2016 Furbearer Program Annual Report

MISSOURI DEPARTMENT OF CONSERVATION

RESOURCE SCIENCE DIVISION

JEFF BERINGER, RESOURCE SCIENTIST

EVAN GRUSENMEYER, RESOURCE ASSISTANT

TABLE OF CONTENTS

INTRODUCTION

Missouri's wild fur market has been monitored annually since 1940, with some information dating back to 1934. Over time, we've seen tremendous fluctuations in the harvest of Missouri's primary furbearing animals as both market and social trends change. The Missouri Department of Conservation (MDC) monitors the fur market using mandatory fur dealer transaction records, mandatory pelt registration of bobcats (since 1980) and river otters (since 1996), and information gathered at fur auctions. The information in this report is based on harvest from trappers and hunters.

The number of Fur Dealer Permits issued by MDC peaked at 1,192 during the 1945-46 trapping and hunting season. In 2015, MDC issued 44 Resident and 3 Non-Resident Fur Dealer Permits. The number of Resident Trapping Permits issued peaked at 13,248 in 1980-81 (permits were first required in 1953), and reached a low of 2,050 in 2000. During the 2015-16 trapping season, MDC issued 7,992 Resident and 337 Non-Resident Trapping Permits (Table 1).

Total pelts harvested reached 834,935 in 1940-41 (over 70% were opossum and skunk pelts), and reached the second highest peak in 1979 at 634,338 when average raccoon pelt values were estimated at $27.50. The economic value of harvested fur also peaked in 1979-80 at over $9 million. Pelt values declined dramatically during the late 1980s and through the mid-1990s; as a result the number of participants fell to all-time lows. Market trends for the 2016-17 season suggest that pelt values for many furbearers are losing strength as territorial disputes in Russia, tariffs in China, and economic woes in Greece add uncertainly for those working in the fur industry.

In addition to harvest information, wildlife population trends are monitored using observations collected by bow hunters (archer's indices) and MDC staff (sign station surveys). Archer's indices are based on annual wildlife observation reports sent in by cooperating bow hunters. Sign station surveys are conducted each September by Conservation Department staff in 25 counties. A more detailed account of sign station surveys and archer's indices is described in Section 2.

Also contained in Section 2 are updates and progress summaries for various furbearer-related research projects, monitoring efforts, and items of interest. Section 2 is for informational purposes and these should be considered preliminary reports. For more information on any of these reports please contact Jeff Beringer at jeff.beringer@mdc.mo.gov.

SECTION 1:
Missouri Furbearer Status 2015-2016

FUR HARVEST COMPARISONS

To buy and sell fur in Missouri (fur dealer) individuals must be issued a commercial permit from the MDC. The permit requirements include maintaining and submitting records of all fur transactions. Data collected from fur dealers gives MDC an estimate of furbearer harvest. In addition, harvest numbers for bobcats and otters are gathered from mandatory pelt registration required by the Convention on International Trade of Endangered Species (CITES).

Fur prices dropped dramatically throughout the season resulting in reduced harvest of most species. MDC issued over 7,000 trapping permits. Forecasts for 2016-17 seasons are poor as most fur houses have high inventories of all species.

Table 1. Furbearer harvest and pelt prices in Missouri over the last three years.

Species	2015-16		2014-15		2013-14	
	Number of pelts sold or registered*	Pelt Prices from MTA Auctions	Number of pelts sold or registered*	Pelt Prices from MTA Auctions	Number of pelts sold or registered*	Pelt Prices from MTA Auctions
Raccoon	34,758	$5.84	85,497	$7.75	134,715	$13.04
Opossum	2,455	$0.64	4,874	$1.80	11,529	$1.63
Muskrat	6,057	$2.37	13,227	$5.58	11,445	$9.94
Coyote	4,419	$12.18	5,264	$18.14	7,631	$18.12
Beaver	1,933	$10.94	4,228	$11.11	5,133	$14.86
Mink	263	(m)$10.81 (f)$9.75	475	(m)$11.18 (f)$4.06	715	(m)$14.81 (f)$12.50
Red Fox	643	$16.34	1,093	$24.81	1,772	$36.24
Gray Fox	308	$15.72	593	$18.47	1,034	$24.01
Striped Skunk	227	-	263	$3.83	402	$2.50
Badger	14	-	37	$32.67	65	$17.50
Bobcat*	2,207	$34.74	3,229	$60.08	4,310	$120.13
River Otter*	1,356	$25.53	2,173	$34.97	2,584	$60.57
Trapping permits issued	7,992		10,197		10,681	

* Pelts issued (except bobcat and otter where harvest is based on CITES registration) is based on reports received from 43 Fur Buyer Permittees.
-None offered

MISSOURI FUR AUCTION PRICES

The Missouri Trappers Association (MTA) held only 1 fur auction in 2015-16. Prices are averaged from all fur sold, including green, finished and damaged (Table 2). Average pelt prices were lower by nearly 44% this year for most species (Table 3). Most notably raccoon prices dropped over 25% from last year and otter prices were off 27%. Bobcats dropped by 42%.

Table 2. Range of furbearer pelt prices in Missouri during the 2015-16 trapping season.

	2015-2016 Auction Summary		
Species	**Total Number of Pelts Sold**	**20-Feb**	**Change in Price from 2014-15**
Raccoon	1,984	$5.84	-24.6%
Opossum	116	$0.64	-64.4%
Muskrat	231	$2.37	-57.5%
Coyote	346	$12.18	-32.9%
Beaver	209	$10.94	-1.5%
Mink	19	$10.48	-6.4%
Red Fox	58	$16.34	-34.1%
Gray Fox	25	$15.72	-14.9%
Striped Skunk	-	-	-
Badger	-	-	-
Bobcat	88	$34.74	-42.2%
Otter	82	$25.53	-27.0%

-None Offered

Table 3. Comparison of average furbearer auction prices over the last five trapping seasons.

Species	Average Price Per Season					5-year average
	2015-16	2014-15	2013-14	2012-13	2011-12	
Raccoon	$5.84	$7.75	$13.04	$20.79	$10.00	$11.48
Opossum	$0.64	$1.80	$1.63	$1.25	$1.23	$1.31
Muskrat	$2.37	$5.58	$9.94	$11.79	$9.49	$7.83
Coyote	$12.18	$18.14	$18.12	$22.26	$14.93	$17.13
Beaver	$10.94	$11.11	$14.86	$21.72	$13.47	$14.42
Mink	$10.47	$11.18	$14.81	$24.05	$18.15	$15.73
Red Fox	$16.34	$24.81	$36.24	$39.13	$30.08	$29.32
Gray Fox	$15.72	$18.47	$24.01	$34.72	$20.26	$22.64
Str. Skunk	-	$3.83	$2.50	$3.25	$1.80	$2.85
Badger	-	$32.67	$17.50	$0.38	$15.63	$16.55
Bobcat	$34.74	$60.08	$120.13	$115.5	$77.66	$81.62
Otter	$25.53	$34.97	$60.57	$85.53	$87.80	$58.88

-None offered

RACCOON POPULATION AND HARVEST TRENDS

Raccoon harvest, including trapping, for the 2015-16 season was 34,758, down 59.35% from the 2014-15 season and down 74.20% from the 2013-14 season (Figure 1). This was the lowest raccoon harvest since 1944. Trapping pressure was high early in the season but diminished as trappers learned of weak prices and weather turned poor.

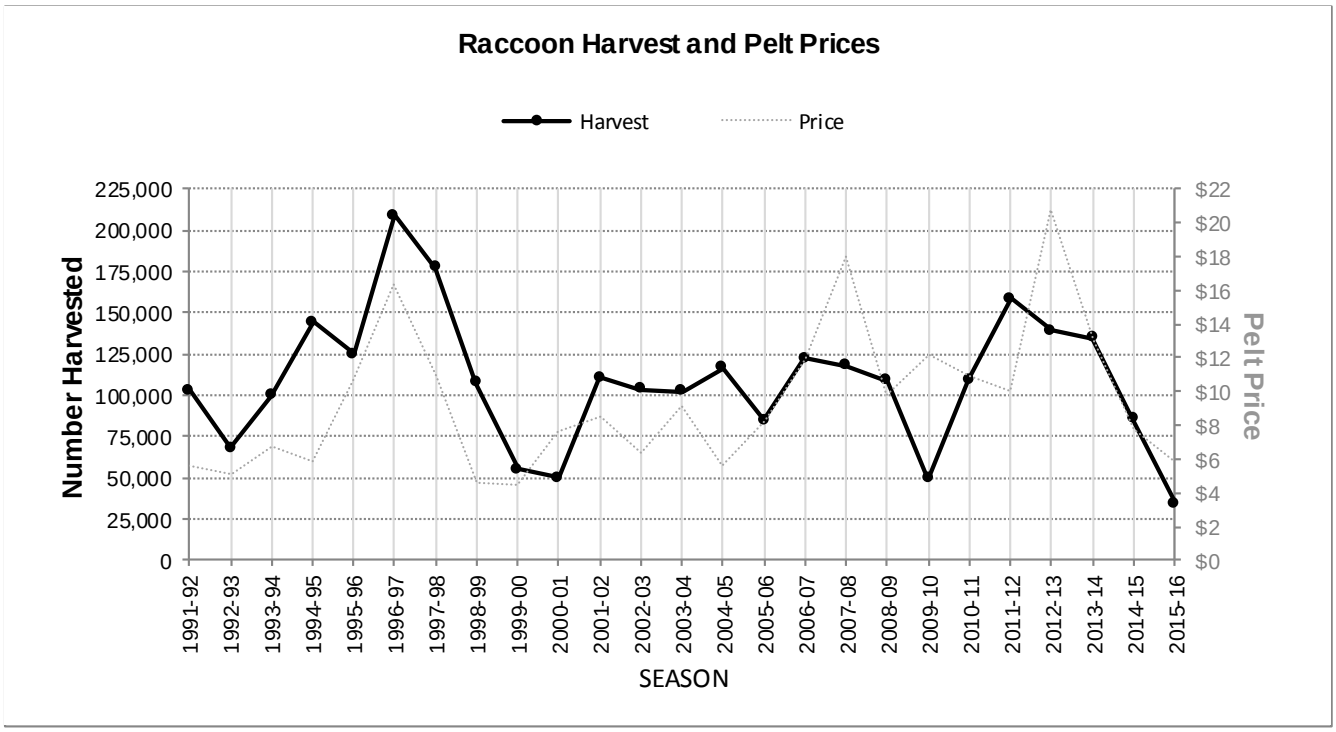

Figure 1. Comparison of raccoon harvest and pelt prices over the last 25 years.

Based on observations from bowhunters, the number of raccoons sighted per 1000 hours of hunting increased about 47.2% to 55.2 in 2015, up from 37.5 in 2014 (Figure 2). The presence of raccoon tracks at furbearer sign stations also increased to an index of 193 in 2015, after reaching an index of 156.22 in 2014. While our raccoon abundance data is based on trend information the fact that multiple trends point to population increases adds credibility to our trend data. Raccoon populations are dynamic and short term population fluctuations are normal and expected. We expect that harvest pressure will be down during 2016 and given the absence of distemper reports we expect that raccoon populations will continue their long term upward trend.

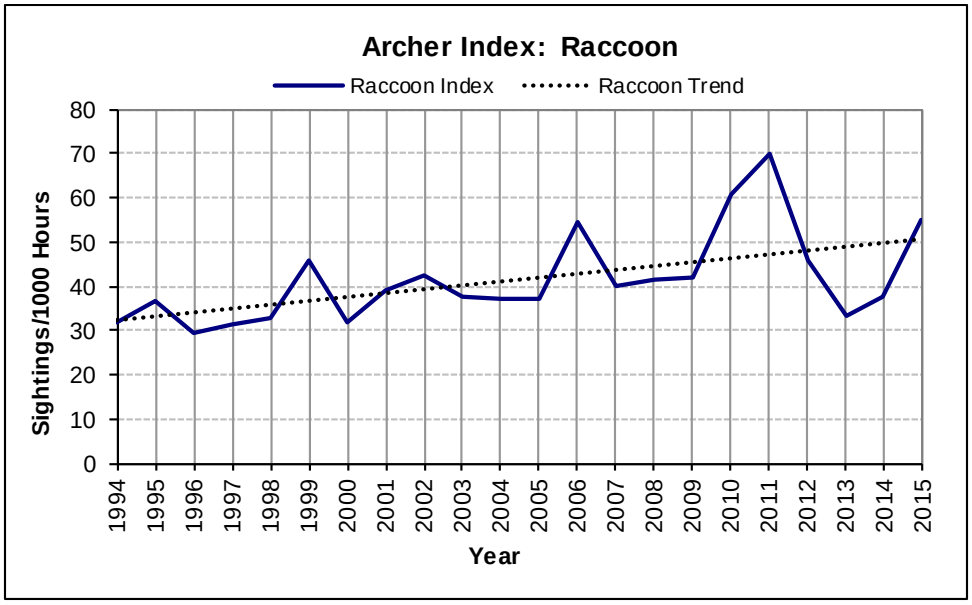

Figure 2. Raccoon population trends based on the MDC bowhunter observation survey.

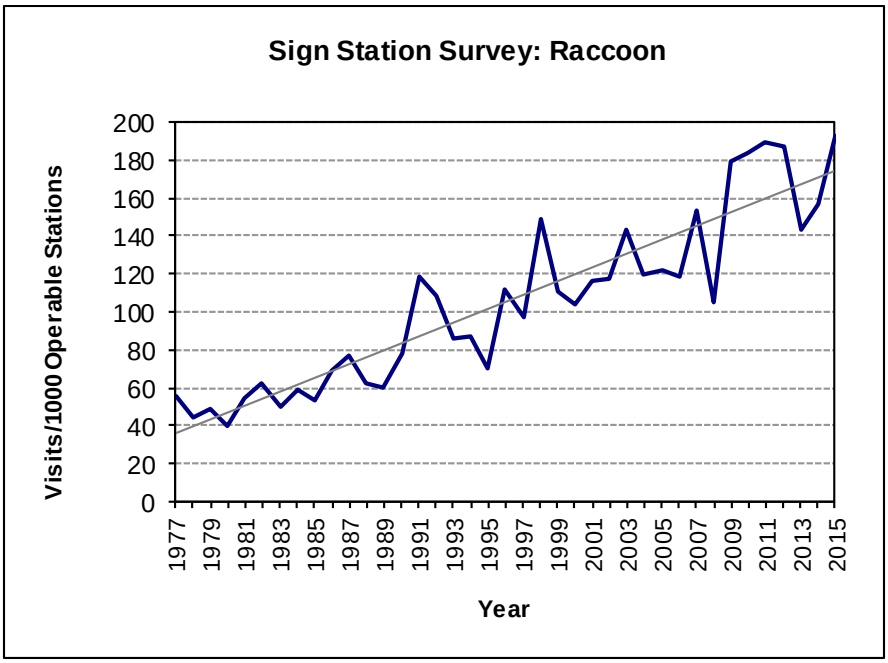

Figure 3. Raccoon population trends based on sign station surveys.

COYOTE POPULATION AND HARVEST TRENDS

Coyote harvest during the 2015-16 furbearer season (4,419) was down 16.05% from the 2014-15 season (Figure 4). Predator hunting continues to increase in popularity and survey data suggest over 25,000 people hunt coyotes annually. Although coyote pelt prices averaged only $12.18, many trappers still enjoy the challenge of catching coyotes. The use of cable restraints has increased coyote harvest for the fur and live markets. Trend data for coyotes suggest populations are stable but higher than those observed during the mid-1970s (Figures 5 and 6). Mange in both coyotes and red fox is reported each year but major outbreaks have not been confirmed for 2016.

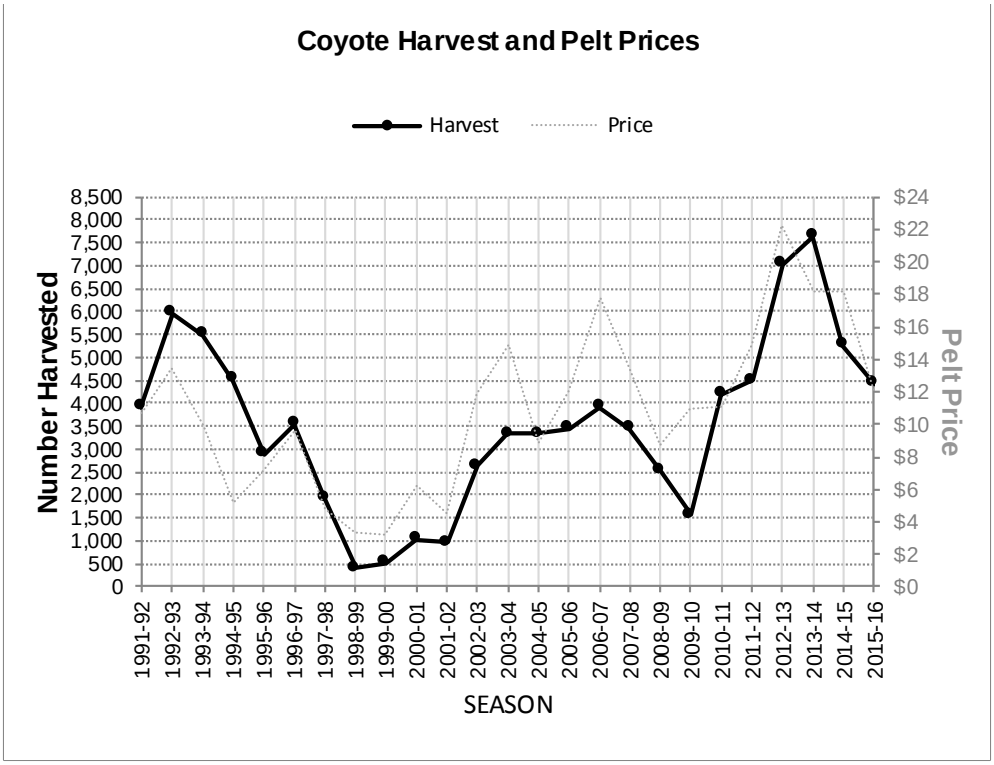

Figure 4. Comparison of coyote harvest and pelt prices over the last 25 years.

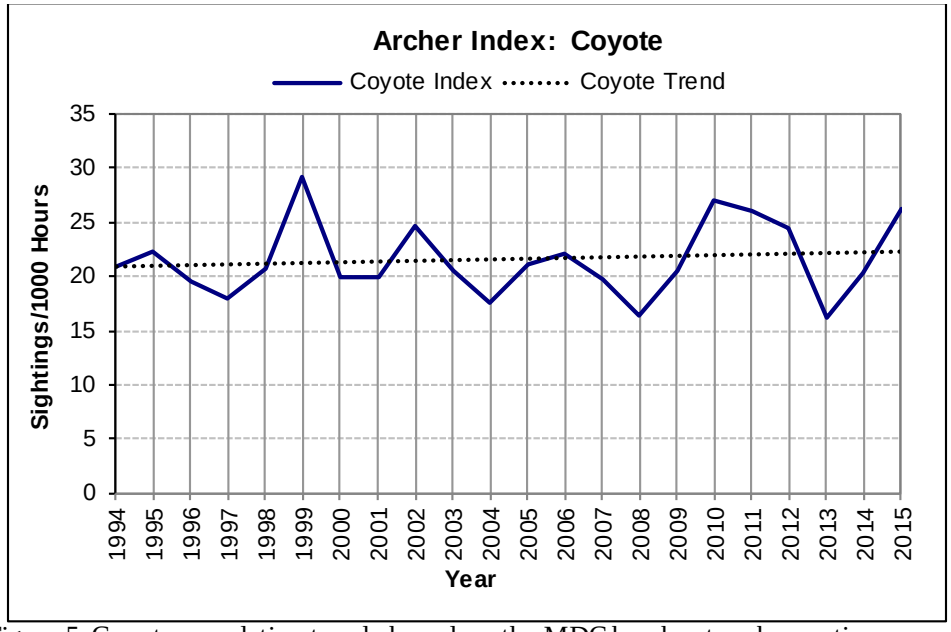

Figure 5. Coyote population trends based on the MDC bowhunter observation survey.

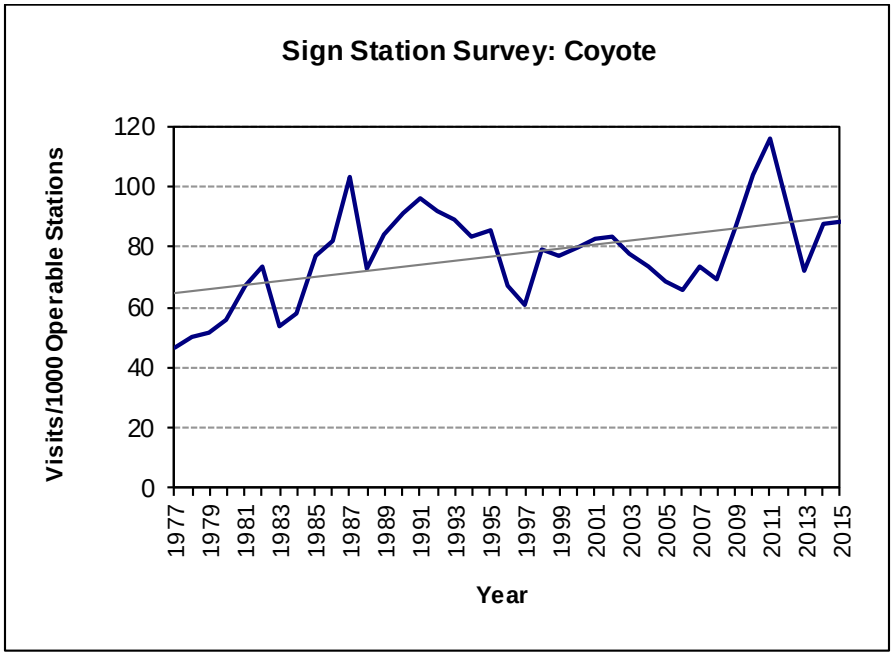

Figure 6. Coyote population trends based on sign station surveys.

FOX POPULATION AND HARVEST TRENDS

During the 2015-16 season, red fox harvest (643) decreased 41.17% and gray fox harvest (308) decreased by 48.06% compared with last year's harvest (Figures 7 and 8). Fox harvest is typically a by-product of bobcat or coyote trapper effort. Bobcat fur prices dropped in 2015-16, and as a result, land trappers were less active. From a long-term perspective, both archer observations and sign station surveys suggest declines in both red and gray fox populations (Figures 9 and 10). Long-term fox population declines may be the result of interspecies competition with coyotes and bobcats. Another possible reason for the gray fox decline could be the increasing population of raccoons and their associated distemper virus; gray fox seem especially vulnerable to distemper virus. We continue to observe slight upticks in trend indicators for both red and gray fox around suburban areas where foxes may be seeking refuge from coyotes.

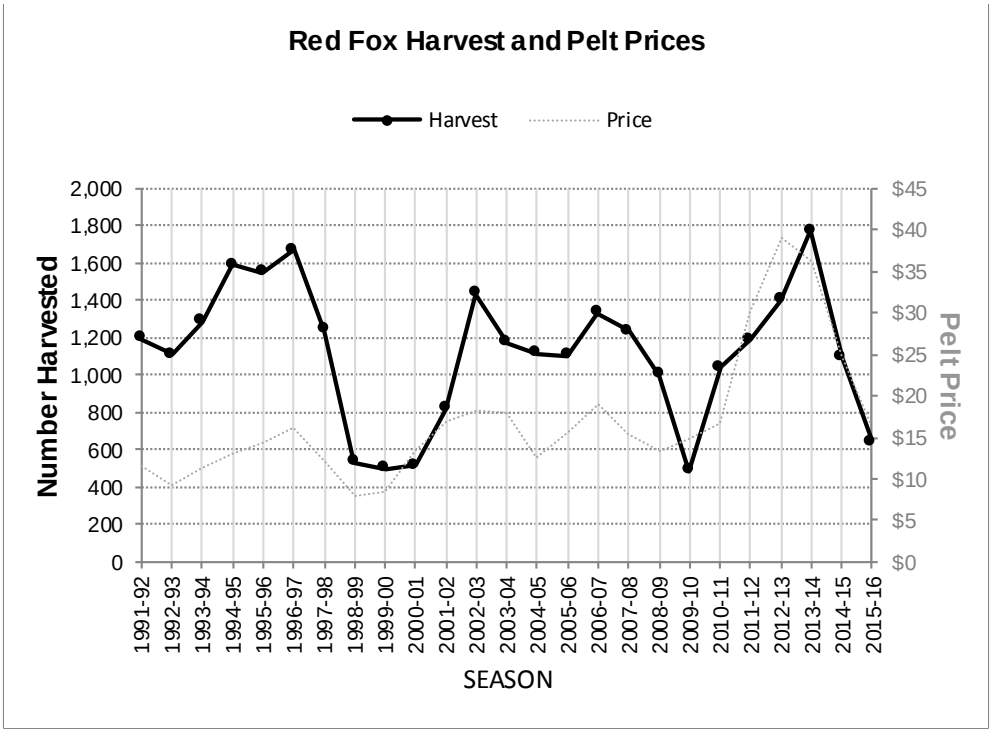

Figure 7. Comparison of red fox harvest and pelt prices over the last 25 years.

