Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Progress Report
1 July 1996- 30 June 1997

Serologic Survey of Alaska Wildlife for Microbial Pathogens

Randall L Zarnke

Grant W-24-5
Study 18.71
June 1997

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STATE OF ALASKA
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DEPARTMENT OF FISH AND GAME
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DIVISION OF WILDLIFE CONSERVATION
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RESEARCH PROGRESS REPORT

STATE: Alaska **STUDY NO.:** 18.71

COOPERATORS: None

GRANT NO.: W-24-5

STUDY TITLE: Serologic Survey of Alaska Wildlife for Microbial Pathogens

AUTHORS: Randall L Zarnke

PERIOD: 1 July 1996-30 June 1997

SUMMARY

Under the study title "Serologic Survey for Microbial Pathogens," 2 major projects have been completed. Formal manuscripts have been submitted to the *Journal of Wildlife Diseases*. These 2 manuscripts constitute the progress report for this reporting period (Appendix A and B).

1 Tongue samples were collected from 148 wolf (*Canis lupus*) carcasses during 1993 and 1994 near Fairbanks, Alaska. A standard peptic digestion procedure was used to detect *Trichinella* spp. larvae. Larvae were found in 54 of 148 samples (36%). There was no significant difference in sex-specific prevalence ($P = 0.902$). Prevalence was significantly related to age ($P < 0.0001$). There was no relationship between the number of larvae per gram of host tissue and the age or sex of the host ($P = 0.629$). *Trichinella* spp. infection may cause illness in individual wolves. However, there was no indication the parasite had any negative impact on the population.

2 Tongue samples were collected from 72 black bear (*Ursus americanus*) skulls. The bears had been killed by hunters in Southeast Alaska during 1996. A standard peptic digestion procedure was used to detect *Trichinella* spp. larvae in tongue tissue. No larvae were found in any of the samples.

CONTENTS

BACKGROUND

Wildlife disease surveys of varying degrees of sophistication have been conducted by ADF&G since the early 1960s. In the early days these surveys were limited in scope, consisting of tests for evidence of 1 or 2 disease agents in 1 or 2 host species. Since the late 1970s, however, the surveys have been expanded to where they now include up to 30 disease agents and 23 potential host species. Such a framework provides for a meaningful health profile of Alaska's wildlife.

OBJECTIVE

The goal of this study is to monitor Alaska wildlife populations for evidence of previous exposure to infectious disease agents. Maximum benefit will be derived by keeping the survey as broad as possible, both in terms of disease agents and potential hosts. In an attempt to keep the cost of this study as low as possible, samples will be collected opportunistically in conjunction with other research and management operations.

METHODS

Samples are usually collected in conjunction with other research and management projects. Preliminary preparation of samples is performed in Fairbanks before shipment to laboratories in other parts of the world. When results are received in Fairbanks, the data are relayed to the contributor, in conjunction with an evaluation of potential management implications.

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APPENDIX A Prevalence of *Trichinella nativa* in Wolves (*Canis lupus*) from Interior Alaska, 1993 to 1994

RH: SHORT COMMUNICATIONS

Prevalence of Trichinella nativa in Wolves (Canis lupus) from Interior Alaska, 1993 to 1994

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ABSTRACT: Tongue samples were collected from 148 wolf (Canis lupus) carcasses during 1993 and 1994 near Fairbanks, Alaska. A standard peptic digestion procedure was used to detect Trichinella spp. larvae. Larvae were found in 54 of 148 samples (36%). There was no significant difference in sex-specific prevalence ($P = 0.902$). Prevalence was significantly related to age ($P < 0.0001$). There was no relationship between the number of larvae per gram of host tissue and the age or sex of the host ($P = 0.629$). Trichinella spp. infection may cause illness in individual wolves. However, there was no indication the parasite had any negative impact on the population.

Key words: Alaska, Canis lupus, Trichinella nativa, wolf.

Trichinella spp. are nematode parasites which are capable of infecting virtually all warm-blooded animals (Dick, 1983). Trichinella spp. are transmitted by ingestion of infected muscle tissue from another host (Bailey and Schantz, 1990). Therefore, strictly carnivorous host species generally have higher infection rates than omnivorous species (Franchimont et al., 1993; Oivanen and Oksanen, 1993). Impacts of infection on individual animals are not well understood. Impacts on populations of free-ranging host species are believed to be minimal (Forrester, 1976).

