

HUNTER EFFORT AND SUCCESS RATES OF HUNTING BEARS WITH HOUNDS IN VIRGINIA

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Abstract: Hunting black bears (*Ursus americanus*) with hounds is viewed by many as unethical, and in 5 of 7 states where the issue was brought to public ballot, bear hunting with the use of hounds was closed. In Virginia, hunting bears with hounds is traditional and the favored method of hunting. We documented hunting effort and success using 3 survey methods. We accompanied houndsmen on 190 hunts during training and firearm seasons. We documented 241 hunts using mail surveys and we documented 828 hunts using hunter diaries. Virginia's houndsmen chased bears in $\leq 74\%$ of hunts and harvested bears in $\leq 17\%$ of hunts. Depending on survey method, bears were treed in 24–44% of hunts. Both the number of houndsmen and hounds ranged from 8–11/party and chases lasted 2–5 hours. Houndsmen exerted 8 hours of effort/hunt, although hounds actively hunted only half as many hours (4.2 hrs/hunt). Houndsmen were able to ascertain the gender of 67% of treed bears. Field surveys were useful, as they gave biologists first-hand knowledge of this method of hunting and removed some of the bias associated with hunter recall. Although the hunter diary and mail survey contained recall bias, they provided larger sample sizes and allowed us to survey large geographic regions. The mail survey received a higher response rate than the hunter diary; however, success rates documented in field surveys and the hunter diary were more consistent than in the mail survey.

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The use of hounds to hunt bears is controversial in some parts of the United States (Elowe 1990). Voters, with the urging of animal rights advocates in Colorado, Oregon, Washington, and Massachusetts, have successfully limited bear hunting by closing black bear hunting seasons, outlawing hunting bears over bait or with hounds, or banning hunting bears in the spring when sows are accompanied by small cubs. However, they did not close bear hunting seasons in Idaho and Michigan.

Hunting bears with hounds is traditional for Virginia hunters who hunt exclusively bears. Hunters can also hunt bears by stalking them, but hunting bears over bait is illegal (Virginia Department of Game and Inland Fisheries 1996). Bears can also be harvested incidental to the white-tail deer (*Odocoileus virginianus*) and wild turkey (*Meleagris gallopavo*) seasons with the purchase of a big game license. Bears can be harvested during the month-long deer archery season in October and in the last week of the deer firearm season in November. During the late deer rifle and muzzleloader season, deer hunters can take bears (in certain counties) during the last 2 weeks of December. The late deer rifle and muzzleloader season and late turkey season overlaps with the bear firearm season. Houndsmen and still hunters can harvest bears during the bear firearm season, which occurs during December. In 1992, houndsmen gained a month-long hound training season in September. During the training season, houndsmen are not allowed to carry a firearm or harvest a bear.

Harvest data from Virginia Department of Game and Inland Fisheries documented success rate by method of hunt. In 1995, 13% of 602 bears harvested were killed by bow hunters, 34% were killed by deer hunters during the rifle season and the deer muzzleloader season, and 52% were killed by houndsmen and still hunters in the bear firearm season. In 1996, bow hunters killed 9%, deer hunters reported taking 28%, and houndsmen and still hunters registered 63% of a harvest of 623.

Mail surveys have been used to document harvest rates and sex ratio in the harvest (DuBrock et al. 1978, Peyton 1989, Litvaitis and Kane 1994), but few have documented effort and success of houndsmen. Our primary objectives were to determine hunting effort and success rates of houndsmen during the hound training season and the bear firearm season so that the effect of houndsmen on Virginia's bear population could be better documented.

STUDY AREAS

Our 2 study areas were located in western Virginia and bordered West Virginia. The southwest (SW) study area includes portions of Craig, Giles, and Montgomery counties. The northwest (NW) study area is located in Rockingham and Augusta counties. Both study areas are located in the ridge and valley region of the Appalachian mountain range (Bailey 1976), with elevations ranging from 488 to 1,378 m. Human population densities in these areas range between 16.32 and 129.50 people/km² (Southern Appalachian Man and the Biospheres 1996). Road densities range from 1.17 km/km² on the SW study area to 0.73 km/km² on the NW study area (J. O'Hear, U. S. Forest Service, Blacksburg, Virginia, USA, personal communication, 2000).

