

Sámi salmon, state salmon: TEK, technoscience and care

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journals.sagepub.com/home/som**Solveig Joks**

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Abstract

How to think about salmon in the Deatnu River in northern Norway? Sámi local ecological experts and biological modellers respond to this question in quite different ways. Local people are embedded in complex and situated webs of relations which include people, salmon, different kinds of fishing, forms of salmon unknown to biology, the state of the river and its flow, and the activities of tourists. For the biologists salmon are known as populations, spawning escapements, stock-specific spawning targets and production potentials. The biologists argue that salmon populations are in decline, and seek fishing restrictions. Since they are close to state regulatory authorities their recommendations lead to policies which reduce fishing and seriously erode Sámi practices and ways of living. This article explores this difference and the controversies to which it leads by situating these historically in the long-term extension of colonial state power and the subordination of Sámi people. Then this difference is explored in terms of care. Arguably both scientists and local ecological experts care for salmon, but how they care and what they care for are also very different. So the biologists divide nature from culture as they care for salmon populations. Despite the fact that they are required to relate to traditional ecological knowledge, in practice population biology does not care for local people in ways recognisable to Sámi. In contrast, Sámi modes of caring simultaneously respond to salmon, to the river and to Sámi economic and cultural practices, but not to population projections. The study uses the STS focus on practice and Helen Verran's attention to 'going on well together in difference' to explore how this power-saturated intersection between these two realities might be rendered more productive. It is argued that scientific ways of thinking need to be 'softened' while Sámi ways of knowing might be 'hardened' and made more transportable.

Keywords

biological modelling, care, environment, indigenous people, nature, postcolonialism, salmon, Sámi, STS, traditional ecological knowledge (TEK)

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Nowadays there are so many people fishing. And of course they will catch fish if they fish day and night. The problem is that the fish never get any peace, not even for an hour. (The words of Petter Somby, Deatnu River fisherman)

An overview of threat factors in the Tana show[s] that overexploitation of salmon in the different parts of the salmon migratory system is the major threat factor for Tana salmon. (A view from the biologists)¹

Introduction

In Sámi 'Deatnu' means 'the big river'. It is also the Sámi name for a major river in Sápmi in north Norway and Finland.² Deatnu (the Norwegians call it 'Tana' and the Finnish 'Teno') is one of the most important salmon rivers in Europe. This article is about that river and the management of its Norwegian part. It is about salmon, people, administration, international frontiers, conflict and conservation on the Deatnu. It is about the Sámi, the indigenous people who live in north Norway, Finland, Sweden and the Russian Kola peninsula. This means that the article is also about at least two different worlds. On the one hand, there are civil servants and politicians and biologists, and conservationists. On the other, there are local people, often though not always Sámi, who fish for salmon in the Deatnu and its tributaries. In one of these worlds, the world of politics and science, the Deatnu is in crisis.³ The number of salmon returning and spawning has fallen. In some places that decline has been extremely serious. Something needs to be done, and it needs to be done urgently. So policies that drastically limit fishing and the ability of local people to fish in their own ways are being imposed. In the other world lived by many local and Sámi people, salmon numbers go up and down, but if there is a crisis then this is not necessarily obvious. And if there are problems about salmon and their numbers then the origins of that problem are not necessarily those identified by the scientists and administrators.⁴

At the same time this article is also about care in at least three ways.⁵ First, it is a story about *what* or *whom* to care for. The numbers of salmon? Their genetic diversity? The birds and animals that fish for salmon, the predators? The people who live by and with the Deatnu? Sámi practices and Sámi ways of relating to salmon? The tourist industry and the revenues that tourism brings to the northernmost counties of Norway and Finland? Perhaps these overlap, but sometimes, perhaps often, they do not. Second, it is a story about *how* to care. That is, it also pits different models for caring against one another: centred modes of knowing the environment as against distributed understandings of how the world works; textual versions of knowledge versus contextually related stories; calculations as opposed to narratives that resist quantification; the idea that knowing is something best made transportable and drawn together in a single location, as against the idea that knowing is located and essentially context and occasion-linked. And then third, it is about *who* it is that does the caring. Sámi people or environmental biologists? Local fishers, Sámi and otherwise, or administrators? Those who live by the Deatnu, or politicians?

What or who gets cared for; how that caring is done; and who it is who does the caring – with these questions we locate our enquiry at the centre of the growing interest in

care in feminist STS (science and technology studies).⁶ Particularly important in this work is its critical sensitivity to the links between care and power. Thus caring takes place within what Lorraine Daston (1995) calls ‘moral economies’ that shape normativities and affects. As Martin, Myers, and Viseu (2015, p. 627) observe, care is also:

... a selective mode of attention: it circumscribes and cherishes some things, lives, or phenomena as its objects. In the process, it excludes others. Practices of care are always shot through with asymmetrical power relations: who has the power to care?

If the central image in care is that of entanglement in constantly changing webs of relations (Mol, 2008, #2662), then it cannot be assumed that all entanglements are desirable, and indeed the dominatory implications of care have been the focus of a range of recent studies.⁷ Overall, the conclusion is that what looks like – and indeed counts as – care from one point of view may look like and be domination from another. And this is indeed how it is in the ‘postcolonial’ controversy that we explore in this article.

In what follows we draw on Joks’ PhD research (Joks, 2015). The PhD explores the controversy briefly described above and attends, in particular, to the marginalised views of local ecological experts expressed in Norwegian and especially Sámi. In what follows we first briefly spell out the entangled history of the Deatnu and its fishing. Second, we describe some of the Sámi ways of knowing and thinking about salmon, *luossa*. We show that these are ways of knowing that can be separated only with difficulty from embedded and located practices of fishing or not fishing, practices that are also about relating to the river. Third, we turn to the practices of the biologists and describe their modelling and the policies that follow from those models. With these contexts in place, we focus on the conflict between conservation biology on the one hand, and particular Sámi versions of traditional ecological knowledge (TEK) on the other.⁸ We show how conservation biology, which is supposed – and indeed legally required – to consult with TEK fails to do so satisfactorily. Indeed, it turns out that it *cannot* really do so because the stories that make up TEK do not count (literally count) as evidence in the world of quantitative population modelling used in conservation biology. So whatever the theory, in practice it is a version of science that currently adjudicates the existence and the character of the problem. Backed by administration, its problematisations dominate, and its solutions rather than those of TEK are put into practice.

