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ABSTRACT: We surveyed 62 hunting clubs in the batture of the Mississippi River in Arkansas and Mississippi to determine the extent and severity of black bear (Ursus americanusl damage. Bear damage was more prevalent in Arkansas (70.6%) than in Mississippi (11.8%). Damage to deer- stands was most common (43.8%), followed by damage to buildings (22.9%), getting in garbage (12.5%) and damage to wildlife food plots (10.4%). Cost estimates of bear damage averaged approximately $40 per incident over the past 5 years. Most (90.9%) clubs rated bear damage as either a slight nuisance or not important at this time, and half have taken no preventive measures to reduce such damage. However, only 18.5% of clubs experiencing frequent damage favored increasing local bear populations, whereas 66.7% of clubs with little or no damage were in favor of increasing local populations. Future management strategies for black bears in the Mississippi Alluvial Valley should include effective public relations and education programs to help minimise potentially negative public opinion of bears in the region.

Once common throughout the Mississippi Alluvial Valley (MAV), black bears were practically eliminated from the region by the early 1900's (Cook 1943, Lowery 1981). However, a small remnant population persisted on the White River National Wildlife Refuge (W'RNWR) in southeastern Arkansas (Rogers 1973, Smith 1985). This population has increased substantially in recent years (Smith 1985) and is now estimated to be the largest population of black bears in the MAV (Smith 1985, Black Bear Cons. Comm. 1992).

Most habitat occupied by black bears in the MAV lies within the batture (Weaver 1990), the land between the **flood** control levees of the Mississippi River and it's tributaries. The majority of the batture is in commercial forest lands (Sternitzke 1975) which are either leased to, or owned by, numerous private hunting clubs. Because these clubs control access to most of the batture, their attitudes and actions regarding black bears may be the primary determinant of long-term viability of bear populations in the MAV. Clark et al. (1991) suggested that landowner attitudes towards black bears may be influenced by episodes of bear damage. Furthermore, Clark et al. (1991) stated

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that damage was primarily a function of bear density and predicted that an increase in bear numbers in the MAV would result in an increase in damage.

To test these hypotheses, we developed a questionnaire to determine the extent, severity and types of black bear damage in the MAV of Arkansas and Mississippi and to assess the influence of bear damage on attitudes of hunting clubs within the MAV towards bear presence and population levels. Our objectives were to: 1) evaluate trends in bear sightings and damage incidents, 2) examine differences in hunting club attitudes towards bear population levels relative to damage occurrence, and 3) estimate economic impact of bear damage in the MAV.

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METHODS

Lists of all Arkansas and Mississippi hunting clubs within the batture and within 40 miles of the WRNWR L = 62) were obtained from wildlife officers and biologists responsible for assisting these clubs with wildlife management practices. The 40-mile radius approximates the effective "area of influence" of the WRNWR black bear population, based on movement and dispersal patterns of black bears in riparian ecosystems of the southeastern United States (Taylor 1971, Smith 1985, Weaver 1990, White et al. 1994).

During June 1995, we mailed a cover letter and a questionnaire to the president or the resident caretaker of each club according to procedures by Dillman (1978). We used only a single mailing because of a high percentage response to the initial survey.

The survey consisted of 14 questions. Three questions addressed the club demographics of acreage, membership, and number of years under lease or ownership. The frequency of bear sightings and the frequency, type and cost of bear damage were addressed in 8 questions. The remaining 3 questions concerned the club's attitudes toward bears and bear damage.

We used chi-square tests to evaluate differences between observed and expected frequencies of categorical responses (Siegel 1956). Differences in club acreage and number of years owned or leased .were compared among attitude types using Kruskall-Wallis tests (Siegel 1956) because 'these variables were not normally distributed. Linear regressions (Myers 1990) were used to detect any significant trends in bear sightings and damage incidents over time and to develop predictive equations of bear sightings, damage incidents and costs. We considered differences significant at a = 0.05 for all comparisons.

RESULTS

Of 62 surveys mailed, 51 (82.2%) w~ completed and returned. Of these, 17 were frc clubs in Mississippi and 34 from Arkansas. Return rates from Mississippi (81.0%) at Arkansas (82.9%) did not differ (xz = 0.045, 1 d P = 0.84).

Mean size of clubs responding was 3153 acre; (SE = 499, n = 51) with an average membership of 41 (SE = 10, n = 51). Mean years of club lease/ownership was 31 (SE = 2, n = 49).

