Luossa and Laks: salmon, science and LEK[1]

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Nils Henrik is a Sámi-speaking Norwegian – and a Norwegian-speaking Sámi. He lives on the banks of one of the world's great Atlantic salmon rivers. In Sámi it is called Deatnu, 'great river'. For the Norwegians it is the Tana, and in Finnish the Teno. It runs south 250 km from the Barents Sea forming the border between Finland and Norway for much of its length. Every spring, after the ice melts, the salmon come up the river. Every summer they breed. And then, a year or two or more later, they return to the Northern Ocean. So Nils Henrik fishes for salmon, for 'luossa' in Sámi (though the Norwegians speak of 'laks'.) He and Sonja, his wife, go out in a two-person river boat with a drift net. They let the net out from the boat so that it spreads across the current. Then they drift downstream with the current, one person sculling, the other standing in the stern of the boat, holding the end of the net. If they are lucky a luossa swims into the net. That's drift net fishing.

Sámi people have probably been fishing on Deatnu for more than a thousand years with rods and bait, using weirs, with seine nets, and with drift nets. If you talk to someone like Nils Henrik he will tell you that in Sámi there are dozens of more or less contextual words for different kinds of salmon, different forms of salmon behaviour, and different relations between salmon and people. This is 'indigenous knowledge'. If you spend time with him you will slowly learn that he also knows his patch of the river like the back of his hand: where the currents flow quickly and where they flow slowly; where there are boulders that might snag the net; where salmon rest and where they don't; what happens if the water level is high, or low; when or whether it is worthwhile fishing on a particular day; and where. You learn that he also maintains his patch of river. Outside the fishing season he might work, for instance, at removing a boulder that is snagging the net.

Indigenous knowledge. Though here's the first problem, and it is simultaneously analytical and political. Nils Henrik is also part of the so-called 'modern' world. He is Sámi and Norwegian. He votes in the elections for the Sámi parliament, and in the Norwegian elections. He fishes, and he also works as journalist. And then there are the material things. He doesn't live in a lávvu (a Sámi tent) or a goahti (a turf hut) but in a modern house looking out over Deatnu. When he's fishing he sculls, but he also uses an outboard motor. He has used monofilament nets, he carries a mobile phone, and he enjoys the benefits of the welfare state. In short, the binaries work poorly: 'Sámi'/'Norwegian'; 'indigenous'/'modern'; or 'traditional knowledge'/'science'. If they work at all, then we need to remind ourselves that the contrasts that make them up are all woven together. As are the politics too.

Here's the second problem. Again it is both analytical and political. These contrasts, these entangled possible-binaries, are also profoundly asymmetrical. The story is familiar. Over three or four centuries the Sámi have been 'Norwegianised'. Subjected to unequal trade, incoming settlement, the imposition of national boundaries, mineral and ethnographic extraction, more or less unsuitable agricultural practices, religion, monolingual Norwegian education, and/or overt racism, Sámi ways of living have been squeezed and squeezed again (Minde: 2003; Riseth: 2007; Ween: 2012; Ween and Colombi: 2013). The good news that in recent decades this has begun to change. It is no longer shaming to speak Sámi as was often the case in the past. There is Sámi language primary, secondary and (in some measure) tertiary education. There is Sámi radio and television. Much of the land in Sápmi in north Norway has been returned to a joint Sámi-Norwegian body that is supposed to determine traditional ownership patterns. (Land would typically be used in different ways by different groups of people). We already mentioned the Sámediggi, the Sámi parliament. And in 1990

Norway also ratified ILO Convention 197 on the rights of indigenous people. So things are better than they were. But/and, much of the time the two halves of this entangled possible-binary are still deeply asymmetrical. And new forms of asymmetry are coming into being too. Often these have to do with so-called 'nature'. So nature reserves have been created and extended. Biodiversity has become the watchword. Fishing with nets on lakes may be illegal. Duck hunting is limited. And herders are allowed to keep fewer reindeer.

