

STATUS OF MINNESOTA BLACK BEARS, 2017

Final Report to Bear Committee

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*All data contained herein are subject to revision,
due to updated information, improved analysis
techniques, and/or regrouping of data for analysis.*

Key points

Table 1 & Fig. 1	<p><i>Overview: Permits, licenses, harvest, and success rates</i></p> <p>Permit applications for bear licenses exceeded 20,000 for the first time since 2002. However, 2,800 applicants, a record high number, applied for area 99, meaning that they only sought to raise their preference level for the permit system. Permit availability was 13% lower than 2016. The low permit availability has driven up sales of no-quota licenses, which were the highest on record in 2016 and nearly the same in 2017. Harvest was reduced 23% from 2016 because of the reduction in quota zone hunters and a slightly lower success rate of quota zone hunters (yet still the second-highest all-time success rate in the quota zone). Hunting success is inversely related to the number of hunters.</p>
Tables 2,3 & Fig. 2	<p><i>Quota zone permits and licenses</i></p> <p>In 2016, Bear Management Unit (BMU) 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). The number of quota zone permits available in 2017 was reduced by 10–30% for all BMUs, except 22 and 41 (which remained the same). This was the 7th year of a system whereby licenses for the quota zone that were not purchased by permittees selected in the lottery could be purchased later as surplus. All surplus licenses (~400) were purchased.</p>
Fig. 3	<p><i>Quota zone applicants</i></p> <p>Statewide, quota zone applications increased by 21% over the past 10 years, but much of that increase was for area 99 (preference level application). Among applications for specific BMUs, only BMU 45 showed a significant, steady increase, nearly tripling from 2008 to 2017. Applications for some BMUs showed a decline.</p>
Table 4	<p><i>Quota zone lottery</i></p> <p>The low quota zone permit availability over the past 5 years has made it more difficult to succeed in the lottery. In 2012, before the large drop in permits (Table 2), all 3rd-year applicants (preference level 3) were drawn, and ~50% or more of 2nd-year applicants were drawn in all but two BMUs (44, 45). By 2017, with the exception of BMU 22 (wilderness area hunt), preference level 2 applicants were drawn only in two BMUs (13, 25; <20% drawn in both), and in four BMUs (28, 46, 47, 45), only some hunters with preference 4 were drawn (i.e., preference 5 was required to guarantee being drawn).</p>

Table 5	<p><i>Harvest by BMU</i></p> <p>In 2017, most BMUs had lower harvests than in 2016, although many were near the previous 5-year mean. The total quota zone harvest (1,547) and no-quota harvest (493) were both close to the respective 5-year means. The sex ratio of the harvest was more male-biased than normal (63%), although typical of the past 4 years (Table 1). Two BMUs had record-high percent males (69–70%). The highly skewed sex ratio may be indicative of increased hunter selection (with a lower hunter density due to reduced quotas) as well as sex-related differences in attraction to baits (given that the no-quota area had an even larger skew toward males: 68%). The only notable harvests were in BMU 10 (Fig. 2) at the south-western fringe of the bear range (record high 18 bears), and the first-known bear legally harvested in southeastern Minnesota.</p>
Fig. 4	<p><i>Harvest by quota vs no-quota zones</i></p> <p>Permit availability continuously declined during the decade 2003–2013 (Table 1), and with that, total harvests declined and the percent of the harvest in the no-quota zone increased. The percent harvest in the no-quota zone has leveled off in recent years (~26%), with stabilization of the number of quota-zone permits available. However, the percent of bear hunters purchasing a no-quota license reached a new high of 50% in 2017.</p>
Table 6	<p><i>Hunting success by BMU</i></p> <p>Hunters in the quota zone had a record high (50%) success in 2016; this was true for most BMUs. Success rates were slightly lower, but still second-highest throughout the quota zone in 2017. BMU 45 had a record high success, and BMU 28 (split from BMU 26 in 2016) had the highest success of any BMU in any year (70%). Success rate was more normal in the no-quota zone — only one-third that of the quota zone in 2017. The distribution of hunters in the no-quota zone is gleaned from where they said they would hunt when they purchased their license: notably, a growing number (137 in 2017) indicated that they planned to hunt in the quota zone.</p>
Table 7	<p><i>Harvest by date</i></p> <p>During years of normal fall food abundance, about 70% of the harvest occurs during the 1st week of the bear season, and ~83% occurs by the end of the 2nd week. The distribution of the harvest by date followed this normal pattern in both 2016 and 2017, which was very unlike the delayed harvest pattern in 2015.</p>

<p>Table 8 & Fig. 5</p>	<p><i>Nuisance complaints and kills</i></p> <p>The total number of recorded bear complaints slowly increased over the past decade, reaching a peak in 2015 and 2016. Number of complaints declined in 2017, despite a higher number of DNR personnel recording complaints. A new recording system was instituted in 2017 whereby Wildlife Managers recorded all bear complaints online as they were received, instead of submitting reports at the end of each month (thus, unlike previous years, Managers who had no complaints were not counted in the number of personnel participating). Conservation Officers continued to use the monthly reporting system (and recorded zero when they had no complaints). Six Wildlife Managers and 2 Conservation Officers received 20 or more (up to 40) nuisance bear reports in 2017. The number of nuisance bears killed in 2017 was less than half that of 2015 and 2016. Conservation Officers recorded 4x the number of bears killed than Wildlife Managers. A new effort to target nuisance bears through an “area 88” quota hunting license resulted in only 1 bear being killed. No bears were killed by permittees.</p>
<p>Tables 9-11 & Fig 6</p>	<p><i>Food abundance</i></p> <p>The composite range-wide, all-season abundance of natural bear foods (fruits and nuts) in 2017 was similar to 2016; this was lower than 2013 and 2014 (both good food years) and above 2015 (a poor food year). Regionally in 2017, more summer foods were below than above the long-term (33-year) average. The statewide fall food index (productivity of dogwood+oak+hazel), which helps predict annual harvest after accounting for hunter effort (Fig. 7), was equivalent to 2013 and 2014, and considerably higher than 2015 and 2016. Dogwood and hazelnut production were low in the north-central and northeast, but high in east-central. Oak was above average in the northwest and north-central, and average elsewhere.</p>
<p>Fig. 7</p>	<p><i>Predictions of harvest from food abundance</i></p> <p>The 2017 statewide harvest was close to what was expected, based on regression of harvest as a function of hunter numbers and the fall food productivity index. This regression is particularly strong (and has accurately predicted previous harvests) when only the past 15 years are considered. However, for the quota zone, the actual harvest in 2017 was higher than predicted by this regression.</p>

Fig. 8	<p><i>Harvest sex ratios</i></p> <p>Sex ratios of harvested bears reflect both the sex ratio of the living population (which varies with harvest pressure) as well as the relative vulnerability of the sexes to hunters (which varies with natural food conditions and hunter selectivity). In general, harvest sex ratios favoring males provide more resilience to the population. Harvest sex ratios within BMUs varied considerably year-to-year over the past 2 decades. Only two BMUs have shown a generally increasing trend in percent males that has continued through 2017 (BMUs 25, 31; both record high in 2017); however, statewide there has been a clear shift toward more males in the harvest (the last 5 years all >60% males; see Fig. 10).</p>
Figs. 9–11	<p><i>Harvest ages</i></p> <p>Statewide, the median age of harvested females increased for the third year in a row (exceeding 3 years old for the first time since 2011). Accordingly, the proportion of the female harvest composed of 1–2 year-olds declined and 4–10 year-olds increased. The median age of harvested males (slightly over 2 years old) has been relatively stable, but creeping upward. On a BMU-basis, variability in median ages has been too extreme to discern a trend over the past 20 years (only BMU 11 shows a continuing declining trend).</p>
Figs. 12–13	<p><i>Submission of bear teeth for aging</i></p> <p>Ages of harvested bears are used as the principal means of monitoring population trends. Although hunters are required to submit a tooth from their harvested bear, historically >25% did not comply. Reminder notices were sent to non-compliant hunters each year since 2014, which spurred a higher initial compliance the following years (>80%). However, ~90% compliance was achieved only through a reminder mailing. Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters has been significantly less than for hunters who registered their bear in person and picked up a tooth envelope at that time. No-quota zone hunters have the poorest rate of tooth submission.</p>

<p>Fig. 14–15</p>	<p><i>Population trend</i></p> <p>Ages of harvested bears accumulated since 1980 were used to reconstruct minimum statewide population sizes through time (i.e., the size of the population that eventually died due to hunting) using a technique formulated by Downing. This was scaled upwards (to include bears that died of other causes), using 4 statewide tetracycline mark–recapture estimates as a guide. Whereas both the tetracycline-based and reconstructed populations showed a “humped” trajectory, with an increase during the 1990s, followed by a decline during the 2000s, the shapes of the 2 trajectories differed somewhat (the reconstructed population curves were less steep). Therefore, it was not possible to exactly match the curve from the reconstruction to all 4 tet-based estimates.</p> <p>Downing population reconstruction assumes equal harvest pressure through time: as harvest pressure is diminished, and fewer bears are killed (as has been the trend since 2003), ensuing population estimates will be biased low, so it is possible that the curve for the most recent years should be higher.</p> <p>Harvests were intentionally reduced in the quota zone when it was surmised (in the mid-2000s) that the population was declining. Since 2013, quotas were maintained at a low and fairly consistent level (Table 2), although harvests varied with food. Population reconstruction does not provide reliable estimates for the 2 most recent years, so the most recent estimate is pre-hunt 2015. This estimate shows an increase of about 10%, following the very low harvest of 2014. Both quota and no-quota zones increased by about the same percent. However, the unexpectedly high harvest of 2016 (in both quota and no-quota zones) is not yet reflected in the model estimates.</p>
<p>Fig. 16</p>	<p><i>Trends in harvest rates</i></p> <p>The sex ratio of harvested bears varies by age in accordance with the relative vulnerability of the sexes. Male bears are more vulnerable to harvest than females, so males always predominate among harvested 1-year-olds (67–75%). Males also predominate, but less strongly among 2 and 3-year-old harvested bears. However, older-aged harvested bears (≥ 7 years) are nearly always dominated by females, because, although old females continue to be less vulnerable, there are far more of them than old males in the living population. The age at which the line fitted to these proportions crosses the 50:50 sex ratio is approximately the inverse of the harvest rate. Segregating the data into time blocks showed harvest rates increasing from 1980–1999, then declining with reductions in hunter numbers (Fig. 1). Harvest rates since 2014 have been significantly less than what they were in the early 1980s, when the bear population was increasing (Fig. 14).</p>

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1997–2017.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Permit applications	27353	30245	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362 ^a	17571 ^a	18647 ^a	19184 ^a	18103 ^a	18107 ^a	18885 ^a	18422 ^a	19958 ^a	21034 ^a
Permits available	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050 ^b	6000	3750	3750	3700	3850	3350
Licenses purchased (total)	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177	6655
Quota zone ^c	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420	2954
Quota surplus/military ^c					235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441	401
No-quota zone ^c	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316 ^h	3300 ^h
% Licenses bought																					
Of permits available ^d	84.9	82.0	79.5	82.2	67.0	60.9	61.6	69.4	68.5	72.3	71.4	67.7	73.4	74.6	100	100	100	100	100	100	100
Of permits issued ^d		84.4	87.2	83.9	69.8	66.3	65.7	68.3	67.1	68.9	70.0	67.2	73.8	74.5	80.7	82.7	85.0	84.7	87.9	88.7	88.2
Estimated no. hunters ^e	10300	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9200	8600	6300	6300	6700	6900	6400
Harvest	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641	2040
Harvest sex ratio (%M) ^f	55	55	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66 ⁱ	61	63
Success rate (%)																					
Total harvest/hunters ^g	31	28	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30	39	32
Quota harvest/licenses	29	25	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39 ^j	50 ^j	46 ^j

^a Includes area 99, a designation to increase preference but not to obtain a license (2008 = 528, 2009 = 835; 2010 = 1194; 2011 = 1626; 2012 = 1907; 2013 = 2129; 2014=2377; 2015=2455; 2016=2641; 2017=2803 (record high); additionally, in 2017, area 88 nuisance-only bear license applications counted in this total [n=3]).

^b Permits reduced because of a new procedure in 2011 that ensures that all available licenses are purchased (see Table 2).

^c Quota zone established in 1982. No-quota zone established in 1987. Surplus licenses from undersubscribed quota areas sold beginning in 2000; originally open only to unsuccessful permit applicants, but beginning in 2003, open to all. In 2011, surplus licenses offered for all lottery licenses not purchased by August 1. Free licenses for 10 and 11 year-olds were available beginning 2009.

^d Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued. Beginning in 2008, some permits were issued for area 99; these are no-hunt permits, just to increase preference, and are not included in this calculation. In 2011–17, all unpurchased licenses were put up for sale and were bought.

^e Number of licensed hunters x percent of license-holders hunting. Percent hunting is based on data from bear hunter surveys conducted during 1981–91, 1998 (86.8%), 2001(93.9%) and 2009 (95.3%). Beginning in 2011 all unpurchased quota licenses were sold as “surplus” in August, and this process is quick and competitive; thus, for 2011–17 all Surplus and Military license-holders were considered to have hunted.

^f Sex ratio as reported by hunters; hunters classify about 10% of female bears as males, so the actual harvest has a lower %M than shown here. In good food years, the harvest is more male-biased.

^g Success rates in 2001–2012 were calculated as number of successful hunters/total hunters, rather than bears killed/total hunters, because no-quota hunters could take 2 bears. After 2012, hunters could take 2 bears only if they bought 2 licenses (1 quota + 1 no-quota). In both 2016 and 2017, 5 hunters legally killed 2 bears.

^h Record high number of no-quota zone licenses purchased in 2016; record high % of licenses in no-quota zone in 2017 (nearly 50%; see Fig. 4).

ⁱ Record high % males in statewide harvest.

^j 2015: highest success rate in quota zone since very poor food year of 1995; 2016: record high success rate; 2017: second-highest success rate.