Although 43 (84.3%) of the clubs reported seeing a bear or bear sign on their property during the past 10 years, the number of such clubs has been increasing (r2=0.907, 10 df, P < 0.001) annually from 25.5% in 1984 to 62.?°lo in 1994 (Figures 1,2). According to these data, annual bear sightings would be probable on all 62 clubs in the sample area by the year 2008. There was no difference between Mississippi and Arkansas in the proportion of clubs reporting bear presence (x2 = 0.324, 1 df, P = 0.588). However, more clubs in Arkansas reported bear damage than in Mississippi (xz = 15.85, 1 df, P < 0.001). Damage to deer stands was most frequent (43.8%), followed by damage to buildings (22.9°/x) and getting into garbage (12.5°!0). Damage to wildlife food plots and miscellaneous damage each accounted for 10.4% of all incidents. Miscellaneous damage included destruction of club road signs, broken tree limbs (feeding activity) and damage to diesel equipment, ice chests, vehicles, and utility poles. Bear damage was reported as most common during summer (32.1%) and fall (53.6%).

Although 48% of all clubs experiencing damage have taken preventive measures, those clubs that considered damage to be unimportant were less likely (Xz = 7.08, 1 df, P = 0.009) to do so than clubs that considered damage to be either a slight nuisance or intolerable. Preventive measures included removing garbage from camp areas, covering wooden structures with metal or wire, and changing from wooden to metal deer stands.

Because the relationship between damage incidents and time was curvilinear, a log transformation of damage as the dependent variable was performed which linearized the relationship (ill = 0.977)(Figure 3). From these data, annual bear damage incidents may double by the year 2005. Cost estimates of bear damage over each of the past 5 years indicate an increase (ill = 0.927, 4 df, P = 0.033) in annual costs concomitant with an increase (r2 = 0.977, 4 df, P = 0.002) in damage incidents (Figure 4). Average cost per incident over the past 5 years was $39.62 ($7,250/183 incidents).

Overall, when categorizing their attitudes towards bear presence and sightings, clubs that had experienced damage did not differ (V = 2.86, 1 df, P = 0.093) from those with no damage (Table 1). However, more clubs in Mississippi had a positive attitude toward bears than in Arkansas (xz = 6.39, 1 df, P = 0.012). Additionally, clubs that had experienced damage were more likely (X' = 8.75, 2 df, P = 0.013) to want the bear population decreased than those without damage (Table 2). All clubs without damage indicated that the bear population should be either increased or held at present levels, whereas 36% of clubs experiencing damage desired a reduction of the bear population. Opinions also differed (xz = 16.79, 2 df, P < 0.001) by state, with 71.4% of Mississippi clubs desiring an increase in the local bear population, compared to only 18.5% of Arkansas clubs. There was no difference (H = 0.75, 2 df, P = 0.682) in years of club leaselownership, or in club acreage (H = 3.27, 2 df, P = 0.195) with respect to club opinion on bear population levels.

DISCUSSION

Although black bears are present within the batture of both Arkansas and Mississippi, bear damage occurs predominately in the Arkansas batture west of the Mississippi River. This finding parallels that of Clark et al. (1991) regarding the relationship between bear damage and bear population density in the Ozark Mountains of Arkansas. Currently, bear numbers are greatest in the batture west of the Mississippi River (Smith 1985, Shropshire 1990, White et al. 1994). However, bear sightings and bear damage throughout the batture have been significantly increasing in recent years. Consequently, as bear numbers increase east of the Mississippi River, bear damage incidents in Mississippi will likely also increase.

Hunting clubs that experienced damage harbored more negative attitudes towards bears than clubs without damage. Thus, the currently widespread positive attitudes towards bears among Mississippi hunting clubs may change with an increase in damage incidents. This underscores the need for proactive strategies to minimize the nuisance effect of bear damage in Mississippi as bear numbers increase. For example, by using metal deer stands and removing garbage from camp areas, Mississippi hunting clubs may be able to prevent over 56% of bear damage before it becomes a problem.

The economic impact of bear damage in the MAV is minimal compared to that of other regions (Lord 1979, Vaughan et al. 1989, Clark et al. 1991). Cost estimates of bear damage in the MAV currently average approximately $40/incident. Given observed trends in bear sightings and damage incidents, average per club financial liability would be only $66.32/year by the year 2008, when it is projected that bears will be present annually on all 62 clubs within the study area. However, clubs in areas of highest bear densities will probably incur a larger percentage of the financial costs.

The survey responses indicate that, compared to Mississippi, hunting clubs in the Arkansas batture have more bears and want less. Conversely, clubs in the Mississippi batture have fewer bears and want more. Future management strategies to bolster Mississippi black bear populations may consider the possibility of translocating bears from high density areas in Arkansas to areas of suitable habitat in Mississippi where landowner and public attitudes are positive toward bears. Such translocations should be coupled with landowner education about, and ongoing assistance with, bear damage incidents to insure long-term maintenance of these positive attitudes. Although it is doubtful

that translocations alone can effectively reduce problems associated with bear damage in the Arkansas batture, the effort may be viewed by the local public as a positive response to a perceived problem. It could serve also as a source of bears for possible relocation to suitable areas of Mississippi currently either unoccupied or with low densities of black bears.

