A. From the available literature on domestic sheep which I have read, there is good evidence to show that the quality of the forage is very significant, more so than the quantity. The better the quality, the greater the amount of milk produced. This effect is significant whenever the high quality feeding regime is started; whether it is started prior to lactation or up to 4 weeks after its onset.

Comment: On Bill's question about the difference between Banff and Radium (Kootenay), you could probably go back to some of the information on the population at Radium before the die-off in 1966-67 and see that the lambs at that time had the same appearance as the ones at Banff do now, and that the range conditions were similar.

A. Well, John has the information about this and I am also collecting data on the horn growth and development, from rams which are still living and which were alive before the die-off. There is tentative evidence to support your suggestion.

Comment: There is more evidence from the Wigwam herd as well and this almost parallels your findings Dave.

Q. Dave, do you have any differences in the time of weaning or didn't you record this?

A. I guess in domestic sheep weaning occurs around 70 days of age, but I couldn't say for sure in bighorns.

Q. Was the herd structure the same for both parks?

A. In Banff there were: 30 adult ewes, 10 lambs, six 2-year old males, six 2-year old females, 4 yearling males and 5 yearling females, giving a total of 61. In Kootenay there were: 26 adult ewes, 19 lambs (12 male and 7 female), one 2-year old male, two 2-year old females, 3 yearling females, 3 yearling males, and 9 rams of 3-years and older, giving a total of 63.

ON THE SIGNIFICANCE OF THERMOCLINES TO THE BIOLOGY OF WINTERING MOUNTAIN SHEEP

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Abstract

The theoretical significance of why mountain sheep frequent high elevations during mid-winter is investigated. A thermocline is found at high elevations which allows sheep and mountain goats to live at higher ambient temperatures than those occurring in the valleys below. It can be shown that each day-degree in a warmer microclimate saves a significant amount of fat from oxidation, if the animals live below the temperature at which their food intake is insufficient to cover the cost of keeping warm. With the aid of formulas derived from experiments on the bioenergetics of ruminants, it can be shown that each day-degree

saved can also be expressed in terms of food quantity and quality. Thus at high ambient temperatures a sheep may live on poorer forage than at low ambient temperatures. These formulas were tested against digestibility of forage and found to predict accurately. It can be shown that for an identical content of crude fibre and protein, green forages have a higher digestibility than dry forages. Using the formulas and figures derived it can be shown that lambs must have considerably better forage than rams to survive identical climatic conditions. It is predicted that lambs will differ from adults in food habits by being more selective feeders -- taking in forage of relatively low fibre and higher protein content. The highest energy expenditures would be incurred in the valley where ambient temperatures are lower, and temperatures fluctuate more than in the thermocline. Both the high ambient temperatures and the reduced temperature fluctuations in the thermocline are shown to be important for sheep in energy conservation.

Dr. Val Geist - Question Period

Q. How sensitive is forage intake to forage volume requirements in wild populations? It is very good where forage is very high, but in the field can you use forage quality as an estimate of forage intake? Is that with winter range?

A. I would be delighted to have an answer to that question myself. This is exactly why we do these things -- to raise questions that one hopes to be answered.

Q. Suppose you had the opportunity to test these models; where would you start and what would be the first thing you would start to find out?

A. This model assumes the animal is standing, it does not make the assumption at any point that the animal is lying down. The moment the animal lies down there is part of his body in contact with the ground and you do in fact increase the insulation considerably because the ground warms up where the animal lies down. I do not know what percentage touches the ground -- one third or one quarter. This must be worked out. Then you have to know quite accurately how long on the average the animal touches the ground, at what time period he lies down. It would have to be set up as a sub-program. The first thing that I can see is that there are still a lot of details that need cleaning up.

Q. I was wondering why you use protein and fibre as the main base for nutritional computer work here when I believe that carbohydrate energy and Vitamin 'A' and mineral intake are generally considered by nutritionists to be an important year round concern from the standpoint of the animal's welfare and energy requirements. Protein and fibre would generally be one of the last you would like to look at.

A. Quite simply, protein and fibre do predict quite accurately the intake of the animal. So, it tells you how many calories it is going to take in and this has been worked out very well. The amount of Vitamin 'A' and what effect it has on intake per se, I frankly at present am not prepared to say and maybe you have some indication in

some of your work, but I am quite sure that it has considerable effect and I am aware that Vitamin 'A' content, at least during the winter time, would very likely derive supplement from the Vitamin 'A' stores in the liver itself. Some of the Russian work indicates that the Vitamin 'A' content in the liver declines during the winter time. I suspect even if the Vitamin 'A' content in winter forage is very low, which it very likely is because green forage is very low in their intake, it will be supplemented fairly adequately in that case. As far as phosphates are concerned, there is work to indicate that they are absorbed from bone during the winter time. This would be true for other minerals as well. It is my present understanding that the animal goes into winter with a store of energy in the form of fat, a store of minerals in the form of dense bone, a store of vitamins in the form of Vitamin 'A' in the liver, and they use these things up during the winter months and that they replenish them at salt licks in the case of minerals and in the case of forage, of course, during the following summer.

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My main points in sheep management are:

1. The need to conserve unhunted and unmanaged populations of sheep of all races, and ecological types. Thus we need a viable Stone's sheep population under protection. Next, we need not only high-mountain populations under protection but also some lowland sheep, i.e. such as in cliff belts along major rivers, such as the Yukon. These small, but viable populations would be our insurance against mismanagement, since they represent untapped information and a reserve of animals for reintroduction programs.
2. The need to keep unmanaged, unaltered, natural populations in our National Parks so that we can inform ourselves on how the ecological parameters of the habitat translate into the sheep's population dynamics, growth, physiology and behaviour. Sheep that graze fertilized roadbanks and lawns, are fed and salted by tourists, whose population is reduced by trapping programs and highway traffic, do not fit the requirements.
3. Once these requirements are satisfied, we can manage and experiment with new management concepts on populations used for hunting or for recreational, aesthetic, etc. needs, in good conscience.
4. A desirable objective is to rehabilitate areas from which sheep were eradicated in earlier years. This applies to large areas in the Yukon Territory where market hunting destroyed sheep populations.
5. I emphasized that in dealing with social animals we must not apply our knowledge gained from moose or deer, since their adaptive strategies differ too greatly.

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Is sheep management in Alberta affected by the presence of National Parks? Obviously the answer is yes, after looking at the relationship of winter sheep ranges on the East Slope to the location of the Park boundary.

Alberta East Slope Bighorn Range - 50 miles x 450 miles with half in the National Park. But, most (60-70%) of the winter ranges in the Province are within 10 miles of the boundary. There is, therefore, a very marked movement of sheep: Park in summer, outside Park in winter. But the number and availability of winter ranges is the key to bighorn survival and population numbers.