Fig. 1. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2017 (no-quota zone first partitioned out in 1987). Number of licenses explains 48% of variation in hunting success during this period. Large variation in hunting success is also attributable to food conditions.

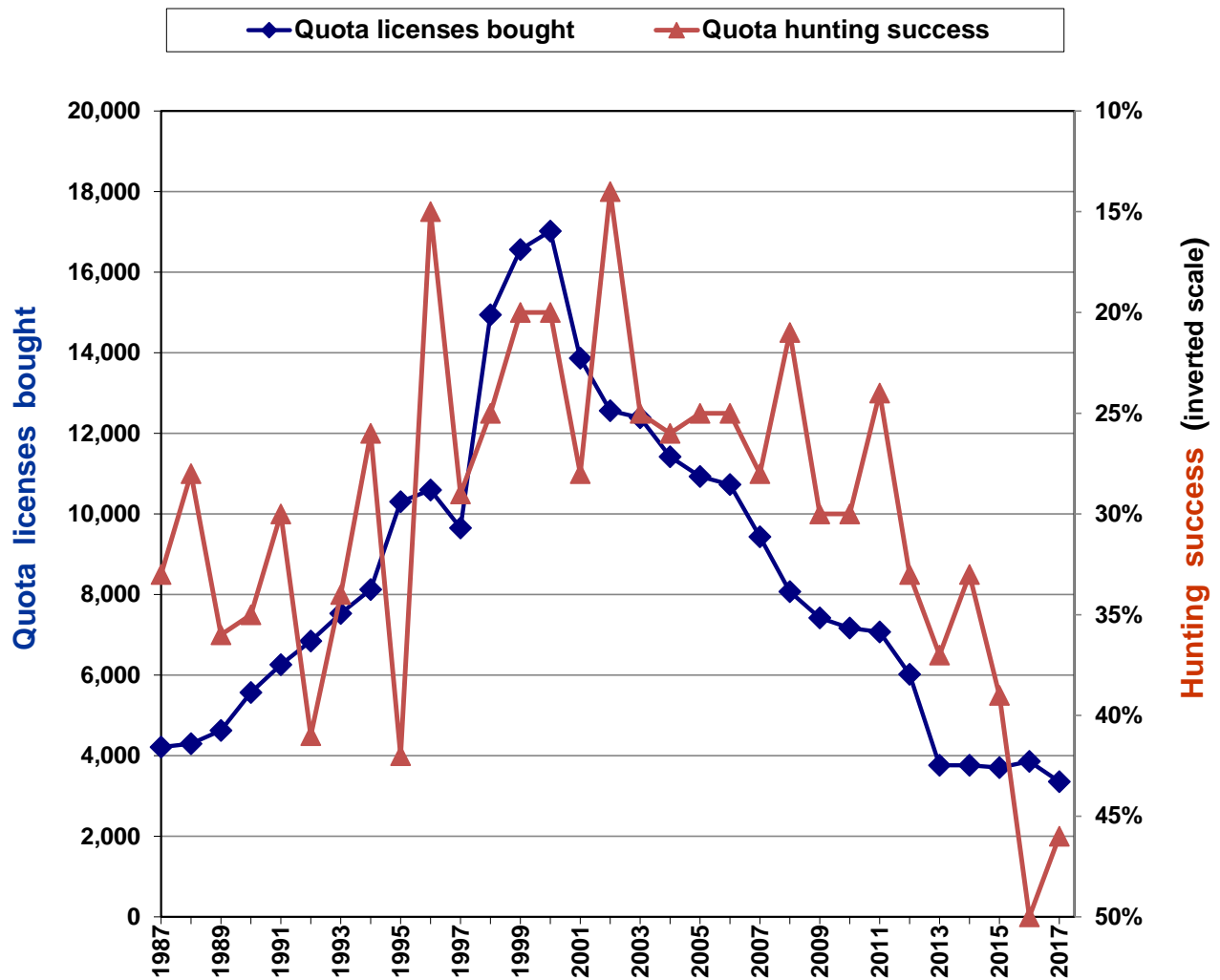


Fig. 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation). No-quota hunters can hunt anywhere within the gray-colored zone, including the southeast corner of Minnesota (not shown; designated area 60).

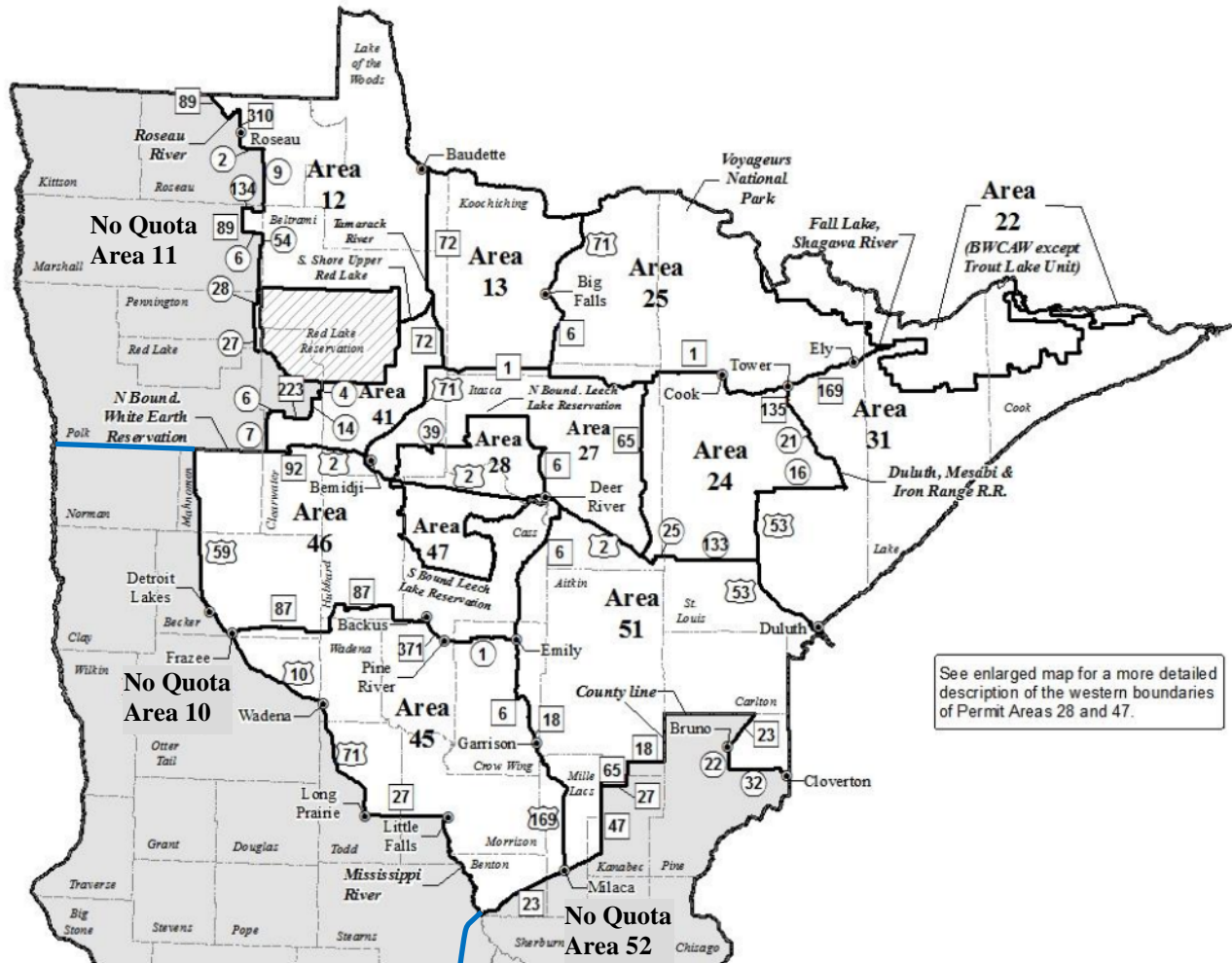


Table 2. Number of bear hunting quota area permits available, 2012–2017. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

BMU	2012	2013	2014	2015	2016		2017
					Before BMU split ^a	After BMU split	
12	300	200	200	150	150	150	125
13	400	250	250	250	250	250	225
22	100	50	50	50	50	50	50
24	300	200	200	200	200	200	175
25	850	500	500	500	500	500	400
26	550	350	350	350	325		
27						250	225
28						75	60
31	900	550	550	550	550	550	500
41	250	150	150	150	125	125	125
44	700	450	450	450	450		
46						400	350
47						50	40
45	200	150	150	150	250	250	175
51	1450	900	900	900	1000	1000	900
Total	1650	3750	3750	3700	3850	3850	1465

^a In 2016, the Leech Lake Reservation was split from BMUs 26 and 44 to form BMUs 28 (north) and 47 (south), with the remaining area of BMU 26 renamed BMU 28 and remaining area of BMU 44 renamed BMU 46. The column shows permit allocation before the split in order to compare with previous years.

Table 3. Number of quota BMU permit applicants (Apps), licenses bought (after permits drawn) and surplus licenses bought, 2012–2017^a. Shaded values indicate undersubscribed (applications less than permits available).

BMU	2012			2013			2014			2015			2016			2017		
	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought	Apps	Bought license	Surplus bought
12	813	244	60	707	160	44	661	164	36	612	130	20	624	133	17	774	113	12
13	719	325	76	664	213	37	703	218	32	692	210	40	716	221	29	772	200	25
22	83	56	43	55	36	14	65	33	17	48	36	9 ^b	52	37	13	47	34	16
24	888	253	47	763	170	30	875	174	26	771	171	29	884	173	27	945	158	17
25	1625	713	137	1575	432	69	1533	424	76	1396	433	67	1443	440	60	1651	354	46
26	1666	458	92	1695	303	47	1696	298	52	1650	309	42						
27													1224	219	31	1297	197	28
28													325	72	3	330	52	8
31	2406	758	146	2261	478	72	2257	468	82	2021	488	62	2180	489	62	2076	441	59
41	592	208	42	575	135	15	561	129	21	570	129	21	618	114	11	614	109	16
44	2619	612	88	2682	386	65	2751	393	57	2626	402	48						
46													2690	370	30	2774	319	31
47													194	45	5	214	33	7
45	1135	170	30	1205	141	9	1403	127	23	1703	139	11	2046	227	23	2323	161	14
51	3650	1154	296	3796	734	166	4003	748	152	3878	810	90	4321	880	121	4411	783	117
Total ^c	4785	1324	326	15978	3188	568	5406	875	175	5581	949	101	17317	3420	432	9722	1296	169

^a Beginning in 2011, all licenses not purchased by permittees were sold as “surplus”. In all cases but one (see footnote b), all of the surplus licenses were purchased. Surplus = Permits available (Table 2) minus Bought license (± 4 to account for groups applying together).

^b Even after purchase of surplus licenses, this BMU remained undersubscribed.

^c Beginning in 2008, applicants could apply for area 99 in order to increase future preference, but not buy a license; these are not included in the total number of applications (unlike Table 1, where they are included).

Fig 3. Trends in number of applicants for quota zone permits by BMU over past 10 years, 2008–2017. For 2016 and 2017, BMUs 27 and 28 were grouped into old BMU 26 and BMUs 46 and 47 were grouped into old BMU 44. BMU 45 is highlighted because applications there nearly tripled over this time period.

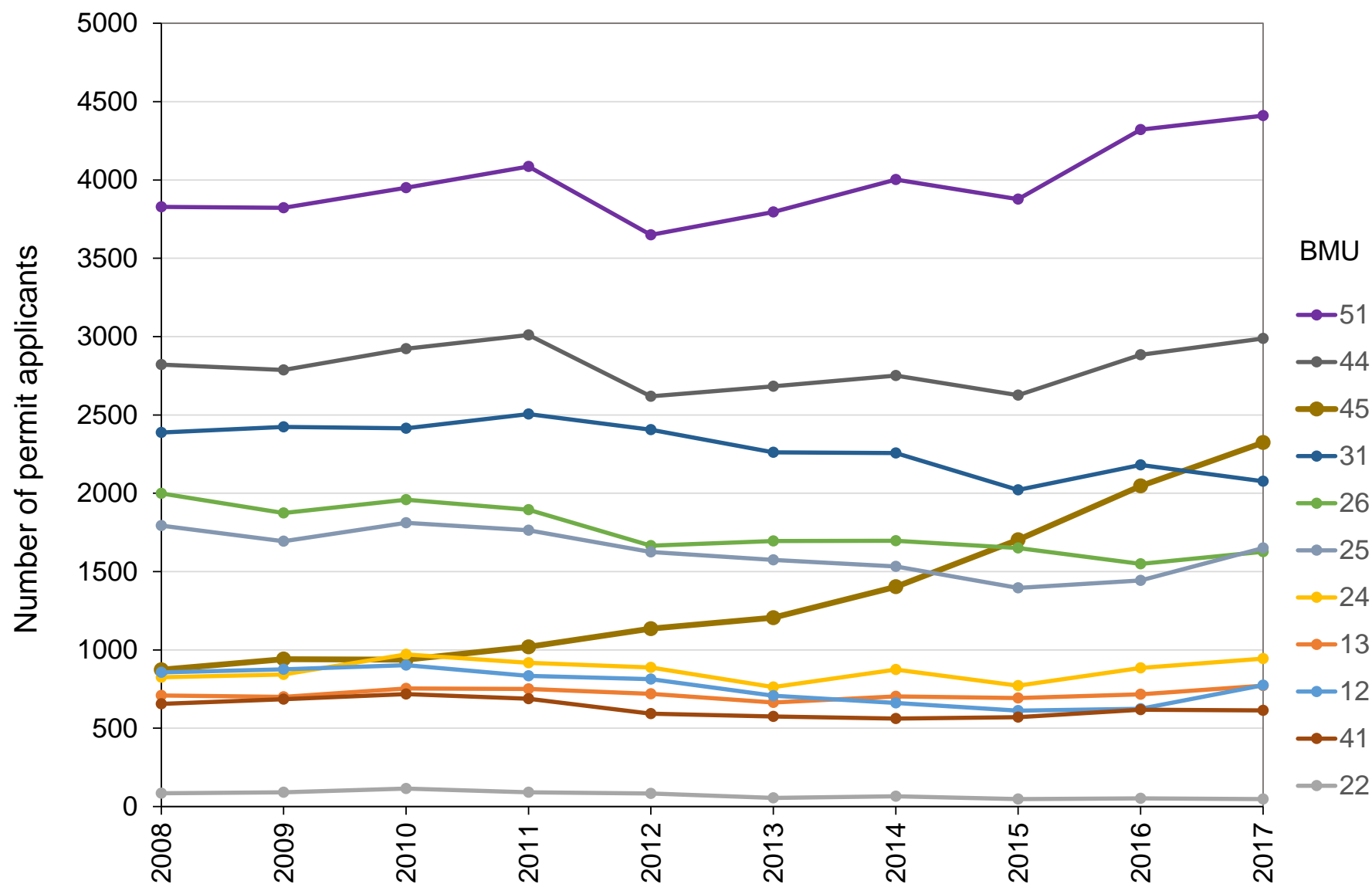


Table 4. Percent of quota BMU lottery applicants with preference levels 1 (1st-year applicants), 2, 3, and 4 who were drawn for a bear permit during 2012–2017. Blank spaces indicate 100% of applicants were drawn. All preference level 2 applicants were drawn, except where 0 preference level 1 applicants were drawn. Likewise, all preference level 3 applicants were drawn, except where 0 preference level 2 applicants were drawn^a.

