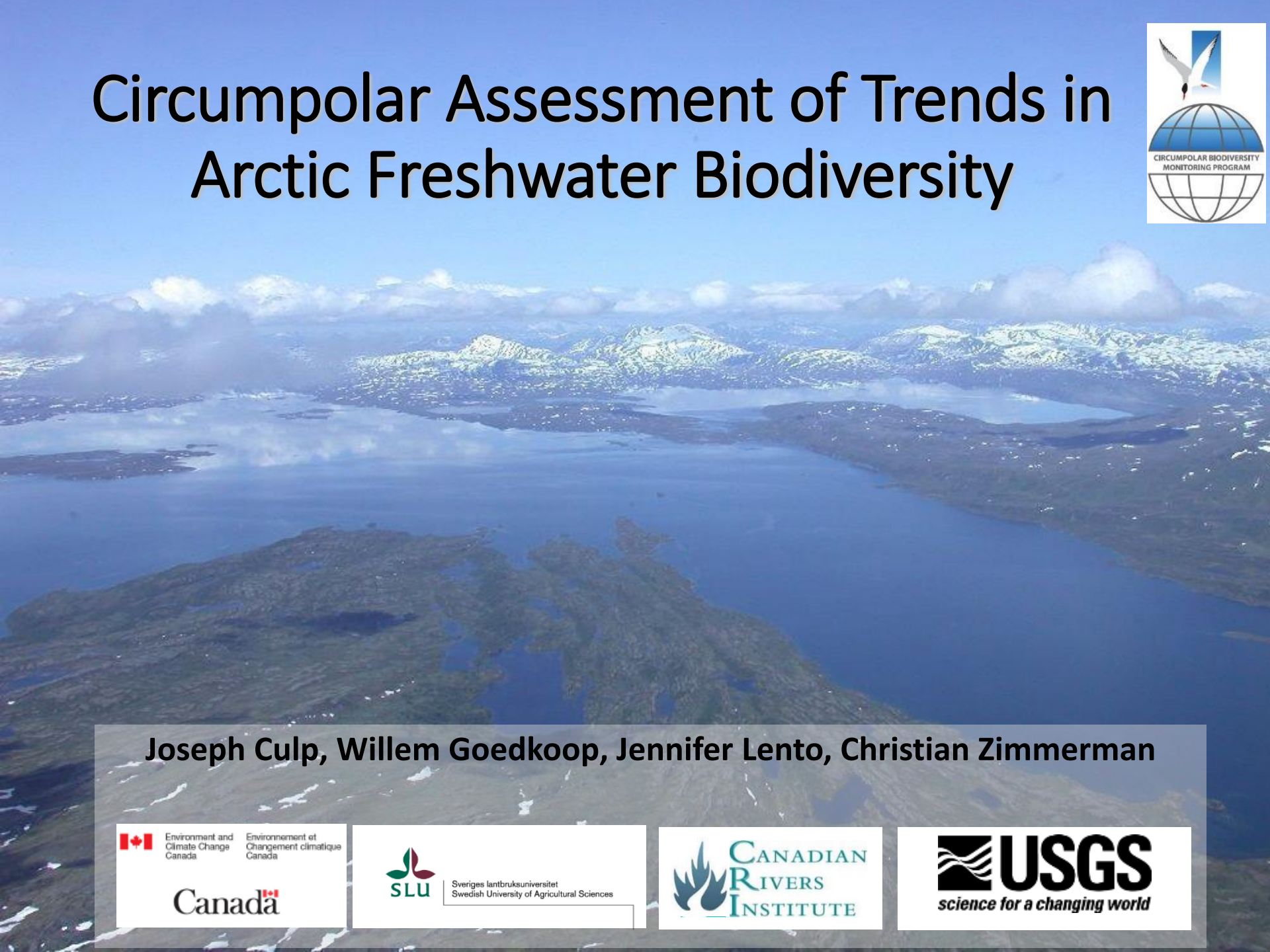
Circumpolar Assessment of Trends in Arctic Freshwater Biodiversity



