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USGS Research Overview in the Arctic

U.S. – Canada Northern Oil & Gas Forum

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John Pearce, Chief, Wetland and Terrestrial Ecosystems Office

USGS Alaska Science Center

jpearce@usgs.gov

U.S. Department of the Interior
U.S. Geological Survey

USGS Research in the Arctic

Talk Outline

Overview of Arctic Ecosystem Topics

USGS Research Role on Arctic Topics

Examples of USGS Research Relevant to Oil and Gas Decisions in the Arctic

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Overview of Arctic Ecosystem Topics

Habitat changes from increased temperature, decline of sea ice, and coastal flooding

Increase of some wildlife populations, while uncertainty for others

Significant potential for natural resource development

Food security and fish and wildlife management

The near-future state of wildlife and habitats is needed by DOI agencies that manage these resources

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USGS Research Role on Arctic Topics

Why the USGS conducts this work:

- USGS is the science research agency for DOI
- No regulatory mandate
- A mission to deliver relevant, sound, and impartial science information to management agencies for their decision making
- Biology research incorporated into USGS in mid-1990s following DOI reorganization

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USGS Research Role on Arctic Topics

USGS plays a large role in Federal research in Alaska because:

- 60% of land in Alaska is managed by federal entities
- Many DOI trust species and resource management issues here:
  - Migratory birds (USFWS)
  - Marine mammals (USFWS, BOEM)
  - Land and resource management (BLM, NPS, USFWS, BOEM)

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USGS Research Role on Arctic Topics

USGS Alaska Science Center

- Delivers science to federal and state managers on the following:
  - Wildlife and habitats
  - Earthquake and tsunami hazards
  - Energy and minerals
  - Water, glaciology and permafrost
  - Biosecurity
  - Technology development and data infrastructure

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Examples of USGS Research

Main drivers of USGS research:

- Current and upcoming decisions for DOI management agencies (e.g., ESA, permitting, harvest levels)
- Current status and future response of wildlife and habitats to rapid physical changes in the Arctic
- Areas of industry interest

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Examples of USGS Research

- Northeastern NPR-A
- Prudhoe Bay region
- Along entire coastline
- Offshore

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Examples of USGS Research

Collaborate with USFWS on annual survey projects

- Annual Arctic Coastal Plain survey (1986 – present)
- Gradient of bird density and diversity across the North Slope
- NPR-A is one of the most important areas for birds in the Arctic

USFWS Arctic Coastal Plain survey strata

	NPR-A	Prudhoe Bay	Arctic Refuge
Proportion of population	0.84	0.14	0.02
Density	3.37	2.29	1.51
Population size (millions)	5.4	2.0	0.40

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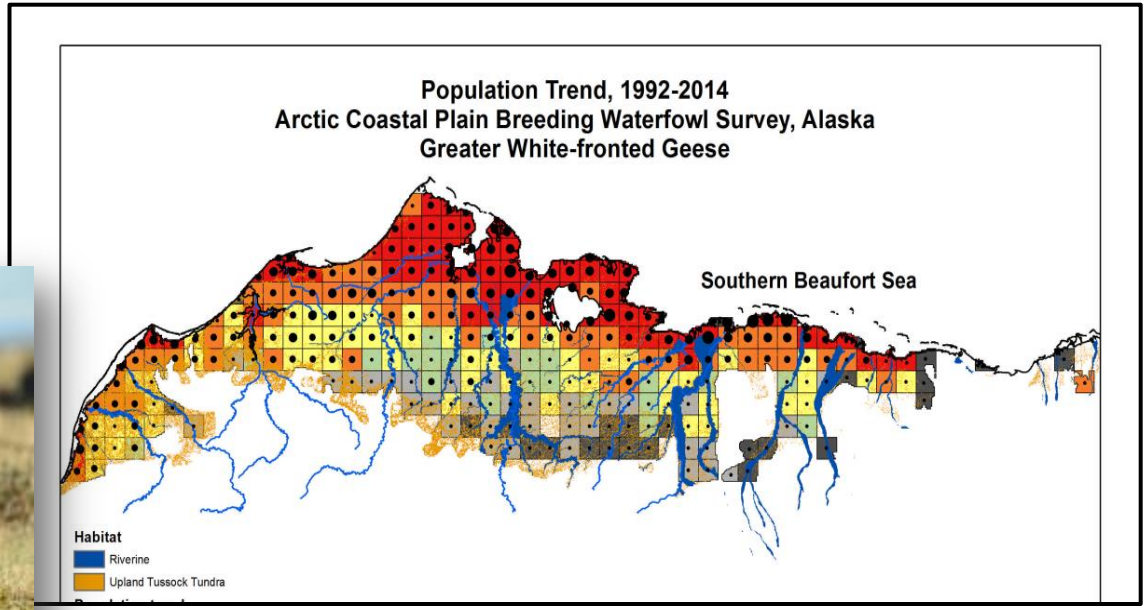
Bart et al. (2013) *Conservation Biology*

