STATUS OF MINNESOTA BLACK BEARS, 2008

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.

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Key points: 2008 bear harvest, nuisance activity, foods & population status

Table 1	Permit applications increased to the highest level in 6 years. This may have been in response to the diminished number of permits available, which was the lowest since 1998. The estimated number of hunters in the field (9,800) was the lowest since 1995. Harvest (2,135) was down by more than a thousand bears from the mean of the past 5 years (3,350). Harvest sex ratio was very skewed toward males (62%); the last time the harvest sex ratio was that skewed was 1996.
Fig. 1, Tables 2-3	Permits were reduced in 2008 in 9 of 11 BMUs in the Quota Zone, to reduce harvest pressure. Due to this reduction, only 2 of 11 BMUs were undersubscribed, and most surplus licenses were purchased (except BMU 22, BWCAW).
Table 4	Harvest in every BMU was below the previous 5-year mean. Harvest was particularly low (lowest since 1996) in BMUs 24, 25, 26 and 31 (northeast and north-central areas). The sex ratio was exceptionally skewed toward males in BMUs 12, 24, 31 and 51 (compared to historical records in these areas).
Table 5	Statewide hunting success was the lowest since 2002. In all BMUs except one (BMU 41), hunting success was below the previous 5-year mean.
Table 6	Harvest was low in the beginning of the season, with less than 60% of the total taken in the first week. This is often a reflection of abundant natural foods, making bears less apt to come to bait.
Tables 7-8	The number of wildlife and enforcement personnel submitting bear nuisance tally forms each month was rather low, probably a reflection of the generally low nuisance activity . The number of on-site investigation (59) was typical of the previous 3 years, as was the number of complaints dealt with by phone (452; 88% were handled by phone). Across the state, 23 nuisance bears were reported killed by private parties, DNR, and permittees, and 3 were captured and moved.
Tables 9-11 & Fig. 2	Overall, natural food abundance was above normal in the north-central, and east-central portions of the state. Most summer foods were abundant across the bear range. Oak, dogwood and hazel, the three key fall foods, were all above normal in certain areas, and many summer fruits were still available in the early fall, when the hunting season began. However, overall fall food ratings were considerably higher than normal only for the east-central portion of the range (particularly high in no-quota area, BMU 52).

Fig. 3	A combination of two key factors, fall food abundance and number of hunters, accounts for 82% of the yearly variation in the female harvest. In each of the past 7 years, however, the regression based on these 2 variables predicted a higher harvest than actually occurred.
Fig. 4	Sex ratios of harvested bears reflect both the sex ratio of the living population as well as the relative vulnerability of the sexes to hunters (which varies with natural food conditions). The statewide harvest sex ratio was exceptionally male-dominated, and several BMUs (12, 24, 31, 51) had unusually high proportions of males in the harvest.
Fig. 5-6	Ages of harvested bears of both sexes steadily declined for about 2 decades (decline in median age and increase in proportion of 1-2 year olds in the harvest), reflecting increasingly higher harvest levels over this period. The proportion of old bears (>10 years) in the harvest has remained relatively constant over this period, suggesting that some animals (due to their behavior pr location) can avoid being hunted for a number of years.
Tables 12-14	Tetracycline biomarking baits set in the summer of 2008 were used to mark bears for a mark-recapture estimate. Baits were set throughout the bear range, and housed in wooden boxes. The boxes prevented visits by other animals, but also deterred visits by bears, due to reduced scent emanation: 489 of 3540 baits were eaten by bears, yielding ~480 marked bears (accounting for bears that took 2 baits). Ribs and teeth were collected from 71% of harvested bears and inspected for tetracycline marks; 57 (3.8%) of these were marked. The proportion of samples that were marked was very similar to that in 2002, the last time marking was done, but the number marked was much lower in 2008, so the resulting population estimate (=no. marked/proportion marked) was also much (~ 5,000 bears) lower. However, a final population estimate will not be available until a second sample of ribs and teeth can be obtained, because the first year's collection always yields an underestimate.
Fig. 7	BMUs in the northwest (11, 12, 13) showed little change, or a slight increase (BMU 11) in numbers of bears from 1997 to 2008. North-central BMUs (24, 25, 26) showed large swings in estimated numbers, apparently due to movements of marked bears (generally southward in fall) through this area – as a group, though, bear numbers in this area have declined. Significant declines were also observed in BMUs 44, 45, 51 and 52.

Table 1. Bear permits, licenses, hunters, harvests, and success rates, 1987–2008.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Permit applications	19687	25879	24096	24861	25890	26428	27365	30127	29922	30405	27353	30245	29384	29275	26824	21886	16431	16466	16153	15725	16345	17362[a]
Permits available	4810	5310	5520	6370	7140	7920	8630	9400	11950	12030	11370	18210	20840	20710	20710	20610	20110	16450	15950	14850	13200	11850
Licenses purchased (total)	6054	5643	5901	7094	7757	8485	9224	9826	12448	12414	11440	16737	18355	19304	16510	14639	14409	13669	13199	13164	11936	10404
Quota area [b]	4213	4297	4628	5568	6257	6845	7528	8125	10304	10592	9655	14941	16563	17021	13632	12350	9833	10063	9340	9169	8905	7842
Quota surplus/military [b]															235	209	2554	1356	1591	1561	526	233
No-quota area [b]	1841	1346	1273	1526	1500	1640	1696	1701	2144	1822	1785	1796	1792	2283	2643	2080	2022	2238	2268	2434	2505	2329
% Licenses bought [c]																						
Of permits available [c]	87.6	80.9	83.8	87.4	87.6	86.4	87.2	86.4	86.2	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
Of permits issued [c]												84.4	87.2	83.9	69.8	66.3	65.7	68.3	67.1	68.9	70.0	67.2
Estimated no. hunters [d]	5600	5100	5500	6600	7200	7900	8600	9100	11600	11500	10300	14500	15900	16800	15500	13700	13500	12800	12400	12400	11200	9800
Harvest	1577	1509	1930	2381	2143	3175	3003	2329	4956	1874	3212	4110	3620	3898	4936	1915	3598	3391	3340	3290	3172	2135
Harvest sex ratio (%M) [e]	60	58	57	52	59	50	56	62	47	62	55	55	53	58	56	61	58	57	59	58	57	62 f
Success rate (%) [g]																						
Total harvest/hunters	28	30	35	36	30	40	35	26	43	16	31	28	23	23	29	14	26	26	26	26	28	21
Quota harvest/licenses	33	28	36	35	30	41	34	26	42	15	29	25	20	20	28	14	25	26	25	25	28	21

[a] Includes 528 applicants for area 99, a designation to increase preference but not to obtain a license.

