SECOND WESTERN BLACK BEAR WORKSHOP

PROCEEDINGS

Logan, Utah

2~4 March 1982

Proceedings of

The

SECOND WESTERN BLACK BEAR WORKSHOP[a]

Logan, Utah

2-4 March, 1982

Utah Cooperative Wildlife Research Unit

Utah Division of Wildlife Resources

Compiled and Edited by:

Frederick G. Lindzey

[a]This workshop was conducted in cooperation with the Bear Biology Association. Additional copies of the Proceedings may be obtained by writing:

Clifford Martinka
Glacier National Park
West Glacier, MT 59936

Forward

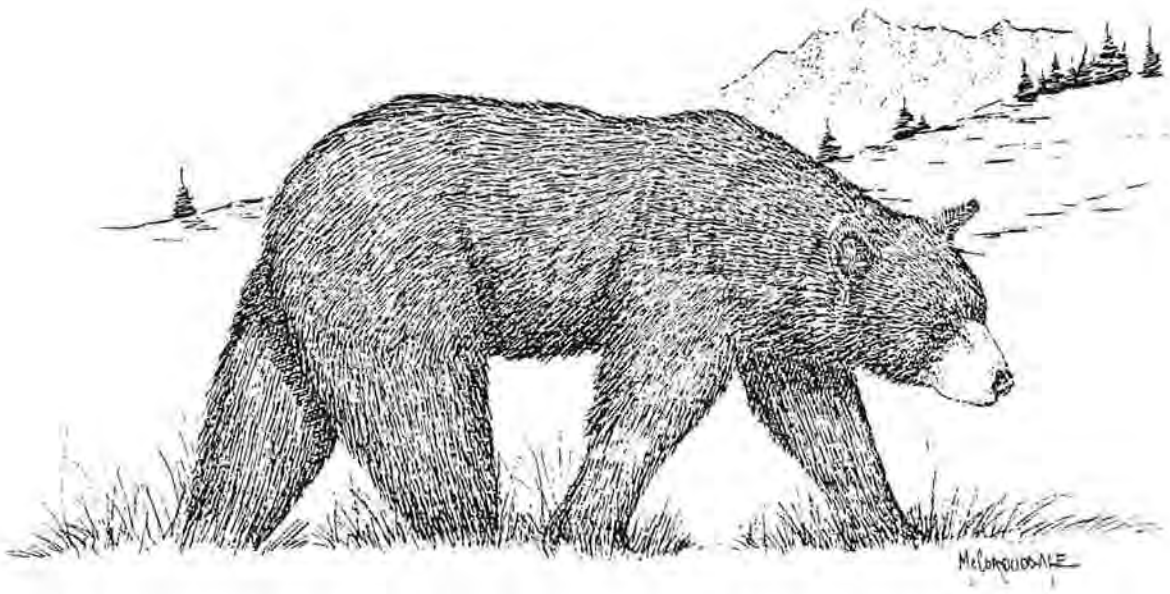
Participants at the workshop identified major topics of interest and need during the initial working session. A chairman was then assigned to introduce each of the topics and direct the discussion sessions. Each chairman was provided a tape of his session and given free reign in design of the session summary. Chairmen were asked to not simply report comments verbatum but to synthesize comments and ideas of the participants and to provide insights, challenges and criticisms of their own. As a result, each summary is different.

Jim Burruss contributed to the initial planning of the workshop and Ellen Parker assisted greatly in the typing and formating of the Proceedings. Special thanks to the invited speakers, the chairmen who took on their roles on short notice and to Scott McCorquodale who provided the art work found throughout these Proceedings. Cindy Waller provided the cover illustration.

--Fred Lindzey

Table of Contents

STATUS REPORTS



ALASKA

Jim Lieb
Alaska Department of Fish and Game

Black bears are abundant and populations stable in most units. Accurate population density indices are unavailable for black bears, but biologists felt that black bear populations were high and perhaps increasing in Units 15 and 16 and at least stable elsewhere. Sealing of black bears is required only in Units 1-7, 11-16, and 20; statewide harvests are therefore not available. Among those units in which sealing is required, the recorded take in 1980 was highest in Unit 16 (243, a record kill), followed by 161 bears in Unit 15 (also a record), 134 bears in Unit 20, and 89 bears in Unit 14. In most units black bears are under-utilized relative to their population levels. Season vary by unit but generally occur between late fall and early spring. Bag limits vary from one to three bears.

The black bear harvest for Unit 1A was down 7 percent from the long-term average and down 10 percent from the 1979 harvest. In general, the Unit 1A harvest has remained fairly constant. In Unit 2, the harvest appeared to be rising slowly and steadily. The 1980 harvest was up 26 percent from the long-term average and 4 percent from the 1979 harvest. While the harvest for both Units should continue to increase, Unit 2 will probably show greater proportional increases because of the heavy logging activity currently in progress, and planned for the future. Extensive logging road systems are being opened and connected, making the area attractive to hunters having motorized camping units.

Available information did not indicate any significant change in the black bear population in Unit 1D since 1979. Due to revisions in determining tooth cementum ages of black bears, tooth samples from previous years' harvests are in the process of being reread for data consistency. With black bears increasing in importance as a game animal, new information through research and S&I activities will be needed in the future to effectively manage the species. No changes in seasons or bag limits are recommended.

Generally, the black bear population appears to be stable unit-wide (Unit 5) and production appears to be good. The hunting pressure seems to remain fairly constant from year to year, but harvest levels fluctuate considerably. This fluctuation is most likely due to the wide variability in the spring weather and the resultant change in the timing of "leaf out." Guides plan their first hunt to begin about the same time each year. If spring comes early (or late) on any given year it can result in a harvest different from the "average" level.

The harvest of 66 bears in Unit 6 was the smallest annual harvest on record. The 7-year average was 106 bears. The 1980 harvest was normal in all respects except for the number of bears taken. The following harvest characteristics were similar to previous years: 1) percent of bears taken during the spring season, 2) percent of males in the harvest, 3) chronology of harvest, and 4) skull size. Average age of males harvested in 1980 was near the 7-year average, but the average age of females harvested was considerably below average. This could be a function of small sample size.

Unit 7 has sustained a relatively stable year-to-year harvest of black bears since 1973. The 1980 harvest of 70 bears was slightly higher than the annual average kill of 57 bears. Short-term reductions of up to 2 years in the mean age of harvested bears are not interpreted with alram at this time, since annual variations of this magnitude appear normal. A stable harvest trend and an increasing number of observations of bears indicate that bears are abundant in Unit 7 under the current management system. Consequently, no changes in season or bag limit were recommended.

Since National Monument regluations prohibiting sport hunting were still in effect during 1980, the hunting effort did not increase over levels observed in 1979. The low black bear harvest reflects this low hunter participation in Unit 11.

The black bear population in Unit 12 is believed to be stable, limited by natural factors. Hunting pressure is low in relation to the bear population and is restricted to areas near the road system. No changes in the existing management scheme are needed at this time.

Although the black bear population in Unit 20 is believed to be essentially stable, black bear population dynamics are poorly understood in Interior Alaska. Black bear populations appear to fluctuate independent of hunting, although hunting has certainly affected local populations. Nevertheless, there are few data available to indicate the effects of varying levels of harvest on bear populations. In addition, little is known about basic biology, movements, and population status of black bears in Unit 20. Black bears should be managed responsibly as a big game animal and not as another nuisance species. With the continuing high interest in black bear hunting and the increased hunting pressure in the Interior, biological information on black bears is of increasing importance and should be collected.

Editor's note: This report was synthesized by the editor from a larger report sent.

ALBERTA

Brian O. Pelchat
Alberta Energy and Natural Resources Fish and Wildlife Division

Introduction

The black bear (Ursus americanus) is not recognized as a trophy animal or valued sport hunting species by most hunters in Alberta. Hunting is not intensive and most fall hunters purchase bear licenses for the opportunity to shoot a bear while pursuing more valued game such as elk or moose. Annual inventories are not conducted and population trends, age structure and regional densities are unknown. Consequently, periodic changes in licensing and bag limits are more related to current management philosophies and value judgments by wildlife managers than to bear numbers or the incidents of nuisance bears. Agricultural depredations and other nuisances are common, and extensive management of nuisance bears is practiced in Alberta (More 1978, Gurba and Neave 1979). Public attitudes towards bears vary from acute intolerance by some agriculturalists and park users through indifference by many residents to recognition of the black bear as a valued wilderness species by probably a minority of Albertans. Recent bear maulings, however, have aroused peoples' curiosities and opinions about bears.

Numbers and Distributions

Except for a few isolated studies, black bear densities and population age structures are largely unknown. Based on general observations and nuisance complaints most wildlife managers consider black bears abundant in Alberta. Densities have been estimated at 1 bear/2-3km^2 for the boreal mixedwood forests near Cold Lake (Kemp 1976) and 1 bear/6-8 km^2 for the boreal foothills and subalpine forests of Kananaskis Country (Pelchat and Taggart 1982). Subadult (2-3 years) - adult ratios of trapped bears were 100:100 in the hunted population in Kananaskis Country and 100:297 in the unhunted population prior to the selective removal of large male bears near Cold Lake.

Black bears inhabit most of Alberta's forested areas, about 463,000 km^2 or 70% of the land area (Fig. 1). Black and grizzly (Ursus arctos) bears are sympatric in the mountains and foothills of western Alberta as well as in the Swan Hills of central Alberta.

Laws and Regulations

Laws and regulations pertaining to black bears are written in The Wildlife Act and are administered by the Fish and Wildlife Division of Alberta Energy and Natural Resources. Basically, it is illegal to set out baits or poisons for bears, to use dogs to hunt bears, to set out snares or traps for bears, to shoot bears with the aid of a night-light, and to hunt or possess bear cubs or hunt any female bear accompanied by young. Also, to control nuisance bears and protect private property, residents of the province do not require a hunting license to shoot black bears on their property or any private property to which they have lawful access during any time of the year.

Hunting

On most public lands in Alberta, the black bear is managed as a big game species. Exceptions are Military Reserves, Provincial Parks and Wildlife Sanctuaries where hunting is not allowed. For at least the past 25 years, black bears have been hunted during both spring and fall seasons. Dates have varied slightly among years and big game zones, but over most of the forested areas black bears are hunted from September 2 to November 28 and from April 1 to June 5. Bag limits are reviewed annually and have varied from 1 to 4 bears per hunter (Table 1).

Interest in hunting black bears by resident Albertans has increased dramatically over the past 10 years. Since 1971, license sales to resident hunters have increased steadily from 2,805 licenses to 15,915 in 1980-81 (Table 2). License sales to non-resident hunters have varied little between years ranging from 317 in 1970-71 to 660 in 1979-80. Currently, black bear licenses cost resident Albertans $10.00, resident Canadians from outside Alberta $50.00, and all others $100.00. A bear license purchased in the fall is valid for the spring bear season provided the hunter is under the annual bag limit of 2 bears.

Beginning in 1974, registered trappers were allowed to take by lawful hunting methods 2 black bears from the area of their registered trapline during the legal hunting seasons each year. This annual quota per trapper was increased to 4 bears in 1976 and applies only to traplines registered north of the Red Deer River.

Nuisance Bears

Fish and Wildlife Officers and Problem Wildlife Specialists investigate hundreds of bear complaints each year (Table 3). Typically complaints involve such problems as damages to beehives (Gunson 1974), loss of cereal grains, injury and death to livestock (Horstman and Gunson in press), and nuisance, threat and injury to humans (MacDonald 1965). Since 1965, 3 people have died from black bear attacks in Alberta (Alberta Report, August 29, 1980).

Management strategies include control of nuisance bears, compensation for damage and prevention of further depredation. Bear control involves trapping nuisance bears and destroying or relocating them. Presently most nuisance bears are shot (Table 3). Bears that have displayed abnormally aggressive behavior towards humans are destroyed. Compensation is paid to ranchers for probable (50% compensation) and confirmed (80% compensation) losses of livestock to bears through the Livestock Predator Indemnity Program of Alberta Agriculture. Losses of swathed and standing cereal grains are compensated through the Wildlife Damage Fund Regulations of the Wildlife Act. Beekeepers are compensated for hive materials, but not honey (Gunson 1980). Strategies for preventing bear depredations include electric fencing of beehives (beekeepers are reimbursed 100 dollars per fence to a maximum of 15 fences per year) (Gunson 1980), better location of dumps as well as fencing and incinerating garbage (Loucks 1978, Grant 1980), use of bear-proof garbage receptacles at campgrounds (More 1978), and aversive conditioning of nuisance bears (Dorrance and Roy 1978).

Research - Past and Present

Three field studies addressing many aspects of black bears ecology have been completed in Alberta and their findings have either been published or are currently being analysed for publication.

At Cold Lake, a long-term study was initiated in 1968 by Alberta Fish and Wildlife Division and was continued from 1974 through 1977 under the auspices of The University of Wisconsin at Madison. The goals of this study were to provide basic ecological and life history information on bears and to identify and describe the intrinsic and environmental mechanisms influencing the distribution and abundance of bears in an unhunted population (Ruff 1978). Results of this work included demographic analyses (Kemp 1972), response of the bear population to selective removal of large males (Kemp 1976, Young and Ruff in press), den ecology (Tietje and Ruff 1980), spatial and habitat relationships (Pelchat and Ruff in prep.) and response of bears to industrial developments (Tietje 1979).

In the Peace River region of northwestern Alberta, black bear damage to beeyards was investigated during a 5-year study. Work emphasized assessing the extent of damage to beeyards (Gunson 1974), aversive conditioning of bears (Dorrance and Roy 1978), and electric fencing of beeyards and translocations of nuisance bears (Gunson 1980).

In the Fort Hills area of northeastern Alberta, Fuller and Keith (1980) reported on the summer ranges, use of different vegetation types and denning of black bears.

Finally, black bear data were collected as part of a Canadian Wildlife Service study of the grizzly bear in the Swan Hills area of central Alberta (Nagy and Russell 1978).

Currently, 4 field research studies are underway in Alberta. Two were initiated in 1980 by B. Pelchat, J. Taggart, P. Paul and H. Carr in Kananaskis Country--a mountainous area along the great divide southwest of Calgary. Our study investigates the population dynamics and spatial relationships of black bears as well as their use of habitat. Its objectives are to determine the impacts of human recreational activities on bears and to conduct demographic analyses so that we can better manage bears as big game. Preliminary findings are reported by Pelchat and Taggart (1982). The second study in Kananaskis Country was designed to document the nature of bear/human conflicts and to determine if bears can be safely and successfully relocated in the foothill and mountain ecosystems. Numerous nuisance bears were tagged and translocated and bear complaints since 1972 were analyzed. Reports are in preparation.

A study was initiated near the Berland River in West-central Alberta in 1981 by M. Barrett, J. Nagy, J. Nolan and A. Hawley and is part of a large study addressing the interrelationships between timber harvesting and wildlife. The major thrust of this study involves grizzly bears, but black bears are being radio-collared to compare such parameters as home range size, activities, food habits and den site selection between the two bear species. Finally, a study on the use of ketamine hydrochloride (Ketaset) and xylozine hydrochloride (Rompun) to immobilize bears was initiated in 1980 by G. Lynch, B. Hall, J. Hansen and B. Pelchat. Its purpose is to determine the optimum dosage of these drugs for quick immobilization and safe handling time for black and grizzly bears. Data are compiled annually and reports are in preparation.

Literature Cited

Dorrance, J. J. and L. D. Roy. 1978. Aversive conditioning test of black bears in beeyard failed. Proc. 8th Vert. Pest Conf., Sacramento, CA.

Fuller, T. K. and L. B. Keith. 1980. Summer ranges, cover types used, and denning of black bears near Fort McMurray, Alberta. Can. Field-Nat. 94(1):80-83.

Grant, R. D. 1980. Evaluation of industrial bear problems in six Fish and Wildlife Districts in Alberta: 1977-1979. Alberta Fish and Wildlife Div. 13 pp.

Gunson, J. R. 1974. Evaluation of black bear damage to apiaries in the Peace River Area: 1973. Alberta Fish and Wildlife Div. 74 pp.

Gunson, J. R. 1979. Status report from Alberta. Pages 25-32 in A. LeCount (ed.). First Western Black Bear workshop. Bear Biology Assn. and Arizona Game and Fish Dept., Arizona State Univ., Tempe AZ.

Gunson, J. R. 1980. Black bear-beeyard management in Alberta. Pages 62-70 in Proc. Vert. Pest Manage. Seminar, Can. Pest Manage. Soc. Edmonton, Alberta. Aug. 3-6, 1980.

Gurba, J. B. and D. J. Neave. 1979. Problem wildlife management in Alberta. Alberta Agric. and Alberta Fish and Wildlife Div.

Horstman, L. P. and J. R. Gunson. In press. Black bear predation on livestock in Alberta. Wildl. Soc. Bull.

Kemp, G. A. 1972. Black bear population dynamics at Cold Lake, Alberta, 1968-1970. Pages 26-31 in S. Herrero (ed.). Bears--their biology and management. IUCN New. Ser. Publ. 23. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

Kemp, G. A. 1976. The dynamics and regulations of black bear (Ursus americanus) populations in north Alberta. Pages 191-197 in M. R. Pelton et al. (eds.). Bears--their biology and management. IUCN New. Ser. Publ. 40 International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

Loucks, D. E. 1978. A preliminary review of black bear-human interactions and recommended strategies for the AOSERP study area. Alberta Oil Sands Envrionmental Research Program, Alberta. 59 pp.

MacDonald, W. H. 1965. Bears and people. Lands, Forests, Wildlife. 9(4):16-32.

More, G. 1978. Bear conflict prevention programme. Alberta Prov. Parks. 21 pp.

Nagy, J. A. and R. H. Russell. 1978. Ecological studies of the boreal forest grizzly bear (Ursus arctos L.) annual report for 1977. Can. Wildl. Serv., Edmonton, Alberta. 77 pp.

Pelchat, B. O. and R. L. Ruff. In prep. Spatial and habitat relationships of black bears in the boreal mixedwood forest of Alberta.

Pelchat, B. O. and J. R. Taggart. 1982. Kananaskis Country black bear studies. Alberta Fish and Wildlife Div. Rep.

Ruff, R. L. 1978. A study of natural regulatory mechanisms acting on an unhunted population of black bears near Cold Lake, Alberta. Dept. Wildl. Ecol., Univ. Wisc., Madison. 107 pp.

Tietje, W. D. 1979. Responses of black bears to oil development in east-central Alberta. M.S. Thesis. Dept. Wildl. Ecol., Univ. Wisc., Madison. 64 pp.

Tietje, W. D. and R. L. Ruff. 1980. Denning behavior of black bears in the boreal forest of Alberta. J. Wildl. Manage. 44(4):858-870.

Young, B. F. and R. L. Ruff. In press. Population dynamics of black bears in east-central Alberta. J. Wildl. Manage.

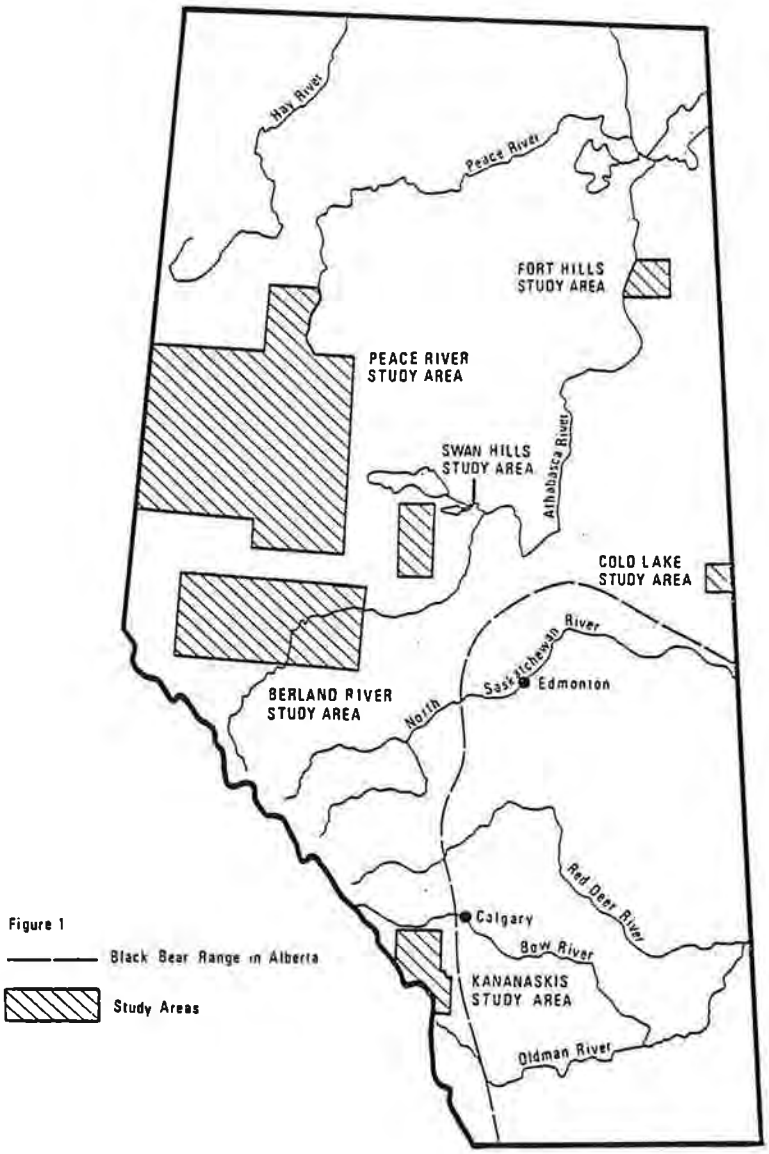


Table 1. Licensing and bag limits for black bears in Alberta from 1957 through 1981.

Year	Spring license	Bag limit	Fall license	Bag limit	Annual bag limit
1957-61	Spring Bear	1	Big Game	1	2
1962-67	Spring Bear	2	Big Game	2	4
1968-70	Spring Bear	2	Moose/elk	1/each	4
1971-75	Black Bear	1	Black Bear	1	1
1976-81	Black Bear	2	Black Bear	2	2

Table 2. Number of black bear licenses purchased by hunters in Alberta each year from fall 1971 through spring 1981.

Year of season[a]		Number of licenses purchased	
Fall	Spring	Residents	Others
1971	1972	2805	317
1972	1973	3274	366
1973	1974	4016	434
1974	1975	4483	384
1975	1976	5662	323
1976	1977	9487	420
1977	1978	10,659	487
1978	1979	11,100	529
1979	1980	13,182	660
1980	1981	15,915	485

[a]License sales for spring and fall of previous year cannot be separated because licenses purchased during the fall are valid the following spring.

Table 3. Number of complaints and fate of nuisance bears in Alberta each year from April 1, 1972 through March 31, 1982.

Fiscal year[a]	Number of complaints	Fate of bears captured	
		Shot	Translocated
1972-73	404	326	29
1973-74	1013	304	100
1974-75	958	193	126
1975-76	1038	151	198
1976-77	1751	506	222
1977-78	1484	434	169
1978-79	766	208	70
1979-80	776	209	73
1980-81	1012	251	68
1981-82	2148	636	211

[a]Fiscal year of Alberta Government ends March 31.

ARIZONA

Tom Waddell
Arizona Fish and Game

Introduction

Black bears are found throughout the mountainous areas of Arizona with the exception of the desert mountains in the western and southwestern portions. An estimated population of 2,000-3,500 bears occupy 10,000 square miles of habitat on non-Indian lands. Bears also occur on the Fort Apache, San Carlos and Navaho Indian Reservations.

Bears utilize habitats ranging from desert scrublands to boreal grasslands and forests.

The U.S. Forest Service is responsible for 90% of Arizona's non-Indian bear habitat. Other public agencies administer 4%, while 6% of the habitat is privately owned.

The black bear was first described in Arizona in the early 1800s. Bears were basically considered livestock predators and enjoyed no protection until 1927 when the Arizona Game and Fish Commission established a fall season, an annual limit of one and relegated control of "stock killers" to State and Federal personnel.

Bears were reclassified as predators in 1945, a move that removed all protections until 1953 when the Arizona State Legislature declared bears small game. Fundamentally, this allowed for bear tags to be sold. However, methods of taking and a sport harvest of one per year were re-established. Livestock operators could take bears by any method at any time.

In 1968, bears were promoted to big game status. A general fall season was re-established and livestock operators were required to report bears taken as "stock killers." No portion of a bear taken as a "stock killer" could be possessed.

The season length in one management unit was reduced in 1971 to October. The season length was further reduced to 10 days in 1972 and 2 more management units added to the short hunt in 1975. To date, 8 management units have 10 days seasons and the general statewide hunt season has been reduced from September-December to September-November. There are no spring bear hunts; however, on the Fort Apache Indian Reservation there is a July-August depredation hunt which requires an Indian guide and is limited to problem occurrences.

A mandatory check-out of all bear kills was initiated in 3 management units in 1975 and was subsequently expanded to a statewide regulation in 1980. Hunters have 72 hours in which to report their kill to the Game and Fish Department. Hunter acceptance and compliance was considered good but the efforts of an already overworked field force cound be improved.

A permit-only 10 day season is being recommended in 2-4 management units for the 1982 hunt as well as regulations designed to control or prevent baiting.

Regulations involving the taking of "stock killing" bears remains unchanged with virtually no controls. Livestock predators rarely comply with reporting requirements. The very nature of the persons, locations of kills or the monetary incentives involved have made the enforcement of required reports and proper justification of loss impossible. A new approach to this problem has been implemented for a few management units in southeastern Arizona. The. U.S. Forest Service has begun to add to grazing leases, as they are renewed, a clause which states that compliance with State regulations on the taking of "stock killers" is a condition of the lease. This should serve to encourage compliance as the penalty for abuse could be more severe than a misdemeanor charge in a Justice of the Peace Court.

Harvest Information

Roughly 8,500 bear tags, at $4.50 for residents and $20.50 for non-residents, are sold annually to sportsmen, of which an estimated 5,000 actually hunt. The annual bear harvest of 250 animals represents a hunt success of 5%.

Harvest data, in the past, was gathered from mailed questionnaire returns received from persons who purchased bear tags. In 1980-81 data were gathered from both a mailed questionnaire and a statewide mandatory bear check-out requirement. In addition to basic information, a tooth was removed whenever possible for aging purposes.

Records of killing data from the year's mandatory check-out of bears indicated 55% were males; adult males made up the largest group and represented 36% of the kill. Sixty-four percent of the kill were adult bears. More detailed information will be included in the written report.

Hunting methods used in Arizona, from the most successful to least, are dogs only, stalking and glassing, bears taken while hunting other game, baiting and baiting in conjunction with dogs and use of a predator call. Only 4% of the hunters use dogs; however, they account for more than 25% of the kill. Baiting is only beginning to become popular with the general hunting public.

Cubs and sows with cubs are not protected.

Management Programs

Arizona has developed a Strategic Plan for the management of black bear in the state. In general, the plan covers current status, estimated supply

and anticipated demand, management goals and strategies to solve problems through 1985.

One project has been completed and the field work completed on 2 others covering density, seasonal movements, reproduction, habitat use and the effect of harvest. Five research projects remain in force on non-Indian lands and Pat Ryan, tribal biologist, has a project going on the Navaho Indian Reservation.

With knowledge gained from Arizona and other western states' completed research projects, the much improved kill data should be more accurately analyzed. A variety of management alternatives have been developed, accepted and should continue to increase.

A bear study team concept has been developed and deployed in two mountain ranges with favorable success. A team of individuals with field expertise and a variety of experience with bear habitat types travels with the unit manager and identifies key use areas and develops general information on habitat potential and resident populations. This process elevates the manager's awareness of bear biology concepts, management alternatives and provides the best and most economical information on bear status on a statewide basis. Hopefully, this concept will be applied to all bear habitats in the state in the near future.

Bear management in the State of Arizona has made substantial strides forward since the last meeting of this group when lack of information and public as well as professional apathy was the prime concern. Hopefully, with information from all western bear biologists, our improved data and completed projects, we will be able to make equal progress by the next meeting.

BRITISH COLUMBIA

F. S. Tompa
Fish and Wildlife Branch, Ministry of Environment

Introduction

Distribution and Abundance. Moderate to high densities of black bear occur in all habitat types throughout practically all of British Columbia. In many areas black bear concentrations exist close to human settlements because of the extra food sources (primarily refuse) which occur seasonally or throughout the year.

The current population estimates for black bear are outlined by Resources Management Region in Table 1. Regional estimates are based on habitat distributions, subjective regional knowledge of local densities, and research and black bear density figures from other parts of North America. Figure 1 shows the current distribution and relative abundance of the black bear in B.C. In many areas black bear populations are stable or continuing to increase; the current provincial population is estimated to be about 63,000 animals (Preliminary Black Bear Management Plan for British Columbia, Ministry of Environment, Victoria, B.C., Canada, 1980).

Public Attitudes and Management Concerns. Although the hunting of the black bear in the Province is legal, it is not a major big game species due to lack of interest. Trophy hunting of the black bear is low and subsistence hunting is minimal or non-existent. In most areas close to human settlements or other human activity areas black bear are considered a "nuisance." Human safety problems, property damage and livestock depredation by black bear can be of major concern. Protest against the control of problem bear is minimal.

