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SURVEY FOR RABIES, LEPTOSPIROSIS, TOXOPLASMOSIS AND TULAREMIA IN STRIPED SKUNKS *(Mephitis mephitis)* FROM THREE PUBLIC USE AREAS IN NORTHWESTERN ARKANSAS

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Abstract: During a skunk eradication program in late August, 1979, 53 striped skunks *(Mephitis mephitis)* were removed from three public use areas on Beaver Lake, Benton and Carroll counties in northwestern Arkansas. None of the 53 animals were positive for rabies (fluorescent antibody technique) and only one of 45 (2.2%) was positive for rabies antibodies. Twenty-one of 45 animals (46.6%) tested were positive for leptospirosis; 10 of 45 (22.2%) were positive for toxoplasmosis; and none were positive for tularemia. High populations of striped skunks in public use areas could be a potentially important reservoir for several diseases affecting both humans and other animals.

INTRODUCTION

Each year thousands of persons visit parks across the United States to participate in various recreational activities such as camping, swimming and fishing. The general construction and layout of many of these parks are ecologically conducive to concentrating populations of various species of wild animals, including the striped skunk *(Mephitis mephitis)*. For example, woodlots and the rocky embankments of roads and dams provide denning sites, numerous culverts provide runs and hiding places, mowed fields and associated lighting and careless camping habits of visitors provide food. Thus, the general behavior of skunks toward humans make it a nocturnal visitor to many campsites. Given these conditions, the striped skunk has become a potentially important reservoir of several diseases, including rabies, leptospirosis and tularemia.[3,13-15,17,18,21]

Arkansas currently is experiencing an epizootic of rabies among the striped skunk population; and, in addition, leptospirosis and tularemia appear to be epizootic in the state among some animal species (Pers. comm. Dr. Tom McChesney, Arkansas Dept. of Health, 1979). Toxoplasmosis, while apparently not serious in Arkansas may infect up to one third of the human population in certain areas of the country. In conjunction with a U.S. Army Corps of Engineers' skunk eradication program, 53 striped skunks were removed from three public recreation areas (Horseshoe Bend, Prairie Creek and Dam Site) on Beaver Lake, Carroll and Benton Counties, in northwest Arkansas between 24-30 August 1979. These skunks were tested for rabies infection, antibodies to rabies, leptospirosis, tularemia and toxoplasmosis to determine the potential risk the skunk population might have to human and domestic animals visiting the recreation areas.

MATERIALS AND METHODS

Skunks were captured by using either Tomahawk #105 live traps,[1] baited with

[1] Tomahawk Live Trap Co., P.O. Box 323, Tomahawk, Wisconsin 54487, USA.

sardines, or by a hoop net[11] and spotlighting. The animals were bled by cardiac puncture, the blood was held on ice for 1 to 2 h, serum was then removed and stored at -20 C until serological analyses could be performed. Antibody determinations for rabies-neutralizing antibody was conducted by the mouse neutralization technique using from 25-50 MLD_{50} of rabies virus (CVS strain). Serum determinations of antibodies against live antigens of *Leptospira canicola, grippotyphosa, hardjo, icterohaemorrhagiae, pomona* were conducted using the microscopic agglutination technique.[6] For discussion, a positive response against any of the serovars of *Leptospira* was considered a positive for leptospirosis. *Toxoplasma* antibodies were determined by the hemagglutination technique.[10] Tularemia antibodies were detected by tube agglutination techniques. The serum dilution used to indicate seroconversion for the designated antigens was based on the recommendations outlined by the procedure employed.[10]

Spinal cord tissue immediately posterior to the brain was removed from carcasses held at -20 C. These tissues were tested for rabies virus by the fluorescent antibody technique.[7] Spinal cord tissue was used because the intact skull was needed for other studies. While brain tissue may have been preferable it has been shown that spinal cord tissue is also a reliable indicator for rabies in skunks (Pers. comm., J. Shaddock, Center for Disease Control).

RESULTS AND DISCUSSION

Rabies. Skunks are reservoirs as well as effective vectors of rabies.[21] In 1979, the Center for Disease Control reported a total of 5,119 laboratory confirmed cases of animal rabies in the United States, with 3,031 occurring in skunks (59.2%).[4] Furthermore, Arkansas reported a dramatic increase in skunk rabies from 1978 to 1979 (140 to 297 laboratory confirmed cases) causing the Arkansas Department of Health to declare a rabies epizootic among striped skunks.

None of the 53 animals examined in this study were positive for rabies virus. In addition, one animal which came from the Prairie Creek recreation area was seropositive at a titer ≥1:5. This was a mature female that possibly had moved into the area after having contracted and recovered from the disease. Storm[20] and Bailey[1] reported that from August to October the percentage of rabid skunks often decline.[5] Webster[22] proposed that Storm's and Bailey's results were due to an increase of young independent skunks being submitted for examination which had not yet contracted the disease. This may partially explain the absence of skunks with rabies virus or seroconversion since, based on size and weight, the majority of the skunks were young of the year.