[b] Quota area established in 1982. No-quota area 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. Total licenses = quota + quota surplus + no-quota + military (no permit needed).

[c] Quota licenses bought (including surplus)/permits available, or licenses bought (prior to surplus)/permits issued (permits issued more relevant for years when some areas were undersubscribed; see Table 3). 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.

[d] 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%), and 2001(93.9%).

[e] 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.

[f] Record high percent males in harvest (equal only to 1992)

[g] Success rates in 2001–2008 were calculated as number of successful hunters/total hunters, rather than bears killed/total hunters, because hunters could take 2 bears. In 2008, 36 hunters took more than 1 bear (34 took 2 bears on NQ license, 1 hunter took 1 quota and 1 NQ bear, and 1 hunter took 1 quota and 2 NQ bears): thus, the 2135 bears were taken by 2098 different hunters, so success = 2098/9800 = 21%.

Fig. 1. 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.

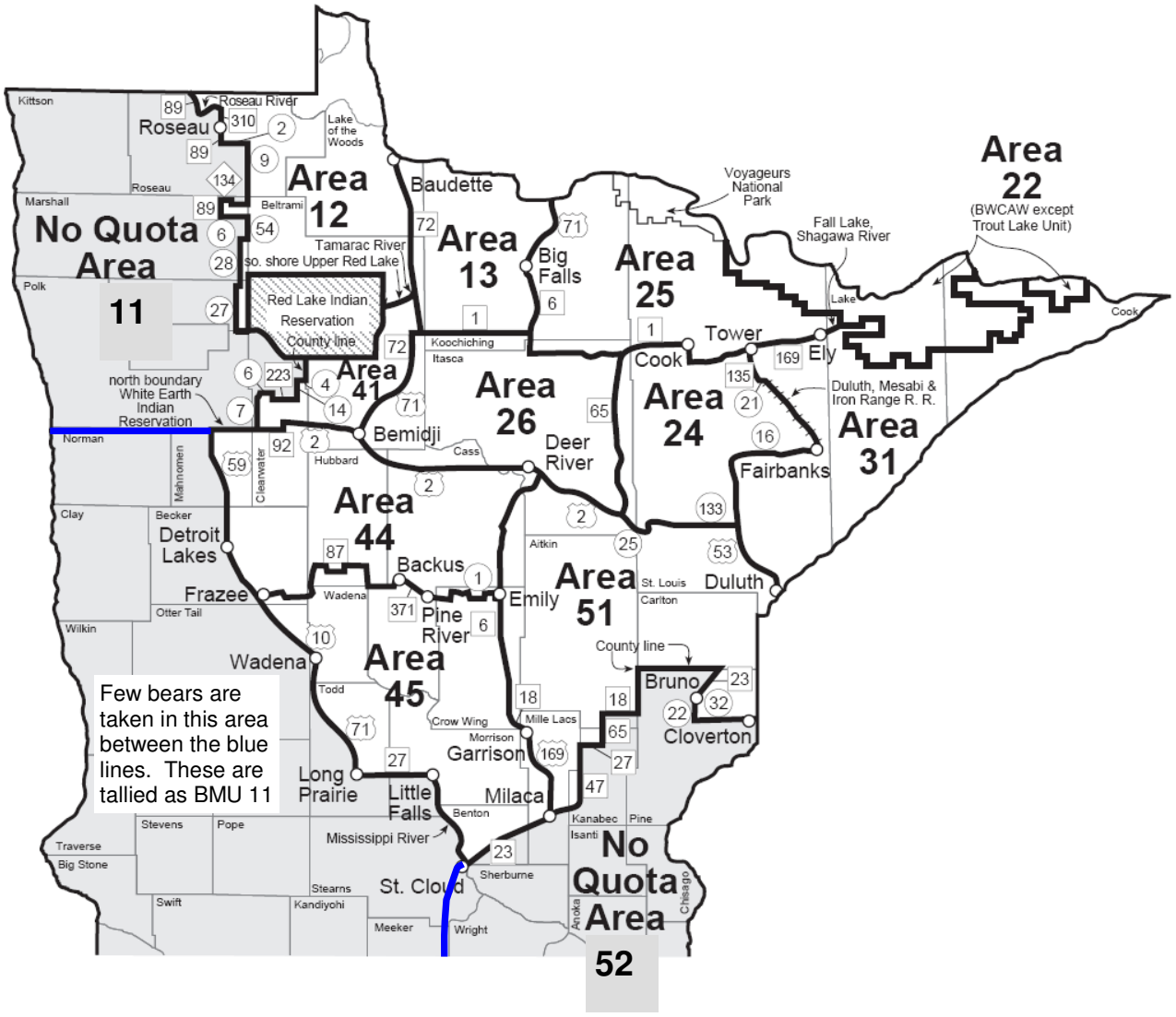

Table 2. Number of bear hunting permits available per year, 2004–2008 (aligned with permit applications in Table 3 below; highlighted numbers show drop from previous year).

BMU	2008	2007	2006	2005	2004
12	450	500	550	550	700
13	650	700	800	900	900
22	150	150	150	150	150
24	750	900	1000	1200	1200
25	1550	1700	1900	1900	1900
26	1150	1250	1500	1500	1500
31	1700	1900	2100	2100	2100
41	400	400	450	450	500
44	1350	1500	1700	1700	2000
45	1000	1200	1200	1500	1500
51	2700	3000	3500	4000	4000
Total	11850	13200	14850	15950	16450

Table 3. Number of bear hunting license applicants, and number and percent of available surplus licenses bought, 2004–2008[a].

