BLACK BEAR MANAGEMENT IN GREAT SMOKY MOUNTAINS NATIONAL PARK

RESEARCH/RESOURCES MANAGEMENT REPORT No. 13

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GREAT SMOKY MOUNTAINS NATIONAL PARK
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BLACK BEAR MANAGEMENT

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By

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ABSTRACT

Black bear management actions in Great Smoky Mountains National Park from 1964-1976 resulted in a total of 332 captures and relocations, and the disposal of 18 bears. The largest number of management actions on bears have consistently occurred in Cades Cove campground (40 percent) and along Clingman's Dome Road (19 percent). The greatest proportion, 76 (71 percent) of the 107 human injuries resulting from black bears (Ursus americanus), occurred along Newfound Gap Road (U.S. Highway 441); 49 (46 percent) of these injuries were associated with violations of National Park Service regulations, particularly, feeding of bears. Sows with cubs occurred in a significantly greater proportion of personal injuries than in property damage incidents, reflecting the natural defensive behavior of females with young. Reported property damage incidents totaled 715 during the 12-year period with a major shift from primarily front-country to primarily back-country incidents occurring during 1973-1976. This shift in incidents followed a major increase in overnight back-country use since 1970. Occurrence of black bear damage incidents was significantly associated with the number of visitor nights at a back-country site.

Substantial portions of this paper were presented at the Fourth International Conference on Bear Management and Research at Kalispell, Montana, February 21-24, 1977.

INTRODUCTION

Conflicts between black bears and visitors have increased in Great Smoky Mountains National Park since its establishment in 1932. Black bear populations increased under the protection provided by the park (LaFollette 1974) and now number approximately one bear per 3.5 km in one study area (Beeman 1975, Marcum 1974). Visitor use of the park increased tremendously from 1953-1973, averaging nearly 7 percent increase per year and reaching approximately 8.5 million visits in 1975 (U.S. Department of the Interior, National Park Service 1976).

Major revisions of black bear management actions in the park began in 1976, with rewriting of the black bear management plan and creation of a black bear management task force. The purpose of this paper is to review black bear management in Great Smoky Mountains National Park, 1964-1976.

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METHODS

A total of 1,028 reports concerning damage incidents, personal injuries and management actions associated with black bears were evaluated for the 1964-1976 period. Data for 1965 was not available and therefore is not included. Three different forms for reporting incidents were used during the period, each form requiring slightly different information.

Visitor use of back-country sites was estimated by the number of legal permits issued for that site, although this does not provide an exact number. The data on garbage distribution in back-country sites and the data on the size of back-country sites were taken from a campsite damage survey conducted in 1975-1976, by the staff of Uplands Field Research Laboratory.

The office of Resource Management maintained reports of human injuries, property damage incidents and all bear control actions. A management action was recorded each time a bear was captured and transplanted, or destroyed. University of Tennessee research teams participated in management actions from 1971-1976, in addition to handling of bears for research purposes. Bears were captured with baited culvert traps or with sernaylan (Phencyclidine hydrochloride) administered by projectile

syringe. Bears were sexed from 1966 on, and marked with ear markers from 1967 on. Presentation of data follows that of Yosemite National Park (Harms 1976).

RESULTS

Personal Injuries

The number of personal injuries due to black bears ranged from 1 to 23 during 1964-1976. The greatest proportion, 76 (71 percent), of the reported 107 personal injuries occurred along or very near the roadside of Newfound Gap Road (formerly U.S. Highway 441) and the Clingman's Dome Road. Black bears concentrate along this roadside utilizing artificial food from garbage cans, refuse near roadside pullouts and picnic areas, and food obtained by begging. Numbers of personal injuries, citations and management actions on bears occurring along Newfound Gap Road and Clingman's Dome Road generally fluctuated together, 1964-1976 (Figure 1). Years of high injury incidence (1966, 1967, 1972 and 1976) either follow by 1 year or coincide with years of significant increases in annual visitation, with the exception of 1974 (Figure 1). During these years, patrol and enforcement by Park Rangers are overtaxed, as are garbage disposal units and pickup schedules. Visitor violations and increases in garbage availability to bears are likely to increase.

Figure 1. Annual fluctuations in total damage incidents by black bears contrasted with annual fluctuations in annual visitor use, Great Smoky Mountains National Park.


NUMBER OF INCIDENTS
0
10
20
30
40
50
60
70
80
90
100
1964
1966
1968
1970
1972
1974
1976
MANAGEMENT ACTIONS
PERSONAL INJURIES
FEEDING CITATIONS
ANNUAL VISITS
0
1
2
3
4
5
6
7
8
9
10
ANNUAL VISITS (IN MILLIONS)

Known violations of National Park Service regulations were associated with 35 of the 76 personal injuries occurring along Newfound Gap Road and Clingman's Dome Road. In 32 (41 percent) instances the person was watching and/or photographing the bear. The person was eating a picnic lunch in four (5 percent) instances and in three (4 percent) instances the person was petting the bear. In three (4 percent) instances the person was putting food into, or the bear was feeding from, a garbage can; while in 17 (22 percent) instances the report was inadequate to provide the circumstances. In 11 of the injury cases, the person was inside an automobile, and in two of these 11 cases the person was caught in a "bear jam" and surprised by the bear. In many instances people approached sows with cubs or surrounded the bears.

Bear-vehicle collisions along Newfound Gap Road were known to be in part associated with the panhandling habit and concentrations of bears along the road. Nineteen (90 percent) of 22 collisions with bears recorded in the park from 1964-1976 occurred along Newfound Gap Road. That road received the heaviest traffic of any park road, and since it is the only "through" road, it also experiences the highest vehicle speeds. Five cases of known poaching of bears along Newfound Gap Road were also related to panhandling habits. Four of these bears were poached as they fed from roadside garbage cans, and one as it was begging along the roadside.