Joseph Culp, Willem Goedkoop, Jennifer Lento, Christian Zimmerman

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

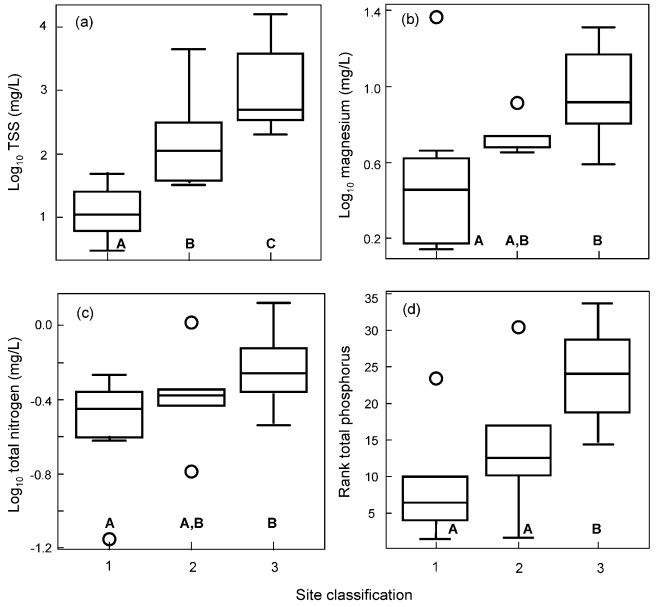
SLU Sveriges lantbruksuniversitet Swedish University of Agricultural Sciences

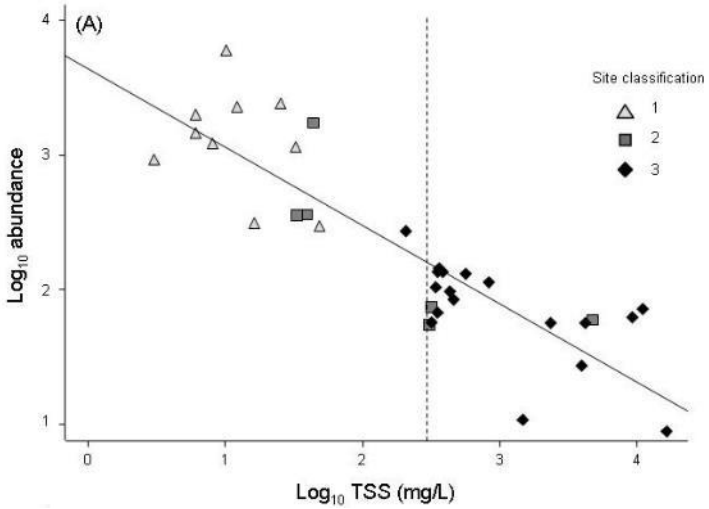
Canadian Rivers Institute

USGS science for a changing world

Freshwaters as Mirrors of the Landscape

- Impacts of landscape disturbances (e.g., permafrost thaw slumps) can be detected as shifts in water chemistry and biotic communities of freshwater systems