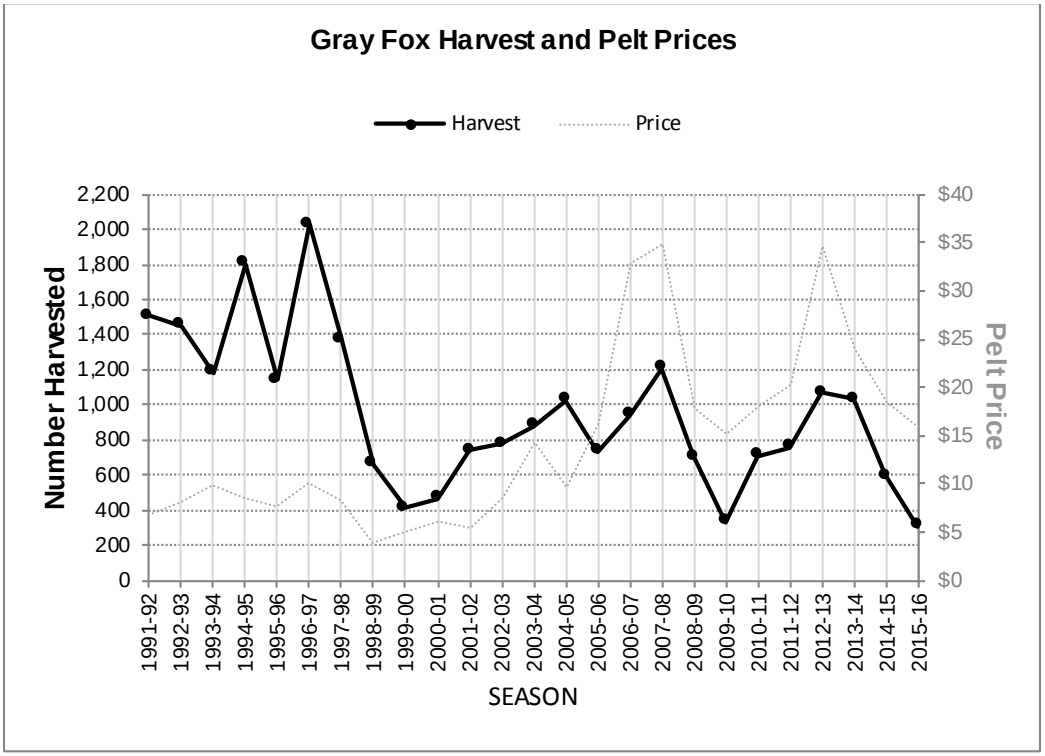

Figure 8. Comparison of gray fox harvest and pelt prices over the last 25 years.

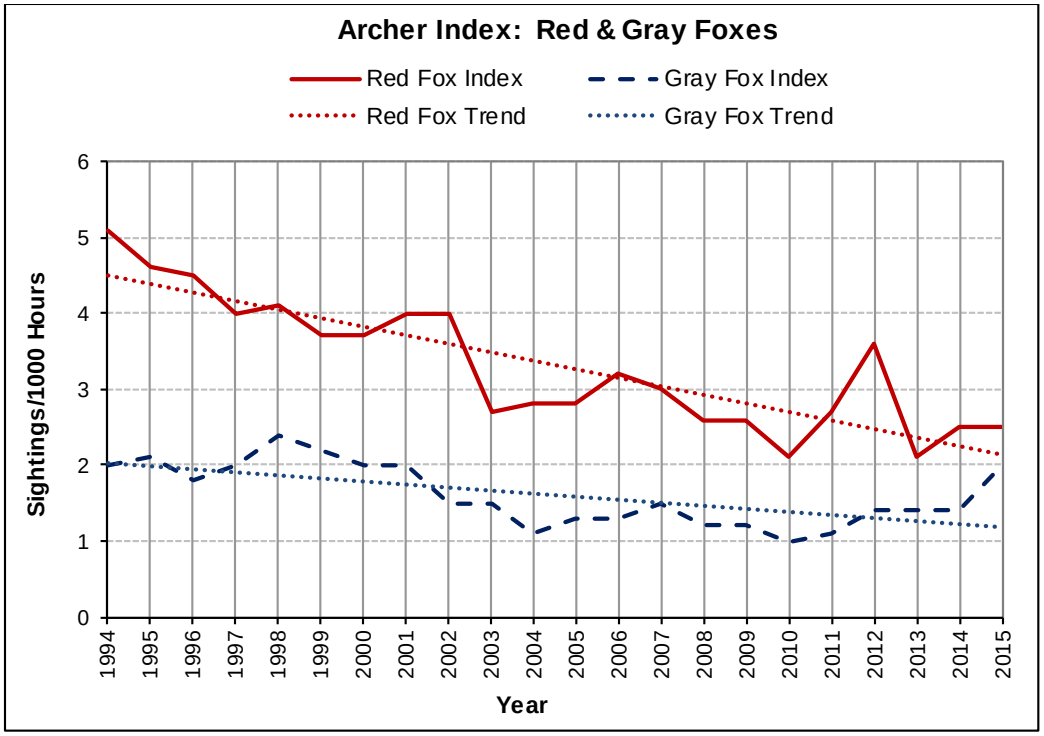

Figure 9. Fox population trends based on MDC bowhunter observation survey.

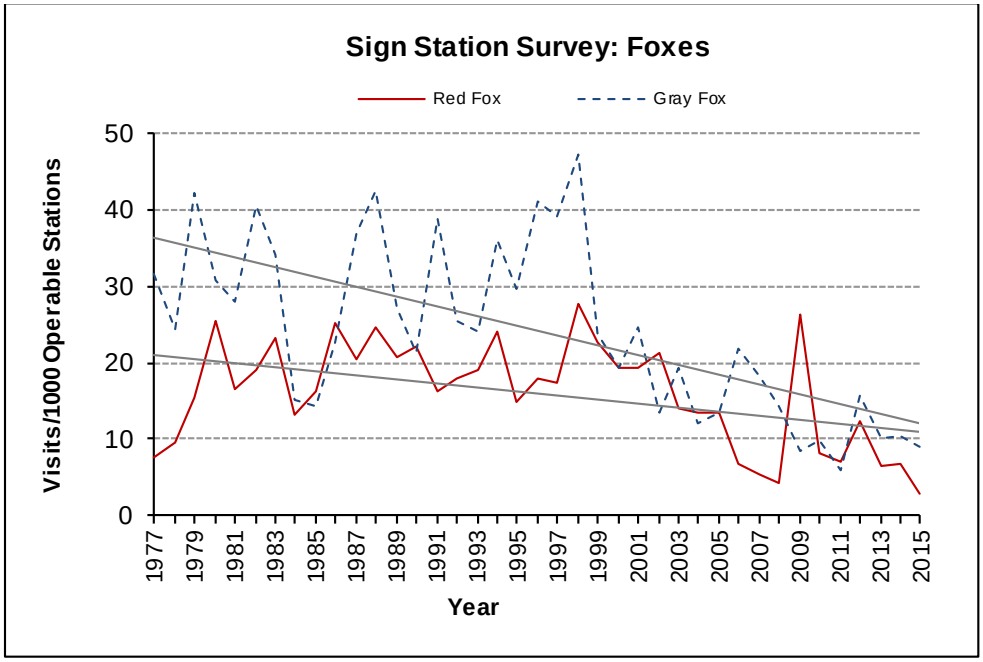

Figure 10. Fox population trends based on sign station surveys.

BOBCAT POPULATION AND HARVEST TRENDS

Trappers and hunters are required to check or register bobcat carcasses or green pelts at MDC offices or with Conservation Agents. The data collected are used to monitor bobcat harvest in Missouri and to comply with CITES regulations.

During 2015-16, 2,207 bobcats were harvested, a decrease of 31.65% from 2014-15, and 50.29% below 2013-14 season harvest (Figure 11). Prices during 2015-16 dropped by 42.2% and fewer bobcats were harvested. Bobcats have continued to expand across north Missouri and have now established in all suitable habitats including suburban landscapes.

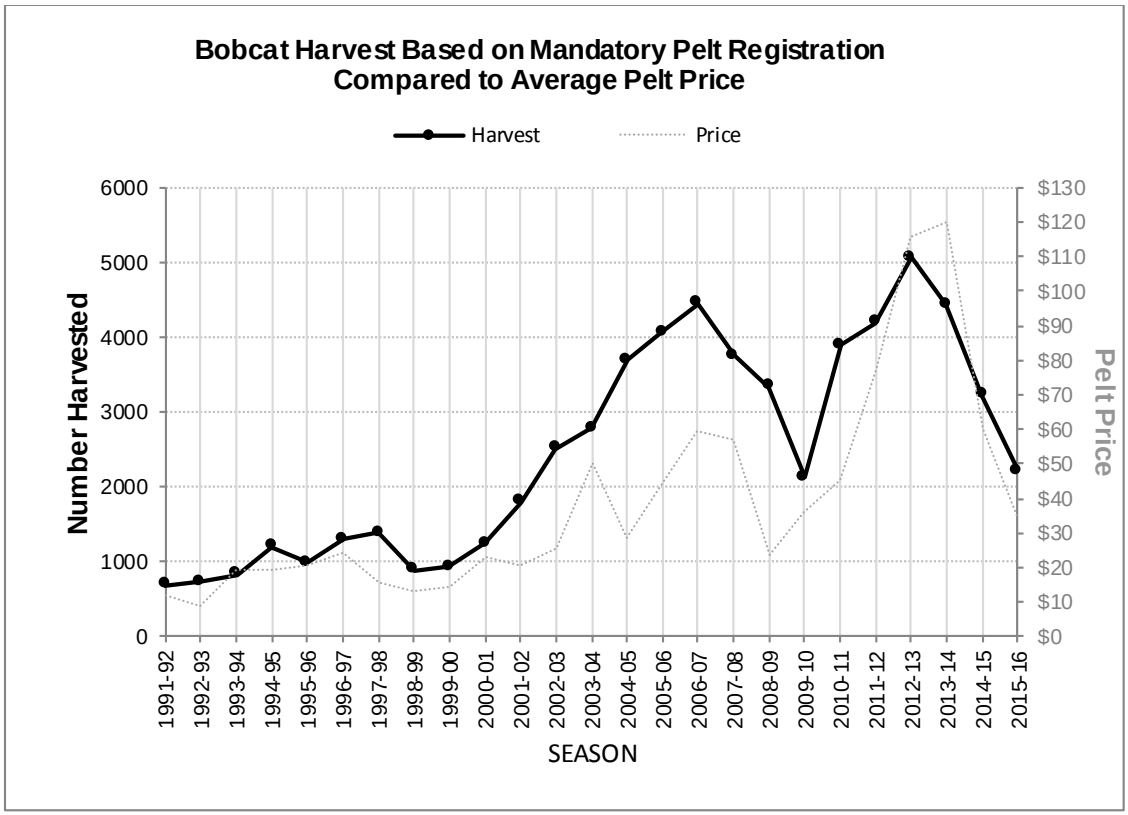

Figure 11. Bobcat harvest trends over the last 25 years compared to average pelt prices.

The number of bobcat pelts purchased by fur dealers (802) was significantly less than the number of bobcats checked by trappers and hunters as required by CITES (2,207). Instead of selling to fur buyers, trappers can make more money by selling carcasses to taxidermists or selling mounted bobcats on the internet. The significant drop in pelt sales to fur dealers is likely a reflection of this trend.

Both sign station and Archer Index data suggest bobcat populations may have dipped some over the last couple years – the overall trend appears to be stable (Figures 12 and 13). Regional harvest varied and was significantly lower in Northwestern and Southern regions. Limited habitat during winter likely increases vulnerability of bobcats in these regions. (Table 4, Figure 15). Bobcat harvest distribution suggests high harvest occurs early in the season, mostly from firearms deer hunters, and trapping harvest is later (Table 5). Pelts are generally prime after December.

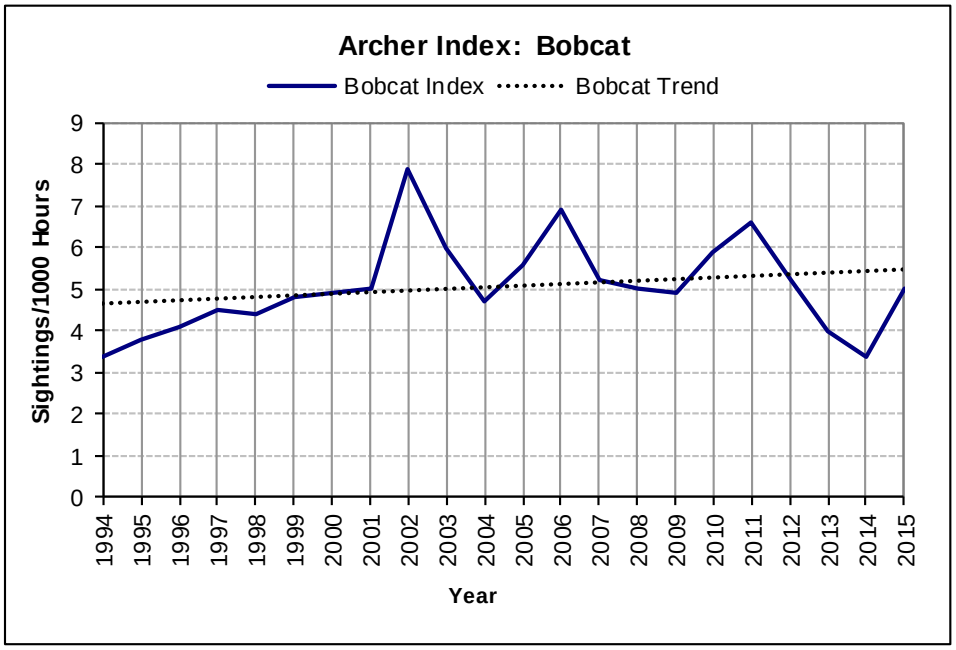

Figure 12. Bobcat population trends based on the MDC bowhunter observation survey.

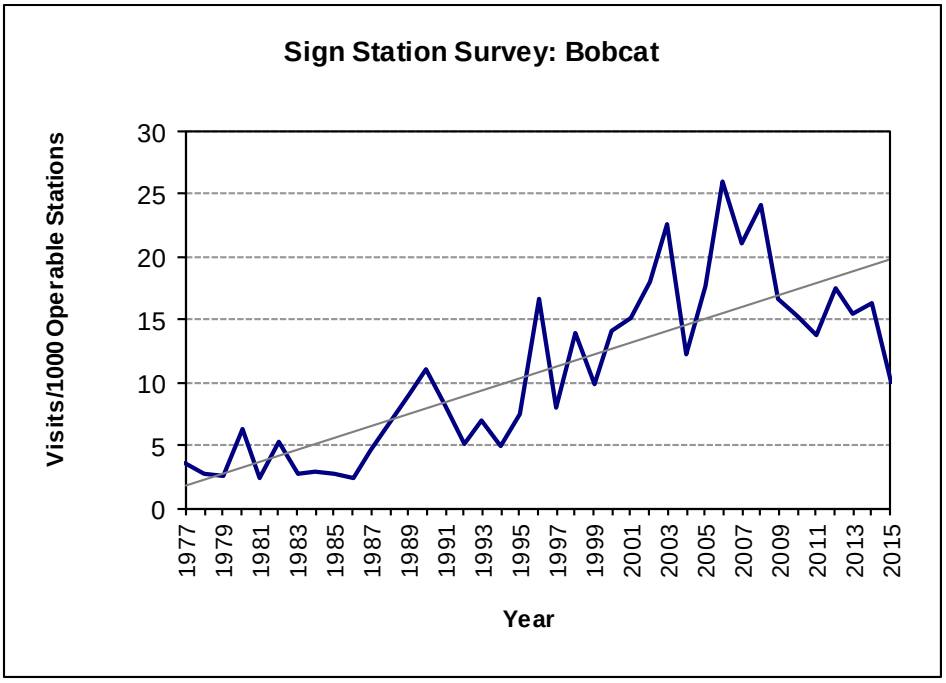

Figure 13. Bobcat population trends based on sign station surveys.

Table 4. Bobcat harvest (based on mandatory pelt registration) and pelt prices from 2006 – 2016, in Missouri, by zoological region.

	Bobcats Harvested per Season									
Zoological Region	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
Northwest Prairie	493	358	341	150	342	391	421	260	231	133
Northern Riverbreaks	636	373	404	192	412	465	473	374	261	191
Northeast Riverbreaks	678	521	492	379	608	617	644	544	474	399
Western Prairie	763	572	446	235	542	694	807	629	299	331
Western Ozark Border	431	377	312	223	453	450	560	444	342	214
Ozark Plateau	918	984	868	550	962	1012	1486	1459	1056	593
North and East Ozark Border	372	316	307	243	369	395	439	429	355	239
Mississippi Lowlands	158	159	157	154	185	165	208	159	176	87
Unknown	4	46	6	2	0	10	21	12	0	20
TOTAL	**4,453**	**3,706**	**3,333**	**2,128**	**3,888**	**4,199**	**5,059**	**4,310**	**3,223**	**2,207**
Bobcat Pelt Prices	**$59.78**	**$56.93**	**$23.68**	**$36.30**	**$45.21**	**$77.66**	**$115.50**	**$120.13**	**$60.08**	**$34.74**

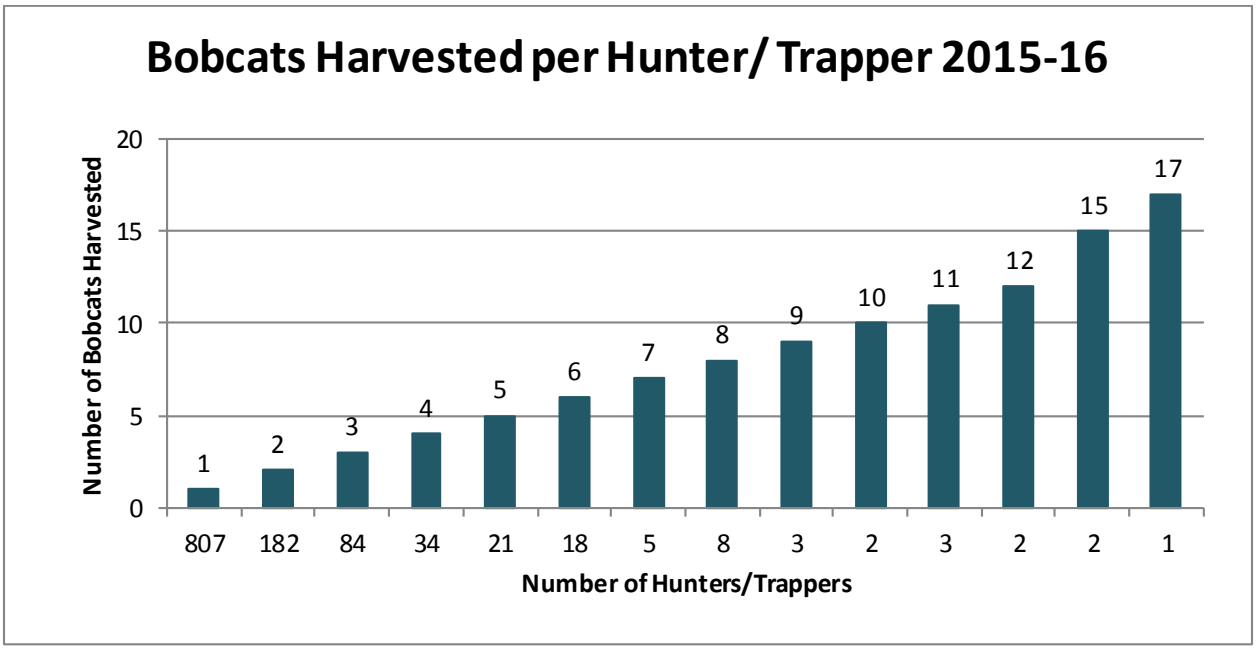

Figure 14. Number of bobcats harvested per individual hunter/trapper.

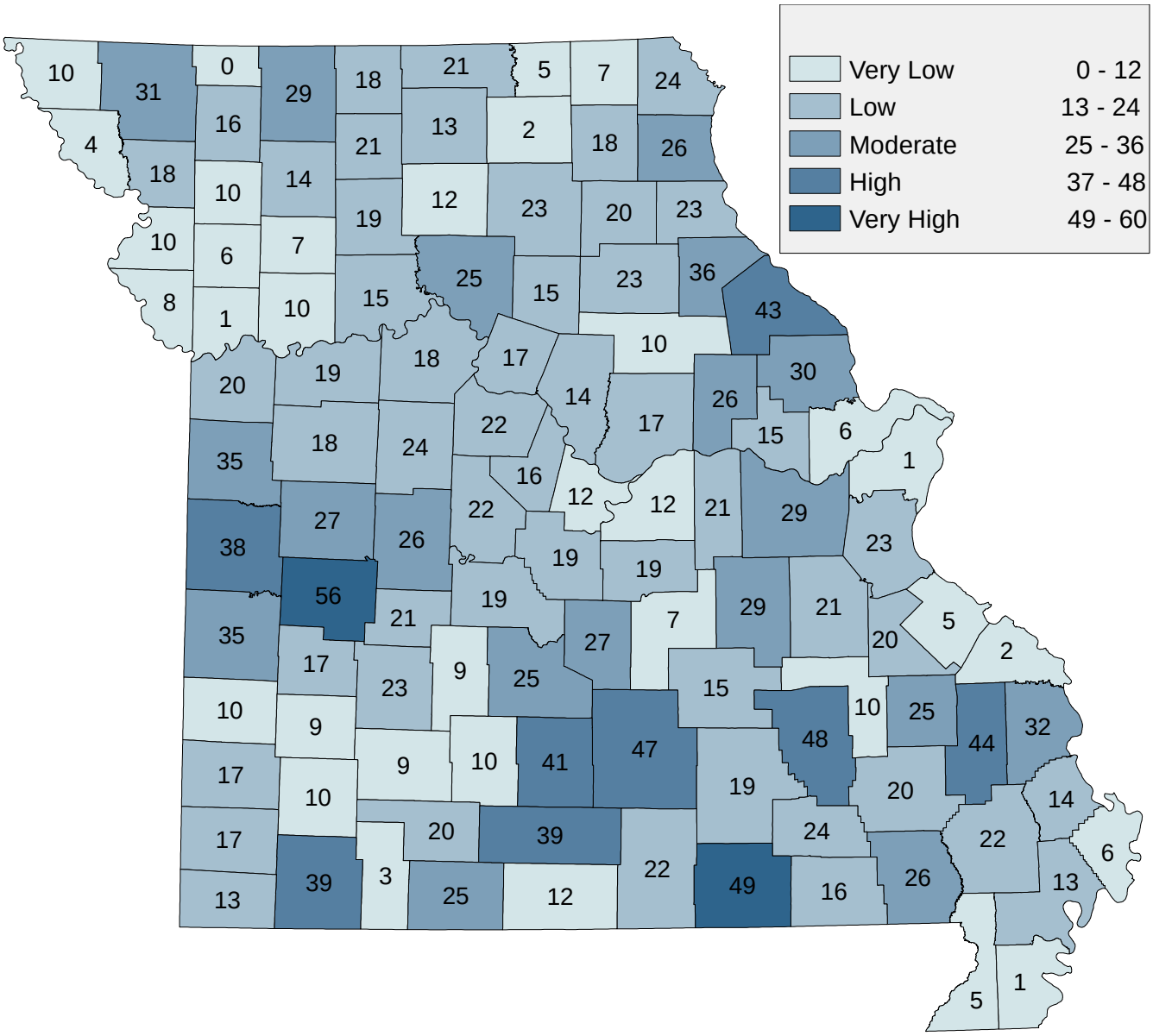

Figure 15. Bobcat harvest per county during the 2015-2016 furbearer season.

