

University of Montana

## ScholarWorks at University of Montana

---

Graduate Student Theses, Dissertations, &  
Professional Papers

Graduate School

---

1985

### Research and management implications of the pursuit of black bears with trained bear dogs

R. Bradford Allen  
*The University of Montana*

Follow this and additional works at: <https://scholarworks.umt.edu/etd>

**Let us know how access to this document benefits you.**

---

#### Recommended Citation

Allen, R. Bradford, "Research and management implications of the pursuit of black bears with trained bear dogs" (1985). *Graduate Student Theses, Dissertations, & Professional Papers*. 3410.  
<https://scholarworks.umt.edu/etd/3410>

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact [scholarworks@mso.umt.edu](mailto:scholarworks@mso.umt.edu).

COPYRIGHT ACT OF 1976

THIS IS AN UNPUBLISHED MANUSCRIPT IN WHICH COPYRIGHT SUBSISTS. ANY FURTHER REPRINTING OF ITS CONTENTS MUST BE APPROVED BY THE AUTHOR.

MANSFIELD LIBRARY

UNIVERSITY OF MONTANA

DATE: 1985



RESEARCH AND MANAGEMENT IMPLICATIONS OF THE PURSUIT OF  
BLACK BEARS WITH TRAINED BEAR DOGS

By

R. Bradford Allen

B.S., University of Maine at Orono, 1979

Presented in partial fulfillment of the requirements

for the degree of

Master of Science

University of Montana

1985

Approved by



---

Chairman, Board of Examiners



---

Dean, Graduate School

August 1985  
Date

UMI Number: EP35500

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



UMI EP35500

Published by ProQuest LLC (2012). Copyright in the Dissertation held by the Author.

Microform Edition © ProQuest LLC.

All rights reserved. This work is protected against unauthorized copying under Title 17, United States Code




ProQuest LLC.  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106 - 1346

Allen, R. Bradford, M.S., April 1985

Wildlife Biology

Research and Management Implications of the Pursuit of Black Bears with Trained Bear Dogs

Director: C. J. Jonkel 

Primary thesis objectives were to describe the effect of hunting with dogs (Canis familiaris) on black bear (Ursus americanus) ecology: to determine any age, sex, or seasonal selectivity of this hunting method; to describe the efficiency of this hunting method; and to describe the behavior of individual, chased bears.

Between September 1979 and October 1981, 81 experimental chases of black bears with trained bear dogs were recorded. Bears were either struck and run (43), located by radio telemetry and run (22), or run from bait stations (16). I was unable to initiate any chase on 35 occasions during the 2 field seasons. Chases averaged 3.2 hours and the average recorded distance covered in a chase was 6.5 km. No significant difference was noted in either chase duration or length by how a run was initiated ( $P > 0.10$ ).

Sixteen different bears were treed 27 times in 81 chases (33%), and these chases averaged 100 minutes. Bears treed more frequently on hardwood ridges (63%) and usually in trees greater than 61 cm in diameter. Pursued female bears with cubs climbed trees during each of 6 times run, but never with their cubs. Eight pursued, collared bears stayed within the boundaries of their home ranges in 15 of 28 instances. Five bears left their ranges during pursuit by less than 2 km and generally returned later that same day. One bear, a subadult female, took 4 days to return to her normal range. Home range sizes of 2 adult female bears averaged 14.9 km<sup>2</sup> and were determined as the area within the outside boundary of a composite map of all circuitous runs.

The vulnerability of bears to dog hunters was tested during the 2 field seasons. Twenty-two "kills" were recorded after 94 days of hunting. The sex, ages, and weights were obtained from 12 bears (8 females:4 males). Four other bears were treed but not handled; three were believed to be males because of their large size. The average age and weight of a handled bear was 4.7 years and 40 kg. Subadult bears appeared to be located and run more often, but usually outdistanced the dogs. Concurrent data on the bear kill by dog hunters in Maine are presented and used in the interpretation of my results.

## ACKNOWLEDGEMENTS

This thesis could not have been completed without the cooperative effort of many people. R. D. Hugie and L. Perry, both formerly of the Maine Department of Inland Fisheries and Wildlife, were instrumental in the initial planning and implementation of field investigations. Dr. C. J. Jonkel was my thesis advisor and was responsible for the coordination of my class work. I will never forget this man's generosity to and compassion for students in the wildlife sciences. Dr. G. J. Matula, Jr. came to my rescue after I encountered problems in the field. Dr. Jonkel's and Dr. Matula's efforts during the preparation of the manuscript are especially appreciated. I also wish to thank the other members of my committee, Drs. B. O'Gara, R. McClelland, and L. Metzgar for their teaching, cooperation, and assistance.

W. Hudson and R. Sprague supplied most of the hunting dogs. This investigation would not have been possible without their perseverance. S. Woodward, R. Smith, R. Levesque, and M. Caron were most helpful as field assistants. I thank them for putting up with me.

Funds were supplied by the Maine Department of Inland Fisheries and Wildlife, the Wildlife Management Institute, the National Rifle Association of America, and L. L. Bean, Inc. I am indebted to the University of Montana, the city of Missoula, and the State of Montana for the education each has given me.

## TABLE OF CONTENTS

	<u>PAGE</u>
ABSTRACT . . . . .	ii
ACKNOWLEDGEMENTS . . . . .	iii
LIST OF TABLES . . . . .	v
LIST OF FIGURES . . . . .	vi
GENERAL INTRODUCTION . . . . .	1
CHAPTER I: EXPERIMENTAL PURSUIT OF BLACK BEARS WITH TRAINED BEAR DOGS . . . . .	5
INTRODUCTION . . . . .	5
STUDY AREA . . . . .	5
METHODS . . . . .	7
RESULTS AND DISCUSSION . . . . .	11
All chases . . . . .	11
Chases to trees . . . . .	12
Females with cubs . . . . .	16
Chase - home range relationships . . . . .	17
Home range by circuitous runs . . . . .	20
Management considerations . . . . .	22
CHAPTER II: BLACK BEAR VULNERABILITY TO HUNTERS USING DOGS IN MAINE . . . . .	25
INTRODUCTION . . . . .	25
METHODS . . . . .	25
RESULTS AND DISCUSSION . . . . .	26
Management considerations . . . . .	31
LITERATURE CITED . . . . .	34
APPENDIX I: SUPPLEMENTAL INFORMATION . . . . .	38
APPENDIX II: TABLES AND SUPPLEMENTARY DATA . . . . .	42
APPENDIX III: MAPS OF BLACK BEAR HOME RANGES AND PURSUIT PATTERNS . . . . .	48



LIST OF TABLES

<u>TABLE</u>		<u>PAGE</u>
1.	Summaries of bear chases by how a run was initiated, September 1979 to October 1981 . . . . .	14
2.	Seasonal home range sizes for 2 female bears as determined by outermost telemetry points (OTP) and the circuitous run method (CRM) . . . . .	21
3.	Sex, age, and weight of 12 of 22 theoretically killed bears . . . . .	28
4.	Maine black bear harvest (1974-1981) using dogs . . . . .	31

LIST OF FIGURES

<u>TABLE</u>	<u>PAGE</u>
1. Three chases of an adult female bear in relation to her home range . . . . .	19

## GENERAL INTRODUCTION

In Maine, black bears (Ursus americanus) have been regarded as big game trophies, furbearers, tourist attractions, and at times, nuisances. In 1931, the black bear was classified as a game animal (The Revised Statutes of Maine, Chapter 38, Section 72). Despite this classification, anyone killing a black bear was entitled to a \$15.00 bounty through 1957. The first closed season on bears occurred in 1966. A limit of 1 bear per person per year was established in 1969. Spring bear hunting was abolished in 1981. Today, there is an open season on bears from 1 September to 30 November annually (Statutes of Maine, Chapter 707, Section 7451).

Bear harvest methods in Maine remain liberal compared to most states. Hunting bears over bait, with up to 4 dogs during September and October, or by rifle during the firearm season on deer (November) is legal. Trapping bears with leg-hold or cable traps, both with certain restrictions, is also legal. Hides and teeth can be sold from hunted or trapped bears. Attempts to control nuisance bear activities are coordinated by the Animal Damage Control Program.

The importance of the black bear in Maine has improved in recent years because of an increase in hunting pressure and public interest. The registered annual kill from 1974 through 1979 was 751, 959, 1,008, 1,066, 1,320 and 1,630 (a record), respectively (Banasiak et al. 1979). The average annual kill was 1,122 for the 6-year period. This registered kill represents the efforts of an estimated 30,000 hunters per year. With the kill from hunters expected to continue to increase,

adequate management is especially warranted. Hugie (1976) stated that the abundance of black bears is keyed to the perpetuation of suitable habitat and to a control over removal (harvest) from the population. The use of dogs to hunt bears is just one of several hunting methods available to a hunter in Maine, and will be evaluated in this paper.

Differing attitudes exist regarding the use of dogs as a bear hunting method. Critics claim that bear hunting with dogs (particularly radio-collared dogs) is too efficient, leads to high kill rates, and is not "sporting". Supporters of dog hunting cite the advantages of greater selectivity, such as starting dogs only on the tracks of large bears or leaving small bears in trees, no crippling loss, and a more active participation by the hunter compared to bait hunting. Dog hunting regulations vary considerably among states with open seasons on black bears. Currently, bear hunting with dogs is legal in 22 states and in a few select areas of Canada (Appendix I). Bear hunting with dogs is not legal in 6 states with black bear seasons and throughout most of Canada. The open season in states and provinces where dog hunting is allowed is generally early fall. Colorado has a spring bear hunting season where hunting with dogs is legal. Most states are currently addressing changes in their dog hunting regulations. But, in terms of bear management, the practice of hunting with dogs and its effect on bear populations and individual bears is not well understood.

The use of dogs in wildlife management has long been recognized as a useful technique for gathering information (Zwickel 1969).

Hornocker et al. (1965) used dogs to tree mountain lions for immobilization with drugs. However, dogs have not been used in black bear studies until recently. Researchers in New England have recently used dogs to tree bears. Treed bears were immobilized and tagged in Vermont and immobilized, tagged and radio-collared in Massachusetts. Certain objectives of the Vermont and Massachusetts studies are similar to those of this study. However, the major difference was that this study was also designed to investigate the effect of dogs on individual bears, rather than to merely tag and collar bears. This bear population had already been studied in terms of bear home range size and habitat use (Hugie 1982, Lamb 1983).

