DEPARTMENT OF NATURAL RESOURCES

STATUS OF MINNESOTA BLACK BEARS, 2016

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	***Overview: Permits, licenses, harvest, and success rates*** Permit applications for bear licenses increased to nearly 20,000 (the highest in 14 years). Permit availability has remained fairly constant for the past 4 years. The low permit availability has driven up sales of no-quota licenses, which were the highest on record in 2016, comprising 46% of total licenses purchased. The higher number of hunters combined with an usually high success rate resulted in the highest statewide harvest in 6 years. Hunting success is affected by numbers of hunters (i.e., competition), food supply (affecting bears' attraction to baits), and density of bears.
Tables 2,3 & Fig. 2	***Quota zone permits and licenses*** 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 available quota zone permits remained the same or declined slightly for all BMUs except BMUs 45 and 51, which were increased in response to a perceived increasing trend in bear numbers. This was the 6th 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 were purchased.
Table 4	***Quota zone lottery*** The low permit availability over the past 4 years has made it more difficult to draw a permit in the lottery. In 2011, some 1st-year applicants (preference level 1) were drawn in all but 3 BMUs. But since 2014, 1st-year applicants were drawn only in BMU 22 (BWCAW). In 2016, preference level 2 hunters were drawn only in BMUs 22, 13, and 25. Drawing a permit in BMUs 28, 46 and 45 required a preference level of 4 or higher.
Table 5 & Fig. 3	***Harvest by BMU*** In 2016, most BMUs had higher harvests than in 2015. BMU 45 had an especially high harvest. A record high harvest occurred in the no-quota zone. The percent of the total statewide harvest contained within the no-quota zone has increased with reduction of quota zone permits. 2015 was notable for a record high male-biased harvest sex ratio; in 2016, the sex ratio was more normal, except BMUs 25 and 26 (now 27/28), which had record high percent males, versus BMU 41, which had a female-dominated harvest.

Table 6	***Hunting success by BMU*** Hunters in the quota zone had a record high (50%) success in 2016. All quota zone BMUs (except 22, where unattended baiting is not allowed) had record high or near record high success. Success rate was more normal in the no-quota zone. However, estimating success in the 3 no-quota BMUs (Fig. 2) remains difficult, as it is based on where hunters indicated they planned to hunt when they purchased their license, and many of these hunters (>100) chose places within the quota zone (but most likely did not hunt there, as only 9 killed a bear in the quota zone with a no-quota license).
Table 7	***Harvest by date*** 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 2016, despite being a year with low abundance of fall foods (very unlike 2015, which also had low fall food abundance).
Tables 8–9 & Fig. 4	***Nuisance complaints and kills*** The total number of registered complaints in the past 2 years were the highest since institution of a new nuisance bear policy in 2000 (whereby DNR personnel handled most bear complaints by phone, and rarely translocated bears). Some "hotspots" of nuisance activity occurred at various locations across the state. There appears to be a general upward trend in complaints over the past decade, along with a disproportionate increase (doubling) in the number of nuisance bears killed (while the number of car-killed bears has remained low).
Tables 10-12 & Fig 5	***Food abundance*** The composite range-wide, all-season abundance of natural foods (fruits and nuts) for bears in 2016 was lower than 2013 and 2014 (both good food years) and slightly above 2015. Statewide, crops of summer and fall foods, except for chokecherry and highbush cranberry, were at or below the 32-year average. Oak production was especially poor in the west-central and east-central parts of the bear range. Hazel was below average in the east-central and northeast, but above average in the northwest. The statewide fall food index (productivity of dogwood+oak+hazel), which predicts annual harvest after accounting for hunter effort, was the lowest since 2001. The fall food index was slightly lower than 2015, when hazelnuts were poor across the state but oaks were about average; in 2016, the generally poor oak crop drove the low index. Fall food index values were higher in the Arrowhead region and in Lake of the Woods, northern Beltrami, and eastern Roseau and Marshall counties.

Fig. 6	***Predictions of harvest from food abundance*** The 2016 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.
Fig. 7	***Harvest sex ratios*** 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 density). In general, harvest sex ratios favoring males (the more vulnerable sex, and hence the minority sex in the living population) provide more resilience to the population. Harvest sex ratios within BMUs varied considerably year-to-year over the past 2 decades. Three BMUs have shown a generally increasing trend in percent males in the harvest: BMU 25, 26, and 51.
Figs. 8–10	***Harvest ages*** Median age of harvested females increased in nearly all BMUs, and statewide, in 2016. A long-term declining trend in median age of harvested females continues to be evident in BMU 25. Statewide, the proportion of the female harvest composed of 1–2 year-olds declined and 4–10 year-olds increased. Median ages of harvested males have been relatively stable for 2 decades.
Figs. 11–12	***Submission of bear teeth for aging*** Ages of harvested bears are now 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. "Violation notices" were sent to non-compliant hunters each year since 2014, which spurred a higher initial compliance in 2015 and 2016 (>80%), and a compliance after the reminder notice of ~90%. Since 2013, hunters could register by phone or internet, and pick up a tooth submission envelope later: tooth submission compliance by these hunters is less than for hunters who register their bear in person and pick up a tooth envelope at that time. No-quota zone hunters (BMUs 11, 10, 52) have the poorest rate of tooth submission.

Fig. 13–14	***Population trend*** 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. 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. 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 level, although harvests varied with food. Population reconstruction does not provide reliable estimates for the 2 most recent years, and since the model provides "pre-hunt" estimates, the most recent estimate shows only the effects of the 2013 harvest (and not the low harvest of 2014, or unexpectedly high harvest of 2016). The no-quota zone has also shown a population decline during the 2000s, but at a slower rate than in the quota zone. Again, though, model results following the record no-quota harvest in 2016 are not yet available.
Fig. 15	***Trends in harvest rates*** The sex ratio of harvested bears varies by age in accordance with the relative vulnerability of the sexes. With male bears being more vulnerable to harvest than females, males always predominate among harvested 1-year-olds (67–75%). They also predominate, but less strongly among 2 and 3-year-old harvested bears. However, older aged 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. 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 (Table 1; Fig. 1). Harvest rates since 2010 have been, on average, less than what they were in the early 1980s, when the population was increasing (Fig. 13).

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1996–2016.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Permit applications	30405	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]
Permits available	12030	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850	10000	9500	7050[b]	6000	3750	3750	3700	3850
Licenses purchased (total)	12414	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404	9892	9689	9555	8986	6589	6620	6962	7177
Quota zone [c]	10592	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842	7342	7086	5684	4951	3188	3177	3257	3420
Quota surplus/military [c]						235	209	2554	1356	1591	1561	526	233	77	83	1385	1070	578	583	446	441
No-quota zone [c]	1822	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329	2473	2520	2486	2965	2823	2860	3259	3316 [h]
% Licenses bought																					
Of permits available [d]	88.0	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
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
Estimated no. hunters [e]	11500	10300	14500	15900	16800	15500	13800	13600	12900	12500	12500	11300	9900	9400	9200	9100	8600	6300	6300	6600	6800
Harvest	1874	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135	2801	2699	2131	2604	1866	1627	1971	2641
Harvest sex ratio (%M) [f]	62	55	55	53	58	56	61	58	57	59	58	57	62	59	59	61	59	62	62	66 [i]	61
Success rate (%)																					
Total harvest/hunters [g]	16	31	28	23	23	29	14	26	26	26	26	28	21	30	29	23	30	30	26	30	39
Quota harvest/licenses	15	29	25	20	20	28	14	25	26	25	25	28	21	30	30	24	33	37	33	39 [j]	50 [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).

[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 2011–16, 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%). The estimated no. of hunters in 2011–16 may be under-estimated because a large no. of people bought surplus licenses 1 month before the season, so they were more apt to hunt.

[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 2016, 5 hunters killed 2 bears.

[h] Record high number of no-quota zone licenses purchased (46% of total licenses purchased).

[i] Record high % males in statewide harvest.

[j] 2016: record high success rate. 2015: highest success rate since very poor food year of 1995.

Fig. 1. Relationship between licenses sold and hunting success (*note inverted scale*) in quota zone, 1987–2016 (no-quota zone first partitioned out in 1987). Number of licenses explains 42% of variation in hunting success during this period (P = 0.0001). Large variation in hunting success is also attributable to food conditions.

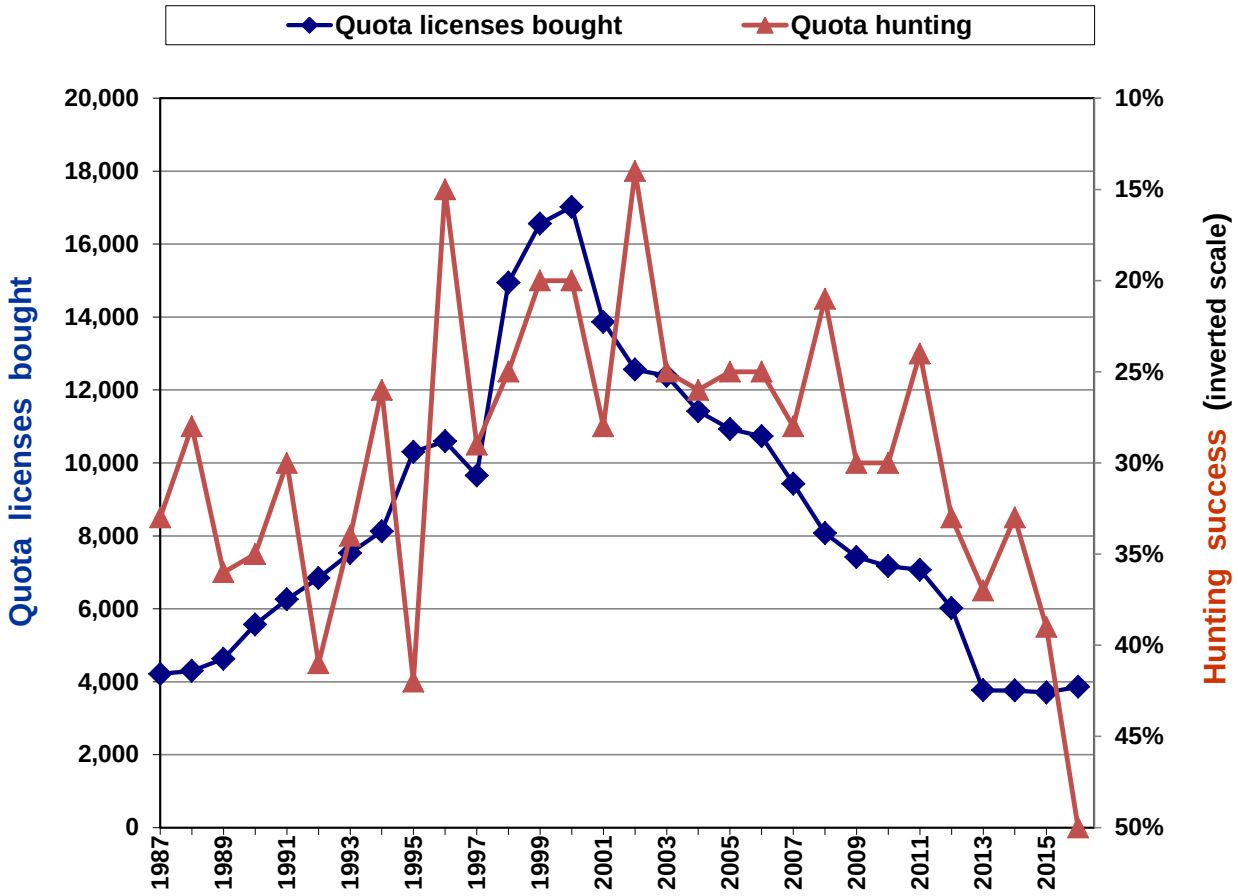

Fig. 2. Bear management units (BMUs) within quota (white) and no-quota (gray) zones. Hunters in the quota zone are restricted to a single BMU, whereas no-quota hunters can hunt anywhere within that zone. In 2016, BMU 26 was divided into 27 and 28, and BMU 44 was split into 46 and 47 (BMUs 28 and 47 comprise the Leech Lake Reservation).

