

Colorado Parks and Wildlife
Furbearer Management Report
2015-2016 Harvest Year



Report By:

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In July 2011, the Colorado Parks and Wildlife Commission directed staff to review the management priorities, data collection processes, and management approaches for furbearer species in a consultative process with interested stakeholders. Subsequent recommendations on priorities, processes, and management guidelines were forwarded to the Parks and Wildlife Commission in a 2 step public review process and were finalized in July 2012. The review process prioritized furbearer species for enhanced harvest data collection and for development of species specific management guidelines. Priority species identified for improved harvest data collection are: gray fox, swift fox, and pine marten. Priority species identified for development of management guidelines priority species are: bobcat, gray fox, and swift fox.

Colorado Parks and Wildlife (CPW) decided to use the Harvest Information Program (HIP) as a means of “pre-registering” fur harvester’s intent to take these species. Doing so allows stratification of survey samples in an effort to improve the confidence in harvest estimates and the location of harvest. Despite these efforts survey results continue to be plagued by extremely large confidence limits, variance, and lack precision. This is primarily due to the extremely small number of fur harvest participants within the very large pool of licensed individuals. In Colorado a person with a small game license can harvest furbearers just as a person with a furbearer license can. Therefore, it is extremely difficult to obtain sufficient sample size when conducting harvest surveys. Stratification of the survey sample based on fur harvesters self reported propensity to hunt/trap gray fox, swift fox, or pine marten did not improve the precision or accuracy of the harvest estimates. For 2015-2016, the swift fox harvest estimate is exemplary of the inaccuracy of harvest estimates.

Because improvement to the harvest estimates has not been realized, CPW is now in the process of re-examining how it can improve furbearer harvest estimates.

Bobcats were also identified as a high priority species for harvest data collection; although the mandatory check process was deemed adequate for obtaining harvest data. We did however revise the mandatory bobcat check form to include information to estimate bobcat harvest per unit effort, which is one of the management guidelines developed for bobcats.

In July 2012, following the program review process the Parks and Wildlife Commission approved the data collection processes and new management guidelines for bobcat, gray fox, and swift fox. Those guidelines and their corresponding data results are summarized in specific sections of this report.

This report contains several sections:

- Section I Historic and recent harvest data
- Section II Bobcat management guideline analysis
- Section III Swift fox guideline analysis
- Section IV Gray fox management guideline analysis
- Section V Pine Marten harvest data analysis
- Section VI Summary and critique of harvest data collection and management guideline analysis and recommendations for improvement

SECTION I: Recreational Harvest Data

HISTORIC HARVEST DATA

	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Badger	697	158	159	110	n/s	135	n/s	n/s	225	n/s	102	550	n/s	n/s	n/s
Beaver	4033	1576	896	238	n/s	1072	n/s	n/s	356	n/s	782	1147	n/s	n/s	n/s
Bobcat (Total Mortality)	461	644	766	796	1261	1708	1845	1783	1399	1578	1686	1917	2022	1695	1407
Bobcat (Harvest Only)	387	562	680	717	1163	1605	1743	1668	1303	1489	1628	1854	1945	1634	1352
Coyote	34413	39610	45912	38211	n/s	34943	31204	42427	n/s	49974	64294	41337	n/s	28529	42513
Gray Fox	CS	CS	CS	CS	CS	CS	CS	CS	109	n/s	510	763	1047	164	1003
Red Fox	1540	1517	997	457	n/s	n/s	n/s	n/s	1925	n/s	n/s	n/s	n/s	n/s	n/s
Swift Fox	CS	CS	CS	CS	CS	CS	CS	CS	153	n/s	107	381	416	609	11417
Mink	CS	CS	CS	CS	CS	0	n/s	n/s	15	n/s	n/s	n/s	n/s	n/s	n/s
Muskrat	1870	1300	87	439	n/s	1230	1230	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Opossum	CS	CS	CS	CS	CS	CS	CS	CS	45	n/s	n/s	n/s	n/s	n/s	n/s
Pine Marten	CS	CS	CS	CS	CS	175	n/s	n/s	52	n/s	139	940	1569	2018	993
Raccoon	3703	2777	2153	293	n/s	n/s	n/s	n/s	5299	n/s	n/s	n/s	n/s	n/s	n/s
Ring-tailed Cat	CS	CS	CS	CS	CS	CS	CS	CS	0	n/s	9	74	n/s	n/s	n/s
Striped Skunk	1668	2482	896	274	n/s	n/s	n/s	n/s	948	n/s	n/s	n/s	n/s	n/s	n/s
Western Spotted Skunk	CS	CS	CS	CS	CS	CS	CS	CS	0	n/s	n/s	n/s	n/s	n/s	n/s
Long-tailed Weasel	CS	CS	CS	CS	CS	CS	CS	CS	0	n/s	n/s	n/s	n/s	n/s	n/s
Short-tailed Weasel	CS	CS	CS	CS	CS	CS	CS	CS	0	n/s	n/s	n/s	n/s	n/s	n/s

CS = closed season n/s = not surveyed

SECTION I: Recreational Harvest Data

2011 – 2012 Harvest Data

Species	Hunters	Hunters Low – High Confidence Range	Days Hunted	Days Hunted Low – High Confidence Range	Harvest	Harvest Low – High Confidence Range
Badger	144	104 – 201	2,097	1,350 – 3,258	102	66 – 156
Beaver	223	162 – 307	1,824	1,316 – 2,527	782	480 – 1,274
Bobcat	-		-		1,628	
Coyote	15,119	14,100 – 16,213	329,465	258,896 – 419,269	64,294	49,947 – 82,763
Gray Fox	228	152 – 342	3,610	2,543 – 5,125	510	294 – 884
Swift Fox	88	55 – 143	1,267	763 – 2,105	107	53 – 218
Pine Marten	24	14 – 43	243	106 – 558	139	49 – 399
Ring-tailed Cat	9	4 – 12	190	57 – 637	9	3 – 27

Not Surveyed: Red Fox, Mink, Opossum, Raccoon, Striped Skunk, Western Spotted Skunk, Long-tailed Weasel, Short-tailed Weasel

2012 – 2013 Harvest Data

Species	Hunters	Hunters Low – High Confidence Range	Days Hunted	Days Hunted Low – High Confidence Range	Harvest	Harvest Low – High Confidence Range
Badger	285	182 – 445	3,301	2,162 – 5,039	550	278 – 1,091
Beaver	299	207 – 432	3,737	2,198 – 6,353	1,147	690 – 1,907
Bobcat	-		-		1,854	
Coyote	9,782	pending	156,768	pending	41,337	pending
Gray Fox	214	146 – 313	6,109	3,646 – 10,238	763	396 – 1,470
Swift Fox	318	106 – 956	1,980	901 – 4,355	381	116 – 1,248
Pine Marten	235	60 – 927	5,102	1,271 – 20,476	940	310 – 2,850
Ring-tailed Cat	23	4 – 115	45	9 – 231	0	0 – 0

2013 – 2014 Harvest Data

Species	Hunters	Hunters Low – High Confidence Range	Days Hunted	Days Hunted Low – High Confidence Range	Harvest	Harvest Low – High Confidence Range
Bobcat	-		-		1,945	
Gray Fox	1,419	991 – 2,032	not asked		1,047	610 – 1,798
Swift Fox	702	452 – 1,090	not asked		416	227 – 763
Pine Marten	979	627 – 1,530	not asked		1,569	769 – 3,202