My study was conducted during the summer-fall field seasons of 1980 and 1981. My goal was to investigate the method of hunting with dogs and their effect on a bear population. My objectives were to: describe the effect of hunting with dogs on bear home range, distribution and movements using known, radio-collared bears; determine any sex, age, or seasonal selectivity of this method; describe the efficiency of this hunting method; and describe the behavior of individual bears during and after the chase. Both the Maine Legislature and Department of Inland Fisheries and Wildlife required this information for making management decisions; the controversial nature of bear hunting with dogs made the research urgent.

My results are presented in the form of 2 papers prepared for publication. The first paper describes the results of all chases.

Chase durations, distances, and treeing rates are presented. Bear home range-chase relationships are described and a potential method for determining home range sizes of female bears by mapping a composite of all chases is discussed. This paper was presented at the 7th Eastern Black Bear Workshop and was published in the proceedings of that conference. The second paper describes black bear vulnerability to hunters using dogs in Maine. Kill rate and sex and age vulnerability data are presented. This paper will be submitted to the editors of the 8th Eastern Black Bear Workshop. A popular article synthesizing the results of both papers appeared in the Fall 1983 issue of the Department of Inland Fisheries and Wildlife's Fish and Wildlife magazine.

## CHAPTER I: EXPERIMENTAL PURSUIT OF BLACK BEARS WITH TRAINED BEAR DOGS

### INTRODUCTION

Using dogs (Canis familiaris) in wildlife home range and behavior studies is not new. Lowe (1958) and Toll et al. (1960) studied swamp rabbit (Sylvilagus aquaticus) home ranges by locating and pursuing rabbits with beagles. Other researchers used dogs to collect information on the responses of white-tailed deer (Odocoileus virginianus) to harassment by dogs. Their data showed that white-tailed deer could be driven out of their home ranges, but that the deer usually returned within a day (Progulske and Baskett 1958, Marchinton et al. 1970, Corbett et al. 1971, Sweeney et al. 1971, and Gavitt 1973). Willey (1982) used dogs to capture families of black bears (Ursus americanus) in Vermont. My goal was to obtain data on the impact of hunting bears with dogs for use in bear management and research. My specific study objectives were to describe the effects of hunting with dogs on black bear home ranges and movements and to observe and document the escape behavior and behavioral change of each bear during and after the chase.

### STUDY AREA

Maine is subdivided into townships, each of which is about 92 km<sup>2</sup> (36 mi<sup>2</sup>). My study area included 4 townships (T11 R8 W.E.L.S., T11 R9 W.E.L.S., T10 R8 W.E.L.S., and T10 R9 W.E.L.S.) west of Ashland, Maine, the closest organized town. The study area is the identical

area chosen by Hugie (1982) for his investigation of an unexploited bear population (Appendix I).

This study area is 95% forested, with northern hardwood-softwood cover types dominating. The area has 12 lakes and ponds ranging in size from 0.2 to 3.1 km<sup>2</sup>. One river, 1 stream, and about 45 small brooks drain the area (Hugie 1982). Large areas forested with American beech (Fagus grandifolia), red maple (Acer rubrum), and sugar maple (A. saccharum) are common. Red spruce (Picea rubens) and balsam fir (Abies balsamea) occur on wetter sites. Extensive stands of white cedar (Thuja occidentalis) predominate on poorly drained sites.

Land uses in this area are mainly oriented to the growth of forest products and outdoor recreation. Selective cutting for softwood pulp in the late 1960's left the area with numerous forest openings connected by a network of now abandoned roads. Past and current logging practices have created favorable conditions for the establishment of food-producing trees and shrubs important to wildlife. Historically, there has been little demand for hardwood forest products in northern Maine. Extensive stands of mature American beech now occur on well drained sites. Periodic crops of beechnuts, together with good years of beaked hazelnuts (Corylus cornuta), provide bears with an important hard mast food base. Recent site disturbance associated with logging operations create favorable conditions for soft mast producing plants. Red raspberry (Rubus ordoratus), common chokecherry (Prunus virginiana), and red elderberry (Sambucus rubens) are common in the study area.



The diversity of bear foods, remoteness of the area, and lack of access in the area combine to create excellent bear habitat. Hugie (1982) reported bear densities in this area as 0.57 bears/mi<sup>2</sup>. Other bear researchers, working in the same area since Hugie's initial investigation, believe that his estimate of bear density is conservative (pers. comm. G. Matula).

Hugie (1982) chose this area for its unexploited bear population. This circumstance no longer exists. However, hunting bears with dogs in this area was nonexistent until this study, which allowed me to study a bear population that had never been exposed to hunting dogs.

The vegetation, climate, and land use practices were described by Hugie (1982). A companion study provided information on the vulnerability of bears to hunters using dogs (Chapter II).

#### METHODS

Our daily routine was to release trained dogs on a bear's trail and to ultimately force the bear to seek refuge in a tree. A bear was considered "treed" if our crew reached the tree while the bear was still in it. A decision of whether or not to attempt immobilization of the bear was made at the tree.

Thirty-four dogs were used to locate, run, and tree bears during an initial experimental chase in 1979 and during two subsequent field seasons. During the first season, 19 June to 11 September 1980, Bluetick, Walker, and Redbone breeds were used. During the second season, 9 May to 1 October 1981, 25 different Plott hounds and 1 Bluetick were used. All hounds had been previously trained by

professional bear guides. At least 1 guide and/or experienced dog handler was present during each day of field work.

It is appropriate that some terminology be defined. For the purpose of these papers, the strike dog (a houndsman's term) is the dog used to locate the bear's scent. A scented bear is thereby "struck" when located by this dog. The field work was modeled on existing bear hunting techniques. At first light, a crew of at least 4 people drove slowly along study area roads until the "strike" dog, from its elevated position on a platform in the back of the truck, scented a bear that had recently crossed the road. The strike dog would then be taken off the truck and allowed to search the roadside for the trail. The level of excitement in the dog as it worked the trail enabled the dog handler to assess the freshness of the track and the direction moved by the bear. A fresh track warranted release of the other dogs (a total of 4 by law, including the strike dog). All dogs were equipped with modified bear radio collars so we could monitor their movements during the chase, and to facilitate retrieval of lost or injured dogs. A chase began when all dogs were released on the bear's trail and ended when the dogs were retrieved.

Poor scent conditions and/or the lack of bear movement over study area roads made locating bears difficult at times. When this happened, we scanned the immediate area for radio-collared bears. The locations of all collared bears were mapped, and the bear closest to a road was located and run. The chase was documented by listening to the barking of the dogs, plotting the signal from the dog's radio

collar(s), and locating the signal from the bear's radio collar. A third method used to initiate a chase involved attracting bears to large bait piles. This method of chase initiation received our lowest priority, partly because the baits distorted bear movements. A chase could usually be initiated using one of the above methods. To facilitate accurate mapping of each chase, we tried to anticipate points where the bear and dogs might cross roads. Sightings of the bear and dogs provided insight into the size of the bear chased, the closeness of dogs to the bear, and the actual location where the bear crossed the road.

If a bear was treed, and we decided that it could be captured and handled safely, several preparations had to follow. All branches, rocks, and debris were cleared from the area around the base of the tree. Two rectangular nets (3.5 by 6.5 m) were placed around the base of the tree, as high above the ground as we could reach, and tied to nearby trees. Next, a mixture of ketamine hydrochloride (Vetalar; Parke-Davis Co.) at 2 mg/kg and xylazine hydrochloride (Rompun; Haver-Lockhart Co.) at 1 mg/kg was administered using a Cap-Chur gun (Palmer Chemical Company; Douglasville, Georgia) or a homemade jab stick. The dogs were removed from the area to allow the bear to come down once drugged. Dog removal also prevented possible injury to either the bear or the dogs had the bear descended before fully anesthetized. Willey (1982) has described this method in more detail.

Each immobilized bear was inspected for sex, and the presence of chest blazes, scars, tags, tattoos, and injuries. If the bear was

unmarked, tags were placed in each ear, the upper lip was tattooed, and a premolar was removed for age determination by the cementum annuli technique (Stoneberg and Jonkel 1966, Willey 1974). Head, neck, chest, and weight measurements were taken for further identification and nutritional status. Selected animals (mostly females) were radio collared (Telonics, Incorporated, Mesa, Arizona). All bears were released at the capture site. Radio-collared bears that had been run and treed were not always handled. In these instances, the crew removed the dogs from the area and allowed the bear to come down from the tree. On days when the weather was cool and the initial chase was short, the dogs were released for a second chase on the same bear. The second chase was monitored as before. Before we left the tree site, we recorded the species, height, and diameter of the tree the bear chose for refuge. Unusual characteristics of the tree (i.e. largest tree in sight or leaning at  $45^{\circ}$ ) and physical descriptions of the surrounding area were recorded. The chase was recorded as being either straight or circuitous, and either short ( $< 5$  km) or long ( $> 5$  km).

Most radio tracking was done by ground triangulation (Craighead and Craighead 1965). When available, a single engine float plane equipped with Telonics RA-2A 'H' antennas on each wing strut, was used to locate radio-collared bears.

All locations were mapped on USGS 15 minute quadrangle maps and recorded, using the Universal Transverse Mercator (UTM) grid coordinates. Seasonal home range sizes were determined by connecting

the outermost telemetry points (Lindzey and Meslow 1977) using non-chase locations. The home ranges do not include areas occupied in late August, 1981 when several bears left their normal spring-summer ranges to exploit an area with abundant raspberries. Documentation of seasonal home range sizes and boundaries were rough and were only intended to be used to determine the relationship between a bear's escape patterns during pursuit and its home range.

Additional home range size estimates were determined for 2 female bears by mapping a composite of all chases of each bear and measuring the area within the boundary with a planimeter. This supplementary technique was attempted after finding that these 2 bears seldom left the areas we had determined to be their ranges by connecting the outermost telemetry points. This was not an original objective of the study but is offered as a potential technique for estimating female bear home range size. The Chi-square goodness of fit (test) was used for statistical comparisons.