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The SW study area encompasses 1,526 km² in the Blacksburg and New Castle ranger districts of the George Washington and Jefferson National Forests (GW & JNF; Fig. 1). This portion of the GW & JNF has many small private inholdings dispersed throughout. Important tree species in the SW study area were white oak (*Quercus alba*), scarlet oak (*Q. coccinea*), chestnut oak (*Q. prinus*), black oak (*Q. velutina*), and northern red oak (*Q. rubra*) (J. Overcash, U.S. Forest Service, Blacksburg, Virginia, USA, personal communication, 1996).

The NW study area was an 840-km² area in the Dry River and Deerfield ranger districts of the GW & JNF (Fig. 1). The NW study area is nearly contiguous national forest land. In the NW study area dominant tree species were eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), chestnut oak, pitch pine (*Pinus rigida*), white oak, black oak, northern red oak, yellow poplar (*Liriodendron tulipifera*), and eastern white pine (*P. strobus*) (Godfrey 1996, Higgins 1997).

METHODS

We conducted field surveys during the 1995 and 1996 hound training and bear firearm seasons by accompanying hunting parties on both study areas as they pursued bears with hounds. These field surveys documented their hunting effort and success rates. Hunting effort was the number of hunters participating in the hunt, the number

of hounds involved in each chase, and the length of each chase. During any given hunt, when a bear was chased more than once or more than 1 bear was chased, the successive chases were referred to as the second chase of the hunt. We described hunter success in terms of bears chased (first and second bear), bears treed (first and second bear), and in the bear firearm season, bears harvested (first and second bear). A treed bear was a bear that climbed a tree to escape the dogs and remained in the tree long enough for hunters to approach close and observe it. Hunters almost exclusively harvested bears that were treed and rarely harvested bears as they crossed roads or trails. We also recorded the sex of bears that were treed or harvested and whether the bear was marked (i.e., radiocollared, ear tagged, lip tattooed). The Cooperative Alleghany Bear Study (CABS) provided information and held meetings to inform hunters that bears were being radiocollared and that it was legal to harvest a radiocollared bear.

In 1995, we sent a mail survey to bear hunters to complement the data collected while accompanying hunters in the field. Hunters were randomly selected from either the 1993 and 1994 bear harvest data (still hunters and opportunistic hunters were included in the harvest data), Virginia Bear Hunters Association (VBHA) membership, or hunters that CABS personnel accompanied during the hound training season and bear firearm season. Surveys were sent out during the first, third, and fifth weeks of the bear firearm season, and we mailed reminders 2 weeks after each mailing to nonrespondents (Dillman 1978). We

