How many wolves does it take to protect the population? Minimum viable population size as a technology of government in endangered species management (Norway, 1970s–2000s)[1]

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Abstract:

The article investigates how the protection of wolves in Norway has been conducted in practice since the legal protection of wolves was enacted in the early 1970s, by tracing how political decisions to regulate the number of wolves Norway should protect have been determined. The scientific concept of a 'minimum viable population size' (MVP size), which the article construes as a technology of government, has been a central instrument in these processes. The article examines how biologists, nature managers, bureaucrats, politicians and others have attempted to define and employ MVP size through the period, and how many of the political negotiations concerning Norwegian wolf numbers have played out as controversies over what constitutes a viable population. The major issues have concerned how a viable population should be theoretically defined, how many wolves this would mean in practice, and whether a viable population could be shared with other countries. The article identifies two decisive moments of transition in the way MVP size has been employed in the protection of wolves in Norway, in which the authority to define its content was transferred first from biologists to nature managers, and later to politicians. These shifts involved major transitions in the practice of determining MVP size and in the number of wolves considered necessary for protecting a viable population. In a larger perspective, the article argues that environmental historians have much to gain from delving deeper into the practices and technologies of government, in terms of the histories of endangered species management and nature management, more generally.

KEYWORDS

Endangered species, biodiversity, wildlife management, governmental technologies, wolves

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Introduction

Since the legal protection of wolves in Norway was enacted in the early 1970s, there has been much controversy over the population size of wolves and which number of this protected species that should be allowed to live within our borders. The political goals of protecting a viable population of wolves and continuing the practice of largely unattended livestock grazing in remote areas[2] have proven controversial. Additionally, social and cultural dimensions have intensified the controversy.[3] These developments have led biologists, nature managers, bureaucrats, politicians, NGOs, and others to ask: How many wolves are required to protect the population? This number has been produced as a population goal, and is currently set as three new litters of cubs each year. The Norwegian government has argued that this population goal is sufficient for protecting a viable population of wolves. The article traces the historical development of this number – how it was produced and negotiated, and who took part in these activities – and examines the central role of the concept of 'minimum viable population size' (MVP size) in this development.

Kristin Asdal argued in 2003 that environmental historians could benefit from taking what she called 'post-constructivism' into account, in order to avoid basing histories on dichotomies such as nature–culture and science–politics, and to become aware of the role of science in the construction of various 'natures'. Rather than seeking nature through sciences such as ecology, as Worster argued, Asdal argued that we should pursue a more radical historicity in which the scientific construction of nature is part of its history, rather than its truth-base. In her argument, Asdal drew on Latour and Haraway, in particular, but also referred to the constructivist methodology of the larger field of science and technology studies (STS).[4] Therefore, one aspect of what Asdal termed 'the post-constructivist challenge to environmental history' is, as Latour put it, to 'open the black box of science'.[5] The 'black box' refers to the reduction of complicated mechanisms in cybernetics or genetics to a black box, by focusing only on its input and output. In Latour's approach to studies of science, the black box designates how the complex process and context of the creation of scientific knowledge is often forgotten or neglected, once the knowledge has been accepted as true. Nevertheless, the process and context often have a decisive impact on how we later understand and treat the object of knowledge. Scholars of science – and indeed environmental historians, one might add – should therefore attempt to open the black boxes of nature to understand how the scientific construction of knowledge about nature is part of the history of this nature. Since 2003, the number of environmental history publications that have engaged in STS literature have increased; one example is the recently edited volume, *New Natures – Joining Environmental History with Science and Technology Studies*.[6]

In a similar line of argument, but with greater emphasis on politics, Sörlin and Warde argued that environmental history could make great gains by considering 'the roles of *knowledge* and *science* in relation to environmental politics'[7], and how science-based environmental policy has recently shaped (or even created) nature. They drew on Asdal's studies of Norwegian environmental politics and her emphasis on 'technologies of government'. The concept of 'technologies of government' was developed by Peter Miller and Nikolas Rose, in their

[2] Forskrifter om forvaltning av bjørn, jerv og ulv 1983, § 1; St. meld. nr. 27 1991-1992, pp. 33–34; St. meld. nr. 35 1996-1997, p. 59; St. meld. Nr. 15 2003-2004, pp. 7–9.
[3] Skogen and Krange 2003; Krange and Skogen 2011; Figari and Skogen 2011.
[4] Asdal 2003.
[5] Latour 1987.
[6] See also the introductory chapter of the volume for a discussion of the degree to which STS has influenced environmental history, and vice versa (Pritchard 2013).
[7] Sörlin and Warde 2007, p. 124.

investigations of how government is conducted in practice. Partly inspired by STS, Miller and Rose argued that studies of government should focus on the actual mechanisms, or 'technologies', that enable government in practice. These often include 'apparently humble and mundane mechanisms' such as techniques of notation, computation, calculation, and assessment.[8] In short, how various objects are made amenable to government. Similar to what STS scholars have argued in relation to science, the work behind such aspects of government tend to be forgotten or left out of both public debates and historical narratives concerning the politics of, for example, nature. We could perhaps speak of a black box of government, as well, that environmental historians should be more aware of and attempt to open in their studies.

The literature on endangered species history illustrates this. In relation to nature reserves, Sörlin argued that 'research on preservation and on natural and national parks is among the few areas in the history of science that have been almost untouched by the rolling wave of STS work crashing on our shores since the late 1980s', and one could be tempted to add endangered species to this list. Much of the historical literature has focused on the protective status of endangered species – including if and how this status was achieved. For example, who was responsible for discovering and providing knowledge about endangered species[9], ideas of conservation[10], and controversies and battles to protect particular species or establish particular regulations[11]. Similarly, the historical literature about wolves typically focuses on eradication measures[12] and subsequent transformations in attitudes towards wolves[13]. There are certainly exceptions to this very brief and rough outline of wolf and endangered species literature, and the literature cited here can, of course, not be reduced to the labels I give it.[14] I will argue, however, that the general trend in these two fields of literature has been to employ science as a truth-base or to avoid scientific knowledge, altogether. In other words, the trend has been to leave the black box of science unopened. Another general trend in these fields has been a preoccupation with the general political status of endangered species, including eradication plans and legal protection. This is not surprising, and as it should be. However, I will argue that we should also investigate what happens beyond the political realm as it is commonly perceived – how political decisions and ideologies are put into practice by various means.

It is particularly important to employ this approach when studying the aftermath of public or legal protection, considering the massive and complex problems that have been encountered by biologists, nature managers, bureaucrats, and others when attempting to conduct protection in practice. The practical technicalities of endangered species management have been investigated more thoroughly in other fields of study, such as conservation biology. Vucetich et al. 2006, for example, investigated the legal meaning of 'endangered' and 'recovery' in the U.S. Endangered Species Act, and how decisions about whether and how to protect a species can be understood as a complicated interaction between descriptive and normative elements. However, such studies rarely employ a historical perspective. By opening the black box of government, environmental historians can contribute to a more comprehensive understanding of how various actors have sought to accomplish the protection of endangered species in practice, often through complex scientific-bureaucratic technologies of government intended to render the objects of protection amenable to intervention. We should not overlook this part of the history of

[8] Miller and Rose 2008, p. 32. See also Rose 1989; Porter 1995; Barry 2001; Dean 2010.
[9] Barrow 2009a, 2009b.
[10] Farnham 2007; Takacs 1996.
[11] Cioc 2009; Petersen 2002; Holdgate 1999. See also a forum on wildlife in America in *Environmental History*, volume 16, number 3 (Alagona 2011).
[12] Robinson 2005; Walker 2005; Coleman 2004.
[13] Jones 2010; Worster 1994, pp. 258–291; Dunlap 1988.
[14] Some examples are Alagona 2004, 2013; Bocking 2000; Lowe 2006. These researchers have focused more on the practice of protection.

endangered species, as it is often through such obscure and technical arrangements that the very concrete politics of endangered species is determined.

In this article I will illustrate how crucial technologies of government can be for the practice of protecting endangered species, by examining the protection of wolves in Norway since legal protection was enacted in the early 1970s. I will focus on the decisive question of how many wolves Norway should protect – a controversial question that has occupied many since protection was put in place. The scientific concept of a 'minimum viable population' (MVP) size, originally from the field of conservation biology, has been a central technology of government employed to deal with this problem. The concept was developed in the early 1980s as an approach to estimating the smallest number of individuals required for an isolated population to persist.[15] Small and isolated populations are, for many reasons, more vulnerable to extinction, and the MVP size approach has mainly consisted of mathematical estimates of future population numbers based on variables such as birth rates, density dependence, catastrophe stochasticity, inbreeding depression, and so forth. It has been extensively used in species recovery and conservation management programs, but has also remained controversial among biologists, due to concerns over its accuracy and applicability.[16] Although the employment of MVP size internationally seems to have waned since the 1990s, the concept has been a central part of Norwegian wolf number negotiations and decisions throughout the period examined in this article. The related concept of population viability analysis (PVA) became a more common tool internationally for estimating viability, and it complemented MVP size in Norwegian viability estimates of wolves in the 2000s. However, MVP size is the main focus of this article, because it has been more decisive than PVA for Norwegian wolf number regulations throughout the period of study. This article examines the ways in which biologists strived to make use of MVP size as a technology of government in Norwegian wolf management, and how other actors, such as NGOs, international conventions, bureaucrats, legal researchers, and politicians, eventually joined them in attempting to define how many wolves a 'viable' population would constitute. As such, the article represents an investigation of the function, weaknesses, and unintended consequences of MVP size as a technology of government.

