Traditional Knowledge of Northern Waters

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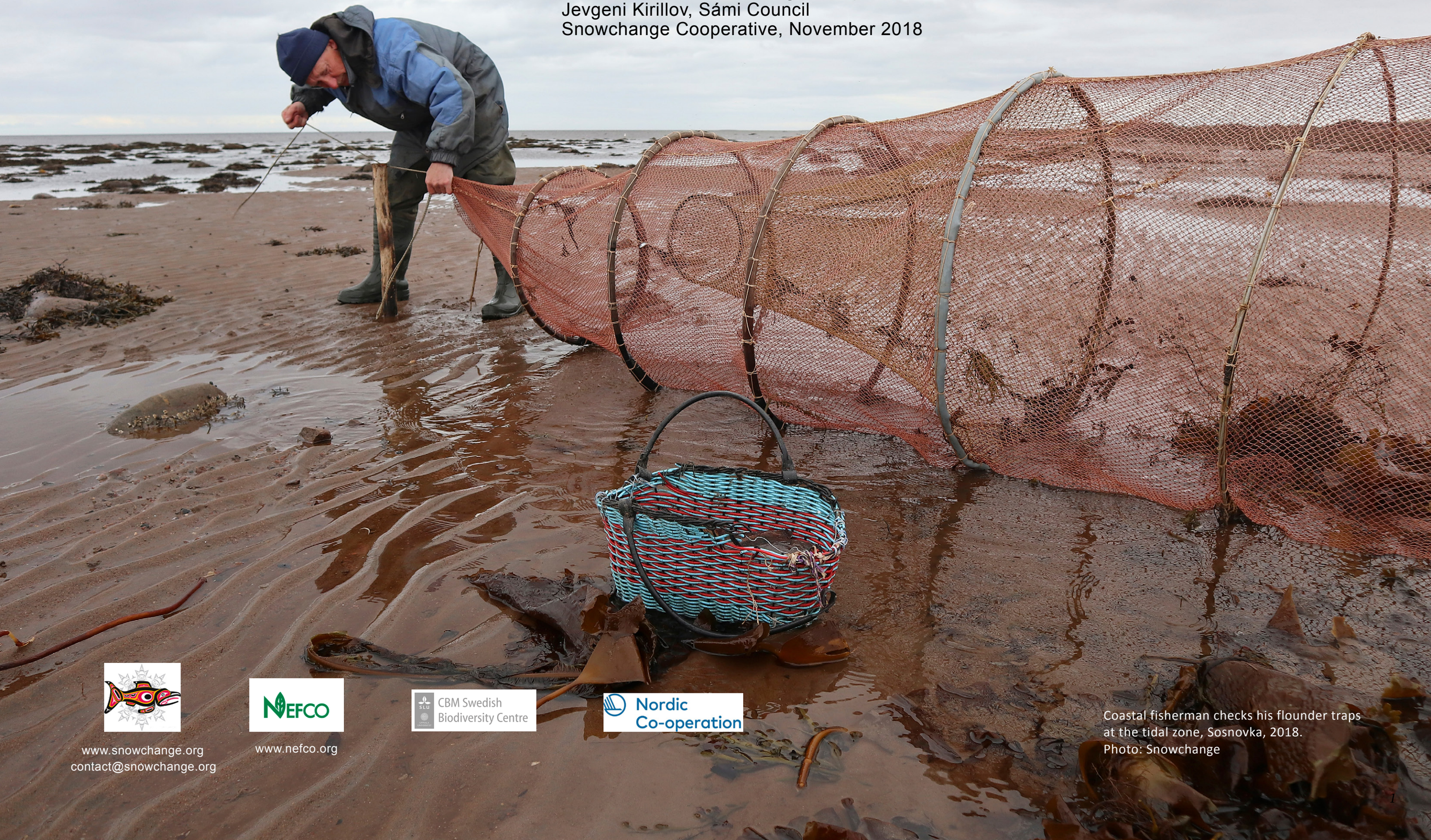
Snowchange Cooperative, November 2018



Coastal fisherman checks his flounder traps at the tidal zone, Sosnovka, 2018.
Photo: Snowchange

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CBM Swedish Biodiversity Centre

Nordic Co-operation

Executive summary

Traditional Knowledge of Northern Waters 2018 was a project that focused on two iconic Arctic river basins in the Fennoscandian and Russian North – the Skolt Sámi home stream of Näätämö river flowing from Finland to the Barents Sea and Ponoi river on Kola Peninsula, Russia. A third geographical area of the project was the coastal community of Sosnovka which is in close proximity to the Ponoi river mouth. The project benefitted from previous scientific work that commenced in the area 2006.

The project was led by the Snowchange Cooperative (FI) with House of Culture (Lovozero, Russia) and CBM – Swedish Biodiversity Center being project partners together with Sámi organisations. Funding was provided by NEFCO PECC-1 Programme.

View of traditional Sámi community of Chalme-Varre, Spring 2018, Snowchange

Over 9,000 data items ranging from Indigenous knowledge and oral histories to historical weather records resulting back to 1863 were produced in the project. The main findings are:

1. **Climate change is now an urgent reality that is affecting the health of both fish and ecosystems in Näätämö and Ponoi catchment areas as well as Sosnovka.** Water temperatures are becoming dangerously warm and threat of fish deaths is real. Record warm spells triggered forest fires both in Finland and in Russia. Threats to salmonide fish, especially Arctic Char, is now imminent and their survival is at stake.
2. **Villages involved have living traditional knowledge and a willingness to observe, report and act on the results.** A monitoring network is now in place and should be supported, long-term, to understand climate and ecological change in the basins both from science and traditional knowledge. This includes Indigenous and local customary governance and self-limiting of harvests especially of spawning salmon. Many people expressed their growing concern on the impacts of catch and release practices within sport fishing. Villages have sets of holistic biocultural indicators, often gendered, with which they monitor ecosystems. Women in the villages have special knowledge of the rivers.
3. **Striking similarities in biodiversity changes, especially fish health, emerged from all regions.** Whitefish suffer from major parasites, salmon stocks are dwindling, the expansion of the range of Pink salmon (*Oncorhynchus gorbuscha*), introduced species, is now a reality on both Näätämö and Ponoi as well as Sosnovka river. For the Russian communities, the back-log of Soviet land use and pollution events should be investigated as a long-term driver of change.
4. **Scientific results, in part beginning from 1863, on water quality, humidity and temperature indicate that Näätämö, Ponoi and Sosnovka are some of the last wilderness areas in the European North.** They are for the most part in pristine condition. However the weather data confirm the local observations of the urgency of climate change and creates conditions for fish death and algal bloom events. Summer 2018 was the hottest on record in this area and the project documented the impacts of the warm spells on fish, rivers and water conditions.
5. **The project partners will disseminate the key results of the work in a range of media including Arctic science meetings, visual histories and online platforms, social media and peer-reviewed co-produced papers.** The success of the project should be replicated and expanded urgently across the European North to allow more community-based monitoring of change (CBM) to take place.

Ponoi river downstream from the community of Krasnochelye. Snowchange

Aerial view of the marshmires of the Ponoi catchment area, August 2018. They are in pristine condition and key carbon sinks in the European North. Snowchange

This report is divided into an introduction and methods section. **Then the results from the Näätämö catchment area are presented,** including a climate action the Skolt Sámi have initiated – Indigenous-led ecological restoration of 'lost' aquatic habitats to combat climate change. This process is unique across the Arctic.

In the third part we hear the results from Ponoi catchment area and the coastal community of Sosnovka. This iconic salmon stream is of great international importance as the 'last' remaining fully intact wilderness basin in the European North.

Fourthly, the conclusion of the 2018 work peaked at the Festival of Northern Fishing Traditions, in Tornio, Finland in September 2018. All monitoring teams and international Indigenous and local-traditional fishermen arrived to northern Finland to review and discuss the pressures of climate and environmental change on their home areas.

In Conclusions the next steps of the process are reviewed and discussed. Additionally, reference information and visual histories online on the video portal of Snowchange Co-op are shared.

A New View of Näätämö, Ponoi and Coast of Kola Peninsula

"Traditional Knowledge of the Northern Waters" is a Snowchange Cooperative project funded by NEFCO[1] as a part of the Programme for the Environment and Climate Cooperation – PECC. We focused on two iconic Arctic rivers in the European and Russian North – the Skolt Sámi home stream of Näätämö river flowing from Finland to Norway and the Barents Sea as well as the Ponoi river on Kola Peninsula. A third geographical area included in the work was the community of Sosnovka which is in close proximity to Ponoi.

In short, "Traditional Knowledge of the Northern Waters" established a community-based monitoring network (CBM) to monitor the Ponoi(RU) and Näätämö(FI/NO) watershed during 2018. Snowchange had been working in both catchment areas and in Sosnovka since 2006-2007, so the project built on a well-prepared ground for climate action. On the Näätämö catchment area we could take additional advantage from the on-going Näätämö collaborative management actions that were established in 2011 by the Skolt Sámi and Snowchange.

Incidently, the project actions took place in the context of rapidly proceeding climate change that is impacting the biodiversity of these catchment areas. The record warm summer of 2018 further stressed this fact and the project could not have been timelier.

In Näätämö the main partners of the work are the Indigenous Skolt Sámi. The project also collaborates with the national minority of Kvens on the Norwegian side.

For Ponoi the focus was to train and work with teams in the wilderness communities of Kanevka, Krasnochelye, Sosnovka as well as seasonal settlements of Ponoi and Chalme-Varre / Ivanovka.

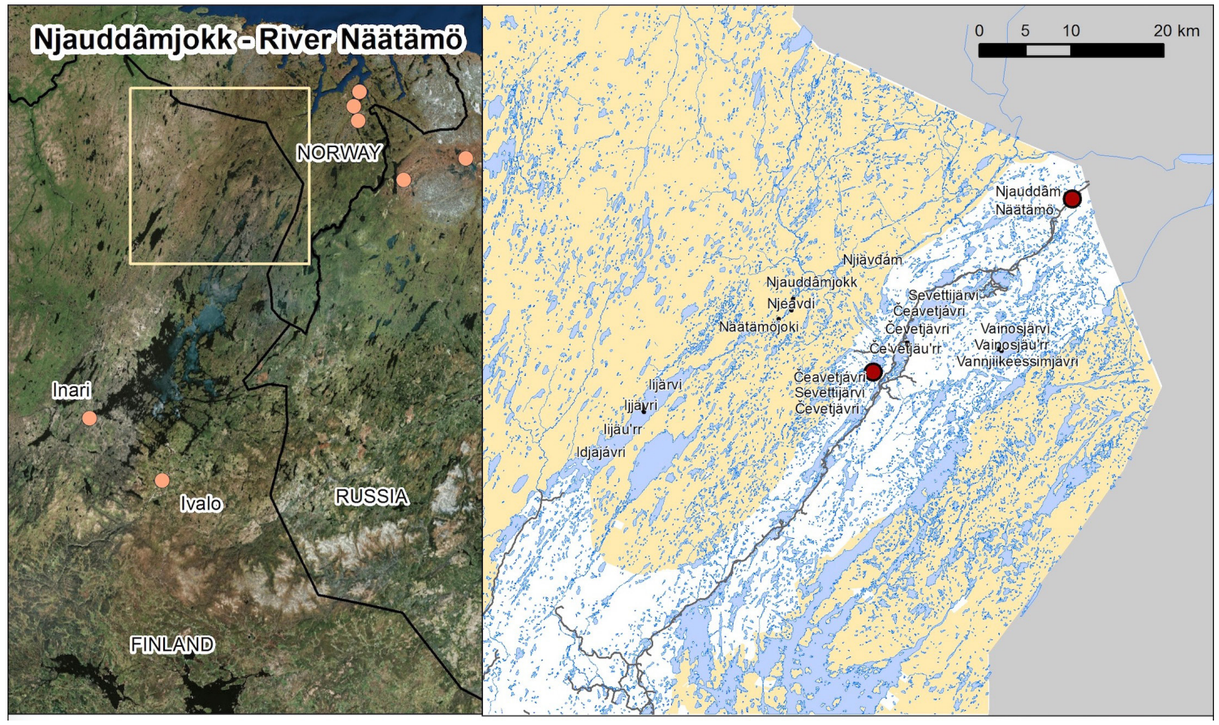
We can summarize the main objective of the project to have been a new engagement in culturally appropriate terms with Indigenous and local-traditional communities of two iconic Atlantic Salmon rivers in the European North to provide a socio-ecological monitoring and assessment of the changes that climate and environmental impacts are causing. The materials collected form a substantial new baseline for future actions on climate monitoring, adaptation and resilience.

Snowchange Cooperative was the lead partner in the project. Main Russian Partner was the House of Culture, Murmansk region, Russia.

Main Swedish Partner is Swedish Biodiversity Center, a non-profit science facility at the Swedish University of Agricultural Sciences and Uppsala University.

Another Regional Partner is Saa'mi Nue'tt, a Cultural Organisation.

