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BUREAU OF WILDLIFE MANAGEMENT
RESEARCH DIVISION
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TITLE: Survey and Statistical Support Section

PROJECT JOB NO.: 11101

TITLE: Game Take and Furtaker Surveys

PERIOD COVERED: 1 July 2000 to 30 June 2001

COOPERATING AGENCIES: Bureau of Automated Technology Services (BATS), Bureau of Administrative Services

WORK LOCATION(S): Harrisburg, Pennsylvania

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DATE: 31 July 2001

Abstract: A questionnaire was mailed to a random sample of purchasers of a 2000 general hunting license (20,321 questionnaires mailed) to estimate number of hunters, harvest, and hunter-days of small game species during the 2000-01 hunting season. After three mailings, 61.2% responded. Overall, between 1999-00 and 2000-01 hunting seasons, harvests and hunter numbers increased slightly. Some of this increase resulted from the addition of Resident Senior Lifetime Renewal licenses to the sample. Seventeen-year trends in harvest and hunter participation indicate a continued decline for nearly all small game species. A separate questionnaire was mailed to a random sample of purchasers of a furtaker license (2,436 mailed) to estimate harvest of furbearer species and trapper-days. After two mailings, 71.5% responded. Overall, the harvest of furbearer species and the number of hunters/trappers changed little between the 1999-00 and 2000-01 seasons. Seventeen-year trends for harvests of furbearers indicate harvests have declined dramatically for most species. Junior and senior combination license holders are not included in the furtaker sample, thus some furtakers are not included in survey estimates. 2000-01 furbearer harvests and hunter estimates provided in this report are adjusted to compensate for combination license holders (Rosenberry 2000).

OBJECTIVES

To estimate the number of animals harvested, number of participants, and number of days spent hunting (hunter-days) for small game species during the 2000-01 hunting season. To estimate the number of furbearers trapped or shot and number of trappers/hunters during the 2000-01 furbearer seasons. To monitor long-term trends in harvest, number of hunters and trappers, hunter-days, and harvest per 100 hunter-days.

PROCEDURES

In March 2001, following the close of trapping and small game hunting seasons, the names and addresses of general hunting license buyers whose license number ended in either 01 or 51, and furtakers whose license number ended in either 1 or 6, were drawn from the duplicate licenses on file in the License Division of the Bureau of Administrative Services and from the electronic file of

over the counter (OTC) sales. Photocopies of the duplicates and the OTC file were used by BATS to prepare the mailing list. BATS and Bureau of Administrative Services addressed and mailed 20,321 Game Take questionnaires and 2,436 Furtaker questionnaires. In addition to the initial mailing, two follow-up mailings were sent to nonrespondents of the Game Take Survey and one follow-up mailing was sent to nonrespondents of the Furtaker Survey.

These surveys reflect major changes from pre-1990 surveys of information requested from hunters and trappers. First, information about small game and furbearer species were separated into Game Take and Furtaker Surveys, respectively. Second, the Game Take questionnaire was expanded to include more harvestable species and the number of days of hunting per species per county. Third, harvest and hunting effort on shooting preserves were requested separately for ring-necked pheasant, quail, and ducks. Fourth, estimates of coyote harvest included those shot by hunters (Game Take Survey excluding Furtaker license buyers) and those trapped or shot by furtakers (Furtaker Survey). Fifth, a cover letter to encourage response was included in all mailings.

