PENNSYLVANIA GAME COMMISSION BUREAU OF WILDLIFE MANAGEMENT PROJECT ANNUAL JOB REPORT

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TITLE: Black Bear Research and Management

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TITLE: Black Bear Harvest and Population Monitoring

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COOPERATING AGENCIES: No cooperating agencies

WORK LOCATION: Statewide

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ABSTRACT In 2014, the statewide black bear population was estimated to be 18,320 bears with a 95% confidence interval of 15,558 to 21,698 bears, which was nearly identical to the 2013 population estimate and the seventh consecutive year for stable estimates centered at 18,000 bears. Hunters purchased a record 173,523 bear licenses, which resulted in the harvest of 3,368 bears: 9 during the early season, 171 during the archery season, 2,449 during the general season, and 739 during the extended season. Season totals were close to 5-yr mean values except in the archery season, where a second year of declining harvest occurred. Inclement weather during key days of the archery season is believed to be a contributing factor, but attention to this trend in 2015 is recommended. Eight hundred and ninety-seven bears were captured and tagged statewide during 2014. In 3 core areas of the range – Wildlife Management Unit (WMU) 2C in the southwest region, WMU 2G in the northcentral region, and WMU 3D in the northeast region – 125, 203, and 159 bears were tagged, respectively, and in the remaining 12 WMUs comprising the primary bear range, mean number of bears tagged was 33 bears. Tagging in WMUs 2E, 4B, and 4E should be a priority in 2015 as <20 bears were tagged in each. The statewide harvest rate during the general season as determined from recovery of ear-tagged animals was 13.3%. In WMUs open to extended hunting, harvest rates averaged 24.7%. In WMUs 2C and 4B, where extended hunting was opened for the first time, harvest rates were 22.0% and 35.3%, respectively, which were considered acceptable for continuing the season. Bear hunting seasons similar to 2014 are recommended for 2015.

OBJECTIVE

To document bear harvest and population trends, and to make bear management recommendations based on these trends.

METHODS

We captured bears using culvert traps or foot snares set in nuisance and non-nuisance situations during May–October, and by visiting winter dens in February and March. Each captured bear was marked with a uniquely numbered metal ear tag in each ear, and a first premolar tooth was extracted for age determination from bears over 12 months old. Some bears also were weighed, tattooed on the inside upper lip, or fitted with a radio-transmitting neck collar. All capture and handling of bears was done by Wildlife Conservation Officers, land management staff, biologists, and wildlife technicians employed by the Game Commission.

Tagging was encouraged throughout the primary bear range by assigning capture objectives to 54 counties. Capture objectives mirrored harvest distribution and summed to 700. We asked personnel responsible for tagging bears to use their local county objective as a trapping goal.

Bear hunting occurred during 4 seasons: an early season in Wildlife Management Unit (WMU) 2B, 5B, 5C, and 5D concurrent with archery (20 September-15 November), muzzleloader (18-25 October) or special firearms (23-25 October) seasons for white-tailed deer; a statewide archery bear season during 17-21 November, a statewide general bear season during 22 and 24-26 November, and an extended bear season in select WMUs during the general firearms deer season. Length of the extended season varied based on location, and occurred during 1-6 December in WMU 3A, 3B, 3C, and 3D; 1-13 December in WMU 2B, 5B, 5C, and 5D, and 3-6 December in WMU 2C, 4B, 4C, 4D, and 4E (Fig. 1).

Hunters were required to purchase a bear license in addition to a general hunting license before participating in a bear season. Bear licenses could be purchased until the day before the general season (21 November) and between the general and extended seasons (27-30 November). There was no limit on the number of licenses available, and they could be purchased at any license-issuing location. The annual bag limit was 1 bear per licensed hunter in all seasons combined.

Successful hunters were required to present their bear for inspection at a check station within 24 hours of harvest. While checking bears, we recorded sex, age (cub or adult), harvest location, time of death, and marking (ear tag or tattoo) information. We collected a premolar tooth for ageing, weighed the bear, and interviewed the hunter to obtain name, address, and biographical data. Cause of death, location, sex, age, and tag information also was collected from any dead bears reported to the Game Commission outside the hunting season (e.g., vehicle collisions, damage or nuisance removals, loss due to disease, and poaching incidents).

