



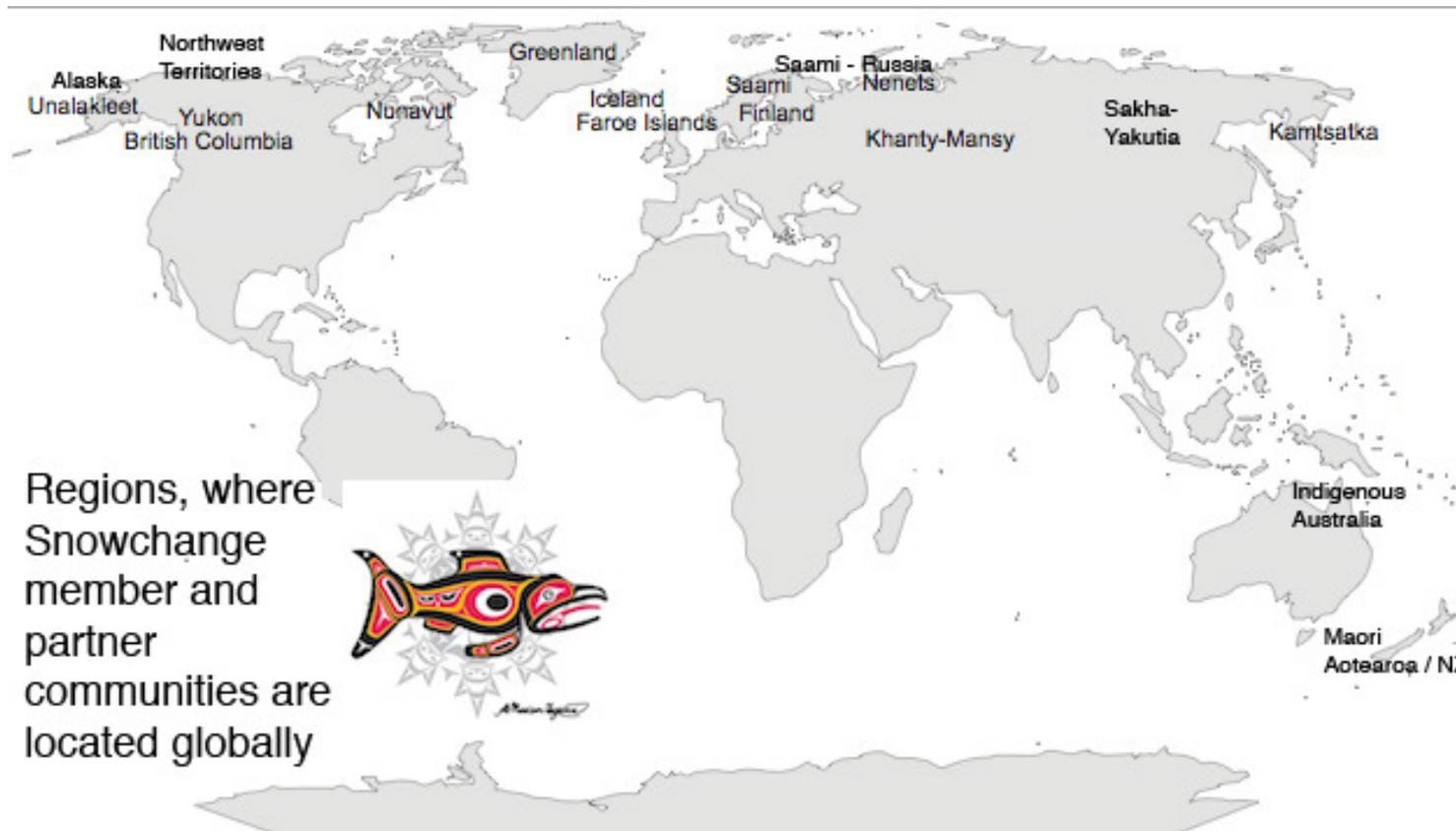
Community-led Monitoring and Ecological Restoration in the North