[1] Nordic Environment Finance Corporation, www.nefco.fi

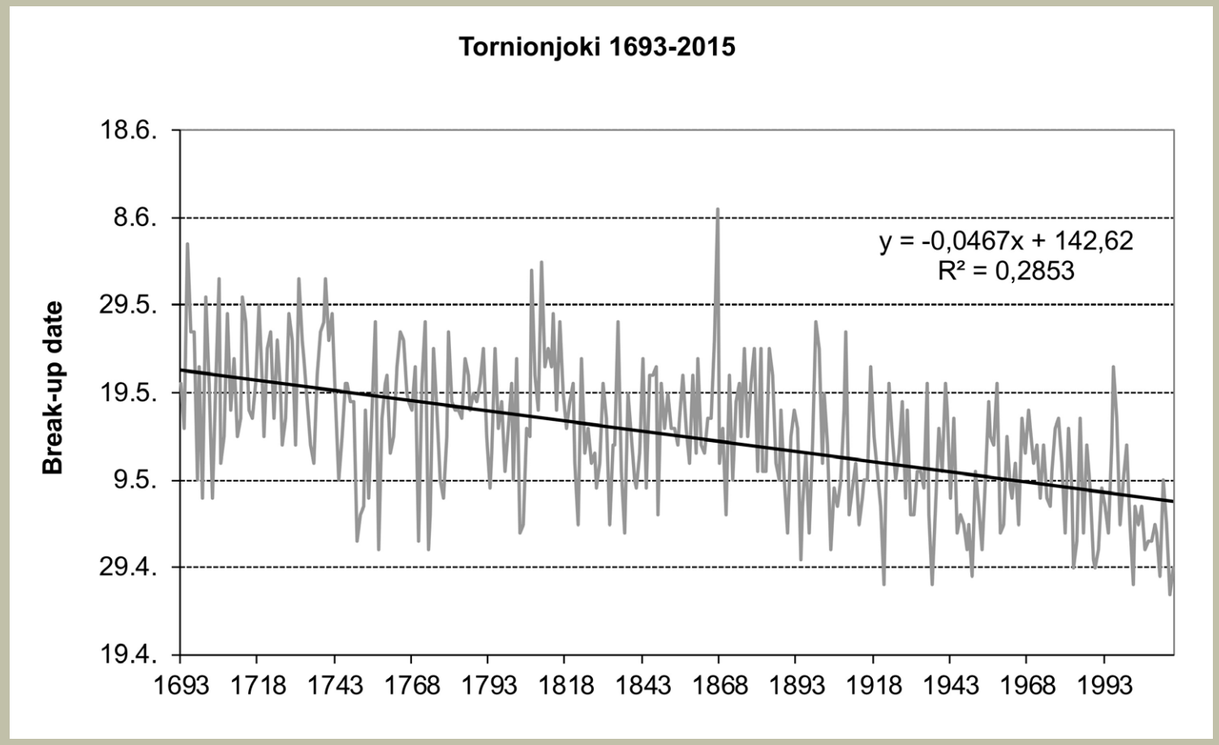


In short the main results of the project were:

1. ***There*** *is a comprehensive monitoring network of Näätämö and Ponoi now in place building both on traditional knowledge / citizen science as well as science.*
2. ***A workshop*** *and a final Conference, "Festival of Northern Fishing Traditions" of capacity building between Russian and Finnish teams that was organised inspired and helped to support the development of the CBM model to other river systems (such as Teno,Tuloma, Kemijoki) and coastal areas (Kalix archipelago) in the region. Communities from these other areas participated in the Festival and co-learned and shared for future plans.*
3. ***There*** *was a rigorous monitoring interface from NW Russia and FI/ NO remote communities on the impacts of biodiversity and climate change on aquatic habitats.*
4. ***The project*** *will offer lasting documentation of oral and visual histories, traditional and scientific knowledge of the villages to investigate past and present environmental and climate change.*
5. ***All in all*** *over 9,000 data items were collected during the project. This massive database with source material includes land use and occupancy maps, hundreds of monitoring photographs, visual and oral history recordings, PISUNA[2] monitoring forms, gender-specific biocultural indicator charts, traditional songs devoted to lakes and rivers, scientific temperature and water quality data and drawings and paintings from these waters.*

[2] A local observations database developed in Western and Northern Greenland to record, archive, and share indigenous and local knowledge and expertise on natural resources and resource use. See further below and at https://eloka-arctic.org/pisuna-net/en/about

River Näätämöjoki in the Spring 2018 at the delta. Snowchange / Eero Murtomäki



Climate change is evident in the European North for example by tracking spring melt of ice. This graph documents ice break-up between 1693-2015 on river Tornio at the Swedish-Finnish border. A clear trend emerges with the melt getting earlier and earlier. Data from Pekka Räinä / Lapland Center of the Economy, Transport and the Environment.

About Methods Used During the Project

"Traditional Knowledge of the Northern Waters" contains a deep and comprehensive view of two rivers: full inclusion of community-based and traditional knowledge materials combined with scientific analysis of climate and weather research. By focusing on catchment areas of Näätämö and Ponoi as well as the coast of Sosnovka area a holistic geographical focus could be achieved.

That in itself is a rather significant turn of events. Often traditional knowledge and science studies are separate in their own realms and disciplines. Our project wanted to break this mold by having a new view, a view that would be accessible and easy to understand also to the local communities.

Trout caught from the lake Sevettijärvi, Näätämö basin, during the community monitoring work. Snowchange

Broadly our methods in the work included the following tools:

- **Field visits by local teams:** In all villages, the local people were invited to be the 'guardians' of their waters and provide new observations that they feel are relevant in their field visits.
- **Visual histories:** We encouraged the community monitoring to use and be open to the uses of what are known today as 'visual histories' – communal actions in photography and video recordings that convey change, meaning and continuity. We remained open to the contents as long as they conveyed essentials regarding aquatic health and change.
- **Fishing forms:** Learning from previous years' work in Western and Northern Greenland, we worked to implement the PISUNA method, i.e. collection of catch statistics and observations by fishing women and men on these rivers and coast of Sosnovka. This complemented and added to the oral histories and visual observations significantly.
- **Biocultural Indicators:** Pre-selected local team experts, mostly women, also used the method of biocultural indicators, i.e. events in nature important to local ways of life, to point to how climate and weather change is affecting these villages.
- **Maps:** In all regions we asked local teams to map their marine and freshwater use and occupancy and harvest areas. These exact harvest locations will remain with the families and people of the villages but for the sake of the project these map actions have been summarized in this report.
- **CBM links to science:** Documented CBM (community-based monitoring) observations were then analysed by scientific experts in the Snowchange Cooperative to provide a socio-ecological view of these key Atlantic Salmon basins and drivers of change. We did use[3] and see messages from literature and science reviews on these rivers but we wanted the 2018 operations to be also completely new, so that the observations and the methods used could be fresh in application on Näätämö and Ponoi.
- **Science materials:** Snowchange Co-op worked with our partners at the Swedish Biodiversity Center, Russian Academy of Sciences (not part of the project consortium) and Alaska (not part of the project consortium) to summarize main trends of water quality, temperature and humidity of the project locations to contribute to the understanding of climate change in the region.

[3] Full list of science references available from Snowchange Co-op

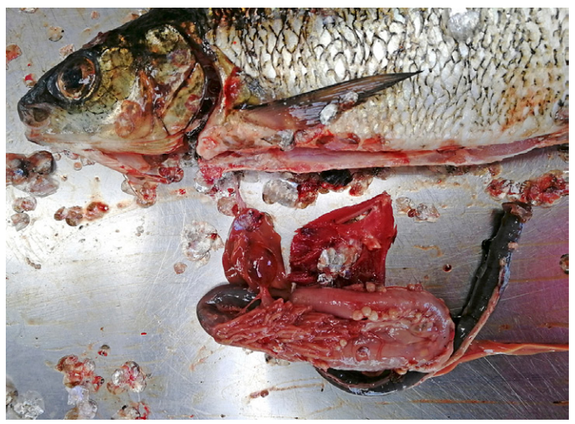
The primary team of the project included Jevgenii Kirillov, Alexander Paul, Dennis Barudkin, Anna Kolesnikova, Irina Kurzeneva, Petteri Feodoroff, Pauliina Feodoroff, Vladimir Feodoroff, Juha Feodoroff, Ari Parviainen, Phillippe Fayt, Kaisu Mustonen, Tero Mustonen, Håkan Tunón, Marie Kvarnström, Johanna Roto, Eero Murtomäki, Satu Moshnikoff and Rita Lukkarinen. Additionally dozens of people in the village formed the local teams and support units. A major thanks to all of them.

We are also very thankful to NEFCO, especially Henrik Forström and Kari Hämekoski for a successful implementation of a very intense project! In Alaska Ph D Brie Van Dam produced the weather and water quality graphs for Snowchange, thank you for that. We have received weather data for the villages from the State Hydrological Institute in St. Petersburg that is represented in summary graphics.

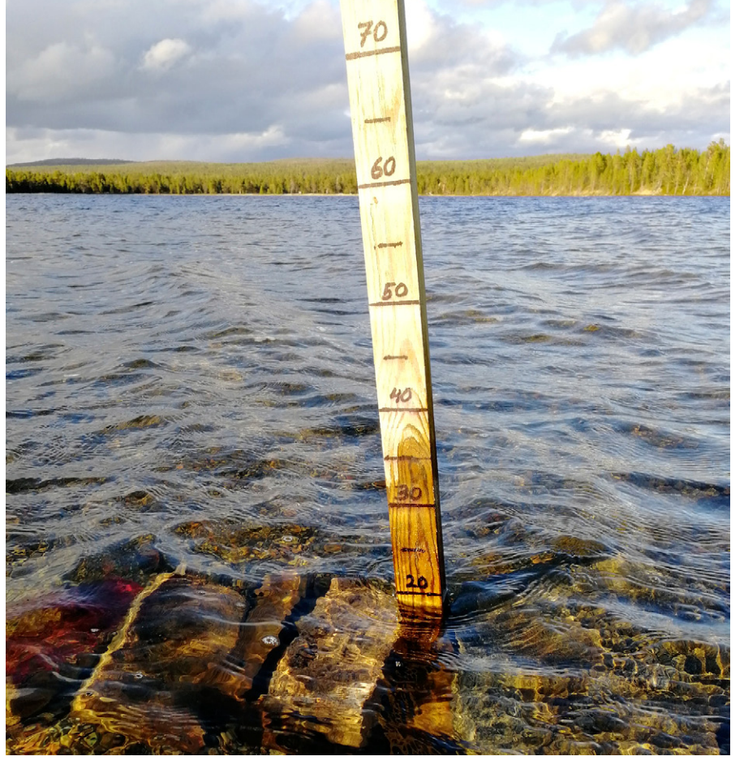
Work in Näätämö River Basin

Geographical Overview of Näätämö Basin:

The Näätämö river begins on the lake Iijärvi on the Finnish side and flows into the Neiden Fjord on the Norwegian side. The total length of Näätämö is about 100 kilometers and the watershed area is 2962 square kilometres. On the Finnish side the river flows for approximately 50 kilometres. On lake Iijärvi the water level is 193 meters above the sea, and at the fjord 130 meters above the sea. During its course the river forms lakes such as Kaarttilompolo, Vuodasluobal and Opukasjärvi. The Näätämöjoki basin project sites included: Lake Sevettijärvi: A central lake where majority of the Skolt Sámi in the basin live. It has suffered from erosion, water level changes and fish health problems for several decades. It is of high social importance for the local Indigenous peoples. Vainosjoki: A sub-catchment river of Näätämö river where man-made alterations in 1960s and 1970s negatively affected the water quality and biodiversity. Now the target of Sámi-led restoration efforts. Näätämö main course: The river itself is a central stream for the Skolt Sámi and the spawning river of Atlantic salmon stocks.



Skolt Sámi teams monitored the water levels on lake Sevettijärvi through the season (above) as well as the whitefish health (below). Whitefish were affected by parasitic Triaenophorus worm and other parasites on the lake. Snowchange



The fish on the river include (Latin names in parentheses):

- Atlantic salmon (Salmo salar)
- Lake trout (Salmo trutta)
- Sea trout (Salmo trutta trutta)
- Grayling (Thymallus thymallus)
- Northern pike (Esox tickl)
- Whitefish (Coregonus lavaretus sp.), including stocks that migrate to the Barents Sea, 40 kilometers from the river.
- Arctic Char (Salvelinus alpinus)
- Burbot (Lota lota)
- Perch (Perca fluviatis)
- Pike (Esox tickl)
- Three-spined stickleback (Gasterosteus aculeatus)
- Nine-spined tickleback (Pungitius pungitius)
- Common minnow (Phoxinus phoxinus)
- Flounder (platichthys flesus) (Below Skoltfossen)
- Occasional visitors include escapee pink salmon from the Russian side, which are spawning on the river, are caught, as well as European eel, European river lamprey.

Results from the Community-Based Monitoring Work:

Whitefish Health and Water Levels on Näätämö and Lake Sevettijärvi
Lead and Co-researcher Petteri Feodoroff

Skolt Sámi Co-researcher Petteri Feodoroff conducted his seasonal monitoring of four central points in the Näätämö basin:

1. Outflow at Lake Rautaperäjärvi
2. Water levels, status and health of Nilijoki river
3. Water levels, status and health of Lake Sevettijärvi, including whitefish
4. Water levels of the outflow at Jäniskoski rapids

The extreme heat of July 2018 is reflected in the water levels in the results. This forms a central baseline for future water level fluctuations at the key points.

Petteri also conducted CBM fishing with gill nets on the lake Sevettijärvi over the summer. In short, an abundance of parasitic worms and other deterioration of fish health was evident in all samples of whitefish that Petteri and his co-workers caught, analysed and recorded. This is of great concern and will be raised future management and monitoring meetings with the authorities.

Team Members Included in the Work: 11

Vladimir (left), Juha and Veikko Feodoroff, three Skolt Sámi brothers, discuss seining with Aslak Holmberg and Halfdan Pedersen from Greenland. Snowchange

Revitalisation of Communal Seining on Lake Sevettijärvi
Lead Juha Feodoroff

One of the actions to combat the parasites and weakening whitefish health on lake Sevettijärvi, central lake of the Skolt Sámi in Finland, has been to restore and revive communal seining. This builds on the understanding that a partial reason for the poor status of the whitefish results from too dense stocks of the fish in the lake. By renewing harvests of whitefish, the Skolt Sámi hope to affect the stock composition and health as well as extending their monitoring efforts on the lake. This work has been advanced in 2018 by Skolt Sámi fisherman Juha Feodoroff, member of the project team.

Gendered Biocultural Indicators of Change in the Näätämö Basin
Co-researcher Satu Moshnikoff

Satu Moshnikoff, a Skolt Sámi woman and Elder from Sevettijärvi community contributed her records of biocultural indicators to the project. She has been monitoring five sets of ecological indicators since 1978 in the village:

1. Sprouting of the birch tree leaf buds in the spring
2. Appearance of the first mosquitoes
3. First snow fall in the Autumn
4. Snow depth
5. First melt spots in the spring in the snowpack

Several trends emerge from Satu's observations: Birch tree leaf buds have almost systematically started to sprout in May, as opposed to June in the past. Watermark is the year 2000, with only four years in the 2000s having the sprouting in June.

Mosquitoes have more varied trends – they usually appear in mid-June, but exceptional years have included 1993 with first mosquitoes in July and 2009 with no insects at all.

Permanent snow has arrived as early as 31st August in mid 1980s but the onset has been pushed back especially in the 2000s so that latest permanent snow cover has come early November, even 1st December in 1981.

First melt spots in the spring in the snowpack follow a similar trend with "normal winters" still in 1970s and 1980s, with bigger changes under way closer to 2010s. For example in 2002 the snowless spots appeared already in mid-March, and since then the first melt stops have appeared in late March to early April.

Satu Moshnikoff and Tero Mustonen discuss climate change issues on lake Sevettijärvi in September 2013. Photo: Gleb Raygorodetsky

Detection of Outbreak of Algae in the Vainosjoki Sub-Catchment Area
Lead Tero Mustonen, Co-Researcher
Juha Feodoroff

As a part of the monitoring mission special attention was paid to the Vainosjoki sub catchment area of Näätämö river, due to the ecological restoration actions underway there (see below). Fisherman Juha Feodoroff detected, following the heat spells of June and July carpets of algae growth on the smaller pools and even the main stream of Vainosjoki river. Samples were taken by the science team and with the cooperation of the laboratory located at the Finnish Environmental Institute, the algae were identified.

Most likely the outburst of algae had resulted from the record-high temperatures and a heatwave lasting for weeks in the region. In parts the algae covered small pools to the depth of 40-50 cm. More precisely the species were *Frustulia crassinervia* as well as *Navicula*, *Encyonopsis, Eunotia* and *Gomphonema*. Skolts worked with a team of scientists to identify the species, confirming the observation and are contemplating a range of responses to the phenomena.