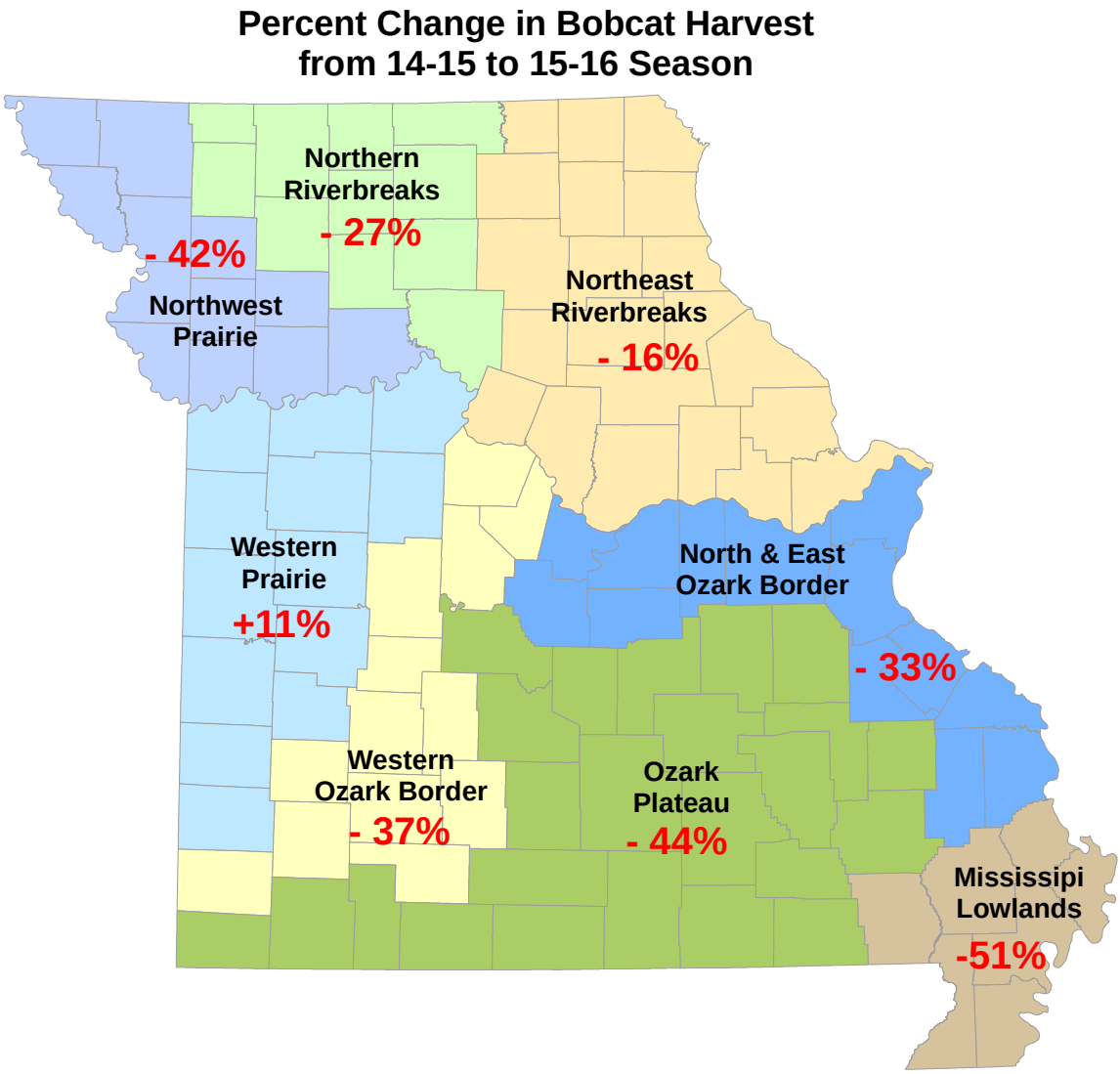

Figure 16. Comparison of bobcat harvest by Zoological region between the 2014-15 and 2015-16 furbearer seasons.

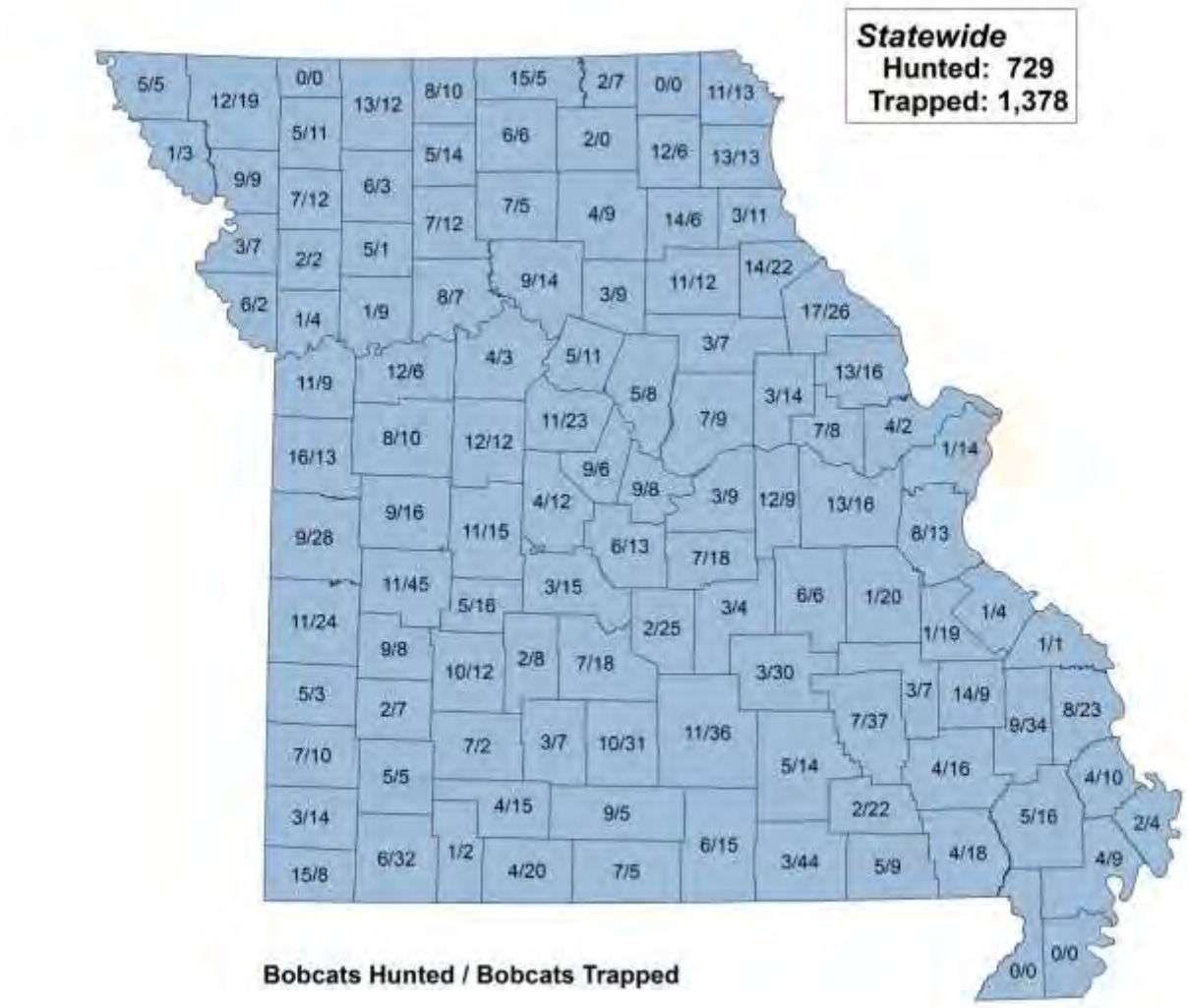

Figure 17. Comparison of hunted vs. trapped bobcats per county in the 2015-2016 season.

OTTER POPULATION AND HARVEST TRENDS

Trappers are required to check or register river otter carcasses or green hides at MDC offices or with Conservation Agents. The data collected are used to monitor statewide and regional otter harvest in Missouri and to comply with CITES regulations.

The 2015-16 furbearer season resulted in a harvest of 1,356 animals. This is down 37.60% from last year, and down 49.21% from the 2013-2014 season. Otter pelt prices declined 27% from last year. High harvest during the previous two furbearer seasons and lower pelt prices are likely the reasons for decreased harvest in the 2015-16 season (Figure 18). Overall statewide otter numbers are down. Harvest data for otter and bobcat are available as a result of CITES tagging. Both species have a relatively long harvest season (Table 5).

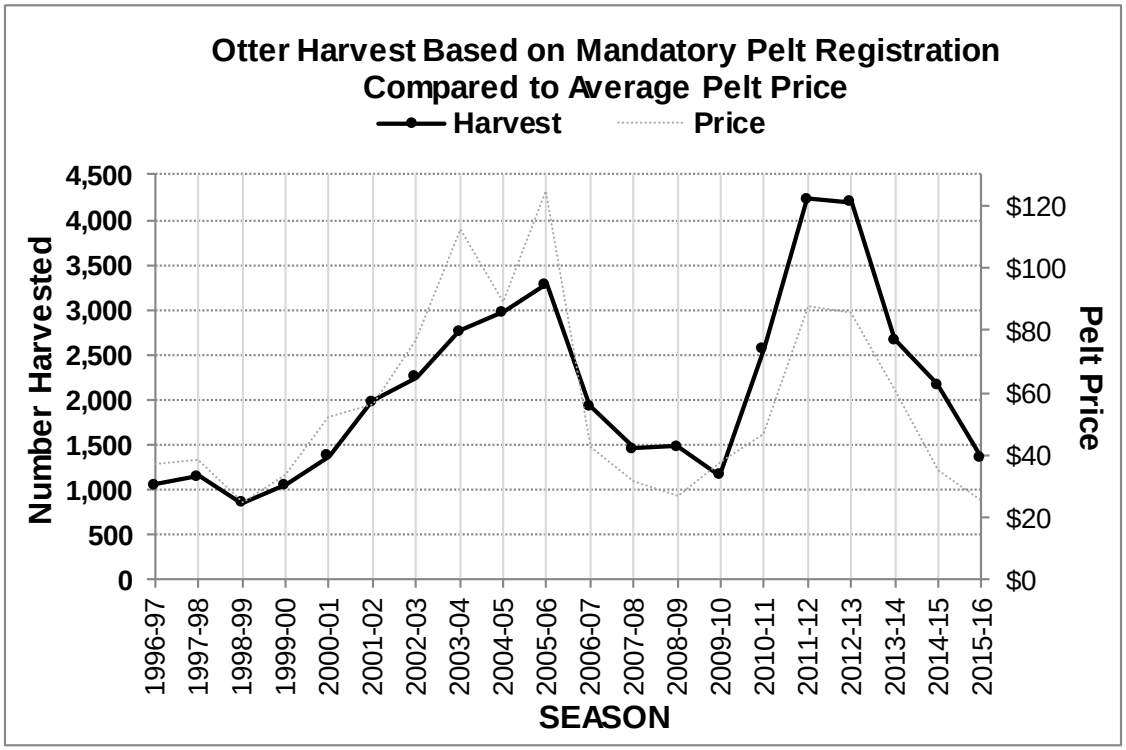

Figure 18. Otter harvest and pelt prices from 1996 – 2016.

Table 5. Bobcat and otter harvest during each week of the 2014-15 season.

Week of Season	Dates	Number of Bobcats Harvested	Number of Otters Harvested
---	Before Nov. 15	4	4
1	Nov.15 – 16	105	14
2	Nov. 17 – 23	194	65
3	Nov. 24 – Nov. 30	146	85
4	Dec. 1 – 7	175	122
5	Dec. 8 – 14	148	101
6	Dec. 15 – 21	230	145
7	Dec. 22 – 28	166	136
8	Dec. 29 – Jan 4	241	65
9	Jan. 5 –11	212	89
10	Jan. 12 – 18	215	73
11	Jan. 19 – 25	182	80
12	Jan. 26 – Feb 1	126	95
13	Feb 2 – 8	---season closed---	95
14	Feb. 9 – 15	---season closed---	91
---	Feb 16 – 20	---season closed---	81
---	Unknown date	63	15
	TOTAL	2,207	1,356

Although most otter harvest occurs during December and January (Table 5), a longer season does facilitate targeted harvests. From a county basis, otter harvest was highest in Chariton, Henry and Johnson counties with harvests of 83, 49 and 46, respectively (Figure 19). Other high harvest counties were in the northeast and northcentral regions of Missouri.

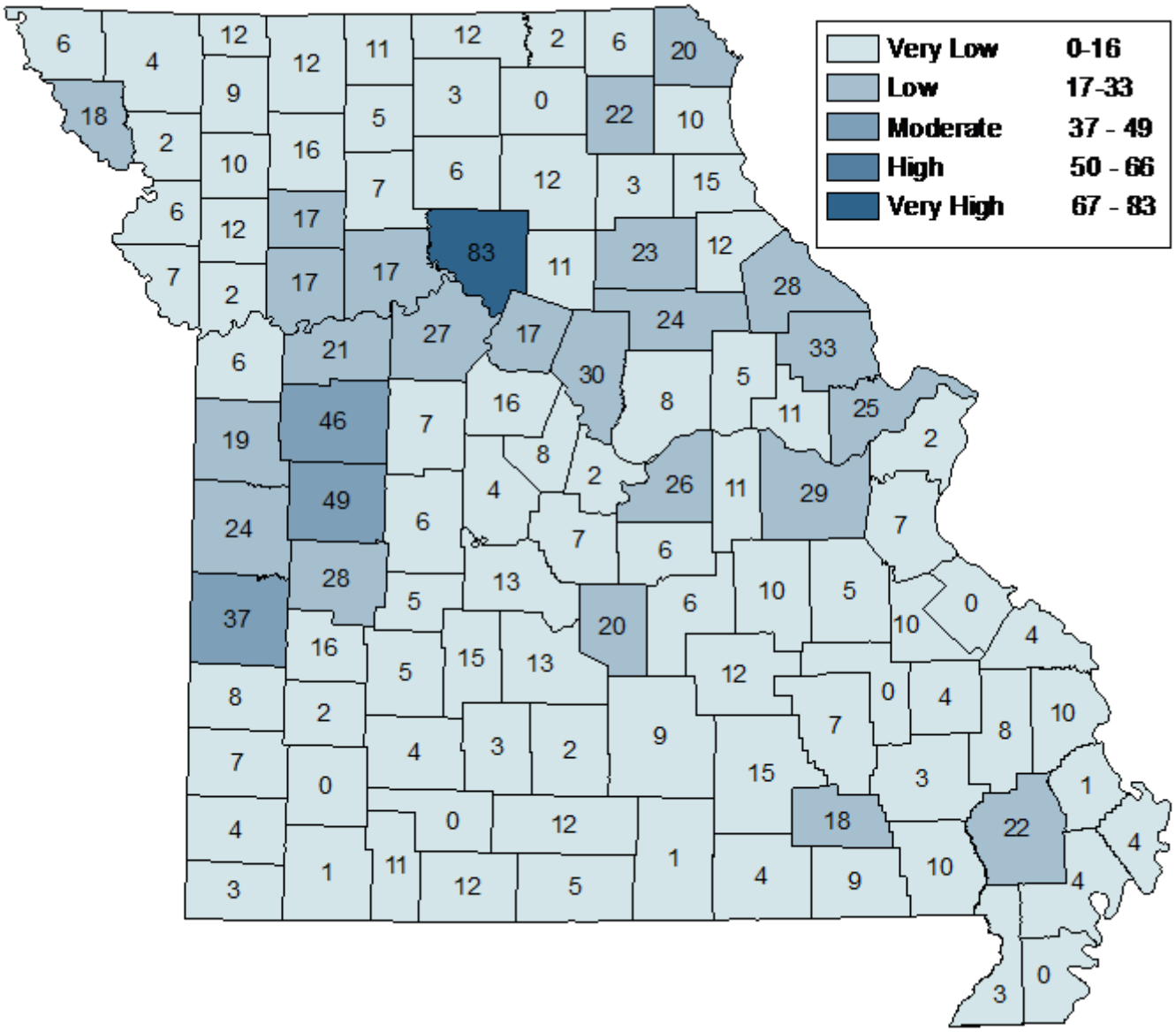

Figure 19. The number of otters harvested by county during the 2015-16 season.

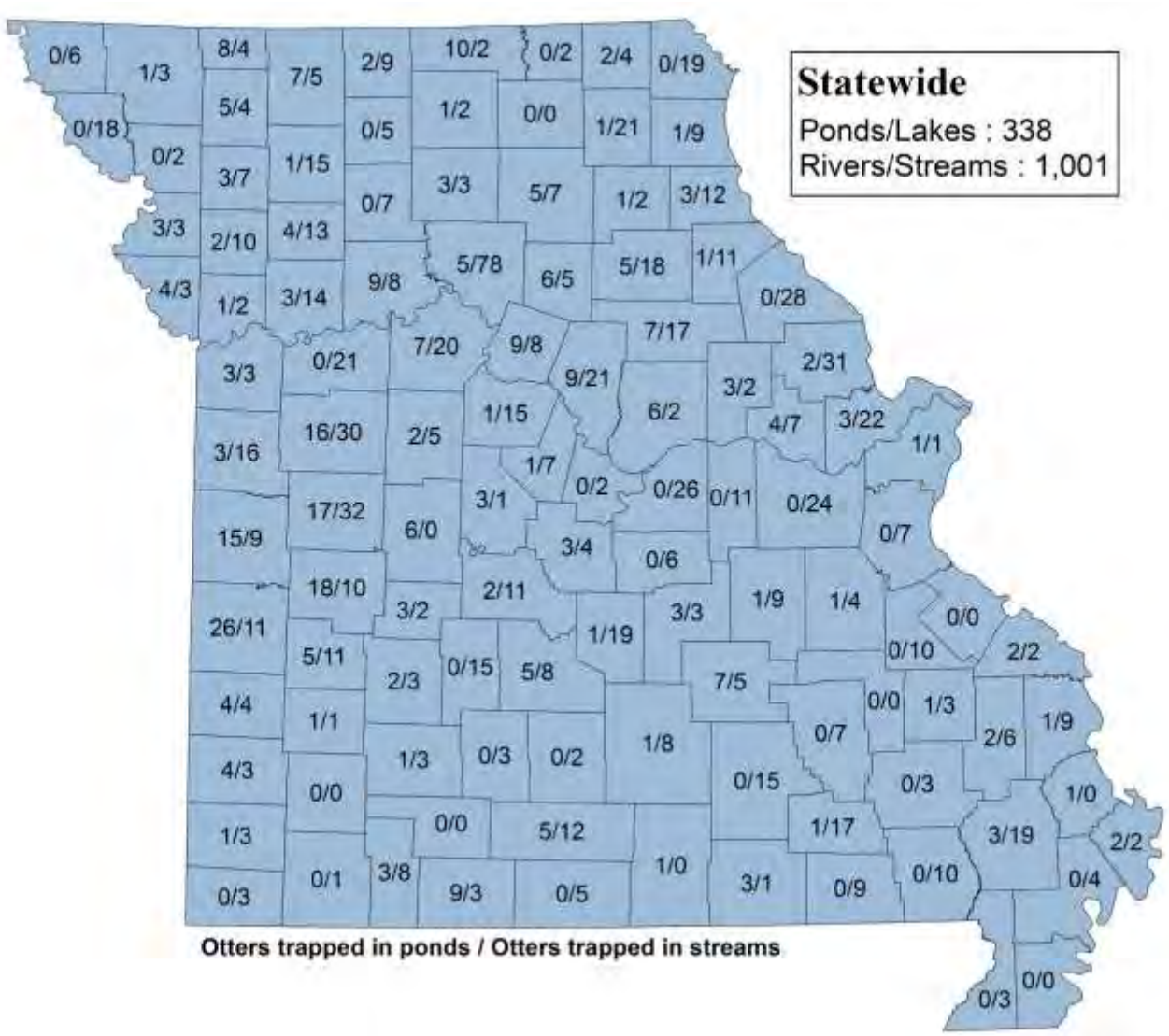

Figure 20. Comparison of otters trapped in ponds vs. streams.

Otter harvest during the 2015-16 season was highest in the Missouri River, Grand River, Chariton River and South Grand River watersheds (Figure 21, Table 6). Over 20% (282) of total otters harvested were in these three watersheds. Other watersheds with high harvest included the Blackwater River, Upper Mississippi River and Current River.

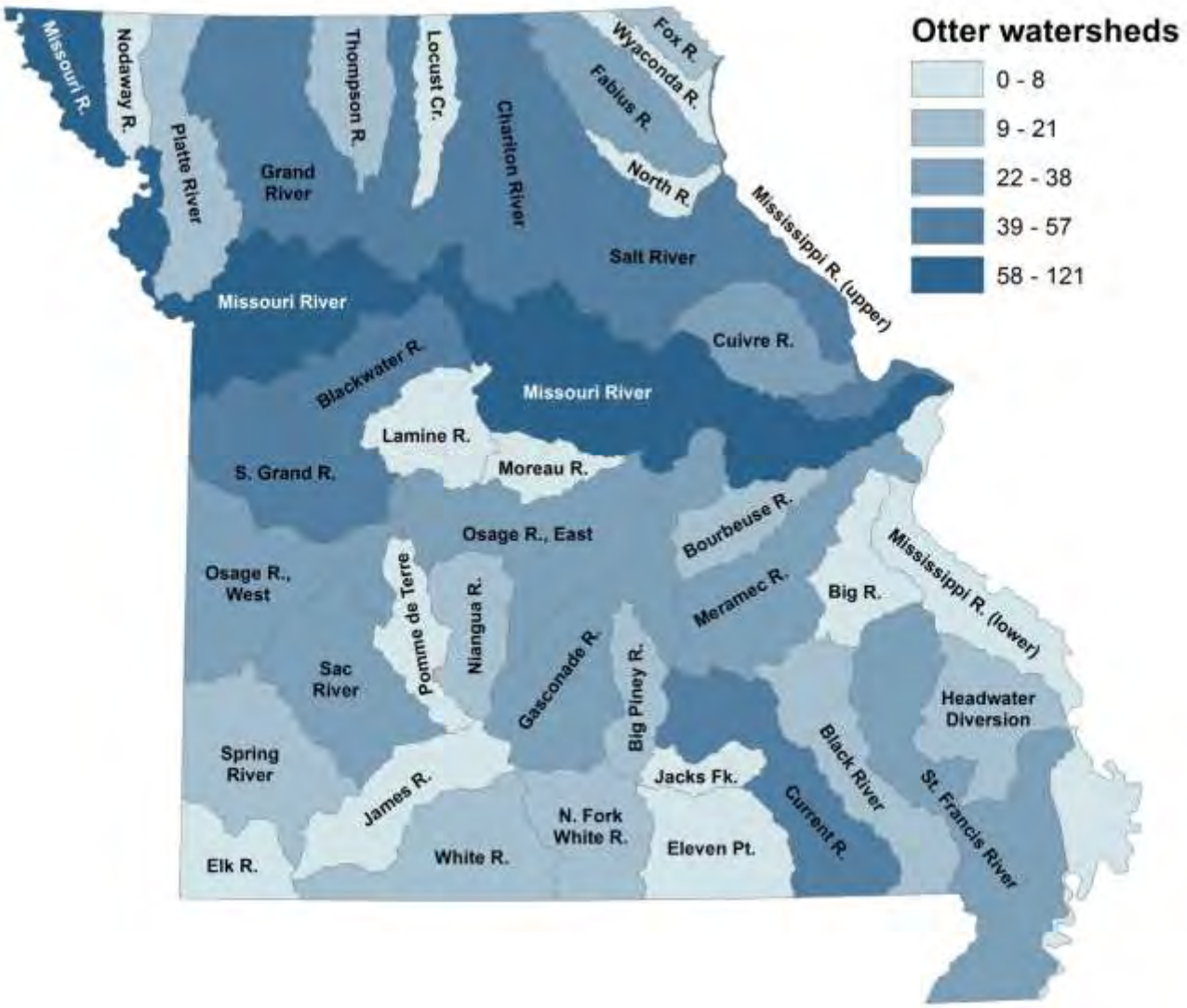

Figure 21. Otter harvest distribution among watersheds during the 2015-16 trapping season.