Salmon fishers like Nils Henrik know about so-called 'nature' too, because fishing on Deatnu is being fiercely restricted. The population biologists say that the river is being overfished, and they back what they say with a welter of population statistics and modelled projections (Joks: 2015; Joks and Law: 2016, in the press). Their argument is that many of the seventeen biologically distinct salmon populations in the Deatnu river system are not reproducing themselves and that biodiversity is at risk. Fishing needs to be cut (Working Group on Salmon Monitoring and Research in the Tana River System: 2012). It needs to be cut further overall, and as a part of this, drift net fishing also needs to be further reduced. Currently certain classes of landowners can drift net fish for twelve or thirteen days a year, but if new restrictions are approved, in future people like Nils Henrik will only be able to fish for four days a year. Unsurprisingly this is bitterly controversial. It is also likely to mean that driftnet fishing will die, for the knowledges and competences of people such as Nils Henrik will slowly disappear. It is, for example, difficult to imagine Nils Henrik being able to pass on what he knows to his daughter Eva. How much can she learn in four days a year? The answer is: probably not much.

There are many ways of telling this. One, and it isn't wrong even if it may be too binary, is to say that we're looking at a clash between two knowledge systems and their corresponding sets of practices; between technoscience in the form of a particular version of biology on the one hand, and indigenous knowledge on the other. So local people (both Norwegian and Sámi speakers) know much that the scientists do not take to be important. They know, for instance, about the ways in which changes in temperature affects how salmon swim: if it is too warm the salmon get lazy and look for colder places. They also argue that the scientists' statistics aren't right. They ask whether catch figures reflect the limits set to fishing rather than the populations themselves. They argue, too, that predators such as seals, otters and mergansers prey heavily on the salmon populations. The biologists disagree. For them many years of work in fish stock ecology reveals that the effects of natural predators on fish populations are self-limiting. Most local people don't accept this argument. We used to kill predators, they say, but now these are protected. No, insist the biologists, the problem is indeed overfishing.

In practice many local people agree with this, at least in part. Indeed, they complain that at the height of the fishing season the river is 'black with boats'. They say that the salmon are being disturbed, they are not getting the peace that they need, and that they're being overfished. Indeed, the claim is specific, and directly has to do with reproduction. Salmon, they say, need calm when they are spawning, so when the salmon start to spawn locals stop fishing. And how do they know that it is spawning time? The answer is that the salmon turn black. But those who are not local don't stop. Perfectly happy to catch black fish, they simply carry on. There are complexities about national borders and Finnish land ownership that we cannot explore here. However, at its simplest the argument is that far too many people from the south, far too many non-local tourists, are rod fishing

on and from the Finnish side of the river (in Norway it is different). But, as we noted above, the regulations that are being imposed apply not just to rod fishing or tourist fishing. They apply equally to drift net fishing and other longstanding local practices such as weir and seine net fishing. As a result, those regulations are squeezing not just recreational fishing, but sets of very old Sámi practices as well. As we have said, if present policies are pursued then these Sámi practices are likely to disappear.

So the politics are complicated and asymmetrical: the Norwegian state and its local agencies hold the whip hand. But the debates between fish stock modelling and local ecological knowledge (LEK), are complicated too, and this is a divide that also resonates with many other postcolonial encounters (Blaser: 2013; de la Cadena: 2010; Green: 2013). For an anthropology of knowledge, the general point is clear. More often than not, in these struggles LEK (or indigenous ecological knowledge, IEK) is disqualified. Rather than counting as knowledge, LEK is transmuted into 'culture'. It turns into 'beliefs' that are held by possibly well-intentioned but mistaken locals who cannot see what is taken to be the bigger ecological picture and do not have the scientific tools needed to determine the truth about the environment. Truth versus more or less mistaken beliefs: that's the form the binary tends to take. The assumption is that science sees objectively, and that it isn't itself a form of culture. Donna Haraway (1988) calls this the 'God trick' because it claims to be a view from nowhere.