The remaining 31 personal injuries occurred in vehicle access campgrounds along the park boundary, including one each at Cosby and Greenbrier (now a picnic area), and three at Elkmont. Four injuries occurred along heavily used day-hiking trails (Alum Cave Bluffs and Rainbow Falls); seven occurred at overnight back-country sites, while the location of 16 injuries could not be determined from the report. Appalachian Trail sites (Pecks Corner, Double Springs, Derrick Knob and LeConte Shelter), all among the most heavily visited back-country sites, accounted for five of the seven back-country injuries. The remaining two back-country injuries occurred at heavily used designated sites at McGhee Springs and Rough Creek which were located, at that time, only 1.6 km from vehicle access points. Three back-country injuries occurred while the person was cooking or eating dinner, and four while the person was asleep in a sleeping bag; three of those cases involved biting a foot through the bag. Five (71 percent) of the back-country injuries occurred during the nighttime, while in contrast, 72 (80 percent) of the injuries along Newfound Gap Road and Clingman's Dome Road occurred during the daytime (0600-2100 hours).

The hypothesis was tested that sows with cubs were disproportionately involved in personal injuries. The number of sows with cubs involved in property damage incidents was 37 (6 percent) and this was judged to be a sample of the proportion of productive females in the nuisance

bear population. Sows with cubs were involved in 18 (17 percent) of the personal injuries reported, however, this was significantly different ($X^2 = 17.9 > X^2 = 10.81$) from the general nuisance population. Cole (1972) recognized the importance of the natural defensive behavior of females with young in grizzly-caused injuries. Herrero (1970) reported that sow grizzlies with cubs accounted for 71 percent of all grizzly incidents involving hiking in both Canada and the United States.

Property Damage Incidents

A total of 715 property damage incidents attributable to black bears was reported from 1964-1976; the number of incidents in any particular year ranging from 9 to 116 ($\bar{x} = 59.6$, SD = 40.2). Different report forms and different emphasis upon the reporting of incidents makes determination of trends or actual changes in incident rate difficult.

The types of property damaged by black bears shifted dramatically in 1975 and 1976, from the previous 10-year period, 1964-1974 (Table 1). Front-country damage involving automobiles, campground tents and food coolers predominated (75 percent) during 1964-1974, but in 1975 and 1976, back-country damage involved backpacks on ground, backpacks in trees, and bluff charges (64 percent incidents).

Damage incidents as they relate to food storage (proper or improper) are listed in Table 2. In only 245 (34 percent) of the incidents was food storage judged to be proper, and the resulting bear damage attributed to conditioned behavior of the bear. In 269 (38 percent) of the incidents, food-storage was clearly improper.

Misconceptions about what constitutes proper food storage were the overriding factors in most damage incidents. For example, food was left in the passenger section of the car, often with windows cracked open, in 51 (7 percent) incidents. Food was stored in a tent-trailer or food-storage trailer separated from the sleeping tent or trailer in 35 (5 percent) incidents, often under the misconception that the food was protected there.

The greatest back-country problem focused on backpacks with food hung in trees, since black bears often obtained the food by climbing the tree, breaking the limb and/or chewing through tie ropes. Illegal camping was undoubtedly underestimated as a factor causing damage incidents since the person would be less likely to report the incident. Most reported incidents involving illegal camping occurred around Appalachian Trail shelters where the party receiving damage was outside the fenced shelter.

Table 1. The types of property damage incidents by black bears in Great Smoky Mountains National Park, 1964-1976. Bluff charges are also included as incidents.

Type of Damage	Average 1964-1974 (Av. %)	1975 (%)	1976 (%)
Backpack (on ground)	2.4 (5)	7 (15)	28 (24)
Backpack (in tree)	1.6 (3)	11 (23)	29 (25)
Automobile	11.0 (21)	9 (19)	23 (20)
Campground tent	14.0 (27)	4 (9)	10 (9)
Back-country tent	1.3 (2)	3 (6)	0 (0)
Food cooler	14.2 (27)	2 (4)	4 (3)
Appalachian Trail shelter	1.3 (2)	1 (2)	0 (0)
Buildings	1.9 (4)	1 (2)	3 (3)
Picnic lunches/dinners	1.4 (3)	2 (4)	3 (3)
Bluff charges	1.5 (3)	7 (15)	15 (13)
Unknown/miscellaneous	.9 (2)	0 (0)	1 (1)
Total	51.5 (99)	47 (99)	116 (101)

Table 2. Property damage incidents in Great Smoky Mountains National Park related to food storage, 1964-1976.

	Number	(%)
Food/cooler left out	114	(16)
Food left in passenger section	31	(7)
Food left in tent	37	(5)
Left backpack unguarded	20	(3)
Illegal campsite	12	(2)
Tent trailer/food-storage trailer	35	(5)
Unknown	201	(28)
Proper food storage	245	(34)
Total	715	(100)

Front-country damage incidents were in the majority until 1973. From 1973 on, the majority of damage incidents occurred in the back-country (Figure 2). Proportion of total damage incidents was chosen as an indicator since reporting emphasis was inconsistent between years, but tended to be consistent within years. The increase in back-country use in the park has been far in excess of the increase in total visitor use. For example, from 1963 to 1975, total visitor use increased 62 percent, front-country camping increased only 23 percent, while back-country camping increased 250 percent from 30,088 to 105,220 visitor nights (U.S. Department of the Interior, National Park Service 1976).