Table 6. Otter harvest distribution among watersheds during the 2015-16 trapping season.

Watershed	Number Harvested	Percent of Harvest
Big Piney River	13	0.96%
Big River	8	0.59%
Black River	16	1.18%
Blackwater River	48	3.54%
Bourbeuse River	10	0.74%
Chariton River	53	3.91%
Cuivre River	35	2.58%
Current River	46	3.39%
Eleven Point River	1	0.07%
Elk River	4	0.29%
Fabius River	25	1.84%
Fox River	14	1.03%
Gasconade River	38	2.80%
Grand River	57	4.20%
Headwater Diversion	12	0.88%
Jacks Fork River	0	0.00%
James River	4	0.29%
Lamine River	8	0.59%
Locust Creek	4	0.29%
Meramec River	35	2.58%
Mississippi R. (lower)	6	0.44%
Mississippi R. (upper)	47	3.47%
Missouri River	121	8.92%
Moreau River	6	0.44%
N. Fork White River	13	0.96%
Niangua River	21	1.55%
Nodaway River	3	0.22%
North River	3	0.22%
Osage River East	35	2.58%
Osage River West	28	2.06%
Platte River	12	0.88%
Pomme de Terre River	0	0.00%
S. Grand River	51	3.76%
Sac River	23	1.70%
Salt River	41	3.02%
Spring River	12	0.88%
St. Francis River	26	1.92%
Thompson River	19	1.40%
White River	15	1.11%
Wyaconda River	6	0.44%
Unknown	437	32.23%
TOTAL HARVEST	1356	100%

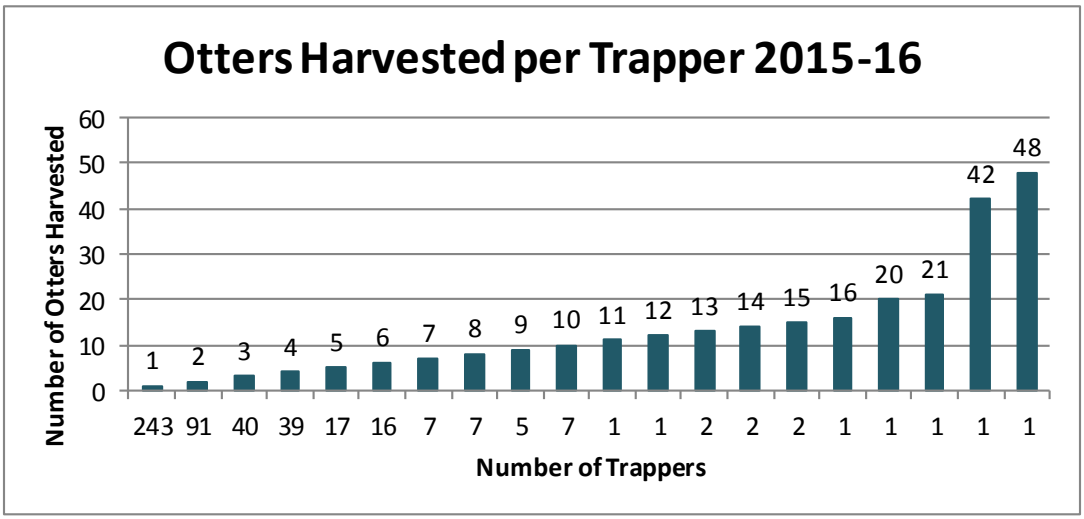

Figure 22. Number of otters harvested per trapper.

BEAVER AND MUSKRAT HARVEST TRENDS

Harvest rates for beaver and muskrat continue to fluctuate in somewhat predictable ranges. Since 1990 muskrat harvests have varied from about 5,000 – 20,000 and beaver from 2,000 – 10,000. Historically, muskrat numbers have fluctuated widely however habitat degradation has limited populations. Beavers are a longer-lived species and are less vulnerable to predators; harvest rates are more likely related to pelt values. This past season trappers harvested 6,057 muskrats and 1,933 beaver.

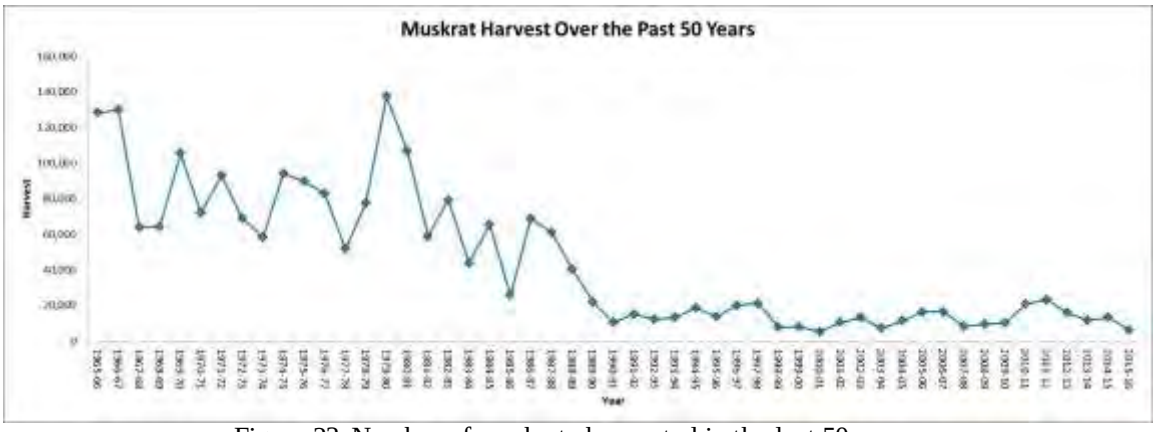

Figure 23. Number of muskrats harvested in the last 50 years.

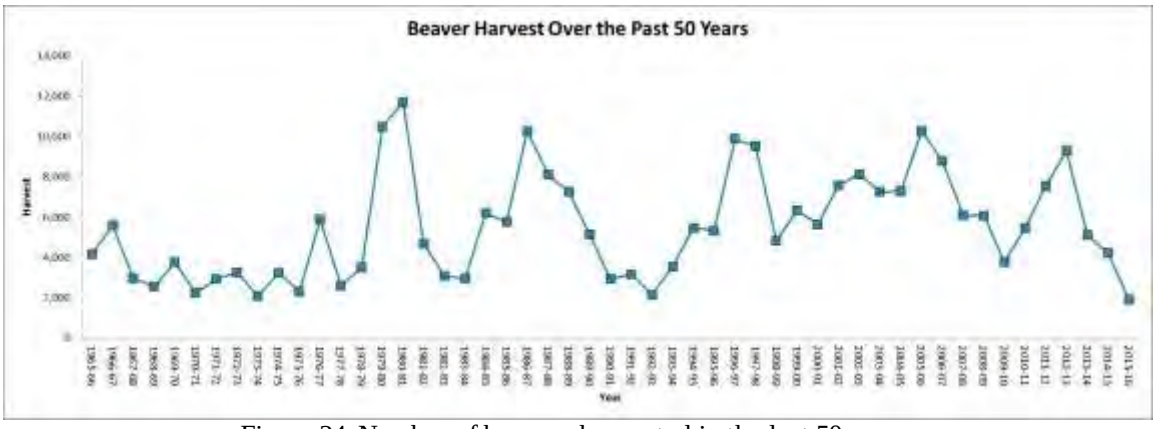

Figure 24. Number of beavers harvested in the last 50 years.

SECTION 2:
Project Updates and Summaries

Cable Restraints in Missouri

After studying reports about the safe and efficient use of cable restraints to capture coyotes and foxes, the Missouri Trappers Association (MTA) and the Missouri Department of Conservation (MDC) entered into a cooperative agreement to provide resident trappers in Missouri with training to learn the best methods for using cable restraints on land for appropriate furbearers. When used properly, cable restraints hold captured animals without mortalities and with few significant injuries.

Using cable restraints is a highly regulated activity as are all trapping methods. Anyone who traps must follow strict rules established and enforced by the Missouri Department of Conservation. Trappers may use cable restraints after completing a certified cable restraint training course. Check the MDC website for full regulations on the use of cable restraints in Missouri. There have been over 6,172 trappers certified to use cable restraints since 2004 (Figure 25).

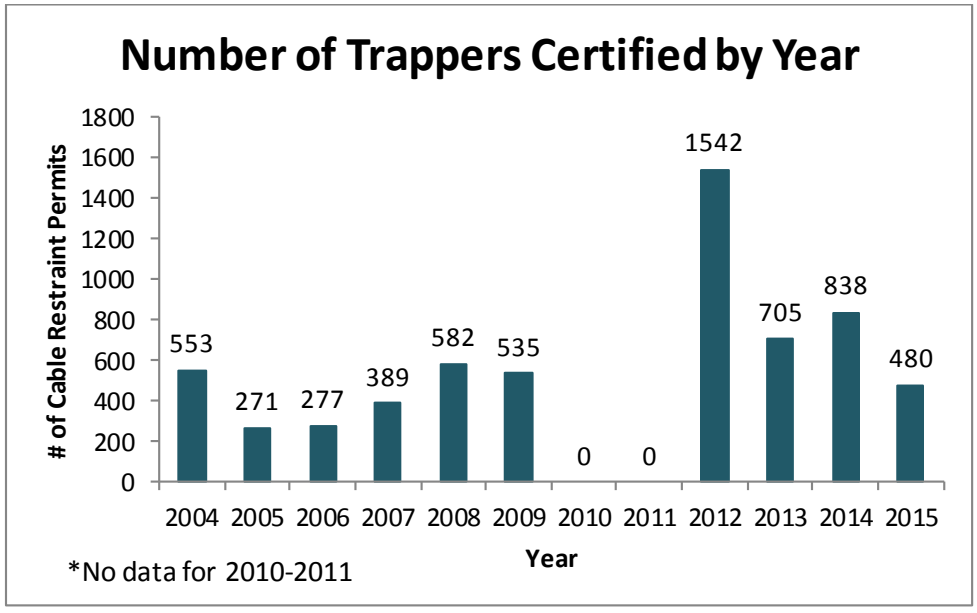

Figure 25. Number of trappers certified by year

FURBEARER SIGN STATION SURVEY

Background

The furbearer sign station survey occurs annually each September. The survey dates back to 1977 and gathers furbearer population trend information across the state. Currently there are twenty-five routes, each in a different county. Each route is broken into five segments with 10 sign stations each, for a total of 50 sign stations per route. Sign stations are 36-inch diameter circles of sifted soil, set up every 0.3 miles along shoulders of gravel roads. In the middle of each station is a scent disc infused with a fatty acid scent attractant. Stations are set up in one day and checked the next day for presence of animal tracks.

When checking the stations, observers note whether or not stations are operable. If a station has been destroyed by a road grader or other vehicle, the station is deemed inoperable and not included in index calculations. If a station is operable, it is included in the calculation of indices regardless of the presence of tracks. Observers identify any tracks within the station but do not count the number of animals of any species visiting a station.

Results

In 2015 we completed 24 out of 25 routes (Figure 26) with a total of 1134 operable stations out of a possible 1200. A breakdown of operable stations per Zoological region is shown in Table 7. Inoperable stations were due to tire tracks and road graders.

Table 7. Summary of operable and inoperable sign stations in 2014 by Zoological region.

Zooregion	Number of routes completed	Number of operable stations	Number of inoperable stations
Northwest Prairie	2	99	1
Northern Riverbreaks	3	141	9
Northeast Riverbreaks	4	178	22
Western Prairie	3	138	12
Western Ozark Border	3	143	7
Ozark Plateau	5	243	7
North & East Ozark Border	3	142	8
Mississippi Lowlands	1	50	0
TOTAL	24	1134	66

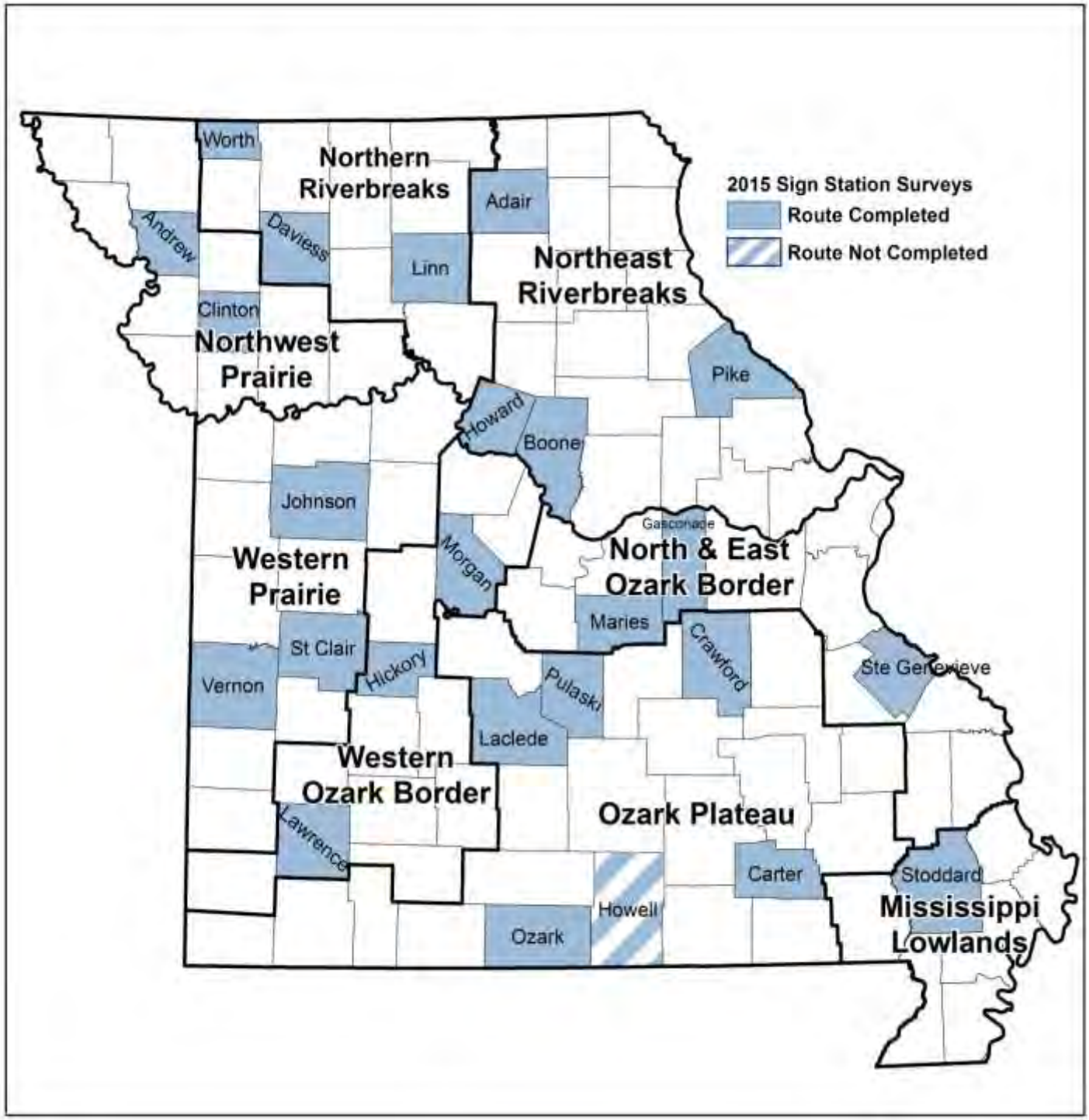

Figure 26. Map of Missouri showing counties with sign station routes within their respective Zoological region.

The most common species to visit sign stations include raccoon, opossum and coyote (Figure 27). Less common visitors include fox, mink and weasel. Birds, such as turkeys and crows, make up the majority of the non-mammal species that visit each site.

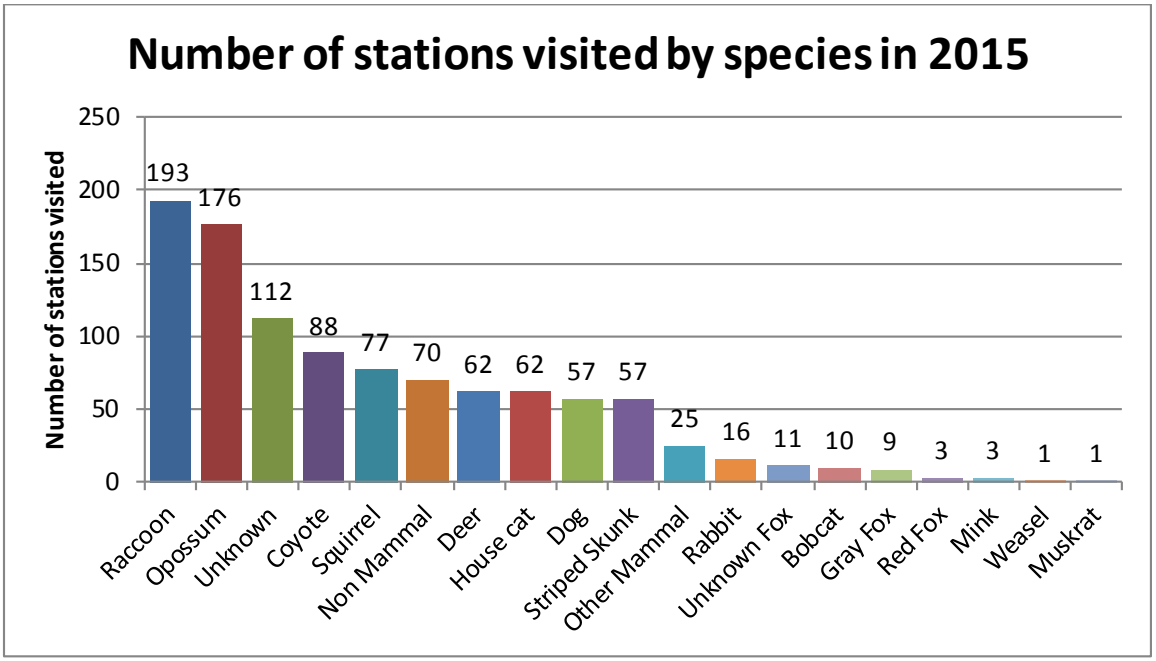

Figure 27. The number of stations visited by mammal species (including non-furbearers) out of 1134 operable stations in the 2015 survey.

Figures 28 through 31 show furbearer population trends based on the Furbearer Sign Station Survey, 1977-2015. Overall, trends indicate that most furbearer species have steady to slightly increasing populations. A slight downward trend is indicated for red and gray fox populations, which is also reflected in bowhunter observations and harvest records.

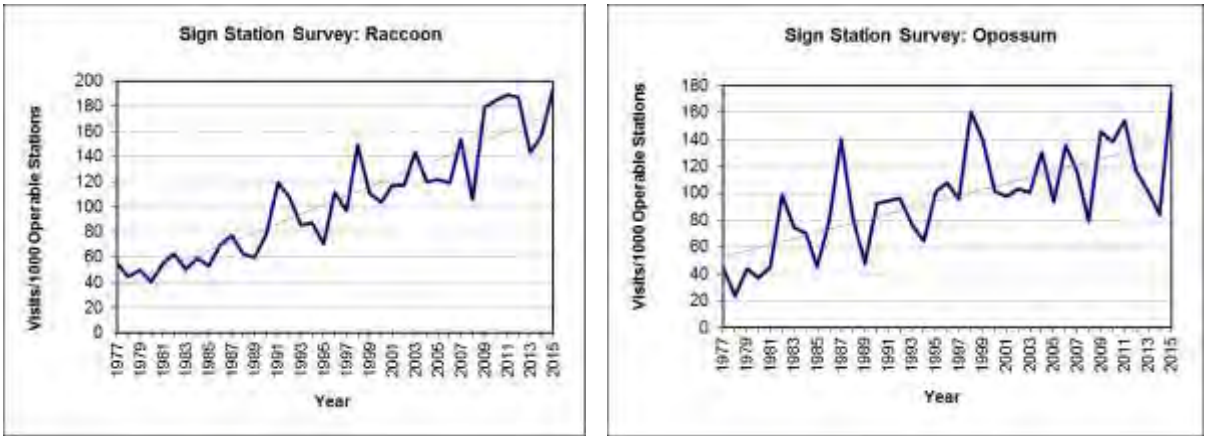

Figure 28. Raccoon and opossum population trends based on annual furbearer sign station survey.

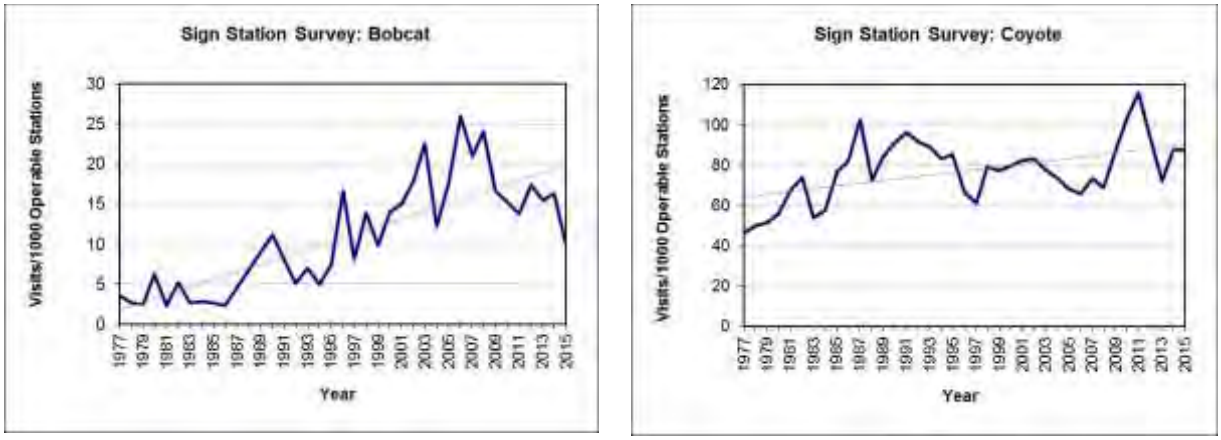

Figure 29. Bobcat and coyote population trends based on annual furbearer sign station survey.

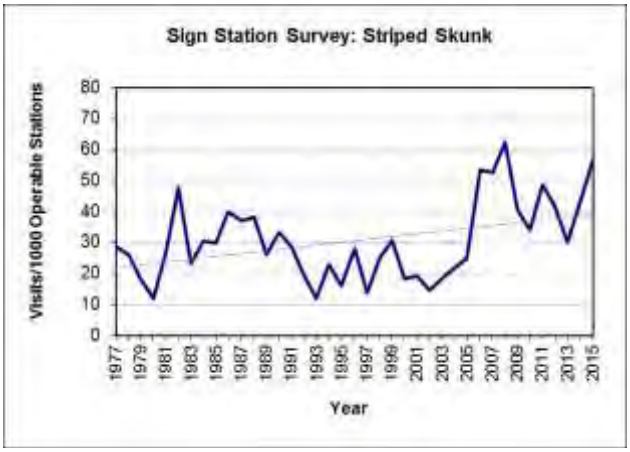

Figure 30. Skunk population trend based on annual furbearer sign station survey.

