

ECTO- AND ENDOPARASITES OF THE BLACK BEAR  
IN NORTHERN WISCONSIN

by  
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## ABSTRACT

Black bears (*Ursus americanus*) were live-trapped and examined for ectoparasites during the summers of 1974 and 1975 in northern Wisconsin. Nine bears were captured in 1974 and 104 bears (including 18 recaptures) were captured in 1975.

Thirty-five (79.5%) of 44 captures from Clam Lake in 1975 carried the dog tick (*Dermacentor variabilis* Say, 1821), one (2.3%) the winter tick (*D. albipictus* Packard, 1869), and one (2.3%) the black-legged tick (*Ixodes scapularis* Say, 1821) -- a new host and state record. Forty-five (75%) of 60 bears captured in Iron County in 1975 carried dog ticks. Dog ticks occurred on 76.9% of the 1975 captures and on 72.6% of all captures. Four (6.7%) of the bears captured in Iron County in 1975 had moderate to heavy infestations of a louse (*Trichodectes pinguis euarctidos* Hopkins, 1954). Mange was observed on five (5.8%) bears captured in 1975; two *Demodex* (Owen, 1843) mites were discovered in a scab sample. The black bear is a new recorded host for this mite. None of 70 tissue samples was positive for *Demodex*. A flea was collected in 1974 from an Iron County bear. Dental caries were present in nine (10.5%) bears captured in 1975. Periodontal disease was present in one (1.2%) Clam Lake bear.

Twenty-eight viscera were obtained from hunter-killed bears during the 1974 and 1975 fall bear hunting seasons. Twenty-five (89.3%) intestinal tracts contained ascarid worms (*Baylisascaris transfuga* Rudolphi, 1819). Fifty-nine (64.1%) of 92 fecal samples examined from live-trapped bears had *B. transfuga* eggs; 11 (39.3%) of 28 samples examined from viscera were positive. An unidentified hookworm larva was recovered from a bear captured in 1975. Adult filarial worms (*Dirofilaria ursi*

Yamaguti, 1941) were found in two (7.1%) viscera. Seventeen (19.5%) of 87 blood smears contained microfilariae. The broad fish tapeworm (Diphyllobothrium latum Linnaeus, 1785), reportedly common in humans and black bears in the Lake Superior region earlier in this century, was absent from all viscera and fecal samples examined. The trichina worm (Trichinella spiralis Owen, 1835) was found in 6 (3.8%) of 163 Wisconsin bears in a study from 1970 to 1973; none was found in viscera or tissue samples examined from this study.

Tooth sectioning revealed an age range from 0.5 to 15.5 years for bears captured in 1975. The average age for males and females was 4.5 and 6.02 years, respectively.

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## TABLE OF CONTENTS

ABSTRACT . . . . .	iii
ACKNOWLEDGEMENTS . . . . .	v
LIST OF TABLES . . . . .	ix
LIST OF FIGURES . . . . .	ix
INTRODUCTION . . . . .	1
LITERATURE REVIEW . . . . .	2
STUDY AREA . . . . .	9
METHODS AND MATERIALS . . . . .	10
Capture Methods . . . . .	10
Ectoparasite Examination, Blood and Fecal Preparation . . . . .	14
Endoparasite Examination . . . . .	15
RESULTS AND DISCUSSION . . . . .	16
Live-trapping . . . . .	16
Ticks . . . . .	20
The Dog Tick . . . . .	20
The Winter Tick . . . . .	22
The Black-legged Tick . . . . .	23
Tick Bites . . . . .	23
Tick Paralysis . . . . .	24
Medical and Veterinary Significance of Tick Incidence to this Study . . . . .	24
Follicular Mites . . . . .	26
Fleas . . . . .	28
Lice . . . . .	29
Deerflies . . . . .	30
Mosquitoes . . . . .	30

Viscera Acquisition	. . . . .	31
Ascarid Worms	. . . . .	31
Dirofilariidae	. . . . .	35
Trichinae	. . . . .	36
Diseases	. . . . .	37
Dental Caries	. . . . .	37
Periodontal Disease	. . . . .	38
SUMMARY	. . . . .	40
LITERATURE CITED	. . . . .	42
APPENDIX A - Parasites and Disease Reported from <u>Ursus</u> <u>americanus</u> , <u>Ursus</u> spp., and <u>Ailurus</u> <u>fulgens</u> (Procyonidae)	. . . . .	49

## LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Incidence of dental caries in bears captured in the Clam Lake area and in Iron County, summer 1975.	39

## LIST OF FIGURES

1	Black bear capture sites, summer and fall 1974, and summer 1975.	18
2	Points of capture of 444 bears in the Clam Lake area 1975, and 60 bears in Iron County 1975.	19
3	Estimated incidence of <u>Dermacentor variabilis</u> from 444 black bears live-trapped in the Clam Lake area 1975, with one case each of <u>D. albipictus</u> (No. 444) and <u>Ixodes scapularis</u> (No. 42).	21
4	Mange-infected 46.2-kg boar, live-trapped in Iron County 16 May 1975. Note alopecia on most of the head.	27
5	Incidence of adult <u>Baylisascaris transfuga</u> from 28 hunter-killed black bears from northern Wisconsin, fall 1974 and 1975. Two bears carrying 51 and 132 <u>B. transfuga</u> had portions of their small intestines occluded.	32
6	Points of harvest of 25 bears infected with <u>Baylisascaris transfuga</u> in northern Wisconsin, fall 1974 and 1975.	33

## INTRODUCTION

The black bear (*Ursus americanus*) is an important big game species in Wisconsin with an annual harvest of 500 - 800 animals. Although its habits, food preferences and activities are generally well known, little is known in this state about its parasites and diseases. The only study of bear parasites undertaken in Wisconsin was a study of trichinosis in black bears (Zimmerman cited in Rogers 1975). With recent trichinosis flare-ups in Alaska (Maynard and Pauls 1962), California (Jordan et al. 1975), New England (Roselle et al. 1965), Minnesota and Michigan (Rogers 1975), New York, Pennsylvania, Vermont and West Virginia (Zimmerman 1970), and Saskatchewan (Emson et al. 1972), the potential for this problem should be re-examined in Wisconsin. Because bear meat in Wisconsin is used to a moderate extent for human consumption, and since bears live in close proximity to domestic and game animals, they may serve as reservoir hosts for parasites of public health and veterinary importance.

Parasites of public health importance that were investigated in this study include the trichina worm (*Trichinella spiralis*), the broad fish tapeworm (*Diphyllobothrium latum*), the hydatid tapeworm (*Echinococcus granulosus*), the wood tick (*Dermacentor andersoni*), the dog tick (*D. variabilis*), and the winter tick (*D. albipictus*). Parasites of veterinary significance, in addition to those just listed, include the common stomach worm (*Haemonchus contortus*), the salmon poisoning fluke (*Nanophyetus salmincola*), and the dog hookworm (*Ancylostoma caninum*).

The objectives of this study are: (1) to determine the incidence of ecto- and endoparasites and disease in northern Wisconsin black

bear, and (2) to investigate parasites and/or disease as a factor governing bear abundance.

#### LITERATURE REVIEW

Current parasite data on the black bear, particularly from the Lake Superior region, is lacking. Zimmerman (cited in Rogers 1975) conducted a three-year study of trichinosis in Wisconsin and northern Michigan black bears, and Rogers (1975) studied bear parasites in northeastern Minnesota and northern Michigan. Published literature on parasites in this area is limited to reports of filariid worms (Dirofilaria ursi) from southern Ontario (Anderson 1952; Choquette 1952), and a report of broad fish tapeworms (Diphyllobothrium latum) from northern Minnesota (Vergeer 1930). Although Jackson (1961) described several parasites found in Wisconsin bears, including a tick (Dermacentor sp.), a flea (Chaetopsylla setosa) and the trichina worm (Trichinella spiralis), no reference to an authority was cited. Dental caries in molars were mentioned as a common problem. A comprehensive ecto- and endoparasite survey of the black bear in northern Wisconsin had not been undertaken.

Twenty-five species of parasites are known to infect the black bear throughout North America (see Appendix A). Erickson (1967) stated that in North America infestations of ectoparasites are generally rare in black bears, but when present, include ticks, lice and fleas. Endoparasites are generally more common and include trichinae, ascarid worms, tapeworms, lungworms, eyeworms, hookworms, and filariid worms. Trichinae gave the most cause for public concern since the propensity of bears to forage at sanitary landfills affords ample opportunity for bears

to be infected by Trichinella spiralis.

Except for dental and skeletal disorders, Erickson (1967) reported that diseases of black bears occur infrequently (see Appendix A).

Dental diseases and periodontal disease were common in older bears.

Other reported diseases include liposarcoma tumors of the uterine horn, tumors of the eyelid and scrotum, and broncho-pneumonia.

Rogers (1975) discovered the following parasites in Minnesota and Michigan black bear: dog ticks, winter ticks, lice (Trichodectes pinguis euarctidos), ascarid worms (Baylisascaris transfuga), filariid worms, taeniid tapeworms (Multiceps serialis), and unidentified fleas.

Anderson (1951, 1952) found filariid worms in subcutaneous tissues of all 20 black bears examined from Algonquin Park, southern Ontario.

Choquette (1952) reported a new species of filariid worm (Dirofilaria desportesi) in black bear from Ontario. However, Yamaguti (1961) considers D. desportesi synonymous with D. ursi, and not a new species as Choquette (1952) indicated.

D. ursi have been found throughout the northern United States, including Montana (Jonkel and Cowan 1971; Worley et al. 1975), New York (King et al. 1960), and Alaska (Rausch 1961).

The broad fish tapeworm is important to public health because earlier in this century it was common in humans and black bears in the Lake States (Magath 1927; Vergeer 1930; Rogers 1975). Infection with this parasite is acquired by ingesting fish containing live larvae. Infected bears serve as a reservoir host for the parasite and provide a source of infection for fish by contaminating lakes and streams with feces containing worm eggs (Horstman 1949).

Vergeer (1928) successfully infected two black bears with plerocercoids (infective larvae found in fish muscle) of Diphyllobothrium latum.

