



Research Article

Building biological realism into wolf management policy: the development of the population approach in Europe

John D.C. LINNELL^{a,*}, Luigi BOITANI^b

^aNorwegian Institute for Nature Research, PO Box 5685 Sluppen, NO-7485 Trondheim, Norway

^bDepartment of Biology and Biotechnologies, Sapienza University of Rome, Viale dell'Università 32, 00185 Rome, Italy

Keywords:

Article history:

Received: 19 July 2011

Accepted: 25 April 2012

Acknowledgements

The ideas and concepts presented in this paper were developed through countless hours of discussions during workshops and field visits with our colleagues in the Large Carnivore Initiative for Europe. We are especially grateful to Eladio Fernandez-Galiano for helping us enter the pan-European policy world through the Bern Convention, however, it was through two contracts for the EU's DG Environment (Contract nr. 070501/2005/424162/MAR/B2) that we were able to crystallise these ideas, discuss them with most European management agencies, and get them down onto paper. The writing of this paper was also supported by the EU's 7th Framework Program through the project "HUNTING for Sustainability".

Abstract

During the last few decades wolf management objectives have largely switched from state sponsored control to conservation. Following this change in status there has been a succession of changes in policy approaches that have sought to balance the ecological needs of wolves with the political structures that govern our continent and the challenges of sharing our landscapes with wolves in the face of diverse conflicts with rural interests. One of the most crucial challenges is adapting our administrative structures to the biological scales at which wolf populations operate. Their low densities and wide ranging movements result in biological populations that span many national and international jurisdictions. We describe a series of steps that have been adopted over the years to integrate the idea of managing wolves at a biologically realistic scale into the policies of the two major pan-European legislative frameworks, the Bern Convention and the Habitats Directive. This has resulted in a set of guidelines, endorsed by both the European Commission's DG Environment and the Bern Convention Standing Committee, that aim to chart out a future for wolf conservation based on managing wolf populations within their biological borders and adopting coordinated, yet flexible and pragmatic, policies.

Introduction

Wolves (*Canis lupus*) are challenging animals to conserve, especially in the context of a crowded continent like Europe. Virtually all European landscapes are human-dominated and dedicated to multiple uses, with any given landscape trying to simultaneously satisfy production (i.e. agriculture, forestry), recreation, conservation and residential goals. The result is that wolf conservation must take into account both the eco-

logical needs of wolves and the social, cultural, economic and political needs of people. Balancing biological realism and anthropogenic pragmatism is the key challenge in European large carnivore management today. This balance is especially difficult to reach when it comes to the application of international legislation (which is intended to apply to all biodiversity, much of which is not controversial) to controversial species like wolves. The complexity is compounded to an even greater extent when this common legislation has to be interpreted and applied across a diversity of local contexts. For the last 15 years the Large Carnivore Initiative for Europe (LCIE;

*Corresponding author

Email address: john.linnell@nina.no

(John D.C. LINNELL)

a Specialist Group within the IUCN's Species Survival Commission; <http://www.lcie.org>) has been involved in attempts to introduce best practice guidelines for large carnivore management across Europe. The ambition of the LCIE has been to develop guidelines that:

1. Are compatible with existing legislation,
2. Consider the ecological needs of the species,
3. Take into account the legitimate needs and desires of diverse stakeholder groups,
4. Coordinate activity across Europe,
5. Take into account the diversity of ecological, social, cultural, political and economic situations that occur across Europe.

The major challenge is to balance the potential conflicts that exist between these multiple aims. This paper aims to explain the background to this balancing and chart progress made during the last 15 years for large carnivores, using the wolf as an example.

Legislation across Europe

Europe is a very fragmented and constantly changing political landscape (Boitani and Ciucci, 2009). At the time of writing wolves are present in 32 European countries (including Russia). In fact they are only absent from Denmark, the Benelux countries (although unconfirmed sightings of wolves have been reported in both the Netherlands and Belgium during September 2011 (Hans de Jongh, *personal communication*) and the British Isles. Some of these countries have formal or de facto federal status (Germany, Spain, Austria, Italy, Switzerland, Bosnia & Herzegovina) where a good deal of responsibility for environmental issues is delegated down to the level of individual regions, provinces or cantons. This potentially adds another 82 administrative bodies (at least 35 of which have breeding wolves) to the already complex structures.

Fortunately, there are two major pan-European bodies that seek to apply some coordination across this fragmented political landscape. The Council of Europe "Convention on the Conservation of European Wildlife and Natural Habit-

ats" (Bern Convention) has operated since 1972 and involves all members of the Council of Europe which includes 29 of the wolf containing European countries (Salvatori and Linnell, 2005). Only Russia, Belarus and Kosovo have wolves and are not members. The European Union "Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora" (Habitats Directive) has operated since 1992 and applies to all EU countries, 19 of which currently have wolves (Trouwborst, 2010). The Bern Convention basically represents a statement of a shared intention for signatories to cooperate in a joint effort to conserve wolves, but it does not state specific conservation objectives and has few legal sanctions to react with if countries do not follow-up on their commitments. It has been very active in large carnivore issues since the mid 1990s and has worked with the LCIE and others on a range of meetings, workshops (Bath, 2005), status reports (Anonymous, 1990; Breitenmoser and Breitenmoser-Würsten, 1994; Salvatori and Linnell, 2005) and action plans (Boitani, 2000; Breitenmoser et al., 2000; Landa et al., 2000; Swenson et al., 2000) that have served to transfer capacities, coordinate activities, and keep large carnivore conservation on the political agenda. A long series of formal recommendations from the convention have encouraged signatory states to engage in transboundary cooperation in wolf management (Recommendations of the Standing Committee nrs. 10, 17, 20, 82, 89, 100, 101, 115; <http://www.coe.int>).

