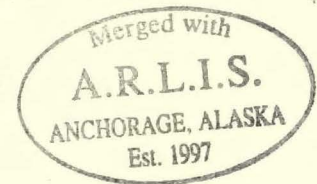


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SEROLOGIC SURVEYS FOR MICROBIAL PATHOGENS

By

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Volume IV

Progress Report  
Federal Aid in Wildlife Restoration  
Project W-22-1 and W-22-2, Job 18.5R

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Project No.: W-22-1      Project Title: Big Game Investigations  
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(additional data collected April-June 1982)

SUMMARY

A serological survey of 10 wildlife species occurring throughout Alaska indicated the occurrence of several diseases. Q fever antibody was found in 5 of 22 (23%) caribou (Rangifer tarandus), 2 of 39 (5%) Dall sheep (Ovis dalli), 6 of 18 (33%) mountain goat (Oreamnos americanus), 2 of 31 (6%) musk-ox (Ovibos moschatus), 3 of 97 (3%) bison (Bison bison), 8 of 31 (26%) arctic fox (Alopex lagopus), 1 of 5 (20%) red fox (Vulpes fulva), and 2 of 8 (25%) domestic dog (Canis familiaris) sera. Epizootic hemorrhagic disease (EHD) and/or bluetongue (BT) virus antibody was detected in 4 of 24 (17%) caribou, 2 of 9 (22%) Sitka black-tailed deer (Odocoileus hemionus sitkensis), 3 of 25 (12%) moose (Alces alces), and 2 of 107 (2%) bison sera. Canine parvovirus antibody was found in 1 of 31 (3%) arctic fox, 2 of 5 (40%) red fox, and 14 of 22 (64%) domestic dog sera. Leptospira spp. antibody was detected in 1 of 5 (20%) red fox, and 4 of 22 (18%) domestic dog sera. Brucella spp. antibody was found in 1 of 4 (25%) red fox, and 7 of 21 (33%) polar bear (Thalarctos maritimus) sera. Tularemia antibody was detected in 3 of 21 (14%) polar bear sera, although this may have been cross-reacting Brucella spp. antibody. Contagious ecthyma virus antibody was found in 5 of 12 (42%) Dall sheep sera.

Key words: Alaska, microbial pathogens, serological surveys, wildlife.

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## BACKGROUND

The agricultural industry in Alaska is small but appears to be on the verge of major expansion. In an effort to determine which diseases are present in wildlife populations prior to this expected agricultural expansion, a serologic survey was initiated. All of the etiologic agents which were included in this survey have been detected in various North American wildlife species by means of isolation of the agent or by serologic tests (Calhoun et al. 1956; McKeever et al. 1958; Neiland et al. 1968; Murray and Trainer 1970; Reilly et al. 1970; Rieman et al. 1979; Nettles et al. 1980; Dieterich et al. 1981; Lance et al. 1981).

## OBJECTIVE

To determine the prevalence of antibody to selected microbial disease agents in Alaskan wildlife.

## MATERIALS AND METHODS

Blood samples were collected from animals at locations indicated in Fig. 1. All bison (Bison bison) and musk-ox (Ovibos moschatus) specimens and 2 Sitka black-tailed deer (Odocoileus hemionus sitkensis) samples were from animals killed by hunters. Samples from red (Vulpes fulva) and arctic (Alopex lagopus) foxes were collected by trappers from animals captured in leg-hold traps. All remaining samples were collected by Alaska Department of Fish and Game personnel during studies which entailed capture of free-ranging animals.

Six bison specimens were collected in 1975 and 1976. Nineteen Dall sheep (Ovis dalli) samples were taken during 1971 and 1972. All other sera were gathered during 1977-82. Blood samples were allowed to settle for 12-36 hours at ambient or refrigerated temperatures. Sera were separated from clots by aspiration and frozen. All serologic tests were performed at the National Veterinary Services Laboratory (U.S. Department of Agriculture, Ames, Iowa).



