DEER IN IOWA

1978

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Phase D. Study No. 13
Job No. 1: Deer Harvest Survey

Phase D. Study No. 15
Job No. 1: Winter Population Estimate
Job No. 2: Miscellaneous Mortality Survey
Job No. 3: Sex and Age Ratio Survey

by

Lee Gladfelter
Wildlife Research Biologist

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ABSTRACT

Hunting season regulations are the primary deer management tool in Iowa and results of the harvest and annual population surveys are used in formulating these regulations. The total estimated harvest in 1978 was 18,125 deer. An estimated 15,168 (±531) deer were harvested by shotgun hunters and 2,957 (±197) by archers. This represents a 19% increase from the 1977 harvest in spite of reduced hunter numbers and severe winter weather during the season. There were 51,934 paid shotgun licenses issued; a 12% reduction from 1977, probably due to increased license fees. In addition, 15,699 free landowner-tenant licenses were issued and 12,809 bow and arrow licenses sold. About ½ of the shotgun licenses were issued for each season but 7,886 deer were harvested during the 2nd season compared to 7,282 the 1st. The higher number of any-sex permits issued the 2nd season probably accounted for the difference. Mean expectation of life determined from central deer incisors submitted by hunters indicated no changes from the previous year. A total of 2,872 deer were killed in traffic accidents, a reduction of about 4% from 1977. A major peak in traffic mortality occurred during October-November (71% bucks) with a smaller peak in March-June. The percentage of does in the traffic kill decreased to 47% indicating possible bias in the data or a change in the sex ratio of the population. Winter population estimates increased 4% from the previous year with deer survey units 8 and 9 recording the largest increases.

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INTRODUCTION

The deer management program in Iowa has 3 basic goals, to maintain a stable to slightly increasing herd on a regional basis, to provide the maximum amount of quality recreation without endangering the resource, and to monitor population trends and recommend hunting regulations which ensure that the 1st 2 goals are met. To help meet these goals, results of the hunting season are tabulated from information provided by hunters on post-season report cards and 2 population trend surveys are conducted annually: traffic kill and winter population estimate. Examples of harvest information collected are: estimated harvest, hunter success, hunter effort, sex ratio of the harvest, and crippling rate. The age composition of a sample of harvested deer is determined and mean expectation of life calculated. All of these surveys are used as a basis for making annual hunting season recommendations. Manipulation of the harvest is the primary tool for managing deer populations in Iowa. Since hunting is the largest mortality factor for deer, it is important that season recommendations be formulated that provide regional regulation of harvest. Results of the 1978 hunting season and annual population trend surveys are presented in this bulletin.

HUNTING SEASON REGULATIONS

Two separate shotgun seasons were conducted (2-5 December and 9-15 December), however hunters were allowed to apply for a license in only 1 hunting zone and season combination. A quota was placed on the number of any-sex licenses issued in each of the 10 hunting zones (Fig. 1). Twice as many any-sex licenses were issued for the 2nd season as the 1st. This was done to equalize hunter numbers, harvest and hunting success rates. Any-sex licenses were issued after a randomized computer drawing from all applications for each zone and season combination. All unsuccessful applicants in the any-sex license drawing received a bucks-only license valid for the zone and season they indicated on their application. Landowner-tenants were issued free shotgun licenses at the same bucks-only to any-sex ratio as determined for paid shotgun hunters in each zone and season combination. Landowner-tenants were allowed only 1 free license per farm unit and they could hunt only on their own property. The license fee for paid shotgun hunters was increased from $10 to $15. Other regulations included shooting hours from sunrise to sunset and a 1 deer bag and possession limit.

A 56 day bow and arrow season was held from 7 October to 1 December. Hunters could buy an any-sex license at County Recorder offices for $15. Hours of hunting for archers were ½ hour before sunrise to ½ hour after sunset with a 1 deer bag and possession limit.

HUNTING SEASON RESULTS

Hunter Report Card Survey

A hunter report card was mailed to 31% of the licensed hunters (24% of the paid shotgun and 55% of the landowner-tenants) immediately