The objectives of this project were: 1) to determine the prevalence of Trichinella spp. in a wolf (Canis lupus) population living in Interior Alaska, and 2) the relationship between prevalence and sex and age of the host.

The 5531-mi^2 study area was located south of Fairbanks. The corners of the collection area were located at: 64°45′N and 147°30′W; 63°30′N and 146°15′W; 63°30′N and 149°15′W; and 64°32′N and 149°W.

One hundred twenty-two wolf carcasses were collected in conjunction with a state-sponsored population control program. This program was conducted during the winter of 1993-1994 ($N = 91$) and early winter 1994 ($N = 31$). Twenty-six additional carcasses were purchased from private trappers who captured wolves in this same area.

Tongue specimens were collected during post-mortem examinations. Sex of each carcass was recorded at that time. Age was determined by counting cementum annuli of an extracted premolar tooth (Ballard et al., 1996). A standard peptic digestion procedure was used to detect Trichinella sp. (Worley et al., 1991). A minimum of 25 gm of tongue tissue was tested from each animal.

A generalized linear model with a logit link function and binomial distribution (McCullagh and Nelder, 1989) was used to determine if prevalence was related to age or sex of the host. Age was treated as a continuous variable up to a quadratic term. Sex was treated as a categorical variable. All main and pair-wise interactions were considered in the model. Effects that were not significant ($\alpha > 0.05$) were removed until the most parsimonious model was obtained. The final model contained only those effects, and

possible interactions, which were significant with a log-likelihood ratio statistic at $\alpha \leq 0.05$. Multiple linear regression (Snedecor and Cochran, 1980) was used to determine if the number of larvae per gram of tissue (LPG) was related to age or sex for those wolves that were infected.

Larvae were detected in 54 of 148 (36%) tissue samples. Sex-specific prevalence was 23 of 64 (36%) for males and 31 of 84 (37%) for females. These values were not significantly different ($P = 0.902$). Prevalence was significantly ($P < 0.0001$) related to age (Table 1). The logit model estimated prevalence as a function of age (Fig. 1) according to the following formula:

$$\text{Probability of infection} = \frac{\exp(-1.0465 + 0.4347 \times \text{age})}{1 + \exp(-1.0465 + 0.4347 \times \text{age})}$$

Intensity ranged from 0.02 to 52.9 LPG. There was no relationship between LPG and age or sex of the host ($P = 0.629$), for those animals which were infected.

A prevalence of 33% (51/154) was reported for wolves in Alaska during the 1950s (Rausch et al., 1956). Collection areas were not indicated. Results of the current survey are in close agreement to this previously-reported value.

More recent surveys of other host species have been conducted in or near the current study area. Serum antibody prevalence was 22% (22/99) for grizzly bears (Zarnke et al., 1997). Prevalence of larvae in lynx tongue tissue was 19% (63/328) (Zarnke et al., 1995). Obviously, prevalence in wolves is much higher than these two species.

Grizzly bears are omnivores. Vegetation represents a major portion of their diet during certain annual periods (Craighead and Mitchell, 1982). Wolves are more strictly carnivorous than bears. Results of the current survey concur with the observation that prevalence of trichinosis is higher in strictly carnivorous species compared with omnivorous species (Franchimont et al., 1993; Oivanen and Oksanen, 1993).

Lynx prey primarily on snowshoe hares (Lepus americanus). Hares are strongly herbivorous. Prevalence of trichinosis in hares is very low (Rausch et al., 1956). Therefore, they are not considered a major source of Trichinella sp. Obviously, lynx are exposed via alternate prey species. The relative positions of wolves and lynx in the food chain is reflected in their respective prevalences of trichinosis.