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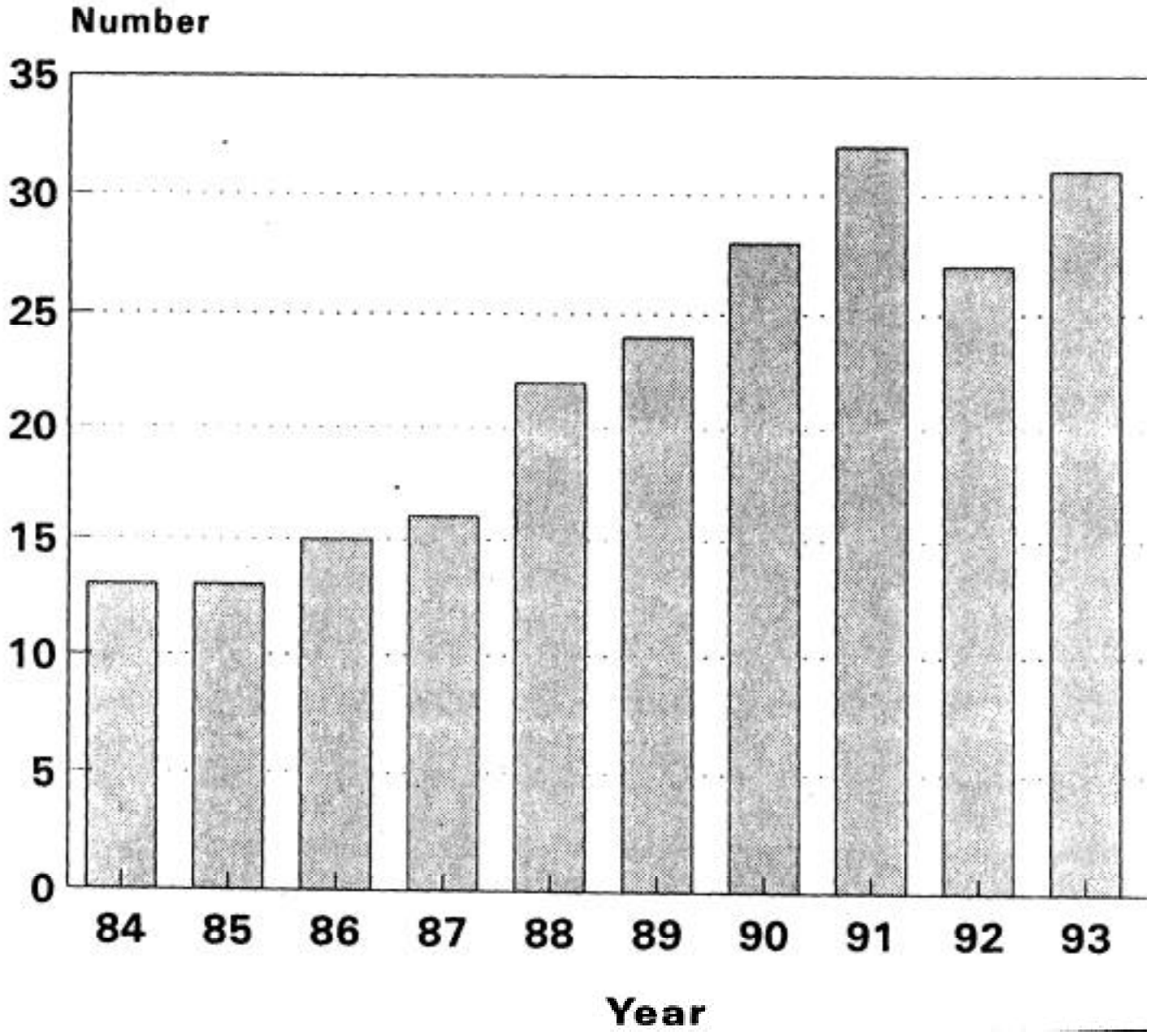
Table 1. Hunting club attitudes in the batture of Arkansas and Mississippi toward black bear presence on club property by state and by damage occurrence.

	State		Damage incidents	
Response (%)e	AR	MS	Yes	No
Enjoy	41.2	76.5	41.2	65.0
Cautious	35.3	5.9	29.4	15.0
Nuisance	17.6	11.8	11.8	10.0
Dangerous	5.9	0.0	5.9	0.0
Wish bears were not there	14.7	5.9	11.7	10.0

Totals > 100% because some respondents indicated > 1 category.

