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Support for hunting as a means of wolf *Canis lupus* population control in Sweden

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The recolonising wolf *Canis lupus* population has created conflicts in Scandinavia, and it will eventually be necessary to control wolf numbers if the population continues to grow. One mechanism for this is hunting. Under what circumstances will the Swedish public support hunting of wolves? We examined this question for the general public and for three stakeholder groups: all hunters, the public living in areas with wolf populations and hunters living in wolf population areas. A majority of all four groups found it acceptable to hunt wolves to reduce the risk of livestock depredation (53-91%), and if wolves had been coming into populated areas (54-86%). However, about one fifth of the Swedish public was neutral to any justification, so an extreme or a well-publicised event could alter the current levels of support. The majority in all groups did not support wolf hunting merely because people were afraid of them (22-46%), or because wolves compete with humans for game (11-45%). A majority of all hunters found wolf hunting to be justified if wolves were a threat to dogs in the area, but the majority of the general public even in the wolf population areas did not find this to be appropriate justification. Our study shows the importance of surveying stakeholder groups as well as the general public to develop sound and acceptable conservation and management plans for rebounding populations of large carnivores such as wolves.

Key words: attitudes, carnivore, conservation, hunting, management, public, Scandinavia

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Successful management efforts to promote populations of the wolf *Canis lupis* were common in the latter part of the 20th century (e.g. Breitenmoser 1998, Enck & Bath 2001, Williams, Ericsson & Heberlein 2002). However, as these populations rebound a new debate will focus on how to control increasing wolf numbers (e.g. Cluff & Murray 1995, Mech 2001a). Hunting has been the traditional method to control game populations (Decker, Brown & Siemer 2001a), but public and even professional support for controlling wolf numbers by hunting can not be assumed (Duda, Bissell & Young 1998). Those who have been most active in the restoration and preservation may have difficulty shifting to strategies which involve hunting wolves (e.g. Mech 2001a, b). Trapping and relocating, capturing and sterilising wolves, or even using paid sharpshooters to kill individual animals could be considered in addition to sport hunting (e.g. Cluff & Murray 1995, Haight & Mech 1997, Smith, Linnell, Odden & Swenson 2000, Mech 2001a).

It has long been recognised that the general public may have ideas and priorities about managing wildlife that are different from those of the professional managers (e.g. Kellert 2000, Mech 2001a). This is why managers have turned to surveys since 1973 (Williams et al. 2002) to learn about the attitudes and opinions of the general public or specific groups toward wolves. Surveys thus play an increasingly prominent role in wildlife management (Decker, Brown & Siemer 2001b). These surveys have generally shown that the general public has positive attitudes towards wolves (Williams et al. 2002), so they may not support any population control, or may support population control only under certain circumstances.

If hunting is to be considered as a means of wolf control, then the circumstances under which the general public would support wolf hunting need to be known. It may be necessary to document the existence of certain problems associated with wolves in order to justify hunting (Ciucci & Boitani 1998, Mech, Harper, Meier & Paul 2000, Mech 2001a, Treves, Jurewicz, Naughton-Treves, Rose, Willging & Wydeven 2002). It seems that the provision of recreational benefits from a sustainable population is no longer sufficient justification for hunting various species (Heberlein & Willebrand 1998, Ericsson & Heberlein 2003a). Recent opposition to a proposed mourning dove *Zenaida macroura* hunting season in Wisconsin, USA, used the argument that since doves caused 'no problem' there was no reason to hunt them. Unlike doves, increasing wolf populations often cause human conflicts and people have called for a reduction in wolf numbers to reduce such conflicts (e.g. Fritts, Paul &

Mech 1984, Bjerke, Reitan & Kellert 1998, Mishra 1997, Breitenmoser 1998, Ciucci & Boitani 1998, Mech et al. 2000, Smith et al. 2000, Vos 2000, Wabakken, Sand, Liberg & Bjärvall 2001).