Backpacking in the Great Smoky Mountains is concentrated along certain sites and trails. In 1973, 54 percent of nights on the trail spent in shelters along the Appalachian Trail, which only totals 18 percent of the designated back-country sites (U.S. Department of the Interior, National Park Service 1976). It was hypothesized that bear damage incidents in the back-country were related to heavy visitor use. In order to test this hypothesis, the presence or absence of bear incidents (combined for 1975 and 1976) were compared to visitor nights for the preceding year, 1974 (Table 3), since 1975 and 1976, data was unavailable. A chi-square test of independence indicated that occurrence of black bear damage incidents was associated with the number of visitor nights at a site ($X^2 = 22.89 > 5.99$, $p < .05$).

Figure 2. Trends in proportion of damage incidents occurring in the back-country and increases in back-country overnight use, 1964-1976.

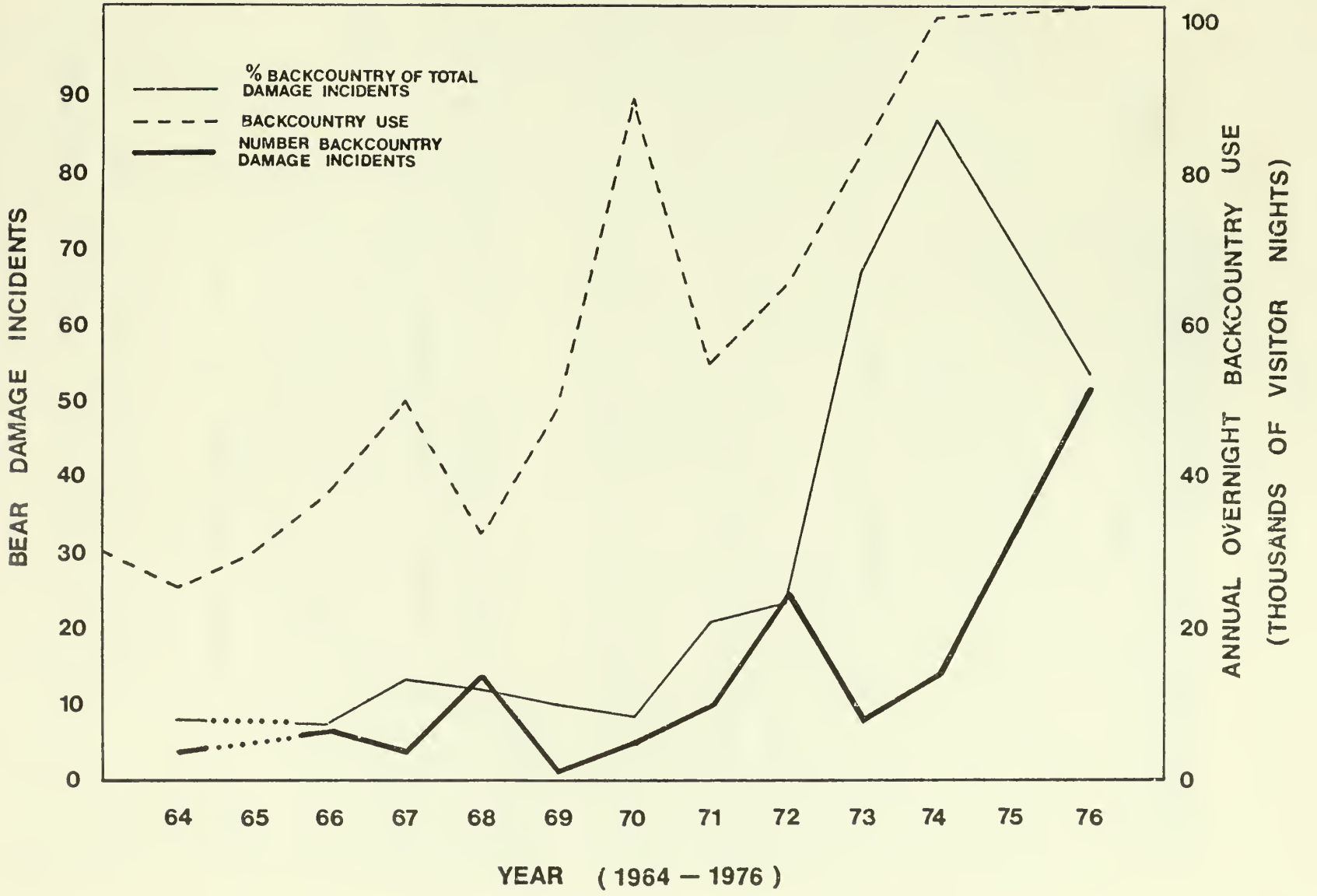
% BACKCOUNTRY OF TOTAL DAMAGE INCIDENTS
BACKCOUNTRY USE
NUMBER BACKCOUNTRY DAMAGE INCIDENTS
BEAR DAMAGE INCIDENTS
ANNUAL OVERNIGHT BACKCOUNTRY USE (THOUSANDS OF VISITOR NIGHTS)
0
10
20
30
40
50
60
70
80
90
100
64
65
66
67
68
69
70
71
72
73
74
75
76
YEAR (1964 — 1976)

Table 3. The occurrence of black bear incidents in 1975 and 1976 at back-country sites with high, moderate and low incidence of visitor nights during previous year.

	Back-country Sites			
	High Visitor Use (>1000)	Moderate Use (1000-400)	Low Use (<400)	Total
Sites with Reported Bear Incidents	15 (65%)	8 (35%)	0	23 (100%)
Sites without Reported Bear Incidents	18 (21%)	28 (32%)	41 (47%)	87 (100%)

The occurrence of black bear incidents is not associated with the amount of garbage at a site at a single point in time. Garbage was found to be an emphemeral and difficult to quantify substance at back-country sites and, given the measuring technique used, is probably not a good indicator of potential bear problems.

