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Sokolickova, Zdenka; Ramírez Hincapié, Esteban; Zhang, Jasmine; Lennert, Ann Eileen; Löf, Annette; van der Wal, René

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Research article

Waters that matter: How human-environment relations are changing in high-Arctic Svalbard

Zdenka Sokolíčková

Arctic Centre, University of Groningen, the Netherlands, z.sokolickova@rug.nl

Esteban Ramirez Hincapié

Arctic Centre, University of Groningen, the Netherlands, c.e.ramirez.hincapie@rug.nl

Jasmine Zhang

Department of Ecology & Swedish Center for Nature Interpretation, Department of Urban and Rural Development, Swedish University of Agricultural Sciences, Sweden, jasmine.zhang@slu.se

Ann E. Lennert

Department of Arctic and Marine Biology, The University of Tromsø – The Arctic University of Norway, ann.e.lennert@uit.no

Annette Löf

Stockholm Environment Institute & Department of Environmental Communication, Swedish University of Agricultural Sciences, Sweden, annette.lof@sei.org

René van der Wal

Department of Ecology, Swedish University of Agricultural Sciences, Sweden, rene.-van.der.wal@slu.se

Abstract

There is scientific consensus that the archipelago of Svalbard is warming up faster than other parts of the planet. People who live in or regularly visit this part of the

European high Arctic observe and experience these changes in a subjective and relational manner. This article illustrates how perceptions of environmental change are enmeshed with our ways of interacting with water(s) and dwelling in the landscape. What kind of water-related change do people talk about? How do changes in the different water worlds matter? How does water help us portray what environmental change means? We show that "what" and "how" we know about water(s) amidst change are in many ways inseparable. Our contribution offers a benchmark for discussing water-related environmental change in Svalbard from a perspective that goes beyond "what long-term monitoring tells us" towards "what bodies experience." Through accounts shared mostly by scientists, technicians, and tour guides, we explore notions of water in its various forms, such as sea ice, glaciers, rivers, the wetness of the tundra, snow, and weather phenomena including rain. We focus on processes such as disappearing, melting, freezing, swelling, saturating, drying up, eroding, appearing, and threatening, and discuss what the observed and experienced changes mean for human-environment relations. Our interlocutors emphasize many facets of their relationship with the landscape, including identity, expectations, emotions, knowledge, and practices. Our study demonstrates how the experiential perspective is largely ordered and filtered through activities and practices, among which mobility and reading, or predicting, the landscape stand out as particularly important. Through a relational approach to water(s) permeation, we apply Tim Ingold's concept of taskscapes and his perspectives on dwelling to show how time scales and connection to place matter. We juxtapose scientific knowledge produced through long-term monitoring with experiential knowledge, and demonstrate their entanglement in the Svalbard context, dominated by scientific ways of knowing.

KEYWORDS: Svalbard, environment, change, long-term monitoring, experiential knowledge

Introduction

> When we arrived at the site, five people were already there. Without saying a word or waiting for anyone, they took a place on the beach and undressed. As if by inertia, and with the feeling that there was no turning back, the rest of us did the same.... I was naked and ran out. As I entered the water, my ears went out. I dove in up to my neck, turned around, and ran out of the water. It all happened fast. I didn't feel the cold. It's as if the thermal shock was so abrupt that it anesthetized my body. It was also the first moment I felt that we humans do not belong in this Arctic world. But anyway, here we are. (E. Ramirez, fieldnotes, 13 October 2021)

This quote from one of the authors' fieldnotes is an illustration of how a cold swim in an Arctic fjord that nowadays hardly ever freezes, helps us as researchers to "learn about and with the world by a sensorial engagement in it, thereby identifying an emplaced ethnography that attends to the question of experience for the relationships between bodies, minds, and the materiality and sensoriality of the environment" (Rodineliussen, 2021, p. 72). Likewise, the stories of water we heard from our participants demonstrate how they engage with, read, and relate to their changing surroundings.

It is uncommon to meet people who know about Svalbard. Most of those who do know about it have either heard of the Global Seed Vault,[1] seen images of the majestic archipelago on social media, or encountered news items in which Svalbard is labelled as one of the "fastest-heating places on Earth" (Watts, 2019). This affirmation is broadly supported scientifically, and short-hand for numerous ongoing change processes[2] in the high Arctic archipelago (e.g. Bystrowska, 2019; Van Pelt et al., 2019; Dahlke et al., 2020); who live and travel in Svalbard – whether for a lifetime, decades, or for shorter periods – observe and experience such changes (Francome, 2020). Nevertheless, only the more recent environmental changes overlap with the short history of human visitation and inhabitation of the archipelago: Pomor hunters and the first documentation by the Dutch date back to the late 16th century; intensive whaling took place during the 17th, 18th, and 19th centuries; hunting and trapping, the onset of coal mining and the signing of the Svalbard Treaty placing the territory under Norwegian sovereignty occurred in the early 20th century; and today's Svalbard is an Arctic tourism hotspot and a site for vibrant environmental research.

In this contribution, we explore perceptions of changing environments through water(s). Water has been an important part of our knowledge, imaginaries, and experiences of Svalbard (see e.g. Ritter, 2010) and forms an important bond and medium for relating to the archipelago. Much of Svalbard's contemporary land surface was under water up to 370 million years ago as it moved northwards from the equator, and has been surrounded by frozen water in the last millennia. Changes in Svalbard's physical environment have been entangled with, by, and through water. In the past, humans have mostly in-

1 The Svalbard Global Seed Vault is a physical infrastructure opened in 2008, owned by Norway, that currently stores duplicates of more than 1 million seed samples from all around the world. The purpose of the storage facility is safe keeping the world's food crops.

2 According to Hanssen-Bauer et al. (2019), Svalbard environments are likely to keep changing fast, also due to the so-called Arctic amplification, with medium to high scenarios for future climate gas emissions. The projected changes (1971–2000 versus 2071–2100) include e.g. increased annual air temperature by 7-10°C, increased annual precipitation by 45-65%, more frequent heavy rain, increased river flows, shorter snow season, increased risk of erosion, avalanches, and landslides, decrease of glacier area and sea ice concentration.

teracted with and related to a climate that was cold and dry, but today this has transformed into interactions and relations built upon defrosting and increasing wetness. "Warmer" and "wetter" is what climate scientists predict Svalbard will be like in the future (Hanssen-Bauer et al., 2019). While water and its hydrological cycle are increasingly researched in the natural sciences, how the changing dimensions of water are experienced and understood in social contexts is rarely discussed.

This article engages in scholarly conversations connected with environmental change: how we experience and formulate knowledge of change, and how the "what" and the "how" are related. More specifically, we[3] contribute to the growing interest in linking hydrological changes with human-nonhuman relations using fieldwork data from Svalbard, gathered through in-depth interviews and focus groups. Scholars in anthropology and cultural geography have researched human-water relations in other circumpolar regions through Indigenous and scientific ways of knowing and making sense of environmental change (e.g. Hastrup, 2013; Nuttall, 2019; O'Reilly, 2016). Such perspectives onto transient Svalbard society are lacking; hence, we ask how water, in its multiple forms and dynamic agency, transforms human-environment relations in this archipelago. Using water as a lens, we demonstrate what and how natural scientists, technicians, and tour guides know about a changing environment, how they sense changes through situated and embodied experiences, and what this means for their lifeworlds.