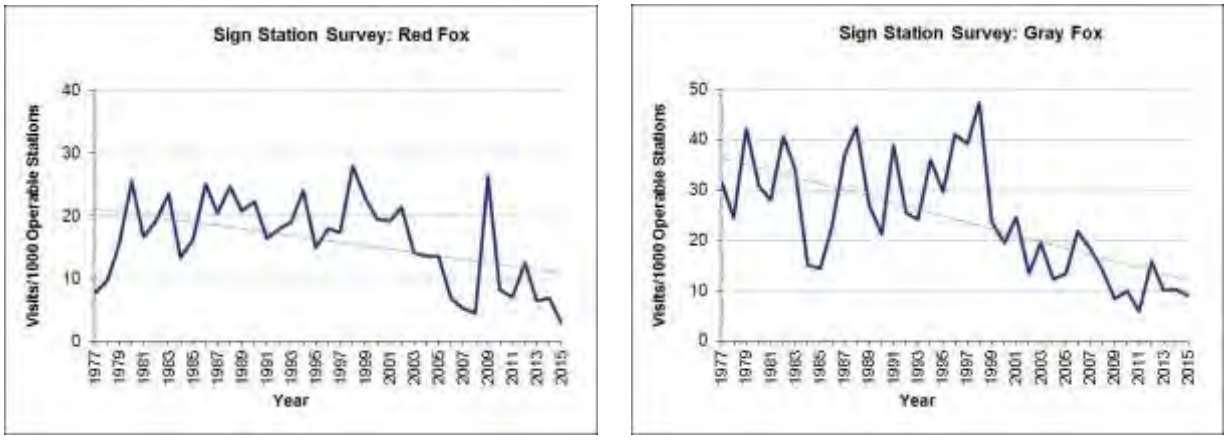

Figure 31. Red and gray fox population trends based on annual furbearer sign station survey.

ARCHER'S INDEX TO FURBEARER POPULATIONS

MONITORING FURBEARER TRENDS USING DATA GATHERED FROM COOPERATOR BOWHUNTERS

Introduction

The MDC has conducted annual surveys of wildlife populations via the bowhunters observation survey for 33 consecutive years (1983-2015). Each fall, several thousand archery deer and turkey hunters keep daily observation records for furbearers, other small game animals, deer and turkeys. Archers volunteer through post-season surveys, articles in the *Missouri Conservationist* magazine, and during sign-ups at bowhunter club meetings and other outdoor events. Archery hunters are asked to record the number of hours hunted, during both morning and evening hunts, and to use a standardized daily diary to record hours and sightings of wildlife. MDC uses the number of sightings of each species divided by the total number of hours hunted statewide to calculate a sighting index which is expressed as sightings per 1,000 hunter hours.

Wildlife population indices calculated from archer's diaries are useful trend indicators for terrestrial wildlife such as, coyotes, raccoons, foxes, bobcats, white-tailed deer, and turkeys. Hunters are well distributed statewide, with volunteers in 113 of the 114 counties during most years. Bowhunters averaged 53,645 hours in the stand over the last 33 years, and ranged from 30,990 in 1985 to 84,497 in 1988 (Table 8).

Table 8. Hunter hours and furbearer population indices based on archer's diaries, 1983-2014.

Years	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1983	55,374	20.0	6.5	5.1	1.7	23.8	12.6	5.0	0.7	0.3	0.5	0.1	0.1	0.0	0.0
1984	32,746	18.8	6.8	3.1	1.2	16.9	6.4	3.5	0.3	0.3	0.1	0.0	0.1	0.0	0.0
1985	30,990	20.1	5.3	2.8	1.5	15.4	8.6	4.2	0.5	0.4	0.4	0.1	0.1	0.1	0.0
1986	51,727	23.5	5.7	2.8	1.5	15.3	6.9	3.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0
1987	57,457	23.5	4.5	2.5	2.0	23.3	10.1	3.0	0.3	0.7	0.2	0.1	0.1	0.1	0.0
1988	84,497	22.4	4.7	2.4	1.7	16.7	4.8	2.7	0.3	0.6	0.1	0.0	0.1	0.1	0.0
1989	72,992	21.1	5.1	2.4	1.8	19.6	5.6	3.5	0.1	0.6	0.1	0.0	0.2	0.1	0.0
1990	72,227	23.6	4.9	2.3	2.9	24.0	7.2	3.5	0.2	0.4	0.1	0.0	0.1	0.1	0.0
1991	64,434	26.1	4.7	3.0	3.3	30.5	11.7	4.0	0.3	0.3	0.1	0.0	0.1	0.0	0.1
1992	64,452	22.5	4.7	2.3	2.9	24.3	8.9	2.8	0.6	0.7	0.1	0.0	0.1	0.3	0.0
1993	53,857	19.7	4.2	2.1	3.2	28.1	7.7	3.7	0.2	0.5	0.2	0.0	0.1	0.3	0.0
1994	49,102	21.0	5.1	2.0	3.4	32.0	7.6	3.2	0.1	0.5	0.2	0.0	0.2	0.2	0.0
1995	66,106	22.3	4.6	2.1	3.8	36.5	9.6	3.6	0.1	0.3	0.1	0.0	0.1	0.3	0.1
1996	60,077	19.6	4.5	1.8	4.1	29.7	6.6	2.7	0.0	0.3	0.0	0.0	0.1	0.5	0.0
1997	47,816	18.0	4.0	2.0	4.5	31.2	7.4	2.7	0.1	0.4	0.0	0.0	0.1	0.6	0.0
1998	43,152	20.8	4.1	2.4	4.4	33.0	10.6	4.2	0.1	0.3	0.1	0.0	0.2	0.3	0.1

Years	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1999	44,012	29.2	3.7	2.2	4.8	45.9	12.5	4.0	0.2	0.3	0.1	0.0	0.1	0.5	0.0
2000	50,795	20.0	3.7	2.0	4.9	32.1	8.1	3.3	0.0	0.2	0.0	0.0	0.1	0.3	0.0
2001	47,023	19.5	3.6	2.1	5.2	38.7	8.2	4.7	0.1	0.4	0.0	0.0	0.1	0.3	0.0
2002	42,826	24.6	3.8	1.5	7.9	42.6	14.4	5.6	0.3	0.1	0.0	0.0	0.1	0.8	0.1
2003	39,964	20.5	2.7	1.5	6.0	37.9	7.2	3.2	0.1	0.1	0.0	0.0	0.2	0.6	0.0
2004	35,071	17.6	2.8	1.1	4.7	37.3	7.9	2.6	0.1	0.1	0.1	0.0	0.1	1.2	0.0
2005	68,440	21.2	2.8	1.3	5.6	37.3	8.5	2.5	0.1	0.3	0.0	0.0	0.1	0.5	0.0
2006	60,040	22.2	3.2	1.3	6.9	54.4	14.4	3.8	0.3	0.2	0.0	0.0	0.1	0.5	0.0
2007	50,390	19.8	3.0	1.5	5.2	40.0	9.4	4.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0
2008	44,471	16.3	2.6	1.2	5.0	41.5	7.8	3.7	0.1	0.1	0.1	0.0	0.4	0.3	0.0
2009	44,919	20.6	2.6	1.2	4.9	42.0	12.4	4.4	0.1	0.1	0.1	0.0	0.2	1.2	0.1
2010	42,907	27.1	2.1	1.0	5.9	60.6	12.9	3.1	0.2	0.1	0.0	0.0	0.2	0.7	0.0
2011	41,370	26.1	2.7	1.1	6.6	70.1	16.6	4.6	0.2	0.1	0.1	0.0	0.2	0.9	0.1
2012	63,621	24.4	3.6	1.4	5.3	45.8	7.1	5.6	0.1	0.1	0.0	0.0	0.3	1.1	0.0
2013	68,674	16.2	2.1	1.4	4.0	33.3	5.7	2.9	0.1	0.2	0.1	0.0	0.1	0.6	0.1
2014	60,560	20.3	2.5	1.3	3.4	37.5	5.8	2.8	0.0	0.1	0.0	0.0	0.3	0.3	0.1
2015	58,203	26.2	2.5	2	5	55.2	13.4	3.8	0	0	0.1	0.0	0.3	0.6	0.1

Line graph representations of archer indices for several furbearer species are shown in Figure 32. Based on these indices, long term raccoon, bobcat and opossum observations suggest population increases. Striped skunk and coyote populations are relatively steady, while observations suggest a downward trend for red and gray fox populations. Wildlife population indices are also depicted by county (Table 9).

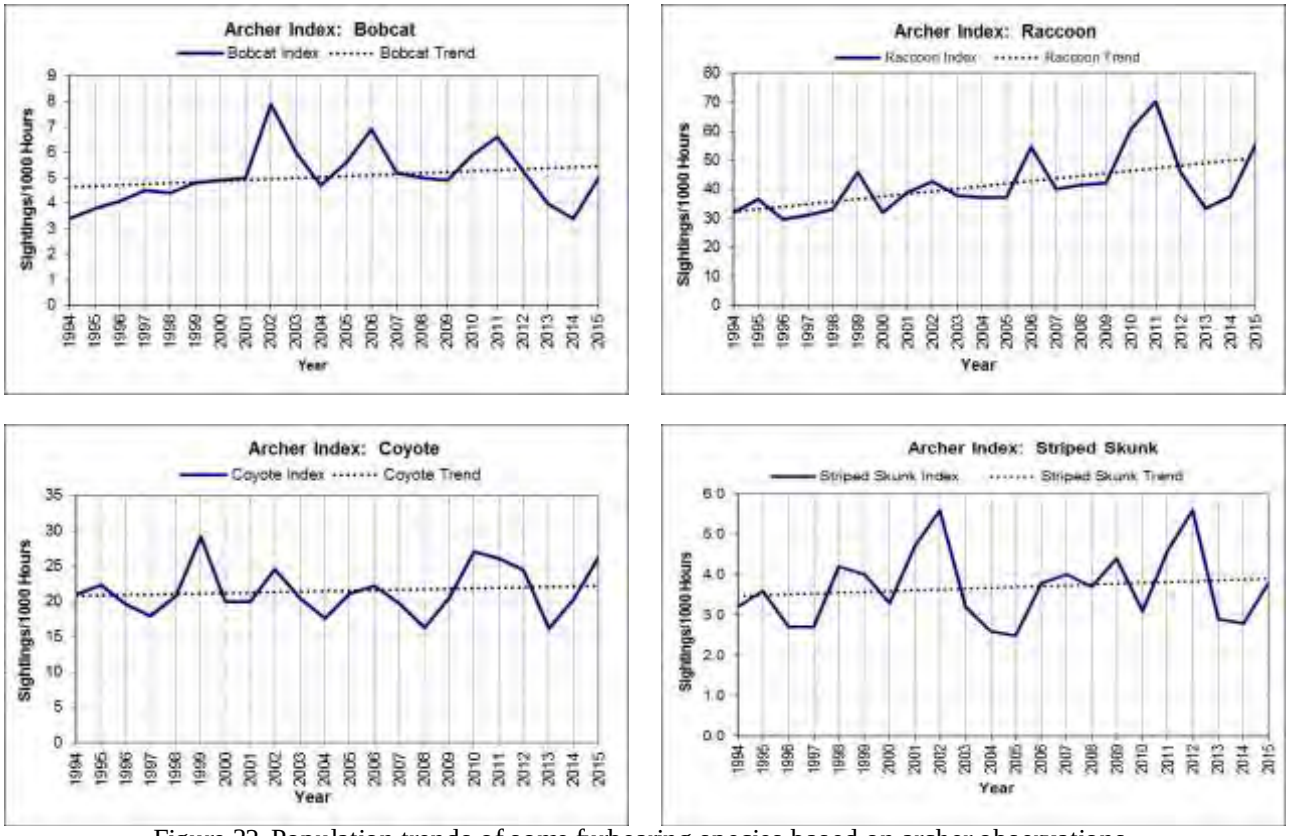

Figure 32. Population trends of some furbearing species based on archer observations.

Figure 32 (continued). Population trends of some furbearing species based on archer indices.

Table 9. County wildlife Indices for 2014 based on sightings by cooperating archery hunters (sightings/1,000 hours)

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Adair	14	1258	404	65	4	.	.	1	.	.
Andrew	111	1145	430	115	37	5	.	37	.	.
Atchison	60	774	142	129	.	.	.	.	.	.
Audrain	39	836	315	102	13	5	.	9	.	.
Barry	16	465	131	49	2	4	.	10	.	.
Barton	123	1498	1416	57	38	5	19	8	.	.
Bates	60	776	701	57	21	4	.	11	.	.
Benton	12	650	564	9	7	3	1	1	.	.
Bollinger	39	533	131	31	2	.	.	8	.	.
Boone	29	956	290	47	22	13	.	7	.	.
Buchanan	75	482	207	106	13	.	.	13	.	.
Butler	5	1082	10	5	.	.	.	.	.	.
Caldwell	17	1045	803	242	45	.	.	22	.	.
Callaway	21	792	412	26	23	5	6	2	.	.
Camden	16	634	417	21	8	4	.	4	.	.
Cape Girardeau	43	623	312	69	17	.	.	6	.	.
Carroll	46	1048	268	106	17	.	.	.	.	.
Carter	6	474	62	34	.	3	.	31	.	.
Cass	51	711	280	46	11	.	2	4	.	.
Cedar	23	1344	922	59	12	.	3	3	.	.
Chariton	46	1172	421	98	20	.	.	9	.	.
Christian	16	235	116	3	.	.	.	.	.	3
Clark	16	706	202	32	.	.	.	4	.	.
Clay	5	339	258	90	18	14	.	.	.	.
Clinton	83	1009	505	101	.	.	.	.	.	.
Cole	20	606	525	37	6	2	2	2	.	.
Cooper	34	1215	439	101	15	2	.	6	.	.
Crawford	8	385	374	24	11	.	11	.	.	1

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Dade	11	471	249	19	15	.	.	.	.	.
Dallas	16	582	617	25	.	8	.	.	.	.
Davies	22	1146	605	177	34	6	.	11	.	.
Dekalb	14	685	346	107	12	.	.	12	.	.
Dent	15	600	1150	15	.	.	4	7	.	.
Douglas	10	324	618	15	.	.	.	.	.	.
Dunklin	13	92	.	.	.	.	.	79	.	.
Franklin	45	764	546	50	13	3	.	4	1	.
Gasconade	12	590	514	30	11	4	7	1	.	.
Gentry	54	647	173	140	11	5	.	5	.	.
Greene	26	1136	490	35	24	14	.	2	.	.
Grundy	14	1073	236	36	9	.	.	5	.	.
Harrison	23	1662	630	64	10	.	.	5	5	.
Henry	72	1051	375	57	37	3	.	21	3	.
Hickory	17	921	796	37	8	.	.	12	.	.
Holt	62	745	1549	99	51	4	.	7	.	.
Howard	28	1554	315	96	12	.	.	6	.	.
Howell	2	780	290	5	.	2	5	.	.	2
Iron	43	400	389	119	.	.	.	11	.	.
Jackson	24	715	309	22	19	3	.	1	.	.
Jasper	13	1400	488	124	17	.	.	.	.	.
Jefferson	10	539	214	38	9	2	.	4	1	.
Johnson	42	837	354	22	10	1	.	4	.	.
Knox	38	1466	452	106	14	.	.	13	2	.
Laclede	19	534	363	4	4	.	4	8	.	.
Lafayette	67	607	303	221	4	8	.	.	.	.
Lawrence	24	603	428	19	.	5	.	5	.	.
Lewis	24	1123	261	93	16	.	.	.	.	.
Lincoln	25	711	190	83	4	.	.	1	.	.
Linn	22	1462	341	148	11	.	.	5	.	.
Livingston	22	665	509	99	26	.	.	.	.	.
McDonald	17	651	.	17	.	.	.	.	.	.
Macon	31	979	493	87	13	.	1	2	.	.
Madison	19	448	90	.	.	.	6	2	.	.
Maries	15	508	573	68	11	.	9	2	.	.
Marion	33	1188	510	80	17	.	.	7	.	.
Mercer	3	1104	383	34	12	3	.	3	.	.
Miller	20	639	619	17	22	.	.	2	.	.
Mississippi	.	.	.	.	182	.	.	.	.	.
Moniteau	7	2866	944	28	42	.	.	7	.	.
Monroe	24	641	406	39	14	8	1	6	.	.
Montgomery	28	810	262	39	16	1	.	4	.	.
Morgan	13	737	300	47	5	2	11	1	.	.
New Madrid	28	152	.	.	.	.	.	.	.	.
Newton	25	695	603	37	18	.	5	9	2	.
Nodaway	35	1043	253	274	61	3	.	.	.	.
Oregon	16	934	195	26	3	.	.	3	.	.
Osage	16	877	652	71	18	2	2	.	2	.

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Ozark	16	681	211	26	6	1	.	6	.	.
Pemiscot	.	391	.	87	87	.	.	43	.	.
Perry	16	580	438	36	10	.	.	5	.	.
Pettis	52	1192	601	97	16	.	.	13	2	.
Phelps	14	642	510	26	9	.	.	2	.	.
Pike	38	1129	177	82	41	1	5	3	.	.
Platte	21	441	233	89	42	.	.	2	.	.
Polk	27	991	517	19	12	.	.	.	.	.
Pulaski	11	669	226	50	35	.	3	17	.	.
Putnam	21	1217	402	58	10	.	2	2	.	.
Ralls	44	1279	370	46	13	8	.	6	.	.
Randolph	87	1212	748	64	11	2	.	14	.	.
Ray	24	689	138	195	18	18	.	6	.	.
Reynolds	25	840	282	3	.	.	.	9	.	.
Ripley	7	704	193	7	.	.	.	.	.	.
St Charles	11	832	185	70	8	23	1	.	.	.
St Clair	15	596	394	30	10	.	.	8	.	.
St Francois	11	389	279	9	.	4	.	2	.	.
St Genevieve	17	410	295	22	10	3	.	2	1	.
St Louis	30	953	177	40	5	2	.	.	1	1
Saline	50	1103	282	124	35	.	2	7	4	.
Schuyler	24	702	412	140	34	.	.	10	.	.
Scotland	8	1380	194	153	20	4	.	2	.	.
Scott	26	697	145	92	.	.	.	13	.	.
Shannon	16	324	324	8	.	.	.	.	.	.
Shelby	24	1152	297	114	11	7	.	15	.	.
Stoddard	16	406	221	55	32	4	.	.	.	.
Stone	13	390	524	35	15	2	.	7	.	.
Sullivan	66	1379	488	66	11	.	.	11	.	.
Taney	6	454	401	.	6	.	.	6	.	.
Texas	19	522	652	17	.	.	.	3	.	.
Vernon	39	860	405	63	18	.	.	8	.	.
Warren	10	394	62	3	14	.	.	.	.	.
Washington	21	285	171	3	15	.	.	9	.	.
Wayne	4	410	106	21	14	1	.	1	.	.
Webster	56	616	256	13	13	.	.	.	.	.
Worth	38	950	69	46	8	.	.	8	8	.
Wright	55	825	472	74	5	.	3	5	.	.
State-wide Index	28.3	811.0	397.2	63.4	19.2	5.0	4.8	8.3	2.6	1.9

BADGER STATUS IN MISSOURI

AN EXPLORATORY ASSESSMENT OF BADGER DEMOGRAPHICS AND CONSERVATION STATUS IN MISSOURI

The badger is uncommon in Missouri and is considered a species of conservation concern. Its official rank is Unrankable (SU), however, as little data are available to form the basis for a ranking. MDC is collecting badger observations and specimens from across the state to better understand the demographics and distribution of badgers in Missouri and to provide data from which to refine the status of badgers in Missouri.

The badger is a harvested species in Missouri, but harvest numbers have historically been low (generally fewer than 200 per year since the 1960s, and fewer than 100 per year since the 1990s). Arkansas ranks the species as S1 (Critically Imperiled), Ohio and Indiana as S2 (Imperiled), and Kansas as S3 (Vulnerable). Iowa ranks the badger as S4 (Apparently Secure), reflecting their apparent increased abundance in the grassland and open habitats that dominate the state. This habitat preference is also seen in Missouri, as the majority of harvested animals are from the northern portion of the state, and especially from northwestern Missouri.

Badger habitat has declined substantially in areas converted from grassland to intensive agriculture. Also, colonial rodents such as prairie dogs and ground squirrels (as in Missouri, where both Franklin's and thirteen-lined ground squirrels are also species of conservation concern) have been reduced or eliminated. Assessing the range and demographics of badgers in Missouri is hindered by a lack of information because 1) harvest data are insufficient to properly assess trends and 2) little baseline data are available on the biology and demographics of the species. MDC is using verified sightings from the public to define the minimum range of badgers in Missouri, to make initial and preliminary insights into the demographics of the Missouri population and to better refine the status of the species in MDC's heritage database.

Preliminary Results

Since May 2010 we have received 347 badger reports. Physical data from badger carcasses collected in Missouri through June of 2016 show an average whole carcass weight of 16.7 lbs. (n = 32) and an average length of 25 in (n = 30). Data for the carcasses that were received already skinned show an average weight of 13.2 lbs. (n = 58) and a length of 23.6 in (n = 56). Each carcass collected had a tooth extracted and sent in for aging. Almost one-half (44%) of badgers collected were less than 1-year-old (Figure 33).

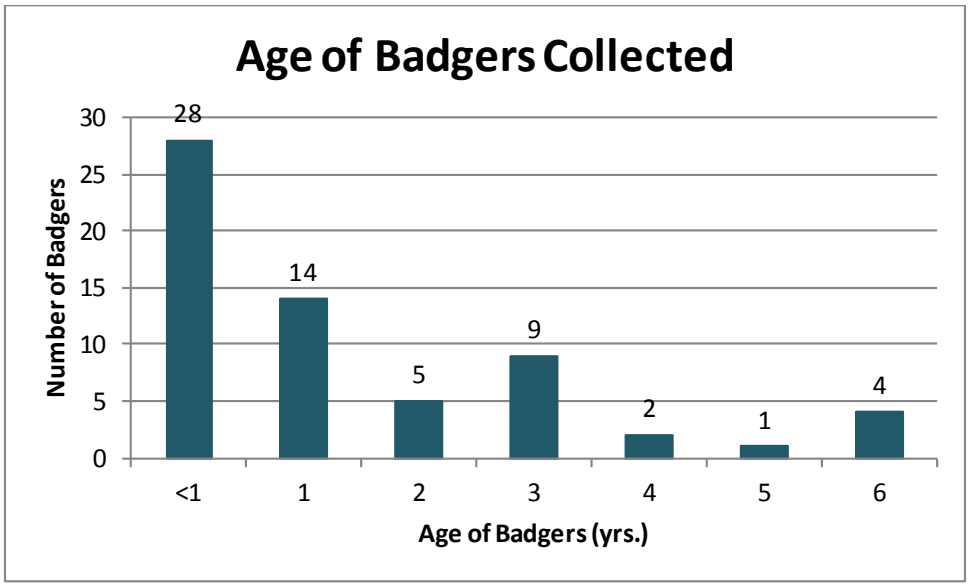

Figure 33. Age of badgers collected from 2010-2016

Data collected during this study were used to study the relationship between habitat and badger occurrence in Missouri. Badger observations were compared to land cover, elevation and soil type. Habitat characteristics associated with badger observations were then compared to habitat across the state. Results showed that 78 percent of observations occurred in grassland or cropland (Figure 34), 64 percent of observations occurred in residium and glacial drift soils (Figure 35) and 71 percent of observations occurred between 623 and 1016 feet elevation (Figure 36)

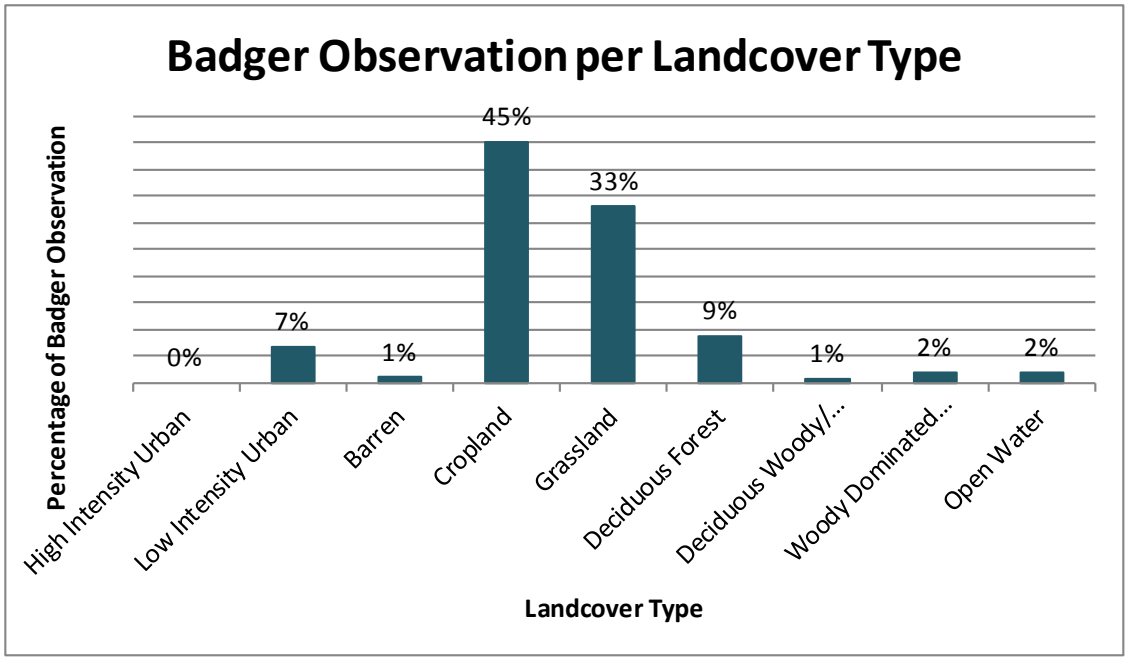

Figure 34. Percentage of badger observations per land cover type in Missouri.