I identify two decisive moments of transition in the employment of the governmental technology of MVP size in the practice of protecting wolves in Norway. I describe these moments of transition as 'translations', inspired by actor-network theory (ANT) from STS. In ANT, 'translation' describes the various processes of transformation in the power-relations of actor-networks, denoted problematisation, interessement, enrolment, and mobilisation.[17] In this article, I will employ the concept in a narrower and simpler sense, to denote how technologies of government often transform when put to practical use in management or politics. In the case of MVP size, I argue that the two translations noted here involved alterations in both the content of the technology of government and the persons who defined this content: the power of definition was first transferred from biologists to nature managers, and secondly from nature managers to politicians. These shifts involved major transitions in the practice of determining MVP size, and in the number of wolves considered necessary for protecting a viable population.

The article construes these translations as intrinsic to the process in which MVP size became what could be called an 'obligatory passage point' in the negotiations concerning wolf numbers.[18] After regulations established that Norway should protect a 'viable' population of

[15] Shaffer 1981.
[16] Traill, Bradshaw, and Brook 2007.
[17] Callon 1986.
[18] 'Obligatory passage point' is another concept from ANT that I employ in this article to denote governmental technologies that have achieved a position in which statements and actions must relate to them in order to be considered valid (Callon 1986).

wolves, all arguments concerning population size had to relate to viability in order to be considered valid. This prompted stakeholders, NGOs, bureaucrats, legal professionals, and politicians, in addition to biologists and nature managers, to attempt to define what would constitute a viable population of wolves. As a consequence, a large proportion of the political negotiations concerning the number of wolves Norway should protect played out as a controversy over this definition. The three major issues in this controversy were: How should a viable population be theoretically defined? How many wolves would that mean in practice? and Could this viable population be shared with other countries?

Methodologically, the article investigates how political documents such as management plans, white papers, and regulations have established the number of wolves Norway should protect. The decisions have often been based on studies or reports by biologists, nature managers, and others, and the article examines how the question has been understood and treated by these, as well. The major political documents of Norwegian wolf management have included a proposition to a national plan as well as a national plan in the 1980s, two white papers in the 1990s, a third white paper and two parliamentary conciliations in the new millennium, and the legal protection from 1971, as well as subsequent alterations of these regulations. The article constitutes an in-depth analysis of wolf number regulations in the case of Norway. Scientific reports and political negotiations concerning the regulation of wolves in other countries are, therefore, chiefly relevant if they affect Norwegian number regulations. The article tracks the processes that have led to the current regulations on wolf numbers in Norway, and examines the documents that have been employed in these processes. The latter have predominantly constituted Norwegian documents, and this is reflected by the sources employed in the article.

The article narrates the history of *how* Norwegian wolf number regulations have been determined, in order to enable a more comprehensive understanding of these regulations and the practice of endangered species management more generally. It does not attempt to explain exhaustively *why* specific decisions were made or *why* the authority to define viability was transferred between actors. Miller and Rose criticized the tendency in much social scientific work to provide explanations for various phenomena through an "appeal to pre-given notions of class or professional 'interests'"[19] or "by gesturing to global processes such as modernization or individualization"[20]. Instead, they advocated for a shift in research questions from *why* to *how*, "thereby lightening the weight of causality … and enabling us to abstain from the problems of 'explaining' such indigestible phenomena as state, class, and so on – indeed we argued that these typically went unexplained despite the claims of those theorists who wrote in these terms"[21]. By making this shift, they argued, it is easier to study the singularity and complexity of particular historical developments and "begin to discern the web of relations and practices that result in particular ways of governing"[22].

Historical background

After varying highly in numbers since at least the sixteenth century – most historical accounts identify three periods of high numbers interrupted by periods of low numbers[23] – the population of wolves in Norway significantly decreased in the second half of the nineteenth century and

[19] Miller and Rose 2008, p. 6.
[20] Miller and Rose 2008, p. 6.
[21] Miller and Rose 2008, p. 6.
[22] Miller and Rose 2008, p. 7.
[23] Myrberget 1969a, pp. 3–9; Johnsen and Myrberget 1969, pp. 197–198; Vaag et al. 1986, p. 119; Drabløs 2003, pp. 135–140; Collett 1912; Johnsen 1928.

into the twentieth century.[24] The latest decrease in numbers, which coincided with the government's establishment of public bounties and other measures to eradicate wolves (such as the publication of a book on methods for killing wolves[25]) from the 1840s, lasted until wolves were protected by law in 1971. This decrease made it possible for livestock owners to reduce their level of attendance at summertime grazing in outlying fields and remote areas, and the practice of continual herding was abandoned in the twentieth century.[26] Efforts to eradicate wolves in Norway were part of an international trend of utilitarian conservation in game management, which prevailed in much of the Western world in the nineteenth century and into the twentieth century.[27] This rational approach, which had roots in eighteenth century scientific agriculture and forestry, prescribed that eradicating large predators would maximise game populations and reduce livestock losses.[28] A few of the most influential Norwegian foresters of the nineteenth century had been educated at the influential German school of scientific forestry at Tharand.[29] The efforts to eradicate carnivores peaked in the first decade of the twentieth century, when the government supported a 'war' on carnivores conducted by the Norwegian Association of Hunters and Anglers.[30]

In 1914, the internationally renowned explorer and scientist Fridtjof Nansen argued that Norway would benefit from a more systematic and scientific approach to game management.[31] Statens viltundersøkelser [the Government's Game Research], which would later become part of the Directorate for Nature Management (DN)[32] was established in 1936 for this purpose.[33] A move away from utilitarian conservation and towards a more ecologically-based conservation ideology, in line with international trends, occurred in the decades following World War II.[34] Yngvar Hagen, the leader of Statens viltundersøkelser from 1955 to 1977, criticised the eradication campaigns in an extensive book called *Rovfuglene og viltpleien* [Raptors and Game Management]. The book (first published in 1952) is currently considered a classic in Norwegian nature management, and Hagen has been credited as one of the most important characters in the move towards a more ecological management and public understanding of nature.[35] According to Hagen, the complexity of ecological mechanisms has often meant that eradication measures have not led to the anticipated increases in game populations.[36] This line of reasoning implies that the eradication campaigns had been responsible for killing a great number of

[24] Myrberget 1969a, pp. 3–9. See also Collett 1912; Helland 1914; Aaseth 1935; Olstad 1945; Johnsen 1957. These crude accounts of the changes in wolf numbers were made in general books on the status of wild animals or carnivores in Norway, and were based on the number of granted wolf bounties.
[25] Asbjørnsen 1840.
[26] St. meld. Nr. 35 1996-1997, pp. 54–55. See also Drabløs 2003.
[27] Walker 2005; Robinson 2005; Coleman 2004; Lopez 1978; Jones 2002.
[28] Worster 1994, p. 256; Scott 1998, p. 11; Dunlap 1988, p. 48.
[29] Berntsen 2011, p. 32.
[30] The association waged war by various means, including importing traps from Germany and supporting the education and costs of a teacher travelling throughout Norway to teach methods of trapping and killing carnivores (Søilen 1995, p. 95).
[31] Hagen 1952, p. 17.
[32] The Directorate for Nature Management changed title several times during the period covered by this article. It was founded in 1964 as the Directorate for Hunting, Game Management and Freshwater Fishing, and was renamed in 1974 to the Directorate for Game and Freshwater Fish, as it was transferred from the Ministry of Agriculture to the Ministry of the Environment. In 1985, the name changed to the Directorate for Nature Management, and, in 1988, the research section was separated out as NINA (the Norwegian Institute for Nature Research). In July 2013, the name was changed to the Norwegian Environment Agency, as it merged with the Norwegian Climate and Pollution Agency. To facilitate the readers, however, I refer to the institution as simply 'DN,' or 'the Directorate for Nature Management,' throughout the article.
[33] Skavhaug 2005, p. 69.
[34] Berntsen 2011; Worster 1994.
[35] Mysterud 2001.
[36] Hagen 1952, pp. 558–598.

carnivores in vain. While Hagen mostly concerned himself with raptors, other wildlife biologists would soon draw similar arguments for the protection of wolves.