The broad fish tapeworm has been found in black bears in Yellowstone National Park (Scott and Honess 1934; Rush 1932). Scott (1932, 1934) found D. cordatum in bears from the same locality. Skinker (1931, 1935) reported D. latum in a black bear cub in Yellowstone Park. He also reported (1931) a 7.3 m broad fish tapeworm from an adult black bear in Kechikan, Alaska. Martin (1950) discovered the first case of an unidentified larval tapeworm infection in a California black bear.

In the laboratory, a captive bear was fed Diphyllobothrium plerocercoids and the cestodes penetrated the duodenum into the two pancreatic ducts, completely occluding them and killing the bear (Rausch 1955).

Rausch (1954) discovered a new species of tapeworm (D. ursi) in black bears of Kodiak Island, Alaska.

The common dog heartworm (Dirofilaria immitis) was first reported in a black bear from North Carolina (Johnson 1975). Five adult heartworms were recovered from the right ventricle and pulmonary artery. The uteri of the two largest female worms contained infertile ova. The black bear is not a suitable host for completion of the life cycle of D. immitis. D. immitis is easy to distinguish from D. ursi which lives as adults in the connective tissue of black bears.

Jonkel and Cowan (1971) examined black bears in the Big Creek area, west of Glacier National Park, Montana and ectoparasites were the primary form of parasitism in bears. All bears had wood ticks (Dermacentor andersoni) and fleas (Arctopsylla ursi) were found on two bears as were microfilarids (Dirofilaria ursi). Tapeworms (Taenia saginata) were occasionally collected in the scats and hookworms (Uncinaria yukonensis) were found in one bear. Wolfgang (1956) described

this hookworm (U. (=Dochmoides) yukonensis) from a black bear in the Yukon. Jonkel and Cowan (1971) found no diseased black bears. They concluded that even though parasites and disease contribute to some bear deaths, especially subadults, they were of no importance in their study.

King et al. (1960) noted that black bears in New York were relatively disease-free. Disease problems included tumors, an abdominal hernia, alopecia, bronchiectasis, micro-abscesses on the diaphragm and liver, emphysema and pneumonia.

Bear parasite incidence varies according to location, time of year, moisture conditions and other variables. While Jonkel and Cowan (1971) found all their Montana black bears infected with wood ticks, only two ticks (Ixodes sp.) were found on 306 black bears examined in New York by King et al. (1960). Lice, microfilariae (Dirofilaria ursi), roundworms (Toxascaris multipapillata), trichinae and a new genus of lung-worm (Crenosoma) were discovered in the New York bears.

Dodds et al. (1969) reported the dog tick (Dermacentor variabilis) from a black bear in Nova Scotia.

Rogers (1975) discovered unidentified fleas on a black bear in Michigan. Prior to this find, the southeastern-most records came from Montana (Hubbard 1968; Jonkel and Cowan 1971; Worley et al. 1975). However, the Mallophagan louse (Trichodectes pinguis euarctidos) is more widespread, having been reported on black bear in New York (King et al. 1960), Ontario and British Columbia (Hopkins 1954), Montana (Jonkel and Cowan 1971; Worley et al. 1975) and Michigan (Rogers 1975).

Hopkins (1954) described a new subspecies of louse (Trichodectes pinguis euarctidos) on a black bear from British Columbia and on a bear from Algonquin Park, Ontario.

Olsen (1968) reported a new species of hookworm (Uncinaria rauschi) in Alaskan black bears.

Horstman (1949) examined five black bears killed in southwestern Colorado and discovered the following parasites: wood ticks, ascarid worms (Toxascaris multipapillata) and three species of tapeworms (Taenia pisiformis, Mesocestoides krulli and Anacanthotaenia olseni). The latter two tapeworm species were previously undescribed.

The ascarid worm (Baylisascaris transfuga) has been reported throughout the range of the black bear in Canada and northern United States (Sprent 1968; Rogers 1975), but not from southern United States (Rogers and Rogers 1975).

Herman (1944) listed the black bear as a host for the eyeworm (Thelazia californiensis). Blindness may be caused by this nematode.

Five (2.6%) of 195 black bear skulls examined by Hall (1940) had dental caries. Hall (1945) found dental caries to be fairly common, particularly in older animals.

Trichinosis is the most widely studied parasite in black bears because of its danger to humans. An epidemic of trichinosis occurred in New England in 1965 when six people ate inadequately cooked black bear meat and became ill (Roselle et al. 1965). Two outbreaks occurred in the Bethel area among the Eskimos in 1962 in Alaska. The source of the infestations was traced to meat of black and brown bears (Ursus arctos) (Maynard and Pauls 1962; Maynard and Kagan 1964). Twenty-three people were involved in an outbreak of trichinosis resulting from ingestion of black bear meat in Georgia in 1972 (Ward and Lyman 1972). Twelve of the 18 persons who ate uncooked meat developed fever, muscle pains, edema and an increase in the eosinophil blood count.

A 22-year-old Alaskan woman ate poorly cooked bear meat in a bizarre suicide attempt in 1967 (trichinosis can prove fatal) (Wilson 1967). She became severely ill and biopsy of her calf muscle showed motile larvae of T. spiralis. She was treated with an antinematodal agent, thiabendazole, and recovered.

A severe human case of trichinosis was reported by Jordan et al. (1975) following ingestion of raw black bear meat from California. In addition, a marked rise in titer of antibodies to Toxoplasma gondii was observed in the patient. A dual infection could have been acquired from the bear meat.

Babbott and Day (1968) conducted a trichinosis survey from 35 black bears in Vermont with negative results.

Zimmerman (cited in Rogers 1975) discovered 6 (3.8%) of 1963 black bears between 1970 and 1973 in Wisconsin carrying trichina cysts. In a 1970 study, 5 (1.3%) of 372 bears examined from New York, Pennsylvania, Vermont and West Virginia were infected with trichinae (Zimmerman 1970).

Five of 23 black bears examined in southern Alaska were infected with T. spiralis (Rausch et al. 1956). Two women from Nenana, Alaska ate black bear meat and were infected with trichinosis.

According to Zimmerman (1970), the trichina worm is the most ubiquitous of helminth parasites known; probably all mammals and some birds are carriers. He discussed other means of transmission: scavenging, fecal transmission and mechanical transmission by carrion-eating insects. Over 104 animals are known hosts (Zimmerman 1971).

Trichinosis among bears is a world-wide problem. Epidemics have been reported in humans eating raw meat of the Himalayan bear (Selenarctos thibetanus) (Doerge et al. 1969) and brown bear (Bauer 1957).

According to Rogers (1975) cannibalism of carcasses is common in the black bear and may play a major role in trichinosis transmission.

Farrell et al. (1973) experimentally introduced the trematode (Nanophyetus salmincola) containing the salmon-poisoning disease rickettsial organism (Neorickettsia helminthoeca) into black bear. This condition was designated Elokomin fluke fever. This unique trematode is commonly called the salmon-poisoning fluke because it serves as the vector for N. helminthoeca which is extremely toxic to canine hosts that ingest raw salmon parasitized with this trematode. Usually about 90% of naturally infected dogs die of salmon-poisoning disease (Cheng 1973).

Ticks are medically important as vectors of Rocky Mountain spotted fever, tularemia, tick paralysis and other diseases (Horstman 1949).

Hair and Mahrt (1970) described two new species of sporozoan parasites (Eimeria albertensis and E. borealis) from black bears in Alberta.

Noble (1958) reported several protozoa found in Wyoming black bear. These included flagellates (Cercomonas sp., Copromonas ruminantium and Monas communis), amoeba (Vahlkampfia sp. and Sappinia diploidea) and ciliates (Nyctotherus sp.).

West (1972) listed the black bear as one of the mammals involved in a rabies epidemic in Alberta from 1952 to 1954. He also stated that in 1967 at least 185 people required treatment after bites from rabid bears.

## STUDY AREA

Bears were live-trapped in northern Wisconsin in Iron, Oneida and Taylor counties during 1974. The topography of Iron County is generally rolling with many lakes, swamps and bogs. The predominant vegetation type is northern mesic forest composed largely of red maple (Acer rubrum), sugar maple (A. saccharinum), hemlock (Tsuga canadensis), yellow birch (Betula lutea), white birch (B. papyrifera) and quaking aspen (Populus tremuloides) (Curtis 1971). The central and far northern portions of the county consist of boreal forest with balsam fir (Abies balsamea) and white spruce (Picea glauca) predominating. The central and southern portions of Iron County contain conifer swamps dominated by black spruce (P. mariana), tamarack (Larix laricina) and white cedar (Thuja occidentalis). Oneida County is also generally rolling with an abundance of lakes. The predominant vegetation is pine forest; white pine (Pinus strobus) and red pine (P. resinosa) are the dominant species. Quaking aspen has replaced many of the conifer stands where logging has occurred. The northern mesic forest is second largest in importance, followed by conifer swamps and pine barrens. The latter consist largely of jack pine (P. banksiana) and prairie grasses. The topography of Taylor County is flat to gently rolling; few lakes are present. The dominant vegetation is northern mesic forest. Much of this area is covered by quaking aspen since about 50% of all land was logged in Taylor County (Stone and Thorne 1961).

Bears were live-trapped in Iron County and in the Clam Lake area (Ashland, Bayfield and Sawyer counties -- referred to as "the Clam Lake area") in 1975. The topography of the Clam Lake area is flat to gently rolling; many lakes, swamps and bogs are evident. The dominant vegetation in this area is northern mesic forest (Curtis 1971). Basswood (Tilia americana) is also a dominant species. Conifer swamps

comprise the second most abundant vegetation type in this area. Quaking aspen has replaced much of the northern forest vegetation where logging has occurred.

The vegetation in the Clam Lake area is generally younger successional than in Iron County although vegetative cover types of Iron County and the Clam Lake area are similar according to Curtis (1971). Soils in the Clam Lake area are generally sandy to sandy loam types while those in Iron County are heavier and more mature.

Only one active sanitary landfill maintained by the National Forest Service just east of Forest Road 191, Bayfield County, is present in the Clam Lake area. Nine sanitary landfills are present in the Iron County study area.