Black bear incidents are apparently related to the area of ground trampled at back-country campsites. Although few (13 percent) of the very small sites (less than 100 m^2 of vegetation damage) have incidents and many (42 percent) of the very large sites (greater than 20,000 m^2) have incidents, the pattern breaks down in the case of the moderate sized sites. Sites between 20,000 m^2 and 5,000 m^2 in size have about the same percentage of incidents (23 percent) as sites between 5,000 m^2 and 1,000 m^2 in size (24 percent). Some of the smaller sites with bear incidents such as Maddron Bald #33 have been recently moved to a new location and the bears have apparently moved with the site or the small site is part of a cluster area of legal or illegal sites with bear problems, such as Haw Gap #87, which is near Spence Field.

Four major clusters of back-country sites which are subject to black bear incidents can be recognized: Elkmont - Silers Bald (including camps #23, #24, #25, #26, #80 and #81; LeConte (including the lodge, shelter and camp #31); Maddron Bald - Walnut Bottoms (including camps #27, #33 and over 10 illegal sites); and Chasteen Creek area (including sites #44,

#47, #48, #49 and #50). The general pattern for these clusters is closely spaced lines up a drainage or heads of drainages occurring with nearby heavily used trail shelters. When trail shelters are full to capacity there is a tendency to route people down to nearby (1.6 - 4.8 km) sites in drainage heads in order to allow them to remain near the Appalachian Trail.

Observations by Uplands Field Research Laboratory personnel demonstrated the incompleteness of back-country reports. For example, two incidents were reported from Spence Field in 1976, yet at least 32 were known to have occurred. Details of 19 incidents were gathered by interviews in August (none of which were reported in park files). Fifty-two back-country incidents were reported in 1976, yet the real figure was probably greater than 1,000. Low reporting rates for the back-country are due to: (1) a lack of manpower to adequately contact visitors in the back-country, (2) a lack of emphasis upon reporting, (3) visitors may leave the park at a number of points which are unmanned by rangers, and (4) there are no notices encouraging visitors to report incidents.

Property damage incidents by black bears occur primarily (93 percent) from April through September, although incidents may occur during any month of the year. The frequency of incidents often lags the frequency of visitor use by a 1-month interval (Figure 3). For example, due to an

exceptionally early and sunny spring, visitor use in 1976 peaked in April and subsequent damage incidents due to black bears were higher in May. Incidents declined from June to July averaging 7.3 percent from 1964-1976, a phenomenon that is not explained by the analysis of the available data.

Visitor use in Great Smoky Mountains National Park is significantly associated with weekends ($X^2 = 127.78 > 3.84$, $p < .05$), the visitor use on Saturdays and Sundays being about one-third greater than Monday through Friday. Black bear property damage incidents, however, were independent of a weekend pattern ($X^2 = .12 > 3.84$, $p < .05$) and tended to be randomly distributed throughout the week.

Damage incidents appeared to be associated with nighttime during 1975 and 1976 (Table 4). Artificial food sources such as unguarded backpacks, coolers and overflowing garbage receptacles are more available during nighttime. In contrast, there are no overnight camping facilities along Newfound Gap Road, and visitor use and artificial food sources peak 1,000-1,400 hours (U.S. Department of the Interior, National Park Service 1976). The majority of the black bear activity and 80 percent of the personal injuries occurring along Newfound Gap Road occur during the daytime. Activity of free-ranging bears in the park has been shown to peak during crepuscular hours, 0600-1000 hours and 1500-2100 hours (Eubanks 1976). Therefore, exploitation of artificial food sources during the night at

Figure 3. Monthly incidence of black bear property damage in Great Smoky Mountains National Park, 1964-1974, 1975 and 1976, and monthly visitor use.