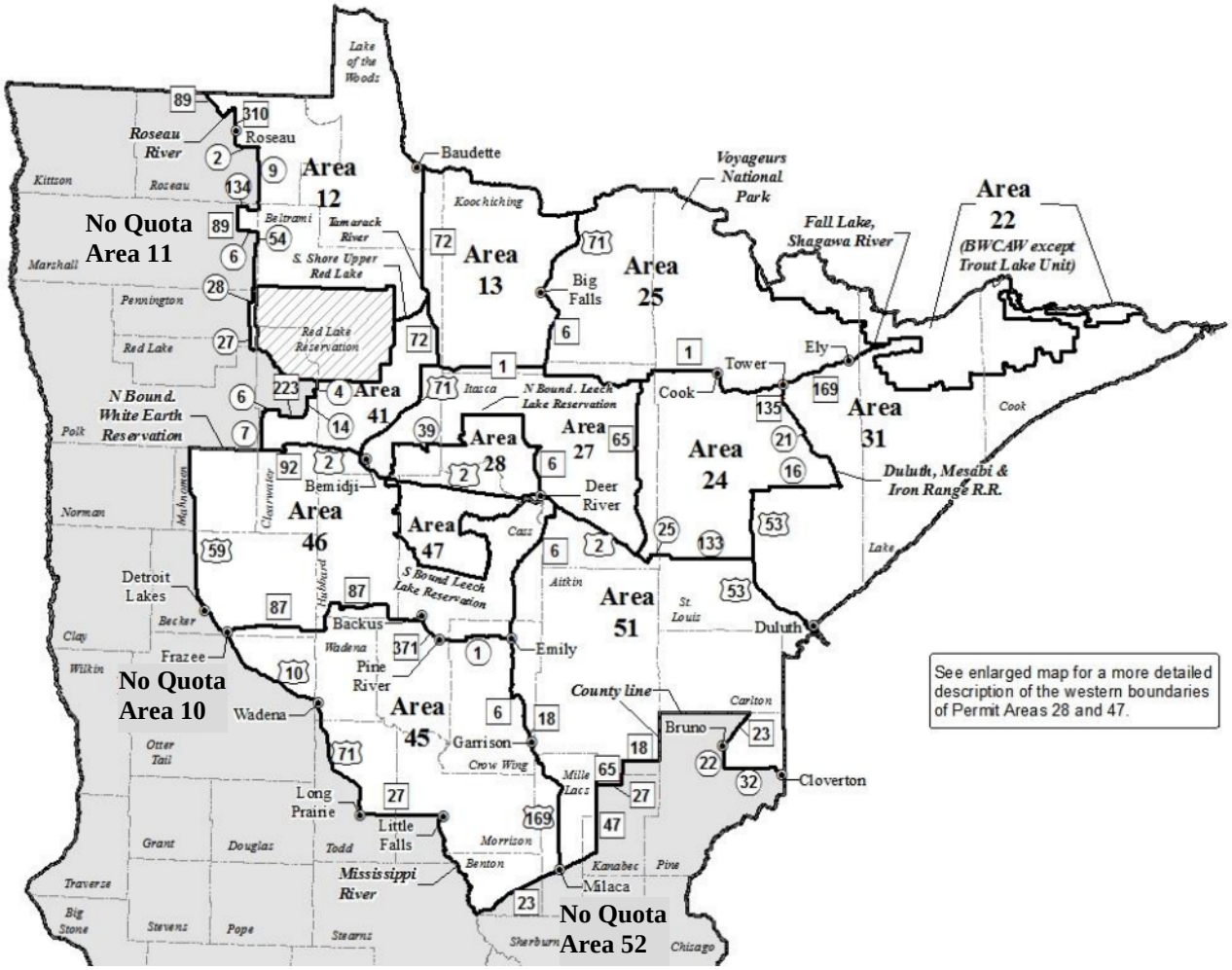

Table 2. Number of bear hunting quota area permits available, 2011–2016. Highlighted values show a change from the previous year. BMUs 26 and 44 were divided into 27/28 and 46/47, respectively, in 2016.

BMU	2011		2012	2013	2014	2015	2016	
	Before reduction	After reduction[a]					Before BMU split [b]	After BMU split
12	450	350	300	200	200	150	150	150
13	600	450	400	250	250	250	250	250
22	125	100	100	50	50	50	50	50
24	500	350	300	200	200	200	200	200
25	1200	900	850	500	500	500	500	500
26	900	650	550	350	350	350	325	
27								250
28								75
31	1300	1000	900	550	550	550	550	550
41	400	300	250	150	150	150	125	125
44	1100	850	700	450	450	450	450	
46								400
47								50
45	400	250	200	150	150	150	250	250
51	2500	1850	1450	900	900	900	1000	1000
Total	9475	7050	6000	3750	3750	3700	3850	3850

[a] Beginning in 2011, all licenses not purchased by permittees were sold (Table 3). In order not to increase the number of hunters, 2011 permit allocations were reduced by the mean percentage of licenses that were purchased in each BMU in 2009–2010. The table shows the permit allocation before and after this reduction. All subsequent allocations were based on the assumption that the quota would be filled (Table 3).

[b] 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, 2011–2016[a]. Shaded values indicate undersubscribed areas (applications < permits available).

BMU	2011			2012			2013			2014			2015			2016		
	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	834	267	84	813	244	60	707	160	44	661	164	36	612	130	20	624	133	17
13	751	366	84	719	325	76	664	213	37	703	218	32	692	210	40	716	221	29
22	90	71	31	83	56	43	55	36	14	65	33	17	48	36	9[b]	52	37	13
24	918	294	56	888	253	47	763	170	30	875	174	26	771	171	29	884	173	27
25	1763	712	190	1625	713	137	1575	432	69	1533	424	76	1396	433	67	1443	440	60
26	1894	512	139	1666	458	92	1695	303	47	1696	298	52	1650	309	42			
27																1224	219	31
28																325	72	3
31	2505	826	174	2406	758	146	2261	478	72	2257	468	82	2021	488	62	2180	489	62
41	688	253	47	592	208	42	575	135	15	561	129	21	570	129	21	618	114	11
44	3010	697	154	2619	612	88	2682	386	65	2751	393	57	2626	402	48			
46																2690	370	30
47																194	45	5
45	1019	208	42	1135	170	30	1205	141	9	1403	127	23	1703	139	11	2046	227	23
51	4086	1478	372	3650	1154	296	3796	734	166	4003	748	152	3878	810	90	4321	880	121
Total[c]	17558	5684	1373	16196	4951	1057	15978	3188	568	16508	3176	574	15967	3257	439	17317	3420	432

[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).

Table 4. Percentage of quota BMU lottery applicants with preference level 1 (1st-year applicants), 2, 3, and 4 who were drawn for a bear permit, 2011–2016. Blank spaces signify 100% of applicants 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].

	2011		2012		2013			2014			2015				2016			
BMU	Pref 1	Pref 2	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
12	2		0	80	0	49		0	40		0	17			0	0	98	
13	51		33		4			0	72		0	56			0	38	100	
22	100		100		89			72			100				98	100		
24	14		0	75	0	41		0	13		0	2			0	0	86	
25	35		28		0	81		0	57		0	44			0	42	100	
26[b]	0	77	0	49	0	7		0	0	80	0	0	51					
27															0	0	30	
28															0	0	0	99
31	11		0	84	0	45		0	15		0	0	87		0	0	75	
41	6		0	86	0	43		0	19		0	0	99		0	0	77	
44[b]	0	55	0	28	0	0	68	0	0	41	0	0	18					
46															0	0	0	85
47															0	0	10	
45	0	67	0	29	0	0	75	0	0	30	0	0	0	81	0	0	0	63
51	25		1		0	53		0	22		0	0	89		0	0	72	

[a] As an example: In BMU 12: in 2011, 2% of preference level 1 applicants were drawn and 100% of preference 2 applicants were drawn for a permit; by 2016, no preference 1 or 2 applicants were drawn, 98% of preference 3 and 100% of preference 4 (and above) were drawn. In BMU 45: in 2016, no preference 1–3 applicants were drawn, 63% of preference 3 were drawn, and 100% of 4 (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 2016 by Bear Management Unit (BMU)[a] and sex[b] compared to harvests during 2011–2015 and record high and low harvests (since establishment of each BMU).

	2016											
BMU	M	(%M)	F	Total	2015	2014	2013	2012	2011	5-year mean	Record low harvest (yr)	Record high harvest (yr)
Quota												
12	54	(69)	24	78	60	38[d]	62	82	106	70	38 (14)	263 (01)
13	94	(64)	53	147	72[e]	91	95	112	119	98	71 (88)	258 (95)
22	3	(60)	2	5	7	5	9	8	11	8	3 (03)	41 (89)
24	64	(67)	32	96	97	50[f]	76	108	122	91	50 (14)	288 (95)
25	186	(65)[m]	101	287	227	168[g]	197	254	317	233	149 (96)	584 (01)
26	[127]	(74)[m]	[44]	[171]	121	117[h]	121	238	167	153	117 (14)	513 (95)
27	98	(75)	33	131								
28	29	(73)	11	40								
31	201	(64)	111	312	307	221	197	363	358	289	157 (88)	697 (01)
41	25	(44)[n]	32	57	35[i]	36	40	70	54	47	35 (15)	201 (01)
44	[114]	(53)	[101]	[215]	158	170	181	188	130	165	130 (11)	643 (95)
46	100	(53)	90	190								
47	14	(56)	11	25								
45	51	(50)	51	102[p]	55	54	48	67	32	51	32 (11)	178 (01)
51	268	(58)	194	463[c]	302	291	349	471	288	340	247 (91)	895 (01)
Total	1187	(61)	745	1933[c]	1441	1241[j]	1375	1961	1704	1544	1192 (88)	4288 (01)
No-Quota[b]												
11	196	(67)	95	291	195	77[k]	136	224	219	170	38 (87)	351 (05)
10	9	(60)	6	15[q]	11	8	9	14	3	9		14 (12)
52	231	(57)	171	402	324	301	346	405	205	316	105 (02)	405 (12)
Total	436	(62)	272	708[q]	530	386	491	643	427	495	198 (87)	678 (95)
State	1623	(61)	1017	2641[c]	1971	1627[j]	1866	2604	2131	2040		4956 (95)

[a] Some tooth envelopes were received from hunters who did not register their bear. These were added to the harvest tally:
2011:13; 2012:7; 2013:6; 2014:3; 2015:6; 2016:7.
Some hunters with no-quota licenses hunted in the quota zone, and their kills were assigned to the BMU where they apparently hunted:
2011:14; 2012:8; 2013:11; 2014:4; 2015:12; 2016:9.
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 because normally only ~70% of tooth envelopes are submitted.