## RESULTS AND DISCUSSION

### All Chases

To begin a bear chase it was necessary for a bear to be close to one of the study area logging roads. Therefore, it was likely that we introduced a bias when we either ran bears whose home ranges included passable roads or were travelling through the area when detected. From September 1979 to October 1981, 81 experimental chases of an undetermined number of black bears were recorded. Bears were either

struck and run (43), located by telemetry and run (22), or run from bait stations (16). We were unable to initiate chases during 35 attempts during the 2 field seasons because of adverse weather conditions. Weather conditions considered poor for bear location and pursuit include periods of extended heavy rains or hot, dry spells. Locating a bear under these conditions is difficult because the bears move less during such periods, and their scent is quickly washed or dissipated from the vegetation.

The amount of time that the dogs pursued a bear depended on many variables. If the dogs lacked speed and endurance, most bears outdistanced them quickly. The length of time the dogs pursued bears ranged from 10 minutes to over 12 hours (Table 1) and averaged 3.2 hours. No significant difference ( $P > 0.10$ ) was noted in chase duration by how a run was initiated (Student's t-test). However, chases initiated by radio telemetry locations of radio-collared bears tended to be shorter, lasting an average of 2.2 hours. Here the dogs had the advantage of being released very close to the bear. The average recorded distance covered in a chase was 6.5 km, with extremes of 1.5 km and 23 km. No significant difference ( $P > 0.10$ ) was noted in chase distance by how a run was initiated (Table 1).

#### Chases to Trees

It was difficult to apply adequate pursuit pressure to tree (capture) a bear. Some hounds, even though they appeared to be in prime physical condition, lacked the aggressive qualities necessary to force a bear to seek refuge in a tree. Even less predictable was the

condition and behavior of the pursued bear. Some bears sustained chases for hours and stayed just ahead of the dogs. They intermittently walked and ran, but never treed. Larger bears often chose to run and would then stand their ground and fight the dogs. They fled only after the approach of humans. In this study, pursued bears treed 33% of the time. Ten different radio-collared bears (3 males:7 females) treed most frequently (9 times in 22 chases or 41%) when telemetry was used to initiate the chase. Four of these bears (1 male:3 females) treed each time ran, while 5 bears (2 males:3 females) never treed after being located by telemetry and run. Twelve different bears (6 males:6 females) located by dogs from the truck treed 14 times in 43 chases (32%), and 4 bears (1 male:3 females) run from bait treed 4 times in 16 attempts (25%) (Table 1). These latter 2 methods of locating bears are the most common ones used by bear hunters with hounds in Maine. Collectively, the latter 2 methods generated 18 treed bears in 59 chases for a treed rate of 30%.

The duration of the chase to the time the bear was treed was shortest for radio-collared bears ( $X=81$  min). Chases initiated by the strike dog and from bait stations averaged 99 and 145 minutes respectively, to the time the bear was treed. The average time from bear detection to the time the bear was treed was 100 minutes (Table 1). The average distance covered from where the chase was initiated until the time the bear was treed was just over 5 km and did not differ significantly ( $P > 0.10$ ) by how a run was initiated. Because pursuit effort varied considerably during the 2 field seasons, no

Table 1. Summaries of bear chases by how a run was initiated, September 1979 to October 1981. These data show the wide range of variability encountered during a bear chase and that most bears outdistanced the dogs.

Run Initiate	Number of Runs	Mean Time (min)	Range	Mean Distance (km)	Range	Tree Rate				
						Number Treed	Mean Time (min)	Range	Mean Distance (km)	Range
Strike	43	211	(10-750)	6.4	(0.5-23.0)	14 (32%)	99	(10-330)	5.0	(0.5-13.3)
Radio Telemetry	22	149	(10-360)	6.6	(0.4-16.0)	9 (41%)	81	(10-180)	5.6	(0.4-16.0)
Bait	16	224	(15-540)	6.8	(1.5-16.0)	4 (25%)	145	(15-345)	5.7	(1.5-11.2)
Totals	81	192		6.6		27 (33%)	100		5.3	



in-depth analysis of treed or capture rate by month of pursuit was attempted.

Bears frequently treed on hardwood ridges. Hardwood ridges comprised roughly 40% of the study area. Seventeen of 27 treed locations (63%) were on sites characterized by 80% or more hardwoods. Bears often chose to tree in large maple and beech trees (Appendix II, Table 1). Ten tree locations (37%) were in areas comprised of 80% or more softwoods. Tree locations generally lacked slash and understory vegetation but this was a subjective judgment. From observation, it appeared the dogs ran very effectively through these areas and applied enough pressure to tree bears. The average diameter of trees chosen for refuge by bears was 61 cm and was generally, but not always, the largest tree in the area (Appendix II, Table 1). The large trees, particularly trees that were leaning, may be easier to climb. The larger size may also provide a greater sense of security from harassment by the hounds. No statistics were used to test if bears selected large trees in a proportion different than their availability. The importance of large trees became evident late in the first field season when a large bear treed in a white pine that measured 2 m in diameter. During the second field season, radio-collared bear No. 123 treed in a large oak tree which measured 2 m in diameter. This was the only oak tree I have seen in the study area in 5 years.

### Females with Cubs

During the 2 field seasons we had 6 opportunities to pursue 3 different adult female bears (2 radio-collared and 1 not) with cubs. All females treed after short chases but never with their cubs. These chases were difficult to quantify and map because the pursued bear usually returned to the chase initiation point minutes after the chase began, perhaps to check on treed cubs. Experienced houndsmen are aware of this unique behavior which helps them know when their dogs are chasing a female bear with cubs. While pursuit of bears with dogs did result in the separation of the females from their cubs, I believe it was for only a short time.

During the winter of 1981-82, we had the opportunity to check the reproductive success of the radio-collared female bears that had been chased by dogs. Three radio-collared bears were not expected to produce cubs because they were too young. One other female bear was with yearlings. Consequently, only 2 bears that had been chased by dogs were expected to produce cubs. Bear No. 223 produced a litter of 3 while bear No. 126 was solitary. Rogers (1976) reported poor black bear reproductive success following food shortages the previous fall. Food shortages occurred during the fall of 1981 in northern Maine, and may have contributed to a general lack of reproduction (few cubs seen or captured) in the study area in 1982. Unfortunately, adequate quantification of the effect of dogs on the reproductive success of bears is difficult and is uninterpretable from the data presented here.

Repeated harassment of individual bears during the breeding season and prior to blastocyst implantation in November could reduce

production through physiological stresses (Jonkel 1967). I would not recommend repeated chases of individual bears during the peak of the breeding period, particularly on hot days. I believe the best time to pursue and study female bears is during late May or early June, a period prior to the peak of breeding and before summer and fall sallies from established home ranges. The researcher should select cool days for pursuit. This would reduce heat stress on bears and should result in more efficient chases as scent conditions are more favorable.

#### Chase - Home Range Relationships

Eleven radio-collared bears (3 males:8 females) were pursued 32 times. Three chases that resulted in the initial collaring of the bear are included. Chase duration averaged 3.2 hours and ranged from 2 chases of 10 minutes to one that lasted more than 6 hours. Chase distance averaged 6 km with extremes of 0.4 km and 22 km. Collared bears were treed 17 times in 32 chases. Twenty-one chases were straight line chases. Male bears used straight line escape patterns in all 6 chases and usually used speed and rough terrain to outdistance the dogs. Eleven chases were circuitous in pattern. A chase was recorded as circuitous if the bear crossed a point where it had been earlier in the same chase, or when this circuitous pattern could be confirmed by continuous monitoring with radio telemetry. Sweeney et al. (1971) suggested that white-tailed deer circled when pursued by dogs so they could watch their back trails. Circuitous running by female bears occurred when the bears attempted to evade the

dogs, but did so within the boundaries of their small home ranges. These bears tended to cross roads at predictable places near the edges of their ranges, sometimes within a few meters of us.

Data on bear home ranges in this study area from Hugie (1982), Lamb (1983), and this study were combined and incorporated onto 1 map and used to describe the seasonal home ranges of 9 of the 11 radio-collared bears. We failed to get an adequate number of locations for home range delineation of 2 collared bears. Home ranges were delineated by connecting the outermost locations. These bears were pursued 28 times to describe the relationship between escape patterns and home ranges (Appendix II, Table 4). The number of repeated chases on the same bear ranged from 0 to 6.

Pursued bears stayed within the boundaries of their home range in 15 of 28 chases (53%), either because the chase was short and the bear was treed quickly, or because the bear chose a complicated, circuitous route of escape (Fig. 1). Four chases involved 2 adult male bears whose home ranges had been determined by Hugie (1982). Chases on these bears were short and the bears never came close to leaving their home ranges.

