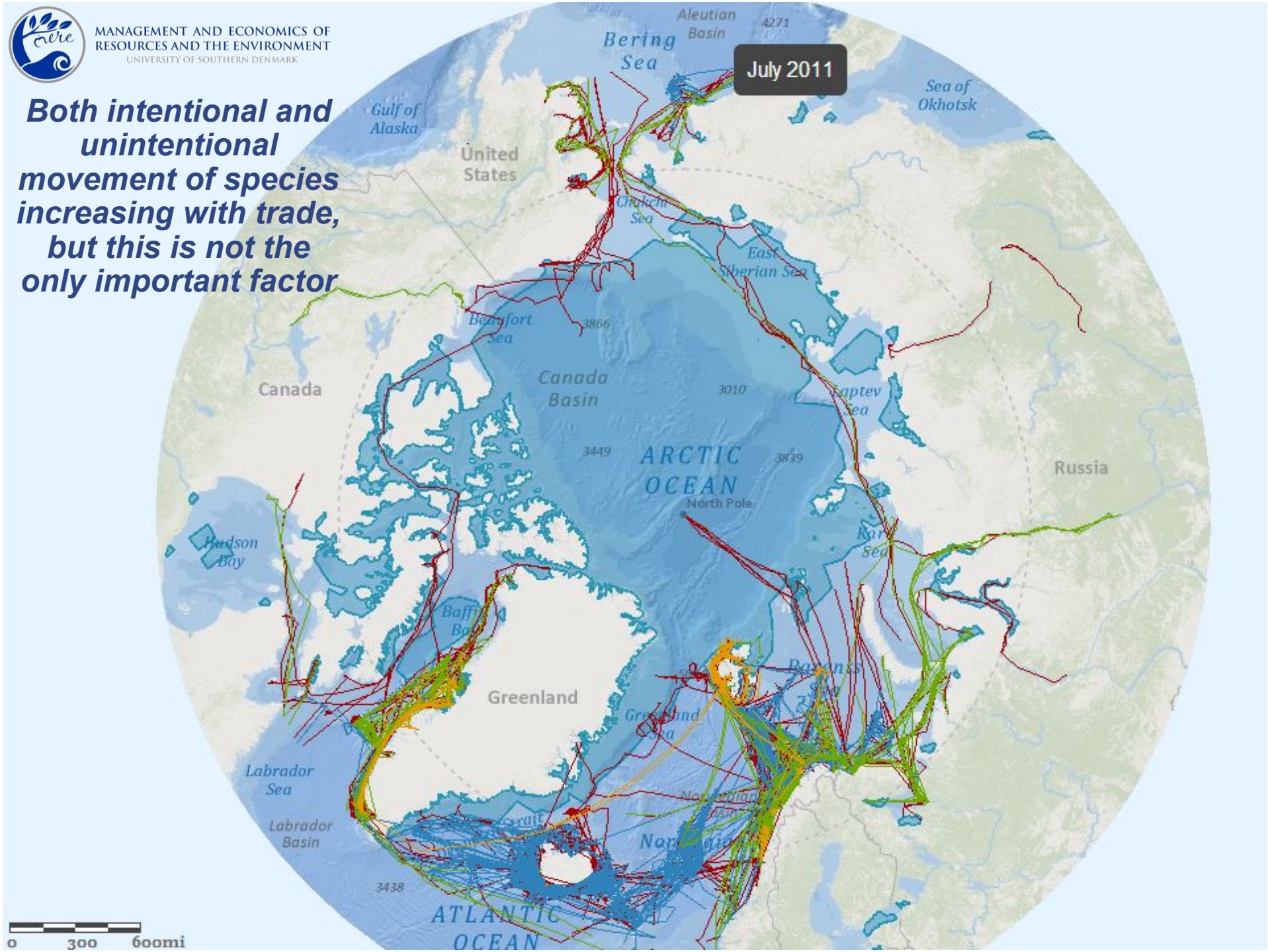
- Liability may be more difficult to assign
- Damaging species may be more difficult to predict

- may pit 'individual' benefits against community/ ecosystem costs

Different pathways need different (complementary) policies
But both require coordinated community action

