BLACK BEAR DAMAGE IN VIRGINIA

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ABSTRACT

We examined records of black bear damage in Virginia on Shenandoah National Park, (SNP) (1979-1988) and non-Park lands (1973-1988). Mean annual damage was $5,470 on non-Park lands and $1,217 on the Park. Corn and beehives accounted for 79 percent and personal property for 72 percent of the economic loss on non-Park and Park lands respectively. Young males were responsible for most damage on non-Park lands while adults of both sexes caused most damage on SNP. Over 70 percent of bear damage incidents in the state occurred either on the Park or on land immediately adjacent to the Park. Moving bears to alleviate damage is expensive and may only move the problem to a new location.

INTRODUCTION

Recently, attention has been focused on interactions between humans and bears, and on management of problem bears (Bromley, 1989). In North America, problem black bears (Ursus americanus) damage forests, beehives, agricultural crops, livestock, and personal belongings (Jorgensen et al, 1979, Lord 1979, Baumgartner et al., 1987). In Virginia, most bear-caused damage is to beehives and agricultural crops [Virginia Department of Game and Inland Fisheries (VDGIF) 1977-1988]. Biologists and wildlife managers use different approaches to reduce bear damage, but no technique appears fully successful in eliminating damage. This paper examines the types and extent of damage caused by black bears in Virginia and contrasts damage on National Park Service land and non-Park land.

METHODS

Data was provided by the VDGIF and the Resource Management Office of SNP. The former reported damage on National Forests and state and private land and the latter reported damage on SNP. VDGIF data dated back to 1973 and SNP data dated back to 1979.

Records on agricultural and livestock production were gathered from the Virginia Agricultural Statistics Service (VASS) and the Virginia Crop Reporting Service (VCRS).

Data were analyzed using standard statistical procedures (SAS Institute 1982). Simple Pearson correlation analysis was used to examine relationships between bear demographic parameters and damage parameters. ANOVA was used to test for differences among means and students-t was used to test for differences between 2 means. Chi-square analysis was used to compare age and sex distribution of problem bears. Statistical significance was set at probability level 0.05.

RESULTS

Damage on Non-Park Service Lands

During 1973-1988 the number of reported bear damage incidents ranged from 14-59 and averaged 31/year (Table 1). The total economic value of damage over the 16-year period was $87,514 ($\bar{x}$ = $5,470/year). Damage to corn (Zea maize) crops accounted for 31 percent of reported damage incidents and 41 percent of their total economic value. Another 22 percent of incidents and 38 percent of

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economic value involved beehive destruction. While 24 percent of damage incidents fell into a miscellaneous category (trash cans, screen doors, etc.), these incidents accounted for only 4 percent of the economic value of damage. The value of damage to corn and beehives was similar (ANOVA $P > 0.05$), while the value of damage in all other categories was less ($P < 0.05$) than the former.

Bear damage complaints peaked in May then again August (Fig. 1). The May peak coincided with the peak in beehive damage complaints while the August peak coincided with the peak in corn damage complaints. Damage to livestock was highest in May and damage to fruit orchards was relatively constant throughout the summer months.

Seventy-one percent of all bear damage incidents occurred in just 7 of the 100 counties in Virginia (Fig. 2); a minimum of 35 counties have bear populations. Six of the seven were adjoining counties in the mountainous region of the state and 1 county was in the coastal plain. Seventy-two percent of corn damage incidents occurred in 3 counties, 55 percent of beehive occurred in 4 counties, and 59 percent of orchard damage occurred in 1 county.

During the 16-year period, 105 bears were reported destroyed by game officials or landowners with permits to do so and 5,517 were harvested by hunters (Table 2). During 1970-1988, state biologists captured and moved 432 bears; 46 percent were captured in the last 5 years (Table 3). Seventy-five percent of those captured as nuisance bears were males (X^2 test, $P < 0.05$) and 58 percent were ≤ 1.5 years old (X^2 test, $P < 0.05$)(Table 4). Only 24 percent of all nuisance bears captured were 4 years old or older. Fifty-eight percent of all bears captured weighed between 45-90 kg.

