

**Articles reviewed:**

- 1) The diet of brown bears *Ursus arctos* in central Scandinavia: Effect of access to free-ranging domestic sheep *Ovis aries***
  - 2) Terrain use by an expanding brown bear population in relation to age, recreational resorts and human settlements**
  - 3) Behavioral responses of brown bears mediate nutritional effects of experimentally introduced tourism**
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**Introduction**Brown bear *Ursus arctos*

About 150 years ago, Scandinavian bear population was around 4000-5000 animals, but they were hunted and became almost extinct. In 1973 bears were totally protected in Norway. Today the Scandinavian population is growing as a result of the efforts made in conservation, and there are two populations of brown bears. Bears in Finmark belong to the Norwegian-Finnish-Russian population, and bears in other parts of Norway belongs to a common Scandinavian population. In South-Trøndelag county and the northern counties there are approximately 71 brown bears in 2006. In Sweden there are approximately 2550 brown bears (2006). The brown bear is threatened by habitat loss due to reduced wilderness areas by roads, human settlements, forestry and second-home cabins. The purpose of research in **article 2** is to compare bear densities in different areas in relation to distance from human settlement.

The purpose of the research in **article 1** was to analyse seasonal food habits of brown bears belonging to the common Scandinavian population, and the impact of free-ranging domestic sheep. This question is important because there are conflicts between sheep farmers and bears as bears disperse into Norway from Sweden. In Norway the brown bear is a predator of free ranging domestic sheep. Brown bears shift food according to what is available. The study area used in the article include eastern North-Trøndelag County in Norway and northwestern Jamtland country in Sweden. In this area, human population is sparse, and Norway spruce, lakes and mountains dominate the area. In Norway unguarded sheep were present from June to September but was absent in Sweden. In Sweden, bilberry and crowberry covered the area. Wild prey was moose, roe deer and semidomestic rein deer. Bears were active from April to September.

**Article 3** uses predator-prey theory for human-bear respectively, in order to get a better understanding on the interactions between them. Tourist-based bear viewing is a growing industry, and the research aimed to determine whether fleeing or staying in the presence of bear viewers had effect on fitness (nutrition and condition) of brown bears.

**Methods**Article 1

A sample of 266 scats from 200 locations was collected from 1987-1988 and 1993-1995. Scats was found by walking in the area incidentally or along 28 defined transect lines, which were used to reflect different habitat types. Transect lines were walked in late April, June, July and September.

The year was divided into spring, summer and autumn and the availability of different foods shifted according to seasons. During spring/summer grass and forbes was available, in

summer/autumn there were berries. Scats found was analysed and classified into presumed month of defecation. Scat analyses were summarised as Frequency of Occurrence (FO) and Faecal Volume (FV) in percent. Correction Factors (CF) were used to find the original diet composition, different foods have different CF, i.e. vegetation have 0,26. This was multiplied with FV for each food. Observations showed that bears also consumed depleted carcasses of moose and reindeer with only little available meat left, and CF for those are less than 1. The scientists found that all scats in spring containing sheep came from previous summer, and little meat remained on them due to previous scavenging. There were more bone and hair remains in the scats, which actually reduce protein digestibility and should be avoided by unstarved bears. Sheep were available in summer and autumn and preyed upon by bears. Certain estimates for converting dry matter to digestible energy were used, i.e. 11.7 for berries.

### Article 2

Study area was south-central Sweden and Hedmark county in southeastern Norway. 95% of area consist of forest, a road system goes through the area, and there are 6 settlements with 3000-11000 inhabitants and 2 tourists resorts. Bear density was 30 per 1000 square meters. The area was divided into 771 4X4 squares, and classified according to i.e. distance to human settlements. Use of habitats by brown bears within was estimated by using radio-collars.

### Article 3

The location for the research was on the state land surrounding the west branch of Douglas river on the Alaska Peninsula. A simulation tourist group were introduced, they did hiking and observed feeding of bears and other activities. 16 bears were collared prior to observation during the 2 years of study. Available resources for feeding of the bears was quantified. Detailed behaviour was recorded, this included feeding on salmon, salt marsh, playing, aggression and running away from humans. The bears was observed in one pre-treatment year and in a following treatment year.

## **Results**

### Article 1

The scat analysis of the Swedish area revealed that during spring, ungulates was the largest component in the scats. This was most likely animals who had died in previous winter. The second largest volume of the scats was made up of graminoids, but this provided least energy. Dominating the ingestible energy was reindeer and moose, followed by ants, graminoids and berries. Forbs (especially blue sow thistle) were found in 98% of the scats collected and contributed to 24-40% of digestible energy. Ants contributed to 26-46% of the digestible energy. Crowberry and bilberry dominated the diet throughout the autumn and contributed to 80-81% of digestible energy.