The source of infection for wolves in this survey is unknown. Wolves prey and scavenge on a variety of mammals. Snowshoe hares, beaver (Castor canadensis), red squirrels (Tamiasciuris hudsonicus), muskrat (Ondatra zibethicus), and numerous microtine rodent species are potential sources (Rausch et al., 1956). However, prevalences in these species are very low. Therefore, their role in the epizootiology of sylvatic trichinosis in Alaska is probably minimal. More likely potential sources of exposure for wolves include lynx (Felis

lynx), red fox (Vulpes vulpes), black bear (Ursus americanus), grizzly bear (Ursus arctos), and other wolves.

The impact of infection on individual wolves is unknown. Severity of symptoms in domestic dogs can range from inapparent to severe clinical disease (Madsen, 1961; Soulsby, 1965). The LPG values are low in red foxes, coyotes and wolves (Zimmermann, 1971; Worley and Greer, 1982). Trichinella spp. infections in most free-ranging canids are believed to be subclinical (Zimmermann, 1971). All wolves in the current survey were apparently active, functional members of the population. There was no evidence that Trichinella spp. infection had any measurable negative impact on either the individual wolves or the population.

This project was supported by Federal Aid in Wildlife Restoration Projects W-24-2 and W-24-3. The authors thank Floyd M. Seesee who processed tissues, Ed Crain and Danny Grangaard who conducted fieldwork, the trappers who contributed carcasses, and the pilots who worked under difficult field conditions to collect the animals which comprise this survey.

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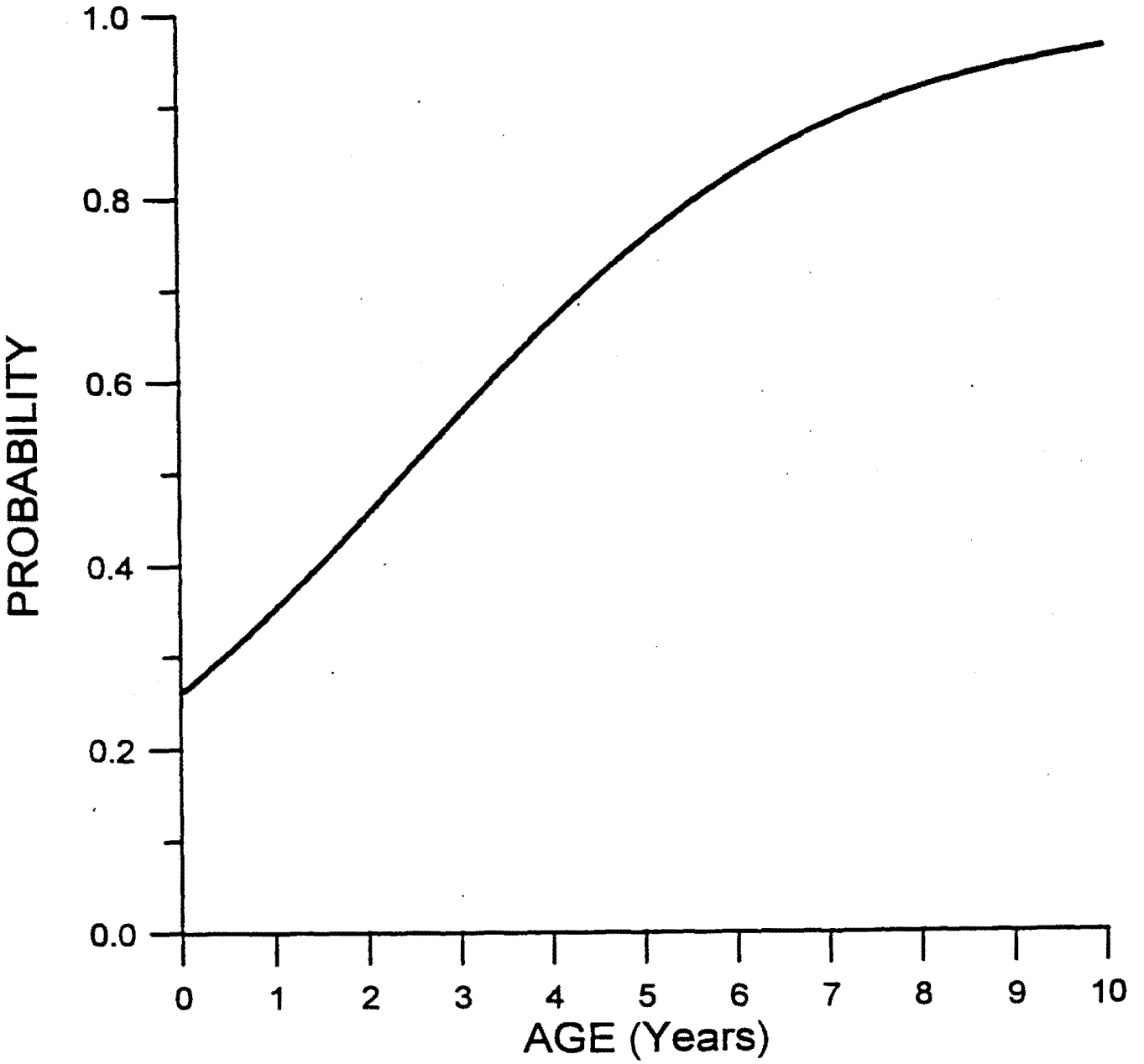