The wolf population kept decreasing further into the twentieth century, and, by the 1960s, wildlife biologists assumed that the population was almost extinct.[37] In an effort to save the very few wolves remaining, the wolves were protected by law in 1971, after wildlife biologists called for their legal protection in a report on the status of wolves in the Nordic countries.[38] Due to immigrant wolves from Finland and Russia, the numbers started to rise again – mostly from the 1990s. (Figure 1) Today, there are about 30 wolves in Norway, 320 in Sweden, and 50 residing on both sides of the border.[39]

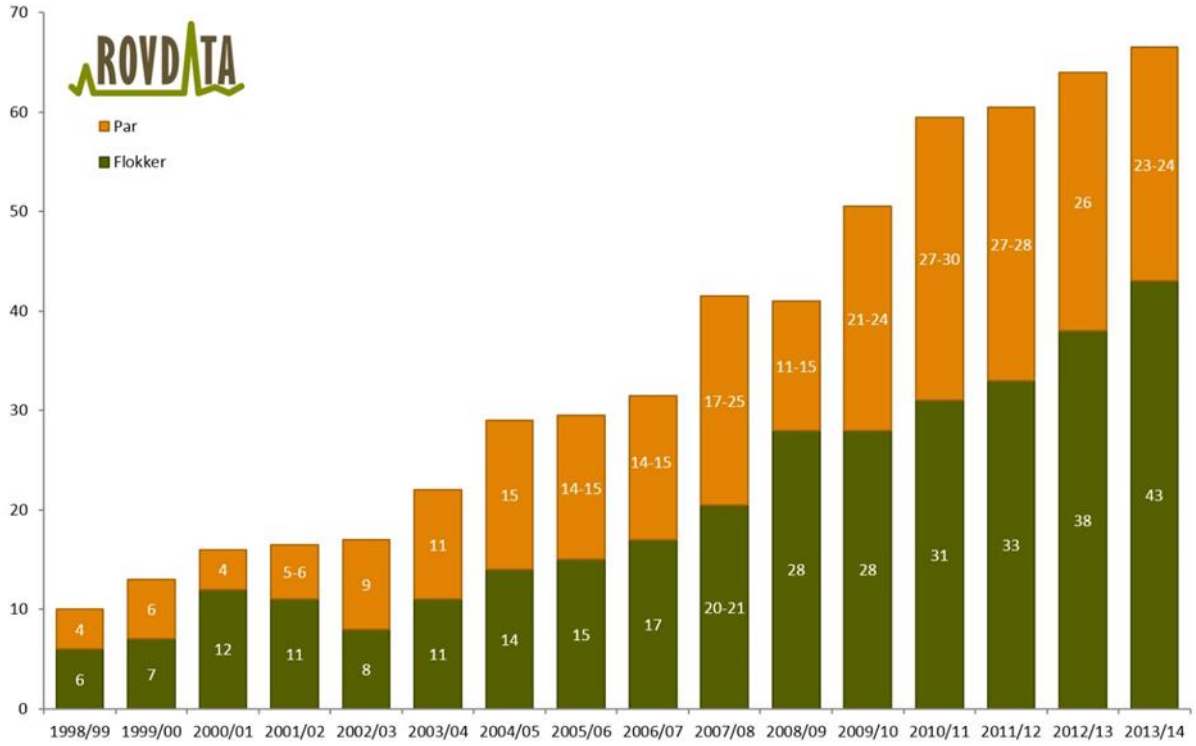

Figure 1: Number of wolf packs (green/dark) and pairs of wolves marking territory (orange/light) in Scandinavia from 1998/99 to 2013/14. © Reproduced by permission of Rovdata.

In this regard, the protection of wolves in Scandinavia has been successful, at least to some degree. The Scandinavian population has followed a recovery pattern similar to many other European countries. (Table 1) The reasons for the successful European recovery of large carnivores, which also encompasses brown bears, Eurasian lynxes and wolverines, range from coordinated legislation, the stable political climate since World War II, the rise of the environmental movements in the 1970s, socio-economic changes such as the widespread exodus from rural areas and associated abandonment of agricultural land, and context-specific

[37] Myrberget 1969a, 1969b.
[38] Stokland 2015, pp. 4-11.
[39] Wabakken et al. 2014.

Population	Country	Recent wolf number estimate	Past wolf number estimate
Scandinavian	Norway	30	Extinct
	Sweden	230-300	Extinct
	Total	**260-330**	**Extinct**
Karelian	Finland	**150-165**	**Almost extinct**
Baltic	Estonia	200-260	-
	Latvia	200-400	Almost extinct
	Lithuania	300	34-56
	Poland	267-359	11
	Total	**870-1400**	**-**
Central European lowlands	Germany	43	Extinct
	Poland	100-110	Extinct
	Total	**150**	**Extinct**
Carpathian	Czech	1	Extinct
	Hungary	1-5	Extinct
	Poland	209-254	45
	Romania	2300-2700	1550
	Slovakia	200-400	100-150
	Total	**3000**	**1700**
Dinaric-Balkan	Albania	200-250	-
	Bosnia-Herzegovina	650	1000
	Bulgaria	700-800	100-150
	Croatia	168-219	50
	Greece	700	500
	FYR Macedonia	466	267
	Serbia	750-850	500-600
	Slovenia	32-43	10-15
	Total	**3900**	**-**
Italian peninsula	Italy	**600-800**	**100**
Alpine	Austria	2-8	Extinct
	France	13 packs + 7 border ones	Extinct
	Italy	12 packs + 7 border ones	Extinct
	Switzerland	8	Extinct
	Total	**160 (32 packs)**	**Extinct**
NW Iberian	Spain	2000	350-500
	Portugal	220-435	150-200
	Total	**2200-2500**	**500-700**
Sierra Morena	Spain	**6**	**60**
Total		**12000**	**-**

Table 1: Estimated numbers of current and past European wolf populations (Chapron et al. 2014). Recent estimates are for years 2010, 2011 or 2012, while past estimates refer to the lowest abundance during the 1950–1970s.

management practices and institutional arrangements.[40] However, the number of wolves in Norway are significantly lower than in Sweden and several other countries which to a similar degree encompasses areas of potentially suitable wolf habitat. Large carnivore protection have been most challenging in countries where the species were previously extirpated, and this led to altered practices in husbandry or other activities. In some such cases the return of large carnivores have led to social conflicts.[41] Although this article does not conclusively explain why Norwegian wolf numbers are relatively low in a European framework, it is possible to discern some of the general rationale behind the current numbers through the political and scientific negotiations of viability that it examines. A recurring issue specific to Norway has been the extensive number of sheep grazing largely unattended in remote areas – a tradition that originated in the period after most of the large predators had been decimated. Livestock owners release about two million sheep to graze in the mountains and hills of Norway each summer, and this, of course, is not easily combinable with a protected population of wolves.[42] Owners of sheep, in addition to reindeer owners, hunters and land owners, have opposed wolf protection for economical reasons. Controversy concerning wolf protection in Norway have, however, encompassed a broader context than potential economic loss. The social conflicts concerning wolf protection have to a large degree been related to social transformation processes and cultural and economical power-relations, such as urban-rural tensions.[43]

Practical problems of protection

The regulatory text from the legal protection in 1971 granted wolves strict protection. At the time, nature managers and bureaucrats debated – to some degree – whether the protection should be 'total', or whether a potential growth of the population should be restricted. Although they agreed that the population should not be allowed to grow uncontrollably, they did not deem it necessary to incorporate any restrictions into the regulations at the time, as biologists considered the population to be almost extinct.[44] However, bears and wolverines were also granted legal protection in the early 1970s, and the challenges of managing the rising numbers of these large carnivores became gradually clearer for nature managers at DN as the animals became the objects of growing controversy and compensational demands from livestock owners.[45] In order to deal with these problems, the Storting [the Norwegian Parliament] loosened the regulations for bears and wolverines in 1979, stating that DN could grant permission to cull animals if they caused serious damage.[46] This led to a practice in which nature managers granted applications for hunts on an ad-hoc basis without always having a good overview of the populations.[47] In order to improve management practices, DN initiated the first large-scale research project on large carnivores in Norway, which was conducted between 1980 and 1984.[48] Additionally, arguing for a more systematic management of large carnivores, which was thought to aid both the protection of large carnivores and the

[40] Chapron 2014.
[41] Chapron 2014.
[42] St. meld. nr. 15 2003-2004, p. 46.
[43] Skogen and Krange 2003; Krange and Skogen 2011; Figari and Skogen 2011.
[44] DN archive: I. e. Vern av de store rovdyr [Protection of large carnivores]. Utkast til kongelig resolusjon, statsrådsak nr. 4.5.73, p. 6; Fredning av ulv, bjørn og jerv [Protection of wolves, bears, and wolverines]. 30.8.71. 3329/71 – 761.545. Both in archival box: 761.545. Fredning av ulv, bjørn, jerv, gaupe 1966-75 [Protection of wolf, bear, wolverine, and lynx 1966-75].
[45] Sørensen and Kvam 1984, pp. 15–17.
[46] The protection regulations for bears and wolverines were loosened in 1979, while those for wolves were loosened in 1983 (Vaag et al. 1986, pp. 20–21).
[47] Direktoratet for naturforvaltning 1987, p. 11.
[48] Stokland 2015, pp. 12-21.

continuation of grazing livestock by establishing clearer objectives, DN proposed (in 1981) that a national plan be composed.[49] The construction of national plans for the protection of wild flora and fauna was also in accordance with the Bern Convention, which Norway had signed in 1979 but had not yet ratified.