The expansion of the EU into Eastern Europe has led to the Habitats Directive being an increasingly important framework for wolf conservation. The Habitats Directive has more specific objectives, framed within the concept of Favourable Conservation Status (FCS), and has a range of sanctions that can be imposed by the European Court on countries that do not fulfill their obligations. The EU has been active in large carnivore issues through funding relevant LIFE projects, bringing cases before the European Court for legal clarification, funding a project on developing population based management approaches (see below), as well as maintaining a dialogue with several countries concerning controversial aspects of their national

Table 1 – Overview of the international conventions and treaties that the various countries of continental Europe have signed, with details of any species specific exceptions. HD = Habitats Directive, CBD = Convention on Biological Diversity, Y = yes, A = accession country that will soon be member, MoU = has not ratified but takes part in some specific agreements through a memorandum of understanding.

Country	HD ¹	Bern ¹¹	Bonn	CBD	Country	HD ¹	Bern ¹¹	Bonn	CBD
Albania		Y	Y	Y	Luxembourg	Y	Y	Y	Y
Andorra		Y			Moldova		Y		Y
Austria	Y	Y	Y	Y	Montenegro		Y		Y
Belarus			Y	Y	Netherlands	Y	Y	Y	Y
Belgium	Y	Y	Y	Y	Norway		Y	Y	Y
Bosnia and Herzegovina				Y	Poland	Y ⁷	Y ¹⁸	Y	Y
Bulgaria	Y	Y ¹²	Y	Y	Portugal	Y	Y	Y	Y
Croatia	A	Y ¹³	Y	Y	Romania	Y	Y	Y	Y
Czech Republic	Y	Y ¹⁴	Y	Y	Russian Federation			MoU	Y
Denmark	Y	Y	Y	Y	San Marino				Y
Estonia	Y ²	Y		Y	Serbia				Y
Finland	Y ³	Y ¹⁵	Y	Y	Slovakia	Y ⁸	Y ¹⁹	Y	Y
France	Y	Y	Y	Y	Slovenia	Y	Y ²⁰	Y	Y
Germany	Y	Y	Y	Y	Spain	Y ⁹	Y ²¹	Y	Y
Greece	Y ⁴	Y	Y	Y	Sweden	Y ¹⁰	Y	Y	Y
Hungary	Y	Y	Y	Y	Switzerland		Y	Y	Y
Italy	Y	Y	Y	Y	The former Yugoslav Republic of Macedonia		Y ²²	Y	Y
Latvia	Y ⁵	Y ¹⁶	Y	Y	Turkey		Y ²³		Y
Liechtenstein		Y	Y	Y	Ukraine		Y ²⁴	Y	Y
Lithuania	Y ⁶	Y ¹⁷	Y	Y					

¹ By default wolf, bear, lynx and wolverine are on annex II and annex IV under the habitats directive.

² Estonia: exception for wolf, bear and lynx from annex II; wolf and lynx on annex V.

³ Finland: exception for wolf, bear and lynx from annex II; wolf in reindeer husbandry area is on annex V.

⁴ Greece: exception for wolf north of the 39th parallel from annex II; wolves over 39 N are on annex V.

⁵ Latvia: exception for wolf and lynx from annex II; wolf on annex V.

⁶ Lithuania: exception for wolf from annex II; wolf on annex V.

^{7,8} Poland, Slovakia: exception so that wolf is placed on annex V.

⁹ Spain: exception for wolf north of river Duero from annex II: wolves north of Duero are on annex V.

¹⁰ Sweden: exception for bears from annex II.

¹¹ By default wolves, bears and wolverines are on appendix II, lynx on appendix III under Bern Convention.

^{12, 16, 18, 22} Bulgaria, Latvia, Poland, Macedonia: wolves excluded from appendix II.

¹³ Croatia: bears will be treated as appendix III.

^{14, 23} Czech Republic, Turkey: wolves and bears excluded from appendix II.

¹⁵ Finland: wolves and bears excluded from appendix II.

^{17, 21} Lithuania, Spain: wolves will be treated as appendix III.

^{19, 20} Slovakia, Slovenia: wolves and bears excluded from appendix II.

²⁴ Ukraine: wolves and bears on appendix II, but with the right to control population to limit damage.

management activities.

Although these international agreements seek to standardise conservation actions across Europe, both the Bern Convention and the Habitats Directive have allowed some countries to make national or sub-national exceptions or local modifications to the status of wolves under the legislation (Tab. 1; Linnell et al. 2008; Salvatori and Linnell 2005). These exceptions and reservations were allowed at the time of signing the respective agreements, but neither agreement has

formal mechanisms to permit future changes in a species status to respond to changes in their conservation status (Shine, 2005; Trouwborst, 2010).

In addition to these two bodies of legislation there are a number of other frameworks that also aspire to coordinate countries' conservation efforts. The "Convention on Migratory Species" (Bonn Convention) has included transboundary populations into its conceptual framework, although it has never focused explicitly on large

carnivores. The “Convention on the Protection of the Alps’ and the “Convention on the Protection and Sustainable Development of the Carpathians” have both included large carnivore specific activities.

When ecological reality clashes with politics and legislation

Despite all the transboundary initiatives and pan-European legal frameworks mentioned above, the formal legal responsibility to conserve wolves still falls independently on each country. In the case of some federal countries this responsibility has been devolved to an even lower level. The pan-European legal frameworks, especially the Habitats Directive, are also quite conservative with respect to permitted management regimes as they generally prescribe strict protection for wolves. Derogation on a case by case basis is possible under the Habitats Directive, although this can be controversial as the European Court case against Finland’s wolf hunting in 2006-2007 reveals (Case C-342/05, Hiedanpää and Bromley 2011). These two technical aspects represent major problems for actually achieving wolf conservation in the real world.