Figure 1. Relationship between wolf (Canis lupus) age and predicted probability of Trichinella nativa in a wolf from Interior Alaska.

Table 1. Age-specific prevalence and intensity of Trichinella nativa in wolves (Canis lupus) from Interior Alaska, 1993-1994.

Wolf age	Prevalence	Intensity
0[a]	17/84 (20%)[b]	2.9[c]
1	17/31 (55%)	10.6
2+	20/33 (61%)	2.3

[a] Years of age.
[b] Number positive/number tested (%).
[c] Mean number of larvae per gram of tongue tissue.

APPENDIX B Prevalence of *Trichinella* spp. in Black Bears (*Ursus americanus*) from Southeast Alaska, 1996

RH: SHORT COMMUNICATIONS

Prevalence of Trichinella spp. in Black Bears (Ursus americanus) from Southeast Alaska, 1996

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ABSTRACT: Tongue samples were collected from 72 black bear (Ursus americanus) skulls. The bears had been killed by hunters in Southeast Alaska during 1996. A standard peptic digestion procedure was used to detect Trichinella spp. larvae in tongue tissue. No larvae were found in any of the samples.

Key words: Alaska, black bear, Trichinella spp., Ursus americanus.

Trichinella spp. are nematode parasites which are capable of infecting virtually all warm-blooded animals (Dick, 1983). Trichinella spp. are transmitted by ingestion of infected muscle tissue from another host (Bailey and Schantz, 1990). Impacts of infection on individual animals are not well understood. Impacts on populations of free-ranging host species are believed to be minimal (Forrester, 1976).

Black bears (Ursus americanus) are a widely-recognized wildlife host species. Black bear meat can serve as a source of infection for humans. A recent change in hunting regulations requires successful black bear hunters to salvage meat from the carcass. Some hunters object to this regulatory requirement. This objection is based, in part, on the potential threat to human health from eating bear meat.

The objective of this project was to determine the prevalence of trichinosis in black bears from selected areas of southeastern Alaska.

Bears were killed by hunters in Game Management Units 1A, 1B, 1C, 2, 3 and 4 (Fig. 1). In Alaska, successful bear hunters are required to present the bear's skull and hide for examination and attachment of locking tags. At that time, sex was recorded and tongue samples were collected from: a) 26 bears at the Juneau ADF&G office, b) 26 at the Ketchikan office, c) 13 at the Petersburg office, and d) 7 at the Sitka office. A standard peptic digestion procedure was used to detect Trichinella spp. larvae (Worley et al., 1991). A minimum of 25 gm of tongue tissue was tested from each bear.

No larvae were detected in any of the samples. Serum antibody prevalence of Trichinella spp. exposure in brown/grizzly bears (Ursus arctos) was very low in Southeast Alaska (Zarnke et al., 1997). Prevalence of larvae was 4% (4 positive of 97 tested) in black bears from mainland Alaska during the late 1980s (Zarnke, unpubl.). Conversely, prevalence was 53% (9/17) in black bears collected from unidentified areas of Alaska during the 1950s (Rausch et al., 1956). No studies of trichinosis in black bears have been conducted in coastal British Columbia (Appleyard, pers. comm.).