We maintained a database of all reported captures, harvests, and nonharvest mortalities. We used bears captured in the 12 months before the hunting season as marked animals and bears killed during the hunting season as a recapture sample to estimate population size using the unbiased Lincoln-Petersen equation (Seber 1982). Bears with ear tags from previous years were treated as unmarked unless recaptured in 2014 to reduce the effects of tag loss (Alt et al. 1985), dispersal (Alt

1978), and undetected mortality. Marked bears that were known to die prior to the hunting season (recapture period) were excluded from population estimate calculations.

Population estimates were calculated for individual WMUs and the entire state. When estimating population size for the entire state, we limited the recapture period to the general hunting season to be consistent with estimation procedures used in prior years. When estimating population size for individual WMUs, we pooled all bear hunting seasons (early, archery, general, and extended) into a single recapture period. Population estimates were not calculated for WMUs that had 10 or fewer bears marked during 2014.

We calculated harvest rate (percent of the population removed by hunting) as the proportion of tagged bears that were harvested, regardless of where they were harvested or in which season. Harvest rates were calculated for the entire state and individual WMUs with >10 bears marked and not recovered dead prior to the hunting season.

RESULTS

Captures and Tagging

A record 897 bears were captured 1,044 times between 1 December 2013 and 21 November 2014. This compares with 795 bears and 901 captures the previous year. Forty-two percent of the bears handled during 2014 were captured in nuisance situations (40% in 2013).

Capture objectives were met or exceeded in 30 of 54 counties, while 4 counties outside the primary bear range that have no assigned capture quota also tagged bears (Table 1). The number of counties meeting at least 75% or more of their assigned tagging objective increased from the previous year (39 versus 33 counties in 2013).

Forty-one tagged bears (4.6%) died prior to the fall hunting season; 1 also died during the early hunting season, and 11 died during the archery season, leaving a sample of 844 bears for computing the statewide population estimate. The most common cause of death prior to hunting season was automotive collisions (27 of 41, 66%).

Population Estimates

Statewide Population.--The 2014 statewide population estimate was 18,320 bears with a 95% confidence interval of 15,558 to 21,698 bears (Table 2). Although the 2014 estimate was slightly below the 2013 estimate, both were statistically similar because confidence intervals overlapped. The statewide population estimate has been stable near 18,000 bears since 2008.

Individual WMUs.--Data were available to estimate population size in 15 WMUs (Table 3). Estimates were not calculated for Units 1A, 1B, 2A, 2B, 5A, or 5C because there were an insufficient number of bears tagged, although some harvest did occur there. Similarly, estimates were not calculated for 5B or 5D because there was no harvest.

Unit 2G had the largest population estimate and Units 4E, 2E, and 2H had the smallest estimates. Three WMUs had density estimates that were ≥ 1.0 bear per square-mile; the lowest

Harvest

Bear License Sales.--Hunters purchased a record 173,523 bear licenses during 2014, which was a 3.6% increase from the number sold in 2013 (167,439 licenses). Approximately 3.5% were nonresidents, which was typical of recent years. Eighteen percent of all licensed hunters in 2014 purchased a bear license.

The increase in bear license sales may have been partly due to expanded hunting opportunity in WMUs 2C and 4B, where a 4-day extended season was opened for the first time in 2014. However, a general increase in bear license sales has occurred during the past 15 years beginning before extended seasons and other changes to the bear season were initiated.

Although an increasing trend in bear license sales has not appeared to negatively impact bear populations, continued increase in hunter participation should be closely monitored. During the 1970s when a bear license was not required, an estimated 250,000 hunters pursued bears and bear populations noticeably declined (Lindzey et al. 1983).

Harvest Size and Location.--Hunters killed 3,368 bears during 2014, which included 9 bears during the early season, 171 bears during the archery season, 2,449 bears during the general season, and 739 bears during the extended season (Table 4). The 2014 harvest was a 4.0% decrease from the 2013 harvest, but it ranked seventh in overall harvests behind a harvest of 3,460 in 2008, 3,510 in 2013, 3,513 in 2009, 3,632 in 2012, 4,162 in 2005, and 4,350 in 2011.

Bears were taken in 56 of Pennsylvania's 67 counties. The top 10 counties in 2013 were Lycoming (286 bears), Tioga (275 bears), Clinton (179 bears), Potter (157 bears), Centre (117 bears), Pike (111 bears), Somerset (109 bears), Bradford (108 bears), Fayette (103 bears), and McKean (100 bears).