The paper proceeds with a brief review of scholarship discussing water and scientific knowledge from a social science perspective. We then introduce Svalbard and our interlocutors alongside the methods used during fieldwork and analysis. The main part of the article consists of a descriptive section clustering notions of change as related to various forms of water, and a short summarising section discussing ways in which these changes matter locally. Our contribution departs from the phenomena people experience and highlights why attending to water(s) makes sense. We find overlaps as well as tensions between different forms of knowing and experiencing and, using Ingold's (1993) taskscapes as a loose analytical frame, in our discussion we sketch the entanglements of scientific and experiential knowledge in Svalbard.

[3] This paper is one of the outcomes of a research project seeking to integrate long-term environmental monitoring data and other types of data such as personal observations and accounts of how people experience the environment. Given that the overarching aim of the project is to obtain an overview of how people – from different backgrounds but all related to Svalbard – experience, observe and understand environmental changes, water-related changes become one apparent aspect generated from our empirical data.

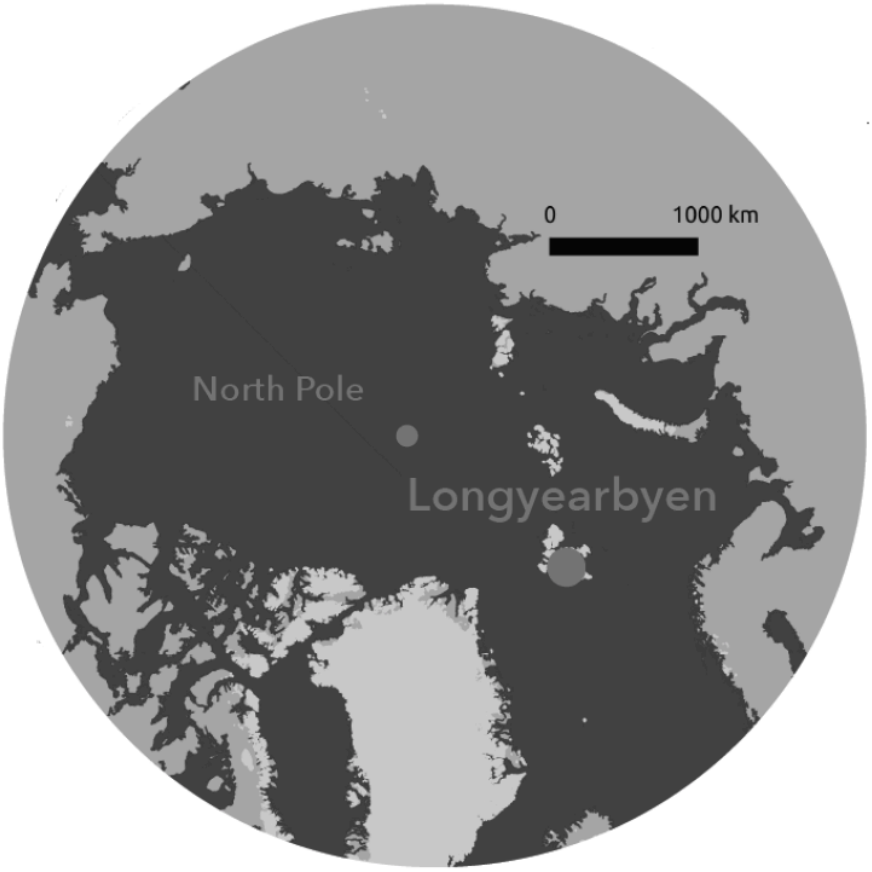

Figure 1. *Situating Svalbard (Map Jakub Žárský).*

What and how we know about water

Water, in its manifold forms, has long been studied by natural scientists at widely varying scales. The scientific representations in modern times and mostly in Western societies seem to have shaped our common understanding of water as a substance, a catalyst, a habitat, a condition for life, and an environmental concern (Linton, 2010). Peterson (2020) notes that philosophers and social scientists have brought forward alternate conceptions of water that "treat the substance differently in its various forms and at different scales, whether molecular or physio-geographic" (p. 12). We pay attention in our readings to ways of understanding water that 1) encompass multi-scales and spheres, and 2) include humans or society.

Previous studies on human-water relations in the field of anthropology are particularly useful in that they urge a reassessment of "how water is made known, how particular kinds of social relations produce different kinds of waters, and how produced water in turn reconfigures social relations" (Radonic, 2019, p. 219). While the chemico-physical

scientific representation of water as H_2O continues to dominate our ways of thinking of and relating to it, social-relational readings of water offer other ways of reimagining it in its social and physical contexts (Neimanis, 2017). Once the false dichotomy of nature-culture is recognized and challenged, water can no longer be seen just as a thing, but also as a process, a living entity with its own agency and even rights. The anthropology of water has become a prominent field, among others, in which this view is fostered (e.g. Strang, 2004; Barnes & Alatout, 2012; Hastrup & Rubow, 2014; Hastrup, 2017; Ballestero, 2019; Paerregaard & Uimonen, 2021). Hastrup (2014), for instance, sees water "as an experience, something that must be socialized and qualified" (p. 22). Rodneliussen (2021) interlinks water with the social, cultural, spiritual, and political. Ballestero (2019, p. 47) builds on Linton's (2010) alternate notion of a hydro-social cycle, "a process that constitutes humans and water alike, rather than taking them as pre-existing entities affecting from the outside the sociomaterial life of the other." Such a stake implies that anthropology can analyse "how people live with water in the everyday and encounter [the] extreme" (Ballestero, 2019, p. 47).

As Strang's (2004) long-term studies on water usage show, physical, sensory, and cognitive experiences of water intertwine with cultural meanings and values. Together they form our complex relationship with water, which goes beyond its gaseous, liquid, and solid forms, as "multiple, never singular. Entangled, never isolated. Material, only artificially abstracted" (Ballestero, 2019, p. 415). Focusing on relations, anthropology contributes to investigations of the "entanglement of natural and social realities without simplifying the causal link" (Hastrup, 2013a, p. 279). We do not intend to show "how things are," but explore what is being noticed, in which way, and what it means for the entities involved.

As Peterson (2020) points out, studying more-than-human phenomena also means we need to be mindful about "what" one knows about them, and here we add, "how" one knows about them. Experiences and observations of water (or lack thereof), their forms, and agencies are never only about water itself, but include the values, relations, and meanings generated and embraced. In the context of our case study, we approach water to make sense of environmental change. It is, therefore, useful to invite literature on knowledge production into the conversation. Although our article does not intend to unpack the issue of scientific knowledge production in Svalbard, the topic is omnipresent, given the pool of our participants (see below), and the dominant role science(s) plays in Svalbard as a community. We thus briefly delineate our awareness

that the "how" counts equally as much as the "what," and indeed, in many perspectives, including Ingold's (1993), are one and the same.