Bears left the areas designated as their seasonal home ranges during pursuit 13 times. In 9 instances, the pursued bears left their ranges, but only by a distance of less than 2 km. They returned either immediately (5), or later the same day (4). Given the likelihood of telemetry error in mountainous terrain and the few number of locations used to determine the home range sizes of certain

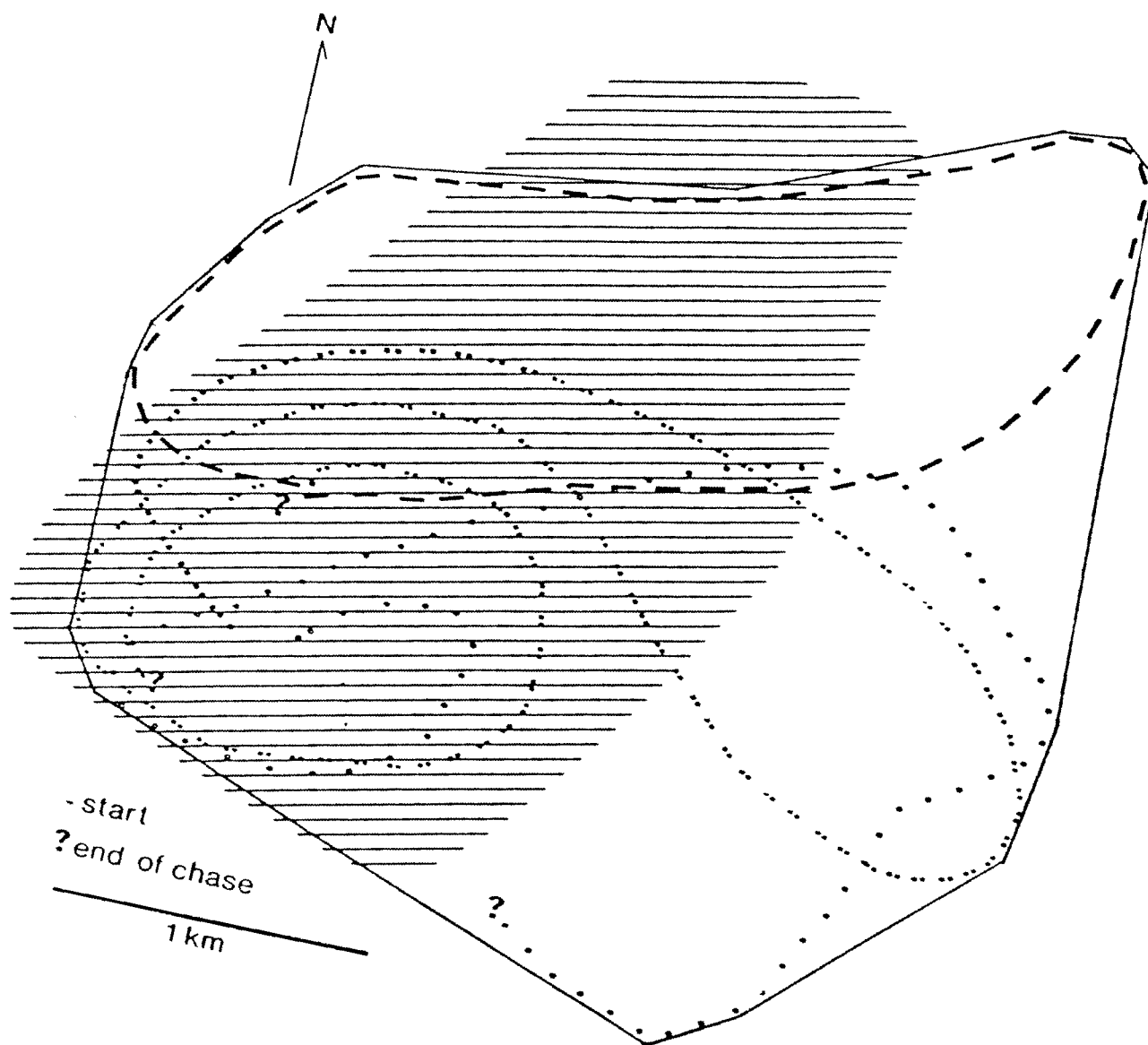


Figure 1. Three chases (dotted lines) of an adult female bear in relation to her home range (lined area). The outside boundary of the 3 runs is indicated by the solid black line. The area within this line represents the bear's home range by the circuitous run method (CRM).

bears, these bears may in fact have never left their ranges at all. Two female bears (a 2-year-old and a 3-year-old) were the only bears to leave their ranges by more than 2 km. The 3-year-old returned later the same day (Appendix III, Map 1). The 2-year-old, however, took 1 day to return after one chase and 4 days to return after a second chase (Appendix III, Map 2). It is interesting to note that 1 chase of this subadult female bear occurred shortly after she had returned to her normal range from an area with abundant raspberries. After 30 minutes of pursuit in her normal range, she then ran to and treed in the area she had occupied for the 3 previous weeks. She covered a straight line distance of roughly 15 km. With the above exceptions noted, it appears that pursued bears exhibited a strong tendency to stay in their home range, or to return to their home ranges after displacement. However, next day relocations indicated that the bears had moved to parts of their ranges that were secure, e.g., inaccessible to travel with trucks (Appendix III, Map 3). Landers et al. (1979) suggested that these inaccessible areas may be the most critical component of black bear habitat in North Carolina, where hunting with dogs is a common practice.

#### Home Range by Circuitous Runs

An animal's home range is that area normally occupied for feeding, resting, and escape activities (Dasmann and Taber 1956). The size and shape of a black bear's home range is determined by the capability of that area to provide the animal's annual needs (Hamilton 1978). Mean home range sizes for black bears vary considerably depending on sex, age, season, and population density. In addition to these factors,

Pelton (1982) states that the measurements of black bear ranges vary according to the techniques used in data collection and analysis.

Lamb (1983) and Hugie (1982) reported average seasonal home range size for their studied female bears to be 24.7 km<sup>2</sup> (convex polygon method) and 26.8 km<sup>2</sup> ('grid-fill'), respectively. During this study, the home range size for a 5-year-old female bear and a 3-year-old female bear was 9.5 km<sup>2</sup> and 8.2 km<sup>2</sup> (outermost telemetry points), respectively (Table 2). These home range size estimates, though small, are within the range reported for female bears in the literature. I believe the ranges depict the area intensively used by these 2 bears. However, movements from these areas did occur (Appendix III, Map 1).

Table 2. Seasonal home range sizes for 2 female bears as determined by outermost telemetry points (OTP) and the circuitous run method (CRM).

Bears	Number of Runs	OTP (km <sup>2</sup> )	CRM (km <sup>2</sup> )
5-year-old female	3	9.6 (n=81) <sup>1</sup>	14.9
3-year-old female	4	8.2 (n=22)	14.9
	7	$\bar{X} = 8.9$	$\bar{X} = 14.9$

<sup>1</sup>(n) = sample size in number of locations used.

Subsequent chases of the same 2 bears revealed strong fidelity to their ranges. Both bears, when pursued to the edge of their range, frequently doubled back towards the dogs or the hunters in an apparent

attempt to stay within the area with which they were most familiar. Lengthy chases were mapped and revealed considerable circuitous running. Here, I offer a possible technique for the determination of female bear home range size and shape. This technique will be referred to as the circuitous run method (CRM) and is depicted in Figure 1. The solid line represents the outside boundary of the 3 longest chases of the 5-year-old female bear. The shaded area depicts her home range as determined when the outermost telemetry points were connected. Similar methods were used to show this relationship for the 3-year-old female bear (Appendix III, Map 1). The area within the outside boundary (seasonal home range size) of the chases for both bears measured  $14.9 \text{ km}^2$  (Table 2). These areas not only represent that portion of the bear's home range used for escape activities, but also for most other annual activities as well. The CRM may be a useful and efficient technique for the determination of female bear seasonal home range size and shape, as these estimates were generated after only 7 days of pursuit.

#### Management Considerations

The studies completed here indicate that trained bear dogs can have a unique role in black bear research and management, if the objectives are clearly defined. For instance, dogs may be particularly useful when the researcher wishes to capture and handle female bears with cubs. Once the bears or their tracks are located, the researcher has several hours (under ideal weather conditions) to contact a dog owner and begin pursuit of the bear family. Dogs could also be used to



calculate female bear home range sizes in a new area where only limited time was available to complete research. I recommend researchers attempt this in May and early June. In addition, the use of dogs can be an efficient way to capture certain radio-collared bears. For example, we used radio telemetry to locate an adult male bear that had a radio collar with failing batteries. Four dogs were released on the trail of this bear and he treed after 2 hours of pursuit. After the bear was immobilized, we removed the radio collar. Bear dogs were also used in the capture of a bear that had escaped from a wildlife zoo in coastal Maine. Instances as these demonstrate the versatile use of dogs in a bear management program. However, more needs to be known about biases in the technique as the bears learn to deal with the dogs.

The pursuit of bears with dogs may have physiological and behavioral impacts on the bears, but I was unable to quantify these parameters. The quick return of the bears to their home ranges indicates a return to stability, but their selection of secure areas within their range indicates behavioral and habitat use changes which may be detrimental. Jonkel (pers. comm.) noted that in experiments on polar bears, the highest deep body temperatures were recorded one hour after bears worked on a treadmill, which would indicate possible delayed effects from chases by dogs, especially during hot weather.

As a final note, I would like to add that expert bear hunters and well-trained, physically fit dogs are essential. Trained bear dogs

are expensive, and the time required of the dog handlers can be great. Therefore, a method whereby a researcher could solicit the help of several bear hunters and their dogs on a volunteer basis would be desirable.

## CHAPTER II: BLACK BEAR VULNERABILITY TO HUNTERS USING DOGS IN MAINE

### INTRODUCTION

The hunting of black bears (Ursus americanus) using from 1 to 4 trained bear dogs (Canis familiaris) during September and October is an accepted, though controversial, hunting method in Maine. Critics claim that hunting bears with dogs (particularly radio-collared dogs) is too efficient, leads to high kill rates, and is not "sporting". From a game management standpoint, the practice of hunting with dogs, and its effect on bear populations, is not well understood. This paper is an attempt to describe the vulnerability of hunted bears by sex and age while using dogs in Maine. A secondary objective is to describe the efficiency of this hunting method. These data should supply wildlife biologists with information pertinent to dog-bear hunting effort and success. The study area was originally chosen by Hugie (1982) because of its nonhunted bear population. Use of the same area for this study was appropriate because of the existing data base on bears and bear ranges, and because the hunting of bears with dogs in this remote area was nonexistent until this study.

### METHODS

Attempts were made to duplicate the hunting practices of houndsmen in Maine, which includes the use of radio collars (modified black bear collars, Telonics, Incorporated, Mesa, Arizona) on the dogs. The most common method used to locate a bear was by "striking", whereby the

strike dog was positioned in the back of a pickup truck. At first light, a crew of at least 4 people would slowly drive along study area roads until the strike dog scented a bear that had recently crossed the road. The strike dog would then be taken off the truck and allowed to search the roadside for the trail. The level of excitement in the dog as it worked the trail enabled the dog handler to assess the freshness of the track and the direction moved by the bear. A fresh track warranted the release of the other dogs (a total of 4 by law). In addition, bait piles of meat scraps and old bakery goods were maintained throughout the study area to attract bears and to facilitate chases when no bears were struck along the roads. A bear was considered "killed" if we found it treed or held at bay by the dogs. In some instances, I made a judgment as to whether we could have killed a bear as it crossed the road immediately in front of us. This was necessary because bear hunters in Maine do attempt to shoot bears on the ground ahead of the dogs, not waiting for the bear to tree. Attempts were made to immobilize and handle all treed bears.