What are the human conflicts that might be used to justify wolf hunting? Probably the most widely discussed justification for killing wolves is to protect livestock (e.g. Mishra 1997, Mech 1998, Bath & Majić 1999, Bath 2000, Bjerke & Kaltenborn 2000, Mech 2001a, Treves et al. 2002). In the United States, where the wolf is endangered, wolves that are known to kill livestock may be relocated or destroyed (e.g. Cluff & Murray 1995, Mech 2001a). Livestock damage was the major justification for the Norwegian wolf hunt in 2001 (Directorate for Nature Management Norway 2001a), when Norwegian management authorities proposed killing 10 wolves out of a population of no more than 28 wolves (Aronsson & Wabakken 2001). However, it is not clear if the general public will accept livestock damage as justification for controlling wolf numbers (e.g. Bath 2000). Most residents of the United States and Europe live in cities and are far removed from food production (Kellert 1996, Duda et al. 1998). They did not grow up on farms nor do they know anyone who has livestock. They may not have much sympathy for the rural people who are losing livestock to expanding wolf populations. The efforts to reduce wolf numbers in Norway attracted world-wide opposition (Anon. 2001, Directorate for Nature Management Norway 2001b) in spite of the justification that the wolves were being hunted to protect livestock.

A second justification for hunting wolves involves threats to humans (e.g. Bath & Majić 1999, Bath 2000, Linnell & Bjerke 2002, Treves et al. 2002). The historical discussion of wolf myths has long involved wolves becoming acclimated to and actually attacking humans. Whereas such attacks by wolves have been infrequent compared to attacks by mountain lion *Felis concolor*, bear *Ursus* sp., or even moose *Alces alces* (Conover, Pitt, Kessler, DuBov & Sanborn 1995, Linnell & Bjerke 2002,) the belief in the possibility of such attacks certainly exists. If wolves lose their shyness and actually attack humans, this could be justification for wolf hunting. Recovering wolf populations are spreading into more densely populated areas (e.g. Mech 2001a, Wabakken et al. 2001). On 7 May, 2001 a wolf wandered through central Stockholm, Sweden, which created some public concern (Anonymous 2001), although no urbanites have yet been harmed by wolves in Scandinavia.

A third justification for population reduction would be the conflict between wolves and hunters (Bath & Majić 1999, Bath 2000). Wildlife management has a long

tradition of predator control (e.g. Ballard 1991). Wolves, like hunters, are predators and in some cases compete for the same game. Moreover, wolves may be able to regulate populations of large game, e.g. moose (Messier & Joly 2000). It would thus be reasonable to expect that hunters might support the reduction of wolves in an effort to protect game populations.

In Wisconsin the expansion of wolves has recently become a problem for bear hunters who train their dogs in the forest (Treves et al. 2002). When these dogs move into a wolf territory, particularly near dens with pups, they may be attacked and killed by the wolves. The Wisconsin Department of Natural Resources has paid compensation for the slain hunting dogs. Finland has a wolf population similar to the one in Sweden, and wolf attacks on dogs is now a problem facing small and large game hunters (Kojola & Kuittinen 2002). Likewise, in Sweden hunters pursue moose with dogs and these dogs are legally required to track shot game (Heberlein 2000). They are also highly valued by the hunters (e.g. Karlsson 2001). Wolves occasionally kill dogs (Viltskadecentrum 2001). Thus, the protection of dogs might be a fourth justification among hunters for using hunting to reduce wolf numbers.

There is also a fraction of the public that might be more or less supportive of these justifications (Bath & Majic 1999, Bath 2000, Ericsson & Heberlein 2003b). Frequently general population surveys are done to inform wildlife managers (e.g. Duda et al. 1998, Decker et al. 2001b). Whereas these may be representative of the entire adult population of a state or country, they are often challenged by wildlife managers who observe that most of the general population is unfamiliar with wildlife issues (e.g. Bath 2000, Ericsson & Heberlein 2003b).

Two more stakeholder groups are relevant for management decisions. First, the people who live where the wolves are located (e.g. Bjerke et al. 1998, Bath & Majic 1999, Williams et al. 2002). Those who have direct experience living with wolves have a claim for special attention. The Malawi principle (UNEP/CBD/COP/4/Inf. 9) argues that wildlife management should be decentralised to the lowest possible level. Regardless of how the general public views wolf hunting, local people may feel differently. Because wolves live where there are few people, the local public may represent only a small fraction of the total population. Thus, if this group has a different opinion it will not show up even in large general surveys.

A third segment of the public is hunters, who get direct recreational benefits from wildlife and who generally provide the bulk of funding for wildlife management, at least in Sweden and the US (Heberlein 1991). Like

the local public, hunters often constitute < 5% of the population (Heberlein, Ericsson & Wollscheid 2003), but since they are directly affected by hunting and provide the funding for wildlife management their opinions are important. They are often surveyed by wildlife agencies or given opportunities to make their views known through meetings and other mechanisms (Conover & Messmer 2001).