Examples of USGS Research

Further quantify change and determine mechanisms



Amundson et al. (In Prep.)

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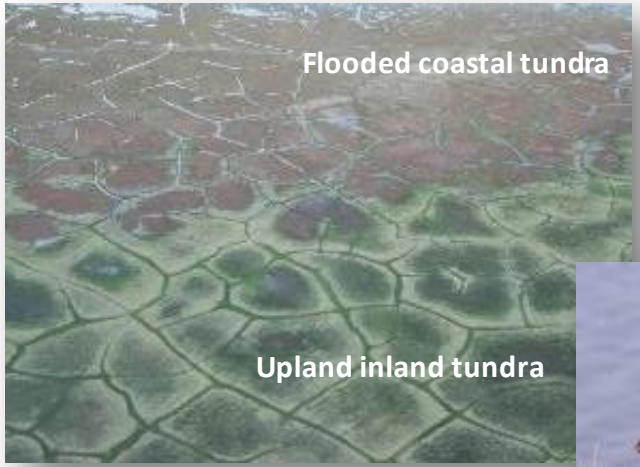
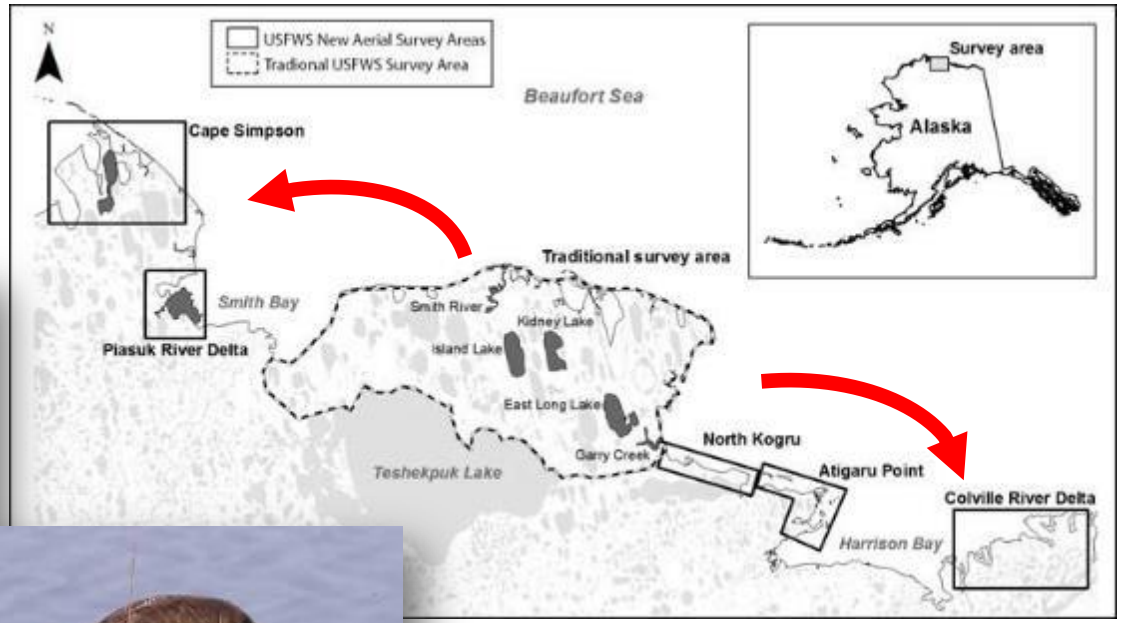
Examples of USGS Research