In conclusion, we ask what might be done. Politically our first commitment is to the dominated TEK (which is also a largely Sámi expression of – and part of – long-term and particular relations involving people, the river and its fish.) But what of biology? This fits much less well with the model of changing and responsive entanglement that lies at the heart of care. It also fails to care for TEK or Sámi ways of relating to the river by substantially ignoring these. At the same time, however, since it attends to otherwise invisible realities distributed across time and space, it is also too simple to say that biology is ‘uncaring’. So what is to be done? What might better caring look like?

To think about this we draw on the work of Helen Verran (1998, 1999, 2001) and ask what it might take for these two modes of caring to *go on well together practically in difference*. In the power-saturated circumstances we are describing there is no easy

formula. However, our general suggestion, one common to the sympathetic literatures on TEK,⁹ is that on the Deatnu biology needs to learn ways of attending to TEK. In particular, it needs to generate practices that *soften* its understanding of ecologically-relevant realities sufficiently to allow it to better attend to what it is being told by local experts. As many have noted in similar contexts, this implies attention to the issue of quantification. It also suggests the need to think hard about the nature/culture binaries embedded in fish population models. Here a TEK critique of the basis of many of the statistics becomes important. At the same time, Sámi ways of knowing also need some adaptation. Thus, statistics in nature conservation and policy are profoundly controversial in Sápmi. In particular, there is a grim history in which quantified environmental modelling has been used to impose alien understandings of reindeer herding and equally alien policies in which this is limited and controlled (Benjaminsen, Reinert, Sjaastad, & Sara, 2015; Reinert, 2014). At the same time, we nevertheless warily suggest that local experts would be wise to attend to biological predictions of declining salmon populations – though this does not necessarily imply accepting these in their present form. Nonetheless (this moves us back to the biologists), it is clear that, as in many other contexts (Gadams et al., 2015), local expertise might be used to explore, elaborate and modify those modelling predictions. Finally, we also argue that it is crucially important to find ways of assembling TEK and rendering it transportable and more legible to outsiders such as biologists. In short, our argument is that it is urgent to find ways of *hardening* that knowledge. Our object is not to suggest that consensus can – or even should be – achieved. We can, for instance, think of no conceivable circumstances in which local experts would come to think in the same way as environmental modellers, and neither do we think this would be desirable. The issue is rather to follow Verran and explore practical and material ways of allowing the two sets of practices to go on better in difference.

Histories

The geographers tell us that the Deatnu is located on the Finnish–Norwegian border in Sápmi. They add that it runs for 348 kilometres, and for around 256 kilometres it marks the border between Finland and Norway. The historians tell long and complex geopolitical stories about empires, nations, boundaries, state-building, racism and ownership (Pedersen, 2011). Until 1751 there were no fixed national boundaries, and even when the boundaries were defined, the so-called ‘Lapp Codicil’ in the same year allowed Sámi people and their reindeer free movement across those borders (Pedersen, 2008). Geopolitics continued to unfold as the borders between Norway, Sweden, Finland and Russia shifted in ways that were at best arbitrary from the point of view of Sámi people, and sometimes disastrous.¹⁰ And new settlers moved into areas that had previously been Sámi. All this happened in a century of gradual state-building, and against a backdrop that was colonial at best and often straightforwardly racist. This was a world in which the Sámi were inferior.

As a part of this, legal scholars tell equally complex stories about ownership. This took different forms at different times and places, but overall it worked to re-contextualise collective ownership of fishing rights. As the process of nation-building continued, in 1871 (Solbakk, 2011a) and despite resistance, new fishing rules were imposed which

marked the beginning of the end of Sámi self-government. The 1888 Act on fishing rights in the Deatnu River (the Tana Act) restricted net fishing on the river¹¹ to local householders who owned or leased fields, and excluded other household members, though fishing with a rod was still permitted. The rights of householders were further restricted in 1911 through the 'Royal Resolution', which was resisted by many upriver Sámi who were not consulted about these changes.¹² Fishing with nets was confined to those who produced 2000 kilos of hay a year. The overall trend was one that favoured settlement – settled agriculturalists – against those who lived by herding, hunting and gathering. It also, albeit incrementally, made space for outsiders to fish for a fee¹³ – a space that was progressively occupied by sports fishing, and gradually impacted on net fishing, such that, to bring the story up to date, in 2012 rod fishing, partly local and partly by outsiders, took around 60% of the total catch of the Deatnu and its tributaries (Erkinaro, Falkegård, Niemelä, & Heggberget, 2012, p. 4).

That is the law. But administration and international politics add their own further complexities. So, for instance, since 2011, the part of the Deatnu in Norway has been managed by a local administrative body, the Deatnu River Fish Management Board (Deanučázádaga Guolástushálddahus/Tanavassdragets Fiskeforvaltning – DG/TF) (Deanučázádaga guolástanhálddahus/Tanavassdragets fiskeforvaltning, 2016). Locally appointed, most members represent net fishermen, and there are additional representatives from the Deatnu and Kárášjohka municipalities. The main tasks for the DG/TF are to regulate fishing, organise river policing and manage fishing licence revenues. On the Finnish side, it is all a little different. Fishing rights generally belong to the owner of the land, a so-called 'water area' (Burgess, 1996). Land ownership includes membership of the Fishing Cooperative, which is a register of all landowners with fishing rights. The main difference with respect to net fishing between Norway and Finland is therefore that hay production is crucial in Norway, while fishing rights in Finland are connected to land ownership. The different rules in Finland and Norway have meant that it has been easier to establish fishing rights in Finland than in Norway. And this is crucially important because many new households were created in Finland in the 1970s in the Ohcejohka/Usjoki municipality (Burgess, 1996). Anglers and companies have come from south Finland in large numbers, have bought property from locals and built cottages. As a result, large numbers of people have become members of one or other of the fishing cooperatives, and now have the right to fish with a rod from boats (though not nets) within their cooperative area even though they are outsiders. Indeed, the locals talk of them as 'tourists'. This contrasts with Norway where no-one from outside the Deatnu can fish alone from a boat. Without a local person to row the boat, they have to fish from the river bank.