## METHODS AND MATERIALS

### Capture Methods

Four types of traps were used to capture bears for ectoparasite study. A trailer-mounted culvert trap was used during the summer of 1974 and on one occasion during the summer of 1975. A steel-mesh box trap was used on one occasion in the Clam Lake area in 1975 and the Aldrich foot snare was used in Iron County in 1975.

The newest capture method is the barrel trap developed in Minnesota (Rogers 1974 pers. comm.; Kohn 1974 pers. comm.). The trap consists of two 55-gallon steel drums welded together. Bait (meat scraps, oil of anise and Liquid Smoke) was placed at the distal end of the trap behind a vertical, notched trip stick. The bear bumps the stick, disengaging the notch and releasing a guillotine-like trap door. Wheels were added

to increase trap maneuverability; total trap weight averaged 50 kg.

Culvert trapping was undertaken in the Chequamegon National Forest, Taylor County, and in Bayfield County from 27 June to 14 August 1974.

I used four barrel traps during intermittent trapping in Iron, Marathon and Portage counties from 31 August to 13 October 1974. Seven barrel traps were set in the Clam Lake area from 18 May to 27 June and from 6 July to 11 August in 1975.

Barrel traps usually were set in late afternoon or early evening and were checked at least once daily, usually in the morning. Traps were removed from the area, scrubbed down with water and detergent, and returned to be reset following each capture in the Clam Lake area during the breeding season (15 June to 15 July). This procedure removed any scents that could have frightened other bears. This practice was discontinued following the breeding season. Old bait and fecal matter were removed from the trap when a bear was captured; the trap was re-baited and reset. The trap was removed and set in a new area after two recaptures were made. All traps in the Clam Lake area were numbered, marked and chained to nearby trees because of the theft of a trap in Iron County in 1974.

All trap sets, except one at a National Forest Service sanitary landfill, were located in wild forested sites in the Clam Lake area. In Iron County, traps were set by the DNR in nine sanitary landfills and numerous wild forested sites during the summer of 1975.

Once a bear was captured in a barrel trap, the trap and bear were elevated for weighing using a block and tackle attached to a spring scale. The bear's actual weight was determined by subtracting the trap weight. This procedure permitted an accurate determination of the

animal's weight to calculate drug dosage. Weight was estimated in cases where bears were captured in culvert or box traps, or Aldrich foot snares. Each bear was later reweighed by placing a rope around the front and opposite hind foot and hoisting the animal on a block and tackle attached to a scale.

Bears were anesthetized with a combination of phencyclidine hydrochloride (Sernylan; 1.1 mg/kg of body weight) and promazine hydrochloride (Sparine; 0.55 mg/kg of body weight) (Rogers 1974 pers. comm.). Phencyclidine hydrochloride was first used successfully on 52 black bears in 1968 (Pearson et al. 1968). However, when the drug was used alone, minor twitching and muscular spasms resulted (Harthoorn 1965). When used in combination with promazine hydrochloride, spasms were eliminated (Harthoorn 1965; Rogers 1974 pers. comm.). No antagonist was used with the Sernylan-Sparine drug combination.

A bear was deemed safe for handling after its head lay flat on the trap and a finger-snapping or trap-tapping stimulus failed to elicit a blink response. The bear was then removed from the trap and placed on its side, with the head slightly elevated, allowing for drainage of saliva.

A conventional jab stick was used to inject bears with the drug combination during 1974 and early in the summer of 1975 (Rogers 1974 pers. comm.; Kohn 1974 pers. comm.). As a result of premature injection of drug into cutaneous and subcutaneous tissue, a new type of jab stick was developed by Kohn (1975 pers. comm.) of the Wisconsin DNR. The syringe needle enters muscle tissue before the drug is released and no drug is lost during tissue entry. Only when the needle is fully inserted into tissue is the plunger depressed and the drug expelled. I

shortened the jab stick developed by Kohn for lighter weight and greater maneuverability and handling qualities.

About 1 cc of Procaine (a local anesthetic) was introduced into the gum around one of the two P1 teeth of the lower jaw before the tooth was extracted for sectioning and aging. The tooth was extracted with dental pliers and a probe about 5 minutes after Procaine injection. The wound was cleansed with 70% isopropyl alcohol and a sterile pad. Age was determined by counting cementum annuli (Craighead et al. 1970; Willey 1974).

Procaine was injected into the vastus externus/gastrocnemius area prior to tissue biopsy, and about 3 mm<sup>3</sup> of tissue were collected. The tissue was fixed in 10% formalin. The wound was washed with 70% isopropyl alcohol and treated with Furacin powder to reduce the possibility of infection. Hair was removed from the biopsy area for later examination of louse eggs.

Nose to ear length and nose to tail length were taken from each bear. Although these measurements only give an approximate indication of age, they are helpful when correlated with tooth-sectioning data. An estimated age was recorded for each bear live-trapped in the field using skull length, body length, weight and tooth wear.

Each bear was examined for dental caries and periodontal disease. Suspected decayed areas of the teeth were scraped with a dental probe to differentiate simple plaque deposits and tartar from true dental caries. Decay was evident where the enamel and dentin were broken down or disintegrated. Acid-producing bacteria and their products are the causative agents of dental caries (Dorland 1917).

Numbered metal cattle ear tags were placed in the proximal dorsal

cartilaginous portion of each ear. Each tag had a DNR return address; successful bear hunters could claim a \$5 reward for each tag.

#### Ectoparasite Examination, Blood and Fecal Preparation

Ticks were removed from the neck, underforeleg and groin areas of anesthetized bears. All ticks were removed where infestations were light. Only a portion of the ticks was removed where tick incidence numbered in the hundreds. An estimate of the adult male-female tick population could be made for each bear examined by random removal.

Fleas and lice also were collected and all or portions of scabs were scraped or cut off and later examined for mites.

About 50 cc of bear fecal matter was collected and stored in 10% formalin for later fecal flotation studies. Fecal matter was readily available from the traps.

Any scars, infections or diseases were noted. Scrotal sacs were examined for bot fly larvae (Cuterebra emasculator). Photographs of each capture were taken for documentation purposes. Ten cc of blood were extracted from the femoral artery using a heparinized Vacutainer tube and were refrigerated as quickly as possible. Two blood smears were made during this procedure. Slides were air-dried, later fixed in absolute methanol, and Giemsa-stained for microfilarian examination.

Ectoparasites were counted and examined to determine species and sex. Ticks of the genus Dermacentor were identified from Cooley (1938). The Ixodes tick was identified from Cooley and Kohls (1945). Trichodectes were speciated and sexed using Hopkins (1954). Mites were identified using Pillers (1921), Baker and Wharton (1952), Hughes (1959),

Carpenter et al. (1972) and Desch and Nutting (1974).

Tick and lice specimens were cleared in 10% KOH using standard methods described by Kennedy (1932) and Frankel et al. (1970). Biopsy samples were prepared using standard histological procedures (Frankel et al. 1970). Additional tissue samples were placed in 5% KOH for 18 hours at room temperature to acquire whole mites (Carpenter et al. 1972).

Deerflies (Chrysops discalis) and mosquitoes (Culex) were stored in a 70% ethanol 10% glycerin solution.

The refrigerated blood was centrifuged at 2500 rpm's for 10 minutes and two additional blood smears were prepared from the buffy area immediately above the erythrocytes (Sweicki 1974 pers. comm.). These also were stained with Giemsa.

Slides of fecal flotation material were prepared using the standard Sheather's sugar flotation technique described by Sloss (1972).

#### Endoparasite Examination

Hunters were contacted personally, by phone or by mail, and asked to place the viscera from harvested bears in plastic garbage bags and freeze them. No attempt was made to tie off portions of the intestine to prevent postmortem helminth migration before freezing.

A blood sample was syringe-extracted from the heart or lungs, smeared on a slide, fixed in absolute methanol and stained in Giemsa as the viscera thawed.

Each organ was then removed and carefully examined for parasites. Diaphragm samples were examined for trichinosis using the standard digestion technique described by Hill (1951). In addition to visual examination, all organs were washed in a water bath to detect any

parasites that might be partially concealed in blood clots, body fluids or food material. Epidermal tissue around the genital area was examined for mites. Portions of intestinal matter were examined microscopically and fecal samples were collected for flotation studies.

All ascarid worms were stored in a 70% ethanol 10% glycerin solution. Number, location and sex of each worm were recorded. Adult microfilarian worms were stored in this ethanol-glycerin solution, later to be cleared in acetic acid and mounted in lacto-phenol for species and sex determination.

Three literature sources were used to identify ascarid worms: Sprent (1968), Yamaguti (1961) and Okoshi et al. (1962). Keys by Anderson (1952), Choquette (1952) and Yamaguti (1961) were used to classify filariids.

## RESULTS AND DISCUSSION

### Live-trapping

Bears up to 181 kg were captured in barrel traps. Once a bear was drug-injected inside a barrel trap, it became immobilized in approximately 6 to 10 minutes; the anesthetization lasted 1 to 1.5 hours.

During the summer of 1974 trap visitation by bears was poor; only one bear was captured in a culvert trap in Taylor County on 12 August. From 6 August to 2 September 1974, DNR personnel set barrel traps at sanitary landfills in Oneida County and six bears were captured. I captured two additional bears in Iron County on 12 and 13 October 1974.

Trapping success improved in 1975 and I made 44 captures involving

26 individuals from 18 May to 11 August. Barrel traps were set in a four township area in Ashland, Bayfield and Sawyer counties (T42-43N, R4-5W). One nuisance bear was captured 13.7 km east of the study area, north of Torrey Lake on Highway 13. DNR personnel provided parasite data from 60 bears captured in Iron County from 7 May to 26 August 1975 (Figs. 1 and 2).

I captured one bear during 34 nights of trapping (one trap set per night) between 27 June and 14 August 1974, and two additional bears during 25 nights of trapping (four traps set per night) from 31 August to 13 October 1974. Forty-four captures were made during 57 nights of trapping (seven traps set per night) from 19 May to 11 August 1975 in the Clam Lake area when trap visitation averaged one bear per four traps set nightly.