2014– 2015 Harvest Data

Species	Hunters	Hunters Low – High Confidence Range	Days Hunted	Days Hunted Low – High Confidence Range	Harvest	Harvest Low – High Confidence Range
Bobcat	-		-		1,634	
Gray Fox	479	249 – 920	not asked		164	82 – 329
Swift Fox	519	321 – 839	not asked		609	287 – 1,293
Pine Marten	802	510 – 1,263	not asked		2,018	812 – 5,020

SECTION I: Recreational Harvest Data

2015 – 2016 Harvest Data

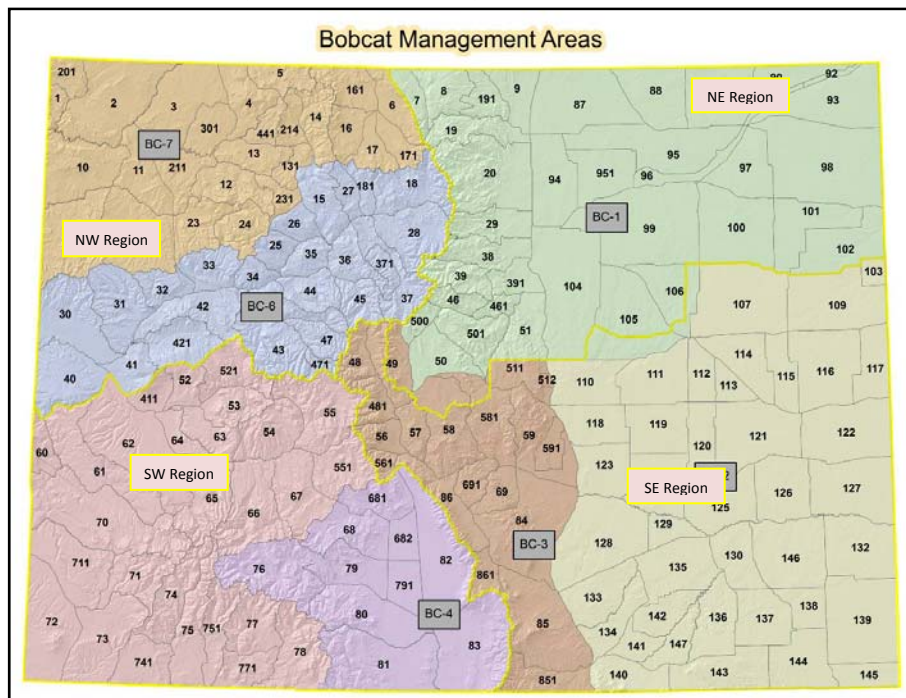
Species	Hunters	Hunters Low – High Confidence Range	Days Hunted	Days Hunted Low – High Confidence Range	Harvest	Harvest Low – High Confidence Range
Bobcat	-		-		1,352	
Gray Fox	880	599 – 1,293	not asked		1,003	496 – 2,027
Swift Fox	1,000	668 – 1,498	not asked		11,417	2,459 – 53,000
Pine Marten	1,156	820 – 1,629	not asked		993	398 – 2,479

Bobcat Mortality Summary

	Total Mortality	Gender			Mortality Type						
		Male	Female	Unk	Hunt	Live Trap	30-day Permit	Road Kill	Game Dmg	Misc	Unk
2015-16	1407	795	589	23	470	882	7	38	2	6	2
2014-15	1695	1000	682	13	472	1162	2	36	2	1	20
2013-14	2022	1127	868	27	595	1350	9	45	5	8	10
2012/13	1917	1052	839	26	648	1206	2	36	2	5	18
2011/12	1686	942	718	26	607	1021	13	26	4	4	11
2010/11	1578	851	700	21	676	813	8	43	5	2	25
2009/10	1399	727	644	28	782	521	18	42	15		21
2008/09	1783	952	797	34	884	784	14	56	16		29
2007/08	1845	1063	760	22	974	769	14	44	5		39
2006/07	1708	966	705	37	797	808	2	62	3		36
2005/06	1261	732	508	21	656	507	33	53	5		7
2004/05	796	457	334	5	469	248	32	33	13		1
2003/04	766	456	289	20	453	227	7	54	22		3
2002/03	644	369	258	17	439	123	1	28	48		14
2001/02	461	247	197	17	336	51	1	32	25		16

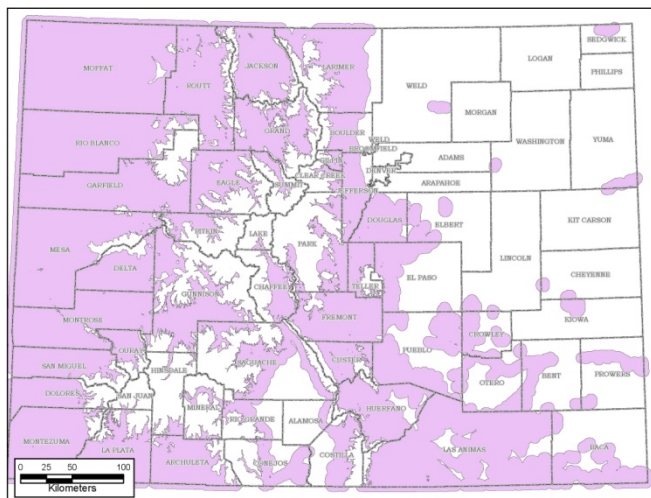
From 1998 through 2005 about 60%-70% of bobcat harvest came through hunting methods of take. Since then this has completely switched and in the 2014 seasons to live traps represent 70% and hunting methods 30% of all harvest. Aside from this the other obvious trend is increasing harvest and total mortality. Although not shown on the tables, this increasing harvest trend generally follows trends in prices for bobcat pelts. Given these increases, monitoring bobcat through established management guidelines is increasingly important.

Figure 1. Bobcat management areas and regional boundaries.



A suite of management guidelines is used in evaluating the status of bobcats and population trajectory. Data is analyzed at three increasing spatial scales: bobcat management areas (Fig. 1), Colorado Parks and Wildlife regions, East/West of the continental divide, and statewide.

Figure 2. Modeled bobcat habitat used for mortality density analysis.



A habitat model was developed to represent core bobcat habitat within the state. While bobcat may occur anywhere in the state a core habitat model was considered more appropriate to conservatively represent essential bobcat habitat. Core habitat was constrained to less than 9,500 feet elevation; woodland and shrubland vegetation types identified in CPW Basinwide vegetation classifications buffered to about 7 km distance in order to smooth boundaries (Fig. 2).

Mortality Thresholds

Mortality Density

The mortality density threshold is to not exceed 2.55 bobcat mortalities per 100 km². This is derived assuming an average population density of not more than 15 bobcat/100 km² across modeled habitat and a mortality threshold of not more than 17%. These are examined at the 4 spatial scales previously mentioned: bobcat management areas, regions, east/west of the continental divide (except that the San Luis Valley shall be included with west of the divide), and statewide.

The Bobcat Mortality Density Analysis Table below indicates that the average mortality density decreased at all spatial scales from preceding year 3-year averages.

The established mortality thresholds have not been exceeded at any of the spatial scales that analysis is performed.