BMU	2012		2013			2014			2015				2016				2017			
	Pref 1	Pref 2	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4	Pref 1	Pref 2	Pref 3	Pref 4
12	0	80	0	49		0	40		0	17			0	0	98		0	0	57	
13	33		4			0	72		0	56			0	38			0	16		
22	100		89			72			100				98				100			
24	0	75	0	41		0	13		0	2			0	0	86		0	0	57	
25	28		0	81		0	57		0	44			0	42			0	6		
26 ^b	0	49	0	7		0	0	80	0	0	51									
27													0	0	30		0	0	2	
28													0	0	0	99	0	0	0	76
31	0	84	0	45		0	15		0	0	87		0	0	75		0	0	67	
41	0	86	0	43		0	19		0	0	99		0	0	77		0	0	56	
44 ^b	0	28	0	0	68	0	0	41	0	0	18									
46													0	0	0	85	0	0	0	51
47													0	0	10		0	0	0	49
45	0	29	0	0	75	0	0	30	0	0	0	81	0	0	0	63	0	0	0	16
51	1		0	53		0	22		0	0	89		0	0	72		0	0	54	

^a As an example, in 2017: BMU 12: 0% of preference level 1 and 2 applicants were drawn, 57% of preference level 3, and 100% of preference level 4 and above were drawn for a permit; BMU 22: all preference level 1 applicants were selected; BMU 45: no preference level 1–3 applicants were drawn, 16% of hunters with preference 4 were drawn, and 100% of hunters with preference level 5 and above were drawn.

^b BMU 26 was split into 27/28 and BMU 44 was split into 46/47 in 2016.

Table 5. Minnesota bear harvest tally for 2017 by Bear Management Unit (BMU)^a and sex^b compared to harvests during 2012–2016 and record high and low harvests (since establishment of each BMU).

BMU	2017				2016	2015	2014	2013	2012	5-year mean	Record low harvest (yr)	Record high harvest (yr)
	M	(%M)	F	Total								
Quota												
12	36	(67)	18	54	78	60	38 ^d	62	82	64	38 (14)	263 (01)
13	67	(67)	33	100	147	72 ^e	91	95	112	103	71 (88)	258 (95)
22	4	(50)	4	8	5	7	5	9	8	7	3 (03)	41 (89)
24	45	(56)	36	81	96	97	50 ^f	76	108	85	50 (14)	288 (95)
25	146	(69) ^p	66	212	287 ^p	227	168 ^g	197	254	227	149 (96)	584 (01)
26	[96]	[59]	[66]	[162]	[171] ^p	121	117 ^h	121	238	154	117 (14)	513 (95)
27	72	(60)	48	120	131							
28	24	(57)	18	42	40							
31	183	(70) ^p	79	262	312	307	221	197	363	280	157 (88)	697 (01)
41	34	(56)	27	61	57	35 ⁱ	36	40	70	48	35 (15)	201 (01)
44	[99]	[63]	[59]	[158]	[215]	158	170	181	188	182	130 (11)	643 (95)
46	91	(65)	50	141	190							
47	8	(47)	9	17	25							
45	47	(61)	30	77	102 ^m	55	54	48	67	65	32 (11)	178 (01)
51	191	(51)	181	372	463	302	291	349	471	375	247 (91)	895 (01)
Total	948	(61)	599	607	1933	357	345 ^j	397	1961	1590	1192 (88)	4288 (01)
No-Quota ^b												
11	127	(71)	52	179	291	195	77 ^k	136	224	185	38 (87)	351 (05)
10	14	(78)	4	18 ⁿ	15	11	8	9	14	11		15 (16)
52	195	(66)	100	295	402	324	301	346	405	356	105 (02)	405 (12)
60	1 ^c		0	1	0	0	0	0	0			
Total	337	(68)	156	296	708 ⁿ	530	386	491	643	552	198 (87)	708 (16)
State	1285	(63)	755	2040	2641	1971	1627 ^j	1866	2604	2142		4956 (95)

^a Some tooth envelopes were received from hunters who did not register their bear. These were added to the harvest tally:

2012:7; 2013:6; 2014:3; 2015:6; 2016:7; 2017:4.

Some hunters with no-quota licenses hunted in the quota zone, and their kills were assigned to the BMU where they apparently hunted:

2012:8; 2013:11; 2014:4; 2015:12; 2016:9; 2017:2

Some quota area hunters also apparently hunted in the wrong BMU, based on the block where they said they killed a bear, but these were recorded in the BMU where they were assigned (presuming most were misreported kill locations).

^b Sex recorded on tooth envelopes may differ from the registered sex. Sex shown on table is the registered sex.

^c BMU 60 designates SE Minnesota, which is within No-quota zone. This is the first hunter-harvested bear in this area.

Notable harvests:

^d Record low harvest since this area was established in 1987.

^e Lowest harvest since 1988.

^f Record low harvest since this area was established in 1989.

^g Lowest harvest since 1996.

^h Record low harvest since this area was established in 1991.

ⁱ Record low harvest since this area was established in 1990.

^j Lowest harvest since 1988 (quota—no-quota split in 1987).

^k Lowest harvest since 1999.

^m Highest harvest since 2007.

ⁿ Record high harvest.

^o Record high % males.

Fig. 4. Trends in statewide bear harvest and proportions of harvest and licenses in the no-quota zones, 1987–2017.

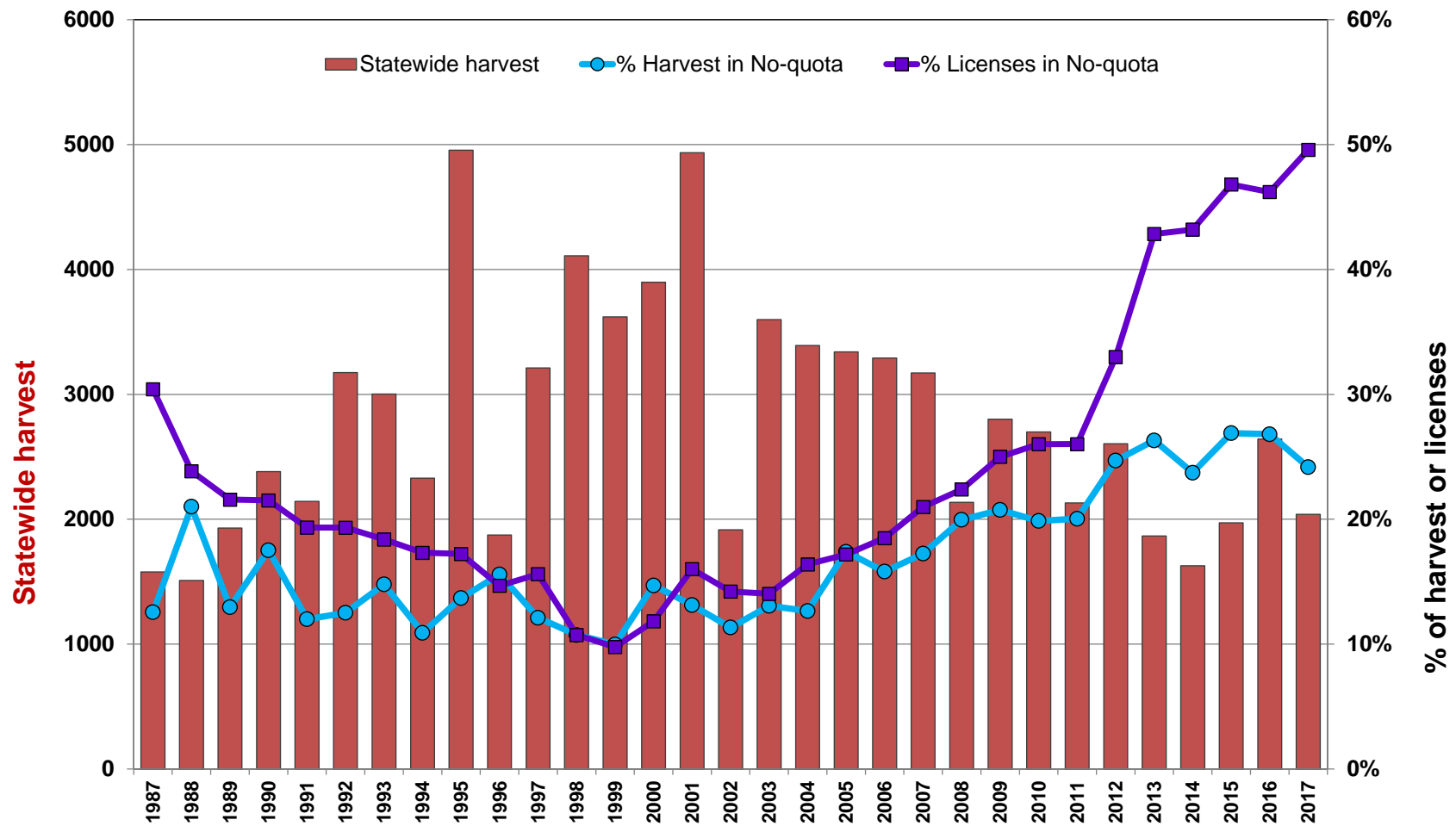


Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold^a, 2012–2017.

BMU	Max success (yr) prior to 2016		Mean success 2012–2016	2017	2016	2015	2014	2013	2012
12	49	(95)	34	43	52 ^b	40	19 ^e	30	27
13	59	(95)	38	44 ^c	59 ^b	29	36	38	28
22	21	(92)	12	16	10	13	10	18 ^c	8
24	45	(92)	39	46 ^c	48 ^b	48 ^b	25	38	36
25	47	(92)	41	53 ^c	57 ^b	45	34	39	30
26	59	(95)	39	57 ^c	52	34	33	34	43
27				53	52				
28				70 ^d	53				
31	55	(92)	46	52	56 ^b	56 ^b	40	36	40
141	50	(95)	29	49 ^c	46	23	24	26	28
44	43	(95)	37	41	48 ^b	35	38	40	27
46				40	47				
47				43	50				
45	36	(14,15)	35	44 ^b	40 ^c	36	36	32	33
51	39	(13)	36	41 ^c	46 ^b	33	32	39	32
Quota	42	(95)	38	46 ^c	50 ^b	39	33	37	33
11 ^f			18	17	28	20	9	15	
10 ^f			9	8	9	7	7	12	
52 ^f			17	14	19	15	16	19	
No Quota	32	(95)	18	15	21	16	13	17	20
Statewide	40	(95)	29	31	37 ^c	28	25	28	28

^a Registered harvest/licenses instead of harvest/hunters because BMU-year-specific estimates for the proportion of license-holders that hunted are unreliable. Statewide estimates of harvest/hunters are presented in Table 1.

^b Record high (or tied record high) success.

^c Second highest success.

^d Highest success ever for any BMU.

^e Tied record lowest success.

^f Since 2013, an attempt was made to differentiate the number of no-quota (NQ) hunters by BMU in order to estimate success rates. When no-quota hunters bought licenses, they recorded the deer block where they anticipated hunting. A significant number chose blocks in the quota zone; those who did not harvest a bear in the quota zone were divided up into NQ-BMUs in proportion to those who chose blocks in or adjacent to NQ-BMUs. A few chose BMU 60 (SE Minnesota); the first bear was harvested there in 2017. Table shows % indicating where they planned to hunt (number of hunters in parentheses for BMU 60 and Quota zone):

BMU	2017	2016	2015	2014	2013
11	29.8	30.3	29.3	28.5	30.0
10	6.6	4.9	4.4	4.1	2.6
52	59.2	61.2	63.9	64.7	62.6
60 (n)	0.1 (4)	0.4 (12)	0.2 (8)	0.6 (17)	0.4 (10)
Quota zone (n)	4.2 (137)	3.2 (105)	3.1 (101)	2.1 (60)	4.5 (127)

Table 7. Cumulative bear harvest (% of total harvest) by date, 1997–2017.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
1997	Mon		76	88	97
1998	Tue		76	87	96
1999	Wed		69	81	95
2000	Wed	57	72	82	96
2001	Wed	67	82	88	98
2002	Sun		57 ^a	69 ^a	90
2003	Mon		72	84	96
2004	Wed		68	82	95
2005	Thu		72	81	94
2006	Fri		69	83	96
2007	Sat		69	82	96
2008	Mon		58 ^a	71 ^a	92
2009	Tue		74	86	96
2010	Wed		69	84	96
2011	Thu		65	78	93
2012	Sat		68	83	96
2013	Sun		61	76	94
2014	Mon		60	75	92
2015	Tue		58 ^b	75	91
2016	Thu		68	83	95
2017	Fri		69	83	93

^a The low proportion of total harvest taken during the opening week (<60%) reflects a high abundance of natural foods.