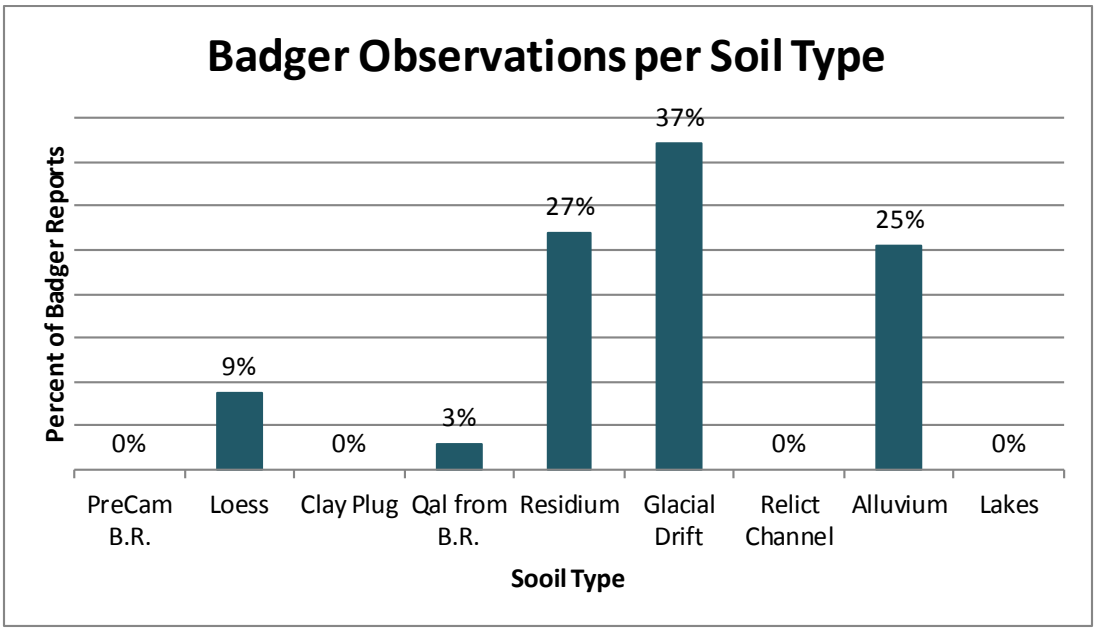

Figure 35. Percentage of badger observations per soil type in Missouri.

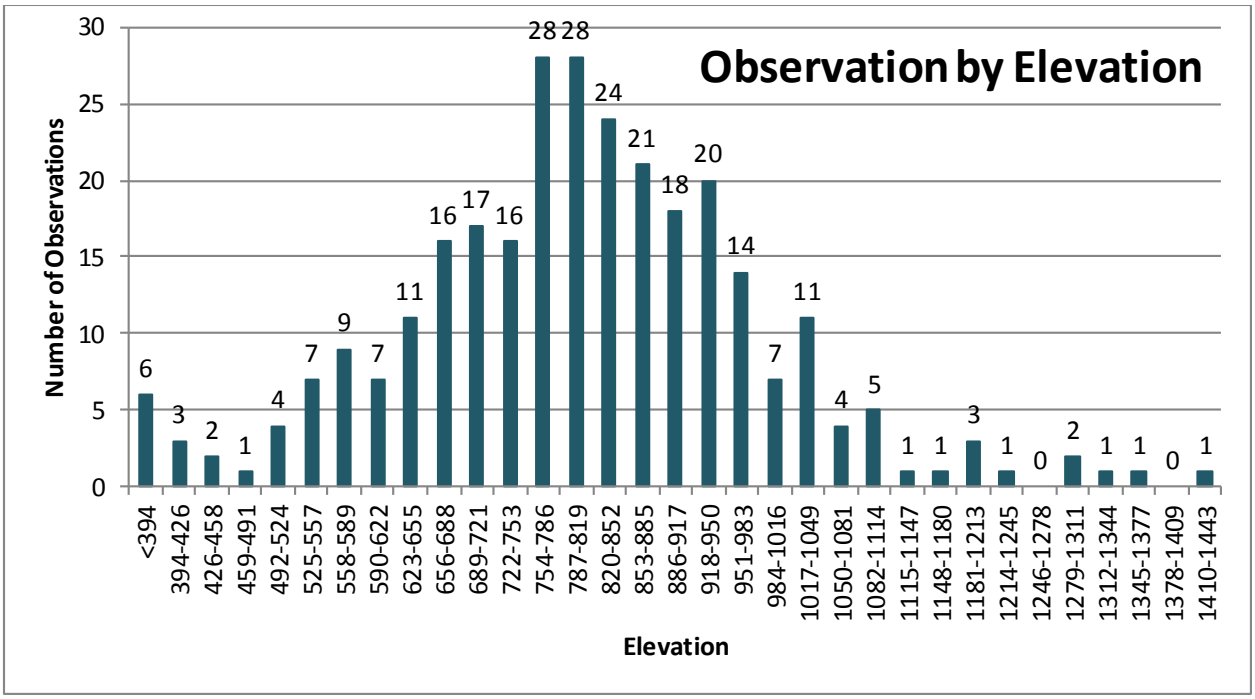

Figure 36. Badger observations compared to elevation in Missouri.

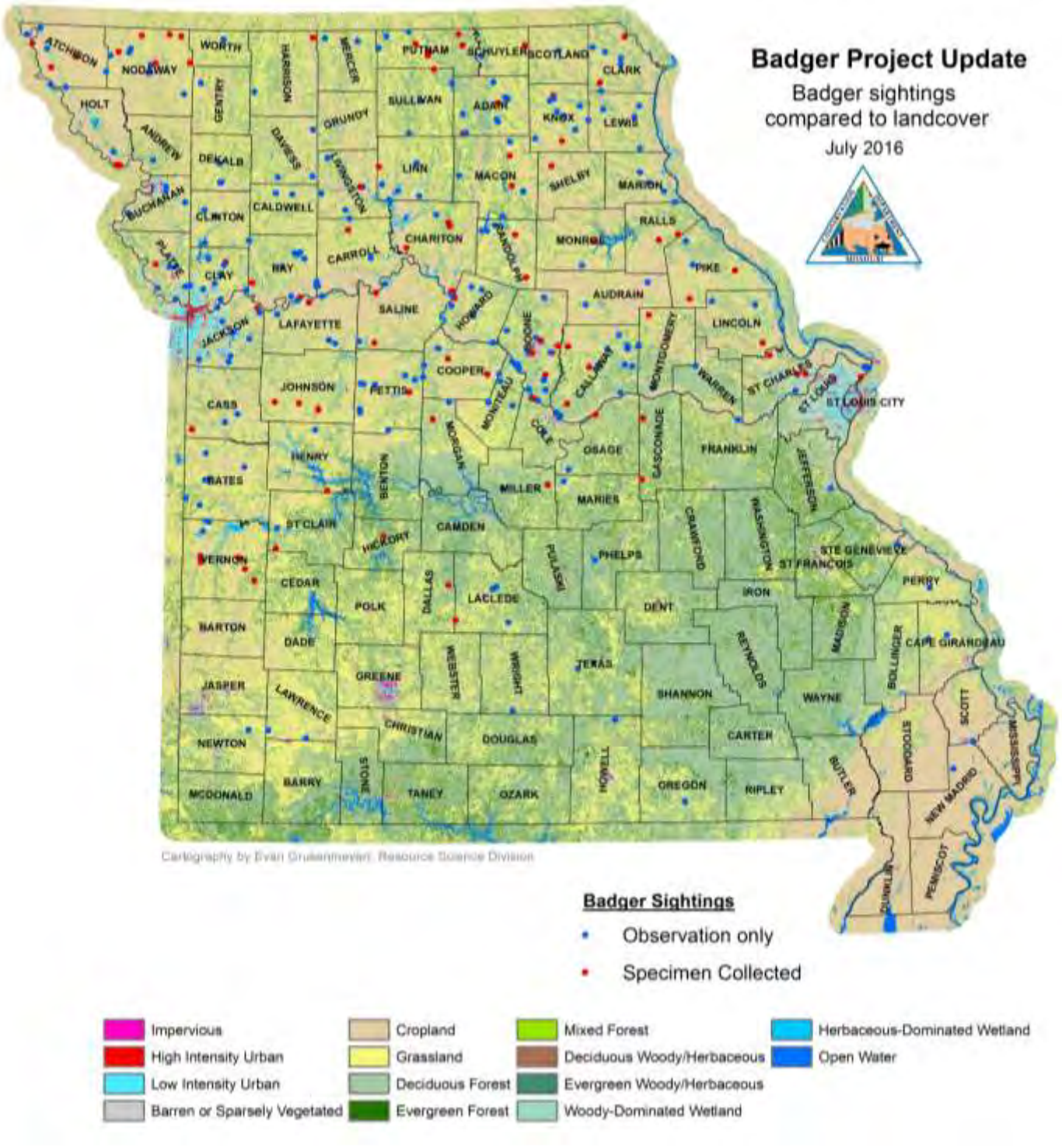

Figure 37. Badger locations based on reported sightings and carcass recoveries from trappers and road killed animals.

MONITORING AND DEMOGRAPHIC ASSESSMENT OF RIVER OTTERS AND BOBCATS IN MISSOURI

Currently, Missouri has no harvest level restrictions on river otters or bobcats. Past harvest data suggest these species are not in danger of being overharvested. However, harvest of these species has been challenged in a number of states. Plaintiffs have alleged state agencies lacked sufficient data to allow harvest at current levels. Bobcat trapping was recently banned in the state of California because state agencies were unable to demonstrate that annual bobcat harvests were sustainable. In order to obtain a better idea of the age and sex characteristics of statewide populations of river otters and bobcats, as well as to legally defend our harvest if needed, the MDC began a research project to document the sex and age of harvested animals and measure harvest effort by trappers for these species. These and other data will enable us to generate abundance estimates and measure the impact of harvest and regulations on otter and bobcat populations.

Statistical Population Reconstruction (SPR) provides a broad scale assessment whereas most other techniques are applicable to only local areas. Through SPR, the MDC will have a better understanding of the relationship between harvest rates and demographics of each species. Population reconstruction will also provide the MDC with solid harvest and population data. This format will be the MDC's long-term monitoring plan.

Tooth envelopes and survey packets are sent to Missouri trappers at the start of each trapping season. These packets contain a monthly journal to aid trappers in recording effort or trap-nights per captured animal. Trap-nights per capture will reveal the amount of trapping pressure these species undergo each year. Trappers are also asked to remove one of the lower canine teeth from each otter and bobcat they harvest so that we can determine age-at-harvest. This allows us to determine if a population is increasing, decreasing or stable. The effort survey and teeth are collected when hunters and trappers register their animals with Conservation personnel for CITES purposes. See figures 38 and 41 for initial age analysis of samples for the 2015-2016 season.

In total, 342 lower canine teeth were collected from both river otters and bobcats with 17 samples being excluded from analysis because they were cut too short or the wrong tooth was sent in for aging. The samples consisted of 184 river otter and 141 bobcat teeth.

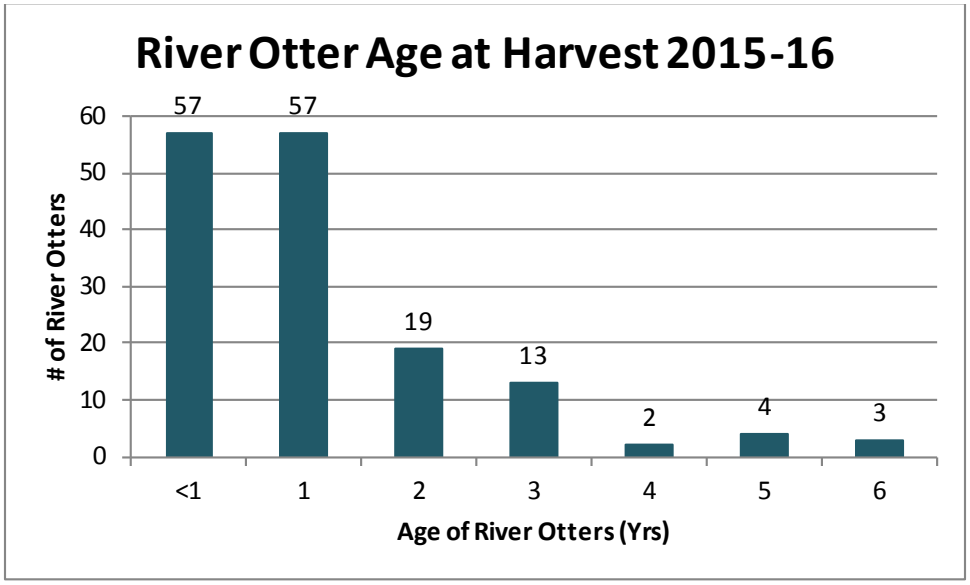

Figure 38. Age of otters sampled 2015-2016.

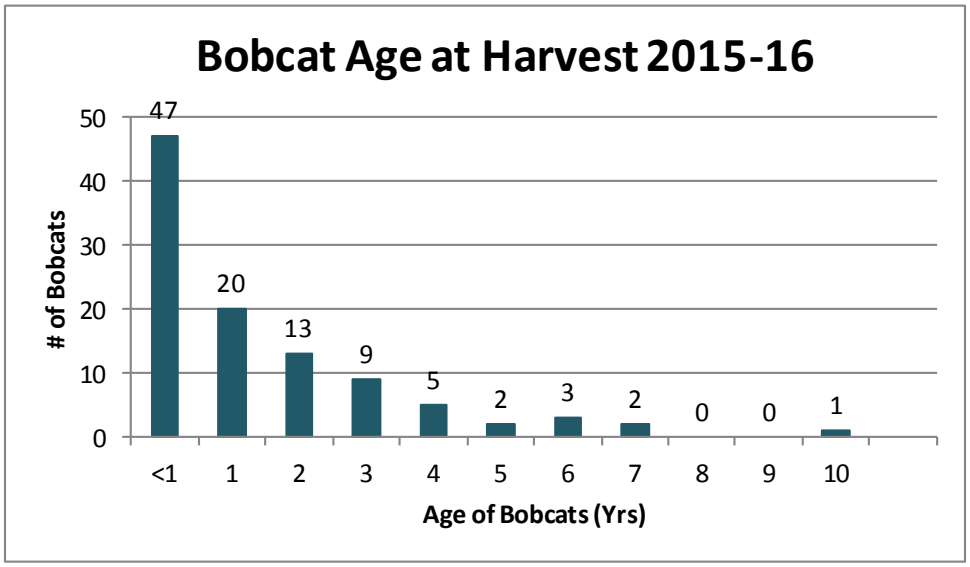

Figure 39. Age of bobcats sampled 2015-2016.

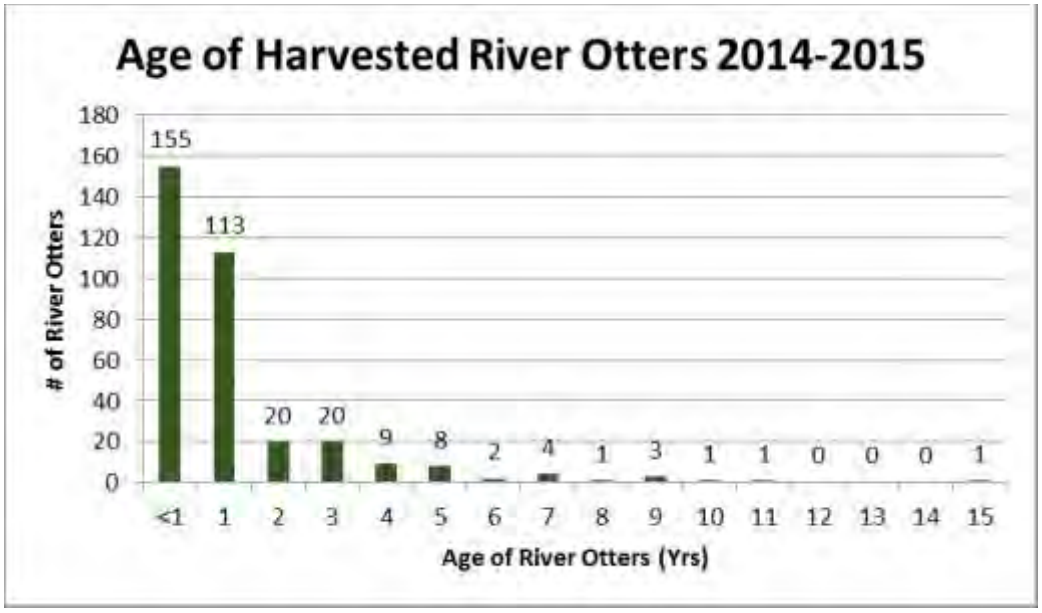

Figure 40: Age of otters sampled 2014-2015

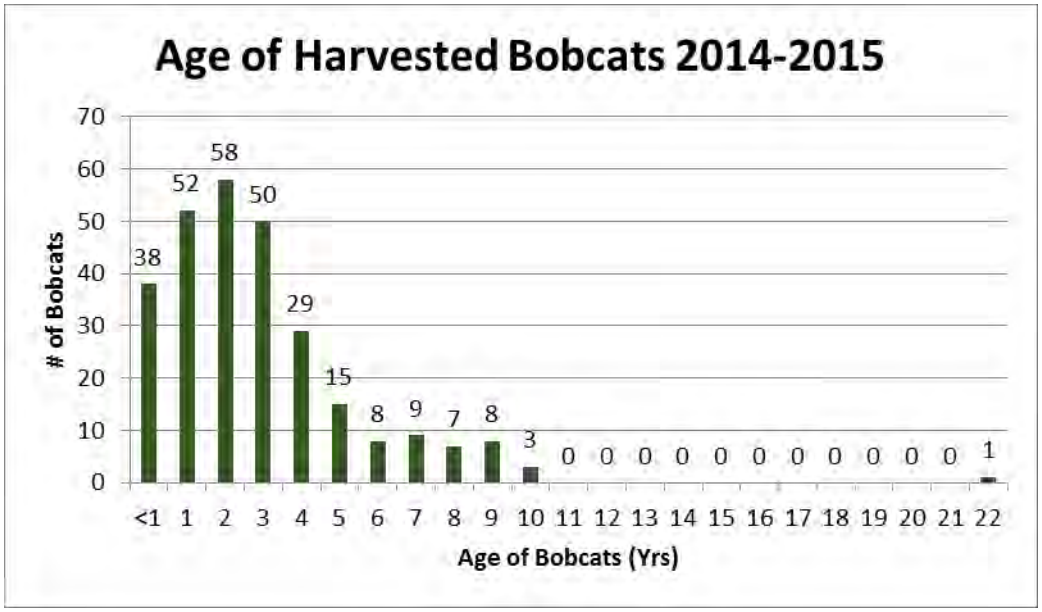

Figure 41: Age of bobcats sampled 2014-2015

LARGE CARNIVORE INVENTORY

LARGE CARNIVORE INVENTORY AND MARKING STUDY:

Background

Dangerous captive animals have recently come under public scrutiny. Because of the inherent danger and potential liability associated with the possession of large carnivores, an effective system was needed to verify ownership and better monitor the legitimate purchase, sale and trade of these animals. The Department of Agriculture is currently evaluating regulations for the possession of dangerous carnivores other than those regulated by MDC. The MDC has taken a proactive approach in response to the public demand for more accountability and to provide some consistency between us and the Department of Agriculture. The intent of these new provisions is to better enable our enforcement and record keeping obligations, safeguard permit holders from false claims of ownership, and satisfy public demand for higher accountability of these potentially dangerous animals. In addition, our Department will have the ability to distinguish captive animals from truly wild animals.

Based on these issues, MDC made significant regulation changes pertaining to large carnivores owned under the Class II Wildlife Breeder Permit. The proposal to permanently mark all captive bears, mountain lions, wolves and wolf hybrids was approved by the Regulations Committee and Conservation Commission in 2007. The regulation became effective March 1st, 2008 under code: 3 CSR 10-9.353 Privileges of Class I and Class II Wildlife Breeders and had a 1 July 2008 compliance date. Effective July 1, 2008, all mountain lions, black bears, wolves and wolf-hybrids held under the privileges of a Class II Wildlife Breeder Permit were required to be uniquely identified with a permanent Passive Integrated Transponder (PIT) microchip. These microchips are about the size of a grain of rice and contain an electromagnetic code that can be used to identify animals. They can be injected under the skin to permanently mark animals without altering external appearance. Microchips are normally placed just under the skin along the back of the animal, between the shoulder blades. This standardized protocol allows animals to be searched quickly and efficiently. The regulation also requires owners to allow the Department to obtain, from each animal, a small blood or tissue sample sufficient for DNA analysis.

Progress to Date

Surveys and interviews were completed for 33 of the then 50 captive carnivore owners in the state. Feedback from the interviews showed that a majority of owners are generally supportive of the new regulations, but have concerns about the welfare of their animals. An informational workshop was held in Jefferson City on February 9, 2008. The workshop provided a forum for MDC personnel, veterinarians and captive carnivore owners to discuss the procedures for marking captive animals. The contract with Wildlife Genetics International for DNA testing was renewed for the 2016 year. DNA samples will be stored at Resource Science in Columbia until all samples have been collected and then will be sent to Wildlife Genetics International for analysis.

Department personnel have assisted in implanting microchips in and collecting DNA samples from 188 different animals at 46 facilities around the state. A total of 35 mountain lions, 34 black bears, 53 wolves and 66 wolf hybrids have been tagged. As of June 2015, all known owners of captive carnivores are in compliance with the regulation.

All permits to hold large carnivores expire June 30th of each year. Renewal letters and applications were sent to all current permit holders in April and May 2016. If the permits are not renewed by their expiration date, the permit holder is considered to be in violation of Missouri state code. Permit holders in violation may receive a citation from their local conservation agent if they wish to continue to hold large carnivores.

MOUNTAIN LION RESPONSE TEAM

The Missouri Department of Conservation developed a Mountain Lion Response Team (MLRT) in 1996 to address the concerns and reports from the public regarding mountain lions and the occasional confirmed occurrence of a mountain lion in the state. The MLRT consists of employees across the state. MLRT members have special qualifications or have received training to address mountain lion concerns and conduct investigations when evidence is present.

All mountain lion sightings are categorized and entered into a long-term database. The MLRT also keeps track of confirmed cases of mountain lions in Missouri when there is physical evidence to support a sighting such as a track, carcass, photo, video, etc. The MLRT has logged over 2,500 sightings in the database since 1994. During this time period there have been 64 mountain lion observations confirmed in the state (Table 10, Figure 42). Mountain lion confirmations continue to increase. Missouri has confirmed more mountain lion incidents than any other state without a known population. Lion confirmations in Missouri are the result of trail camera photos (65%), followed by DNA confirmation from hair, carcasses, and tracks. Genetic analysis from killed lions indicated origins of South Dakota, Montana and Colorado; all DNA-confirmed animals were males. Although the sex and origin from only 4 of our 64 confirmations has been documented, the information does help explain some of what is likely happening with lions in Missouri – that being that the majority of confirmed reports result from transient subadult males. Learning the sex and origins of some lions has enabled MDC to provide the public and media with timely updates about mountain lion occurrences, factual information about individual animals, and general information about their biology and habits.