In her seminal work on the epistemic heterogeneity of the natural sciences in their "machineries of knowing," Knorr-Cetina (1999) provides thick insights into the differences between epistemic cultures of physics and molecular biology. The often assumed unity of the natural sciences and existence of "one science" that delivers coherent and objective knowledge is disrupted by such a study, which shows the diversity and messiness of the processes, and the subjectivity of those who engage with science, not in a neutral void but embedded in politics and ethics (see e.g. Rabinow, 1996; Knox, 2015). In her study about "sensing the ice," which entangles scientific and experiential knowledge in a circumpolar setting, O'Reilly (2016) elaborates on the statement that "scientific knowledge can be formed through intimate interaction with the objects of study, in contrast to the ideal of a scientist as a detached, objective observer" (p. 29). Her work also shows that embodied and experiential knowledge is not culture-independent; on the contrary, sensory engagements are "trained, learned, disciplined, and contextual" (p. 28).

In other parts of the Arctic, scholars have shown that people "are never simply placed in the environment; they actively interfere with it" (Hastrup, 2014, p. 23). By presenting the connections between observed changes and social, embodied relations, we show that in Svalbard, people are also part of the place and it's entanglements.

Bodies that experience: Where and how we worked

Svalbard is both unique and symptomatic in the context of Arctic science. The first polar expeditions that reached or passed through the area were already co-driven by scientific curiosity. Interest in Svalbard on the part of (notably natural) scientists goes far back but intensified with the University Centre in Svalbard (UNIS) opening its doors in 1993. By the early 2020s, UNIS hosted almost 800 international students, over 60 scientists as permanent staff and about 160 yearly visiting guest lecturers, performing ample scientific and educational roles. Additionally, the research station of Ny-Ålesund hosts over 20 research institutions engaged in long-term research and monitoring activities. More than 30 people (mostly technicians and scientists) stay all year round but research activities intensify during summer when the station hosts over 100 seasonal researchers. On 21 October 2022, the Research in Svalbard portal[4] featured 4,330 projects (of which 585 were listed as active); 137 (31 active) of those were classified under the social sciences, mean-

[4] https://www.researchinsvalbard.no/

ing that over 95% of all (registered) research conducted in Svalbard classifies as natural science.

Alongside the steady growth in scientific interest, a tourism industry (cf. Saville, 2022), now fully-fledged, has been developing since the 1980s, becoming one of the most significant employment areas, resulting in research and tourism being the main activity spheres in Svalbard. These spheres are also part of the historical demographic changes and variations in Svalbard settlements. Founded in 1906, at that time for the sole purpose of coal mining, Longyearbyen has been inviting seasonal and yearly workers on lucrative wages ever since. Today, about 2,400 people live in Longyearbyen on a semi-permanent basis, with 64% of residents staying for fewer than five years (43% for fewer than two years), and only 6% for more than 20 years (status in spring 2021, personal communication with Norwegian Tax Office in Svalbard; see also Timlin et al., 2022).

This article is written as part of a Special Issue on *Changing environments: Knowledges and Experiences* primarily for an audience interested in anthropology. Yet what we present is not a strict anthropological study but an interdisciplinary one, in which the argument is not conveyed *through* individuals we met in the field, but rather *across* them. We do so to give a general overview of observed water-related changes, and their repercussions for human-environment relations in Svalbard. The team working on this article consists of people anchored in different scientific realms and disciplines: the humanities and social sciences (anthropology, human geography, political science) and natural science (ecology), thus contributing a diverse range of epistemologies, perceptions, and discourses.

We worked qualitatively in the field, digitally, or in person, between November 2020 and February 2022. The first set of data consists of 33 semi-structured interviews conducted online with people who spend a lot of time experiencing and observing their surroundings: natural scientists who have long-term research experience on Svalbard, technicians specialized in environmental monitoring logistics and instruments, and tour guides whose expertize is helping others to experience Svalbard. Our sample further includes seasonal but experienced visitors and people living, or having lived on Svalbard. We met some of our interlocutors for a follow-up interview in late 2021 in Longyearbyen, once the COVID-19-related travel restrictions were lifted. The second set of data stems from four focus groups organized in Longyearbyen (late 2021 and early 2022) with

English and Russian-speaking tour guides,[5] long-term residents, and early career (natural science) researchers. All materials were transcribed. Selecting interlocutors was influenced by both presumed and emergent aspects. We invited people who were "trained" or "predisposed" to notice change, which led to identifying groups who are often out in the natural environment and have extensive experience. We started with our networks from previous and current work in the field and used snowballing to reach a diverse grouping of Svalbard-experienced participants. In both interviews and focus groups, we asked our participants to recollect and describe how they experienced Svalbard's environment, either social or natural, although the techniques used varied due to the different social dynamics of each setting. When "change" (or lack thereof) appeared in interviews, we invited the participants to elaborate on this and when possible express how they perceived or felt about it.

Scanning the transcribed interviews and focus groups to identify the water forms, water bodies, or water-related phenomena which received the most attention, we ended up with seven families of keywords surrounding the following categories: glaciers, sea ice, rivers, the wetness of the tundra, snow, avalanches, and weather. These were later regrouped (e.g. merging snow and avalanches as they are inseparable), reordered and checked against each other, both to avoid repetitions and uncover connections. In this phase, we concentrated more on the material aspects of environmental change. We followed an abductive approach to data analysis, going back and forth between what we know from the literature and from reading, coding, and interpreting the data. Thus, the meaning-making process allowed us to move in between induction and deduction, which kept discovery and justification entangled (Tavory & Timmermans, 2014).

[5] The reason for an English-speaking and Russian-speaking group of tour guides was that the only two family settlements on the archipelago are the Norwegian town of Longyearbyen (with an international population), and the Russian town of Barentsburg (populated by Russians and Ukrainians). The Russian-speaking focus group was organized after we encountered several Russian-speaking guides in Longyearbyen in preparation for our fieldwork in Barentsburg. We assumed their observations and experience might differ given that tourism is practiced in different ways and also partially different geographical areas on Svalbard.

Figure 2. *Working with tour guides during a focus group in Longyearbyen (photo byAnn E. Lennert, October 2021).*

Waters that change

To navigate the materials gathered in the field, we let three questions guide our reading: 1) What kind of water-related change do people talk about? 2) How do changes in the different water worlds impact people (or other life forms as noticed by people)? 3) How does water help us portray what environmental change means? With these questions in mind, we tell a story of Svalbard "waters that matter" as a patchwork narrated across the voices of our participants. Speaking to the first question, we display what the materials show; here we engage in the art of noticing and describing (as inspired by Tsing, 2015).

Sea ice was a frequently mentioned form of water, depicted as shrinking, disappearing, deforming, and deteriorating. As one scientist observed,

> When we were approaching Svalbard [in 1977], the first pieces of ice appeared.... We were following a Russian icebreaker to Longyearbyen. That's quite unimaginable nowadays...when there's hardly any sea ice anymore. (Interview with scientist)

People consider the change of sea ice fast and visible, and an indicator of climate change. Sea ice provides the surface for travel routes both along the coast and across fjords, and at times also supports snowmobile trips close to glaciers. Our interlocutors remembered the presence of sea ice in the past as solid and trustworthy, while today they see it as unreliable, unpredictable, unstable, and dangerous, as it forms late, is sensitive to strong winds, rising temperature, and early melting.

Figure 3. *The Ice Fjord, Adventfjorden (photo by Dagmara Wojtanowicz, 2018).*

The lack of stable sea ice makes fieldwork, guiding, and leisure activities difficult or impossible. The function of sea ice as passage not only for humans but also for mammals such as polar bears and reindeer was discussed, along with how the changing sea ice conditions affected other species such as birds in terms of foraging, nesting, and flight ranges. Other broader impacts mentioned include the decrease of albedo effects, light change underwater, and more waves that cause erosion on the coast. Sea ice is not just a singular entity, but an ecosystem, which by disappearing impacts species assemblages.