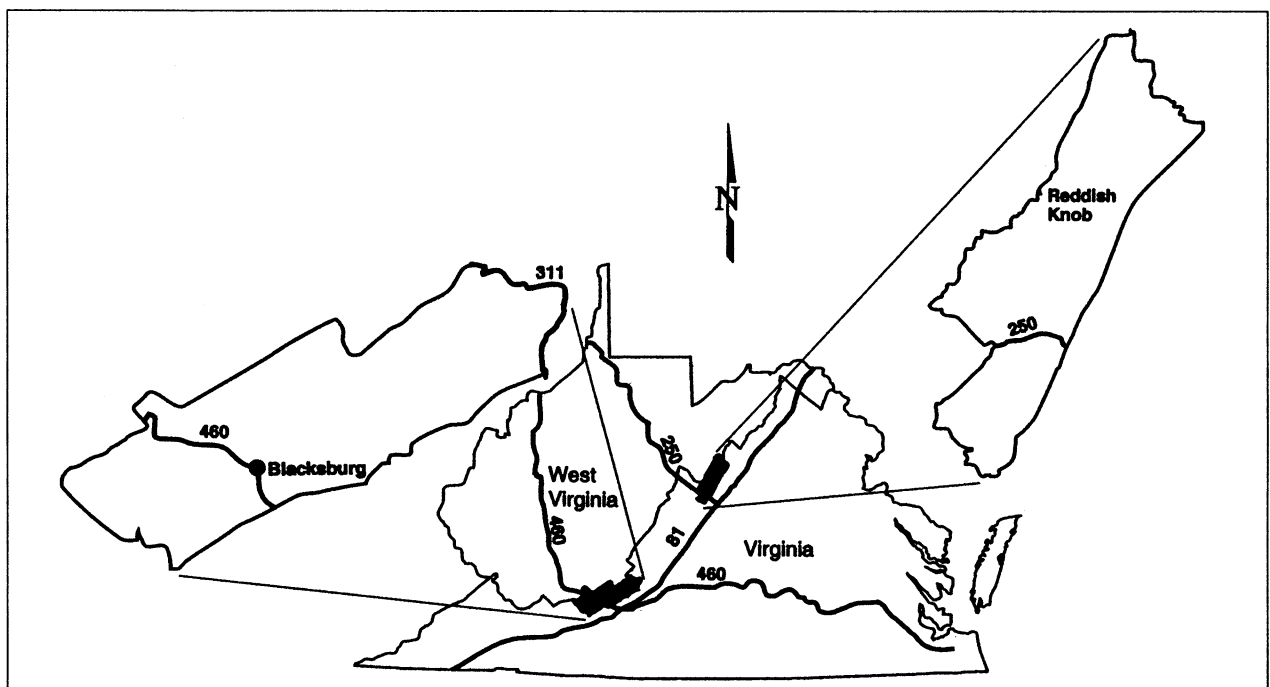


Fig. 1. Northwest and southwest study areas of the Cooperative Alleghany Bear Study, Virginia, USA.

asked hunters to describe their most recent hunt and asked for the same information that was collected in the field surveys.

After preliminary analysis of the mail survey of bear hunters, we determined that hunting effort throughout the season needed to be better documented. Thus, a diary was developed for the 1996 bear firearm season. In an attempt to select only houndsmen for the diary, only bear hunters that harvested a bear in the general bear season in December of 1995 were sampled. In addition, VBHA members and houndsmen that CABS personnel accompanied during the hound training season and bear firearm season were sampled. We mailed letters to hunters asking them to volunteer to complete a Hound Hunter Diary, then mailed diaries 1 week before the start of the bear firearm season to participating hunters. A reminder letter was sent to hunters who had not returned their diaries 1 week after the season closed.

We used the Wilcoxon rank sum test to evaluate differences in hunting effort between the NW and SW study areas, between 1995 and 1996 seasons, and between the hound training season and bear firearm season. The χ^2 goodness of fit and Fisher's exact test were used to test for differences in hunter success. A significance level of 0.05 for these tests was selected *a priori*.

RESULTS

1995 and 1996 Bear Hunter Field Surveys

We documented 190 hunts by 13 hunting parties in 2 study areas in 1995 and 1996 (Table 1). On average, 8 houndsmen and 11 hounds participated in each of the hunts that we documented in 1995 and 1996 and the average length of chase was 1.5 hours (Tables 2–4).

Hunting Effort from Field Surveys

Average number of hunters ranged from 4.5 (1995, SW, training season) to 12.3 (1996, NW, firearm season). Number of hounds averaged 2.5 (1995, SW, firearm season) to 12.3 (1996, SW, firearm season) hounds in each chase (a chase is defined as each separate attempt to chase a bear during one day of hunting effort). Length of a chase averaged 0.7 hours (1996, NW, firearm season) to 1.9 hours (1995, NW, training season; 1995, SW, firearm season, 1996; SW, training season; Table 2).

We documented differences in hunting effort between seasons, study areas, and years. During 1995 in the SW study area, the mean number of hounds and the length of the first chase in the hound training season and the bear firearm season did not differ ($P = 0.10$). However, more hunters participated in the kill season ($P = 0.05$). On the NW study area, all measures of effort for the hound train-

Table 1. Number of hunts and bears treed from field surveys by 13 hunting parties on the southwest (SW) and northwest (NW) study areas of the Cooperative Alleghany Bear Study, Virginia, 1995–96.

Area, Result	Hunts		
	1995	1996	
SW, number of hunts	41	41	
treed	12	18	
NW, number of hunts	65	43	
treed	29	9	
Total hunts	106	84	190

ing season were similar to those for the bear firearm season ($P = 0.13$ – 0.65).

In 1995, more hunters participated in hunts on the NW study area than on the SW study area during both the hound training season ($P = 0.0001$) and bear firearm season ($P = 0.006$; Table 2). However, there was no difference in the number of hounds participating in the first or the second chase ($P = 0.15$ – 0.74) or in the length of each chase ($P = 0.11$ – 0.49) between the 2 study areas (Table 2).