[c] Total includes 1 bear of unknown sex.

Notable harvests 2011–2015:
[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.

Notable harvests 2016:
[m] Record (or tie record) high % males.
[n] Second lowest % males (42% in 2014).
[p] Highest harvest since 2007.
[q] Record high harvest.

Fig. 3. Trends in statewide bear harvest and proportions of harvest in the no-quota zones, 1987–2016.

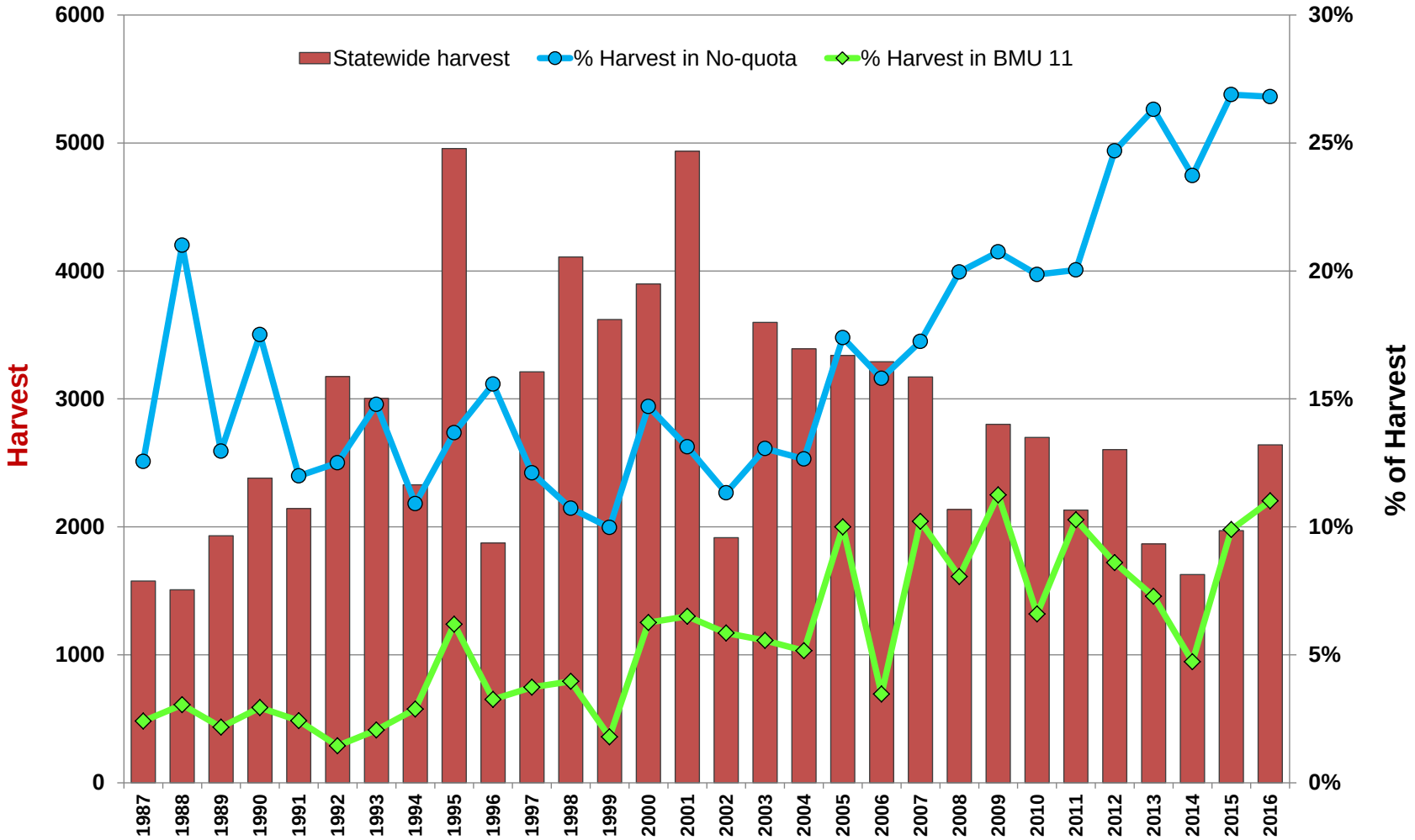

Table 6. Bear hunting success (%) by BMU, measured as the registered harvest divided by the number of licenses sold[a], 2011–2016.

BMU	Max success (yr) prior to 2016		Mean success 2011–2015	2016	2015	2014	2013	2012	2011
12	49	(95)	29	52[b]	40	19[d]	30	27	30
13	59	(95)	31	59[b]	29	36	38[c]	28	26
22	21	(92)	12	10	13	10	18[c]	8	11
24	45	(92)	36	48[b]	48[b]	25	38	36	35
25	47	(92)	36	57[b]	45	34	39	30	35
26	59	(95)	34	52[c]	34	33	34	43	26
27				52					
28				53					
31	55	(92)	42	56[b]	56[b]	40	36	40	36
41	50	(95)	24	46[c]	23	24	26	28	18
44	43	(95)	31	48[b]	35	38	40	27	15[f]
46				47					
47				50					
45	36	(14,15)	30	40[b]	36[c]	36[c]	32	33	13
51	39	(13)	31	46[b]	33	32	39[c]	32	16
Quota	42	(95)	33	50[b]	39	33	37	33	24
11[e]				28	20	9	15		
10[e]				9	7	7	12		
52[e]				19	15	16	19		
No Quota	32	(95)	16	21	16	13	17	20	15[f]
Statewide	40	(95)	26	37	28	25	28	28	22

[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] Tied record lowest success.

[e] 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) but so far none have killed a bear there. Table shows % indicating where they planned to hunt:

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

Table 7. Cumulative bear harvest (% of total harvest) by date, 1996–2016.

Year	Day of week for opener	Aug 22/23 – Aug 31	Sep 1 – Sep 7	Sep 1 – Sep 14	Sep 1 – Sep 30
1996	Sun		56[a]	70	87
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

[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 people participating in nuisance bear survey, 1996–2016.

	Apr	May	Jun	Jul	Aug	Sep	Oct
1996	71	83	84	77	75	67	54
1997	61	69	69	64	62	60	43
1998	34	67	71	63	55	41	33
1999	52	52	40	47	44	39	16
2000	60	58	50	54	42	37	33
2001 [a]	52	54	50	49	42	32	21
2002	50	44	43	46	35	29	19
2003	36	39	34	29	27	25	14
2004	28	33	34	32	32	24	13
2005	35	36	42	36	35	26	20
2006	28	39	46	43	30	29	24
2007	46	41	39	35	40	31	21
2008	31	35	37	33	23	20	17
2009	44	51	41	40	39	35	28
2010	36	40	33	27	28	23	16
2011	30	34	29	31	29	27	21
2012	56	52	47	40	38	32	23
2013	63	56	62	49	42	42	32
2014	48	64	58	50	48	36	25
2015	61	58	53	50	43	39	24
2016	51	53	55	55	50	36	26

[a] Electronic submission of monthly complaint tally beginning in 2001.

Table 9. Number of nuisance bear complaints registered by Conservation Officers and Wildlife Managers during 1996–2016, including number of nuisance bears killed and translocated, and bears killed in vehicular collisions.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of personnel participating in survey [a]	84	69	71	52	60	54	50	39	34	42	46	46	37	51	40	34	56	63	64	61	55
Complaints examined on site	337	661	226	189	105	122	75	81	75	61	57	63	59	65	70	37 [h]	113	69	79	97	118
Complaints handled by phone [b]	959	2196	743	987	618	660	550	424	507	451	426	380	452	535	514	396 [h]	722	623	570	840	780
Total complaints received	1296	2857	969	1176	723	782	625	505	582	512	483	443	511	600	584	433 [h]	835	692	649	937	898
• % Handled by phone	74%	77%	77%	84%	85%	84%	88%	84%	87%	88%	88%	86%	88%	89%	88%	91%	86%	90%	88%	90%	87%
Bears killed by:																					
• Private party or DNR	27	93	31	25	25	22	12	13	25	28	11	21	22	23	22	9 [h]	16	24	26	45	53
• Hunter before season [c]																					
– from nuisance survey	6	32	23	5	7	4	0	3	3	6	2	18	3	4	3	3	11	0	0	1	13
– from registration file	18	35	31	24	43	20	11	8	4	13	6	25	5	15	10	5	12	0	1	4	6
• Hunter during/after season [d]	0	4	3	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1
• Permittee [e]	4	7	11	7	2	6	4	6	1	5	4	5	1	3	5	0	0	1	0	3	0
Bears translocated	64	115	24	29	1	6	3	1	3	3	3	1	3	2	2	2	0	3	2	0	0
• % bears translocated [f]	19	17	11	15	1	5	4	1	4	5	5	2	5	3	3	5	0	4	3	0	0
Bears killed by cars [g]	42	52	61	60	39	43	26	25	16	22	18	20	27	18	28	15 [h]	33	32	28	33	27

Table 9 footnotes:

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[a] Maximum number of people turning in a nuisance bear report each month (from Table 7). Monthly reports were required beginning in 1984.

[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] 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.

[f] Percent of on-site investigations resulting in a bear being captured and translocated.

[g] 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 confiscation records.

[h] Lowest since record-keeping began (1981 for on-site complaints, nuisance bears killed and car-kills). However, participation in this survey may have affected the results.

Fig. 4. Trends in nuisance bear complaints, and nuisance bears killed and moved, 1981–2016, showing dramatic effect of change in nuisance bear policy, and increasing trend in recent years.