Sámi ways of knowing salmon

Quiet

Ethnography. It is 2.00 p.m. on 1 July 2011. Petter and Solveig are meeting at Petter's house. They have chosen this time to fish with rods because the Finnish tourists are not allowed to fish from boats between 2.00 and 8.00 p.m. *Fiertu ja beaivadat*: 'it is a

quiet sunny day'. They walk down to the river. No tourists. It is indeed really quiet. Solveig notes:

We do not use the boat's outboard. Instead, Petter starts to row from Moskki to Mákkidsavvoniid. Anglers are not allowed to fish from boats, not at this time. On the Finnish side Solveig can see five people fishing from the bank with rods. She can also see two boats. People are repairing their outboards. Solveig is sitting in the stern. She is letting out the lines, an arm's length at a time. For both the rods. By now Petter is rowing in the *savvon*.¹⁴ There are no [fishing] weirs in sight. And no boats either. Not at Mákkidsavvoniid.

For a moment the clamour of tourist fishing has been stilled. Since Petter and Solveig are the only people fly fishing, it must seem very quiet for the salmon, which must be good for them. We want to say that this is about *care*, for caring for the river and the fish in the river is partly about being quiet. Allowing the salmon to swim in peace. Partly, too, it is about flies. Petter makes his own flies. This means that each is a little different. If the salmon see the same kind of fly again and again – if they see manufactured flies – then, says Petter, they no longer find these attractive and hide in quieter places like *guoikkat* (rapids) or places in the river where there is *coahki* (low water).¹⁵ But care or its absence is also about the sheer number of fishermen:

With all the tourists the river has turned into a motorway. And they are screaming, the fish. Tourists buy a 24-hour card. They don't have time to take a coffee break. And the tourists want to fish at the best places during their 24 hours. (Petter Somby)

Another of Solveig's interviewees, Johannes Varsi, says that there are hundreds of tourists on the Finnish side of the river. The river is black, he says, filled (*čáhppadin*) with tourists, and much of the time there are dozens of boats on the Finnish side, queuing and waiting to fish. Petter says that the problem is that you cannot rest if you are a tourist. You cannot put off fishing if the weather is not right. You cannot avoid fishing if the state of the river is not right. If the water level is too high (*dulvi*), or too low (*coahki*). You have to make full use of your 24 hours even if local fishermen would not dream of fishing in those conditions.

Respect, bivdit, and 'what is meant'

Back to Solveig's notes:

We take a break. Petter rows to the bank, and we drink coffee. And then, while we are sitting on the bank, we see a boat. They are fishing. We watch as they catch a salmon. Solveig calls out. 'Do you see that? If we'd been on the river that fish could have been ours.' 'No', says Petter. 'That's not right. Because that fish was not meant for us' [*Diet guolli ii lean munnuide oidnojuvvon*]. He adds: 'We can't catch the fish that are already caught' [*Ean moai sáhte goitotge goddit daid guliid mat leat juo goddojuvvon*].

Another thread from this ethnographic story. The word *oidnojuvvon*. Above we have translated this as 'was not meant'. But we might equally have written 'was not fated',

‘was not intended’, or ‘was not given to us’. For there is indeed something about *being given* here, something that is *outside the power of people*. It has to do with Petter and Solveig and the salmon in question, but it is also bigger than people and fish alone. We are in a particular kind of relational world. So, for instance, salmon may *smell* people. Thus, Petter tells Solveig to hold the fly for a while before she releases it into the water. Solveig interprets this to mean that she needs to create a contact between herself and the salmon. But Petter is also implying something more general about salmon, people, and a wider context. In what way?

One answer is that salmon are not easy prey. They make a choice. If a fisherman shows appropriate respect then a salmon may give itself to that fisherman. The Sámi word *bivdit* indexes what is at stake. On the one hand, it means to hunt and to fish. On the other hand, it also means to plead or to ask – for instance, to ask someone to do something.¹⁶ Fishing, then, is partly about asking, and asking respectfully. The salmon may accept the request, or it may not. In a certain way it has autonomy. It may choose to sacrifice itself to a particular person, or not.¹⁷ At this particular place, and at this particular time.¹⁸ This also suggests that personal humility is important, a further expression of respect (‘Because that fish was not meant for us’).

Bragging about a salmon catch would put you above it as something you had conquered due to your own cleverness. If part of the reason behind the catch had to do with the salmon’s willingness to be caught or the wilderness’s willingness to share something with you, then expressing it as a private success would threaten the contractual nature of the catch. The result might well be that the next time you fished at the same spot you would catch nothing. (Schanche, 2004, p. 3)

So respect is important before, during, and also after fishing. And, as we suggested above, the context extends to larger patterns of intention (Schanche’s term ‘contractual’ is probably too restricted). And sometimes – not always – that context includes God:

Gosa bat dat Ipmilláhji lea šaddan? Ozai čuimmiid ja luŋkkáid vuolde. - Vai johkii dat láhji njuikii?

[What’s become of ‘God’s gift’. He searched for it under the pillars and doors. – Or did the ‘gift’ jump into the river?] (Guttorm, 1982, p. 31)

In this quote from a Sámi novel the protagonist is trying to count the salmon that he has caught, but the reference to God is seriously intended. Care, then, is about respect. It is about knowing limits. It is about entering into a relation with the river and its salmon, and not exceeding oneself.

Plenty or not?

But let us return to Solveig’s ethnography.

Petter and Solveig fish at the first spot for an hour. No bites. No fish. They take the lines in, start the outboard and set off downstream to Uvllásavvoniid. Fifteen or twenty minutes later Petter

cuts the outboard. He starts rowing, and Solveig puts out the rods and lets out the line again. It's the same again. No fish.

Petter says: 'This has happened to me many times. Going fishing but not catching anything. The fish that are swimming now aren't easy to catch. They are very fat, and very hard, and they are short too. But some years ago I didn't catch many fish either. It was before 13 July. I remember the date because that's when they had the fishing competition in Sírnmá.¹⁹

So fish vary in appearance ('very fat, and very hard'), and good fishing comes and goes, with good years and bad years. Similar stories turn up in the newspapers and on the web pages of the Norwegian broadcaster, NRK. For instance, 2014 is a good year. 'Tidenes beste laksesommer' ('The best salmon summer for ages'²⁰). Here is Andreas Njårga, again quoted by NRK:

'I have personally never experienced a better salmon summer than this year. I've been fishing for two weeks, and during this time I have caught all the salmon that I need. I've caught enough for myself, my wife and the whole family.' (Larsen & Nosta, 2014, our translation)

Something similar is happening in one of the fjords, the Skillefjord. Here is Torbjørn Olsen quoted in the same NRK report:

'I have never experienced anything so extraordinary as this year. Here we have even had to increase the size of our freezers to keep up with all the fish.' (Larsen & Nosta, 2014, our translation)

Though people – if they are not respectful – may also bring trouble down on their heads:

Petter and Solveig are talking about the Sámi television news. Solveig says that she has heard a man from Kárášjohka. He said that drift net fishing catches the salmon that were meant to go upriver to the Kárášjohka river. Petter disagrees. He says that the fish which belong to the area where they are fishing never go to the Kárášjohka river. It was the people there who destroyed the river, themselves, because they used Seine nets (*nuhtton*), and the breeding salmon meant to go there (*stámmaguolli*) have disappeared.