BMU	2008		2007		2006		2005		2004	
	Apps	Surplus bought	Apps	Surplus bought	Apps	Surplus bought	Apps	Surplus bought	Apps	Surplus bought
12	857		811		1005		864		808	
13	709		745		680	120 100%	714	186 100%	670	129 56%
22	85	50 77%	87	51 81%	92	58 100%	65	46 54%	73	47 61%
24	825		742	159 100%	624	367 98%	749	270 60%	766	259 60%
25	1793	4[c]	1799		1789	112 100%	1923		1793	111 100%
26	1999	2[c]	2028		1915		1997		2110	
31	2388	3[c]	2383		2290		2097	4 100%	2006	92 100%
41	656		577		683		653		601	
44	2821		2669		2838		2884		2934	
45	873	128 100%	936	266 100%	840	360 100%	927	346 60%	1092	332 81%
51	3828		3568		2969	531 100%	3276	726 100%	3613	386 100%
Total	16834[b]	178 92%	16345	476 98%	15725	1548 ~100%	16149	1578 78%	16466	1356 78%

[a] Surplus licenses available beginning in 2001.
[b] Beginning in 2008, applicants could apply for area 99 in order to receive preference, but not buy a license; these are not included in this total (528 chose this option in 2008).
[C] Courtesy licenses issued by Commissioner, not actual surplus.

Undersubscribed

Table 4. Minnesota bear harvest tally[a] for 2008 by Bear Management Unit (BMU) and sex compared to harvests during 2003-2007 and record high harvests.

	2008											
BMU	M	(%M)	F	U	**Total**	**2007**	**2006**	**2005**	**2004**	**2003**	**5 year mean**	**Record high harvest** (yr)
Quota												
12	74	(74)[b]	26	1	101	124	70	165	165	174	140	263 (01)
13	80	(62)	49	0	129	163	151	205	197	185	180	258 (95)
22	5	(71)	2	0	7	15	15	8	10	3	10	41 (89)
24	73	(73)[b]	27	0	100[c]	134	194	144	212	163	169	288 (95)
25	165	(55)	133	0	298[c]	369	421	404	546	510	450	584 (01)
26	71	(52)	66	0	137[c]	315	314	285	320	303	307	513 (95)
31	168	(68)[b]	80	0	248[c]	398	482	445	484	436	449	697 (01)
41	44	(57)	33	0	77	104	40	104	83	100	86	201 (01)
44	119	(61)	77	0	196	333	192	273	283	444	305	643 (95)
45	35	(49)	37	0	72	113	118	107	118	143	120	178 (01)
51	217	(63)[b]	127	0	344	557	721	505	544	667	599	895 (01)
Total	1051	(62)	657	1	1709	2625	2718	2759[d]	2962	3128	2838	4288 (01)
No Quota[e]												
11	124	(71)	51	0	175	328[f]	120	335	177	200	232	351 (05)
52	148	(59)	103	0	251	219	400	223	252	270	273	400 (06)
Total	272	(64)	154	0	426	547	520	581[d]	429	470	509	678 (95)
State	1323	(62)	811	1	**2135**	3172	3290[d]	3340[d]	3391	3598	3358	4956 (95)

[a] Hunters receive tooth envelopes and registration stations. The following table shows the number of tooth envelopes that had no corresponding registration slip or e-registration. These were added to the harvest tally.

Year	Quota area	No-quota area
2003	84	13
2004	96	39
2005	179	31
2006	63	15
2007	27	9
2008	23	4

[b] Highest percent males ever recorded for BMUs 24, 31 and 51; second highest for BMU 12 (76% in 1992).

[c] Lowest harvest since 1996.

[d] The estimated registered harvest, including those in which registration data were lost and no tooth envelope was received. Value does not match column total because other data on table are uncorrected for estimated lost registration data.

[e] Some hunters with no-quota licenses hunted in the quota area, and their kills were assigned to the BMU where they apparently hunted (*n* = 28 in 2006, 27 in 2007, 14 in 2008). Some quota area hunters also apparently hunted in the wrong BMU, based on the block where they said they killed a bear. However, some of these blocks may have been read wrong from the map, so all these were recorded in the BMU where they were assigned, not the BMU of the indicated harvest block.

[f] Second highest harvest for this area. Third highest was 321 bears in 2001.

Table 5. Bear hunting success (%) by BMU, measured as the registered harvest (excluding second bear) divided by the number of licenses sold[a], 2003–2008.

BMU	Mean success 2003-2007	2008		2007		2006		2005[b]		2004		2003		2002
		% Success	% 2 bears[c]	% Success	% 2 bears[c]	% Success	% 2 bears[c]	% Success	% 2 bears[c]	% Success	% 2 bears[c]	% Success	% 2 bears[c]	% Success
Quota	26	21		28		25		25		26		25		14
12	33	32		36		19		41		33		35		22
13	30	28		31		24		32		33		31		19
22	11	8		14		14		10		11		4		8
24	23	20		20		25		20		27		25		15
25	33	28 [d]		31		30		30		38		34		23
26	32	17 [d]		36		30		34		31		29		17
31	30	21 [d]		28		33		31		33		25		17
41	26	27		35		13		31		23		29		14
44	23	21		30		16		24		20		26		9
45	13	11[d]		14		14		13		12		13		4
51	23	19		27		28		18		19		21		9
No Quota	21	17 [d]	(8)	19	(11)	22	(9)	23	(9)	18	(7)	21	(10)	10
Statewide	25	20		26		25		25		25		25		13

[a] Harvest/licenses instead of harvest/hunters because BMU-year-specific estimates for the rate of hunting by licensed hunters are unreliable. Statewide estimates of harvest/hunters are presented in Table 1.

[b] For 2005, estimated registered harvest was used instead of known registered harvest due to a large loss of registration data.

[c] Percent of successful hunters that shot 2 bears; 2nd bear is not included in the calculation of hunting success. The taking of 2 bears was legal only in the no-quota area in 2002–2008.

[d] Lowest success since 2002.

Table 6. Cumulative bear harvest (% of total harvest) by date, 1990–2008.

Year	Day of week for opener	Aug 22/23 – Aug 31 (9–10 days)	Sep 1 – Sep 7 (7 days)	Sep 8 – Sep 14 (7 days)	Sep 15 – Sep 30 (16 days)
1990	Sat		69	82	96
1991	Sun		64	76	93
1992	Tue		72	86	96
1993	Wed		67	80	94
1994	Thu		67	78	92
1995	Fri		72	87	97
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	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	92

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

Table 7. Number of people participating in nuisance bear survey, 1987 – 2008.