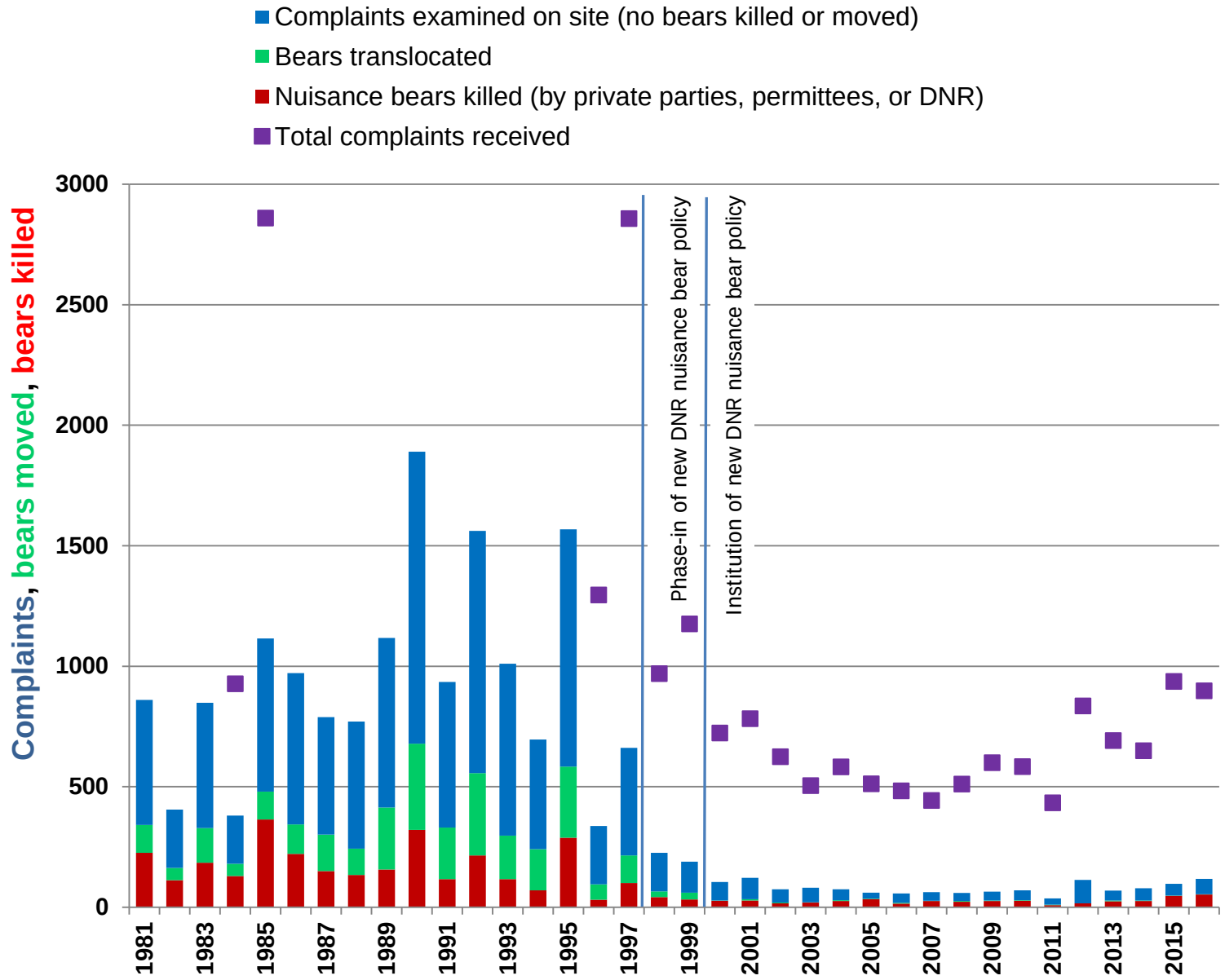
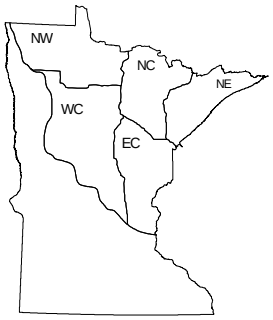


Table 10. Regional bear food indices[a] in Minnesota's bear range, 1984–2016. Shaded blocks indicate particularly low (<45; pink) or high (≥70; green) values.

Year	Survey Area					
	NW	NC	NE	WC	EC	Entire Range
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	52.2	57.5	47.0	62.9	50.0	54.6
2016	75.1	60.3	73.8	53.7	57.0	60.7



[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 11. Regional mean index values[a] for bear food species in 2016 compared to the previous 32-year mean (1984-2015) 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).

	NW		NC		NE		WC		EC		Entire Range	
FRUIT	32-yr mean	2016 *n* = 11 [b]	32-yr mean	2016 *n* = 8	32-yr mean	2016 *n* =3	32-yr mean	2016 *n* = 11	32-yr mean	2016 *n* = 8	32-yr mean	2016 *n* =30 [c]
SUMMER												
Sarsaparilla	4.6	4.9	5.9	4.7	5.3	5.8	4.5	3.5	5.5	4.1	5.1	4.3
Pincherry	3.3	5.9	4.4	4.9	4.1	6.2	3.8	2.6	3.7	3.2	3.8	4.4
Chokecherry	5.7	9.3	5.4	6.6	4.5	6.0	5.4	6.0	4.6	5.1	5.3	7.0
Juneberry	5.2	9.4	5.4	4.7	4.9	6.2	3.7	3.0	4.0	3.4	4.4	5.3
Elderberry	1.6	0.5	3.0	1.2	3.6	3.9	3.1	1.5	3.2	1.2	2.9	1.4
Blueberry	5.2	8.3	5.4	6.3	5.0	7.0	3.7	2.2	3.7	4.2	4.5	4.8
Raspberry	6.6	6.4	8.1	6.5	8.1	7.8	7.1	7.1	7.0	7.9	7.3	6.7
Blackberry	1.3	0.7	2.4	1.1	1.2	1.0	3.4	4.4	4.4	3.3	2.9	1.9
FALL												
Wild Plum	2.2	3.1	1.8	1.3	1.0	3.5	2.6	2.7	2.4	1.9	2.1	2.2
HB Cranberry	5.2	6.5	4.4	5.9	3.8	6.0	3.7	4.8	3.7	5.0	4.0	5.7
Dogwood	6.0	6.5	5.7	5.4	5.0	4.7	5.9	6.3	5.9	6.6	5.7	6.0
Oak	3.5	2.6	3.0	2.7	1.8	4.0	5.8	2.2	5.7	3.1	4.3	2.4
Mountain Ash	1.6	2.7	2.6	2.3	4.6	5.6	1.6	0.3	2.4	2.5	2.5	1.2
Hazel	6.4	8.3	7.5	6.7	7.2	6.1	8.0	7.1	7.7	5.5	7.3	7.0
TOTAL	58.4	75.1	65.0	60.3	60.1	73.8	62.3	53.7	63.9	57.0	62.1	60.7

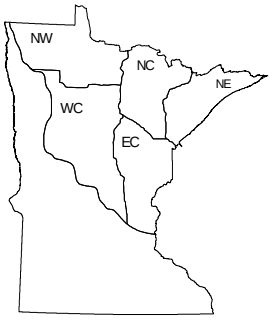
[a] Food abundance indices were calculated by multiplying species abundance ratings x fruit production ratings.

[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 12. Regional productivity index[a] for important fall foods (oak + hazel + dogwood) in Minnesota's bear range, 1984–2016. Shading indicates particularly low (≤ 5.0; yellow) or high (≥8.0; tan) values.

Year	Survey Area					
	NW	NC	NE	WC	EC	Entire Range
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	5.4	5.4	3.6[b]	7.6	4.0[b]	5.4
2016	5.7	5.3	6.0	5.4	5.3	5.3



[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 5. Map of fall bear foods (oak, hazel, and dogwood) across Minnesota, 2016.

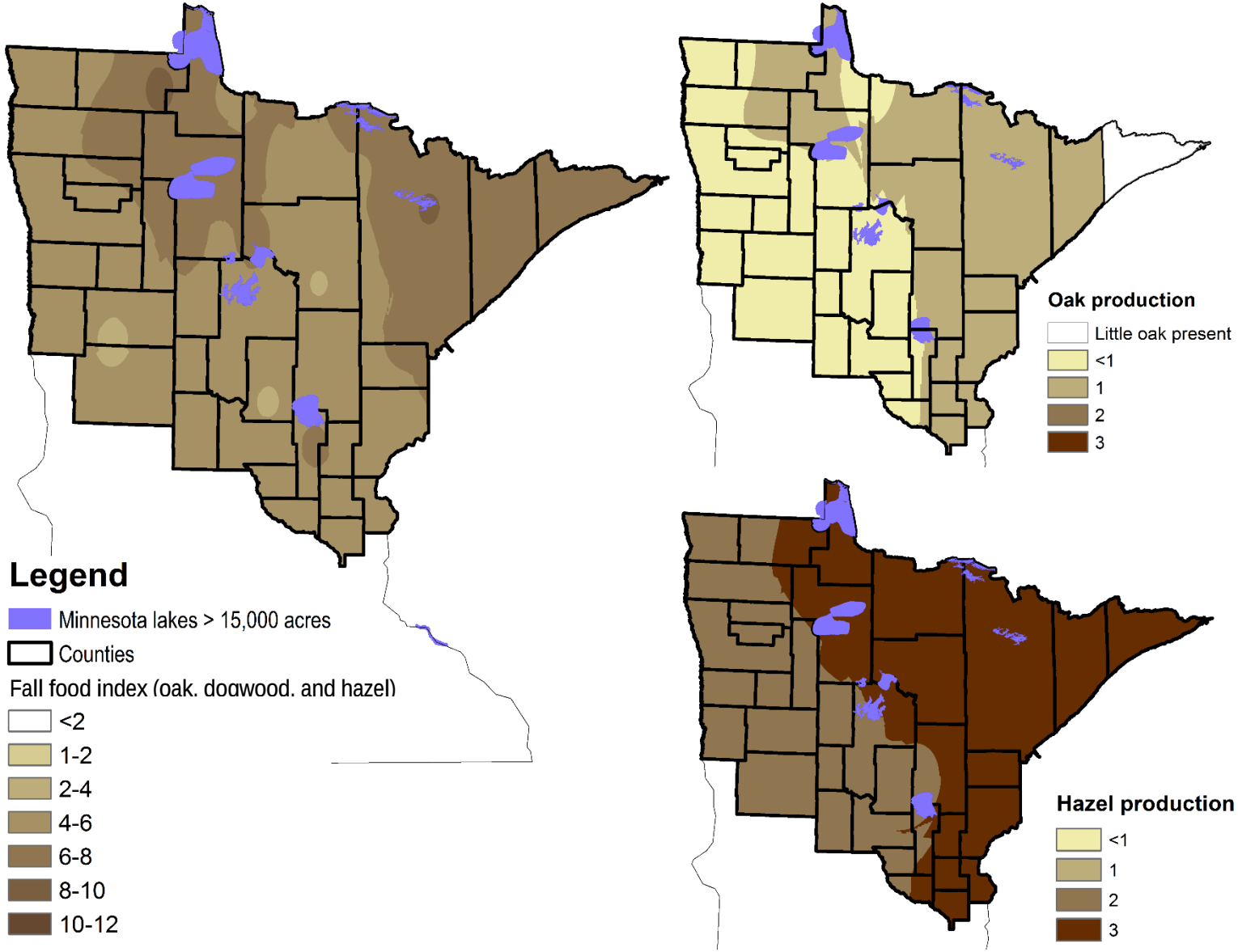
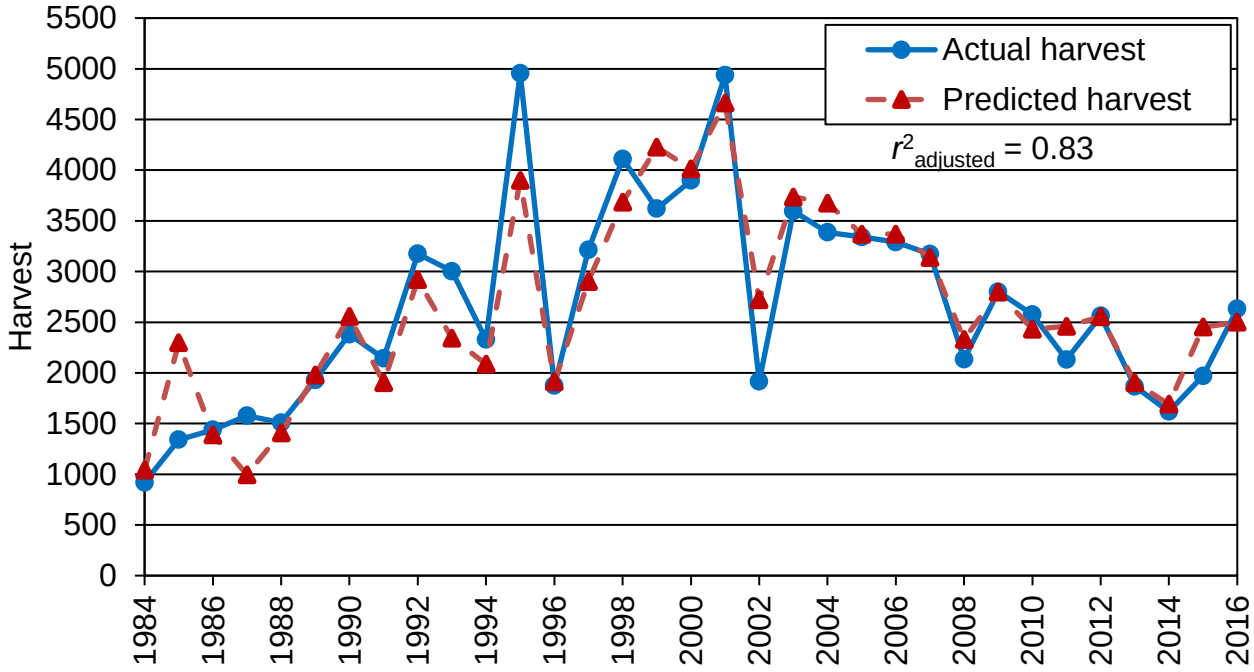