During 1990-00, methods used to survey small-game hunters and furtakers have been the same with the following exceptions. The Game Take Survey for 1992 consisted of 2/3 the usual sample size (i.e., every third 01 or 51 license was skipped) and only 2 mailings were conducted, but a telephone survey of nonrespondents was conducted to estimate nonresponse bias. Estimates using the standard estimation techniques (Shope 1985) were similar to those obtained when incorporating nonresponse bias (Diefenbach 1993). Therefore, estimates from the 1992 survey should be comparable to results from other years. In 1996 hunters were asked to report their Canada goose harvest by season (early, regular, late),and their snow goose harvest. This change was implemented to assess the effect of special goose seasons since the regular season was closed for most of the state, and to compare our estimates to those obtained by the newly implemented Migratory Bird Harvest Information Program. Since 1998 Game Take Survey turkey hunters were to report the management unit in which they hunted instead of the county. In 2000, landowner, resident senior lifetime upgrades, and resident senior lifetime renewals were included in the total licenses sold for calculating harvests and participation. This resulted in the addition of 40,350 licenses to our survey population that otherwise would not have been included. The added senior licenses have existed since 1996 for lifetime renewals and 1999 for lifetime upgrades. Therefore, estimates of Game Take Surveys from 1996 - 1999 likely underestimate harvest by about 2-3%. Landowner licenses represent less than 0.5% of license sales and would have had minimal effect on previous survey estimates.

The 1999 furtaker survey sampled those who purchased a furtaker license but not those who purchased junior and senior combination licenses, which include furtaker privileges. As a result of this licensing change, furtaker harvest and participation estimates beginning in 1999 are biased low compared to pre-1999 estimates. To reduce this bias, a correction factor is used to adjust harvest and participation estimates (Rosenberry 2000).

Respondents to the Game Take Survey were post-stratified on the basis of whether or not they had purchased special licenses or stamps, to reduce the effect of nonresponse bias on estimates (see Shope 1985). Nonresponse bias for the Furtaker Survey was not corrected.

I estimated (by species) total harvest, number of participants, hunter-days, and harvest per 100 hunter-days based on 1,035,748 general hunting licenses sold for the Game Take Survey, and 18,551 furtaker licenses sold for the Furtaker Survey. I estimated trends over time using Pearson product-moment correlation

coefficients.

FINDINGS

For the Game Take and Furtaker Survey respectively, 11,882 and 1,680 useable, returned questionnaires were processed. The response rates, after adjusting for deceased license buyers and undeliverable questionnaires, were 61.2% for the Game Take Survey and 71.5% for the Furtaker Survey. The response rate for the Game Take and Furtaker surveys decreased about 4% from the previous year.

During 2000-01, 4,128 hunters harvested an estimated 31,942 snow geese during 25,340 hunter-days. This represents an increase in harvests and harvest rates from the 1999-00 season, when 2,874 hunters harvested 9,703 snow geese during 12,344 hunting days.

Annual changes.--Harvests of 9 of 12 small game species increased, however, grouse, dove, and hare harvests decreased (Table 1). The number of hunters and hunter-days increased for 9 of 12 small game species (Tables 2 and 3). Turkey harvests increased, but hunters and hunter days decreased for both the spring and fall seasons.

Harvest per 100 hunter-days increased for 7 of 12 small game species (Table 4). Grouse, pheasant, quail, dove, and hare hunters reported declines in success rates.

The number of hunters/trappers of furbearers increased or remained the same for 8 of 9 species (Table 5). Harvests increased for 4 of 9 species (Table 6).

Seventeen-year trends.--Harvest have declined ($P < 0.10$) for all species except turkey, geese, and ducks ($P < 0.10$), although the trends for crow ($P = 0.25$) and quail ($P = 0.34$) were not significant (Table 1). Number of hunters has declined for all seasons/species ($P < 0.10$) except spring turkey and ducks (Table 2).

Number of hunters/trappers of most furbearer species has increased or remained stable since 1990, although the number of hunter/trappers pursuing raccoons has declined ($r = -0.794$, $P < 0.01$) since 1983. The number of hunters and trappers pursuing coyotes continues to increase ($r = 0.975$, $P < 0.01$) (Table 5). The harvest of all furbearers for which we have 1983-00 data has declined ($P < 0.06$). Since 1990, coyote harvests have increased ($r = 0.932$, $P < 0.01$) and weasel harvest have varied with no consistent change ($P = 0.77$).

RECOMMENDATIONS

1. Harvest and participant data collected from the game take and furtaker surveys are the best source for this type of data; thus, I recommend continuing this survey.

2. The addition of combination licenses reduces reliability of furtaker estimates, and the correction method should be viewed as a stopgap measure and not a long-term substitute for appropriate sampling methods. A computerized license database could eliminate the need for the temporary correction factor.