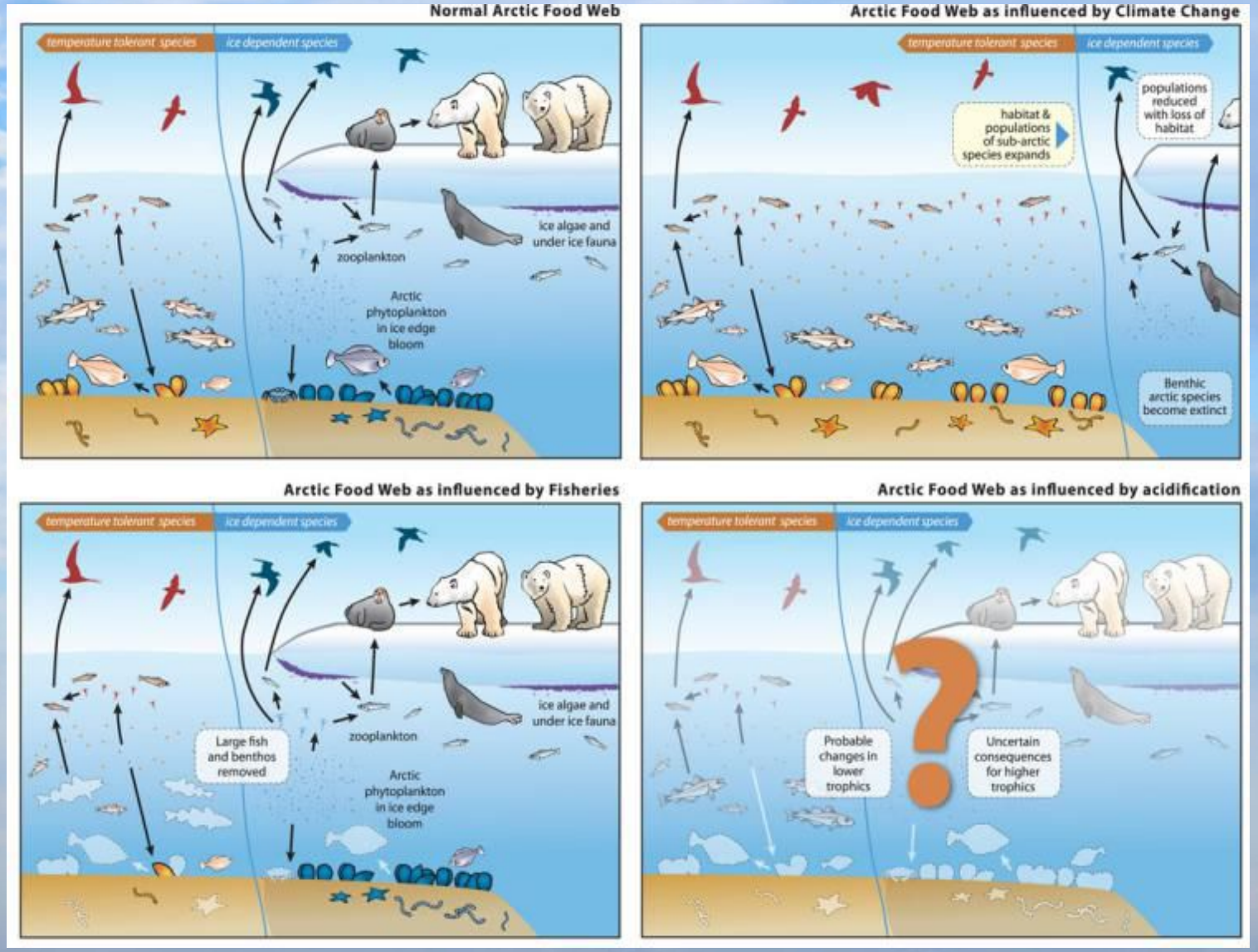
MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Both intentional and unintentional movement of species increasing with trade, but this is not the only important factor



Threats & costs related to invasives

- Movement of species may *or may not(!)* have high external costs.
- Need for cooperation among scientific disciplines of ecology and economics.
- Biology/ecology of invasions involves lags, uncertainties, that are not always well understood



From Gill et al. Arctic Marine Biodiversity Monitoring Plan. 2011.