Management Information

Regulations. Black bear are considered big game and may be hunted with a rifle or shotgun (20 gauge, or larger; shot size SG, or larger). Special seasons exist for archers in special areas.

A resident ($4.00) or non-resident ($40.00) species license is required in addition to the general hunting license by black bear hunters (1981/82 B.C. Hunting Regulations Synopsis, Ministry of Environment, Victoria, B.C. 1981).

Depending on locations, spring seasons are open between April-June and fall seasons between September-December. The provincial bag limit is

two. In areas of chronic black bear problems seasons may be opened around the year and the bag limit may be increased to five (Hunting Regulations, ibid).

Evidence of species must be provided by leaving a readily identifiable part of the hide, not less than 100 cm^2, attached to the carcass. Evidence of sex is not required for black bear.

In 1981 the species was also given a fur-bearer status through Order-in-Council. Trappers must harvest black bear in accordance with hunting regulations described above. The use of traps and snares is not allowed. There is no bag limit for trappers harvesting black bear within their trapline. The season for trappers is open from October until May. The royalty on black bear pelt is $1.66 during the current season (B.C. Trapping Regulations Synopsis 1981-82, Ministry of Environment, Victoria, B.C. 1981). Prior to 1981 hunters could market black bear pelts upon the payment of royalties.

Harvest Data Black bear harvest shows an increasing trend over the past five years (Table 2), particularly in 1980. This may be attributed to a gradual change in public attitude towards bear hunting, to increased participation by the public in resolving local problem bear situations through hunting as well as to the increasing tendency by Ministry personnel, in line with existing policies to destroy conditioned problem bears to prevent problem escalation.

The last three years' average indicates an approximate 8% annual harvest rate. Considering that an unknown proportion of black bear taken are young of the year, which are excluded from the provincial population estimate, the true legal harvest rate of the species is presumably less than 8%. With the inclusion of illegal and accidental kills the rate is expected to be near 10%. Such a harvest rate, if sustained over the years, may cause local population declines unless the present population levels are underestimated. At the present there is no indication of such declines.

In addition to bears destroyed through control 47, 88 and 75, problem black bears were captured and translocated in 1978, 1979 and 1980, respectively.

Management Goals

The Provincial Black Bear Management Plan (ibid) includes the following management objectives:

1. Maintain viable black bear populations in suitable habitats throughout its range.

2. Maintain opportunities for people to view black bear in their natural habitat.

3. Remove the major attractions which cause black bear to become problems and remove those bear which persist as problems.

4. Provide 60,000 hunter days of recreation and an annual sustained kill of about 4,000 black bear.

5. Provide for the harvest of black bear by licensed trappers in some chronic problem areas.

To achieve these objectives black bear are managed as an integral part of wild ecosystems and the first priority for use is for observation under natural conditions. The second priority for use is of hunting. Harvest rates will generally not exceed 8% of the total population (yearlings, subadults and adults) and will consist mainly of subadults and males through the protection of young and females with young in certain areas. However, in some areas of high black bear populations adjacent to human settlements, considerably higher harvest levels may be necessary to reduce bear/human conflicts; the harvest (primarily by shooting) of black bear of both sexes and all ages by licensed trappers in those areas is encouraged. Conditioned problem bear are generally destroyed rather than translocated where these bear threaten human safety or cause property damage (Black Bear Management Plan, ibid).

In addition, steps are taken to improve the storage and disposal of garbage and other attractants in and near human settlemtns as well as to increase public awareness of the potentials of problem bear situations and the necessity of problem prevention.

Research Projects

1. A small scale marking project was started in October 1981 on the Lower Mainland by regional Fish and Wildlife personnel, B.C. Institute of Technology students and voluntary helpers to monitor the movements of problem bears around refuse dumps and human settlements.

2. Information is gathered on black bear as a by-product of a grizzly study in the Revelstoke area, conducted by Fish and Wildlife Branch personnel and financed by B.C. Hydro.

3. Information on all problem black bear complaints is collected and put on computed forms by investigating Ministry personnel.

Reports/Publications

Houde, S. 1977. White bears of the West Coast. Can Geographical Journal. August/September 1977:10-17.

Tompa, F. S. 1977. Problem bear in British Columbia: A review of the problems. Fish and Wildlife Branch, Ministry of Recreation and Conservation, Victoria, B.C. Unpublished 30 pp.

Table 1. Population estimates for black bear.

Resource Management Region	Estimated number of black bear	Estimated outside limits	Percent of Total estimates
1. Vancouver Island	7,000	(5,000-12,000)	11
2. Lower Mainland	5,000	(2,000-7,500)	8
3. Thompson-Nicola	4,300	(2,500-7,000)	7
4. Kootenay	4,500	(2,500-7,000)	7
5. Caribou	5,000	(2,500-7,500)	8
6. Skeena	14,400	(8,000-20,000)	22
7. Omineca-Peace	20,000	(12,000-25,000)	32
8. Okanagan	3,000	(2,000-5,000)	5
Total all regions	62,800	(37,000-91,000)	100

Table 2. Black bear harvest through 1976-1980.

	Numbers taken through				
Year	Resident hunting	Non-resident hunting	Trapping	Control	Total harvest
1976	3,202	233	n/a	n/a	--
1977	3,453	257	328	n/a	--
1978	3,076	328	566	303	4,273
1979	2,731	421	480	596	3,632
1980	5,670	627	358	704	7,359
Annual average	3,627	373	433	534	5,088

Fig. 1. Black Bear Distribution and Relative Abundance in British Columbia.

CALIFORNIA

L. W. Sitton
California Department of Fish and Game

In California, the black bear inhabits approximately 103,000 square kilometers of diverse habitat in rough terrain. Most of the bears are found in the Cascade, Klamath, North and South Coast, Penninsular, Sierra Nevada, and Transverse mountain ranges (see map).

California Department of Fish and Game (CDFG) estimates of population size are between 12,000 and 15,000 animals, including cubs. The population trend is presently downward because of ever-increasing habitat loss and accessibility to hunters and poachers.

Age class data from field studies and harvest reveal a young bear population with an average age of four and adult:sub-adult ratios approaching 50:50. These figures are both indications of population overexploitation. The legal harvest of black bear in the last five years has varied from 451 (1977) to 766 (1981). The harvest table includes information from the last 11 hunting seasons by county. A list of management changes since the early 1920s is also included. The present hunting season begins in mid-October and continues through December, but the last five years have seen the creation and elimination of a spring-summer hunting season and the creation of a pursuit only (dog training) season. A one-bear bag limit (no cubs or female w/cubs) has been in effect for over a decade.

Deer hunters have been responsible for the "target of opportunity" harvest of some bears, but the bulk of the harvest is by houndmen, and especially houndmen as licensed guides. Baiting and traps are illegal to use and only specific firearms and archery equipment may be used.

Changes in Black Bear Ststus and Management Since 1900

1923 - Furbearer
1933 - Introduced into San Gabriel and San Bernardino Mountains
1924-1947 - Unprotected
1948-Present - Game animal, license required, begin collecting hunt data
1952 - Trapping season established
1953 - Early archery season
1957 - Tags required
1961 - Special bear trapping season eliminated
1962 - Bear hunter questionnaire
1963 - Bear management handbook for Department field personnel
1967 - Steel jaw trap outlawed
1968 - Sample tooth from harvest
1969 - Sample tooth from harvest, bag limit one bear per year
1971 - Season shortened

1972 - No cub or female w/cub in harvest, Trinity County bear study, emphasize trapping and relocation of problem bears
1974 - No baiting or hunting near garbage dumps, early season in part of California, suit to prohibit hunting
1977 - Reduce length of season, season recommendations conform to E.Q.A.
1978-1981 - Bear study statewide
1978 - Pursuit only season started
1979 - Eliminate early bear season
1980 - Revamp hunting dog regulations
1981 - Bear poaching undercover work results in numerous arrests and information on poaching and marketing of bear parts, reduce length of season in portion of state, establish statewide DFG Black Bear Committee and develop management recommendations for 1982, complete bear study.

Illegal kill of black bears is intensive throughout California. Undercover operations by CDFG wardens have resulted in arrests, and have revealed the international scope of the bear poaching problem. The trade in bear parts such as galls for the oriental aphrodesiac market, and teeth-claws for the jewelry market has stimulated poaching. CDFG investigators feel the illegal kill is from one to three times the legal take.

The goals of bear management in California are:

1. Maintain an environmentally sound bear population
2. Integrate the needs of black bear into related resource planning at all levels of government
3. Minimize property damage and nuisance problems from black bears

The realization of the plan's goals is through the achievement of certain specific objectives. The objectives address the spectrum of bear management from hunting regulations, law enforcement, and depredation control to habitat manipulation, public education and research.

The objectives that the CDFG believes will lead to the management goals include:

1. Propose regulations and legislation regarding needed changes in bear policy in the areas of hunting and depredation to help create an older, more viable population of California black bears.

2. Meet with other governmental agencies to include black bear needs into agency resource planning.

3. Promote protection of mast-berry and riparian habitats within bear distribution.

4. Develop a public information system.

5. Train CDFG field personnel in handling depredation and poaching problems.

6. Attempt to regard biological data in making political decisions on black bear management.

Specific recommendations to achieve management objectives are being developed and include:

1. Central issue and mandatory return of all 1982 bear tags.

2. Anyone convicted of a bear tag violation would not be issued a succeeding year bear tag.

3. All persons who kill a bear while using a guide must place his guide license number on their bear tags.

4. Require that successful bear hunters retain the lower jaw for a period of 90 days after the close of the season. This is to provide an opportunity for the Department to obtain better age samples.

5. Modify the bear season to begin the first Saturday in November and extend for 51 consecutive days. This is a shortening of approximately one week for the North Central area and three weeks for the balance of the state.

6. The training season for bear dogs should be eliminated or drastically reduced. Section 265 should be modified to close the woods to dogs until the opening of deer season.

7. The Commission does not have authority to limit the number of bear hunters in a given area; that authority should be sought via legislation.

8. Make selling of bear parts a felony.

9. More emphasis on enforcement of existing regulations especially those relating to guides.

10. Change depredation regulations to allow the Department the discretion of issuing a depredation permit.

Personnel involved in developing bear management and research are primarily wildlife biologists with the CDFG's Wildlife Management Branch and Regional California Department of Fish and Game Biologists.

Recent Literature

Cal. Dept. of Fish and Game. 1980. Wildlife Management Handbook-Report. 1980 Game Take Hunter Survey.

Fleming, Gene. 1979. Bear hunter survey tables - 1976. Cal. Dept. of Fish and Game Operations Research Branch Report. 15 pp.

Gordon, K. R. 1974. Taxonomic, sexual, and evolutionary aspects of black bear dentition. Masters Thesis, San Jose State Univ. 62 pp.

Graber, D. 1979. Depredation and campground problems. Pages 213-234 in A. LeCount ed. 1979. First Western Black Bear Workshop. Bear Biology Assn. and Arizona St. Univ., Tempe. 339 pp.

Grenfell, W. 1979. Food habits and habitat utilization of California black bears. CDFG-Wildlife Mgmt. Branch Progress Rept. W52R II (2).

_____. 1981. Habitat capability model California black bear. Cal. Dept. of Fish and Game - Food Habits Sec. Report. 8 pp.

_____, and A. Brady. 1981. Food and habitat selection by black bears in California. Cal. Dept. Fish and Game, Sacramento, CA.

Harms, Dale R. 1980. Black bear management in Yosemite National Park. Pages 205-212 in C. J. Martinka and K. L. McArthur eds. 1980. Bears-Their Biology and Management. Bear Biology Assn. 375 pp.

Kellyhouse, D. G. 1980. Habitat utilization by black bear in northern California. Pages 221-227 in C. J. Martinka and K. L. McArthur eds. 1980. Bears-Their Biology and Management. Bear Biology Assn. 375 pp.

Novick, H. J. 1979. Home range and habitat preferences of the black bears (Ursus americanus) in the San Bernardino Mountains of Southern California. Masters Thesis. Calif. St. Poly. Univ. Pomona. 58 pp.

Ruppanner, R., D. Jessup, I. Ohishi, and D. Behmer. 1981. Serological survey of free living bears (Ursus americanus) in California. Draft copy. CDFG Wildlife Management Branch Report. 14 pp.

Siperek, J. M. 1979. Physical characteristics and blood analysis of black bears (Ursus americanus) in the San Bernardino Mountains. Masters Thesis. Calif. St. Poly, Univ. Pomona. 63 pp.

Sitton, L. W. 1980. Black bear field studies. PR Progress Report. W51R 25 (IV-4). 47 pp.

_____. 1982. Black bear field studies. PR Final Report. W51R26 (IV-4). In press.

Zardus, M. J. and D. J. Parsons. 1980. Black bear management in the Sequoia and Kings Canyon National Parks. C. J. Martinka and K. L. McArthur eds. 1980. Bears-Their Biology and Management. Bear Biology Assn. 375 pp.

BLACK BEAR DISTRIBUTION

Table 1. Average bear kill in California.

County	1971-75	1976-80	1971-80	1981	County	1971-75	1976-80	1971-80	1981
Alameda	-	-	-	-	Placer	10	15	12	13
Alpine	1	1	1	1	Plumas	25	30	28	42
Amador	1	3	2	1	Riverside	1	-	1	-
Butte	23	21	22	14	Sacramento	-	-	-	-
Calaveras	2	2	2	10	San Benito	-	-	-	-
Colusa	1	1	1	1	San Bernardino	2	5	4	12
Contra Costa	-	-	-	-	San Diego	-	-	-	-
Del Norte	27	9	18	16	San Francisco	-	-	-	-
El Dorado	14	16	15	17	San Joaquin	-	-	-	-
Fresno	14	13	14	19	San Luis Obispo	-	-	-	-
Glenn	8	5	6	8	San Mateo	-	-	-	-
Humboldt	49	37	43	57	Santa Barbara	-	1	1	3
Imperial	-	-	-	-	Santa Clara	-	-	-	-
Inyo	1	1	1	-	Santa Cruz	-	-	-	-
Kern	11	6	8	22	Shasta	88	105	97	94
Kings	-	-	-	-	Sierra	11	7	9	17
Lake	5	5	5	6	Siskiyou	108	108	108	146
Lassen	8	6	7	5	Solano	-	-	-	-
Los Angeles	2	2	2	1	Sonoma	-	-	-	-
Madera	7	9	8	9	Stanislaus	-	-	-	-
Marin	-	-	-	-	Sutter	-	-	-	-
Mariposa	8	10	9	9	Tehama	18	26	22	16
Mendocino	23	26	24	18	Trinity	99	74	86	114
Merced	-	-	-	-	Tulare	28	24	26	53
Modoc	2	3	2	8	Tuolumne	18	18	18	13
Mono	2	1	2	1	Ventura	1	1	1	3
Monterey	-	-	-	-	Yolo	-	-	-	-
Napa	-	-	-	-	Yuba	4	1	2	6
Nevada	6	7	6	10	Unknown	1	2	2	-
Orange	-	-	-	-					

Total 1971-75=629, 1976-80=601, 1971-80=615, 1981=766

IDAHO

John Beecham
Idaho Fish and Game Department

Introduction

The black bear (*Ursus americanus*) is a shy, adaptable species that occupies almost 85,000 km^2 in Idaho and whose distribution coincides closely with that of the coniferous forests in the State.

Although the black bear was considered a game animal in 1943, with a bag limit of one per year, only sporadic protective laws were passed until 1973. In that year, resident bear hunters were required to have a bear tag in their possession when hunting bears in those game management units without a year-around bear season. Nonresidents were required to have a bear tag while hunting bear in all units.

Some segments of Idaho's populace still regard the black bear as a nuisance animal at best, but most people recognize its value as a big game animal and as a part of the native fauna of the state. Several recent changes in the management of black bear in Idaho reflect these divergent attitudes.

Idaho is divided into six regions for game management purposes. Ninety-three percent of the black bear harvest in Idaho occurs in Regions I (Coeur d'Alene), II (Lewiston), and III (Boise). The projected kill of black bear has ranged from 1,500-2,500 since the black bear tag was required in 1973. In addition, a minimum of 30 black bears have been killed per year for depredation control purposes in the last 10 years.

Present laws and regulations in effect for black bear include the following:

1. Harvest tag required in all game management units in the state.

2. Bag Limit - 1 black bear per year except in Management Units 12, 16A, 17, 19, 19A, 20 20A, 23 24, 25, 26, 33, 34, 35, 39, 43, and 44 (which have a 2-bear-per-year limit).

3. Cubs and females accompanied by cubs of the year are protected during spring season.

4. Unlawful to hunt within 200 yards of a dump or landfill.

5. Unlawful to capture or hold in captivity any bear without a permit.

6. Unlawful to trap or snare bears, but baiting is legal.

7. Unlawful to hunt bears with dogs during the general deer and elk seasons or in certain management units during the spring.

8. Season lengths generally run from September 1 until July 1, with some units having no closed season.

In accessible areas, black bear populations are stable or slightly decreasing. Population levels, in these areas, are being maintained primarily by the ingress of sub-adults from adjacent areas that receive less hunting pressure. In remote areas, bear populations are relatively stable and are regulated by habitat quality.

Some additional information needed by game managers to formulate specific management programs for the black bear in Idaho include:

1. More precise information on black bear distribution, density, and population status.

2. Better definition of their habitat preferences with regard to feeding, denning, and cover requirements.

3. Accurate assessment of harvest characteristics including the number of bears killed by area and season (spring/fall); sex and age composition of the kill.

4. Basic data relative to survival rates of emigrating sub-adults from exploited and unexploited populations.

Publications

Benson, W. W., J. Gabica, and J. Beecham. 1974. Pesticide and mercury levels in bear. Bull. Environ. Contam., Toxicology 11(1):1-4.

Amstrup, S. C. and J. Beecham. 1976. Activity patterns of radiocollared black bears in Idaho. J. Wildl. Manage. 40(2):340-348.

Beecham, J. 1978. The bears. Idaho Wildlife 1(5):10-12.

Beecham, J. 1980. Digging in for bears. Idaho Wildlife 2(2):2-8.

Beecham, J. 1980. Some population characteristics of two black bear populations in Idaho. Pages 201-204 in C. J. Martinka and K. L. McArthur, eds. Bears--Their biology and management. U.S. Government Printing Office, Washington, D.C.

Reynolds, D. C. and J. J. Beecham. 1980. Home range activities and reproduction of black bears in west-central Idaho. Pages 181-190 in C. J. Martinka and K. L. McArthur, eds. Bears--Their biology and management. U.S. Government Printing Office, Washington, D.C.

Jonkel, C., P. Husby, R. Russell, and J. Beecham. 1980. The reintroduction of orphaned grizzly bear cubs into the wild. Pages 369-372 in C. J. Martinka and K. L. McArthur, eds. Bears--Their biology and management. U.S. Government Printing Office, Washington, D.C.

Binninger, C. E., J. J. Beecham, L. A. Thomas, and L. D. Winward. 1980. A serologic survey for selected infectious diseases of black bears in Idaho. J. Wild. Dis. 16(3):423-430.

Yunker, C. E., C. E. Binninger, J. E. Keirans, J. Beecham and M. Schlegel. 1980. Clinical mange of the black bear, Ursus americanus, associated with Uriscoptes americanus (Acari:Audycoptidae). J. Wildl. Dis. 16(3):347-356.

Beecham, J. J. 1980. Population characteristics, denning, and growth patterns of black bears in Idaho. Ph.D. Dissertation. The Univ. of Montana, Missoula. 101 pp.

Beecham, J. J., D. G. Reynolds, and M. G. Hornocker. 1980. Black bear denning activities and den characteristics in west-central Idaho. Proc. Fifth Int. Conf. Bear Res. and Manage. 5(in press).

Beecham, J. J. In Pres. What color was that black bear? Idaho Wildlife.

An additional 11 technical and semi-technical papers are in various stages of completion and will be submitted to appropriate journals in the near future.

MONTANA

Glenn L. Erickson
Montana Department of Fish, Wildlife, and Parks

Introduction

Good populations of black bear (Ursus americanus) exist throughout the western third of Montana. Their habitat is continuous from western Montana to the wooded foothills east of the Continental Divide. The distribution of black bear has not changed noticeably since 1941 (Greer, 1979). Generally, densities are greater west of the divide. Public interest in black bears and black bear hunting has increased steadily the past few years (Table 1). There has been a marked increase in hunter interest during the spring season, especially in the more accessible areas of western Montana. This increase in demand, together with increased roading and timber removal, has influenced the security of the habitat significantly. The more restrictive seasons in Region One of northwestern Montana are the result (Table 1).

Harvest

The black bear harvest prior to 1978 had steadily increased on a yearly basis. Since that time the harvest has stabilized (Table 1). In 1980 a total of 18,135 hunters took 1,870 black bears. Approximately 48 percent of those were taken during the spring/summer period. Hunting districts west of the divide in Regions One and Two have consistently provided the bulk of the black bear harvest. Although Region One in northwestern Montana had the most restrictive hunting season, it provided 44 percent of the black bear harvest in 1980.

Management

Black bear management in Montana has been geared primarily toward developing a data base from which to refine management. The low priority status of the black bear along with recent budget reductions has prevented marked expansion of the program. However, emphasis is still directed at expanding the information base through redirection of time and effort. In northwestern Montana, where more of the hunting pressure has occurred, teeth from bears have been collected for aging through taxidermist contacts. These data provide an indication of the age structure of the harvest and aid in assessing population status. In addition, information on color phases and general size has also been collected.

In addition to gathering biological information, considerable effort has been directed toward influencing various land managing agencies to consider black bear needs in their planning. The reduction in security from increased road access, timber removal and subdivision development continues to be the major factor affecting bear populations statewide. The development of road closure policies is one direction the department intends to pursue in the future.

Research

In June of 1980 a research project on black bears was initiated in the North Fork of the Flathead River drainage of northwestern Montana. The principle investigator is University of Montana graduate student Harry Carilles. Major emphasis of the study will be to compare black bear ecology to that of the grizzly bear at the same time and in the same location. The grizzly bear work is being cooperatively accomplished with the Border Grizzly Project under the direction of Dr. Charles Jonkel. A final report of the results should be available in the spring of 1983.

Publications

All the recent management data gathered in Montana on black bears are contained in the annual Federal Aid reports (W-130-R - Survey and Inventory) for the period July-June 30. Incidental black bear information has also been collected on the various grizzly bear projects associated with the Northwest and Yellowstone Ecosystems. These data are usually summarized in the annual reports of the Border Grizzly Project, the Yellowstone Grizzly Study Team and the East Front Wildlife Monitoring Team.

Literature Cited

Greer, K. R. 1979. Status report of black bears in Montana. Trans. First Western Black Bear Workshop. Arizona State Univ. pp. 55-62.

Table 1. License fees, season structure, and harvest of black bear in Montana, 1976-81.

Year	License Fees ($) R	NR	Licenses issued R	NR Big Game	NR Fall	NR Spring	Season Dates	Est. harvest[1/] R	NR	Total
1976	6	2/	7,251	12,689	58	287	Apr 1 - Nov 28	1,293	344	1,637
1977	6	2/	7,866	13,767	47	412	Apr 1 - Nov 27[3/]	1,270	463	1,733
1978	6	2/	7,901	16,553	81	613	Apr 1 - Nov 26[4/]	1,331	507	1,838
1979	6	2/	9,694	17,000	108	1,057	Apr 1 - Nov 25[4/]	1,201	629	1,830
1980	6	6/	10,159	17,000	620	5/	Apr 1 - Nov 30[4/]	1,301	569	1,870
1981	6	6/	9,345	17,000	593		Apr 1 - Nov 29[4/]	-	-	-

1/ Estimated from mail survey.

2/ Revised license structure included black bear with deer, elk, birds and fish $225; black bear license only $50 with $50 combination license prerequisite; spring black bear $35 with $1 conservation license prerequisite.

3/ Region One closed July and August.

4/ Region One, April 15 - May 31 and September 9 - end of season (1978); Sept. 8 (1979); Sept. 6 (1980); Sept. 5 (1981).

5/ Spring black bear no longer issued; season license includes spring and fall.

6/ Revised license structure - big game $225; black bear $100 with conservation license prerequisite $1.

NAVAJO INDIAN RESERVATION

Kathleen McCoy

To understand present and future black bear management on the reservation some background information is useful.

The reservation covers a 25,000 square mile area. Over 750 square miles in the northeast part of the reservation are occupied bear habitat covering one main mountain chain, the Chuskas - Lukachukais - Carrizos and part of the Ft. Defiance Plateau, consisting mainly of mixed conifers.

Because of Navajo legends the black bear was traditionally a very respected animal, for the most part left alone. But in modern times many people have gotten away from tradition. Bear habitat is much more accessible, there are numerous roads, increased livestock grazing and oil and mineral development, resulting in more bear-human interactions.

During the 1960s an organized animal damage control program handled livestock and crop loss complaints involving bears. Accurate records weren't maintained but about 10 bears a year were killed.

In 1964 a sport hunting season was begun. About 20 bears a year were taken. Then in the late 1960s animal damage control people were receiving fewer bear damage complaints. There was concern that the black bear population might be declining. As a result sport hunting was stopped in 1971. Then in the mid-1970s animal damage complaints began to increase again and there was speculation the population was increasing too rapidly.

All this pointed to the fact that very little was known about the black bear on the reservation. As a result a research study was begun in 1979.

Presently the bear population on the reservation seems to be basically stable. There is roughly one bear per three square miles. This is a conservative estimate.

Since there is no sport hunting at present our management deals mainly with depredation problems, usually involving livestock or crops. The majority of complaints are received in August and September. Livestock grazing pressure in the bear habitat is especially heavy during those two months, the same time the bear's food supply is poor. In 1979 one sow and two cubs were killed, in 1980 one sow, three cubs and one adult male were killed, and in 1981 three adult males and one unknown

age bear were killed because of reported depredation. One of the males killed in 1981 had been relocated in an area about 200 air miles from the capture site, a cornfield he had raided. He was shot and killed by a local resident ten days later. He was evidently on his way back to his original home range.

Of those 11 bears killed because of reported depredation only two were confirmed as having killed livestock. This figure of eleven bears in three years only represents the number actually reported to us.

Because of continuing human encroachment into bear habitat including logging, grazing, oil and uranium exploration, bear-human problems will continue, requiring some kind of bear, human or habitat management. Human management will become more important in the future, with emphasis on changes in livestock and agriculture practices. The problem will get worse before it gets better.

NEVADA

Mike Hess
Nevada Department of Wildlife

Introduction

Nevada's black bear population is extremely limited in both numbers and distribution. Estimating roughly, Nevada has less than 50 bear which are restricted to the extreme western portion of the State in the immediate vicinity of Lake Tahoe. The majority of Nevadans are not even aware that black bear are present in the State.

Harvest Information

Nevada has never held an open season for black bear and it is unlikely that a season will ever be held. A single large commercial poaching ring working on Nevada bear was broken up by federal wardens several years ago. Since that time, the Department is not aware of a similar situation.

Management Program

Nevada's black bear management has been restricted simply to the removal of animals which are depredating or have become a public nuisance. Bears are either trapped or drugged and relocated.

OKLAHOMA

Reggie Thackston
Oklahoma Department of Wildlife Conservation

Introduction

The black bear (Ursus americanus) was at one time, abundant throughout the state of Oklahoma. Beginning in the late 1880s, destruction of habitat coupled with market hunting, resulted in drastic declines in bear populations. By the 1950s, the only bears known to exist within Oklahoma were located in the more rugged and remote areas of the Ouachita Mountains, in the southeast region of the state (Oklahoma Wildlife Commission, 1964).

The Arkansas Game and Fish Commission successfully reintroduced bears into the Ouachita Mountains of Arkansas, between 1959 and 1968 (Conley, 1978) and there has been some movement of these bears and/or their offspring into southeastern Oklahoma. Currently, bears are known to be present in four eastern counties (Figure 1). However, while populations have increased during the past 20 years, they still remain at very low levels.

Bear populations in Oklahoma are limited by poaching and lack of suitable habitat. Habitat limitations have become even more critical during the past ten years due to industrial forest management practices. Rugged and remote areas of mature oak-pine forest, once capable of supporting bear populations, have been opened up with logging roads and converted extensively into even-aged pine plantations. As a result, bear populations are limited primarily to the 240,000 acres of the Ouachita National Forest in LeFlore County.

While public attitudes toward bears appear to be improving, many people still regard bears as predators which pose a threat to personal safety and livestock. This attitude has resulted in the killing of several bears during the past few years.

Harvest Information

There is no hunting season on black bears in Oklahoma. During the past five years, there have been illegal kills resulting in one prosecution and one pending court case. Another bear, which had killed four calves on a private ranch was killed by State Game Rangers.

Management Programs

The only management program for bears in Oklahoma is to give them protective status and monitor population distribution and trends by confirming and recording incidental sightings (Table 1). Also, articles have been written in newspapers and magazines in an attempt to increase public knowledge and awareness with respect to the black bear.