	Apr	May	Jun	Jul	Aug	Sep	Oct
1987	45	71	75	65	62	52	37
1988	68	74	77	75	73	68	69
1989	67	84	80	85	81	79	66
1990	75	79	80	81	78	74	70
1991	82	83	87	85	82	85	67
1992	74	79	81	85	83	74	62
1993	83	84	82	88	82	81	68
1994	77	88	82	86	83	68	61
1995	74	77	79	83	80	72	61
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

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

Table 8. Number of nuisance bear complaints registered by Conservation Officers and Wildlife Managers during 1986–2008, including number of nuisance bears killed and translocated, and bears killed in vehicular collisions.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of personnel participating in survey [a]	75	77	85	81	87	85	88	86	83	84	69	71	52	60	54	50	39	34	42	46	46	37
Complaints examined on site [b]	789	771	1117	1890	935	1562	1010	696	1568	337	661	226	189	105	122	75	81	75	61	57	63	59
Complaints handled by phone [c]										959	2196	743	987	618	660	550	424	507	451	426	380	452
Total complaints received										1296	2857	969	1176	723	782	625	505	582	512	483	443	511
• % Handled by phone										74%	77%	77%	84%	85%	84%	88%	84%	87%	88%	88%	86%	88%
Bears killed by:																						
• Private party or DNR	150	134	157	321	97	187	111	67	232	27	93	31	25	25	22	12	13	25	28	11	21	22
• Hunter before season [d]																						
– from nuisance survey	9	44	27	69	14	38	21	28	81	6	32	23	5	7	4	0	3	3	6	2	18	3
– from registration file	9	35	15	50	15	52	30	25	138	18	35	31	24	43	20	11	8	4	13	6	25	5
• Hunter during/after season [e]	6	11	15	21	16	19	8	3	13	0	4	3	0	1	1	0	0	0	1	0	0	0
• Permittee [f]					20	28	6	3	57	4	7	11	7	2	6	4	6	1	5	4	5	1
Bears translocated	152	109	257	358	214	342	180	171	295	64	115	24	29	1	6	3	1	3	3	3	1	3
• % bears translocated [g]	19	14	23	19	23	22	18	25	19	19	17	11	15	1	5	4	1	4	5	5	2	5
Bears killed by cars	75	46	69	74	50	90	54	40	68	42	52	61	60	39	43	26	25	16	22 [h]	18 [h]	20 [h]	27 [h]

Table 8 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] Adjusted for low and variable survey participation during 1981–86.

[c] Tallies of complaints handled by phone were made only during the indicated years.

[d] The discrepancy between the number recorded on the nuisance survey and the number registered before the opening of the season indicates incomplete data.

[e] Data only from nuisance survey because registration data do not indicate whether bear was a nuisance.

[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.

[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 confiscation records. Values shown for 2005-2008 are either from the forms or from the confiscation records, whichever was greater (they differed very little).

Table 9. Bear food index values for five survey areas (see map below) in northern Minnesota's bear range, 1984 – 2008. Pink-shaded blocks indicate particularly low index values (<45); green blocks indicate particularly high index values (≥70).

	Survey Area					
Year	NW	NC	NE	WC	EC	Entire Range[a]
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

[a] Values represent the sums of mean statewide index values for 14 species surveyed. Means were calculated using all surveys completed in the state, not by averaging values from the 5 food survey areas.

Fig 1. Boundaries of Minnesota's 5 bear food survey areas.

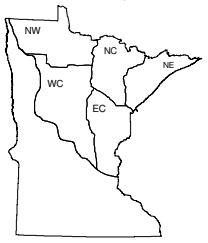

Table 10. Index values of bear food abundance[a] in 2008 compared to the previous 24-year mean (1984-2007) in 5 survey areas across Minnesota's bear range. Green-shaded blocks indicate high fruit abundance (≥1 point higher than average).

	NW		NC		NE		WC		EC		Entire Range	
FRUIT	24yr mean	2008 *n* = 10[b]	24yr mean	2008 *n* =16	24yr mean	2008 *n* = 12	24yr mean	2008 *n* = 17	24yr mean	2008 *n* = 10	24yr mean	2008 *n*=50[b]
SUMMER												
Sarsaparilla	4.0	5.6	5.7	6.8	5.3	5.2	4.4	5.4	5.0	6.1	4.8	5.6
Pincherry	3.0	2.4	4.3	4.4	4.0	5.1	3.9	3.9	3.5	2.9	3.7	3.6
Chokecherry	5.4	6.0	5.0	6.9	4.0	5.9	5.3	5.3	4.5	4.3	4.8	5.6
Juneberry	4.7	4.4	4.7	5.7	4.7	4.3	3.6	4.8	3.8	3.3	4.2	4.4
Elderberry	1.4	0.5	3.0	3.3	3.3	2.6	3.1	3.1	3.1	4.6	2.8	2.8
Blueberry	4.6	5.7	5.1	8.4	4.5	7.5	3.3	5.2	3.1	3.9	4.0	5.5
Raspberry	6.4	7.5	7.9	8.6	7.8	7.9	6.8	7.0	6.9	7.7	7.1	7.2
Blackberry	1.1	0.6	2.1	1.9	0.7	1.8	3.2	2.9	4.2	3.5	2.5	2.4
FALL												
Wild Plum	2.1	1.7	1.8	1.3	0.8	1.2	2.5	2.3	2.1	2.5	1.9	1.9
HB Cranberry	5.0	4.9	4.1	4.7	3.2	3.0	3.5	3.9	3.4	4.1	3.7	3.9
Dogwood	5.8	7.2	5.5	6.2	4.9	4.8	5.6	6.3	5.8	7.2	5.5	6.5
Oak	3.1	4.2	2.7	3.1	1.3	1.5	5.6	6.2	5.7	7.1	3.9	4.8
Mountain Ash	1.4	0.9	2.2	2.1	4.2	4.9	1.7	1.5	1.8	2.5	2.3	2.1
Hazel	6.1	7.2	7.4	10.9	7.1	9.1	8.1	9.0	7.8	11.9	7.3	9.1
TOTAL	54.1	58.6	61.3	74.1	55.8	64.7	60.5	66.6	60.6	71.4	58.3	65.4

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

[b] *n* = Number of surveys used to calculate 2008 area means.

[C] Sample size for the entire bear range does not equal the sum of the sample sizes of the 5 areas because some surveys were conducted on the border of 2 or more areas and were included in tabulations for each area.

Table 11. Regional productivity indices (summed) for oak, hazel, and dogwood, 1984 – 2008. Shaded blocks indicate particularly low (≤ 5.0, yellow) or high (≥8.0, tan) fall food productivity.