And determine mechanisms for change: Impact of arctic sea ice loss





Flint et al. (2014) *J. Field Ornithology*

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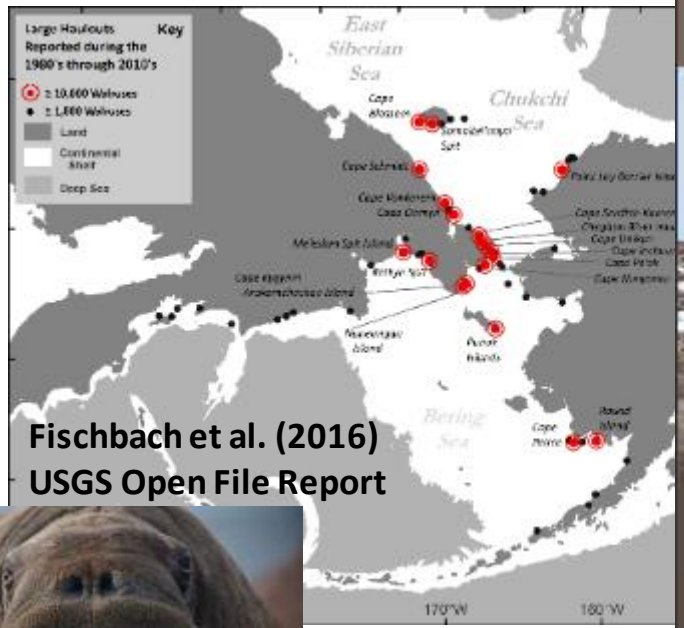
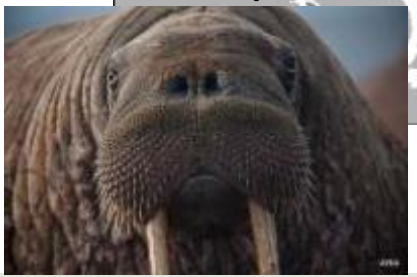
Observe, Understand & Predict Artic Change

Impact of arctic sea ice loss to species distribution and abundance

- Pacific walrus
- Polar bear



Fischbach et al. (2016)
USGS Open File Report



Atwood et al. (2014, 2017)

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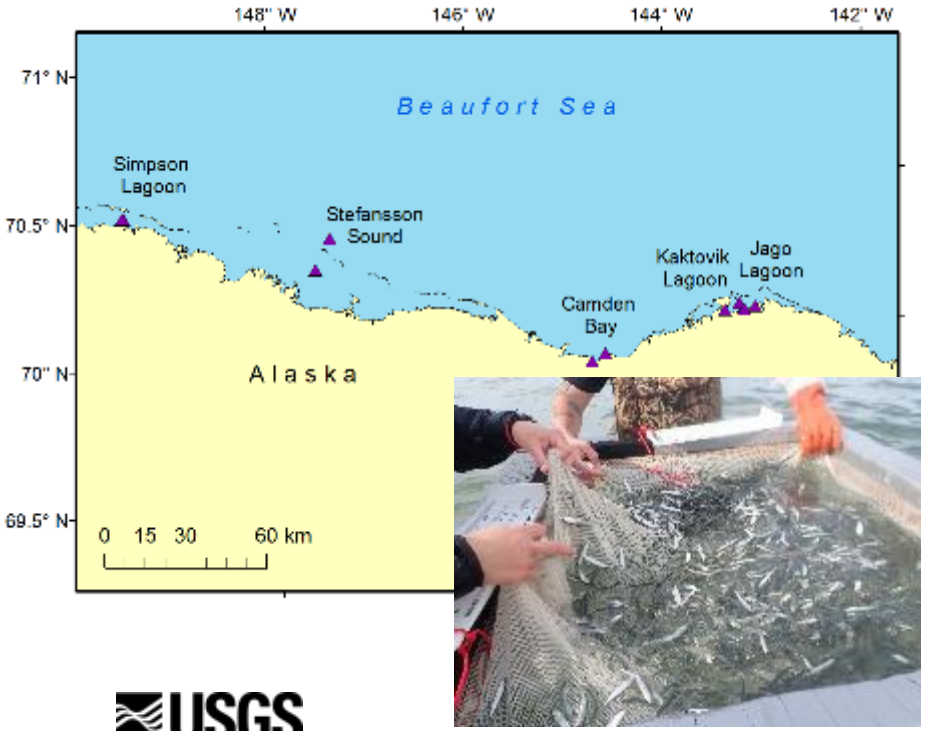
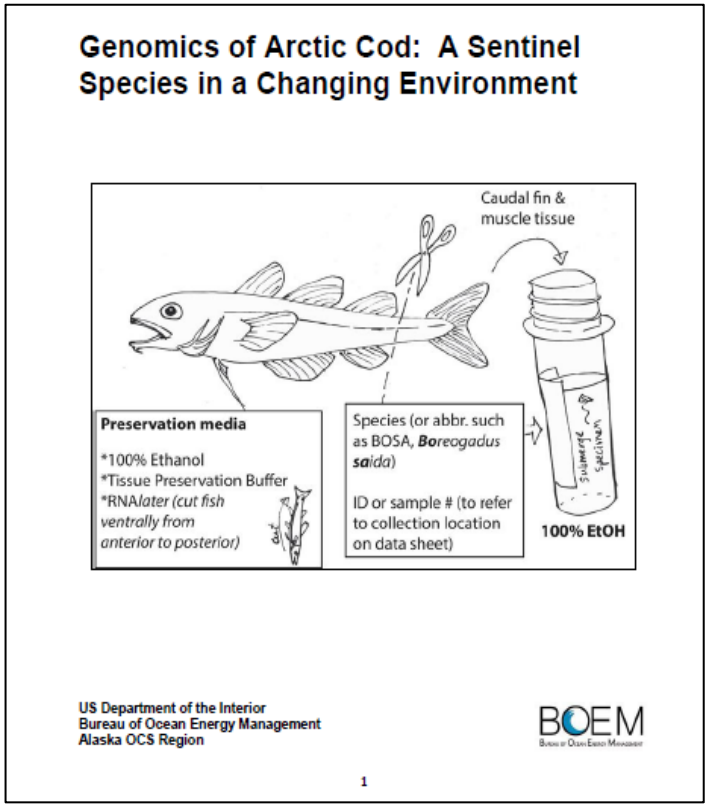
Observe, Understand & Predict Artic Change