Forest grazing is extensively practiced in eastern Oklahoma. As a result, cases have arisen of livestock depredation by bears. This poses a dilemma since the only areas of suitable habitat to which bears can be translocated are either in close proximity to private land with cattle, or they are not of sufficient distance to prevent the bear from returning to the problem area.

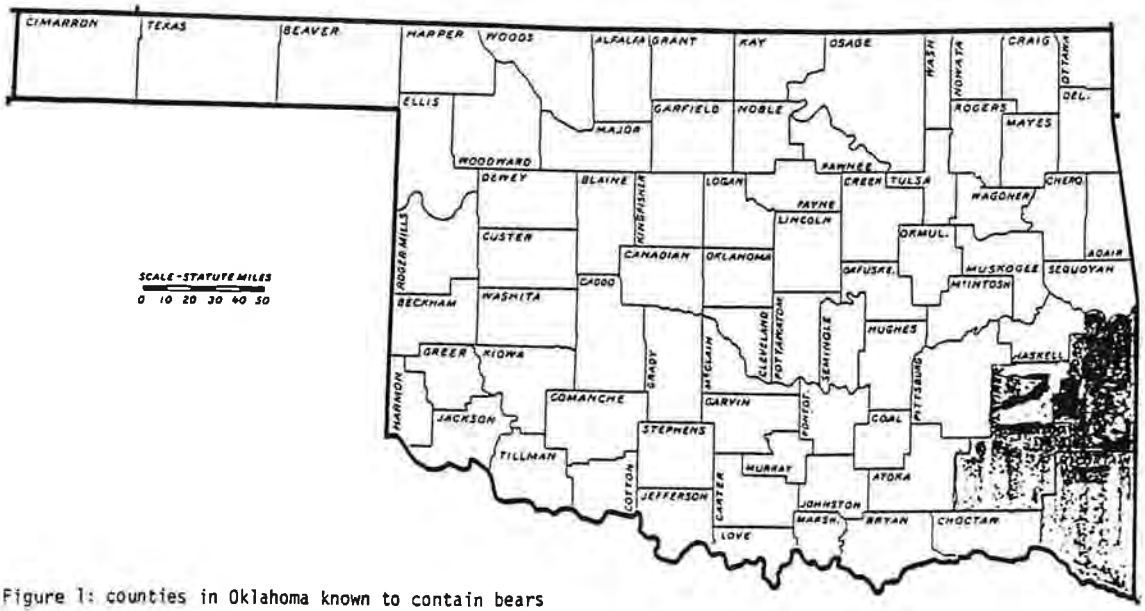


Figure 1: counties in Oklahoma known to contain bears

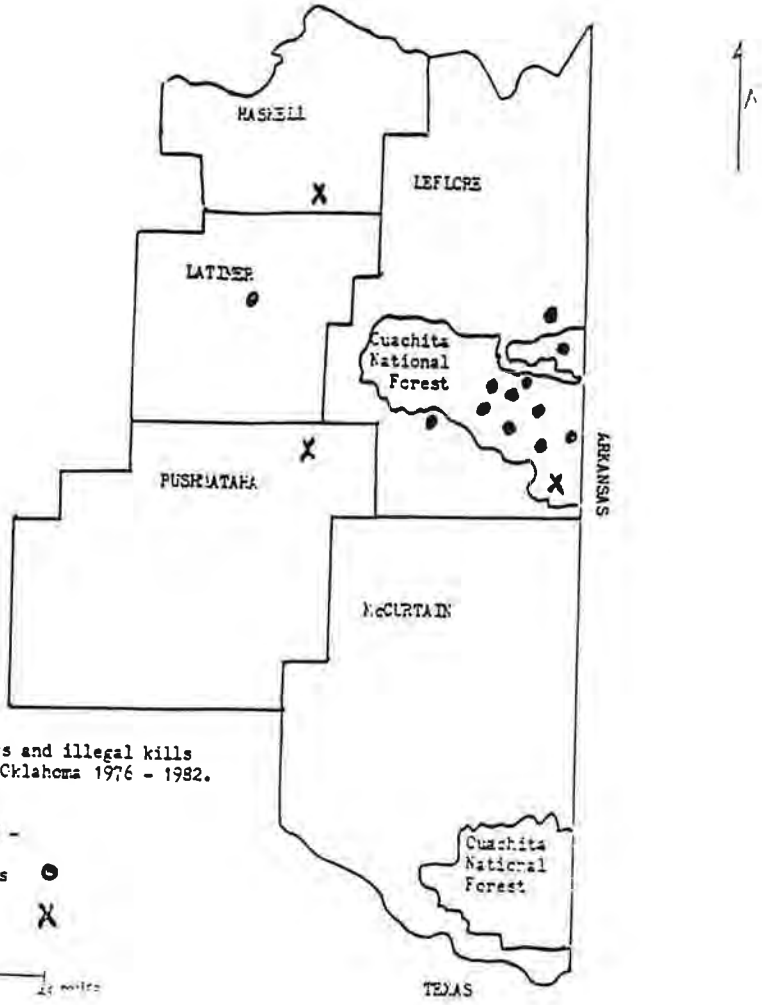


Fig.2 Confirmed sightings and illegal kills of black bears in Oklahoma 1976 - 1982.

- Legend -

Confirmed Sightings

Illegal Kills

Scale:

Table 1. Confirmed sightings and illegal kills of black bears in Oklahoma 1976-1982.

Year	Location	Sex	Age	Remarks
1977	Loving, Oklahoma LeFlore County	-	S.A.*	Two cubs
1979	Walnut Mountain LeFlore County	-	A	Killed by bowhunter
1979	S. of Hwy. 259 & 59 Jct. LeFlore Co.	-	-	
1980	Kiamichi Mt. Pushmataha County	M	A	317 lbs.; killed by landowner
1980	Blue Mt. Haskel County	-	A	Killed by landowner
1980	Emerald Vista Tower--Winding Stair Mountain LeFlore County	-	-	
1980	Rich Mountain LeFlore County	-	-	
1980	Pipe Springs, LeFlore County	-	-	
1980	2 mi. N. of Prison LeFlore County	-	A	Shot by landowner but never found
1980	Walker Mountain, LeFlore County	F	A	Sow and two cubs
1981	2 mi. N. Big Cedar LeFlore County	-	A	
1981	Lenox Ridge & Billy Creek LeFlore County	F	A	Killed by Game Ranger
1981	Robbers Cave State Park Latimer County	F	A	Sow and two cubs
1982	N. side Kiamichi Mt. 62 Hwy LaFlore County	-	-	
1982	Pine Mt. N 63 Hwy. LeFlore County	-	-	

*S.A. = Sub-adult

OREGON

John Thiebes
Department of Fish and Game

Introduction

The status of black bear has changed several times since the first restrictions were applied in 1925. The first attempt to regulate the take of bear failed and the legislature returned the bear to the predatory animal status with no restriction on taking. In 1961, the state legislature passed a bill allowing the department to declare the bear a game animal in areas where they were not causing damage. The first season was established in 1962 in a limited portion of the state on national forest lands. In 1970, the bear was declared a game animal statewide and in 1974 a bear tag was required to hunt bear. In 1975, sows with cubs and cubs were protected. Starting in 1978, bear tag sales were terminated at midnight before the season opened.

Bear are found throughout the forested areas of Oregon in varying numbers, depending upon habitat type. Highest densities occur in the Coast Range while lowest densities are found in Ponderosa pine and lodgepole pine forests of central Oregon. The current statewide population estimate of 20,000 bear was obtained by expanded harvest records.

A few people in the state are concerned because they seldom see bear while hunting other animals or while traveling, but the greatest concern is over the use of dogs to hunt bear. They feel the bear does not stand much of a chance when dogs are used and that it is not the sportsman-like way to hunt this animal. Spring pursuit seasons have created considerable adverse comment. The concern is over dogs in the woods at a time when most wildlife are producing their young and the philosophical need to chase bear. Beginning in 1981, spring pursuit seasons were terminated.

Pursuit Seasons

Hunters participating in the summer bear pursuit seasons were required to purchase permits and submit a report on their activity. Persons failing to report their activity would not be issued a permit the following year. The following tables are a result of those reports.

Table 1. Average effort to locate strike or bear.

	Hours of search per strike located			Hours of search per bear located and chased		
	1981	1980	1979	1981	1980	1979
State total	2.3	2.3	2.3	3.2	3.3	2.9

	Average number cubs per sow observed			Hour of search per sow with cubs		
	1981	1980	1979	1981	1980	1979
State total	1.62	1.66	1.62	21.5	28.0	33.3

Table 2. Average age of bears observed.

	Percent juveniles		Percent adults	
	1981	1980	1981	1980
State total	28	29	72	71

Harvest Information

The attached Hunting Seasons and Harvest table lists records since 1962. Hunter numbers, harvest and days of hunting for the state have been computed from data received from an annual questionnaire mailed to a 5 percent sample of all individuals buying hunting licenses. A report card has been issued since 1974 to individuals buying a bear tag. Data from the report card has been used to prorate harvest by management units. The sex of the bear killed by month of the year is obtained from the card as well as whether dogs were used to hunt the bear (Table 3).

Approximately sixty percent of the bear harvest in past years have been taken by hunters not using dogs. The percentage of males in the harvest varies annually by method of take but averaged 68 percent during the last three years.

Management Programs

Since the department has been unable to develop reliable census procedures or methods for determining densities by management unit, management plans for this species have received low priority. Harvest recommendations are

based on the gut feeling of the district wildlife biologist, but because of the lack of substantiating data, seasons fluctuate depending on recommendations from very well organized Sporting Dogs groups and the feelings of the Commission. The main objective of present management is to allow a maximum of harvest and recreation while maintaining optimum population levels.

Damage caused by bear to forest stands has increased during the last two years. Oregon law presently allows any landowner suffering damage from bear to kill the offending animal. The landowner does not have to obtain permission prior to killing the animal nor is he required to turn in the carcass. Fortunately, this authority has not been badly abused. Some private timber companies have been very cooperative and have worked out a removal program with wildlife biologists. The department does have 5 culvert traps that are used occasionally but basically the department's assistance is in the form of advice. The Animal Damage Control Division of the U.S. Fish and Wildlife Service also assists by removal of some problem bears.

Table 3. Oregon bear hunting seasons and harvest.

Year	Season dates	Portion of state covered by hunting regulations	No. of hunters	No. of bear Taken	% hunter success	Total hunter days	Days/ hunter	Days/ bear	No. of Tags Sold
	Open season all year. No bag limit. Entire state.								
1961	Legislative authority to declare bear a game animal where not causing damage								
1962	9/1-12/15	Cascades & Rogue Areas							
1963	8/31-12/15	Cascades & Rogue Areas							
1964	8/29-12/15	Cascades & Rogue Areas							
1965	8/14-11/30	Cascades & Rogue Areas							
1966	8/13-12/31	Cascades & Rogue Areas	8,500	3,380	46				
1967	8/12-12/41 (4/15-6/15 (Tr.season	10 Nat. For. & parts 5 southwest units	10,800	3,800	35				
1968	8/10-12/31 (4/15-6/15 (Tr.season	10 Nat. For. & parts 5 southwest units	10,100	2,900	29				
1969	8/9-12/31 (4/15-6/16 (Tr.season	11 Nat. For. & parts 5 southwest units	10,400	3,600	35				
1970	9/1-12/31 4/20-5/20	Entire state	8,850	1,840	21				
1971	8/1-12/31	Entire state	10,341	1,876	18	64,309	6.2	34.3	
1972	8/1-12/31	Entire state	9,722	1,491	15	68,079	7.0	45.7	
1973	8/1-12/31	Entire state	14,669	1,734	12	109,535	7.5	63.2	
1974	8/1-12/31	Entire state	16,720	1,703	10	133,353	8.0	78.3	18,239
1975	7/1-12/31 8/1-11/30	Entire state	16,247	1,841	11	148,092	9.1	80.4	17,924
1976	8/1-12/31 8/1-11/30	Entire state	11,043	1,074	10	102,557	9.3	95.5	14,660
1977	8/1-12/31 8/1-11/30	Entire state	12,833	920	7	133,570	10.4	145.2	15,847
1978	8/1-12/31	3/4 state	-	560	-	-	-	-	8,721[1/]
1979	9/1-11/30	3/4 state	11,324	812	7	118,338	10.5	145.7	15,705
1980	8/23-11/30	Entire state	11,072	958	9	-	-	-	14,788
1981[2/]	8/29-11/30	Entire state	10,847	908	8	-	-	-	15,429

[1/] Tag sale deadline begins

[2/] Tag sales and questionnaire estimates incomplete

SASKATCHEWAN

Earl Wiltse
Saskatchewan Fisheries and Wildlife

An estimated population of 25,000+ black bear occupy some 40,000 square miles of habitat throughout Saskatchewan. Recent estimates indicate an overall increase of bear over the past 4 years.

The distribution of black bear closely coincides with the distribution of the boreal forest. An exception to this would be a few drainage systems, discontinuous with boreal forests which have shown an increased use by black bear in recent years.

A general complete lack of understanding the nature and needs of black bear by the public is prevalent throughout the province. Different groups perceive the bear as a trophy game animal, as destroyer of crops, predator and nuisance (parks, campgrounds, etc.).

Black bear harvest is comprised of both sport and trapper harvest. Sport harvest has averaged 576 bear, or 48 percent, of the total harvest since 1973.

	Hunters			
Year	License Sales	Harvest	Percent Success	Trapper Harvest
1976-77	3,259	819	21.0	518
1977-78	3,313	913	31.3	354
1978-79	3,390	963	32.4	244
1979-80	3,209	764	25.6	379
1980-81	5,400	1,374	30.8	418
1981-82	3,242	939	29.0	---

Saskatchewan has spring and fall bear hunting seasons. The spring season opens in late April and closes in early June, while the fall season opens in early September and continues to mid-October.

Since 1976, two licenses could be purchased which entitled hunters to harvest one bear per license.

Methods of bear hunting include: still hunting, bait hunting, bear taken incidental to hunting other game, bow hunting, and trapping, Hunting regulations pertinent to bear hunting are:

1. No person shall hunt, take, shoot at, wound or kill any big game animal between sunset and one-half hour before sunrise.

2. Hunters are required to wear a complete outer suit colored scarlet, bright yellow, blaze orange, white or any combination of these colors. The cap may be any of these colors except white.

3. Illegal to take live bears into captivity without special permit.

4. Hunters are requested not to shoot female bears with cubs during the spring bear season.

Control of nuisance bears is normally facilitated through issuance of kill permits, live trapping and removal and preventive measures such as electric fences. Landowners can kill bears causing damage on their own land and beekeepers can kill bears within 1 kilometer of their bee hives without a permit but they must immediately report the killing to a wildlife officer.

Since 1979 Saskatchewan has made compensation payments for damage caused by bear. The procedure for bear damage claims is as follows:

1. Damage must be reported to nearest Conservation Officer as soon as possible.

2. Conservation Officer inspects and verifies damage and recommends prevention techniques.

3. Conservation Officer prepares a report which contains circumstances, actions taken by the property owner, any evidence to verify the amount of damage and that the damage was actually caused by bear.

4. Each claim is processed if over $100. Payment is 75% of damage to a maximum of $2500.

Most bear damage claims have been for cattle and beehive losses.

Saskatchewan wildlife management personnel have prepared management goals and objectives for black bear and other wildlife species. This was intended to provide a guide by which black bear will be managed until 1985.

At present there are no active or planned research programs for black bear in Saskatchewan.

TEXAS

Charles K. Winkler
Texas Parks and Wildlife Department
Austin, Texas 78744

Introduction

Black bear (Ursus americana) were originally widely distributed throughout Texas (Davis, 1974); however, according to Hall and Kelson (1959), the species did not occur in the extreme southern portion of the state (Fig. 1). By the early 1900s, according to Bailey (1905), the distribution was restricted to the Trans-Pecos, southern Edwards Plateau, extreme eastern Texas and the upper Gulf Coast, and the Panhandle (Fig. 2). At the present time resident populations are known to occur in isolated areas of the Trans-Pecos and some of the remote bottomlands of southeast Texas; however, since 1977 several bears have been sighted in the South Texas Plains, Edwards Plateau and East Texas Pineywoods (Fig. 3). These sightings have been summarized by Wallace (1981).

Currently, the statewide population is estimated to be less than 50 animals, consisting primarily of migrants from Mexico, Louisiana and Arkansas. At least one bear is known to exist in Guadalupe Mountains National Park and is presumed to be a permanent resident. In 1978 a sow and her cub were reported from Angelina County in East Texas after a cub was released from a steel trap by a coyote trapper.

The decline in the black bear population in Texas is attributed largely to hunting for subsistence, sport and predator control. Due to real and imagined depredations to humans and their property, it is doubtful that landholders would tolerate a bear population of sufficient magnitude to support sport hunting.

Harvest Information

In 1925 the State Legislature established a restricted hunting season--November 16 through December 31--and bag limit--one bear per hunter per season--throughout the state. In 1973 the Parks and Wildlife Commission closed the hunting season on bear in all counties under its regulatory authority; however, the legislative bear season persists in 27 counties where the Commission lacks the authority to regulate the harvest of bear. In eight of the counties bear may also be taken during the October archery season.

Although bear hunting persisted as a popular sport in Texas well into the present century (Fleming, 1980), precise data on the annual harvest

during this period are nonexistent. Since 1977, three black bears are known to have been killed in Texas. All three were taken illegally, resulting in citations being issued by state game wardens. Due to the small number of bears encountered by humans, they do not constitute a law enforcement problem.

Management Programs

The goal of the Department's bear program is to maintain the black bear as a wildlife resource in Texas. This goal is being pursued by providing complete protection of the species from sport hunting everywhere that the Department has the authority to regulate the harvest.

Additionally, all reported bear sightings are investigated by a wildlife biologist to verify the existence of the bear if possible. These investigations also provide information on bear distribution, relative abundance, movement patterns, origin, known activities, food habits, estimated age, weight and habitat preferences.

Research Programs

There is no black bear research being conducted in Texas at the present time.

Recent Literature

Fleming, K. M. 1980. Texas bear hunting. Tex. Parks & Wildlife 38(5):12-15.

Spencer, G. E. 1978. Status of black bear. Fed. Aid Perf. Rept., Big Game Invest., Project W-109-R-1, Job. No. 10, Tex. Parks & Wildl. Dept., 2 pp. mimeo.

_____. 1979. Status of black bear. Fed. Aid Perf. Rept., Big Game Invest., Project W-109-R-2, Job No. 10, Tex. Parks & Wildl. Dept., 3 pp. mimeo.

Wallace, J. D. 1980. Status of black bear. Fed. Aid Perf. Rept., Big Game Invest., Project W-109-R-3, Job No. 10, Tex. Parks & Wildl. Dept., 7 pp mimeo.

_____. Status of black bear. Fed. Aid Perf. Rept., Big Game Invest., Project W-109-R-4, Job No. 10, Tex. Parks & Wildl. Dept. 16 pp. mimeo.

LITERATURE CITED

Bailey, Vernon. 1905. A biological survey of Texas. USDA, N. Amer. Fauna 25:186-192.

Davis, W. B. 1974. The mammals of Texas. Texas Parks & Wildlife Dept. Bulletin #41, pp. 89-91.

Fleming, K. M. 1980. Texas bear hunting. Tex. Parks & Wildlife 38(5):12-15.

Hall, E. R. and K. R. Kelson. 1959. The mammals of North America. The Ronald Press Co., New York, NY. pp. 865-869.

Wallace, J. D. 1981. Status of black bear. Fed. Aid Perf. Rept., Big Game Invest., Project W-109-R-4, Job No. 10, Tex. Parks & Wildl. Dept., 16 pp. mimeo.

Figure 1. Historic range of black bear in Texas.

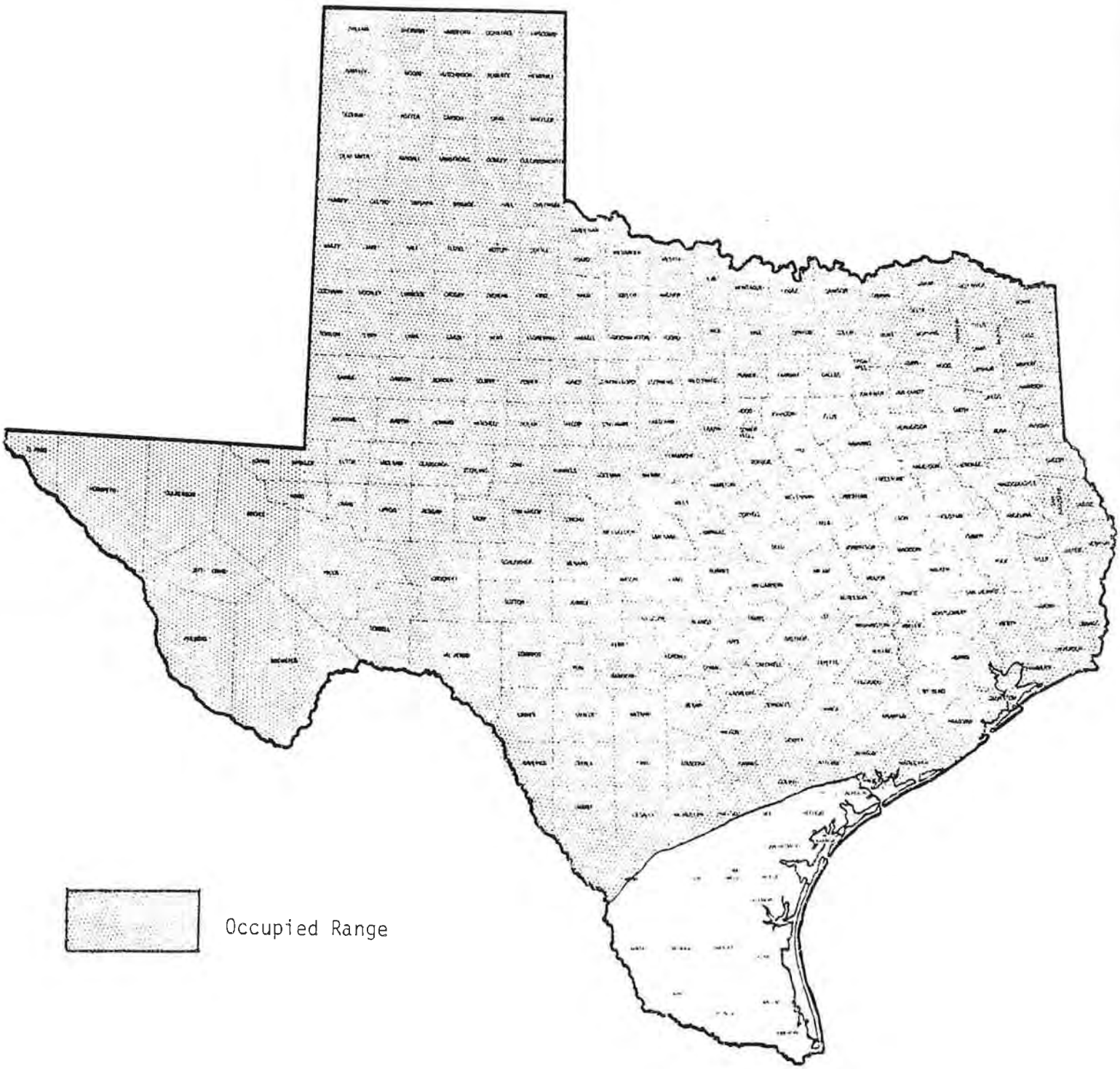


Figure 2. Black bear distribution in Texas circa 1900.

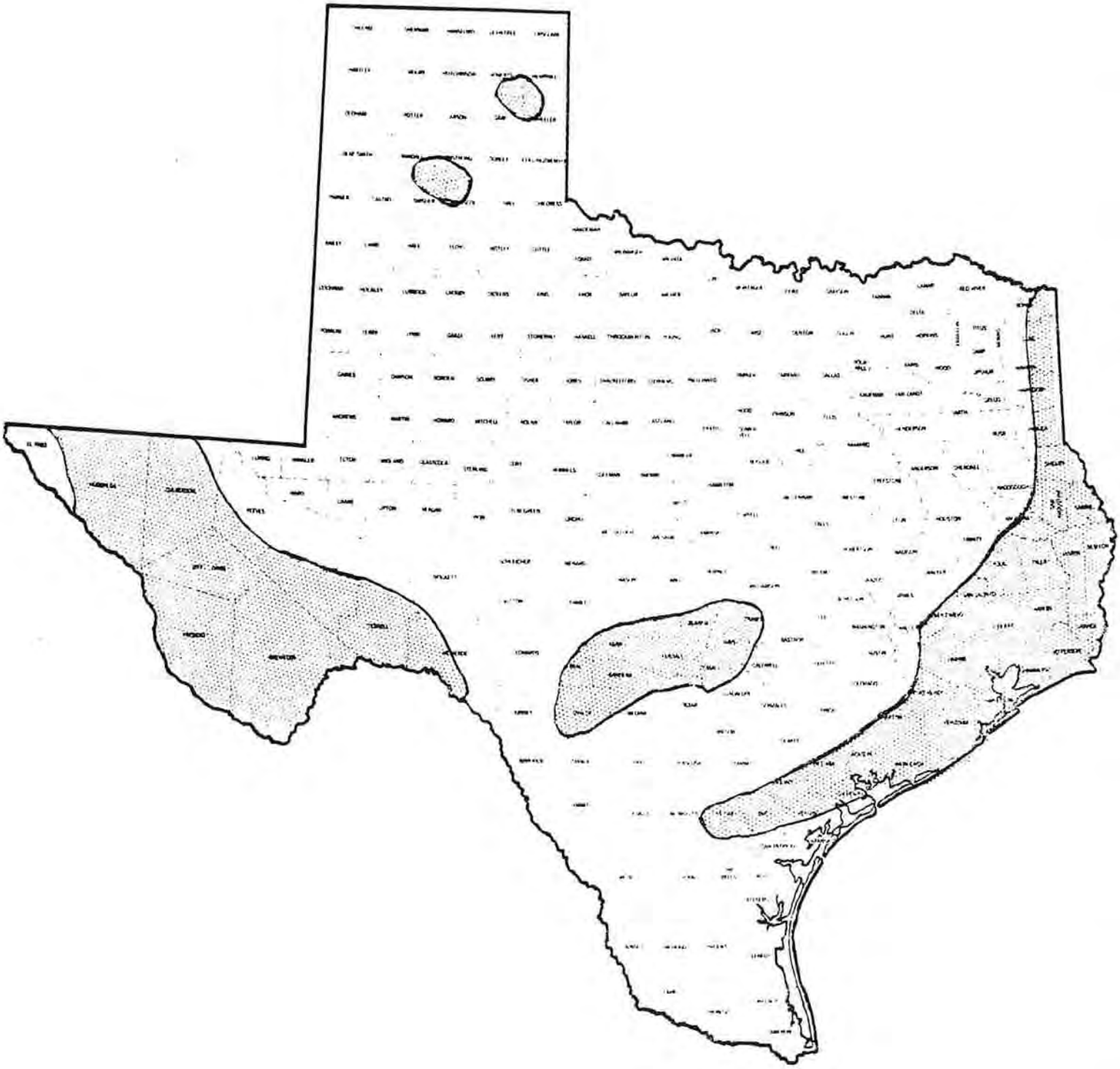
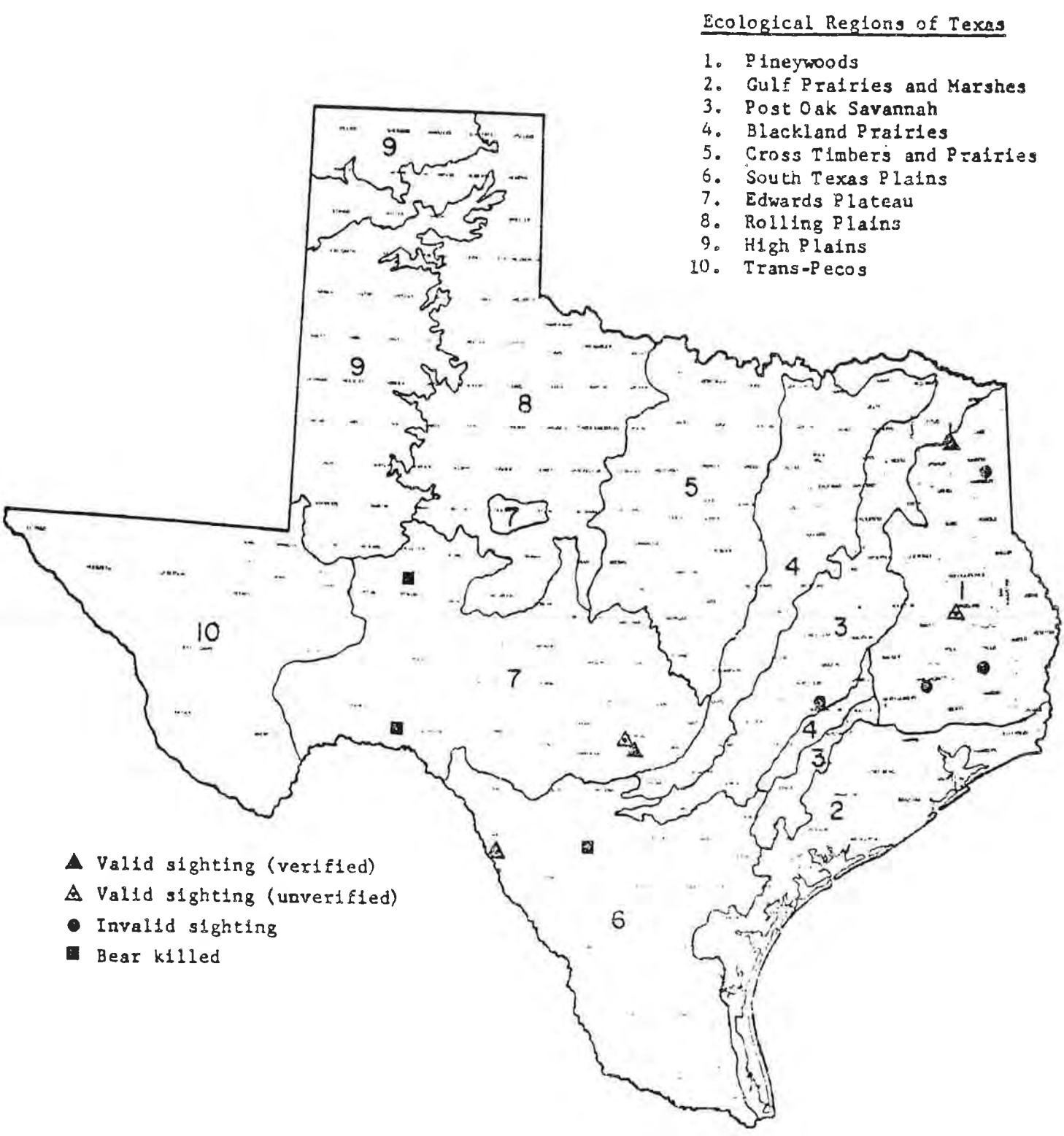


Figure 3. Black bears reported in Texas, 1977-1981.