^b The slow start the first week was likely due to especially warm weather.

Table 8. Number of nuisance bear complaints registered by Conservation Officers and Wildlife Managers during 1997–2017, including number of nuisance bears killed and translocated, and bears killed in vehicular collisions.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 ⁱ
Number of personnel participating in survey ^a	69	71	52	60	54	50	39	34	42	46	46	37	51	40	34	56	63	64	61	55	86 (51,35)
Complaints examined on site	661	226	189	105	122	75	81	75	61	57	63	59	65	70	37	113	69	79	97	118	71 (22,49)
Complaints handled by phone ^b	2196	743	987	618	660	550	424	507	451	426	380	452	535	514	396	722	623	570	840	780	644 (450,194)
Total complaints received	2857	969	1176	723	782	625	505	582	512	483	443	511	600	584	433	835	692	649	937	898	715
• % Handled by phone	77%	77%	84%	85%	84%	88%	84%	87%	88%	88%	86%	88%	89%	88%	91%	86%	90%	88%	90%	87%	90%
Bears killed by:																					
• Private party or DNR	93	31	25	25	22	12	13	25	28	11	21	22	23	22	9	16	24	26	45	53	22 (4, 18)
• Hunter before season ^c																					
– from nuisance survey	32	23	5	7	4	0	3	3	6	2	18	3	4	3	3	11	0	0	1	13	1
– from registration file	35	31	24	43	20	11	8	4	13	6	25	5	15	10	5	12	0	1	4	6	3
• Hunter during/after season ^d	4	3	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1
• Hunter by Area 88 license ^e																					1
• Permittee ^f	7	11	7	2	6	4	6	1	5	4	5	1	3	5	0	0	1	0	3	0	0

Table 8. (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Bears translocated	115	24	29	1	6	3	1	3	3	3	1	3	2	2	2	0	3	2	0	0	0
• % bears translocated ^g	17	11	15	1	5	4	1	4	5	5	2	5	3	3	5	0	4	3	0	0	0
Bears killed by cars ^h	52	61	60	39	43	26	25	16	22	18	20	27	18	28	15	33	32	28	47 ^h	27	9 ^h

^a Maximum number of people turning in a nuisance bear report each month. Monthly reports were required beginning in 1984, and included cases of zero complaints. In 2017, the recording system was changed, where it was no longer possible to differentiate Wildlife Managers who participated month by month. Instead, the number reflects the total number of people receiving and recording at least 1 complaint during that year. For consistency, the records from Conservation Officers were handled the same way.

^b If a complaint was handled by phone, it means a site visit was not made.

^c The discrepancy between the number recorded on the nuisance survey and the number registered before the opening of the season indicates incomplete data. Similarity between the two values does not necessarily mean the same bears were reported.

^d Data only from nuisance survey because registration data do not indicate whether bear was a nuisance.

^e Beginning in 2017, hunters could choose Area 88 in the quota lottery, and if drawn, could hunt for a nuisance bear, if authorized. In 2017, 11 hunters were authorized, but only 1 killed a bear.

^f A permit for non-landowners to take a nuisance bear before the bear season was officially implemented in 1992, but some COs individually implemented this program in 1991. Data are based on records from the nuisance survey, not directly from permit receipts. Only 4 bears have been killed by permittees since 2011.

^g Percent of on-site investigations resulting in a bear being captured and translocated.

^h Car kill data were reported on the monthly nuisance form for the first time in 2005. In all previous years, car kill data were from Enforcement's confiscation records. In 2015, confiscation records had more car-kills than the nuisance survey (47 vs 33), so the higher number is shown here. In 2017, only 1 car-kill was in the confiscation records. The number of reported car-kills in 2017 was the lowest since record-keeping began in 1981.

ⁱ Beginning in 2017, Wildlife Managers recorded nuisance bear complaints on an all-species wildlife damage app, whereas Conservation Officers continued to submit monthly nuisance bear survey forms (April–Oct). The 2 survey tools are not exactly the same, so data are presented separately for each in parenthesis (Wildlife Managers, COs). For consistency, only April–October data are included (in 2017 10 calls were received in other months).

Fig. 5. Trends in nuisance bear complaints, and nuisance bears killed and moved, 1981–2017, showing dramatic effect of change in nuisance bear policy, and slight increasing trend over past decade.

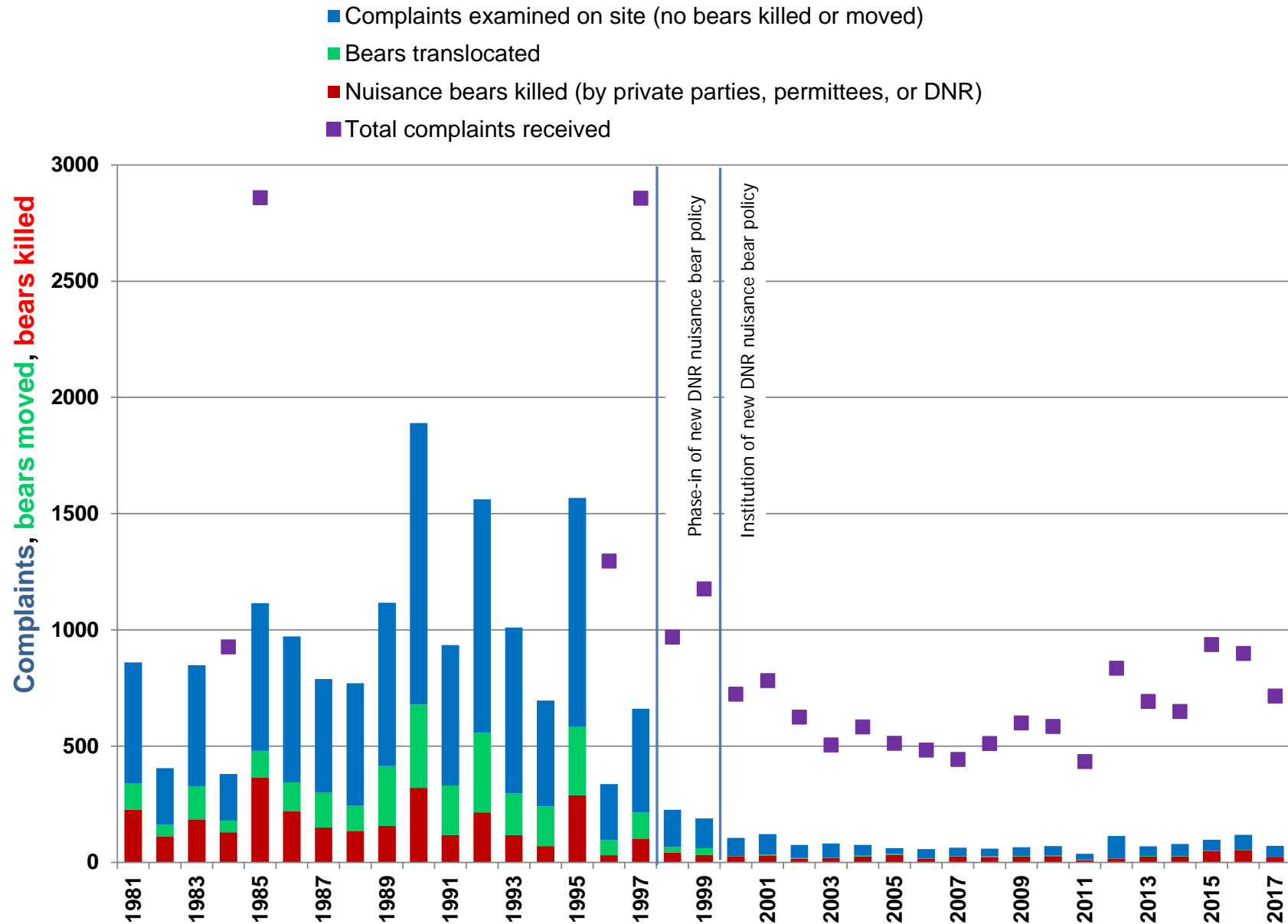
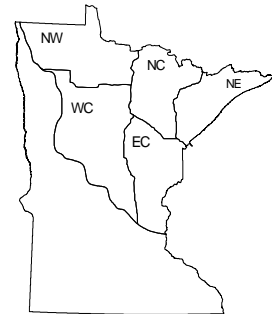


Table 9. Regional bear food indices^a in Minnesota's bear range, 1984–2017. Shaded blocks indicate particularly low (<45; pink) or high (≥70; green) values.

Year	Survey Area					Rangewide
	NW	NC	NE	WC	EC	
1984	32.3	66.8	48.9	51.4	45.4	51.8
1985	43.0	37.5	35.3	43.5	55.5	42.7
1986	83.9	66.0	54.7	74.7	61.1	67.7
1987	62.7	57.3	46.8	67.4	69.0	61.8
1988	51.2	61.1	62.7	54.4	47.3	56.0
1989	55.4	58.8	48.1	47.8	52.9	51.6
1990	29.1	39.4	55.4	44.0	47.9	44.1
1991	59.7	71.2	64.8	72.1	78.9	68.4
1992	52.3	59.9	48.6	48.1	63.3	58.2
1993	59.8	87.8	75.0	73.9	76.8	74.3
1994	68.6	82.3	61.3	81.5	68.2	72.3
1995	33.8	46.5	43.9	42.0	50.9	44.4
1996	89.5	93.2	88.4	92.2	82.1	87.6
1997	58.2	55.5	58.8	62.0	70.1	63.9
1998	56.9	72.8	66.4	72.3	84.5	71.1
1999	63.7	59.9	61.1	63.2	60.6	62.0
2000	57.7	68.0	54.7	69.2	67.4	62.3
2001	40.6	48.7	55.6	62.2	66.0	55.8
2002	53.1	63.4	60.4	68.6	68.3	66.8
2003	59.1	57.5	55.2	58.6	49.7	58.8
2004	57.0	60.5	61.1	70.3	67.9	64.4
2005	53.4	65.9	61.4	59.9	72.6	62.3
2006	51.0	64.9	53.4	51.0	52.1	56.9
2007	68.4	79.0	67.3	67.6	70.0	69.4
2008	58.6	74.1	64.7	66.6	71.4	65.4
2009	59.9	67.8	63.2	69.2	69.5	66.5
2010	70.0	71.3	79.0	60.8	57.3	68.0
2011	61.4	59.6	57.9	66.7	63.5	62.5
2012	49.1	50.3	59.4	50.5	41.5	50.7
2013	71.9	77.1	76.0	59.1	63.2	71.8
2014	71.4	70.7	71.4	61.0	66.5	70.2
2015	47.1	56.3	41.3	64.8	45.5	48.7
2016	71.9	60.3	73.8	53.7	57.0	60.3
2017	57.2	55.7	52.7	62.2	68.3	58.9



^a Each bear food index value represents the sum of the mean index values for 14 species, based on surveys conducted in that area. Range-wide mean is derived directly from all surveys conducted in the state (i.e., not by averaging survey area means).

Table 10. Regional mean index values^a for bear food species in 2017 compared to the previous 33-year mean (1984-2016) in Minnesota's bear range. Shading indicates particularly high (green) or low (pink) fruit abundance relative to average (≥ 1 point difference for individual foods; ≥ 5 points difference for totals).

FRUIT	NW		NC		NE		WC		EC		Rangewide	
	33yr mean	2017 (n = 10 ^b)	33yr mean	2017 (n = 11)	33yr mean	2017 (n = 6)	33yr mean	2017 (n = 9)	33yr mean	2017 (n = 8)	33yr mean	2017 (n = 37)
SUMMER												
Sarsaparilla	4.5	4.3	5.7	4.9	5.2	2.7	4.5	3.3	5.3	5.9	5.0	4.3
Pincherry	3.3	3.1	4.5	3.9	4.2	4.3	3.7	3.1	3.7	4.3	3.8	3.7
Chokecherry	5.7	5.5	5.5	5.1	4.5	5.3	5.4	4.7	4.6	4.3	5.2	5.0
Juneberry	5.1	4.4	4.9	4.3	5.0	4.3	3.6	3.0	4.0	3.0	4.3	3.8
Elderberry	1.6	0.8	3.0	1.7	3.6	3.1	3.1	0.8	3.3	2.3	3.1	1.9
Blueberry	5.0	3.0	5.4	5.8	4.9	5.7	3.5	3.3	3.6	5.0	4.4	4.4
Raspberry	6.4	6.0	8.0	5.8	7.9	7.8	7.0	8.2	7.0	7.3	7.0	6.8
Blackberry	1.3	1.1	2.4	2.2	1.2	1.0	3.5	4.7	4.4	4.9	2.9	2.7
FALL												
Wild Plum	2.1	3.4	1.8	1.0	1.1	1.8	2.7	4.4	2.4	2.4	2.2	2.7
HB Cranberry	5.3	5.1	4.5	4.2	3.9	2.4	3.9	3.3	3.7	4.9	4.2	3.8
Dogwood	6.0	8.2	5.7	4.7	4.9	4.0	6.0	6.5	5.8	6.9	5.7	6.3
Oak	3.6	4.8	3.1	4.1	1.9	1.3	5.9	6.1	5.6	4.9	4.4	4.4
Mountain Ash	1.5	1.1	2.5	1.8	4.6	2.7	1.6	2.9	2.2	2.5	2.5	1.8
Hazel	6.3	6.4	7.3	6.2	7.0	6.3	7.9	7.9	7.5	9.7	7.2	7.3
TOTAL	57.9	57.2	64.3	55.7	59.7	52.7	62.3	62.2	63.3	68.3	61.9	58.9

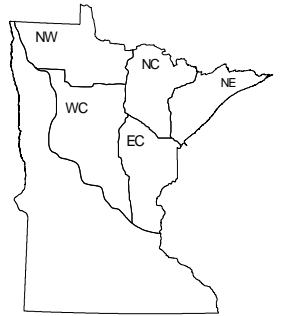
^a Food abundance indices were calculated by multiplying species abundance ratings x fruit production ratings.