2015-2016 Bobcat Mortality Density Analysis										
Management Threshold: 3-Year Average Mortality Should Not Exceed 2.55 bobcat/100 km ²										
Region	Bobcat Mgmt Area	Bobcat Core Habitat	2013-14 Mortality	2014-15 Mortality	2015-16 Mortality	3-Yr Average Mortality	2015-16 3-Yr Average Mortality Density	2014-15 Results	2013-14 Results	2012-13 Results
NE	BC-1	12101	133	113	115	120	0.99	1.01	1.09	0.97
NW	BC-6	19988	370	333	293	332	1.66	1.72	1.73	1.72
	BC-7	28044	255	227	174	219	0.78	0.91	0.96	0.96
NW Region Total		48032	625	560	467	551	1.15	1.25	1.28	1.26
SE	BC-2	22212	315	229	196	247	1.11	1.35	1.43	1.28
	BC-3	15779	287	232	250	256	1.62	1.70	1.56	1.34
SE Region Total		37991	602	461	446	503	1.32	1.50	1.49	1.30
SW	BC-4	6785	105	99	85	96	1.42	1.52	1.59	1.54
	BC-5	33193	557	462	294	438	1.32	1.47	1.37	1.14
SW Region Total		39978	662	561	379	534	1.34	1.47	1.41	1.21
East Slope		50092	735	574	561	623	1.24	1.38	1.39	1.22
West Slope		88010	1287	1121	846	1085	1.23	1.35	1.32	1.24
Statewide		138103	2022	1695	1407	1708	1.24	1.36	1.36	1.23

Harvest Gender Composition

As with other wild felids, data suggest males are more vulnerable to harvest and are usually more prevalent in harvest records. Thus, increasing amounts of females in harvest has been suggested as a means of monitoring population impacts. Colorado's management threshold on female harvest is that the female harvest composition should not equal or exceed 50% for more than two consecutive years.

The table on the following page indicates that this management threshold is not exceeded at any of the spatial scales that monitoring is performed. Trapping remains a noticeably more selective method of take than does hunting harvest. If not for the selection for males in trapping harvest, most spatial scales would have exceeded management thresholds if hunting harvest were the only harvest considered.

SECTION II: Bobcat Management Guidelines Analysis

2015-2016 Bobcat Harvest Gender Composition											
Management Threshold: Females Should Not Exceed 50% of Harvest											
Region	Bobcat Mgmt Area	Method	Female	Male	Unk	Grand Total	2015-16 % Female and Unknown in Mortality	2014-15 Results	2013-14 Results	2012-13 Results	
NE	BC-1	Hunt	29	21	1	51	59%	40%	57%	59%	
		Live Trap	20	32	0	52	38%	36%	53%	53%	
	NE Region Total			49	53	1	103	49%	38%	54%	56%
NW	BC-6	Hunt	44	28	3	75	63%	47%	42%	46%	
		Live Trap	80	134	0	214	37%	36%	41%	43%	
	BC-6 Total			124	162	3	289	44%	38%	41%	43%
	BC-7	Hunt	25	37	2	64	42%	45%	44%	43%	
		Live Trap	38	64	1	103	38%	36%	37%	41%	
	BC-7 Total			63	101	3	167	40%	38%	40%	42%
	Region	Hunt	69	65	5	139	53%	46%	43%	44%	
Live Trap		118	198	1	317	38%	36%	39%	42%		
NW Region Total			187	263	6	456	42%	38%	41%	43%	
SE	BC-2	Hunt	29	37	0	66	44%	44%	49%	57%	
		Live Trap	50	69	1	120	43%	48%	50%	43%	
	BC-2 Total			79	106	1	186	43%	47%	50%	47%
	BC-3	Hunt	44	47	2	93	49%	55%	47%	47%	
		Live Trap	62	83	1	146	43%	38%	41%	43%	
	BC-3 Total			106	130	3	239	46%	46%	43%	44%
	Region	Hunt	73	84	2	159	47%	52%	48%	51%	
Live Trap		112	152	2	266	43%	44%	46%	43%		
SE Region Total			185	236	4	425	44%	47%	47%	46%	
SW	BC-4	Hunt	19	21	4	44	52%	37%	49%	54%	
		Live Trap	17	22	0	39	44%	37%	30%	39%	
	BC-4 Total			36	43	4	83	48%	37%	38%	45%
	BC-5	Hunt	35	40	2	77	48%	41%	43%	45%	
		Live Trap	77	131	0	208	37%	38%	42%	45%	
	BC-5 Total			112	171	2	285	40%	39%	43%	45%
	Region	Hunt	54	61	6	121	50%	40%	45%	47%	
Live Trap		94	153	0	247	38%	38%	41%	44%		
SW Region Total			148	214	6	368	42%	38%	42%	45%	
East Slope	Hunt	102	105	3	210	50%	49%	50%	53%		
	Live Trap	132	184	2	318	42%	43%	47%	44%		
East Slope Total			234	289	5	528	45%	45%	48%	46%	
West Slope	Hunt	123	126	11	260	52%	42%	44%	45%		
	Live Trap	212	351	1	564	38%	37%	40%	43%		
West Slope Total			335	477	12	824	42%	38%	41%	44%	
Statewide	Hunt	225	231	14	470	51%	45%	46%	48%		
	Live Trap	344	535	3	882	39%	39%	43%	43%		
Statewide Grand Total			569	766	17	1352	43%	40%	44%	45%	

SECTION II: Bobcat Management Guidelines Analysis

Harvest per Unit Effort (HPUE)

This measures the amount of effort put forth to harvest each bobcat. Increasing or decreasing effort per bobcat harvested should be related on a broad scale to the relative abundance of bobcats. Colorado has collected this information only since 2012-13. It is anticipated that 3-5 years will be necessary to develop the initial baseline HPUE data from which future benchmarks can be established. This represents the third year of data collection.

2015-2016 Bobcat Harvest Effort Analysis								
Management Threshold: pending 3-5 year data set								
Region	Bobcat Mgmt Area	Method	Cats Sealed	Days Hunted	No. of Traps Set	Days Traps Set	Hunt Days Per Harvest	Trap Days Per Harvest
NE Total	BC-1	Hunt	47	267			5.68	
		Live Trap	51		148	478		1387
NW	BC-6	Hunt	73	298			4.08	
		Live Trap	216		440	2333		4752
	BC-7	Hunt	79	195			2.47	
		Live Trap	86		233	658		1783
NW Total	Hunt		152	493			3.24	
	Live Trap		302		673	2991		6665
SE	BC-2	Hunt	67	238			3.55	
		Live Trap	112		290	671		1740
	BC-3	Hunt	94	423			4.50	
		Live Trap	145		464	1159		3709
SE Total	Hunt		161	661			4.11	
	Live Trap		257		754	1831		5372
SW	BC-4	Hunt	43	200			4.65	
		Live Trap	42		116	613		1693
	BC-5	Hunt	85	246			2.89	
		Live Trap	194		629	2222		7204
SW Total	Hunt		128	446			3.48	
	Live Trap		236		745	2835		8949
East Slope	Hunt		208	928			4.46	
	Live Trap		308		902	2309		6762
West Slope	Hunt		280	939			3.35	
	Live Trap		538		1418	5826		15356
Statewide	Hunt		488	1867			3.83	
	Live Trap		846		2320	8135		22309

SECTION II: Bobcat Management Guidelines Analysis

The following table displays HPUE for four years of data collection.

