Long- versus short term effects of dam construction on reindeer habitat use and behavior

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Here we use data from 82 female reindeer equipped with GPS- collars and examine the combined effects of a water reservoir and other infrastructure in comparison to the local effects of dam construction on reindeer habitat use. GPS-data collected in the winter prior to (Nov- Des 2011 and Jan- March 2012) and during (Nov and Des 2012 and Jan – March 2013) construction work shows no significant difference in density or distance to the construction site. We found no significant correlations between calculated step lengths (indicative of a flight response) and mining events. Our data therefor suggests none or insignificant effects of the local construction work whereas the combined effects of the reservoir, a road and cabins appeared to be substantial and forms a significant barrier to reindeer movements.

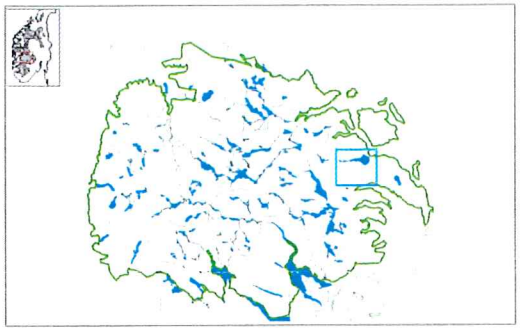

Figure 1. Our study area is located to the eastern part of the Hardangervidda plateau. Hardangervidda is the largest wild reindeer area in southern Norway covering 8200 km2. Approximately 50% of the rage is national park having few technical installations. Recently, the Norwegian Water Resources and Energy Directorate (NVE) out of safety reasons instructed the owner to rehabilitate the dam. The construction work was carried out during summer 2013 – winter 2014.

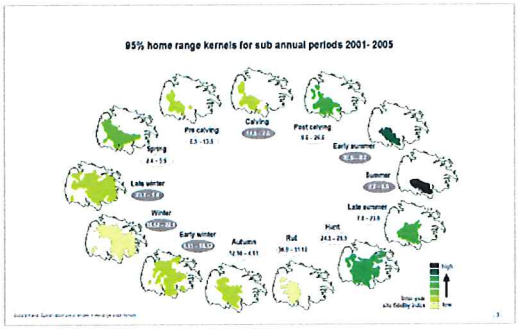

Figure 2. Seasonal Kernel polygons for GPS – data collected between 2001 and 2005 show that reindeer in Hardangervidda have a nomadic lifestyle with a preference to habitats in west and south during spring and summer. Central and eastern areas are preferred in fall and winter as these areas have less snow in winter and have more developed and richer lichen mats (Falldorf 2011).

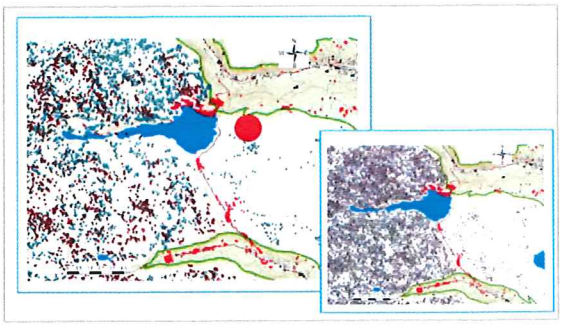

Figure 3. Hardangervidda and our study area at Sønstevann has a long history of piece-meal developments, which is typical to many wild reindeer areas and natural environments in general. Prior to hydroelectric developments in the 1960's the reservoir Sønstevann consisted of three different lakes. Pit-fall systems located between the former lakes show that reindeer used and traversed through this area in earlier times. The construction work in 1966, and an new road, improved accessibility to the area and several cabins was built at Sønstevann and Småroi during the 1970s and 80s (red squares). Today the area holds more than 200 cabins and one larger resort. The road is closed in wintertime (December through March), but local interest groups advocates for the road to be maintained and open also in winter. GPS-data collected since 2001 (small inserted map) clearly show that reindeer today stay vest of the developed area and that they rarely (n= 4) move into areas east of the developed zone at Sønstevann.

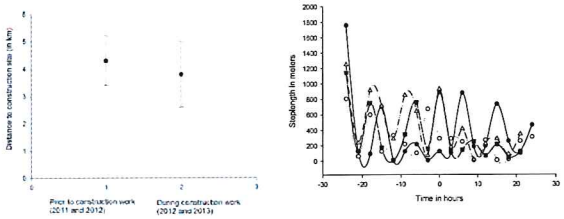

Figure 4. Reindeer used our study area during late fall and winter (November through March) both in 2011, 2012 and 2013. Average distance between GPS-fixes (collected inside our study area) and the construction site did not differ between years (red dots for the year prior to construction, and blue dots for the construction period in fig 3; ANOVA P > 0,05) and suggests that construction work did not impose any significant displacement of reindeer. Local effects of intensive construction work was examined by comparing step lengths prior to and after dynamite explosions. Explosions was set off at fixed time intervals (at 1600 hours) and logged by the entrepreneur during the entire construction period. We found no significant correlations between step lengths and mining events.

Discussion

Reindeer habitat preferences in wintertime depends on forage availability and quality. An alternative hypothesis to our results is therefore that bad foraging conditions in the interior parts of Hardangervidda forced animals to stay in the study area in spite of the disturbance generated by the construction work. Local measures of snow conditions and interpolated data of snow depth (www.nve.no) together with observations in the field do not support this idea. Note however that home ranges and habitat preferences in winter varied significantly between years, and few collared reindeer was observed inside our study area prior to 2007 and also in 2010.

The fact that habitat use vary both spatially and temporally (because of natural factors) underlines the possible cav-eats connected with studies of anthropogenic influences in natural environments and the need for experimental designs to reduce natural and potential confounding variation. Bearing this in mind, our data show that the construction work did not act to displace reindeer from our study area, whereas the combined effects of infrastructures in the developed area at Sønstevann forms a significant barrier to reindeer movements.