> It's a system collapse, in my view, of sea ice habitat loss.... There's just less and less of it, it's less stable and less predictable.... The multiyear sea ice percentage is dropping dramatically, so we basically don't have it anymore in our part of the Arctic. And that means the part of the habitat which some organisms used to rely

> on...is reduced.... And there is no place for them...because they're being outcompeted by other species, which can do well without ice and...in open water. (Interview with scientist)

While half a century ago, an icebreaker was necessary to get into the fjord, today the warmer ocean, in interplay with other factors such as winds and temperatures, breaks up and melts the ice. New species appear, displacing those better equipped for a colder Svalbard. The different environments constituted by transformed waterscapes make people reflect on nonhuman life forms, how they thrive and what impact the new conditions have on them. Changes in flora and fauna are commonly observed.

> I think the warmer water and more nutrition bring the whales.... It's many more sightings now,... more energy in the air,... more animals. At least some of them seem to be profiting from the warmth. (Focus group with Russian-speaking tour guides)

> The first few years when I was coming to Ny-Ålesund we were fishing for cod, but we never could get it. Now, there is warmer Atlantic water coming into the fjords [so] there is plenty of cod. [A]ll these changes [are] kind of interesting and scary..., because definitely we are destroying our planet. (Interview with scientist)

Glaciers were another "species" that featured heavily in our materials. As Cruikshank (2005) writes, "concerns about global climate change are giving glaciers new meaning for many people who may previously have considered them eternally frozen, safely distant, and largely inert. Most of the world's glaciers now seem to be melting rather than reproducing themselves, becoming a new kind of endangered species" (p. 7-8). Our interlocutors mostly mentioned glaciers in the context of their retreating and exposing traversable land and sea.

> In the good old days, we had to cross the glacier and walk on ice. Now you can only walk on rock and soil" (Focus group with Russian-speaking tour guides).

In certain places, notably large glaciers facing the sea, this led to considerable differences in topography: new islands, different coastlines, future sailing passages.

> P1: I marked one area down here. In Hornsund, actually. The glacier that is going to the East Coast.... They've found out now that there is no land beneath it. So there will be a new island coming here in the south.
>
> P2: Oh, so there is no land?

P1: There is no land.... Things [are] getting a bit separate, or like, I don't want to say it's falling apart, but things are melting…. So maybe that's why I marked it.

P3: Symbolic?

P1: Yes, it's a bit symbolic. It's kind of beautiful as well, to imagine how it's going to look like when it has happened, just the act itself. But I think it's also very sad. (Focus group with international tour guides)

A retreating glacier reveals that what was thought to be a peninsula for centuries is actually another island; *Sørkapp Land* will become *Sørkappøya*. The local sense of emplacement is embedded in place-naming, which reflects the apparent changes.

Figure 4. *Longyearbreen in the 1950s (photo by Leif Arche Grøndal).*

Where in the past icebergs were small, accelerated rates of calving led to more and bigger icebergs being observed. Changes were generally seen as rapid and unfolding in many places. Yet others pointed out glaciers that did not seem to change, or where change may be part of a retreating-advancing cycle that stretches over several decades. People acknowledged the importance of regular visits and a longer time perspective to judge changes, but also that they were sometimes so fast that one would need to visit a glacier every year in order to monitor conditions. Other common observations were less snow on the glacier and bigger crevasses. Both curtail travelling over glaciers on skis

and by snowmobile, which are two highly popular activities on Svalbard. As with the mobility and transport impacted by changing sea ice conditions, field safety (in terms of both taking precautions against losing material equipment and risking lives) is an important dimension here. Those doing fieldwork on glaciers must consider the shorter season but also be flexible in reaching a destination and moving carefully whilst on the glacier. Where for the latter snowmobiles have been the main mode of transport in the past two decades, now helicopters are often required (comparable to using boats instead of snowmobiles to move along the fjords). People talk about the changing glaciers in a broad context; less snow cover means a reduction in albedo, species inhabiting glaciers have less space, and with glacial melt river flows get heavier.

Glacial ***rivers*** were often evoked by our participants when reporting that water volume in the rivers had changed remarkably. Much more water was observed in rivers during spring because of a more rapid snow melt, with the main consequence being harder river crossings.

> What you see is big differences between years, which are far more striking than any trends over the years.... It's most noticeable in how I get to the place, because then I need to cross many rivers. In some years you can do that just in your walking boots and rain trousers.... In other years, it's impossible.... That tells you something about rainfall and the rate of melting of the glaciers.... I still remember sitting at the table in one of the cabins with a PhD student of mine, and we heard this massive noise and we thought, "What the heck is that?" It happened after two really warm days, I think 19 degrees or so. We walked out, and we saw that this snow patch...was melting at a phenomenal rate.... And the next morning there was a layer of silt 10 or 15 centimetres deep.... We couldn't cross. It was really dangerous. (Interview with scientist)

Again, these changes lead to reconfiguring plans for work and travel, shifting fieldwork periods into earlier months, for example. While in the spring people observe heavier river flows, the opposite is reported during summer, also in connection with glaciers. Our participants saw rivers not only as barriers in the landscape that are increasingly difficult or even impossible to cross, but also as agents that can erode and transport sediment from glacier to fjord.

> There is a river running through Longyearbyen and it's now been controlled by humans for a long time because [of] buildings on either side..., and of course people don't want the houses to get flooded. So there's been a lot of...moving, making walls, and restrictions on this river. And that will of course influence

what comes out of the river and how fast it runs, and it will also influence the sediment that comes straight out...and how that is distributed right outside the river mouth. (Interview with tour guide)

Figure 5. *Crossing a river (photo by René van der Wal, 2018).*

When we traced in the data how people see and experience change related to water forms that are supposedly harder to notice in a straightforward visual way, such as water contained in soil, the wetness of Svalbard's ***tundra*** was a specific aspect our participants commented on. While the disappearance of sea ice or the overall trend of glacial mass balance loss were rather consensual, judging what is happening to the tundra proved more difficult, due to its ranging from very wet to very dry, both spatially and seasonally. People felt the changes were rather small, local, and only presumed unless confirmed by systematic monitoring. Accounts of change went in the directions of both saturation and drying, but factors driving changes in tundra wetness were considerably less ambiguous, and primarily concerned shifts from a frozen state to liquid. Earlier snowmelt in spring was viewed to cause drier soils later in summer. Most common, however, was the connection with permafrost. The deepening of the active layer, together with more rainfall and higher air temperatures, was seen as the common cause be-

hind a wetter tundra. Accounts of changed visual, olfactory, and haptic experience with the tundra were numerous.

> When I walk on the tundra, I notice it's more thawed. It's softer. And there's much more water in the ground.... It used to be dry and hard. But it's not anymore. And also the smell. There used to be such dry air here, you couldn't really [smell] anything. But now you have an almost normal range of scents in the air. (Focus group with international tour guides)

> July is a very wet month and then there's a lot of tundra that will suffer much more if the ice and snow melt in May.... I was a bit shocked this year now that I have been out the last three weeks on boats. I had the feeling I was in a lot of places where there were...tracks...visible on the tundra. I've never seen that before. (Interview with tour guide)

Figure 6. *Wet tundra (photo by René van der Wal, 2018).*

The increased sensitivity to saturated tundra affected scientists but even more so tour guides who reported they need to adjust their plans for landings and prevent unneces-

sary damage when guiding people in the landscape, which may be demanding to explain to tourists.