The first major problem is one of scale. Wolves, as territorial top predators, use massive home ranges and as a result occur at low density. Individual pack territories typically range from 100 to 1000 km², depending on your location in Europe (Jedrzejewski et al., 2007; Nilsen et al., 2005) which results in densities in the range of 0.2 to 2 wolves per 100 km². Although wolves are able to tolerate a wide range of habitats, there are limits to the areas where they can persist (Jedrzejewski et al., 2005, 2004). Although the Habitat Directive concept of favourable conservation status is not formally defined in demographic or genetic terms, it is understood to be linked to the general concept of population viability (Bessinger and McCullough, 2002). Because of the densities at which wolves occur there are many countries that simply do not have enough available habitat to support enough

wolves to achieve high degrees of long term viability if they are to achieve this independently from their neighbours. This is especially true if the long term viability that involves genetic issues is considered as this is believed to require effective population sizes in the order of several thousand animals (Linnell et al., 2008). Realistically speaking it is only by pooling the efforts of many neighbouring countries, or in fact large parts of Europe, that long term viability can really be achieved.

Attempting to achieve a high degree of viability within national borders would also require a management regime based around maximizing wolf density and reducing human-caused wolf mortality to a minimum. Such a regime is likely to exacerbate the second major problem, which is associated with the strict protection of wolves. Wolves are associated with a wide range of conflicts. Most common is that associated with their depredation on domestic livestock and pets (Bjarvall and Isakson, 1982; Kaczensky, 1999; Kojola et al., 2004). A second widespread conflict is that with hunters, who perceive and / or experience (depending on context) wolves as a competitor for shared prey species. Wolves are also occasionally a vector of diseases like rabies which at least historically has been associated with many cases of human and livestock mortality (Linnell et al., 2002; Rootsi, 2003). Beyond these conflicts (which have a physical, material and economic basis) are a wide range of social conflicts that range from a direct fear for personal safety in the presence of wolves to a fear of the social-economic changes (such as changing societal values or rural-urban migration) that wolves often come to symbolise (Bisi et al., 2007; Moore, 1994; Skogen et al., 2006; Skogen and Thrane, 2008). These conflicts when combined often lead to a very low tolerance of wolves among the rural communities with whom they have to share living space. Factors affecting tolerance for wolves are highly complex and context dependent (Boitani, 1995, 2003; Boitani and Zimen, 1979). Although there are some general factors that appear to consistently affect attitudes (e.g. Kaltenborn and Bjerke 2002; Kaltenborn et al. 1998; Røskaft et al. 2003; Skogen and Thrane 2008), there is still only a very poor understanding of

what determines the variation in the extent to which wolves become a controversial political issue and to where negative attitudes translate into illegal actions such as poaching (Huber et al., 2002).

What we do see is that tolerance in many areas (especially those in eastern and northern Europe) is often decreased by high densities of wolves and by strict protection. For many areas we find that being able to continue traditional wolf hunting activities (Salvatori et al., 2002) and / or being able to respond to conflicts with lethal control is probably crucial to maintaining tolerance levels (Bisi et al., 2007; Ericsson et al., 2004; Hiedanpää and Bromley, 2011; Les-cureux and Linnell, 2010; Sjölander-Lindqvist et al., 2010). The basic mechanism behind this pattern appears to be one of empowerment – where the ability to take matters into their own hands allows rural communities to tolerate wolf presence. There are also many real world management situations that arise where lethal control is the only viable action (Bangs et al., 2006). These situations include areas where zoning policies (Linnell et al., 2005) need to be enforced, where individual wolves develop problematic behavior (i.e. loss of shyness), or where wolf population densities need to be regulated at desired levels. Live capture and translocation (Linnell et al., 1997), or removal to captivity, are simply not practical methods when it concerns upscaling to large numbers of wolves. However, there are also many areas where wolf hunting and lethal control would not be socially acceptable, and would not enhance tolerance, even if they were appropriate or defensible from a biological standpoint. The point here is that wolf management needs to be flexible and adaptable, responding to specific issues, local situations and changing circumstances. Blanket protection does not permit this degree of flexibility and simply confuses a conservation tool (protection) with a goal.

A vision for wolf conservation

An understanding of the complexity of wolf conservation has been acquired by the members of the LCIE during its 15 years of existence (Boi-

tani and Ciucci, 2009). It has also allowed the identification of some strategies that could potentially be useful to achieve wolf conservation in modern day Europe. The first step that is required is to move away from viewing wolf distribution within the arbitrary lines on maps that national or provincial borders represent and to look at the actual distributions. The resulting view is one of a “meta-population like” structure where demographic viability is achievable in many regional units that have a more or less continuous distribution of wolves (populations). It is crucial that these populations are managed as biological units – with the administrative bodies (be they intra- or inter-national) that share a population coordinating their activities to ensure that their independent actions enhance rather than hinder each other (Salvatori et al., 2002). Coordinating maximum permissible levels of mortality, zoning of wolves and activities with which they conflict, and preventing unmitigated infrastructure developments that may cause internal fragmentation are examples of issues that need to be coordinated. Other issues of key importance involve ensuring the compatibility of different monitoring methods, as well as trying to ensure a certain degree of consistency in management practices and conflict mitigation measures. Most European wolf populations are transboundary in the international sense, so this is a point of near universal relevance (Tab. 2; Anonymous 1990; Boitani 2000; Boitani and Ciucci 2009; Linnell et al. 2008; Salvatori and Linnell 2005).