Forty-three percent (186 of 432) of all nuisance bears trapped and moved were eventually recovered. Of those recovered, 44 percent were recovered in the county of release and 47 percent were recovered in a different county ($P > 0.05$). Eighty-five percent of all nuisance bears captured were captured in a 6 county area which closely coincided with those counties receiving the most damage.

Damage on National Park Service Lands

During the 10-year period 1979-1988, 297 incidents causing damage estimated at $12,171 were reported. Damage to personal items (tents, clothes, etc.) and food accounted for 68 percent of the incidents and 72 percent of the estimated economic value (Table 5). Thirteen percent of all incidents were direct confrontations between bears and people. No serious injuries occurred.

The number of incidents per year was relatively constant during 1979-1984 (Range = 26-64) but decreased significantly ($P < 0.05$) during 1985-1988 (Range = 8-13). Damage was reported in each month except February and March, and the number of incidents reported peaked in August. Eighty-seven percent of all incidents occurred between May and August (Fig. 3).

The Park occupies parts of 8 counties, but 91 percent of all incidents occurred in just 3 counties. The 2 counties in the Park with the most reported bear damage incidents were the same 2 counties reporting the most bear damage incidents in the State of Virginia.

The Park was further divided into districts (north, central, and south) and into frontcountry (picnic and camping areas along paved roads) and backcountry (remote hiking and camping areas). A similar number of incidents were reported in the north ($\bar{x} = 13.1$) and central ($\bar{x} = 13.5$) districts, but significantly fewer (ANOVA, $P < 0.05$) were reported in the south district ($\bar{x} = 3.0$). Most (61 percent) incidents took place in the backcountry including 75 percent of those involving personal property (Table 6). However, 38 percent of all bear/people confrontations and 33 percent of all bear observations were in the frontcountry.

In 71.4 percent of the reported bear incidents in SNP, the age class (adult, yearling/cub) of the offending bear was recorded. In those instances, ($\underline{N}$ = 212), adults accounted for 73.6 percent and yearlings/cubs accounted for the remainder. Sex of offending bears was reported in only 51 incidents, and 39 (76 percent) of those were females.

DISCUSSIONS

Bear incidents on SNP and incidents on state and private land surrounding the Park were closely related because SNP is the center of bear activity in Virginia, i.e., 62 percent of all damage in Virginia occurred in the 8 counties bordering the Park. Carney (1985) and Garner (1986) reported that SNP has an extremely dense bear population (1 bear/0.96-1.49 km^2) and that bears from the Park often move on to adjacent state and private land where they cause damage.

Most damage on state and private lands (non-Park lands) was corn destruction followed by damage to beehives, livestock, and orchards. However, the economic value of the damage was only a fraction of the economic value of the resource. While reported bear damage averaged only $5,470/year, the average annual value of corn and livestock (cattle, sheep, and swine) in the 7 Virginia counties reporting the greatest damage was 19.1 and 2.5 million dollars, respectively (VASS 1986-89, VCRS 1985) (Tables 7 and 8). Honey and apple production in the state was valued at 2.5 and 42.0 million dollars respectively (VASS 1989). In an earlier study of the economic value of black bears in Virginia, Davenport (1953) reported that the state bear population estimated at 1,547 bears in 1950 was responsible for damage to sheep and corn valued at $2,232 per year during 1941-50. The counties receiving the greatest damage then were the same as those receiving the greatest damage now.

As in other U.S. National Parks with black bear populations (Merrill 1978, Keay and Van Wagtendonk 1983, Graber 1986), bear incidents in SNP primarily involved damage to personal property. Garner and Vaughan (1989) recently demonstrated that despite the high bear density (Carney 1985) and the high visitation rate (about 2 million people per year), bear incidents in SNP were on the decline. They attributed the decline to proper management and research on Park bears (bear-proof garbage cans, removal of artificial food sources and frequent capture by researchers). Garner and Vaughan (1989) further noted that most bear incidents had moved from the frontcountry to the backcountry for the reasons noted above, plus the removal of frontcountry nuisance bears from the Park. A similar phenomenon was noted in Yosemite National Park, California (Keay and Van Wagtendonk 1983, Hasting and Gilbert 1987).