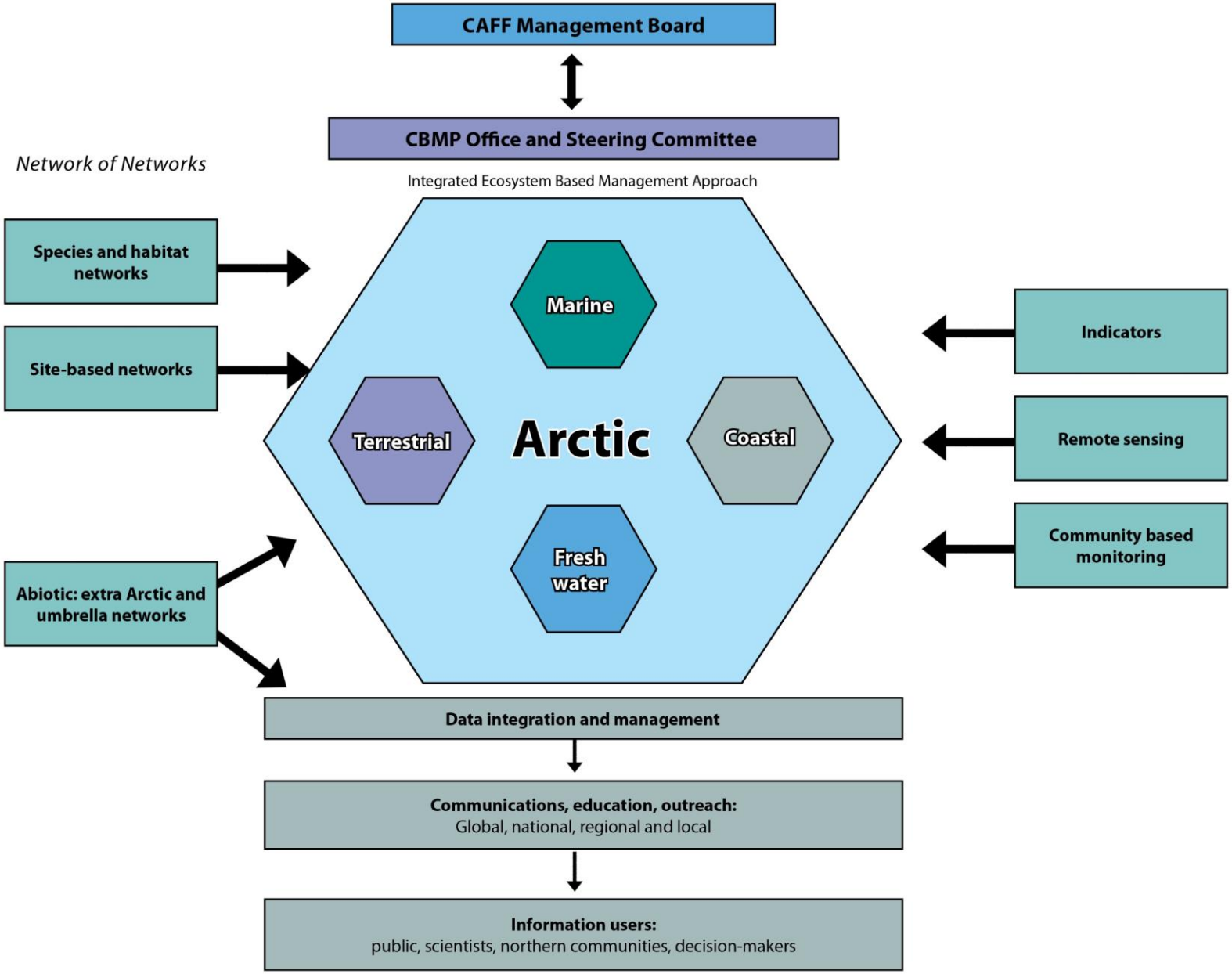




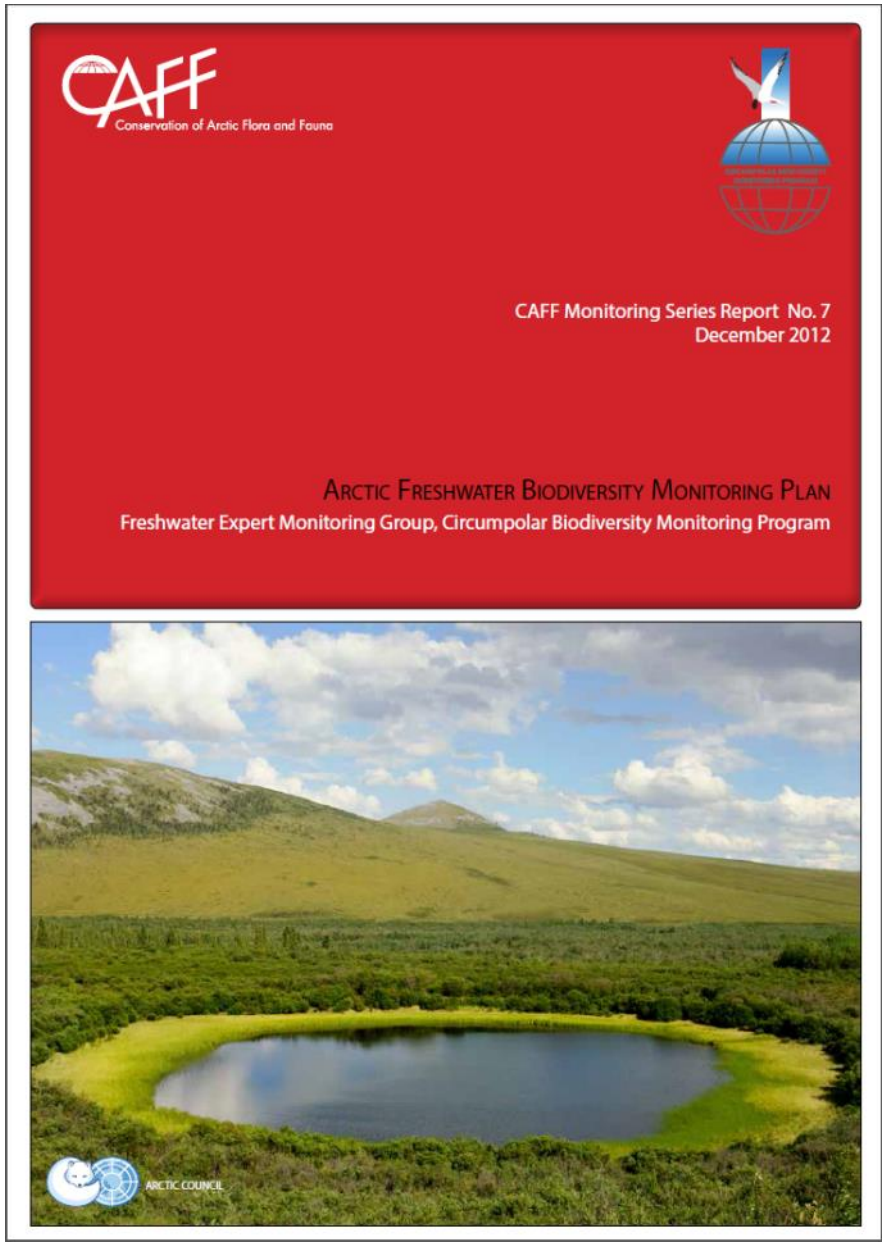
Chin et al. 2016 Global Change Biology

Monitoring to detect Ecological Changes in the Arctic

- Biological monitoring largely uncoordinated; no circumpolar assessments
- Arctic's size makes detection of biodiversity shifts difficult
- Need ecosystem-based approach to identify state, trends & causal relationships over a reasonable time frame (e.g.10 y)
- Key goal identified in Arctic Climate Impact Assessment (2005) and Arctic Biodiversity Assessment (2013)


CAFF Management Board
CBMP Office and Steering Committee
Network of Networks
Integrated Ecosystem Based Management Approach
Species and habitat networks
Site-based networks
Abiotic: extra Arctic and umbrella networks
Marine
Terrestrial
Arctic
Coastal
Fresh water
Indicators
Remote sensing
Community based monitoring
Data integration and management
Communications, education, outreach:
Global, national, regional and local
Information users:
public, scientists, northern communities, decision-makers