Arctic Species Introductions

- Arctic has many characteristics like island ecosystem wrt invasives
  - Isolated development; unique biota
  - resource limitations might drive purposeful introductions, e.g for food/profit (Red King Crab)
  - Ecosystem still in place.
    - For conservation, this is different. This is not restoration work.
  - Complicated human responses due to private benefits, including purposeful spreading of species faster than unassisted spread would occur; and other disconnects between benefits and costs (e.g. shippers and fishers)

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Spatial management approach

- Minimize

  Management costs + ecological and economic damages
- Management costs:
  - Spatially dependent
  - Dependent on invasion stage (from pre-arrival through accommodation)
- Ecological/economic damages:
  - population and spatial dependency (how many specimens, and where they are)

KEY: intervene when & where net benefits of intervention are highest, not just where costs are lowest (or damages highest)

Go Big, or Let Home Evolve

- Magnitude and Timing matter for successful intervention
  - Too little effort to compensate for growth will just waste $$. May need to remove high percentages of growth *(e.g. up to 75% for weedy tree in HI)* to prevent combination of damages and expenditures exceeding doing nothing at all

- But going big requires commitment….
  - Currently countries rely on quarantines, bans for purposeful introductions; dissemination of information and inspection for accidental introductions
  - Arctic has missing information on economic and ecological aspects, and missing governance across stakeholders

Between prevention and control,

- Policy opportunities:
  - Pre-clearance & liability
  - Quarantine & liability
  - Early detection and Rapid Response
  - Broader monitoring, incl. community
  - Enforcement of preventative regulations
- And challenges:
  - Biases of research, based on differences in values, expected costs of the problem
  - Needles in haystacks?
- Economies of scope: Monitoring, mapping, knowledge

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

WORST-CASE SCENARIO

- Funding for interventions is too piecemeal and becomes essentially wasted because
  - growth outpaces effort.
  - With gaps and conflicts in local policies and/or international agreements, policies not determined by likelihood of threat or expected damages
  - Complex market interactions generate conflicting policy interests (e.g. RKC and SC in the Barents) that can limit interest in invasives management

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Principal Arctic Concerns

- Right focus?
  - **Shipping**: Ballast water and hull fouling. Shipping industry protective of low costs. 'Work with the man,' if possible. Technology forcing regulations?
  - **Recreation**: Income-driven; exotic experience driven. Slower moving. Bigger problem than we currently think?
  - **Aquaculture**: ecosystem transport, exotic experience, benefits expected to some.
  - **Changing (and wealthier?) communities in Arctic in general**. Attraction of populations from different ecosystems, and their 'home environment'
- Coordination for purposeful introductions? (Will anyone add some more species as warming makes it likely they might take?!)

Further Policy issues (1)

- Prevention will fail
  - Management decisions should not be taken in isolation of their substitutes
  - e.g. to decide about prevention, understand damages and control costs.
- Expect the unexpected – is climate change an env. window?
- Don’t fight mother nature if you can use her instead
- e.g. Direct investment in resilience
- e.g. Joint production of prevention that looks not only for a target list of species but for
  - Unexpectedly dangerous vectors (e.g. whole ecosystem transplanting)
  - Disrupting vectors, life cycles, markets

Further Policy issues (2)

- Space and Time and property rights over them matter, and can be used strategically.
  - Human behavior and values affect each other and opportunities for management
  - Networks for distribution and disruption

- Values differ. Without markets, governance will direct and determine outcomes for value preserved or lost. Stakeholder buy-in and awareness must be continuous and comprehensive.

MANAGEMENT AND ECONOMICS OF RESOURCES AND THE ENVIRONMENT
UNIVERSITY OF SOUTHERN DENMARK

Thank you very much for your attention

This research has been supported by:
The University of Southern Denmark, Department of Environmental and Bus. Economics
Nordregio, Nordic Council of Ministers, Arctic Co-operation Programme
The Danish Ministry of Higher Education and Science International Network Programme
The Carlsberg Foundation
The Joint Committee for Nordic Research Councils for the Humanities and the Social Sciences

With contributions from:
Linda Fernandez, VCU; Niels Vestergaard, SDU and Melina Kourantidou, SDU
Spatial Issues in Arctic Marine Resource Governance Workshop, Stockholm, SE 9-2014
Marine invasive species in the Arctic: Management issues Workshop, Esbjerg, DK 10-2013