Bears were harvested in 21 of 23 WMUs. Harvest decreased from the previous year in 14 WMUs, remained the same in 1, and increased in 8 (Table 5). The largest increase occurred in WMU 4B, where harvest more than doubled because of the newly opened extended season, and adjacent WMU 5A where 4 bears were harvested after none in 2013.

Harvest Rate.--Of the 855 tagged bears assumed to be alive at the start of the statewide archery season, 11 were killed yielding a harvest rate of 1.3%, which was nearly identical to the rate observed during 2013 (1.6%; Table 4). Harvest rate during the general season was 13.3%, which was below average for general seasons in years with extended hunting but similar to the rate observed in 2013 (13.5%; Table 4). The decrease in harvest rate during the general season presumably occurred because a significant ice storm occurred across most of the state during opening day.

Total harvest rate for the area open to extending hunting was 18.3% and the mean rate across affected WMUs was 24.7% (Table 4). Five WMUs had harvest rates in the 20 to 25% range, which is considered sufficient for stabilizing growth in black bear populations; 1 exceeded 25%, which can reduce populations if repeated, and 9 were below 20%, which is typically insufficient to stop

population growth (Table 5). The lowest harvest rate (9%) occurred in WMU 3D, which was unusual because a 6-day extended season was available and the WMU is typically a popular area for bear hunting.

Hunter Success Rate.--Approximately 1.9% or 1 in 52 hunters who purchased a bear license were successful in 2014 (Table 4). This value was below the 5-yr and 10-yr mean of 2.3%; the last time success rate was 1.9% was in 2010 when the extended season was closed statewide due to opening day of the general season being moved from Monday to Saturday. Inclement weather on opening day of the general season is believed to have contributed to the lower success in 2014.

Timing of Kills.--Sixty-seven percent of the general season harvest occurred on opening-day (Saturday) and 19% occurred on the second day (Table 4). The second-day percentage was the lowest value to be observed since moving from Monday to Saturday in 2010 (2010-2013 mean = 27%); only 454 bears were taken on the second day. Harvest during the third and fourth days was typical. The decline on the second day was likely a consequence of the widespread ice storm on Saturday, which may have encouraged many hunters to return home on Sunday.

During the archery season, harvest is typically greatest on opening day (Monday), and then steadily declines before increasing again on the last day (Friday). However, in 2014, harvest was noticeably low on the first and last days of the archery season, which resulted in an overall below-average harvest. The same trend also occurred in 2013. During 2010-2012, mean harvest on opening and ending day of the archery season was 107 and 58 bears, respectively; in 2014, 37 and 38 bears were taken. Like the general season, inclement weather probably contributed to the low harvest those days, but now that the same trend has occurred in 2 consecutive years, close attention to this season is recommended for 2015.

Weights of Harvested Bears.--Weights were obtained for 3,230 bears, which was 96% of the harvest. Forty-nine percent of the bears not weighed occurred in the archery season where bears are typically checked in the field by Wildlife Conservation Officers.

One hundred four bears (3.2% of the total harvest) weighed 400 pounds or more and 41 (1.3%) weighed over 500 pounds calculated live weight. These percentages were slightly lower than in 2013 when 141 bears (4.0%) weighed 400 pounds or more and 58 bears (1.7%) weighed 500 pounds or more. The largest bear had a dressed weight of 574 pounds, or 677 pounds estimated liveweight, and was harvested in WMU 2F, Warren County on the first day of the general season.

The average live-weight of all bears harvested during 2014 was 172 pounds (179 lbs in 2013). The average weight of bears taken during the archery season was slightly higher than the average weight of bears taken during either the general or extended seasons (196 lbs vs. 170 lbs and 175 lbs, respectively). This trend also occurred in prior years.

Non-Hunting Mortalities

Five hundred ninety-five bear mortalities were documented outside of the hunting season during 2014. They included 438 automotive collisions, 14 illegal shootings, 31 damage removals, and 112 other miscellaneous causes of death (Table 6).

Miscellaneous mortalities were greatest during the past 3 years (Other category, Table 6), including 112 mortalities in 2014. Approximately two-thirds of these mortalities have typically involved mange, including 70 mortalities in 2012 and 66 in 2013. However, in 2014, the percentage decreased to 45% (n = 50 mortalities). Reports of bears with mange have increased in number and distribution during the past 15 years (Sommerer 2014), but the reasons for an increase and an estimate of prevalence in the population are unknown, as is the cause for a decline in incidents in 2014.