3. If the response rate for the Furtaker Survey becomes <70% I recommend conducting a third mailing.

Major changes to the Game Take and Furtaker Surveys should only be

instituted when more efficient sampling of license buyers is possible. When the Game Commission implements a computerized licensing system, samples that are stratified by license type and location of residence will provide more accurate and precise harvest estimates. When such a system is implemented, phone calls to obtain estimates of harvest and hunting effort of nonrespondents to the mail survey may be useful. A computerized licensing system would allow us to survey hunters much sooner after hunting seasons ended, which has been shown to result in more accurate estimates of harvest and hunter participation (e.g., Barker 1991). Moreover, a computerized license system would provide greater flexibility in adapting sampling methods to future licensing changes that may reduce the reliability of estimates.

LITERATURE CITED

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Table 1. Harvest, by species, 1983-00, Pennsylvania.

Year	Spring turkey	Fall turkey	Rabbits	Grouse	Squirrel	Pheasant[a]	Woodcock	Quail[a]	Dove	Geese	Ducks[a]	Hare	Woodchuck	Crow
1983	10,852	20,494	2,156,565	493,737	2,259,320		186,319		1,690,158	68,333		10,867		
1984	9,723	15,844	1,939,399	475,960	2,256,311		170,296		1,402,180	64,452		13,989		
1985	14,197	18,217	2,137,737	511,271	2,428,683		137,183		1,443,109	56,233		14,749		
1986	16,155	26,763	2,092,910	536,553	2,833,061		165,685		1,531,868	69,748		13,189		
1987	14,674	28,346	1,764,744	484,016	2,364,596		175,124		1,374,110	68,541		14,412		
1988	14,659	22,515	1,930,737	523,271	2,313,153		165,590		1,520,322	49,573		8,488		
1989	17,154	21,669	1,696,712	410,371	2,206,719		143,502		1,209,438	78,821		7,595		
1990	17,472	25,527	1,672,360	353,647	2,044,264	302,276	50,918	7,879	1,022,402	72,901	98,026	3,615	1,299,647	355,492
1991	16,606	31,979	1,462,270	293,891	1,632,108	269,065	53,183	3,005	968,421	69,127	87,478	3,579	1,304,020	257,009
1992	18,180	21,468	1,488,850	254,539	1,761,285	261,541	51,246	1,236	734,707	78,883	93,687	3,961	1,157,090	185,192
1993	24,068	30,477	1,160,939	272,690	1,585,368	250,149	52,959	4,837	735,089	84,251	133,354	2,114	1,274,166	191,639
1994	28,558	39,094	1,025,319	304,162	1,826,618	236,698	29,654	2,902	669,459	102,979	128,164	3,352	1,284,819	247,219
1995	36,401	49,748	1,010,938	315,197	1,599,104	250,930	28,624	1,204	670,791	64,382	156,511	2,997	1,225,101	295,962
1996	33,726	35,787	807,072	218,256	1,442,560	215,502	26,846	3,387	603,114	96,910	151,142	1,582	1,149,995	275,541
1997	30,956	37,398	827,520	187,770	1,352,038	219,864	23,878	1,766	506,677	115,506	188,034	1,432	1,251,145	184,944
1998	32,661	33,628	911,003	183,468	1,331,051	216,669	31,602	241	562,348	131,831	146,050	2,507	1,204,582	247,047
1999	37,806	40,718	715,862	177,355	1,236,108	211,257	25,704	3,938	519,116	128,385	164,328	2,412	1,117,970	209,273
2000	43,815	44,865	770,841	145,525	1,276,009	233,537	31,199	4,373	478,602	194,480	185,185	1,747	1,191,114	219,773
r[b]	0.943	0.832	-0.971	-0.942	-0.915	-0.856	-0.899	-0.318	-0.957	0.794	0.891	-0.878	-0.619	-0.383
P	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.34	<0.01	<0.01	<0.01	<0.01	0.04	0.25

[a]Estimates exclude harvest on shooting preserves.
[b]Pearson product-moment correlation coefficient.