Juha Feodoroff (left) and Janne Raassina (right) sampling the diatom algae. Photo: Snowchange

Initial Inventory of the Birds of the Näätämö Basin
Lead Ari Parviainen, Co-Researcher
Philippe Fayt

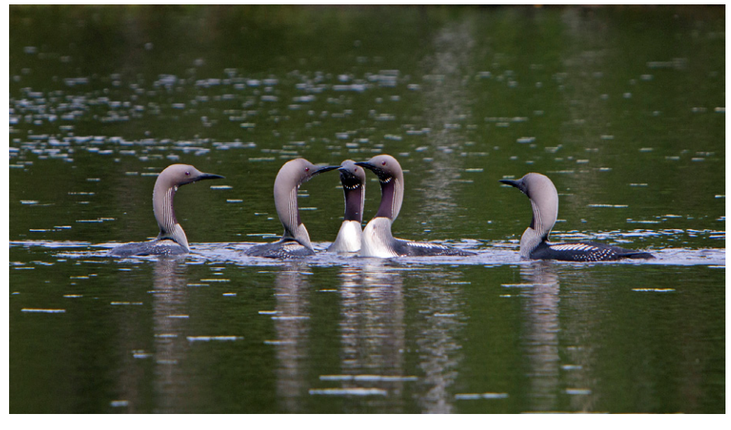
A team of ornithologists surveyed early and late summer bird stocks. Some of the preliminary results indicate that:

- Näätämö catchment area has been mostly under monitored in the past in the context of status and trends of birds as a cross border region. The northern part of the catchment area in Kaldoaivi wilderness is more plentiful in terms of species numbers whilst the southern Vätsäri parts of the catchment area seem to point to lower levels of species.
- Locations of the high priority co-management survey have included parts of the main course of the Näätämö river, key areas of the sub-catchment area such as Vainosjoki, Vätsäri and the delta of Näätämö in Norway.
- Early results include detection, habitats and range of a set of key indicator species, including for example common loons *(gavia arctica)*, red-throated loon *(Gavia stellata)*, smew *(Mergellus albellus)*, golden eagle *(Aquila chrysaetos)*, waders especially in the delta, ptarmigan, forest grouse, Siberian jay, Pine grosbeak *(Pinicola enucleator)*
- The monitoring efforts have benefitted from the uses of oral histories and local records of bird stocks. A full database is expected in 2019.

The key bird indicator species documented so far point to a fairly intact habitat both for aquatic and terrestrial birds. However, some species such as the ptarmigan are under rather heavy tourist hunting pressure and will be further investigated.

Arctic Terns.

At the nest of a Golden Eagle



Loons. Photos: Eero Murtomäki

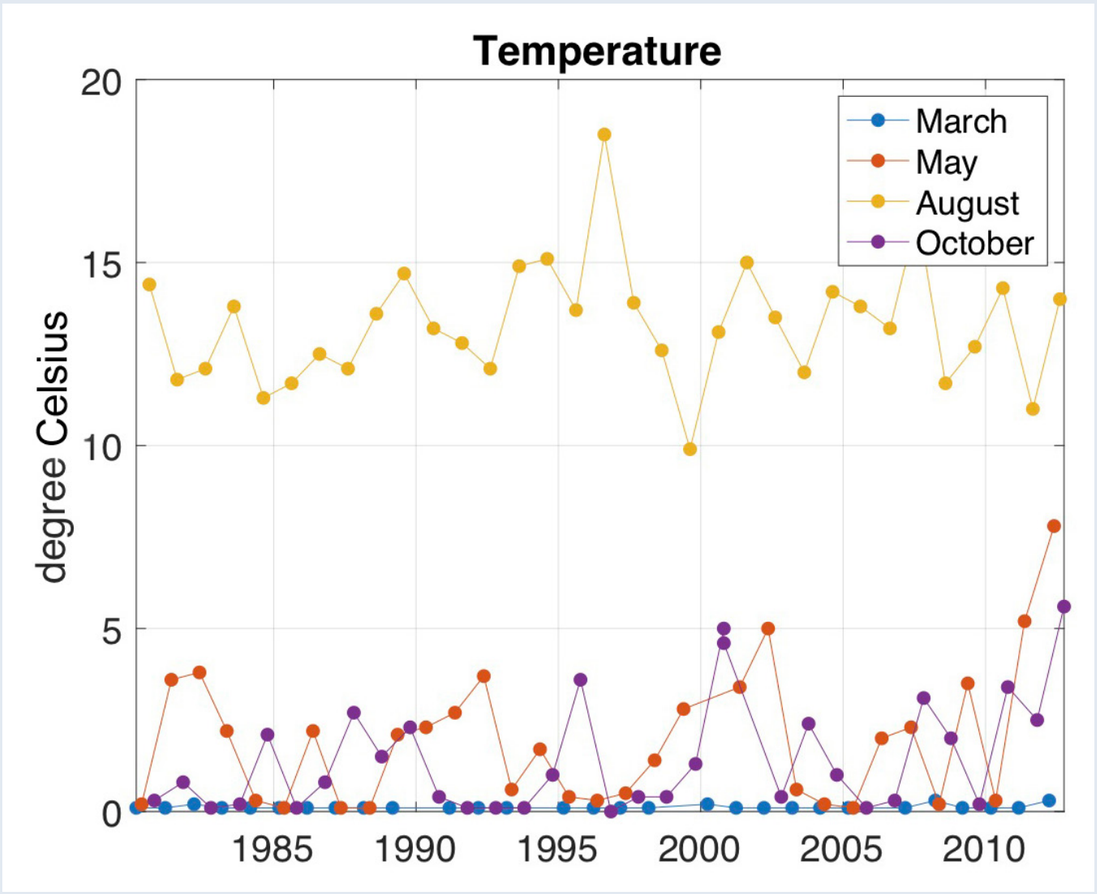
Water Quality of the Näätämö River: Selected Indicators of Change
Lead Kaisu Mustonen and Tero Mustonen, Co-Researcher Brie Von Dam

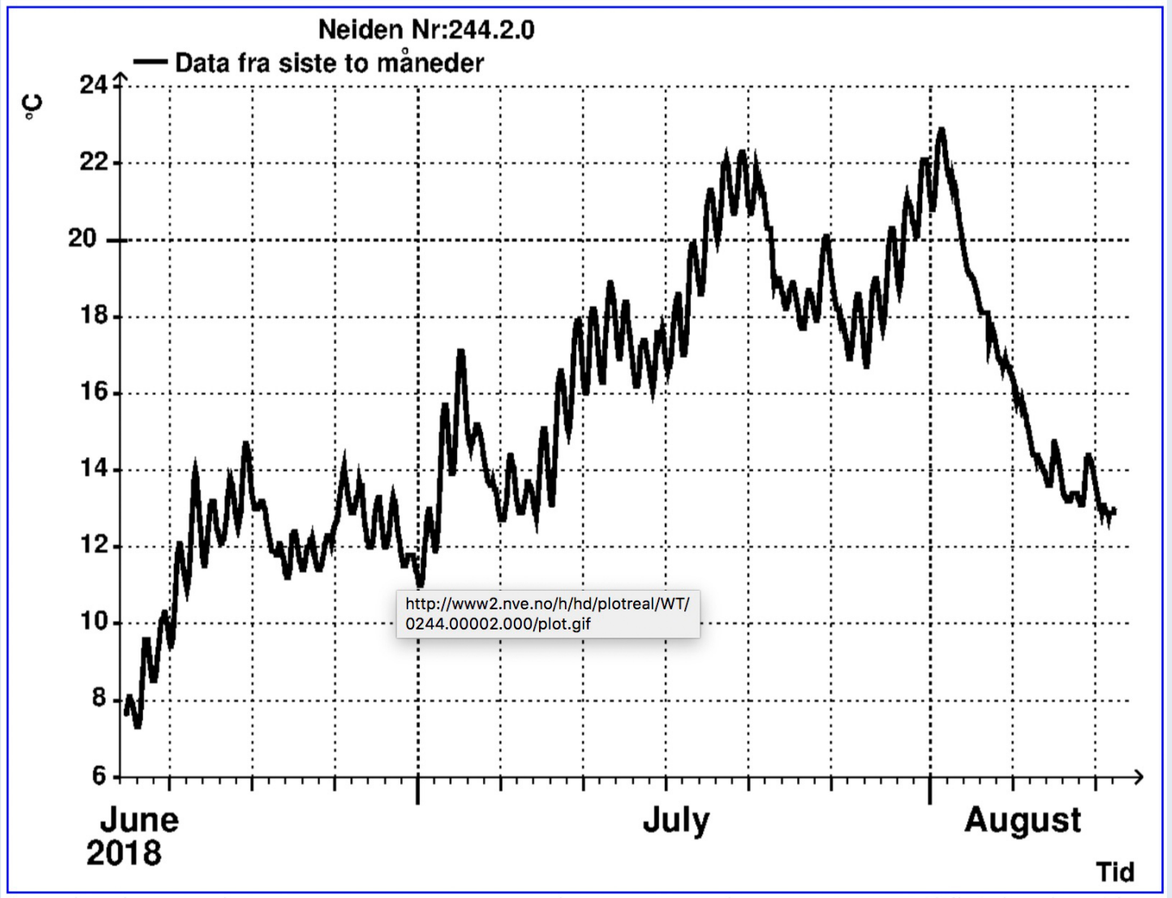
Scientific monitoring of Näätämö river has taken place throughout the 1900s. Since 1980s results on the Finnish side have been digitalized and are publicly available.

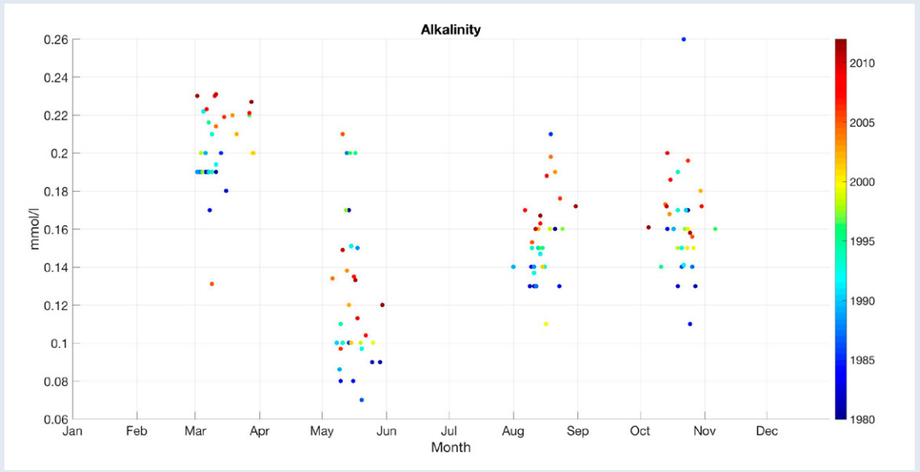
We have used the latest results from the water measurements to offer a sample and a selected summary of current trends and issues between 1980-2018. The full list of science indicators and biodiversity assessments forms a central node of the co-management work.

Water temperature ranges within the analysis period have been summarized into a chart above. In 1990s and in mid-2010s we can see the peaking of both autumn and winter / spring water temperatures in the catchment area. Early 2000s are another period of warm summers and autumn. The summer of 2018 was all-time record warm through-out the Sámi home area. This is reflected in the seasonal weather measurements on Näätämö on the Norwegian measurement station:

Of particular concern are the high peaks over 22 C in first week of July and end of July. These are extremely dangerous temperatures for the salmonid fish, especially Arctic char and trout species in the catchment area.