Tooth and biopsy wounds were closely examined on all 18 bears recaptured in the Clam Lake area. All wounds healed well, some in less than a week's time.

Two bears in the Clam Lake area reacted poorly to the Sernylan-Sparine drug combination due to each animal's specific reaction to the drugs. Each developed spasmodic tremors and mild convulsions. An additional dosage of about 1 cc of promazine hydrochloride (a tranquilizer) was injected into the front shoulder of each bear, and convulsions stopped. No mortality resulted using the above drug combination.

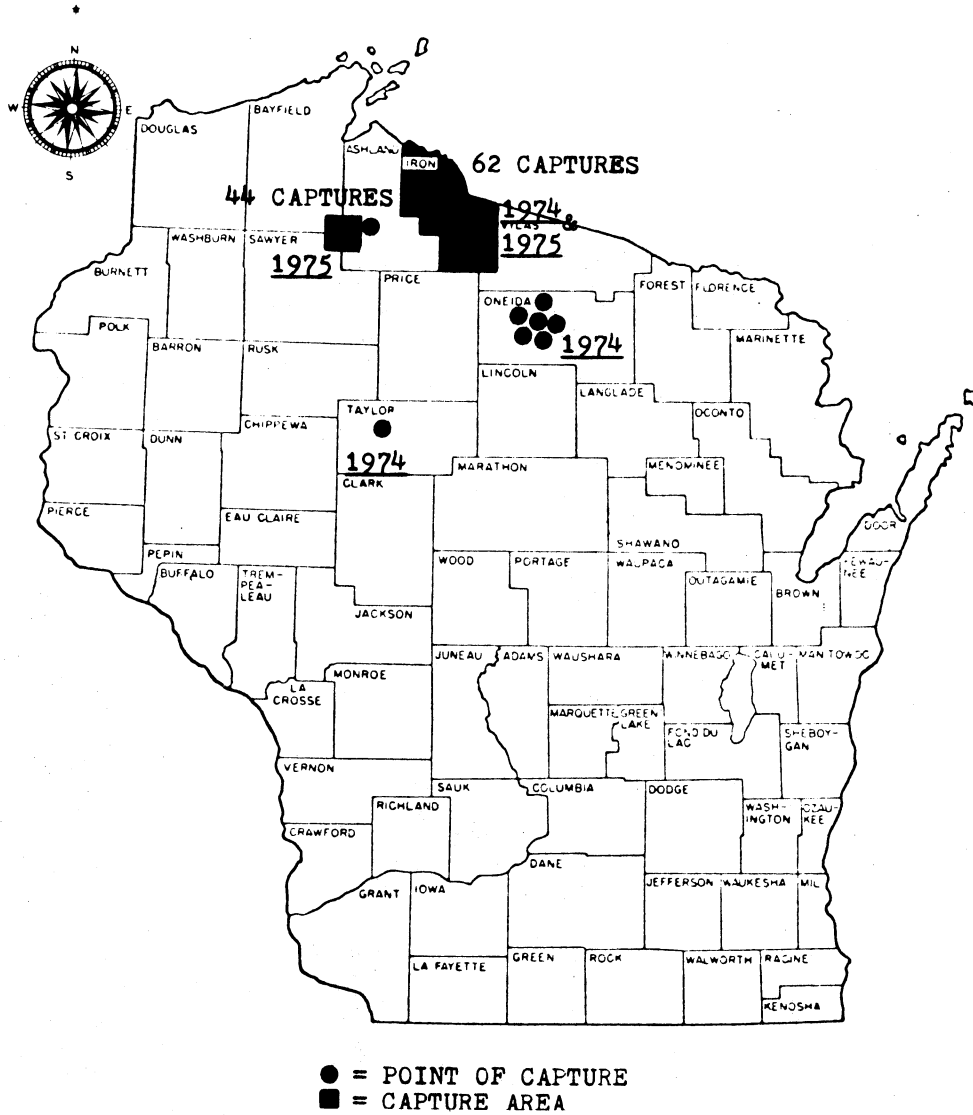


Fig. 1 Black bear capture sites, summer and fall 1974, and summer 1975.

CLAM LAKE AREA  
ASHLAND, BAYFIELD, & SAWYER COUNTIES

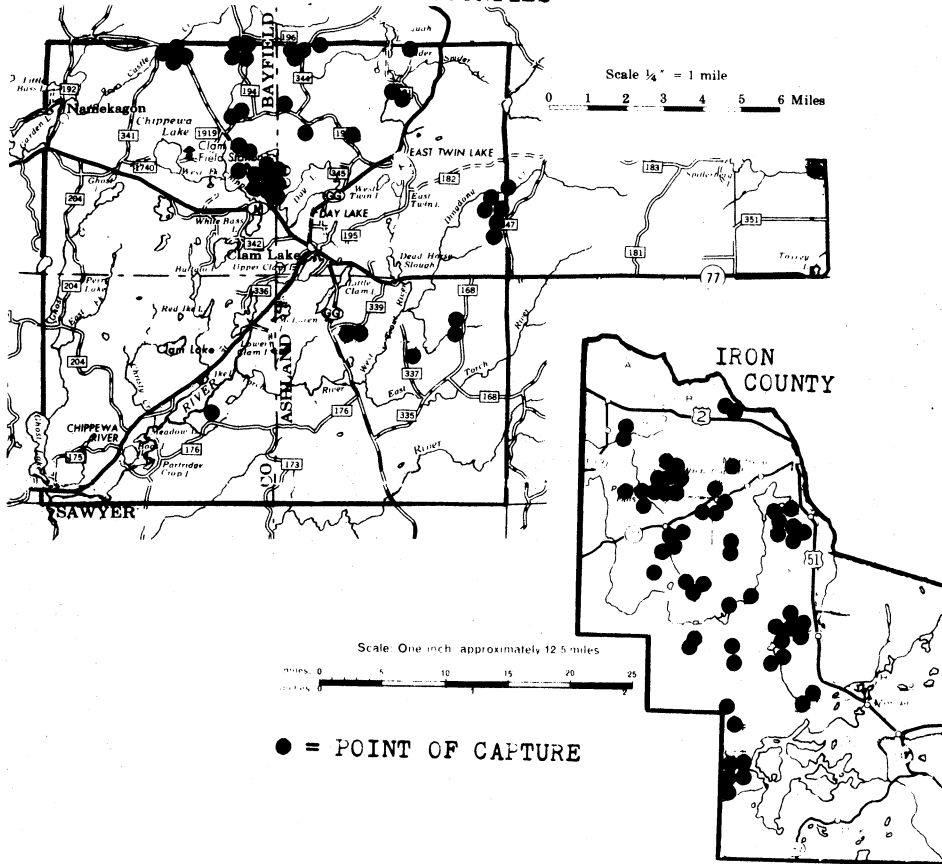


Fig. 2 Points of capture of 44 bears in the Clam Lake area 1975, and 60 bears in Iron County 1975.

## Ticks

### The Dog Tick

Common dog ticks (Dermacentor variabilis) were found on three (33%) of nine bears captured in 1974, 35 (79.5%) of 44 bears captured in the Clam Lake area in 1975, and on 45 (75%) of 60 bears captured in Iron County in 1975. Of the bears captured in 1975, 76.9% carried the dog tick; 72.9% of all bears carried the dog tick.

Dog tick incidence varied from 1 to about 1000 ticks on the 35 bears carrying D. variabilis (Fig. 3). It is possible to count ticks more than once on bears recaptured at short intervals. However, intervals between recaptures were at least a week in duration (except in four cases). Although 15 of the 35 tick-infected bears were recaptured animals, the likelihood of recounting female ticks previously tallied from an earlier capture is minimized because adult female dog ticks drop to the ground to lay their eggs as early as the 3rd day after attachment to their host (Soulsby 1968).

The fourteen dog ticks collected from three bears live-trapped in 1974 consisted of seven males and seven females. Student assistants removed 1557 dog ticks from black bears in the Clam Lake area in 1975; 774 were males and 783 were females. DNR personnel removed 215 dog ticks from 45 Iron County bears in 1975.

Clam Lake bears carried an average of 187 dog ticks from 21 May to 15 July, and an average of nine dog ticks from 16 July to 28 July in 1975 (Fig. 3). Iron County bears carried an estimated average of 50 dog ticks from early May to mid-June, and an estimated average of 30 from mid-June to 28 July in 1975. Dog ticks were not found on bears captured after 28 July 1975 in either area.

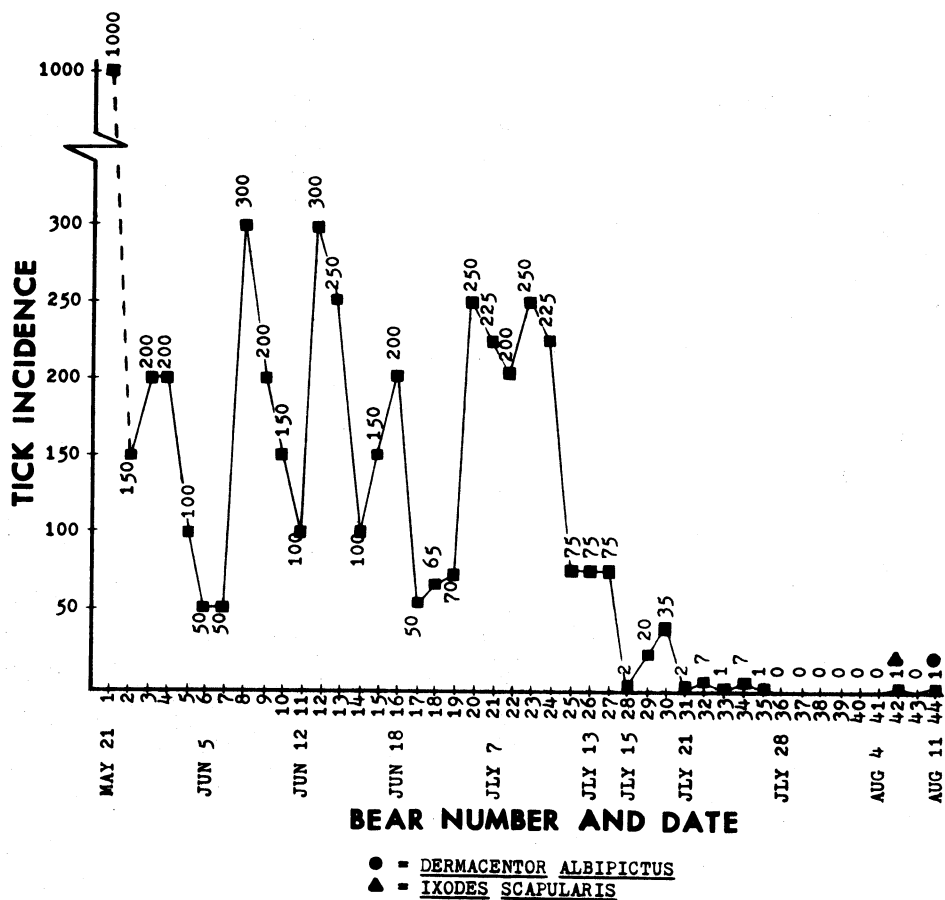


Fig. 3 Estimated incidence of Dermacentor variabilis from 44 black bears live-trapped in the Clam Lake area 1975, with one case each of D. albipictus (No. 44) and Ixodes scapularis (No. 42).