Monitoring to detect Ecological Changes in the Arctic



- CAFF has a plan that is now being implemented for freshwaters

ARCTIC COUNCIL

CBMP International Approach to Circumpolar Monitoring

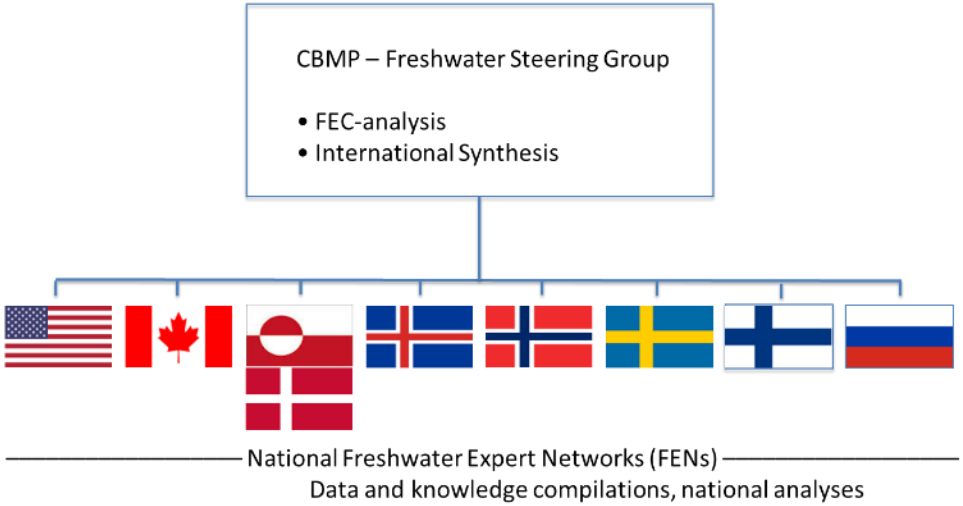
Circumpolar Biodiversity Monitoring Program

- Network of scientists, governments, Indigenous organizations and conservation groups working to harmonize and integrate efforts to monitor and assess the Arctic's biodiversity and living resources
- Facilitate more rapid detection, communication, and response to the ongoing biodiversity-related trends and pressures
- Coordinate circumpolar assessments of status and trends in biodiversity

ARCTIC COUNCIL

CIRCUMPOLAR BIODIVERSITY MONITORING PROGRAM

Freshwater Steering Group (FSG)



- Circumpolar monitoring plan for freshwaters
- Regional and circumpolar assessments of biodiversity
- National Freshwater Expert Networks to facilitate data collection and assessment
- Upcoming 2018 State of Arctic Freshwater Biodiversity Report (SAFBR) and special issue of Freshwater Biology
- Database of Arctic freshwater biodiversity and abiotic drivers

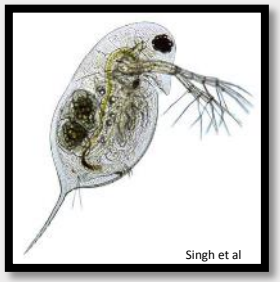
Focal Ecosystem Components

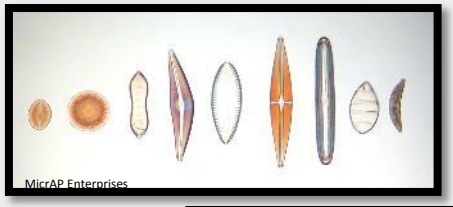
FEC: *Biotic or Abiotic Element judged to be ecologically pivotal, charismatic or particularly sensitive to environmental change*

State of Arctic Freshwater Biodiversity Report: focus on biotic FECs with most data and supporting abiotic variables (where possible):

BIOTIC

- Phytoplankton (Lakes)
- Benthic algae (Lakes, Rivers)
- Zooplankton (Lakes)
- Benthic invertebrates (Lakes, Rivers)
- Fish (Lakes, Rivers)
- Macrophytes (Lakes)