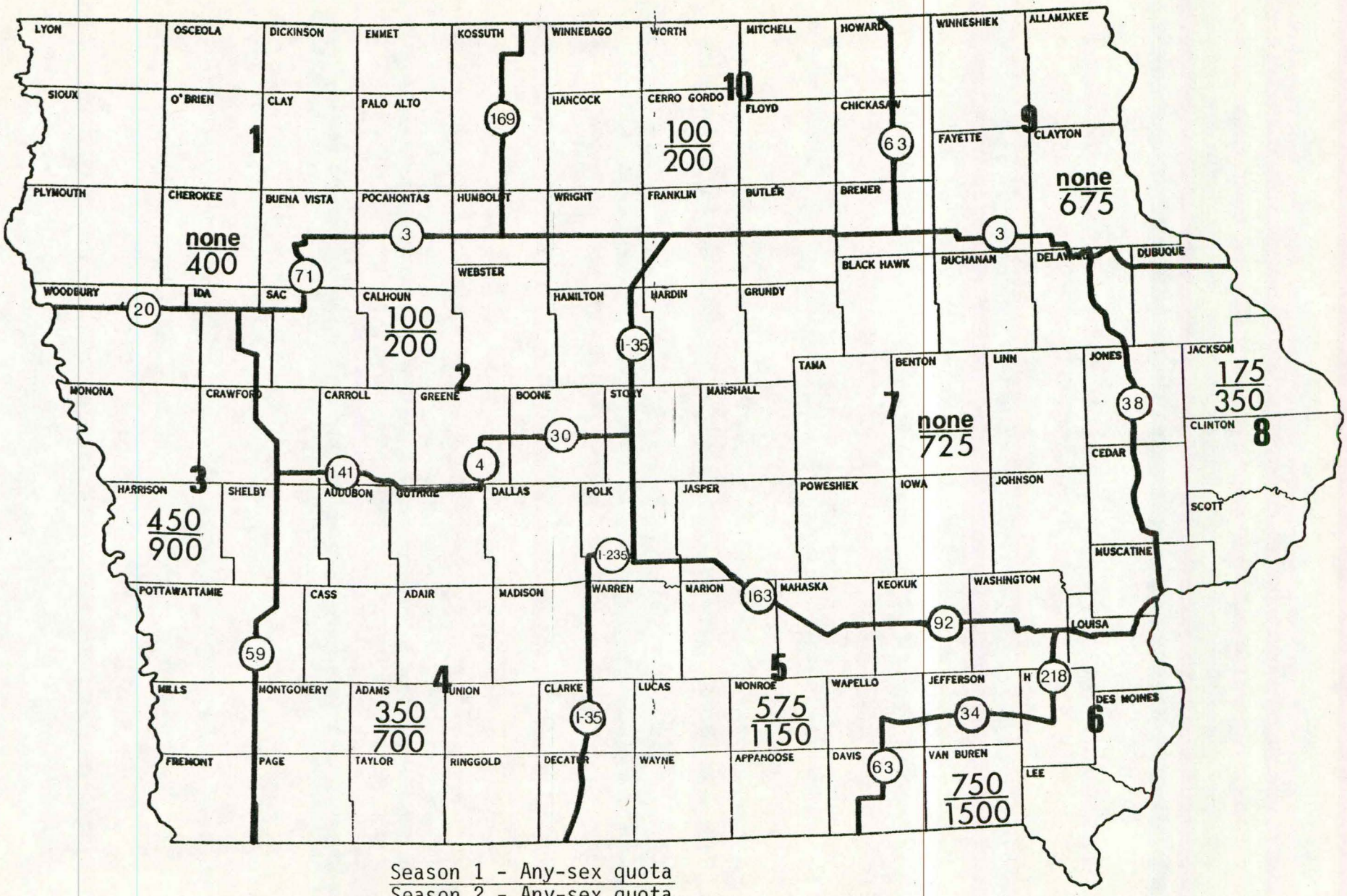

Figure 1. Hunting zone boundaries and paid shotgun any-sex license quota for 1978 in each zone and season.

following the season they hunted. Information requested on the report card included hunter success, sex of deer harvested, hunting effort crippling rate, and type of weapon used. If a reply to the 1st mailing was not received within 1 month, a follow-up card was sent. Of 21,059 hunters surveyed, 76% returned report cards (75% of the paid shotgun and 77% of the landowner-tenants). About 54% of the respondents returned the 1st mailing. A sample of 3,500 bow and arrow hunters were surveyed and 76% returned report cards. Harvest survey results were expanded to the appropriate hunting population by assigning non-residents the same success rates as those responding to the follow-up report cards. Success rates were calculated only for those that reported they hunted.

License Issue and Hunting Pressure

There were 51,934 paid shotgun licenses issued; a 12% reduction from 1977, probably because of increased license fees. In addition, 15,699 free landowner-tenant shotgun licenses were issued but more than 1,000 were later confiscated by law enforcement officers because they were obtained illegally. About ½ of the shotgun licenses were issued for each hunting season (Table 1). A total of 12,809 bow and arrrow licenses were sold.

Table 1. License issue by type of hunter, zone, and season for 1978.