Impact of arctic sea ice loss to species distribution and abundance





Wilson et al. (In Review) *BOEM Final Report*

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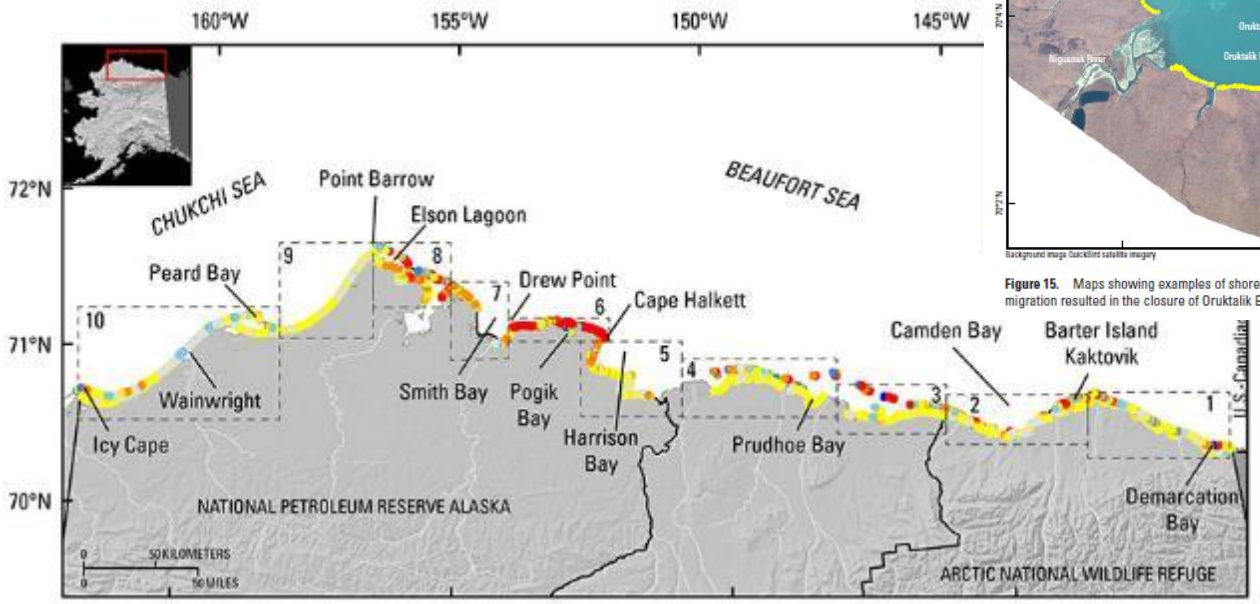
Observe, Understand & Predict Artic Change