In 1996, hunting effort within seasons and between study areas did not differ ($P = 0.11$ – 0.97 ; Table 2). Similarly, hunting effort in the hound training season was similar to that in the bear firearm season on both study areas (SW, $P = 0.07$ – 1.0 ; NW, $P = 0.35$ – 0.88), although more hunters participated in hunts on the SW study area during the 1995 firearm season. Hunting effort during the hound training season was the same in 1995 and 1996 ($P = 0.10$ – 0.93) on both study areas, although more hunters participated in hunts on the SW study area during the 1996 hound training season ($n = 6.7$, $P = 0.01$). We did not detect differences between years during the bear firearm seasons of 1995 and 1996 ($P = 0.27$ – 1.0). Hunting effort in 1995 and 1996 was not combined because we were interested in documenting between-year differences.

Hunter Success from Field Surveys

On average, bears were chased in 65% of hunts; 24% of bears chased were treed, and a bear was harvested in 5% of all hunts (Tables 3, 5). Our field surveys indicated that the range of success in chasing a bear was 33% (1995, SW, firearm season, second bear) to 83% (1995, NW, training season, second bear) of all hunts and treed on 0% (1995, SW firearm season, second bear; 1996, NW firearm season, second bear) to 63% (1995, NW, firearm season, second bear) of all attempted chases (Table 4). Bears were harvested from 0% (1995, SW, second bear; 1996, NW, first and second bear) to 40% (1996, SW, second bear) of all chases during the firearm seasons. Hunting success (chasing or treeing a bear) during the hound training season was not different from hunting success during the bear firearm season in 1995 or in 1996 ($P = 0.06$ – 1.0). However, in 1996 houndsmen on the NW study area had a higher chance of chasing a bear in the hound training

Table 2. Comparison of hunting effort from field surveys during the hound training and the bear firearm (kill) seasons between the southwest (SW) and northwest (NW) study areas of the Cooperative Alleghany Bear Study, Virginia, 1995–96.

Season year, study area	Hunter effort										
	Hunters/hunt		Number of hounds				Length (hrs.)				
	Hunts	\bar{x} (SD)	First chase		Second chase ^a		First chase		Second chase ^a		
		Hunts	\bar{x} (SD)	Hunts	\bar{x} (SD)	Hunts	\bar{x} (SD)	Hunts	\bar{x} (SD)	Hunts	\bar{x} (SD)
Hound training											
1995 SW	24	4.5 (2.8)	25	6.6 (5.4)	9	7.4 (4.4)	25	1.0 (1.5)	8	1.3 (1.5)	
NW	44	10.0 (5.8)	44	7.9 (5.4)	25	7.2 (5.7)	44	1.5 (1.7)	24	1.9 (1.9)	
<i>P</i> ^b		0.0001		0.32		0.74		0.11		0.42	
1996 SW	29	6.7 (3.3)	29	8.0 (5.2)	8	11.4 (8.3)	29	1.9 (2.5)	8	0.8 (0.9)	
NW	34	8.5 (4.3)	34	9.3 (8.6)	8	9.0 (7.2)	34	1.5 (1.9)	8	1.1 (2.0)	
<i>P</i> ^b		0.11		0.92		0.49		0.67		0.55	
Bear Firearm											
1995 SW	15	6.6 (3.3)	16	8.4 (4.4)	2	2.5 (2.1)	14	1.9 (1.9)	2	–	
NW	21	11.7 (5.9)	21	6.2 (5.4)	9	9.8 (8.4)	21	1.6 (2.2)	8	0.9 (1.0)	
<i>P</i> ^b		0.006		0.15		–		0.49		–	
1996 SW	12	6.8 (3.9)	12	12.3 (7.7)	5	9.6 (4.5)	12	1.3 (1.5)	5	0.8 (1.3)	
NW	9	12.3 (11.1)	9	8.1 (7.9)	5	7.0 (4.2)	9	1.6 (2.1)	5	0.7 (1.0)	
<i>P</i> ^b		0.15		0.20		0.35		0.97		0.82	

^a Second chase starts after the bear trees and is chased again, or a different bear is chased.