As the wolf population started to grow slightly in the 1980s, and a single wolf became the centre of a nation-wide controversy after killing a number of grazing sheep in 1982/1983, the regulation of wolves – often referred to as 'total protection' – was also loosened by the Storting in order to allow a hunt for this wolf.[50] The concept of a viable population of wolves was used for the first time in the Norwegian regulation of wolves in the legal text granting this loosening, which also replaced the former regulations on bears and wolverines: 'The purpose of these regulations is to keep the damages on livestock at an acceptable level while simultaneously securing viable populations of bear, wolverine and wolf in Norway.'[51] At this time, wildlife biologists assumed that there were fewer than 15 wolves in Norway[52], and the new regulations raised the question of how many wolves Norway should protect, and, more specifically, how many wolves would constitute a viable population. How should one determine, in practice, whether culling a wolf would be incompatible with the objective of protecting a viable population? The question was raised in the context of practical management problems in relation to a particular wolf, and the nature managers sought a fairly quick answer. The license for hunting this wolf was issued by DN only three weeks after the new regulations were approved by the Storting.[53] However, the new regulations also initiated controversy over what would constitute a viable population – a question that is still intensely debated to this day. Permitting wolf culls while simultaneously maintaining the protection of a viable population, the regulations begged for a definition and measure of viability in order to facilitate the practical decisions concerning wolf numbers. In other words, it was very difficult for nature managers to enforce the new regulations without a well-functioning instrument that could determine when the viability of the population was secure. It is not clear from the archival material whether use of the term 'viable' in the regulations was related to the two prior years' presentation of MVP size within the field of conservation biology. This is plausible, however, as the term had not been employed in previous regulations and is not a commonly used term in Norwegian. The answer that biologists and (later) others attempted to provide to the question of viability was, in any case, the governmental technology of MVP size. However, as we will see in the next section, it was not easy to put it into practical use.

The regulatory framework of the Bern Convention on the Conservation of European Wildlife and Natural Habitats also prompted biologists and others to search for a measure of viability. In 1986, Norway ratified the convention, which had been open for signature since 1979. It required participating nations to protect the listed species, including wolves, but also allowed

[49] DN archive: Forslag til elementer i en landsplan for forvaltning av bjørn og jerv [Propositions to elements in a national plan for management of bear and wolverine]. Internt notat [Internal note]. 18.09.81-JS/mb, pp. 1–2. Folder: Forvaltningen av de store rovdyr [Management of the large carnivores]. 1981. Archival box: Forvaltning av store rovdyr 1980-1981 [Management of large carnivores 1980-1981]. 461.545. At first the plan was to address only bears and wolverines, as these species had increased most in number and caused the most conflict at the time. However, when wolves appeared in two different locations by 1982 and sparked a nation-wide controversy, they were also included in the subsequent proposals for a national plan concerning large carnivores. See also Vaag et al. 1986, p. 15.

[50] Vaag et al. 1986, p. 21.

[51] Forskrifter om forvaltning av bjørn, jerv og ulv 1983, § 1. Author´s translation – this applies to all citations of Norwegian documents in the article.

[52] Sørensen and Kvam 1984, p. 59.

[53] DN archive: Pressemelding [Press release]. 25.02.1983. Folder: Ulv som gjør skade [Wolf that causes damage]. ¼ 1982-1983. Archival box: 462.444. Felling av ulv som gjør skade [Culling of wolf that causes damage]. ¼ 1982-1990.

for exceptions for various reasons according to Article 9, 'provided that there is no other satisfactory solution and that the exception will not be detrimental to the survival of the population concerned'[54]. The Storting treatment of the ratification of the convention, conducted by the Committee for Foreign and Constitutional Affairs, emphasised the extensive use of unattended grazing in Norway and stated that this could cause problems for the protection of large carnivores such as wolves, wolverines, and bears. It also stated – by reference to Article 9 in the convention – that DN could be assigned the tasks of monitoring populations and estimating the level and vitality necessary for their survival, as well as regulating the size of the populations if they were to become so numerous that they would inflict serious damage on livestock.[55] The Bern Convention, therefore, in addition to the legal regulations specific to Norway, prompted biologists and others to search for a measure of what would and would not be detrimental to the survival of the wolf population.

Searching for a scientific measure of viability

In the first years after the regulations were loosened, the task of defining a viable population of wolves was given to wildlife biologists. This is perhaps not surprising, as the concept of a viable population had originated from the field of conservation biology and involved calculations of population dynamics. The biologists' first attempt was made with reference to the regulations' stated intention to protect a viable population. In a 1986 report on the status of large carnivores in Norway, which was the final report of the first large-scale research project on large carnivores in Norway, they classified the population by employing this definition:

> A 'viable' Norwegian population is a population with a minimum number of 15-50 animals. Verification that at least 3 female wolves capable of reproduction are accompanying male wolves is required for this category, as well as verification that reproduction occurs at a regular basis. The habitats of the population should to a very large degree be restricted to Norway, and the area of critical habitat and pray animals should be large enough to carry the size of the population (5000-25000 km²).[56]

When proposing this definition, the wildlife biologists stated that no specific calculations of minimum viable population size based on the reproductive biology of wolves had been published. Therefore, they based their definition on David Mech's studies of wolves on Isle Royal in Lake Superior from the 1960s, as well as Rolf Peterson's studies at the same location from the early 1980s. Although Mech and Peterson's understandings of the population dynamics of the Isle Royal wolves had diverged by the 1980s, the Norwegian report referenced their studies as an example establishing that a group of about 25 animals (up to 50 for a short period) had survived in packs of one to five animals for 35 years. Based on this, the Norwegian biologists presumed that a viable population of wolves could consist of three to five pairs that reproduce on a yearly or semi-yearly basis, assuming that hunting and other human-induced causes of death were kept under control. Given an average litter size of six cubs, a 50 per cent death rate in the first year, and two to four older wolves in each pack, they estimated that the population would vary between 15 and 50 animals. According to the Norwegian biologists, the viability of such a population would precondition immigrations from a larger population on a regular basis. This definition of MVP size was related to the international community of wildlife biologists – not only through the interpretation of Mech and Peterson's studies, but also through viability discussions at an IUCN wolf specialist group's meeting in Edmonton, Canada.

[54] Council of Europe 1979, Article 9.
[55] Innst. S. nr. 92 (1985-1986), p. 2.
[56] Sørensen et al. 1986, p. 35.

In agreement with the Ministry of the Environment (ME) and the Ministry of Agriculture (MA) in 1983, DN assigned a small working-group that consisted of one representative from each institution. These representatives were to provide a proposition for a national plan concerning the management of bears, wolverines, and wolves.[57] The proposition, which was made public in 1986, drew heavily on the first large-scale research project on large carnivores in Norway. In their proposition, the nature managers from DN and the two bureaucrats repeated the biologists' evaluations of a viable wolf population, and, based on these evaluations, proposed that a viable Norwegian wolf population should consist of three to five family groups of wolves within the country's borders.[58]

When DN published the national plan for the management of bears, wolverines, and wolves in 1987, it was in large part based on the proposition of the small working-group. However, they ordered an additional study concerning the dynamics of small populations. This was a theoretical study conducted by biologists at the University of Oslo, which specifically addressed the dynamics of the populations of bears, wolverines, and wolves in Norway at that time.[59] The main purpose of the study was to produce a tool that nature managers and others could use to predict the probabilities of different future population sizes – that is, a technology that could aid DN in answering the question of what would constitute a viable population of wolves. This might indicate that DN was not satisfied with the working-group's definitions, or that they followed up on the lack of specific calculations addressed by the group. The tool would base its estimates of viability on the probability of future population increase or decrease, rather than on numbers of animals alone. The study argued that it was very hard to translate rates of reproduction and survival into factors of population dynamics such as population increases or decreases, and especially so in small populations.[60] They argued that stochastic modelling was necessary to predict probability for small populations, in order to incorporate the possibly larger effects of random events.[61] The two biologists working on the project created a software programme called PREDATOR, which could simulate the future development of 500 hypothetical populations based on the same original population. By doing this, it could produce pA, which represented the probability of a population decrease after a chosen number of years. For example, a result of pA = 0.65 would indicate that there was a 65 percent probability for a population decrease after *x* years.