RECOMMENDATIONS

- 1. Continue monitoring hunter participation during 2015 by requiring purchase of a bear license and listing all bear hunting seasons on the annual Game Take Survey.
- 2. Accurately measure tag-returns (in order to estimate population size and harvest rate) by operating check stations during all days of the general season and select days of the extended season. When check stations are not being operated, e.g., during the early, archery, or parts of the extended season, require harvested bears to be field-checked by agency staff. Mandatory checking of all harvested bears, whether at established check stations or in the field, should continue.
- 3. Tag a minimum of 700 bears during 2015, including bears recaptured from previous years. Make tagging of bears in WMUs with extended seasons a priority; in particular, tagging should be increased in WMU 4E, 4B, 3A, and 2D.

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Table 1. Number of bears tagged by county and region, tagging objectives, and percent each objective was filled during 2014.

Region	County	No. Bears Captured	Tagging Objective	% Filled
North-	Butler	2	6	33
West	Clarion	8	8	100
	Crawford	1	6	17
	Erie	0	3	0
	Forest	9	10	90
	Jefferson	6	10	60
	Lawrence	0	0	n/a
	Mercer	2	4	50
	Venango	16	9	>100
	Warren	14	11	>100
	Entire Region	58	67	87
South-	Allegheny	2	2	100
West	Armstrong	8	9	89
	Beaver	1	0	>100
	Cambria	20	19	>100
	Fayette	13	14	93
	Greene	0	0	n/a
	Indiana	8	14	57
	Somerset	46	23	>100
	Washington	0	0	n/a
	Westmoreland	45	25	>100
	Entire Region	143	106	>100
North-	Cameron	12	12	100
Central	Centre	15	29	52
	Clearfield	22	24	92
	Clinton	150	31	>100
	Elk	20	19	>100
	Lycoming	23	32	72
	McKean	34	21	>100
	Potter	25	22	>100
	Tioga	24	26	92
	Union	4	15	27
	Entire Region	329	231	>100
South-	Adams	1	0	>100
Central	Bedford	10	12	83
	Blair	11	9	>100
	Cumberland	2	0	>100
	Franklin	3	4	75
	Fulton	7	6	>100
	Huntingdon	18	18	100
	Juniata	8	7	>100
	Mifflin	13	11	>100

Table 1 cont.

Region	County	No. Bears Captured	Tagging Objective	% Filled
South-	Perry	10	4	>100
Central cont.	Snyder	4	4	100
	Entire Region	0	0	n/a
North-	Bradford	87	75	>100
East	Carbon	5	16	31
	Columbia	17	14	>100
	Lackawanna	1	7	14
	Luzerne	18	14	>100
	Monroe	22	21	>100
	Montour	49	26	>100
	Northumberland	0	1	0
	Pike	1	4	25
	Sullivan	74	31	>100
	Susquehanna	5	14	36
	Wayne	11	9	>100
	Wyoming	31	19	>100
	Entire Region	16	10	>100
South-	Berks	250	186	>100
East	Bucks	7	7	100
	Chester	0	0	n/a
	Dauphin	0	0	n/a
	Delaware	4	5	80
	Lancaster	0	0	n/a
	Lebanon	0	0	n/a
	Lehigh	3	3	100
	Montgomery	2	3	67
	Northampton	2	0	>100
	Schuylkill	11	3	>100
	York	11	14	79
	Entire Region	40	35	>100
Statewide (all reg	gions)	897ª	700	>100

^a Does not equal to sum of column because some bears were captured in more than one county and have been counted in each counties' capture numbers.

Table 2. Lincoln-Petersen mark-recapture population estimates for black bears in Pennsylvania, 1992-2014.