There have been 30 sightings in a six- county region including Shannon, Texas, Oregon, Carter, Ripley and Reynolds counties. There have been 21 sightings confirmed by photos, two by hair samples, and one each of a carcass, saliva DNA test and a live capture. Six months after the first sightings, a mountain lion was killed in Texas County that was physically different than the mountain lions that had been previously caught on game camera. During the summers of 2011 and 2012, multiple Shannon county lion photos and kill sites were investigated over a course of six months; some of the photos were collected from the same location. During this past year, over 100 reports of mountain lions were recorded in the state. This is a minimum number because many reports to local agency staff are not recorded. Most reports are the result of the MLRT website reporting form and email account. The MLRT confirmed nine mountain lion sightings this past year.

Table 10. Confirmed Instances of Mountain Lions in Missouri.

2016-April St. Clair Co	64 Found dead on Harry S. Truman Reservoir shoreline by angler. Samples have been sent off to determine sex, origin and age.
2016- April Shannon Co	63 Photo of mountain lion taken by a motion-activated game camera
2015- December Boone Co	62 Photo of mountain lion taken by a motion-activated game camera
2016- February Shannon Co	61 A three year old cow elk, suspected to be affected by brain worm, was killed by a mountain lion. Samples have been collected to determine origin and sex of the mountain lion.
2016- January Henry Co	60 Photo of mountain lion taken by a motion-activated game camera
2015-November Warren Co	59 Photo of mountain lion taken by a motion-activated game camera
2015- December Reynolds Co	58 Photo of mountain lion taken by a motion-activated game camera
2015- October Miller Co	57 Photo of mountain lion taken by a motion-activated game camera
2015- August Carter Co	56 Photo of mountain lion taken by a motion-activated game camera. As well as the kill site of an 80 lb. elk calf with the characteristics of a mountain lion kill.
2015- May Shannon Co	55 Citizen reported mountain lion tracks along the Current River. MLRT investigation confirmed.
2015- May Laclede Co	54 Adult male killed in motor vehicle accident. No obvious signs of confinement. Genetic testing is underway to determine origin.
2015- February Harrison Co	53 Photo of mountain lion taken by a motion-activated game camera
2014- November Douglas Co	52 Photo of mountain lion taken by a motion-activated game camera
2014- November Taney Co	51 Photo of mountain lion taken by motion-activated game camera
2014-October Madison Co	50 Photo of mountain lion taken by motion-activated game camera
2014-October Carter Co	49 Photo of mountain lion taken by motion-activated game camera
2014- June Oregon County	48 Photo of mountain lion taken by motion-activated game camera
2013-October Barry County	47 Photo of mountain lion taken by motion-activated game camera
2014-March Carter Co	46 Photo of mountain lion taken by motion-activated game camera
2013-November Madison Co	45 Photo of mountain lion taken by motion-activated game camera
2013-October Reynolds Co	44 Photo of mountain lion taken by motion-activated game camera
2013-October Shannon Co	43 Photo of mountain lion taken by motion-activated game camera

2013 - September Carter Co	42 Photo of mountain lion taken by motion-activated game camera
2013 – August Pulaski Co	41 Photo of mountain lion taken by motion-activated game camera
2013 - February Carter Co	40 Photo of mountain lion taken by motion-activated game camera
2013 - January Warren Co	39 Photo of mountain lion taken by motion-activated game camera
2012 – December Warren Co	38 Photo of mountain lion taken by motion-activated game camera (photo taken during the same time period as the other Warren county confirmation. Likely the same animal.)
2012 - December Carter Co	37 Photo of mountain lion taken by motion-activated game camera
2012 - December DeKalb Co	36 Photo of mountain lion taken by motion-activated game camera
2012 - November Taney Co	35 Photo of mountain lion taken by motion-activated game camera
2012 - October Ripley Co	34 Photo of mountain lion taken by motion-activated game camera
2012 - October Shannon Co	33 Photo of mountain lion taken by motion-activated game camera
2012 - September Shannon Co	32 Photo of mountain lion taken by motion-activated game camera
2012 - September Grundy Co	31 Photo of mountain lion taken by motion-activated game camera (Photo taken in April, near to and soon after previous Grundy county confirmation, not submitted until September.)
2012 - September Shannon Co	30 Photo of mountain lion taken by motion-activated game camera
2012 - April Grundy Co	29 Photo of mountain lion taken by motion-activated game camera
2012 - February Reynolds Co	28 Photo of mountain lion taken by motion-activated game camera
2012 - January Reynolds Co	27 Citizen captured mountain lion in live trap. Mountain lion was tranquilized, measured, weighed and released.
2011 - September Gasconade Co	26 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.
2011 - September Carter Co	25 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.
2011 - September Reynolds Co	24 Photo of mountain lion taken by motion-activated game camera
2011 - September Wayne Co	23 MDC employee reported mountain lion tracks in roadway. MLRT investigation confirmed.
2011 - September Shannon Co	22 Photo of mountain lion taken by motion-activated game camera
2011 - September Texas Co	21 Sub adult male shot by landowner. No obvious signs of confinement.

2011 - September Shannon Co	20 Photo of mountain lion taken by motion-activated game camera
2011 - August Oregon Co	19 Photo of mountain lion hindquarters taken by motion-activated game camera
2011 - August Shannon Co	18 Photo of probably subadult disperser taken by motion-activated game camera
2011 - April Macon Co	17 Citizen reported mountain lion tracks in creek bed. MLRT investigation confirmed.
2011 – March Oregon Co	16 Citizen reported observing a cat jump a fence. DNA analysis of hairs collected at the scene confirmed species, ancestry analysis underway.
2011 – February Linn Co	15 Photo of probably subadult disperser taken by motion-activated game camera
2011 – January Macon Co	14 Subadult male shot by coyote hunters. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
2011 – January St Louis Co	13 Photo of probable subadult disperser taken by motion-activated game camera.
2010 – December Ray Co	12 Subadult male shot by raccoon hunter. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
2010 – November Platte Co	11 Photo of probable subadult disperser taken by landowner. DNA analysis of hairs collected at the scene could not confirm ancestry.
2006 – December Livingston Co	10 Photo of probable subadult disperser taken by motion-activated game camera.
2006 – November Shannon Co	9 Deer carcass characteristic of mountain lion kill with tracks found nearby.
2003 – August Callaway Co	8 Approximately 1½-year-old male road kill. No obvious signs of confinement. All four toes and pad of left forepaw missing but healed over (dewclaw present); cause of injury unknown, but did not appear to be trap-related. Stomach and intestines contained remains of squirrel, rabbit, and white-tailed deer. DNA analysis indicated North American heredity.
2002 – October Clay Co	7 Two-to-three-year-old male road kill. No obvious signs of confinement. Intestines contained deer and raccoon hairs, and also man-made fibers. DNA analysis indicated North American heredity.
2001 – December Pulaski Co	6 Photo of probable subadult disperser taken by motion-activated game camera.
2000 – December Lewis Co	5 Video by deer hunter in a tree stand.
1999 – January Texas Co	4 Animal treed by rabbit hunters' dogs. Tracks in snow, and two deer carcasses characteristic of mountain lion kills found nearby.
1997 – January Christian Co	3 Video by property owner (obtained through Dr. Lynn Robbins at Missouri State University in Springfield). Animal's behavior suggested possible former captive.
1996 – November Reynolds Co	2 Night-time video by Conservation Agent of cat on deer carcass.
1994 – December Carter Co	1 Small adult female treed and shot (through the eye with a .22) by two raccoon hunters near Peck Ranch Conservation Area. Carcass was never recovered, but obtained photo of animal on truck tailgate. Federal authorities fined each hunter $2,000. In November 1998 a deer hunter found the skinned pelt of a small adult female with head and feet attached by a remote Texas County road. Pelt showed signs of freezer burn, and X-ray of skull revealed bullet fragments. Although likely the same animal, it cannot be confirmed.

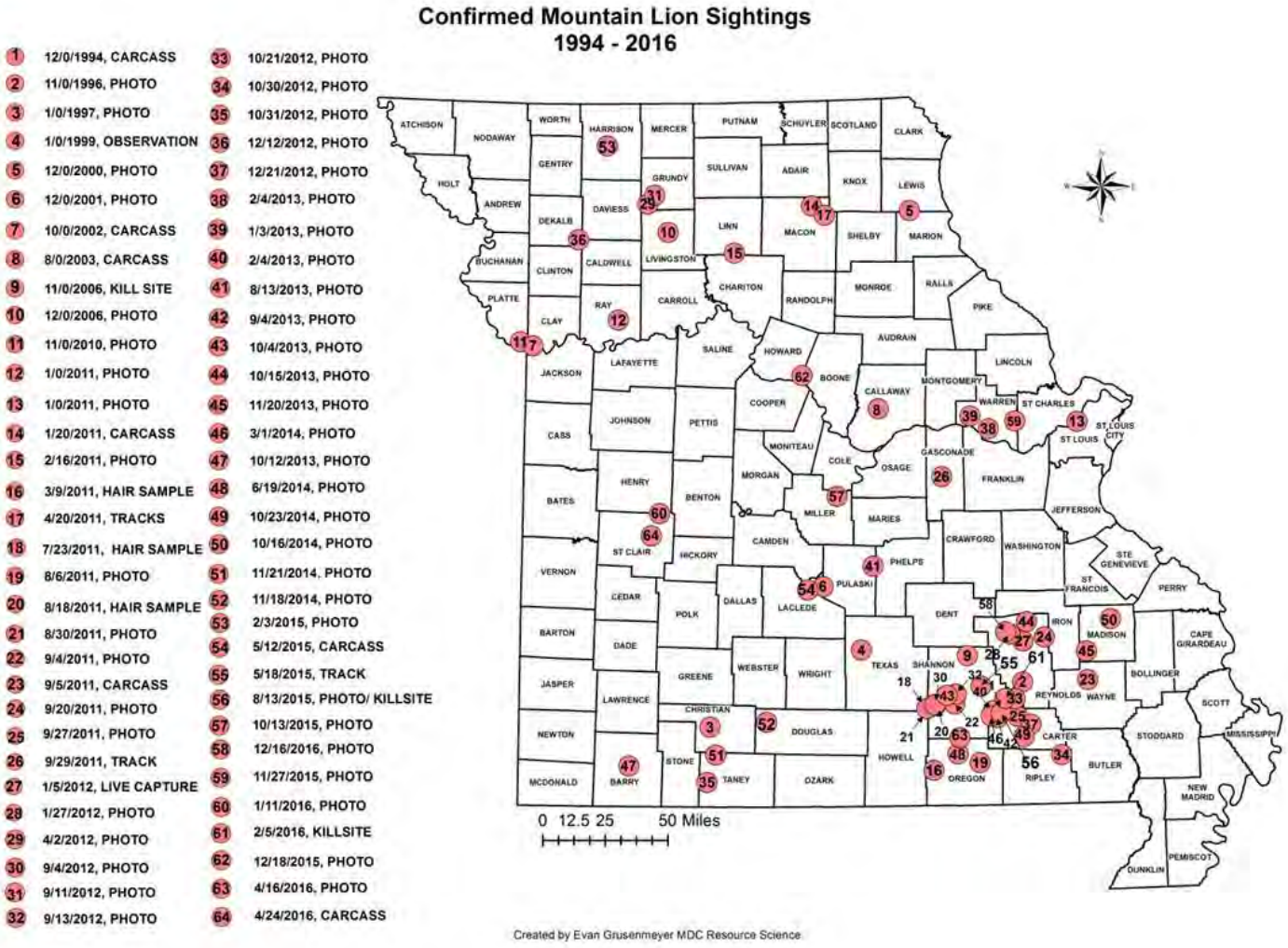

Figure 42. Confirmed locations and information for mountain lions in Missouri from 1994-2016.

DETERMINING ORIGIN, SEX, GENOTYPE, AND MOVEMENTS OF MOUNTAIN LIONS IN MISSOURI

There is mounting evidence that mountain lion populations are in the process of reclaiming former habitats in the Midwest. Given the numerous lion confirmations in Missouri, especially the southeastern Ozarks, there seems to be an attraction to this area and some lions appear to be establishing home ranges. In order to continue to learn about and monitor these animals we are using scat detection dogs to collect genetic materials in areas around confirmed sightings and will opportunistically capture and radio-mark lions with satellite equipped transmitters. Our investigations will reveal the sex, genotype, and origin of individual lions and reveal whether lions have established home ranges in the state. The information gained from this study will give us a clearer picture of what is happening with lions in Missouri. We currently do not know if we have detected one lion multiple times or ten different lions only once in any given time period. Identifying the sex of individual lions is important because finding a female suggests a strong chance for reproduction. Radio-marked animals will allow us to examine movement patterns and, over time habitat use, prey selection, and home range size or dispersal movements. We believe this information will give us a better understanding of the biology and ecology of lions in Missouri. When we are able to document female lions and/or reproduction lions will no longer be considered extirpated and we will draft a management plan for lions in a similar process as was conducted for black bears.

Our approach is to search areas around verified lion incidents with the aid of scat detection dogs trained for finding only lion scat. Dogs and their handler search areas around confirmed sightings. Collected scats are preserved and shipped to the USDA Wildlife Ecology Research Unit of the Rocky Mountain Research Station. Collected DNA is amplified and species, sex, and genotype are identified (Table 11). To infer the source of these lions, genotypes will be compared with those in the laboratory's database. We will compare lion genetic samples collected in Missouri and those from surrounding states to quantify a minimum number of individual lions.

Capture and radio marking lions: We will opportunistically attempt to capture lions with walk-in cage traps, covered with vegetation to offer security and thermal cover; traps checked at 24 hour intervals. Captures sites will be around kill sites and potentially near locations for which we have confirmed a sighting. In some cases lions may be treed or bayed with trained dogs during November-March when conditions are suitable for tracking and trailing lions. For animals bayed in trees we will secure a 2.5 m radius nylon landing net to the base of the tree with the perimeter tied to adjacent trees and positioned >1m above ground to prevent injury to the animal if it falls. We will climb the tree and attach a rope to the animal's foot and lower sedated animals to the ground. Captured lions will be immobilized with concentrations of 200 mg/mL of ketamine hydrochloride and 20 mg/mL of xylazine hydrochloride at doses of 12 mg/kg of estimated body weight (Ross and Jalkotzy 1992, Logan et al. 1996, Spreadbury et al. 1996). Immobilization drugs will be administered from 3.0-cc darts fired from a CO_2 powered dart gun (Pneu dart, Knoxville, TN). We will monitor vital rates including temperature, pulse, and visual observation of respiration, pulse, and capillary refill of gums and will remain at the capture site to monitor animals until they are fully ambulatory following anesthesia.
Processing will consist of morphological measurements, marking animals with numbered identifiable ear-tags. We will collect tissue and blood samples to assess physical condition, test for disease, and analyze and catalogue DNA profiles. We will determine sex by examining visible genitalia and age from measurements of gum regression (Laundre et al. 2000). Lions will be assigned to age classes as kitten (0-12 months), juvenile (13-24 months), and adult (25+ months). All captured animals will be fitted with collars equipped with Global Positioning System (GPS) and VHF transmitters (VECTRONIC Aerospace, Carl-Scheele-Str. 12 D-12489, Berlin Germany), weighing <650 gm (< 5% of body weight). Collars will be fitted with cotton spacers designed to break-away from the animal after approximately one year (Hellgren et al. 1988). Collars are programmed to collect GPS coordinates at 4-hour intervals and location data will be sent from satellites via email.

Table 11. DNA results of scat samples collected in Missouri from 2014-2016.

Sample ID	Type	Location	Date Collected	DNA Result	Sex	Individual	Recapture?
MDC-1	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-2	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-3	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-4	Scat	Peck Ranch Conservation Area	3/25/2014	bobcat			
MDC-5	Scat	Peck Ranch Conservation Area	3/25/2014	Cougar	Male	MO-MDC-5	no
MDC-6	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-7	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-8	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-9	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-10	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-11	Scat	Peck Ranch Conservation Area	3/25/2014	coyote			
MDC-854-1	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-854-2	Scat	Peck Ranch Conservation Area	3/25/2014	poor DNA			
MDC-12	Scat	Private Property Near Doniphan	12/2/2014	coyote			
MDC-13	Scat	Private Property Near Doniphan	12/2/2014	coyote			
MDC-14	Scat	Private Property Near Doniphan	12/2/2014	Poor DNA			
MDC-15	Scat	Private Property Near Doniphan	12/2/2014	coyote			
MDC-16	Scat	Private Property Near Doniphan	12/2/2014	coyote			
MDC-15S1	Scat	Private Property Near Henley	10/13/2015	coyote			
MDC-15S2	Scat	Private Property Near Henley	10/13/2015	coyote			
MDC-15S3	Scat	Private Property Near Henley	10/13/2015	coyote			

BLACK BEAR DISTRIBUTION AND STATUS

Summary

The MDC completed a new management plan for black bears in Missouri in 2008. The plan was drafted and approved by a multi-agency group of resource professionals from the Missouri Department of Conservation, U.S. Forest Service, National Park Service and Missouri Department of Natural Resources during summer of 2008 and was signed and approved by MDC administration during fall of 2008.

Black bear goal/vision statement:
To encourage black bear population expansion within their natural range in Missouri, and to manage black bears consistent with the available habitat and within the limits of human tolerance.

Black bear program objectives:

- Increase knowledge about current black bear population status in Missouri.
- Increase knowledge of black bear ecology in Missouri, how they move, disperse and travel on a landscape level and identify source and sink populations.
- Develop black bear conservation and management strategies based on information gathered through research, monitoring and surveys.
- Educate Missouri's public, the media and other resource professionals in Missouri and the Midwest about black bears and Missouri's black bear management program.

The entire black bear management plan can be viewed on SharePoint at:
http://mdcsharepoint/sites/resourcescience/Documents/Terrestrial%20Fauna/Furbearers/Black%20Bear%20Management%20Plan%20November%2025%202008.pdf.

Black bear research – population estimation
American black bears (*Ursus americanus*) are an important wildlife resource in Missouri, yet little information is known about their population status. Black bears were believed to be extirpated from Missouri by the early 1900s due to overharvest and deforestation; however, they have been naturally recolonizing and increasing in abundance in southern areas of the state since the 1960s. Increased abundance has resulted in more interest in black bears as well as occasional nuisance complaints and safety concerns from the public. The Missouri Department of Conservation (MDC) is encouraging range expansion of black bears while managing the species consistent with available habitat and within limits of human tolerance. MDC's intent is to conduct research that will increase knowledge of black bear ecology critical for developing conservation and management strategies.

In a recently recovering population of black bears, such as in Missouri, establishing an accurate population estimate is critical for developing a reliable long-term conservation plan. Our current black bear population estimate is 350 bears in 16 counties in Missouri (Figure 43).

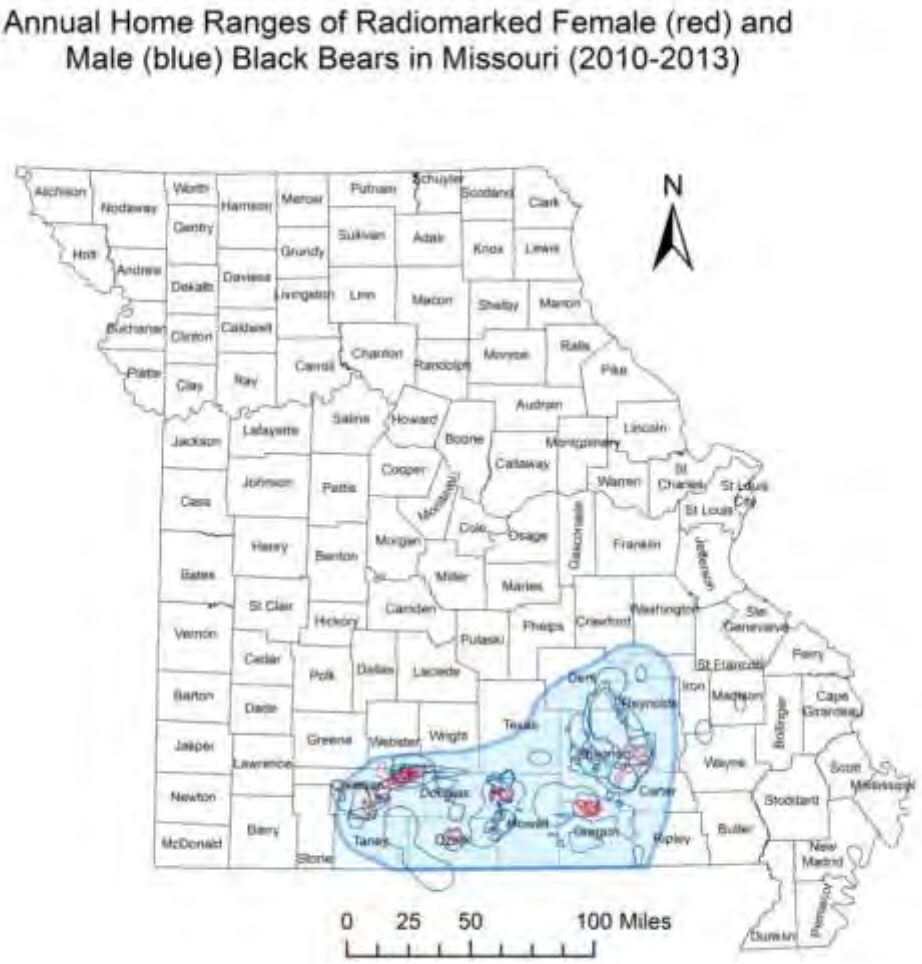

Figure 43. Current Missouri Black Bear range.

Cumulative capture results

Capture efforts to date include 138 individual bears including 80 males and 58 females (Figure 44). Ages at capture, determined from cementum annulations on upper premolars, ranged from 1 – 19 years (Figure 45). The age distribution of captured bears is not a reflection of overall ages. During capture sessions we target adult bears; especially adult female bears. Captured bears are weighed, measured, and fitted with GPS equipped collars (Figure 46).