Though Seine nets are not necessarily to be avoided. Elsewhere, for instance in the lakes in Sápmi, they may also become important tools for caring.²¹ But not in the river, at least according to Petter.

So people like Petter care about fishing. As a part of this they care for fish in the Deatnu, and how to relate to those fish. This is a part of the context that we need if we are to understand the deeply felt dispute about fishing and its regulation. Here is the NRK again:

Over the past few years, a number of scientists have come up with warnings that there are few salmon in the Deatnu. The Deatnu salmon has been described as an endangered species, liable to disappear entirely unless fishing is restricted immediately. Against this, Andreas Njårga reports that there have been good catches in the weirs for the last two years. Therefore, he doubts the scientists.

'Researchers seem to have decided that there are few salmon in the Deatnu. That the salmon here are about to disappear. But if this is so, then I have to ask where the fish are coming from. Are they falling from the sky into the Deatnu? How does this all hang together?' (Larsen & Nosta, 2014, our translation)

A good question. So what are the scientists saying?

Biological ways of knowing salmon

The Working Group on Salmon Monitoring and Research in the Tana River System (the 'Group') is a Norwegian–Finnish government-level initiative established in 2010. It reports annually on the status and trends of salmon stocks (Erkinaro et al., 2012, p. 10), evaluates stock management with reference to North Atlantic Salmon Conservation Organisation (NASCO) guidelines, assesses gaps in knowledge, offers research guidance and scientific advice to managers. The Group's four members come from the Finnish Game and Fisheries Research Institute and the Norwegian Institute for Nature Research (NINA). Three have 'experience and detailed knowledge' of the Tana (Erkinaro et al., 2012, p. 10), while the fourth, representing NINA, links the Group to the Institute's scientific expertise.

The Group's first report appeared in 2012 (Erkinaro et al., 2012) and is gloomy. It argues that despite fluctuations, catches have been in long-term decline. Here we are in a world of quantification. The question is: are salmon stocks optimally reproducing themselves? To answer this, stock-specific spawning targets that will permit sustainable yields are calculated, and then estimates of the actual numbers of returning female spawning salmon are made to determine whether those targets are being met. This works:

- To distinguish different genetically distinct tributary populations (the argument is that there is relatively little interbreeding between salmon belonging to different populations);
- To estimate annual spawning by hypothesising relations between a series of variables,²² for instance by assuming that predation and exploitation reduce the numbers of breeding salmon;
- As noted above, by comparing actual production of smolt (young salmon) for each stock with target thresholds²³ (production is lower than those targets); and
- By estimating the maximum number of smolt that can be produced for each river and tributary (again with a narrative about the significance of particular variables)²⁴ (Erkinaro et al., 2012, pp. 60–64).

The result is a story that is both quantitatively precise and predictive,²⁵ though as the report makes clear, its input figures are often the product of guesswork, so precision does not necessarily imply accuracy. So, for instance, tributary populations are hard to distinguish in practice. Production potential is uncertain because standardised estimates for density dependence are difficult or impossible to attain.²⁶ And estimates for spawning fish are similarly uncertain. It is best, notes the report (Erkinaro et al., 2012, p. 65), if

spawning fish can be directly counted by divers. Failing this, videos of acoustic counts of fish moving up the river may be combined with catch statistics. Least good, catch statistics can be combined with an estimate of the proportion of fish being caught (the ‘exploitation rate’, a figure derived from comparison with other river systems, and to which we return below). In practice, it is this third method that is most widely used in the 2012 report, which then uses these statistics to run simulations and probability distributions, and arrives at the conclusion foreshadowed above that:

... target attainment is currently very bad in the Tana river system. ... in the period 2004–2010, and in most years the spawning stocks were far below the targets. (Erkinaro et al., 2012, pp. 5–6)²⁷

Indeed, in some places there is no sustainable surplus at all.

There is much more than this in the report, but the management advice is clear:

An overview of threat factors in the Tana show [*sic*] that overexploitation of salmon in the different parts of the salmon migratory system is the major threat factor for Tana salmon. (Erkinaro et al., 2012, p. 5)

Much tighter – and controversial – regulation of fishing, and especially of returning female salmon, is urgently needed. But controversial too are the causes of any decline, so the report also crosses swords with local experts about the significance of predators and different forms of fishing, an issue to which we return below.

Science and TEK

Procedurally, the Group is required:

‘To integrate local and traditional knowledge of the stocks in their evaluations’ and ‘[t]o collect information from local communities and organizations and cooperate with such bodies in the dissemination of scientific results to the public.’ (Erkinaro et al., 2012, p. 10)

The report notes that there is much encouraging ‘contact and cooperation between locals, researchers, and managers’, before moving to its own account of TEK/LEK. This, it says, ‘is tied to a place ... and is knowledge acquired through experience and observation’ (Erkinaro et al., 2012, p. 29). It cites Berkes, Colding, and Folke (2000) to say that it ‘can broaden the information base needed for decision-making’, adding that this is less useful for well-studied species such as salmon. Then it turns to epistemology.