UTAH

James W. Fitzgerald
Utah Division of Wildlife Resources

At this time no formal study of black bear population, trend, primary habitat etc., has been started in Utah. It is our hope that such a valuable study will be initiated.

However, personnel from the Division of Wildlife Resources have been, and are presently involved in compiling black bear harvest information in Utah, funded under the Pitman-Robertson Federal Aid Program. Data are gathered from postage-paid self-addressed questionnaire cards, and from Regional offices and conservation officers. As a followup, questionnaires are sent to hunters who did not send in the first card.

Harvest figures have been compiled since 1967 when the black bear was first designated as a game animal. Statistics show that the popularity of bear hunting is still growing slowly in Utah. The number of hunters afield has risen from a low of 31 in 1969, when permits were first required, to a high of 196 hunters in 1979. The number of bears harvested has also varied from a high of 38 to a low of 16 bears during a given season (Table 1).

Illegally taken or unreported bear kills contribute significantly to the yearly harvest. Twenty-nine were identified since 1973.

The 1978, 1979 and 1980 black bear proclamations allowed the legal taking of bear from April 16 through June 15, and from September 1 through October 15, except on elk, moose, buffalo, antelope and bighorn hunting units during their respective seasons.

Any black bear was legal game during the open season, except for any cub, or sow accompanied by young. The season limit was one bear.

All successful bear hunters were required by proclamation, to report their kill within 48 hours to a conservation officer or Wildlife Resource office, to obtain harvest information. Questionnaires were mailed to all permittees who were unsuccessful.

Harvest data for the 1978-79 report period indicate that 213 regular season bear permits were sold to residents and 9 to non-residents. For the 1979-80 season, 223 regular season permits were sold to residents and 17 to non-residents. The 1980-81 season totaled 209 permits sold to residents and 8 to non-residents.

Special bear damage permits were issued to two ranchers during the 1978-79 period, one during the 1979-80 period, and none during the 1980-81 period.

Harvest figures for the last three years show that during the 1978-79 spring season, sportsmen harvested 17 bears, and thirteen in the fall, for a total of 30, with a hunter success of 10.8 percent. During that same period eight depredating bears were taken by government trappers and two by ranchers for an overall total of 40 bears harvested.

For the 1979 season, sportsmen harvested 12 bears in the spring, seven during the fall hunt, and of unknown dates, for a total of 23. The percent hunter success was 11.7. Also during that period five depredating bears were taken by government trappers, for an overall total of 28 bears.

For the 1980 season, 24 bears were reported harvested by sportsmen in the spring and two in the fall, a total of 26, for a hunter success of 20.0 percent. Depredating figures were six bears taken by government trappers. A reported total of 32 black bears were harvested in Utah during the 1980 season.

At present harvest figures for the 1981-82 season, are being compiled. Permits sold to residents were 251, and 10 sold to non-residents. Harvest figures received so far show that during the spring season, April 16 to June 30 five mature males were taken, 6 mature females, and 3 juvenile males. Bear damage reports indicate that 3 bear were taken by government trappers during the 1981 season (Tables 2 and 3).

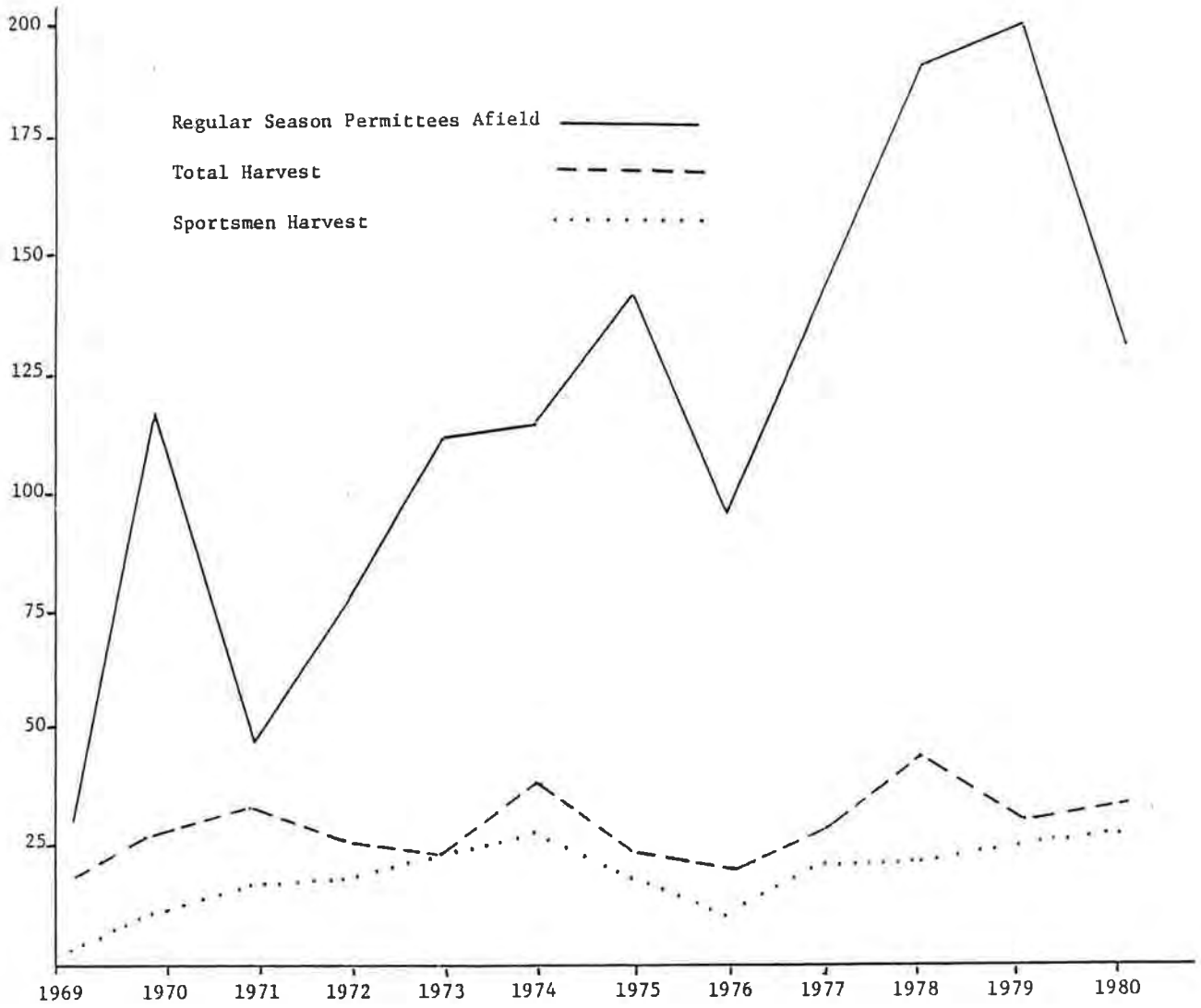


Figure 2. Summary of Regular Season Permittees Afield. Total Harvest and Regular Season Harvest of Black Bear in Utah, 1969-1981. The Difference Between Regular Season and Total Harvest Represents the Number of Depredating Animals Removed.

Table 1. Summary of Utah black bear seasons.

Year	Season dates	Season lengths (days)	Limits	Price of Permits	Nonresident hunting
1970	7/01/69-04/15/70	289	1	R $1	Closed
1971	5/15 - 10/15	104	1	R $1	Closed
1972	5/15 - 10/15	154	1	R $15	Closed
1973	5/01 - 10/19	173	1	R $15 NR $100	Book Cliffs
1974*	5/01 - 10/15	168	1	R $15 NR $100	Book Cliffs
1975	**5/01 - 10/15	168	1	R $15 NR $150	Book Cliffs
1976	**5/01 - 06/15 and 9/15 - 10/15	77	1	R $15 NR $150	Book Cliffs
1977	**4/16 - 06/15 and 9/01 - 10/15	106	1	R $15 NR $150	Statewide
1978	**4/16 - 06/15 and 9/01 - 10/15	106	1	R $15 NR $150	Statewide
1979	**4/16 - 06/15 and 9/01 - 10/15	106	1	R $15 NR $150	Statewide
1980	**4/16 - 06/15 and 9/01 - 10/15	106	1	R $15 NR $150	Statewide
1981	**4/16 - 06/30 and 9/01 - 10/15	111	1	R $15 NR $150	Statewide

*Cougar-bear pursuit permits were first authorized by the 1974-1975 proclamation and have been authorized in subsequent years.

**Northwestern area of state - no open season.

Table 2. Partial bear harvest, 1981

	4/16/80-10/15/80		4/16/81-10/15/81	
Permits sold	209 (8NR)		251 (10 NR)	
Pursuit permit sales	95		77	
Percent returns	62.2		--	
No hunt	32		--	
Hunt-no kill	104		--	
No. cornered (in addition to those killed)	40		--	
Sportsmen harvest	26		14	
Mature male	13		5	
Mature female	6		6	
Juvenile male	5		3	
Juvenile female	2		0	
Damage harvest	6		3	
Livestock owner	0		0	
Government trapper	6		3	
Other mortality	4		1	
Total harvest	36		18	

Table 3. Partial bear harvest, April 16, 1981 to October 15, 1981.

Region	Sport harvest	Damage harvest reports and Permits
Northern	0	0
Central	1	6
Northeastern	7	0
Southeastern	5	0
Southern	1	1
Total	14	7

WASHINGTON

Lowell D. Parsons
Washington Department of Fish and Game

The 1980 harvest of 2,600 bear was the lowest recorded since harvests were first calculated in 1950. Reduced hunting opportunity on the westside, where the summer season was reduced to one month, was partially, but not entirely, responsible (Table 1).

Westside Population Trend Index shows a continued decline in bear numbers between 1964 and 1980. While the decline was more rapid during the 1960s, it has, nontheless, continued at a slower rate during the 1970s. Presently, PTI for the state approximates 25,000 of which about 14,000 is from the westside. There were 3.4 bear on the westside in 1964 compared to one in 1980. Also, bear damage to commercial timber has been reduced to the point where no spring damage season was set for 1981 (Tables 2,3,4).

In 1980, only 26% of the bear were taken with hounds (34% on the westside). Thirty-two percent were taken during the deer season (25% on the westside). As to bear pelage color, 77% were black, 20% brown and 3% were cinnamon (red). This compares to 72%, 25% and 3% in 1979. Harvest was 58% male and 68% adult (compared to 59% and 64% last year). Cubs were down from 7% to 4% of the harvest (Table 5).

Thirty-one percent of the bear harvest was reported on the Bear Kill Report Cards (42% east, 25% west), indicating a PTI of 0.58 bear per square mile (0.49 east, 0.69 west). Unit Data was constructed from 1976 to 1980 report cards. While not damage areas, highest unit densities were 105 Kellyhill (2.51), 460 Snoqualmie (2.50), 684 Longbeach (2.50) and Bow Area No. 2 Long Island (2.11).

To address population declines, a one tag (one bear limit) statewide hunt was implemented for 1981. While we suspect that habitat is the key to the decline, we have reduced bear hunting from 7 months in 1980 to 3 months in 1981.

Table 1. 1950 - 1980 black bear harvest.

	Bear Harvest			Hunters		Percent						
Year	Sport	Control	Total	Esti. Hunters	Tags Sold	Harvest Eastside	Hounds	Male	Adult	Yearling	Cub	Card Return
1950	5,200	-	5,200									
1951	7,600	5	7,605									
1952	8,000	108	8,108									
1953	6,700	187	6,887									
1954	9,100	165	9,265									
1955	6,600	154	6,754									
1956	6,700	115	6,815									
1957	5,200	87	5,287									
1958	6,900	137	7,037									
1959	6,200	203	6,403									
1960	8,900	167	9,067			26						
1961	5,500	412	5,912			16						
1962	8,700	685	9,385			22						
1963	6,900	658	7,558			15						
1964	8,100	541	8,641			22						
1965	7,400	611	8,011	35,560		22						
1966	4,710	460	5,170	32,700		30						
1967	3,180	450	3,630	22,500	12,745	31		56	56	39	5	11
1968	4,150	426	4,576	26,900	17,938	21		62	51	41	8	13
1969	3,410	419	3,829	24,800	19,819	26		59	60	32	8	18
1970	3,470	226	3,696	21,000	21,444	31		61	63	32	5	20
1971	4,100	216	4,316	21,000	21,742	29		58	59	34	7	18
1972	3,400	227	3,627	21,000	21,572	31		61	59	36	5	21
1973	2,830	211	3,041	25,000	25,355	24	50	57	68	28	4	22
1974	3,910	213	3,123	24,500	24,711	28	33	55	69	26	5	18
1975	3,760	192	3,952	23,800	24,010	31	35	55	64	31	5	18
1976	3,150	238	3,388	22,300	22,266	31	37	55	67	29	4	27
1977	2,650	199	2,849	22,730	23,505	38	35	58	63	31	6	33
1978	3,000	205	3,205	24,000	23,690	39	26	55	66	29	5	30
1979	2,750	94	2,844	26,250	26,830	45	37	59	64	29	7	35
1980	2,600	65	2,665	26,050	27,130	35	26	58	68	28	4	35
Total	164,770	8,076	172,846	400,090	312,757	593	279	809	877	445	78	319
Average	5,315	261	5,576	25,006	22,340	28%	35%	58%	63%	32%	6%	23%

Table 2. Westside bear harvest 1960-1980.

Year	Sport Harvest	Control Kill	Total
1961	4,570	412	4,982
1962	6,660	685	7,345
1963	5,770	658	6,428
1964	6,460	541	7,001
1965	5,760	611	6,371
1966	3,280	460	3,740
1967	2,200	450	2,650
1968	3,210	426	3,636
1969	2,420	419	2,839
1970	2,320	226	2,546
1971	2,860	216	3,076
1971	2,270	227	2,497
1973	2,090	211	2,301
1974	2,740	213	2,953
1975	2,520	192	2,712
1976	2,100	238	2,338
1977	1,630	199	1,829
1978	1,860	205	2,065
1979	1,500	94	1,594
1980	1,700	65	1,765

Table 3. 1980 estimated spring bear harvest, April-July 1980.

Spring bear unit No.	Name	WFPA Control kill	Report cards	Estimated sport harvest[1]	Square miles unit	Total bear kill[2]	Bear kill per sq. mile
2	Skookumchuck	6	18	70	251	76	0.30
3	Coweeman	5	6	23	100	28	0.28
4	Huffaker Mtn.	-	1	4	41	4	0.10
5	Toutle-Green	3	4	14	161	17	0.11
6	Grays River	1	10	43	48	44	0.92
10	Capitol Peak	-	11	43	184	43	0.23
12	Hoquiam-Humptulips	5	4	18	234	23	0.10
13	Promised Land	4	20	90	190	94	0.49
14	Sekiu River	17	7	31	208	48	0.23
15	Pysht-Calawah	4	9	41	272	45	0.17
17	Clearwater	4	7	30	201	34	0.17
Spring Unit Total		49	97	407	1,890	456	0.24

[1]Based on report card return proportion of county bear harvest

[2]Estimated sport harvest plus W.F.P.A. control kill; "Hot Spot" bear kill not included in these data (7 report cards)

Table 4. History of spring bear hunt to reduce forest damage in western Washington, 1973-1980.

Apr-Jun Period Year	No. of Bear Units	WFPA Control Kill	Kill Report Cards	Estim. Sport Harvest[1]	Card Percent Return	Sq. Miles Unit	Total Bear Kill[2]	Bear kill per Sq. Mile
1973	16	81*	150	650	23%	2,520	731	0.29
1974	17	90	119	680	18%	3,270	770	0.24
1975	16	77	113	740	15%	3,103	817	0.26
1976	12	65	115	510	23%	2,486	575	0.23
1977	16	85	134	520	26%	2,778	605	0.22
1978	16	87	94	430	22%	2,580	517	0.20
1979	13	52	68	272	19%	2,016	324	0.16
1980	11	49	97	407	24%	1,890	456	0.24
Total	117	586	890	4,209	21%	20,643	4,795	0.23
Average	15	73	111	526	21%	2,580	599	0.23

[1]Based on report card return proportion of county bear harvest

[2]Estimated sport harvest plus W.F.P.A. control kill

*Actual data not available; the 1974-1978 average was used

Table 5. Bear pelage color - 1980 report card data.

Region No.	Name	Black No.	Black Pct.	Brown No.	Brown Pct.	Red No.	Red Pct.	Unknown No.	Total No.
1.	Spokane	180	67%	78	29%	10	4%	8	276
2.	Okanogan	44	53%	31	37%	8	10%	2	85
3.	Yakima	71	70%	25	24%	6	6%	6	108
Eastside		295	65%	134	30%	24	5%	16	469
4.	Sound	158	36%	23	13%	2	1%	3	186
5.	St. Helens	72	83%	13	15%	2	2%	3	90
6.	Coastal	147	98%	2	1%	2	1%	5	156
Westside		377	90%	38	9%	6	1%	11	432
Statewide		672	77%	172	20%	30	3%	27	901

WYOMING

Forrest Hammond
Wyoming Game and Fish Department
Laramie, Wyoming 82071

Introduction

Black bear inhabit most of the mountainous portions of Wyoming with the exception of the Black Hills in the northeastern corner of the state (Fig. 1). An estimated winter population of 2,300 black bear occupy approximately 9,700 square miles of habitat located largely in northern and western regions of the state. Little is known regarding the status of the black bear in much of its range. The population appears relatively stable and presumably at carrying capacity in suitable habitat. Major factors controlling the expansion of the black bear in numbers and distribution may be related to the quality of feeding habitat and man's tolerance of bear presence near domestic livestock and summer homes. Typical summer and fall ranges, with abundant berry and mast producing plants, are lacking in many of Wyoming's mountain ranges and significant numbers of bears are killed annually in depredation and nuisance control programs.

Harvest Information

Wyoming has both a spring and fall hunting season. Spring bear seasons generally run from May 1 through June 30. Fall seasons vary widely in length concurrent with deer and elk seasons. REsident hunters must obtain a special bear license for spring bear, while all resident elk hunters automatically receive a bear tag when purchasing their elk license in the fall. Non-residents are required to buy a separate bear license to hunt. Hunter numbers, harvest, and days of hunting are computed from an annual questionnaire mailed to all spring bear hunters and to a 30 percent sample of all individuals purchasing elk permits.

The average annual hunter kill of bears for the last 5 years (1976-80) was 324 (Table 1). Total license sales and the number of hunter days have increased substantially since 1976 (Table 2), while the annual harvest has risen to a lesser degree. The percentage of total harvest taken during the spring (when bear are the primary target and not taken incidental to other big game hunting) has increased from 10 percent in 1970 to 50 percent in 1975 and 49 percent in 1980.

Table 1. Harvest and number hunter days, 1976-1980.

Year	Spring harvest	Fall harvest	Total harvest	Hunter days
1976	117	176	293	27,772
1977	117	151	268	20,741
1978	159	183	342	48,183
1979	125	186	311	42,031
1980	201	207	408	62,612

Table 2. License sales, 1976-1980.

Year	Resident	Nonresident	Total
1976	44	743	787
1977	44	1,010	1,054
1978	36	1,210	1,245
1979	44	1,287	1,331
1980*	722	866	1,588

*License fees increased for both resident and nonresident. 1980 was also the first year residents were required to purchase a spring bear license separate from their elk permit.

Management Programs

The main objective of present management is to allow a maximum of harvest and recreation while maintaining optimum habitat and population levels. To help in achieving these objectives the department has initiated a mandatory reporting program and extracts a premolar for determining the age of each bear harvested. Additional information is needed on population density and trend, black bear habitat requirements, and management alternatives for handling livestock depredation problems.

Research Programs

A black bear food habits study was initiated in April of 1981. The study is being conducted in the Wyoming and Salt River Ranges of western Wyoming to determine the seasonal diet of black bears and assess the relative availability of the major foods by habitat type. The project is under the supervision of Dr. Larry Irwin and is scheduled for completion in 1983.

Recent Literature

Anonymous. 1980. Comprehensive wildlife management plan for national forest system lands in Wyoming. 144 pp.

Wyoming Game and Fish Department. 1978-82. Annual big and trophy game completion reports. Wyoming Game and Fish Dept., Cheyenne.

_____. 1978-82. Annual report of big game harvest. Wyoming Game and Fish Dept., Cheyenne.

_____. 1978. A strategic plan for the comprehensive management of wildlife in Wyoming 1978-1983. Wyoming Game and Fish Dept., Cheyenne. 143 pp.

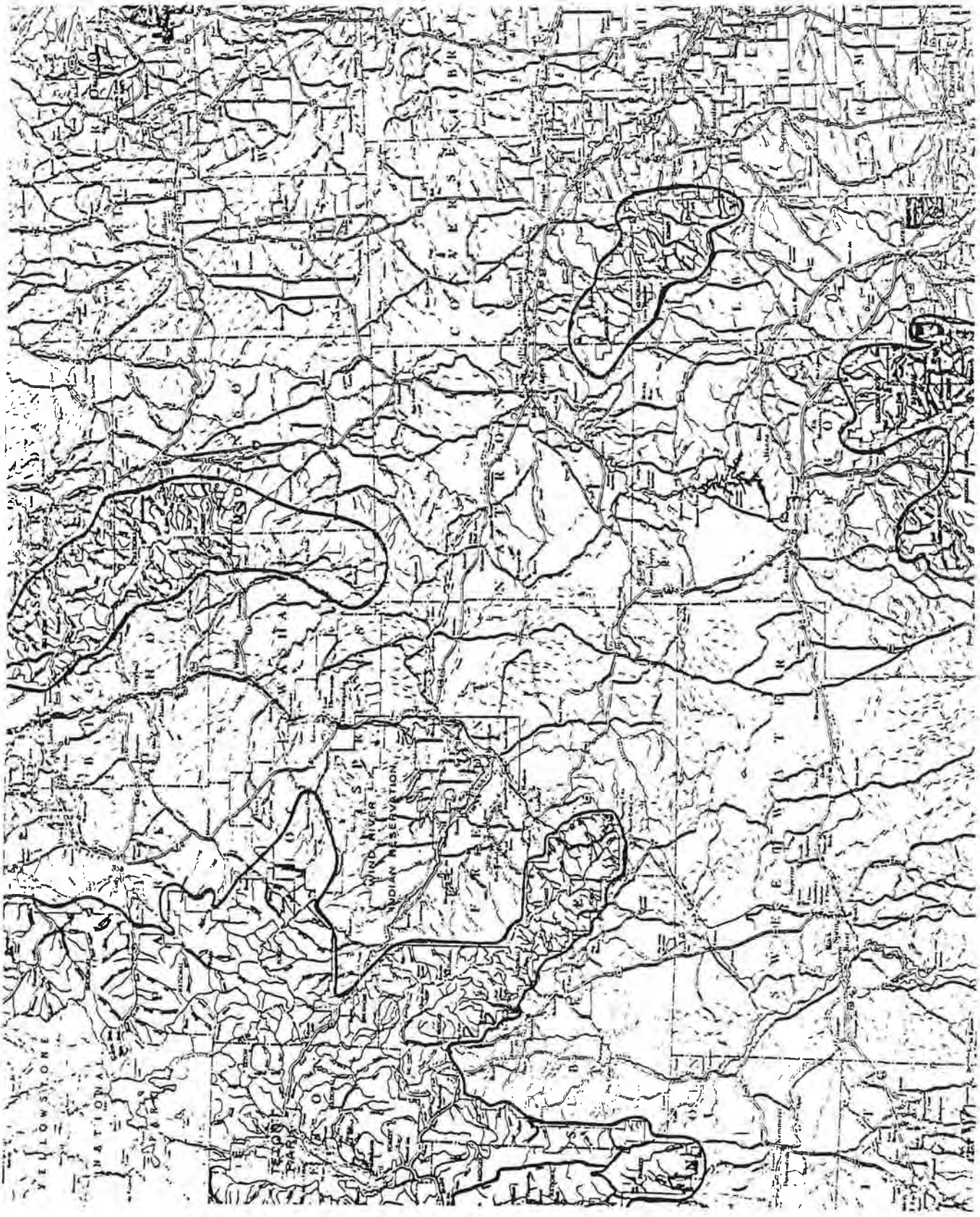


Figure 1. General distribution of black bear in Wyoming.

YUKON TERRITORY

Bernard L. Smith
Department of Renewable Resources

There is little of consequence to report regarding changes in black bear management and population status since that reported by Lortie and Smith (1979). Sport harvest estimates are not significantly different than those reported earlier, however, unreported control losses are likely increasing with the recent increases in placer mining activities.

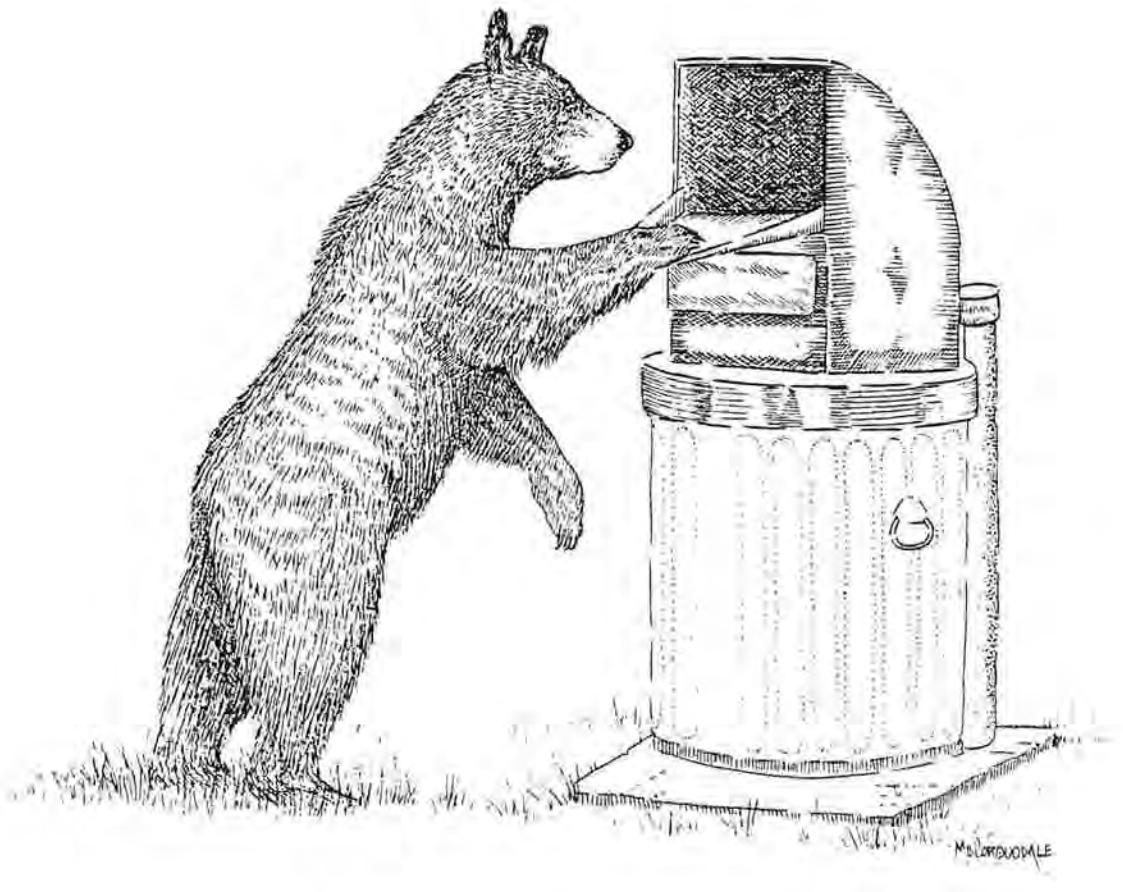
Currently territory-wide sport harvests are 34 percent female. Experimental April season openings and two bear bag limits are being tested in some areas to determine if harvest densities and sex ratios will be altered. In addition, selective lethal control strategies are being tested whereby subadult, particularly male "first offenders" are destroyed and rehabilitative measures attempted with adults. Hopefully, these may alleviate the development of control-caused population sinks adjacent to developed areas that are suspected to be "filling up" with potentially troublesome subadults.