Fig. 6. Number of bears harvested vs. number predicted to be harvested based on fall food production and the number of hunters statewide: top: 1984–2016; bottom: 2002–2016.



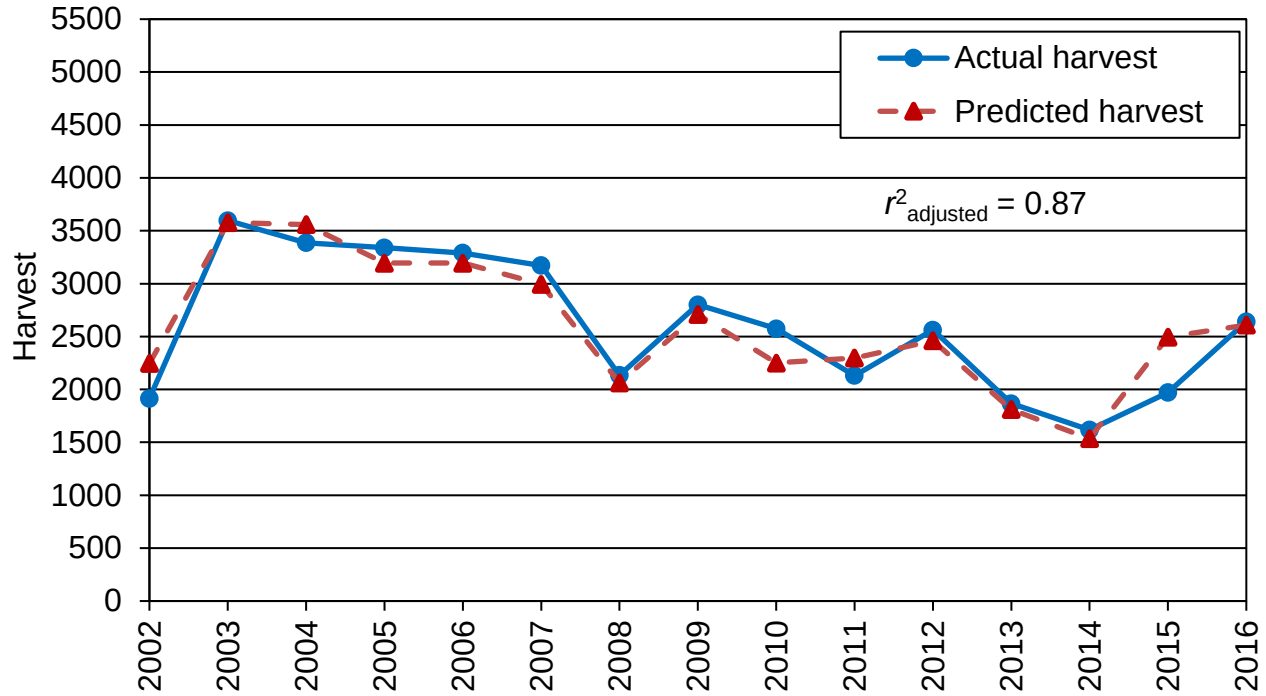
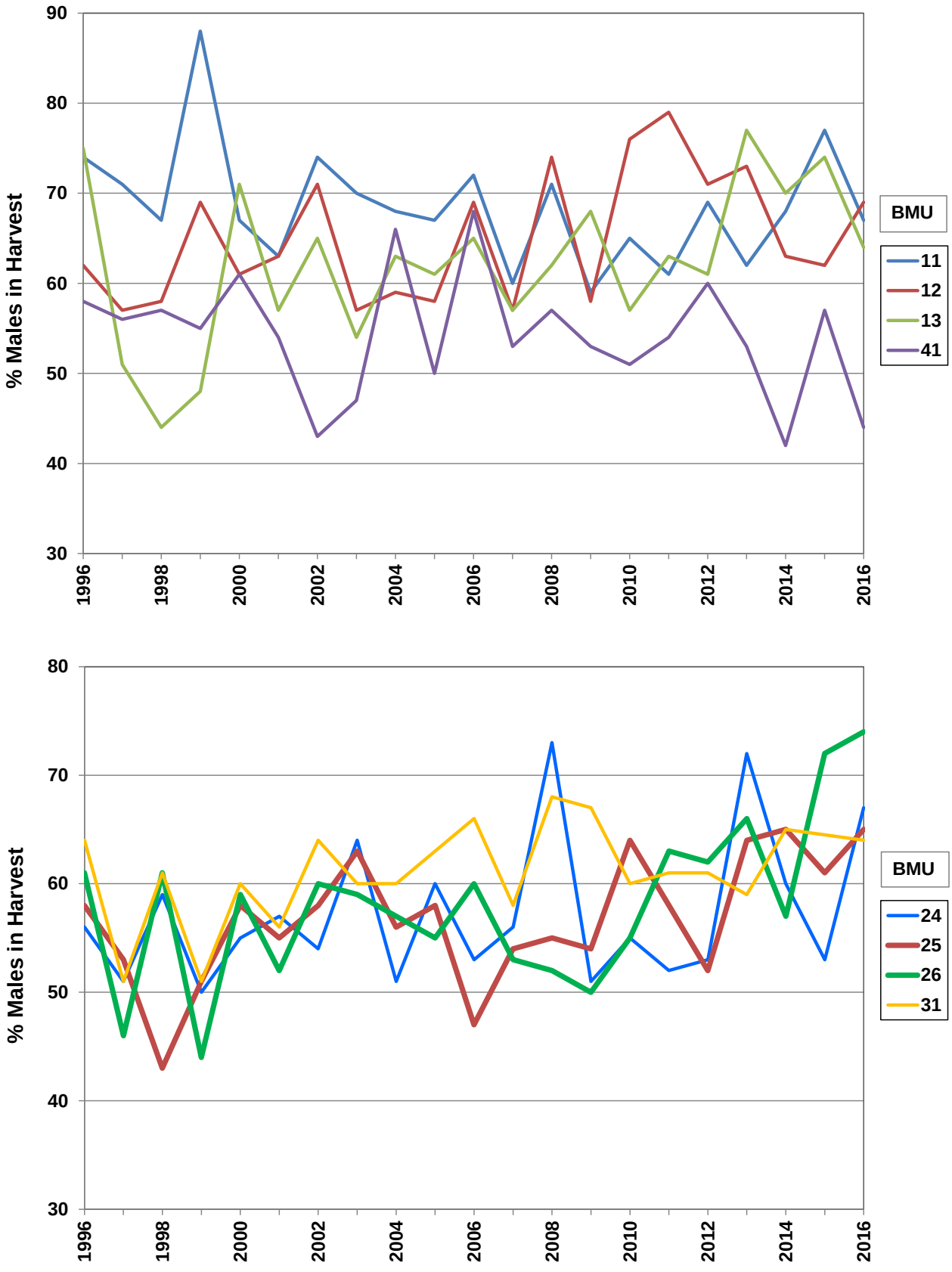


Fig 7. Sex ratios of harvested bears by BMU, 1996–2016. Thick lines show increasing trends.