As it happens this divide is particularly visible for Deatnu salmon. This is because the biologists are legally required to take account of LEK. In their first report which appeared in 2012 the consequence is an unusually explicit attempt by working scientists to articulate an epistemology of science, a topic that is more usually confined to philosophy or STS. The flavour of their approach is revealed in this short excerpt:

> '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, through the use of a strict sampling design, are largely objective and quantitative. The usefulness and relevance of LEK/TEK therefore becomes highly limited.' (Working Group on Salmon Monitoring and Research in the Tana River System: 2012, 30-31)

LEK has its place in this scientific world because every 'bit of information' can in principle contribute to the work of science. It may generate new hypotheses. Alternatively, its observations may be used to test and interpret scientific results. The story on offer is therefore that science is all-inclusive, which means it can make use of local knowledge by including bits of the latter so long as these are properly framed. At the same time it is argued that LEK is not a separate and legitimate knowledge system, even if this idea might at first glance seem attractive. (Working Group on Salmon Monitoring and Research in the Tana River System: 2012, 30). Here are some of the binaries at work in the Report:

Science	LEK/IEK
Model or hypothesis based	Experience based
Systematic data	Intuitive, Oral, visual

Objective	Subjective
Strict sampling	
Quantitative	Qualitative

As we have already said, these are being enacted into policy with the backing of the Norwegian state. The consequence is the epistemological and political conflict we have described, together with the squeeze on the fishing practices of people like Nils Henrik.

Knowledge asymmetries have always been central to postcolonial anthropology and have more recently become important to STS (Verran (1998; 2001), Thompson (2002), Blaser (2009; 2010), de la Cadena (2010; 2015), Hetherington (2011)). So how to think about such asymmetries? If we treat them as expressions of power-knowledge we can see that particular epistemological preferences come to dominate others for more or less contingent reasons. So, for instance, the gold standard of most branches of natural science is quantification, perhaps in part because this is productive for state practices of government (Daston (1995), Porter (1995) and Mitchell (2002)). Unsurprisingly given this and the history of environmental science, the authors of the Report take the virtues of counting for granted. They assume that properly done numbers assure objectivity. That numbering might be a contingent and historically generated suite of practices is not apparent. Neither is the idea that any particular set of numbers is similarly contingent, a practical and possibly shaky achievement (Latour: 1998). This is 'seeing like a state' (Scott: 1998), and the state of nature becomes an important part of that seeing.

But we can add to and shift this story by noting that the apparatuses for knowing are also performative. It isn't easy to achieve this in practice, but those apparatuses know and see because they are also able to format the world in the appropriate way. The argument comes in three interrelated material and practical layers. First there is epistemology. The need is to create and align practices of data collection, analysis, modelling, and representation, and to link these more or less satisfactorily to those practices that are already in place. This is not easy (Law: 2009) and it may not work, but when it does it is performative because it generates, legitimates and stabilises particular knowledges of the world – for instance statistics about declining salmon populations. Second there are institutions. Here again practices also need to be aligned: training, posts, laboratories, research institutes, grant-giving agencies, government ministries and systems of reporting and publication: without these there are no biological knowledges. Once again it's a two-way traffic. Researchers depend on these, but also help to reproduce them. (This is obvious for Deatnu salmon where the science is state-funded and, in a virtuous cycle, feeds straight back into policy). And third there are metaphysics, deep-seated enactments of the character of reality. In some instances these are binary. For instance, as we have seen, the Report distinguishes between 'predation' and 'exploitation' (Working Group on Salmon Monitoring and Research in the Tana River System: 2012, 5). Predation is okay because it is 'natural', but exploitation ('cultural', 'social', 'economic' or otherwise human) is not. A conceptual and practical division is being made that is both epistemologically and policy-relevant, but a binary metaphysics, one that is very common in dominant EuroAmerican traditions, is also being done.

How does this play for people such as Nils Henrik? The answer is: really badly. Politically, we have seen that the policies that follow from this biology are squeezing drift net fishing to the point of