Of the total of 1775 dog ticks removed from 83 tick-infected bears examined in 1974 and 1975, the female to male ratio was nearly even.

A coefficient of correlation was calculated using bear age and dog tick incidence as the dependent and independent variables, respectively, to determine if tick incidence was related to the age of bears. The correlation coefficients from both a 16-bear group of individual captures and a 26-bear group of captures and recaptures were not statistically significant.

#### The Winter Tick

The winter tick (D. albipictus) was found on one bear (2.3%) captured in the Clam Lake area. This was an engorged female collected from the right ear of a 3.5-year-old, 65.7-kg bear captured 11 August 1975 (Ashland County, Section 11, T42N, R4W).

Rogers (1975) noted that among eight adult bears examined in March in Minnesota a sow bore at least 30 winter ticks; her two 2-month-old cubs were free of ticks.

The winter tick has differing habits from other species of Dermacentor. Cold weather stimulates the larvae to seek out a host to which they become attached throughout the winter (Cheng 1973). The larvae, nymphs and adults of this species are found on the same host, illustrating a one-host cycle. After the adult female is engorged, she drops off and lays eggs on the ground. The winter tick may cause a general weakening of the host and even death. The causative agent of death is usually a bacterium (Klebsiella paralytica) carried by the tick (Cheng 1973; Arthur 1962).

### The Black-legged Tick

The black-legged tick (*Ixodes scapularis*) previously found neither on black bear nor in Wisconsin, was identified from one bear (2.3%) in the Clam Lake area in 1975. The tick was a partially engorged adult female collected on 6 August 1975 from the neck of an 8.5-year-old, 83-kg lactating sow with one cub (Sawyer County, Section 23, T42N, R5W).

Say (cited in Cooley and Kohls 1945) reported that the black-legged, or shoulder, tick was common in forests, frequently found attached to animals. No other details were provided. Banks (cited in Cooley and Kohls 1945:15) stated that the black-legged tick was found "from many places in the South, especially abundant in Florida and southern Texas, where it occurs on dogs and man as well as on various wild animals." His northern-most record was from Indiana. Hooker et al. (1912) pointed out that adult black-legged ticks have been recorded on dog, deer, horse and opossum, with the immatures of this species on birds, including quail, jay and thrush. The black-legged tick may have come to Wisconsin, then, through avian transmission.

Gregson (1956) stated that *I. scapularis* may already be present in Canada. It may be introduced by domestic or game species moved by man or in natural migration.

*I. scapularis* is listed as an effective experimental vector of tularemia in the United States (Hopla 1960).

### Tick Bites

Tick bites may produce two pathological conditions: local and systemic damage. Of the former, local inflammation and traumatic damage usually occur at the site of hypostome attachment (Cheng 1973).

The damage may only be mild inflammation, or it may be more serious if the auditory canal is invaded. The second may result in paralysis.

### Tick Paralysis

Systemic damage results from the bite of D. andersoni, D. variabilis and others, resulting in a condition termed tick paralysis. The infliction is a motor paralysis induced by the bites of Dermacentor spp. on man, domestic animals and wildlife (Arthur 1962). There is no evidence of infective organism involvement. The cause of the disease has not as yet been conclusively proven, but the anticoagulant secreted by the salivary glands of the tick is suspected as the paralyzing agent and a type of systemic sensitization reaction may occur. The actual toxic substance responsible for the paralysis is believed to be associated with the tick's ovaries or ova (Arthur 1962; Kaire 1966; Cheng 1973). However, in several cases reported by Naegele (1964), a male D. andersoni in Alberta, two Amblyomma americanum males in Florida, and three nymphs in Louisiana were credited with causing tick paralysis in humans.

Although Arthur (1962) stated that wildlife generally appear to be resistant to this disease -- the sole record being an outbreak paralyzing six American buffalo -- subadult black bears, particularly cubs, should be considered potential victims of this disease, especially if they are in poor health prior to infection. The chances of finding a dead or parasitized black bear in the wild, though, are slight.

### Medical and Veterinary Significance of Tick Incidence to This Study

I. scapularis may be responsible for the transmission of the blood disease bovine anaplasmosis (Anaplasma spp.) in some areas (Soulsby 1968). The disease is widely distributed; its acute form kills 30 to 50% of the

cattle it attacks in 24 to 72 hours, following a 40 to 100 day incubation period.

In addition to the black-legged tick, D. andersoni, D. albipictus and D. variabilis have been implicated as vectors of this disease (Hutyra et al. 1949; Arthur 1962).

Since 1939 anaplasmosis has become prevalent in the United States (Naegele 1964). No cure for the disease is currently known (Jones 1967; Cheng 1973). Although black bears appear to play no role as reservoir hosts or as disease transmitters, their role as hosts for dog ticks, particularly in areas where they live in close proximity to cattle, must be recognized.

One of the most feared tick-borne rickettsial diseases in the United States is Rocky Mountain spotted fever caused by Rickettsia rickettsi (Cheng 1973). Ticks responsible as vectors of this disease in central and eastern United States include D. variabilis and D. albipictus.

Rocky Mountain spotted fever has not yet been reported in Wisconsin (Lasitza 1976 pers. comm.). However, reports from eastern Iowa and northern Illinois would indicate a growing possibility of its presence in Wisconsin, especially since reported cases have been increasing since 1959 (U.S. Dept. of Health, Education, and Welfare Public Health Service 1975). The black bear serves as a host of the tick species that could transmit this disease in Wisconsin.

Tularemia, a disease reported in 46 states (Hubbard 1968), is transmitted by the wood tick (D. andersoni), the dog tick, the deerfly (Chrysops discalis), lice and fleas (Noble and Noble 1961). Only ticks

are capable of maintaining the pathogen indefinitely and passing it on to their progeny (Jones 1967).

In 1974, tularemia was reported from two areas in Wisconsin (U.S. Dept. of Health, Education, and Welfare Public Health Service 1975). Although nothing in the literature implicates the black bear as either an asymptomatic intermediate host or as a tularemia disease victim, the use of the bear as a host by the dog tick may help perpetrate this disease in the wild. One of the tularemia cases reported in Wisconsin in 1974 occurred in prime bear habitat.

The chances of dog ticks transferring tularemia to wild animals and humans were enhanced by the presence of large numbers of these ticks, especially during the early summer months of 1975 in the Clam Lake area.

The Saint Louis strain of the Japanese type B encephalitis has been transmitted under laboratory conditions by D. variabilis (Arthur 1962). This past summer several cases of this disease were recorded in South Dakota and in Minnesota. The possibility that the black bear could serve as a reservoir host (from bites either by mosquitoes or dog ticks) cannot be dismissed.

#### Follicular Mites

Five bears live-trapped in northern Wisconsin in 1975 were infected with mange. Two of the bears from Iron County were almost completely bald from the snout to the neck (Fig. 4). Scabby patches were present on a third Iron County bear but baldness was not evident. Two bears from the Clam Lake area were mange-infected. One was partially alopecic on the left shoulder with scabby patches evident, while the other



Fig. 4 Mange-infected 46.2-kg boar, live-trapped in Iron County 16 May 1975. Note alopecia on most of the head.

illustrated diffuse alopecia over the back and flank areas.

The causative agent of mange in the five alopecic bears examined in northern Wisconsin was likely the follicular mite (Demodex sp.). Two cigar-shaped follicular mites similar in appearance to D. canis and D. odocoilei were dissolved out of scab samples from a 2.5-year-old, 54.4-kg sow captured 13 June 1975 in Bayfield County.

Tissue and scab samples from the 54.4-kg sow were dissolved using the technique described by Carpenter et al. (1972). Two Demodex sp. were observed in the KOH solution. Unfortunately, either the KOH concentration was too great or the duration in the solution was too long for the cuticle on both mites was badly dissolved. The mites broke apart and were lost during a pipette transfer to an acid 70% ethanol solution. No other whole mite samples were acquired from numerous tissue samples dissolved in 5% KOH at a 6 hour interval. None of the 70 tissue samples examined following standard histological preparation was positive for Demodex.

To my knowledge, the black bear is a new host record for Demodex.

#### Fleas

One flea was removed from a 161-kg boar captured 12 October 1974 in Iron County, but was lost before it could be identified.

Because of the life history of the flea, bears are not usually parasitized. Fleas are parasitic only as adults. As larvae, fleas feed on detritus, organic debris and blood derived from the excreta of adults. The immature flea then spins a cocoon within which it pupates (Noble and Noble 1961). Except during the winter months, bears rarely bed down in the same site. The chances of acquiring a flea infection,

or of carrying one for any length of time, are minimal.

### Lice

Four (6.67%) of the bears captured in Iron County in 1975 were infected with a Mallophagan louse (Trichodectes pinguis euarctidos). Two bears were suffering from extremely heavy infestations. One bear captured 27 June 1975 was a 11.5-year-old sow weighing 55.7 kg. More severely affected as a 2.5-year-old boar captured 30 June 1975 which weighed only 17.6 kg! The bear carried an estimated 5000 T. pinguis euarctidos and was covered with lice. All four lice-infected bears carried approximately 30 dog ticks each.