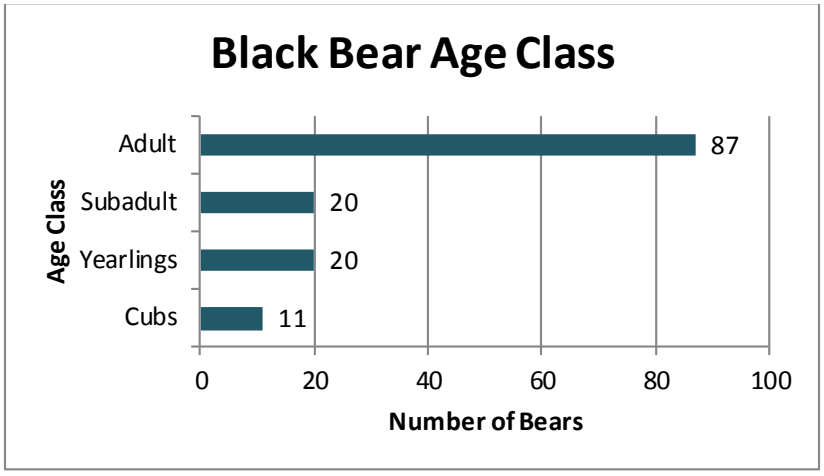

Figure 44. Black bear capture by age class

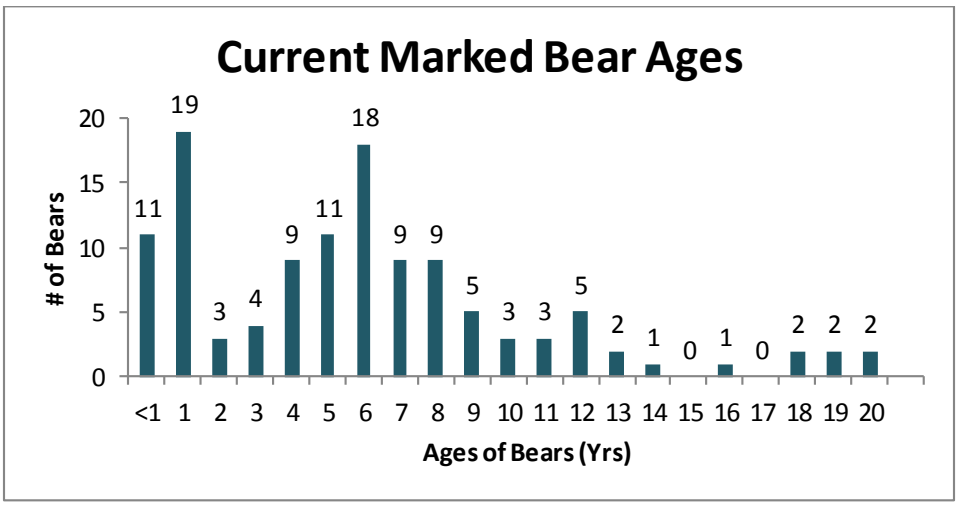

Figure 45. Current ages of black bears marked as part of the Missouri black bear research project

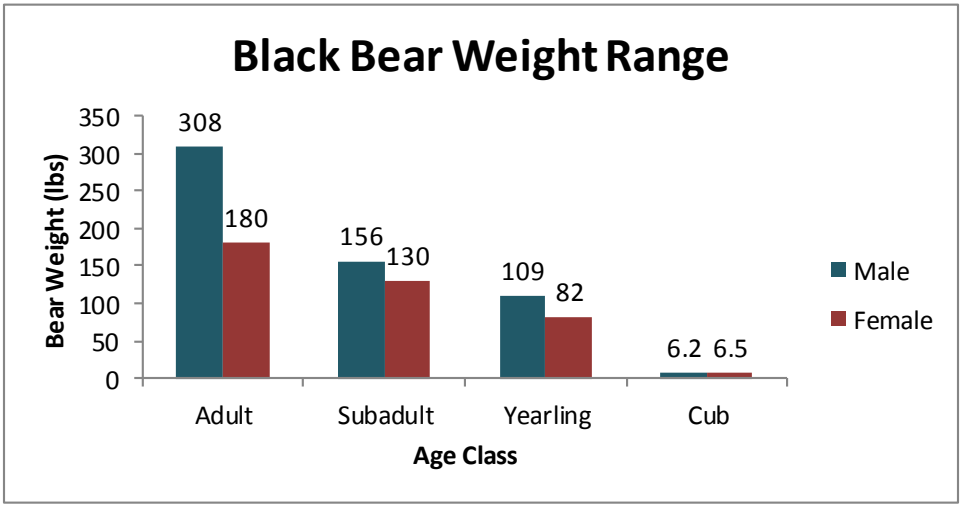

Figure 46. Weights of black bears captured as part of the Missouri black bear research project

Black bear range and reporting

Citizen reports of black bear sightings are important for delineating bear range expansion in the state. Reports of bears with cubs help to define the breeding range of bears in Missouri. Bear sightings are reported to local Conservation staff and through an electronic reporting system.

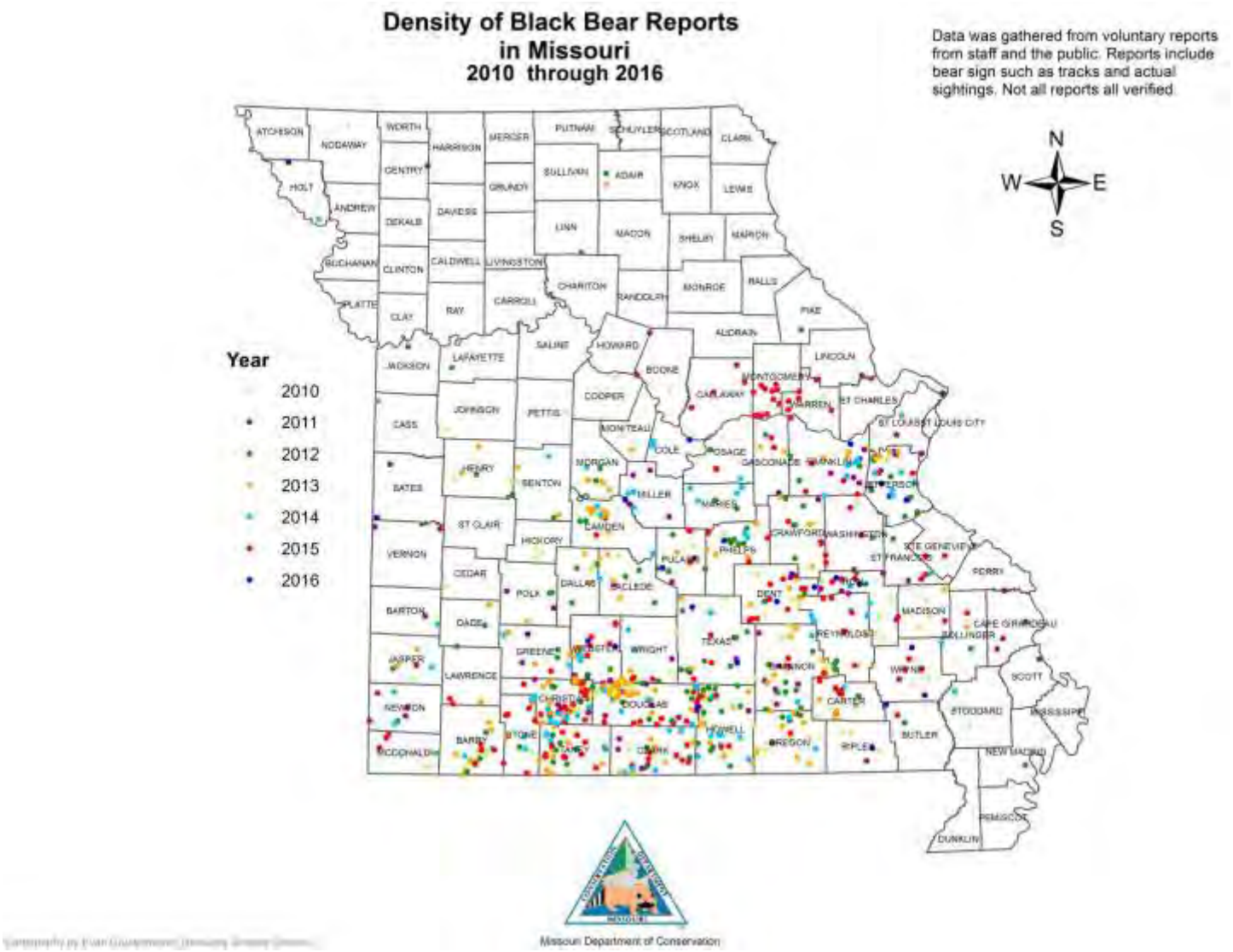

Figure 47. Bear sightings from 2010-2016.

Black bear research – survival and recruitment

Our initial population research suggested a 2012 statewide estimated population of just under 300 bears. In order to model statewide bear numbers and estimate population trajectory we began a project to measure reproductive and survival rates of female bears in Missouri. Our goal is to capture and monitor at least 25 female bears annually for 7 years. This black bear population model will be used to predict growth and trajectory of our black bear population. Current plans are to initiate a limited harvest once bear numbers exceed 500 animals. Other research objectives include measuring black bear habitat use and movement patterns, identifying suitable but unoccupied habitat and to delineate travel corridors that link large tracts of suitable bear habitat in the state. A comprehensive project summary, data, and movements of marked individuals can be found at:
http://mdc4.mdc.mo.gov/applications/BearSleuth/Default.aspx

Since the initiation of the Missouri black bear research project in 2010, MDC has acquired locations for 38 female and 40 male black bears. These bears were fitted with GPS collars either as yearlings (1-2 yrs) or as adults (≥ 3 yrs). Bears retained their collar for various lengths of time which dictated the number of locations recorded for each bear (range). Deployed collars that were worn for longer lengths of time ultimately provided more location data than those that fell from animals prematurely. Figure 48 illustrates the preliminary findings of these bears and portrays their movements during their collared period. As indicated by the compiled data from 2010-2014, the area occupied by collared black bears differs significantly between males and females, males occupying nearly twice the range of females. These dissimilarities are also apparent between age classes. Young bears, often yearling males, demonstrate large dispersal events which can be observed through the wide distribution of points. Data collected from these dispersing individuals demonstrate inconsistent movements that are typically erratic and unpredictable in contrast to adult locations which often demonstrate predictable consistent movements within an established home range.
In addition to other biological measurements taken during black bear capture events, pelage color was often recorded. These details were known for 104 individual bears at initial capture. Figure 49 illustrates the distribution of those bears characterized as black, brown, or mixed (black & brown). The three classifications and their apparent distribution on the landscape provide support for current assumptions of relatedness between Missouri black bears. Between 2010 and 2012 collaring efforts determined the persistence of separate populations of female black bears within southern Missouri. Current findings determined that bears trended towards black pelage color in the southwestern portion of their distribution while bears trended towards brown pelage color within the central part of their distribution. Bears distributed in southeast portions of Missouri had near equal proportions of black and brown pelage color among bears. These findings indicate a relationship between black pelage coloration and the suspected remnant population of bears in southwest Missouri. Curiously this suggests that black pelage color may have been a dominant trait within bears that originally persisted in the state. Bears that predominantly reside in areas concurrent to the expansion of reintroduced bears from Arkansas more readily possess brown pelage coloration. The equal proportions of black and brown pelage color that is seen within the southeast may demonstrate the migration of male bears into unoccupied parts of the state. Monitoring the trend of pelage color may allow for an additional gauge of population expansion as the pelage color trait transitions across the landscape. For now, the current evaluation of this physical attribute offers insight of an interesting relationship among Missouri bears and we expect to see a melding pelage colors as the population expands.

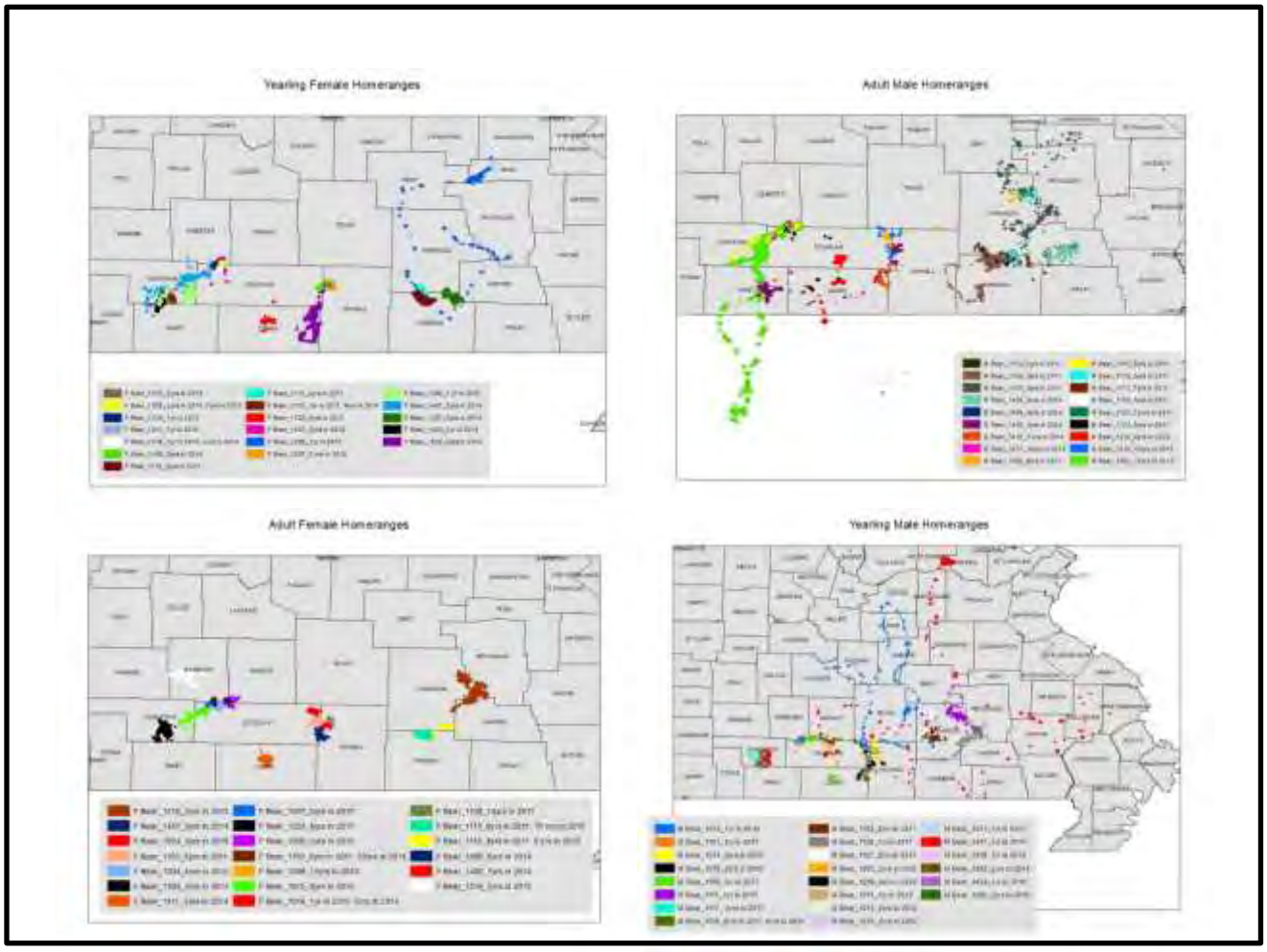

Figure 48. Home ranges of radio-marked black bears in Missouri.

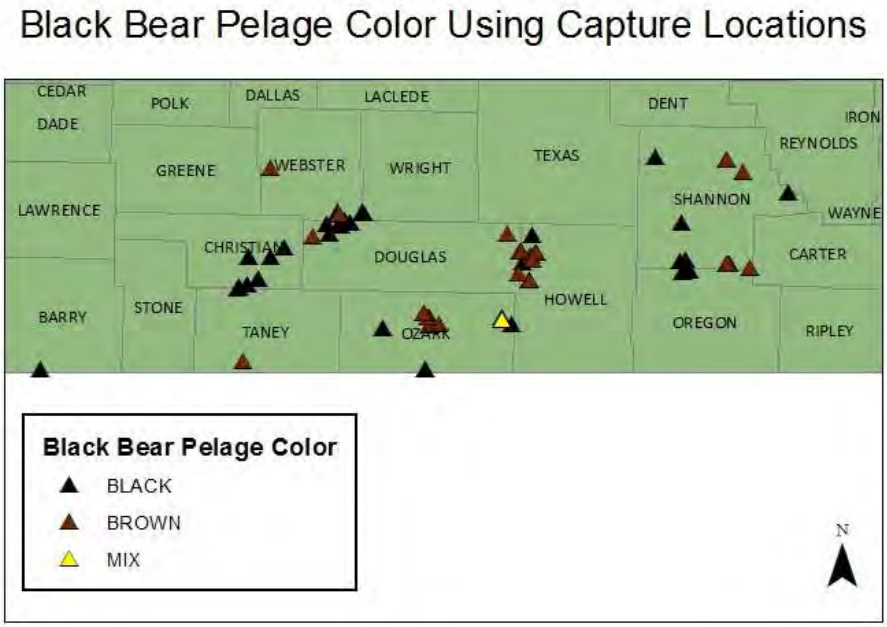

Figure 49. Pelage color for captured bears in Missouri.

Other activities

Tick loads: During 2015 we began to measure tick loads and species present on captured bears. Ticks are a probable stressor for bears and can carry a variety of diseases. Tick numbers on captured bears ranged from 15 to almost 1000. We identified 5 different tick species. Future efforts will examine seasonal changes, disease occurrence, and the relationship between habitat use by bears and tick occurrence.

Capture protocols:
Capturing bears during spring and summer requires efforts to ensure animals do not suffer from hyperthermia. We are currently using data loggers to measure ambient and inside-trap air temperatures for 3 different styles of bear traps. We will use this information to determine which trap styles are most appropriate under various weather conditions and help with trap check protocols. Our next step will be to measure inside-trap air temperatures with a simulated bear capture – using a mechanical device that gives off heat at a rate and level similar to an adult bear. Our preliminary information suggests that the new "box style" trailer traps are most appropriate for summer time bear captures.

Donuts and other sweet baits are effective for black bear captures but exposure to these human foods could condition bears to human foods and cause tooth decay. We have developed to methods to limit bears' exposure to these baits. First, we created bait holders from PVC pipes that are used inside traps to hold sweet baits but limit bears from actually eating the bait. Missouri pecans were used as a natural bait this past year and results suggest this may be a viable natural food bait for black bears in the state.

State Furbearer Records

We often receive calls from trappers, telling us about their latest, exceptionally large catch, wondering if it could be a new state record or asking what the state record is. In 2011, we began keeping information on record weight furbearers. Candidate furbearers must be brought to one of the statewide fur auctions or to the Central regional office in Columbia for weighing on a certified scale.

Current Record Furbearers

Species	Sex	Date Taken	County Taken	Weight (lbs.)	Hunter/Trapper
Badger	M	12/17/14	Perry	28.9	Corey Robinson
Beaver	M	12/17/14	Marion	73	Jeff Dornberger and Blaine Pope
Bobcat	F	1/18/2014	Macon	36.0	Shane Viers
Coyote	M	12/2/2015	Vernon	48	Tyler Shouse
Gray Fox	M	1/2/2016	Marion	12.7	Lance Hudson & Bobby Gruenloh
Mink	M	1/19/2013	Ralls	5.2	Jeff Thompson
Muskrat	M	1/29/2013	Boone	3.6	Chuck Regnireb
Nutria	M	2/2/2014	Pemiscot	15.8	Charlie Brown
Opossum	M	12/25/2015	Adair	14.8	Randy Eiler Jr. and Gauge Craig
Raccoon	M	12/4/2015	Gentry	28.5	Dennis Nelson
Red Fox	M	12/18/2015	St. Francois	13	Justin Skiles
River Otter	M	Unknown	Osage	31.2	Jacob Rehagen
Striped Skunk	UNK	12/4/2015	Marion	7	Blaine & Teagan Pope

Table 12. The current Furbearer Record holders.

MULTI-STATE GRAY FOX GENETICS

Population genetics of gray fox (*Urocyon cinereoargenteus*) in the Midwest, USA

Background: The gray fox is widespread and relatively abundant across much of North America and into central and northern South America. Morphological differences across its range have been recognized by dividing the species into 16 subspecies, 4 of which occur in the eastern U.S. (Figure 48). It is legally harvested in most states. Despite the ecological and economic importance of gray fox, surprisingly little research has been done on this species, including genetic analyses. Identifying the locations of genetic boundaries, if they exist, in gray fox is relevant for the conservation and management of this species. In particular, a recent petition to list the prairie gray fox under the Endangered Species Act has stimulated the USFWS to initiate a status review to determine if listing is warranted (Department of the Interior 2012). However, it is uncertain whether the prairie gray fox is actually a genetically distinct segment of the contiguous gray fox range.

Figure 48. Map of gray fox subspecies ranges.

Issues:

- It is unclear whether the current subspecies delineations reflect the actual structure of gray fox populations
- Recent study across 15 states found little genetic differentiation between the two southeastern subspecies (*U. c. cinereoargenteus* and *U. c. floridanus*).
- No genetic data from gray fox in range of *U. c. ocythus*

Questions:

- Is the "prairie gray fox" (*U. c. ocythus*) genetically unique relative to surrounding populations?
- If so, what is its range? Does it match the current subspecies map?

Research Goals:

- Sample gray fox across the United States to cover a broad range of habitats and subspecific designations
- Sequence the same 411 bp segment of the mtDNA control region to compare results with the eastern samples analyzed in Bozarth *et al*. (2011)
- Develop nuclear genetic markers

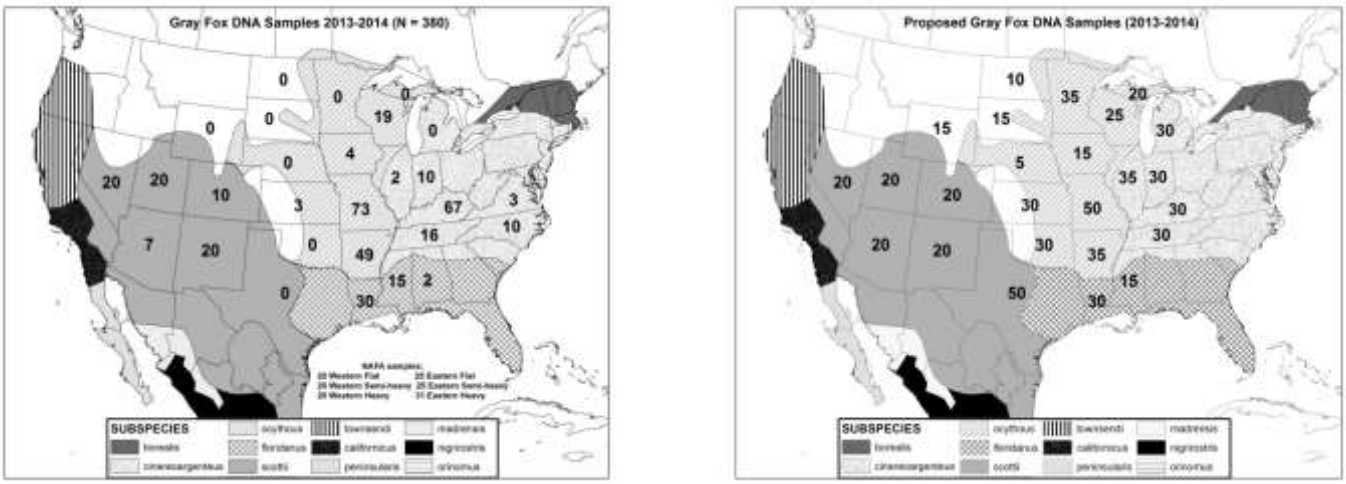

Figure 49. Collected and proposed gray fox samples to determine subspecies via mtDNA sequences.

Preliminary results:

- Found 17 distinct mtDNA sequences ("haplotypes") among the 49 individuals (Figure 50):
  - 10 of these haplotypes are newly discovered
  - 7 were found in eastern gray fox.
- Haplotype network shows little geographic structure:
  - Northeastern US is recent and distinct
  - Midwestern haplotypes are often the same as, or genetically close to, those found in the eastern U.S.
  - MO – AR – OK haplotypes can be separated but are not exceedingly different from Eastern
  - Some haplotypes are shared between multiple sites
  - There is more unique genetic variation in Midwestern samples as compared to Eastern samples

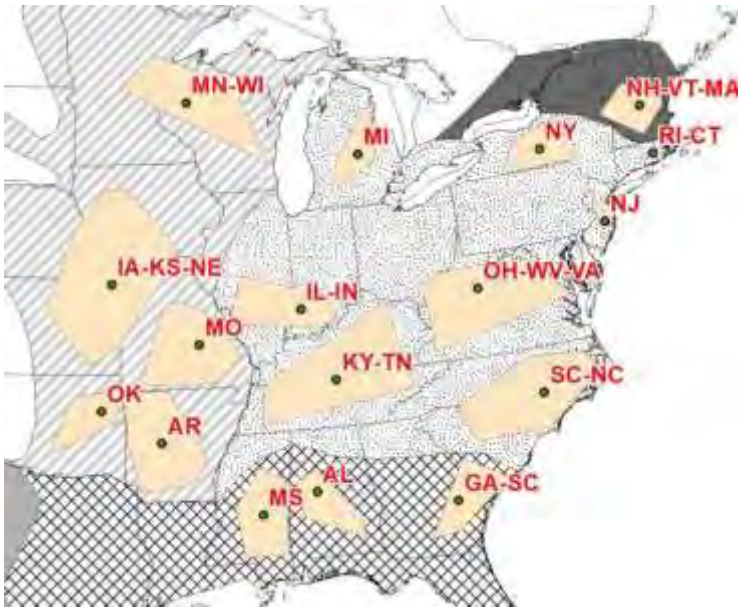

Figure 50. Genetic divergence in gray fox samples from Eastern states.