Several other permafrost-related changes were observed, including the emergence of sinkholes and tundra slipping off mountain slopes. Not many talked about such changes, however, and others indicated that even in the warmer parts of Svalbard these phenomena remain local and small-scale. On the other hand, landslides were observed to have become more common near the biggest settlement, Longyearbyen, and people share the expectation that such phenomena will increase in frequency. Researchers noticed retreating permafrost influenced lakes with consequences for biota therein, and destabilized rock surfaces leading to changing working routines (e.g. the need to wear helmets as protection against falling rocks from once stable slopes). Likewise, people pay attention to land being carved off along the coast, requiring infrastructure (protected cultural heritage, houses, and cabins in use) to be moved.

Figure 7. *Coastal erosion in Bjørndalen (photo by Jakub Žárský, 2020).*

There was consensus on less ***snow*** remaining during summer, and more precipitation that has a less predictable form now compared to the past. Changing snowscapes have an impact on mobility and a range of other practicalities. People need to adapt their plans for leisure trips and fieldwork to snow conditions that get more difficult to foresee, but snowing also impacts air travel, which is how the vast majority of people get to and

from Svalbard. Since snowmobiles are one of the most used means of transportation during winter and spring in Svalbard (in the leisure time of residents, and also for scientists and tourists), snow conditions determine opportunities for travelling. In fresh snow the machine gets stuck, while little snow uncovers rocks (and tundra) that cannot (or should not) be driven on.

> The local people are very much tied to snow, of course.... Their life starts as soon as there's sufficient snow to go around. And they're really sad when the snow disappears in spring, which forces them to stay at home,... they can't drive snow scooters anymore (Interview with tour guide).

Snow-related knowledge was connected to the issue of safety, especially in and near urban areas but also generally in the Svalbard terrain. The perception of the avalanche danger has changed over the course of time; those having a longer experience of Svalbard, whether residents and/or scientists, technicians or guides, claim there were probably fewer avalanches in the past, but also that fewer people were out in the landscape exposed to the danger (given that both the human population and activities such as tourism and research have increased considerably during the past decades). In addition, the perception of risk (and tolerance thereof) has shifted, with increased focus on the dangerous aspects of snow acting differently (as in an avalanche) or turning into different water forms (such as landslides or slush).

Our participants raised the issue of avalanches both as something that strongly impacts science in terms of monitoring programmes and in relation to notions of safety. These two are interconnected, as having up-to-date information and tools to predict snow conditions increase the ability to navigate safely in the terrain. Paying attention to avalanches also makes people want to learn about the phenomenon, be able to estimate the avalanche risk, and make choices accordingly. Some contested the link between avalanches and climate change, while for others the connection was obvious.

> And then avalanches. We used to go up the local mountains and onto the slopes, whereas now you have to be really careful what time of the year you do that.... Yes, global warming is making it a different, tougher environment to work in, that's for sure. (Interview with field safety official)

> A good example is avalanches. I moved to Svalbard in 1997/1998. I came from northern Norway where there is considerable attention paid to avalanches because that's always been a problem in Norway,... but in Svalbard I didn't see a single avalanche for the first two years because the conditions were stable, dry

> all winter. And then the snow would just evaporate during spring, while it's an increasing change in temperature, changing precipitation in wind directions that are not good for the way houses are built.... We don't have the methods...to support our decision-making by now, because the change has been so fast, we are still missing models to calculate avalanche accidents. (Interview with technician)

Snow is an indicator that people easily relate to, as they can observe the landscape looks different in the present compared to how they remember it from the past. The notion of change in snow brings in reflections on personal bonds with the place and the feeling of loss:

> It's colours. Probably more shades of colours. Structures. I like a lot…the first snow layer on the mountains, it's just this fresh powder. It's like the sugar you put on a cake. With that you can see the real shape of the mountain.… It's just a brown mountain now. There's not so much to see" (Interview with tour guide).

Figure 8. *Warm spell in spring (photo by Morten Hilmer, 2022).*

The loss of snow cover in general is an impact people mostly link with climate change, also connecting it further to permafrost thaw (happening faster when the soil is more exposed to sun), rain-on-snow events, or glaciers losing mass balance.

Nevertheless, the accounts of what is happening with snow varied across our participants. People notice less snow in general, but also that years differ greatly from each other. Snow scientists see snow as part of the effort to understand the environment in its complexity; its accumulation, distribution, and melting influence the "foodscapes:" birds can nest earlier in the season if the snow disappears earlier, but also an earlier snowmelt means a more vulnerable tundra. They notice significant connections to glaciology, physics, (micro)biology, chemistry and modelling.

> It's been growing with snow for me for many years. At the beginning, it was just like a part of the water cycle. And since I work with chemists and microbiologists, I can feel the environmental importance of snow. So it's like a habitat. I try not to eat snow that much as there's lots of bacteria living there. There's lots of deposited contaminants.... It's not only about water that is stored in snow. (Interview with scientist)

Indeed, it is never only about water. The last grouping of associations, observations, and experiences with Svalbard's changing environments concerns ***weather*** patterns, where rain features to a great extent, together with phenomena such as rain-on-snow events, increasing temperatures, snow and wind conditions becoming unpredictable, and changing visibility. Weather, how it has always been changing and how much more changeable it has become, is something people depend upon on Svalbard, as with glaciers, sea ice, and snow. Weather was experienced in diverse, subjective, and emotional ways, adding to the difficulty of capturing change. The time perspective is key again, with longer periods of observation acknowledged as necessary in order to draw conclusions, given how much one year might differ from another. For some, family memories serve as a backdrop for comparison with the present, but many people who live on Svalbard for short or medium periods only hear about the past from others.

Several participants described their experience with changing weather patterns as more extreme, unpredictable, and unusual. Weather episodes such as heavy rainfall, rather atypical for an Arctic desert like Svalbard, seem to last longer, together with warmer air temperatures, windy periods, and more precipitation of various kinds. Particular "extremities" which regularly featured in accounts related to snow, rain, and tundra, are the so-called rain-on-snow events impacting the reindeer population dynamics on Svalbard. Warm spells during winter months (when rain partially melts the snow cover and the the frost returns) create an icy lid covering the tundra, making grazing difficult.

> Some years you see a lot of carcasses.... When we started the [monitoring] system we called it an extreme event because it's really extreme for the reindeer. Some

places it can kill 80% .... We haven't seen such heavy kills...but it can be 60%...and that's a whole heck of dead reindeer. So these are extreme events...because they were rare and now they happen almost every year. (Interview with scientist)

Figure 9. *Ice-covered tundra (photo René van der Wal, 2010).*

For seasonal visitors, each year differs from the previous ones, which makes it hard to observe changes as trends or patterns. What people experienced and observed as changing weather is therefore interwoven with how they experienced the changes, and what kind of situations or pathways the different physical phenomena created.