Tero Mustonen, Philippe Fayt &
Simone Gress Hansen

Snowchange Cooperative, Finland

Snowchange Cooperative Geographical Areas of Community-Based Monitoring Work

- **Snowchange Co-op** is a fully independent, not-for-profit organisation devoted to the CBM, traditional knowledge, culture and science work in the Arctic
- **The Snowchange network has worked 2001-2018**, spans all of the Arctic, has over 2,000 Indigenous and local community representatives involved
- **Works with the Arctic Council, ELOKA, RAIPON, BSSN, SAON, Arctic Observation Summit and other CBM networks**



The Arctic is in the middle of a monumental system shift affecting the ecology, human societies and the position of the region in the global context.

- 12th December, 2017: NOAA science results indicating that the Arctic sea ice is permanently affected by climate change and the “new normal” conditions are here.
- Pecl et al. (2017): Largest climate-driven global redistribution of species since the Last Glacial Maximum.

RESEARCH

REVIEW SUMMARY

CLIMATE CHANGE

Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being

Greta T. Pecl,* Miguel B. Araújo,† Johann D. Bell, Julia Blanchard, Timothy C. Bonebrake, I-Ching Chen, Timothy D. Clark, Robert K. Colwell, Finn Danielsen, Birgitta Evengård, Lorena Falcoi, Simon Ferrier, Stewart Frusher, Raquel A. Garcia, Roger B. Griffiths, Alastair J. Hobday, Charlene Janion-Schepers, Marta A. Jazayna, Sarah Jennings, Jonathan Lenoir, Hålf E. Linsenmair, Victoria Y. Martin, Phillipa C. McCormack, Jan McDonald, Nicola J. Mitchell, Tero Mustonen, John M. Pandolfi, Nathalie Pettorelli, Ekaterina Popova, Sharon A. Robinson, Brett R. Scheffers, Justine D. Shaw, Cascade J. B. Sorte, Jan M. Struppell, Jennifer M. Sunday, Mao-Ning Tuanmu, Adriana Vergis, Cecilia Villanueva, Thomas Wernberg, Erik Wapstra, Stephen E. Williams

BACKGROUND: The success of human societies depends intimately on the living components of natural and managed systems. Although the geographical range limits of species are dynamic and fluctuate over time, climate change is impelling a universal redistribution of life on Earth. For marine, freshwater, and terrestrial species alike, the first response to changing climate is often a shift in location, to stay within preferred environmental conditions. At the cooler extremes of their distributions, species

are moving poleward, whereas range limits are contracting at the warmer range edge, where temperatures are no longer tolerable. On land, species are also moving to cooler, higher elevations; in the ocean, they are moving to colder water at greater depths. Because different species respond at different rates and to varying degrees, key interactions among species are often disrupted, and new interactions develop. These idiosyncrasies can result in novel biotic communities and rapid changes in ecosystem functioning,

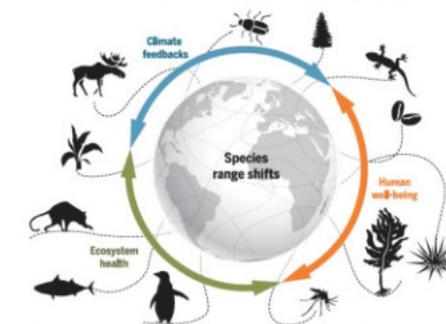
with pervasive and sometimes unexpected consequences that propagate through and affect both biological and human communities.

ADVANCES: At a time when the world is anticipating unprecedented increases in human population growth and demands, the ability of natural ecosystems to deliver ecosystem services is being challenged by the largest climate-driven global redistribution of species since the Last Glacial Maximum. We demonstrate the serious consequences of this species redistribution for economic development, livelihoods, food security,

human health, and culture, and we document feedbacks on climate itself. As with other impacts of climate change, species range shifts will leave “winners” and “losers” in their wake, radically reshaping the pattern of human well-being between regions and different sectors and potentially leading to substantial conflict. The pervasive impacts of changes in species distribution transcend single systems or dimensions, with feedbacks and linkages between multiple interacting scales and through whole ecosystems, inclusive of humans. We argue that the negative effects of climate change cannot be adequately anticipated or prepared for unless species responses are explicitly included in decision-making and global strategic frameworks.