suffocation. Epistemologically we have learned that Sámi ways of knowing salmon are being systematically disqualified by biology. But let's attend to the third metaphysical struggle, and pick up on the nature-culture binary. In the Sámi world interactions with fish (or reindeer, or features of the landscape, or lakes, or rivers, or the weather, or unseen beings) are relational, specific, and circumstantial (Mazzullo and Ingold: 2008; Schanche: 2004). There is no 'nature' in binary opposition to 'culture'. The idea that the environment or its processes and inhabitants might be 'natural' because they live beyond or outside or in no relation to the human, makes no sense. This means that to translate 'nature' (Norwegian 'natur') into Sámi as 'luondu' (as is standard practice, for instance in administrative documents) is a mistranslation[2], though it is also more complicated than this. Since we are not watching two pristine cultures ('Sámi' and 'non-Sámi' practices are thoroughly entangled) people such as Nils Henrik have epistemological and metaphysical access to both. They enact nature-culture binaries in addition to circumstantial relationalities,[3] though as we have seen, the latter are under pressure on the Deatnu. As they also are, we need to add, in such other Sámi practices as reindeer herding, lake fishing, cloudberry picking, and moose and duck hunting (Johnsen, Benjaminsen, and Eira: 2015; Oskal: 2000; Reinert: 2014; Sara: 2009). So what is to be done?

We are not very optimistic. 'Indigenous knowledges' tend to come off badly when they butt up against science and administration (Escobar: 2008). Nevertheless, STS and cultural anthropology suggest several rules of thumb for trying to work differently. The first and perhaps the most basic is to attend carefully to the significance of down-to-earth material practices. This is because everything – politics, power, knowledges, ways of being, techniques and metaphysics – is inescapably done in mundane though often more or less invisible material practices. It is done with and through what Kristin Asdal (2008) calls 'little tools'. There is nothing outside such practices. Indeed, even in science facts achieve their status by circulating through institutions such as laboratories and journal pages or instruments that have embedded and work with those little tools (Latour: 1988, 227). So the first lesson is that materials matter. And the advice is that it is important to start tinkering with the material forms of those practices and tools to see if they can be made to work differently. To be clear we don't want to imply that this is easy. Material practices and little tools are deeply implicated in (and performative) of the politics, the epistemologies, and the metaphysics of power. Nevertheless, there are experiments in the literatures of STS, cultural anthropology, postcolonialism and indigenous studies that point to ways in which this might be attempted (Smith: 2012). So, for instance, if formal meetings close off realities then it may be wise to try to invent more open-ended ways of talking (Callon, Lascoumes, and Barthe: 2009; Waterton and Tsouvalis: 2015). If office talk doesn't work, it might be that collaborative field trips would work better (Verran: 2002). If the figures generated by biology do not catch what is important, then it may make sense to generate alternative ways of depicting the world. To try, for instance, to shift the character of the object that is being managed (Johnsen, Hersoug, and Solås: 2014), to create alternative material spaces that can be inhabited by stories (Verran: 1998), or to go looking for alternative tropes (Haraway: 1991). If numbering is unavoidable, then thinking about techniques for creating alternative statistics seems like a good idea. Or if LEK doesn't transport well (surely one of its problems is precisely that it is local), then asking very practically how such movement might be achieved – how the arguments

[2] Luondu' is more like the character of a person or an animal. To talk of 'good luondu' is to say of someone that s/he is a good person.

[3] Analogous arguments have been made for women in sexist society (Smith: 1987) and subalterns (Chakrabarty: 2000).

could be taken back to science, perhaps indeed in the form of numbers – might be productive (Gadamus and others: 2015).

The second rule of thumb, again from cultural anthropology and STS, is almost as important as the first. This is that it is crucial to find ways of recognising metaphysical difference. Thus it is vital to recognise that difference reaches beyond politics (where it is self-evident) and epistemology (where it is also quite obvious) to metaphysics. Here the argument is as straightforward as it is counterintuitive to EuroAmerican common sense. It is that it is not just epistemologies and politics that differ between practices, but worlds and realities too. The reason for this is that they are being done differently in those practices (Mol: 2002; Moser: 2008; Viveiros de Castro: 1998). We have briefly made this argument above for the nature/culture binary. This, we said, is enacted in population ecology, and at least in principle it is not enacted in the Sámi practices of fishing, hunting, herding and gathering. But there is a second metaphysical principle being done in science that we also need most urgently to tease out. This is the assumption that we live within a single world. So, for instance, when biology studies objects such as salmon and salmon numbers, events such as the annual arrival of salmon, and processes such as reproduction rates, the unspoken assumption is that all of these subsist within one world. It is accepted that particular claims (for instance about the number of salmon) might be wrong, and no doubt what becomes visible depends on the approach or perspective adopted, but it is taken for granted that they all point to phenomena within the same world or reality. They are not pointing to different realities. This tells us that what is being enacted is a metaphysics of single-ness: a 'one-world world' (Law: 2015). The unspoken assumption is something like this: that the world is a large space-time container and that everything is located inside this container and can, at least in principle, be known. And it is this that brings us to the importance of this metaphysics for the Deatnu salmon controversy. The implicit commitment to this metaphysical single-ness means that scientists find it difficult – indeed almost unthinkable – to adopt the second rule of thumb. From within a one-world world, the possibility of metaphysical difference is almost impossible to recognise (de la Cadena: 2015). The idea that Sámi salmon ('luossa') might exist in a somewhat different and relational Sámi world is nearly impossible. As is the idea that those salmon partake of realities that could not be reduced to the world of population ecology and administration. Rather than a glimpse of a somewhat different reality, the assumption is that LEK at best offers a second-best description of the one-world world within which we all subsist.[4]