^b Wilcoxon rank sum test.

season ($P = 0.02$). In the 1995 hound training season, hunting success was the same between study areas ($P = 0.20$ – 1.0), with the exception of higher success in chasing the first bear on the NW study area ($\chi^2 = 4.22$, $P = 0.04$; Table 3). In the 1995 bear firearm season, hunting success did not differ between study areas ($P = 0.25$ – 1.0 ; Table 3), although hunters treed more bears on the NW study area ($P = 0.008$; Table 3). In the 1996 hound training and bear firearm season, hunters had higher overall success of chasing a bear (first and second bears chased included in calculation) in the firearm season on the NW study area ($P = 0.04$; Table 4); all others did not differ between study areas ($P > 0.10$; Table 3). We found no between-year differences in hunting success during the hound training season ($P = 0.08$ – 1.0) or the bear firearm

season ($P = 0.07$ – 1.0) on either study area, although more bears were treed in 1996 on the SW study area during the firearm season ($P = 0.02$).

Characteristics of Harvested Bears from Field Surveys

In the 1995 bear firearm season, we accompanied hunters on 37 hunts. A single male bear weighing 77 kg (live weight) was harvested on the SW study area. The 3 bears harvested during our field surveys in the NW study area were males and averaged 87 kg (live weight). In 1995, three bears were harvested in the SW study area during field surveys; they averaged 102 kg. The one female harvested was 8 years old, weighed 72 kg, and had 4 cubs when handled in March of 1996. The hunters did not

Table 3. Comparison of hunting success from field surveys during the hound training and the bear firearm (kill) seasons between the southwest (SW) and northwest (NW) study areas of the Cooperative Alleghany Bear Study, Virginia, 1995–96.

Season year, study area	Hunter Success					
	Chased		Treed		Harvested	
	First bear <i>n</i> (%)	Second bear ^a <i>n</i> (%)	First bear <i>n</i> (%)	Second bear ^a <i>n</i> (%)	First bear <i>n</i> (%)	Second bear ^a <i>n</i> (%)
Hound training						
1995 SW	25 (48)	10 (60)	25 (28)	10 (30)	–	–
NW	44 (73)	24 (83)	44 (23)	24 (29)	–	–
<i>P</i> ^b		0.04		0.63		–
1996 SW	29 (62)	8 (63)	29 (24)	8 (38)	–	–
NW	34 (71)	8 (75)	34 (9)	8 (13)	–	–
<i>P</i> ^b		0.48		0.17		–
Bear Firearm						
1995 SW	16 (63)	3 (33)	16 (13)	3 (0)	16 (6)	3 (0)
NW	21 (67)	8 (63)	21 (33)	8 (63)	21 (5)	8 (25)
<i>P</i> ^b		0.79		0.25		1.00
1996 SW	12 (75)	5 (80)	12 (42)	5 (60)	12 (8)	5 (40)
NW	9 (56)	5 (40)	9 (56)	5 (0)	9 (0)	5 (0)
<i>P</i> ^b		0.40		0.17		1.00

^a Second chase starts after the bear trees and is chased again, or a different bear is chased.

^b Fisher's exact test.

observe cubs with the bear when she was harvested the following December. No bears were harvested when we accompanied hunters in the NW study area in 1996.

1995 Mail Survey

We mailed 762 surveys to bear hunters in 1995; 30 were undeliverable and 532 (73%) hunters returned their surveys. Of the 532 respondents, 241 (45%) were bear hunters who used hounds to hunt bears in the 1995 bear firearm season. Only hunters who used hounds ($n = 241$) were included in the analyses.

As reported from the mail survey, the average hunting party consisted of 10.4 hunters and, on average, 8.4 hounds participated in the first chase (Table 4). Bears were chased in 53% of hunts; 31% of bears chased were treed, and a bear was harvested in 14% of all hunts (Table 5). During these chases, a bear escaped from the original tree and ran to a second tree 21% of the time. The average length of the first chase was 4.6 hours (Table 4). Treed bears were 46% male and 16% female; 38% could not be identified by sex.

A second chase occurred in 27 of the 241 hunts (11%) with an average of 9 hounds involved in each of the second chases. The average length of the second chase was 3.7 hours and the bear was treed 9% of the time. When a second bear was chased, 27% of the bears that were treed were males, 15% were females, and the sex of 58% was not determined. During the second chase a bear was harvested 19% of the time (Table 5).