A black bear population study has been proposed for the Stewart River area to start in 1982. Independently wealthy researchers interested in the population dynamics of Arctic Circle black bear populations would be welcomed.

LITERATURE CITED

Lortie, G. M. and B. L. Smith. 1979. The status and management of the black bear in the Yukon Territory, 1979. Pages 97-100 in Proceedings of the First Western Black Bear Workshop.

RESEARCH REPORTS



ALASKA

Black Bear Research in Alaska

Jim Lieb

Alaska Department of Fish an Game

The preliminary findings of Schwartz et al. (1981) and the steadily increasing number of bear observations by the general public strongly suggest that this increase in harvest reflects the current overall high density of black bears in Unit 15.

Research data indicated that a good age distribution exists in captured bears from the studied portions of Unit 13. Reproduction appeared adequate. No changes in bag limits or season dates were recommended.

Miller, S. D., and D. C. McAllister. 1981. Alaska Power Authority, Susitna Hydroelectric Project, Environmental Studies Annual Progress Report. Subtask 7.11 Big Game. Alaska Dept. of Fish and Game.

Schwartz, C. C., A. W. Franzmann, and D. C. Johnson. 1981. Black bear predation on moose. Fed. Aid Wildl. Rest. Rep., Prog. Rep. Proj. W-17-11 and W-21-1. Alaska Dept. of Fish and Game, Juneau. 16pp.

Spraker, T. H. 1979. Black bear survey-inventory progress report. In R. A. Hinman (ed.). Annual report of survey-inventory activities. Part I, Vol. X. Fed. Aid Wildl. Res. Rep., Proj. W-17-11, Job. No's. 17.0, 4.0 and 22.0. Alaska Dept. Fish and Game, Juneau.

Tobey, R. W. 1980. Annual report of survey-inventory activities. Part I. In R. A. Hinman (Ed.). Alaska Fed. Aid in Wildl. Res. Proj. W-17-11.

ARIZONA

Black Bear Research in Arizona

Albert L. LeCount

Arizona Game and Fish Department

The Arizona Game and Fish Department has been involved in black bear research since 1973. The primary objective of this research program is to collect sufficient biological data on black bear ecology to develop an effective management program for the species. Currently 5 active black bear research projects are in progress in Arizona on 2 separate study areas. A 6th project has recently been completed and the results are in various stages of publication.

Three of Arizona's research projects are concerned with gathering information on a black bear population in the Four Peaks area of central Arizona. This study area is primarily a chaparral area but also contains desert scrub, riparian, pine-oak woodland, and ponderosa pine vegetation types. The objectives of the first project started on this area in 1973 were to determine density, seasonal movements, and home range size of the population. Seventy bears were captured and marked during the 5 years this study was conducted. Thirty-six were radio-instrumented and over 3,000 locations were recorded. A density of 1 bear/1.25 square miles was found to inhabit the area. Four papers covering the results of this study have been accepted for publication:

1. Characteristics of a central Arizona black bear population (LeCount, accepted for publication, JWM)

2. An analysis of the black bear harvest in Arizona, 1968-78 (LeCount, in press, Arizona Game and Fish Department)

3. A survey of trichinosis among black bears of Arizona (LeCount, J. Wildl. Dis. 17:349-351)

4. Some aspects of black bear ecology in the Arizona chaparral (LeCount, Proc. 4th Int. Conf. on Bear Res. & Mgmt., pp. 175-180)

The objective of one was to determine requirements of black bears on the study area. Use of various vegetation types was gathered by radio-tracking bears throughout the study area. Data on plant phenology, nutritional content and diets of bears was also gathered.

Data analyses and final report writing are nearing completion on a portion of this project and 1 paper has been accepted for publication:

1. Denning ecology of black bears in central Arizona (LeCount, accepted for publication, Proc. 5th Int. Conf. on Bear Res. and Mgmt.)

The objective of the other project started in central Arizona in 1978 was to determine the reproductive rate of the study area population. Field work on this project is finishing this year. Information on minimum breeding age, mean litter size, interval between litters, and survival of cubs through their first year has been gathered by monitoring 10 radio-collared females. Reproductive data on the majority of these individuals has been recorded since work initially began on the study area in 1973. Average litter size over the 9 years of study has been 1.9 cubs with 54% of these surviving to 1 year of age. The final report on this project will be prepared in 1983.

In 1980, 2 new research projects were begun in the ponderosa pine and mixed conifer areas of the Mogollan Rim area of northern Arizona to gather the same type of ecological information on bears in this portion of the state that has been gathered in the chaparral area of central Arizona. The objective of 1 study was to determine density, movements, reproductive and harvest rates of a northern Arizona black bear population. The objective of the other study was to determine black bear habitat requirements in northern Arizona and the effects of logging, recreation, and road building on bear habitat. The study approach duplicates that of the central Arizona work. In the first 1-1/2 years, 35 individual bears have been captured, 24 radio-collared, and approximately 700 locations recorded. A vegetation sampling system using current USFS techniques has been developed in cooperation with FS personnel and intensive vegetation sampling will begin in the spring of 1982. Both of these studies are scheduled for completion in 1984.

Arizona's 6th black bear project involves the development of a "Black Bear Field Guide" for use by wildlife managers. This project will bring together in a single publication, which can be easily carried into the field, the information the manager needs to deal with most bear or bear-related problems. Topics covered in the field guide will include restraint, marking, transportation, collection of biological information and samples, recognition of bear sign, and bear depredation investigation. This project was initiated in 1980 and is scheduled for completion in 1983.

CALIFORNIA

Black Bear Study in Redwood National Park

Mark T. Schroeder

Prior to expansion in 1978, Redwood National Park in northcoastal California and associated State parks encompassed a narrow coastal strip of old-growth redwood and cutover stands stretching from Crescent City to Orick. When compared to old-growth forests, cutover land is superior for bears in that it provides abundant food resources.

Park expansion resulted in 36,000 acres of cutover land within the Redwood Creek basin being added to the Park. Habitats within the Redwood Creek basin consist of a mosaic of redwood forests in various stages of succession, from virgin to recently harvested stands. In addition, there are riparian areas, prairies, and higher elevation/inland stands predominated by Douglas fir and oak woodlands. Depending on age of cut, slope, aspect, soil type, etc., these areas vary greatly in rates of succession and relative productivity. Therefore, a variety of habitat types is available.

The primary objective of this study is to determine habitat use patterns and distribution of black bear within the redwood region. The study will determine what successional stages are preferred by bears and the proportion of time bears spend in each habitat. Seasonal changes in these selection patterns will also be documented. The future availability of similar preferred habitat will then be predicted. With an anticipated influx of visitors into the Redwood Creek basin, the opportunity for human/bear encounters increases. Therefore, one of the factors to consider when planning the distribution and use of visitor facilities is the distribution of optimal bear habitat. Intensive visitor management is planned after facilities are constructed to further reduce unfavorable human/bear interactions. Subobjectives include food habits analysis and population ecology, i.e., population estimate, density, sex-age ratio, fecundity and mortality. The study will also attempt to collect observations of bear social and tree-girdling behaviors. We will determine the significance of cambium in the black bear diet and document, where possible, which bears utilize cambium as a food source. The answer to these questions are of obvious importance to commercial timber companies as well as wildlife and other resource management agencies.

Eight bears have been captured to date. Radio-telemetry collars were placed on four. We have collected pre-molar samples, hair samples,

somatic measurements, parasites, and weights from the eight bears. Activity patterns and movement data have been collected since capture on the four collared bears. Scats have been collected since July, 1981.

Of particular interest is the denning behavior exhibited by the collared bears. Bears have been monitored at den sites since November, 1981. One particular young female is believed to have given birth to her first cubs from a den within an old-growth redwood. To avoid human-induced abandonments, bears will be recaptured just before their anticipated time of emergence. Collars will be adjusted, weights will be taken, and den construction parameters measured. Rainfall, temperature, and relative humidity in the study area are being recorded.

Some bears, particularly males, do not appear to be denning, but instead simply reduce their activity to match reduced food availability and seek shelter during inclement weather. This behavior poses the question, do these bears enter a true ursine hibernation, with periods of ingestion and elimination, and, if so, what are they ingesting? Additional years of record keeping will be required to understand the relative roles of food availability and weather on the dormancy behavior of the black bear in northcoastal California.

IDAHO

Black Bear Habitat Use at Priest Lake

Don Young

University of Montana

In 1980, an investigation of black bear habitat use patterns was initiated by the Idaho Department of Fish and Game at Priest Lake. The goal of this investigation was to provide information for use in formulating a long-term management plan for the black bear in Idaho. Secondarily, the data should allow predictions on the impacts of habitat alterations to black bear populations. The specific objectives of this study were to:

1. Quantify seasonal habitat use patterns of Priest Lake black bears;

2. Determine whether habitat use patterns differ among sex segments of the population;

3. Compare use of disturbed (i.e., logged) and undisturbed sites by black bears;

4. Identify relationships between habitat selection and the occurrence, abundance, and phenological development of key bear food plants;

5. Determine whether black bear habitat use patterns differ by activity (i.e., feeding, breeding, travelling, denning).

Nine adult black bears (4 males and 5 females) were instrumented with bimodal, motion-sensitive radio transmitters and monitored between June 1980 and November 1981. Both signal mode and signal integrity were used as criteria to discern between types of activity. Habitat selection was determined primarily from radio locations obtained by ground tracking at close range. Bear locations were classified according to the habitat component, habitat type, and timber type (Idaho Department of Public Lands) classification systems. The chi-square test of fit and Bonferonni Z statistic were used for statistical testing.

Over 1100 bear locations were obtained during the study. Radio monitoring accounted for more than 750 locations; whereas, incidental sign (scats, tracks, beds, etc.) accounted for about 300 locations. Data analysis and the subsequent write-up will be completed by June 1982.

IDAHO

Research in Idaho

John Beecham

Idaho Fish and Game

In 1972, the Department of Fish and Game initiated a black bear ecology research project designed to collect the biological data on black bear necessary to develop a comprehensive management program.

To date, five geographically discrete black bear populations have been studied in Idaho. These studies were initially designed to determine the status of each black bear population, although data were also collected on their food habits, physical condition, denning requirements, and activity patterns, etc. The present emphasis has shifted towards learning more about black bear habitat utilization patterns and developing a population monitoring system that will provide game managers with information on which they can make short-term management decisions.

In 1973, a population ecology study was initiated near Council in west-central Idaho. The objectives of this study were to ascertain the population size, sex, and age structure, movement and activity patterns, reproductive biology, denning activities and den characteristics, and food habits of a hunted bear population.

A second study was begun in 1975 in north-central Idaho near Lowell in conjunction with the Department's calf elk (Cervus elaphus) mortality study conducted by Mike Schlegel. The objectives of this study were to determine the population size, and sex/age composition of an essentially unhunted bear population. An additional objective was to measure the response of this population to a major dislocation program in conjunction with the calf elk mortality study.

A third study was conducted during 1978 in the Coeur d'Alene River drainage north of Wallace, Idaho. The objectives of this study were to ascertain the population status of the bears in that area by collecting data on sex and age structure, population size, and food habits.

A fourth study was begun in 1979 on the east side of Priest Lake with essentially the same objectives as those for the Council study, except that more emphasis was placed on black bear habitat utilization patterns in our telemetry studies.

A fifth study was initiated in 1981 near Elk River, Idaho. The objectives of this study were to ascertain population status by collecting data on sex and age distribution, population size, and food habits.

To date, we have captured and handled over 1,200 black bears on the five study areas, collected and analyzed over 2,000 scats, collected over 750 blood samples, and examined 65 different dens at Council and have located about 20 dens on the Priest Lake study area.

MAINE

Black Bear Research in Maine

Brad Allen

Maine Department of Inland Fisheries and Wildlife

As part of the ongoing black bear research program in Maine, this study was initiated to determine the impact of hunting with dogs on bears in Maine. The primary objectives were to describe the effect of hunting with dogs on bear home ranges and movements and to describe escape behavior of each bear during the chase.

Trained hunting dogs were used to experimentally locate and pursue black bears in northern Maine. Both uncollared and previously radio-collared bears were chosen for pursuit. From June 1980 to October 1981, 77 experimental chases were recorded. During the 2 field seasons, 28 of the 77 experimental chases involved collared bears. Analyses of chases of bears with known home ranges indicated that bears rarely leave their home ranges when pursued; instead, they (particularly female bears) run complicated, circuitous patterns within their ranges while attempting to evade the dogs. Relocations after harassment reveal that the pursued bear seeks areas within its range that have heavy cover and little access by roads.

Field work for this study has been completed and data analyses and study writeup are in progress.

MONTANA

Black Bear Studies, North Fork of the Flathead River, Northwest Montana and Southeast British Columbia

Harry Carriles

University of Montana

Grizzly bear studies have been conducted in the North Fork of the Flathead River drainage since 1975. Black bear research was initiated in 1980 to compare the food habits and habitat use of black bears to that of grizzlies within the same study area.

Objectives include:

1. Determine similarities and/or differences between black bear and grizzly bear food habits;

2. Compare the habitat component preferences of both species;

3. Compare black bear and grizzly bear food habits in the context of the phenology and productivity of certain plant foods.

Since July 1980, 11 black bears have been collared. Two males were legally shot subsequent to their radio transmitters failing. One subadult female was legally shot within a week of dropping her collar. Three other bears (2 subadults, 1 adult) dropped their collars. At present, three adult females (2 with 5 cubs between them) and an adult male continue to carry functioning radio collars. A subadult female has not been located since August 1981. Her collar may have failed or she has just left the study area and hasn't been relocated.

Data on habitat use and food habits have been collected, on a continuing basis, for two adult females since they were captured in July 1980. Data on other bears is less complete. The two family groups, and a third female expecting to have cubs this winter, will be monitored extensively during the coming field season.

During Spring 1982 all five yearlings will be radio-collared. I hope to acquire data on the dispersal and/or mortality of these subadults during their first year of independence from the female. Habitat use and food habits data will also be collected on the dispersing subadults, and all data will be used in the comparison of black bear and grizzly bear habitat use and food habits.

NAVAJO NATION

Research Progress Report

Patrick Ryan

Due to a concern for the impacts of logging, mining, grazing and animal damage control (ADC) on the black bear occurring in the Chuska Mountains and nearby Ft. Defiance Plateau, the tribe initiated a study of black bear population characteristics in 1979.

The project objective is to develop management plans that will ensure the continued coexistence of the black bear and humans on the Navajo Reservation.

The study objectives seek to document and determine sex and age structure of bears involved in man-bear conflicts which are either livestock, agricultural or "potential" depredation cases.

Depredation usually involves an individual bear, often old and crippled or otherwise disabled. A bear of this sort often returns to sheep corrals or cornfields on a regular basis. To traditional Navajos, once a bear has walked into their cornfield they feel he has claimed the corn for himself and they will not harvest it for their own use.

This study also seeks:

1. To determine density and sex and age structure of a black bear population on a selected study area;

2. To determine reproduction rates and denning behavior;

3. To determine habitat requirements, home ranges and territoriality using radio telemetry;

4. To determine food preferences by analysis of bear scats collected on a system of "index" trails established on the study area.

The Navajo Reservation has about 750 square miles of occupied bear habitat. A study area of about 100 square miles has been established in the Roof Butte area of the Chuska Mountains. The study area represents a cross section of the mountain range extending from about 6200 ft to

to over 9800 ft in elevation. The lower zones are primarily sagebrush-saltbush associations. Mid-elevations are pinon-juniper. Pondersoa pine covers about 60% of the area near 8000 to 9000 ft in elevation. The small peaks on top of the plateau-like mountains support mixed conifer and aspen stands.

Riparian areas at all elevations have been determined to be "high use" areas for bears. This vegetation type includes most of the berry producing plants, dense cover and water.

Typical capture-recapture and observation-reobservation methods are being used to examine density and age structure of the bear population. Twenty bears have been captured, marked and released. Eleven of the twenty bears were also instrumented with radio transmitter collars.

Average age of the adult segment is 5.95 years (N=11) at age of capture. Only one subadult (2-1/2 year old female) has been captured on the study area. The proportion of males in the population ($m/m+f=\hat{p}$) is .5 (N=20).

Radio locations are determined weekly using a Cessna 206 with a rotatable, H-type antenna mounted through the floorboard. Twenty-four hour radio tracking collects movement information on a monthly basis.

Den visitations are performed annually in early to mid-March to determine reproduction and behavior related to den site selection. To date, thirteen den sites have been located. In 1980 four adult females produced at least seven cubs. Three of these cubs were found denned with their mothers in 1981.

Food preferences are being studied primarily by examining all "known-age" bear scats located while traveling a series of index trails on a seasonal basis.

In general, spring foods are commonly juniper berries, insects and grass. Late summer foods include a few berries and grass until the Gambel's Oak acorns are ripe. Gambel's Oak acorns are almost 100% of the fall food taken by bears on the study area.

Depredation problems occur almost exclusively in late summer and early fall and may be directly related to the scarcity of berry producing plants or other suitable alternative food sources. This may suggest a direct competition with grazing livestock.

Habitat vegetation analysis has not yet begun except for the collection and preparation of a plant reference collection. Future work will utilize line transects tabulating plant species occurrance, percent ground cover, percent cover at bear height and overstory and canopy measurements. Transects will be stratified according to bear use as

determined by radio locations and compared to a set of completely random vegetation sampling transects.

All information collected during this study along with appropriate recommendations will be made available to tribal resource managers and land use planners through the use of word processor systems linked to the tribal data banks.

Funding for this black bear study has been a joint effort of the Navajo Tribe Division of Resources and the Bureau of Indian Affairs Branch of Land Operations.

NORTHWEST TERRITORIES

Bear Detection and Deterrent Program

Gordon B. Stenhouse
Paul A. Gray

Northwest Territories Wildlife Service

Currently there is no reliable method of detecting and deterring a bear from approaching a camp, a machine, or a man. In response to the need to develop effective detection and deterrent systems for use against black bears (Ursus americanis), grizzly bears (Ursus arctos), and polar bears (Ursus maritimus), a program was initiated by government and industry in the Northwest Territories in 1981. Initial tests were completed on polar bears at Cape Churchill, Manitoba; however, we plan to begin work with black bears and grizzly bears in the near future.

The 1981 program was funded by: Cominco Ltd.; the Federal Department of Energy, Mines and Resources (EMR); Mobil Oil Ltd.; the Federal Department of Indian Affairs and Northern Development (DIAND); Petro-Canada Ltd.; Environmental Assessment and Planning Division and the Wildlife Service Division, Department of Renewable Resources, Government of the Northwest Territories. The Manitoba Department of Renewable Resources provided logistical support at the study site. The Canadian Wildlife Service (CWS) loaned their observation tower, and marked polar bears near the study site to allow identification of individuals. In addition, CWS personnel provided logistical advice.

The goals of the program are:

1. To develop a variety of effective detection and deterrent programs that can be applied to each type of human installation, whether it be a small exploration camp or a large industrial site or community.

2. To develop and implement education and training programs for personnel working in bear habitat.

The short-term objectives of this program are to evaluate the effectiveness of commercially available detection and deterrent systems on polar bears by:

1. Documenting the behavior of individual bears during approach and avoidance of deterrent systems.

2. Developing objective criteria of detection and deterrence for free-ranging polar bears, and

3. Determining whether experienced bears respond with statistically significant different behavior patterns than inexperienced bears.

The long-term objective is to develop safe and practical techniques, aimed at changing behavior of bears rather than those that result in the death of the bears.

Field testing of microwave motion detection units, recordings of barking dogs, a 38 mm multi-purpose riot gun (rubber bullets), syringe darts, and an electrified fence was conducted from 16 September to 23 November at Cape Churchill, Manitoba (Stenhouse 1982).

A total of 86 polar bears were tested as they approached an observation tower at the study site. Microwave motion detection units were 100% successful in detecting approaching bears (N=66) during the daylight hours. The recordings of barking dogs did not stop the advance of 87% of the approaching polar bears (N=26), and in four instances elicited aggressive responses.

The 38 mm multi-purpose riot gun (rubber bullets) was successfully used to deter the approach of all bears (N=24) which were struck. All bears darted with an antibiotic (N=8) left the study area. Ninety-three percent of the polar bears tested (N=50) passed through the electrified barbed wire fence (30,000 volts, 1.75 amps).

Although preliminary, the results collected during the first season suggest that there may be effective techniques to detect and deter bears.

Literature Cited

Stenhouse, G. B. 1982. Bear detection and deterrent study, Cape Churchill, Manitoba, Fall 1981: Interim report. NWT Wildlife Service, file rep., in press.

WASHINGTON

Black Bear Research on Long Island, Washington[a]

Kim R. Barber
Frederick G. Lindzey

Utah Cooperative Wildlife Research Unit

Clearcut logging modifies thousands of acres of timbered habitats in the Pacific Northwest annually. The size, configuration, juxtaposition and age of these clearcuts may affect their use by black bears.

A study designed to investigate the use of clearcut habitats by black bears was initiated in the spring of 1980, on Long Island, Washington. The island, located in the Sitka spruce zone, is characterized by clearcuts and timbered stands of various sizes, ages and shapes as a result of past logging.

Twenty-five bears, 6 adult males, 3 yearling males, 15 adult females and 1 sub-adult female, were captured between 15 April 1980 and 4 August 1981. These bears were subsequently relocated daily, resulting in approximately 5900 independent (at least 1 hour apart) relocations. These data have not been analyzed as yet; however the importance of clearcuts as feeding areas and small timbered stands for travel lanes and escape cover is apparent. Additionally, bears were monitored biweekly from a fixed antenna at 2-hour intervals for 24-hour periods. Initial analysis indicated that bears were active 76% (N=1285) of the time during the day and 11% (N=672) of the time at night.

The phenology of major bear foods was monitored weekly and over 400 scats have been collected and analyzed. Various methods of monitoring were tested to determine the best sampling approach to quantify habitat use patterns. Damage to conifers by black bears was investigated.

Analysis of data is in progress. Final analysis will include characterization of the clearcut habitats selected for by black bears as well as changes in use of these clearcut habitats over time, through comparisons with habitat use information obtained from earlier work on the island (1973-1975).

[a]Funding provided by the Washington Forest Protection Association and the U.S. Fish and Wildlife Service (Division of Federal Aid and Refuge Division.

WYOMING

Seasonal Food Habits of Black Bears in the Wyoming Range

Forrest Hammond

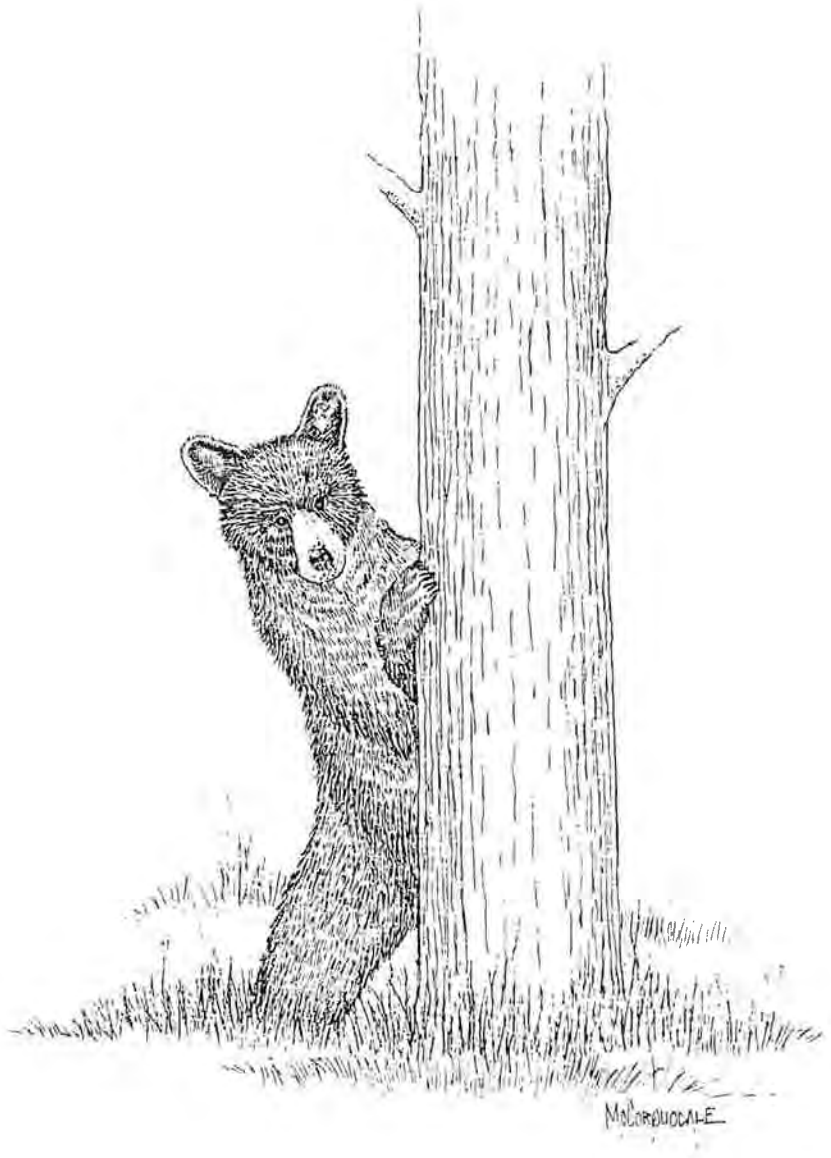
University of Wyoming

In an effort to begin answering some of the questions regarding habitat requirements of black bears in Wyoming, research work was begun in 1981. The area selected for this work was the Wyoming Range, located on the Bridger-Teton National Forest in west central Wyoming. Historically this area has seen extensive timber harvest by clear cutting and heavy livestock grazing. Oil and gas leases completely cover the study area and exploration activity is intense.

The main objectives of this study are to identify the seasonal diet of black bears by scat analysis and then inventory the major food items by habitat type.

During the first field season 298 scats and 3 stomachs were collected and are being analyzed at this time. The project is funded by the Wyoming Game and Fish Department and by the Wyoming Cooperative Fish and Wildlife Research Unit. Project completion is scheduled for May of 1983.

DISCUSSION SESSIONS



DYNAMICS OF BLACK BEAR POPULATIONS:

(LOW TO NO HUMAN EXPLOITATION)

Robert L. Ruff
University of Wisconsin-Madison

The purpose of this session was to provide an opportunity for meaningful dialogue among researchers and managers concerning the dynamics of black bear populations subjected to low or no human exploitation. It was anticipated that the results of such discussions could be interpreted and applied in the development of management strategies for hunted and non-hunted populations. An underlying premise of this approach was that resource managers on the one hand may opt for more, fewer, or constant numbers of bears; or on the other hand, larger (i.e., trophy) animals, although the two objectives may not be mutually exclusive. Accordingly, it was deemed that unexploited or "natural" populations constituted a logical starting point for providing baseline data.

Panel members were selected on the basis of their respective works with unexploited populations in western habitats. Populations examined ranged across a wide spectrum of habitat types from boreal-mixedwood forest in Alberta (Ruff), the montane environs of Idaho (Beecham), chaparral of Arizona (LeCount), and a coastal island of Washington (Lindzey). Additional observations were provided for exploited vs. unexploited populations in Maine (Hugie), and the role of animal behavior was also examined relative to its impact on black bear population dynamics (Gilbert et al.).

Before this session began, all workshop participants were polled for desired program content. Three major points were selected for discussion within the broad framework of bear population dynamics specific to unexploited or lowly exploited populations: (a) behavior and "natural regulation"; (b) reproduction as it relates to density; and (c) age and sex specific mortality schedules. Session participants were hopeful that certain generalizations would derive from these discussions to serve future management designs. These proved elusive and instead, numerous exceptions to unwritten rules were related which cautioned against overgeneralization. What follows is simply an attempt to distill pertinent observations from the discussions and place them into management perspective. The disparity in material beneath each heading is not necessarily a reflection of interest alone, but also of data availability. The published works of panel members pertaining to their comments during the workshop are cited wherever possible. Finally, the panel identified future research and management needs relative to bear population dynamics.