The third rule of thumb, also counterintuitive, grows directly from the second. It says that seeking consensus or even compromise is likely to be a mistake. Such ambitions are only possible if politics, epistemologies and metaphysics are all aligned. But if worlds are different there are no common framings. It is better to look, instead, for practical ways of going on well together in difference (Verran: 2013). It becomes important, for instance, to find ways of crafting down-to-earth material practices in which relationally circumstantial 'luossa' and the population statistics of 'laks' can be done side-by-side without reducing one to the other (Verran: 1999). In which each is able to give some shape to the other without either denying it or seeking to absorb it. This suggests the need to be down-to-earth and practical rather than global or general (Verran: 2001). Practices need to be

[4] To use the language of Viveiros de Castro (1998) (see also Descola (2006), multiculturalism is self-evident but multinaturalism is inconceivable.

created that will handle particular circumstances in practical ways for going on together in difference as well as possible, moment by moment.

We cannot foretell the character of such arrangements, and they will necessarily be context-dependent. However, one thing is clear. Thinking in this way implies changes in the practices of both LEK and biology. LEK will need to 'harden' itself in order to make itself more transportable so that it can be heard in other locations. It will also need to recognise biological findings even as it challenges them. After all, in the one-world world of biology those findings and their implications for conservation are very far from trivial. But at the same time it seems likely that it is the biological practices that will need to change more. In particular these will need to find ways of clinging less tightly to a one-world world. They will need to find ways of recognising both that LEK realities and differences are to be taken seriously, and that they cannot be reduced to biology. And simultaneously it will have to understand that even as biology holds on to its figures, models, and projections, it will need to become more comfortable with the idea that these are contingent. It will need, in other words, to learn to 'soften' itself. And it is this thought that leads us to the final STS lesson.

Science may imagine itself to be a coherent set of tools for knowing a single world. It may imagine that the discoveries that it makes when it uses its tools will in principle align because all those tools are looking at a single reality. But STS suggests otherwise. As we have seen, it argues that in representational practices realities are not simply described but are also being done. But then it also argues that science practices are not identical, but instead suggests that they work in different ways. The profoundly important implication of this is that in its many little tools science is enacting subtly different albeit somewhat overlapping realities (Law: 2004; Mol: 2002). And therein lies hope. For first, under appropriate circumstances the evidence suggests that biological practitioners can become comfortable with the idea that their knowledge is contingent, provisional, and circumstantial (Waterton and Tsouvalis: 2015). But second, it also seems reasonable to hope that they might learn to recognise and become comfortable with the multiplicity of their own practices and the differing realities that go with those practices. They might come to see, in other words, that even within the practices of biology different kinds of salmon are being enacted. This suggests that a hopeful future for Deatnu lies in working at a very practical task. This is to craft material practices in which the acknowledgement of this multiplicity and contingency becomes possible both within and beyond biology. In which different and possibly novel biological versions of 'luossa' and 'laks' become conceivable. In which different versions of 'luossa' and 'laks' also become possible alongside one another. In which one might, for instance, imagine genetically distinct salmon populations and Nils Henrik's 'black salmon' both being sustained. This would be a future in which Sámi fishing and conservation were able to go on well together in difference.

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