#### RESULTS AND DISCUSSION

From June 1980 to October 1981, 94 days (201 man-days) of hunting were required to obtain 59 bear chases. Forty-three chases were initiated by the strike dog. Sixteen chases started at one of the bait stations. We failed to initiate a chase in 35 attempts, despite an average of 4 hours of search. A number of conditions were responsible for the days when no bears were run. They include:

lessened bear activity due to adverse weather; poor scent conditions on hot, dry mornings; chases of non-target wildlife; and exhausted dogs.

During the 2 field seasons, 22 "kills" were recorded. Eighteen bears were treed and were considered killed and another 4 could have been killed on the ground. Therefore, nearly 4.5 days of hunting were required to generate a kill (94 days hunting/22 kills). Once a bear chase was initiated, we experienced a kill rate of 37% (22 kills/59 chases) and a tree rate of 30% (18 trees/59 chases). Bears treed 4 times in 16 chases (25%) when chased from baits. In an experimental pursuit season in Oregon, hunters reported a "kill" rate that ranged from 48% to 84% and averaged 69% statewide (Ebert 1979). The Oregon hunters were not limited to the number of dogs they could use. Willey (1982) captured 10 bears during 34 days of pursuit in Vermont.

In general, male bears are more vulnerable to bear hunters than females (Jonkel and Cowan 1971, Willey 1971, Kemp 1974, Alt 1980, Beecham 1980, and Hugie 1982). But, Bunnell and Tait (1980) suggested that the use of dogs generates a pattern of hunting that has the hunter moving over large areas rather than traditional paths. They believe that the use of dogs reduces the relative hunting vulnerability of male to female bears and predict that hunters using dogs will kill equal numbers of male and female bears.

During this study, the sex, age, and weight of treed bears were obtained on only 12 occasions. Of these 12 bears, more females (8) treed and were handled than males (4). The average age and weight of

a handled bear was 4.7 to 40 kg, respectively (Table 3). This disparity in sex ratio is in part due to differential immobilization of treed bears. Smaller bears, many of which were females, were easier to immobilize because they required less drug and were less dangerous to handle if only partially anesthetized. A few large bears, presumably males, treed but were not handled for safety reasons. For instance, 2 large bears became more dangerous when they sustained chases until after dark before they treed. No attempts were made to immobilize these bears, but they were nevertheless considered theoretically killed because most hunters would have shot them. Had these bears and the 4 bears killed on the ground been handled, the sex ratio of killed bears would have more likely been even. I conclude that both sexes in general are equally vulnerable to hunters using dogs.

Table 3. Sex, age, and weight of 12 of 22 theoretically killed bears. This shows that there was considerable variability in the age and weight of treed and handled bears. However, younger and smaller bears were handled more often.

Sex	Number	Average Age		Average Weight	
		(years)	Range	(kg)	Range
Female	8	5.5	1-12	31	30-64
Male	4	3.0	2-6	58	27-136
	12	4.7	-	40	-

During this study, females with cubs were located by the dogs and run only twice. In both cases, the female treed after a short chase. Radio-collared females with cubs, once located with telemetry and run with dogs, treed easily and never in the same tree with their cubs (Allen 1985). While both sexes of solitary bears seemed equally

capable of sustaining long chases, females with cubs did not. Females with cubs, if not treed immediately, generally circled back to where the chase began, perhaps to check on treed cubs. This behavior, together with cub tracks in the immediate area, provide clues to the hunter that a female with cubs is being pursued. Hunters who wish not to shoot a female with cubs should be aware of this unique chase pattern. I conclude that this component of a bear population would be most vulnerable if the bear families crossed roads (where their scent could be detected more easily by dogs) as frequently as other bears. However, females with cubs have restricted movement patterns and small home ranges, and thus are less likely to be shot (Hugie 1982).

Subadult bears appeared to be struck, run, and seen more often, but they usually outdistanced the dogs. Subadult bears would be struck more often if this segment of the population exhibited a disproportionate amount of crepuscular activity, thereby leaving fresher tracks for the dogs to detect. In Tennessee, subadults were more active than solitary adults of their respective sex (Garshelis and Pelton 1980). Willey (1982) reported balanced sex and age ratios (8 females and 8 males; 7 adults, 5 subadults, and 4 cubs) in his dog-captured bears. Elowe (1984) thought that if dog handlers are willing to check feeding areas, crossings, and wetland fringes, they would capture each sex or age class equally.

Annual sex and age class data from bears killed by hunters are commonly collected for management purposes. The number of bears killed which are of a particular sex and age class is determined by

the number available to be killed, the relative vulnerability of that sex and age class to the hunting method, and the total hunting pressure (Gilbert et al. 1978). In general, males predominate in the overall bear harvest because of hunter selection or differential availability to hunters, or both (McIlroy 1972). One would expect this to occur with bears killed using dogs, because hound hunters have two unique opportunities to select the kind of bear they will shoot. One reason is the opportunity for releasing the dogs on the trails of large bears (based on tracks), and two, the opportunity to shoot only large bears from the tree, opting to leave smaller bears. But, as Rieffenberger et al. (1981) point out "bears look big in trees and consequently small bears, many of them females, are also killed." Poelker and Hartwell (1973) reported that Washington's bear kill using dogs had significantly more females than males.

Hunters using dogs annually kill an average of 124 bears in Maine (range 79-205), based on 1974-1981 kill figures (Banasiak and Matula 1982). These figures represent roughly 11.5% (range 7.4% - 15.6%) of the statewide bear kill over the same period. Houndsmen registered 571 males (58%) and 416 females (42%) over the 8-year period (Table 4). It is unclear whether hunter selection, differential vulnerability, or both, are factors operating relative to the sex of bears in the Maine bear harvest using dogs. At present, it is not likely that hunters using dogs will seriously impact Maine's bear population if these harvest trends continue through the 1980's. But locally, a potential exists for overharvest in heavily hunted areas



with extensive road access.

Table 4. Maine black bear harvest (1974-1981) using dogs. These data show that males outnumber females in the registered kill and that dog hunters take roughly 11.5% of the annual kill.

Year	Males	Females	Unk.	Total	Statewide Harvest	Percent of Harvest
1981	52	35	-	87	1,001	8.7
1980*	44	34	1	79	1,058	7.4
1979	109	95	1	205	1,630	12.6
1978	75	57	2	134	1,320	10.1
1977	99	49	-	148	1,066	13.9
1976	42	44	-	86	1,008	8.5
1975	76	60	1	137	947	14.4
1974	74	42	-	116	744	15.6
Totals	571	416	5	992	8,774	11.5

\*September 15 emergency closure

#### Management Considerations

Successful management of black bears requires a knowledge of all allowable hunting methods in a given area. However, before this study, information was lacking on the use of dogs to hunt bears other than the total kill.

Hunting success for black bears is partially determined by the amount of road access to and within bear range (Jonkel and Cowan 1971). Kellyhouse (1977) warned that extensive forest road systems in northern California may allow hound hunting to become too efficient and result in overharvest. In North Carolina, bears chased through sand ridges and pine forests were vulnerable to hunters because these areas were saturated with access roads (Landers et al. 1979). Carr (1983) stated that female bears that inhabit areas close to roads are

especially vulnerable to being killed. My data on pursued females substantiate this. Carr (1983) also suggested that road access should be restricted to protect the breeding portion of the population. If desirable, a system of gates into forest systems may be a means to regulate hound hunting pressure in some areas. Unfortunately, most wildlife managers may not have the opportunity to limit access into bear range. The perpetuation of bear populations in areas with extensive access may be dependent on the bears that learn to avoid roads, together with careful adjustments in hunting season lengths.

In my studies, I found that hunting bears with hounds is not an efficient way to capture (or theoretically kill) a large number of bears. However, houndsmen claim that bear chases are both exciting and physically demanding. Consequently, much hunter satisfaction is derived. They further claim that a successful hunt is the bear chase, not the bear kill. Sport hunting with dogs will no doubt be perpetuated if hunters continue to derive pleasure from the chase and if the hunting public is satisfied with a low hunting return. The overharvest of bear populations may be prevented if large tracts of land with limited or no access can be maintained to serve as bear refuges from Man and hounds. Habitat management is the key to maintaining any species. Secure areas of escape cover and protected feeding areas are two important components of habitat that are crucial to maintaining a population. Roadless habitat automatically provides the necessary security.

Hunting with dogs may prove a valuable management tool where nuisance bears are habitually a problem. Poelker and Parsons (1977) concluded that hound hunting is essential to obtain an adequate kill of bears where damage to trees by tearing off the bark and eating the cambium is excessive. In Maine, hunters have been employed to trail and destroy nuisance bears from corn fields and apiaries. Simply running nuisance bears with dogs repeatedly may be enough to modify a nuisance bear's behavior (pers. comm. Chas. Jonkel).

Future research should further explore behavioral impacts on the bears by the dogs, and the possibility of physiological or reproductive upsets from extended chases. Bear managers would be well advised to consider these implications, along with any appreciation for the hunting of bears with dogs or the motivations which maintain the hunters. The concept of hunting with dogs as a "quality" hunt has merit, but the refinement of techniques such as the use of radio-collars for the tracking of dogs must be regulated. The potential for use of the technique in behavioral modification (aversive conditioning) for problem bears also deserves further attention.