> So there are some years that are very, very wet, and I just look around and think, wow. The mountains look green this year, you know? And that's one of those years with warmer temperatures and a lot of precipitation.... The tents are made for snow and not for rain. [It] becomes muddy, and it's no fun because you have to clean all the time. And people are not happy, because their stuff is wet.... [This all] makes you more aware of wet summers.... Being on the ship...you see green mountains, like three or four years ago..., it was really green, and I'm like, I've never seen this.... It looked like the Faroe Islands here. (Interview with tour guide)

People talk about up-to-date scientific knowledge on weather as key for both mobility and safety, but at the same time recognize it is difficult to obtain the knowledge. The hurdles are manifold: for example, while some locations are monitored long and well, other places are hard or costly to get to and data is lacking, or accurate measurements are difficult to secure due to harsh or unpredictable weather. Some reported that weather data are among the longest-term data existing on Svalbard; others argued that fast changes make knowledge based on earlier measurements less valid in today's conditions. A specific facet of the urgency to collect weather data while weather conditions make this difficult was voiced by technicians working for research stations. Their field-based knowledge, including reading and predicting weather, is key in facilitating research and monitoring, yet, despite their long-term experience, technicians reported uncertainties in recent years.

> So for many years the situation was kind of stable, you know that you go at that certain time of the year and use the snow scooter and then from June on you can use the boats. But now everything is changing, years are different, so you have to use different methods, it is getting more complicated and the weather is unpredictable. (Interview with technician)

This has led to more precautions being taken with regard to field safety, which technicians and scientists discuss as a contentious topic. For technicians, weather is a "wild-card," but often forgotten or disregarded by scientists who may have tight schedules and costly (and thus short) fieldwork periods. Sometimes technicians felt pressured as they couldn't forecast the weather, yet the research projects would unfold anyway and would have to adapt. As one observed,

> I always say, double the time because you never know about the weather. And before, it was possible, because you knew that in April everything was frozen, solid, nice weather, but now… (Interview with technician).

Overall, weather is a natural part of people's everyday experience of the local environment. For some, experiencing the contrasts in weather is part of why they love Svalbard, for others, sharing stories and knowledge about weather is their way of sharing passion for the place. And for yet others, experiencing extreme weather events works as a wake-up call regarding rapid environmental change that is well underway in Svalbard.

How changing water(s) matter

From the observations and experiences voiced above, we identify four cross-cutting themes that strongly manifest themselves, namely: mobility, safety, emotional valuing, and place-naming.

Through changed ***mobility*** (which impacts on the local economy but also lifestyles), environmental change is experienced in physical and situated processes of "enskilment" (see Ingold, 1993): by struggling with muddy tents, travelling through open water or walking on bare rocks, crossing difficult rivers, witnessing moist tundra that "remembers" where people walk in the form of visible tracks, or encountering the carcasses of reindeer that have starved to death; but also by realising that once suitable equipment is no longer fit for purpose due to a changing environment (such as camping gear or windproof but not fully water-proof clothing).

Perceptions of environmental change in Svalbard are also largely associated with individual and collective well-being in the form of reflections on risk and danger that are transforming the discourse of ***safety***. These dangers are being evaluated by those who increasingly come across them, be they harder river crossings, less reliable sea ice, more numerous glacier crevasses, avalanches, slush, and landslides. Our case study confirms that waters can clearly be "feral and trouble-making" (Ballestero, 2019, p. 416).

To come to terms with an environment losing familiarity also triggers emotional labour: reflections on identity and how one feels – often ambiguously – about change. Ambivalent ***emotional valuing*** of environmental change was palpable.

> It's not nice that it's changing. Because it would, of course, be best if it were stable, the way it should be.... If I take away the fear of what the future will bring for my kids and everything, for me personally it will make no sense to be...in a dark wet place.... I wanted cold, I wanted white. I wanted the Arctic. It will be strange, still dark, but...without snow, without glaciers. (Focus group with international tour guides)

This quote from a tour guide – a cry from the heart about expectations no longer met due to the wetter climate – is one of many that demonstrated dimensions of loss. The range of emotional reactions to environmental change physically lived through meeting changing waterscapes is wide, with people expressing astonishment, shock, curiosity, love, enchantment, concern, fear, and sadness. They recognize that while the current conditions make some forms of life suffer, others might appear and "profit from the warmth." Observations of change can thus have negative or positive connotations but

are rarely neutral, and they raise wider questions such as "to what extent," "where," and "for whom."

Another theme illustrating how people observe, make sense of, and deal with changing environments is that of confirming perceptions by bringing order. ***Naming places*** that appear (or noticing and renaming places that disappear) satisfies a need for some sort of stability and anchoring. Named places are "elusive in the process, because they are practical landmarks rather than abstract notations" (Hastrup, 2013b, p. 59). The practicality of place-naming on Svalbard relates back to mobility,[6] whether for hunting and trapping, the logistics of industries such as mining, research, or tourism, or as part of the prominent outdoor life, which also shows that these dimensions are connected.

Figure 10. *Tour guides playing on ice (photo by Jakub Žárský, 2020).*

[6] There is also a political aspect of place-naming in Svalbard, including changing the name of the archipelago from Spitsbergen to Svalbard in 1919. See Arlov (2020).

Discussion: Thinking with Ingold about entanglements of knowing and experiencing waters midst change

> P1: If you come here in ten years, the stories about driving over glaciers I think they will be…
>
> P5: Legendary.
>
> P2: Yes, people would sit here and say "Yeah, I remember we were driving a snowmobile over the glacier." (Focus group with Russian-speaking tour guides)

In the previous section we described our interlocutors' experiences of water-related changes and how they impact and matter to them. Here we pay attention to what these experiences can enable us to learn about changing environments in Svalbard and beyond. For this we draw on Tim Ingold's writings, in particular the related notions of taskscapes and "the dwelling perspective" (Ingold, 1993), which help us delve deeper into the connection between experiencing, knowing change, and the limits thereof. We further discuss our findings in relation to understanding change through long-term environmental monitoring, as this is present in the empirical material and context in different ways: through our interlocutors' stories and practices as well as forming part of a knowledge system structuring human-ecological relations on Svalbard.

On taskscapes, time, and dwelling

The notion of *taskscape* was designed to offer an alternative to the human-nature dichotomy and rests on a relational approach wherein the "what" and the "how" of knowing, observing, and experiencing are fundamentally linked. Viewed as taskscapes, landscapes emerge from manifold social, political, and economic activities and relations. People are not separate from but "do" landscape in an "entanglement of different activities performed by humans and non-humans, in a process of resonance" (Grupposo & Whitehouse, 2020, p. 592). It is through dwelling or practice that we become active participants in the landscape, and learn about it as it shapes us. This means that people do not just tell stories about landscapes; landscapes themselves are stories told as acts of remembrance, and Ingold encourages the reader to explore the process of "engaging perceptually with an environment that is itself pregnant with the past" (Ingold, 1993, p. 153).

By focusing on water, we were able to place human-environment *relations* rather than *observations* centre stage. We demonstrate that embodied and experiential knowledge is also relevant for living, travelling, and working in Svalbard. In many Indigenous con-

texts, in the Arctic and beyond, "ongoing perceptual monitoring" (Ingold, 1993, p. 160) has been widely documented, often recognized in the form of traditional, Indigenous, or ecological knowledge: for example, mobility and safety feature strongly among reindeer herding Sámi (e.g. Löf, 2013), and traditional harvest activities among the Inuit (Ford et al., 2013). In Svalbard, however, characterized by a transient and hyper-mobile settler community (Brode-Roger et al., 2022; Sokolíčková, 2022), the value of such "ongoing perceptual monitoring" may be less prominent. Yet the stories of changing waters told by technicians, guides, and researchers demonstrate that, for them, relational and constitutive aspects of experiencing the environment are also part and parcel of being embedded in a place. This raises the question of whether it is possible to neatly separate between the what (data) and how (methods), and whether we should think of water(s) as an agent in our lifeworlds rather than an object.