1996 Bear Hunter Diary

Letters were mailed to 611 houndsmen asking them to volunteer to complete a hunter diary; 102 houndsmen volunteered to participate. Twenty-three percent of Virginia Bear Hunters Association members ($n = 67$) and 11% of houndsmen not affiliated with VBHA ($n = 35$) that harvested a bear in 1995 volunteered to complete a diary. The response rate was 59% (60 diaries). Five of the 102 diaries were not used because the hunters were unable to hunt that year.

According to the diaries, the average hunting party in 1996 consisted of 10.5 hunters, and, on average, 7.5 hounds were used in the first chase (Table 6). Hunters spent, on average, 8 hours on each hunt, and hounds chased or tracked a bear an average of 4.2 hours. The average time the first bear was actively pursued by hounds was 2.4 hours. A bear was chased during 74% of all hunts, and in 44% of all hunts a bear was treed (Table 5). The first bear chased was treed twice in 9% of the hunts and the second bear was treed twice in 8% of the hunts. Two hundred and forty-three (67%) of 361 treed bears were identified by sex (65% male; Table 6).

A second bear was chased on 139 (17%) of 828 hunts. On average, 10 hunters and 8 hounds were involved in the second chase (Table 4). The average time a second bear was actively pursued by hounds was 2.6 hours. A bear was chased 96% of the time that a second chase was attempted, and in 49% of all hunts a bear was treed in the second chase (Table 5). Forty-six of 68 treed bears (68%) were identified by sex (72% male; Table 6). A bear was

Table 4. Comparison of hunting effort between field surveys, mail surveys, and bear hunter diary, Virginia, 1995 and 1996.

	Hunter effort									
			First chase				Second chase ^a			
	<i>n</i> ^b	Average hunters/hunt	<i>n</i> ^b	Average no. of hounds	<i>n</i> ^b	Average length (hr)	<i>n</i> ^b	Average no. of hounds	<i>n</i> ^b	Average length (hr)
Field surveys ^c	188	8.3	190	11.3	187	1.5	188	8.0	69	3.0
Mail surveys	241	10.4	241	8.4	241	4.6	27	9.0	26	3.7
Hunter diary	761	10.5	821	7.5	796	2.4	138	8.0	132	2.6

^a Second chase starts after the bear trees and is chased again, or a different bear is chased.

^b Sample size (*n*) represents number of hunts and not all hunters reported all information.

^c Results from training and firearm seasons combined.

Table 5. Comparison of hunting success between field surveys, mail surveys, and bear hunter diary, Virginia, 1995 and 1996.

	Hunter success					
	Chased		Treed		Harvested	
	First bear % (<i>n</i> ^b)	Second bear ^a % (<i>n</i> ^b)	First bear % (<i>n</i> ^b)	Second bear ^a % (<i>n</i> ^b)	First bear % (<i>n</i> ^b)	Second bear ^a % (<i>n</i> ^b)
Field surveys ^c	65 (190)	69 (71)	24 (190)	31 (71)	5 (58)	19 (21)
Mail surveys	53 (241)	11 (241)	31 (241)	9 (241)	14 (241)	19 (26)
Hunter diary	74 (828)	96 (139)	44 (828)	49 (138)	17 (828)	21 (140)

^a Second chase starts after the bear trees and is chased again, or a different bear is chased.

^b Sample size (*n*) represents number of hunts and not all hunters reported all information.

^c Results from training and firearm seasons combined.

Table 6. Sex of bears that were treed during the 1996 bear firearm season as reported in sixty 1996–97 bear hunter diaries, Cooperative Alleghany Bear Study, Virginia.

	<i>n</i> ^a	Male (%)	Female (%)
First bear treed	243	65.0	35.0
Second bear treed ^b	46	71.7	28.3
First bear chased and harvested	140	76.4	23.6
Second bear chased and harvested ^b	34	79.4	20.6

^a Not all hunters reported all information.

^b Second chase starts after the bear trees and is chased again, or a different bear is chased.

harvested by 17% of those that attempted a first chase and by 21% of those that attempted a second chase (Table 5). Overall, a bear was harvested in 20% of all hunts (includes first and second chases); males comprised 76% of the bears harvested from the first chase and 79% of the bears harvested from the second chase (Table 6).