Region	Bobcat Mgmt Area	2015-16		2014-15		2013-14		2012-13		Average	
		Hunt Days/ Harvest	Trap Days/ Harvest	Hunt Days/ Harvest	Trap Days/ Harvest	Hunt Days/ Harvest	Trap Days/ Harvest	Hunt Days/ Harvest	Trap Days/ Harvest	Hunt Days/ Harvest	Trap Days/ Harvest
NE (BC-1) Total		5.7	1,387	5.3	2,572	5.1	4,209	4.2	3,468	5.1	2,909
NW	BC-6	4.1	4,752	2.1	6,308	4.0	14,426	6.0	10,099	4.0	8,896
	BC-7	2.5	1,783	1.5	3,891	3.0	4,703	2.0	2,879	2.2	3,314
NW Total		3.2	6,665	1.8	10,217	3.4	18,977	3.4	13,037	3.0	12,224
SE	BC-2	3.6	1,740	2.4	3,197	3.8	5,406	2.7	10,947	3.1	5,323
	BC-3	4.5	3,709	3.7	2,937	5.2	5,943	3.7	3,530	4.3	4,030
SE Total		4.1	5,372	3.3	6,108	4.6	11,285	3.3	6,108	3.8	7,218
SW	BC-4	4.7	1,693	4.2	2,464	4.0	2,040	5.6	2,416	4.6	2,153
	BC-5	2.9	7,204	3.2	8,408	2.7	11,959	4.3	8,570	3.3	9,035
SW Total		3.5	8,949	3.4	10,816	3.1	13,965	4.6	16,989	3.6	12,680
East Slope		4.5	6,762	3.8	8,513	4.7	15,108	3.5	18,479	4.1	12,216
West Slope		3.4	15,356	2.8	20,990	3.2	32,620	3.9	24,007	3.3	23,243
Statewide		3.8	22,309	3.2	29,694	3.8	47,735	3.7	44,665	3.6	36,101

It is evident that there is a high degree of variability in this dataset. There may be reporting errors and data analysis errors that create some of this variation. Trappers have a choice to take an animal caught in a trap or to release that animal. That available choice creates an added variable in the meaning of trap days per harvest. Consequently, the hunt days per bobcat harvest may be a more sensitive index of bobcat abundance because it is more a product of hunter encounter probabilities than subjective choice. In light of this, we can expect that the number of hunt days per harvest in the west slope should be fewer than those found in the east slope because of the lower bobcat densities found in plains habitats.

On average, and rounding to the nearest ½ day:

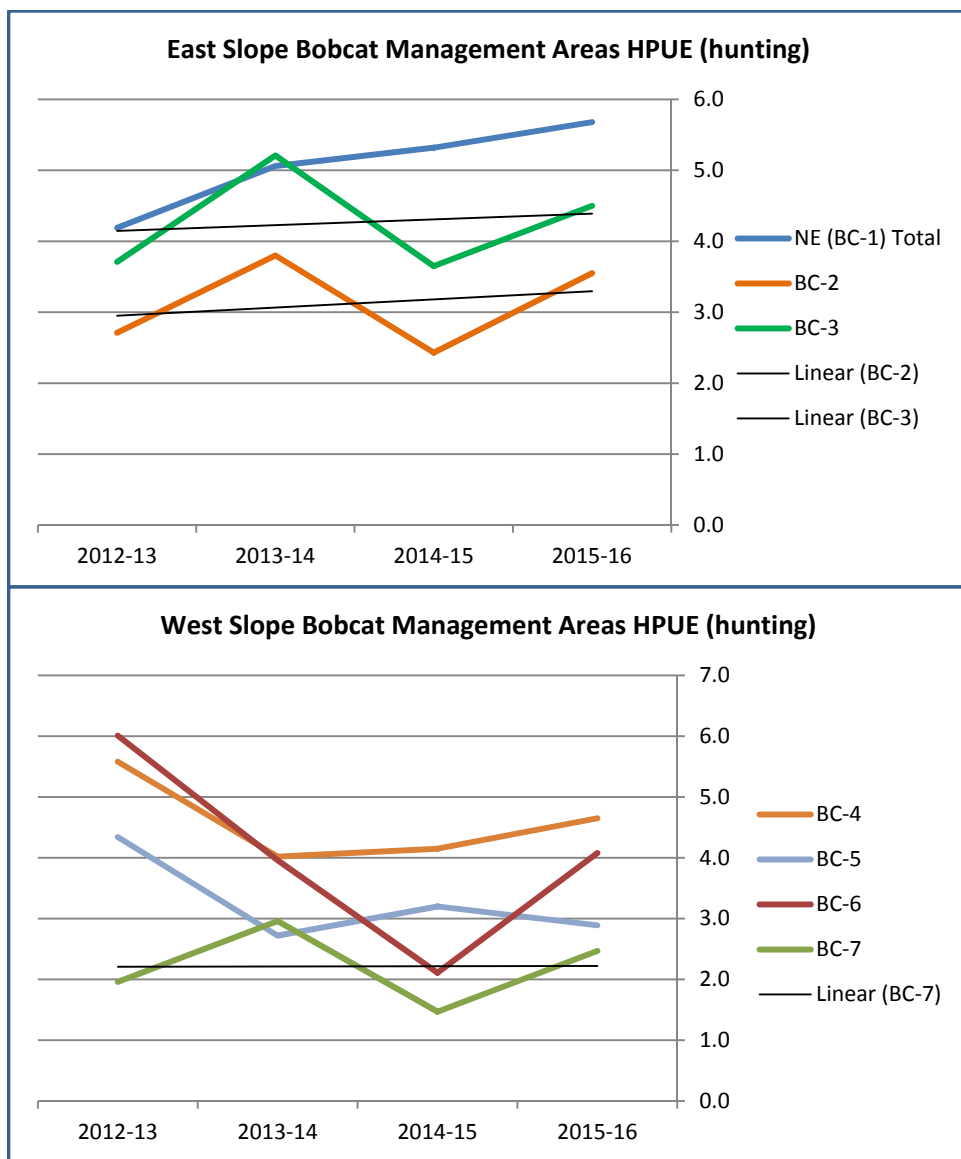
- In the NE Region it takes 5 days of hunting for a hunter to harvest a bobcat.
- In the NW Region it takes 3 days of hunting per bobcat harvest, although, there is considerable variability in the NW Region between the two bobcat management zones. In the Yampa basin it takes about 2 days per harvest, whereas in the Colorado basin it takes about twice that at 4 days per harvest.
- In the SE Region hunters use 4 days per bobcat harvest. Interestingly, the plains bobcat management zone requires fewer days per bobcat harvest (3 days). Compared to 4.5 days per harvest in the mountainous bobcat management zone. The explanation of the apparent incongruity may be because most of the bobcat taken in BC-2 occurs in the canyons and mesas of the Purgatoire River and the riparian habitat of the lower Arkansas River. Both of these areas are high quality bobcat habitat.
- In the SW Region hunters take about 3.5 days to harvest a bobcat. But the San Luis Valley hunters use about 4.5 days, compared to about 3.5 days in the rest of the SW Region.

SECTION II: Bobcat Management Guidelines Analysis

East Slope bobcat management areas all demonstrate an increasing number of days per hunter harvest. In the SE Region areas the trend is not significant from annual variation. In the NE Region however, the trend is consistent and considerable from 2012-2015 seasons.

On the West Slope the trend is a general decrease in the number of days per hunter harvest, except for the Yampa River basin bobcat management area in which there is no change in the time to harvest. In the San Luis Valley and in the Colorado River basin bobcat management areas the trend is significant and consistent except for the most recent season in the Colorado River basin.