Finally, there is the intersection of these last two stakeholder groups; the hunters who live in the rural areas where wolves are present. These are the individuals who may be in direct conflict with wolves because the wolves compete for game, and in Sweden these hunters also have the kinds of dogs that are most at risk of being killed by wolves (Karlsson 2001).

In Sweden, the time is rapidly approaching when wolf hunting needs to be considered (e.g. Persson & Larsson 2000, Wabakken et al. 2001). The number of wolves has grown from < 10 in the early 1980s to about 100 today (Wabakken et al. 2001), and there could be as many as 1,000 wolves in Sweden by 2009 (Persson & Sand 1998, Wabakken et al. 2001). Wolves are already killing livestock (compensation for which is paid by the Swedish government and county boards; Viltskadecentrum 2001, <http://www.environ.se>). During 1996-2001, hunters reported 24 dogs to have been killed by wolves, and this has received substantial attention by the local and the national press (<http://www.jagareforbundet.se>). As a result, the Swedish Association for Hunting and Wildlife Management (SAHWM) has proposed circumstances under which the government should allow sport hunting for wolves. For example in 2002, the SAHWM, the Farmers association (LRF), reindeer herding Saami-villages and private persons put forth 12 applications to hunt specific wolves. This is a considerable increase compared to 2001 when only three applications were submitted to the Swedish Environmental Protection Agency (A. Bjärvall, pers. comm.).

The goal of our research is to learn under what circumstances each of the four groups public, hunters, wolf area public (WA public), and wolf area hunters (WA hunters) would support hunting as a means of wolf population control.

Material and methods

Study populations and sampling

We obtained a random sample of the general Swedish public aged 16-65 from PAR (Person- och Adressregistret, SE-117 90 Stockholm, Sweden) which has full, continually updated and unrestricted access to the

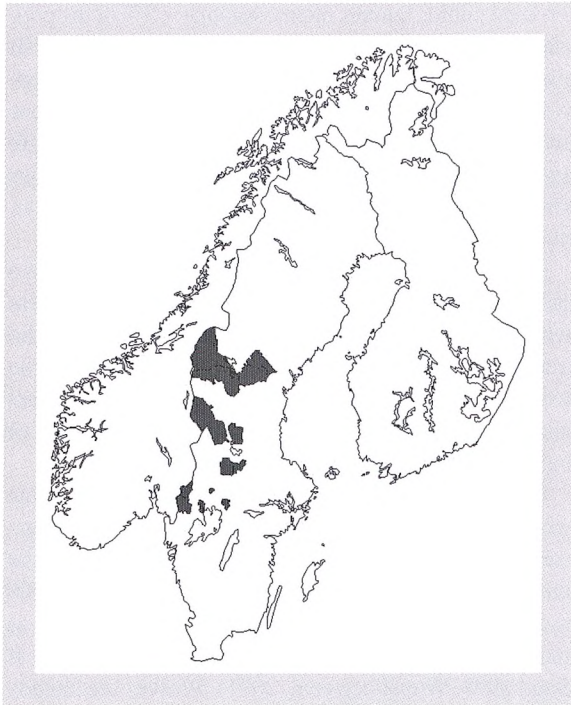


Figure 1. Location of the 10 rural municipalities in the three Swedish provinces Dalarna, Jämtland and Värmland from which the wolf area sample was collected. Four groups were sampled: the public, hunters, public living in areas with wolves (WA public), and hunters in areas with wolves (WA hunters).

national register including all permanent residents of Sweden, hereafter called the public. To survey the three stakeholder groups we first obtained a sample of the public living in provinces where wolves are present, hereafter called WA public (Wabakken et al. 2001; Fig. 1) from the same source as the public sample. From the official register of people paying the mandatory annual hunting fee we obtained samples of the hunters from outside the wolf area (hunters) and hunters from inside the wolf area (WA hunters; Table 1). The non-hunting public outside the wolf area makes up 94.3% of the Swedish population aged 16-65 years, the non-hunters in the wolf areas make up 1.1%, the hunters make up about 4.6%

Table 1. Sample size (N) and survey response rates (in %) for the Swedish public and the three stakeholder groups hunters, public living in the wolf area (WA public) and hunters living in the wolf area (WA hunters). The overall response rate was 78% (1,734 of 2,216 surveys) with four personalised mailings. The wolf area samples were from municipalities in three provinces; Dalarna (Orsa 7,000 inhabitants, Vansbro 7,400, Älvdalen 7,800 and Gagnef 10,100), Jämtland (Ragunda 6,500, Bräcke 7,700, Berg 8,300 and Åre 9,700), and Värmland (Munkfors 4,200, Storfors 4,800, Eda 8,700, Grums 9,700 and Årjäng 9,800).