Table 2. Number of hunters, by species, 1983-00, Pennsylvania.

Year	Spring turkey	Fall turkey	Rabbits	Grouse	Squirrel	Pheasant[a]	Woodcock	Quail[a]	Dove	Geese	Ducks[a]	Hare	Woodchuck	Crow
1983	255,982	367,657	738,970	471,640	614,324		148,887		188,727	70,019		28,960		
1984	209,717	322,347	626,892	419,367	525,670		120,643		162,779	66,406		27,133		
1985	214,331	298,055	619,220	423,393	528,599		100,270		150,904	62,742		25,141		
1986	246,039	336,225	612,424	442,897	552,336		110,886		166,139	65,087		27,557		
1987	206,039	282,761	516,281	374,741	472,250		96,936		137,402	50,804		19,573		
1988	226,008	300,055	528,615	390,192	472,841		93,110		143,981	53,475		21,873		
1989	224,138	296,139	497,463	365,211	464,434		87,053		131,321	43,603		17,568		
1990	191,442	234,911	436,961	299,534	369,848	274,957	30,045	5,378	93,532	33,509	28,443	7,831	123,204	39,579
1991	179,202	252,210	405,004	292,418	348,868	254,051	24,681	3,279	86,377	36,032	29,247	7,601	118,257	39,014
1992	186,738	212,104	373,800	254,724	329,726	217,189	25,916	1,444	76,998	38,301	29,263	6,156	114,515	34,442
1993	201,060	222,780	347,129	242,398	311,103	198,657	23,452	2,657	73,462	41,577	35,782	5,801	109,576	34,648
1994	224,405	244,095	335,715	259,727	326,271	205,384	19,401	1,323	74,589	40,106	34,097	7,236	117,251	37,841
1995	239,521	261,395	297,570	239,014	293,852	182,224	15,702	1,451	67,754	28,715	30,274	5,949	113,127	36,782
1996	241,613	250,377	280,351	214,272	279,259	171,275	14,464	1,184	65,808	31,119	32,434	5,011	101,576	30,087
1997	233,287	249,934	261,115	197,994	267,051	148,900	13,374	1,009	60,178	30,574	32,180	3,723	104,561	30,696
1998	194,819[b]	199,696[b]	242,509	183,511	252,738	158,497	12,907	1,116	57,579	32,871	34,103	5,506	92,517	31,390
1999	237,984	244,638	221,179	174,576	238,887	142,142	12,212	1,550	49,551	33,734	31,503	4,379	90,853	29,131
2000	231,860	230,448	229,906	162,073	238,540	149,260	12,977	1,870	52,496	35,628	31,998	3,666	99,294	29,371
r[c]	0.018	-0.806	-0.982	-0.979	-0.968	-0.949	-0.914	-0.664	-0.955	-0.875	0.422	-0.914	-0.900	-0.877
P	0.94	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.20	<0.01	<0.01	<0.01

[a]Estimates exclude number of hunters on shooting preserves.
[b]Cautionary note: these low values may have been caused by inadvertently not including the TMA map on the 1998-99 survey instructions. See 1998-99 annual report.
[c]Pearson product-moment correlation coefficient.

Table 3. Trends of hunter-days, by species, 1990-00, Pennsylvania.