Results of the current survey indicate that consumption of black bear meat from Southeast Alaska poses little or no threat to human health as a source of Trichinella spp. Hunters who have any lingering doubts regarding safety should be advised to cook meat thoroughly. Temperatures greater than 137 F kill Trichinella spp. larvae. Human health authorities recommend cooking bear meat to an internal temperature of 170 F to provide a margin of safety.

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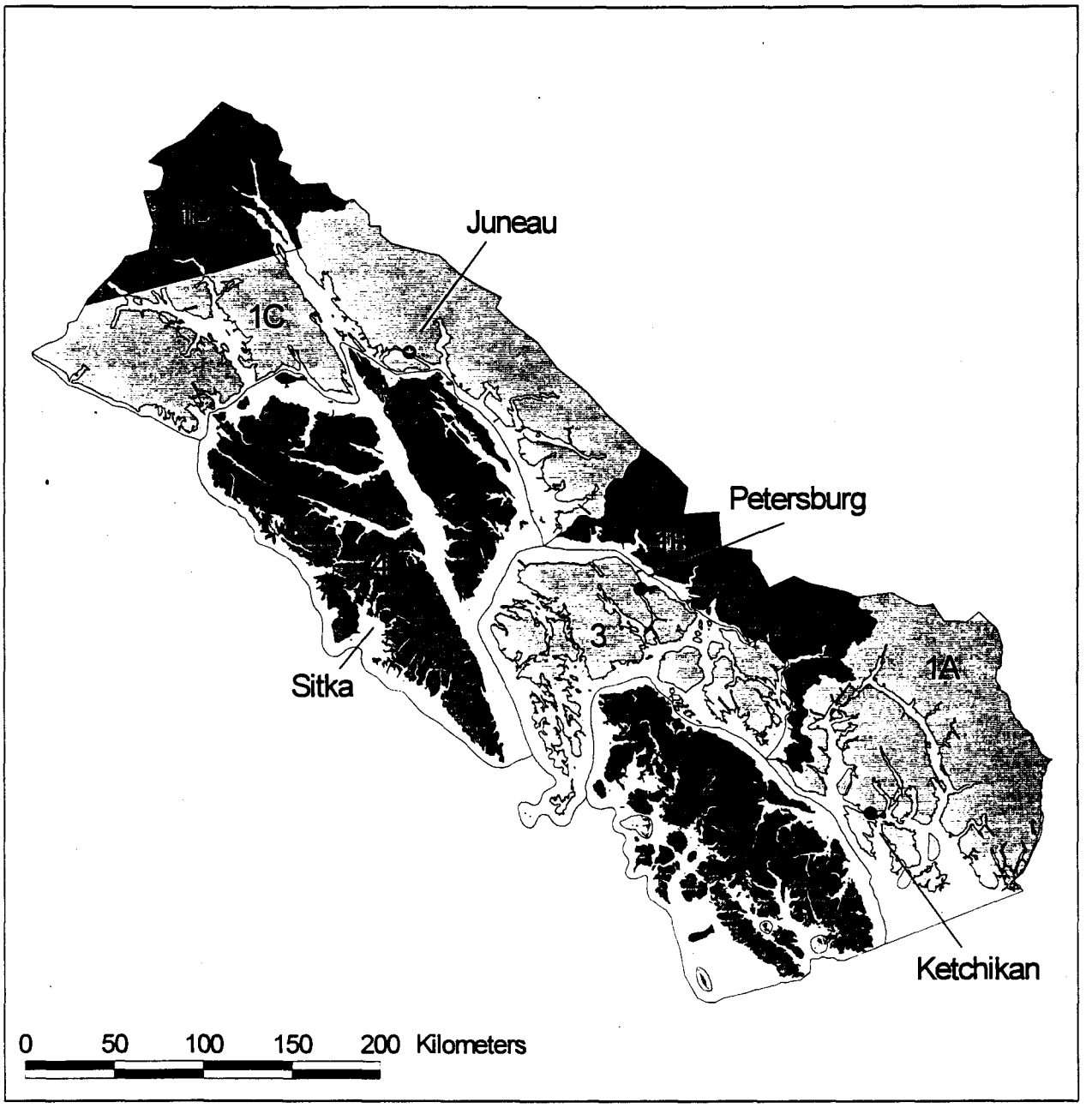