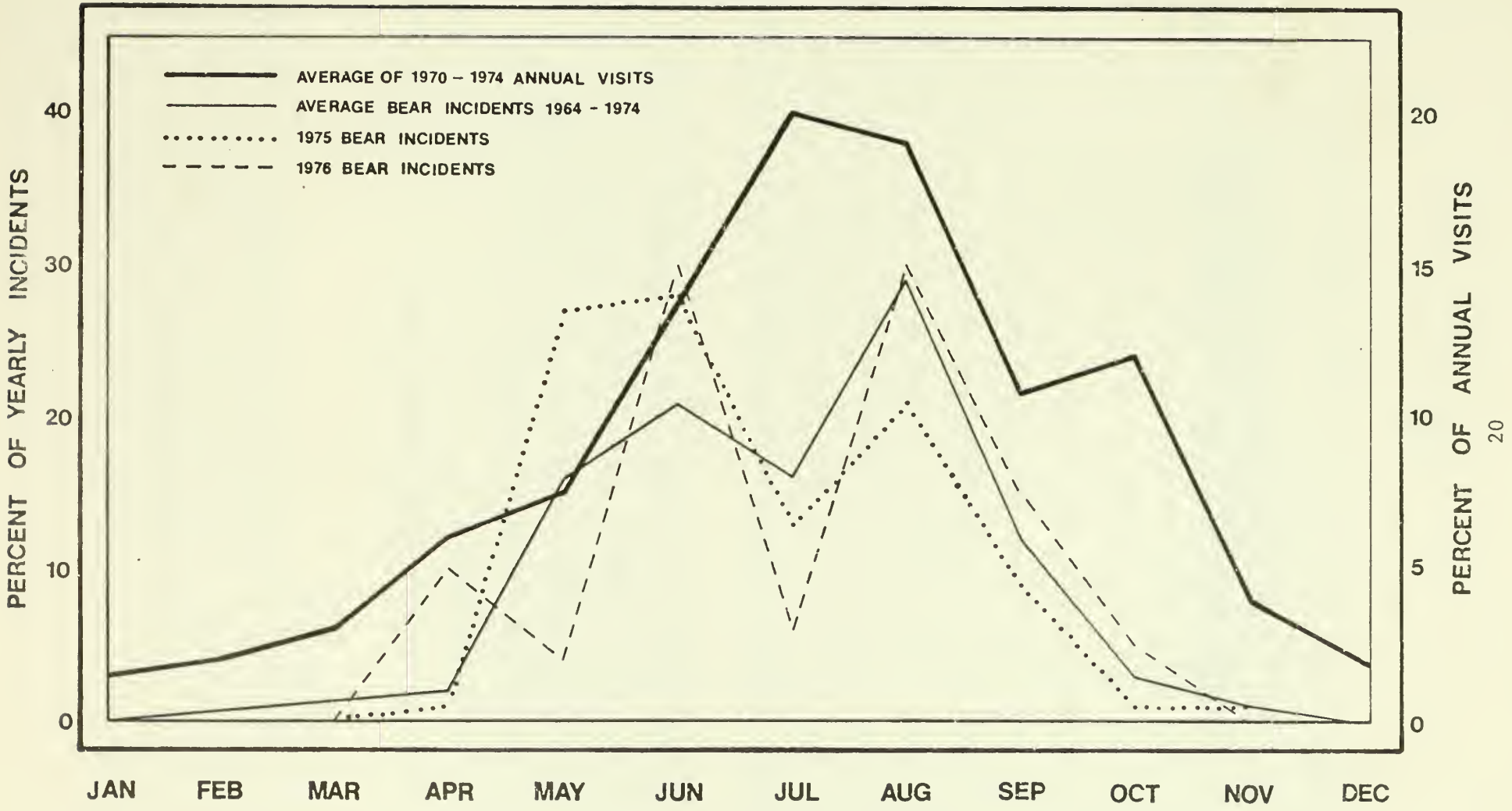
AVERAGE OF 1970 – 1974 ANNUAL VISITS
AVERAGE BEAR INCIDENTS 1964 - 1974
1975 BEAR INCIDENTS
1976 BEAR INCIDENTS
PERCENT OF YEARLY INCIDENTS
PERCENT OF ANNUAL VISITS
0
10
20
30
40
0
5
10
15
20
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Table 4. Reported damage incidents by black bears in relation to time of the day, 1975 and 1976.

	Daytime (0601-2100 hours)	Nighttime (2101-0600 hours)	Total
1975	20 (57%)	15 (43%)	35
1976	41 (39%)	63 (61%)	104

front and back-country campsites and during the midday along Newfound Gap Road both suggest alterations of normal activity patterns.

Management Actions on Bears

A total of 332 captures and relocations of black bears were made from 1964-1976, and 18 bears were destroyed (Table 5). Seven (39 percent) of the 18 deaths were accidental. Large numbers of management actions consistently occurred at Cades Cove, 130 (40 percent), and along Newfound Gap-Clingman's Dome Roads, 63 (19 percent) actions. Other temporary problem areas were corrected with permanent closures (Chimneys Campground in 1969) and with the installation of bear-proof garbage cans. The greatest number of management actions occurred in 1966, 1968, 1972 and 1976, when the greatest number of property damage incidents and human injuries occurred, i.e., management actions tended to be "responsive" rather than "preventive" (Cole 1972).

Research on black bears has been conducted by the University of Tennessee since 1970. During that time, University personnel made 192 captures and releases for research purposes, and an additional 41 management captures of nuisance bears; four accidental deaths and eight serious injuries related to research snaring occurred.

Table 5. Numbers of black bears relocated and destroyed in Great Smoky Mountains National Park.

	Management Captures		Bears Disposed of	Research Captures (Univ. Tenn.)
	Natl. Park Serv.	Univ. Tenn.		
1964	30		2	
1965	-	-	-	-
1966	61		2	
1967	35		4	
1968	56		5	
1969	7			
1970	27	2	1	
1971	14	3		
1972	22	23	2	16
1973	6			39
1974	2			41
1975	17	5	1	40
1976	29	8	1	56

Beeman and Pelton (1976) analyzed bear relocations in the Great Smokies from 1967-1974 and found a strong tendency for bears transplanted farther from their capture point to have a lower probability of homing. Fifty percent of male bears captured for the first time homed and 70 percent of bears transplanted for the second time homed. The authors also found significantly fewer bears released at a park boundary point (Parson's Branch) homed than did bears released at a central park point (Tremont). Both release points were approximately equidistant from the top site, and it was suggested that the difference was due to different poaching levels. Sauer et al., (1969) found that homing of black bears in New York fell off sharply when bears were moved more than 40 miles (64 km). Craighead and Craighead (1972) reached a similar conclusion for grizzly bears relocated greater than 30 miles (48 km). Harms (1976) reported that the transplant success of 85 percent for black bears transferred 23-30 miles (36.8-48 km) in Yosemite National Park was significantly greater ($p < .05$) than the 65 percent success for bears transferred 8 to 17.9 miles (12.8-28.6 km).

A total of 27 bears were captured and relocated 37 times during 1975 and 1976 (Table 6). Transplant success was clearly related to relocation distance, 86 percent for bears transferred 16 to 30 km, but only 9 percent success for bears transferred 3 to 15 km. The difference is very significant ($X^2 = 6.59 > X^2 .025 = 10.8$).

Table 6. Black Bear transplant success in 1975 and 1976 in relation to release distances, Great Smoky Mountains National Park.