Behavior and Natural Regulation in Unexploited Populations

Preliminary discussions noted that a population of bears or any other species is simply a group of organisms limited in space and time about which it is meaningful to discuss certain characteristics such as numbers, density, births, deaths, growth rate, distribution, movements, and behavior. It is especially important to examine these parameters in "natural" or undisturbed populations as a basis for assessing human exploitation of populations and their habitats. Of central concern is a determination whether regulation does in fact exist in natural populations, and if so, to identify and evaluate the importance of factors which bring it about.

As Keith (1974) points out, semantic problems have frequently created or aggravated different points of view regarding the existence and mechanisms of population regulation. The synonymous use of the terms "control" and "regulate" are especially noteworthy in this regard. Operationally, they may mean different things to different people. An extensive treatise could and has been written on this subject by numerous authors. That was not the intent of this session however, and the reader is encouraged to read elsewhere for reviews of the subject (Keith 1974, Slobodkin et al. 1967, Solomon 1970, Wagner 1969, Watson and Moss 1969, Wynne-Edwards 1965). In so doing, and by defining terms at the outset of writings and discussions, bear biologists may indeed find agreement on key issues, or at the very least, better identify areas of conflict and potential resolution.

In the simplest of terms and as used here, the following definitions apply (Keith 1974):

Population Control: The maintenance of a population in being; this may involve both density-dependent and density-independent processes which allow a population to exist and persist.

Population Regulation: The dampening of numerical fluctuations about some long-term mean by density dependent processes.

Implicit in the latter definition is that any regulatory factor must be capable of responding to changes in density by driving numbers down if they exceed the long-term mean or equilibrium density and conversely, increasing numbers when population levels drop below the mean density. This may be accomplished by changes in mortality, natality, or both. Accordingly, only those factors which operate in a density-dependent fashion can be considered truly regulatory, and these are usually viewed as intrinsic and social in nature. On the other hand, the precise level at which equilibrium density or population balance occurs may be dependent upon a host of both social (e.g., behavior) and non-social (e.g., food,

climate) factors which collectively impact upon populations and their habitat. Indeed, upper and lower levels to population size may be "determined" or "controlled" by the combined or single action of these factors. Food and overall habitat quality have frequently been implicated as the major or ultimate factors in this regard. But because population size in black bears appears to stabilize at a density somewhat less than can be accommodated by the habitat, some proximate regulating factor appears to come into play. Panel members identified social interactions in the form of agonistic behavior as the potential factor.

An important clue that some form of population regulation is operative in a population is long-term stability in numbers or the maintenance of an equilibrium density. Among black bears and in the absence of human disturbance, long-term stability (i.e., equilibrium, homeostasis, balance) in population density was manifest at Cold Lake, Alberta (Young and Ruff 1982, Kemp 1972, 1976), near Four Peaks Arizona (LeCount 1982), in northcentral Idaho (Beecham 1980), and on an island in Washington (Lindzey and Meslow 1977). Although the precise level at which equilibrium density occurs may vary from area to area, population regulation is nonetheless indicated by the lack of or dampening of wide fluctuations in numbers.

In each of these field investigations, a tacit or expressed objective was to identify the roles which animal behavior and the environment play in regulating the abundance and local distribution of bears. Historically, in both laboratory and field studies of other vertebrates, the debate of causal elements is of long standing. Some ecologists have maintained that social interaction or intraspecific competition is paramount in this regard (Milne 1957, Nicholson 1933, 1957, Wynne-Edwards 1962) while others have contended that non-social factors of the environment are more important (Andrewartha and Birch 1954, Lack 1954, 1966). Still, at least among mammals, social interaction is the one and possibly only element common to all populations which may elicit an entire gamut of physiological and behavioral responses to influence both reproduction and mortality commensurate with changes in density (Christian 1963). Therefore, it has the potential to regulate animal numbers and thereby achieve population balance (Wynne-Edwards 1978).

The socio-psychological stress that accompanies social interaction appears responsible for a wide array of physiological and behavioral responses in animals which in turn contribute to population regulation. This has been demonstrated frequently in classical studies of laboratory populations consisting of small mammals, particularly rodents. As crowding and the rate of social interactions increase, the magnitude of stress and concomittant effects upon reproduction and mortality may also increase by way of the pituitary-adrenal-gonadal system. Some animals fail to breed while others breed but produce few or no young (Bruce, 1960, Calhoun 1962, Mykytowycz 1960, Strecker and Emlen 1953, Terman 1965). Some animals lose their embryos through resorption or have reduced secretion of prolactin which results in a breakdown of maternal care and a subsequent increase in juvenile mortality (Calhoun 1962, 1963, Rosenblatt and Lehrman

1963, Southwick 1955). Dispersal, which often results in increased mortality, may also rise with increasing social strife (Strecker 1954). In some cases, this heightened mortality and partial or complete suppression of reproduction may be so great as to bring about balance in the population (Clarke 1955, Southwick 1955, Terman 1965). Furthermore, the effects of crowding on certain behaviors, especially maternal care, may persist for several generations even after crowding has been relieved (Christian and LeMunyan 1958).

Animals in natural populations apparently respond to social stressors in a similar fashion but the data are inconclusive (Christian and Davis 1956, Hoffman 1958, Kalela 1957). This is largely because animals in the wild are difficult to observe, population and behavioral data are lacking for many species, and most importantly, there is difficulty in differentiating between animal responses to social stimuli as opposed to other environmental variables. These limitations apply equally well to black bears.

Many physiological measures have been used as indices of response to socially induced stress: histological and morphological changes in endocrine glands (Barnett 1958, Christian 1955, 1956, 1959, 1963, Christian and Davis 1955, 1956), pathology of the thymicolymphatic system and gastrointestinal tract (Brady 1958, Chitty et al. 1956, Clarke 1953), and counts of circulating eosinophils and lymphocytes (Louch 1956, 1958, Southwick 1959). However, all of these are extremely labile and are probably best used to describe long-term responses to the sum of environmental and social stressors (Christian 1963, Selye 1956). Still, there are opportunities to examine these and other physiologic indicators of stress in bears either under confined conditions, or in the field. Researchers now have extensive life history data on many animals, and recent advances in physiologic telemetry (heart rate, body temperature) certainly make it feasible at this juncture to measure bear responses to social interaction (Candland 1968, Candland and Matthews 1966, Candland et al. 1967, 1969).

Little has been done in this regard to date, and especially in terms of relating physiologic responses to population regulation. Instead, biologists have examined overt behavioral responses by bears to conspecifics and environmental changes in the hope of identifying those natality and mortality factors which may serve a regulatory role. Consequently, research has focused on reproduction and immigration as recruitment avenues, and on deaths and emigration as mortality factors in response to stress.

There now seems little doubt among panel members that reproductive rates among black bears are under the primary influence of nutritional condition. Litter size, age at first reproduction, and breeding interval are all under nutritional control (Rogers 1976, Reynolds and Beecham 1980, Bunnell and Tait 1981). In food-rich environments, minimum breeding age approximates 3.5 years, litter size approaches 2.5, and breeding intervals are typically 2 years. In food-poor habitats, corresponding figures are 4.5-7.5 years of age at first breeding, less than 2 cubs/litter, and

more than 3 year breeding intervals. But because food production and its availability to bears is a density independent phenomenon, it cannot act as a regulator of animal numbers. It can, and probably does, however, act as a principal determinant of population maxima and minima and therefore of the general level (i.e., carrying capacity) at which population regulation occurs.

If recruitment of cubs into a population is largely a density-independent phenomenon, regulation must occur largely in the form of mortality. This recognizes that black bears in unexploited populations have no natural enemies other than conspecifics. Indeed, the killing of snared bears, usually subadults, by larger bears (Jonkel and Cowan 1971, Kemp 1976) prompted the hypothesis among ecologists that adult males may be a regulatory force. To test this hypothesis in an unexploited population near Cold Lake, Alberta, adult males were selectively removed from an otherwise demographically stable population (Kemp 1972, 1976). Within 2 years the population doubled. Much of the increase was attributed to ingress by subadult males and to a lesser extent, to increased subadult survival. The passing of 4 additional years saw the maturation of subadults to adulthood and at the same time, the population declined once again to pre-removal levels (Young and Ruff 1982, Ruff and Kemp 1980).

The sudden and dramatic numerical increase certainly suggests that adult males are important self-regulators of population density. It is emphasized however, that the maintenance of numbers at the preremoval level (1968-71), and the decline from the peak years of 1972-73 was not caused by outright killing of bears by adult males. Although this occurred on occasion, the principal cause of decline appeared related to the dispersal of subadults as adults matured on the area and once again asserted their dominance. This in keeping with Beecham (1980) who concluded that subadult dispersal, primarily among males, was the most important regulating mechanism in an unexploited population at Lowell, Idaho. Similarly, LeCount (1982) noted that subadult dispersal was an important factor regulating bear numbers in an unexploited population in Arizona.

Before managers seize upon the Cold Lake experiment as a means of increasing bear numbers through adult male removal (e.g., trophy hunting, late fall or early spring hunts, etc.), we hasten to emphasize that little or no conclusive evidence is available to suggest that increased survival of resident cubs or subadults was enhanced. Nearly 80% of the population increase could be attributed to subadult ingress from a large (5,600 km^2) and unhunted reservoir area surrounding the Cold Lake study area. The temporary social vacuum created by the adult male removal merely facilitated the settlement of the wandering cohort of subadult males. Indeed, Beecham reported at this workshop on the removal of both males and females from an unhunted area in Idaho surrounded by an unexploited reservoir area similar to that at Cold Lake, yet no population increase was noted. Instead, the population declined initially, apparently because of the removal, and then simply increased to the pre-removal level once again.

Furthermore, he observed little ingress and that which occurred involved 4 to 6-year old bears rather than subadults.

Gilbert and Beecham acknowledged that the lack of response may have reflected the low productivity of food, and hence of cubs on the Idaho study unit. Litter size was 1.65, a figure lower than those reported for most other western populations. At Cold Lake, for example, litter size at the den was 3.0 for females more than 5 years of age. Hence, Beecham's area may simply have lacked the mobile subadult cohort for ingress at the time of adult removals. Furthermore, Gilbert, Beecham, LeCount and Ruff all concur that little or no compensatory increase in litter size may be expected among adult females in response to decreased density stemming from sudden adult removals by either experimental design or hunting. Black bears in any given area simply do not have the plasticity to significantly alter litter size. On the other hand, greater cub and subadult survival is a distinct possibility and may account for small-scale population increase under such conditions. Increased survival of animals born to an area may result from decreased dispersal or lessened mortality inflicted by the adult male cohort.

Another dimension in the complex issue of population regulation is that of food availability and its influence on bear aggression and reproduction. Gilbert noted the work of Egbert and Stokes (1976) with brown bears at McNeil Falls, Alaska and how aggressive encounters between bears declined with increasing food availability. Field observations indicate this may be extrapolated to black bears. Overall habitat quality may determine the extent and intensity of social interactions for available resources which in turn determines population density. As Gilbert suggested, bear populations approximate an elastic disc which expand or contract according to habitat quality. In this sense, habitat and behavior combine to determine mean density in any given area, but only the density-dependent process of social interaction has the potential of dampening fluctuations about this mean over time.

In summary, the foregoing is in basic agreement with Bunnell and Tait (1981) who concluded that a consistent pattern of population regulation is evident in the genus Ursus: whereas nutritional condition dominates the reproductive rate in a largely density-independent fashion, social interactions primarily among males tend to regulate bear numbers in a density-dependent manner largely through dispersal of subadults.

Reproduction as it Relates to Density

As discussed previously, reproduction in the female component of the population is largely under nutritional control. The most in-depth studies of this aspect have been conducted for eastern populations (Rogers 1976, 1977, Rogers et al. 1976), but the work of Jonkel and Cowan (1971) in Montana is also supportive of this contention. Following an extensive literature review on this subject, Bunnell and Tait (1981) make the case that in eastern habitats, with their mast and

berry production providing an energy and nutrient-rich food base, mean litter sizes range from 2.15 to 2.74 with an overall mean of 2.42. In the West, mean litter sizes for different areas range from 1.32 to 1.96 with an overall mean of 1.71. Eastern black bears are also about 40% heavier than their western counterparts and tend to have more rapid growth rates. The breeding interval for eastern black bears is commonly 2 years as compared to 3 or more years in the west, and the age at first reproduction is about 4 years in the east and 5-8 years in the west. Exceptions are noteworthy, however. Reynolds and Beecham (1980) reported females successfully breeding at 3.5 and 4.5 years of age. At Cold Lake, Alberta, the mean litter size was calculated at 2.4 when based on captures of family units throughout the summer. This is considerably higher than reported by Reynolds and Beecham (1980), Jonkel and Cowan (1971), and Lindzey and Meslow (1977). Furthermore, a mean litter size of 3.0 (n=5) was determined for females $\geq$ years of age at the den just prior to family emergence from hibernation in the springs of 1976 and 1977. From then on, litter size for all females declined progressively through the summer: 2.3 (n=18) for captures after July 4; 2.1 (n=14) after July 22; and 2.0 (n=10) after August 1. Hence, some caution must be exercised when reporting or interpreting litter sizes without consideration for dates or methods of obtaining the data. Nonetheless, panel members are in accord that nutrition is the principal factor determining reproductive performance in female black bears.

The role of density in altering reproductive parameters is not clear. During this workshop session, it was noted that an analysis of the Yellowstone grizzly population by McCullough (1981) indicated a compensatory response among grizzlies in that cub recruitment increased as the number of adult bears in the population decreased. The question was then raised whether anyone had observed this among black bears. Lindzey elaborated on his work on Long Island, Washington where recently logged land provided food-rich habitat for black bears. Bear density approximated 4 bears/mi^2 in 1977 and it was evident that reproduction was showing signs of curtailment. Cub survival was severely reduced and Lindzey hypothesized this may have been stress induced by the large number of females in the population. However, he also cautioned that habitat quality had reached a "maximum" and was beginning to deteriorate at about the same time that reproduction diminished and bear density had approached 5 bears/mi^2. Hence, these confounding variables preclude for the moment the conclusion that reproduction is related to density.

Hugie also reported that an exploited (i.e., low density) population in Maine exhibited a larger litter size, lower minimum breeding age, and greater survival of cubs to 3 years of age than was evident in an unexploited population having a higher density. Once again, however, habitat quality was assessed to be greater in the exploited population and hence, density alone did not account for the observed differences in reproduction.

In general, no evidence was presented which conclusively linked changes in reproduction among black bears with changes in population density. At

Cold Lake, a general negative relationship existed between recruitment rate (R/N, where R=no. cubs and N=no. adults in population) and the size of the adult population (N) just as McCullough (1981) noted for the Yellowstone grizzly. However, the correlation was not strong and reproductive synchrony (Free and McCaffrey 1972) in the population, a phenomenon not observed in the Yellowstone bears, may have masked any significant relationhip during the 10-year study at Cold Lake. Treatment of data for the 5 years of low cub production showed a stronger correlation in the negative relationship between recruitment and the size of the adult population than did the 5 years of high cub production. This is certainly an area in need of further research, or at least of greater scrutiny of existing data to ascertain density/reproduction relationships.

Age and Sex Specific Mortality in Unexploited Populations

Among black bear populations throughout western North America, hunting by man is identified as the major cause of mortality (Bunnell and Tait 1981, Cowan 1972). Mortality may also be inflicted by grizzlies, wolves and coyotes. Although all of the latter may be operative in either hunted or unhunted populations, it is unlikely that interspecific predation is of any real significance. Likewise, disease, starvation, and catastrophic events have not been implicated as major or persistent causes of mortality.

Intuitively, researchers have thus turned to intraspecific interactions as a principal causal agent. Mortality stemming from conspecifics may be direct (i.e., killing and cannibalism) or indirect (i.e., dispersal from the population). Whether members of the dispersing cohort actually die or survive elsewhere may not be of critical concern to population demographers because dispersing animals are nonetheless lost to the population per se. But from a more practical standpoint, knowledge of the causes of mortality among all cohorts is important for refined species management.

Data on sex- and age-specific mortality, aside from that induced by hunting, is at best, difficult to obtain. Prior to radio-telemetry, little was known about this aspect of population dynamics as attested by the nearly complete lack of carcasses reported in the wild. Even with the aid of telemetry, it may not be possible to assign causes of death and dispersal. Scavenging and cannibalism may mask the actual cause of death. The secretive nature of black bears and their occupancy of densely vegetated habitat may also preclude visual determinations of the causes for dispersal. As a result, and because so few unexploited populations have been studied, limited data were presented at this workshop. The following therefore borrows from workshop discussions and papers previously published by panel members. Three age classes are examined briefly: cubs (<1 year), subadults (1-3 years) and adults ($\geq$4 years).

Cubs generally remain in the care of their mothers during the first year of life, and are usually considered as unhunted cohorts because of their small size and general legal protection from hunting. Unless the female

is killed, mortality among cubs may therefore be considered natural. Estimates of cub mortality are often based on observations of partial or whole litter loss from time of birth or first capture to time of known death or disappearance. LeCount (1982) in Arizona recorded 52% mortality among cubs observed at the den to 1 year of age. Kemp (1972) estimated cub mortality at 26.7% in Alberta based upon capture-recapture data (May-September) during a period of population stability. On the same study area, but with the aid of radio-telemetry to locate litters at the den, Ruff (unpublished data) estimated 50% cub mortality based on progressive reductions in observed litter size from observation at the den to 5 months of age. Bunnell and Tait (1981) estimated 25 to 30% mortality rates for black bear cubs.

The causes of cub mortality are not fully understood. Lindzey and Meslow (1977) found the remains of a cub in a bear scat in Washington, while LeCount (1982) hypothesized that both starvation and cannibalism were involved in his study. Of particular interest is the relationship between cub mortality and years of high or low cub production. Lindzey and Meslow (1977) recorded 2 deaths of cubs in 1975, a year of low cub production. In 1974, a year of high cub production, they observed no mortality of cubs during the period of emergence from the den to 7 months of age. They then speculated that if adult bears are potential predators of cubs, adult females without cubs in years of low cub production could also pose a threat to cubs. Such behavior would tend to perpetuate breeding synchrony. LeCount (1982) related that starvation may account for some of the 52% mortality on his area, but that both high and low cub survival occurred in years of similar forage conditions. He concluded that low cub survival in poor forage years may be nutritionally related but cub mortality in good forage years must be related to some other cause such as cannibalism. Other participants at the workshop related findings similar to those of Lindzey and LeCount, but no additional data were presented.

Dispersal and mortality in the subadult cohort in black bear populations has been identified by most workers as the proximate factor in regulating density (Kemp 1972, Young and Ruff 1982, Beecham 1980, LeCount 1982). Specific cases of adults killing subadults have been recorded in nearly all studies to date, but it remains that dispersal of subadults, particularly males, is the major drain of numbers from unexploited populations. LeCount (1982) reported the dispersal (i.e., disappearance) of 10 of 13 subadult males (77%) from a population in Arizona. Of the 3 that remained on the area, all were originally captured as 2.5 year-olds and conceivably could have ingressed. At Cold Lake, Alberta, only 10-20% of the subadult males captured on the study area ultimately established residence there. But as in Arizona, some of these were captured as 1.5 to 2.5-year olds and could have ingressed. With the use of radio-telemetry, estimates of 60 to 80% annual mortality among subadults were recorded during 1974-1977 even though the area was closed to sport hunting. Many of the deaths were human induced. Poaching, bear/vehicle collisions, and nuisance control were important causes of mortality, and only 1 bear was believed

to have died of natural causes. Although dispersal was deemed important as a cause of population mortality, some difficulty was experienced in defining "dispersal." Instances of bears making excursions of 50 to 70 kilometers for extended periods, and then returning, made for arbitrary interpretations. Likewise, Alt (1978) cautioned about the hazards of assuming dispersal when in fact, some long movements are common to particular animals.

Mortality among adult black bears in unexploited populations was not considered in any detail during this workshop because of time constraints. Bunnell and Tait (1981) provide a brief review of these data for the reader who is interested.

Related Topics Dealing with Unexploited Populations

Throughout workshop discussions, several points of interest emerged which could not be tied directly to the preceding headings. They are presented here for further consideration by the reader.

The question was raised by Lindzey whether there was any element common to all populations which provided an indication of the presence of and the level of exploitation. None was identified. The mean age of populations may yield a clue in some instances, but it is not a reliable indicator. Beecham reported a mean age of 3.5 years, 5.5 years and 7.5 years for high, moderate, and low levels of exploitation in Idaho, respectively. Beecham cautioned however that the sex and age structure should be provided with the mean age to aid in interpretation. LeCount calculated a mean age of 9 years and 6.5 years for unexploited populations in Arizona. Hugie saw a lesser age for an exploited vs. unexploited population in Maine (age not provided) and Beck reported a low average age for heavily exploited populations in Colorado. Beecham further emphasized that vulnerability of black bears to hunting is greatest for adult males, followed by subadult males, adult females and finally by subadult females. Therefore, populations with high numbers of adult males will also have high numbers of adult females. Hence, age ratios in favor of subadults would be indicative of exploitation. At Cold Lake, Ruff reported a subadult:adult ratio of 45:55 under conditions of no exploitation, and 66:34 following the removal of adult males. Beck saw a nearly identical ratio of 65:35 for a "massively" overexploited population in Colorado. In summary, average age of the population and subadult:adult ratios provide clues of exploitation levels, but by themselves, are not conclusive evidence of same.

Scarring among bears was also suggested as a possible indicator of social strife and perhaps, exploitation in a population. Beecham reported no scarring at all in a heavily exploited population having a mean age of 3.5 years. In sharp contrast, LeCount saw no scarring in an unexploited population where the mean age was 6.5 years, and Hugie observed good scarring in an exploited population. Ruff and Kemp witnessed moderate (50%) scarring among adult males in an unexploited population in Alberta.

This increased to 80% with some exploitation (i.e., experimental removal of some adult males) and then declined to 25% with the return of population stability and younger age classes of adult males in the population. Hugie and Ruff contended that scarring would be expected in an exploited population because of jockeying by males for new openings in the social scheme, and conversely, lower in unexploited populations because of social stability. The lack of scarring in Beecham's population may have been a product of the young age of potential combatants. However, this aspect of behavior is in need of further study and participants agreed that more critical inspection of existing data is merited before drawing conclusions.

Future Research Needs with Unexploited Populations

In light of the various shortcomings and scope of research conducted on black bears thus far, panel members suggested that new areas of research were needed for improved management of the species. Rather than each state or individual biologist developing research projects already conducted by others, many of which had inherent flaws and objectives, it was suggested that a study area and research program be specifically developed to answer questions not yet addressed or where extant data were lacking. Such questions cross many ecological, philosophic and political boundaries. A funding source consisting of dollars donated by states having a vested stake in project objectives and results was suggested. Although the political problems in such an approach were recognized, broad support from the BBA could buffer potential problems. In any event, the following may provide researchers and managers with some new challenges:

1. Population and study area. Although each of the panel members has studied populations which were believed to have low or no human exploitation, each had its disadvantages and pitfalls. Ideally, what is now needed is (a) a discrete population, either an island bounded by water or a study area of more than 200 km2 which is ecologically separated from adjoining bear habitat; and (b) definitely known to be unexploited, i.e., not hunted or poached, and without uncontrolled human disturbance on the landscape. The political climate should also allow for experimental manipulations of individual bears and their habitats. If these criteria cannot be satisfied, the "island-like" nature of the area may be exempted provided that measures of ingress and egress can be accurately obtained. The physical climate and physiognomy should also be representative of ecotypes currently occupied by black bears (i.e., eastern deciduous forest, boreal forest, spruce-fir, etc.).

2. Research and management objectives

    a. Determine sex- and age-specific mortality in the absence of human influence.

b. Determine more precisely the role of adult males as self-regulators of density. This could be accomplished either through experimental removals of adult males, or through intensive physiologic telemetry to assess responses (e.g., heart rate, body temperature, etc.) in both adult males and subadults to various kinds and levels of social interaction. Physical measures of social interactions, such as scarring rates and kinds, may be advisable.

c. Determine the role of adult females as regulators of density, especially those females in years without cubs. Do they function in a manner similar to males, or does their territorial spacing place a lid on numbers? Experimental removal of females is one approach, but sterilization (e.g., tubal ligation or application of chemical sterilants) would be more meaningful because the animal would still be in place. Would these non-reproductive animals tolerate other adult females or ingressing subadult females within their home ranges?

d. Determine effect of no exploitation on the female segment of the population when conditions become overcrowded. How many female offspring will adult females tolerate within their respective territories? Will a level be reached where adult females kill their offspring, or will female subadults simply disperse?

e. Determine the role of nutrition to home range size, and various reproductive elements such as age at first breeding and first reproduction, breeding interval, litter size, and litter survival.

LITERATURE CITED

Andrewartha, H. G. and L. C. Birch. 1954. The distribution and abundance of animals. Univ. Chicago Press, Chicago. 782 pp.

Barnett, S. A. 1958. Physiological effects of "social stress" in wild rats. I. The adrenal cortex. J. Psychosom. Res. 3:1-11.

Beecham, J. J. 1980. Some population characteristics of two black bear populations in Idaho. Pages 201-204 in C. J. Martinka and K. L. McArthur (eds.). Bears--their biology and management. Bear Biol. Assoc. Conf. Ser. 3.

Brady, J. V. 1958. Ulcers in "executive" monkeys. Scientific Amer. 199(4):95-98, 100.

Bruce, H. M. 1960. A block to pregnancy in the mouse caused by the proximity of strange males. J. Reprod. Fert. 1:96-103.

Bunnell, F. L., and D.E.N. Tait. 1981. Population dynamics of bears--implications. Pages 75-98 in C. W. Fowler and T. D. Smith (eds.). Dynamics of large mammal populations. John Wiley and Sons, New York, NY.

Calhoun, J. B. 1962. The ecology and sociology of the Norway rat. U.S. Dept. Health, Education and Welfare. Public Health Service Publ. 1008. 228 pp.

Calhoun, J. B. 1962. Population density and social pathology. Scientific Amer. 206:139-146.

Calhoun, J. B. 1963. The social usage of space. Pages 1-187 in W. W. Mayer, and R. G. Van Gelder (eds.). Physiological mammalogy. Academic Press, New York and London. 381 pp.

Candland, D. K. 1968. Heartrate and dominance in chicken and squirrel monkey. Amer. Zool. 8:739-740.

Candland, D. K., and T. J. Mathews. 1966. Prediction of dominance rank from heart rate of the domestic fowl. Amer. Zool. 6:584.

Candland, D. K., K. D. Pack, and T. J. Mathews. 1967. Comparison of heartrate and defecation frequency as measures of rodent emotionality. J. Comp. Physiol. Psychol. 64(1):146-150.

Candland, D. K., D. B. Taylor, L. Dresdale, J. M. Leiphart, and S. P. Solow. 1969. Heart rate, aggression, and dominance in the domestic chicken. J. Comp. Physiol. Psychol. 67(1):70-76.

Chitty, D., H. Chitty, P. H. Leslie, and J. C. Scott. 1956. Changes in the relative size of the nucleus in the intervertebral disc of stressed orkney voles (Microtus orcadensis). J. Pathol. Bacteriol. 72:459-470.

Christian, J. J. 1955. Effect of population size on the weights of the reproductive organs of white mice. Am. J. Physiol. 181(3):477-480.

Christian, J. J. 1955. Effect of population size on the adrenal glands and reproductive organs of male mice in populations of fixed size. Am. J. Physiol. 182(2):292-300.

Christian, J. J. 1956. Adrenal reproductive responses to population size in mice from freely growing populations. Ecology 37:258-273.

Christian, J. J. 1959. Control of population growth in rodents by interplay between population density and endocrine physiology. Wildlife Disease 1:1-38.

Christian, J. J. 1963. Endocrine adaptive mechanisms and the physiologic regulation of population growth. Pages 189-381 in W. W. Mayer and R.G. VanGelder (eds.). Physiological mammalogy. Academic Press, New York and London.

Christian, J. J., and D. E. Davis. 1955. Reduction of adrenal weight in rodents by reducing population size. Trans. N. A. Wildl. Conf. 20:117-189.

Christian, J. J., and D. E. Davis. 1956. The relationship between adrenal weight and population status in Norway rats. J. Mammal. 37(4): 475-486.

Christian, J. J., and C. D. LeMunyan. 1958. Adverse effects of crowding on lactation and reproduction of mice and two generations of their offspring. Endocrinology 63(5):517-529.

Clarke, J. R. 1953. The effect of fighting on the adrenals, thymus, and spleen of the vole (Microtus agrestis). J. Endocrinol. 9(1):114-126.

Clarke, J. R. 1955. Influence of numbers on reproduction and survival in two experimental vole populations. Proc. Royal Soc. B144, 68-85.

Egbert, A. L. and A. W. Stokes. 1976. The social behavior of brown bears on an Alaskan salmon stream. Pages 41-56 in M. R. Pelton, J. W. Lentfor, and G. E. Folk (eds.). Bears--their biology and management. Int. Union Conserv. Nat. New Ser. 40. Morges, Switzerland.