Four of 10 adult specimens of T. pinguis euarctidos from the infected bears were males and 6 were females.

Mallophaga feed on the hair of their host (Scanlon 1955). Combine these feeding habits with a heavy louse infestation causing injury and irritation, and it is likely that the host will be unduely stressed. Such appeared to be the case in the 17.6-kg bear.

Tularemia may be carried by T. pinguis euarctidos found on the black bear (Scanlon 1955).

Kartman (1942) conducted experiments with lice on laboratory rats. He noted that those rats in better health had fewer lice than those in poor physical condition. The amount of vitamins in the diet appeared to be directly related to lice incidence -- the greater the vitamin content, the fewer the lice. Kartman's (1942) study may be related to black bear resistance, particularly if an unhealthy animal becomes parasitized.

### Deerflies

Three female deerflies (Chrysops discalis) were collected from an Iron County bear on 14 June 1975. Deerflies were common during mid to late summer 1975. Their importance as an ectoparasite on black bears is probably negligible.

### Mosquitoes

Numerous specimens of Culex, and a few specimens of Aedes and Mansonia were collected from bears in the Clam Lake area and in Iron County, 1975. Bears were readily parasitized by various species of female mosquitoes usually by bites on the nose, snout, lips, and less frequently on other areas of the body that were sparsely covered with hair. Because of a mild winter and unusually moist conditions in the late spring, mosquitoes were prolific in the Clam Lake area and were quite numerous in Iron County from May to early July 1975.

Mosquitoes serve as vectors of various pathogens. The dog heart-worm (Dirofilaria immitis) is transmitted by Culex pipiens (Cheng 1973). Culex, Aedes and Mansonia also may be responsible for transmission of the bear microfilarian (D. ursi). The Saint Louis strain of viral encephalitis has been reported in Illinois, Indiana, Minnesota and other localities. Equine encephalitis, although primarily a disease of horses, occasionally occurs in humans. Western equine encephalitis, carried by Culex pipiens and other species, has been reported in Wisconsin. Eastern equine encephalitis, carried by Mansonia, Culex and Aedes, has occasionally been reported in Wisconsin (Cheng 1973). Although it is extremely unlikely that bears are affected by viral encephalitis, they

could serve as potential reservoir hosts for these diseases.

#### Viscera Acquisition

Thirteen viscera were collected from hunters in Iron, Price, Rusk and Taylor counties in 1974. Fifteen viscera were obtained from hunters in Ashland, Iron, Price and Rusk counties in 1975. Twenty-three of the viscera were complete. One had the heart missing, one was without the heart and kidneys, and heart and liver had been removed from three others.

#### Ascarid Worms

The ascarid worm (Baylisascaris transfuga) was the most prevalent helminth parasite present in the 28 viscera acquired from hunters. Twenty-five (89.2%) of the 28 intestinal tracts had this parasite, ranging from 1 to 132 worms per bear (Fig. 5). Hunter-killed bears yielded a total of 419 worms (Fig. 6). Of these, 204 were males and 215 were females. The average number of adult worms per infected bear was 16.76 ( $n=25$ ,  $s.d.=26.4$ , range 1-132); the average number of adult male and female worms per bear was 8.16 ( $n=25$ ,  $s.d.=12.6$ ) and 8.6 ( $n=25$ ,  $s.d.=14.0$ ), respectively. One adult female B. transfuga was removed from the anus of an Iron County bear on 11 July 1975.

The most frequent location of ascarid worms was in the duodenum (47.7%), followed by the jejunum (27.2%), ileum (18.1%), stomach (4.5%) and finally the ascending colon (2.2%). Although B. transfuga is normally found in the duodenal area of the small intestine, postmortem helminth migration likely occurred before the viscera were frozen. This would partly account for the worm's presence in the stomach and

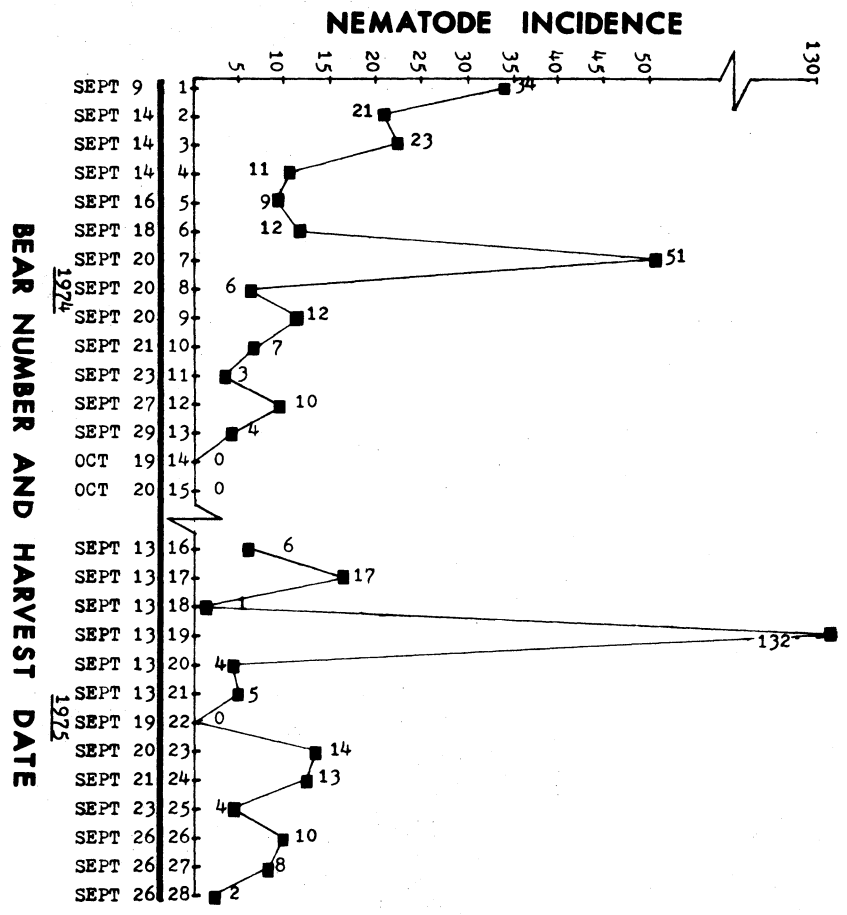


Fig. 5 Incidence of adult Baylisascaris transfuga from 28 hunter-killed black bears from northern Wisconsin, fall 1974 and 1975. Two bears carrying 51 and 132 B. transfuga had portions of their small intestines occluded.

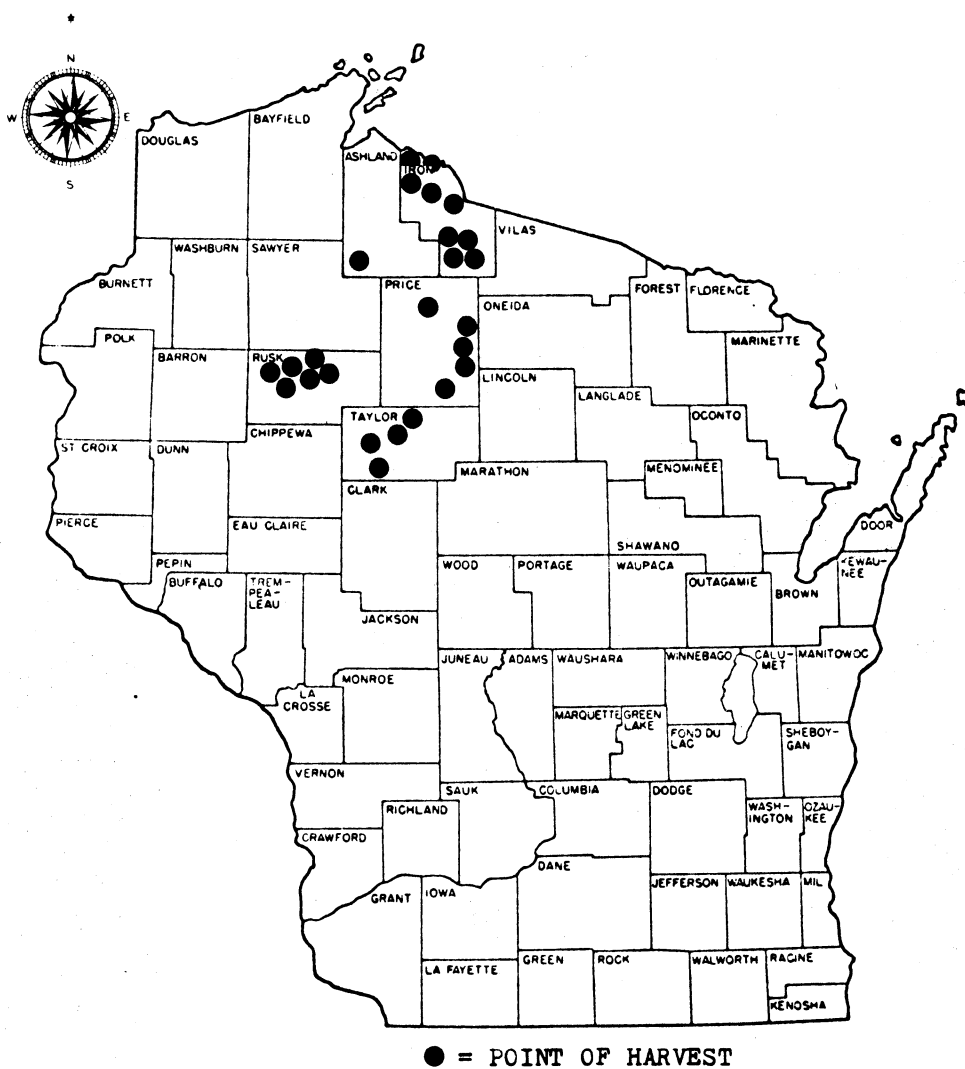


Fig. 6 Points of harvest of 25 bears infected with Baylisascaris transfuga in northern Wisconsin, fall 1974 and 1975.

ascending colon. Since bears change their diets, eating quantities of acorns just prior to winter denning (as food and as an anthelmintic) (Rausch 1954), some of these worms may have been in the process of being eliminated from the intestinal tract.