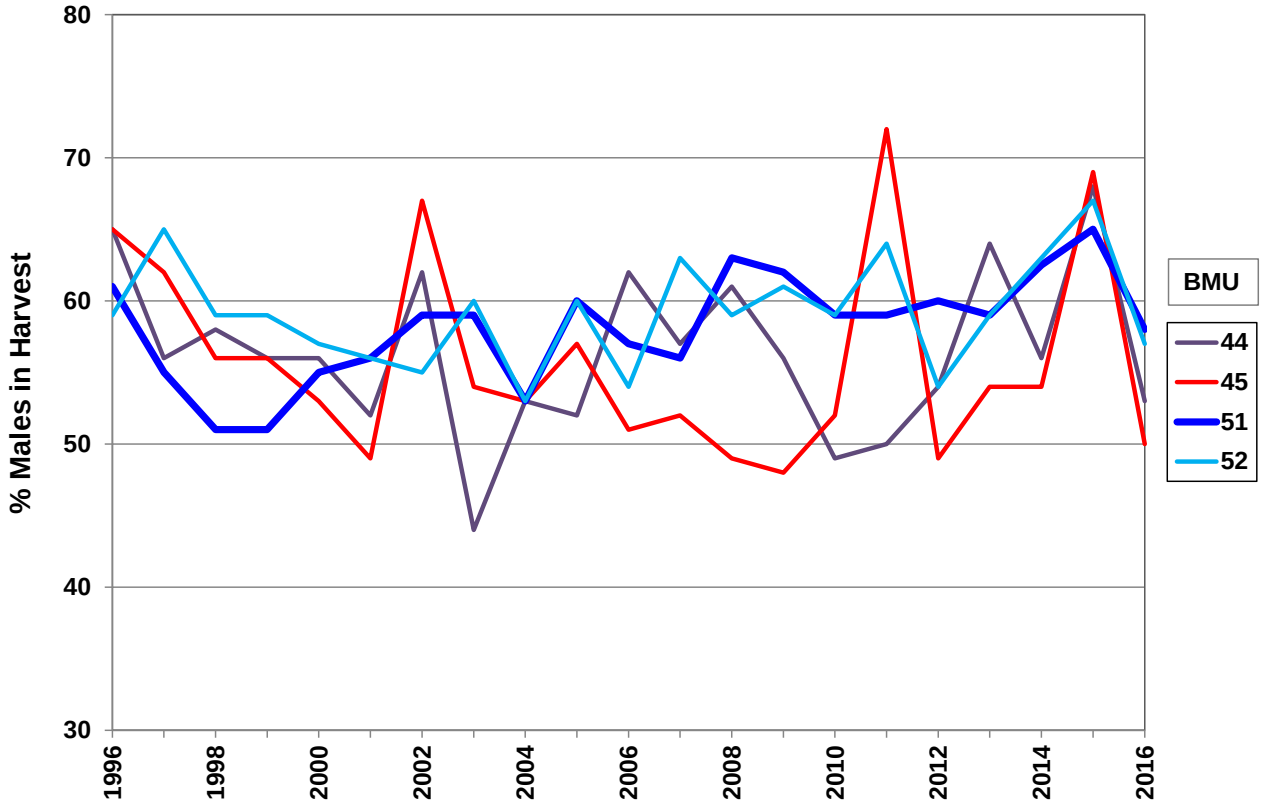
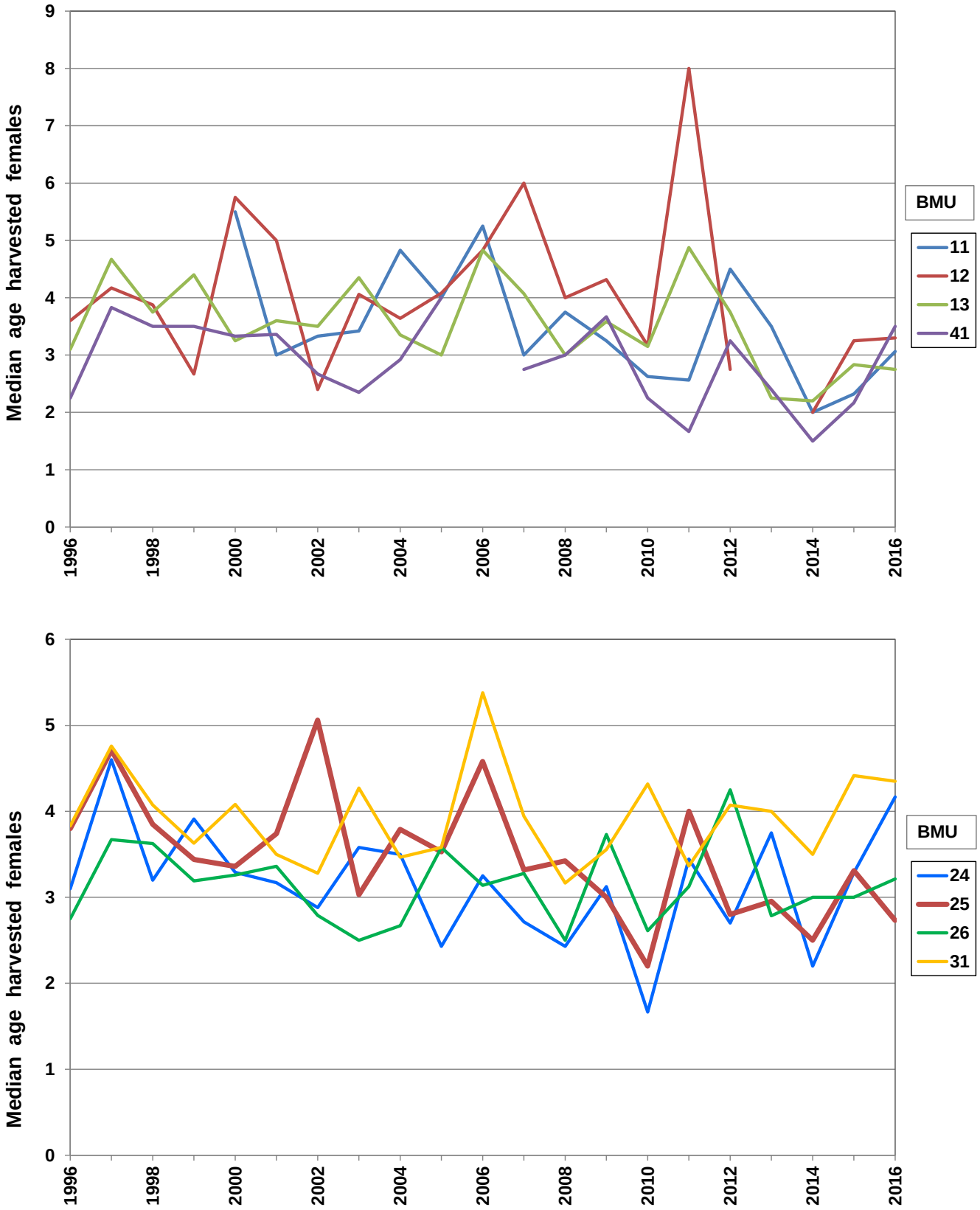

% Males in Harvest
80
70
60
50
40
30
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
BMU
44
45
51
52

Fig 8. Median ages of harvested female bears by BMU, 1996–2016. Thick lines show declining trends.



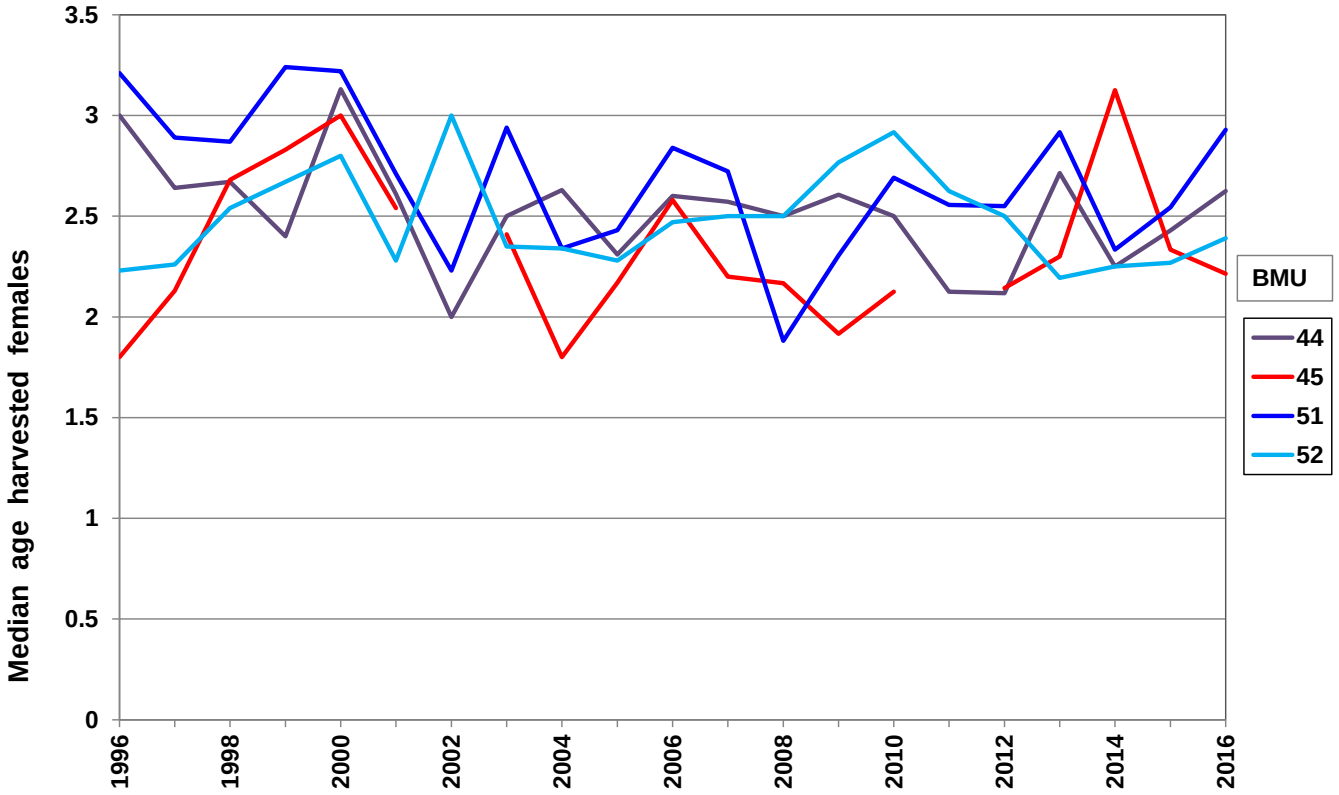

Median age harvested females
3.5
3
2.5
2
1.5
1
0.5
0
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
BMU
44
45
51
52

Fig. 9. Statewide median ages (yrs) of harvested bears by sex, 1982–2016.

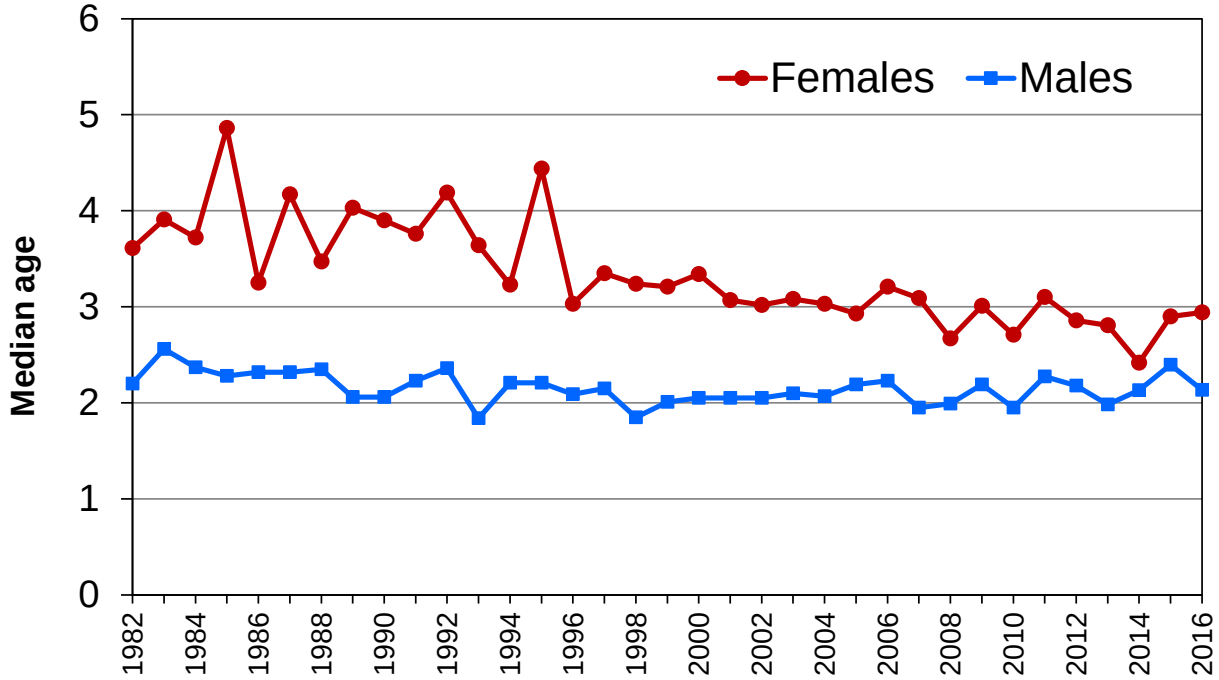


Fig. 10. Statewide harvest structure: proportion of each sex in age category, 1982–2016. Trend lines are significant.