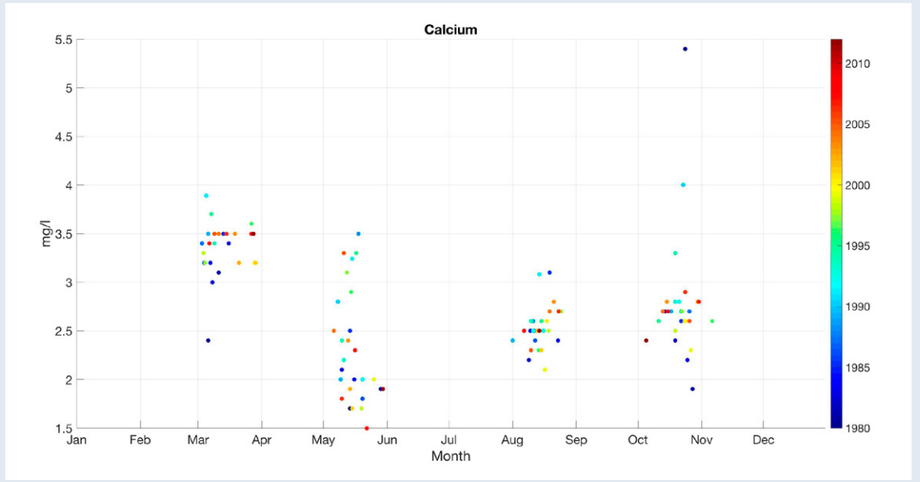


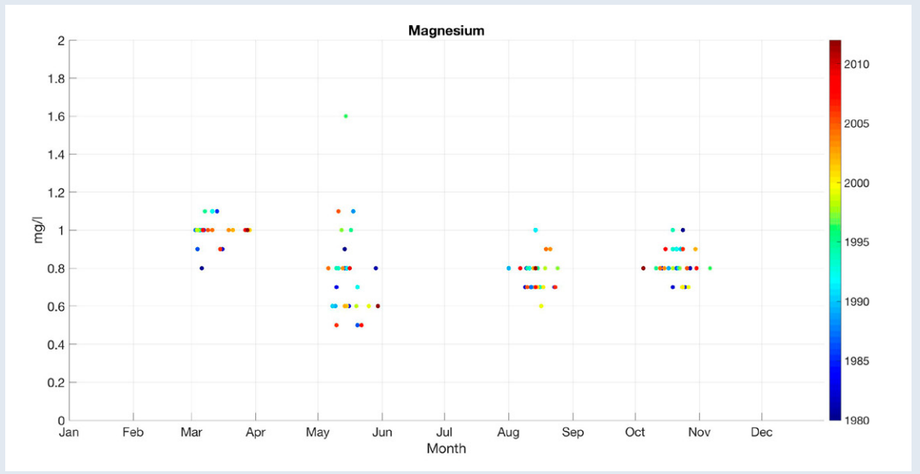


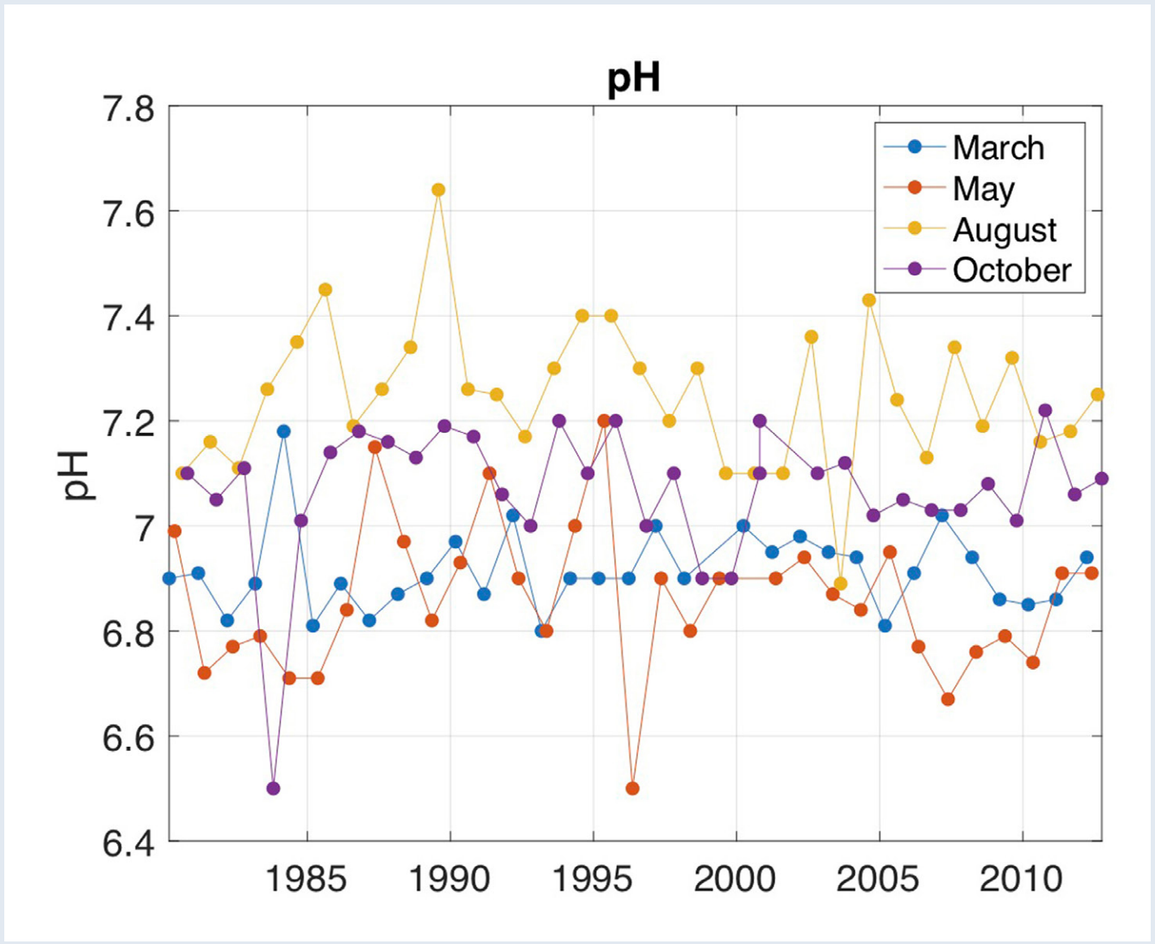
Alkanity of Näätämö is generally between 0,12-0,231 mmol/l, which indicates a very good buffering capacity.

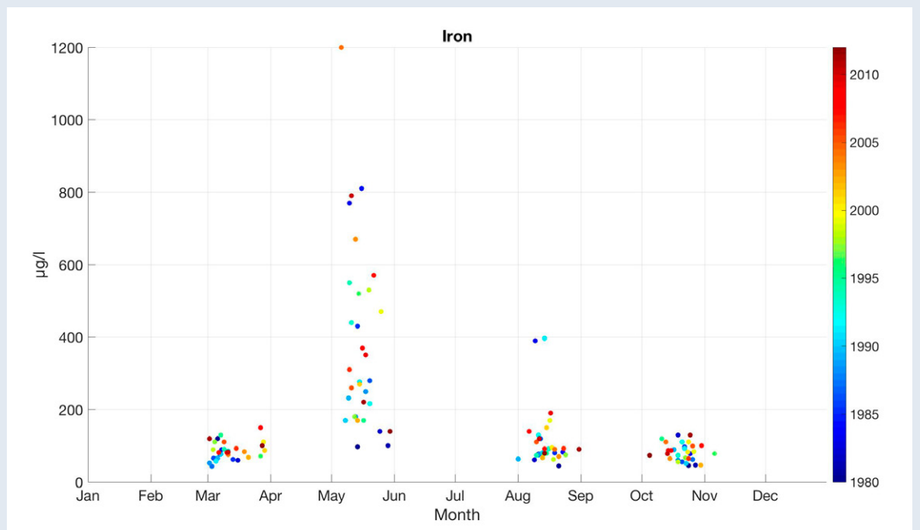
pH of the water ranges from 6,74 to 7,25 with an average of pH 7,01, almost neutral. On the monthly chart we can see the impact of spring overflow with a recorded low of 6.4-6.5, especially for 1996:

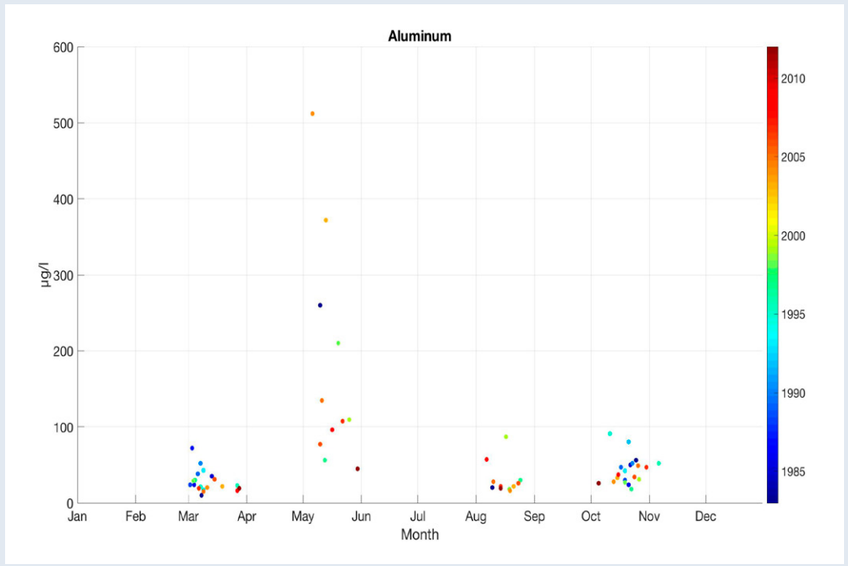
Overall levels of Calcium (in general 1,9-3,5 mg/l), **Magnesium** (0,6-1,0 mg/l), **Iron** (72-220 µg/l, with seasonal peaks for May-June),

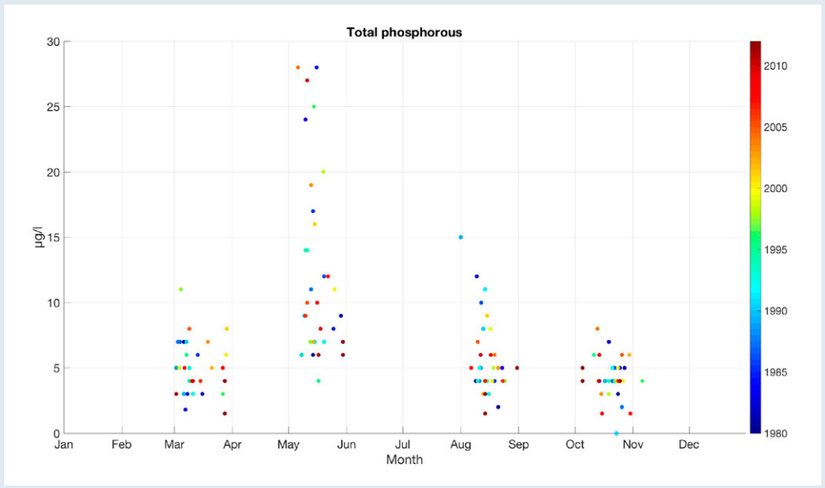


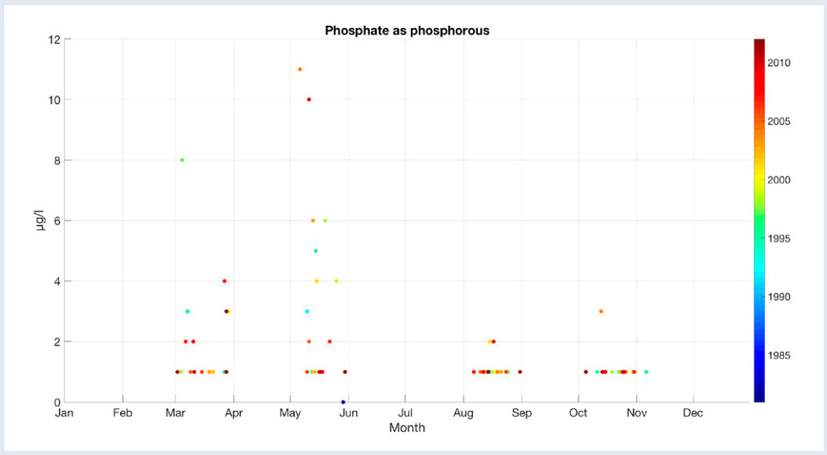










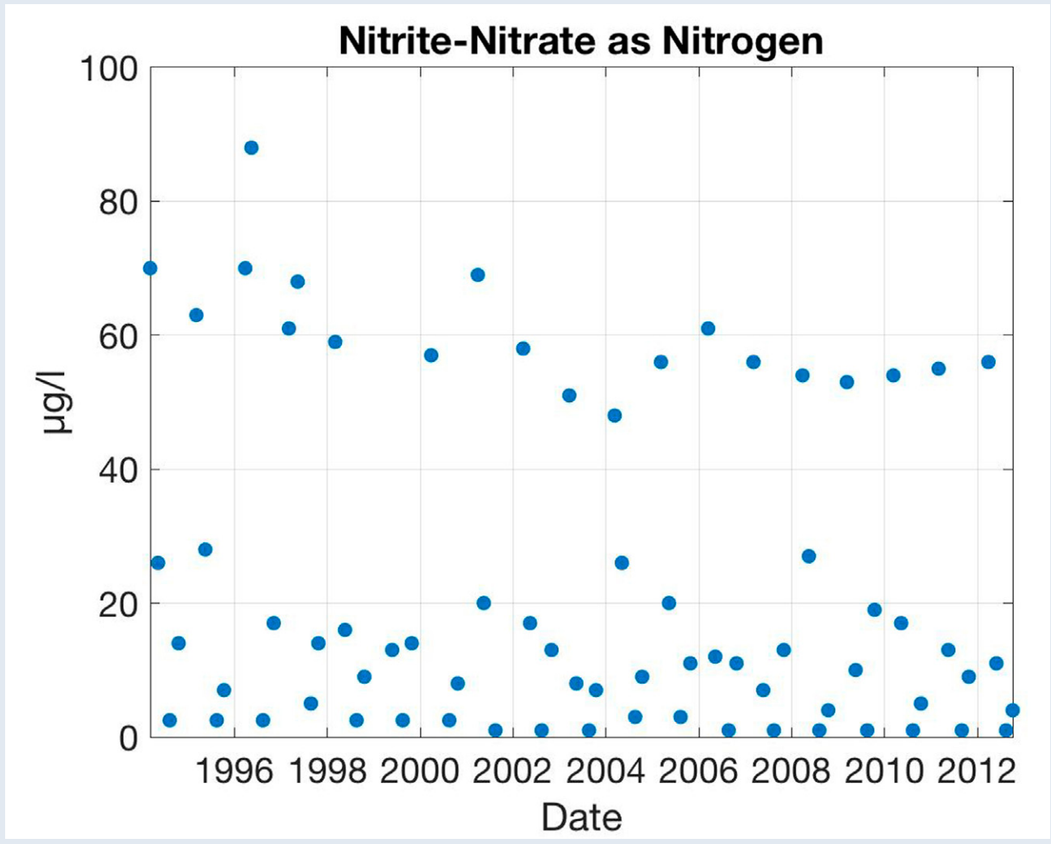


Aluminium (19-45 µg/l) are very low and harmless to various benthos and fish while individual peaking occurs in some years. These charts provide an overall view but future assessments will include cross-referencing and analysis of the impact of the spring peaking in the system.

Total amounts of **Phosporous** (2-27 µg/l), **Phosphate phosphorous** (1-10 µg/l) and **Nitrogen** (160-240 µg/l) are very low and around 30-40 % of national averages. Levels of oxygen are stable. Humus and organic matter are far below national averages.

Overall the following conclusions can be drawn from the data:

- Water levels of Näätämö have remained for the most part at an excellent level. The variation of water quality between 2010-2012 is quite modest, indicating no sudden changes. On the other hand of concern are the peak temperatures in 2018. Secondly the spring flood peaks especially for Iron and other metals will be further investigated in the future.
- To summarize the water quality of Näätämö watershed is premium with low human impacts.



Visual and Oral Histories of the Näätämö Basin
Lead Pauliina Feodoroff, insect section contains text written by Ph D Jaakko Pohjoismäki, University of Eastern Finland

The Skolt Sámi have pioneered a peer-reviewed method of monitoring ecosystem change that is called *visual history*. They can be defined as processes, descriptions, cultural texts, photos and other means of communication that refer to *events* observed by residents of a northern ecosystem that position, frame and interpret them using their own cultural concepts.

To frame a visual history in context, some examples can be used to illustrate how they manifest in their multiplicities. Rock art and pictographs of the northern societies are most likely the oldest forms of human visual histories. A success of the Skolt Sámi visual histories has been the detection of early presence of incoming insect species in the catchment area.

Insect communities can response rapidly to changes in local climatic conditions, providing a sensitive indicator of climate change. For example butterflies and moths, have witnessed an impressive expansion of southern species at the expense of montane and boreo alpine species all over Europe. In Finland, butterfly and moth species such *Aparatura* ilia and *Catocala fulminea* have expanded their range over 500 kilometers north in the last two decades.

In the co-management project work the Skolt Sámi reindeer herders and fishermen were equipped with digital cameras to document their observations during the field season. First of all, the strange or new observations are easily recorded in this way and the people can reflect on the observation themselves. For natural sciences, this has advantages too. Some conspicuous large insects, such as butterflies and some beetles can be reliably monitored also by non-specialists, enabling their use in local information collecting.

Migratory Painted Lady (Vanessa cardui) Photo: Eero Murtomäki

An example of such is the observation of *Potosia cuprea* scarabaeid beetle by Näätämö Skolt Sámi field team documented in the Summer 2012. This is the most northernmost record of this large beetle species in the Nordic countries. Similarly, local people are key observers of fluctuations in insect populations such as outbreaks of aphids or defoliating looper moth larvae.

Since the first applications of the visual history method it has widened and deepened to include moving images, i.e. the uses of participatory and Skolt Sámi digital video recording of change and events in the river system. These materials will be included in a “Living Maps” database due to be completed in 2020.

Seining on Näätämö in 1950s.
Snowchange historical photo archives.