Scat analysis of Norwegian area indicated moose, reindeer and sheep as the most important food during summer, sheep was the main protein rich food. Graminoids, forbs and berries was less important. In summer forbs made a great part of the scats, but sheep contributed to 88-94% of digestible energy. In autumn, sheep and berries was the most important food. Like in the Swedish area, forbs and ants were eaten in August.

The comparison of the two areas showed that protein and lipid-rich food like sheep and insects contributed to 36-43% of digestible energy in Sweden and 78-92% in Norway. Berries made up 44-46% of the digestible energy in Sweden and 6-17% in Norway.

### Article 2

The amount of bears increased with increasing distance to human settlement, this revealed undisturbed rugged forested terrain far from humans as the preferred area. The differences in bear use <10 km and >10 km from settlements were compared, and the researchers found the bears observed closer than 10 km to human settlement younger, and the trend was most evident in males.

### Article 3

In the period from May-July bears fed on salt marshes on vegetation with high protein, and from August to October salmon was available. The research also revealed that collared and un-collared bears had the same reactions to humans. 10 of 16 bears never visited the area of human or hunting activity. The presence of humans near bear feeding sites resulted in decrease of bear numbers compared to the time period before viewer groups, but this was not the case for bears using salt marsh and salmon run. It was also observed that number of bears using salt marsh during daytime was decreased in presence of tourists. There were also 10% decrease in time spent on fishing during the treatment year. Time spent on resting was increased during treatment year.

## Discussion and conclusion of all the articles reviewed

In article 1 the researchers found that the presence of free-ranging domestic sheep had a great impact on the diet of brown bears in Norway. Sheep provide protein and lipids, and they were available during August and September. Article 1 also concluded that the welfare of bears in Norway is not dependent on sheep alone as bears in Sweden survive very well without access to sheep. Sheep graze unattended in Norway as a difference from other European countries, and this makes them available for bears, and they select sheep instead of other food. It leads to great economical for the farmers and the Norwegian government when sheep become prey for bears. In average, the government pay compensation to sheep farmers for 55 sheep per bear.

A research done by South-Trøndelag College also shows fear towards the bears, some even feel their life quality is decreased because of this fear.

The study in the reviewed article 2 showed how bears avoided area of human activity and a decrease in number of bears due to cabins. With the cabins follow many outdoor activities like fishing and recreation in the woods. In Scandinavia 40% of bears leave their native area, however, human settlement, cabins, recreation might limit this. The result can be more isolated brown bear populations.

In article 3, differences in behaviour was seen among all the bears in the research done during the pre-treatment and treatment year. The animals foraged on salt marsh more at night to avoid humans and they tried to maximize foraging efficiency to compensate for reduced time spent on feeding. Adult male brown bears would most likely be displaced from human activity if there were alternative food resources available away from humans. The research suggests that bears respond to human activity as preys to a predator. Tourist based bear-viewing managers should consider human-free periods as an alternative if they are concerned about adequate access to food.

Article 2 and 3 indicates how the bears fear the humans. On the other side, there are many cases where bears have attacked humans, and in some areas the bear come close to human settlement and cause disturbance. This leads to further discussion about the large carnivores policy. It is highly desirable to maintain a growing bear population in Norway, at the same time the interaction between human population and bears is a challenge.

### References:

**Dahle B, Sørensen O.J., Wedul E.H., Swenson J.E., Sandgreen F. (1998) The diet of brown bears *Ursus arctos* in central Scandinavia: Effect of access to free-ranging domestic sheep *Ovis aries*. *Widl.Biol.* 4:147-158.**

**Nellemann C., Støen O.G., Kindberg J., Swenson J.E., Vistnes I., Ericsson G., Katajisto J., Kaltenborn B.J., Martin J., Ordiz A. (2007): Terrain use by an expanding brown bear population in relation to age, recreational resorts and human settlements. *Biological conservation* 138: 157-165.**

**Rode K.D., Farley S.D., Robbins C.T. (2006): Behavioral responses of brown bears mediate nutritional effects of experimentally introduced tourism. *Biological conservation* 133:70-80.**

[http://en.wikipedia.org/wiki/Brown\\_Bear](http://en.wikipedia.org/wiki/Brown_Bear)

[http://nidaros.nina.no/Publikasjoner/96-01\\_bj%C3%B8rn.pdf](http://nidaros.nina.no/Publikasjoner/96-01_bj%C3%B8rn.pdf)

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