	Season 1			
Hunting	Paid shotgun		Landowner-tenant	
zone	Bucks-only	Any-sex	Bucks-only	Any-sex
1	1,696	0	487	0
2	968	100	276	28
3	1,645	450	308	83
4	3,325	350	914	96
5	3,842	575	1,380	205
6	2,450	750	822	249
7	3,463	0	1,191	0
8	2,112	175	582	48
9	2,849	0	948	0
10	1,240	100	318	25
Total	23,590	2,500	7,226	734

	Season 2			
Hunting	Paid shotgun		Landowner-tenant	
zone	Bucks-only	Any-sex	Bucks-only	Any-sex
1	1,348	400	314	92
2	1,019	200	241	47
3	699	900	182	226
4	1,965	700	692	247
5	2,377	1,150	1,015	483
6	1,516	1,500	512	512
7	4,572	725	1,164	184
8	1,521	350	513	119
9	2,963	675	723	164
10	1,064	200	260	49
Total	19,044	6,800	5,616	2,123

Cold weather and snow during both seasons caused many hunters to stay at home. The percentage of landowner-tenants that did not hunt was higher than in 1977, a year when bad weather was also a factor during the hunting season (Table 2).

Table 2. Percent of hunters that did not hunt, 1975-1978

Type of hunter	Bucks-only				Any-sex			
	1975	1976	1977	1978	1975	1976	1977	1978
Season 1								
Paid shotgun	4	9	11	10	3	6	7	7
Landowner-tenant	21	29	32	36	15	24	23	32
Season 2								
Paid shotgun	6	10	16	10	3	8	10	7
Landowner-tenant	21	32	38	41	13	26	35	33

Harvest and Hunting Success

An estimated 15,168 (±531) deer were harvested by shotgun hunters with 12,815 (±515) taken by paid hunters and 2,353 (±127) by landowner-tenants. There were 7,282 deer taken by shotgun hunters during the 1st season and 7,886 the 2nd. In addition, 2,957 (±197) deer were taken by bow and arrow hunters for a total estimated harvest of 18,125, a 19% increase from 1977. This is the 2nd highest harvest in Iowa history and was accomplished in spite of adverse winter weather during both hunting seasons. Hunter harvest and success rates varied by hunting season (Table 3).

Table 3. Harvest and success rates for active shotgun hunters by hunting zone, 1978.

Hunting zone	Season 1		Season 2		Total harvest
	Bucks-only harvest (% success)	Any-sex harvest (% success)	Bucks-only harvest (% success)	Any-sex harvest (% success)	
1	603 (33)	-------	274 (20)	279 (64)	1,156
2	253 (24)	76 (68)	242 (23)	117 (54)	688
3	384 (23)	223 (47)	168 (24)	455 (47)	1,230
4	765 (22)	206 (52)	535 (25)	399 (48)	1,905
5	1,090 (25)	325 (49)	693 (26)	573 (42)	2,681
6	803 (29)	461 (54)	486 (29)	978 (56)	2,728
7	651 (17)	-------	592 (12)	454 (56)	1,697
8	400 (18)	93 (46)	288 (17)	211 (53)	992
9	546 (17)	-------	443 (14)	419 (56)	1,408
10	331 (24)	72 (63)	140 (12)	140 (61)	683
Total	5,826 (23)	1,456 (52)	3,861 (19)	4,025 (52)	15,168

Hunter success varied by season and type of license and was generally higher than the previous 2 years but did not reach the record high rates set in 1975 (Table 4). An excellent fall deer population was probably the primary reason for higher success rates. First season bucks-only hunters had higher success rates than 2nd season hunters because more bucks were available and they were less wary. Any-sex hunters had about the same success regardless of the season they hunted.

Table 4. Success rates for active shotgun hunters, 1975-1978.

Type of hunter	Bucks-only				Any-sex			
	1975	1976	1977	1978	1975	1976	1977	1978
Season 1								
Paid shotgun	31	18	17	22	63	51	52	54
Landowner-tenant	26	19	18	22	47	42	39	39
Season 2								
Paid shotgun	18	16	16	19	57	47	44	55
Landowner-tenant	20	16	15	17	40	34	32	39

The number of shotgun licenses issued has been decreasing since 1976 (Table 5) probably because of decreased interest in modified bucks-only seasons. Harvest over the past 25 years has generally increased because of growing hunter numbers (until 1976) and good deer populations. The number of bow licenses sold decreased for the 1st time since 1967 (Table 6). Bow harvest and success rates have continued to increase because of higher bow hunter numbers, good deer populations, and increased use of compound bows. A record high success rate of 25% was achieved this year by archers.