Free, S. L., and E. McCaffrey. 1972. Reproductive synchrony in the female black bear. Pages 199-206 in S. Herrero (ed.). Bears--their biology and management. Int. Union Conserv. Nat. New Ser. 23. Morges, Switzerland.

Hoffman, R. S. 1958. The role of reproduction and mortality in population fluctuations of voles (Microtus). Ecol. Monogr. 28:79-109.

Jonkel, C. J., and I. M. Cowan. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. 27. 57 pp.

Kalela, O. 1957. Regulation of reproduction rate in subarctic populations of the vole Clethrionomys rufocanus (Sund.). Ann. Sci. Fennicae, Ser. A. IV. Biol. 34:1-60.

Keith, L. B. 1974. Some features of population dynamics in mammals. Proc. Int. Cong. Game Biol. 11:17-58.

Kemp, G. A. 1972. Black bear population dynamics at Cold Lake, Alberta, 1968-1970. Pages 26-31 in S. Herrero (ed.). Bears--their biology and management. Int. Union Conserv. Nat. New Ser. 23. Morges, Switzerland.

Kemp, G. A. 1976. The dynamics and regulation of black bear (Ursus americanus) populations in northern Alberta. Pages 191-197 in M. R. Pelton, J. W. Lentfer and G. E. Folk (eds.). Bears--their biology and management. Int. Union Conserv. Nat. New Ser. 40. Morges, Switzerland.

Lack, D. 1954. The natural regulation of animal numbers. Oxford University Press, London. 343 pp.

Lack, D. 1966. Population studies of birds. Clarendon Press, Oxford. 341 pp.

LeCount, A. L. 1982. Characteristics of a central Arizona black bear population. J. Wildl. Manage. 46:861-868.

Lindzey, F. G., and E. C. Meslow. 1977. Population characteristics of black bears on an island in Washington. J. Wildl. Manage. 41: 408-412.

Louch, C. D. 1956. Adrenocortical activity in relation to the density and dynamics of three confined populations of Microtus pennsylvanicus. Ecology 37:701-713.

Louch, C. D. 1958. Adrenocortical activity in two meadow vole populations. J. Mammal. 39(1):109-116.

McCullough, D. R. 1981. Population dynamics of the Yellowstone grizzly bear. Pages 173-196 in C. W. Fowler and T. D. Smith (eds.). Dynamics of large mammal populations. John Wiley and Sons, New York, NY.

Milne, A. 1957. The natural control of insect populations. Canad. Ent. 89:193-213.

Mykytowycz, R. 1960. Social behavior of an experimental colony of wild rabbits (Cryctolagus cuniculus). III. Second breeding season. CSIRO Wildl. Res. 5:1-20.

Nicholson, A. J. 1933. The balance of animal populations. J. Animal Ecol. 2:132-178.

Nicholson, A. J. 1957. The self-adjustment of populations to change. Cold Spring Harbor Symposium on Quant. Biol. 22:153-172.

Reynolds, D. and J. J. Beecham. 1980. Home range activities and reproduction of black bears in west-central Idaho. Pages 181-190 in C. J. Martinka and K. L. McArthur (eds.). Bears--their biology and management. Bear Biol. Assoc. Conf. Ser. 3.

Rogers, L. L. 1976. Effects of mast and berry crop failures on survival, growth, and reproductive success of black bears. Trans. North Am. Wildl. and Nat. Resour. Conf. 41:431-438.

Rogers, L. L. 1977. Social relationships, movements, and population dynamics of black bears in northeastern Minnesota. Ph.D. Diss. Univ. Minnesota, Minneapolis. 194 pp.

Rogers, L. L., D. W. Keuhn, A. W. Erickson, E. M. Harger, L. J. Verme, and J. J. Ozoga. 1976. Characteristics and management of black bears that feed in garbage dumps, campgrounds, and residential areas. Pages 169-175 in M. R. Pelton, J. W. Lentfer, and G. E. Folks (eds.). Bears--their biology and management. Int. Union Conserv. Nat. New Ser. 30. Morges, Switzerland.

Rosenblatt, J. S. and D. S. Lehrman. 1963. Maternal behavior of the laboratory rat. Pages 8-57 in H. L. Rheingold (ed.). Maternal behavior in mammals. Wiley, New York. 349 pp.

Ruff, R. L. and G. A. Kemp. 1980. Population dynamics of black bears in boreal forest of Alberta, 1968-77. Paper presented at 5th Int. Conf. Bear Res. and Manage., Madison, WI. Abstract.

Selye, H. 1956. The stress of life. McGraw-Hill, New York. 324 pp.

Slobodkin, L. B., F. E. Smith, and N. G. Hairston. 1967. Regulation in terrestrial ecosystems and the implied balance of nature. Amer. Nat. 101(918):109-124.

Solomon, M. E. 1970. Elements in the development of population dynamics. Pages 29-40 in Dynamics of populations. Proc. Adv. Study Inst. Dynamics Numbers Popul. Oosterbeck.

Southwick, C. H. 1955. The population dynamics of confined house mice supplied with unlimited food. Ecology 36:212-225.

Southwick, C. H. 1955. The regulatory mechanisms of house mouse populations; social behavior affecting litter survival. Ecology 36:627-634.

Southwick, C. H. 1959. Eosinophil response of C57BR mice to behavioral disturbance. Ecology 40:156-157.

Strecker, R. L. 1954. Regulatory mechanics in housemouse populations: The effect of limited food supply on an unconfirmed population. Ecology 35:249-253.

Strecker, R. L., and J. T. Emlen. 1953. Regulatory mechanisms in housemouse populations--the effect of limited food supply on a confined population. Ecology 34:375-385.

Terman, C. R. 1965. A study of population growth and control exhibited in the laboratory by prairie deermice. Ecology 46:890-895.

Wagner, F. H. 1969. Ecosystems concepts in fish and game management. Pages 259-307 in The ecosystem concept in natural resource management. Academic Press, New York.

Watson, A. and R. Moss. 1969. Dominance, spacing behavior and aggression in relation to population limitation in vertebrates. Pages 167-218 in A. Watson (ed.). Animal populations in relation to their food resources. Blackwell Scientific Publications, Oxford.

Wynne-Edwards, V. C. 1962. Animal dispersion in relation to social behavior. Oliver and Boyd, Edinburgh and London. 653 pp.

Wynne-Edwards, V. C. 1965. Self regulating systems in populations of animals. Science 147(3665):1543-1548.

Wynne-Edwards, V. C. 1978. Intrinsic population control: an introduction. Pages 1-22 in F. J. Ebling and D. M. Stoddart (eds.). Population control by social behavior. Praeger Publishers, New York and London. 304 pp.

Young, B. F. and R. L. Ruff. 1982. Population dynamics and movements of black bears in east central Alberta. J. Wildl. Manage. 46:845-860.

BLACK BEAR HABITAT

Peter Zager
Muskingum College

The study of black bears and their habitat in the western United States is of relatively recent origin. Several studies (Lindzey and Meslow 1977, Beecham 1980, LeCount 1980) have produced excellent habitat information, but the discipline is still in its infancy. Thus far, research has focused on the descriptive aspects of bear habitat, e.g., habitat use patterns, food habits, and food production. Collection of this basic information must continue. However, because current land use and resource management practices pose an immediate threat to black bears, biologists must develop ways to apply this information to land management situations and develop new approaches that are more efficient and effective. Bridging the gap between research and management is very important if suitable black bear habitat is to be maintained.

The basic problems confronting biologists regarding black bear habitat are:

1. Deciding upon the information required for proper management of black bear habitat.

2. Developing methods by which these data can be collected efficiently and effectively.

3. Bridging the gap between research and land/wildlife management.

Approaches to Black Bear Habitat Research

The traditional first step in black bear habitat studies is compiling distribution records to identify potential problem and/or study areas. Once identified, these areas are surveyed, searching for sign, collecting scats, and conducting preliminary vegetation analysis. Good information regarding food habits and general habitat use patterns can be gathered using these methods.

The next step in many black bear habitat studies is a capture-mark-recapture program that incorporates radio-telemetry. This approach furnishes data on population characteristics and bear movement patterns. A habitat classification system is generally developed to use in conjunction with movement data so that more detailed, accurate habitat use patterns can be described. Neu et al. (1974), Johnson (1980), Marcum and Loftsgaarden (1980), and Zager (1980) present methods for analysis of such data. Telemetry studies are often the basis for very specific habitat investigations such as description of denning sites and feeding sites. This approach provides sound habitat use information.

Deciding upon the habitat classification system and level of resolution can be a troublesome process. At least two approaches to definition and delineation of habitat types have been used successfully: 1) habitat component hierarchies and 2) systems based on timber types or cover types.

Habitat component hierarchies: Often resolution beyond that provided by habitat types (e.g., Daubenmire and Daubenmire 1968, Pfister et al. 1977, Moir and Ludwig 1979, Layser and Schubert 1979) is required to accurately map and describe current vegetation communities. In these situations a habitat component hierarchy that is superimposed upon habitat types can be developed. Habitat components are based primarily on vegetation structure as it reflects local topo-edaphic conditions and site history (Zager 1980, 1981). Important criteria for habitat component delineation are that they occur regularly and predictably in parcels of at least 2 ha and are easily identified on aerial photographs. Vegetation types that regularly occur as smaller units or are not readily identified can generally be treated as inclusions within larger components without significant information loss.

Habitat components are a viable approach to bear habitat work for several reasons:

1. Habitat components are logical and simple refinements of widely used and accepted habitat type systems already in place (e.g., Daubenmire and Daubenmire 1968, Pfister et al. 1977, Moir and Ludwig 1979, Layser and Schubert 1979). Refinements are directed primarily at seral and disclimax communities that are treated in very general terms by habitat type systems. Conversely, ecologically similar habitat types are often combined for bear habitat analysis.

2. Because habitat components are a refinement of habitat types, site potential is reflected by the classification. This provides predictive capabilities for both overstory and understory vegetation not available with most classification systems.

3. Habitat components are readily applicable in the field because they are easily recognized and identified.

Systems based on timber types or cover types: Most forested lands in the western U.S. and Canada have been classified and mapped according to a timber type or cover type classification. Those systems are based on the percent cover and species composition of the canopy trees currently occupying a site. The understory vegetation is not considered. This is an attractive approach to habitat classification because these systems are in place and have gained wide acceptance by land managers. However, a supplemental system must be developed to identify and describe non-timbered sites, such as wet meadows and shrubfields, that are important to bears in some areas. Also, because these systems are based on the extant vegetation, site potential is not necessarily reflected, reducing the predictive capabilities. Furthermore, these classifications are based on overstory vegetation, while bears probably respond to the understory structure and/or

species composition. Research into the correlation between understory and overstory vegetation would clarify this relationship and make cover type classification systems even more useful.

Juxtaposition: The level of resolution in habitat classification remains a problem regardless of the system employed. Fine-grained resolution is required to detect bear use of small, but often important, patches of habitat. But this level of resolution often requires a cumbersome number of habitat types that quickly becomes unworkable. The alternative is coarse-grained resolution with fewer habitat components. This is generally a more practical approach but it introduces an apparent bias against detection of the use of small habitat patches. One can compensate somewhat for this bias by obtaining a measure of habitat component juxtaposition. Simply measuring the distance from each bear location to the next closest habitat type may reveal the importance of some small patches. For example, several studies have shown that riparian areas are often used extensively by bears (Tisch 1961, Kelleyhouse 1980, Zager 1980). But their relatively small size and the inherent inaccuracy of radio-telemetry combine to introduce a bias against this component: only infrequently do locations actually fall within riparian areas. Measuring the distance from each location to the next closest habitat type may reveal significant use of habitat adjacent to these small patches. Repetition of such a pattern suggests an important role for these small patches as bear habitat.

Habitat quality: Bear movement and habitat use data are extremely important and necessary for proper management. However, they do not reveal habitat quality. If bear reproductive success and overall population vigor is related to the quality of habitat, then populations in marginal habitat must be managed much differently than those occupying prime habitat. Therefore, it is important that a measure of habitat quality be developed.

LeCount (pers. comm.) uses the availablity of vegetative cover 1-6' tall as a measure of habitat suitability. Black bears seem to prefer areas where ample cover 1-6' tall is available (e.g., chaparral) while avoiding areas where this cover is not available (e.g., ponderosa pine stands) (Fig. 1). LeCount's sampling methods are adapted from MacArthur and MacArthur (1961).

LeCount (pers. comm.) is also developing a measure of habitat quality based on the total vegetative cover 1-6' tall and the number of food items on a site. He is finding that bears will not use a site if the proper combination of food and cover is not available (Fig. 2). The consistency of food production is yet to be incorporated into this methodology.

Rather than measure habitat quality directly, Beecham (1980) used black bear growth rate as an indirect measure of habitat quality. Rapid growth rates indicate high quality habitat; slower rates indicate lower quality habitat. These rates were correlated with population characters such as litter size, minimum breeding age, and growth pattern. Home ranges in high quality habitat were relatively large, apparently to take full

advantage of the environmental heterogeneity and diverse, but patchy food resources. Where habitat is more homogeneous and foods more consistent, small home ranges are indicative of high quality habitat.

An advantage of this approach, where bears provide an indirect measure of habitat quality, is that growth rates and home ranges are the result of environmental conditions over several years. Therefore, food production consistency is reflected by the data.

Habitat models: A reasonable next step in black bear habitat research is to develop habitat models. This would involve determining the minimal habitat requirements of bears and describing these requirements operationally. Models would be developed based on research data, tested, modified, and retested. These models would indicate when biologists have enough information about one element of bear habitat, allowing them to concentrate research on other aspects. Once the limitations and attributes of each model are identified, appropriate application of the models to new areas could save time and precious research money.

Black bear denning habitat in the western U.S. may be a candidate for preliminary model development because it appears to be very similar in northern Idaho and the Arizona chaparral (Beecham 1980, LeCount 1980). However, caution must be taken in the application of these models to other regions. A well developed denning habitat model for the western U.S. may not be applicable to the temperate forests of the eastern U.S.

Presently, the lack of adequate habitat data precludes widespread model development, though several studies are underway that will rectify this to some degree.

Recommendations:

1. Elk habitat management guidelines have been developed for much of the northern Rocky Mountains (U.S. Forest Service 1977, 1978a, 1978b). These guidelines are based upon state-of-the-art knowledge regarding the relationship between timber management and elk habitat. Preliminary analysis of these guidelines suggests that many black black bear habitat requirements correspond with elk habitat requirements. It would be expedient if black bear habitat management recommendations could "piggyback" on these widely implemented elk guidelines. The degree of overlap should be assessed, but more importantly, bear habitat requirements that do not overlap with elk requirements must be identified and appropriate guidelines developed. It seems reasonable, therefore, that careful analysis of the elk guidelines by a team of bear habitat specialists is in order.

2. Given the importance of aspen communities to black bears in certain areas, and the lack of knowledge regarding aspen management, it seems appropriate that bear biologists keep abreast of the U.S. Forest Service aspen research program. Information may be forthcoming that is

directly applicable to bear habitat management. Additionally, biologists' input may provide impetus for a slightly different research approach, resulting in information that is even more useful for black bear habitat management.

3. It is important that biologists conduct their research in concert with the needs and concerns of land managers. Biologists should solicit input from land managers during all stages of the project. Furthermore, the results must be directly applicable to on-the-ground situations. Use of in-place habitat classification systems, modified and supplemented as necessary, facilitates this application. Management recommendations emanating from such work must be based on readily available data (e.g., basal area of timber/acre) and easily incorporated into land management plans. Recommendations based on other data will not be implemented as readily.

4. Standardization of basic habitat research and data collection methods is necessary. This would allow direct comparison of data gathered in different areas, facilitating the development of habitat models that might have wide applicability.

Research Needs:

1. Basic information regarding black bear habitat requirements is necessary before the development of models, resource management guidelines, or habitat manipulation programs is feasible. Obtaining adequate information will require several long-term studies in different areas where the methods employed and data collected are comparable. Once this information is available, habitat models should be developed.

2. As lands in the western U.S. become more intensively managed, the pressure on bears and their habitat will increase. Consequently, the need for research into the effects of resource management on bear habitat is critical. Resource management guidelines should be developed from these data.

3. Research into habitat manipulation as a means to create, maintain, or improve bear habitat should be pursued. For example, certain logging or prescribed buring practices may improve bear habitat while other practices may reduce habitat suitability.

4. To improve the resolution and predictive capability of bear habitat classification systems, the correlation between overstory cover and species composition and the understory vegetation should be assessed. A better understanding of these relationships will increase the usefulness of remote sensing techniques.

LITERATURE CITED

Beecham, J. 1980. Population characteristics, denning, and growth patterns of black bears in Idaho. Ph.D. Diss., Univ. of Montana, Missoula. 101p.

Beecham, J., D. Reynolds, and M. Hornocker. Denning ecology of black bear in west-central Idaho. Bear Biol. Conf. Ser. No. 4. (in press).

Daubenmire, R. and J. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Wash. Agric. Exp. Sta. Tech. Bull. 60. 104p.

Johnson, D. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecology 61:65-71.

Kelleyhouse, D. 1980. Habitat utilization by black bears in northern California. Pp. 221-227 in C. J. Martinka and K. L. McArthur (Eds.). Bear Biology Conf. Ser. No. 3.

Layser, E. and G. Schubert. 1979. Preliminary classification for coniferous forest and woodland series of Arizona and New Mexico. USDA For. Serv. Res. Pap. RM-208. 27p.

LeCount, A. 1982. Research Biologist, Arizona Game and Fish Department, Phoenix. Personal communication.

LeCount, A. 1980. Some aspects of black bear ecology in the Arizona chaparral. Pp. 175-179 in C. J. Martinka and K. L. McArthur (Eds.). Bear Biol. Conf. Ser. No. 3.

LeCount, A. Denning ecology of black bears in central Arizona. Bear Biol. Conf. Ser. No. 4. (in press).

Lindzey, F. and E. C. Meslow. 1977. Home range and habitat use by black bears in southwestern Washington. J. Wildl. Manage. 41:413-425.

MacArthur, R. and J. MacArthur. 1961. On bird species diversity. Ecology 42:594-598.

Marcum, C. and O. Loftsgaarden. 1980. A nonparametric technique for studying use vs. availability of environmental components. J. Wildl. Manage. 44:963-968.

Moir, W. and J. Ludwig. 1979. A classification of spruce-fir and mixed conifer types of Arizona and New Mexico. USDA For. Serv. Res. Pap. RM-207. 47p.

Neu, C., C. Byers, and J. Peek. 1974. A technique for analysis of utilization-availability data. J. Wildl. Manage. 38:541-545.

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rept. INT-34. 174p.

Tisch, E. 1961. Seasonal food habits of the black bear in the Whitefish Range of northwestern Montana. M.S. Thesis, Montana State Univ., Missoula. 108p.

U.S. Forest Service. 1977. Elk habitat coordinating guidelines for northern Idaho. 77p.

U.S. Forest Service. 1978a. Elk habitat:timber management guidelines. 20p.

U.S. Forest Service. 1978b. Elk habitat/timber management relationships on eastside forests of the Northern Region, USFS. 48p.

Zager, P. 1980. The influence of logging and wildfire on grizzly bear habitat in northwestern Montana. Ph.D. Diss., Univ. of Montana, Missoula. 131p.

Zager, P. 1981. Northern Selkirk Mountains grizzly bear habitat survey, 1981. Project Rept., USDA For. Serv., Coeur d'Alene, ID. 75p.

Fig. 1. Vegetative cover 1-6' tall can be used as a measure of black bear habitat suitability. Bears use areas where this cover is available (A); they avoid area where cover is not available (B) (LeCount, pers. comm.).

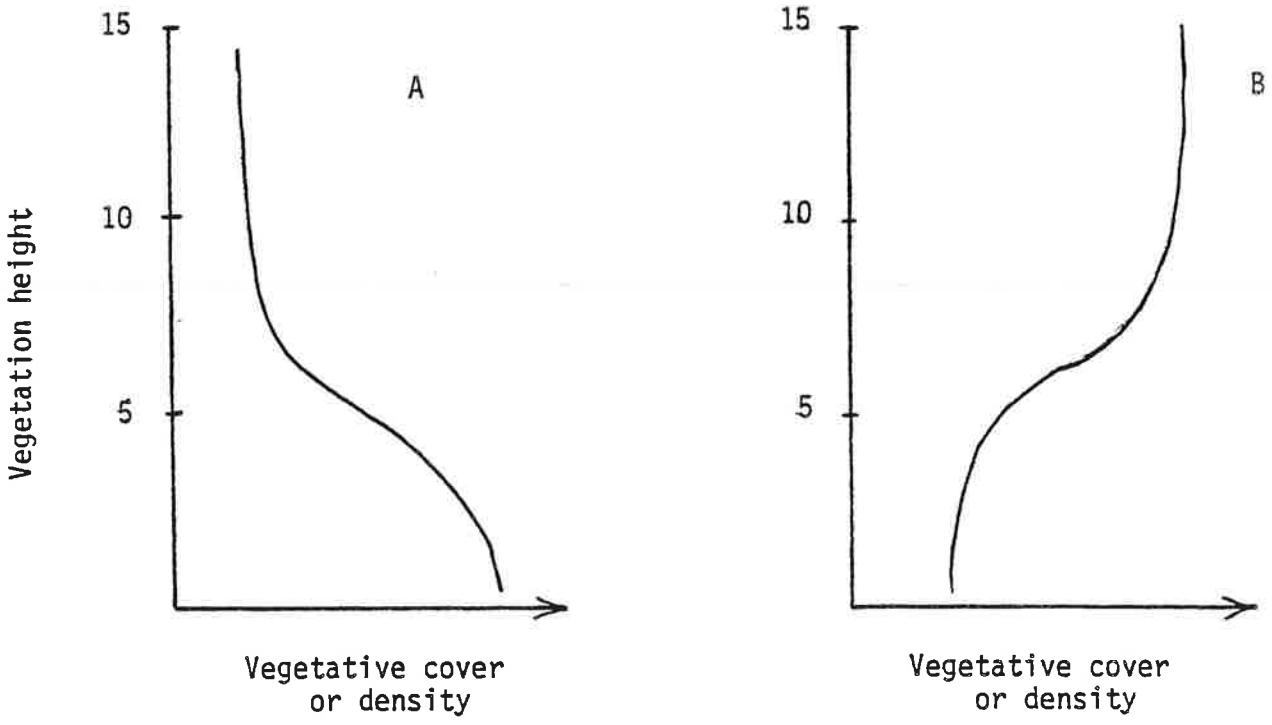
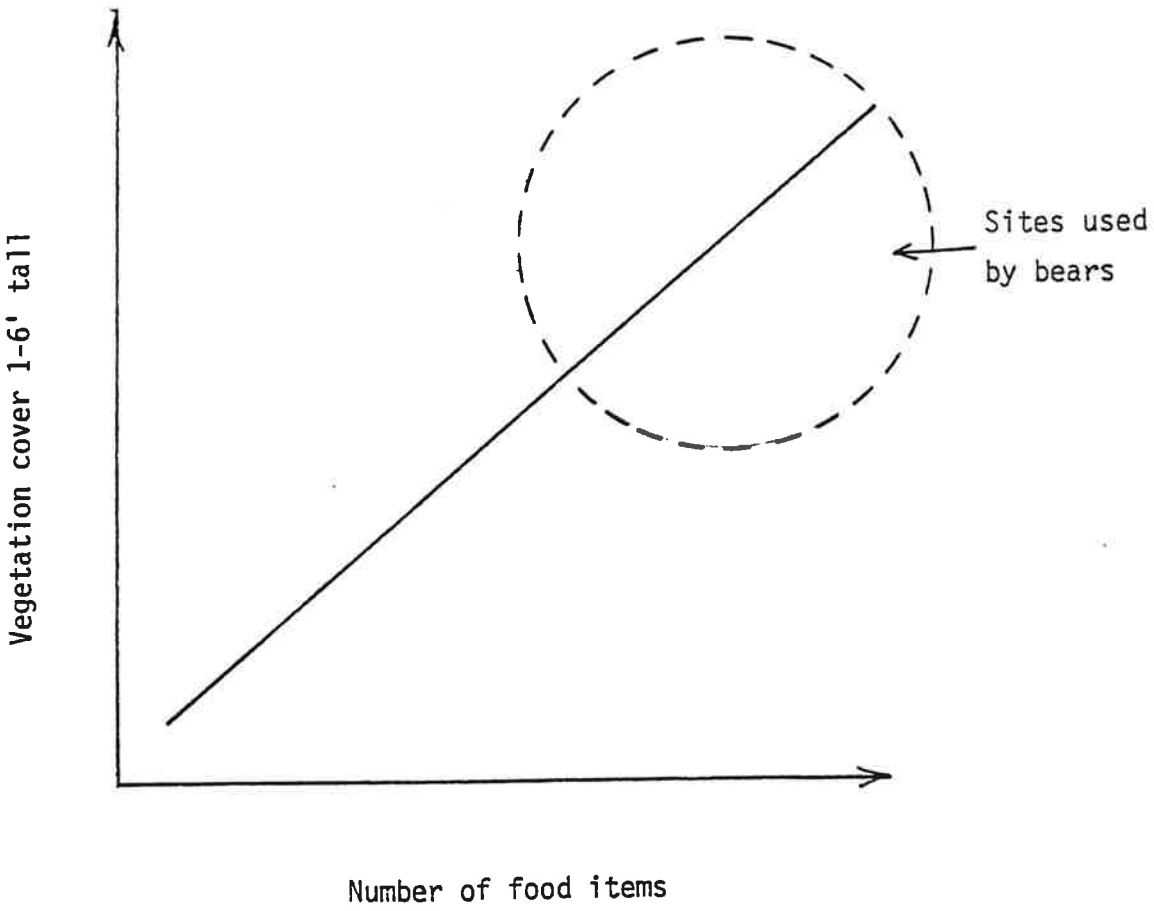


Fig. 2. The relationship between vegetation cover 1-6' tall and the number of food items on a site can be used as a measure of habitat quality. Bears use sites with the proper combination of food and cover (LeCount, pers. comm.).



HUMAN-BEAR PROBLEMS

Barrie K Gilbert
Utah State University

Conflict between bears and human activities was identified as a high priority area for management and research. An acceleration of problems was predicted based on increased use of wild lands for recreation, petrochemical exploration and extraction, dispersed vacation homes, recreational complexes, etc. While our goal is to identify the fundamental causes of the conflicts on a broad general level we should recognize that the conflicts, the behavior and the productivity of bear populations will be different at each site.

It is apparent from this and former black bear workshops that there is confusion about the role of policy, management and research among decision makers. Written policy statements, management goals and plans to attain them will advance this process. Policy is central since value statements about the use of bears will clarify the options and help direct decision and educational efforts. We need agency consensus on whether we are managing populations that are dwindling, highly valued, productive and supporting a quality hunt or productive and a widespread nuisance in an area with relatively low appeal to hunters.

Rhetorical statements that such conflicts are "bear" problems or "it is really a people problem" are frequently heard. A more useful approach might be to conceive of the conflict as a relationship problem between bear behavior and human food stores, (garbage, crops, livestock, camp food, bee hives) which are invariably private property, hence the conflict. This focuses us on the question of how the problem develops and thus how to prevent the initial stages through preventative management.

Identification of the Problems

Before addressing specific human-bear conflicts the chairman opened the session by identifying some common features of conflicts with black bears as well as other species.

Bears are opportunistic feeders which can detect new food sources and move considerable distances to use them. They are learning machines which not only remember the locations of new, rich food sources but also lose their avoidance responses (fear) of man when they are protected from hunting or other harassment. This habituation to humans under protection is observed in all park situations that I am aware of as well as in other situations where destruction of problem bears is prohibited by law. The upsurge in numbers of polar bear incidents in the Churchill, Manitoba area followed shortly the prohibition of killing.

The common thread in these situations is the learning by individual bears not only the message "no threat" but also "good food." I emphasize "individual learning": we need to broaden our focus to develop models which involve animals and especially recognize that different individuals may exhibit very different behavior. For example, juvenile males may exhibit a wider range of feeding patterns than adults under the stress of hunger and social exclusion. The development of learned feeding patterns (food type, location, time), if successful, will be transmitted to offspring and other bears. This process, when viewed over time, takes on the characteristics of a new "cultural" pattern. If the food supply is very rich and abundant, as with backpacker's food in Yosemite National Park, dense concentrations of bee hives in Alberta or tons of edible food in landfills in Yellowstone then a new niche is filled by the behavioral phenotypes prepared to exploit it. Thus, our models relating population dynamics to the forage base need to incorporate more behavioral science if they are to have some predictive value to managers. We already know the fundamentals of this problem bear syndrome sufficiently well that there is no excuse for preventive measures not being incorporated into planning documents for developments in bear management.

A related challenge for researchers is to get on with developing simple models relating food resources to productivity and behavior. Testing specific prediction from the hypotheses would seem to advance our understanding of how "habitat" and bears interact rather than the endless process of identifying vegetation components. Description of plant species can never have much generality considering the astounding diversity of plant communities supporting bears. This is not to say that detailed knowledge of local food supplies is not important to the biologist. Indeed, in the south-eastern U.S. the mast supply may well determine the level of bear problems developing. Thus, a better understanding of the relationship between bear behavior and a variable food supply may provide a window to predict up-coming problems. However, we should be striving for explanations at a more general, fundamental level of nutritional plane, movement and social behavior.