	Survey Area					
Year	NW	NC	NE	WC	EC	Entire Range[a]
1984	4.2	7.6	7.0	6.2	7.0	6.5
1985	4.9	2.8	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	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	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

[a] This value represents the sum of mean statewide productivity index values for hazel, oak, and dogwood. Means were calculated using all surveys completed in the state, not by averaging values from the 5 food survey areas.

Fig. 2. Fall production of primary bear foods, 2008.

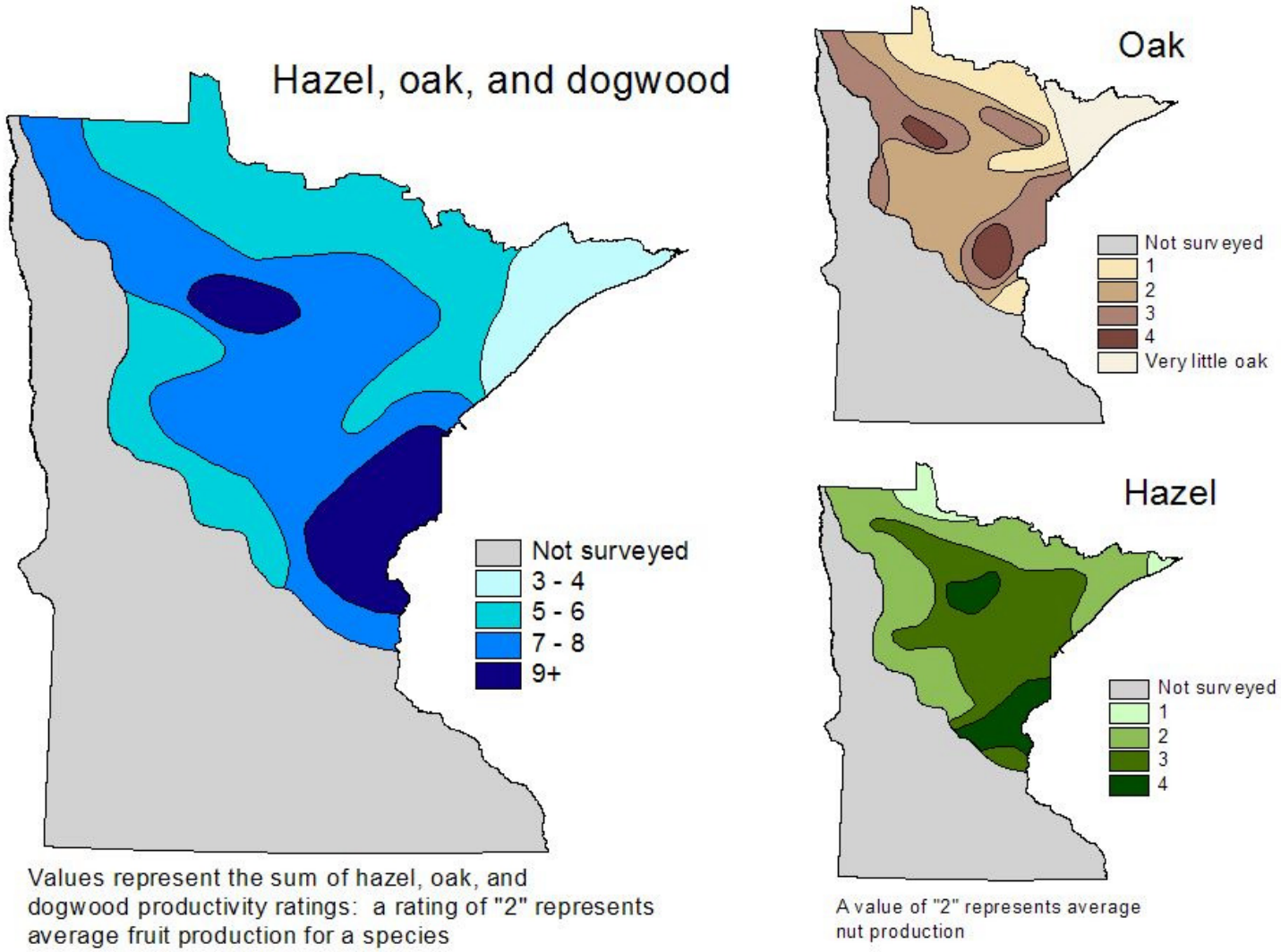

Fig 3. Number of female bears harvested vs. number predicted, based on fall food abundance and hunter numbers. Prediction for 2008 based on regression from 1984–2007 (R^2 = 0.82). Note that predictions exceed actual harvest for all years since 2002.