In attempting to calculate the viability of the Norwegian wolf population, however, the biologists were confronted with the complexity of estimating population dynamics. The tool that was meant to aid nature managers in their practical decisions was completely dependent on the parameters used in the programme. The tool preconditioned accurate knowledge of parameters such as birth rates, death rates, litter sizes, and reproduction probability, including specific rates for each year in a wolf's life. Such rates varied between populations and habitats, and there was no exact knowledge of these rates for the recently returned Norwegian population of wolves. Instead, the biologists had to employ demographical parameters that were estimated on the basis of studies of wolves in North America.[62] Additionally, they could not find any studies containing data for the distribution of litter sizes, and therefore assumed that the probability of four cubs was 0.25; five cubs 0.5; and 6 cubs 0.25. The biologists also noted that they had not included parameters for density dependence, as theirs was mainly a study of small populations. Therefore, the simulations became less valid as the population numbers increased.

[57] Vaag et al. 1986, pp. 15–17.
[58] Vaag et al. 1986, pp. 132–137.
[59] Stenseth and Steen 1987.
[60] Stenseth and Steen 1987, p. 5.
[61] Stenseth and Steen 1987, p. 14.
[62] Stenseth and Steen 1987, p. 29.

The bigger issue at stake here, as they also pointed out in their study, was that the choice of parameters had a major impact on the probable future population sizes. The other major input the model required was current population sizes. The biologists emphasised that the validity of their results depended on the accuracy of these preconditioned estimates: 'If these are wrong, everything must be reconsidered.'[63] However, while the wildlife biologists had attempted to provide such numbers for wolves, bears, and wolverines in their research project, they had encountered difficulties in achieving accurate estimates.[64]

Based on the assumed parameter values and population size, the programme estimated that the south-east population of wolves in Norway had a pA of 0.14, which designated that there was a 14 per cent probability of a decline in population within the following 20 years (without human intervention). In order to estimate the minimum viable population size of Norwegian wolves, however, the model was dependent on a limit that would designate the specific probability of a population decrease that would indicate the population was viable. The two biologists proposed that a population should be considered viable if the probability for a decline in numbers in the following 20 years was less than 5 per cent.[65] They emphasised, however, that these numbers had to be determined by politicians, rather than biologists. In other words, in their opinion, it was politicians, and not biologists, who should determine what constituted a viable population of wolves. This might indicate that the biologists felt uncomfortable being responsible for such a controversial decision, or – perhaps more likely – they considered it a political decision. The limit was, after all, intended to determine the number of wolves Norway should protect. It is clear from this that, although biologists had been given the authority to define viability and determine the number of wolves that Norway should protect, they were not fully inclined to accept the task as one that was purely scientific. In the end, the programme produced a seemingly accurate probability for a future decline in the wolf population that was contingent on several highly uncertain assumptions. This was, however, merely a first attempt to create a model for calculating such probability, in the hope that applicable parameter values, population sizes, and a limit for viability could be produced at a later point of time.

First translation: From biologists to nature managers

The national plan that was published by DN in 1987 restated that the main objective was to protect viable populations of bears, wolverines, and wolves.[66] The plan did not mention the wolves on Isle Royal, which had been used in the proposition in the working-groups' attempt to define viability. Rather, the final plan treated the viability of large carnivores as the more theoretical and specific concept of future population-size probabilities, through reference to the theoretical study of the dynamics of small populations.[67] It stated that the data required for the model was inadequately known at that time, but argued that a management plan should nevertheless include a concrete definition of what would constitute a viable population, in order to make the political decisions concerning viability measureable when compared to the development of the populations. DN did not agree, however, with the definition proposed by the biologists at the University of Oslo. As we have seen, they proposed that the probability for a decline in numbers during the following 20 years should be less than 5 per cent in order for a population to be defined as viable. Arguing for an adjustment of this definition based on the high level of conflicts caused by large carnivores and the proximity of other populations in

[63] Stenseth and Steen 1987, p. 41.
[64] Stokland 2015, pp. 12-21.
[65] Stenseth and Steen 1987, p. 9.
[66] Direktoratet for naturforvaltning 1987, p. 20.
[67] Direktoratet for naturforvaltning 1987, p. 22.

Fennoscandia, DN proposed that a Norwegian population should be accepted as viable if the probability for a decline in numbers during the following 20 years was less than 15 per cent.[68] By altering the limit for viability, nature managers at DN took the first step in the translation of MVP size from the domain of biologists to that of nature managers.

ME followed the national plan with a white paper concerning the management of large carnivores to the Storting, in order to put it into political effect.[69] They based the white paper on the national plan, and repeated DN's definition of viability as a probability of less than 15 per cent for a population decline over the following 20 years.[70] ME also noted that the PREDATOR model had been constructed by theoretical biologists to translate this probability into a specific number of wolves, and hence to enable management decisions on a practical level. However, as the Ministry of Environment stated in their white paper, the data required of the model to calculate probable future population sizes did not exist. This data included, as we have seen, current population size, reproduction rates, death rates, habitat requirements, and more. The white paper, therefore, concluded that more research was needed.[71] What this also indicated, of course, was that, regardless of who defined the viability limit or what exact percentage they decided on, no one would know how to translate this percentage into a minimum number of wolves required to satisfy it. The question of how many wolves Norway should protect was, therefore, not brought significantly closer to conclusion.

While the 1992 white paper concluded that more research was needed in order to determine a minimum viable population, and as the wolf population and controversy started to grow in the early 1990s, the nature managers at DN sought to coordinate the management of large carnivores with Sweden. DN drafted a proposition to a common strategy document for management of wolves in 1993, which Naturvårdsverket, their Swedish counterpart, largely approved of.[72] This document represented a loose agreement between DN and Naturvårdsverket and was not sanctioned by the Storting or made legally binding.[73] One of the purposes of cooperation was to determine common population goals in order to reach common objectives and strategies to achieve them. Cooperation was also part of the implementation of Article 11 (1) in the Bern Convention. DN and Naturvårdsverket agreed with the biological studies and the white paper that the wolves in Scandinavia were critically threatened at the time, and that they should be given strict protection. They were, however, also confronted with an intensifying controversy over the slightly rising number of protected wolves. As a means to alleviate controversy – by giving those opposed to the protection some relief for the future – they sought to set a limit for the number of wolves needed to end the strict protection. It is also probable that the nature managers felt a need for a concrete measure, or a technology of government, to base their often controversial practical decisions on from case to case. They labeled the situation of critically threatened and strictly protected wolves 'phase one', and stated that they would initiate a 'phase two' when they considered the wolf population viable. The second phase would constitute a normalised situation, in which wolves would be regulated on par with other large carnivores (for example, through legally permitted license hunting). As the biological studies concerning viability had not been conclusive, however, the nature managers did not have any concrete numbers to employ in determining when phase one would end and phase two would begin. Therefore, they decided on a number of eight to ten family groups in Scandinavia as the

[68] Direktoratet for naturforvaltning 1987, p. 22.
[69] St. meld. nr. 27 1991-1992.
[70] St. meld. nr. 27 1991-1992, p. 35.
[71] St. meld. nr. 27 1991-1992, p. 35.
[72] Direktoratet for naturforvaltning 1993.
[73] When DN and Naturvårdsverket established cooperation more formally in 1998, the goal of eight to ten family groups was taken out of the strategy plan (Direktoratet for naturforvaltning 1998).

limit between phase one and phase two. This number was not based on any studies of viability, but on the general judgment of nature managers regarding the number of wolves that would be required to secure their survival.[74] The population goal of eight to ten family groups was not, therefore, intended to constitute an accurate limit for the viability of wolf populations. Rather, it was intended to be a technology for alleviating controversy and for lightening practical decisions, based on the knowledge available at the time.

In 1997, the Ministry of Environment published a second white paper concerning large carnivores, in order to adjust the regulations according to new scientific knowledge and regulatory experiences.[75] It stated that extensive research had been conducted both nationally and internationally over the previous five years, and that it was easier at that time to set criteria for the viability of the large carnivore populations.[76] The major development they referred to was the International Union for Conservation of Nature's (IUCN) new classification system for threatened species in 1994, developed for the Red Lists that IUCN produced partly in relation to the Convention on Biological Diversity (CBD) from 1992.[77] According to the white paper, IUCN had made quantitative viability criteria based on theory from modern conservation biology that applied to all species. This had been done to improve the precision and objectivity of the categorisation of species according to vulnerability, and to counter the obstacles many countries had encountered in their efforts to protect threatened species due to vague and conflicted definitions of what should specifically be protected. IUCN had based their new definitions of viability on an accurately defined risk for extinction, regardless of species, observer, or geographical region.[78] Although these criteria had mainly been made to enable judgments on how endangered various species were relative to each other worldwide, the Ministry of Environment adopted them in their evaluations of the viability of the wolf population. The new evaluation criteria for the viability of Norwegian wolves, therefore, became that they should not be classified as critically endangered, endangered, or vulnerable according to the following definitions (which they reproduced from IUCN in the white paper):

> A species is critically endangered if the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer.
>
> A species is endangered if the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer.
>
> A species is vulnerable if the probability of extinction in the wild is at least 10% within 100 years.