Distribution of the harvest during the shotgun seasons was estimated from a question on the deer tooth envelope (see sex and age composition section). Most of the harvest took place on opening weekends with the remainder fairly evenly distributed among weekdays in both seasons (Table 7).

Sex Ratio of Harvest

Paid any-sex shotgun hunters reported that during the 1st season about 62% of their harvest was does with 64% in the 2nd season. Landowner-tenant any-sex hunters reported 54% of their harvest was does during the 1st season and 57% the 2nd. An estimated 3,441 does were reported harvested by shotgun hunters, which is 23% of the shotgun harvest. Since 1973 the number of bucks in the harvest has been high due to the increased pressure of a modified bucks-only season (Table 8). Doe harvest has generally decreased since 1974 because of quota restrictions until 1978 when higher any-sex quotas in Zone 6 and higher hunter success rates increased the doe harvest.

Table 5. Comparison of statewide results from 26 years of shotgun deer seasons in Iowa.

Year	Season length in days	Licenses issued		No. deer harvested		Total gun harvest	Percent success			
							Paid shotgun		Landowner[1]	
		Shotgun	Landowner[1]	Shotgun	Landowner		Any-sex	Bucks-only	Any-sex	Bucks-only
1953	5	3,772	------	2,401	1,606	4,007	61	---	---	---
1954	3	3,788	------	2,414	568	2,982	64	---	---	---
1955	3	5,586	------	2,438	568	3,006	44	---	---	---
1956	2	5,440	------	2,000	561	2,561	39	---	---	---
1957	2	5,997	------	2,187	480	2,667	37	---	---	---
1958	2	6,000	------	2,141	588	2,729	38	---	---	---
1959	2	5,999	------	1,935	541	2,476	33	---	---	---
1960	3	7,000	------	3,188	804	3,992	46	---	---	---
1961	3	8,000	------	4,033	964	4,997	52	---	---	---
1962	3	10,001	------	4,281	1,018	5,299	44	---	---	---
1963	2,3	12,001	------	5,595	1,018	6,613	48	---	---	---
1964	2,4	15,993	------	7,274	1,750	9,024	47	---	---	---
1965	2,4	17,491	------	6,588	1,322	7,910	39	---	---	---
1966	2,4	20,811	------	9,070	1,672	10,742	45	---	---	---
1967	2,3	20,812	21,121	7,628	2,764	10,392	39	---	19	---
1968	2,3	20,485	24,796	9,052	3,890	12,941	48	---	21	---
1969	2,3	18,000	23,476	6,952	2,779	10,731	41	---	21	---
1970	2,3	18,000	21,697	8,398	4,345	12,743	49	---	26	---
1971	2	18,000	10,522	7,779	2,680	10,459	45	---	31	---
1972	2,4	19,000	11,205	7,741	2,738	10,485	44[2]	30	34[2]	20
1973	5	27,530	9,686	10,017	2,191	12,208	58	31	40	25
1974	5	33,772	16,329	11,720	4,097	15,817	64	29	48	27
1975	4,7	56,003	17,821	15,300	3,650	18,950	60	23	43	22
1976	4,7	60,197	17,818	11,725	2,525	14,250	48	17	37	17
1977	4,7	58,715	16,289	10,737	2,051	12,788	47	16	34	16
1978	4,7	51,934	15,699	12,815	2,353	15,168	55	21	39	20

[1] These data have been collected since 1967 when landowner-tenants were 1st required to obtain a permit.
[2] Percent success was calculated, for comparison purposes, for any-sex hunting zones 1, 2, and 4 only.

Table 6. Comparison of statewide results from 26 years of archery deer seasons in Iowa.

Year	Season length in days	Licenses issued	Number of deer harvested	Percent success
1953	5	10	1	10
1954	12	92	10	11
1955	21	414	58	14
1956	31	1,284	117	10
1957	31	1,227	138	11
1958	30	1,380	162	12
1959	31	1,627	255	16
1960	44	1,772	277	16
1961	48	2,190	367	17
1962	51	2,404	404	17
1963	51	2,858	538	19
1964	51	3,687	670	19
1965	51	4,342	710	17
1966	51	4,576	579	13
1967	62	4,413	791	19
1968	62	5,136	830	17
1969	62	5,465	851	16
1970	62	5,930	1,037	18
1971	51	6,789	1,232	19
1972	51	6,916	1,328	20
1973	53	10,506	1,822	18
1974	51	12,040	2,173	19[1]
1975	52	12,296	2,219	19[1]
1976	56	12,522	2,350	20
1977	56	12,994	2,400	21
1978	56	12,809	2,957	25

[1] Average % success from 1970 - 1973 was used to estimate success in 1974 and 1975.