A 68-kg boar containing 51 ascarid worms in its duodenum had portions of the intestinal tract completely occluded by coiled masses of mature gravid female worms, some as long as 34 cm. A 59.8-kg boar had 132 ascarid worms in its duodenum, jejunum and ileum. Portions of the duodenum and jejunum were occluded. Whether these occlusions cause digestive complications is uncertain.

Rogers (1975) examined seven intestinal tracts from bears in Minnesota killed during the summer. Five contained one to four B. transfuga.

The life cycle of the majority of other ascarids parallels that of Ascaris lumbricoides (Cheng 1973). No work on the life cycle of B. transfuga in black bears has been undertaken. Whether Baylisascaris larvae remain in the intestinal tract or whether visceral larval migrations occur is at present speculative. No larvae were found in any organs examined, and only adult ascarids were found in the intestinal tracts.

Both A. lumbricoides and B. transfuga live in the intestinal tract feeding on chyme (Cheng 1973). Adults may puncture the intestinal wall to suck blood. Eggs, probably in the millions, are passed with the feces, and when contaminated animal and vegetable matter is consumed by a bear the whole cycle repeats itself. I suspect that the availability of sanitary landfills, which often are poorly managed, especially in Iron County, tends to attract black bears and allows for transmission of this

parasite. Chances of ascarid acquisition are enhanced since 90% of all black bears visit a sanitary landfill at some time during their lives (Kohn 1975 pers. comm.). The cannibalistic nature of the black bear (Rogers 1975) also would help to spread this parasite.

#### Dirofilaridae

Two (7.14%) of 28 viscera contained adults of the filarial worm (Dirofilaria ursi). One of the bears, a 79.3-kg boar shot 14 September 1974, contained one adult D. ursi. The worm was partially embedded in the tissue on the outer surface of the rectum within 7 cm of the anus. The posterior end was severed in attempts to remove the worm and the sex of this microfilarian was not determined. The viscera from a second bear, a 68-kg boar shot 26 September 1975, contained 19 adult D. ursi. Six of these nematodes were embedded in connective tissue next to the renal artery. Twelve were embedded in the connective tissue surrounding the kidney and one was partially embedded in rectal connective tissue next to the anus. The latter worm was severed in attempts to remove it; only the anterior end was intact. Of the 18 whole specimens, there were 11 males and 7 females.

None of the blood samples from the 28 viscera contained microfilariae. Seventeen (19.5%) of 87 blood smears from live-trapped bears had microfilariae.

Anderson (1952) provided an excellent morphological description of the microfilariae of D. ursi. Since the only reports of filariids in black bears from Michigan and Minnesota are D. ursi (Rogers 1975), it is probable that the microfilariae from Wisconsin bears were of this species.

Rogers (1975) stated that adult D. ursi were found in the connective tissue of bears from Minnesota and Michigan. Microfilariae were found in the blood of each of the 47 bears examined in Minnesota from April to September.

King et al. (1960) reported D. ursi adults in 3 of 55 bears examined in New York. The worms were found in the peritracheal tissues of the neck, around the thyroid glands. Microfilariae were found in blood samples from 34 of 36 wild bears. It is unknown whether D. ursi has debilitating effects on the black bear in Wisconsin.

Microfilariae of D. ursi probably are passed on to bears by the same arthropod vectors that transmit D. immitis. These include mosquitoes of the genera Aedes, Culex and Anopheles, and lice, fleas and ticks (Cheng 1973).

To individuals undertaking blood parasite research on black bear and other mammals I strongly recommend using the modified Knott's technique, now available to veterinarians, which is much more effective for detecting microfilariae (Kimbell 1976; Swiecki 1975 pers. comm.). Microfilariae may be missed in direct blood smears.

### Trichinae

No Trichinella spiralis were found in the viscera of 28 bears in this study. However, Zimmerman (cited in Rogers 1975) found T. spiralis in 6 (3.8%) of 163 diaphragms from northern Wisconsin between 1970 and 1973. Rogers (1975) concluded that a major factor in transmission of trichinosis among black bears is cannibalism of carcasses. In Minnesota, 12 (92%) of 13 carcasses of black bears were cannibalized, often by more than one bear. Cannibalism also has been reported in black bears in

New York (King et al. 1960), in the Arctic (Rausch 1970) and in Montana (Worley et al. 1975).

King et al. (1960) found 3 (6.1%) of 49 bears positive for trichinosis. They mentioned that the probable source of trichinosis infection for wild bears in New York was uncooked garbage including scraps of infected pork. The major source of trichinosis in Wisconsin is likely the infected viscera of bears left in the woods after animals have been field dressed.

Uncooked garbage is likely a secondary source of infection in Wisconsin, especially where open sanitary landfills still occur.

Many of the bear hunters I interviewed in the past 2 years were unaware of the dangers of trichinosis to humans. News releases or printed material included with tags issued to bear hunters in Wisconsin would call attention to the dangers of consuming inadequately cooked bear meat.

As early as the 17th or 18th day after trichina larvae encyst in muscle tissue they are able to resist the action of digestive enzymes. Hence, they are potentially infective to another host that might ingest a parasitized muscle (such as from the carcass of a recently infected bear). The encysted larvae can live for 13 years or longer (Williams 1946; Gould 1970).

### Diseases

#### Dental Caries

Dental caries were observed in 9 (10.5%) of 86 bears captured in northern Wisconsin in 1975 (Table 1).

There is disagreement in the literature as to the incidence of dental caries in bears. Colyer (1936) stated that the Ursidae in the wild state are free from dental caries. This was, he said, because bears in the wild ate vegetation, while those in captivity ate more sweets and foods high in carbohydrates. Hall (1940), on the other hand, discovered dental caries in 5 (2.6%) of 195 wild black bears. Erickson (1967) stated that dental diseases in black bears are common, especially in older animals. Canine teeth are often broken. Many teeth are darkly stained and often decayed.

#### Periodontal Disease

Only one (1.1%) of 95 bears individually live-trapped in northern Wisconsin in 1974 and 1975 was suffering from periodontal disease. This was a 5.5-year-old, 54.4-kg sow captured in Ashland County on 30 July 1975. An infection was noted behind both upper canines; all teeth were intact, and caries were not evident.

Erickson (1967) stated that periodontal disease is often encountered in black bear, particularly among the older animals. Eleven (78.5%) of 14 old-aged Alaskan bears examined by Rausch (1961) were observed with periodontal disease. Seven (20%) of 35 prime-aged bears examined were positive. Injuries to single teeth apparently cause the infection (Erickson 1967). The canines of the infected bear in the Clam Lake area were not injured.

Table 1 Incidence of dental caries in bears captured in the Clam Lake area and in Iron County, summer 1975.

<u>Wt/Sex</u>	<u>Age</u>	<u>Caries Location</u>	<u>Degree</u>
Clam Lake Area:			
1. 38.5 kg F.	3½	M1, upper left, lingual crest	Mild
2. 79.4 kg M.	5½	I3, lower right, lingual crest	Mild
3. 136 kg M.	6½	M3, lower left; I3, upper left	Mild
4. 56.7 kg M.	5½	M1, lower right	Mild
Iron County:			
1. 89.4 kg M.	5½	Not listed	Mild
2. 82.5 kg M.	6½	P3, lower left	Mild
3. 74.8 kg M.	6½	M2, lower	Mild
4. 65.8 kg F.	6½	M3, lower left	Heavy
5. 116 kg F.	15½	Not listed	Mild

## SUMMARY

1. Black bears were live-trapped in Ashland, Bayfield, Iron, Oneida, Sawyer and Taylor counties during the summers of 1974 and 1975. Barrel traps were used as the main capture devices. Bears were anesthetized with phencyclidine hydrochloride and promazine hydrochloride. During this study, 113 bears were captured and examined for ectoparasites and dental disease; bears were measured, weighed, sexed, a P1 tooth extracted for aging, 10 cc of blood collected, a hair sample removed, a fecal sample acquired and a tissue biopsy collected.

2. During the fall hunting seasons, 1974 and 1975, 28 viscera were acquired from hunters in northern Wisconsin. These samples were necropsied for endoparasites. Fecal and blood samples also were taken from the viscera.

3. Common dog ticks (Dermacentor variabilis) were found on 35 of 44 bears from the Clam Lake area in 1975, on 45 of 60 bears from Iron County in 1975, and on three of nine bears from Taylor, Iron and Oneida counties in 1974. Dog tick incidence was extremely high in the Clam Lake area in 1975.

4. The winter tick (D. albipictus) was found on one bear captured in the Clam Lake area in 1975.

5. The black-legged tick (Ixodes scapularis), previously found neither on black bears nor in Wisconsin, was identified from one bear in the Clam Lake area in 1975.

6. Two follicular mites (Demodex sp.) were discovered in scab tissue removed from a mange-infected bear. The black bear is a new host record for this genus of mite. Five bears captured in northern Wisconsin in 1975 were mange-infected. The probable causative agent was

Demodex.

7. One flea was collected from a black bear captured in Iron County in 1974, but was lost before it could be identified.
8. Four bears in Iron County in 1975 were infected with lice (Trichodectes pinguis euarctidos). Two of these bears were suffering from heavy infestations and noticeable weight loss was evident in one.
9. Deerflies (Chrysops discalis) were collected from one bear captured in Iron County in 1975.
10. Mosquitos (Aedes, Culex and Mansonia) were collected from bears in the Clam Lake area and Iron County in 1975.
11. Ascarid worms (Baylisascaris transfuga) occurred in 25 of 28 viscera necropsied. A total of 204 adult male and 215 adult female ascarids was collected. The mean number of adult worms per bear was 16.76 (n=25, s.d.=26.4, range 1 to 132); the mean number of adult male and female worms per bear was 8.16 (n=25, s.d.=12.6) and 8.6 (n=25, s.d.=14.0), respectively.
12. No Trichinella spiralis were found in 28 viscera.
13. Two of 28 bears contained the adults of a filarial worm (Dirofilaria ursi). None of the 28 viscera had microfilariae of D. ursi. Seventeen blood smears from 87 live-trapped bears contained microfilariae.
14. Dental caries were observed in 9 of 86 bears captured in 1975.
15. Periodontal disease was discovered in one bear live-trapped in the Clam Lake area in 1975.