Impact of arctic sea ice loss to coastal erosion



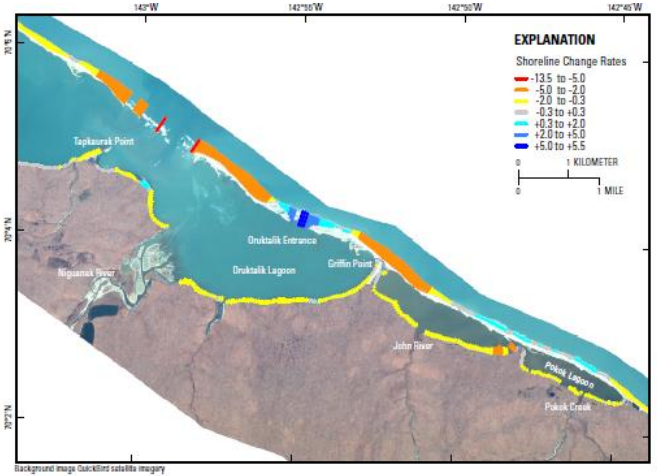


Figure 15. Maps showing examples of shoreline change at Oruktalik Lagoon, north coast of Alaska, where barrier migration resulted in the closure of Oruktalik Entrance between 1947 and 2003.

Gibbs and Richmond (2015, 2017) *USGS Open File Report*

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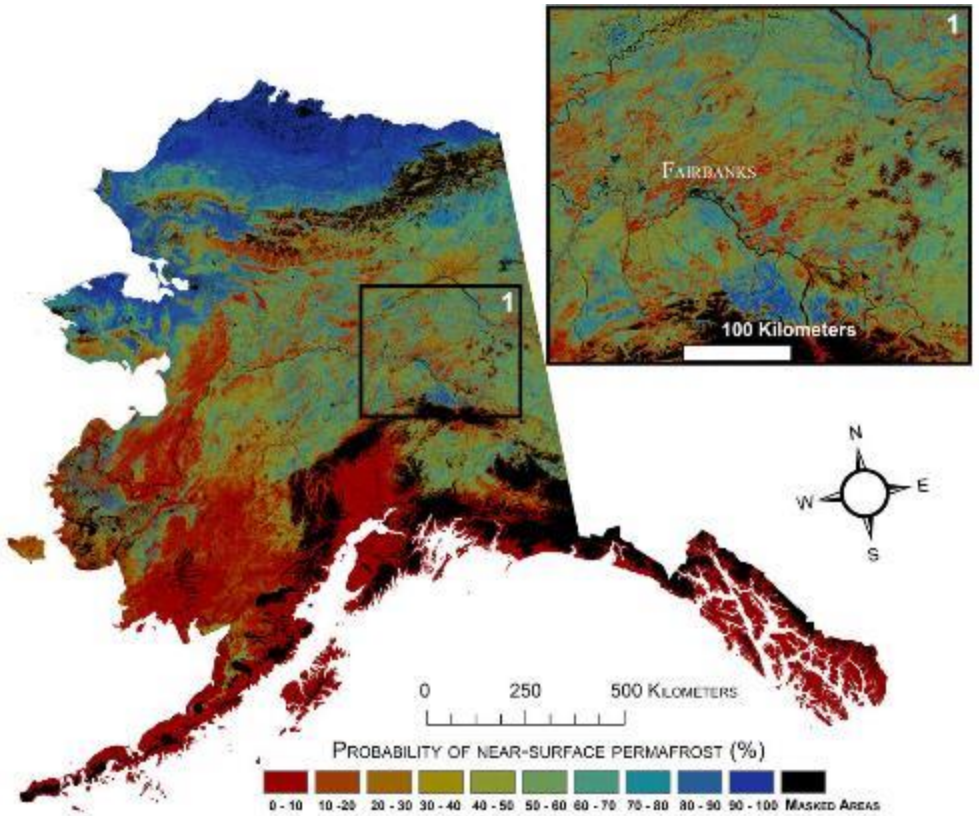
Observe, Understand & Predict Artic Change