However, it is equally important to ensure that distinct populations are managed separately when they occur within a country, and that it is not assumed that demographic viability stems from the total number of animals within a country independent of whether they actually have any connections. A good example of this is from wolves in Spain – where the small and isolated population in the southern Sierra Morena mountains requires specific management actions because it is effectively isolated from the much larger population that spreads across northern Spain and Portugal.

The longer term genetic component of viability can be achieved by wolves moving between these populations. Wolves have phenomenal

Table 2 – Overview of the population structure of wolves (*Canis lupus*) in Europe around 2005-2006.

Region	Population	EU countries	Non-EU countries	Size
Iberia ¹	Northwestern	Spain, Portugal		2400
	Sierra Morena	Spain		50
Alpine / Italian	Western Alps	France, Italy ⁴	Switzerland	100-120
	Italian peninsula	Italy ⁵		500-800
Dinaric-Balkan	Dinaric-Balkan	Slovenia, Greece, Bulgaria	Croatia, Bosnia & Herzegovina, Serbia, Montenegro, FYR Macedonia, Albania	5000
Carpathian	Carpathian	Czech Republic, Slovakia, Poland, Romania, Hungary	Ukraine, Serbia	5000
Northeastern Europe	Scandinavia	Sweden	Norway	130-150
	Karelian	Finland	Russia ²	750
	Baltic	Estonia, Latvia, Lithuania, Poland	Russia ³ , Belarus, Ukraine	3600
	Germany / Western Poland	Germany / Poland		<50

¹ The distribution area covers 8 autonomous regions: Galicia, Asturias, Cantabria, Castilla y León, País Vasco, La Rioja, Castilla-La Mancha and Andalucía.

² Russian oblasts of Murmansk, and Karelia. The southern and eastern border coincides with the natural geographic structures of Lakes Onega and Ladoga and the White Sea.

³ Russian oblasts of Leningrad, Novgorod, Pskov, Tver, Smolensk, Bryansk, Moscow, Kalinigrad, Kaluzh, Tula, Kursk, Belgorod & Orel.

⁴ The distribution area covers 3 regions with autonomous policies: Val d'Aosta, Piemonte, Liguria.

⁵ The distribution area covers 11 autonomous regions: Lombardia, Emilia-Romagna, Toscana, Marche, Lazio, Abruzzo, Molise, Campania, Basilicata, Puglia, Calabria.

dispersal ability. Modern research methods such as GPS telemetry and individual recognition through faecal DNA have revealed some truly spectacular wolf journeys of over 1000 km, with many dispersing wolves being shown to cross multiple countries (Kojola et al., 2006; Linnell et al., 2005; Wabakken et al., 2007). The unassisted reappearance of reproducing wolf populations in Scandinavia, the Alps, and eastern Germany (Wabakken et al., 2001; Weber, 2003) and the documentation of individual wolves in areas distant from any breeding population (such as Austria, northern Germany, the French Pyrenees), testifies to their ability to criss-cross the modern European landscape and “leap-frog” large areas of unoccupied habitat (Bufka et al., 2005; Valière et al., 2003), despite the many barriers that exist (Blanco et al., 2005; Kusak et al., 2009). This implies that maintaining a certain degree of pan-European connectivity should be possible, however, there are also examples of

areas where there is less gene flow than expected when considering the geographic barriers (Aspi et al., 2006; Pilot et al., 2006).

Such a population approach simultaneously seeks to focus on coordinated management of discrete populations and ensuring the maintenance of the connections between these populations. The result should be an increased overall viability of the European wolf meta-population – where the maximum viability is extracted from the animals and habitat that exist. Within such a system the viability is not a product of each administrative unit activities, but proximately from the combined jurisdictions sharing a population and ultimately from the whole (or at least large parts) of the continent. This enhanced viability would permit (from a biological standpoint) a far greater degree of flexibility in management within the different parts of the distribution than would have been possible if each administration had to ensure viability on its own. In practice

this implies being able to accept higher rates of mortality, be it from accidental causes, poaching, legal harvest, or lethal control than what would otherwise be the case. In the experience of the LCIE and an emerging body of social science research (Bisi et al., 2007; Ericsson et al., 2004; Hiedanpää and Bromley, 2011; Les-cureux and Linnell, 2010; Sjölander-Lindqvist et al., 2010) it is this flexibility which may well be crucial to ensure tolerance in many contexts.

From vision to policy

The interactions between the members of the LCIE allowed this overall vision of wolf conservation to emerge, but the challenge was always to turn these ideas into policy. The production of species actions plans for the Bern Convention in 2000 (Boitani, 2000; Breitenmoser et al., 2000; Landa et al., 2000; Swenson et al., 2000) was a first opportunity to promote some of these concepts, along with a workshop in Slovenia on “Transboundary Management of Large Carnivores” organised by the Bern Convention in 2005 (Bath, 2005). However, a series of two contracts from the European Commission’s DG Environment between 2005 and 2008 provided the opportunity to crystallize these ideas into a document with associated supporting materials and communication tools. These “Guidelines for Population Level Management Plans for Large Carnivores” (Linnell et al., 2008) describe the overall philosophy of our approach and place it within the context of existing European legislation.