	Number of tagged		95% Confidence Interval		
	bears available	Population -	75 / 0 Comita	chec mer var	
Year	for recapture ^a	estimate	Lower	Upper	
1992	301	8,252	6,726	10,618	
1993	356	8,880	7,370	11,062	
1994	386	8,525	6,945	10,870	
1995	439	9,269	7,957	11,055	
1996	420	8,596	7,266	10,454	
1997	566	10,057	8,213	11,204	
1998	441	9,902	8,588	11,666	
1999	404	11,957	9,659	15,394	
2000	388	15,340	12,796	18,963	
2001	428	15,387	12,989	18,721	
2002	564	15,104	12,753	18,341	
2003	586	16,064	13,609	19,105	
2004	551	13,810	11,636	16,525	
2005	506	15,901	13,550	18,810	
2006	558	15,121	12,705	18,142	
2007	566	13,363	11,112	16,202	
2008	592	17,504	14,762	20,911	
2009	806	17,852	15,449	20,749	
2010	702	18,375	15,572	21,824	
2011	753	17,831	15,405	20,763	
2012	695	16,255	13,868	19,179	
2013	748	18,518	15,592	22,134	
2014	844	18,320	15,558	21,698	

^a Bears that were tagged in the current year and not discovered dead prior to the general hunting season (i.e., recapture period). See Table 1 for total number of captures in 2014.

Table 3. Lincoln-Petersen mark-recapture black bear population estimates by WMU in the primary bear range during 2014.

WMU	Area (mi²)	Population estimate	Est. number of bears/mi ²	Lower 95% CI	Upper 95% CI
2C	3,100	1,288	0.42	973	1,772
2D	2,487	923	0.37	495	1,922
2E	1,262	293	0.23	145	709
2F	2,411	1,314	0.55	828	2,250
2G	3,115	3,880	1.25	2,905	5,302
2H	999	354	0.35	214	659
3A	1,508	1,147	0.76	693	2,136
3B	2,218	2,862	1.29	1,479	6,017
3C	2,191	658	0.30	429	1,112
3D	2,103	3,086	1.47	1,984	4,968
4A	1,736	427	0.25	255	826
4B	1,591	364	0.23	241	656
4C	1,717	528	0.31	329	948
4D	2,743	1,010	0.37	694	1,580
4E	1,736	259	0.15	137	617

Table 4. Statewide black bear hunting season and harvest statistics, 2009-2014.

	Season			Harv	est					
	length	Season	First	Second	Third		Harvest	Number of	Hunter	Hunters
Year	(days)	dates	day	day	day	Total	rate (%)	licenses sold	success (%)	/bear
2009 ^c	2	18-19 Nov	90	26		116	0.6			
2009	3	23-25 Nov	2,163	630	259	3,052	17.0	147,728	2.4	42
2009 ^a	6	30 Nov-5 Dec	122	62	83	345	31.6			
2010^{c}	5	15-19 Nov	115	36	32	268	2.1			
2010	3	20, 22-23 Nov	1,755	794	273	2,822	15.2	161,119	1.9	52
2011 ^c	5	14-18 Nov	99	63	34	304	2.2			
2011	4	19, 21-23 Nov	1,960	857	223	3,168	17.7	162,170	2.7	37
2011 ^a	6	28 Nov-3 Dec	291	91	95	878	21.2			
2012^{d}	57	15 Sep-10 Nov	0	0	1	13				
2012 ^c	5	12-16 Nov	106	46	40	262	1.7			
2012	4	17, 19-21 Nov	1,558	614	332	2,685	16.4	160,852	2.3	44
2012 a	6	26 Nov-1 Dec	194	49	104	672	20.5^{b}			
2013^{d}	57	21 Sep-16 Nov	1	0	1	12				
2013 ^c	5	18-22 Nov	57	43	39	197	1.6			
2013	4	23, 25-27 Nov	1,356	760	214	2,521	13.5	167,439	2.1	48
2013 a	6	2-7 Dec	305	142	96	780	26.2^{b}			
2014^{d}	57	20 Sep-15 Nov	1	0	0	9				
2014 ^c	5	17-21 Nov	37	30	33	171	1.3			
2014	4	22, 24-26 Nov	1,640	454	250	2,449	13.3	173,523	1.9	52
2014 a	6	1-6 Dec	243	122	88	739	24.7^{b}			

^a Extended season.

^b Mean WMU harvest rate combining all seasons in WMUs open to extended hunting.

^c Archery season.

^d Early season.

Table 5. Black bear harvest statistics by WMU, 2014.

