Brucellosis in Moose (*Alces alces*). A Serological Survey in an Open Range Cattle Area of North Central British Columbia Recently Infected with Bovine Brucellosis

M. HUDSON, K.N. CHILD, D.F. HATLER, K.K. FUJINO AND K.A. HODSON*

SUMMARY

A serological survey for *Brucella abortus* antibodies in mature cow moose (*Alces alces*) was made in an area of northcentral British Columbia which recently had been heavily infected with bovine brucellosis and in which there was considerable intermixing of moose and range cattle. No evidence of *Brucella* infection was found in the moose tested and it was concluded that they were probably not of great significance in the epidemiology of bovine brucellosis in the study area and were therefore unlikely to have hindered attempts to eradicate brucellosis from the cattle in that area.

RÉSUMÉ

Brucellose chez l'orignal, *Alces alces*. Une enquête sérologique portant sur un vaste territoire où des bovins paissaient en liberté, au centre nord de la Colombie Britannique, et où la brucellose bovine sévissait depuis peu

Cette étude consistait à rechercher des anticorps sériques à l'endroit de *Brucella abortus*, chez les orignaux adultes femelles, *Alces alces*, abattues dans une région du centre nord de la Colombie Britannique où sévistait depuis peu la brucellose bovine et où se produisaient des contacts fréquents entre les orignaux et les bovins en paissance sur ce vaste territoire. Les résultats de cette étude s'avérèrent négatifs et les auteurs en conclurent que les orignaux ne jouaient probablement pas un rôle important dans l'épizootiologie de la brucellose bovine qui sévissait dans cette vaste région. Il ne semble donc pas que les orignaux aient entravé les efforts déployés en vue de l'éradication de la brucellose bovine, sur le territoire en cause.

INTRODUCTION

Where there is considerable intermixing of wildlife and domestic livestock, such as on the open ranges of western North America, wild animals may play an important role in the epidemiology of livestock diseases and influence attempts to bring such diseases under control. For example, the eradication of bovine tuberculosis (*Mycobacterium bovis*) from cattle in southwestern England was complicated by the presence of *M. bovis* infected badgers (*Meles meles*) in that area acting as a reservoir of infection for the cattle (6). Also, the role of wildlife, especially foxes (*Vulpes* sp.) and skunks (*Mephitis* sp.) in North America and bats (*Desmodus* sp.) in South America, is well known in the epidemiology of rabies in domestic livestock (9).

Similarly, understanding the role of wildlife in the epidemiology of bovine brucellosis (*Brucella abortus*) may be of importance in conducting an eradication program for this disease. Several studies have been made on brucellosis in wildlife. Adrian and Keiss (1) conducted a serological survey in Colorado for *Brucella* antibodies in 1650 mule deer (*Odocoileus hemionus*), 3833 elk (*Cervus canadensis*) and 5271 antelope (*Antilocapra americana*) and found no reactors. Choquette *et al* (2) tested the sera of 2365 northern Alberta bison (*Bison bison*) for *Brucella* antibodies and found a reactor rate of 31.2%. Corner and Connell (3) conducted a serological survey in Alberta for brucellosis in 343 bison, 221 elk and 124 moose (*Alces alces*) and found reactor rates of 42% in the bison and 13% in the elk, while the moose sera were negative. They also described two severe clinical cases of brucellosis in moose. A clinical case of brucellosis in a young bull moose in the United States was described by Fenstermacher and Olson (4) while Jellison *et al* (5) reported a clinical case in a young female moose (*A. americanus*) in the United States. The latter authors also conducted serological tests for brucellosis on 44 moose and found nine reactors. Rausch and Huntley (7) reported experimental inoculations of several caribou (*Rangifer tarandus*), two moose and one mountain sheep (*Ovis dalli*) with *Brucella suis*, type 4. Thorne *et al* (10) conducted a serological and bacteriological survey of 1165 elk in Wyoming and found a reactor rate of 31% for brucellosis. They also isolated *Brucella abortus* type 1 from 17 of 45 elk seen at necropsy.

The studies performed on wildlife ungulates have primarily been made from a wildlife management approach and were not prompted by the incidence of brucellosis in nearby domestic livestock. To our knowledge, no study has been made of the local wildlife population immediately following a major outbreak of bovine brucellosis in an open range area, where intermixing of cattle and wildlife occurs. This paper describes such a study, made over a two year period (1977-79), on moose (*Alces alces*) in the Bulkley-Nechako Valley of northcentral British Columbia.