Table 1 identifies the serologic test utilized for each etiologic agent. Leptospira interrogans serovarieties tested for included the following: pomona, ballum, canicola, icterohaemorrhagiae, wolffi, grippotyphosa, hardjo, autumnalis, bataviae, tarassovi, australis, and pyrogenes. For the card test and the immunodiffusion test, specimens were considered either positive or negative. For all other tests, minimum titers were established (Table 1) based upon natural or experimental infection of the host species in question or a selected domestic animal species. Sera which met or exceeded these titers (plus those designated "positive" in the card or immunodiffusion tests) were considered to contain evidence of past infection by the agent in question. Differences in prevalence were tested for significance by means of the chi-square test (Johnson 1980).

## RESULTS AND DISCUSSION

The disease known as Q fever is caused by the rickettsia (Coxiella burnetti) (Randhawa et al. 1977). The disease is world-wide in distribution. Coxiella burnetti is shed in milk, feces, birth fluids, and placental tissues. The organism is resistant to many common disinfectants and can survive in feces or blood for more than a year. The primary route of infection is respiratory via inhalation of aerosols or dust contaminated with the organism (Enright et al. 1969). The agent was first discovered in 1938 (Davis and Cox 1938). Most subsequent research on the agent has dealt with the disease in humans and domestic animals. In humans, the acute form of the disease is similar to influenza with symptoms of malaise, chills, fever, myalgia, and headache (Bell 1981). Pneumonia may follow. Chronic carrier infections can develop (Bell 1981). Treatment with selected antibiotics is effective if begun early in the course of infection. Death is rare (Bell 1981).

The animal host range of Q fever is broad, including many species of wild and domestic birds and animals. Although the disease is usually mild in domestic species, abortions do occur in sheep and goats (Enright et al. 1963). Previous reports have documented the presence of the disease in Alaska (Hopla 1975). Species implicated as hosts (based upon serologic tests) include domestic cattle (Bos taurus), arctic ground squirrel (Citellus undulatus), meadow vole (Microtus pennsylvanicus), tundra vole (Microtus oeconomus), snowshoe hare (Lepus americanus), redback vole (Clethrionomys rutilus), caribou (Rangifer tarandus), and perhaps grizzly bear (Ursus arctos), and wolverine (Gulo gulo) (Hopla 1965, 1966). The course, or ultimate resolution of infection, in any of these wild species is largely unknown.

A well-known Q fever researcher has hypothesized that "it seems reasonable to assume that the disease is common at times among ungulates that congregate in large herds in enzootic areas. However, evidence of such occurrence is lacking" (Bell 1981). Serologic evidence of Q fever infection was previously reported

in 37 of 355 (10.4%) caribou from the Alaska Range, and the agent was also isolated from the spleen of one of these animals (Hopla 1975). Results of the current survey indicate that the disease is still prevalent and being actively transmitted among Alaskan caribou.

In an earlier survey, Q fever antibody was found in 5 of 15 (33%) Dall sheep (Zarnke 1983). The 5% prevalence found in the current study indicates the disease is still being maintained in Alaska Range Dall sheep.

This is believed to be the 1st report of Q fever antibody in mountain goat (Oreamnos americanus), musk-ox, bison, and arctic and red fox. Coxiella burnetti has been isolated from both coyotes (Canis latrans) and gray foxes (Urocyon cinereoargenteus), and there is serologic evidence of infection in kit fox (Vulpes macrotis) (Bell 1981). The significance of the current serologic data for the health of the species involved is unknown.

There has been no recorded evidence of inexplicable reproductive failures or other abnormalities in any of the species included in the present survey. Current plans include continuation of the sero-survey and attempts to isolate the organism from placental tissue.

Leptospirosis is found in both wild and domestic canids throughout the world (Reilly et al. 1970). The serologic results presented here (20% positive, red fox and dog) agree with the current understanding of the epizootiology of this disease which links transmission to the predation of these canines on rodents and also to water-borne transmission. Red fox are known hosts for several serovars of Leptospira (Shotts 1981), and are believed to be important carriers of the 2 serovars detected in the current survey. In most species, especially carnivores, infection by Leptospira localizes in the kidney. Pathology may range from inapparent to severe. The single animal in the current study with evidence of previous exposure was maintained in captivity for over a year after the blood sample was collected and showed no overt signs of disease.