The first part of the project aimed to summarise existing data on wolf status and distribution (<http://www.lcie.org>; Boitani and Ciucci 2009) in Europe and to define some operational population units (Tab. 2). By contacting experts in all countries and consulting the latest status and monitoring publications we were able to draw up a map of wolf distribution that represents the situation in the period 2005-2007. Although separating between populations is somewhat a subjective process, we considered both the continuity of wolf distribution and major ecological discontinuities and classified 10 distinct populations (Tab. 2). All apart from one of these

populations spanned international borders; the exception was the Sierra Morena population in southern Spain. The greatest uncertainties occurred in the Dinaric-Balkan region of south-eastern Europe where not enough detailed data was available to draw up a more spatially differentiated map. These classifications should be regarded as preliminary, and we hope that further research on wolf distribution and patterns of gene flow will clarify some of the uncertain issues.

The second part of the project involved an exploration of the Habitat Directive concept of Favourable Conservation Status (FCS) and an attempt to link it to existing scientific concepts such as population viability analysis and minimum viable populations. Integrating the text of the Directive and the existing guidance documents that various working groups have prepared earlier¹ with our knowledge of wolf ecology and conservation issues we developed a set of 8 criteria which would all need to be met to accept FCS for wolves. These criteria are (Linnell et al., 2008):

1. “*Population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitat*” (Article 1 (i)). We interpret this as implying that monitoring data indicate the population has a stable or increasing trend. In some cases we believe that a slight reduction in population size should be permitted if it is a result of response to changes in prey density or habitat quality that are not cause by direct human action. And,
2. “*The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future*” (Article 1 (i)). We interpret this as implying that the overall distribution of the population is stable or increasing. And,
3. “*There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis*” (Article 1 (i)). We interpret this to imply that the quality and continuity of hab-

¹Guidance document on the strict protection of animal species of community interest provided by the “Habitats” Directive 92/43/EEC. (Draft version 5 April 2006).

- itat should be sufficient to contain a favourable reference population, and have a stable or increasing trend. And,
4. The population size and range are equal to or greater than when the directive came into force within a given country. And,
 5. The favourable reference population size has been reached. According to our proposal this will be set at levels greater than those regarded as being viable using the IUCN red list criteria D or E (IUCN 2003, 2006). And,
 6. The favourable reference range has been occupied. According to our proposal the favourable reference range is simply the area needed to contain the favourable reference population, and does not automatically imply all available habitat or the full historic distribution. And,
 7. Connectivity within and between populations is being maintained or enhanced. And,
 8. “Member States shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species” (Article 11) and “Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a)” (Article 12.4). These statements combine to indicate that the population should be subject to a robust monitoring program.

Criteria 1-3 and 8 are taken directly from the directive text; criteria 4 and 6 are taken from the pre-existing guidance documents, while criteria 5 and 7 are based on our own recommended interpretation of the guidance documents text. The overall concept behind these definitions aims to describe well monitored wolf populations that are independently viable (according to existing IUCN guidelines) in a demographic sense, that are connected from the point of view of gene flow to ensure genetic viability, and that occupy habitat that is sufficient and secure. While most of this proposal was based on existing legislative structures we proposed that the unit for favourable conservation status (FCS) assessment should be the population within its

biological borders, under the condition that a formal population level management has been developed by the parties sharing the population. In theory, this would allow a transboundary population shared by several countries to be regarded as being at FCS even if the individual national parts were not. We believe that this compromise reflects both the ecological and political reality of wolf conservation, although parts of this proposal have been critiqued from a genetics point of view (Laikre et al., 2009).

The third part of the project focused on developing a set of policy support statements, or good practice guidelines for various aspects of large carnivore management. Most controversial among these is a proposal to accept the validity of wolf hunting, or de facto hunting, under specific circumstances and in specific contexts (Linnell et al., 2008), as a legitimate management regime which can be compatible with wolf conservation, and may in some contexts be needed to maintain tolerance (Ericsson et al., 2004; Sjölander-Lindqvist et al., 2010). The legal procedures that have been brought against Finland (Hiedanpää and Bromley, 2011), and with which Sweden have recently been threatened (during 2010 and 2011), indicate that there is still a long way to go before the Habitats Directive adopts the same pragmatic stance as the Bern Convention (Shine, 2005).

Status in the Habitats Directive

The guidelines that were drafted in late 2007 went through an extensive consultation process. Workshops with responsible authorities and stakeholders were held in Sweden, Finland, Latvia / Estonia (joint workshop), Lithuania, Slovakia / Czech Republic (joint workshop), Slovenia, Spain, Italy, Portugal, Romania, Bulgaria, Germany, Austria.

Workshops were also held outside the EU in Switzerland and Croatia, and the guidelines were presented to the Nordic Council and management authorities in Norway. In addition to these workshops we received many written comments from the European Commission, national authorities and diverse stakeholders. A final

pan-European workshop was held in Slovenia in 2008. Following the acceptance of the final version the document, DG Environment endorsed them by describing them as “best practice” and “a reference point against which DG Environment will monitor the actions taken by the member states in fulfillment of their obligations under the Habitats Directive”. This implies that they do not have the status of being legally binding, which would require a full process under the European Parliament, but they do have the highest status that guidelines can achieve within the European system. In the 28th Standing Committee Meeting of the Bern Convention in 2008 a recommendation (Recommendation No. 137, 2008) was passed drawing the attention of governments to the guidelines.

The population approach in practice

This endorsement by both the Habitats Directive and the Bern Convention is crucial as many of the designated populations stretch across areas that include non-EU countries – such as Switzerland, Norway, Ukraine, Serbia, Croatia, Bosnia & Herzegovina, Montenegro, Albania and Macedonia. Implementation of the population approach is greatly enhanced if all authorities that share populations coordinate their actions. A greater challenge exists because neither Russia nor Belarus is covered by these pan-European conservation agreements and they have crucial borders with Finland, the Baltic States and Poland. There is therefore going to be an additional challenge to find a way to integrate these key countries into what is already a complex exercise in international politics. The unclarified legal status of Kosovo also represents certain challenges within the western Balkan population.