OUTLOOK: Despite mounting evidence for the pervasive and substantial impacts of a climate-driven redistribution of Earth’s species, current global goals, policies, and international agreements fail to account for these effects. With the predicted intensification of species movements and their diverse societal and environmental impacts, awareness of species “on the move” should be incorporated into local, regional, and global assessments as standard practice. This will raise hope that future targets—whether they be global sustainability goals, plans for regional biodiversity maintenance, or local fishing or forestry harvest strategies—can be achievable and that society is prepared for a world of universal ecological change. Human society has yet to appreciate the implications of unprecedented species redistribution for life on Earth, including for human lives. Even if greenhouse gas emissions stopped today, the responses required in human systems to adapt to the most serious effects of climate-driven species redistribution would be massive. Meeting these challenges requires governance that can anticipate and adapt to changing conditions, as well as minimize negative consequences. ■

ON OUR WEBSITE
Read the full article at <http://dx.doi.org/10.1126/science.aa69214>



As the global climate changes, human well-being, ecosystem function, and even climate itself are increasingly affected by the shifting geography of life. Climate-driven changes in species distributions, or range shifts, affect human well-being both directly (for example, through emerging diseases and changes in food supply) and indirectly (by degrading ecosystem health). Some range shifts even create feedbacks (positive or negative) on the climate system, altering the pace of climate change.

The list of author affiliations is available in the full article online.
*Corresponding author. Email: greta.pecl@utah.edu
†All authors after the first author are listed alphabetically.
Cite this article as G. T. Pecl et al., *Science* 358, ea69214 (2017). DOI: 10.1126/science.aa69214



Monitoring and Knowledge Traditions in the Arctic - examples

- Science monitoring
- Community-based Monitoring
- 'Citizen Science'
- Endemic monitoring with cultural indicators, oral histories and local baselines





A Need and A Time for "Dynamic Governance"