Brucellosis antibody was found in 7 of 21 polar bears (Thalarctos maritimus). The source of infection for these animals is unknown. Implications for the health of individual bears is the same as for other species, and primarily involves the threat of reproductive failure. The absence of any serologic evidence of brucellosis in the 25 caribou sampled is surprising. Positive sera have been previously reported from both of the herds included in the current survey (Neiland et al. 1968). However, prevalences in specific herds can vary from 0-25% over a period of years (Neiland et al. 1968). In addition, sample sizes from the 2 herds in the current study were small. Sample size may

have been inadequate to detect low prevalence. Brucellosis in moose (Alces alces) is extremely rare (Jellison et al. 1953). Therefore, the absence of positive sera in the current study was expected. The disease has been reported previously from Alaskan red fox (Neiland 1975). It is not believed to represent a serious health hazard to the fox population, although it could affect individual animals by causing abortion and other reproductive problems. A verified case of brucellosis has never been found in Alaskan bison.

The primary host for tularemia in Alaska is the snowshoe hare (Lepus americanus). Several cases per year are confirmed by isolation of the organism from infected hares in the Fairbanks area (Zarnke, unpubl. data). Tularemia in dogs is not uncommon. During summer 1981, there were several cases in the Fairbanks area which required veterinary attention (Zarnke, unpubl. data). It is believed that dogs are exposed when they capture and consume infected hares. The 3 polar bear sera indicated as positive in Table 1 are believed to represent nonspecific cross-reactivity with Brucella spp. antibody.

Antibody to epizootic hemorrhagic disease (EHD) and/or bluetongue (BT) viruses was found in 2 of 107 (2%) bison, 3 of 25 (12%) moose, 4 of 24 (16%) caribou, and 2 of 9 (22%) deer. Sero-positive bison, reindeer (Rangifer tarandus), whitetail (Odocoileus virginianus), and mule deer (Odocoileus hemionus) have been previously reported (Hoff and Trainer 1978; Zarnke 1983). The data in Table 1 are based upon results of the immunodiffusion test. When the same sera were tested by means of the more specific serum neutralization test, no neutralization of the viruses occurred. Thus, the sera in question contained antibody to a virus related to (but distinct from) EHD and BT. Minor antigenic variation is common for field isolates of these viruses. Perhaps such a phenomenon is responsible for this situation. Alternatively, perhaps a unique variant of one or both of these viruses is found in Alaska. The significance of infection of wildlife by this virus (whatever its identity may be) is unknown. Plans for the future include continuation of the serologic survey and for collecting Culicoides spp. gnats near the area where sero-positive caribou and Dall sheep were found. These gnats will be tested for virus content.

Contagious ecthyma (CE) is enzootic in Alaska's Dall sheep (Zarnke 1983). Sera included in the current survey were collected from sheep at the Dry Creek mineral lick which is located approximately 75 mi south of Fairbanks. Previous surveys at this location found prevalences of 30% (3/10) in 1971 and 100% (13/13) in 1978 (Zarnke et al. 1983). Antibody decay during an interepizootic period could easily explain the decrease in prevalence between 1978 and 1982.

Canine parvoviral (CPV) disease emerged as a serious disease of domestic dogs in 1978 (Appel et al. 1978, Pollock et al. 1980). It is believed to be a variant of feline panleukopenia virus

(Craigie 1979, Flower et al. 1980). The host range of CPV appears to be limited to the families Canidae (Eugster et al. 1978, Fletcher et al. 1979, Evermann et al. 1980) and Procyonidae (Nettles et al. 1980). There are 2 clinical forms of the disease in dogs. The first is a highly contagious enteritis (Appel et al. 1978, Black et al. 1979, Merickel et al. 1980). The second is a myocarditis in puppies less than 6 months old (Kramer et al. 1980, Lenghaus et al. 1980). Cases of CPV are most prevalent in puppies, and symptoms seem to be most severe in this age group as well (Appel et al. 1978). Outbreaks of CPV in domestic dogs have occurred throughout the U.S. Serum antibody prevalence ranges from 20% to 50% in dogs and varies between different geographic areas (Anonymous 1980, Kramer et al. 1980). Vaccines are available for dogs (Appel et al. 1980). Treatment is primarily symptomatic.