## LITERATURE CITED

- Allen, R. B. 1985. Experimental pursuit of black bears with trained bear dogs. Presented at the 7th E. Black Bear Workshop. Homosassa Springs, FL.
- Alt, G. L. 1980. Hunting vulnerability of bears. PA. Game News 51(7):7-10.
- Banasiak, C. F., R. D. Hugie, G. R. Lavigne, K. I. Morris. 1979. 1978 Big Game Project Report. Maine Department of Inland Fisheries and Wildlife. Wildlife Division Leaflet Series. Vol. 11(2). 23pp.
- \_\_\_\_\_, G. J. Matula, G. R. Lavigne, K. I. Morris. 1982. 1981 Big Game Project Report. Maine Department of Inland Fisheries and Wildlife. Wildlife Division Leaflet Series. Vol. 14(2). 33 pp.
- Beecham, J. 1980. Some population characteristics of two black bear populations in Idaho. Pp. 201-204 in C. J. Martinka and K. L. McArthur, eds., Bears -- Their Biology and Management. Proc. 4th Int. Conf. on Bear Res. and Management. Kallispell, MT.
- Bunnell, F. L., and D. E. N. Tait. 1980. Bears in models and in reality - implications to management. Pp. 15-23 in C. J. Martinka and K. L. McArthur, eds., Bears -- Their Biology and Management. Proc. 4th Int. Conf. on Bear Res. and Management. Kallispell, MT.
- Carr, P. C. 1983. Habitat utilization and seasonal movements of black bears in the Great Smoky Mountains National Park. M. S. Thesis. Univ. of Tennessee, Knoxville. 95pp.
- Corbett, R. L., R. L. Marchinton, and C. E. Hill. 1971. Preliminary study of the effects of dogs on radio-equipped deer in a mountainous habitat. Proc. Annu. Conf. Southeast Game and Fish Comm. pp. 69-77.
- Craighead, F. C., Jr. and J. J. Craighead. 1965. Tracking grizzly bears. Bio Science 15:88-92.
- Dasmann, R. F., and R. D. Taber. 1956. Behavior of Columbian black-tailed deer with reference to population ecology. J. Mammal. 37:143-164.
- Ebert, P. W. 1979. Oregon's 1978 bear pursuit season. Pp. 261-266 in Proc. 1st W. Black Bear Workshop. Tempe, AZ.
- Elowe, K. D. 1984. Home range, movements and habitat preferences of black bears (Ursus americanus) in western Massachusetts. M. S. Thesis. Univ. of Massachusetts, Amherst. 104pp.

- Garshelis, D. L., and M. R. Pelton. 1980. Activity of black bears in the Great Smoky Mountains National Park. *J. Mammal.* 61:8-19.
- Gavitt, J. D. 1973. Disturbance effect of free-ranging dogs on deer reproduction. M. S. Thesis. VPI, Blacksburg, VA. 53pp.
- Gilbert, J. R., W. S. Kordek, J. Collins, and R. Conley. 1978. Interpreting sex and age data from legal kills of bears. Pp. 253-262 in R. D. Hugie, ed., 4th Eastern Black Bear Workshop. Greenville, ME.
- Hamilton, R. J. 1978. Ecology of the black bear in southeastern North Carolina. M. S. Thesis. Univ. of Georgia, Athens. 214pp.
- Hornocker, M. G., J. J. Craighead, and E. W. Pfeiffer. 1965. Immobilizing mountain lions with succinylcholine and pentobarbital sodium. *J. Wildl. Manage.* 29:880-883.
- Hugie, R. D. 1976. Black bear ecology and management in the northern coniferous-deciduous forests of Maine. Ph. D. Thesis proposal, Univ. of Montana, Missoula. 22pp.
- \_\_\_\_\_. 1982. Black bear ecology and management in the northern coniferous-deciduous forests of Maine. Ph. D. Thesis. Univ. of Montana, Missoula. 217pp.
- Jonkel, C. J. 1967. The ecology, population dynamics, and management of the black bear in the spruce-fir forest of northwestern Montana. Ph.D. Thesis. Univ. British Columbia, Vancouver. 170pp.
- \_\_\_\_\_, and I. M. Cowan. 1971. The black bear in the spruce-fir forest. *Wildl. Monogr.* 27:57pp.
- Kellyhouse, D. G. 1980. Habitat utilization of black bears in northern California. Pp. 221-227 in C. J. Martinka and K. L. McArthur, eds., *Bears -- Their Biology and Management*. Proc. 4th Int. Conf. on Bear Res. and Management. Kallispell, MT.
- Kemp, G. A. 1974. The dynamics and regulation of black bear (*Ursus americanus*) populations in northern Alberta. Pp. 191-197 in M. R. Pelton, J. W. Lentfer, and G. E. Folk, Jr., eds., *Bears -- Their Biology and Management*. IUCN Publ. New Ser. 40.
- Lamb, G. R.. 1983. Home range and habitat use of female bears in northern Maine. M. S. Thesis. University of Maine, Orono. 26pp.
- Landers, J. L., R. J. Hamilton, A. S. Johnson, and R. L. Marchinton. 1979. Foods and habitat of bears in southeastern North Carolina. *J. Wildl. Manage.* 43:143-153.

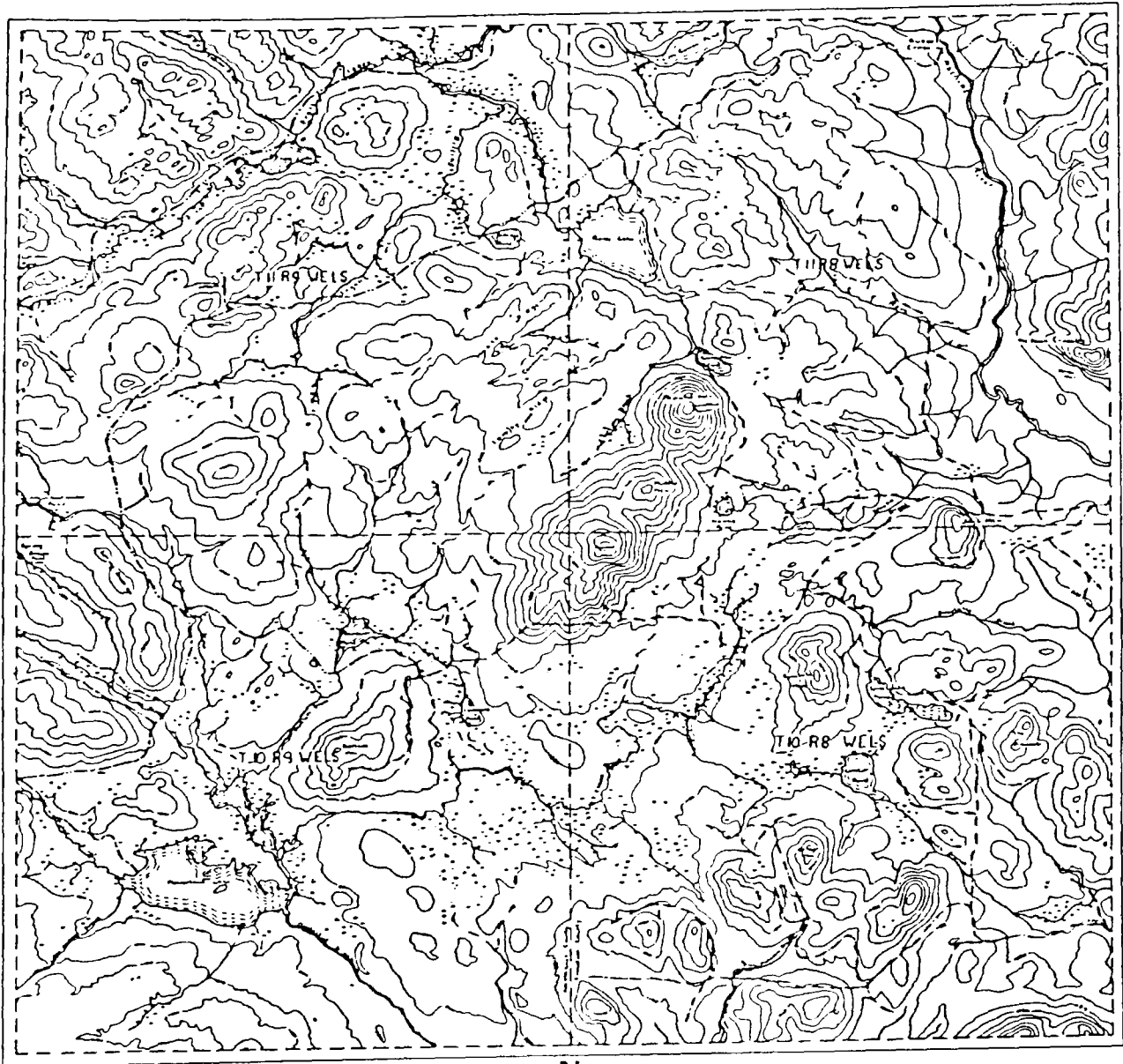
- Lindzey, F. G. and E. C. Meslow. 1977. Home range and habitat use by black bears in southeastern Washington. *J. Wildl. Manage.* 41:413-425.
- Lowe, C. E. 1958. Ecology of the swamp rabbit in Georgia. *J. Mammal.* 39:116-127.
- Marchinton, L. R., A. S. Johnson, J. R. Sweeney, and J. M. Sweeney. 1970. Legal hunting of white-tailed deer with dogs: biology, sociology, and management. *Proc. Annu. Conf. Southeast Assoc. Game and Fish Comm.* pp. 74-89.
- McIlroy, C. W. 1972. Effects of hunting on black bears in Prince William Sound. *J. Wildl. Manage.* 36:828-837.
- Pelton, M. R. 1982. Black bear. Pp. 504-514 in J. A. Chapman and G. A. Feldhamer, eds., *Wild Mammals of North America: Biology, Management, and Economics*. Johns Hopkins University Press. 1147pp.
- Poelker, R. J., and H. D. Hartwell. 1973. Black bear of Washington. *Washington State Game Dept. Bio. Bull.* 18. 180pp.
- \_\_\_\_\_, and L. D. Parsons. 1977. Black bear hunting to reduce forest damage. Pp. 191-193 in C. J. Martinka and K. L. McArthur, eds., *Bears -- Their Biology and Management*. *Proc. 4th Int. Conf. Bear Res. and Management*. Kallispell, MT.
- Progulske, D. R., and T. S. Baskett. 1958. Mobility of Missouri deer and their harassment by dogs. *J. Wildl. Manage.* 22:184-192.
- Rieffenberger, J. C., R. J. Anderson, W. S. Brown, K. B. Knight, and J. I. Cromer. 1981. West Virginia Black Bear. *West Virginia Department of Natural Resources. Wildlife Resources Division Bull.* 9. 55pp.
- Rogers, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. *Trans. N. Am. Wildl. Conf.* 41:431-437.
- Stoneberg, R. P., and C. J. Jonkel. 1966. Age determination of black bears by cementum layers. *J. Wildl. Manage.* 30:411-414.
- Sweeney, J. R., R. L. Marchinton, and J. M. Sweeney. 1971. Responses of radio-monitored white-tailed deer chases by dogs. *J. Wildl. Manage.* 35:707-716.
- Toll, J. E., T. S. Baskett, and C. H. Conaway. 1960. Home range, reproduction, and foods of the swamp rabbit in Missouri. *Am. Midl. Nat.* 63:398-412.