To understand change through Ingold's lens of dwelling and taskscapes means challenging linear perspectives on time (cf. Munn, 1992). For Ingold, time is neither chronological nor historical but rather ongoing; past, present, and future coexist and emerge through dwelling (Grupposo & Whitehouse, 2020). Dwelling typically assumes long-term engagement with a specific place, such as commonly found in Indigenous and other forms of nature-based livelihood communities, where "place" and "being" are natural parts of each other (e.g. Ford et al., 2013) and knowledge is therefore an embodied and place-based practice which cannot be readily extracted or transferred (Latulippe & Klenk, 2020). It is common for people to think in generations, recall the lifeworlds of their grandparents, and evoke the lifeworlds of their grandchildren, stretching the time horizons of places with which they have a personal relation to more than a century. While our study highlights similar experiential dimensions of knowledge, it also points to a specific trace of Svalbard's transient populations: expressions of an individual, narrower time scale that most people mention when asked to elaborate on environmental change.

When juxtaposing scientific and experiential knowledge, scaling time is of the utmost importance. Our interlocutors told us of water forms and processes out of tempo (Simonetti, 2019), in different ways that relate to their dwelling and taskscapes; in other words, based on where they stand. Interlocutors with a scientific background often reflected on time scales relevant to their disciplines and the things they measure, with reindeer ecologists reflecting on change over years to decades, whilst glaciologists and geologists placed their observations in much longer timescales. Technicians weighed their field-based knowledge from the past against the present need to deliver a specific

service, yet within the boundaries of year-to-year variability, and tour guides focused on seasonality when planning ahead. Diverse temporalities mingle in people's stories of change, giving vistas of the past but always returning to the present. People thus approach time differently according to the taskscapes in which they normally dwell. While the geological, deep-time perspective is represented in Svalbard through the scientific gaze, and the individual narrow time scale is prevalent among Svalbard's transient inhabitants, the generational time scale common in other Arctic locales is rather underrepresented given the place's historical and current political boundaries. What role does or can long-term monitoring play here?

Doubt-casting and the legitimacy of knowing

How we perceive and deal with change depends on how one knows as well as what one expects can be known. Ingold (2022) argues against being naive about, or surprised by change, as if things were ever predictable. Locales inhabited by Indigenous peoples are places in a state of a never-ending "becoming" rather than landscapes subject to abrupt change to which one must suddenly adapt (Lennert & Berge, 2019; Simonetti & Ingold 2018). "To-not-know" remains a perspective and skill typically in contrast with natural scientific methods geared at identifying regularities (Ingold, 2022), which is also the purpose of long-term environmental monitoring.

Here the issue of time is again placed centre stage, resonating with discussing perspectives on change and what is knowable. Yet, instead of claiming to "add a human aspect" to "objective" notions of change captured through scientific monitoring focused on chronology, abundant in Svalbard – and in which many of our interlocutors professionally take part – we shift the focus to the temporalities of landscapes. Employing the dichotomy of subjective (non-scientific, experiential) and objective (scientific, measured) and distinguishing between them prevents us from attending to "a landscape [where] each component enfolds within its essence the totality of its relations with each and every other" (Ingold, 1993, p. 154). As one of our ecologist interlocutors reflected, "these are extreme events because they were rare and now they happen almost every year." Here we document a shifting perception of what is "extreme" (or unfamiliar) and what is "normal." This oscillation between extreme and normal has an impact on reorganising how we build, live, and operate in a landscape, and how we read it. What in the past was considered an exception has become the rule (such as heavy rainfall in winter), and what in the past was normal now seems rather exceptional (such as solid sea ice). In the realm of long-term monitoring, knowing (e.g. what is normal and what is extreme) is also uncertain as normality/extremity must always be related to a constructed time

scale. And as we have shown above, time scales are not objective, but rather subjective relational notions of the ongoingness of time influenced by the taskscapes in which we dwell, or cultural and, thus, specific to the disciplines in which we are trained.

Can we tame uncertainty and unfamiliarity, so strongly speaking to us through the accounts of experiencing water in the midst of change, through understanding better the importance of experiencing for knowing, while also accepting not knowing as part of how we dwell in landscapes? The accounts shared by our interlocutors show how using all the senses complements monitoring and bear witness to how very complex and subjective a process change is to experience. While long-term monitoring is expected to generate knowledge on trends (such as increase, decrease, and no change, which are often communicated graphically), experiential knowledge resists such data-fication. It remains patchy, subjective, and relational.

Our findings suggest, however, that long-term monitoring might play an important role for people living, working, and travelling in Svalbard *together* with their own embodied knowledge. While people agree on being able to observe and experience some aspects of change, other facets appear difficult if not impossible to notice without the support of science (e.g. changes in marine life or permafrost). In those cases, people hesitate to draw conclusions on trends without triangulating with scientific knowledge. In the context of safety, monitoring becomes an important tool for verification and a knowledge base for decision-making. Other contexts (e.g. the ability to predict weather) reveal the practical importance of monitoring for life in Svalbard here and now, whether for leisure mobility, planning fieldwork, or trips with tourists. Many also cast doubt on the reliability of their experience. We speculate it could be related to their short term or seasonal residency which makes them turn to long-term monitoring instead of earlier generations to fill this role. What they are sure about are the striking differences between years, which are also known from Indigenous contexts: "one year is not another's brother" (Tyler et al., 2007, p. 196). Huge variation from one year to the next was reported with regard to glaciers, sea ice, snow, rivers, and weather. The desire for predictability is interesting here, with people agreeing they need to know (for leisure, work, feeling safe). At the same time, despite having long-term monitoring data in an accessible form at their disposal, they will never know for sure. Their being out in the landscape is thus often based on their experiential knowledge – always open to relating to the given circumstances – and not (only) scientific projections. The different kinds of knowing – scientific, based on measurements, and experiential, based on embodied experience – do not necessarily contradict each other, but neither is their relationship blunt or linear. In the accounts of

scientists, technicians, tour guides, and long term residents, they rather prove to be feeding into each other. Our case study thus reiterates and reinforces the prominence of (Western) science(s) as a knowledge system for verifying change that is observed and sensed in Svalbard, meanwhile highlighting the entangled rather than dichotomous relationship between different ways of knowing.

Conclusions

"Now it is over with 'refrigerator temperatures' we were used to having earlier, when you could count on keeping your food fresh in your backpack for several days when on a hike, says Isaksen" (Øystå, 2022). This was how Kjetil Isaksen, senior researcher at the Norwegian Meteorological Institute, one of the key scientific figures in the Svalbard context and communicator of climatic trends documented through monitoring programmes, commented on the release of Svalbard temperature statistics of summer 2022. Experiential knowledge meets long-term monitoring; embodied notions of provisions, melting and going off in the warmth, intertwine with modelling temperature trends.