The disease is common in domestic dogs in Alaska (R. Barrett, pers. commun.). The results of the current survey provide the 1st evidence that the disease has been transmitted to wild canids in Alaska as well. This disease could pose a threat to the productivity of wild canids and thus may have implications for optimum human harvest levels. Enteritis and/or myocarditis in young animals could adversely affect survival. In an attempt to further clarify the geographic distribution and prevalence of this disease, serologic surveys will continue. In addition, experimental studies to determine the course and severity of the disease in wild canids are warranted.

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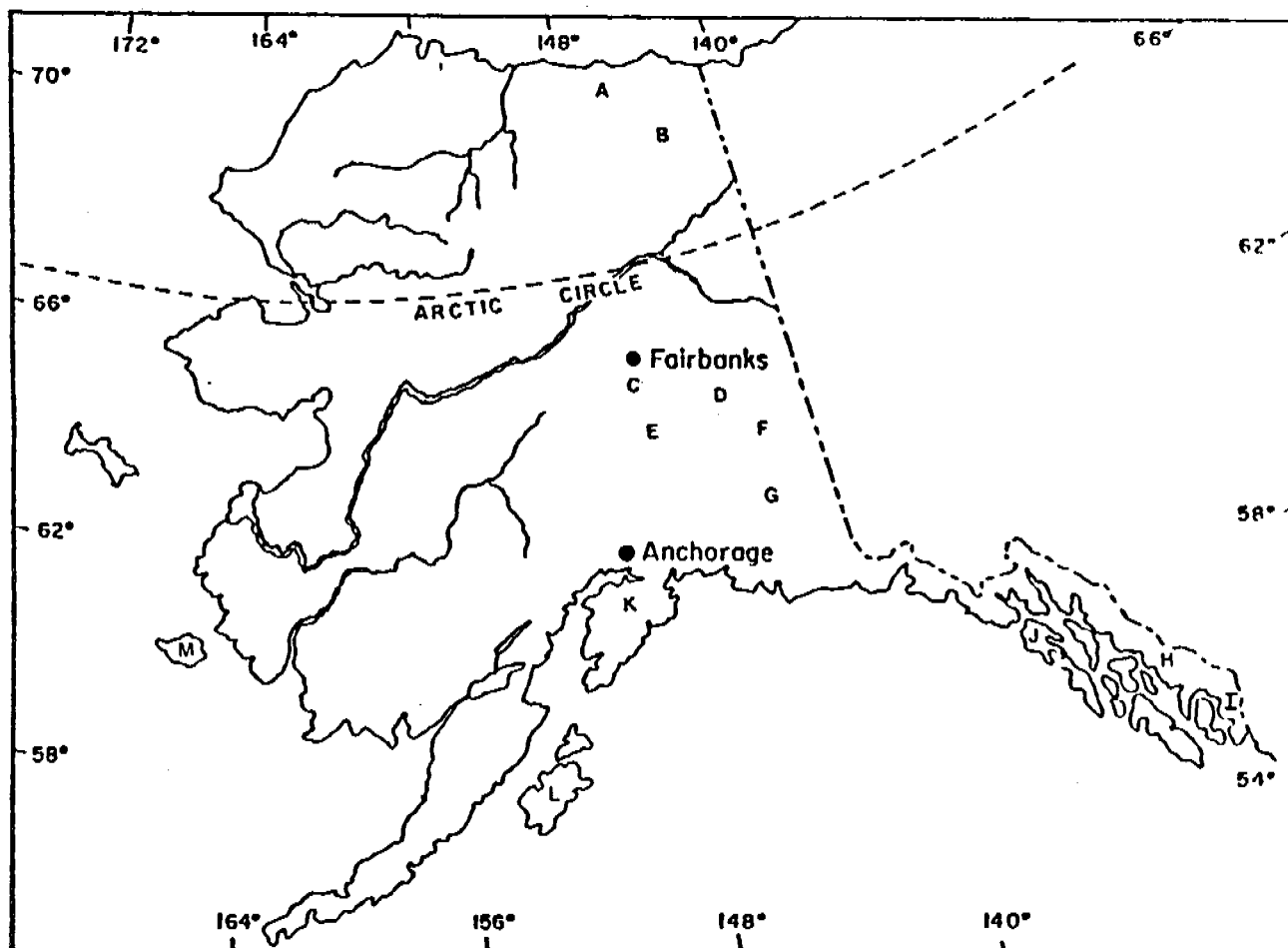