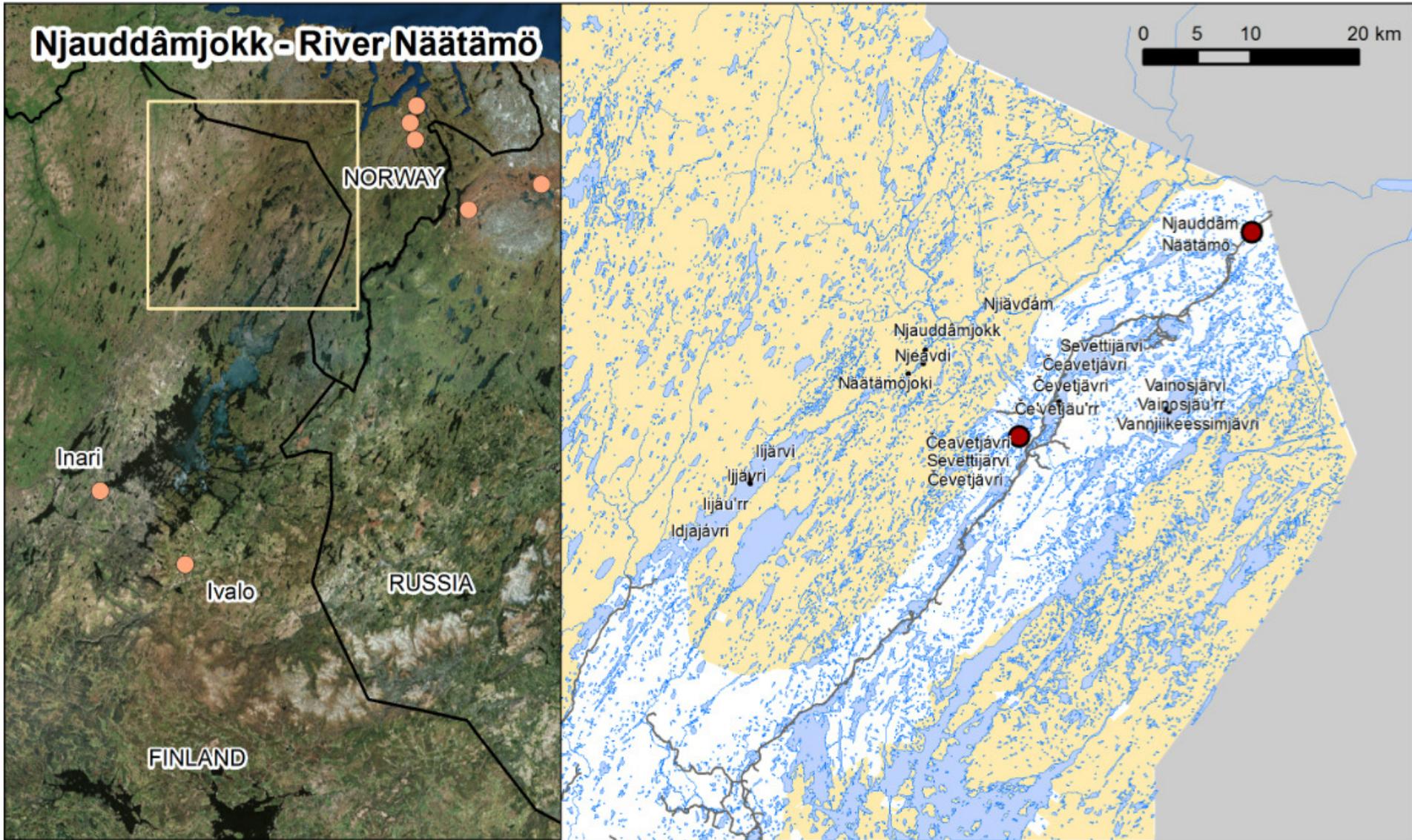
Bonebrake et al. (2017): "Maintaining relatively intact ecosystems is crucial to the preservation of livelihoods, cosmologies, cultures and languages of Indigenous groups, and many have developed governance systems for their biological resources based on holistic observations and checks-and-balances to prevent overharvesting. Alterations in species ranges and relative abundances due to climate change will have profound consequences for these governance systems"...

*Community Responses:
Skolt Sámi Co-
Management on
Njâuddam River and
Indigenous-led
Restoration, Sámi,
Finland*



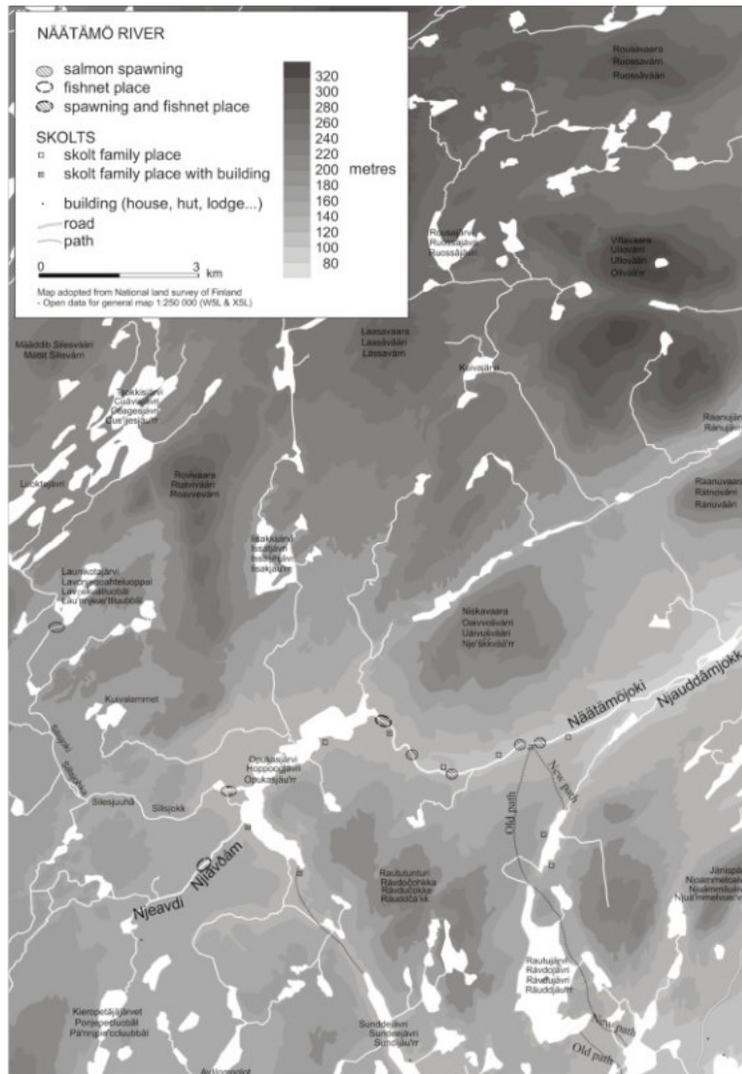
Location of Näätämö in relation to
Snowchange HQ