At present there are no formal population level management plans, although there are plenty of examples where research teams and responsible authorities sharing a population are increasing their cross-border contact and working to standardise monitoring and other activities. Examples include the Alpine Wolf Group (France, Italy, Switzerland) and the Scand-

navian Wolf Project (Norway and Sweden). Unfortunately, there are also other examples from Europe where management actions in one jurisdiction are potentially detrimental to activities being conducted in a neighboring jurisdiction, despite the population being shared (Salvatori et al., 2002). An example here is the extreme skew in the level of ambition for wolf conservation between Norway and Sweden. Another is found among the dramatic differences in wolf management that exist in eastern Europe, from protected on one side of a border to open harvest and bounties on the other (e.g. Poland - Ukraine).

The way forward

Our view is that the present “population approach” guidelines provide a conceptually solid, and pragmatic, framework to take European wolf conservation forward into the 21st century. In general wolves have shown an amazing ability to respond to improved legislation and have stabilized or recolonised many areas. For most wolf populations we are no longer trying to save them from imminent extinction (although the Sierra Morena population falls into this category), but are trying to establish a new sustainable relationship with them. This sustainability does not only refer to the viability of the wolf populations; it also refers to the sustainability of our management systems and of the ways we interact with them. Perhaps most importantly it concerns the sustainability of the ways in which people interact with each other, in the way that different interest groups and stakeholders can negotiate their differences, and seek consensus, or at least compromise (Bath, 2009). Although this in itself is not special for wolf conservation, it is both the need to conduct these processes at very large spatial scales that span intra- and inter-national jurisdictions, and the fact that wolf conservation is often highly symbolic, which makes wolf conservation so hard. The remaining challenges are to take the existing guidelines and operationalise them; to get the responsible authorities in different jurisdictions to sit down and draw up binding agreements to jointly manage the populations for which they have a shared

responsibility. The greatest needs for research lie in developing the policy processes and administrative structures that facilitate multi-scale planning and decision making (Bisi et al., 2007; Linnell, 2005; Sandström et al., 2009), rather than in the natural science fields of conservation biology.

Although progress may appear to be slow it is important to reflect on the fact that it is only a few decades since wolves changed their official status from vermin to conservation icons, and when European countries made the transition from cold war stand-off and multiple civil wars to peace and cooperation, it is important to accept that we need to settle in for a long process and to use time to do things slowly and well. There has never been a time in European history when we have tried to form a sustainable and respectful relationship with wolves, or indeed any other large carnivore (Boitani, 1995; Breitenmoser, 1998; Landa et al., 2000; Linnell et al., 2010), so it is not surprising that the process takes time and is stormy. 

References

- Anonymous, 1990. Status and conservation needs of the wolf (*Canis lupus*) in the Council of Europe member states. Council of Europe Publishing, Nature and Environment 47: 1–50.
- Aspi J., Roininen E., Ruokonen M., Kojola I., Vilà C., 2006. Genetic diversity, population structure, effective population size and demographic history of the Finnish wolf population. *Molec. Ecol.* 15: 1561–1576.
- Bangs E.E., Jimenez M.D., Niemeyer C., Fontaine J.A., Collinge M., Krsichke R., Handegard L., Shivik J., Sime C., Nadeau S., Mack C.M., Smith D.W., Asher V., Stone S., 2006. Non-lethal and lethal tools to manage wolf-livestock conflict in the northwestern United States. *Proc. Vertebr. Pest Conf.* 227–16.
- Bath A., 2005. Transboundary management of large carnivore populations. Reports from the meeting held in Osilnica, Slovenia, April 2005. Council of Europe T-PVS (2005) 10.
- Bath A., 2009. Working with people to achieve wolf conservation in Europe and North America. In: Musiani M., Boitani L., Paquet P.C. (Eds.). *A new era for wolves and people: wolf recovery, human attitudes, and policy.* University of Calgary Press, Calgary: 173–200.
- Bessinger S.R., McCullough D.R., 2002. Population viability analysis. Chicago.
- Bisi J., Kurki S., Svensberg M., Liukkonen T., 2007. Human dimensions of wolf (*Canis lupus*) conflicts in Finland. *Euro. J. Wildl. Res.* 53: 304–314.
- Bjarvall A., Isakson E., (1982). Winter ecology of a pack of three wolves in northern Sweden. In: Harrington F.H., Paquet P.C. (Eds.). *Wolves of the world: perspectives of behaviour, ecology, and conservation.* Noyes, New Jersey, pp: 146–157.
- Blanco J.C., Cortés Y., Virgós E., 2005. Wolf response to two kinds of barriers in an agricultural habitat in Spain. *Canadian Journal of Zoology* 83: 312–323.
- Boitani L., 1995. Ecological and cultural diversities in the evolution of wolf human relationships. In: Carbyn L.N., Fritts S.H., Seip D.R. (Eds.). *Ecology and conservation of wolves in a changing world.* Canadian Circumpolar Institute Alberta, Canada: 3–12.
- Boitani L., 2000. Action plan for the conservation of the wolves (*Canis lupus*) in Europe. *Nature and Environment, Council of Europe Publishing* 11: 31–86.
- Boitani L., 2003. Wolf conservation and recovery. In: Mech L.D., Boitani L. (Eds.). *Wolves: behavior, ecology, and conservation.* University of Chicago Press Chicago: 317–340.
- Boitani L., Ciucci P., 2009. Wolf management across Europe: species conservation without boundaries. In: Musiani M., Boitani L., Paquet P.C. (Eds.). *A new era for wolves and people: wolf recovery, human attitudes, and policy.* University of Calgary Press. Calgary: 15–40.
- Boitani L., Zimen E., 1979. The role of public opinion in wolf management. In: Klinghammer E. (Ed.). *The behavior and ecology of wolves.* Garland STPM Press. London: 471–477.
- Breitenmoser U., 1998. Large predators in the Alps: the fall and rise of man's competitors. *Biol. Conserv.* 83(3): 279–289.
- Breitenmoser U., Breitenmoser-Würsten C., 1994. SCALP – status and conservation of the alpine lynx population. *Council of Europe Environmental Encounters* 17: 111–112.
- Breitenmoser U., Breitenmoser-Würsten C., Okarma H., Kaphegyi T., Kaphegyi-Wallmann U., Müller U.M., 2000. Action plan for the conservation of the Eurasian lynx in Europe (*Lynx lynx*). *Council of Europe Nature and Environment* 11: 21–69.
- Bufka L., Heurich M., Engleder T., Wölfl M., Cerveny J., Scherzinger W., 2005. Wolf occurrence in the Czech-Bavarian-Austrian border region – review of the history and current status. *Silva Gabreta* 11(1): 27–42.
- Ericsson G., Heberlein T.A., Karlsson J., Bjärvall A., Lundvall A., 2004. Support for hunting as a means of wolf *Canis lupus* population control in Sweden. *Wildl. Biol.* 10: 260–276.
- Hiedanpää J., Bromley D.W., 2011. The harmonization game: reasons and rules in European biodiversity policy. *Environmental Policy and Governance*, 21: 99–111.
- Huber D., Kusak J., Frkovic A., Gužvica G., Gomercic T., 2002. Causes of wolf mortality in Croatia in the period 1986–2001. *Veterinarski Arhiv* 72(3): 131–139.
- IUCN, 2003. Guidelines for Application of IUCN Red List Criteria at Regional Levels, Version 3.0. IUCN Species Survival Commission. Gland, Switzerland and Cambridge, UK.
- IUCN, 2006. Guidelines for using the IUCN red list categories and criteria. version 6.1 (July 2006). Standards and Petitions Working Group, IUCN SSC Biodiversity Assessments Sub-Committee.