LEK and TEK is largely oral and visual, intuitive, experience based, subjective and highly qualitative, while science is based on systematic data within a model- or hypothesis-based framework which, though the use of a strict sampling design, are largely objective and quantitative. The usefulness and relevance of LEK/TEK therefore becomes highly limited. (Erkinaro et al., 2012, pp. 29–30)

Picking up a theme from the previous page, it continues:

The attempts at segregating LEK/TEK from science also contain a strong element of misunderstanding about what science really is. Science is described as strictly hypothesis-based, linear, oversimplified and reductionistic, and this description is used to illustrate how far removed science is from the realities of nature. This is, of course, a fundamentally wrong description of science, and the attempts at establishing LEK/TEK as an equal alternative to science becomes [*sic*] flawed. (Erkinaro et al., 2012, p. 30)

Then it offers its own empiricist theory of science:

Every bit of information is exactly that, information. And all bits of information have their place within natural science and can be included. ... So when fishermen, which are the contributors of LEK/TEK, complain that their knowledge is not being taken into account when scientific results and evaluations are presented, they do so largely because they fundamentally misunderstand at which level and how TEK/LEK are included and used. (Erkinaro et al., 2012, p. 30)

In practice, then, the conclusion is that TEK/LEK can do one of two things for scientific enquiry. Its observations may lead to new scientific hypotheses, or be used to test and interpret scientific results.²⁸

So what to make of this? We foreshadowed our argument in the introduction. It is clear that in this understanding biology fits only partially into the model of changing and responsive entanglement that lies at the heart of care. It looks a lot more like Mol's (2008) 'control'. In practice it is dismissive of TEK, and of the Sámi ways of knowing and being that underpin this. Its models stipulate a relatively limited set of possible relations and exclude many others of vital importance to local people. Its relations also rest on a division between nature and culture – a point to which we return below. On the other hand, it is too simple to say that the biology is 'uncaring'. This is because it generates and attends to realities distributed across time and space that would otherwise be invisible. Arguably, then, it cares about and for salmon stocks, for the long-term preservation of those stocks and their genetic diversity. It cares about doing good science and about getting the right answers. And it does so by quantifying and modelling; by estimating its inputs when it has no choice; by juxtaposing statistics to create chains of inference in its models; by comparing actual outcomes with targets; by foreseeing outcomes; and by telling stories about the future that have implications for the present.

Creating traditional ecological knowledge

Though the scientists may have their disagreements, in practice for people who live with the river those scientists usually speak with a single voice. Claims about salmon stocks are made. Regulations appear. And then those regulations are imposed. So what of the local people? The answer is that though they have their own disagreements, as we mentioned above they often experience the findings of the biologists and the regulations that follow as arbitrary or irrelevant. Importantly, the science frequently cuts across ways of fishing central to the lives of many, continuing a process of erosion that has been going on since Norway and its neighbours set out on the process of nation-building. We cannot explore the complexities here, but we can give the sense of a particular Sámi position by returning

to Petter Somby, one of the fishermen whom we met above, and drawing too on interview material with Aslak Varsi. Our concern is to extend what we have already said about Petter's TEK. And as a part of this, it is to understand what this implies for care – for caring for fish, the river, people, and the relations in which they are embedded.

First let us briefly note that people like Petter study the overall river, and especially their part of the river, very carefully indeed. So, for instance, they distinguish between *čázis*, *coahki* and *dulvi*. *Dulvi* means 'high water' and *coahki* 'low water'. As with some of the terms that we discussed above, for Petter and his fellow fishermen these terms are practical – they have to do with where to fish, including where to place fishing weirs. In the past when Sámi people managed the river themselves they would always fish in *čázis* locations. These were places where the water level was optimal. In a *čázis* area fishing is excellent. But now often such fishing is not possible. This is because the river is zoned, and its drift net fishing permits are restricted to individual zones for a three-week period between May and June. Since some zones are not in *čázis* at the right time this means that no drift net fishing takes place.

As the biologists who wrote the Tana River Report note, this kind of local knowledge generates ways of thinking quite unlike their own. '[O]ral and visual, intuitive, experience based, subjective and highly qualitative', those were their words. We do not buy into the whole list ('subjective'?) but categories such as *čázis*, *coahki* and *dulvi* are certainly experience-based and qualitative. And then there are fish in Petter's world that do not appear in biology. These include *orru guolli*, *vuoggaguolli* and *čáhppes guolli*. *Guolli* means 'fish'. But these are not biologically taxonomic. For Petter an *orru guolli* is a salmon that stays in the same place. The significance of this is that it is a fish that will only take a particular kind of fly. Aslak, who lives in Petter's area, describes a visit by one of the best Deatnu fishermen who usually fished a long way downstream. But when he came to visit he caught nothing because he used his own different flies. Obviously the *orru guolli* is a category of fish neither relevant to, nor noticed by, the biologists, but it illustrates the fine grain of TEK.

Then there are *vuoggaguolli*. These are fish of no particular appearance. *Vuogga* is Sámi for fly, so a *vuoggaguolli* is a 'fly fish'. It is, Petter explains, difficult – even impossible – to catch salmon with a rod unless there are *vuoggaguolli* swimming in the river. But a fisherman will never say that he has caught a *vuoggaguolli*. He might, instead, say that he has caught a *diddi*, a small salmon weighing between one and three kilos. A *vuoggaguolli* is a relationally behavioural category to do with fishing with a rod and line. It is a way of talking about the likelihood of catching salmon: about whether it is worthwhile going out with a rod at all. So it describes the behaviour of fish. Again it is not taxonomic, but reflects detailed and fine-grained knowledge of the behaviour of salmon.

Finally, there are *čáhppes guolli* or 'black fish'. These are fish getting ready to spawn.

Petter says that first of all we have to protect *čáhppes guolli*. 'From the beginning of August we should not be fishing at all. But it's not worthwhile throwing them back if it's only me and a few others who are doing so, because the Finnish tourists will keep on fishing them anyway. And *čáhppes guolli* have to spawn and therefore it's important that they can get peace and quiet.'

These stories tell us three things. First that Petter's form of fishing is under continuing pressure. Second, that Petter and people like him know a great deal about the river, the fish in the river, and the relations between people, fish and the larger forces at work. And third, that their ways of knowing and managing the river also have to do with caring. They want – and they need – the salmon to return, and they have thought carefully about what this might imply. So as we have just seen, Petter has strong views about *čáhppes guolli* or black fish. These should be protected. In August they should not be caught at all. And he has equally strong views about overfishing. Remember that he and Solveig also went out to fish at the only moment during the day when the river was not being overrun by Finnish tourists in boats. The two of them needed space to fish, but Petter is also implying that too many salmon were being caught overall. Perhaps as importantly, the wrong kind of salmon (black fish) were being taken or disturbed. And finally, there is the point about quiet. For as we have seen, the river was never quiet, which was bad for fishing, bad for the fish, bad for black fish, and therefore bad for spawning, fish fry and fish stocks in general.

Petter makes a further point also made by many others: that predators make serious inroads into the numbers of salmon:

'Sharp-billed' birds eat salmon fry, such as *gáhkko*, that is red-throated diver. *Čeavrrit* (otters) have increased.

Many along the Deatnu talk about birds of prey, predators and carnivores (Ween, 2012b, pp. 155ff.). Here the difficulty is that the predators are protected. Aslak describes the seabirds that turn up on small islands close to where he lives on the Deatnu:

It is full of birds here, and this leads to problems because they eat salmon fry that are growing.