Map of permafrost distribution

- USGS projected that near-surface permafrost that presently underlies 38% of boreal and arctic Alaska would be reduced 16-24% by end of the 21st century

- Permafrost declines more likely in central Alaska than northern Alaska



Pastick et al. (2015) *Remote Sensing of Environment*

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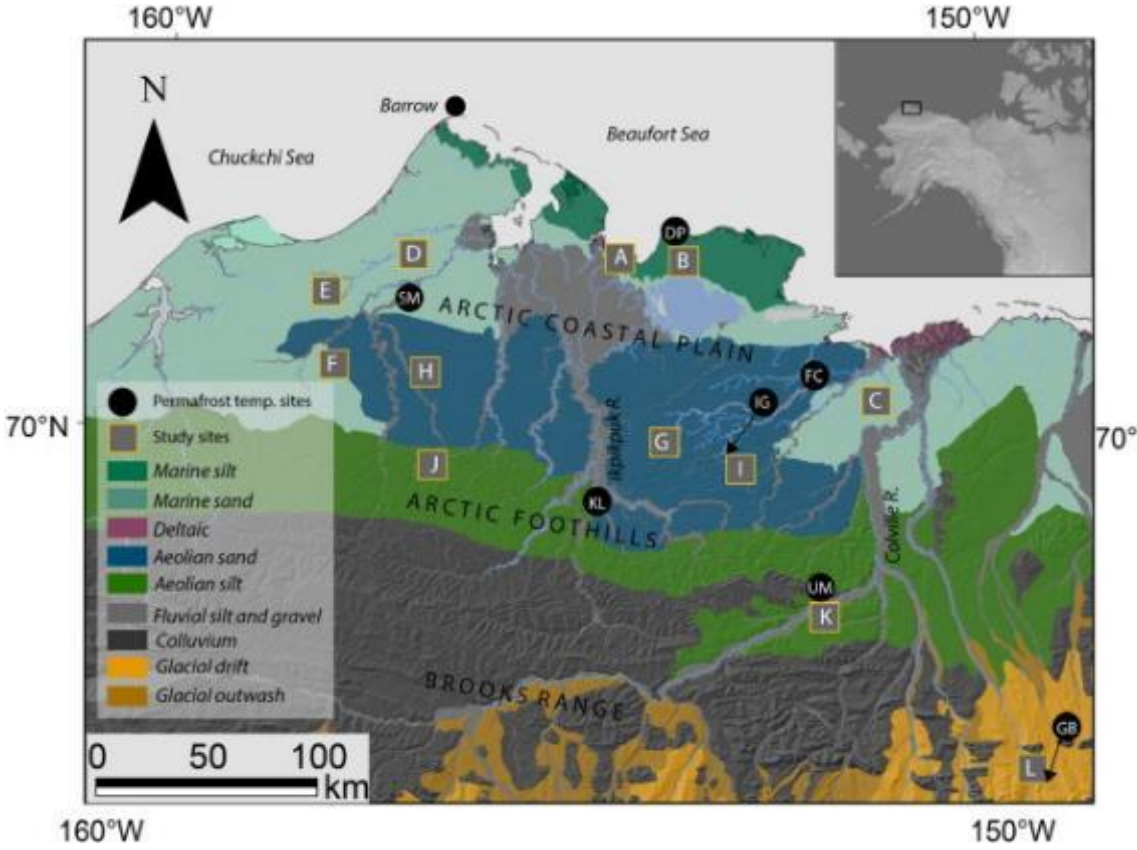
Observe, Understand & Predict Artic Change

Map of thermokarst distribution

- NPR-A region map linking thermokarst with surficial geology
- Identifies which terrain types may be vulnerable to thaw (e.g., marine silt)



