

Dissertations

Monica Alterskjær Olsen (b. 1966) defended her thesis; 'Microbial digestion in reindeer and minke whales' for the degree of Doctor Philosophiae at the University of Tromsø, Norway, April 2000. Olsen completed her Cand. Scient. degree at Department of Arctic Biology, University of Tromsø in 1992. She conducted her doctoral work at the same department, where she is currently employed as an associate professor.



Her doctoral thesis was based on the following seven papers:

1. Olsen, M. A., Aagnes, T.H. & Mathiesen, S. D. 1995. Failure of cellulolysis in the rumen of reindeer fed timothy silage. – *Rangifer* 15: 79–86.
2. Olsen, M. A., Aagnes, T. H. & Mathiesen, S. D. 1997. The effect of timothy silage on the bacterial population in rumen fluid of reindeer (*Rangifer tarandus tarandus*) from natural summer and winter pasture. – *FEMS Microbial Ecol.* 24: 127–136.
3. Olsen, M. A. & Mathiesen, S. D. 1998. The bacterial population adherent to plant particles in the rumen of reindeer (*Rangifer tarandus tarandus*) fed lichen, timothy hay or silage. – *Rangifer* 18: 55–64.
4. Moen, R., Olsen, M. A., Haga, Ø. E., Sørmo, W., Utsi, T. H. A. & Mathiesen, S. D. 1998. Digestion of timothy silage and hay in reindeer. – *Rangifer* 18: 35–45.
5. Olsen, M. A., Aagnes, T. H. & Mathiesen, S. D. 1994. Digestion of herring by indigenous bacteria in the minke whale forestomach. – *Appl. Environ. Microbiol.* 60: 4445–4455.
6. Olsen, M. A. & Mathiesen, S. D. 1996. Production rates of volatile fatty acids in the minke whale (*Balaenoptera acutorostrata*) forestomach. – *Brit. J. Nutr.* 75: 21–31.
7. Olsen, M. A., Blix, A. S., Aagnes, T. H., Sørmo, W. & Mathiesen, S. D. 2000. Chitino-lytic bacteria in the minke whale forestomach. – *Can. J. Microbiol.* 46: 85–94.

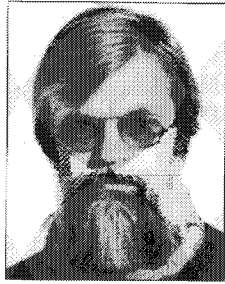
Abstract: Both reindeer and minke whales have multi-chambered stomach systems with a non-glandular forestomach allowing retention of digesta and growth of anaerobic bacteria. The objective of this study was to explore the microbiota of these two systems in relation to diet and function. Whales and ruminants had common ancestors about 60 million years ago, and the forestomach fermentation of the prey in whales is probably a remnant from their terrestrial herbivorous ancestors maintained to utilise complex nutrients such as chitin. Reindeer rely on a complex system of symbiotic rumen microorganisms to digest the cell wall carbohydrates of the forage plants that they eat, resulting in microbial protein and volatile fatty acids (VFA). The thesis demonstrates that the numbers and composition of the rumen bacterial population in reindeer change in response to diet. Furthermore, the extent of cellulose degradation was found to be higher in rumen fluid from reindeer on a natural pasture in northern Norway, both summer and winter, as compared to previous results from Svalbard reindeer, indicating a positive effect of the energy-rich lichen in winter on mainland Norway. Viable numbers of bacteria adherent to plant particles in the rumen of reindeer fed lichen were high (26.5×10^9 – 53.0×10^9), while numbers of cellulolytic bacteria adherent to the rumen particles were low. Depression of cellulose degradation after prolonged feeding with lichen alone could result from nitrogen deficiency due to the low nitrogen contents in the lichen. Starvation during the winter season greatly influences both numbers and composition of rumen microorganisms with a resultant depression in rumen cellulolysis. Loss of some of the synergistic bacterial species in the complex rumen ecosystem may cause problems when food is again available. Transfer of rumen fluid from sheep appears to help restore rumen function in such situations. Depressed rate of rumen cellulolysis was demonstrated in individual reindeer even 4 – 5 weeks after being re-fed on timothy silage. Slow ruminal fibre degradation was associated with low ruminal VFA concentrations, a high pH and an increase in relative rumen fill compared to other animals eating the same food. Overall *in vivo* cellulose degradation was, however, unchanged indicating that depressed rate of rumen cellulolysis was compensated for either by a longer ruminal retention time and/or by increased hindgut degradation. Numbers of bacteria adherent to the rumen plant particles was significantly lower in reindeer fed timothy prepared as silage compared to hay from the same crop. Likewise, timothy silage appeared to depress numbers of cellulolytic bacteria both in the rumen fluid and adherent to the plant particles. Supplement of easily digestible carbohydrates to the timothy silage seems to stimulate not only food intake but also ruminal cellulose digestion and production rates of