	Public	Stakeholders		
		Hunters	WA public	WA hunters
Sample size (N)	1001	631	252	388
Undeliverable (deceased, abroad, address unknown, handicap)	30	15	8	3
Effective sample size	971	616	244	385
Returned surveys (N)	707	520	175	332
Response rate	73%	84%	72%	86%

of the population, and the hunters in the wolf area comprise about 0.1% (see <http://www.scb.se> or <http://www.jagareforbundet.se>).

The response rate for the public was 73% and netted 707 usable surveys. The WA public returned 175 surveys, yielding a response rate of 72%. The two groups of hunters were more likely to return their surveys. Hunters showed an 84% response rate, and WA hunters returned 86% of surveys including surveys from respondents who initially were selected as being WA public but answered positively to the control questions that they actually should have been classified as WA hunters (see Table 1). Based on the postal code, 16 people living in the wolf area that initially were 'picked up' as being public were identified and thus analysed with the WA public. In total, 18% responded after the Norwegian hunt became a widely publicised issue on 20-21 January, 2001 in Sweden (e.g. Gibbs 2001), but their answers did not significantly differ from those responding before this event for any of the four groups (χ^2 -test, $P > 0.23$).

Survey instrument

The entire survey instrument was an 18-page booklet with sections about wildlife (Ericsson & Heberlein 2003a), attitudes towards wolves (Ericsson & Heberlein 2003b), attitudes towards hunting (Heberlein & Ericsson in press) and attitudes towards wolf damage control (this study). The section about wolf damage control was presented on page seven after the general section about hunting, but before the section about attitude towards wolves. We presented five justifications for using hunting as a means of damage control in an unbroken sequence and asked if the respondents accepted them or not (yes, no, don't know). In the following order we asked "Is it acceptable to hunt wolves to control their number and distribution:

- because wolves compete with humans for game?
- to reduce the risk of domestic animals (e.g. cattle, sheep, reindeer) being killed?
- because people are afraid?

Table 2. Distributions of answers (in %) to the five justifications for wolf hunting among the four Swedish groups. Identical letters indicate that there is no difference between the groups according to Tukey's post-hoc test ($P < 0.05$).

		General public (N = 707)	Stakeholders	
			Hunters (N = 520)	Live in wolf area WA public (N = 175) WA hunters (N = 332)
Proportion of the Swedish population		94.3	4.6	1.1 0.1
Is it acceptable to hunt wolves to control their number and distribution... to reduce the risk of domestic animals (eg. cattle, sheep, reindeer) being killed?	Support	53	83 ^{DE}	68 ^D 91 ^E
	Neutral	17	6	10 4
	Oppose	30	11	22 5
if wolves lose their natural fear of humans and come into populated areas?	Support	54 ^B	80 ^{DE}	65 ^{BD} 86 ^E
	Neutral	21	8	15 5
	Oppose	25	12	20 9
to reduce the risk of dogs being killed?	Support	24	56 ^{DE}	37 ^D 70 ^E
	Neutral	23	10	21 9
	Oppose	53	34	42 21
because people are afraid of wolves?	Support	22 ^B	36 ^{DE}	33 ^{BD} 46 ^E
	Neutral	18	10	12 13
	Oppose	60	54	55 41
because wolves compete with humans over game?	Support	11 ^B	35 ^{DE}	18 ^{BD} 45 ^E
	Neutral	17	12	18 12
	Oppose	72	53	64 43

- if wolves lose their natural fear of humans and come into populated areas?
- to reduce the risk of dogs being killed?"

Survey administration

We conducted the mail survey between December 2000 and February 2001. Four personalised mailings were used, and a telephone follow-up of non-respondents (Dillman 2000). We included control mailings to ourselves in all correspondence. The first mailing, a pre-notice card, was sent with bulk mail on 27 December 2000 arriving, to most respondents, on 2 January 2001. On 4 January, the respondents received a handwritten envelope including the questionnaire, a pre-paid return envelope, and a cover letter explaining the study and asking for their voluntary participation. A combined reminder and thank-you postcard was sent out on 7 January. We sent a second complete mailing with a new cover letter and a replacement questionnaire on 1 February.