Young male bears were most frequently identified as nuisance bears on non-Park lands while adults of both sexes were most frequently identified on Park lands. Both trends, however, were consistent with previous reports. Rogers et al. (1976) and Garshelis (1989) in Minnesota reported that young and very old males were the most frequent offenders while Keay and Van Wagtendonk (1983) reported that bears causing damage in Yosemite National Park were most often adults. Part of the difference may be due to the age and sex structure in a protected versus an unprotected population and part may be due to accuracy in reporting. The age and sex ratios of nuisance bears reported by state biologists for non-Park lands are likely accurate because in each case the bears were handled and teeth taken for aging. In SNP, age and sex of nuisance bears was most often determined by observation from a distance. Thus, age (adult or yearling/cub) was determined by size and the tendency for Park visitors to report bears as "big" bears would

result in a bias toward adults. Sex was rarely reported and usually depended on the presence of a cub resulting in a reporting bias toward females. Another explanation may be that most bears causing damage on non-Park lands are young dispersing males while bears causing damage on Park lands are resident adults.

A high percentage (43 percent) of bears trapped by the state were eventually recovered and most (81 percent) of those were recovered in a different county than released. Although only implied by a gross examination of the data, a closer look at individuals suggested that many recovered bears were attempting to home, a common phenomenon among bears (Hagar 1974, McArthur 1981, Massopust and Anderson 1984, Rogers 1986, Brannon 1987). State and Park biologists manage bear damage by moving nuisance bears to a distant location. While this alleviates the immediate problem, the efficacy of this procedure in solving the overall problem of nuisance bears has not been evaluated. The rate of recurring damage by moved bears, the homing rate, and the survival rate has not been determined. The cost in both time and real dollars involved in trapping and moving bears to a new location far exceeds the cost of bear damage. Since many of the bears causing damage on state and private lands originate from SNP, a joint evaluation of the bear damage control efforts might result in a more cost effective method of dealing with the problem.

In conclusion, while bear related damage has little economic impact on the commodity being damaged, individuals may suffer catastrophic loss in either an agricultural or outdoor recreation setting. Further, the long-term effectiveness of techniques to manage bear damage has not been properly evaluated and attention should be focused in that direction.

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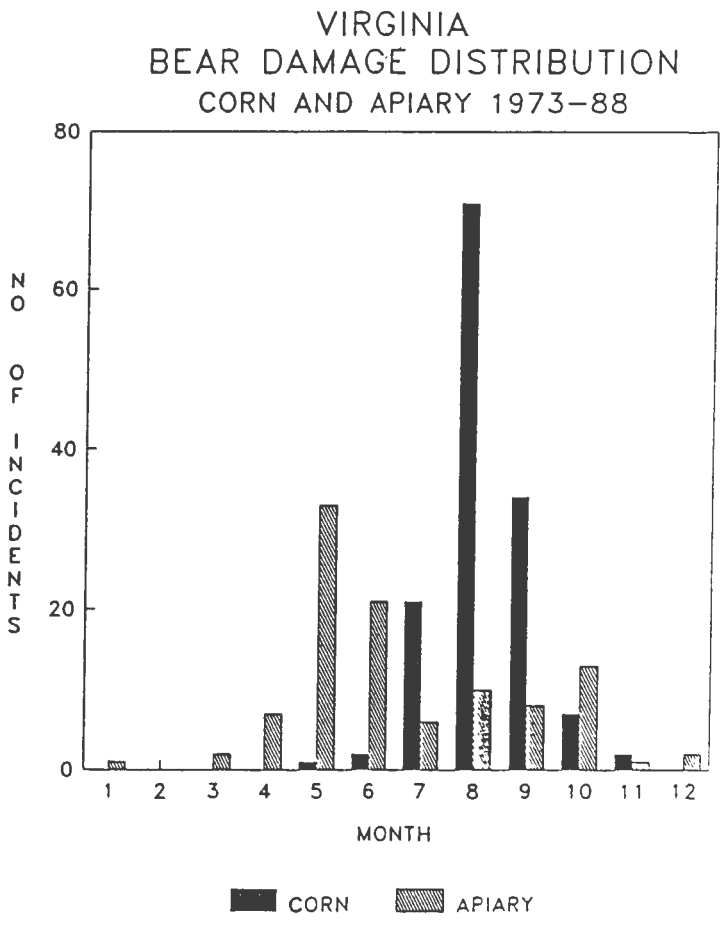

Figure 1. Annual distribution of black bear damage to corn and beehives in Virginia, 1973-88.