VFA in reindeer. It is recommended that leafy timothy rich in easily digestible carbohydrates and proreins preserved as hay is used as emergency feed for reindeer in winter.

Olsen's studies were supported by grants from the Norwegian Reindeer Husbandry Research Council under the

auspices of the Norwegian Ministry of Agriculture, from the Norwegian Research Council, from the University of Tromsø, the Roald Amundsen Centre of Arctic Research, and from Kjellfrid and Helge Jakobsens Foundation at the University of Tromsø.

On June 22, Cand. Agric. Jan Åge Riseth successfully defended his dissertation "Sámi reindeer management under technological change 1960-1990: Implications for Common-Pool Resource Use Under Various Natural And Institutional Conditions. A comparative analysis of regional development paths in West Finnmark, North Trøndelag, and South Trøndelag/Hedmark, Norway." for the degree Dr. Scient. at the Agricultural University of Norway (AUN), Dept. of Economics and Social Sciences.



His supervisor has been Professor Arild Vatn (AUN). The evaluation committee consisted of Prof. Daniel Bromley, University of Wisconsin, Madison, USA, Prof. Carl Erik Schultz, University of Tromsø and Assoc. Prof. Olvar Bergland, AUN.

The dissertation is a monography, and aims to explain *why the development paths of reindeer management in Finnmark and Trøndelag have been so different in the period studied. While Trøndelag during the 1980s has prospered, most of Finnmark at the same time developed an accelerating overgrazing of vulnerable lichen pastures.*

Riseth's basic approach is the multidisciplinary "Institution and Development (IAD) Framework". The framework analyses both ecological and socio-economic factors, and is developed in the research environment around Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, USA. For the ecological factors Riseth has developed a new herbivore-pasture model for grazing seasonally at lichen winter pastures and "green" summer pastures. The main ecological factors analysed are pasture balance and landscape structure, while hypotheses are developed for a series of socio-economic factors.

The empirical analysis is comparative contrasting West-Finnmark (denoted North) with Trøndelag (denoted South). Riseth finds that under technological change (motorization) in the North both ecological factors are in favour of herd-expanding strategies, while they in the South support herd-stabilising strategies. In the North both (1)summer-pasture limitation and (2) a relatively open landscape with weak natural borders between season pastures, facilitate a gradual out of season grazing from the midst of the 1970s and throughout the century.

For the socio-economic factors Riseth finds that the more extensive exposure to the pressure from the expanding Norwegian farmer society and the resulting Sámi organisation efforts from early in the 20th century, made South herder leaders better prepared for the changes from the 1960s than their fellows in the North. South herders have developed trust and co-operation with the extension service. In accordance with this the main adaptation strategy in the South seems to have been herd stabilisation and production increase, while the main strategy in the North seems to have been competitive herd expansion. In the North the influence of groups being the relative winners of the pasture competition also seems to have been an obstacle for the herder society to take action against the overgrazing.

Riseth was born in 1953 in Snåsa, North Trøndelag. He earned his master degree in natural conservation management at AUN in 1979 with a thesis within vegetation ecology and conservation. He also has studied land use planning, law history and public management. He was a co-worker of the Norwegian Reindeer Husbandry Administration (Reindriftsforvaltninga), Alta, for practically the whole 1980s as "Statskonsulent i reindrift" (Vice Director of Planning, Extension and Information Services) and editor of the Norwegian information journal of reindeer husbandry "Reindriftsnytt". He