Table 7. Percentage distribution of the 1978 deer harvest by day of season.

Day	Season 1 harvest	Cumulative %	Season 2 harvest	Cumulative %
Saturday	35	35	25	25
Sunday	31	66	27	52
Monday	17	83	14	66
Tuesday	17	100	9	75
Wednesday			7	82
Thursday			9	91
Friday			9	100

Table 8. Comparison of antlered, antlerless, and doe harvest for 1953-78.

Year	Total harvest	Antlered harvest	Antlerless harvest[1]	Doe harvest
1953	4,008	1,580	2,428	1,858
1954	2,992	964	2,028	1,246
1955	3,064	1,046	2,018	1,460
1956	2,678	964	1,714	1,234
1957	2,805	884	1,921	1,316
1958	2,891	828	2,063	1,360
1959	2,731	959	1,772	1,176
1960	4,269	1,348	2,921	1,881
1961	5,364	1,599	3,765	2,512
1962	5,703	1,709	3,994	2,814
1963	7,151	2,117	5,034	3,366
1964	9,694	2,486	7,208	4,846
1965	8,620	2,668	5,952	3,886
1966	11,321	3,101	8,220	5,392
1967	11,183	3,110	8,073	5,361
1968	13,771	3,583	10,188	6,808
1969	11,582	3,034	8,548	5,456
1970	13,780	3,612	10,168	6,951
1971	11,691	3,091	8,600	5,735
1972	11,813	3,697	8,116	5,294
1973	14,030	6,796	7,234	4,875
1974	17,990	9,071	8,919	6,607
1975	21,166	13,141	8,025	6,037
1976	16,600	10,255	6,345	4,779
1977	15,188	9,297	5,891	3,553
1978	18,125	11,567	6,558	4,565

[1] Antlerless harvest includes male fawns.

Bow and arrow hunters reported that 62% of their harvest was bucks and 38% does. Iowa bow hunters appear to be selecting for bucks.

Hunter Effort

An estimated 1 million hours during 167,000 days were spent by shotgun hunters pursuing deer. An average of 2.6 days were spent per shotgun hunter in the field during the 1st season, compared to 3.3 for the 2nd season. Those that hunted spent fewer days in the field compared to 1977, but hunted the same number of hours (Table 9). An average of 92 hours of hunting were required for bucks-only hunters to bag a buck compared to 114 hours in 1977. Any-sex hunters required only 35 hours per deer compared to 41 hours in 1977.

Bow hunters spent an estimated 667,000 hours during 184,600 days hunting deer, with the average archer hunting 15 days. Bow hunters required an average of 225 hours of hunting to bag a deer, compared to 285 in 1977.

Table 9. Hunter effort, 1975-1978.

Type of hunter	Hours per hunter				Days per hunter			
	1975	1976	1977	1978	1975	1976	1977	1978
Season 1								
Paid shotgun	17	18	17	17	2.6	3.5	3.2	2.7
Landowner-tenant	11	12	11	11	2.2	3.2	2.8	2.3
Season 2								
Paid shotgun	24	22	21	21	3.6	4.2	3.8	3.4
Landowner-tenant	14	13	12	12	2.8	3.5	3.1	2.6

Crippling Rate

Crippling rate for shotgun hunters again increased in 1978 to 12.4% (7,000 deer) which may be an indication of the effect of snow cover on reporting rate. Crippling rates in 1977 and 1978 were much higher than in previous years presumably because of increasing ability of hunters to determine if deer were crippled because of fresh snow. Crippled deer may recover or be harvested by other hunters and, therefore cannot be considered a loss in addition to the reported harvest. Crippling rate for archers was 14% which is about average for this group of hunters.

Muzzleloader Use and Purchase of Both Bow and Shotgun License

The use of muzzleloaders during the deer season was estimated for the 1st time this year. About 6% of the paid shotgun hunters and 5% of the landowner-tenants reported using a muzzleloader during the season. This would extrapolate to about 4,000 hunters in the state that used primitive weapons during the shotgun season. Muzzleloader success rates were good but were lower (30%) than the average shotgun hunter (36%) when all license types are combined.

It is legal to purchase both a bow license and a shotgun license as long as only 1 deer is taken during the season. About 3,700 hunters purchased both types of licenses in 1978. Success rates for shotgun hunters that reported they also purchased a bow license were slightly higher (40%) than the average for shotgun hunters (36%).