Table 2. Hunting club desires in the batture of Arkansas and Mississippi regarding local black bear population level by state and by damage occurrence.

	State		Damage incidents	
Response (%)	AR	MS	Yes	No
Increase	18.5	71.4	24.0	60.0
Present level	48.1	21.4	40.0	40.0
Decrease	29.6	7.2	32.0	0.0
Eradicate	3.7	0.0	4.0	0.0


Number
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30
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20
15
10
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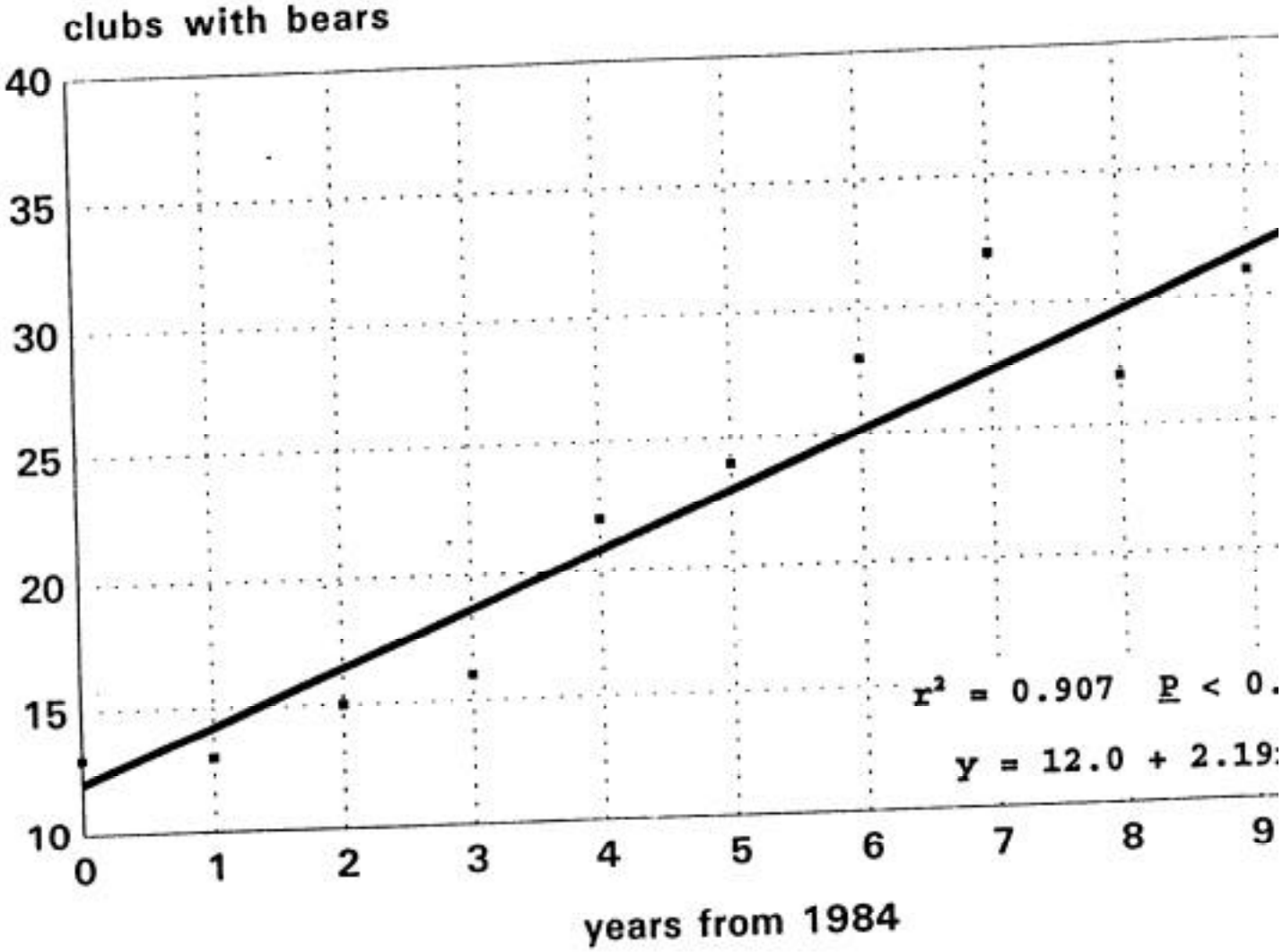
0
84
85
86
87
88
89
90
91
92
93
Year


clubs with bears
40
35
30
25
20
15
10
0
1
2
3
4
5
6
7
8
9
years from 1984
r² = 0.907 P < 0.
y = 12.0 + 2.19