From this point on, therefore, Norwegian wolves were considered viable if they had a 'less than 10 % chance of extinction within 100 years'. With the IUCN definition, which has largely remained authoritative since the mid-1990s, questions concerning the definition of viability and the probability for population decline came to a temporary conclusion. The question of how many wolves Norway should protect, however, was far from settled: the problem of translating such general criteria to the minimum number of wolves required to ensure the viability of the Norwegian population, remained. And this was exactly what nature managers had called for in order to make management decisions on a very practical level.

[74] Direktoratet for naturforvaltning 1993, p. 17.
[75] St. meld. nr. 35 (1996-1997), p. 5.
[76] St. meld. nr. 35 (1996-1997), p. 48.
[77] See also Holdgate 1999 and Gustafsson and Lidskog 2013.
[78] St. meld. nr. 35 (1996-1997), p. 49.

Biologists created a Norwegian Red List based on the IUCN criteria in 1996, in which they classified wolves as critically endangered.[79] Based in part on this, ME stated that, at the time, Norwegian wolves were not viable.[80] They proposed that wolves be strictly protected in Norway until a population goal of eight to ten family groups in Scandinavia was achieved, and until the wolves had reproduced within the borders of Norway.[81] The population goal of eight to ten family groups was based on the 1993 agreement between DN and Naturvårdsverket, which had established this number as a goal. The majority of the Storting committee agreed to these propositions.[82] The bureaucrats at ME and the politicians at the Storting, therefore, composed the practical politics and regulations based on the general judgment of nature managers, rather than biological studies or IUCN's standard of viability, as the latter did not provide any concrete numbers to base regulations on. In this way, the authority of defining what would constitute a viable population of wolves, in practice, was effectively transferred from biologists to nature managers. It is not evident that the biologists struggled to keep this authority, or that nature managers struggled to get it. Rather, the first translation of MVP size as a technology of government seems to have been the consequence of two main factors: the unsuccessful efforts by biologists to provide an accurate MVP size for Scandinavian wolves and the practically experienced need of nature managers for a measure to base their management decisions on from case to case.

The Bern Convention and the question of viability

Another process concerning viability and the number of wolves required to protect the population – running parallel to the process of finding a measure of viability – concerned the question of whether Norway should protect a viable population of its own, or whether the population could be shared with neighboring countries. If the latter was found to be the case, this raised the additional question of how the responsibility for protection should be shared between countries. The question was first taken up by the Board of Nordic Farmers' Organizations, and mainly revolved around the Bern Convention requirements for Norway.

When DN published the national plan for large carnivores in 1987, some livestock owners did not approve of the plan's objective of protecting viable populations of large carnivores. As a countermeasure, they proposed an alternative plan through the Board of Nordic Farmers' Organizations in the following year.[83] In this plan, they argued that it would be extremely difficult for Norway, Sweden, and Finland to maintain carnivore populations that would satisfy the strict international criteria for viability. The best solution to this problem, they argued, would be what they termed a Nordic 'package deal'. Their proposal was that Fennoscandia, consisting of Norway, Sweden and Finland, should be treated as a continuous management zone, with the obligations of the Bern Convention applied as if they were one country. The status of this Fennoscandian management zone, according to the proposition, would be as follows:

> By current day population distributions, preservation responsibilities would be evenly spread among the three countries Norway, Sweden and Finland. Norway currently has the largest wolverine population, and would therefore have the primary responsibility for this species. Sweden has the primary population of brown bears, and would therefore be the central land for maintaining a viable bear population. Finland is today the only country in Fennoscandia which

[79] St. meld. nr. 35 (1996-1997), p. 50.
[80] St. meld. nr. 35 (1996-1997), p. 59.
[81] St. meld. nr. 35 (1996-1997), p. 61.
[82] Innst. S. nr. 301 (1996-1997), p. 15.
[83] Nordens bondeorganisationers centralråd 1988.

> has a viable wolf population. With all the commercial activity in Norway and Sweden, it would be logical for Finland to take the chief responsibility for the primary wolf population in Fennoscandia in the future.[84]

In other words, they argued that the obligation to protect a viable population of each species should be distributed, such that only Finland would have a responsibility to protect wolves, and not Norway. However, according to the Board of Nordic Farmer's Organizations, this would nevertheless ensure that the region had large enough numbers of all of the large carnivores necessary for satisfying the demands of viability. This was perhaps an effort to minimise the number of large carnivores in each country, but it might be worth considering that this distribution of responsibility would have been fully compatible with the Bern Convention if the geography of the Nordic countries had constituted only one country. The alternative national plan did not gain broad political support in Norway, and it seems to have had little impact on the development of the first white paper concerning large carnivore management, which was largely based on the original national plan by DN. A proposition for a common Nordic management zone, which was based on the alternative plan, was also submitted to the Nordic council by five politicians from Norway, Sweden, and Finland.[85] However, after the council's legal committee argued that the proposition might reduce the nations' obligations as stated in the Bern Convention, the council voted it down.[86] Although the alternative national plan of the Nordic Farmer's Organizations did not have a significant impact on the management of large carnivores, the emphasis it put on the concept of viability shows how central this concept was in the political negotiations. The efforts they made to reinterpret what it would mean for Norway to protect viable populations of large carnivores, rather than to argue against the objective (as some farmer organizations had done earlier), further indicates that MVP size had become an 'obligatory passage point' in the negotiations.[87] It seems that, in order to be considered valid arguments in the political negotiations, statements had to acknowledge the basic objective of protecting viable populations of large carnivores.

The idea of a common management zone for large carnivores in the Nordic countries was, despite the initial rejection by the Nordic Council, not entirely put to rest. It still figured as a realisable and favourable management solution among farmer organisations and in media debates.[88] As a response to the continued presence of the management propositions from the alternative national plan in debates concerning large carnivores, the Secretariat of the Bern Convention sent a letter to DN in 1996, stating that:

> Any kind of plan for 'management coordination' between different countries which imply that each of the Fennoscandian countries have a responsibility to protect viable populations of only one of the species (brown bear for Sweden, wolf for Finland, or wolverine for Norway) would be a definite misinterpretation of the Parties' obligations under the Bern convention. *All* Nordic countries have obligations to protect populations of all species that inhabit their territory, regardless of positive protective measures implemented in neighboring countries.[89]

In the following year, the majority of the Storting standing committee on Energy and the Environment stated, based on this letter, that Norway had an evident obligation to protect the

[84] Nordens bondeorganisationers centralråd 1988, p. 8.
[85] The National Archives, Sweden: Nordiska rådet [The Nordic Council]. 04. September 1989. A 895/j. Medlemsförslag [Member proposition].
[86] The National Archives, Sweden: Nordiska rådet [The Nordic Council]. Protokoll. 38:e sessionen 1990. 28. Februari. A 895/j.
[87] Callon 1986.
[88] See for example Bondebladet, July 10 1996.
[89] Innst. S. nr. 301 (1996-1997), p. 8.

viability of threatened species within its borders.[90] It also explicitly stated that the Bern Convention could not be interpreted such that it allowed for the transfer of one country's independent responsibility to a neighbouring one. This was stated in the Storting treatment of the second white paper concerning large carnivores. A minority of the committee, however, stated that Norway emphasised an intention to cooperate with neighboring countries in the management of large carnivores in the Storting treatment of the Bern Convention. The proposition of sharing responsibility for protecting a viable population of wolves with Sweden and Finland in such a way that Norway would not be required to protect any wolves, therefore, was rejected by reference to the Bern Convention. However, the letter from the Secretariat of the Bern Convention did not explicitly state that Norway was required to protect a viable population of its own, and the Storting treatment merely stated that the responsibility to protect large carnivores could not be transferred to other countries. Cooperation between Nordic countries in the protection of wolves was, therefore, still a possibility, as long as each country took part in the protection of a viable population. The Secretariat of the Bern Convention did not specify how such cooperation should be conducted in practice, however, and this left, as we shall see, the issue open for interpretation by the cooperating parties.