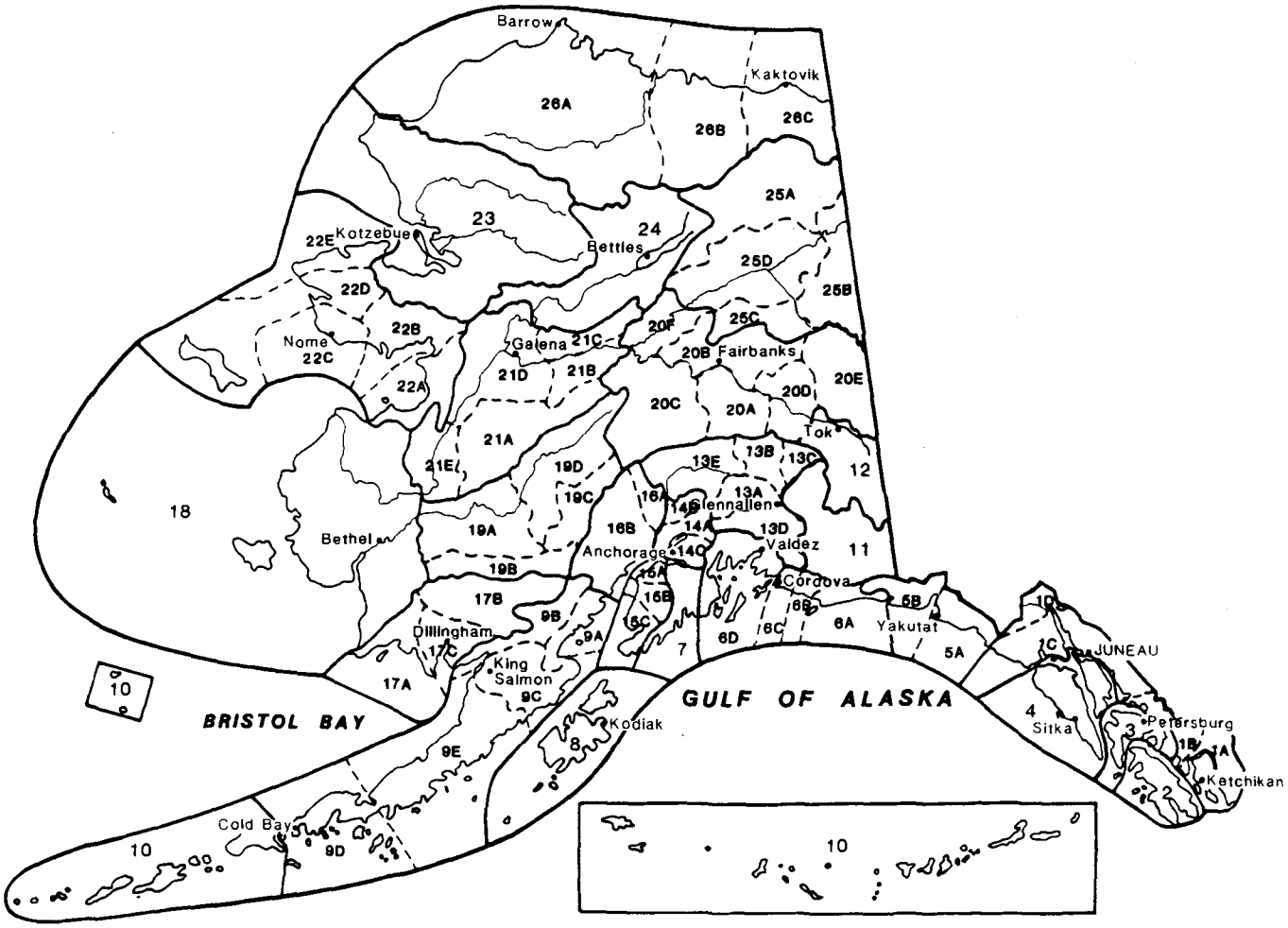
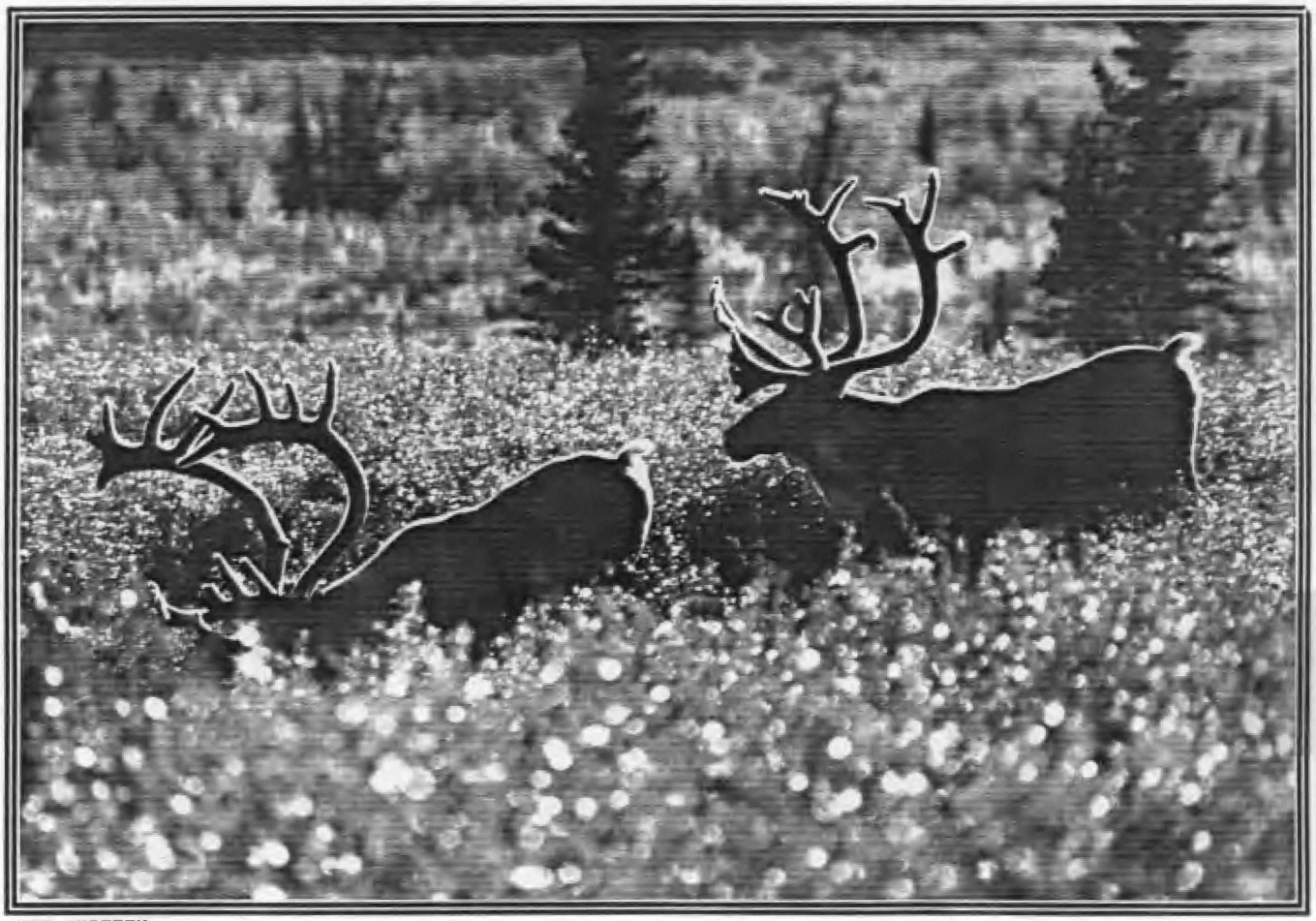


Figure 1. Location of Game Management Units in Southeast Alaska where black bears (Ursus Americanus) were collected for trichinosis survey.

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.



KEN WHITTEN