Distance Transferred	Number Released	Number Returning	Transplant Success
3 - 15 km	11	10 (91%)	9%
16 - 30 km	21	3 (14%)	86%
31 - 65 km*	5	0 (0%)	100%

*Includes 4 animals given to states of North Carolina and Tennessee.

A total of 230 (76.2 percent) nuisance bears handled were males and 72 (23.8 percent) were females (Table 7). These ratios differ significantly ($X^2 = 12.72 > X^2 .001 = 10.81$) from sex ratio of free-ranging bears in the park, which is 52 percent males and 48 percent females (Beeman 1975). Erickson and Petrides (1964) reported that the majority of dump bears were males and the numbers were significantly different from a 50:50 ratio. The proportion of yearlings and cubs in both the park nuisance bears handled and the wild population studied by Beeman (1975) was 14 percent.

A number of different methods have been attempted to negatively condition nuisance bears in the back-country, including birdshot from a shotgun, beatings with sticks after tranquilizing and hitting conscious animals. These inhumane methods apparently achieved no success and were terminated in 1975, except by the author. In 1976, two attempts were made to negatively condition bears to backpacks by adding lithium chloride to food. In one case, the sow with cubs returned to feed in 4.5 hours; in the second case, the sow was first known to return to the shelter in 2 days. Colvin (1975) achieved better results with lithium chloride and was able to negatively condition six of seven penned bears to honey for periods of 15 to 220 days.

Table 7. Sex and age structure of nuisance black bears in Great Smoky Mountains National Park.

	Male				Female				
	Adult	Sub-Adult	Yearling	Cub	Adult*	Sub-Adult	Yearling	Cub	Unknown
1964-1976	191	2	8	1	30 (9)	2	6	18	15
1975	7		4		4 (4)		2	7	9
1976	16		1		12 (1)	1			6
TOTAL		230					82		30

*Productive females.

DISCUSSION

Variation in the emphasis placed upon reporting is responsible for at least part of the large fluctuation in the number of property damage incidents and personal injuries. Personal injuries are most likely to be recorded since hospital records are also available. Front-country incidents are also likely to come to the attention of a Ranger since most campgrounds have a ranger station nearby. Lowest recording success is for back-country incidents since (1) people may leave the park by many unmanned exits, (2) reporting of incidents is not required, (3) many of the incidents are minor and easily ignored, and (4) Ranger-visitor contacts are lowest in the back-country. The incompleteness of records limited the possibilities for data analysis.

Actual increases in nuisance incidents by black bears appeared to coincide with, or follow by 1-year, significant increases in visitation rates, although records were not judged representative enough to test this hypothesis statistically. Fluctuations in bear populations, behavior or forage availability could also alter incident rates; however, these hypotheses could not be tested. Northcott and Elsey (1971) found that increases in bears taken by hunters in northwestern Ontario coincide with warm temperatures and low precipitation in March, April and May, although it was not clear if the fluctuations were caused by the changes of behavior in bears or hunters in favorable weather or by population

cycles. Forage availability, particularly that of oak mast and berries, is known to flucutate greatly between years in the park (Beeman 1975, Matschke 1967) and could influence bear activity.

Violations of National Park Service regulations were a major contributing factor in personal injuries throughout the 1964-1976 period. Cole (1972) also reported that artificial food sources were responsible for 95 percent of grizzly-caused injuries in Yellowstone National Park during a 40-year period. Records indicated that 46 percent of personal injuries along Clingman's Dome - Newfound Gap Roads were linked to known violations of National Park Service regulations. This agrees with findings of an independent questionnaire sent to visitors receiving both injury and property damage by black bears (Scott et al., 1977) which found that 42.4 percent of those visitors admitted they were guilty in regard to their specific incident, and 63.9 percent felt that rules concerning visitors should be more strictly enforced. Information and warnings concerning black bears may be lacking both in quantity and effectiveness. Burghardt et al., (1972) in a study of visitor attitudes and knowledge in the Great Smoky Mountains National Park found that 51.4 percent of the visitors had been exposed to some sort of park information on bears; however, two sources of information, park literature and nature center exhibit, appeared to be far more effective in transmitting knowledge than were road signs and Park Naturalist talks. A very low proportion (.6 percent) of the visitors surveyed recognized the

association between sows with cubs and personal injuries (Burghardt et al., 1972), suggesting one area that needs greater emphasis in education programs.

Occurrence of black bear incidents at back-country sites was associated with high numbers of visitor nights. Distribution of bear incidents was clustered along the mountain crest (Appalachian Trail) and the adjacent drainage heads, and along one long drainage, Hazel Creek. Clustering of bear incidents at sites and limited observations of marked bears in 1976 suggested that bears may be moving between sites. Merrill (1976) reported that bear depredations on back-country sites in Glacier National Park, Montana, were associated with certain topographic and habitat conditions. In these cases, two trails rather than one trail leads to the sites and the sites are associated with good fishing. Campgrounds reflecting heavy human use in Glacier were also those sites at which bear incidents were most frequent. Highest densities of black bears (one bear per .42 mi^2) in the Great Smoky Mountains occurred along the mountain crest (Marcum 1974) suggesting that at least some clusters of problem campsites are also located in the areas of highest bear density.

Research conducted on free-ranging bears in Great Smoky Mountains National Park (Beeman 1975) indicates that the population exists at the relatively high density of about one bear per 2.6 km^2. A higher

proportion of bears, 68 percent, were adults in comparison to 41-45 percent reported from other areas (Poelker and Hartwell 1973, Jonkel and Cowan 1971, Collins 1973). Bears were relatively old aged and the average survival rate of 78.3 percent was relatively high (Beeman 1975). However, the research area in the park was located in prime bear habitat and is reasonably secure from border influences. Hunter kills outside the park, records of poaching and lower returns of bears relocated to a boundary point (Beeman and Pelton 1976) all suggest that border populations could be far less secure.