^b n = Number of surveys used to calculate area-specific means

^c Sample size for the entire range does not equal the sum of the sample sizes of 5 survey areas because some surveys were conducted on the border of 2 or more areas and were included in calculations for both.

Table 11. Regional productivity index^a for important fall foods (oak + hazel + dogwood) in Minnesota's bear range, 1984–2017. Shading indicates particularly low (≤ 5.0 ; yellow) or high (≥ 8.0 ; tan) values.

Year	Survey Area					Entire Range
	NW	NC	NE	WC	EC	
1984	4.2	7.6	7.0	6.2	7.0	6.5
1985	4.9	2.8 ^b	4.2	4.7	5.3	4.4
1986	7.2	5.0	4.0	7.0	6.2	6.2
1987	8.0	7.8	7.3	7.6	8.0	7.7
1988	5.5	7.2	7.3	6.8	6.1	6.7
1989	6.0	5.3	4.1	5.7	6.4	5.8
1990	3.3 ^b	4.2	6.4	5.7	6.4	5.2
1991	6.2	6.2	5.4	7.2	7.7	6.7
1992	4.7	5.0	4.4	4.4 ^b	6.8	5.1
1993	5.3	7.1	6.7	6.2	7.7	6.5
1994	7.1	7.8	5.8	7.8	7.1	7.2
1995	4.8	4.8	5.1	4.6	5.3	4.9
1996	8.7	8.6	8.1	9.2	8.5	8.6
1997	5.8	5.4	5.1	6.8	6.5	6.2
1998	5.8	6.0	6.3	7.1	7.8	6.7
1999	6.4	5.1	5.9	6.6	6.0	6.2
2000	5.8	7.7	7.2	7.5	8.5	7.0
2001	3.4	4.1	5.7	6.0	6.5	5.2
2002	8.7	7.1	6.6	8.8	8.2	8.1
2003	6.3	6.0	5.5	6.2	6.0	6.1
2004	6.1	5.4	5.4	6.4	6.1	5.9
2005	5.8	5.8	6.1	6.4	7.0	6.2
2006	6.7	6.1	6.0	6.7	5.8	6.3
2007	6.0	5.8	5.7	6.6	6.4	6.2
2008	6.6	7.3	6.2	7.0	8.9	7.1
2009	5.1	6.2	5.3	6.3	6.5	6.0
2010	7.7	6.4	6.5	6.2	5.4	6.6
2011	5.8	6.5	6.2	7.0	7.4	6.5
2012	6.2	6.3	6.3	6.5	4.8	6.1
2013	6.8	6.0	5.7	6.7	6.9	6.3
2014	7.0	5.6	5.4	7.7	6.1	6.7
2015	5.8	5.9	3.5 ^b	8.2	3.7 ^b	5.6
2016	5.7	5.2	6.0	5.4	5.3	5.3
2017	6.8	5.6	5.1	7.1	7.4	6.5



^a Values represent the sum of mean production scores for hazel, oak, and dogwood, derived from surveys conducted in each survey area. Range-wide mean is for all surveys conducted in the state (i.e. not an average of survey area means).

^b Record low fall food score in survey area.

Fig 6. Production of fall bear foods (dogwood, oak, hazel) across Minnesota, 2017.

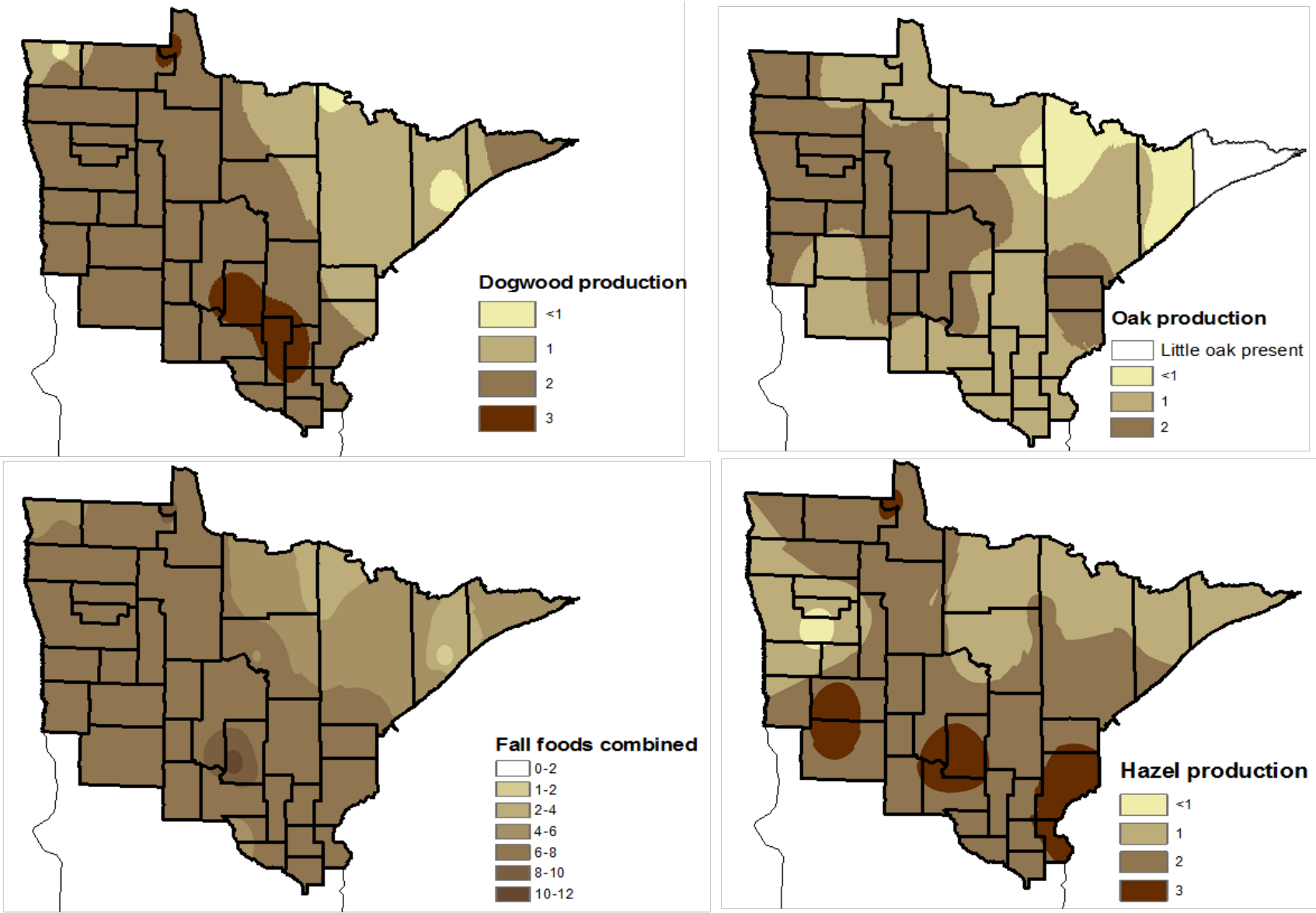


Fig. 7. Number of bears harvested vs. number predicted to be harvested based on number of hunters and fall food production — top panel: statewide 1984–2017; bottom panel: quota zone only, most recent 15 years. Regression for the full dataset included an interaction term between food and hunters to better predict the drastic changes in harvest when fall foods were extremely high or low.

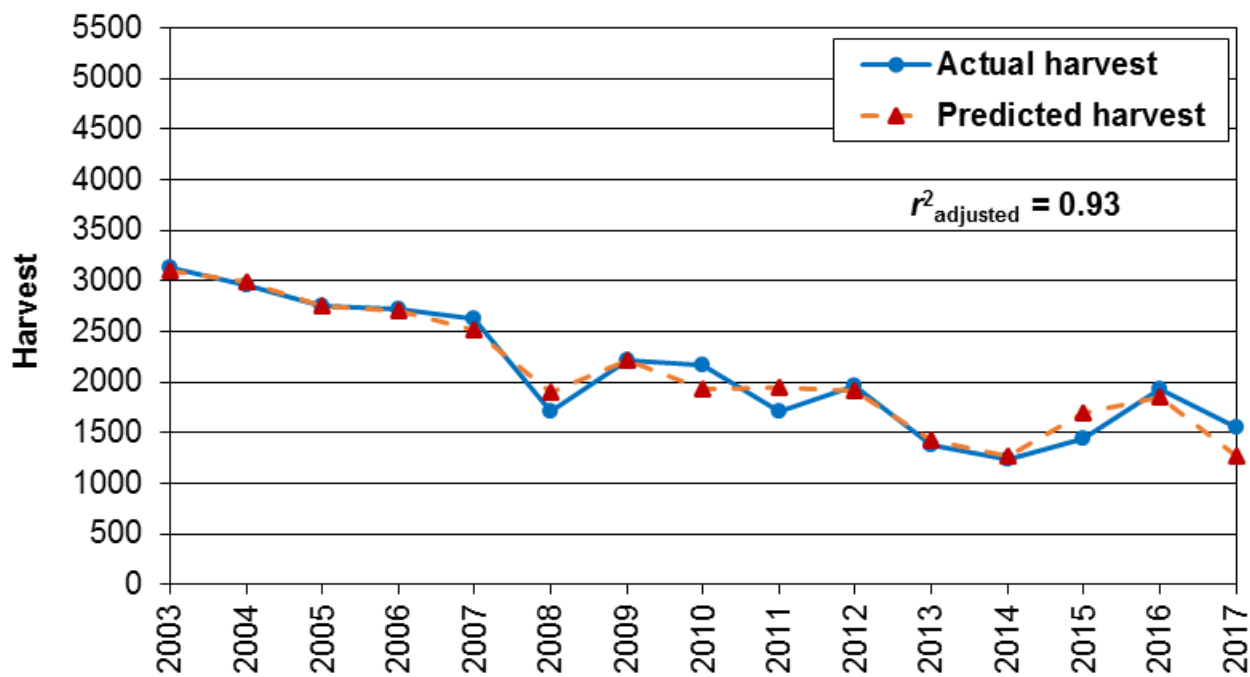
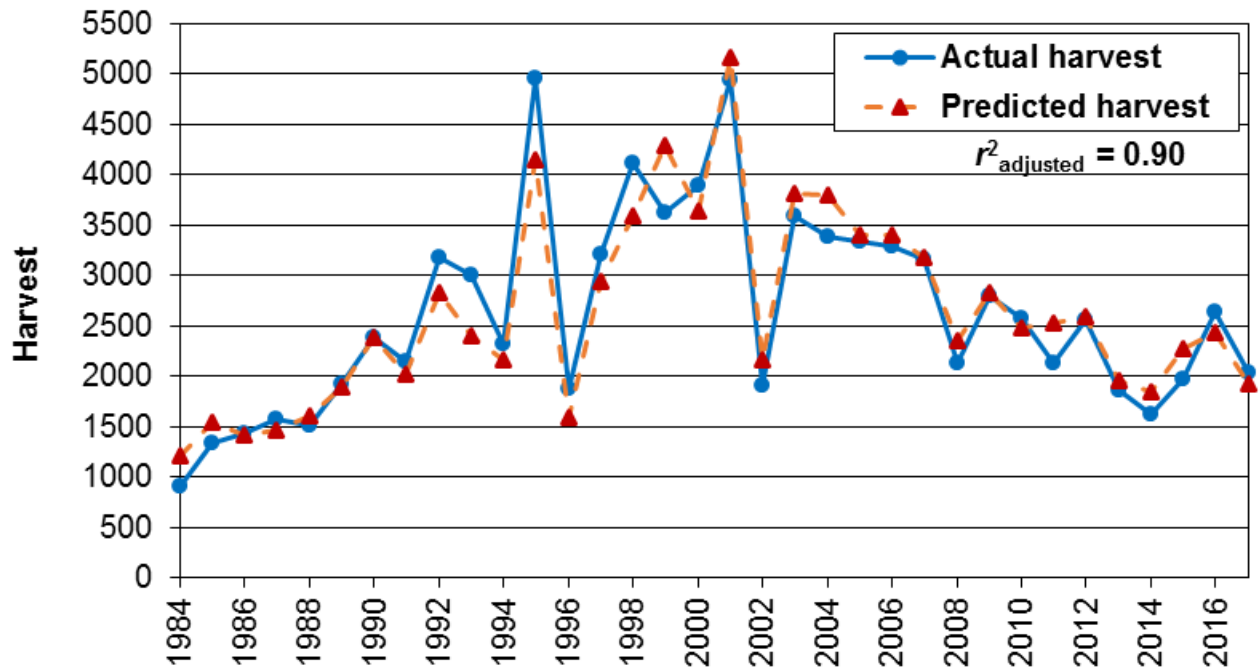
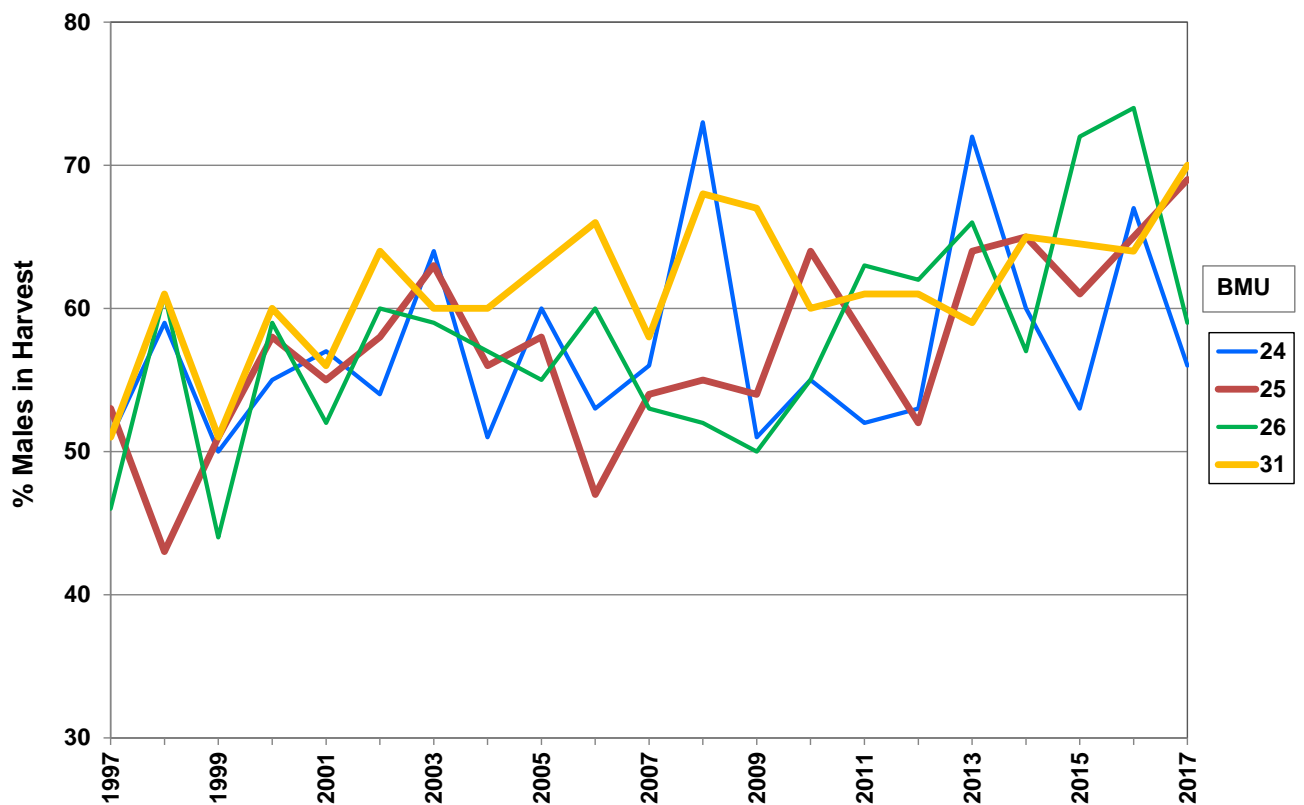
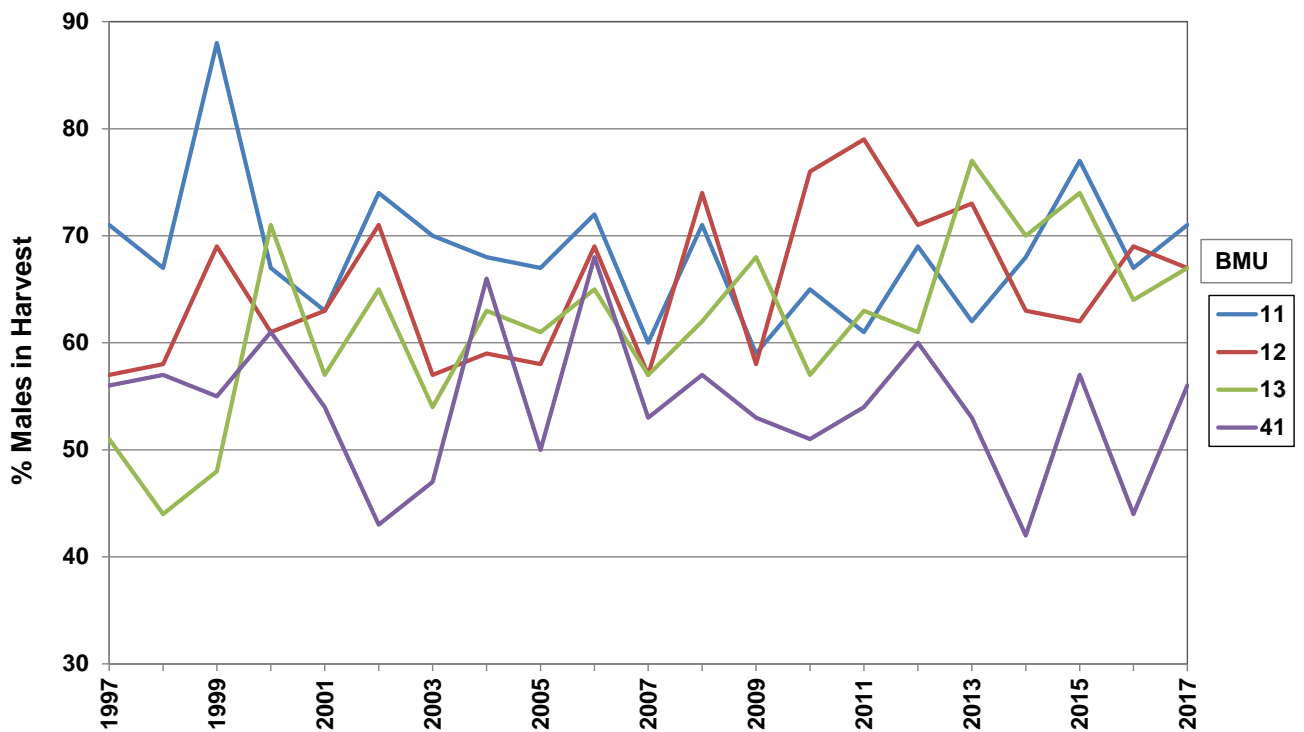