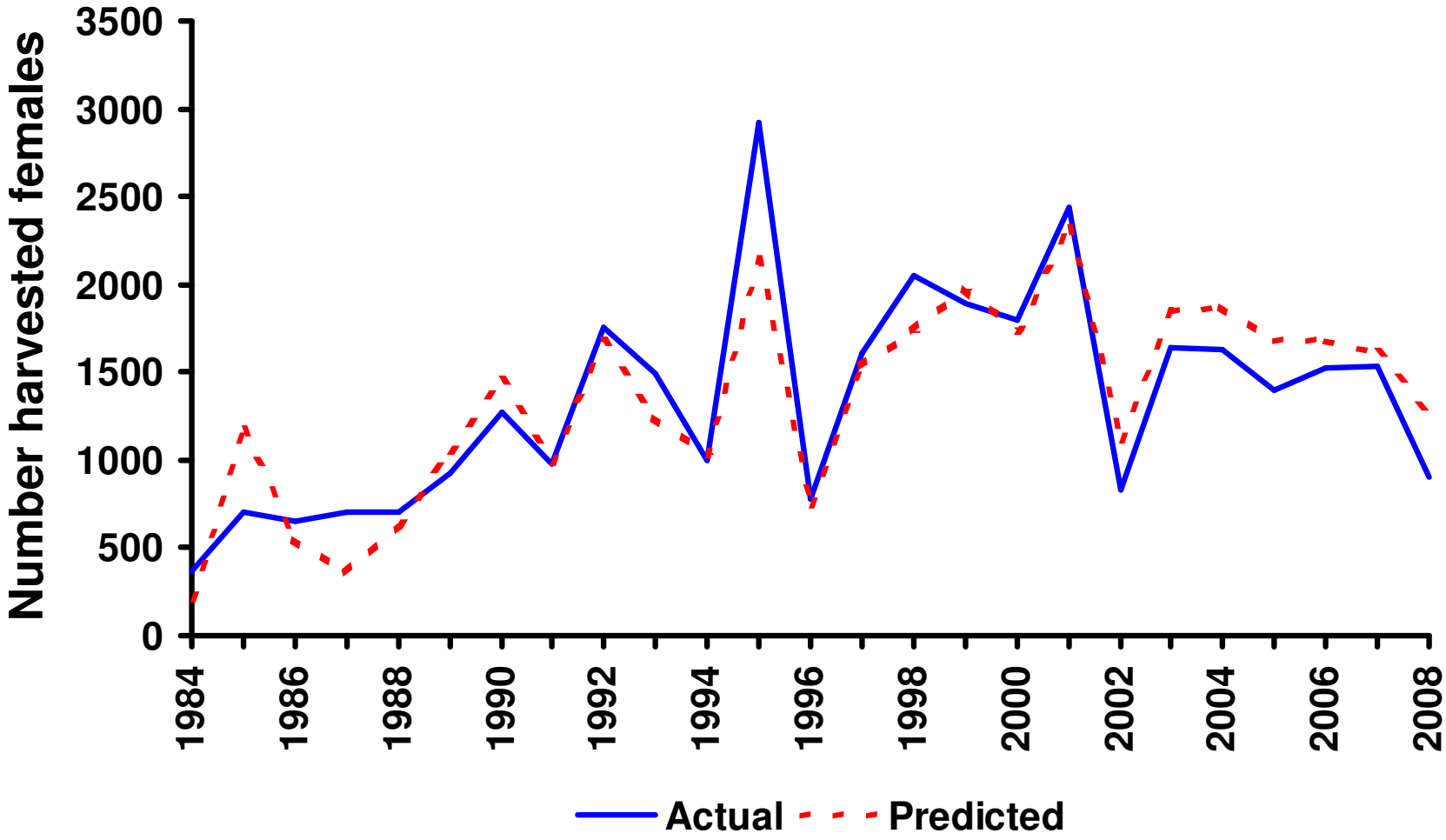

Fig 4. Sex ratios of harvested bears by BMU, 2002–2008.

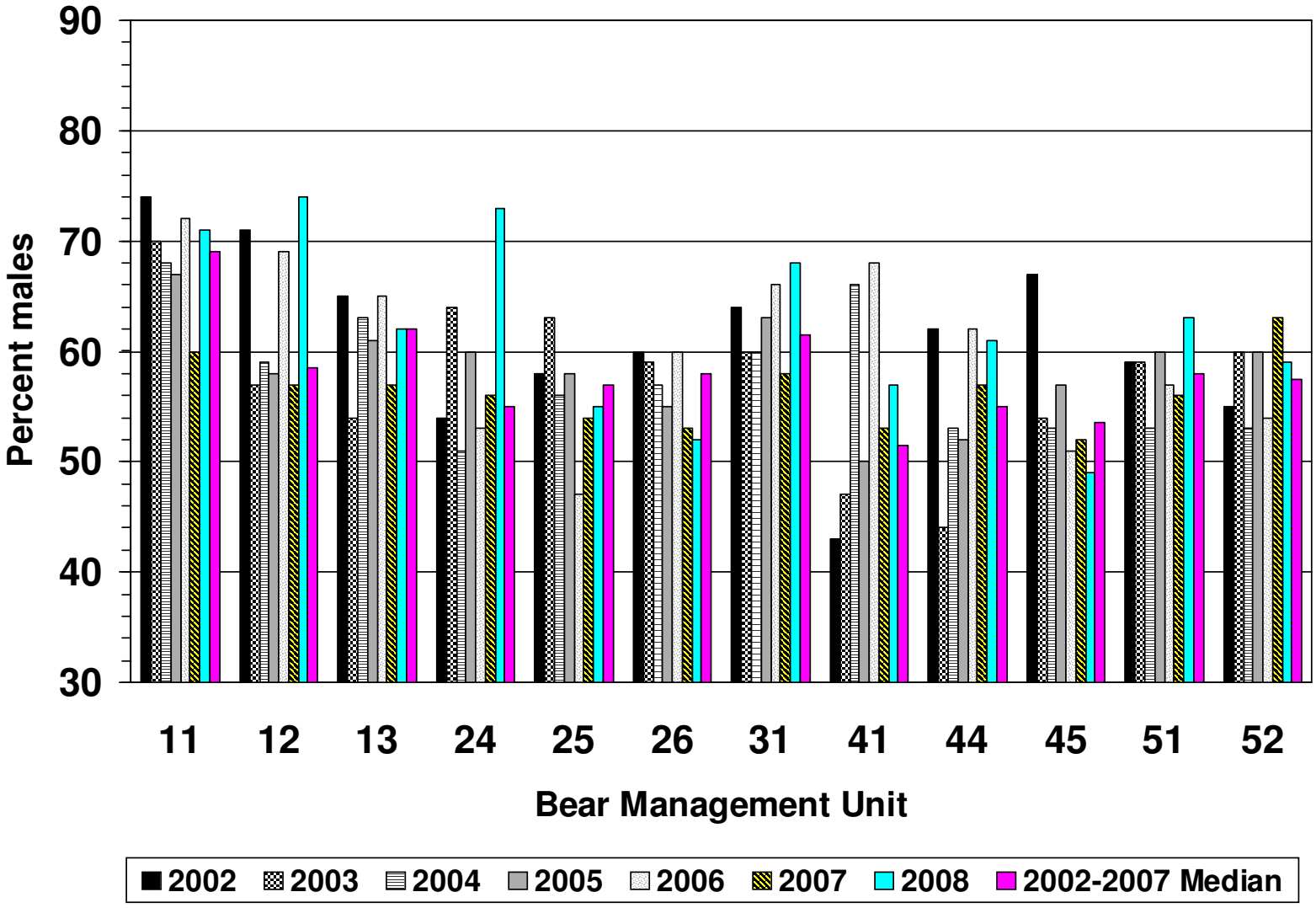

Fig 5. Statewide harvest age structure: median ages by sex, 1982–2008.