Farquharson et al. (2016) Geomorphology

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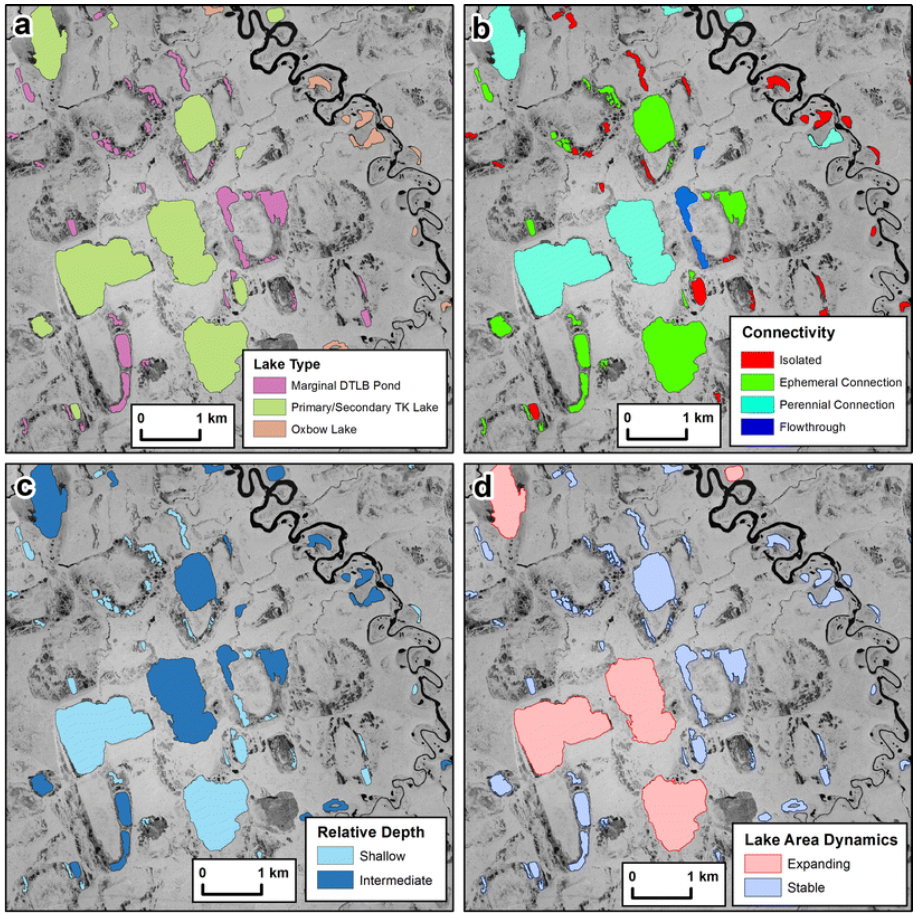
Inform Designs for the Arctic Built Environment

Translate current knowledge of Arctic climate and environment to improve design criteria for development projects

- Geospatial database of 4,362 lakes in NPR-A for resource use planning



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Jones et al. (2017) *Ambio*

Inform Designs for the Arctic Built Environment

- Scenario planning for changes in human-polar bear conflicts
- Habituation of Central Arctic caribou to infrastructure in the Prudhoe Bay region

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Inform Designs for the Arctic Built Environment

- Disturbance metrics for Artic-nesting geese
- Limited effects of indirect industrial disturbance on nest attendance patterns
- No effect of helicopter overflights on nest attendance patterns
- Greater impact from direct human foot traffic and predator use of infrastructure (but only in one year)