Fig 8. Sex ratios of harvested bears by BMU, 1997–2017.
Thick lines show increasing trends continuing through 2017.



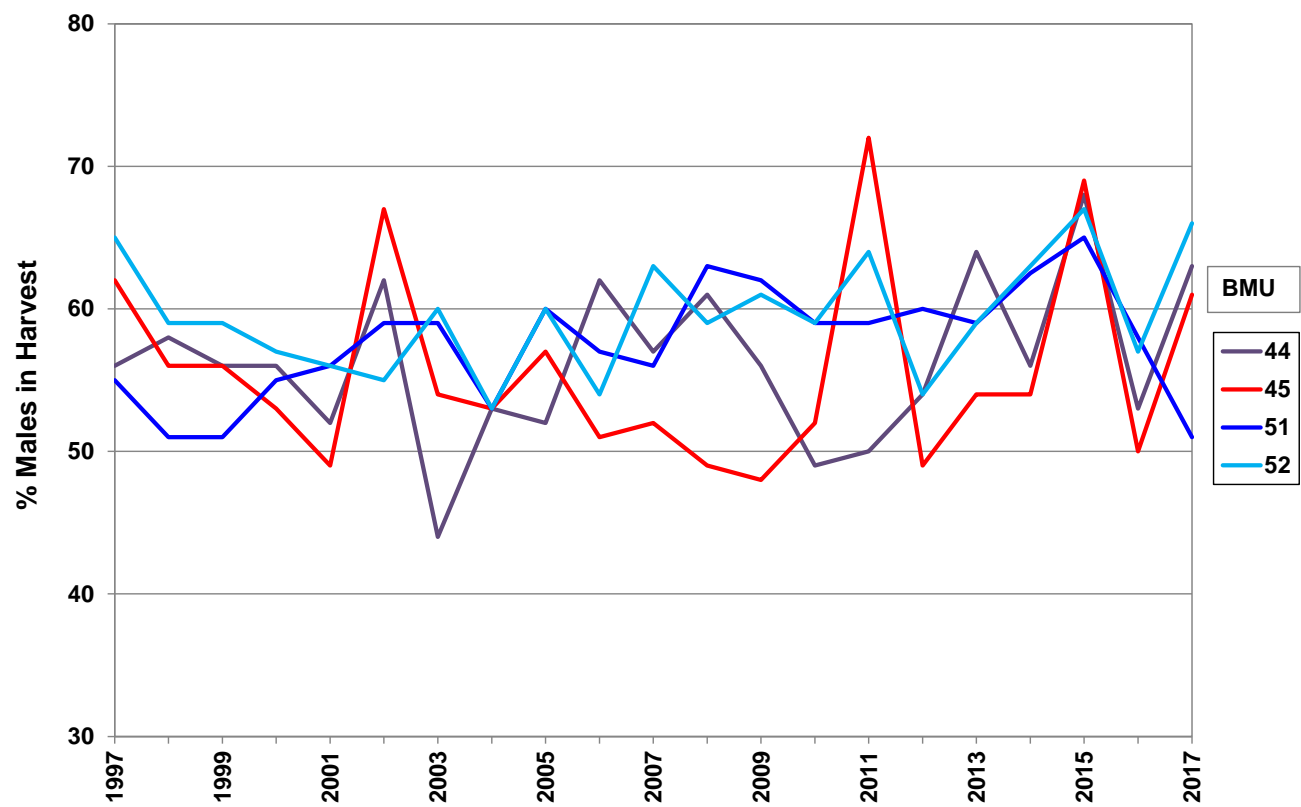
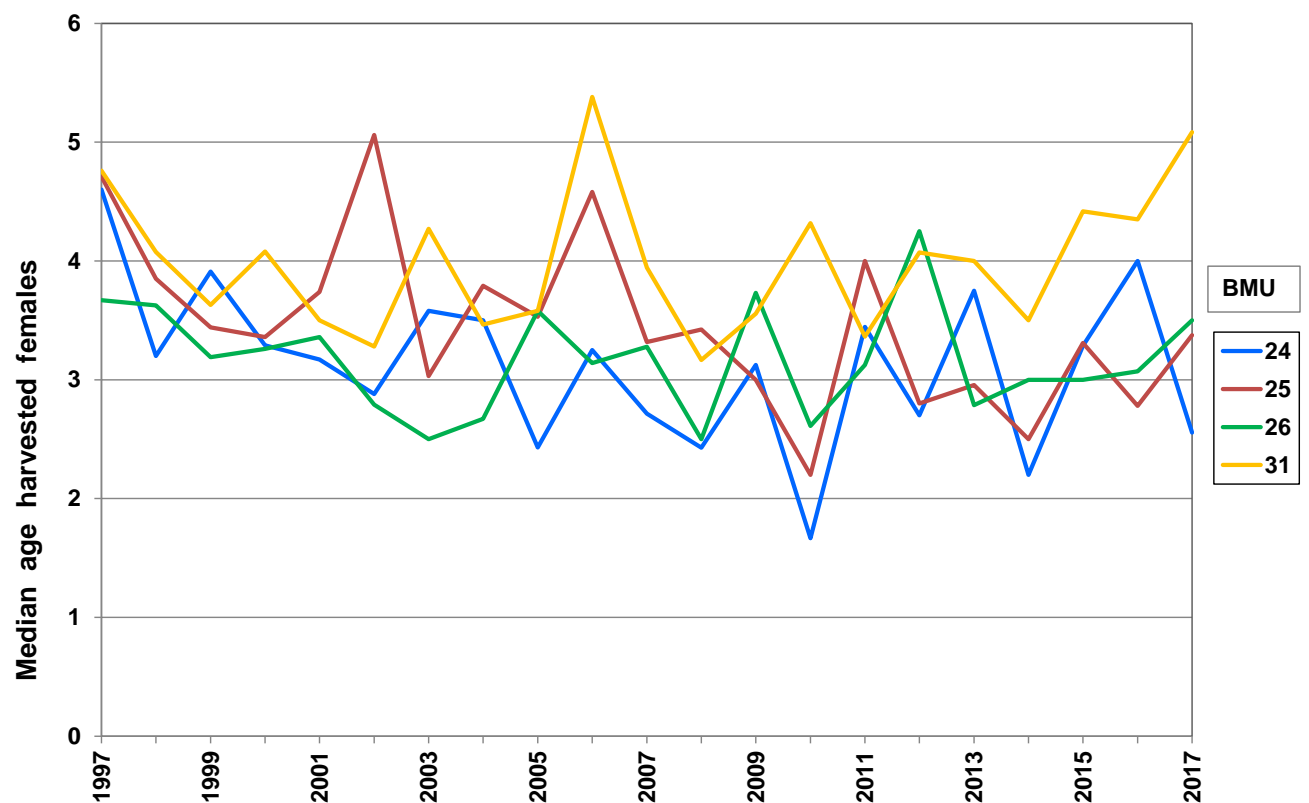
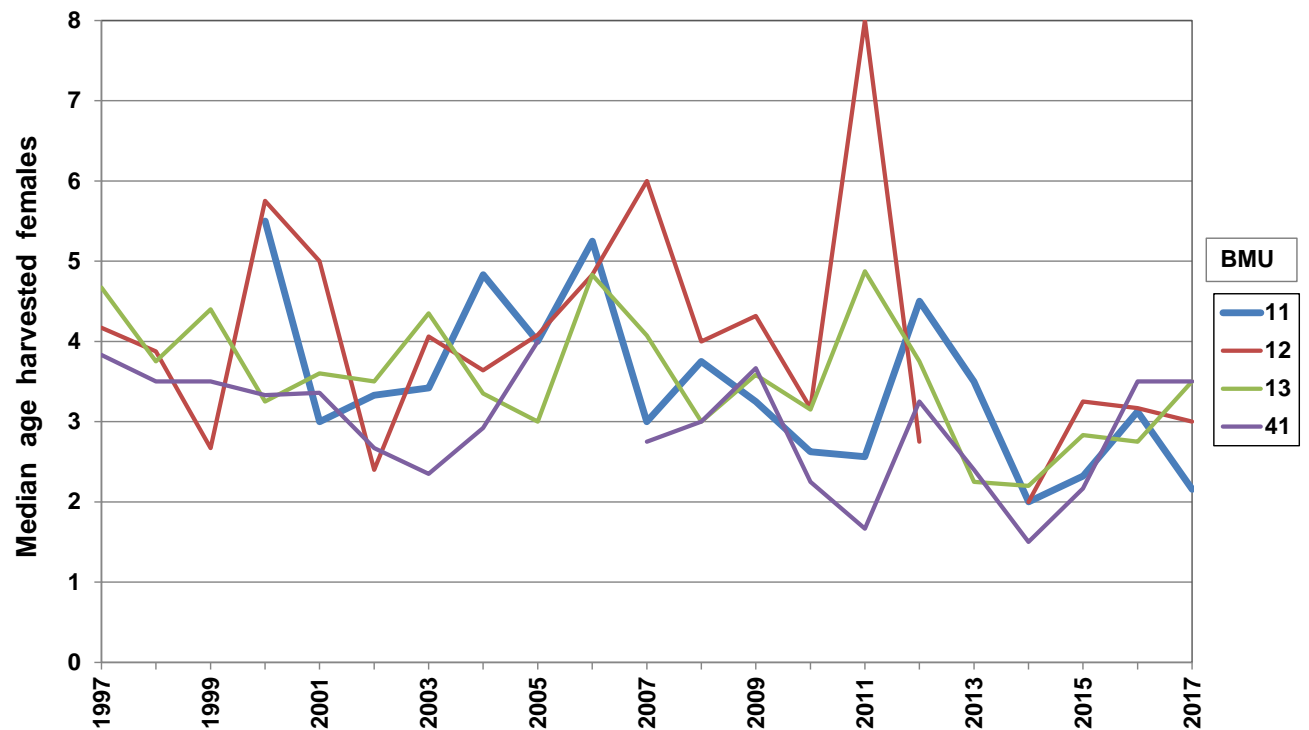


Fig 9. Median ages of harvested female bears by BMU, 1997–2017. Thick lines show decreasing trends continuing through 2017. Breaks in line occur when sample sizes were too small to calculate a meaningful median.