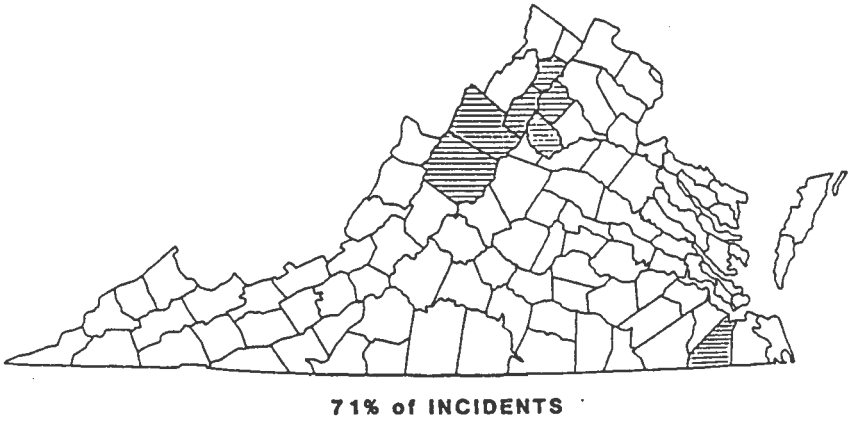

Figure 2. Location of 71 percent of all black bear damage in Virginia, 1973-1988.

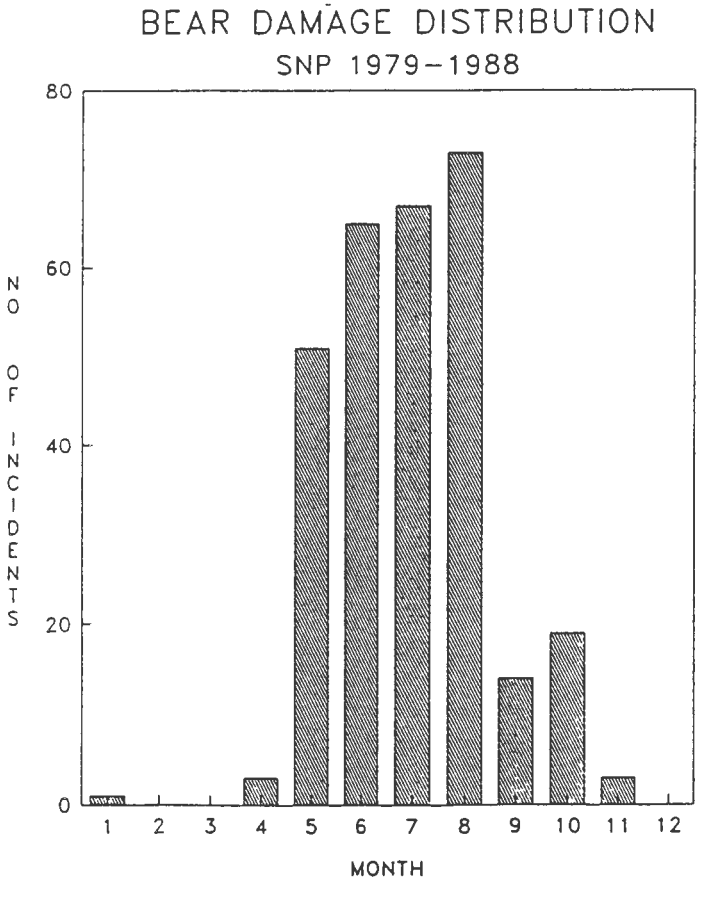

Figure 3. Yearly distribution of black bear incidents in Shenandoah National Park, Virginia, during 1979-80.