The scientists disagree:

Predation is a factor that is widely pointed to locally as a threat for salmon. There is very little biological basis for arguing that naturally occurring predators are a threat to salmon, and predation must rather be viewed as an integral and natural part of the ecosystems that salmon live in and it is rarely possible to measure any negative impacts from predation. The best way of counteracting any potential effects of predation is to make sure that management targets for the stocks are met so that stocks are full-recruited on an annual basis. Other local arguments that are discussed include natural variation, increased tourist angling and decreased number of gillnets. (Erkinaro et al., 2012, p. 5)

Here the scientists and local people are living in two different worlds. So, for instance, at a 2012 seminar on the future management of the Deatnu the need for tighter rules on fishing was discussed by the regulators. For obvious reasons this was controversial, and local people returned to the issue of predators and said that in the past they protected fish fry from those predators. For instance, they set *sáibma*, small-mesh nets, to catch sea trout, but these nets also caught predators such as pike (Pedersen, 2011, p. 5) *Sáibma* were banned from 1990, and many believe that pike stocks have increased as a result.

Neither were there any restrictions on shooting birds such as goosanders, and in the past there were springtime hunts for mergansers (Pedersen, 2011, p. 23). Along with many others, Aslak is frustrated because the scientists ignore these kinds of observations. People are no longer allowed to control predators. And overall, they say that if salmon are under pressure then there are many reasons for this, and some, perhaps most, of these are being refused by the scientists:

The fact that animals eat each other, is an essential and natural mechanism in all ecosystems and one that salmon are well adapted to living with. Tana salmon have lived with predators such as goosanders, pike and seals for thousands of years, and there have never been any problems. (Falkegård, 2014, p. 60, our translation)

The implication is that animals are natural whereas people are not. The biologists are distinguishing, as in so many conservation efforts, between ‘nature’ on the one hand, and ‘culture’ on the other (Hölzl, 2010; West, Igoe, & Brockington, 2006). An undifferentiated mass of people lies outside nature and disturbs nature’s ‘essential and natural mechanism[s]’ by fishing too much or by shooting mergansers.

We know, to be sure, that care is always selective. Despite the fact that locals such as Petter worry about the disappearing *stámmaguolli* or the taking of *čáhppes guolli* (‘black fish’), the biologists would no doubt argue that the local experts do not properly care for long-term salmon stock conservation. But here it is biology (and the policies that derive from its modelling) that dominate, so salmon stocks and predator species such as mergansers, seals, pike and otters are being cared for, while local relations between people, fish and the river are not. Particular kinds of people are being written out of their worlds in ways that prevent them from fishing in ways that they have for generations, and make little sense in the relational world of Sámi experience (Oskal, 1995). But there is a further difficulty that also has to do with care. This is that the efforts of the scientists and the regulations that flow from those efforts degrade the attempts of local people to care for their river and their fish. Why? Because when the fishing is restricted, as it is, people are driven from the river to seek other forms of livelihood. And, no longer watching over and relating to the river, neither are they any longer in a position to care for it. We are, in other words, watching a long-term process of deskilling. The capacity to care locally is under threat. Sámi practices and ways of being are being carelessly eroded.

So what is to be done?

At present in Norway the Deatnu is managed in part by the DG/TF. Above this body there is a hierarchy that includes the Norwegian Miljødirektoratet (Environment Agency) and a series of bilateral arrangements between Norway and Finland that trickle down to produce their own administrative arrangements on the Finnish side. As we have seen, from the point of view of local people many of these arrangements and policies make little or no sense. Scientific knowledge, statistically informed, is decanted into administrative regulations that undermine local ways of living and fishing while ignoring local knowledge of the river and its salmon. As again we have seen above, the scientists are mandated to attend to local ecological knowledge, but fail to do so in a manner that makes any sense to local experts. The question, then, is what is to be done?

There are many complexities here. Many have noted the web of overlapping and conflicting interests at work (Burgess, 1996; Ween, 2012a, 2012b). Local people frequently disagree, and the international differences in ownership and regulation between Norway and Finland further add to this complexity. Ween's (2012b, p. 155) description of the consequent regulation as 'cumbersome' is apt. If, however, we confine ourselves to Norway, some important points of overlap nevertheless emerge between the scientists and policymakers on the one hand, and Sámi experts such as Petter on the other. Both are concerned with spawning and salmon populations. Albeit in different ways, both are concerned with overfishing. Very differently, both are caught up in the same material administrative practices even if the latter manifest themselves in quite different ways. Again, there are also occasional meetings between representatives of the scientists and local people, though these are rare. Finally, we should not forget that the scientists are legally required to attend to TEK, though as we have seen this works poorly for local people. Though things are working badly, it is nevertheless on this rather slender common base that we want to build our conclusion. Our argument which comes from STS is that large differences, political, administrative, epistemological and ontological, all grow out of, imply and are reproduced in *mundane material practices*. The latter include meetings, discussions, texts, tools, instruments and devices, visual depictions, bodies and networks of supporting infrastructure.²⁹

If we start with TEK, the first question is *where* does this appear, and in *what material forms*? The first and most obvious answer is: as embodied skills. People like Petter simply *see* things that are invisible to outsiders. They know their section of the river in ways that visitors and scientists do not. As an important part of this they see both patterns unfolding over time, and *changes* to those patterns. But this cannot be separated from care, for they live and work on and by the river too. Over the years they care for it. And therein lies both the beauty of this kind of expertise but also its disadvantage. Unlike the 2012 Working Group Report discussed above, we do not need to distinguish between the 'objective' and the 'subjective'. STS suggests, instead, that materially situated expertise is relatively untransportable (Latour, 1990). If it is articulated at all (and often this does not arise) then this is probably to share knowledge with other local people, or perhaps to particular individual outsiders. It is unlikely to be in an attempt to make claims about the river or its salmon in distant places such as scientific meetings, management boards, or the offices of administrators. Neither, to be sure, is this kind of knowledge quantitative. Indeed, if it gets translated into any kind of textual form, then the case of the Deatnu suggests that this is likely to be in reaction to outside events. Yes, we may learn from the pages of the press that there are a lot of salmon this year, but articulation of this claim is in part at least a response to the claims of the scientists and managers that salmon populations are falling.