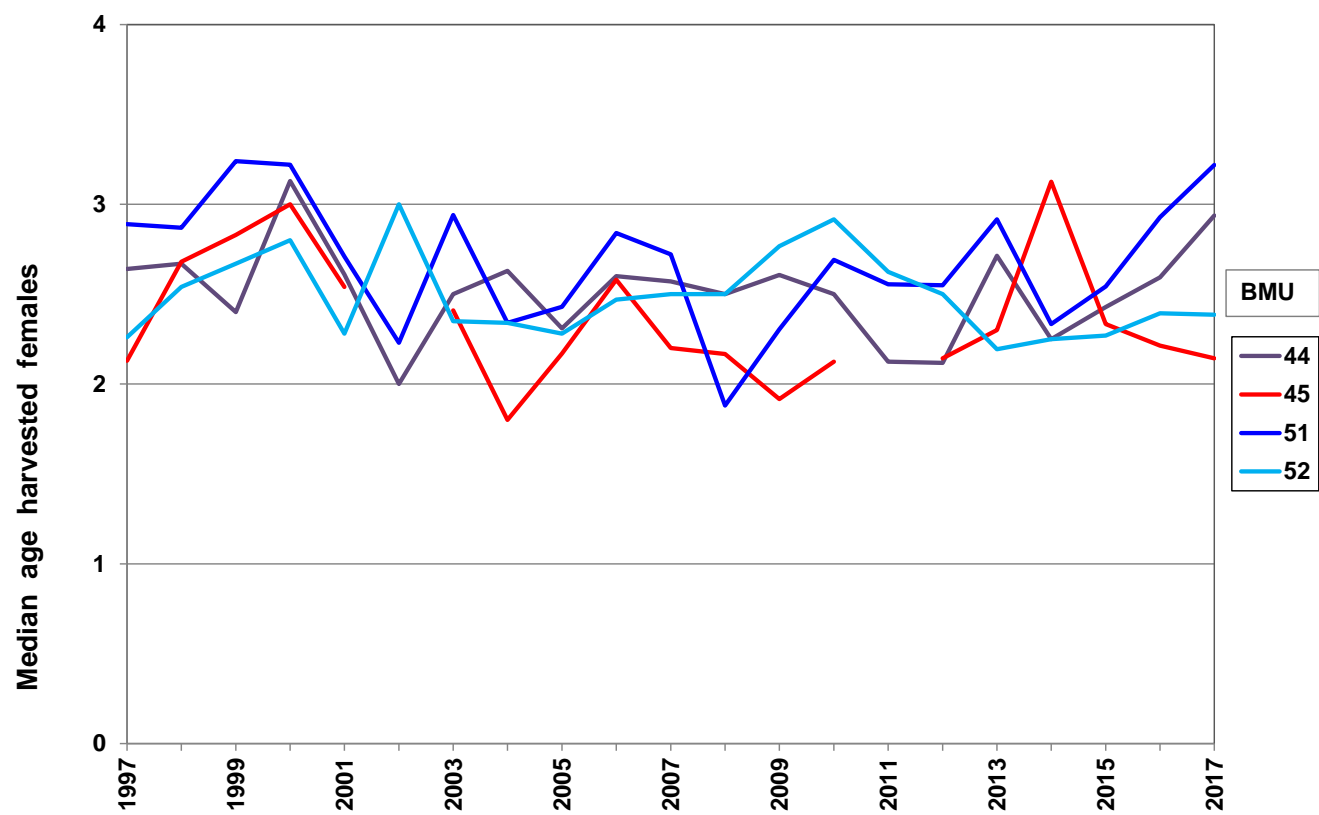


Fig. 10. Statewide median ages (years) and sex ratio of harvested bears, 1982–2017.

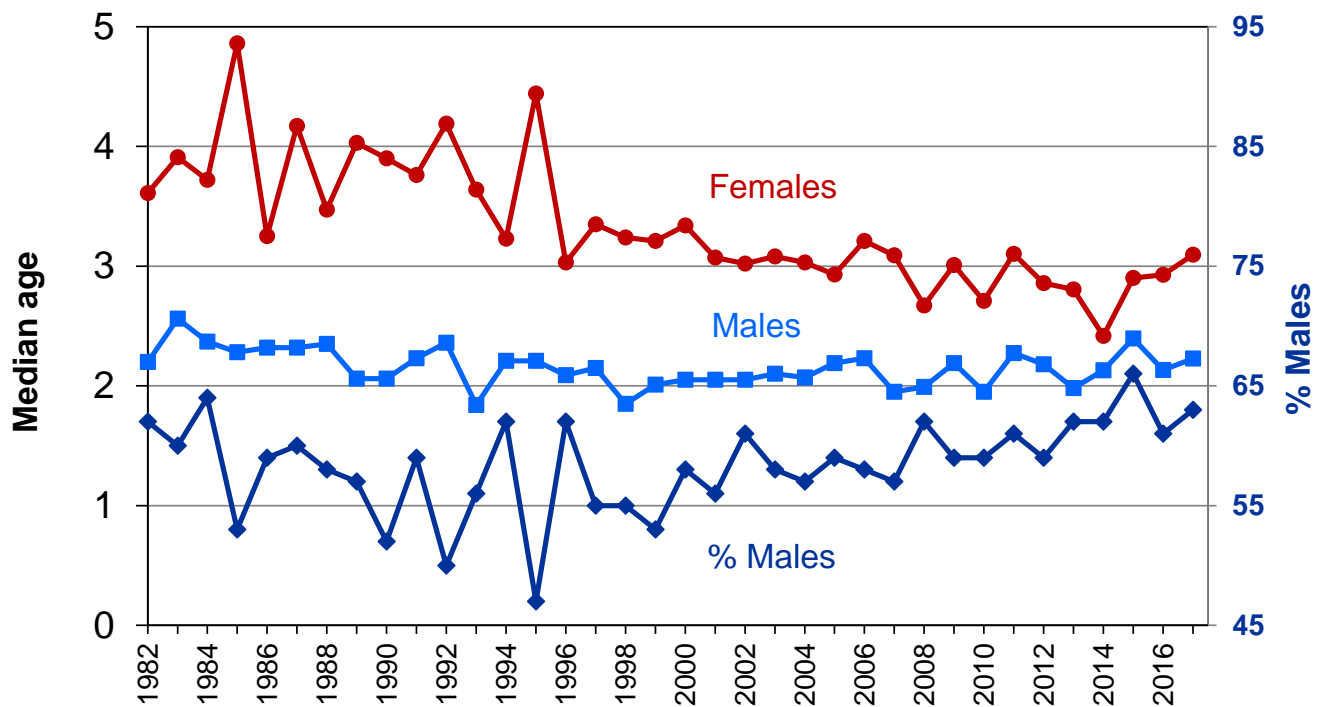


Fig. 11. Statewide harvest structure: proportion of each sex in age category, 1982–2017. Trend lines are significant, but the last few years show a different trend.

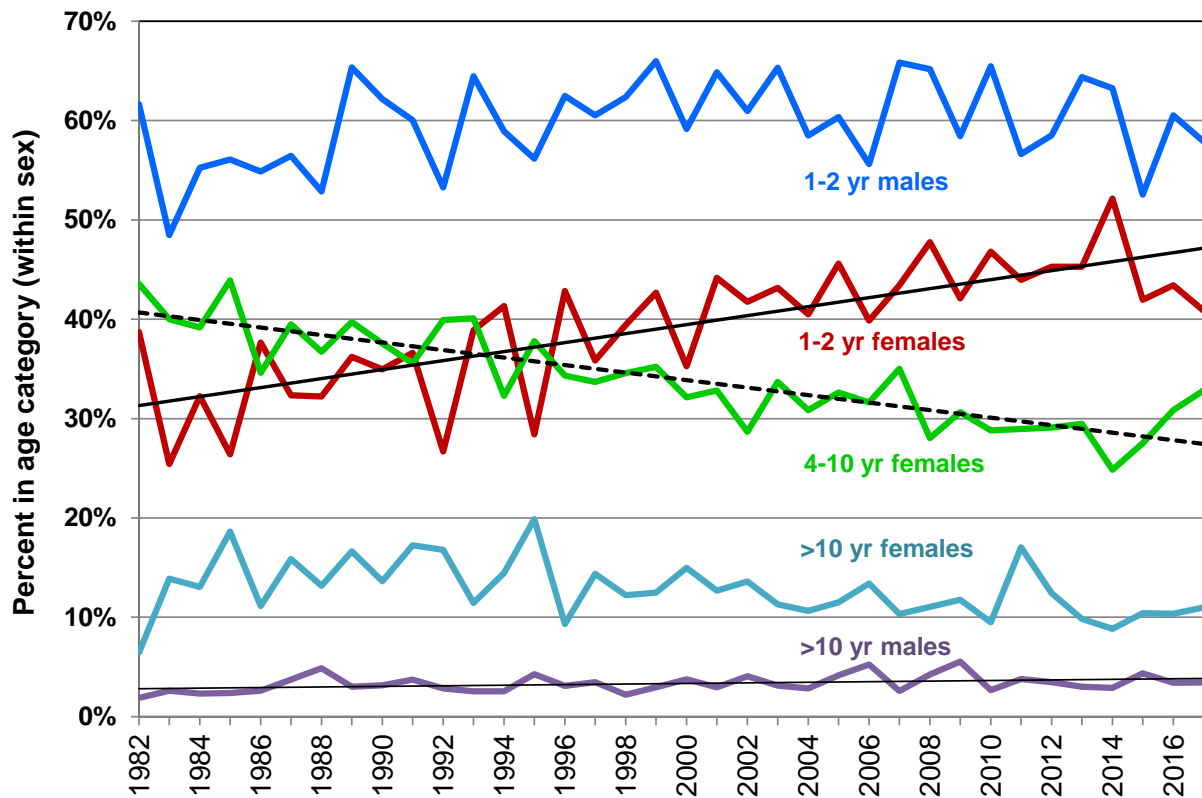


Fig. 12. Percent of hunters submitting useable bear teeth for aging (vital for population monitoring, see Figs. 14–16). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993) and ~90% when non-compliant hunters were sent a reminder letter after the season.

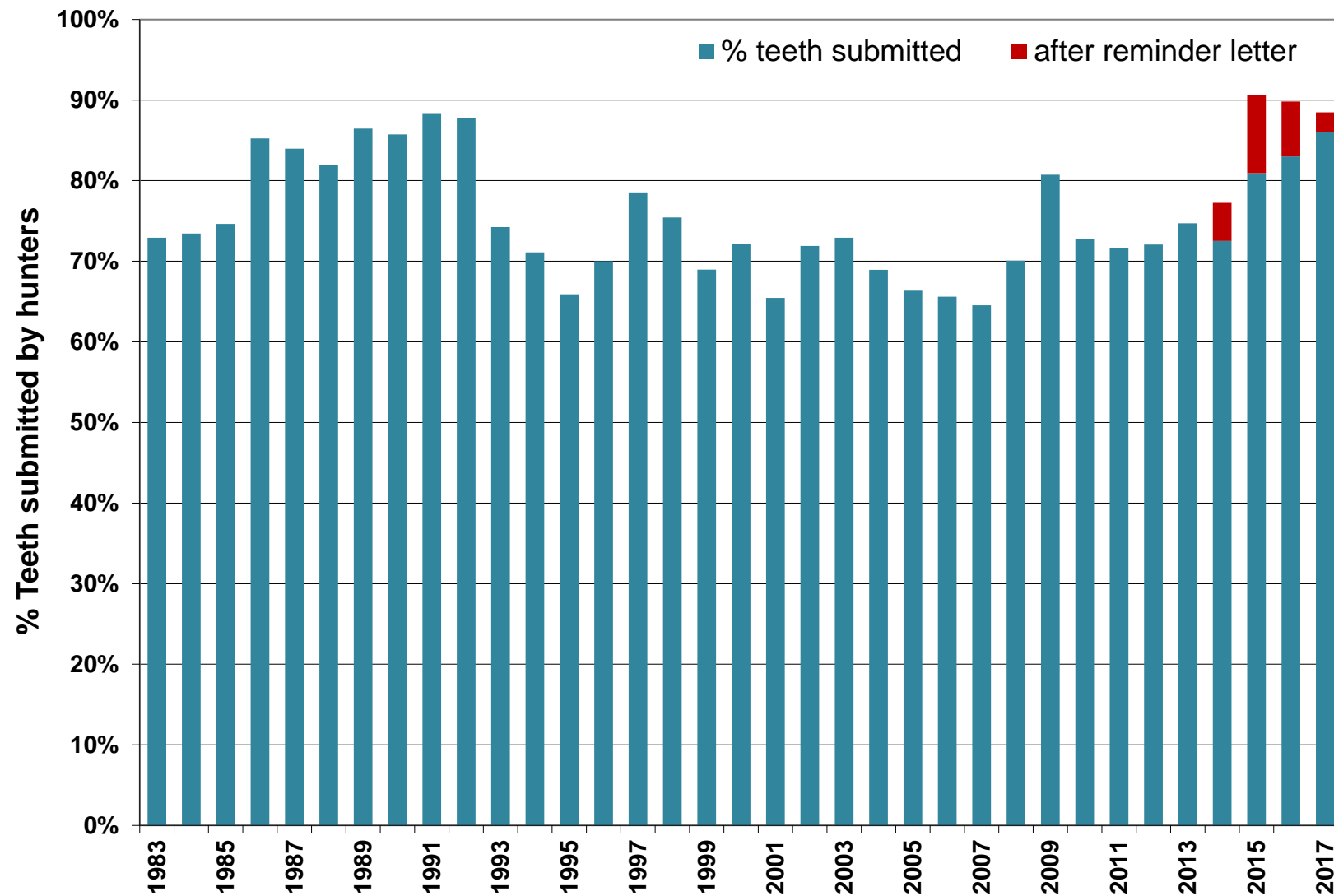


Fig. 13. Percent of hunters who submitted a bear tooth in 2017 by method of registration (top panel) and by BMU (bottom panel). Beginning in 2013, hunters could register their bear by phone or internet, as well as in person at a station.