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## APPENDIX A

Parasites and Disease Reported from Ursus americanus,

Ursus spp., and Ailurus fulgens (Procyonidae)

<u>Parasite</u>	<u>Host</u>	<u>Authority</u>
TICKS		
<u>Dermacentor</u> sp.	<u>Ursus americanus</u> <u>Ursus</u> spp.	Jackson (1961) Stiles and Baker (1935)
<u>D. albipictus</u>	<u>U. americanus</u> <u>Ursus</u> sp.	Rogers (1975) Soulsby (1968)
<u>D. andersoni</u>	<u>U. americanus</u>  <u>U. arctos horribilis</u>	Henshaw and Birdseye (1911), Stiles and Baker (1935), Horstman (1949), Jonkel and Cowan (1971), Rogers and Rogers (1975), Worley et al. (1975) Stiles and Baker (1935), Cooley (1938)
<u>D. variabilis</u>	<u>U. americanus</u>	Dodds et al. (1969), Rogers (1975)
<u>Haemaphysalis</u> sp.	<u>U. thibetanus</u>	Stiles and Baker (1935)
<u>Hyalomma</u> sp.	<u>Ursus</u> spp.	Stiles and Baker (1935)
<u>Ixodes (cookei ?)</u>	<u>U. americanus</u>	King et al. (1960)
<u>Rhipicephalus</u> sp.	<u>Ursus</u> spp.	Stiles and Baker (1935)
LICE		
<u>Trichodectes</u> sp.	<u>U. thibetanus</u>	Stiles and Baker (1935)
<u>T. pinguis euarctidos</u>	<u>U. americanus</u>	Hopkins (1954), King et al. (1960), Jonkel and Cowan (1971), Rogers (1975), Rogers and Rogers (1975), Worley et al. (1975)
FLEAS		
<u>Arctopsylla</u> sp.	<u>Ursus</u> spp.	Stiles and Baker (1935)
<u>A. setosa</u>	<u>U. arctos horribilis</u>	Hubbard (1968)
<u>A. ursi</u>	<u>U. americanus</u>  <u>U. arctos horribilis</u>	Hubbard (1968), Jonkel and Cowan (1971) Stiles and Baker (1935)

<u>Parasite</u>	<u>Host</u>	<u>Authority</u>
<u>Chaetopsylla setosa</u>	<u>U. americanus</u>	Jackson (1961)
<u>Thrassis spenceri</u>	<u>U. arctos horribilis</u>	Hubbard (1968)
PROTOZOA		
<u>Eimeria albertensis</u>	<u>U. americanus</u>	Hair and Mahrt (1970)
<u>E. borealis</u>	<u>U. americanus</u>	Hair and Mahrt (1970)
<u>Leishmania tropica</u>	<u>U. arctos</u>	Marchionini (1967), Cheng (1973)
Mastigophora, Ciliophora and Amoebidae	<u>U. americanus</u>	Noble (1958)
<u>Toxoplasma gondii</u> (?)	<u>U. americanus</u>	Jordan et al. (1975)
<u>Trypanosoma evansi</u>	<u>Melursus ursinus</u> (?)	Venkataratnam et al. (1964)
TREMATODA		
<u>Nanophyetus salmincola</u>	<u>U. americanus</u>	Stiles and Baker (1935), Horstman (1949), Farrell et al. (1973), Poelker and Hartwell (1973)
	<u>Ursus</u> sp.	Cheng (1973)
CESTODA		
<u>Anacanthotaenia olseni</u>	<u>U. americanus</u>	Horstman (1949)
<u>Diphyllobothrium cordatum</u>	<u>U. americanus</u> <u>Ursus</u> sp.	Scott (1932) Scott (1934)
<u>D. latum</u>	<u>U. americanus</u>	Magath (1927), Vergeer (1928, 1930), Skinker (1931, 1935), Rush (1932), Scott (1934), Stiles and Baker (1935), Rogers (1975)
	<u>Ursus</u> sp.	Scott and Honess (1934)
	<u>Thalarctos maritimus</u>	Horstman (1949)
<u>D. ursi</u>	<u>U. americanus</u> <u>U. arctos</u>	Rausch (1954) Rausch (1954)

<u>Parasite</u>	<u>Host</u>	<u>Authority</u>
<u>Echinococcus granulosus</u>	<u>Ursus</u> spp.	Stiles and Baker (1935) Horstman (1949)
<u>Mesocestoides krulli</u>	<u>U. americanus</u>	Horstman (1949)
<u>Multiceps serialis</u>	<u>U. americanus</u>	Rogers (1975)
<u>Pentorchis</u> sp.	<u>Helarctos malayanus</u>	Stiles and Baker (1935)
<u>Taenia pisiformis</u>	<u>U. americanus</u>	Horstman (1949)
<u>T. saginata</u>	<u>U. americanus</u>	Jonkel and Cowan (1971)
NEMATODA		
<u>Ancylostoma caninum</u>	<u>U. americanus</u>	Horstman (1949)
<u>A. malayanum</u>	<u>Ursus</u> spp.	Stiles and Baker (1935)
<u>Baylisascaris transfuga</u>	<u>U. americanus</u>	Sprent (1968), Rogers (1975), Rogers and Rogers (1975)
	<u>U. arctos</u>	Sprent (1968)
	<u>U. arctos horribilis</u>	Sprent (1968)
	<u>U. arctos caucasicus</u>	Sprent (1968)
	<u>U. arctos yesoensis</u>	Sprent (1968)
	<u>U. beringiana</u>	Sprent (1968)
	<u>U. pruinosus</u>	Sprent (1968)
	<u>U. syriacus</u>	Sprent (1968)
	<u>Melursus ursinus</u>	Sprent (1968)
	<u>Thalarctos maritimus</u>	Sprent (1968)
<u>Crenosoma</u> sp.	<u>U. americanus</u>	King et al. (1960)
<u>Cyathostoma bronchiole</u>	<u>Ursus</u> spp.	Stiles and Baker (1935)
<u>Diectophyme renale</u>	<u>Ursus</u> sp.	Hutyra et al. (1949)
<u>Dirofilaria desportesi</u>	<u>U. americanus</u>	Choquette (1952), Yamaguti (1961)
<u>D. immitis</u>	<u>U. americanus</u>	Johnson (1975)
<u>D. ursi</u>	<u>U. americanus</u>	Anderson (1951, 1952), King et al. (1960), Rausch (1961), Yamaguti (1961), Jonkel and Cowan (1971), Rogers (1975), Worley et al. (1975)

<u>Parasite/ Disease</u>	<u>Host</u>	<u>Authority</u>
	<u>U. arctos</u>	Yamaguti (1961)
	<u>U. mantschuricus</u>	Yamaguti (1961)
	<u>U. torquatus</u>	Yamaguti (1961)
<u>Haemonchus contortus</u>	<u>U. americanus</u>	Horstman (1949)
	<u>Thalarctos maritimus</u>	Stiles and Baker (1935)
<u>Thelazia californiensis</u>	<u>U. americanus</u>	Herman (1944)
<u>Toxascaris multi-</u> <u>papillata</u>	<u>U. americanus</u>	King et al. (1960)
<u>T. transfuga</u>	<u>U. americanus</u>	Diesing (1851), Stiles and Baker (1935), Horstman (1949)
	<u>U. arctos</u>	Same as above
	<u>U. arctos horribilis</u>	Same as above
	<u>U. syriacus</u>	Same as above
	<u>Melursus ursinus</u>	Same as above
	<u>Thalarctos maritimus</u>	Same as above
<u>Trichinella spiralis</u>	<u>U. americanus</u>	Rausch et al. (1956), Maynard and Pauls (1962), Maynard and Kagan (1964), Roselle et al. (1965), Wilson (1967), Zimmerman (1970), Emson et al. (1972), Ward and Lyman (1972), Zimmerman (1973), Jordan et al. (1975)
	<u>U. arctos</u>	Bauer (1957), Maynard and Pauls (1962), Maynard and Kagan (1964)
	<u>Selenarctos</u> <u>thibetanus</u>	Doege et al. (1969)
	<u>Thalarctos maritimus</u>	Piusinski (1957)
<u>Uncinaria rauschi</u>	<u>U. americanus</u>	Olsen (1968)
	<u>U. arctos</u>	Olsen (1968)
<u>U. yukonensis</u>	<u>U. americanus</u>	Wolfgang (1956)
DISEASES, ETC.		
Alopecia	<u>U. americanus</u>	King et al. (1960)
Bile Duct Carcinomas	<u>U. arctos horribilis</u>	Moulton (1961)
	<u>Melursus ursinus</u>	Moulton (1961)

<u>Disease</u>	<u>Host</u>	<u>Authority</u>
Broncho-pneumonia	<u>U. americanus</u>	King et al. (1960), Erickson (1967)
Dental Caries	<u>U. americanus</u>	Colyer (1936), Hall (1940, 1945), Erickson (1967)
Distemper	<u>Ailurus fulgens</u> (Procyonidae)	V. Mickwita (1968)
Emphysema and Bronchiectasis	<u>U. americanus</u>	King et al. (1960)
Encephalitis	<u>U. americanus</u> (?) (reservoir host ?)	Andrewes and Pereira (1964), Pshenichnov et al. (1967)
Periodontal Disease	<u>U. americanus</u>	Hall (1940, 1945), Erickson (1967)
Rabies	<u>U. americanus</u> <u>Ursus</u> sp.	West (1972) West (1972)
Rocky Mountain Spotted Fever	<u>U. americanus</u> (reservoir host)	Horstman (1949)
Tick Paralysis	<u>U. americanus</u>	Horstman (1949)
Tularemia	<u>U. americanus</u> (reservoir host)	Horstman (1949)
Tumors	<u>U. americanus</u>	King et al. (1960), Erickson (1967)