One of the powerful visual histories, relayed here using oral history has to do with an account of a spawning moment of a salmon witnessed by an older Skolt: *"[Salmon chooses] a sandy or a gravel bottom for spawning. I have seen when they swim around during the spawning. If there is low water, you can see it. During floods you cannot. There needs to be some flow, it cannot be a still water. That is the spot which they choose. They move in, one fish at a time. It does not take too long for all of them to spawn in one place. First the big kojamo [male salmon] comes. Then the female fish starts to swim in. Big fish spawn first. Slowly they have travelled up the river. Others take their time, come later. It depends on when they have entered the river."*

Skolt Sámi feel they have a responsibility for the river and its health. Or as a 41-year-old man says: *"You cannot muck around on the river. The river used to be sacred before. You needed to thank her, if you received something."*

An oral history dialogue and exchange between elderly Skolt Sámi family members captures the river essence further:

Man: *"We never felt unsafe. It was especially my mother who always said that let us not yield, we have survived so far and we will survive through these times too[4]. This was prominent and shone from these older people – they always reaffirmed their belief in the survival of our people. Today there are not many people who have this kind of courage to believe that everything will be ok. A person needs to possess this internal trust that everything will manage somehow. Human needs to be also honest towards others and should not cause any harm. Everybody should learn to respect each other. This is how relationships will be solid and permanent – no other way."*

Woman: *"One of the things that the grandmother always did, especially when out net fishing was to thank the lake. Same for the picking of Arctic cloudberries – she always thanked the marsh."*

Man: *"I remember this Grandmother Anna saying, because I used to fish on the river with her. We discussed the salmon. She said that if salmon ceases to exist we would no longer be humans either. She was from a fishing family, including coastal and marine fisherfolk. A salmon fisherwoman. And she said we will die with the salmon if there is no more salmon arriving here. Therefore, we needed to harvest a few salmon to maintain this relationship. When grandmother got a salmon, she felt alive and proud to be able to still harvest the salmon. She would cease to exist when she cannot go to the river any more, she said. Then a human being ceases to exist. We'd say to the river: 'Spä'sseb ääkkas – thank you grandmother for giving us this fish."*

Man: *"The salmon has grown in the same manner as you, here, this is its home. The life of salmon has just been ranging over more wide areas than yours. Even though of course we do not know where you might go growing up and doing everything yourself. The salmon travels to the other side of the world in the ocean – all the way to the areas with warm waters. It is swimming and swimming and eating shrimp. Still she is longing towards the home stream, to make her own babies, towards the home stream. No matter how far out in the salty waters she might be, she still smells her home and heads towards it. There are big nets out in the open ocean, drift nets and fish traps and normal standing nets to avoid. Those are the kind of fishing gear it needs to navigate to get to the home fjord. Then she smells the home stream and starts to go up. Again there are nets and fishing rods, trying to capture her. If all goes well she can make it to the same place where she was born. This is how attached salmon is to her home. And humans are attached to the salmon. And therefore, you need to be aware when you are catching her of the difficulties she has passed to become our food. When the salmon have travelled so long on their way to the most important act, the spawning, we should no longer disturb them then. What you will eat, you can take but you cannot kill any more. It is another's spirit you ll take when you eat salmon."*

Pauliina Feodoroff, a Skolt Sámi leader and accomplished artist and playwright has worked as the coordinator of the co-management work for over a decade. She reflects on the work first with a quotation: *"A self-portrait is a representation of an artist that is drawn, painted, photographed, or sculpted by that artist. Although self-portraits have been made since the earliest times, it is not until the Early Renaissance in the mid-15th century that artists can be frequently identified depicting themselves as either the main subject, or as important characters in their work."*

She continues: *"The colonial processes imposed to those young graylings and their habitats are doings of my own kind, the humankind. [At the advent of the ecological restoration of lost streams and] realizing the abovementioned, my self-image bends, reshapes and at least the possibility for a new alliance, new continuation with balanced relationships with the grayling is born."*

Pauliina Feodoroff, a Skolt Sámi leader, documenting seining on lake Sevettijärvi, 2014. Photo: Chris McNeave

[4] Modern times

Climate Action: Ecological Restoration of Vainosjoki and Kirakkakoski 2018
Lead Tero Mustonen

The Vainosjoki river restoration project began in Summer 2017. It is funded by Kone foundation but closely related to the monitoring work. A team of around ten Skolt Sámi together with a restoration consultant and Snowchange manually restored the flow of the river by relocating rocks and boulders in the river.

Afterwards spawning gravel was distributed at suited locations. The restoration work covering all of the length of the Vainosjoki area will continue into 2019. Already the restoration project has showed the first indicators of success, when in early October 2017 an approximately three-kilogram lake trout was seen potentially spawning and residing in the "new" area.

The restoration measures are something the local people have hoped for many years. In the 1960s, the Finnish Forestry Agency, Metsähallitus widened part of the river channels in the catchment area using explosives.

One of these areas was the Vainosjoki sub-catchment area. The alterations of the river flow had a drastic impact on an area which lost its suitable spawning grounds. This had effects on the culture of the Skolt Sámi, who through millennia have fished as part of their culture and subsistence.

In 2015–17 baseline information (in cooperation with scientists) from the co-management work led to the ecological restoration of those spawning areas and habitats that had been altered by the state in the post-war context. These sites can be seen as cultural indicators of resilience. They have also proven the first "real" physical changes for the better in the Näätämö basin by following the method and persistence of a co-management actions.

Unfortunately, while this has motivated the Skolts for the work and produced concrete results, this has not translated, as of yet, to a reform or a serious transformation of those state agencies and officials who form the power levels of river governance.

Ecological restoration of habitats and mitigation of past damages from the 1950-80 time period are difficult issues for these agencies, as they challenge the 'pristine wilderness' narrative of the basin and provide a socio-historical baseline of habitat alterations, including the hydropower development and diversion of the stream flow of the Kallojoki river on the Norwegian side.

Sámi-restored spawning areas of Kirakkakoski (left) and Vainosjoki (right). Snowchange

Geographical Overview of Ponoi Basin:

Ponoi is the largest river of the Kola Peninsula and its total length is about 425 kilometers. It is one of the four rivers in Murmansk Region that are over two hundred kilometers long[5]. The average annual flow is 175 m^3/s.

[5] Ponoi is 425,7 km, Varguza is 262, Strel'na is 213 and Iokan'ga is 202,7 km.

Total area of the watershed is around 15467 km^2.[6] The Ponoi river begins on the western branches of Keiv and flows into the White Sea. The river basin occupies the central part of the eastern half of the Kola Peninsula. More than one fifth of the Ponoi basin is covered by mixed forest, where coniferous trees dominate.

[6] Ponoi is therefore the third largest watershed on the Kola Peninsula after Kovda river [26000 km^2] and Tuuloma river [18000 km^2].

The Ponoi basin may be divided into three parts:

1. Upstream region (211 kilometers from river mouth) consisting mostly of wetland, covered by sparse wood.
2. Middle course of the river (from 211 to hundred kilometers from the mouth) where river flows into stone plateau and forms a valley.
3. Downstream, where the river cuts into the crystalline rocks and its valley looks like canyon. For about seventy-five kilometers the Ponoi flows in the tundra zone.

Intact marshmires of central Kola Peninsula, close to Lovozero.
Snowchange

Aerial view of river Ponoi, summer 2018 and a traditional boat on Ponoi. Snowchange

The width of the Ponoi in the lower reaches at certain places is more than two hundred metres. There are more than 2400 small rivers and tributaries all over the Ponoi watershed which vary in size. Their total length makes up more than 8000 kilometers. The largest tributary of the Ponoi is the Purnach river. It flows into the Ponoi from the southern bank at the distance of 75,7 kilometers from river mouth. The length of the Purnach is 136 kilometers. Other large tributaries are Melnichnyi, Loperyanka, Tomba, Kolmak, Acheryok, Yokonga, Lebyajyi, Sukhaya, Kinemur, Krivaya, Eljok, Kuksha, Elnjok, Kojnjok and Pessarjok. These toponyms reflect a rich history of Eastern Sámi language and presence along the watershed as a part of their seasonal rounds.

Team Members Included in the Work: 18

The Ponoi river and its catchment area are of great ecological and cultural value in Northern Europe. The villages of Krasnochelye and Kanevka are the last “roadless” communities in the Murmansk region. Ponoi river is also important for its rich biodiversity and cultural heritage – the Sámi, Komi, Pomor and Russian cultures meet in these villages. In our project we have included Sosnovka as well to make sure the coastal voices and the remote White Sea situation is a part of the regional assessment.

Northern climate change has emerged as a reality in many of the parts of the Arctic. It is affecting both nature and humans. This year in our work in Ponoi we selected key people and teams who worked with scientists to observe and recount changes to Ponoi, nature, fish, and weather. Their voices are anonymous to preserve neutrality of the observations.

The summer was the hottest on record in many places so it was very timely to focus on the climate impacts. These traditional knowledge materials are then put to a dialogue with science measurements and archive materials to receive a better view of the situation on Ponoi.

These village summaries represent only the most urgent messages and are only a tip of the iceberg of the documented materials.

Results and Voices from Krasnochelye, “Capital of Ponoi”

Krasnoshchelye is the largest inhabited settlement on the Ponoi River. The name of the village Krasnoshchelye can be translated as *“Red shore”* from Komi language. The settlement is located 150 kilometers from Lovozero. One can get to it by air transport (helicopter once a week), and in winter time there is an opportunity to come on a snowmobile or an all-terrain vehicle by the winter road (ice-crossing on the lake Lovozero).

Krasnoshchelye has new kindergarten, three shops, a post office, a branch of the Savings Bank of Russia, a weather station, an ethno-cultural centre, a library, a museum and a “Komi hut”. A new church is being built. There is a small stadium and a hockey rink in the village. Some medical services are available - there’s a paramedic and midwife station and a small pharmacy. In 2019 a new hospital will be constructed. It is still unclear if a new school building will be built in nearby future. Nowadays pupils study in the old school building, which is in very poor condition.

Weather defines all life in the remote villages. This includes also the Ponoi river water levels. One local person had observed that *“before in the spring flood the water rose all the way to the high banks of the Ponoi river. Now we do not have that any more. The spring floods are lesser and in the summer water levels drop dramatically.”*

New church is being constructed to Krasnochelye (top).
Sheep are central to autonomous lifestyles in the wilderness villages (middle). Snowchange
Seasonal hay is collected along Ponoi (summer 2018). Snowchange
Wagtail (top right). Photo: Eero Murtomäki
Ponoi river (below right): Snowchange

Raven and White-tailed eagle. Photo: Eero Murtomäki

Whooper svan. Photo: Eero Murtomäki

According to traditional knowledge observations the number of birds has decreased very much in comparison with the amounts that existed 10-15 years ago, especially among wood grouses and partridges. Usually observed birds close to the community are crows, different ducks, swans, gulls, waders, sandpiper, tits, ptarmigans and hazel hens[7], capercaillie, geese, cranes, wagtail, eagle owl, falcons and the white-tailed eagle. Culturally important is also the Siberian jay (Perisoreus infaustus). One of the local knowledge holders reported that:

"As for birds, I have seen white-tailed eagles in the area between lakes Kalvanozero and Shomes'ozero (Kisloe). There are a lot of swans, ducks, nettas (diving ducks) on those two lakes. In May, near the village one can see wood grouses, wood grouses are not afraid of people, wood grouses come very close to houses".

[7] Local people summarize often ptarmigans, hazel hens and other lesser forest chicken birds using similar terminologies.

Otter. Photo: Heikki Willamo

Close proximity of the grouses to the settlement may be a factor in their losses due to hunting.

The wild reindeer has almost disappeared, or rather it was killed by hunters on snowmobiles and helicopters. Moose is a rarity in forests of Krasnoshchelye. They go away from people to "distant tundra".

These observations brought to light a long-term trend in the region – the poaching of game animals, especially large mammals. This topic has been discussed also with the local administration and the reindeer cooperatives.

In Summer 2018 new information was received regarding the beavers. They were brought to Krasnoshchelye area in 1950s. Beavers did not survive, because local trees were "too solid for them" according to one villager.

In the past there were a lot of otters in local rivers. Otter fur was very popular, and a lot of otters were killed every year. Otter fur was used to make winter hats. In the beginning of 1990s, otter numbers decreased a lot. But later on it became less popular to wear winter hats made of otter fur. The number of otters started to grow. Lately, one can seldom see an otter in local rivers. Local observers stressed a potential disease as a main cause of the recent demise in otter numbers.

Willow ptarmigan. Photo: Eero Murtomäki

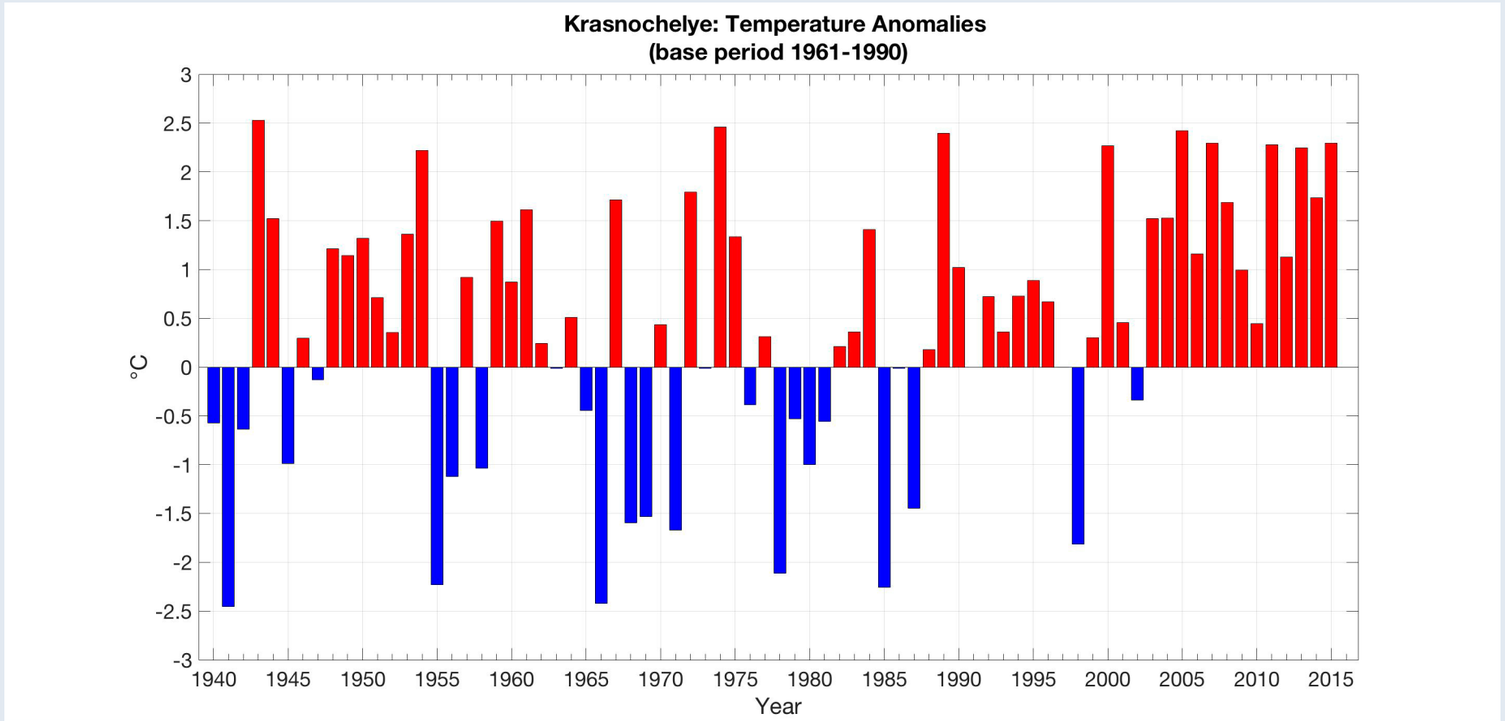
All local observers consider the summer of 2018 to be anomalously hot. The water level of the river fell to historic lows. Boat traffic from Krasnoshchelye down the river at the distance of 15 kilometers was very difficult due to the strong sandy shoals, shaped by the river.