Geographic Coverage

CAFF Boundary or ABA Boundary, whichever is more inclusive

Key Questions for Assessments

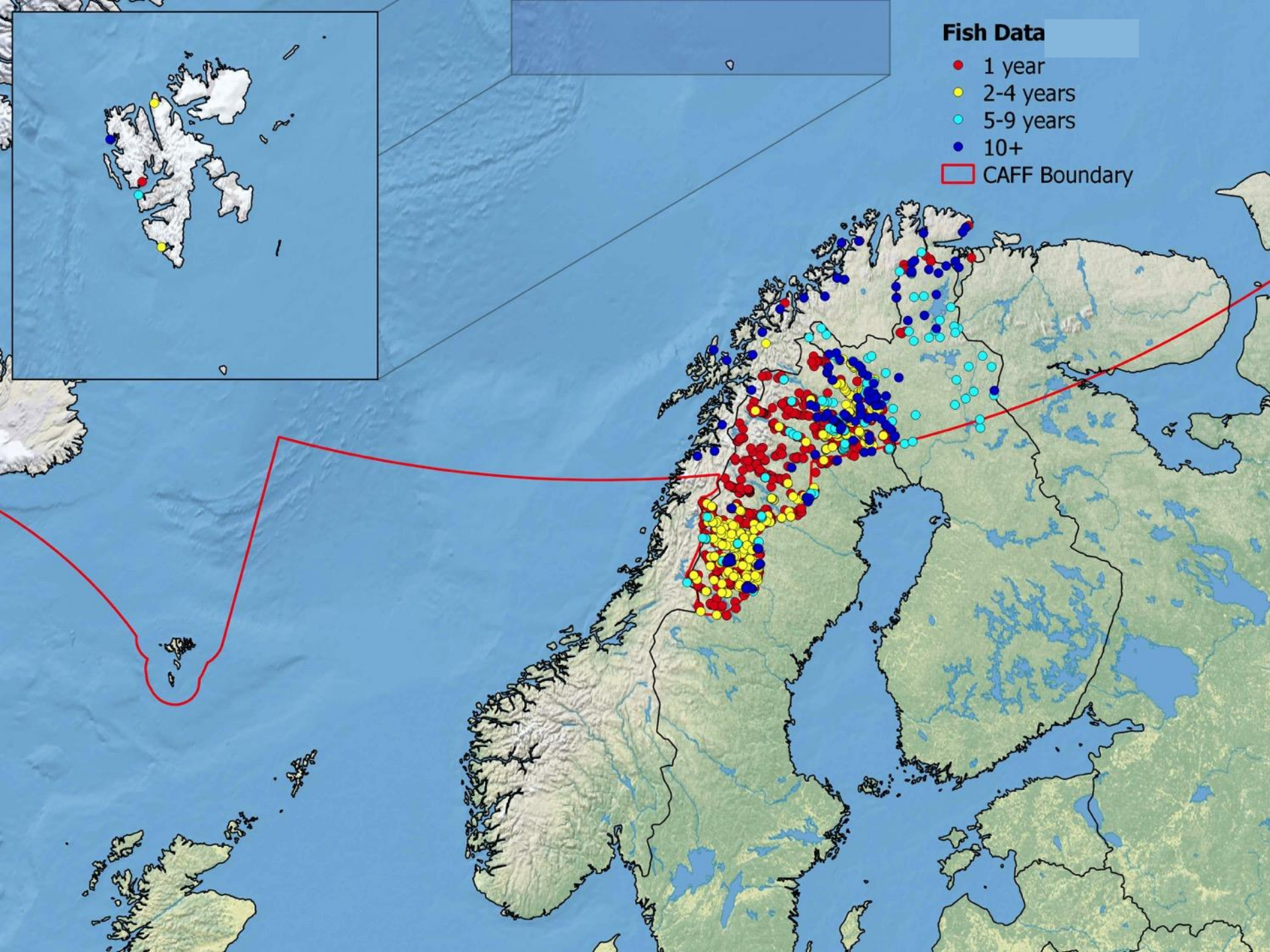
1. What is the current status of Arctic freshwater biodiversity?
2. Can biodiversity status be measured through simple variables and indicators; if so, what suite of these should we apply?
3. Is biodiversity changing; if so, are species increasing, declining, moving or disappearing?
4. What are the primary environmental & anthropogenic drivers causing this change?
5. Are boundaries of Arctic/sub-Arctic ecosystems shifting?