Year	Spring turkey	Fall turkey	Rabbits	Grouse	Squirrel	Pheasant[a]	Woodcock	Quail[a]	Dove	Geese	Ducks[a]	Hare	Woodchuck	Crow
1990	861,086	872,815	2,901,567	1,764,129	2,345,050	1,287,702	133,947	24,493	475,402	171,436	141,411	15,632	1,228,548	223,525
1991	781,499	851,155	2,474,017	1,580,574	2,004,826	1,115,902	119,238	13,630	409,149	167,342	132,775	15,397	1,341,605	227,527
1992	799,621	696,705	2,210,784	1,331,444	1,814,807	902,308	97,699	3,228	329,087	188,303	135,656	11,650	1,191,725	170,185
1993	843,987	753,896	1,926,331	1,246,856	1,721,261	859,018	94,588	16,683	326,265	202,644	174,023	11,882	1,338,167	201,412
1994	1,003,939	857,959	2,104,454	1,438,808	1,919,013	937,974	73,958	4,455	340,661	217,021	163,690	15,208	1,294,150	209,854
1995	1,084,725	865,565	1,769,363	1,281,923	1,630,631	844,056	62,819	6,022	295,114	128,611	165,196	11,712	1,253,239	193,952
1996	1,103,556	867,072	1,641,774	1,130,129	1,568,102	733,806	51,493	5,061	280,603	165,523	168,834	9,230	1,246,439	186,781
1997	1,019,546	834,253	1,525,740	1,022,603	1,462,230	648,985	48,577	2,837	237,910	214,269	199,017	6,849	1,241,112	178,724
1998	881,026[b]	691,787[b]	1,517,673	994,150	1,422,957	775,398	55,343	6,704	261,442	212,538	188,694	11,805	1,359,595	222,980
1999	1,023,988	807,292	1,268,639	882,167	1,306,098	605,034	47,142	5,004	207,743	230,635	189,306	6,864	1,151,067	173,186
2000	995,472	780,297	1,295,397	817,545	1,254,598	652,602	56,098	8,906	230,991	259,153	202,279	5,351	1,196,679	157,828
r[c]	0.614	-0.216	-0.958	-0.953	-0.947	-0.904	-0.912	-0.575	-0.929	0.610	0.912	-0.845	-0.293	-0.575
P	0.04	0.52	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	0.05	<0.01	<0.01	0.38	0.06

[a]Estimates exclude effort on shooting preserves.
[b]Cautionary note: these low values may have been caused by inadvertently not including the TMA map on the 1998-99 survey instructions. See 1998-99 annual report.
[c]Pearson product-moment correlation coefficient.

Table 4. Trends of harvest per 100 hunter-days, by species, 1990-00, Pennsylvania.

Year	Spring turkey	Fall turkey	Rabbits	Grouse	Squirrel	Pheasant[a]	Woodcock	Quail[a]	Dove	Geese	Ducks[a]	Hare	Woodchuck	Crow
1990	2.0	2.9	57.6	20.0	87.2	23.5	38.0	32.2	215.1	42.5	69.3	23.1	105.8	159.0
1991	2.1	3.8	59.1	18.6	81.4	24.1	44.6	22.0	236.7	41.3	65.9	23.2	97.2	113.0
1992	2.3	3.1	67.3	19.1	97.1	29.0	52.5	38.3	223.3	41.9	69.1	34.0	97.1	108.8
1993	2.9	4.0	60.3	21.9	92.1	29.1	56.0	29.0	225.3	41.6	76.6	17.8	95.2	95.1
1994	2.8	4.6	48.7	21.1	85.2	25.2	40.1	65.1	196.5	47.5	78.3	22.0	99.3	117.8
1995	3.4	5.7	57.1	24.6	98.1	29.7	45.6	20.0	227.3	50.1	96.8	25.6	97.8	152.6
1996	3.1	4.1	49.2	19.3	92.0	29.4	52.1	66.9	214.9	55.3	89.5	17.1	92.3	147.5
1997	3.0	4.5	54.2	18.4	92.5	33.9	49.2	62.2	213.0	53.9	94.5	20.9	100.8	103.5
1998	3.7	4.9	60.0	18.5	93.5	27.9	57.1	3.6	215.1	66.9	77.4	21.2	88.6	110.8
1999	3.7	5.0	56.4	20.1	94.6	34.9	54.5	78.7	249.9	55.7	86.8	35.1	97.1	120.8
2000	4.4	5.7	59.5	17.8	101.7	35.8	55.6	49.1	207.2	75.0	91.5	32.6	99.5	139.2
r[b]	0.944	0.804	-0.201	-0.239	0.625	0.819	0.637	0.351	-0.036	0.895	0.736	0.276	-0.360	-0.021
P	<0.01	<0.01	0.55	0.48	0.04	<0.01	0.04	0.29	0.92	<0.01	<0.01	0.41	0.28	0.95

[a]Estimates exclude effort on shooting preserves.
[b]Pearson product-moment correlation coefficient.