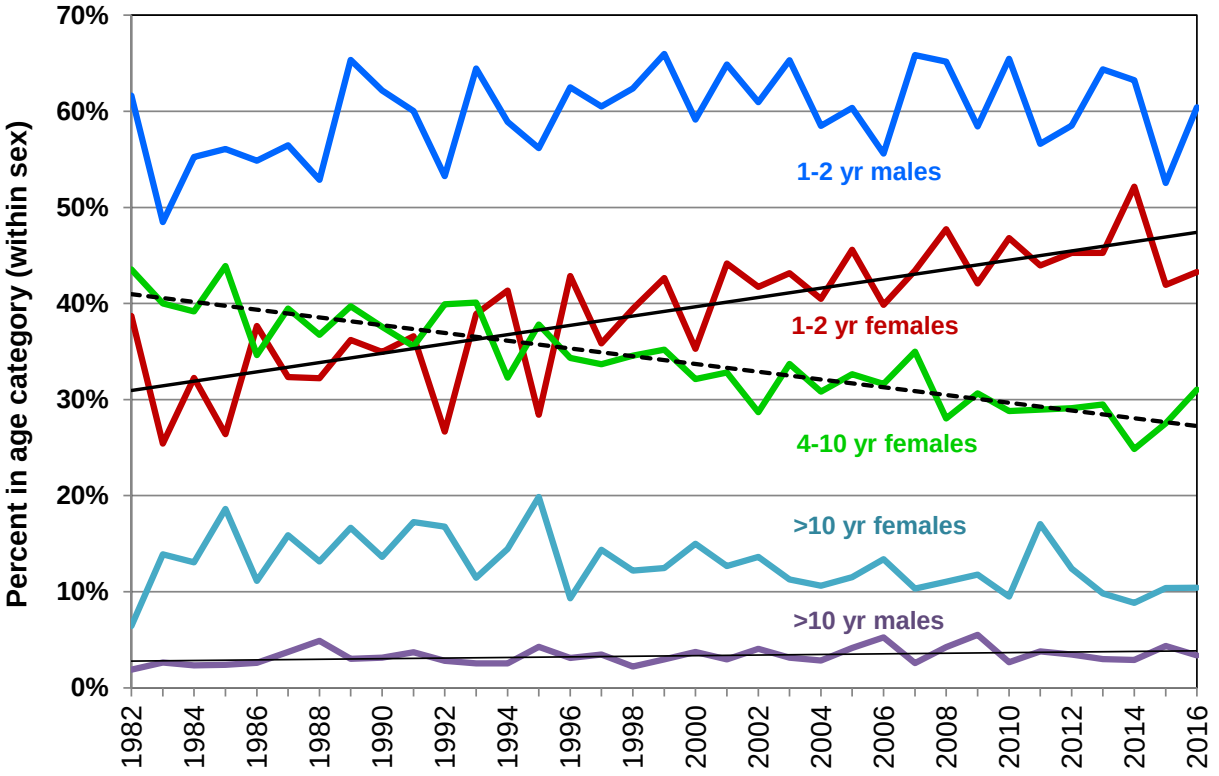


Fig. 11. Percent of hunters submitting useable bear teeth for aging (now vital for population monitoring, see Figs. 12–14). Cooperation levels exceeded 80% when registration stations were paid to extract teeth (this practice ended in 1993) and ~90% when non-compliant hunters were sent a reminder letter in December or January (2015 and 2016).

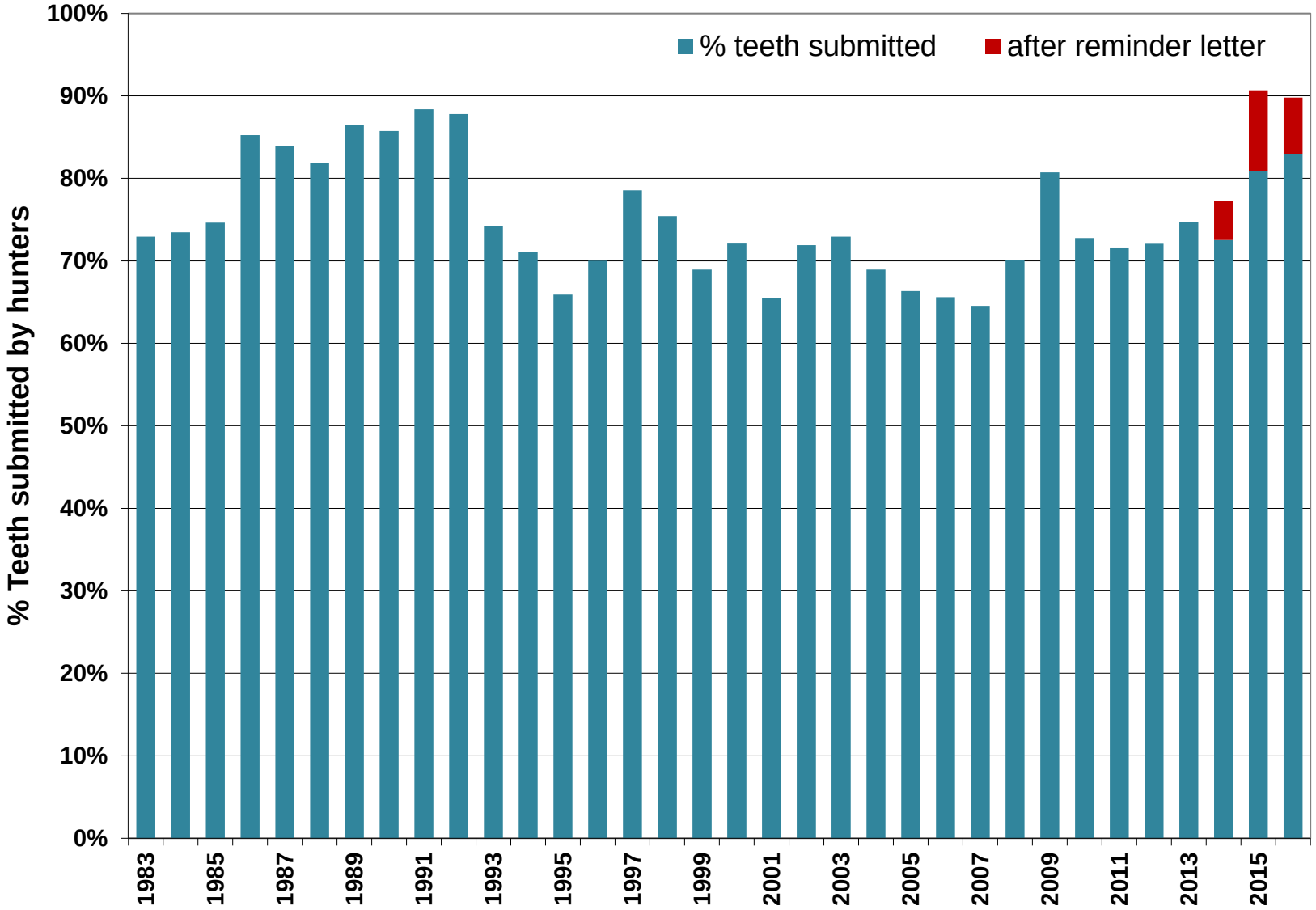
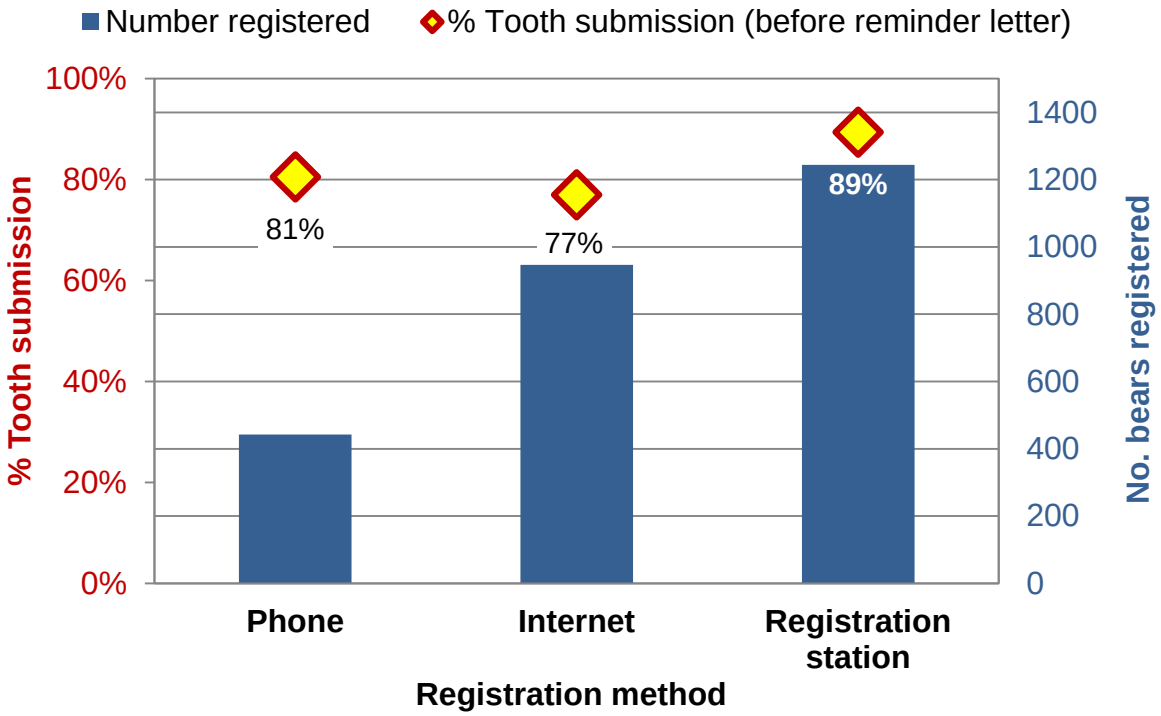


Fig. 12. Percent of hunters who submitted a bear tooth in 2016 by method of registration (top panel) and by BMU (bottom panel; before and after reminder letter). Beginning in 2013, hunters could register their bear by phone or internet.