Overall people observed that the Ponoi river ice became thinner and the ice breaks down due to frequent changes in weather conditions. Ice drift starts unpredictably, but one cannot say that time gap differs very much from year to year. Usually it starts in May, sometimes earlier, sometimes later.

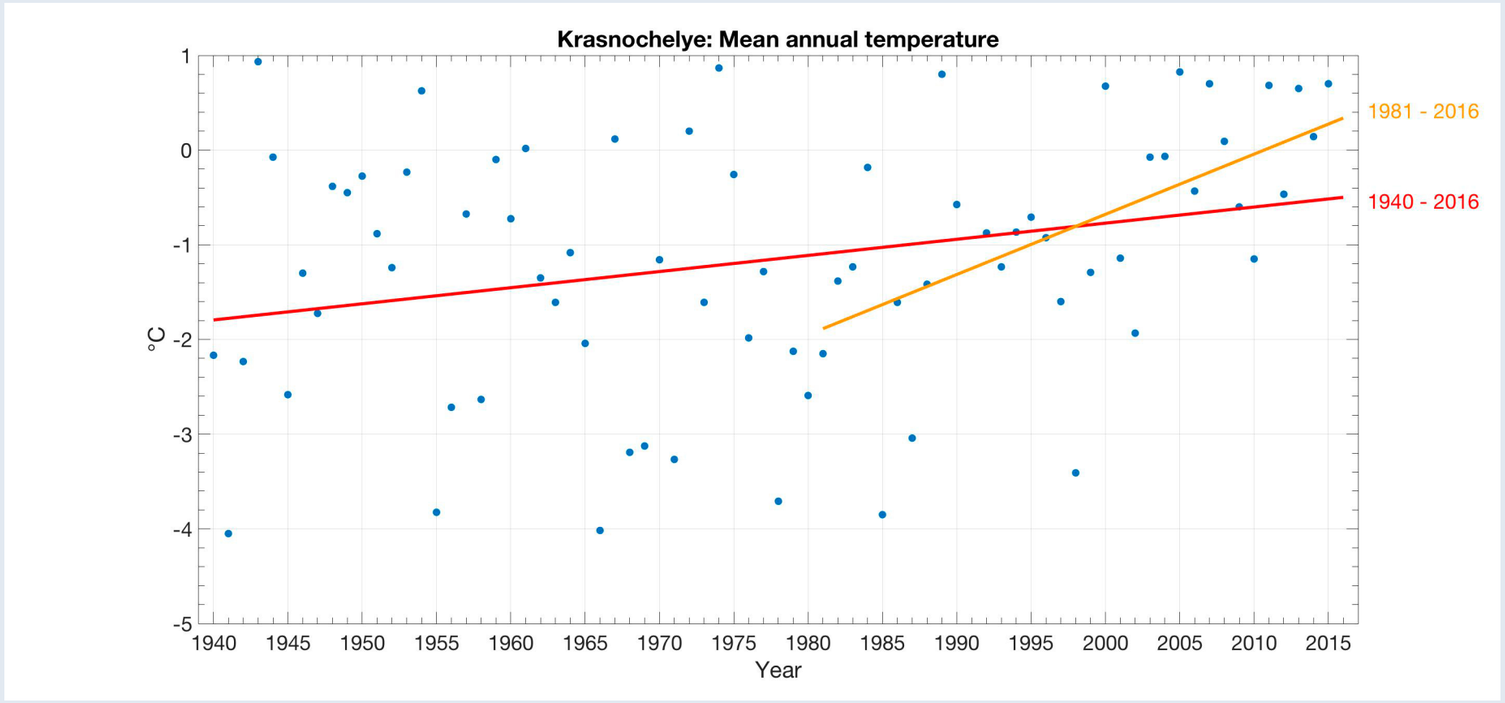
Water fills the river and throws ice on the marshmires and swamps. Ice jams takes places, but jams do not cause any danger to the village. Occasionally the colour of the river water changes. In the late 1980s Russian scientists were invited to investigate this phenomenon. Exact results of this survey are unknown.

One villager has kept very precise diaries of the Ponoi freeze-up over the past decade:

4.11.07	Ice sludge on Ponoi
5.11.08	River freezing-over
30.10.09	River freezing-over.
6.11.10	River freezing-over.
14.11.11	River freezing-over.
27.10.12	River freezing-over.
18.10.13	River freezing-over.
16.10.14	River freezing-over.
8.11.15	River freezing-over.
5.11.16	River freezing-over.
1.11.17	River freezing-over.



For trends years 1981-2016 we have used this time period because it's been used to describe a rise in temperature trend in the Arctic (for example in Comiso et al 2014, Climate trends in the Arctic as observed from space).



We can see from this personal record that the earliest date of freezing has been 16th October in 2014 and the latest 8th November, 2015, meaning almost three weeks of fluctuations. This villager also noted that climate has changed. This person feels noticeable warming. Winters are shorter, spring comes earlier. The river freezes later. The quality of the water has not changed, the water in the river is of good quality, one can drink water from the river according to this observer.

Other traditional knowledge observations regarding fish and river for example included:

- *"Water of Ponoi river is the same as it has been, but it is becoming dirtier. Salmon is not as plentiful as it used to be, especially up in those streams where they spawn."*

- *"In the tundra there are lakes where the whitefish is very sick. It has parasites and small worms."*

- *"There is whitefish in the river and in the lakes of the Ponoi catchment. But local population does not have permission to catch whitefish in lakes. According to them if whitefish is not caught, whitefish begins to get sick. There is fish with injured insides - white worms as in the eggs, capsules on the liver of whitefish as well as burbot liver: "We eat sick fish, but we throw out insides, mostly we fry or boil fish."*

During the Soviet time, Pacific Salmon species of Pink Salmon *(Oncorhynchus gorbuscha)* was introduced to the White and Barents Seas. They have rapidly expanded in range and found new spawning areas. According to local fishermen they used to come up the river every three-four years but now in 2018 they appear "yearly".

One Sámi grandmother conveyed the cultural importance of varied species of fish locals have enjoyed as traditional food:

- *"I cannot live without fish! My favourite one is ide, it is very delicious fish. Very often I make cutlets made of ide, I add several eggs, breadcrumbs. For a long winter I freeze berries. I grow potatoes. I used to sew burki (Sámi boot made from reindeer fur). I sold ones and that was rather good income for me. Now there's no demand for this type of shoes. People buy it very seldom".*

Dried northern pike (left)
and dried perch (right). Snowchange

During the work in Krasnoshchelye one person recounted village experiences of how things have changed since 1970:

- *"Everything is now being assimilated with civilization. Our hey-day in the village was from 1970, perhaps from 1975 to 1985. Then we used to have everything in this village, except a television. I remember when the first satellite dishes were installed in 1983. In my opinion we did not need this television. Each home had radios, radio receivers already. People would communicate with each other then. In the summer we could play volleyball to 4 am each morning. Then we would go to swim in the river and we'd be off to sleep. In the morning mother would give us a ladle of water then we would go to work. We used to be healthier and happier then. But what about now? All the young people are sitting with the keyboard and a mouse. They appear to be tough guys. In fact, when they go berry picking they will get lost. Everything has transformed, for the worse."*

Summarizing the results of the observations from the 2018 work in Krasnoshchelye:

- **Life in Krasnoshchelye** becomes more comfortable, but the traditional way of life is being preserved. Troubles persist in the traditional trades of reindeer herding and fisheries – they fail to attract young people.
- **Climate change** is noticeable, climate warming affects the freeze-up and high water of the river. The weather is less predictable. The summer of 2018 was anomalously hot with three weeks without any rains and temperatures soaring up to +34 C. Forest fires burned close to the village. People remember swimming across the Ponoi still in 1960s but now residents can walk across in the summer.
- **Overall health and water quality** in the Ponoi River do not cause alarm even though past events, such as a 1968 diesel spill are remembered. Amongst next actions will be to compile a historical list of pollution events based on oral histories.
- **The number of salmon** has decreased due to the impact of tourist camps. Salmon population is affected not only by pollution and jet streams of water from motor boats, but salmon are also stressed by the fishing method called “catch-release”. This year salmon fishing season was rather unsuccessful. Some locals remember a science team from late Soviet period warning that there should be “six times more young salmon close to the spawning areas” than there were in 1980s.
- **Other fish** is getting sick more often in lakes than in the river. Pike and perch populations in rivers are in sufficient quantities and of excellent quality. Much like on Näätämö basin, burbot and whitefish in 90% are affected by diseases - parasites in the liver, white worms.
- **Unreasonable fishing** rules are pushing residents of Krasnoshchelye to poach. Therefore, the people felt that it is necessary to allow to catch fish by nets for personal use. Villagers had addressed this issue earlier to the Governor, but the Ministry of Agriculture and Fisheries of the Murmansk region responded that still there is no federal law, according to which it could be done. In order to improve the ecological situation and preserve the traditional nature management it is important to take following actions:
    1. It is necessary to allow local residents to catch fish by nets for private purposes and make hunting available (to issue hunting licenses directly in the village).
    2. Young generation has to be attracted to come back to the village after getting education. To do so, it is necessary to increase the number of jobs. For example, to make the process of obtaining land for the construction of private houses easier, to build a new school, to improve transport connection (by helicopter - twice or thrice a week) and to improve the quality of mobile communications and make the Internet available.
    3. Collection of past traditional knowledge and cultural heritage of Sámi, Komi and other peoples should happen soon because many knowledge holders are getting older

This aerial photo from the Ponoi catchment indicates a site where iron is being released to the stream from the soil and nearby-mire. It has colored the stream red. Snowchange

Chalme-Varre is one of the most remote wilderness communities on Kola Peninsula. Grandmother Luba lives there seasonally. The site is important both for the Komi and the Sámi. Northern pike was sampled and monitored to track anomalies and parasites on this part of Ponoi in the summer work. Snowchange

Kanevka Village Reflects Rich Komi Heritage

Permanent residents of Kanevka village are mostly pensioners. The average age is about 55-65 years. Young people and children come to the village only in the summer time. There is no school, kindergarten or a hospital in the village, which, according to local residents, is the main problem as one local observer puts it:

"I like living here very much, because the nature is primeval here. There is no cellular telecommunication and Internet. There are no cars here. The nature is very beautiful and the air is pure. It's peaceful and wonderful here. There are some difficulties though, of social and infrastructural nature. There is lack of stores. There is no clubhouse."

There were a lot of people in the village before but a lot of people have died now. Some new people have moved in. The population is smaller now than before. Communications with the municipal centre are hard as the plane tickets are expensive. Overall people thought the village is fading out.

Kanevka is rich in fishing traditions, for example seining used to be practiced in the community. Today only one person has a seine, but it is no longer used. Fishing with seine nets was conducted only in one place - the mouth of the river Kolmak. Traditional knowledge of the river and observations of changes are building on many generations of living with Ponoi.

According to local observations there is not so much of white fish near Kanevka, mostly locals catch grayling, less common are perch, pike and burbot. According to local residents, the number of pike has markedly increased. This in their opinion threatens the young salmon fish spawning, as pike eats salmon roe, young salmon and smolts. They say that the whitefish has many parasites in lakes. There is lots of whitefish, but it is all suffering from this condition.

The wilderness villages of Kola, such as Kanevka and Sosnovka are places of rich local culture and sustainable lifestyles. A knowledge holder tends to his garden (above) and the next generation of fishermen is soon going on Ponoi (below). Snowchange

Village people had observed an increase of number of birds, such as geese and swans. Unlike Krasnoshchelye fisheries, the Kanevka salmon season went well according to locals. This year there are more fish in the river. In a deviating observation from upstream this may be a result of a perception due to the fact that this year there was less water in the river due to the hot summer.

Changes in Ponoi have been observed also in Kanevka. According to local observations local observations the river freezes later. The river can still be open in December. This year the river downstream, below the Kolmak river, froze over only in January-February. In the last few years the river thawed already in April. Before ice melt used to be at the end of May, around the 26-28th. Four or five years ago the river thawed in the beginning of April. Last year it thawed as usual, in the end of May.

One special event has been registered by the locals associated with the spring melt and ice flowing down from the Yokanga river at Kanevka:

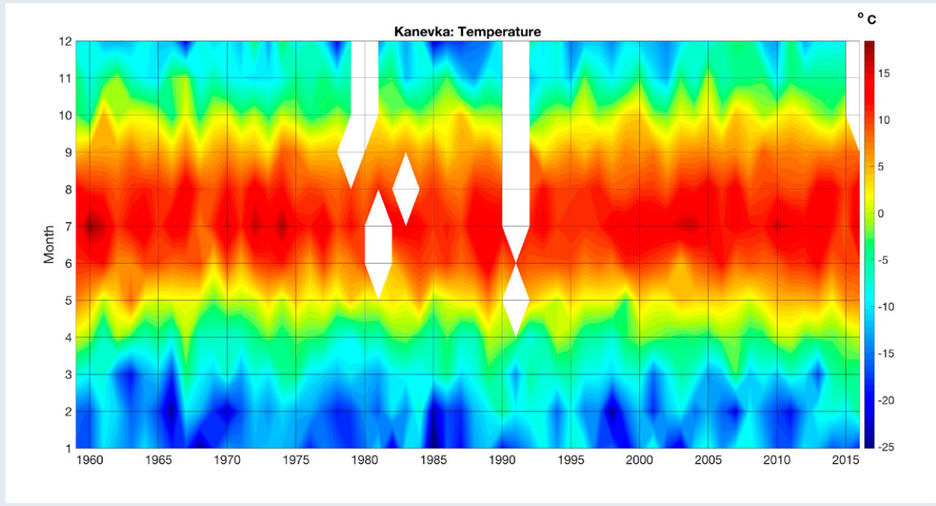
"The ice drift can of course take down the hanging bridge, as it did before and latest maybe 6-7 years ago. The ice started melting down suddenly, the temperature was +20C for almost three days. The ice drift was so strong that it took down the bridge."