Our intent is to continue monitoring bobcat harvest per unit effort and evaluate its utility and perhaps establish management benchmarks after the 2017-2018 seasons.



Prey Abundance

Cottontail rabbits are a primary prey item for bobcat. Although a wide variety of factors can influence cottontail rabbit harvest amounts in Colorado, there is a moderate correlation between rabbit harvest and bobcat harvest. Rabbit harvest may provide an additional piece of information regarding food availability for bobcats and therefore some indication of influences on bobcat populations. Rabbit harvest is collected annually through the small game survey. If rabbit harvest declines and the other monitored indicators are below established thresholds, this would tend to corroborate a possible decline in bobcat populations.

The former threshold (cottontail harvest less than 80,000 on a 3-year running average indicate negative stress on bobcat populations) is rejected and will no longer be used. This threshold was highly conservative in that during the past 15 years cottontail rabbit harvest has only exceeded 80,000 in a single year. Prior to 1999 cottontail rabbit harvests and hunter numbers were considerably greater on average than in more recent years.

Harvest per hunter has been more consistent with perceived rabbit cycles. Therefore, henceforth two aspects of cottontail harvest shall be used to provide an indicator to bobcat prey abundance. We will evaluate total bobcat harvest and the harvest per hunter in the most recent 3 years compared to the 15 year average. Harvest and harvest per hunter greater than 10% above and below the 15 year average will suggest positive and negative stress on bobcat populations respectively.

The 3-year average cottontail rabbit harvest and harvest per hunter is about 5% below the 15 year average. Therefore, cottontail rabbit abundance appears to be more or less average in comparison to the longer term data.

Year	Hunters	Harvest	Harvest per Hunter
2000-01	9,914	46,571	4.7
2001-02	10,029	45,633	4.6
2002-03	10,912	39,629	3.6
2003-04	10,000	52,299	5.2
2004-05	10,938	58,057	5.3
2005-06	11,233	81,415	7.2
2006-07	10,112	69,263	6.8
2007-08	9,365	65,468	7.0
2008-09	8,869	38,693	4.4
2009-10	n/s	n/s	n/s
2010-11	7,442	30,580	4.1
2011-12	13,305	57,859	4.3
2012-13	8,706	52,851	6.1
2013-14	n/s	n/s	n/s
2014-15	11,000	54,083	4.9
2015-16	11,202	42,513	3.8
3 Yr Avg	10,303	49,816	4.8
15 Yr Avg	10,216	52,494	5.1

CPW Manager Knowledge-Professional Judgment

During the course of work activities, wildlife managers and biologists gain anecdotal information about the status of bobcat populations based upon their own observations and the observations of landowners, hunters, trappers, other agency personnel, and other recreationists that CPW staff have contact with. On an annual basis CPW managers and biologists are polled regarding their perceptions of bobcat population status. The survey for 2015-16 is the third year of this effort. Responses are converted to numeric values for averaging and analysis at the different geographic scales.

SECTION II: Bobcat Management Guidelines Analysis

In the Northeast and Northwest Regions bobcat are more strongly perceived as being on an increasing population trajectory. In the SE Region the perception of a somewhat increasing bobcat population is more muted.

Only in bobcat area BC-5 in the Southwest Region are bobcat populations are perceived to be somewhat decreasing in abundance and this perception has been persistent across the 4 years that monitoring has been conducted. However, the strength of this perception of a somewhat decreasing bobcat population is easing in more recent years.

2015-2016 Bobcat Population Status – Professional Assessment							
				Scale			
				2	Increasing		
				1	Somewhat Increasing		
				0	Steady		
				-1	Somewhat Decreasing		
				-2	Decreasing		
Region	Bobcat Mgmt Area	Admin Units	2015-16 Bobcat Population Trend Compared to the Preceding 3 Years	2015-16 Numeric Assessment Value	2014-15 Numeric Assessment Value	2013-14 Numeric Assessment Value	2012-13 Numeric Assessment Value
NE	BC-1	5	Somewhat Increasing	0.80	0.33	1.00	1.00
NW	BC-6	4	Somewhat Increasing	0.50	0.00	-0.40	-0.80
	BC-7	3	Somewhat Increasing	1.00	0.00	0.00	-0.25
NW Region Total		6	Somewhat Increasing	0.71	0.00	-0.25	-0.56
SE	BC-2	2	Somewhat Increasing	0.50	0.67	0.00	1.00
	BC-3	5	Somewhat Increasing	0.40	0.25	0.00	0.75
SE Region Total		7	Somewhat Increasing	0.43	0.43	0.00	0.88
SW	BC-4	1	Steady	0.00	0.00	-1.00	-1.00
	BC-5	3	Somewhat Decreasing	-0.33	-0.33	-0.50	-0.50
SW Region Total		4	Somewhat Decreasing	-0.25	-0.25	-0.60	-0.67
East Slope		12	Somewhat Increasing	0.58	0.40	0.50	0.94
West Slope		11	Somewhat Increasing	0.36	-0.10	-0.38	-0.62
Statewide		23	Somewhat Increasing	0.48	0.15	0.04	0.14

Bobcat Monitoring Summary

Analysis of all monitoring information is conducted annually and uses a preponderance of the evidence standard. Not more than 2 bobcat management areas at any time may exceed more than half of the monitoring thresholds. If so, then the regulations governing bobcat seasons, harvest methods, and/or bag limits will be reexamined and adjustments to constrain harvest may be proposed. If adjustments are made in response to exceeding monitoring thresholds, they should be implemented for 2-3 consecutive years before returning to prior regulatory conditions.

- The mortality density threshold is not exceeded in any locations in Colorado.
- The harvest composition index threshold not exceeded in any locations in Colorado.
- The harvest per unit effort index has obtained applicable data 3 consecutive years; it therefore remains in development pending further data to develop a baseline.
- The prey abundance index indicates that there was an average abundance of prey in 2015-16.
- The manager's assessment index suggests that bobcat populations are steady to somewhat increasing in most locations in Colorado and may still be steady to somewhat declining in the SW part of the state, excluding the San Luis Valley.

Bobcat Mgmt Guideline Analysis 2015-2016					
Region	Bobcat Mgmt Area	Guideline			
		Harvest Density	Harvest Composition	Prey Abundance	Manager Assessment
NE	BC-1	+	+	+	+
NW	BC-6	+	+	+	+
	BC-7	+	+	+	+
SE	BC-2	+	+	+	+
	BC-3	+	+	+	+
SW	BC-4	+	+	+	+
	BC-5	+	+	+	-
East Slope		+	+	+	+
West Slope		+	+	+	+
Statewide		+	+	+	+

+ Meets the guideline

- Does not meet the guideline.