- Jedrzejewski W., Niedzialkowska M., Mysiajek R.W., Nowak S., Jedrzejewska B., 2005. Habitat selection by wolves *Canis lupus* in the uplands and mountains of southern Poland. *Acta Theriologica* 50(3): 417–428.
- Jedrzejewski W., Niedzialkowska M., Nowak S., Jedrzejewska B., 2004. Habitat variables associated with wolf (*Canis lupus*) distribution and abundance in northern Poland. *Div. Distrib.* 10: 225–233.
- Jedrzejewski W., Schmidt K., Theuerkauf J., Jedrzejewska B., Kowalczyk R., 2007. Territory size of wolves *Canis lupus*: linking local (Bialowieza Primeval Forest, Poland) and Holarctic-scale patterns. *Ecography* 30(1): 66–76.
- Kaczynsky P., 1999. Large carnivore depredation on livestock in Europe. *Ursus* 11: 59–72.
- Kaltenborn B.P., Bjerke T., 2002. The relationship of general life values to attitudes toward large carnivores. *Human Ecology Review* 9(1): 55–61.
- Kaltenborn B.P., Bjerke T., Strumse E., 1998. Diverging attitudes towards predators: do environmental beliefs play a part? *Research in Human Ecology* 5(2): 1–9.
- Kojola I., Ronkainen S., Hakala A., Heikkinen S., Kokko S., 2004. Interactions between wolves *Canis lupus* and dogs *C. familiaris* in Finland. *Wildl. Biol.* 10(2): 101–106.
- Kojola I., Aspi J., Hakala A., Heikkinen S., Ilmoni C., Ronkainen S., 2006. Dispersal in an expanding wolf population in Finland. *Journal of Mammalogy* 87(2): 281–286.
- Kusaj J., Huber D., Gomercic T., Schwaderer G., Guzvica G., 2009. The permeability of highway in Gorski kotar (Croatia) for large mammals. *Euro. J. Wildl. Res.* 55: 7–21.
- Laike L., Nilsson T., Primmer C.R., Ryman N., Allendorf F.W., 2009. Importance of genetics in the interpretation of favourable conservation status. *Conserv. Biol.* 23(6): 1378–1381.
- Landa A., Lindén M., Kojola I., 2000. Action plan for the conservation of wolverines in Europe (*Gulo gulo*). Council of Europe Nature and Environment 11: 51–45.
- Landa A., Linnell J.D.C., Swenson J.E., Røskaft E., Moskness I., 2000. Conservation of Scandinavian wolverines in ecological and political landscapes. In: Griffiths H.I. (Ed.). *Mustelids in a modern world: conservation aspects of small carnivore-human interactions*. Backhuys Publishers Leiden, Netherlands: 1–20.
- Lescureux N., Linnell J.D.C., 2010. Species specific ecology influences the perceptions and local knowledge of Macedonian hunters and livestock breeders towards bears, wolves and lynx. *Human Ecology* 38(3): 389–399.
- Linnell J.D.C., 2005. Spatial aspects of managing natural resources and conserving biodiversity – Integrating the global and the local. NINA Rapport 62: 1–42.
- Linnell J., Salvatori V., Boitani L., 2008. Guidelines for population level management plans for large carnivores in Europe. A Large Carnivore Initiative for Europe report prepared for the European Commission (contract 070501/2005/424162/MAR/B2).
- Linnell J.D.C., Brøseth H., Solberg E.J., Brainerd S., 2005. The origins of the southern Scandinavian wolf *Canis lupus* population: potential for natural immigration in relation to dispersal distances, geography and Baltic ice. *Wildl. Biol.* 11(4): 383–391.
- Linnell J.D.C., Brøseth H., Odden J., Nilsen E.B., 2010. Sustainably harvesting a large carnivore? Development of Eurasian lynx populations in Norway during 160 years of shifting policy. *Environ. Manage.* 45: 1142–1154.
- Linnell J.D.C., Nilsen E.B., Lande U.S., Herfindal I., Odden J., Skogen K., Andersen R., Breitenmoser U., 2005. Zoning as a means of mitigating conflicts with large carnivores: principles and reality. In: Woodroffe R., Thirgood S., Rabinowitz A. (Eds.). *People & Wildlife: conflict or co-existence*. Cambridge University Press. Cambridge.
- Linnell J.D.C., Aanes R., Swenson J.E., Odden J., Smith M.E., 1997. Translocation of carnivores as a method for managing problem animals: a review. *Biodiv. Conserv.* 6: 1245–1257.
- Linnell J.D.C., Løe J., Okarma H., Blancos J.C., Anderson Z., Valdmann H., Balčiauskas L., Promberger C., Brainerd S., Wabakken P., Kojola I., Andersen R., Liberg O., Sand H., Solberg E.J., Pedersen H.C., Boitani L., Breitenmoser U., 2002. The fear of wolves: a review of wolf attacks on humans. NINA Oppdragsmelding 73: 11–65.
- Moore R.S., 1994. Metaphors of encroachment: hunting for wolves on a central Greek Mountain. *Anthropol. Quart.* 67(2): 81–88.
- Nilsen E.B., Herfindal I., Linnell J.D.C., 2005. Can intraspecific variation in carnivore home-range size be explained using remote sensing estimates of environmental productivity? *Ecoscience* 12: 68–75.
- Pilot M., Jedrzejewski W., Branicki W., Sidorovich V.E., Jedrzejewska B., Stachura K., Funk S.M., 2006. Ecological factors influence population genetic structure of European grey wolves. *Molec. Ecol.* 15: 4533–4553.
- Rootsi I., 2003. Ravid wolves and man in Estonia of the 18th and 19th centuries. *Acta Zoologica Lithuanica* 13: 72–77.
- Røskaft E., Bjerke T., Kaltenborn B.P., Linnell J.D.C., 2003. Patterns of self reported fear towards large carnivores among the Norwegian public. *Evol. Human Behav.* 24: 184–198.
- Salvatori V., Linnell J.D.C., 2005. Report on the conservation status and threats for wolf (*Canis lupus*) in Europe. Council of Europe Report T-PVS/Inf (2005) 16.
- Salvatori V., Okarma H., Ionescu O., Dovhanych Y., Findo S., Boitani L., 2002. Hunting legislation in the Carpathian Mountains: implications for the conservation and management of large carnivores. *Wildl. Biol.* 8(1): 3–10.
- Sandström C., Pellikka J., Ratamäki O., Sande A., 2009. Management of large carnivores in Fennoscandia: new patterns of regional participation. *Human Dim. Wildl.* 14: 37–50.
- Shine C., 2005. Legal report on the possible need to amend Appendix II of the convention for the wolf. Council of Europe Report T-PVS/Inf (2005) 18, Strasbourg.
- Sjölander-Lindqvist A., Karlsson M., Cinque S., 2010. Att jaga varg: en studie av 2010 års licensjakt i Sverige. CE-FOS Rapport 2010:2. [in Swedish]
- Skogen K., Mauz I., Kränge O., 2006. Wolves and Eco-power. A French-Norwegian Analysis of the Narratives of the Return of Large Carnivores. *J. Alpine Res.* 94(4): 78–87.
- Skogen K., Thrane C., 2008. Wolves in context: Using survey data to situate attitudes within a wider cultural framework. *Soc. Nat. Res.* 21(1): 17–33.