During this investigation the area surrounding Beaver Lake, as was the extreme northwest region of the state, was relatively free of rabies in striped skunks. However, in 1977 and 1978 this area was among the highest in the state in the prevalence of reported cases (unpubl. data). A population of skunks susceptible to rabies in a recreation area would provide a suitable situation for a rapid spread of the disease, with an ensuing epizootic, if infected animals migrate into the population.

Leptospirosis. In the past, leptospirosis generally has been regarded as an occupational disease. Although still true to some extent, the potential for human infection with leptospires from avocational activities has become increasingly important.[3]

The high prevalence of leptospirosis among striped skunks in Louisiana,[6,17] Pennsylvania[5] and Georgia[9,12] indicates that skunks may serve as a source of infection to other animals and man. Roth[16] observed skunks feeding at night among resting cattle, affording the

necessary association for interspecies transmission.

Forty-five serum samples were screened for antibody activity at a serum dilution of 1:50. Fourteen of 26 (53.8%) of the skunks removed from Horseshoe Bend, 4 of 15 (26.7%) animals from Prairie Creek and 3 of 4 (75.0%) from the Dam Site area demonstrated seroconversion (Table 1). In all, 47% of the animals examined in this study had an antibody titer ≥1:50, comparable to the above studies. Sixty-two percent of the animals showing seroconversion were males and 38% were females.

In 1963, Roth[16] reported that the bacteriologic prevalence of leptospires in 650 striped skunks collected at random was 57.4%. He further reported that the serological prevalence of *Leptospira* infection is less than the bacteriological prevalence and proposed that some animals may harbor the causal agent and release leptospires without demonstrating seroconversion. He also reported shedding of viable leptospires for over 100 days and proposed that the striped skunk serves as a principal reservoir and contributor to epizootics of leptospirosis. The extended period of time an infected animal may shed viable leptospires provides considerable opportunity for other animals that visit the same locale to become infected. On several occasions, we observed skunks feeding on human refuse and natural foodstuffs in the immediate vicinity of campers. In addition, encounters between striped skunks and domestic pets were observed within the camping area. Skunks frequented the immediate vicinity of Beaver Lake, thus providing a means by which the surface water could become contaminated.

Toxoplasmosis. Toxoplasmosis is widespread within the animal kingdom.[14] In most animal species studied, individuals may contract the disease and show seroconversion without any apparent clinical signs. Toxoplasmosis has been recorded in striped skunks.[14,19,21]

Ten of 45 (22%) animals tested had antibody titers ≥1:8 to *Toxoplasma* (Table 2). Binniger[2] reported that male bears *(Ursus americanus)* had a higher prevalence of antibody titers to toxoplasmosis than females (in our limited study there was no significant difference between sexes, Chi Square P>.05). Binninger felt that this difference in bears was due to infection from felids, thus the older animals and males with larger

TABLE 1. Prevalence of leptospirosis in striped skunks from three public use areas in northwestern Arkansas.

Public Use Area and Sex	Positive	Negative
Horseshoe Bend		
Male	8 (57)[1]	6 (43)
Female	6 (50)	6 (50)
Prairie Creek		
Male	3 (50)	3 (50)
Female	1 (13)	7 (87)
Unknown		1
Dam Site		
Male	2 (66)	1 (33)
Female	1 (100)	0 (0)
Total	21 (47)	24 (53)

[1]Parenthesis indicates percentage.

TABLE 2. Prevalence of toxoplasmosis in striped skunks from three public use areas in northwestern Arkansas.

Public Use Area and Sex	Positive	Negative
Horseshoe Bend		
Male	1 (7)[1]	13 (93)
Female	4 (33)	8 (66)
Prairie Creek		
Male	0 (0)	6 (100)
Female	3 (38)	5 (62)
Unknown	1	
Dam Site		
Male	1 (33)	2 (66)
Female	0 (0)	1 (100)
Total	10 (22)	35 (78)

[1]Parenthesis indicates percentage.

home ranges, would have greater exposure to the infectious agent. Since both sexes of skunks in a recreational area would have equal chance for exposure there should be no significant sexual differences.

In a public recreational area domestic cats which are not restrained contract the disease in much the same way as resident skunks. Since Miller[14] indicates that skunks cannot shed infective oocysts, skunks are not important in the spread of the disease; however, a high percentage of infected skunks are indicators of the potential for infection of domestic cats with subsequent exposure of humans.

Tularemia. None of the 45 sera tested showed antibody activity to *Francisella tularensis*. However, tularemia antibodies have been demonstrated in skunks we have tested from other geographic areas of the state (unpub. data). In other studies, on mustelids, tularemia has been shown in both skunks[13] and mink.[23] Furthermore, McKeever[13] felt striped skunks were one of the chief mammalian reservoirs of the disease; thus we feel that skunks should continue to be examined for tularemia.

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