Njauddámjokk - River Naátámö





Näätämö Co-Management Project: Recent Updates



- **First collaborative management effort** in the Skolt Sámi area, begun with the UN in 2011, a flagship CBM project in the European North
- **Key cultural indicator species** Atlantic Salmon, Freshwater Mussel, Northern Pike, Burbot
- **Observations of water quality**, levels, ice cover, algae blooms, spawning areas, past damages, weather changes, nutrient and organic matter loading
- **Combines limnological, ecological and geographic analysis with Skolt Sámi Indigenous knowledge**
- ***In 2018 the work was significantly expanded with a PECC-1 Grant from Nordic Environment Finance Corporation – NEFCO:***
- This included major new monitoring on the Russian Ponoï river ecosystem with the villages of Krasnochelye and Kanevka and Sosnovka on the White Sea coast
- Results have included over 125 oral history interviews, dozens of hours of video footage, new information on the spread and impact of introduced species, mapping and over 9000 ecological monitoring photos
- Full results of the NEFCO work will be released internationally on the Snowchange website and other platforms 30th October, 2018.

Summer 2018 Monitoring Efforts Expanded – Focus on Birds

- Team of ornitologists surveyed early and late summer bird stocks using field visits and documentation of Sámi knowledge – some preliminary results indicate that:
 1. Näätamö catchment area (2962 km²) has been mostly undermonitored in the past.
 2. Locations of the high priority co-management survey have included parts of the main course of the Näätamö river, key areas of the sub-catchment area such as Vainosjoki, Vätsäri and the delta of Näätamö in Norway.
 3. Early results include detection, habitats and range a set of key indicator species, including for example black-throated diver (*Gavia arctica*), red-throated diver (*Gavia stellata*), smew (*Mergellus albellus*), golden eagle (*Aquila chrysaetos*), waders especially in the delta, willow grouse (*Lagopus lagopus*), three-toed woodpecker (*Picoides tridactylus*), Siberian tit (*Parus cinctus*), Siberian jay (*Perisoreus infaustus*), pine grosbeak (*Pinicola enucleator*).
 4. The monitoring efforts have benefitted from the uses of oral histories and local records of bird stocks. A full database is expected in 2019.

Ecological Restoration: Voices from the CBM Work of Näätämö

- **Oral histories** of the CBM work can be used as a *baseline of ecological restoration (Mustonen 2013)*
- **Monitoring results in observations**, which then lead to investigation of *reasons and causes*, which lead to the *need of restorative and mitigation measures*
- **For example:** In Näätämö watershed the nutrient and organic loading, past damages of river Vainosjoki and Kuosnijoki, rapid erosion of banks of lake Sevettijärvi
- **Atlantic salmon life cycle:** Actions needed at the ocean, fjord and surrounding catchment area (mines), crossborder areas (Norway-Finland) and finally at the spawning streams and habitats of Näätämö basin
- **Problem is not the monitoring, it is the old way of doing things - Key question:** *What good does monitoring do, if it does not lead to transformative, cross-sectoral, land use, bottom-to-top, governance and restorative REFORM AND CHANGE in administrations, public bodies, state apparatus and other positions of power?*