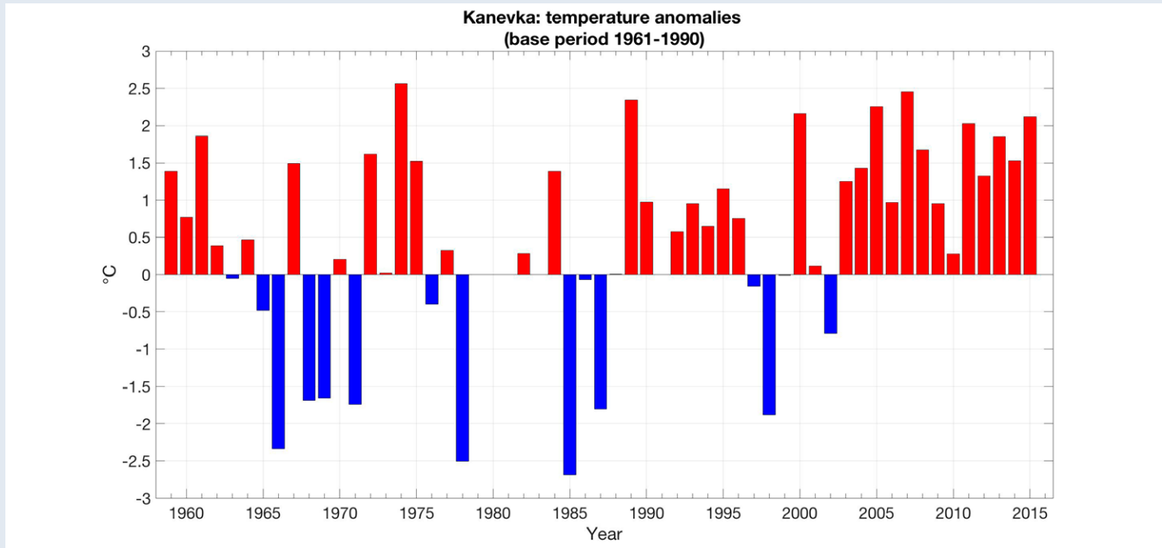
Summarizing local observations and wishes from Kanevka the following points emerged:

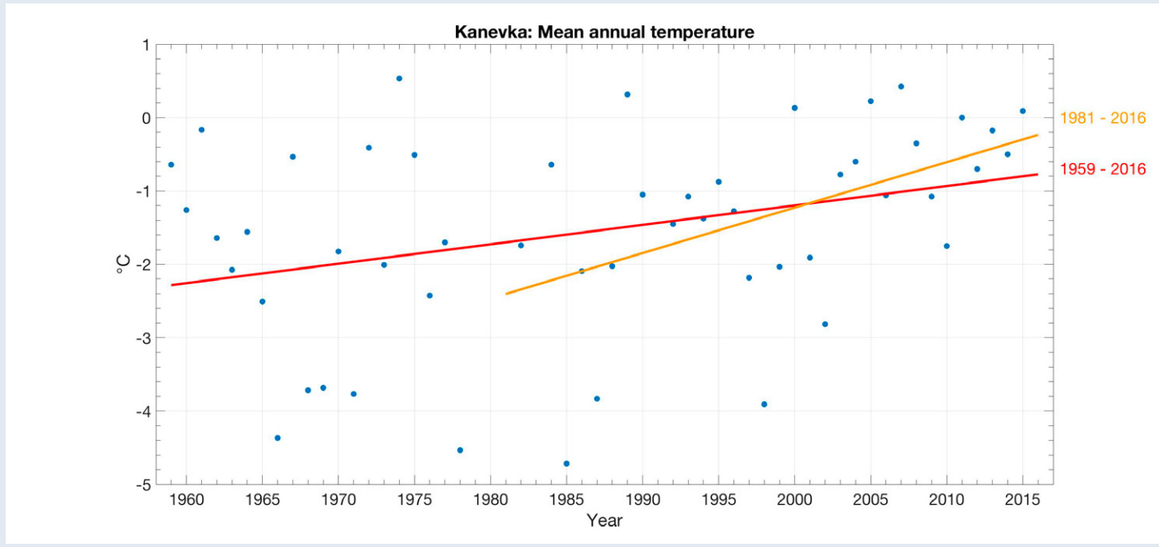
- **Local observations** confirm that the river freeze-up and thaw have shifted considerably in recent years. This has been associated with special events, such as destruction of the bridge connecting the different parts of the village.
- **There are increases** in some bird species such as swans and geese.
- **Local community** has some customary restrictions on salmon. Spawning fish will not be harvested. Atlantic salmon is a key strategic resource in the region due to tourist camps and local people are often excluded from these opportunities. Therefore, salmon is a delicate topic. Traditional knowledge results also convey that salmon has its own cycles, a four year cycle and a seven year cycle. Pink salmon *(Oncorhynchus gorbuscha)* expansion also affects the Atlantic salmon amounts. Pinks die after spawning and locals have observed dead fish for kilometres from Kanevka pointing to radical expansion in ranges and numbers of the introduced fish.
- **As in Krasnoshchelye** the local people have detected parasites in the local whitefish stocks. Grayling stocks are in danger due to impacts from tourist fishery.
- **The local village fishing** area should be expanded, because it is not big enough, it should be expanded towards upstream a little.
- **Youth would** probably stay better in the community if there was a club. One local person said: “The fishing, berries and mushrooms are not enough. If a young family has kids, they need a kindergarten, a school, a job. There’s no job here.”
- **It would be good** to get a first-aid post to Kanevka.
- **Prices** in the store should lower.

The local people summarized their opinions by saying:

“We would like to keep the river full of fish for our children, just like our parents had kept it for us!”







The hanging bridge of Kanevka (top left).
Photo: Snowchange
Stoneflies or plecoptera on snow (top right).
Photo: Eero Murtomäki
The cranes signal the arrival of spring (bottom).
Photo: Eero Murtomäki

Coastal Sosnovka By the Sea

Sosnovka is the most remote settlement of the Murmansk region. It is located on the southern shores of the peninsula, by the White Sea Coast. Historically it was the meeting place for the Pomor (Russian) traders and inland Sámi peoples.

There are no roads to Sosnovka. The main transport link of the village with other settlements of Murmansk region is a helicopter service. These days about twenty people live in the village permanently, and almost all of them are over forty years old Many are already retired. Back in the early 1990s more than a hundred people used to live in Sosnovka. The village had a kindergarten, a school, a medical assistant station. Locals used to work in the fishing and reindeer-herding brigades.

Each arrival of a helicopter is a rather big event for the villagers, because this is the main way they can receive vital goods and products. Arrival of the helicopter is also one of very few events when one can see almost all the villagers in one place at once.

Despite a small number of residents of the village of Sosnovka (in the autumn - winter - spring time no more than twenty people), people live quite apart.

Many of the local observers indicated that the main problem is a ban on salmon fishing. And since the fishing is one of the few ways to ensure one's existence in this remote village, the ban forces locals to become poachers.

Another serious problem is also the lack of work and, as a consequence, the unwillingness of young people to stay in the village. As a problem, residents noted the closure of a medical assistant's station, and thus the inability to receive qualified medical care. As well the closure of the local house of culture had diminished services.

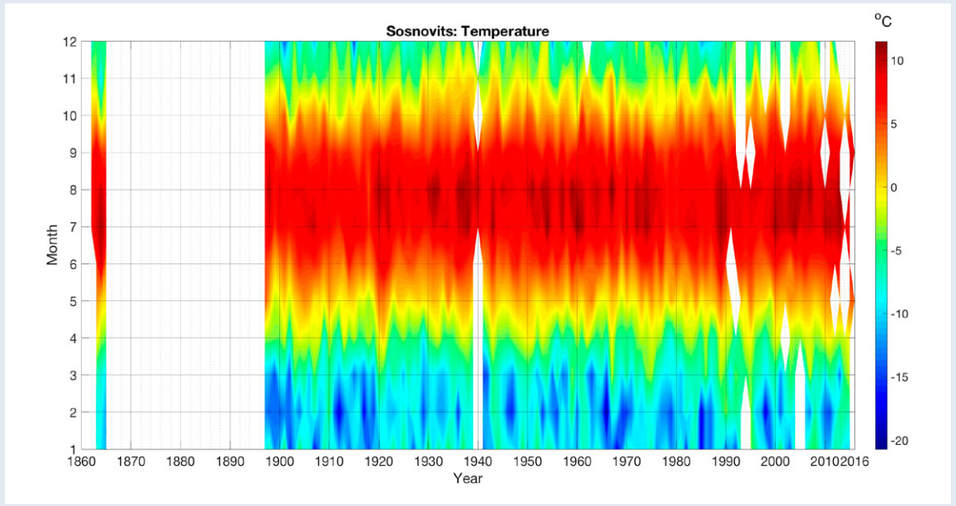
Tidal variation on the coast of Sosnovka.

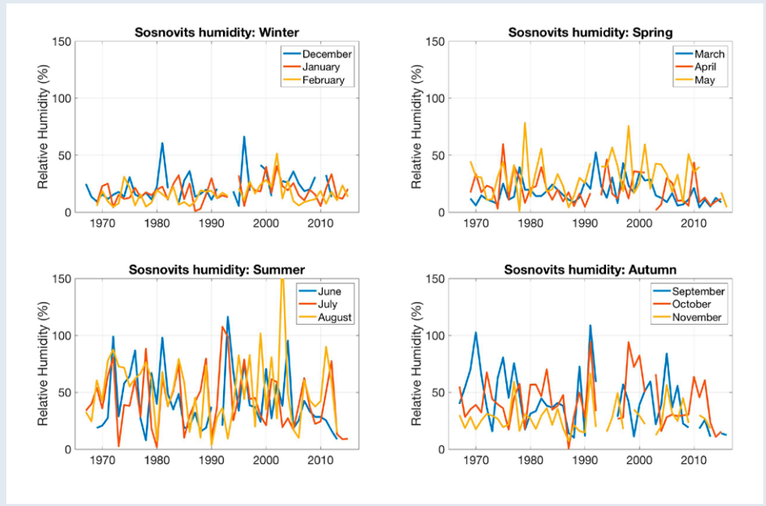
Main Observations from the Shore

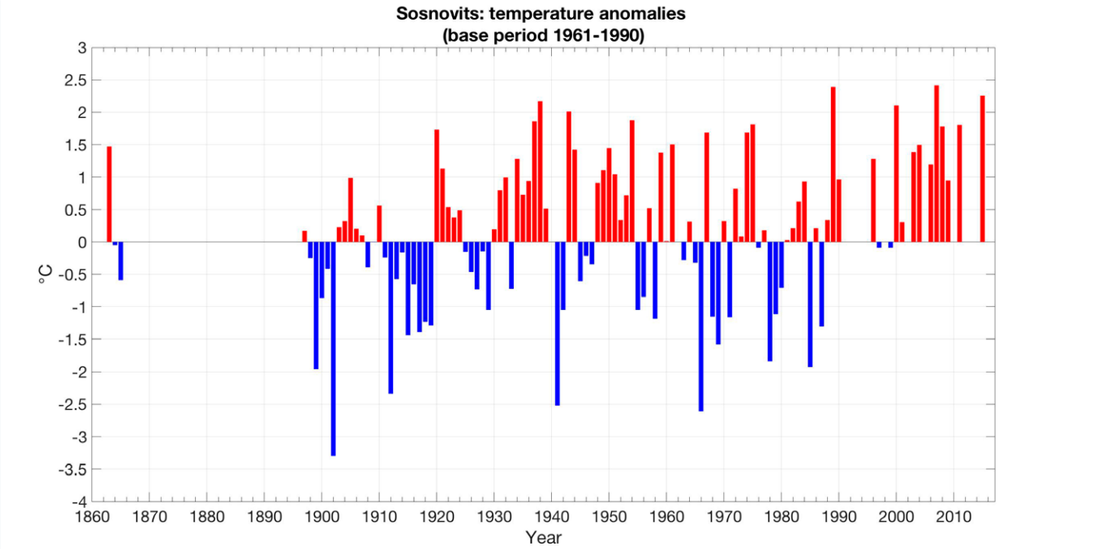
Summer 2018 work focused both on the coastal and terrestrial ecosystem changes and weather as well as the Sosnovka river health. All respondents noted that even in Sosnovka, despite of its close proximity to the cold White and Barents seas, it was unusually hot - up to plus 30 Celsius. This weather strongly influenced the water level in the Sosnovka River, as well as its colour.

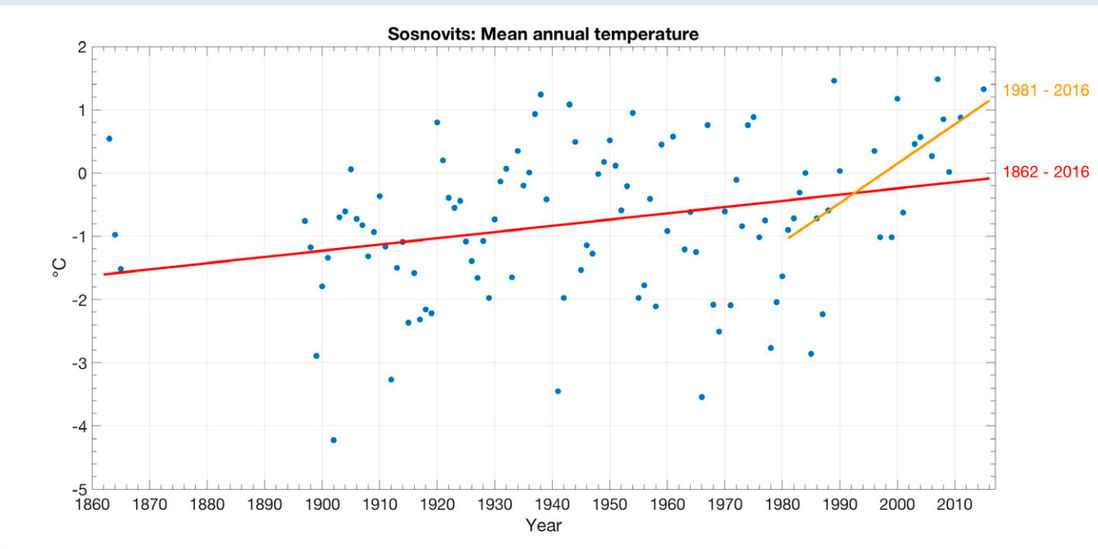
Respondents made an observation and noted that the river had become much shallower, the water became darker, and the stony bottom was heavily covered with algae, mud and silt. According to one of the respondents, this had a significant effect on the attractiveness of the river for fish. According to the respondent, the quantity of fish entering the river significantly decreased. The reason for this was the too high water temperature, low water level and river bottom covered with algae, mud and silt. Interestingly one person noted that there is an occasional slight decrease in the water level in the Sosnovka River, but the reason for this is unknown to him.

Because of this years abnormally high temperatures, all small reservoirs in the vicinity of Sosnovka dried up. Even some swamps around Sosnovka have dried up. The dry summer and lack of rain caused a forest fire near the village. Almost every resident of Sosnovka and even those who came to visit the village took part in extinguishing the fire. All in all it took them two days to put it out.









