

# Viewpoint: The logic of using tracks and signs in predation incidents where bears are suspected

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## Abstract

**Based on recent circumstances in connection with compensation of livestock killed by large, protected carnivores in Norway, this paper discusses what type of logic should be used to establish which animal is the perpetrator. We suggest that the use of a "modus tollens" logic based upon tracks and signs which are *not found at the site* is invalid for management purposes. Instead, we suggest "modus ponens" logic based upon what *is actually found by a carcass*.**

**Key Words:** large carnivores, animal husbandry, livestock loss, compensation, tracks and signs

Brown bear (*Ursus arctos*), wolf (*Canis lupus*), and wolverine (*Gulo gulo*) are protected by law in all of Norway, as is lynx (*Lynx lynx*) in the southern half of the country. There are also several thousand cattle (heifers) (*Bos taurus*) and 2.3 million domesticated sheep (*Ovis aries*) which range free in Norway during the summer. This combination results in some losses to carnivores each year. Losses of domestic animals to large carnivores are compensated by the government when it can be documented by evidence which shows that protected carnivores are responsible for the loss. Research with mortality transmitters (Mysterud and Warren 1991) is being conducted to determine how and why free ranging sheep die (Warren and Mysterud 1990, Mysterud and Warren 1993). In some instances, it is not difficult to determine what has killed livestock. At other times this is difficult, which results in arguments as to whether or not compensation should be paid.

In 1992, we were involved in the "Selbu-case" in South Trøndelag, Norway where more than 20 cattle died by "unexplainable" means (Mysterud and Mysterud 1993). After a thorough evaluation of the case, we considered it probable that these animals were killed/had died in connection with attacks/advances from a (male) brown bear. The incidents took place in an area known to be occupied by bears, based on sightings and signs, but whose role in cattle killing was not confirmed.

The controversy surrounding the Selbu-case started after 1 of us (as an independent expert) evaluated 1 of the killed animals in September 1992. Other experts in Norway rejected the conclusion that bears could be considered as a probable perpetrator. It was argued that neither bear hair nor scats were found by the carcass, nor was the carcass consumed; so bear was not a possible perpetrator.

## Objective Criteria

The following discussion is based upon the logic in using tracks and signs and explore the validity of what one does *not* observe on

or by a carcass. One of the skeptical experts in the Selbu-case introduced his own independent "objective criteria" as to what is necessary in order to confirm that a bear has been present, namely hair, scats, and/or certain tracks (on a suitable surface). With this logic, if none of these criteria could be met, a bear can not be implicated.

The skeptical expert examined hairs that were found at other sites where animals were found killed/had died. The analysis showed these to be hair from domesticated sheep and cattle. This *cannot* be used, as our critic used it, as "proof" for or against the presence of a bear (or bears). Only upon locating its hair can a bear be implicated. We are going to more fully explore this by examining the formal logic in the reasoning and attempt to put the problem into perspective.

To explore the logical validity, we can reason as follows:

"If a bear is the perpetrator, then there will be bear hair(s) on the site where the carcass is found!"

"There are no bear hairs on the site where the carcass is found!"

"Bear is not the perpetrator!"

Formally this is what is known as "*modus tollens*":

"If p, then q!"

"Not q!"

"Not p!"

This is a valid argumentation. The problem is that it is without foundation in reality. If a bear is involved, it can in some instances leave hairs where a carcass is found, but *this need not always be the case*. Extending the previous logic, q follows from p, but q is not the only outcome of p. Even though the bear may have lost hair, it may be difficult to find.

We want to suggest an alternative procedure for such circumstances, based upon what we think should be a more realistic approach.

"If the bear is the perpetrator, then there *can* be bear hair on the site, but there does not *have* to be!"

"There are no hair on the site!"

"The bear does not *have* to be, but *may* be the perpetrator!"

Formally:

"If p, then q or not q!"

"Not q!"

"p or not p!"

Therefore, we can not use *lack* of hair to conclude anything at all.

If one finds bear hair by a carcass, it is certainly important evidence/indication that the bear has been in the area. We can establish that:

"If there are bear hairs on the site, then the bear has been there!"

"There are bear hairs on the site!"

"The bear has been there!"

Formally this is what is called "*modus ponens*":

"If p, then q!"

"p!"

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“q!”

This is also a valid logical argument. The point is, however, that in such instances one needs to focus on the *presence* of hairs (i.e., *modus ponens*) and not on *lack* of hairs (i.e., *modus tollens*)! It is our impression that many of those involved in Norwegian nature conservation are not well enough aware of this, or use such statements consciously to tighten the criteria required to establish that a protected carnivore is the culprit.

### Scats

In the Selbu-case, lack of scats near the carcasses was used to exonerate bears. We maintain that the *absence* of bear scats indicates nothing at all (*modus tollens*). One will often find scat where a bear has consumed much of a carcass, but this is this *modus ponens*-incident. The above (scat deposition) will occur where a predation incident results from foraging by a carnivore. By focusing on lack of scats only, we can *not* say that the bear has killed them as ordinary preys or not. A bear that kills and eats of a carcass may or may not leave scats at the site where the carcass is found. If the bear, for example, is disturbed while eating, it can leave the site. It can also do so before it begins eating, or it can even in the absence of disturbance rest a secure distance away from the carcass, perhaps leaving the carcass indefinitely. The scats will then be left elsewhere. The sexual aggression-hypothesis in the Selbu-case (Mysterud and Mysterud 1993) is based on other observations on and around the carcasses and can explain the lack of feeding signs, among them the lack of scats. It is not certain that the intention of the bear was to eat.

### The Quality of Tracks

One of our critics in the Selbu-case maintains that clear tracks should be made on suitable surfaces (e.g., clay, bare soil etc.) so that claws and contours of the sole are fully visible. Fourteen carcasses in the Selbu area were found in forested terrain, 2 in bogs and 2 on grass-rich pasture. As one can imagine, the probability of

finding a convincing track in these habitats is very small, especially if the tracks and sign are not fresh. Much of the season when this occurred in 1992 was also dry. The use of *lack* of especially good tracks to exonerate a bear, is obviously *modus tollens* logic. The premises are not realistic since a bear of course could have been present without leaving clear tracks.

Finding clear tracks on totally unsuitable surface in a common forest understory is therefore an unreasonably strict criterion in documenting the presence of a bear in the past at the site where a carcass is found. Drought would also make it even harder to find clear tracks, even in bogs.

### Conclusion

It is obvious that the more evidence one finds by a carcass, the easier and more certain it is to evaluate the incident. But it is just as clear that failing to find hair, scats, or clear tracks in cases where large carnivores can be a possible perpetrator can *not* be used to *exclude* the suspected carnivore! *In every such case one needs to focus on what is actually found and on this base one's judgement on the probability for a given perpetrator!*

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