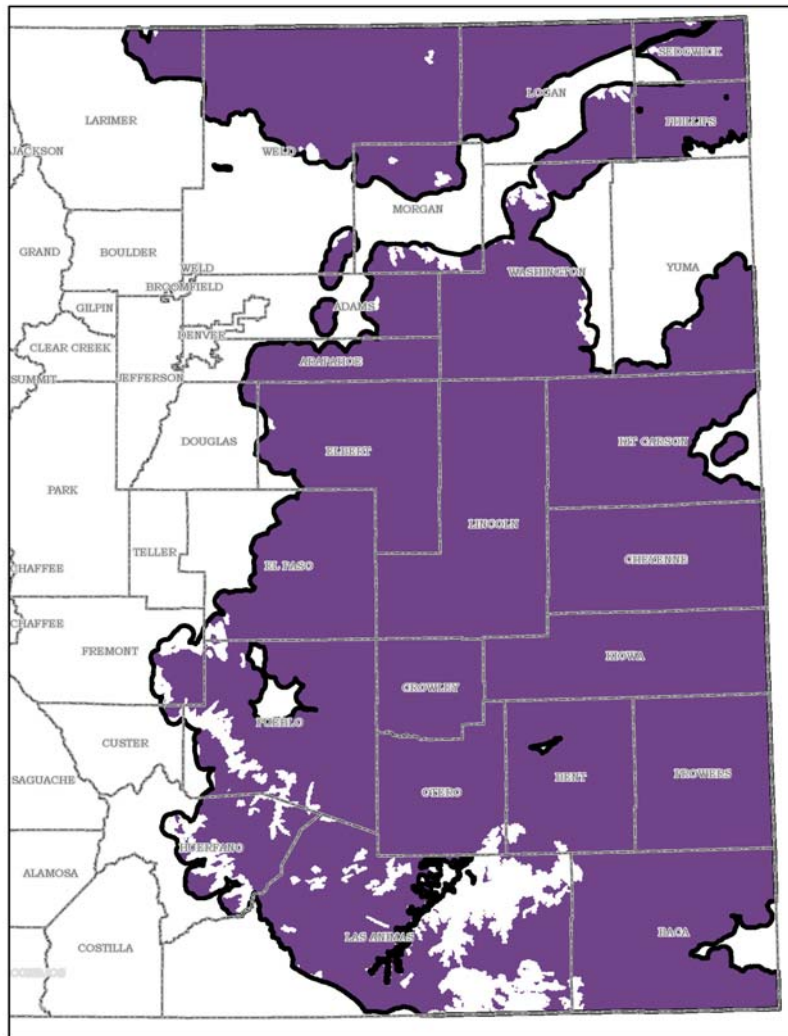
When examined on a preponderance of evidence basis, we conclude that bobcat populations statewide are most likely steady to somewhat increasing, but that certain indicators suggest that it may be slightly increasing largely as a function of increasing prey abundance. Bobcat harvest intensity has declined in 2015-16. Coupled with increasing prey abundance, it is possible that annual production will exceed human and natural mortality, leading to somewhat increased abundance within the next several years.

Management guidelines for swift fox include monitoring habitat occupancy rates in the plains short grass prairie habitats. The other guideline is to annually monitor harvest density by county and range wide with provisions to reduce the frequency of harvest data collection to every other or every third year if harvests remain substantially below thresholds. In order to conduct harvest density analysis CPW developed a more conservative model of swift fox habitat than that used in formulating our occupancy survey grids.

Swift Fox – Short Grass Prairie Habitat Occupancy

Previous occupancy surveys in Colorado conducted detection efforts in short grass prairie habitats but used different methods than applied in a 2011 survey effort. By comparison, the 2011 occupancy survey was more efficient and yielded an occupancy estimate in > 50% short grass prairie habitat in eastern Colorado at 77%. Martin et al. (2007) estimated occupancy in > 50% short grass prairie habitat at 71%. Just examining occupancy in the survey grids Finley et al. (2005) estimated the occupancy in the survey grids of 1995 at 82%. By comparison Martin et. al (2007) estimated the survey grid occupancy rate at 78%, whereas the 2011 survey estimated occupancy in the survey grids at 86%. Thus occupancy does not appear to have changed in short grass prairie habitats since 1995 and the increase noted in the 2011 surveys is likely a result of the increased efficiency of the methods used.

Modeled swift fox habitat for harvest density analysis (purple) compared to boundaries of swift fox habitat for occupancy monitoring (heavy black line).



Although not relevant to short grass prairie occupancy monitoring we note that CPW personnel confirmed the presence of swift fox in the extreme southern end of the San Luis Valley in habitat that has similar structure as short grass in eastern Colorado. Further survey efforts were conducted in the fall of 2013 and 2014. Trail cameras were set for 100 trap nights at 4 separate plots in the fall of 2013 and 93 trap nights at 5 separate

plots in the fall of 2014. Results of those survey efforts found swift fox presence in the same area they were found in 2012, but in other areas of similar habitat swift fox were not detected.

Occupancy surveys are being conducted in swift fox habitat in 2016. Along with core habitat occupancy, the 2016 survey effort is also sampling fringe and alternative habitats to assess occupancy in areas adjacent to core areas but which are considered less than superior swift fox habitat.

Harvest Density

The harvest density threshold we developed is to not exceed more than 3.6 fox harvested per 100 km². This harvest density is derived from an assumed swift fox population density of not more than 24/100 km² and an upper off-take rate of not more than 15% annually. This will be monitored on county and range wide scale.

After the 2013-14 surveys CPW biologists determined that the quality of data provided at the county scale had such broad confidence intervals that they weren't useful for management analysis. Therefore, henceforth harvest survey data analysis at regional scales is the smallest geographic scale that CPW will apply for swift fox.

The results of the harvest survey points out the ongoing problems in obtaining sample sizes that allow for reasonable harvest estimates. Sample sizes are so small that with or without stratification the harvest estimates are completely unreliable. The only resolution to this is some system that allows for ready identification of people that participate in the take of furbearers.

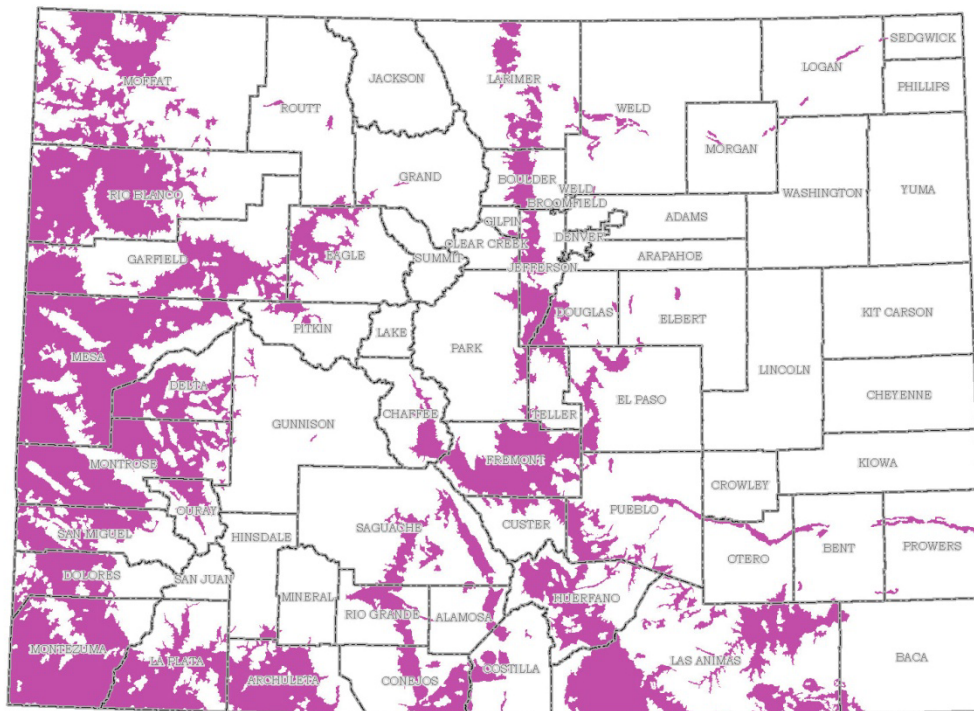
2015-2016 Swift Fox Harvest Density							
Management Threshold: Annual Harvest Mortality Should Not Exceed 3.6 swift fox/100 km ²							
Monitoring Area	Modeled Habitat km ²	2014-15 LCL Harvest	2014-15 UCL Harvest	2014-15 Harvest Estimate	Harvest Density per 100 km ²		
					LCL Harvest Density	UCL Harvest Density	Harvest Density Estimate
North of I-25	24,507	216	2,951	798	0.9	12.0	3.3
South of I-25	59,575	2,105	53,526	10,613	3.5	89.8	17.8
Range Wide	84,082	2,459	53,000	11,417	2.9	63.0	13.6

If we assume that the harvest estimate is correct, then in the SE Region and at the statewide scale swift fox harvest vastly exceeds the established management threshold. Only if the low end of the confidence limit is assumed to be correct would harvest density be within the acceptable threshold.