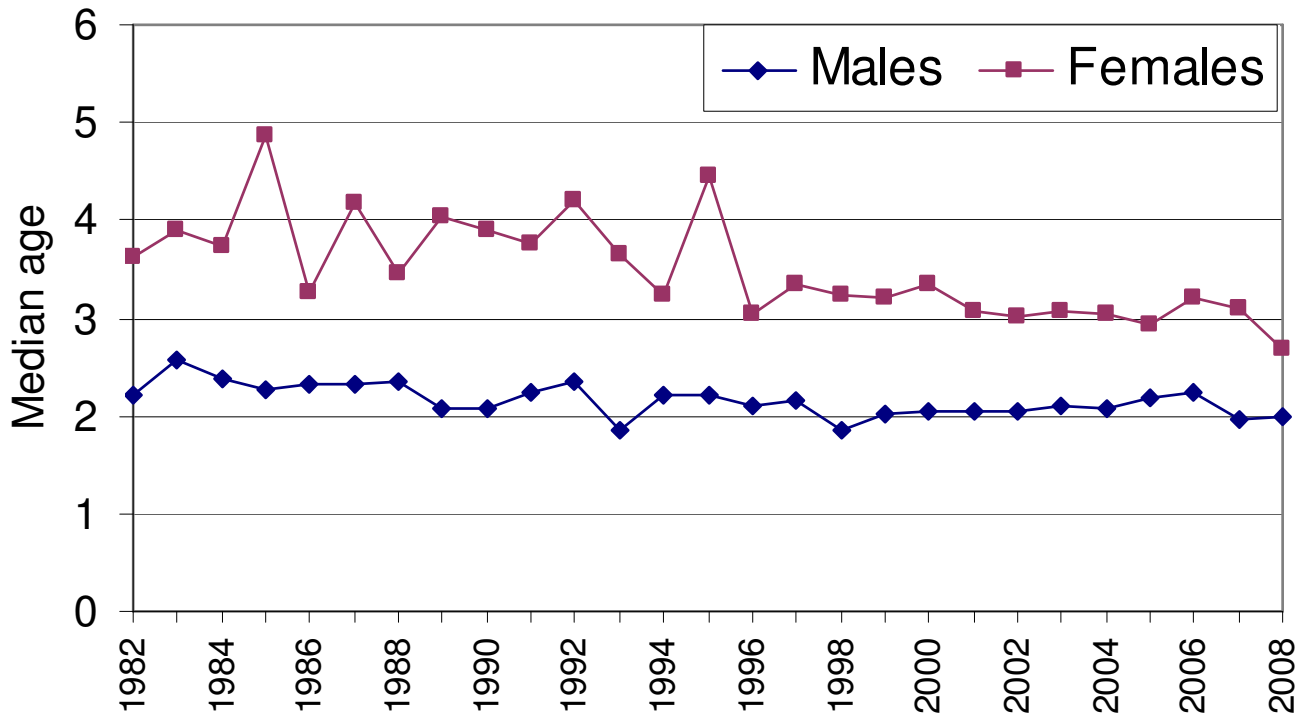

Fig 6. Statewide harvest age structure: proportion of each sex in age category, 1982–2008. Trend lines are significant, indicating a long-term change in age structure.

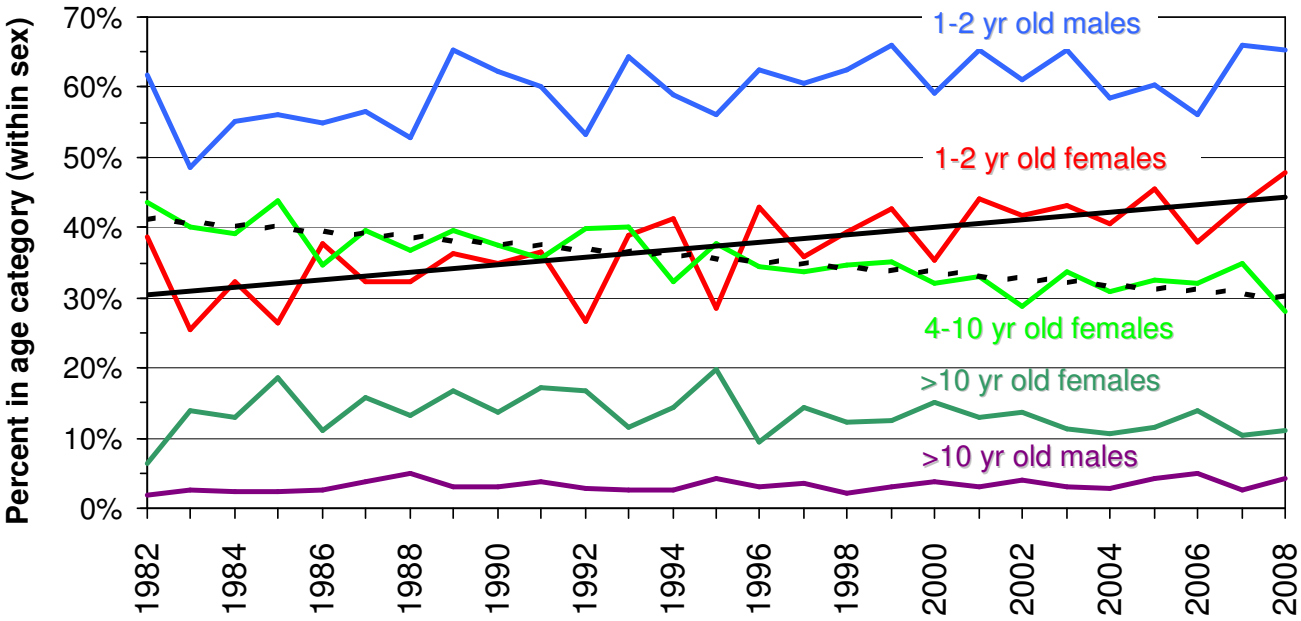

Table 12. Tetracycline-marking data: 1991, 1997, 2002, and 2008 (years of marking).