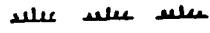

- Willey, C. H. 1971. Vulnerability in Vermont's black bear population. Trans. Northeast Wildl. Conf. 40pp.
- \_\_\_\_\_. 1974. Aging black bears from first premolar tooth sections. J. Wildl. Manage. 38:97-100.
- \_\_\_\_\_. 1982. Black bear location and capture with the aid of trained bear dogs. Proc. 5th E. Black Bear Workshop. Wrightsville Beach, NC. pp.107-119.
- Zwickel, F. C. 1969. Use of dogs in wildlife management. Wildlife Management Techniques, 3rd ed., R. H. Giles, Ed., Edwards Bros., Inc., Ann Arbor, MI. 633pp.

APPENDIX I


SUPPLEMENTAL INFORMATION





**Legend**  
Roads — · · · — · · · —  
Wet areas   
Contour lines 



**Scale**  
  
3 km

Spectacle Pond study area

BLACK BEAR - DOG FIELD NOTES

DATE \_\_\_\_\_ TOWN \_\_\_\_\_ ROAD NO. \_\_\_\_\_  
day-mo-year name: name:

TIME \_\_\_\_\_ TIME UNDER TREE \_\_\_\_\_ TIME ELAPSED \_\_\_\_\_  
24 hr

TREE CHAR. \_\_\_\_\_ TREE HEIGHT \_\_\_\_\_ NO. DOGS AT TREE \_\_\_\_\_  
Species:

DRUG USED \_\_\_\_\_ DOSAGE/LB \_\_\_\_\_ TIME OUT \_\_\_\_\_ TIME UP \_\_\_\_\_

BEAR INFORMATION

SEX \_\_\_\_\_ EST. AGE \_\_\_\_\_ ACTUAL AGE (lab) \_\_\_\_\_ WEIGHT \_\_\_\_\_  
(kg)

TOOTH NO. \_\_\_\_\_ NECK GIRTH \_\_\_\_\_ CHEST GIRTH \_\_\_\_\_  
(cm) (cm)

EAR TAG NUMBERS \_\_\_\_\_

RECAPTURE \_\_\_\_\_ ORIGINAL CAPTURE \_\_\_\_\_ RADIO FREQUENCY \_\_\_\_\_

CUBS PRESENT? \_\_\_\_\_ TOTAL MILES WALKED \_\_\_\_\_ TELEMETRY USED? \_\_\_\_\_

COMMENTS

BEAR RUN BUT NOT HANDLED \_\_\_\_\_  
\_\_\_\_\_

OTHER COMMENTS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RESEARCHERS \_\_\_\_\_ DOG HANDLERS \_\_\_\_\_

## STATES AND PROVINCES WITH BLACK BEAR HUNTING SEASONS

UNITED STATESHounds Legal<sup>1</sup>

Alaska  
 Arizona  
 California  
 Colorado  
 Florida  
 Idaho  
 Maine  
 Massachusetts  
 Michigan  
 New Hampshire  
 New Mexico  
 New York  
 North Carolina  
 Oregon  
 South Carolina  
 Tennessee  
 Utah  
 Vermont  
 Virginia  
 Washington  
 West Virginia  
 Wisconsin

Hounds not Legal

Arkansas  
 Georgia  
 Minnesota  
 Montana  
 Pennsylvania  
 Wyoming

CANADAHounds Legal<sup>1</sup>

British Columbia  
 Ontario  
 Quebec

Hounds not Legal

Alberta  
 Manitoba  
 New Brunswick  
 Newfoundland  
 Northwest Territories  
 Saskatchewan  
 Yukon Territory

<sup>1</sup>Regulations vary, most states and provinces have restrictions.

APPENDIX II

TABLES OF SUPPLEMENTAL DATA

Table 1. General habitat types and tree characteristics of treed bear locations.

Habitat type	Tree Species							Total
	Maple spp.	American beech	Oak	Spruce/Fir	Hemlock	White Pine	Cedar	
Hardwood	7	1	1	-	-	-	-	9
80% Hardwood	3	-	-	4	-	1	-	8
Softwood	-	-	-	1	-	1	-	2
80% Softwood	-	-	-	3	1	1	3	8
	10	1	1	8	1	3	3	27
Average dbh <sup>1</sup> (cm)	61.0	38.1	190.0	45.7	50.8	99.8	50.8	61.0

<sup>1</sup>dbh = diameter breast height

Table 2. Radio-collared bears pursued with dogs by year.

Year	Number of runs	Run initiate			Number treed (Percent)	Number of different bears	
		Strike	Bait	Telemetry			
1979	1	-	-	1	1	100%	1
1980	7	-	1	6	2	29%	5
1981	24	8	2	14	14	58%	10
	32	8	3	21	17	53%	11 (3 males:8 females)

Table 3. Summaries of collared bears pursued with dogs.

Bear No.	Sex	Year Born	Times Ran	Shortest Run (km)	Shortest Time (min)	Longest Run (km)	Longest Time (min)	Average Run (km)	Average Time (min)	Times Treed	Average Time Run to Tree (min)
145	F	75	2	2.0	30	13.0	180	7.5	105	2	105
197	M	75	3	1.0	30	11.3	180	4.7	80	1	180
123	F	76	6	2.5	40	11.2	240	7.0	186	1	40
126	F	69	3	1.2	15	5.0	360	2.6	165	2	67
223	F	77	2	0.6	10	1.5	15	1.0	13	2	13
267	M	79	2	0.8	20	2.2	60	1.5	40	1	40
268	F	79	5	4.0	120	16.0	240	7.7	185	3	160
71	F	71	3	0.4	10	3.6	60	2.1	33	3	33
272	F	78	4	10.4	120	22.4	330	16.0	270	0	-
166	M	75	1	8.0	45	-	-	8.0	45	1	45
221	F	75	1	4.8	40	-	-	4.8	40	1	40
32 <sup>1</sup>								6.0	136	17	

<sup>1</sup>Includes chases that resulted in initial capture

Table 4. Radio-collared bear's home range and run relationships.

Bear No.	Sex	Number of Relocations (Source) <sup>1</sup>		Times Ran	Stayed in Range	Left Range		Time to Return
						< 2 km	/ > 2 km	
145	F	33	(H)	2	1	0	1	Immediately
197	M		(H)	3	3	0	0	-
123	F	81	(H,L)	6	4	0	2	Immediately
126	F	75	(L)	3	1	0	2	Immediately
223	F	too few		2	-	-	-	-
267	M	too few		2	-	-	-	-
268	F	18	(A)	5	2	3	0	1;4+; and 1 (days)
71	F	34	(L)	3	2	0	1	Less than 1 day
272	F	22	(A)	4	0	1	3	Later in day
166	M	15	(H)	1	1	0	0	-
221	F	46	(L)	1	1	0	0	-
				32	15	4	9	

<sup>1</sup>Sources: Hugie 1982 = (H)  
 Lamb 1983 = (L)  
 Allen 1985 = (A) this study



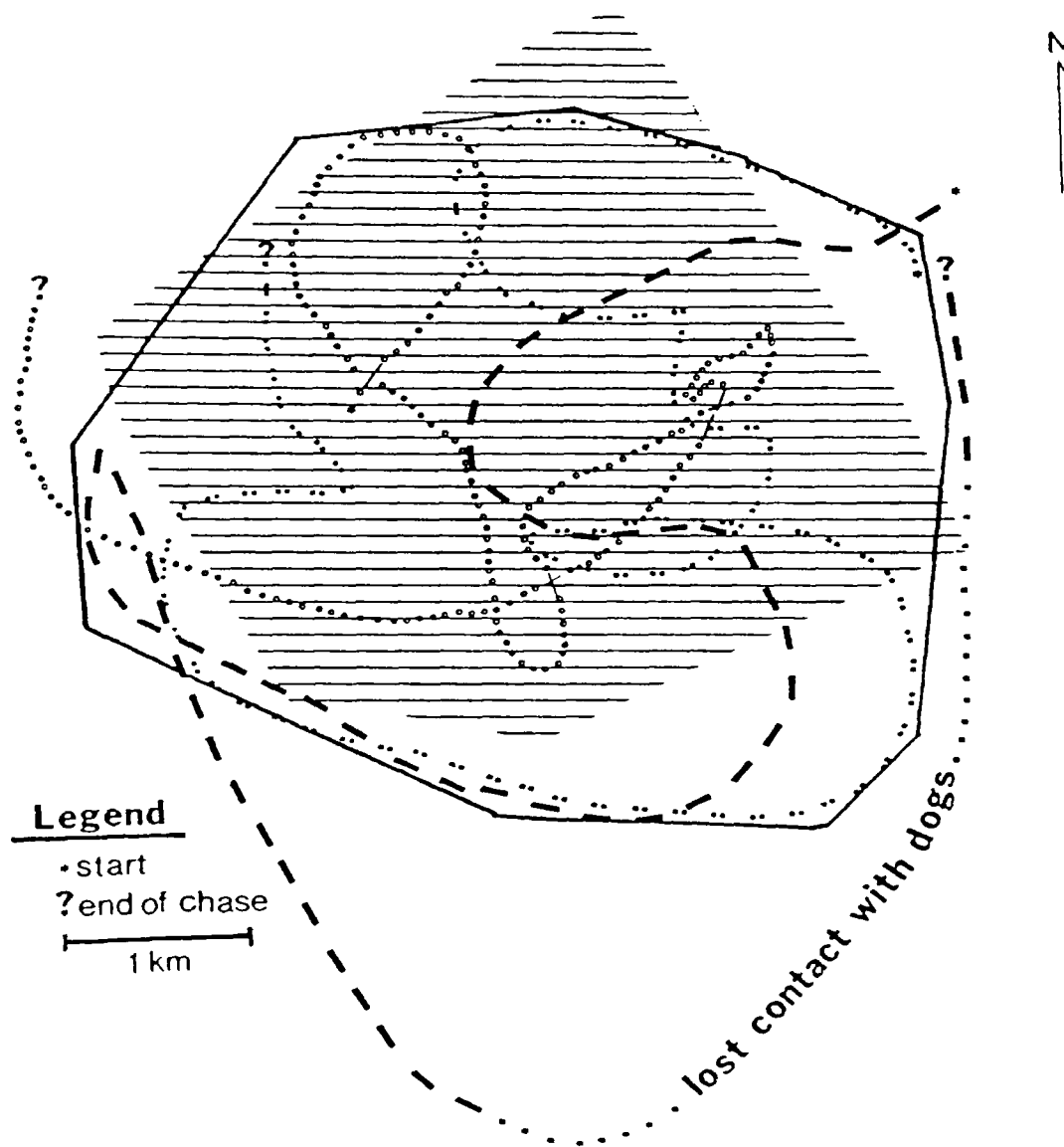
Table 5. Types of runs of radio-collared bears.