SEX AND AGE COMPOSITION

Age Composition

About 11,000 any-sex hunters were sent a deer tooth envelope and asked to insert the central incisors from the deer they harvested and to provide information about their hunt. A total of 1,097 deer incisors were returned for use in aging by the tooth sectioning technique (Low and Cowan 1963). Mean expectation of life was calculated for bucks and does of each age group for comparison with previous years

(Table 10). Mean expectation of life for does remained about the same as in 1977, while expectation of life for bucks declined slightly in the 1½ and older age categories. During the past 5 years, trends in mean expectation of life for does have been stable while bucks have been slightly downward, due presumably to increased hunting pressure on bucks. Mean expectation of life varies by hunting zone because of different mortality rates (Table 11). Mean expectation of life was highest for does in hunting zones 2, 4, and 6 and lowest in zones 3 and 9. Mean expectation of life for bucks on a regional basis is excluded because of small sample size. The oldest deer in the 1978 sample was a 15½ year old doe shot by a bow hunter. The oldest buck harvested was 6½ years old.

Table 10. The statewide mean expectation of life for deer (in years), 1976-78.

Age class	Doe			Buck		
	1976	1977	1978	1976	1977	1978
Fawn	2.14	1.97	2.02	1.27	1.12	1.14
1½	1.79	1.68	1.81	1.17	1.03	.99
2½	1.80	1.68	1.72	1.34	1.18	.90
3½	1.62	1.53	1.43	1.13	1.36	1.14
4½	1.17	1.11	1.10	0.97	.96	1.00
5½+	0.50	0.50	0.50	0.50	.50	.50

Table 11. Mean expectation of life for does (in years), 1978.

Hunting zone	Sample size	Age class					
		Fawn	1½	2½	3½	4½	5½+
1	55	2.25	1.73	1.54	1.43	1.12	.50
2	29	2.40	1.89	1.96	1.61	1.17	.50
3	112	1.86	1.67	1.50	1.45	1.04	.50
4	88	2.15	1.92	1.86	1.54	1.06	.50
5	78	1.79	1.56	1.67	1.52	1.86	.50
6	134	2.16	2.17	1.90	1.63	1.09	.50
7	68	1.85	1.54	1.74	1.50	1.36	.50
8	42	2.17	2.19	1.70	1.35	1.07	.50
9	68	1.78	1.62	1.59	1.12	1.00	.50
10	43	2.17	1.75	1.72	1.70	1.21	.50

Sex Ratio

Sex ratio of the any-sex harvest reported on tooth envelopes indicates that 53% of the fawns harvested were does. Fawns composed 42% of the total any-sex harvest. Adult bucks made up another 15% of the any-sex harvest with adult does accounting for the remaining 43%. The tooth envelope survey indicated that 65% of the total any-sex harvest was does corresponsing closely to the results of the hunter postcard survey.

MISCELLANEOUS MORTALITY

A total of 3,181 deer were reported lost to various non-hunting mortality factors. Traffic accidents were the major factor accounting for 2,872 deer, compared to 2,929 the previous year. The remaining deer were lost to such mortality factors as poaching, dogs, and accidents (fences, mowing, etc.). When deer traffic loss is computed on the basis of deer killed per billion miles traveled and compared to previous years, a usable deer population trend is available. In 1978, an estimated 11.9 billion miles were driven on interstate, primary, and secondary road systems (Iowa Department of Transportation). This would extrapolate to 241 deer killed per billion miles traveled compared to 251 in 1977, a decrease of 4% (Table 12).

Table 12. Deer killed per billion vehicle miles traveled and % does in traffic kill, 1972-1978.

Year	Deer killed per billion miles traveled	% Change from previous year	% Does in traffic kill
1972	232.8	----	47.7
1973[1]	248.3	+6.7	49.8
1974[2]	243.1	-2.1	50.3
1975	222.4	-8.5	53.7
1976	221.0	-0.6	54.1
1977	250.8	+13.5	55.5
1978	240.6	-4.1	47.0

[1] First statewide modified bucks-only season.
[2] First year of 55 MPH speed limit.

Sex ratio of the traffic kill may be an indication of changes taking place in the deer population due to heavy hunting pressure on bucks. Prior to 1978, the ratio of does in the traffic kill has been steadily increasing (Table 12). If the assumption is made that vulnerability has not changed, it would indicate that there was an increase in the percentage of does in the population. The ratio of does in the traffic kill dropped to 47% in 1978 (Table 12). Most of the decrease from previous years in does reported killed occurred during the February through May period. A reproductive study was being conducted during February-May and it is possible some females were not reported on the traffic kill survey.

Changes in traffic mortality by deer survey unit (Gladfelter 1977) are shown in Table 13. These data have been corrected for vehicle mileage by adjusting the traffic kill to deer killed per billion miles traveled. Fluctuating traffic kill trends were recorded in most regions during the past 5 years.