SECTION IV: Gray Fox Management Guidelines Analysis

The management guideline for gray fox is to annually monitor harvest density by county and range wide with provisions to reduce the frequency of harvest data collection to every other year or every third year if harvests remain substantially below thresholds. In order to conduct harvest density analysis CPW developed a conservative model of gray fox habitat. The harvest density threshold we developed is to not exceed more than 4.5 gray fox harvested per 100 km². This harvest density is derived from an assumed gray fox population density of not more than 30/100 km² and an upper off-take rate of not more than 15% annually. This will be monitored on county and range wide scale.

Gray fox modeled habitat (magenta).



SECTION IV: Gray Fox Management Guidelines Analysis

After the 2013-14 surveys CPW biologists determined that the quality of data provided at the county scale had such broad confidence intervals that they weren't useful for management analysis. Therefore, henceforth harvest survey data analysis at regional scales is the smallest geographic scale that CPW will apply for gray fox. It is more realistic to conclude that if monitoring thresholds were exceeded, management actions would be applied at nothing smaller than regional scale. Therefore, we analyzed harvest density at the region and range wide scale.

2015-2016 Gray Fox Harvest Density							
Management Threshold: Annual Harvest Mortality Should Not Exceed 4.5 gray fox/100 km ²							
Quadrant	Modeled Habitat km ²	2014-15 LCL Harvest	2014-15 UCL Harvest	2014-15 Harvest Estimate	Harvest Density per 100 km ²		
					LCL Harvest Density	UCL Harvest Density	Harvest Density Estimate
Northeast	3,515	21	544	106	0.6	15.5	3.0
Northwest	17,056	28	279	89	0.2	1.6	0.5
Southeast	12,634	58	340	141	0.5	2.7	1.1
Southwest	22,436	366	1,217	667	1.6	5.4	3.0
Range Wide	55,641	496	2,027	1,003	0.9	3.6	1.8

The results in the foregoing table demonstrate that on a range wide and at regional scales the gray fox harvest estimate is below the mortality thresholds. Only at the upper confidence limit on the harvest estimate would the harvest density exceed the mortality threshold in the Northeast and Southwest regions.

SECTION V: Pine Marten Harvest Monitoring

No management guidelines were developed for pine marten management. However, there is the potential for rapid landscape scale habitat alteration in subalpine forests from disease and insect infestations. After the 2013-14 surveys CPW biologists determined that the quality of data provided at the county scale had such broad confidence intervals that they weren't useful for management analysis. For the 2014-2015 harvest survey data, analysis at regional scales is the smallest geographic scale that CPW will apply for marten.

2015-2016 Pine Marten – Hunters and Harvest				
Quadrant	Hunters	LCL Harvest	UCL Harvest	Harvest Estimate
Northeast	253	n/a	n/a	0
Northwest	795	302	2,404	852
Southeast	98	19	245	68
Southwest	492	7	129	30
Range Wide	1,156	398	2,479	993

Colorado Parks and Wildlife completed occupancy investigations into how pine marten use changes over time in lodgepole pine and spruce-fir forests damaged by beetles. This investigation did not attempt to estimate changes in abundance or density, but rather focused solely on occupancy. Following data collection in 2013 and 2014 analyses and interpretation suggest that marten may slightly favor spruce-fir vegetation complexes over lodgepole pine, but the difference in use is small. Marten appear to use forest stands largely independent of the extensive damage inflicted on forest stands by insects. This suggests that marten may not be as vulnerable to forest alteration resulting from insect damage as previously thought.

In order to prioritize management and harvest data collection needs, CPW examined furbearer species for their relative reproductive potential, habitat needs and risks to habitat, as well as relative amounts of historic harvest. This examination resulted in development of management guidelines for bobcat, swift fox, and gray fox harvest and efforts toward improving confidence in harvest survey results for swift fox, gray fox, and pine marten.

Bobcat – At all spatial scales bobcat are meeting the management thresholds. The available information suggests that bobcat populations may be steady to somewhat increasing in most of the state except bobcat management area BC-5 in the southwest portion of Colorado. Throughout the state, in most cases female composition has increased which is contrary to the notion of stabilized or increasing bobcat populations. However, it should be noted that while females in hunting harvest, the least selective form of mortality, have risen above 50% at most monitoring scales, that mortality comprises only about 30% of total bobcat mortality. Prey abundance appears to be at or exceeding average levels. Harvest per unit effort results were compiled but need more data years to establish baselines.

Swift Fox – Surveys indicate no significant changes in habitat occupancy between 1995 and 2011. Occupancy surveys will be completed in fall of 2016 and results will be included in future reports. Harvest density considerably exceeds the management threshold in the SE monitoring area and at the statewide scale. The management threshold is not exceeded in the NE monitoring area. The extraordinarily wide confidence limits on harvest and the harvest estimate in the SE area point to a problem with the harvest survey data and the way in which sampling is conducted. This problem calls into question the validity of any furbearer harvest estimates (including swift fox, gray fox, and pine marten) which are derived from the current harvest survey methods. See comments in the Harvest Survey section, below.

Gray Fox – Harvest density thresholds are not exceeded.

Harvest Survey – The harvest survey methods applied in 2012-13 using the Harvest Information Program (HIP) sought to improve the precision of estimates. The concept was to stratify the survey based on the respondents self reported propensity to take select furbearer species. This process coupled with very small sample sizes at the County scale appears to risk amplifying some results and widen confidence intervals. The reality is that there are relatively few fur harvesters in the state and when broken down to take at the county level combined with a survey methodology that samples even smaller subsets within strata; biased results and wide confidence intervals may be inevitable.

Technical problems experienced by the survey contractor in 2013-14 were corrected prior to implementing the 2014-15 surveys.

For 2014-15 the surveys were modified to examine harvest results at regional scales. Since most fur harvesters don't know our agency regional boundaries we will mainly use Interstates 25 and 70 to divide the state into quadrants and we examined harvest at scales no finer than those quadrants for all surveyed species. The stratification was used to test if sample size is sufficient at this scale. Confidence intervals remained very broad and, as expected wider at smaller scales than at larger scales. The wide confidence limits, however,

strain the value of harvest data collection using such an insensitive mechanism as the Harvest Information Program (HIP) registration and survey process.