Fishing at the sea

Overall observation was that the hot weather did not infuence the amount of catches at sea. The quantity of cod and navaga *(Eleginus nawaga)* was the same as in previous years. According to one knowledgeable fisherman, who also participated in filling out the detailed observation forms, fish is healthy and well-nourished. He also noted only two isolated cases, when he caught two apparently sick specimens of navaga, which had “too light skin” colour and and suffered from exhaustion.

Salmon is caught at the sea and as usual at this time of year. One person noted that in this summer period it very hard to catch salmon in rivers, because the fish doesn’t go into rivers. The time when salmon starts to go up the rivers begins immediately after the ice breaks down and lasts for about two to three weeks, and in the autumn until rivers freeze-up.

The monitoring efforts included coastal and on shore fisheries. Local fishermen were able to report their observations using the PISUNA forms and oral histories (left). Coastal fish traps provide flounder and *navaga*, a delicacy of the White Sea. Snowchange

View from Sosnovich Island

Local observations were collected also on the Sosnovich Island which is off-shore from the village itself. The island views benefitted from a temperature record reaching back to 1863. In summary residents had never before seen such a hot summer. At the same time, observations of the water temperature in the sea showed that the water temperature in summer did not exceed the indications of previous years. In the recent years the winter time water temperature has increased, and the five-kilometer strait between the island and the mainland has not been covered with ice. Recently locals observed beluga whales *(Delphinapterus leucas)* nearby the island. This had never happened in the past.

View of the Sosnovich Island (top left). While Sosnovka and the near-by Sosnovich Island have suffered from out-migration, summer brings relatives and seasonal visitors to the remote community. Snowchange

Lahya or **Larisa Pavlovna Saksa** was born in 1936. Her father was a Finn-Ingrian. She had a Russian mother. In 1985 she moved from the Tula region to the Kola Peninsula and settled in the village of Umba. Later on she moved to a place called Lakhta/Lahti.

For many years, until closing, she used to work there in a collective farm. Fishery brigade of the community caught and processed salmon in the mouth of the Ponoi River. After the brigade was dismissed, the village was abandoned.

Since 2011 Lahya Pavlovna has been coming to this abandoned village every summer and spends there all summer long, despite the fact that no one has lived in Lakhta for a long time.

According to Lahya Saksa, she considers the work and the time spent in Lakhta to be the best years of her life. Therefore, in spite of she's 82-year-old grandmother, she comes to the place every summer for the last few years, where, according to Lahya Saksa, she gains strength to survive the winter time. Lahya Pavlovna is going to come to Lakhta every year until she'll be able to do it, in other words - until the day she pass away...

Snowchange

Thickness of permafrost

In some Northern regions like Kola Peninsula or Yakutia, people observe a decrease in the thickness of the permafrost layer[8]. Two years ago a local person dug a well about eight meters deep, and he claims that there is no permafrost in the place where the village of Sosnovka is located.

Very stony soil and numerous underground streams do not allow it to be formed. Another respondent used to install power and telephone lines poles in Sosnovka and along Ponoi River. One observer says that even in a very warm summer, swamp peat used to be heated no more than 30 centimeters depth and then permafrost was visible. This local man believes the situation has not changed much today, but he is unsure whether is observations are valid scientifically.

[8] Technically the continous permafrost does not exist on Kola Peninsula. Discontinuous permafrost is present in palsa marshmires both in Finnish and Russian North.

Arctic cloudberries are central to the local economy on the wilderness areas of Kola Peninsula. Snowchange

We can summarize some of the key findings into a summary below:

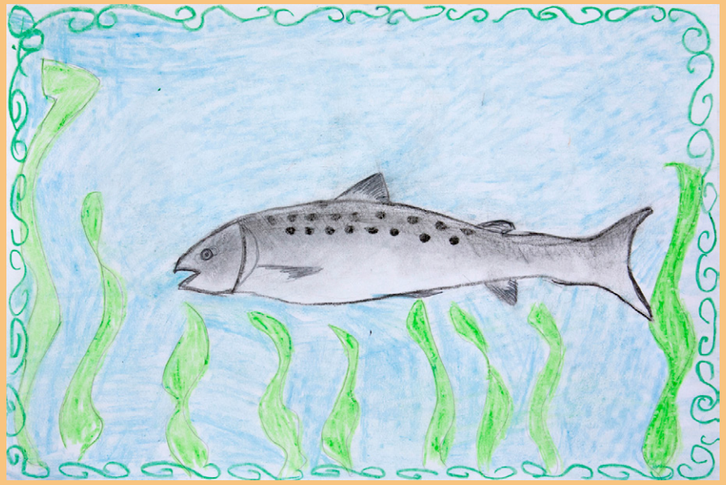
- **The thickness** of ice depends on weather conditions and temperatures. It was noted that the winters have become warmer and the ice, consequently, is thinner.
- **Ice breaks** down at different times each year due to weather conditions, depending on how soon the warm spring comes. (early spring or late spring)
- **Since the winters** have become warmer and the ice is thinner, for the last five years the spring floods and associated ice jams no longer represent any threat to the village. The banks of the river are quite high, and the village itself is high above sea level. Most residents do not consider ice jams dangerous for the village.
- **Interviewed villagers** did not notice any clearly disturbing observations regarding the state of water in the river and the coastal waters of the White Sea. A special observation was a set of 'yellow', burned stripes on the ground close to Sosnovka. On these yellow spots "nothing grows". Some locals pointed to the rocket parts that had fallen to the ground from space.
- **Questions that concerned** the quality of fish, salmon in particular, made people think. Respondents noted that in recent years the salmon has become slightly smaller in size, and the quantity of fish has also decreased. Pink salmon (*Oncorhynchus gorbuscha)* is expanding in number and in range.
- **Changes** in and around Sosnovka were very pronounced. Local people suffered from the drought affecting water sources. The fires burning close to the village were a stark reminder of the risks associated with extreme temperatures.
- **One person recording** the weather carefully informed that he had never seen such a hot summer. At the same time, observations of the water temperature in the sea showed that summer measurements did not exceed the indications of previous years. On the other hand in recent years the winter time water temperature has increased, and the five-kilometer strait between the Sosnovich island and mainland has not been covered with ice.

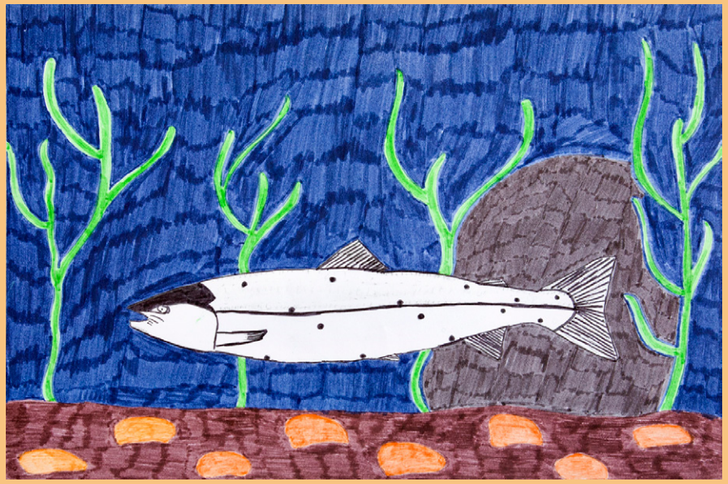
Views of the Sosnovka river and water levels. Snowchange

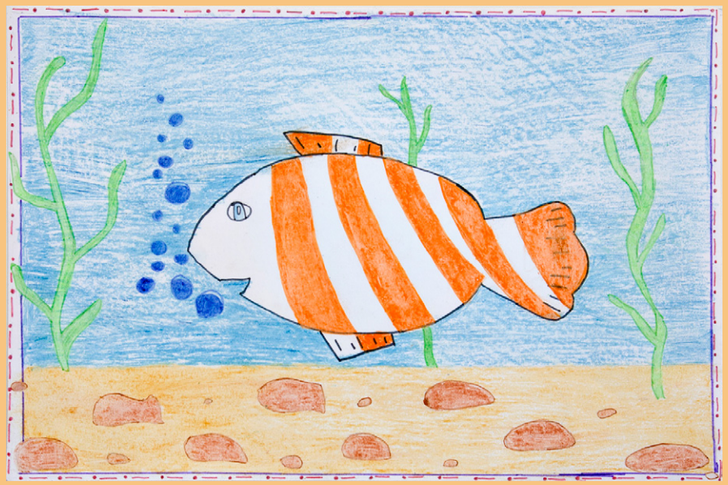
Children Painting the Future of Ponoi

As a part of the community work regarding the Ponoi the school of Krasnoshchelye painted various fish and underwater life to convey the importance of nature to younger generations.

School of Krasnoshchelye children portrayed the Atlantic salmon (left, up), the yellow perch (left, bottom), views of the salmon swimming in Ponoi (middle images), a large yellow perch of Ponoi (right, top) and a new species of fish, perhaps a Goldfish - a sign of things to come when the climate warms?







Festival of Northern Fishing Traditions in Tornio, Finland in September 2018

With contributions from Hannibal Rhoades

From 5-9th of September 2018 over 150 small-scale and indigenous fishermen and women - custodians of water systems from Greenland to Taiwan- came together in Tornio Finland to exchange knowledge and techniques, songs and stories, at the Festival of Northern Fishing Traditions. This formed the conclusion of the Traditional Knowledge of Northern Waters project work in public.

Participants of the Festival of Northern Fishing Traditions, Tornio, Finland. Photo: Kenneth Mikko

Many ways to catch a fish. 150 fishermen and women converged on the Finnish-Swedish town of Tornio-Haparanda for two days of exchange that highlighted the huge diversity of traditional fishing practices used planet-wide, each one locally adapted.

Delegates described how customary governance systems based on rich and long-term knowledge of place has enabled them to sustain fishing activities and good relations with the fish for generations, even as technologies and wider dynamics have changed.

Comprehensive solutions to complex problems are as elusive as salmon have become in many northern rivers, but during their exchanges fishermen and women found common ground on several key actions. They emphasised the importance of creating more awareness of the role of women in both catching fish, and as knowledge holders of how to process, store and cook fish.

Also, the need for more positive, collaborative relationships between scientists and traditional knowledge holders was noted, as seen in Näätämö. Both the Skolt Sámi and the Ponoi teams delivered the key note and regional presentations on the results of the Traditional Knowledge of Northern Waters and the methods to convey local voices of change.

In conclusion it was agreed that where intact fishing traditions and ecosystems remain, they must be recognised and protected together. Where damage has been done, the symbiotic revival of ecosystems and culture must be pursued at landscape-scale through initiatives that can help cool the planet and sustain the fishing cultures that have fed communities large and small since time immemorial.

Exchange itself is also vital. Sustaining connections between small-scale fisher-people globally, gatherings like that in Finland help overcome isolation and nurture strategies for change. The next step on the path will be in Khanty-Mansia, Siberia, where the 2020 Festival of Northern Fisheries will be held.

Dip netting for whitefish on Tornio river was a part of the Festival activities (top left and right). All Festival participants got to try river seining on the river (bottom).
Photo: Eero Murtomäki and Rita Lukkarinen

Summary and Next Steps

The large-scale community-based monitoring and science project “Traditional Knowledge of Northern Waters” has been concluded. All in all over 9,000 data items were collected. The materials range from land use and occupancy maps, hundreds of monitoring photographs, visual and oral history recordings, PISUNA monitoring forms, gender-specific biocultural indicator charts, traditional songs devoted to lakes and rivers, scientific temperature and water quality data and drawings and paintings

What made the 2018 season special was the extremely warm summer. This is a central threat to salmonid fish, such as salmon, trout, whitefish and Arctic char, who cannot survive in warm waters. It also means those fish species such as northern pike will expand in range and numbers as they thrive in warmer water.This in turn may further affect more heat-sensitive fish species.

Kuvateksti

Aerial view of Sosnovka. Snowchange

Key messages from the work include:

1. **Climate change** is now an urgent reality that is affecting the health of both fish and ecosystems in Näätämö and Ponoi catchment areas as well as Sosnovka. Water temperatures are becoming dangerously warm and threat of fish deaths is real. Record warm spells triggered forest fires both in Finland and in Russia.
2. **All villages** have living traditional knowledge and a willingness to observe, report and act on the results. A monitoring network is now in place and should be supported, long-term, to understand climate and ecological change in the basins both from academic science and traditional knowledge. This includes Indigenous and local customary governance and self-limiting of harvests especially on spawning salmon. Many people expressed their growing concern on the catch and release practices. All villages have sets of biocultural indicators with which they monitor ecosystem changes as a holistic mechanism.
3. **Striking similarities** in biodiversity changes, especially fish health, emerged. These included whitefish suffering from parasites, salmon stocks dwindling, urgent voices on the expansion of the range of Pink salmon *(Oncorhynchus gorbuscha)*, an introduced species, on both Näätämö and Ponoi as well as Sosnovka river. For the Russian communities, the back-log of Soviet land use and pollution events should be investigated as a long-term driver of change.
4. **Science results**, in part beginning from 1863, on water quality, humidity and temperature indicate that Näätämö, Ponoi and Sosnovka are some of the last wilderness areas in the European North. They are for the most part in pristine condition. However especially the Russian weather data confirms the local observations of the urgency of climate change.
5. **The project** partners will disseminate the key results of the work in a range of media including science meetings, visual histories and online platforms, social media and peer-reviewed co-produced papers. The success of the project should be replicated and expanded urgently across European North to allow more community-based monitoring of change (CBM) to take place.

Local observations of change have been very meaningful in dialogue with the scientific materials. Community-based monitoring of change (CBM) is emerging as a best practice in the Arctic and our project region is very suitable region for future work in this regard. This includes oral history work with the Elders as there is an urgency of collecting their stories before the old people pass away.

But if there are no people in the remote villages, traditional knowledge cannot exist. Therefore, as many of the local observers have conveyed, there is a need of revitalization of the villages and job availability to encourage families to move back to the area.

The Russian science partners and Snowchange will continue the monitoring efforts and will seek additional measures to keep the Ponoi work under way.

Paula Feodoroff has conveyed several oral histories of the 20th century events of Sevettijärvi village.
School of Sevettijärvi is located just on the lake - a central place of Skolt Sámi culture (left). Snowchange

Access to Visual Histories:

A large body of visual history materials, both in still images and videos has been recorded both in Näätämö and in Ponoi.

A website has been constructed for the access to these materials. It can be found in English at:
https://www.
snowchangevisualhistories.org

This is a portal that will house most of the openly-available visual histories collected in the community work.

References Used:

Traditional Knowledge of the Northern Waters materials have been collected to a central database located at Snowchange Cooperative,
contact@snowchange.org

All in all, 9,000 data items have been collected including weather and water quality data from Russian, Finnish and Norwegian state archives. Summary charts have been produced to offer visual references of the data streams.

Scientific literature behind this summary report and its methods, previous studies and context is available from Snowchange Cooperative,
contact@snowchange.org

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