The scientific measure of viability revisited – in court

The problem of translating abstract definitions of viability into a concrete MVP size for wolves came to the fore of the controversy when DN, in 2001, decided that the Scandinavian population of wolves was large enough for nine wolves to be culled; seven of these wolves constituted an entire family group. DN based the decision on the achievement of the population goal of eight to ten family groups in Scandinavia, and argued that the culling would not jeopardise the survival of the population.[91] The decision turned out to be highly controversial, evoking international media attention[92], and led to another attempt by biologists to determine a scientific measure of viability – only this time, in court. Environmental organisations contested the decision, and, after ME rejected the contestation, they took it to court. The court stated that the question of the population's survival was the determining issue according to Norwegian law and the Bern Convention. An alteration of the Norwegian regulations for large carnivores in 2000 had replaced the objective of protecting viable populations of the animals with an objective of securing the survival of the populations.[93] The latter term had also been employed in the Bern Convention, which contained no mention of the term 'viable'. The court further stated, however, that the objective of securing the survival of large carnivore populations was related to the question of viability, in that it implied that culling should not be allowed if it would obstruct the possibility of achieving a viable population in the longer term. The court summoned four biologists – three ecologists and one (population) geneticist – to expertly assess DN's decision and to consider whether culling nine wolves would jeopardise the survival and long-term viability of the population.[94] It turned out, however, that the experts held considerably differing views concerning this question. The three ecologists stated that it was not likely that the single-time culling of nine wolves would jeopardise the population's survival. One of them further noted that it would delay, but not obstruct, the goal of establishing a viable population of wolves in Norway.[95] The geneticist, however, argued that it would have grave consequences for the survival of the population, and that several hundred wolves would be required before

[90] Innst. S. nr. 301 (1996-1997), pp. 8–9.
[91] Oslo namsrett 2001, p. 7.
[92] See, for example: BBC News 2001; CNN 2001a; CNN 2001b.
[93] Forskrift om forvaltning av bjørn, jerv, ulv og gaupe, 2000.
[94] Liberg 2003, p. 36.
[95] Oslo namsrett 2001, pp. 15-16.

the population could be considered viable. The stark difference in estimates of viability and survival potential – even between biologists – made the governmental technology of MVP size weak in practice, as it did not provide a concrete or even consistent answer to the court's question. The court decided to follow the advice of the majority of the biologists, stating that DN had not made the decision to cull nine wolves on an insufficient basis regarding the survival of the population. Since the court judged in favor of DN, they conducted the wolf cull in the following weeks.

Biologists at SKANDULV, a project established in 2000 to improve cooperation between Norwegian and Swedish wolf research, saw the difference in estimates of viability revealed in court as highly problematic.[96] In response, they made another attempt to scientifically determine the minimum viable population size of Scandinavian wolves. SKANDULV organised a closed workshop on viability and the Scandinavian wolf population in 2002. They specifically intended to address potential differences between genetic and demographic analyses of viability, because genetic aspects had become more central to MVP size analyses since the 1980s, and this seemed to be at the core of the expert disagreement in court. The panel consisted of international expert biologists: three geneticists, one population biologist, and two wolf ecologists. In addition, Scandinavian biologists, nature managers, and NGO representatives participated. The whole panel agreed that the often approximate nature of the criteria used for estimating minimum viable populations represented a problem. This had, for example, led to several different estimates of viability in small wolf populations in the United States.[97] One of the participants commented, however, that conservation biology would continue to be confronted by the question of what number of animals would be sufficient to secure their long-term survival, and that they simply could not avoid it. He argued that biologists were responsible for estimating minimum viable population sizes, but also for describing the weaknesses of the estimates.[98] From the workshop conclusions, which included an estimated MVP size for Scandinavian wolves, it seems that the panel agreed to the latter argument, as well.

The genetic aspects of viability were central to the discussions at this workshop, and the loss of genetic variation in terms of heterozygosity was a topic at the core of these discussions. The geneticists stated that a common criterion for genetic viability was protection of 95 to 98 per cent of the genetic variation of a population over 100 years, and the panel agreed, in the end, to a definition of genetic viability of protecting, at minimum, 95 per cent of the genetic variation over 100 years. There was some debate over this percentage, in which the ecologists seemed ready to accept a lower percentage (as low as 75 per cent). The geneticists, however, argued that empirical data from captive populations indicated a critical limit of 95 per cent.[99] Another issue was that the Scandinavian wolf population had recovered from near extinction in the 1970s, and the new population was based on the genetic material of only three wolves that had migrated from the Finno-Russian population.[100] This meant that the genetic variation of the population was considerably lower than an average population. What did it mean, then, to protect 95 per cent of the genetic variation – would this designate 95 per cent of the current or the original variation? The geneticists emphasised that the most important goal was to maintain as much of the remaining variation as possible, and to monitor the population with particular attention to indications of inbreeding.

[96] Liberg 2003, p. 36.
[97] Liberg 2003, p. 43.
[98] Liberg 2003, p. 44.
[99] Liberg 2003, p. 44.
[100] Liberg 2003, p. 44.

The panel agreed, in the end, to a definition of viability that entailed protecting a minimum of 95 per cent of the genetic variation over 100 years. Employing a principle from population genetics, they also translated this definition to a concrete number of Scandinavian wolves. Protecting 95 per cent of the genetic variation presupposed that a total of 800 wolves would be protected if the population was isolated, or a total of 200 wolves with satisfying immigration. The population at that time consisted of about 100 wolves, and the definition of viability they provided therefore entailed doubling the population, in addition to securing the immigration of at least one to two wolves for each generation (about every fifth year). The workshop also concluded that culling one to two wolves of the Scandinavian population per year would not be threatening to the survival of the population, but that population viability analyses should be conducted if there were plans to cull more than two wolves. Although the biologists' estimates were not in unison, they provided a concrete MVP size for the Scandinavian population. The MVP size concerned the population that was common to Norway and Sweden. Thus, as in the case of the Bern Convention, it was not clear what the political responsibility of each country would be, even if they decided to take the MVP size as a common population goal.

The report from the international workshop concerning the viability of the Scandinavian wolf population was published in Norway as part of a series of studies conducted in preparation for a third white paper concerning large carnivores.[101] ME also made reference to it in the list of reports associated with the preparation of the white paper, which led to a broad Storting conciliation that established new directions and regulations for the management of large carnivores.[102] As we will see in the next section, however, it is not evident that the Norwegian Parliament employed this MVP size as a basis for their new population goal, which they determined as 'three new litters of wolf cubs each year'.

Second translation: From nature managers to politicians

Before the most recent white paper concerning large carnivores in 2004, the Ministry of Environment commissioned a legal study, in addition to several biological studies of Scandinavian large carnivores and social scientific studies of the controversy. The legal study, conducted by a legal researcher from the University of Oslo, examined Norway's obligations in the management of large carnivores according to international conventions, including the Bern Convention.[103] As the Storting committee argued in the treatment of the second white paper, the study concluded that Norway and Sweden had a common responsibility for protecting wolves, and that this responsibility could not be transferred to the other country. Similarly, it concluded that Norway did not have an obligation to protect a viable population within the borders of the country; rather, the responsibility should be shared with Sweden. As the convention did not dictate how this shared responsibility should be distributed, however, the juridical study introduced some new possible interpretations of this specific issue:

> When no previous agreement exists … an obvious starting point would be even distribution [of responsibility between the countries]. An even distribution might designate that the number of animals in the population is distributed somewhat evenly between the countries, but it might also designate that the burden of keeping carnivores is distributed evenly. In this regard, it might matter where carnivores have caused most controversy and conflict, where the most suitable habitats are, and the sizes of the countries.[104]

[101] Liberg 2003.
[102] St. meld. nr. 15 (2003–2004), p. 134.
[103] Schei 2003.
[104] Schei 2003, p. 14.

ME repeated this interpretation of Norway's responsibilities according to the Bern Convention in the white paper, and employed it in their justification of a proposed new population goal.[105]

The new population goal that ME proposed in the white paper was 'some' new litters of cubs each year in Norway. According to the new interpretation of the Bern Convention, and provided that Sweden protected a larger number of wolves on their side of the border, ME argued that Norway, by this population goal, would cover their responsibility for protecting a viable population of wolves:

> The Government has determined the national [population] goals in the understanding that Norway share populations of carnivores with neighboring countries, and that the estimates concerning the different populations' viability in the long term must primarily be based on these continuous populations. Norway differs from Sweden in that we have extensive numbers of sheep grazing unattended in remote areas. This is an important reason why Norway cannot have the same goals as Sweden concerning the different carnivore species … Norway will nevertheless cover their share of the responsibility to protect this important part of our natural heritage and our biological diversity for the future through the proposed goals.[106]

In their treatment of the white paper, however, the politicians at the Storting changed the population goal that ME had proposed from 'some' new litters of cubs each year to exactly three new litters of cubs each year.[107] This was part of a political conciliation of government and opposition parties that secured a solid majority for new directions and regulations concerning the management of large carnivores.[108] The negotiation process between the parties that led to this conciliation was, in large part, hidden from the public, but it is clear that the Labour Party and the Socialist Left Party – at the time not part of government – criticised the inaccurate population goal of 'some new litters each year' and argued that it should be changed to 'four new litters each year'.[109] In the end, however, the parties compromised and settled on a population goal of three new litters each year.[110] As part of the conciliation, the parliamentary committee proposed that legal regulations should be established that would allow for license hunting of wolves when the population goal was exceeded.[111] ME established regulations that carried the new population goal into effect and allowed for license hunting in the following year.[112] Three new litters each year is still Norway's population goal; it was prolonged in a new parliamentary conciliation in 2011, and it was reached in later years but never exceeded.[113] The population goal is, according to the 2011 Storting conciliation, supposed to be revised again soon.[114]