Material presented in this article shows how people who live, work, and travel in Svalbard observe and experience environmental change through water-related phenomena, such as sea ice diminishing, glaciers retreating (and surging), rivers in flux, tundra saturating (and drying), snow disappearing (and appearing in worrisome abundance), and weather becoming unpredictable, with the least popular feature being heavy rain.

The richness of water forms in Svalbard nourishes different relations and emotional bonds. While people describe glaciers as beautiful and breath-taking, sea ice is mostly discussed in functional terms, yet both retreating glaciers and diminishing sea ice shock people with the pace of the change. Human-snow relations on Svalbard oscillate between depicting snow as a key element for aesthetic appreciation of the Arctic landscape, and a pragmatic approach to it as a factor determining both mobility and safety. Avalanches, slush, and landslides, unlike glaciers, sea ice, and snow cover, are less factors to be "observed" (let alone enjoyed) than experienced as events, lived with as threats, and sometimes processed as eye-openers (Ylvisåker, 2022; Meyer, 2022; Sokolíčková, Meyer, & Vlakhov, 2022). Even ice, which is normally ascribed a positive value and understood as providing the refrain of the Arctic (Hastrup, 2013b), acquires a negative connotation when featuring in the drama of rain-on-snow events, a malign variant of ice covering surfaces. Weather is experienced as a mixture of the social and the physical. We find the issue of weathering climate particularly relevant in Svalbard, where "knowledge about climate in science has been understood as beyond the memo-

ries and expectations that people encounter in the present" (Simonetti, 2019, p. 1). We have partly shown how scientists working in Svalbard also "rely on short and fast timescales to make 'visible' to the senses the very long and slow – therefore 'invisible' – timescales of earth history" (Simonetti, 2019, p. 2), but a deeper understanding of the constant confluence of trends (climate) and happenings (weather) in Svalbard's knowledge production context is somehow missing. The range of "waters that matter" which we could document is not exhaustive. We have only hinted at the issue of a warming ocean and related changes in marine life, and we lack data on many less straightforward but no doubt important parts of Svalbard waterworlds (such as freshwater, groundwater, and evaporation; see Nowak et al., 2020).

Our contribution adds to the understanding of how we perceive change through a study of waters that matter in a transient and hyper-mobile Arctic locale. Our findings support Ingold's perspective (1993, 2022) that perceptions are filtered through activities and tasks. This is what makes waters matter and carry value. Our interlocutors describe change in relation to practices, functions, relations, and emotional attachments to Svalbard's environments. The dimensions and layers of meaning-making processes accompanying environmental change emerge as task-based readings of the landscape where mobility patterns and well-being, framed in a discourse of safety, are the most prominent. We consider these examples of place-specific manifestations of performing what Ingold qualifies as tasks, "defined as any practical operation, carried out by a skilled agent in an environment, as part of his or her normal business" (Ingold, 1993, p. 158). The skilled agents we met observed processes interconnected with their own lifeworlds. Ingold's perspective thus helps us interpret these stories beyond neutral observations of hydrological phenomena. We started mapping "environmental change" but our data point out changing hydro-social and ecological relations. Our interdisciplinary team came to think of water less as an object, and more as an agent affecting which lifeworlds, identities, and tasks are made possible and which are not.

This also demonstrates how the "what" is connected to the "how." Perceiving, doing, relating to change, and developing understanding thereof is relational and subjective. It is how we relate that matters. We show that experiential knowledge counts as knowledge, although not "simply expert and cerebral [but] embodied and material" (O'Reilly et al., 2020, p. 18). Water, "in addition to being an ecosystem and 'natural' medium,... is also a human-made context" (Ballestero, 2019, p. 411). Just as science "never speaks in one voice" (Hastrup, 2013b, p. 63; see also O'Reilly, 2016), and uncertainty is something intrinsic to scientific knowing (Ballestero, 2019; Ingold, 2022), we try to "breach conven-

tional knowledge flows" (O'Reilly et al., 2020, p. 18) and show that next to boundaries and dividing points it is also fruitful to explore how different ways of knowing might help us to live with and tackle uncertain times.

Uncertainty is related to casting doubt, acceptance of not knowing, and valuing embodied observations and perceptions. Our study shows how doubt is enmeshed with duration and intensity of dwelling. In other words, how strong does one's relationship to a place have to be to feel certain about the legitimacy of one's experiential knowledge? Can one ever be certain? Svalbard is particular in the Arctic context with its populations' transience, and we hypothesize this is also what complicates the mutual enriching of scientific and experiential knowledge. People trust their ability to read the landscape here and now, but they question extending the relevance of their experiential knowledge to longer time horizons; it is here that long-term monitoring can contribute and gain more societal relevance.

According to Hanssen-Bauer et al. (2019), the discontent with shorter winter seasons and a wetter and warmer climate in Svalbard will not cease in the future. Our participants perceive Svalbard landscapes amidst change, turning in moments from safe to unsafe, from stable to unpredictable, from dominated by frozen water to abounding with liquid water. Waters change, the changes matter, and it also matters how these changes are made known (Radonic, 2019). When some of us swam in *Adventfjorden* in late October 2021, we immersed ourselves in the cold ocean but also noticed there was no need to cut out a hole in sea ice; the water was open. We felt human presence was somewhat inappropriate in Svalbard, but through fieldwork we learned about the myriads of entanglements of people and waters. These lived relations and the stories being told reveal valuable knowledge about environmental changes, likely to intensify in the near future.

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Povzetek

Glede na znanstveni konsenz se otočje Svalbard segreva hitreje kot preostali deli planeta. Posamezniki, ki živijo, raziskujejo ali pa redno obiskujejo ta del evropske visoke Arktike, opazujejo in doživljajo tovrstne spremembe v prepletu med védenjem in intimnim zaznavanjem hitro spreminjajočega okolja na Svalbardu. Vsebina članka razpravlja, kako sta vedenje in doživljanje okoljskih sprememb s strani znanstvenikov, tehnikov in turističnih vodičev, ki raziskujejo in razkazujejo tovrstna okolja, prepletena z njihovimi raznolikimi interakcijami z vodo povezanimi pojavi in procesi. Skozi pripovedi sogovorcev odstira pomene védenja in doživljanja različnih pojavov, kot so morski led, ledeniki, reke, tundra, sneg, dež in z njimi povezanih procesov taljenja, zmrzovanja, nabrekanja, izsuševanja, erozije, pri čemer osvetljuje njihov pomen znotraj soodnosnosti med človekom in okoljem. Sogovorniki poudarjajo številne vidike odnosa s krajino, njihovo identiteto, pričakovanji, strahovi, čustvi, védenjem in praksami. Preko relacijskega pristopa in Ingoldovega koncepta "taskcapes" ter njegove perspektive bivanja, vsebina odstre številne časovnosti, ki sooblikujejo in spreminjajo krajino na Svalbardu. S sopostavitvijo znanstvenega védenja in izkustev, vsebina pokaže kako njuna soodnostnost in prepletenost sooblikuje pomen krajine na Svalbardu.

KLJUČNE BESEDE: Svalbard, okolje, spremembe, dolgoročno spremljanje, izkustveno vedenje

CORRESPONDENCE: ZDENKA SOKOLÍČKOVÁ, Arctic Centre, University of Groningen, PO Box 72, 9700 AB Groningen, Netherlands, z.sokolickova@rug.nl