Data analysis

We performed analysis of variance (ANOVA) and the χ^2 -tests (SAS Institute 1989), and we used the conservative Tukey's Studentized Range post-hoc test to investigate pair-wise differences between levels of the independent variables. We used the SAS-statistical package for the analyses (version 6.12, SAS Institute 1989).

Results

The public supported wolf hunting under two of the five presented conditions; 53% supported hunting to protect livestock and 54% supported hunting if wolves lose their natural fear of humans and come into populated areas (Table 2). The three stakeholder groups showed much stronger support for hunting under these circumstances than the public; 68% of the WA public supported wolf hunting to protect livestock and 65% supported hunting to keep wolves out of populated areas. Of 10 hunters, eight supported hunting for these justifications and nine out of 10 of the WA hunters supported hunting to protect livestock and to keep wolves out of populated areas. Of the public, 30% opposed hunting to protect livestock and 25% opposed hunting to keep wolves out of populated areas.

It should be noted that whereas the majority of the public supported wolf hunting under these two circumstances, the support was not strong. Of the public, 17% was neutral in their support for hunting to protect livestock. They were significantly more likely to be neutral than the three stakeholder groups (χ^2 -test, $P < 0.023$). Of the public, 21% was neutral about hunting to keep wolves out of populated areas. Hunters were less likely to be neutral on this justification than the public (χ^2 -test, $P < 0.0001$), as were WA hunters compared to the WA public (χ^2 -test, $P < 0.0001$).

The majority of the public opposed hunting because people are afraid of wolves (60%) and because wolves compete with humans for game (70%). A majority of the WA public also opposed hunting merely because

people were afraid of wolves (53%) and because wolves compete for game (64%). Similarly, the majority of hunters did not support hunting because people were afraid of wolves (36% support) or because wolves compete for game (35% support). WA hunters were more supportive for hunting under these circumstances, but even for this group the majority did not support wolf hunting. Except for degree all four groups held the same opinion.

The dog issue clearly separated the public from the three stakeholder groups. Of the public, 53% opposed wolf hunting to reduce the risk of dogs being killed. In contrast, 56% of hunters supported hunting to reduce the risk to dogs, and 70% of WA hunters supported hunting for this reason. The WA public was split on the issue, with 37% supporting hunting, 42% opposing hunting and 21% being neutral.

Discussion

Our data show that it is not correct to say that the Swedes always will oppose wolf hunting. However, managers should not be misled. There is no strong public support for wolf hunting even under the five justifications considered here. The high percentage of neutral responses suggests that these opinions are not strong and could change in response to single events or new facts (Petty, Unnava & Strathman 1992, Duda et al. 1998, Enck & Brown 2000, Sharpe, Norton & Donnelley 2001). If a person in Sweden were attacked by a wolf, support for controlling wolf numbers by hunting would no doubt increase. Notable increases in livestock damage or highly publicised brutal killings of livestock by wolves could also shift opinions toward hunting. However, we did find that 13% of the public currently opposes wolf hunting under any of the five justifications.

Our data also show that hunters do not support wolf hunting under all circumstances. Even when they might be expected to protect their own interest and support wolf hunting because wolves compete with hunters for game, a majority of the hunters do not. However, it is safe to say that hunters are more likely to support hunting to control wolves than the public under all five justifications. It is especially true that hunters and people who live in wolf areas will be strong supporters of hunting to control populations to protect livestock and to keep wolves out of cities (e.g. Bjerke & Kaltenborn 2000, Sharpe et al. 2001). But managers must also realise how small these stakeholder groups are. Consequently, a delicate problem in a democratic society is to balance the

views of different-sized interest groups when policies are formed and implemented (Decker & Chase 2001).

There are circumstances under which the Swedish public will support wolf hunting to control numbers (this survey and Karlsson, Bjärvall & Lundvall 1999). This support is not as overwhelmingly strong as it is among hunters, but there is clear majority support. In order to gain public support for wolf hunting justifications should include the protection of livestock and keeping wolves wild and out of urbanised areas. The three additional stakeholder groups, hunters, WA public and WA hunters make up a very small proportion of the population. Yet, the opinions of these groups were similar to that of the public for four out of the five conditions, and the hunters were more concerned about the safety of dogs than the other groups. Thus, the dog protection issue as a sole reason for wolf hunting, although popular among hunters and especially local hunters will not garner broad public support. In conclusion, we find no insurmountable public barrier that will prevent the controlling of wolf numbers through hunting in Sweden, provided the justifications for doing it are acceptable.

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