Comparison of Three Survey Methods

Reports of hunting effort were consistent across the 3 different surveys, with the exception of length of first chase; estimates from the mail survey were 2 to 3 times longer than reported by other methods (Table 4). The higher estimate for length of first chase may be due to recall error. However, reported hunter success rates were less consistent (Table 5). Fewer first bears were reported harvested in field surveys than in the mail surveys or the hunter diaries, and fewer second bears were reported chased and treed in mail surveys.

DISCUSSION

Field surveys indicated there were virtually no differences in hunting effort or hunting success between seasons, study areas, and years, although in some instances this may be a function of sample size. DuBrock et al. (1978) surveyed bear hunters in Virginia to characterize bear hunting with hounds. They found that, on average, hunters that owned hounds owned 4 hounds, had 11 hunters in their hunting party, and used between 2 and 35 hounds in a bear chase. The DuBrock et al. (1978) findings are consistent with this study.

We found some limitations in documenting effort through field surveys and the 1995 mail survey. For instance, we did not document hunting effort in terms of the length of time hunters spent hunting, only length of time bears were chased. The length of chase should be considered as a measure of hound effort and not a measure of the actual length of time a bear was chased. Hounds rarely encounter a bear immediately after they are released on a track. Length of chase may index how long a bear was chased, but is likely an overestimate. Allen (1984) reported that in Maine, chases initiated by hounds locating

a track lasted 3.5 hours. This was consistent with the estimates from the 1995 mail survey but longer than chases documented in the field surveys and the 1996 bear hunter diary.

The use of hounds to hunt bears does not guarantee that a bear will be treed. Elowe (1990) reported that hounds in Massachusetts successfully treed a bear 30% of the time. Hounds released on radiocollared bears in Wisconsin were unable to tree a bear in 8 chases (Massopust and Anderson 1984). In Maine, bears were treed in 9 of 22 chases (41%) when the bear was first located by radiotelemetry. When chased from baits, bears were treed in 4 of 16 chases (25%), and when chased from tracking, they were treed in 14 of 43 chases (32%; Allen 1984). Willey (1980) used hounds in Vermont to capture bears, and in 38 days of chasing only 10 bears were treed. These treeing rates were consistent with those observed in this study (range = 24–44%).

Field surveys documented that houndsmen harvested a bear in the SW study area in 6% and 8% of hunts and in the NW study area in 5% and 0% of hunts in 1995 and 1996, respectively. These houndsmen harvested 14% of the bears that they successfully chased and 24% of the bears that treed. The harvest rates of houndsmen that were accompanied by CABS personnel were consistent with the harvest rates reported in Michigan (17%) and New Hampshire's (18.6%) harvest surveys (Peyton 1989, Litvaitis and Kane 1994). However, harvest rates documented in the 1995 hunter survey and 1996 hunter diary were higher than in Michigan and New Hampshire. Houndsmen that returned mail surveys harvested 25% of the bears they chased and 40% of the bears that were treed. Houndsmen that completed a hunter diary harvested 23% of the bears they chased and 39% of the bears that treed. The low success rate (percent of bears chased that were harvested) in terms of harvest may reflect the selectivity of houndsmen (Willey 1972, Poelker and Hartwell 1973, Hardy 1974, DuBrock et al. 1978, Peyton 1989, Litvaitis and Kane 1994).

Houndsmen claim to select against females, but the mail survey indicated that 40% of houndsmen did not or could not identify sex of the treed bear. In Virginia, we observed a harvest that is skewed toward males (Higgins 1997), most likely because houndsmen select older, larger bears in an effort to select against females or harvest a trophy animal.

The general public often assumes that the use of hounds gives a hunter an unfair advantage (Elowe 1990). Not only does the hound aid the hunter, but the hound exerts the most effort. In an attempt to quantify this facet of "fairness", the 1996 bear hunter diary was implemented. We determined fairness by documenting effort of Virginia's houndsmen, hounds, and bears. Prior to the

implementation of the hunter diary, we only documented length of time hounds spent pursuing a bear. The 1996 bear hunter diary specifically asked hunters what time they started hunting and what time they finished hunting, what time hounds were released and what time hounds finished chasing or tracking a bear, and length of time a bear was chased. Although these estimates are subjective, they are the best we have documented thus far. Hunters exerted the most effort (8 hrs) in terms of time spent in the woods (looking for tracks before releasing hounds and looking for hounds once the chase finished), and hounds actively hunted (4.2 hrs) half as many hours as hunters. Bears were chased by hounds for only half as many hours as hounds actually hunted (2.4 hrs; hounds may be released on a bear's track hours after the bear had been there).