Table 5. Number of hunters and trappers of furbearers, 1990-00, Pennsylvania.

Year	Raccoon	Muskrat	Red Fox	Gray fox	Opossum	Skunk	Mink	Coyote[a]	Weasel
1990	9,676	4,147	7,941	6,542	3,653	1,914	2,560	7,782	508
1991	9,921	4,865	7,827	6,613	3,915	2,264	2,726	12,184	422
1992	9,525	4,419	7,019	6,263	3,793	2,208	2,539	13,643	452
1993	8,195	4,227	6,790	6,089	3,369	1,967	2,465	14,260	387
1994	7,066	5,570	8,319	7,515	4,267	3,071	3,212	20,597	784
1995	9,718	4,465	8,080	6,908	3,989	2,643	2,879	20,413	853
1996	12,951	6,478	10,007	8,361	6,140	3,443	3,703	21,937	942
1997	13,750	7,363	10,330	8,553	6,386	3,473	4,434	24,526	1,125
1998	12,794	5,900	9,982	8,594	5,558	2,948	3,512	30,016	733
1999[d]	8,496	3,565	7,834	6,901	3,129	1,969	2,431	29,190	505
2000[d]	7,947	3,534	8,162	7,112	3,442	2,034	2,334	28,800	600
r[b]	-0.794[c]	0.080	0.468	0.556	0.238	0.254	0.215	0.975	0.354
P	<0.01	0.82	0.15	0.08	0.48	0.45	0.53	<0.01	0.28

[a]Combines estimates from Game Take Survey and Furtaker Survey.
[b]Pearson product-moment correlation coefficient.
[c]Correlation coefficient estimated using 1983-99 data.
[d]Cautionary note: Estimates calculated using correction factor to compensate for combination license bias.

Table 6. Harvest of furbearers, 1983-00, Pennsylvania.

Year	Raccoon	Muskrat	Red fox	Gray fox	Opossum	Skunk	Mink	Coyote[a,b]	Weasel[a]
1983	449,499	575,530	88,643	64,754	339,436	86,769	13,089		
1984	495,106	621,111	75,532	66,975	339,294	72,050	23,627		
1985	557,989	362,074	68,074	40,476	237,493	48,847	13,932		
1986	426,625	440,880	95,330	46,387	210,953	39,064	16,008		
1987	443,934	346,558	74,590	56,944	217,552	39,632	18,513		
1988	247,743	230,058	52,778	23,102	105,881	16,371	12,914		
1989	155,761	141,577	43,525	28,818	80,660	20,409	9,669		
1990	116,443	112,358	32,699	21,653	36,574	9,298	7,053	1,810	798
1991	130,608	156,014	28,495	30,409	37,177	8,907	10,355	3,719	481
1992	124,404	135,533	27,611	25,395	27,754	7,221	9,157	4,402	343
1993	118,964	121,657	25,862	23,839	25,807	7,920	7,808	6,161	526
1994	186,551	178,145	30,649	34,691	29,621	12,620	10,208	6,240	723
1995	120,462	130,442	31,110	23,518	29,688	9,995	8,602	6,662	687
1996	214,958	146,013	29,623	23,307	48,549	11,571	9,315	7,957	589
1997	194,696	216,066	36,923	26,043	60,717	12,344	14,063	6,685	1,172
1998	195,110	148,202	47,202	32,922	56,287	11,190	12,238	11,652	662
1999[d]	107,407	94,215	36,860	26,794	33,723	6,723	13,774	9,586	319
2000[d]	108,890	79,880	33,060	24,452	29,093	7,534	8,614	10,383	340
r[c]	-0.773	-0.798	-0.750	-0.704	-0.818	-0.795	-0.495	0.932	0.099
P	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	0.77

[a]No data are available prior to 1990.
[b]Combines estimates from the Game Take and Furtaker surveys.
[c]Pearson product-moment correlation coefficient.
[d]Cautionary note: Estimates calculated using correction factor to compensate for combination license bias.