Table 1. Amount and value of black bear damage in Virginia during 1973-88.

Damage category	$\bar{x}$ number of incidents/yr.	% of incidents	$\bar{x}$ annual value ($)	% of value
Agriculture	9.5	31.0	2,235	40.9
Apiary	6.6	21.6	2,061	37.7
Livestock	4.9	15.9	558	10.2
Orchard	2.4	7.9	414	7.6
Other	7.3	23.6	202	3.7
Totals	30.7		5,470	

Table 2. Number of black bears harvested and killed as nuisance bears in Virginia, 1973-88.

Period	Number harvested	$\bar{x}$/yr.	Number killed by permit	$\bar{x}$/yr.
1973	1,354	225.7	50	8.3
1979-83	1,581	316.2	49	9.8
1984-88	2,582	516.4	6	1.2
Totals	5,517	344.8	105	6.6

Table 3. Number of nuisance black bears trapped in Virginia during 1970-88.

Period	Number captured	Percent of total	$\bar{x}$ captured/ year
1970-73	55	12.7	13.8
1974-78	83	19.2	16.6
1979-83	95	22.0	19.0
1984-88	199	46.0	39.8
Totals	432	99.9	24.0

Table 4. Age class of nuisance bears captured in Virginia during 1973-88.

Age	Males (%)	Females (%)	Total (%)
0.5 - 1.5	185 (56.9)	67 (62.6)	252 (58.3)
1.6 - 3.5	67 (20.6)	8 (7.5)	75 (17.4)
3.6 - 7.5	63 (19.4)	21 (19.6)	84 (19.4)
>7.5	10 (3.8)	11 (10.3)	21 (4.9)
Totals	325 (75.2)	107 (24.8)	432

Table 5. Black bear damage by category in Shenandoah National Park, Virginia, 1979-88.

Category	$\bar{x}$ number of incidents/yr.	% of incidents	$\bar{x}$ annual value ($)	% of value
Personal items	20.3	68.4	879	72.2
Confrontations	3.9	13.1	11	0.9
Observations	1.8	6.1	0	0
Other	3.7	12.5	328	26.9
Totals	29.7		$1,218	

Table 6. Frontcountry versus backcountry black bear incidents in Shenandoah National Park, Virginia, 1979-88.

Category	Backcountry	Frontcountry	Unclassified	Total
Personal items	153	50	0	203
Confrontations	19	15	5	39
Observations	8	6	4	18
Other	1	21	15	37
Totals	181	92	24	297
Percent	60.9	31.0	8.1	

Table 7. Amount and value of corn in 7 Virginia counties with a high incidence of black bear damage.[1]

County	Thousands of ha harvested	Bu/ha	Dollar value (10^6)
Augusta	9.6	203.7	5.23
Madison	5.3	206.6	2.91
Page	2.9	194.1	1.52
Rappahannock	1.2	192.1	0.61
Rockingham	19.6	217.4	4.27
Suffolk	8.0	199.3	4.24
Warren	0.6	188.7	0.29
Totals	47.2		19.07
Virginia Totals	293.2	190.7	149.30

[1]All values are mean annual values for the 10-year period 1979-88.

Table 8. Number of livestock on inventory in 7 Virginia counties with a high incidence of black bear damage.[1]

	Number (10^3)			
County	Cattle	Sheep	Hogs	Total
Augusta	99.3	20.4	13.8	133.5
Madison	35.8	0.5	6.1	42.4
Page	19.6	1.9	4.9	26.4
Rappahannock	13.4	0.5	1.4[3]	15.3
Rockingham	114.1	28.2	19.8	162.1
Suffolk	6.5	0	23.7	30.2
Warren	11.1	1.0	8.3[3]	20.4
Totals	299.8	52.5	78.0	430.3
Virginia Totals	1,772.0	152.4	551.0	2,475.4
Values Virginia[2]	304.8	5.6	87.2	397.6

[1]All values are mean annual values for the 9-year period 1981-89, with the noted exceptions.

[2]Millions of dollars.

[3]Three year mean for 1981-83.