- Swenson J.E., Gerstl N., Dahle B., Zedrosser A., 2000. Action plan for the conservation of the brown bear (*Ursus arctos*) in Europe. Report to the Council of Europe Convention on the Conservation of European Wildlife and Natural Habitats T-PVS (2000) 241-268.
- Trouwborst A., 2010. Managing the carnivore comeback: international and EU species protection law and the return of lynx, wolf and bear to western Europe. *J. Environ. Law* 22(3): 347–372.
- Valière N., Fumagalli L., Gielly L., Miquel C., Lequette B., Poulle M.L., Weber J.M., Arlettaz R., Taberlet P., 2003. Long-distance wolf recolonization of France and Switzerland inferred from non-invasive genetic sampling of a period of 10 years. *Anim. Conserv.* 6(1): 83–92.
- Wabakken P., Sand H., Liberg O., Bjärvall A., 2001. The recovery, distribution, and population dynamics of wolves on the Scandinavian peninsula, 1978-1998. *Canadian Journal of Zoology* 79: 710–725.
- Wabakken P., Sand H., Kojola I., Zimmermann B., Arnemo J.M., Pedersen C., Liberg O., 2007. Multistage, long-range natal dispersal by a Global Positioning System-collared Scandinavian wolf. *J. Wildl. Manage.* 71(5): 1631–1634.
- Weber J.M., 2003. Wolf monitoring in Switzerland. In: Weber J.M. (Ed.). *Wolf monitoring in the Alps: 2nd Alpine Wolf Workshop*, Boudevilliers (CH), 17–18 March 2003. KORA Bericht Nr. 18. Switzerland: 7–8.

Associate Editor: F. Marucco