Bear No.	Sex	Straight		Circuitous		Total
		Long	Short	Long	Short	
145	F	1	1*	-	-	2
197	M	1	2	-	-	3
123	F	-	1	4	1	6
126	F	2	-	1	-	3
223	F	2	-	-	-	2
267	M	2	-	-	-	2
268	F	3	2	-	-	5
71	F	-	3*	-	-	3
272	F	-	-	4	-	4
166	M	1	-	-	-	1
221	F	-	-	-	1	1
		12	9	9	2	32

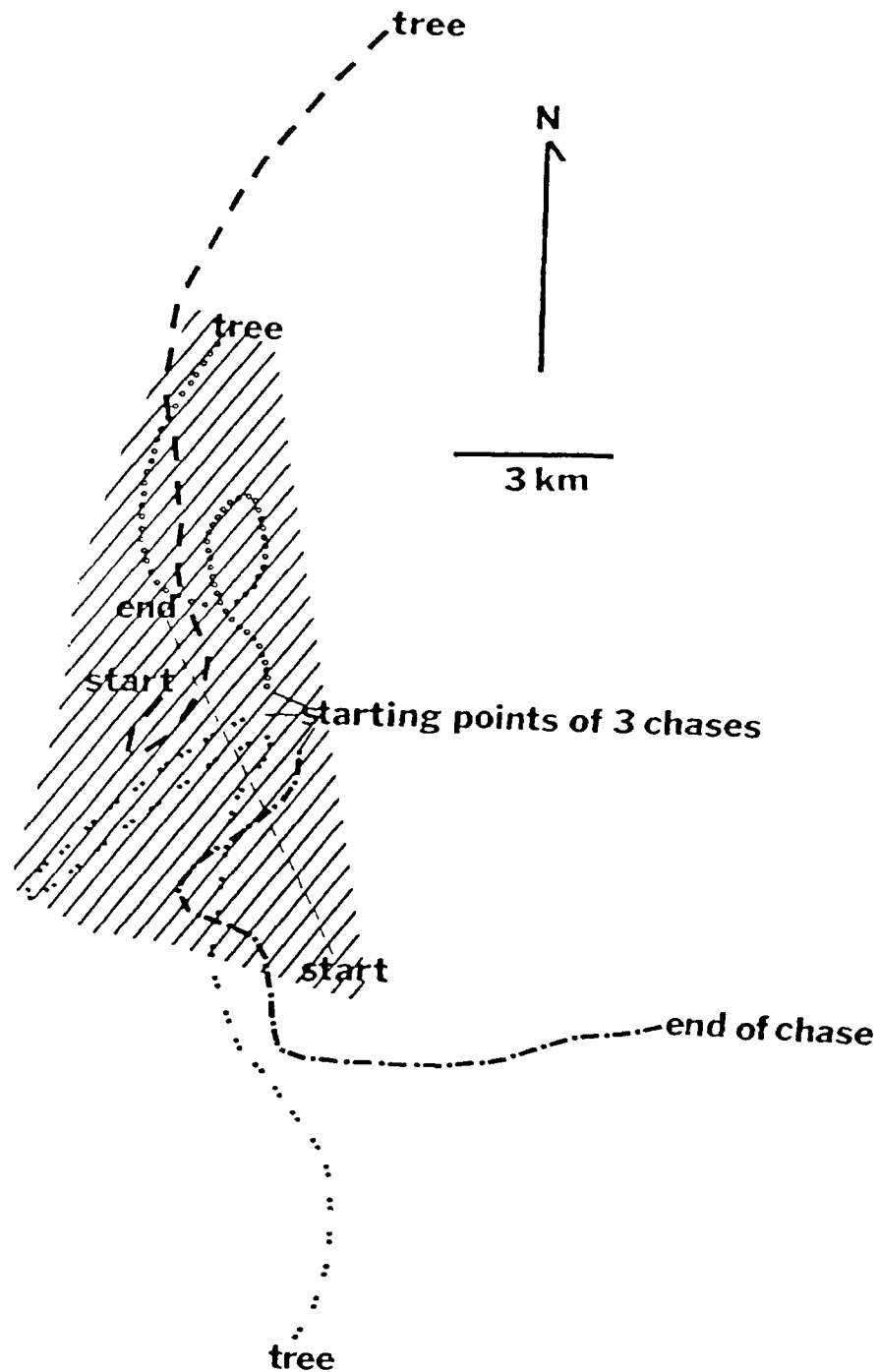
\*With cubs when pursued

APPENDIX III

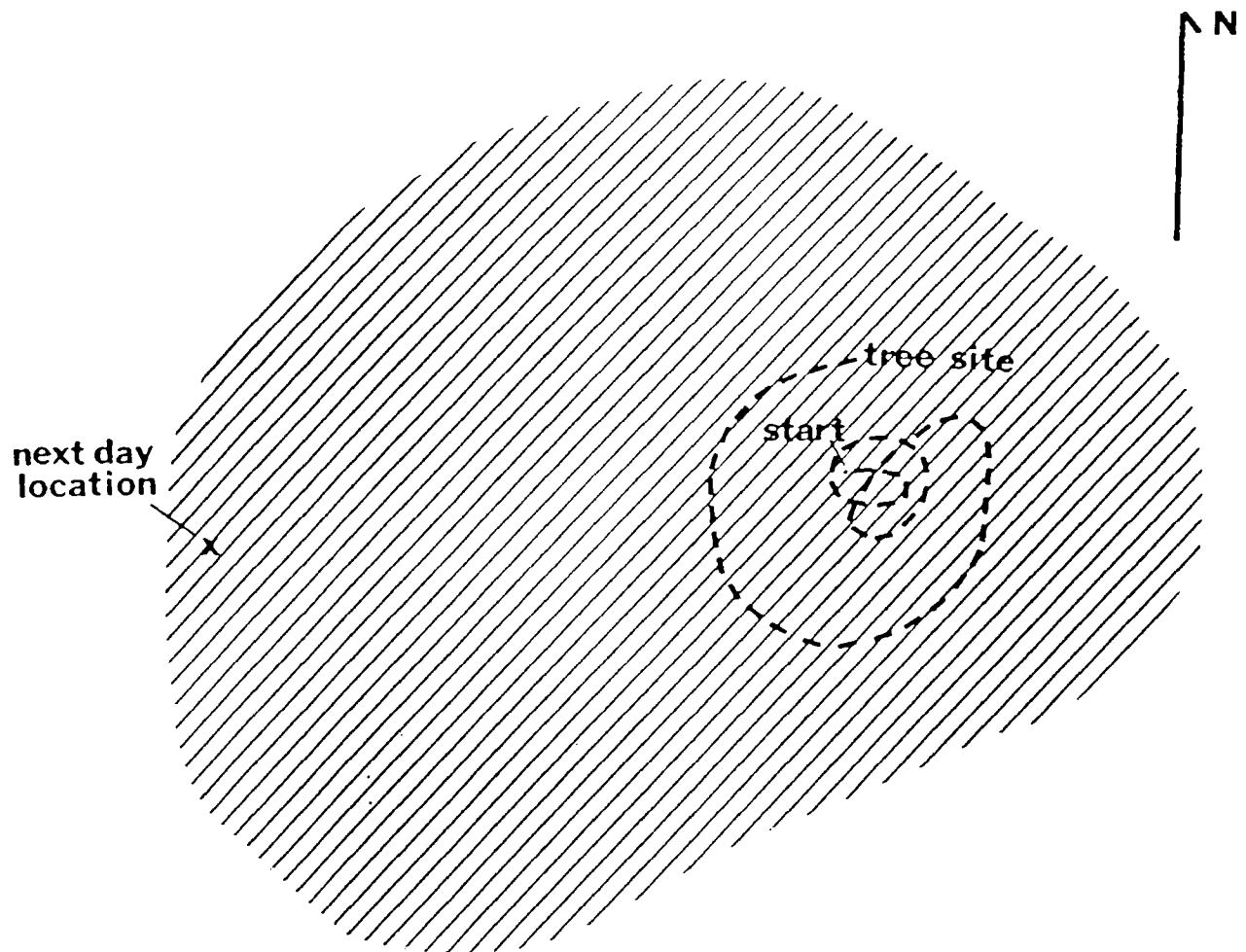
MAPS OF BLACK BEAR HOME RANGES  
AND PURSUIT PATTERNS



Map 1. Three chases (dotted lines) of female bear No. 272 in relation to her home range (lined area). The area within the solid black line represents the bear's home range by the circuitous run method (CRM).



Map 2. Five chases of 2-year-old female bear No. 268 in relation to her home range (lined area). Figure shows that this bear left her home range by  $> 2$  km during 3 of the 5 chases.



Map 3. Chase and subsequent location of female bear No. 221 in relation to her home range (lined area). Figure represents the location of bear in an inaccessible area of her home range 1 day after pursuit by dogs.