The major peak in traffic mortality occurred during the rutting season in October and November (Fig. 2). A higher proportion of the

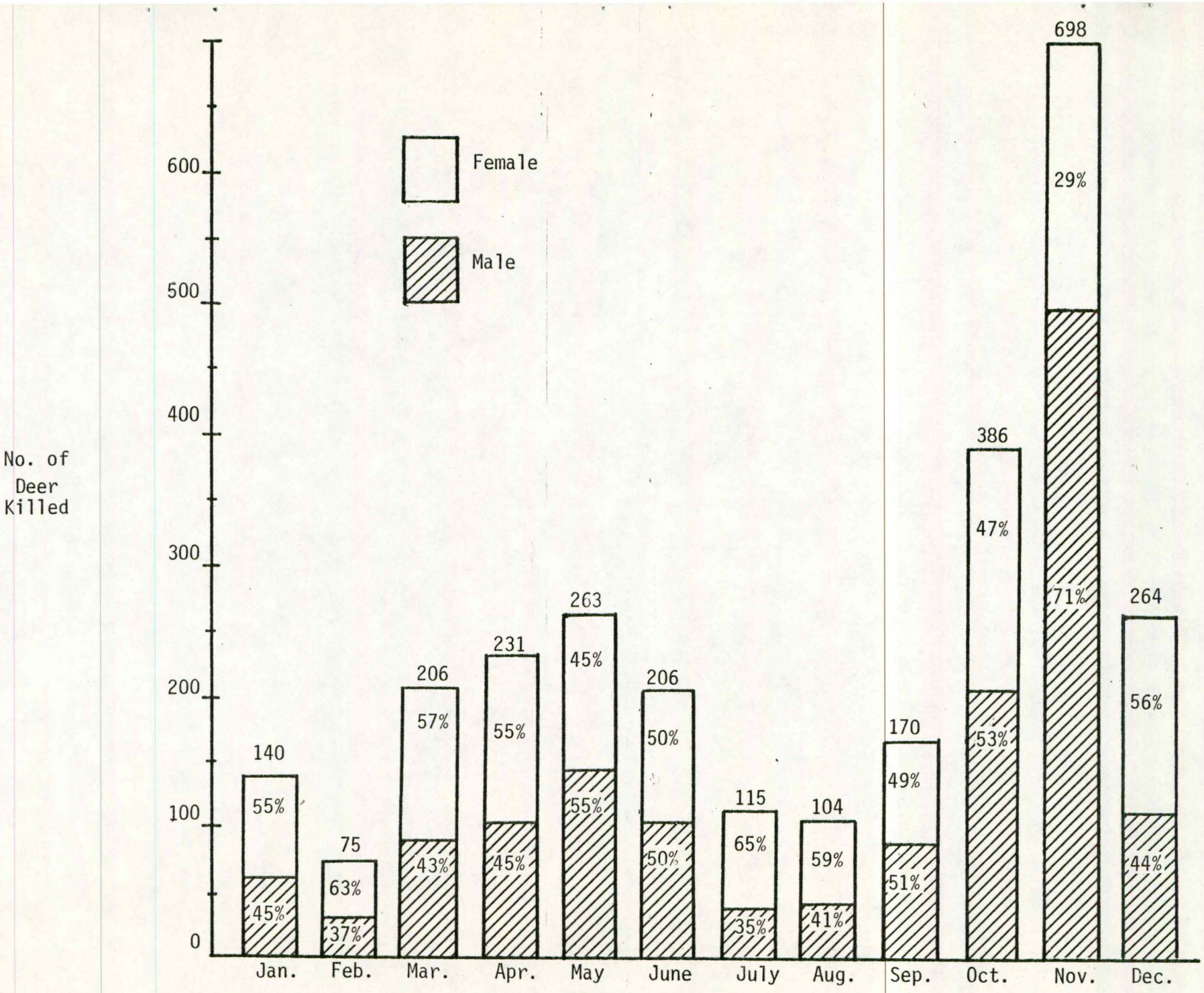

Figure 2. The 1978 traffic mortality by month and sex ratio.

Table 13. Number of deer killed per billion vehicle miles traveled, 1974-1978.

Deer survey unit	Deer killed per billion miles traveled					% Change 1977 to 1978
	1974	1975	1976	1977	1978	
1	224	192	247	223	258	+15.7
2	196	160	156	172	177	+2.9
3	289	222	224	236	219	-7.2
4	187	206	161	209	171	-18.2
5	275	227	264	294	247	-16.0
6	599	470	581	606	607	same
7	174	162	160	211	182	-13.7
8	226	246	219	263	258	-1.9
9	531	586	518	520	682	+31.2
10	272	255[1]	220	252	243	-3.6

[1] Does not include Cerro Gordo County.