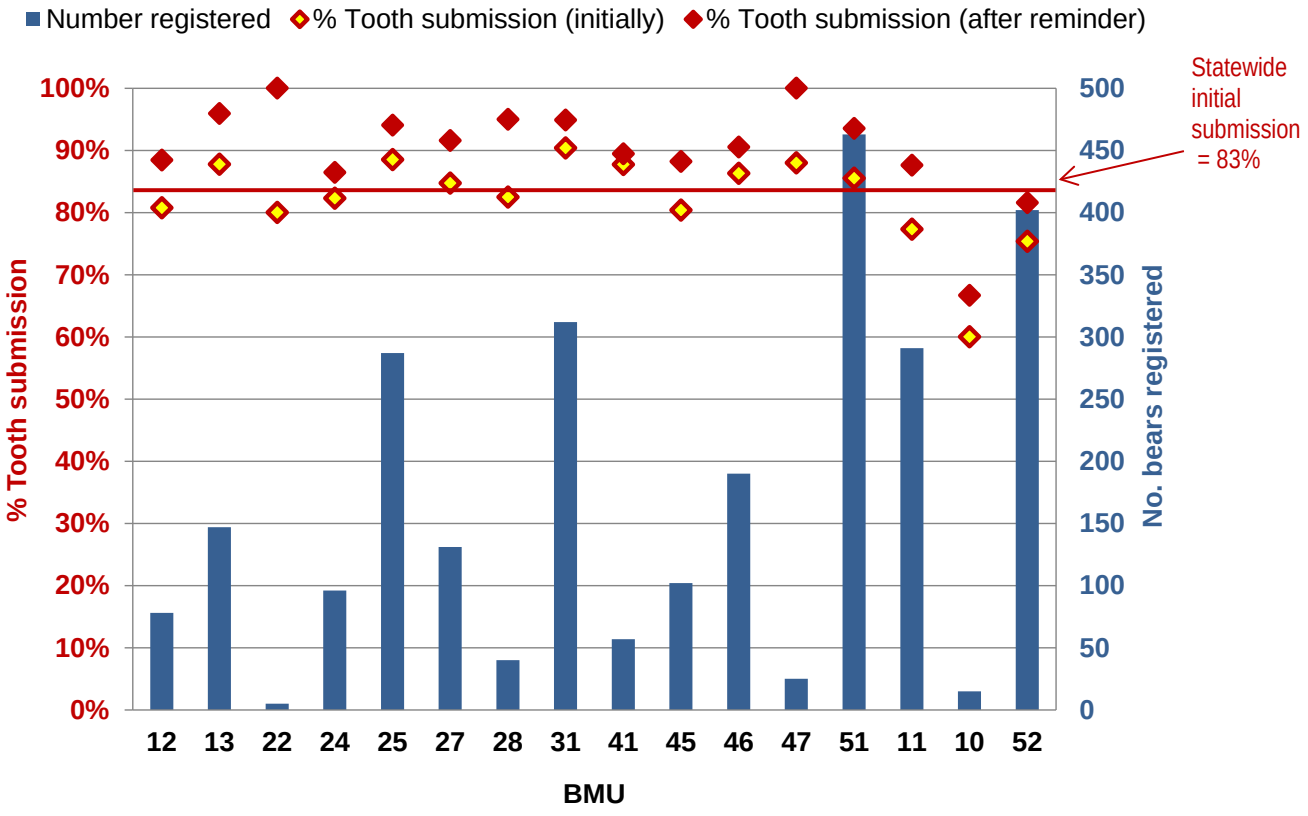


Fig. 13. Statewide bear population trend (pre-hunt) derived from Downing reconstruction using the harvest age structures. Curves were scaled (elevated to account for non-harvest mortality) to various degrees to attempt to match the tetracycline-based mark–recapture estimates. Estimates beyond 2014 are unreliable.

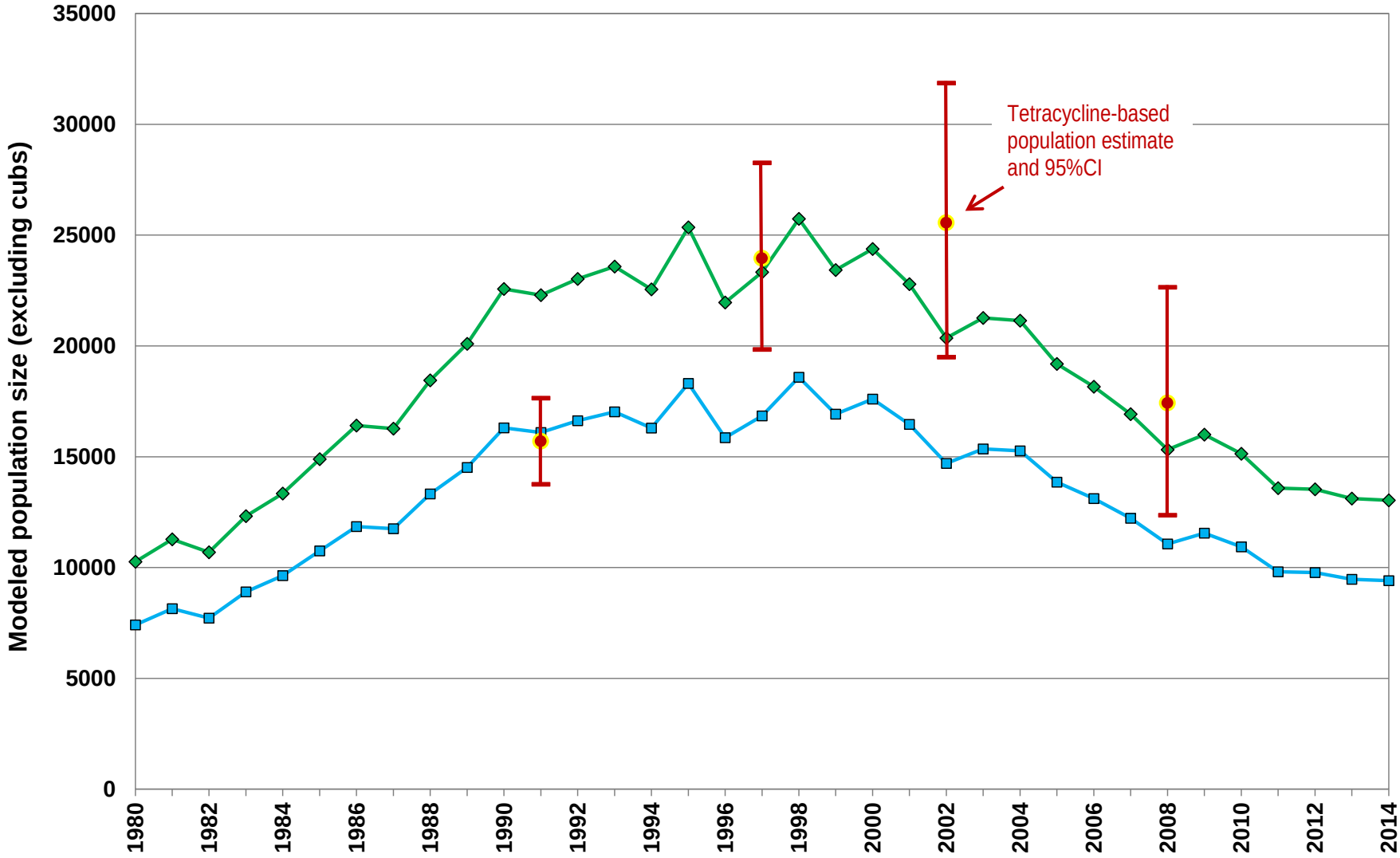


Fig. 14. Population trends during 2000s derived from Downing reconstruction for quota and no-quota zones compared to respective harvests. Population curves were scaled (elevated to account for non-harvest mortality) using a multiplier midway between the two curves in Fig. 13 (i.e., the actual scale of the population estimates is not empirically-based).

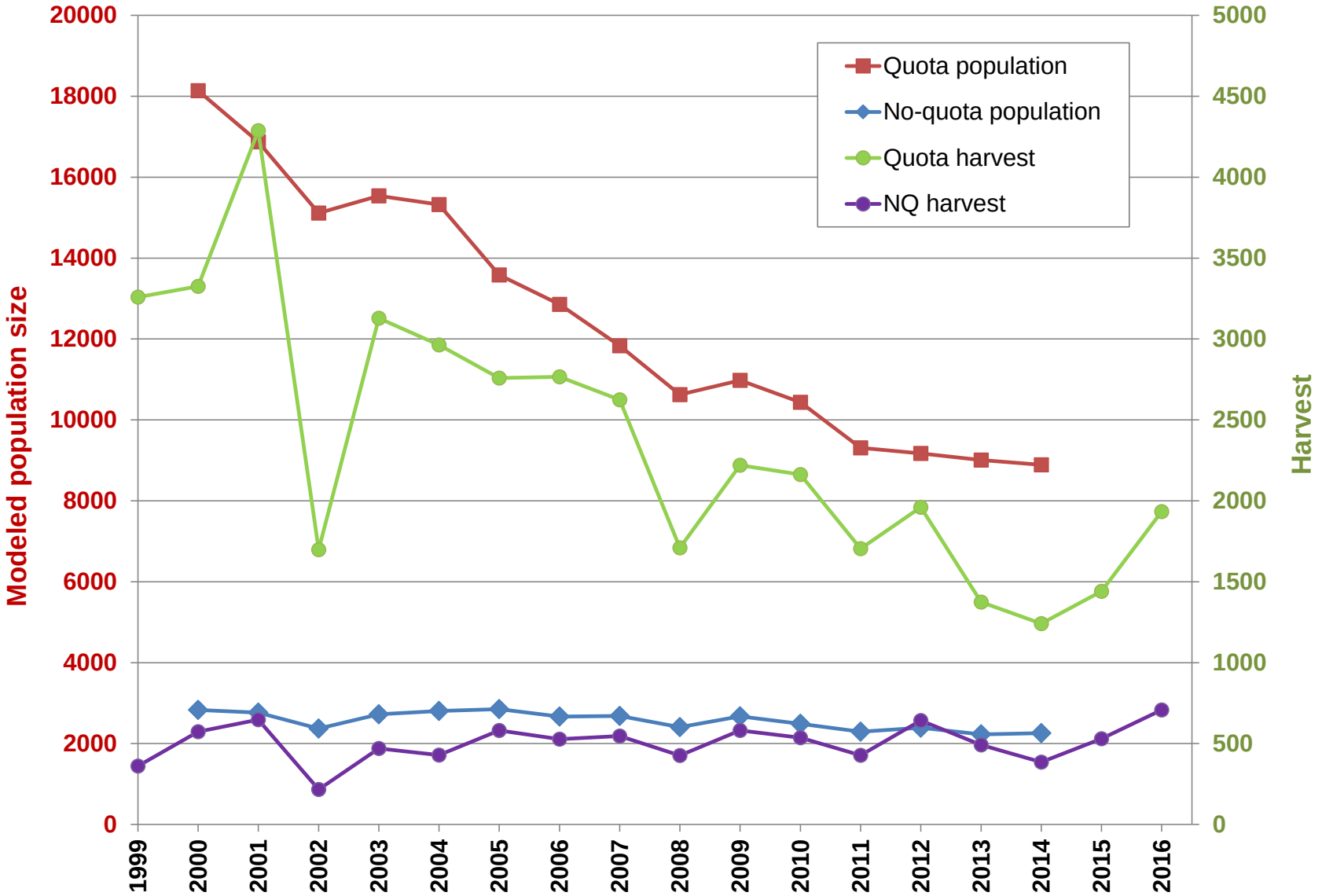


Fig. 15. Trends in proportion of male bears in statewide harvest at each age, 1–10 years, grouped in 5-year time blocks, 1980–2016 (last interval is 7 years). Higher harvest rates result in steeper curves because males are reduced faster than females. Fitting a line to the data for each time block and predicting the age at which 50% of the harvest is male (dashed yellow line) yields approximately the inverse of the harvest rate (derived rates are shown in inset).