Bears everywhere reflect the influence of man. Bear scats collected in campgrounds contained 11 percent garbage; 41 percent of all bear scats collected less than 1.6 km from campgrounds contained garbage (Beeman and Pelton 1976). Although the amounts of garbage decreased with distance from campgrounds, at least some scats were found with garbage from every sector of the Tennessee side of the park (Beeman and Pelton 1976).

Emphasis in management should be placed upon the burgeoning back-country bear-human relations problem, upon reducing sources of artificial foods, upon improving relocation sites for captured bears, and upon more effective means of communicating with visitors. Many scientific questions remain unanswered. For example, the correspondence of the highest nuisance problems in 1968 with apparent poor cub survival (Beeman 1975) that year remains unexplained. In addition, emphasis should be

placed upon developing research methods which provide for a minimum of manipulation and disturbance of natural bear populations.

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Appendix I. Damage incidents by black bears in relation to days of the week, 1975 and 1976.

	Number of Damage Incidents		
	Weekends (Fri-Sun)	Weekdays (Mon-Thurs)	
Year	Observed	Observed	Total
1975	19	28	47
1976	48	68	116

Appendix II. Property damage and personal injuries due to black bears, 1964-1976.

Year	Damage Incidents	Damage Estimate ($)	Decrease/Increase of Incidents from Previous Year (%)	Personal Injuries
1964	49	1210	-	4
1965	-	410	-	3
1966	94	4634	-	21
1967	34	1023	-67%	12
1968	119	2844	250%	7
1969	10	256	-90%	1
1970	62	1838	520%	4
1971	49	1730	-21%	7
1972	107	6241	118%	15
1973	12	825	-89%	3
1974	16	686	33%	12
1975	47	3122	213%	7
1976	116	7518	147%	15

Appendix III. Numbers of sows with cubs involved in personal injuries and property damage incidents in the Great Smoky Mountains National Park, 1964-76.

	Sows with Cubs (5)	Other Bears	Unknown	Total
Personal Injuries	18 (17%)	44 (41%)	45 (42%)	107
Damage Incidents	37 (5%)	341 (48%)	337 (47%)	715

Appendix IV. Numbers of damage incidents attributable to black bears occurring in front-country campgrounds, Great Smoky Mountains National Park.

Campground	Total 1964-74 (%)	1975 (%)	1976 (%)
Cades Cove	187 (41%)	7 (88%)	17 (50%)
Elkmont	92 (20%)	0	10 (29%)
Chimneys (closed 1969)	46 (10%)	-	-
Cosby	56 (12%)	0	1 (35%)
Smokemont	60 (13%)	1 (12%)	6 (18%)
Greenbriar/Deep Cr./ Balsam Mt.	18 (4%)	0	0
Total	459 (100%)	8 (100%)	34 (100%)

Appendix V. Numbers of property damage incidents at back-country sites, Great Smoky Mountains National Park.

Site	Total 1964-1974	1975	1976
LeConte Lodge	3	6	7
LeConte Shelter	2	-	-
Camp Rock	-	1	1
Rough Creek	3	1	9
Lower Buckeye	-	3	-
Dripping Springs	-	1	-
Haw Gap	-	2	-
Walnut Bottoms	9	3	-
Upper Chasteen	-	3	1
Lower Chasteen	1	1	2
Hazel Creek Cascades	3	1	1
Maddron Bald	2	4	7
Guyot Springs	-	1	2
Poke Patch	-	1	4
Cabin Flats	1	1	1
Spence Field	12	-	2
Scott Gap	2	-	-
King Branch	4	-	-
Silers Bald	14	-	6
Tricorner Knob	6	-	1
Cosby Knob	1	-	1
Rough Creek #24	2	-	3
Rough Creek #23	1	-	-
Greenbrier #31	-	-	1
McGhee Springs	1	-	6
Enloe Creek	-	-	1
Medicine Branch	-	-	1
Old Sugarlands	-	-	2
Porters Flat	-	-	1
Mt. Chapman	-	-	2
Inadu Knob	1	-	2
Snake Den	1	-	2
Otter Creek	-	-	4
Hazel Creek #81	-	-	1
Three Forks	1	-	-
Double Springs	4	-	-
Huggins Creek	1	-	-
Ice Water Springs	2	-	-
Pecks Corner	2	-	-

Appendix V Continued

	Total 1964-1974	1975	1976
Illegal Sites	3	-	-
Day Hike Trails:			
Bullhead	-	-	1
Alum Cave	2	9	3
Heavily-used Parking Lots:			
Trail Heads			
Spruce-Fir Lot	1	-	-
Morton Overlook	1	-	-
Fishcamp Prong Turnaround	2	-	-
Rainbow Falls Trailhead	3	-	-
Rich Mt. Trailhead	-	-	1
Grotto Falls Parking Lot	1	-	2
Chimneys Picnic Area	2	-	3

Appendix VI. Location of management actions including capture and relocations and disposals, 1964-76, Great Smoky Mountains National Park.