Response rate in the 1995 mail survey was high (73%) and may indicate hunters' interest in the management of bears. Such high responses are common; many bear hunters in Arkansas (75–85%), Michigan (75%), and New Hampshire (72%) also responded to hunter surveys (Pharris and Clark 1987, Peyton 1989, Litvaitis and Kane 1994). The lower response rate of the 1996–97 bear hunter diary (59%) may be due to the extra time and commitment that a hunter diary requires (S. McMullin, Virginia Polytechnic Institute and State University, personal communication, 1997). The majority of respondents from the 1995 mail survey and 1996 bear hunter diary came from hunters who hunted within the northwest and southwest study areas, or were members of the VBHA. The high response rate of these hunters may be a result of the effort CABS personnel made in establishing a working relationship with the members of the VBHA and with hunters who hunt within the study areas of CABS.

The bear hunter diary appeared to be a reliable means of documenting hunting effort and success. It had the largest sample size of the 3 methods used and it documented hunter effort throughout the season. However, it had a lower response rate than the mail survey. Only 17% of houndsmen asked to complete a hunter diary volunteered to do so and only 60% of these houndsmen returned completed diaries. Therefore, <10% of Virginia's houndsmen were represented in the results of the hunter diary. The success rates documented in field surveys and the hunter diary were more consistent than in the mail survey, again lending greater reliability to field surveys and the diary. Field surveys were valuable as well, and they avoided hunter bias because CABS personnel collected the data. Additionally, the field survey allowed biologists to interact with hunters and experience hunting bears with hounds. However, only 13 hunting parties provided data for the field surveys.

Hunting bears with hounds is a tradition in Virginia. Virginia may eventually be targeted by groups whose intent is to close bear hunting with the use of hounds, thus knowledge of houndsmen effort and success rates may be useful in addressing the issue of fairness. Virginia houndsmen were moderately successful; between 11% and 20% harvested bears. Similar harvest rates have been documented in other states that use hounds to hunt bears (Peyton 1989, Litvaitis and Kane 1994). Data from this study documented that on average houndsmen successfully chased a bear in approximately 70% of all hunts, treed approximately 40% of these bears, and harvested 32% of the bears that were treed. Since houndsmen were relatively successful in chasing a bear, it appears that using hounds is a distinct advantage for encountering bears. However, the low harvest rates suggests that hunters may be selective and that hounds are not used strictly to ensure that a bear is harvested. It is more likely that houndsmen enjoy working with their hounds, as do duck hunters, upland game bird hunters, and rabbit hunters.

MANAGEMENT IMPLICATIONS

Animal rights groups have increased the public's awareness of the methods used to hunt bears and have given the public cause to question the ethics of certain aspects of hunting bears. Many state agencies have switched from managing bears as a nuisance animal to managing them as a game species. However, documentation of methods used to hunt bears has been limited. The current licensing structure (1997) in Virginia allows any hunter that purchases a big game hunting license (deer, bear, turkey tag) to harvest a bear. In December, bears can be taken with the use of hounds, still hunting during late deer muzzleloader season, and during the turkey season; however, method of take is not documented at check stations. As a result, the Virginia Department of Game and Inland Fisheries includes all bears harvested in December in their estimate for hound hunter harvest rates. Thus, the percent of bears taken by houndsmen in Virginia each year is likely over-estimated. For Virginia to more clearly and accurately depict the effect of hunting bears with the use of hounds, method of take could be included on game check station check cards. To aid in identifying the number of bear hunters who use hounds in Virginia, hunters could be required to purchase a separate bear hunting license. The bear hunting license could also have a query for the method used to hunt bears (i.e., hounds, incidental, or still hunting). As a result, the number of houndsmen that hunt bears and the success rates of Virginia's houndsmen can be more accurately depicted from harvest data.

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