Meixell and Flint (2017) ***J. Wildlife Management***

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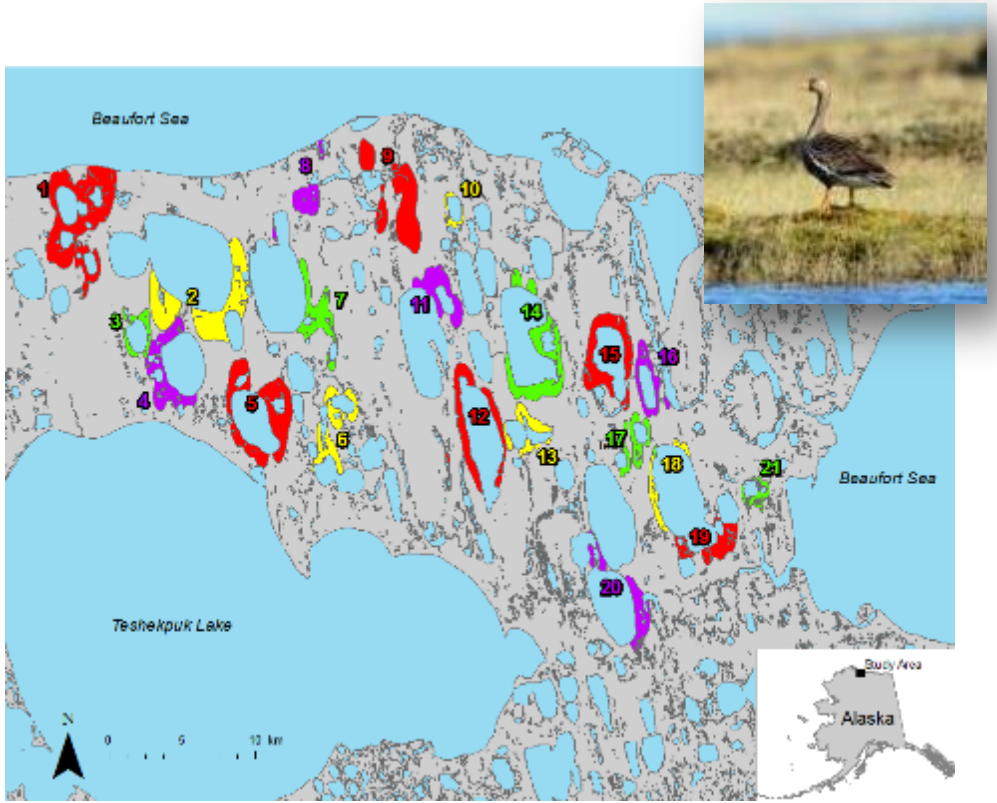
Inform Designs for the Arctic Built Environment

- Movements and habitat use by molting white-fronted geese in northeastern NPR-A
- Birds did not select for specific vegetation types and no shift in habitat use after regaining flight
- White-fronted geese are habitat generalists and preferred molting habitat is abundant in the NPR-A
- Disturbance?



Flint and Meixell (2017) *Waterbirds*

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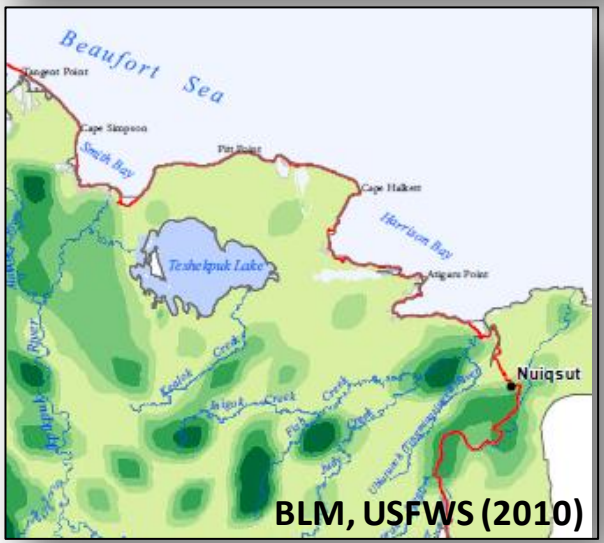
Inform Designs for the Arctic Built Environment

- Nesting yellow-billed loons in the NPR-A
- Very high territory retention rates
- New territories are rarely formed, and occupied territories are never abandoned
- Thus, breeding habitat in northern Alaska appears saturated and may be limiting Yellow-billed Loon populations from additional growth



BLM, USFWS (2010)

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Inform Designs for the Arctic Built Environment

Arctic Refuge Coastal Plain Terrestrial Wildlife Research Summaries (USGS 2002)

- Authored by U.S. and Canadian scientists regarding information collected between 1988-2001
- Recent literature search by USGS suggests similar and different suite of changes than in NPR-A:
  - Decrease in number of muskoxen
  - Polar bears more common onshore
  - No significant overall changes in vegetation or permafrost
  - Significant new research in the area since 2002

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Communication and Partnership

- Work to provide needed information to Federal agencies
- Participate in Alaska and international co-management councils
- Community engagement is constant, but always looking for ways to improve
- Federal Open Data Policy

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USGS Research Role on Arctic Topics

Science for future decisions:

- USGS has a long track record of societally relevant research with partners in Alaska, the U.S., and abroad
- USGS research in the Arctic is of national relevance for energy, biosecurity, and fish and wildlife heritage

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