Fig. 1. Locations at which blood samples for serologic survey were collected, 1971-82. A = red fox ( $\bar{N} = 1$ ), arctic fox ( $\bar{N} = 38$ ), and caribou ( $\bar{N} = 4$ ); B = caribou ( $\bar{N} = 10$ ); C = red fox ( $\bar{N} = 4$ ), moose ( $\bar{N} = 6$ ), and caribou ( $\bar{N} = 11$ ); D = domestic dog ( $\bar{N} = 22$ ) and bison ( $\bar{N} = 101$ ); E = Dall sheep ( $\bar{N} = 21$ ); F = Dall sheep ( $\bar{N} = 18$ ); G = Dall sheep ( $\bar{N} = 3$ ) and bison ( $\bar{N} = 5$ ); H = moose ( $\bar{N} = 19$ ); I = mountain goat ( $\bar{N} = 18$ ); J = Sitka black-tailed deer ( $\bar{N} = 7$ ); K = Dall sheep ( $\bar{N} = 13$ ); L = Sitka black-tailed deer ( $\bar{N} = 2$ ); and M = musk-oxen ( $\bar{N} = 34$ ).

Table 1. Serum antibody prevalence in Alaskan mammals for 8 microbial disease agents, 1971-82.

Disease agent/ serological test	Bison	Dall sheep	Musk-ox	Moose	Caribou	Mountain goat	Blacktail deer	Arctic fox	Red fox	Domestic dog	Polar bear
Q fever CF-20 <sup>a</sup>	3/97	2/39	2/31	ND <sup>b</sup>	5/22	6/18	0/5	8/31	1/5	2/8	0/21
<u>Leptospira</u> spp. MAT-100	0/106	ND	ND	0/25	0/24	ND	0/9	0/16	1/5	4/21	0/21
<u>Brucella</u> spp. BAPA-(±)	0/108	ND	ND	0/25	0/25	ND	0/9	0/22	0/4	2/19	7/21
STT-25	0/3	ND	ND	ND	ND	ND	ND	ND	ND	0/2	4/21
Tularemia TA-20	ND	ND	ND	ND	ND	ND	ND	0/23	1/4	1/20	3/21
Epizootic hemorrhagic disease ID-(±)	2/107	0/54	0/34	3/25	4/24	0/18	2/9	ND	ND	ND	ND
Bluetongue ID-(±)	0/107	0/54	0/34	3/25	2/24	0/18	0/9	ND	ND	ND	ND
Contagious ecthyma CF-10	ND	5/12	0/28	0/24	0/22	0/18	0/4	ND	ND	ND	ND
Canine parvovirus SN-16	ND	ND	ND	ND	ND	ND	ND	1/31	2/5	14/22	ND

<sup>a</sup> Name of test: CF = complement fixation; MAT = microscopic agglutination test; BAPA = card test; STT = standard tube test; TA = tube agglutination; ID = immunodiffusion; SN = serum neutralization. Numbers indicate minimum titer necessary to be considered as evidence of past infection. (±) indicates that the test is read as simply either positive or negative.

<sup>b</sup> ND = not done.