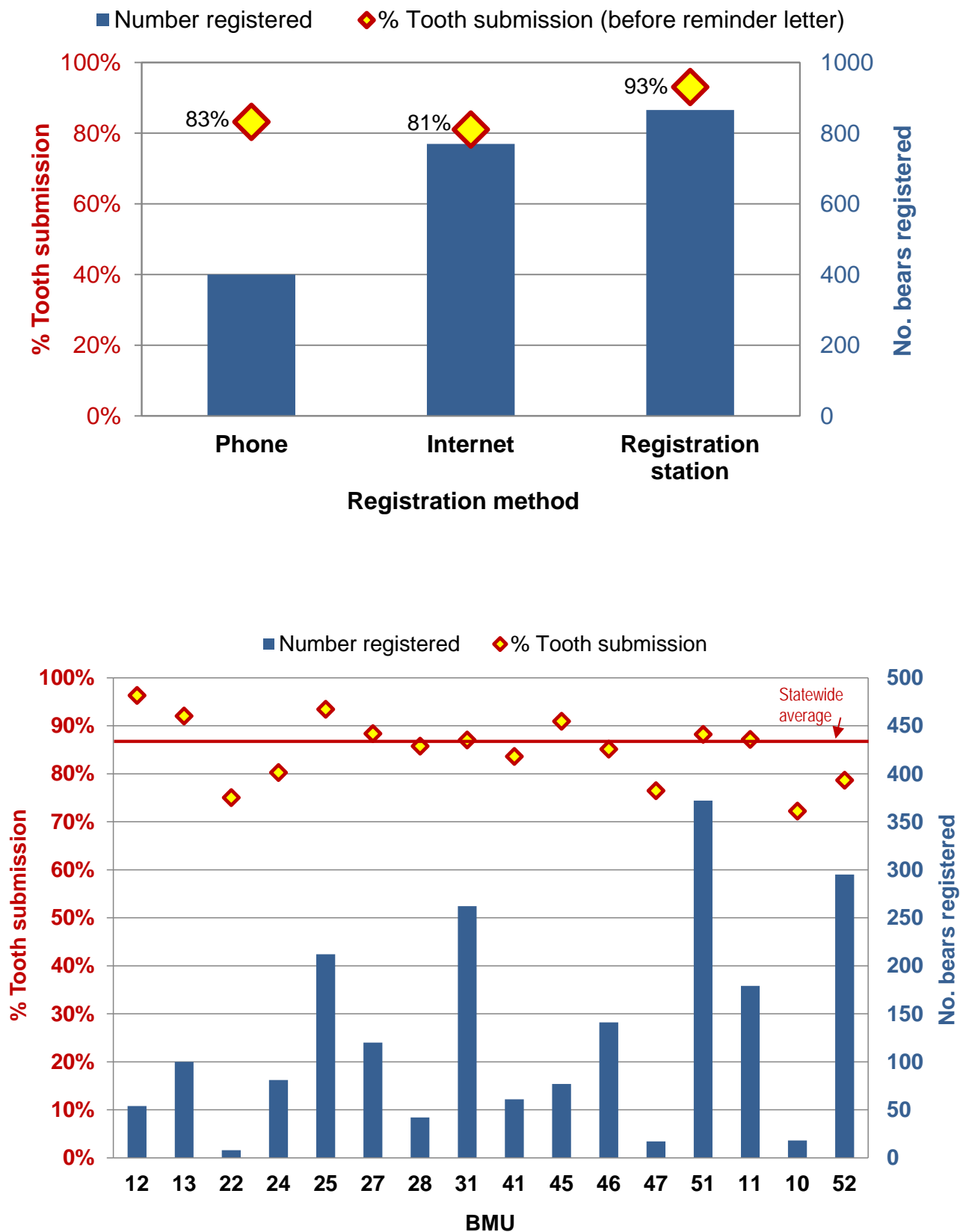


Fig. 14. Statewide bear population trend (pre-hunt) derived from Downing reconstruction using harvest age structures, 1980–2017. Curves were scaled (elevated to account for non-harvest mortality) to various degrees to attempt to match the tetracycline-based mark–recapture estimates (2 such curves shown here). Estimates beyond 2015 are unreliable.

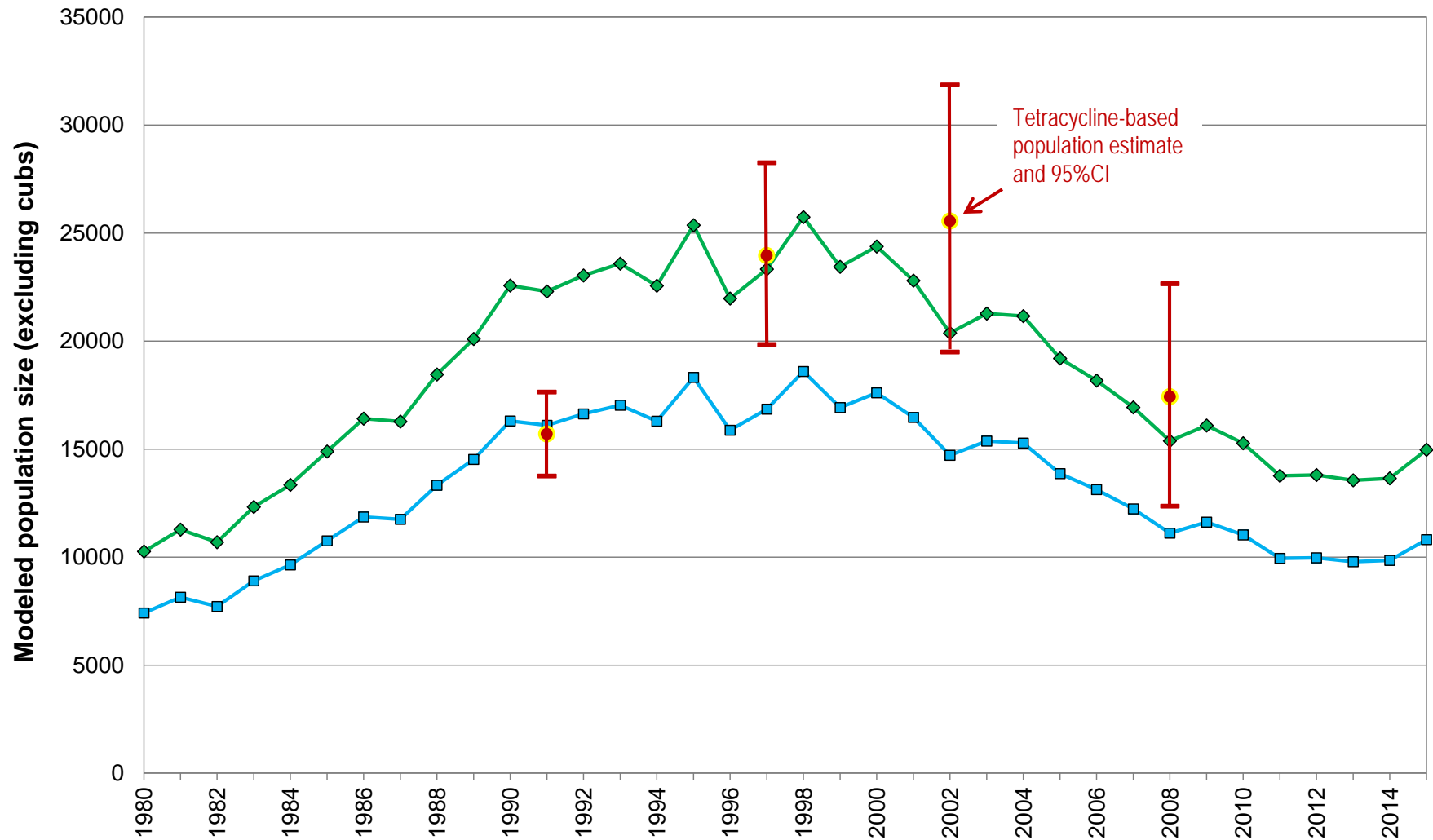


Fig. 15. Population trends during 2000s derived from Downing reconstruction for quota and no-quota zones compared to respective harvests. Reconstruction-based estimates <2 years from the most recent harvest age data are unreliable (hence curves terminate in pre-hunt 2015). Population curves were scaled (elevated to account for non-harvest mortality) to match the lower curve in Fig. 14 (i.e., the actual scale of the population estimates is not empirically-based).

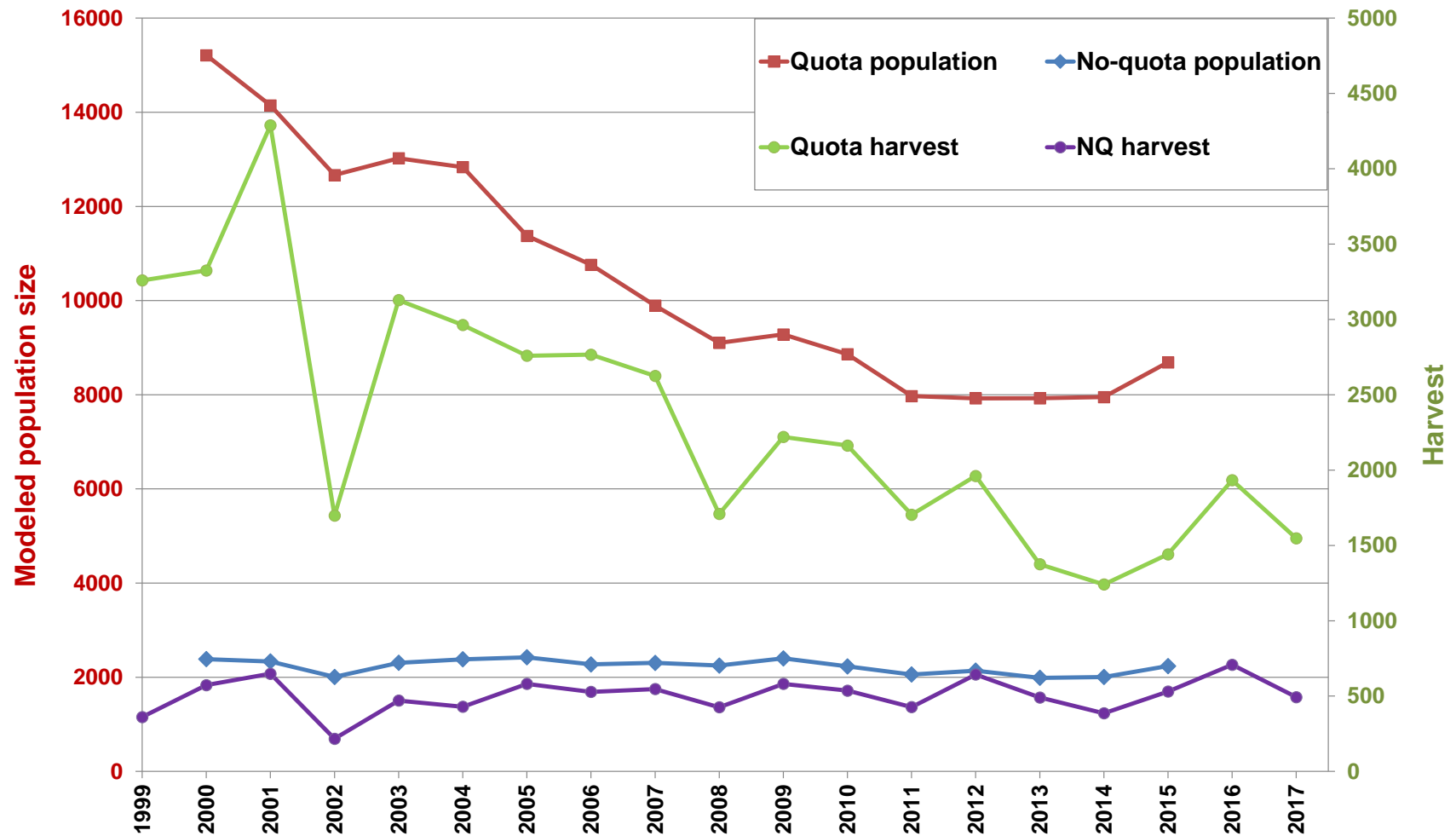


Fig. 16. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2017 (last 2 intervals are 4 years). Higher harvest rates result in steeper curves because males are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed tan line) yields approximately the inverse of the harvest rate (derived rates are shown in inset).