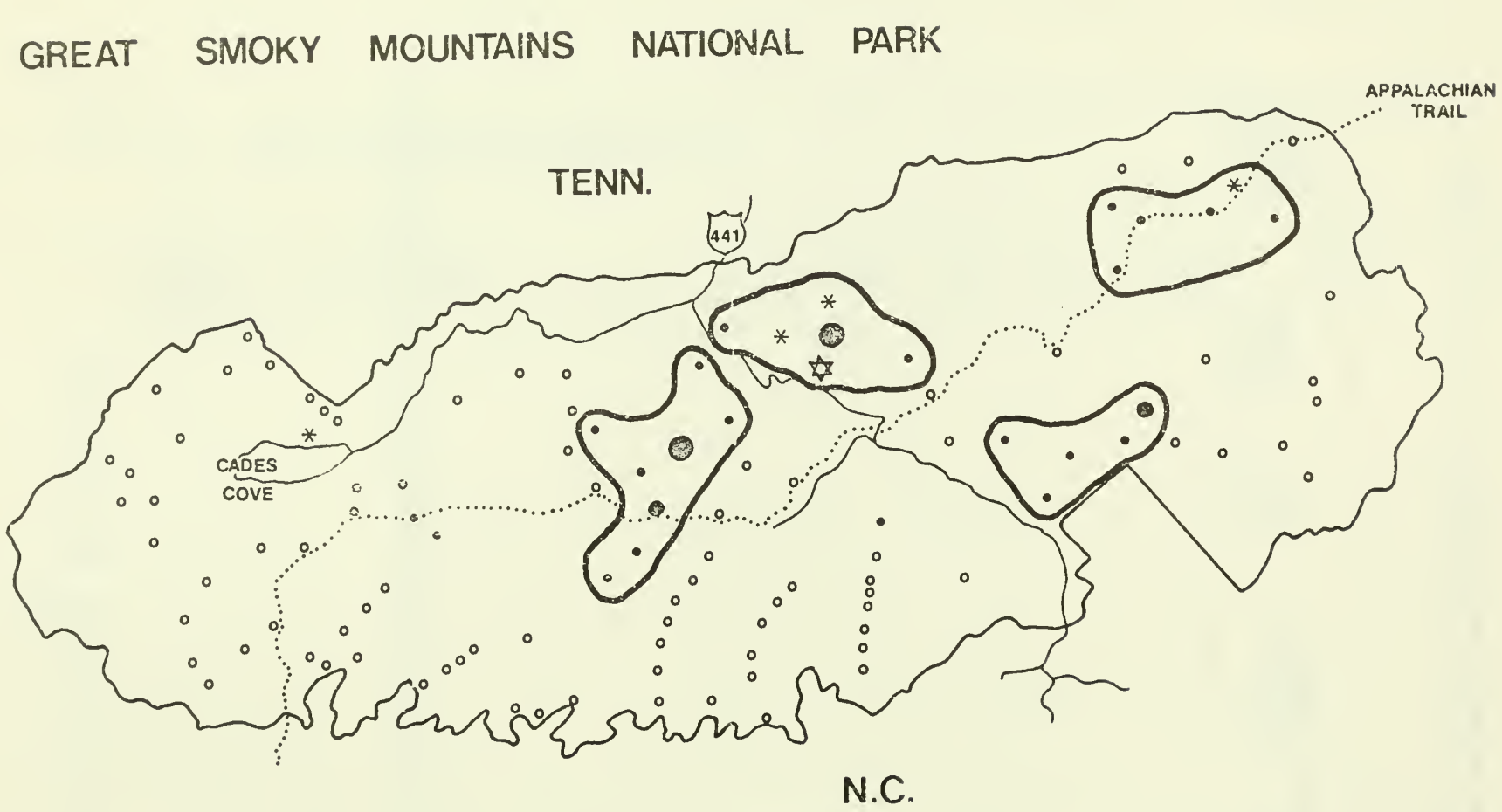
	Cades Cove	Elkmont	Smokemont	Cosby	Green-briar	Newfound Gap/ Clingman's Dome Roads	Sugarlands Area	Chimneys Campground
1964	9	3	1	3	2	44		
1966	9	16	2	12		13	2	7
1967	3	6	4			12		3
1968	28	6	8	11		5		4
1969	4	1		1		1	1	
1970	26			4	1	3		
1971	13		1			2		
1972	27		3			8		
1973	4					2		
1974						2		
1975	3	1				3		
1976	4	2	5			8		

(Cont.)
Appendix VI. Location of management actions including capture and relocations and disposals, 1964-76, Great Smoky Mountains National Park.

	Chimneys Picnic Area	Balsam Mt.	Twin Creeks	Cataloochee	Hazel Creek	Spence Field	Silers Bald	Route 201	Blue Ridge Parkway	Alum Cave Trail	Deep Creek
1964		2	2	2							
1966	2										1
1967		2	1								
1968							1	1			
1969											
1970											
1971											
1972	1										
1973											
1974				1							
1975	2								2	4	
1976	7				1	1					

Appendix VII. Known mortality and injuries of black bears in Great Smoky Mountains National Park.

	Management Actions				
	Intentional Kills	Accidental Kills	Motor Vehicle	Research Deaths	Research (Snare) Injuries
1964	2		2		
1965	(No Data)				
1966		2			
1967	3	1	3		
1968	5		4		
1969		1			
1970	1		3		
1971			2		
1972		2	3	1	2
1973			1	1	
1974			1		3
1975		1			3
1976	1		1	2	1



Appendix VIII. Number of back-country bear incidents 1975-1976.

- ∘ Back-country sites with no incidents reported.
- • Back-country sites with 1-5 reported incidents.
- Back-country sites with 6-9 reported incidents.
- Back-country sites with 10-15 reported incidents.
- * Trails with 1-9 incidents reported.
- ✡ Trails with >10 incidents reported.

Cluster areas of problem sites:
1) Mt. LeConte
2) Elkmont - Silers Bald
3) Maddron Bald - Walnut Bottoms
4) Chasteen Creek - Heintooga