	1991	1997	2002	2008
Baits set	2905	2989	3122	3540
Baits not found	9	20	16	11
Baits checked	2896	2969	3106	3529
Baits visited by other mammal or bird [a]	507 (18%)	747 (25%)	1181 (38%)	218 (6%)
Baits taken by a person	0	6	9	0
Bait taken by animal, not a bear	---	---	1015	37
Bait taken by ambiguous – possibly bear	2	64	30[b]	16
Baits available for bears [c]	2701	2580	2572	3510
Baits visited by bears	1009	1214	755	594
Percent of available baits	(37%)	(47%)	(29%)	(17%)
Baits eaten by bears	998	1213	707	489
Percent of baits visited	(99%)	(100%)	(94%)	(82%)
Percent of available baits	(37%)	(47%)	(27%)	(14%)

[a] Includes all baits visited by small mammals and/or birds. Some of these were not consumed; others were also visited by bears, in which cases they were recorded as taken by bears.
[b] These ambiguous cases are considered first as non-bears, then as bears in population estimates.
[c] Baits taken by small mammals or birds are considered as available for bears half the time (1/2 bait).

Explanatory notes: More tetracycline baits were set in 2008 than in previous surveys. In 2008, baits were enclosed in wooden boxes to prevent consumption by raccoons, fishers, and martens; this technique has proven effective in previous studies in Wisconsin and Alaska. Boxes had holes drilled to allow scent to emanate. As an extra attractant to bears, two-thirds of boxes contained ½-lb patties of ground beaver in addition to standard bacon baits.

As desired, disturbance of baits by animals other than bears was nearly eliminated relative to all previous surveys. However, the number of visits to baits by bears also was much lower. This may have been due, in part, to the generally high availability of summer foods for bears, as during tetracycline marking in the summer of 2002. However, it also suggests that enclosing baits in boxes had a significant negative effect on bears' detection of baits. Boxes appeared to present a physical deterrent as well; 18% of bears that detected and visited baits did not remove the box from the tree, or in some cases, removed the box but did not eat the bait. It also appears likely that the decline in bait visits by bears reflected, at least in part, a decline in bear numbers.

Table 13. Tetracycline recapture data in years of marking: 1991, 1997, 2002, and 2008.

	1991	1997	2002	2008
Harvest	2143	3212	1916	2135
Ribs/teeth collected from harvest [d]	1958 (91%)	2594 (81%)	1417 (74%)	1511 (71%)
Ribs/teeth collected from nuisance or car-killed bears	0	17	12	10
Cub samples excluded		13	16	23
Total samples checked for tetracycline	1958	2611	1429	1498
Tetracycline-marked samples	122 (6.2%)	149 (5.7%)	56 (3.9%)	57 (3.8%)
Double-marked samples	11 (9.0%)	10 (6.7%)	2 (3.6%)	2 (3.5%)

[d] Excluding cubs, which are not counted in population estimates.

Explanatory notes: The 2008 bear harvest, though lower than the previous 5-year average (3360), was similar to the harvest in 2002, the year of the last tetracycline survey. Hunters submitted a similar number of usable tooth and rib samples in 2002 and 2008 and the number (and proportion) of samples that were positive for tetracycline were nearly identical.

Because fewer bears were marked in 2008 than in 2002, however, the 57 tetracycline-positive samples recovered in 2008 represents a larger proportion of the marked bears in the population than did the 56 positive samples in 2002, indicating a likely decrease in the bear population since 2002.

Table 14. Tetracycline-based population estimates: 1991, 1997, 2002, and 2008.

	1991	1997	2002	2008
No. marked bears				
Excluding ambiguous cases	916 (998/1.09)[a]	1134 (1213/1.07)	680 (707/1.04)	472 (489/1.035)
Including ambiguous cases		1193 (1277/1.07)	709 (737/1.04)	488 (505/1.035)
A. Population based on recaptures in year of marking (Yr 1)				
Mean: with and without ambiguous cases	14,600	20,300	17,500	12,400
95% CI				
Min	12,300	17,000	13,000	9,400
Max	16,900	24,000	22,200	15,600
B. Population based on recaptures in year after marking (Yr 2)				
Mean: with and without ambiguous cases	15,800	25,600	27,900	
95% CI				
Min	13,400	20,300	20,160	
Max	18,200	31,100	35,860	
C. Population based on 2-year cumulative recaptures (Yr 1 + Yr 2)				
Mean: with and without ambiguous cases	15,300	22,400	22,700	
95% CI				
Min	13,700	19,400	18,400	
Max	16,800	25,400	27,100	
% increase from first-year estimate	4.8%	10.3%	29.7%[b]	
D. Final estimate (mean of B and C)	15,600	24,000	25,300	
% increase from first-year estimate	6.8%	18.2%	44.6%	

[a] Adjustment for double-marking: No. of tetracycline baits eaten by bears / (no. of marks in samples/no. of marked samples).
[b] Abundant fall foods and low hunter success rate in 2002 suggested that the low bias in the Yr 1 estimate would be exacerbated in 2002. Underestimates of population size based on mark-recapture data from radio-collared bears averaged about 20%.

Explanatory notes: Our initial population estimate derived from the 2008 tetracycline survey suggests a considerable decline in Minnesota's bear population since the last survey in 2002. The estimate is lower than any of the previous first-year estimates. However, experience and theory indicate that estimates based on one year of "recaptures" only – that is, based on ribs and teeth collected from hunter-killed bears during the fall immediately following tetracycline marking – are always biased low. This is because bears consuming tetracycline baits during the summer are somewhat more likely to be shot over hunters' baits that same fall than bears that did not take tetracycline baits in the summer. Addition of samples collected next year will yield a higher and a much less biased estimate. In 3 previous surveys, the amount by which population estimates increased with the addition of a second year of samples has varied considerably. In the last survey, using samples from both 2002 and 2003 hunting seasons

caused an increase of 45% in the population estimate relative to first-year results only. The previous 2 surveys had not displayed as great a change in the estimate from the first to the second year.

Good food conditions were responsible for the very low response to tetracycline baits seen in 2002. We believe that the same may have been at least partly the cause of the low visitation in 2008 as well. Therefore we expect that sampling in 2009 may result in a relatively large increase in the population estimate. Even if this is the case, however, the resulting estimate will likely still be below 20,000, indicating a significant downturn since the high population levels of the late 1990's.

Fig. 7. Population estimates by BMU derived from tetracycline marking, based on recoveries in the year of marking, 1997, 2002, and 2008. All first-year recoveries yield estimates that are biased low (due to a biased recovery – see explanation for Table 14), and the amount of this bias varies yearly. Moreover, movements of bears among BMUs, which varies due to food conditions, makes some of these estimates unreliable (especially BMUs 24, 25, 26).