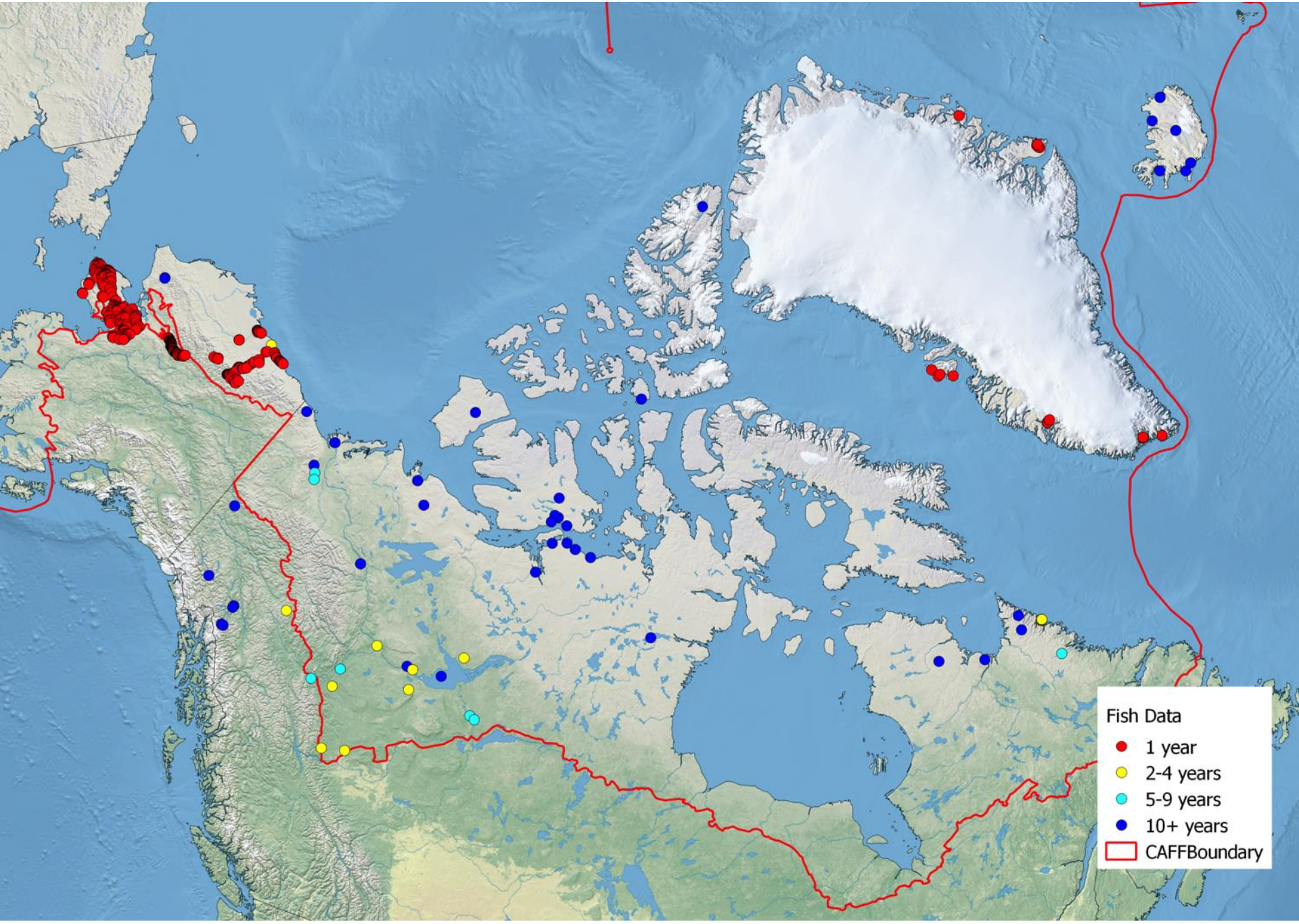
CBMP-Freshwater Biodiversity Assessment

1. Establishing baseline knowledge and data
2. Metadata synthesis (national and circumpolar summaries)
3. Data acquisition and QA/QC
4. Sampling method and data inter-comparability (define limits of comparisons)
5. Regional and circumpolar assessment of status and trends

Data Assessment

- Data collected by each country for each FEC for the time periods:
  - Contemporary: 1950 – present
  - Historical (where available)
    - Post-industrial: 1800 – 1949
    - Pre-industrial: 1800 to ~ 10000 years ago (paleo)
- Represent government, academic, industrial, and where possible, TEK sources
- Coverage was used to select focal sites for assessment of trends