Waddell. We have a very efficient hunt in Arizona so we never develop a chronic bear problem. Our small study area in a state park has bear-proof refuse containers. No food is accessible to bears so development of problem bear behavior is less likely to develop. There are no dumps accessible to bears. A number of bears, however, frequent these areas but as a rule they do not become dangerous. The vulnerability of bears tagged in the park (initial stage of chronic problem) has increased to such a point that we have a minimum of 74% of these bears appearing in the bears killed by hunters. Most of those were first-year recoveries.

Gilbert. This contrasts with the park situation and emphasizes the need to deal with the conditions causing bears to habituate to people before a larger, chronic problem develops. Where a hunt can be used as a management tool to curtail conflicts in the early stages, it is effective. In your case in Arizona with a small, isolated population, the increased vulnerability may be excessive and threatening the maintenance of a stable

population. Actions to prevent habituation and food reinforcement would seem necessary.

Brian Pelchat, would you describe the problems you are encountering in southwestern Alberta?

Pelchat. Kananaskis Country is a recreational development in a 2000 square mile mountain wilderness. Ten years ago there were only gravel roads up river drainages; roads were closed in winter. Livestock grazing and traditional hunting were present. The area was managed as wilderness by the Alberta Forest Service with some timber harvest. Today all major roads are paved. The recreation development includes a 36-hole competition golf course, three alpine village complexes with service centers, racketball and tennis courts, ski developments for the 1990 Winter Olympics, 1000 km of equestrian trails, areas for off-road vehicles, campgrounds for 25 to 400 units and a total expenditure to exceed one billion dollars.

Biologists are trying to document human-bear interactions through time working with the files of bear complaints over the last 10 years. This documentation will continue to see if the pattern changes. Ninety-five percent of complaints were with black bears, not grizzlies. The number of incidents coincides nicely with the use of the area by people: few complaints in May, dramatic increase in June and July, declining in August and petering out in September and October.

The types of complaints were related to activity types: backpackers and campgrounds, residences (mansions) on small acreages, livestock depredations in agricultural areas. This is really a people problem.

We were fortunate in that we could have some input on planning through a Fish and Wildlife Division biologist. All developments had a review group. Certain restrictions on location of 400 km of trails were made, as well as placement of campgrounds to minimize conflict. We did not have a mandate to do basic research prior to development. Suggestions from other areas were implemented, including bear-proof garbage containers, which we feel reduced incidents significantly.

Gilbert. I sense that bear biologists want to study bears in isolation from conflicts and then expect to be able to solve human-bear conflicts. Developing a basis for predicting impacts requires research on the impacting factor on the system, whether pilot scale, simulated or otherwise. Studies on one element (such as bear ecology in native habitat) may provide little basis for predictions of impact in altered systems. This is widely recognized in environmental impact studies and needs to be applied in bear studies.

We ought to expand the range of studies on bears. Solutions to human-bear conflicts could benefit from a better understanding of the dynamics of behavioral development in individual bears. Long term studies on a small

number of young bears focusing on tests of specific predictions would advance our understanding of the early stages of chronic bear problems. Do juveniles get programmed when young on agricultural crops or other atypical foods because of hunger? How does tolerance for people vary with severe nutritional stress? Do bears living on back-pack food, garbage, etc., out-compete bears feeding on natural forage?

Pelchat. We have an opportunity to document changes in behavior in Kananaskis Country by following radio-collared bears prior to development and after campgrounds are operating.

Gilbert. Bruce Hastings' data on human-bear interactions in Yosemite N.P. demonstrated clearly that throwing rocks, yelling and other moderately aggressive behavior is effective in ridding a campground of bears. However, too few people are aware that this will work or are willing to be so "anti-social" toward bears. Unfortunately, even among park naturalists an overly sympathetic attitude contributes to damage levels and potential injury. Passive behavior by people leads to rapid habituation by bears. At the population level we do not know what percentage of bears are involved in depredations.

Beecham. Information from Yellowstone N.P. suggests a majority of bears fed along roads and in dumps. Closing these food sources to bears has essentially eliminated the black bear from Yellowstone. Charles Jonkel caught 5 black bears for each grizzly but Dick Knight's data showed 20 grizzlies per black bear in an intensive study. Only 3-4 black bears were caught in the Yellowstone system per year. Evidence from wool growers on the east side of the park suggests that Yellowstone bears dispersed there in the 2-3 years after closure of the dumps.

Ruff. The bear research at Cold Lake, Alberta began before the extensive development of the Oil Sands on our site so we have data during the implementation of this very large development. Within 5 years a community of 15,000 people will be in place. Despite extensive construction of 5 acre drilling pads we saw no significant dispersal. Adult males and females did not move out. After some initial adjustment the bears habituated to the activity. Not uncommonly bears would walk through the drill site at mid-day. They habituated quickly when they discovered that they would not be shot or harassed. We did see a significant increase in sub-adults at dumps and drilling sites. We placed an experimental dump site on our study site to determine which radio-collared bears would use it. Adult males and females generally maintained their home ranges but sub-adult use did change dramatically.

Beecham. Would you not anticipate over time that the sub-adults which learned about the dumps would adjust their movements as adults?

Ruff. Sure, there is a lot of learning of new patterns. We have a documented history of that. Unfortunately, political realities forced us out of the area.

Pelchat. I think Bob is underestimating the extent of the problem with 50,000 people in the Ft. McMurray area and Esso Resources at Cold Lake considering a 10 billion dollar development. Aside from the industry there are a large number of people looking for recreational opportunities which will impact bears.

Lindzey. One can think of zones of influences, not so much direct displacement of bears but activity of people. This is not really different from crop and livestock conflicts.

Gilbert. Highly productive bear populations may produce an excess of sub-adults which are predisposed to being problem bears because they have not learned to efficiently exploit their environment, are hungry and thus tolerate areas and people that adults would not. At the other end of the scale we have less productive populations (e.g., Arizona) where chronic problems do not develop. We need to study population/food base/behavior interactions.

Beecham. Is anyone working with Taser guns to attempt to short-circuit the learning pattern? Dick Knight tested it on bears and it just flattened them. When used on bears that are habituated to traps it appears that the bear cannot be caught again. Knight has some film footage that shows how effective the Tazer gun is.

Audience. Could its use lead to an aggressive bear?

Beecham. If you let up on the trigger the bear gets up immediately. Knight's experience is that the bear will run immediately.

Gilbert. Further work appears warranted on this technique, also the use of rubber and wooden bullets to develop conditioned aversions in park bears before they develop into chronic problems.

Waddell. There is a different problem further south. In our area there is not ingress or egress because we are surrounded by desert. Bears have a higher value to people because seeing one is so unusual. We have educated the public to appreciate that bears that feed on garbage even if they come quietly at night are as good as dead. This results from high hunter pressure and the higher probability of mortality from a hunter for this type of habituated bear. We address the problem with great concern because this vulnerability to hunter kill may be the greatest source of mortality. We do very little translocation of problem bears because we know in one to three months he will be taken by a hunter.

Pelchat. Could we discuss bear control? In Alberta we have two real problems in bear control. We have three ways of handling management of depredation by bears. We try to prevent damage by bear-proof containers or installing electric fences around bee-yards and we compensate for losses in certain agricultureal areas. I would like to get some ideas on two problems.

First, the provincial agents responsible for bear complaints have no guidelines as to what action to take on a complaint. Where does the liability lie if they make a mistake? If they do not respond to a complaint and someone is hurt, will they be legally liable? As a consequence of this situation whenever a bear complaint is received they respond to it. If they have a bear trap, regardless of the severity of the complaint, it is set. The result of this is that we are handling three to four times as many problem bears as we should. Last year we handled over 800 bears. I would like to see some guidelines written up as to what action should be taken when investigating a complaint about a nuisance bear.

The other problem is what to do with the trapped bear. Do you destroy or relocate it? Traditionally people consider a relocation successful if the bear is not seen again. We have no idea what happens to these bears after release.

I think we should measure the success of relocation in terms of how much we decrease the ability of that animal to survive. And in that respect we may not be changing the survivorship of sub-adult bears much. These animals move around extensively anyway; some of them move 100 miles. By taking a sub-adult bear and moving him that distance are we really affecting his ability to survive? Probably not. So maybe this cohort of the population can be relocated most successfully. Adult females have been found to be site tenacious, almost territorial. What happens to this animal when we relocate it? How much are we affecting the ability of that animal to survive? If they do maintain a bit of space for their sub-adult female offspring to grow up on without harassment, how are we affecting the sub-adult female offspring by removing the parent? Should we be relocating any bear?

Gilbert. Assuming the agency policy places a high value on these bears, the question requires a study to monitor the fate of radio-collared problem bears.

Hugie. There is a lot of data on translocated bears: Gary Alt has published on his Pennsylvania studies. In Baxter State Park in 1973-74 we moved 29 bears. Thirty-seven percent of bears moved out of the park were killed. If you had bears to spare, 37 percent would not be bad. I have had adult females return in four days when moved 126 miles and across two drainages. Adult females home rapidly and consistently. In contrast, adult males moved after the breeding season may take all summer or until the next spring to return 100 miles.

Gilbert. If bear depredations are not of sufficient magnitude to warrant a research project I would strongly recommend that documentation of investigations and actions be accumulated on prepared data sheets. If the problem gets worse, as they often do, then a history is available for swift management action. In our polar bear work we were hampered by inadequate documentation of bear-human encounters.

Beck. We need cooperation between animal damage control and funding agencies to look carefully at the characteristics of those bears that

are killing sheep. In view of the delay in reaction time to depredation incidents, are we catching the right bear?

Gilbert. People involved in solving bear depredations need to identify the range of questions, studies and human talent required. Predator depredations on elk, sheep, waterfowl in federal refuges, etc., should be identified to the U.S. Fish and Wildlife Service for support of research directly targeted at these problems. As Cliff Martinka has pointed out, there is a need to recognize the contribution that the behavioral sciences can make, distinguishing the concepts, principles and methodology of those sciences from bear habits.

Pelchat. How about the area of public education? This summer (1982) in Kananaskis Country we will interview users of the area to determine their knowledge and attitudes about bears. Once we have that we are considering production of a short film on the work we are doing and the sorts of attitudes we would like people to have. We are also thinking of extracting part of the film for TV broadcast, as the Canadian Wildlife Service does with their "Who's Who in Wildlife." Does anyone have any thoughts on that?

Gilbert. One of the recommendations to Yosemite N.P. following our three-year study of human-bear interactions was to produce a short film for people entering the back country and evening nature talks. I can also recommend the film "Bears and Man' produced recently by the National Film Board of Canada.

——Additional information on this topic occurs in The Northwest Territories Research Status Report.

INVITED PRESENTATIONS

THE USE OF HARVEST DATA TO MAKE INFERENCES ABOUT BEAR POPULATIONS

David Anderson

Utah Cooperative Wildlife Research Unit
Utah State University
Logan, Utah 84322

The use of age and sex composition data from the harvest requires a host of important and unlikely assumptions. This is especially true in making inferences about trend, changes in structure, over- or under-exploitation, mortality rates, or changes in any of these quantities over time or area.

This leads to a philosophical question as to whether the use of such procedures has merit. DeLury (1954) believed

> "...it is an expensive impropriety to maintain that an untrustworthy estimate is better than none."

First we will look at some results from the published literature and then judge whether harvest statistics, by themselves, are of value, trustworthy, or worthless.

INFERENCES ABOUT THE POPULATION

Predicting Trend

Caughley (1974a) concluded

> "...age ratios often provide ambiguous information and their interpretation can lead to serious management blunders. Even when the ratio responds to a change in rate of increase there are circumstances in which its trend is the same for two populations, one of which is increasing and the other plunging to extinction."

> "Age ratios cannot be interpreted, even in a general way, without additional demographic information, particularly on the population's rate of increase."

He stated further

> "This is not to say that a sudden change in an age ratio should be ignored--it indicates that something has happened--but that more information is needed to find out what has happened." "Conversely, the fact that an age ratio remains constant does not imply that the population has maintained a constant rate of increase." "Age ratios are not adequate substitutes for accurate estimates of relative or absolute density from which rates of increase can be measured. Nor do they assist in calculation of this rate."

In a further note (Caughley 1974b) he stated

> "The...fallacy lies in the assumption that an allowable rate of harvesting can be calculated from a population's age distribution. Neither age distribution nor fecundity rates, nor the two taken together, reveals very much about sustainable yield or rate of increase."

Life Tables

Harvest statistics are frequently used in a so-called "life table" to estimate mortality. This is a well-known, but poorly understood practice. The standard procedure is illustrated in Table 1. The estimator of M_x, the mortality rate of animals of age x, is for example,

$$M_x = d_x / (\sum_{x}^{\ell} d_x)$$

$$M_2 = d_2 / (\sum_{x=2}^{\ell} d_x)$$

$$M_2 = 28/(28+12+7+3+2+1)$$

$$= 52.8\%$$

This simple procedure is essentially worthless because it is based on a number of assumptions that are biologically unrealistic. Some of the assumptions are given below:

Table 1. Calculating mortality rates using a "dynamic" life table.

Age interval (years x)	Number shot d_x	Annual mortality rate M_x
1-2	84	61.3%
2-3	28	52.8
3-4	12	48.0
4-5	7	53.8
5-6	3	50.0
6-7	2	66.7
7-8	1	100.0
	137	

1. The annual sampling fraction (f_x) is a constant fraction of the annual mortality rate (M_x) for each age

$$\frac{f_x}{M_x} = \text{constant for all } x.$$

2. No time-specific variation in f_x or M_x is allowed.
3. The population must be stable and stationary, this means, for example,
   a. the number of cubs born each year is always the same for all years
   b. there is no variation in survival by year (no time-specific survival)
   c. the size of the population never changes.

No estimates of precision (sampling variance) are available, making rigorous inference impossible. The estimator of M_x is poor as it wastes relevant information. Even if the assumptions were true, a severe age-specific bias exists. This gives the illusion that mortality increases with age (Burnham and Anderson 1979).

Biologically, the assumptions of life table methods range from naive to ridiculous and the method is "sensitive" to violations of these critical assumptions (see Seber 1973).

Other methods exist that have valid statistical properties, but also make unrealistic assumptions for most biological populations. The best known example is the method derived by Chapman and Robson (1960). Here, mortality is estimated as

$$M = 1 - \frac{T}{n+T-1}$$

where: $T = d_1 + 2d_2 + 3d_3 + \ldots$

$n = d_0 + d_1 + d_2 + d_3 + \ldots$

Three assumptions are critical:

1. Stability and stationarity
2. The sampling fraction is a fixed constant
3. Mortality is the same for all age classes.

Given the assumptions, this method is excellent.

A) The estimator is statistically elegant.

B) Sampling variance can be estimated.

C) A statistical test of one assumption is available.

D) Truncation of the data is allowed.

Still, the restrictive nature of the assumptions limits the use of the method tremendously.

Discussion

Relatively little can be said about population parameters, processes, or dynamics from harvest data from unmarked animals. Methods proportedly available make unrealistic assumptions. Only when sweeping assumptions are made, can methods be derived.

What justifies a conclusion? After thinking about this, most people would respond "Valid Methodology." The methodology for making inferences about the population from harvest data on unmarked animals is poor. So we are faced with the belief stated by DeLury (1954). Essentially, can we use a worthless estimate or index? This is a philosophical question.

INFERENCES ABOUT THE TOTAL HARVEST

Valid inferences can often be made about the total harvest from a sample of the harvest. For example, we may wish to test the hypothesis that the sex ratio in the total harvest is even. Standard sampling theory (e.g., see Cochran 1953) covers these procedures. However, most biologists are interested in inferences about the population, rather than the harvest.

Frequently, one sees harvest statistics expressed as "the number of males per female" or "number of young per adult" or, worse yet, "number of young per 100 adults." This represents poor practice because one cannot readily estimate the precision of these quantities.

For this reason, one should present the estimates as a proportion: e.g., the proportion of the sample that is male:

$$\hat{p} = \frac{\text{males}}{\text{males + females}} .$$

Once an estimate $\hat{p}$ of the true proportion p is obtained, a minimal estimate of the sampling variance can be computed as

$$\text{var}(\hat{p}) = \frac{p(1-p)}{n}$$

$$\text{and } \text{se}(\hat{p}) = \sqrt{\text{var}(\hat{p})} .$$

These are measures of precision or repeatability. Furthermore, standard hypothesis tests can be derived from this information.

SUMMARY

My personal philosophy makes me think it is unwise to expend resources gathering harvest statistics if we wish to make conclusions about the population (rather than only the harvest).

LITERATURE CITED

Burnham, K. P., and D. R. Anderson. 1979. The composite dynamic method as evidence for age-specific waterfowl mortality. J. Wildl. Manage. 43(2):356-366.

Caughley, G. 1974a. Interpretation of age ratios. J. Wildl. Manage. 38(3):557-562.

Caughley, G. 1974b. Productivity, offtake, and rate of harvest. J. Wildl. Manage. 38(3):566-567.

Chapman, D. G., and D. S. Robson. 1960. The analysis of a catch curve. Biometrics 16(3):354-368.

Cochran, W. G. 1953. Sampling techniques. John Wiley and Sons, NY.

DeLury, D. B. 1954. On the assumptions underlying estimates of mobile populations. Pages 287-293. Chapter 21 in Statistics and Mathematics in Biology. Iowa St. Coll. Press.

Seber, G.A.F. 1973. The estimation of animal abundance and related parameters. Griffin, London. 506 pp.

AN ENLIGHTENING AND SOBERING EXPERIENCE IN CALIFORNIA

Wayne E. Klein
California Department of Fish and Game

The operation described in this paper strongly indicates that this nation's wildlife resources are under assault by persons who have no regard for perpetuation of wildlife populations or hunting as a sport--their sole interest is monetary gain.

During 1981, the California Department of Fish and Game conducted an undercover investigation to "determine the extent of illegal bear part sales in California and identify some of the persons involved." E. C. Fullerton, Director of California's Department of Fish and Game, approved the undercover plan we proposed and I was assigned the task of supervising and coordinating the operation.

The operation, which lasted for seven months, was made known to only eight people in the Department including myself and the two undercover officers. Undercover officer safety was our primary concern and only those people who had to absolutely know were made aware of the operation.

The investigation was divided into two segments. Both undercover officers were used to penetrate the Korean community in Los Angeles where we knew there was a demand for bear parts--primarily bear gall bladders.

One of the officers had extensive background in bear management and was used in northern California to infiltrate the bear houndsman community. We had long standing information that five or six individuals out of the 200+ houndsmen in the north were dealing in bear parts. How wrong we were!

For the better part of four months, our undercover officer in northern California was a houndsman. He hunted with them, lived with them, and literally became one of them. Just prior to ending the operation, he was asked to run for president of the houndsman club located in Redding. He had truly infiltrated their ranks.

We learned some disturbing facts in the north. Of utmost concern was the fact that virtually every houndsman contacted (in excess of 100) was involved to some degree in the illegal sale of bear gall bladders, feet, claws, or hides. On one end of the spectrum is the hunter who kills bear out of season and only takes the gall bladder and feet. At the other end is the hunter who knows about the killing and does nothing about it.

We found that the hunters were dealing with several buyers and in some cases, one houndsman will buy from another. A single gall bladder may change hands five or six times before it reaches the ultimate consumer and a profit is made on each transaction.

We learned of three major buyers located in Los Angeles, San Francisco, and the state of Washington. The Los Angeles buyer will be discussed later in this paper. The Washington buyer has been identified and will be prosecuted in Washington and California. Investigation is continuing on the San Francisco buyer.

An important bonus from the northern California operation was learning how houndsmen think, operate, and react to the field warden's presence. Sixty wildlife officers assigned to the eight northern counties in California have received training from the undercover team dealing with houndsman problems at the field level. This training will eventually be given throughout California.

In southern California, we really opened up a can of worms. However, before discussing the results of the Korean investigations, we need to put the entire Asian picture in perspective.

Several hundred years ago, halfway around the world, the Asian cultures were using various folk medicines to cure their ills. Somewhere along the way they started using "ungdam" (Korean for bear gall bladder) and "nogyong" (Korean for velvet antler). We all have heard what the Asian appetite for Rhino horn has done to wild Rhino populations. There is no reason to believe it can't happen to bear, deer, elk and moose.

Though the Asian population in this country is well educated, they believe as much in "ungdam" and "nogyong" for curing their ills as we believe in penicillin and aspirin. The various animal parts are used to promote physical well being and Asians believe they cure a wide variety of ills. Contrary to popular belief, the use of animal parts as an aphrodisiac accounts for only a small portion of the overall demand. Most are used for medicinal purposes.

If we accept the above and the fact that half of the world population is Oriental, it's clear we have a problem!

In Los Angeles alone, the Korean population has increased by 100,000 in the last decade. That city has over 300 licensed herbal-acupuncture shops which may or may not be handling animal part products. The few such shops we worked undercover were very interested in obtaining animal parts and weren't too concerned about the the price.

As you read the following, remember that we only worked on three Korean buyers, including one herbal-acupuncture shop, and one Chinese restaurant. We didn't expand the investigation because of finaicial and time constraints. We didn't go into the Chinese community, nor did we work the Thais, Vietnamese, Cambodians, or Japanese. Los Angeles is only one city where Orientals are well represented in this country. Consider how many others have significant Asian populations? How many Asians still believe in the medicinal value of animal parts? How many gall bladders are sent back to the Orient? The potential numbers are staggering!

Our undercover operation in Los Angeles was intermittent during the seven month period. We worked it only when the northern officer could break free and when we had a supply of bear gall bladders or velvet antlers to offer for sale.

The first Korean contacted had been a major buyer since 1978, but had refused to raise his prices as the demand increased and was slowly going out of business. Records of his business transactions seized under authority of a search warrant showed that he had banked $6,000 during the 1978 California bear training season and another $7,000 at the end of the bear season. This was in addition to his normal income.

He had contacted potential supplies through ads in various sporting magazines and from guide lists supplied by various states. He bought bear gall bladders from persons in Arizona, Idaho, Maine, New Mexico, Wyoming, and, of course, California. Arizona and New Mexico are prosecuting persons in their states based upon our evidence. Additional cases are pending against other California suppliers.

The second Korean defendant had just entered the business and his records show that in a four-day period he ordered 300 bear paws, 14 bear gall bladders and 15 cougar galls. These orders were placed with five guides in five different states and he offered to pay $2,750 for the animal parts ordered. Primarily, he was supplying bear feet to Chinese restaurants at $30 apiece, which would be available to restaurant customers upon request.

He had placed other orders in Alaska, British Columbia, Idaho, Montana, Washington, and Wisconsin. Washington has a case working against a licensed guide in their state based upon our evidence. In less than two weeks in the month of July, the Washington guide supplied the Korean buyer 80 bear paws.

The third Korean defendant is an herbal-acupuncturist who ordered 100 frozen bear gall bladders at $100 apiece from the undercover officers after they delivered a whole bear carcass to him and removed the gall bladder to prove they could supply real "galls." This individual had 23 gall bladders and several trays of velvet antlers in his place of business when the search warrant was served.

The fourth Oriental defendant, a Chinese restaurant owner, was charged with possession of bear paws for sale in a restaurant and purchasing bear paws with one of the other defendants.

Working undercover in Los Angeles, our officers were offered $100 per frozen bear gall bladder, $110 per pound for velvet deer antlers, and $4,000 for a set of antlers from a three-point elk in soft velvet. They were asked to supply dead, ungutted bears, and one Korean even wanted to buy live bear for shipment back to the Orient.

We learned that some of the bear gall bladders are sent back to the Orient where a two-pound frozen gall bladder will start at $3,000.

The bear gall bladder business seems to be a free enterprise endeavor amongst the Koreans. However, velvet antlers are another matter. Our evidence points to a well organized Korean crime ring controlling velvet antler exports to the Orient.

Early in November, 1981, we decided to move against the known illegal northern California bear hunters and the Los Angeles Asia buyers simultaneously.

In the north one houndsman was arrested when he sold 187 bear claws, and two gall bladders to one of our officers. He has been charged with ten counts of sale of bear parts. This case is pending.

Eight other northern California houndsmen have been charged with 22 counts involving use of bait to attract bear, running bear out of season, and taking bear out of season. All of these cases are awaiting trial.

In Los Angeles, the Korean gall bladder buyer was charged with ten counts of purchasing bear parts. He was in possession of 17 frozen bear gall bladders at the time of seizure. He has since pled no contest to eight counts, been fined $4,000 plus $2,400 penalty assessment and ordered to pay the Department an additional $2,000 for bear enhancement for a total of $8,400.

The Korean bear paw buyer was charged with seven counts of buying or selling bear parts. This defendant pled no contest to four counts of buying or selling bear parts and was ordered to pay $2,000 plus $1,200 penalty assessment. He was also ordered to pay $2,000 to the Department for bear enhancement and further agreed to testify against the Washington guide who had supplied the 80 bear feet.

We have not filed criminal charges on the herbal-acupuncturist awaiting lab analysis of the seized gall bladders.

The Chinese restaurant owner pled guilty to one count and was fined $400 plus $240 penalty assessment. To date, with ten defendants still awaiting their day in court, fines and assessments exceed $14,000.

The seizures in northern California and Los Angeles involved parts of 55 bear. We can only guess at the number of bear involved in one year's operation by the defendants...?

WHAT DID WE LEARN?

Obviously, we learned that California and the nation has a serious problem that isn't going to go away. In fact, the demand for animal parts far outweighs the supply and as animal populations dwindle, the demand will become more intense and the price will increase.

We know there is a large and growing market for certain animal parts in the Asian community. Most sought after are velvet deer, elk, and possibly moose antlers, bear gall bladders, bear paws and mountain lion parts.

WORKSHOP PARTICIPANTS

Brad Allen
29 Melden Drive
Brunswick, Maine

Rick Armstrong
P. O. Box 3263
Missoula MT 59806

Richard Ashcroft
Box 492
Sunnyside, UT 84539

Kim R. Barber
60 West 1250 South
Logan, UT 84321

James Bates
159 North 100 East
Price, UT

Tom Beck
Box 83
Crawford, CO 81415

John Beecham
109 West 44th
Boise ID 83709

Becky Benda
459 S. LeSueur
Mesa AZ 85204

Neil Bingham
Box 167
Altamont, UT

Leon Bogedahl
Box 126
Bicknell, UT

Norman Bowden
Route Box 67 A
Monroe, UT

S. D. Bunnell
1596 West North Temple
Salt Lake City, UT 84116

Harry Carriles
School of Forestry
University of Montana
Missoula, MT 59801

Garth Carter
532 Oliver St.
Moab, UT 84532

Keven Cherry
845 E 400 N
Sprinville, UT

Karen Corts
225 W 500 N
Logan, UT 84321

Rick E. Danvir
P. O. Box 38
Woodruff, UT 84086

John Dickerson
Box 415
Dutch John, UT 84023

VerrDon Durfee
Foute 1 Box 171 B
Monroe, UT 84754

James Fitzgerald
215 W 400 S
Sandy, UT 84070

Ted Gardiner
Box 567
Page, AZ

Jim Guymon
90 S 200 W
Parowan, UT 84761

Forrest Hammond
Zoology Department
Box 3166
University Station
Laramie, WY 32071

Roy Hugie
P. O. Box 1235
Shady Cove, OR 97539

Grant Jense
2416 E 9110 S
Sandy UT 84092

Derris Jones
455 W. Railroad Ave.
Price, UT 84501

Steven Kearl
Box 3
Echo, UT 84024

John Kimball
2856
Virginia Way
Ogden, UT

Al LeCount
Star Route
Tonto Basin AZ 85553

Fred Lindzey
71 West Center
Millville, UT

Scott McCorquodale
214 E. Kent
Missoula, MT

Kathleen McCoy
P. O. Box 277
Window Rock, AZ 86515

Cheryl Mollohan
1245 East Vine
Mesa AZ 85204

Bob Nielson
Box 481
Vernal, UT 84078

Dave Olsen
3116 S. 500 W.
Vernal, UT 84078

Terry L. Parkin
Rt. 1-A Box 44D
Kamas, UT 84036

Jordan Pederson
1381 E 700 S
Provo, UT

Brian Pelchat
3819 14 St. SW
Calgary, Alberta

Jeff Picton
623 N 300 E
Logan, UT 84321

Bob Ruff
221 Russell Labs.
University of Wisconsin
Madison, WI 53706

Patrick Ryan
P. O. Box 1836
Window Rock AZ 86515

Mark T. Schroeder
P. O. Box 4132
Arcata, CA 95521

Roger Smith
Montana Cooperative Wildlife
Research Unit
Missoula, MT 59806

Nile Sorenson
Box 834
Duchesne, UT

Tom Waddell
P. O. Box 70
Puma, AZ 85543

Dick Worthen
234 N 450 E
Orem, UT 84057

Donald Young
220 S. Avenue E
Missoula, MT 59801

Pete Zager
Biology Department
Muskingum College
New Concord, OH 43762