We are saying, then, that this kind of local ecological knowledge is qualitative, but also that it is not intrinsically textual in form. Furthermore, an important associated point, it is also *distributed*. There are dozens, probably hundreds, of people like Petter who have knowledge about the Deatnu. But their knowledge is not being drawn together. This suggests that whatever one thinks of the outsider knowledge of the biologists, they also deserve some sympathy. The local ecological knowledge that they are running up against and pushing aside is distributed and largely verbal. There is, as it were, nothing for them to push against. There is no fixed place either literally or metaphorically to

which they can go, and to which they can react. This suggests that one of the innovations that local people might consider is the creation of procedural and material ways for gathering knowledge, perhaps textual, that is also transportable in a way that might render it more legible to managers, politicians and biologists.

But legibility is not simply about movement. It also implies the willingness and, more profoundly, the ability on the part of the biologists to attend to testimony about the world that does not fit the standard habits of population biology. As we saw earlier, the 2012 Working Group Report argues that:

[S]cience is based on systematic data within a model- or hypothesis-based framework which, though the use of a strict sampling design, are [*sic*] largely objective and quantitative.

This claim embeds a crucial series of assumptions. In particular, its claim to objectivity probably implies the further assumption that in principle biology is able to stand back and achieve a ‘view from nowhere’ (Daston, 1995). If this is right then it implies a further set of metaphysical assumptions: that the world is not fuzzy or vague or multiple, but that it is rather one particular way, a *one-world world* (Law, 2015); that knowledge is not radically situation-specific (Haraway, 1991); and that in principle it can be moved from place to place without any loss to its validity (Latour, 1990); finally, as a part of this, it is also being assumed that the currency for transportable knowing is number (Porter, 1995).

In practice, to be sure, the biologists also know perfectly well that many of their numbers are less than ideal. As social scientists – and locals – appreciate, like the Deatnu River salmon, statistics do not fall from the sky but are generated in practical institutional and material arrangements (Latour, 1998; Mitchell, 2002). Think, for instance, of catch numbers. As Ween (2012b, p. 166) observes, fisherpeople help to create those figures. And as they do so they ask themselves: how will the authorities react to the figures that they receive? Will they worry about overfishing if the figures are large or that there has been overfishing if the figures are low? And what of the tourist fishermen from Finland who may have no reason to fill in the forms properly at all? So how to think about this? The obvious response is to ask how the figures might be improved.³⁰ But there is a larger problem. This is that in theory these statistics are reporting on a state of nature, but in practice they are better understood as describing a mix of nature and culture (because fish and people are ravelled together in the process of creating numbers).³¹ Social statistics are, to be sure, common enough, but these particular population statistics precisely work by *denying* the social. Or, perhaps more correctly, they work by denying the in-principle impossibility of excluding the social. This is what is needed if the empirical validity of the biological model is to be assured. The messiness and the heterogeneity have to be made to disappear.

Now we begin to see the full scope of the difficulty faced by both local experts if they are to create evidence legible to biologists, and by open-minded biologists who wish to take that evidence seriously. For not only do the local experts need to find ways of hardening their testimony, but the biologists need to find ways of softening their assumptions about what is to count as data; of retreating from a form of knowing that imagines the world to be one particular way, and from objectivity as data describing that world that are detachable from context and essentially transportable. It also implies the need to retreat

from both the insistence on quantification, and the assumption that nature may be tidily detached from culture.³² In practice this means that it will no longer do, for instance, to say that 'predators' are natural while people are responsible for 'exploitation' and treating these in categorically different ways. To put it differently, if there is to be any chance of mutual legibility then biology will need to understand the significance of (also) caring for something more than sustainable salmon populations.

What we are proposing here is not a collapse of biology into TEK, or *vice versa*. These are different ways of knowing and being, and to imagine that a happy dialogue might undo those differences is simply utopian. And dangerous too, because it does not attend well to difference. Instead we are suggesting the importance of experimenting with mechanisms for witnessing, talking and creating spaces for specific and material practices that recognise those differences both practically and metaphysically. The need, then, is for small-scale techniques (Kristin Asdal (2008) usefully calls these 'little tools') that will allow the biologists to entertain the possibility that knowing, local and biological alike, might be situated, and that good ways of knowing (including their own) might breach the divide between nature and culture. Correspondingly, as we have said, these are mechanisms that would make it possible for local experts to find ways of hardening their testimony and rendering it more transportable and legible. And then of asking themselves whether the quantitative tools developed by the biologists, limited and flawed though these may be, might nonetheless be raising questions about longer-term trends that also deserve attention. The issue, then, becomes whether the scientists are seeing things that the local experts do not, and what if anything to make of this.

How to do this? In general we cannot know. If knowledges arise out of 'little tools' there can be no single 'third way'. Instead, perhaps disappointingly, this is a question that needs to be handled instance by instance, practically, experimentally, more or less locally, and year by year. Perhaps, however, it would be wise to start by assembling local expertise for the Management Board. This, after all, includes local representatives as well as the voices of science. If this were achieved, it might then be possible to put local ecological accounts alongside those of the biologists – as indeed the biologists say that they wish.³³ But no doubt there are other possibilities too. Other fora might be created, like the local working group of stakeholders including scientists described by Waterton and Tsouvalis (2015) that gathered to explore the problems of eutrophication in a part of the English Lake District. Perhaps the members of such a group might walk the banks of the Deatnu and visit the places where the biological thinking and modelling is done. For whether or not it counts as a form of care, we have argued above that the science is not uncaring. The biologists that we have described indeed worry about the salmon stocks on Deatnu. But the local experts care as well. They care for the river, for the salmon stocks, for the fishing, but also for local social relations. So, despite the troubling differences in power, we do not want to say that one mode of caring should displace the other. Instead, we want to argue, following Verran, that it would be good to find practical tools that allow them to go on together despite – and indeed because of – those manifest differences.³⁴ With emphases on *both* 'together' and 'difference'. The STS literatures remind us that caring is about material practices for enacting heterogeneity, responsiveness and entanglement. They also tell us that caring is iterative. The conclusion is that the process of 'softening' science and

‘hardening’ TEK needs to be practical, small scale and experimental. Only in this way will it become possible to care for – and across – difference.