MATERIALS AND METHODS

The study area is illustrated in Figure 1. Between October 1975 and February 1977, 26 herds of cattle were under quarantine for brucellosis in the area indicated. Ultimately, 13 of these were totally depopulated because of the high incidence of brucellosis within them. In all, approximately 2000 head of cattle and eight horses were slaughtered before the disease was believed to have been eradicated from that area.

Between mid-November and mid-December of 1977 and 1978 the British Columbia Fish & Wildlife Branch permitted a special antlerless moose hunt over an area which included the brucellosis outbreak zone (Figure 1). Since the Branch required certain moose tissues from successful hunters, this was an ideal opportunity to also

*Animal Health Directorate, Health of Animals Branch, Agriculture Canada, Vancouver International Airport, Vancouver, B.C. A.M.F., V7B 1T8 (Hudson); British Columbia Fish & Wildlife Branch, 1011-4th Ave., Prince George, B.C. (Child, Fujino) and British Columbia Fish & Wildlife Branch, Box 3250, Smithers, B.C. (Hatler, Hodson).

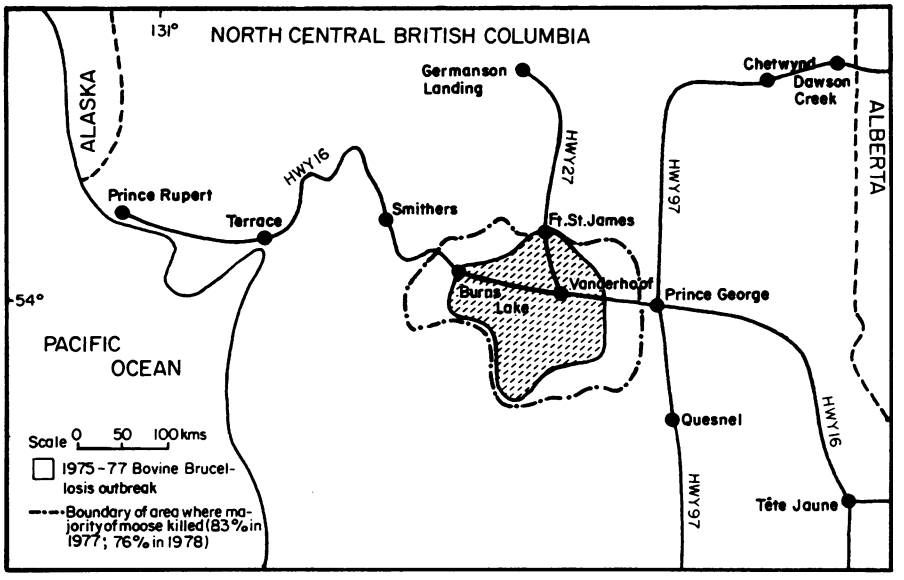

FIGURE 1. Area of British Columbia where moose (*Alces alces*) were hunted and where an outbreak of bovine brucellosis occurred (1975-1977).

obtain blood samples for brucellosis testing. Of 1799 applicants for this hunt over the two years, 436 were finally selected, by draw, and were issued permits to hunt antlerless moose. A condition of each permit was that the hunter, if successful, was to deliver biological material to the nearest officer of the Fish & Wildlife Branch within 24 hours of the kill. Failure to comply was an offense under the Wildlife Act, subject to a fine. The samples required, included the complete reproductive tract of females, the lower jaw (for age determination) and a blood sample. Prior to the hunt, each permittee received a kit including a 10mL vial for collection of the blood samples, instructions on handling the sample to avoid contamination or freezing, and a questionnaire on which to record such data as the location and date of kill. Of the 436 hunters receiving kits, approximately 136 (31%) were successful in shooting an antlerless moose.

The blood samples were mailed or brought to the Prince George district office of the Health of Animals Branch, Agriculture Canada, for serological analysis. After centrifugation, the serum was subjected to the Brewer's Card Test for *Brucella abortus* antibody detection. The ages of the moose killed were accurately determined by analysis of the annulations in the cementum of the incisor teeth (8). From the 136 moose killed during the sample period, 133 blood samples were obtained. Of these, five vials were broken and 24 samples were hemolysed (Table I). Thus, a total of 104 were available for the Brewer's Card Test.