October-November kill was bucks, which are apparently more vulnerable because of increased rutting activity. A smaller peak in mortality occurred in May during the period of family group breakup and fawning.

WINTER POPULATION ESTIMATE

An explanation of the winter population survey can be found in Iowa Wildlife Research Bulletin No. 20 (Gladfelter 1977). Conservation Officers estimated the 1978-79 winter population at around 27,800 deer. This represents an increase of about 4% from the previous year. Because of severe winter conditions, deer were herded together in traditional wintering areas for a long period of time making them highly visible for the survey. Winter population estimates for the 10 deer survey units is shown in Table 14 with comparisons to the previous 5 years. The only survey units to register decreases in estimated winter population were 2, 4, and 5. These declines ranged from 1% to 12%. The remaining survey units recorded increases of from 3% to 26%.

CONCLUSIONS

Deer harvest and success rates in 1978 were extremely good in spite of harsh winter weather. Population surveys indicate a relatively stable deer herd during the past 5 years with annual fluctuations which are probably caused by inconsistencies in survey techniques.

Table 14. Results of winter population estimates, 1973-74 - 1978-79.

Deer survey unit	Winter population estimate						% Change 1977-78 to 1978-79
	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	
1	1,640	1,851	1,811	1,954	1,958	2,229	+13.8
2	1,116	1,234	1,144	1,117	1,449	1,276	-11.9
3	3,376	3,618	3,296	3,201	3,722	3,831	+2.9
4	4,148	4,427	4,052	3,927	4,018	3,958	-1.5
5	4,652	5,357	5,510	4,520	4,539	4,070	-10.3
6	2,912	3,365	3,695	3,225	3,168	3,275	+3.4
7	2,414	2,638	2,266	2,393	2,621	2,884	+10.0
8	1,487	1,660	1,593	1,653	1,820	2,301	+26.4
9	2,500	2,725	2,185	1,840	2,055	2,425	+18.0
10	1,656	1,688	1,307	1,324	1,399	1,542	+10.2
Total	25,901	28,563	26,859	25,154	26,749	27,791	+3.9
% Annual change	----	+10.3	-6.0	-6.3	+6.3	+3.9	

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APPENDIX

County	1978-79 Winter population estimate	1978 Traffic mortality	County	1978-79 Winter population estimate	1978 Traffic mortality
Adair	200	14	Jasper	320	38
Adams	211	7	Jefferson	505	37
Allamakee	880	28	Johnson	340	118
Appanoose	140	10	Jones	770	24
Audubon	150	5	Keokuk	153	18
Benton	64	28	Kossuth	264	47
Black Hawk	125	36	Lee	825	90
Boone	100	24	Linn	320	20
Bremer	140	14	Louisa	400	29
Buchanan	70	9	Lucas	630	30
Buena Vista	116	16	Lyon	130	29
Butler	132	39	Madison	500	17
Calhoun	69	13	Mahaska	168	8
Carroll	49	6	Marion	250	13
Cass	232	23	Marshall	305	43
Cedar	235	21	Mills	435	45
Cerro Gordo	26	27	Mitchell	210	17
Cherokee	261	22	Monona	640	18
Chickasaw	140	19	Monroe	160	6
Clarke	400	13	Montgomery	230	35
Clay	255	34	Muscatine	187	37
Clayton	715	69	O'Brien	225	18
Clinton	309	62	Osceola	140	5
Crawford	240	10	Page	315	5
Dallas	300	39	Palo Alto	135	10
Davis	440	22	Plymouth	217	28
Decatur	635	22	Pocahontas	90	7
Delaware	140	12	Polk	440	75
Des Moines	885	81	Pottawattamie	1,166	95
Dickinson	170	24	Poweshiek	49	14
Dubuque	170	5	Ringgold	360	8
Emmet	187	20	Sac	136	17
Fayette	210	34	Scott	210	65
Floyd	190	27	Shelby	150	11
Franklin	87	33	Sioux	129	28
Fremont	230	14	Story	51	28
Greene	90	13	Tama	141	19
Grundy	11	none	Taylor	235	26
Guthrie	480	19	Union	305	6
Hamilton	165	37	Van Buren	860	31
Hancock	105	14	Wapello	355	37
Hardin	274	43	Warren	300	23
Harrison	800	48	Washington	230	41
Henry	305	45	Wayne	255	23
Howard	150	27	Webster	235	31
Humboldt	155	6	Winnebago	240	25
Ida	68	4	Winneshiek	620	129
Iowa	123	59	Woodbury	170	23
Jackson	420	77	Worth	122	15
			Wright	119	36

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