WMU	Area (mi²)	Number of bears tagged ^a	Harvest rate	Total harvest	Total harvest/ 10 mi ²	Early season harvest	Archery season harvest	General season harvest	Extended season harvest	% Change in total harvest from 2012
1A	1,847	2	b	12	0.1	0	3	9	0	-25
1B	2,117	7	b	90	0.4	0	9	81	0	-4
2A	1,811	0	b	1	0.0	0	0	1	0	100
2B	1,363	3	b	3	0.0	3	0	0	0	-25
2C	3,100	125	0.22	290	0.9	0	14	234	42	17
2D	2,487	31	0.13	148	0.6	0	10	138	0	-13
2E	1,262	19	0.12	48	0.4	0	1	47	0	-48
2F	2,411	50	0.18	262	1.1	0	14	248	0	-15
2G	3,115	203	0.16	623	2.0	0	48	575	0	9
2H	999	37	0.17	68	0.7	0	3	65	0	-22
3A	1,508	29	0.22	286	1.9	0	3	154	129	-21
3B	2,218	39	0.11	366	1.7	0	8	199	159	1
3C	2,191	41	0.24	168	0.8	0	4	65	99	-14
3D	2,103	159	0.09	295	1.4	0	18	169	108	-25
4A	1,736	24	0.22	106	0.6	0	8	98	0	33
4B	1,591	17	0.35	141	0.9	0	5	89	47	110
4C	1,717	38	0.18	120	0.7	0	10	66	44	29
4D	2,743	55	0.25	261	1.0	0	5	175	81	-5
4E	1,736	11	0.18	64	0.4	0	8	31	25	-6
5A	1,301	2	b	4	0.0	0	0	4	0	400
5B	2,640	1	b	0	0.0	0	0	0	0	-100
5C	2,473	8	b	12	0.0	6	0	1	5	-25
5D	835	1	b	0	0.0	0	0	0	0	0

^a Excluding bears that were documented dead prior to hunting season.
^b Harvest rate could not be determined because of an insufficient number of tagged bears, or no tagged bears were harvested.

Table 6. Black bear mortalities documented outside of the legal hunting season in Pennsylvania, January-December, 1995–2014. Category "Other" includes cases of unknown cause of death, malnutrition, disease (including being euthanized for mange), predation, non-vehicle accidents (i.e., collisions with trains), unsuccessful cub reintroductions, handling accidents, and self-defense killings.

	Property or agriculture	Automobile	Illegal		
Year	damage ^a	collisions	shootings	Other	Total
1995	12	251	21	29	313
1996	3	216	14	25	258
1997	6	277	23	32	338
1998	4	262	24	21	311
1999	3	342	19	22	386
2000	25	305	20	26	376
2001	12	312	13	28	365
2002	11	378	22	42	453
2003	25	444	22	61	552
2004	28	354	18	42	442
2005	12	289	8	28	283
2006	12	382	17	51	462
2007	10	314	22	37	383
2008	21	357	14	60	452
2009	35	404	21	61	521
2010	27	405	16	68	516
2011	37	418	12	97	564
2012	34	408	9	115	566
2013	35	411	14	99	559
2014	31	438	14	112	595

^a Includes both agency and landowner removals.

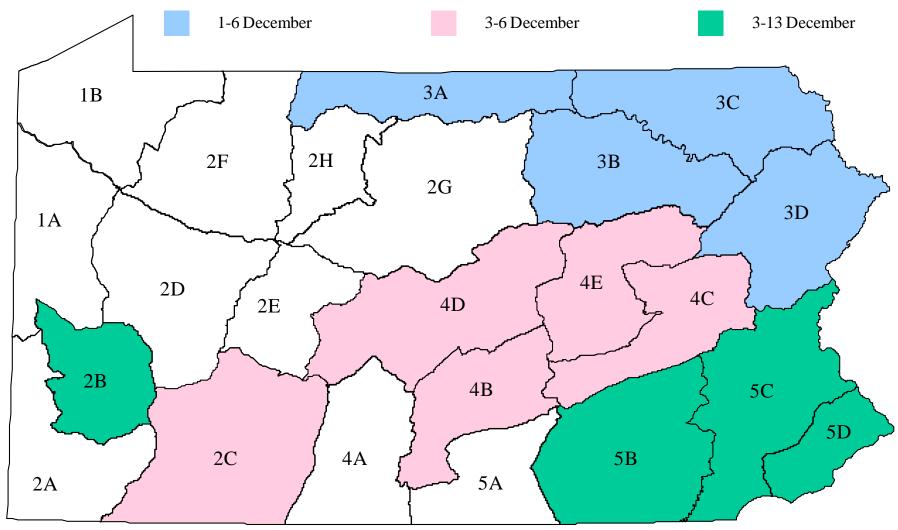


Figure 1. Area and dates open to bear hunting during the 2014 extended season.