RESULTS

As shown in Table I, 136 moose were killed during the period under study and serum samples were obtained for 133 of these animals. The difference in vial breakages between 1977 and 1978 was probably due to the fact that in 1977 plastic vials were used, whereas glass vials were utilized in 1978. The difference in the number of samples hemolysed between the two years was probably due to the quicker retrieval of samples in 1978 and the warmer ambient temperatures that year during the hunting season. In 1977, temperatures were around -35°C at the time of the moose kills and several samples were therefore frozen. The numbers of samples suitable for testing were 41 in 1977 and 63 in 1978. Of these 104 samples, 95 were from adult female moose, two from adult males, four from male calves and three from female calves.

DISCUSSION

As shown in Table I, all of the moose tested were negative for brucellosis. Their age distribution is shown in Table II. Of these 104 moose, 82 (79%) were shot within the brucellosis infected area, or within 50 kilometers of that area. The age distribution for this important sub-sample is given separately in Table II. Of the 34 moose killed in 1977 within the brucellosis infected area, 32 (94%) were old enough to have been alive at the peak of the bovine brucellosis outbreak, and 39 of 48 (81%) killed within that same area in 1978 were presumably also present during the outbreak. Therefore, of the 82 brucellosis-negative moose killed within the brucellosis infected area, 71 (87%) of them were most likely present, both spatially and temporally, when the bovine brucellosis outbreak was at its peak. The other 13% were probably offspring of those present.

The sample size of the moose killed within the brucellosis-infected area may appear relatively small. However, if we assume that the greatest danger of spreading brucellosis between moose, and from moose to cattle, lies in the aborting female (as in the bovine situation), then the fact that approximately 91% of the moose tested were mature cows, makes our results more significant.

The fact that all moose tested were

TABLE I

MOOSE (*ALCES ALCES*) SERA OBTAINED DURING 1977 AND 1978 AND TESTED FOR BRUCELLOSIS

	Nov-Dec 1977	Nov-Dec 1978	Total 1977-78
Reported no. of moose killed	61	75	136
Moose sera returned	60	73	133
% return	98%	97%	98%
Vials broken	0	5	5
Samples, hemolysed	19	5	24
Samples, brucellosis positive	0	0	0
Samples, negative	41	63	104

TABLE II

AGE DISTRIBUTION OF THE 104 MOOSE (*ALCES ALCES*) NEGATIVE FOR BRUCELLOSIS HUNTED WITHIN AN OPEN RANGE HIGH INCIDENCE BOVINE BRUCELLOSIS AREA

	1977			1978		
Age (years)	Total	Brucellosis Area[a]		Total	Brucellosis Area[a]	
< 1	3	2		3	2	
1-2	2	2		8	7	
> 2	31	26	94%	44	33	81%
Unknown (but mature)	5	4		8	6	
Total	41	34		63	48	

[a]This column indicates those moose which were killed within, or within 50 km of, the 1975-77 bovine brucellosis infected area (the indications are that moose in this area have a fairly discrete home range, i.e. within a radius of 50 km).

brucellosis-negative would indicate that either none were directly exposed to the *Brucella* organism (hence did not develop antibodies to it) or, as suggested by some authors (3, 5) those exposed developed such a severe illness that they died. Either way, our data suggests that moose were probably not of any great epidemiological significance in the spread of bovine brucellosis in the area under study. Therefore it would appear that in areas where moose and cattle do intermix relatively freely, moose would be unlikely to hinder a bovine burcellosis eradication program. We intend to continue our monitoring for *Brucella* antibodies in the moose population of this area, and hope to expand our studies to include other wildlife species including mule deer (*Odocoileus hemionus*), coyotes (*Canis latrans*) and wolves (*Canis lupus*).

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LETTER THE THE EDITOR

Radiology Improves Diagnosis in Trauma Cases

DEAR SIR:

This comment is prompted by Dr. Gammie's letter to the editor (Can. vet. J. 20: 251. 1979) concerning the accident case which died. It is intended to be only a comment based on several similar personal incidents and our attempts to prevent a recurrence.

My sympathies are with him as this route is familiar to most veterinarians in small animal practice. The assumption that the dog died directly from the associated hernia is challenged. One might well suspect that the dog had pneumothorax as well as the hernia. It seems a thoracic radiograph is indicated in any trauma case prior to considering even something as "minor" as a coxofemoral luxation which requires a general anesthetic. In our practice, the lives of many patients have been saved since the necessity of thoracic radiography was instituted prior to any orthopedic surgery or general anesthesia.

This may get into the realm of diagnostic "in case you miss something" but in the case of external trauma, however, it is a "must" procedure that insures better service to clients and better veterinary medicine to the patients.

Yours truly,

M.A. BERNARD, D.V.M.
Alta Vista Animal Hospital,
1814 Bank Street, Ottawa, Ontario
K1V 7Y6