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Notes

1. Working Group on Salmon Monitoring and Research in the Tana River System (Erkinaro, Falkegård, Niemelä, & Heggberget, 2012, p. 5).
2. ‘Sápmi’ is the Sámi name for the areas that Sámi people traditionally lived in and in which they continue to live. In Sámi ‘Deatnu’ is nominative, and that in the accusative and genitive it is ‘Deanu’.
3. Politics and science also belong to many worlds. However, for Sámi there are usually fairly tight relations between scientific reports and policy decisions, so we treat them together here.
4. For an overview of the Deatnu River TEK–science differences, see Ween (2012b).
5. For introductions to the literatures on care see Mol (2008), Mol, Moser, and Pols (2010) and Singleton (2010).
6. It is tempting to say that care has become a major matter of concern! For the original argument the right way up see Puig de la Bellacasa (2011).
7. These include women’s health (Murphy, 2015), contemporary farming practices (Puig de la Bellacasa, 2015; Singleton, 2010; Singleton & Law, 2013) and colonial and postcolonial relations (Lyons, 2014). Related literatures in anthropology contrast the changing complexities of entanglement with what Anna Tsing (2012) calls ‘scalability’: that is the dominatory capacity to grow without changing the pattern of relations or those caught up in these relations.
8. The terms ‘local ecological knowledge’ (LEK), ‘traditional ecological knowledge’ (TEK) and ‘indigenous ecological knowledge’ (IEK) overlap considerably. Here we avoid the debates about these terms and talk of TEK because TEK (and IEK) imply adaptive *long-term* learning (Berkes, 2012, Ch. 1).
9. These are large. See, for instance, Berkes, Colding, and Folke (2000) and Berkes (2012).
10. As with the 1852 closure of the border between Norway and Finland for reindeer herding, which catastrophically interfered with annual patterns of long-distance movement (Solbakk, 2011a).
11. In weir fishing a permeable barrier is built which guides the fish into a net. In drift net fishing a net held up at one end by a float is drawn slowly downstream by a boat.
12. Two Sámi municipalities, Kárášjohka and Buolbmát, were not consulted. It was only lower down the river where Norwegians also lived that people were consulted (Pedersen, 2013).
13. The Deatnu became known to English aristocrats in the 1830s and the number of ‘outsiders’ fishing gradually increased (Solbakk, 2011b).

14. A smoothly flowing stretch of water in a big river.
15. For more detail see Joks (2015, p. 146).
16. *Mun bivddán du dahkat juoiddá*: 'I ask you to do something'.
17. See Oskal (1995, 2000) on the related topic of reindeer luck.
18. For further details see Joks (2015, p. 139). See also Willerslev (2007).
19. More than 100 people live in the area where Solveig did her fieldwork.
20. Larsen and Nosta (2014). The same report also quotes biologists saying that Tana salmon are a threatened species.
21. 'The most important fishing gear for settled Sámi in Guovdageaidnu has been the Seine net. The Seine net fishes but it simultaneously cleans the bottom of the lake. The net catches both fish, and twigs and leaves that have accumulated at the bottom of the lake' (Østmo, 2013, p. 53, our translation). Here Seine netting is an important form of care. See also Law and Østmo (2017).
22. These include incoming salmon run size, the weight and number of incoming spawning salmon, the losses to these and the consequent spawning salmon, the total egg production and the production of smolt.
23. The latter are higher than the minimum biologically acceptable limits.
24. This is a function of salmon density-dependent and density-independent variables. Variables for the former include water area and velocity, fish hiding places and food availability. Density-independent variables include floods, drought, temperature and predation.
25. The estimate of the target number of spawning females needed for the system as a whole is 12,539 (Erkinaro et al., 2012, p. 62).
26. Estimates of wetted areas use patchy (and nationally variable) maps and GIS data.
27. Figures ranged from 60% to 20% and were lowest in the upper tributaries.
28. Here the report includes an additional paragraph by one of its members, Tor G. Heggeberget, who presses the need for additional and formalised processes of dialogue between local communities and the Group (Erkinaro et al., 2012, p. 31).
29. See, for instance, Asdal (2008), Callon, Lascoumes, and Barthe (2009), Knorr-Cetina (1981), Latour and Woolgar (1986), Law (2004), Moser (2008) and Verran (1998, 1999, 2002).
30. For instance, by better organisation of reporting arrangements, by deriving findings from other sources (the report is very clear that this is needed), or by algorithmic correction.
31. Here is another Deatnu example. There is the binarising distinction between 'exploitation' of salmon (by human beings who fish) and 'predation' (by non-humans such as other mammals, birds and fish). But (as again the local experts note) the 'natural' figure of predation is also a function of human activity or inactivity (about whether or not to kill predators). For a salmon-relevant example of the complexities of nature/culture divisions see Law and Lien (in press).
32. Here the nature to be cared for becomes sustainable salmon populations while the corresponding 'culture' becomes 'production potential' (Erkinaro et al., 2012, p. 62) and its maximisation for fishing. See Puig de la Bellacasa (2015) for the productionist character of agriculture. It is clear that something akin to productionism is also at work here.
33. For attempts to work in this way see Waterton and Tsouvalis (2015) and Callon et al. (2009).
34. For further suggestions, see Law and Joks (in press).

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Solveig Joks is a researcher at Sámi allaskuvla/Sámi University of Applied Sciences. She works as editor for *Sámi dieđalaš áigečála*, which is a Sámi language interdisciplinary scientific journal. Her PhD thesis from the UiT, the Arctic University of Norway, is based on ethnographic studies of Sámi traditional knowledges in an area where salmon fishing in the river has a long continuity. Joks has also published written texts and films about traditional knowledges that Sámi women possess and transmit to children in a reindeer herding community.

John Law is Emeritus Professor in Sociology at the Open University and holds visiting appointments at Lancaster University and the Sámi University of Applied Sciences in Norway. The author of numerous material-semiotic studies in a wide range of empirical areas including aircraft technologies, disasters and salmon farming, he is particularly interested in the epistemological and ontological performativity of knowledge practices. His current work is focused on the interaction between technoscience and alternative knowledges in contexts of (post)colonial power asymmetries in two main areas. In collaboration with colleagues at the Sámi University for Applied Science including Solveig Joks and Liv Østmo, he is exploring environmental conflicts in north Norway, where technoscience and policy combine to marginalise Sámi practices, realities and understandings of the land and sea. And together with Wen-yuan Lin at the National Tsing Hua University in Hsinchu in Taiwan he is seeking to provincialise STS by exploring the possible character of alternative ways of knowing technoscience that are inspired by knowing practices in Chinese medicine. His recent publications include *Modes of Knowing: Resources from the Baroque* (co-edited with Evelyn Ruppert, 2016), and his personal webpage is at www.heterogeneities.net.