Fish Data
1 year
2-4 years
5-9 years
10+
CAFF Boundary


Fish Data
1 year
2-4 years
5-9 years
10+ years
CAFFBoundary

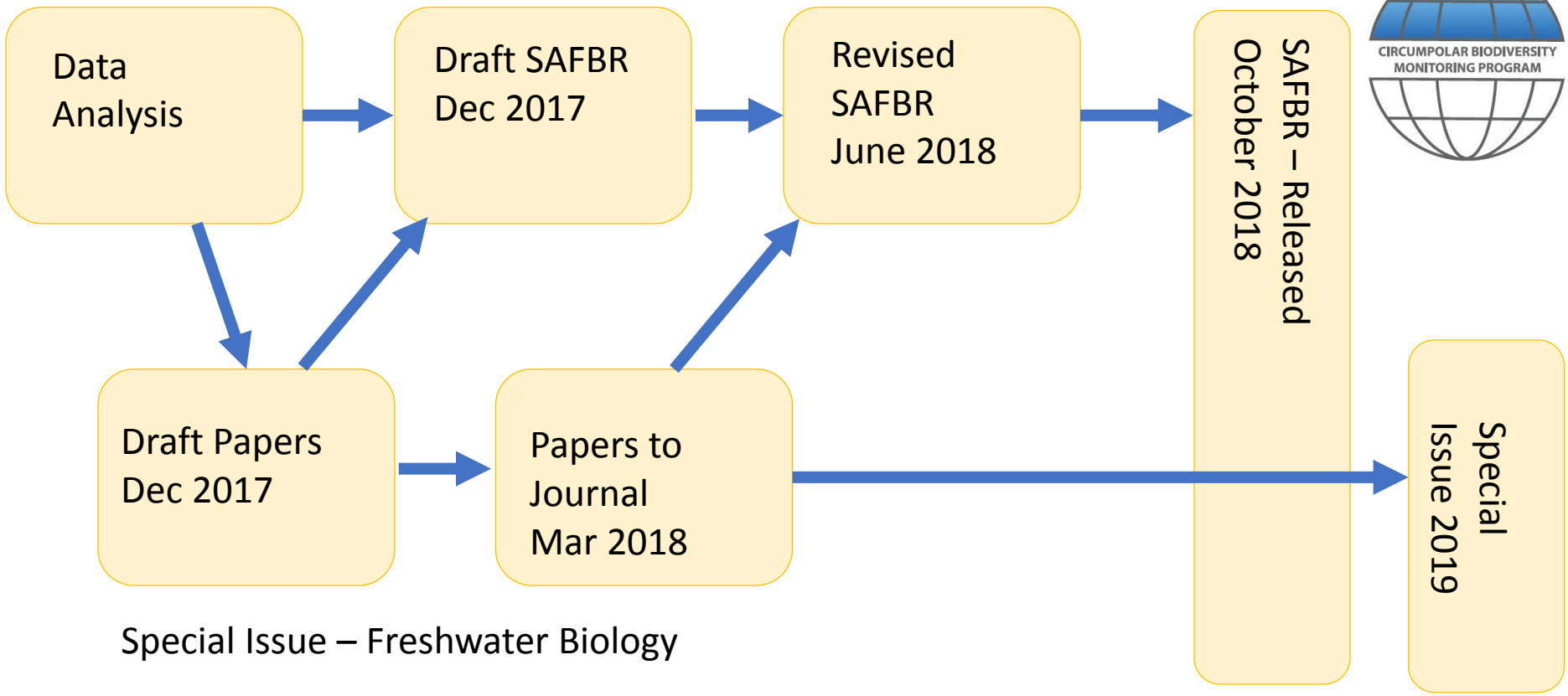
Scope of Assessments

- Regional:
  - North America, Greenland, Iceland, Fenno-Scandia, and Russia
  - Holistic assessments of all FECs at the regional scale
- Circumpolar:
  - Abiotic drivers, plankton, benthic algae, macrophytes, benthic invertebrates, fish, Traditional Ecological Knowledge
  - Separate assessments for each FEC that evaluate large-scale patterns

Assessment Benefits

- International status & trends summary leading to improved scientific understanding
- Input to national/international management decisions & reporting
- Improved information for effective management (i.e., stressor identification)
- Influence national/international biomonitoring program direction
- Build on 2013 Arctic Biodiversity Assessment

State of Arctic Freshwater Biodiversity Report



Special Issue – Freshwater Biology

Thank you!