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[105] St. meld. nr. 15 (2003-2004), p. 84.
[106] St. meld. nr. 15 (2003-2004), p. 114.
[107] Innst. S. nr. 174 (2003-2004), p. 18. (The population goal did not include litters of cubs that were born in family groups that resided on both sides of the border between Norway and Sweden.)
[108] The government consisted of the Conservative Party, the Liberal Party, and the Christian Democrats, while the Labour Party and the Socialist Left Party participated as opposition parties in the conciliation.
[109] Aftenposten, April 29 2004.
[110] Innst. S. nr. 174 (2003-2004), p. 13.
[111] Innst. S. nr. 174 (2003-2004), p. 13.
[112] Forskrift om forvaltning av rovvilt 2005.
[113] The population goal was reached in 2008 (Wabakken et al. 2009, p. 17), 2009 (Wabakken et al. 2010, p. 18), 2010 (Wabakken et al. 2011, p. 18), 2011 (Wabakken et al. 2012, p. 16), 2012 (Wabakken et al. 2013, p. 15.), and 2013 (Wabakken and Maartmann 2014, p. 1).
[114] The initial goal was to establish an agreement with Sweden concerning the distribution of wolves residing on both sides of the border, before determining new national population goals. Norway´s starting position in these negotiations would be that litters of cubs born in family groups residing on both sides of the border would count as 0.5 litters in each country´s national population goal. Norway and Sweden have not come to an agreement on this issue, and the conciliation document stated that if an agreement was not reached in 2013, the parties in Norway should consider a new population goal (Stortinget 2011, p. 4).

It is not immediately evident that the new population goal determined by the Storting politicians constituted a translated version of MVP size. When they treated the white paper, the parliament committee decided to omit the objective of protecting a viable population of wolves, which ME had included in the white paper. Instead, the parliament committee stated that the objectives of Norwegian large carnivore management were to 'secure survival' and conduct 'sustainable management'.[115] These terms were also used in the new regulations of large carnivore management that were established after the Storting conciliation.[116] Although it might be difficult, at first, to see how it would be possible to secure the survival of a population without securing its viability, we have seen that a Norwegian court previously interpreted 'securing survival' as a responsibility for protecting the viability of a population only in a longer perspective. This might indicate that the new regulatory phrasing established a weaker responsibility for the protection of wolves. More specifically, the alteration of terms weakened the link between regulations and the scientific concept of viability, and one might speculate whether this alteration of terms represented an avoidance of any obligations to the concrete MVP size that the biologists had provided two years earlier. The term 'secure survival' had, however – as we have seen – also been preferred over 'secure viable population' in the regulations for large carnivores that were established in 2000, and had also been employed in the Bern Convention. In a larger perspective, the general principle of establishing a lower limit for the number of wolves it would take to protect the population was directly prolonged, even if the alteration of terms shifted the content of the governmental technology to some degree.

In addition to the change in terminology, three other aspects of the new population goal made it appear to be something very different from what the conservation biologists had in mind when they created the governmental technology of MVP size in the 1980s. Firstly, politicians, rather than biologists, determined the number of wolves required for Norway to secure the survival of the population. That is, politicians determined not only the population goal, which stated how many wolves Norway should protect, but also that this number was sufficient to secure the population's survival. Secondly, the MVP level of three new litters of cubs each year was set as a maximum level as well as a minimum level. Thirdly, the exact population goal left the number of wolves in the current population fixed; this was in contrast to the historic population, which was highly varied in number.[117] I will now consider each of these aspects in more depth.

In this second translation of MVP size as a governmental technology, politicians at ME indirectly determined what a viable population would constitute by asserting, in the white paper, that the population goal of 'some litters of cubs each year' was sufficient to cover Norway's responsibility for protecting a viable population of Scandinavian wolves. Earlier, they had granted the authority to determine how many wolves a viable population would constitute to biologists and nature managers. We have also seen that biologists were not always keen to accept this authority, and often emphasised that, regardless of their definitions of viability, it was ultimately the responsibility of politicians to determine population goals. It is not easy to identify why politicians at this point of time chose to take on the authority to evaluate the population's viability, but it is evident that they became more active in wolf regulation as the numbers and the controversy continued to rise from the early 1990s into the 2000s. One might speculate whether politicians found it difficult to reconcile the MVP size of 200 wolves (which the biologists had finally provided) with their objective of mitigating controversy. We have seen, however, that the biological MVP size concerned the Scandinavian population, and that

[115] Innst. S. nr. 174 (2003-2004), p. 7.
[116] Forskrift om forvaltning av rovvilt 2005.
[117] A fourth consequence of the new and exact population goal, which might have been anticipated by the creators of MVP size, was that it required highly detailed monitoring of the wolves in order to be successfully effected (Stokland 2015, pp. 21-30).

it left the question of Norway's responsibilities open for interpretation. The Norwegian population goal that the politicians determined by aid of the legal study could, therefore, still be justified with reference to viability.

The most crucial transformation in the second translation of MVP size as a governmental technology was, however, that the new population goal was set as an exact goal, rather than a minimum goal. This constituted a fundamental alteration of the governmental technology, which effectively transformed the lower limit of viability into a higher limit of the number of wolves that would be necessary to protect, as well. Kristin Asdal found a similar dynamic in her study of the acid rain issue and a governmental technology that designated the 'critical levels of nature'.[118] In her study, she examined how ME and Norwegian scientists had established levels in the 1980s and 1990s that designated how much pollution nature could withstand. The critical levels of nature started out as a successful governmental technology, which persuaded other countries to commit to reductions in their own emissions. Quite soon, however, economists and politicians translated the difference between the current state and the lower limit into economic potential. Understood as such, the critical levels of nature turned into a question of how much more it would be possible to pollute without causing critical damage to nature. In Asdal's interpretation, the transformation of a governmental technology that had been created to protect nature by assigning it a lower limit into one that also constituted a higher limit, was made possible by the cost-efficiency language of economics. In the case of Norwegian wolves, the transformation of the governmental technology was the result of an arduous political compromise. Economic considerations do not seem to have been decisive for the translation of the MVP size for wolves in Norway, although the translation was related to the economic question of grazing livestock and game. It seems, to a larger degree, to have been guided by controversy mitigation considerations, but still with the more general logic of cost-efficiency in play: If a limit shows us how far we can go until nature is irrevocably defunct, then why not go there? The two cases suggest that one should be conscious of a certain dynamic when creating and employing governmental technologies that designate lower limits to what nature can withstand, because the limits might transform into higher limits when employed in practice.

Thirdly, the accurate population goal of three new litters of cubs each year led to a more substantial transformation of the wolf population than had occurred through the adjustment of the number of wolves. Compared to the historic population, which has varied highly in number throughout the centuries, the current population is regulated to stay at a fixed number. It is possible to envision a future – on the basis of a general agreement over the MVP size for wolves and the dynamics of governmental technologies that designate limits for nature – in which every country with wolves protects exactly the same number of them at a fixed level within their borders. If (however unlikely) a broad scientific and political agreement over the specific number of wolves required to secure the viability of a population were to be reached – be this three new litters of cubs each year or a population of 200 wolves – then all countries that struggle with controversies and loss of livestock might decide to follow the logic of cost-efficiency and protect this exact number, and not even one more wolf. Wolves are not the only endangered species with which modern societies struggle to coexist (as this is very often the reason why species become endangered), and the future vision can therefore be extended to encompass a multitude of previously endangered species that exist on the brink of viability. The vision does not entail a probable future, but the unexpected ways in which a governmental technology might transform the nature it was created to protect could be worth considering when discussing or employing it.

[118] Asdal 2011, pp. 139–173.

Conclusion

The case of Norwegian wolf protection shows that governmental technologies such as MVP size, created to achieve certain political objectives such as protecting a viable population of wolves, might transform when they are employed in practice. This might produce unexpected consequences. While MVP size was created to let biologists determine a lower limit for the number of individuals of a specific population that are necessary to protect, the problems Norwegian biologists initially encountered when they attempted to translate MVP size to a particular number of wolves opened the concept for others to interpret. As nature managers, bureaucrats, legal researchers, politicians, and NGOs brought their own interpretations of the number of wolves needed to protect the population, the political negotiations concerning the number of wolves Norway should protect played out, to a large degree, as technical arguments concerning MVP size, rather than political arguments. During these negotiations, MVP size as a governmental technology was altered by two translations, which transferred the authority to define it firstly to nature managers and, secondly, to politicians. These shifts involved major transitions in the practice of determining MVP size, and in the number of wolves considered necessary for protecting a viable population. The governmental technology that was created to determine a lower limit for the number of protected wolves was transformed, in one of these shifts, to function as a higher limit, as well. Controversy mitigation considerations and the general logic of cost-efficiency seem to have been decisive for this shift, which fundamentally altered MVP size as a governmental technology. Further, the accurate population goal of three new litters of cubs each year led to an even more substantial transformation of the wolf population than did adjustment of the number of wolves. Compared to the historic population, which varied highly in number, the current population is regulated to stay at a fixed number.

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