In 2014-15 we recommended that managers should revisit data collection methods and refine the mechanisms and/or the regulatory requirements on fur harvesters in order to improve the quality of harvest data. As yet, we have not had time to do so. However, following the results of the swift fox harvest survey addressing the deficiencies of the harvest survey mechanism for estimating swift fox, gray fox, and pine marten harvest is now unavoidable. In that regard, we have prepared a white paper and have referred the matter to the agency Leadership Team. In the fall of 2016 the Leadership Team determined to assemble a working group of Wildlife Managers, Terrestrial Biologists, and License Services staff to examine the furbearer harvest survey as well as harvest data collection for several other upland game bird species and to formulate a recommendation for resolving these issues prior to CPW small game regulation cycle begins in Sept-November of 2017.

Furbearer Harvest Data Problem - White Paper

Problem Statement Despite efforts to improve the accuracy and precision of all furbearer harvest data (except bobcat), the survey results are plagued by extremely wide confidence limits, to the point of rendering them useless for making management decisions.

Background In 2012 the CPW concluded a furbearer analysis resulting in some changes by ranking and prioritizing furbearer species for management criteria and harvest data collection. Coyote, gray fox, swift fox, and pine marten are to have harvest estimated annually. Beaver, red fox, raccoon, and ring-tailed cats are to have harvest estimated every three years (these latter species are supposed to be surveyed after the upcoming 2016/2017 season).

During the 2012 analysis alternatives were considered to improve harvest data collection; including, mandatory check, furbearer or species specific permits, or incremental improvements to the existing small game/furbearer telephone harvest survey. The decision was made to implement incremental efforts to improve the results of the small game/furbearer telephone harvest surveys. We made the following changes to improve marten, swift fox, and gray fox harvest data.

We used the Harvest Information Program (HIP) to document a fur harvester's intent to take marten, swift fox, or gray fox in the forthcoming year. We then used this level of intent to stratify the sample of fur harvesters that would be surveyed by phone. However, the resulting stratification did not improve the harvest survey results over the previous poor results without stratification.

Examples Pine marten harvest for the 2015/16 season is estimated at 993 with a 95% CI of 398 - 2479 and a CV of 49. The marten estimate was based on an extrapolation derived from about 59,000 hunters/trappers that were segmented into 4 strata on degree of likelihood to hunt/trap marten. Of them a sample of 3,500 was sought to respond. Of them about 1,500 responded. Of them 42 claimed to have actually attempted to take one or more marten. And of them 10 actually killed. So, in fact we estimate statewide harvest of about 1,000 on the basis of 10 marten harvesters.

Swift fox, a species that carries a higher degree of social/political sensitivity, the 2015/16 harvest estimate is 11,417 with a 95% CI of 2,459 - 53,000 and a CV of 92. Here again the potential sample stratified on degree of likelihood to hunt/trap swift fox = about 59,000. A sample of 3,500 sought to respond. Of them a bit over 1,500 responded. Of them 57 said they hunted and of them 18 claimed to have killed. Of note, the five previous harvest estimates from the preceding six years (one year not surveyed) range from ~100 to ~600. However, it is just as unlikely for CPW to comfortably depend on these results as it is to depend on the most recent estimate.

The large increase in swift fox harvest estimate in 2015/16 could have occurred in any of the previous years because despite stratification sample sizes remain incredibly small. If any single responding fur harvester were to report a large harvest (>5 animals) or if a fur harvester in the "unlikely to harvest" strata reports taking more than just one animal it will extraordinarily inflate the harvest estimate.

- Alternatives
- No Change: Continue obtaining harvest estimates via the small game/furbearer telephone survey. Results will continue to be unreliable. The current process overtaxes and stretches the integrity of HIP which may have implications to its original intent, which is to obtain reliable harvest data for waterfowl.
 - Revise how harvest estimates are obtained:
 - Require a mandatory check and marking/sealing of pelts for all or some of the harvested fur species. Harvest results would be firmly accounted and, assuming fur harvesters reasonably complied with reporting requirements harvest estimates would be as accurate as reporting compliance.
 - Require a fur harvest permit or a species specific permit to take one or more or all furbearers. This would allow the telephone survey to select from the population of people that are regularly and directly involved in furbearer harvest.
 - Cease attempts to estimate any furbearer harvest (excluding bobcat) for all currently surveyed species (coyote, gray fox, pine marten, and swift fox annually) (beaver, red fox, raccoon, and ring-tailed cat tri-annually).

Timeline If action is taken to require mandatory reporting, time is needed to develop a reporting database and related processes, along with necessary regulatory changes. Likewise, if a form of permit is required (either species specific or furbearer generic), then the regulation cycle is:

Informal internal discussions & with external interests:	February - March (not later than)
Regulation Review:	April
Issues - Parks and Wildlife Commission:	May
Final Adoption - Parks and Wildlife Commission:	July

The risk of harming any of these species populations by current presumed levels of recreational harvest is quite low. However, in the absence of any reliable harvest estimates that could be interpreted as quite a reckless statement. The social/political risk is probably the greater issue and the perception of the non-hunting public about CPW credibility of harvesting species and caring little or not at all about the amount of harvest must be considered.

SECTION VI: Summary

In 2012, we reassessed the appropriate scale and frequency for harvest surveys for all furbearer species. We concluded that no harvest surveys were necessary until or unless management considerations change for the following species: badger, mink, muskrat, opossum, striped skunk, western-spotted skunk, long-tailed and short-tailed weasels. Scale, survey frequency, type of survey, and rationale are presented as follows:

Species	Harvest Survey Method					Scale
	Mandatory Check of Harvest	Single Species Survey (Annual)	Multi-Species Survey (Bi or Tri Annual)	Small Game Survey (Annual)	No Survey	
Badger					X	
Beaver			X			I-25 & I-70
Bobcat	X					GMU
Coyote				X		County
Gray Fox		X				I-25 & I-70
Red Fox			X			I-25 & I-70
Swift Fox		X				E of Mtns & I-70
Mink					X	
Muskrat					X	
Opossum					X	
Pine Marten		X				I-25 & I-70
Raccoon			X			W of I-25 & I-70
Ring-tailed Cat			X			I-25 & I-70
River Otter	X (if reclassified)					GMU
Striped Skunk					X	
Western-spotted Skunk					X	
Long-tailed Weasel					X	
Short-tailed Weasel					X	
Cottontail Rabbit*				X		

- Although cottontail rabbit are not furbearers, their harvest levels are an indicator of bobcat prey abundance and bobcat reproductive success and is one of the bobcat management guidelines.
- Coyote harvest should be surveyed annually due to real or perceived damage concerns and socio-political influences. In the absence of survey data we risk unsupported opinions and allegations relative to harvest levels, species jeopardy, and agriculture impacts.
- Species listed for no survey have the following characteristics: high reproductive potential and/or high levels of natural annual mortality - thus harvest would be highly compensatory and/or have very low levels historic and most recently documented harvest. Placement in the non-survey category may be reconsidered if the number of pelts sold at local annual fur markets markedly increases.
- Species listed for the periodic survey have relatively lower reproductive potential and/or harvest may be less compensatory and/or have higher conflict potential to human structures.
- Species listed for the annual single species survey were identified in the 2012 furbearer program review as high priority species. Swift and gray fox have management guidelines which require harvest monitoring. Pine marten were designated for increased harvest monitoring due to potential for

habitat changes. If harvest remains persistently low, however, they may be moved to another category.

- If river otter are reclassified as game species; harvest should be limited and harvest documentation mandatory.