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M-44 SODIUM CYANIDE EJECTORS IN THE ANIMAL DAMAGE CONTROL PROGRAM, 1976-1986

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ABSTRACT: This paper summarizes Animal Damage Control (ADC) program records relating to M-44 use during Fiscal Years 1976-86. During these years, M-44s were used in 14 western states to take 103,255 animals, including 92,843 coyotes, 5,544 other target canids, and 4,868 nontarget animals. More animals were taken in Texas than in all other states combined. Program-wide during FY1977-81, M-44 effort averaged approximately 5,600 unit years annually and 1.2 target animals were recovered per M-44 year.

M-44s accounted for 12.3 percent of all coyotes taken by the ADC program during FY 1976-86. The coyote take by M 44s doubled from FY 1981 through 1986. In FY 1986, more coyotes were taken by M-44s than by any other method in Texas, New Mexico, and Nebraska. Program-wide in that year, aerial hunting ranked first, the leghold trap second, and the M-44 third in numbers of coyotes taken. The M-44 has increased in importance since its reregistration in 1971, but the coyote take by M-44 has not approached the peak reached in 1971.

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INTRODUCTION

For many years the federal government has conducted a cooperative program to reduce damage caused by wild animals, as authorized in the Animal Damage Control Act of March 2,1931. The ADC program is managed by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service. Control of mammalian predation on livestock is a major program activity.

Optimum management of livestock predation usually requires an integrated approach using a mixture of predator removal and animal husbandry practices. One important technique is the spring-activated sodium cyanide ejector or M-44, which is used to remove coyotes and other wild canids from areas where depredation occurs. This paper summarizes ADC records of M-44 use and animals taken from July 1975 through September 1986. In concentrating on the M-44 I do not intend to detract from the principle of integrated control. My purpose is to summarize ADC program experience with one of the many techniques used.

The M-44 was invented in the mid-1960s (Poteet 1967) to replace the primer powered cyanide ejector known as the coyote getter (Young and Jackson 1951). After several years of field testing, M-44s officially replaced coyote getters in the ADC program in 1970 (Bacus 1969, n.d.). M-44s accounted for approximately 18,300 coyotes, or 27.3 percent of all coyotes taken by the program in FY 1971 (Evans and Pearson 1980), but in 1972, the Environmental Protection Agency (EPA) cancelled most uses of predacides including sodium cyanide (Ruckelshaus 1972).

This EPA action stimulated much controversy and political concern, one result of which was an eventual reregistration of sodium cyanide for use in the M-44. Experimental programs in 1974 and 1975 led to formal reregistration in September 1975 (Train 1975, Matheny 1976). From that date M-44s have been used continuously by the ADC programs in most western states. State-certified, private applicators also use M-44s in certain states but this paper only describes ADC program activities.

MATERIALS AND METHODS

Equipment

An M-44 consists of a metal stake, ejector, and capsule holder or top, inside of which is a plastic capsule containing sodium cyanide mixture. M-44 training manuals, such as Shult et al. (1976), illustrate the equipment and provide instructions for its use. M-44 equipment used in the ADC program is manufactured at the Pocatello Supply Depot, Pocatello, Idaho. M-44 cyanide capsules are made and used in accordance with EPA-approved labeling (Figure 1) including 26 use restrictions (US DI 1978:163-164). The label shown in Figure 1 covered all ADC program use of M-44s during FY 1976- 86. Labeling was revised in 1988.

Records on M-44 Use

During FY 1976-86, the federally supervised ADC program offered operational predator control assistance to livestock and poultry producers in 14 western states. In addition, M-44 use by a state supervised program in South Dakota was included in ADC program annual reports. Of the 15 states with operational programs, M-44s were used in all but North Dakota (Table 1).

M-44s are used by approximately 300 individuals in the ADC program. Each user records M-44 use along with other activities. These records are tabulated in state offices to produce yearly summaries for each state's annual report. State reports are prepared on a fiscal year (FY) basis. FY 1976extended from July 1,1975, through June 30,1976. The federal government then added a transition quarter (July-

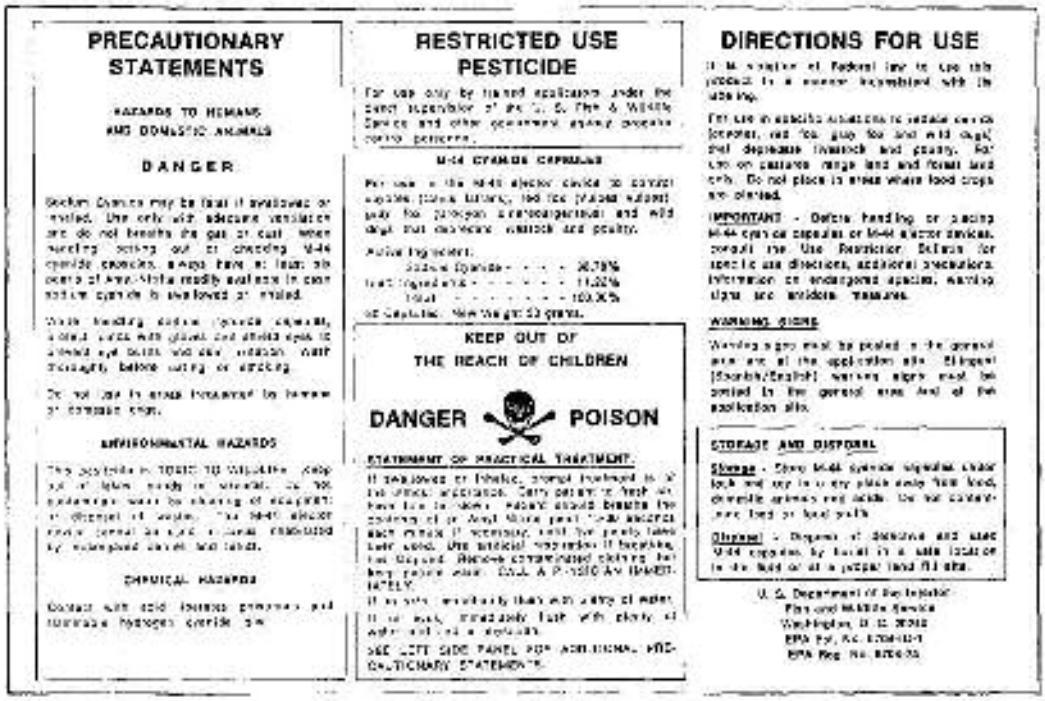

Fig 1. EPA-approved label for M-44 cyanide capsules used in the ADC program, 1976-1986. The registration number changed to 56228-15 effective January 13, 1987.

September 1976) and switched to an October 1 -September 30 fiscal year beginning in 1977. Information for this paper was compiled from 160 annual state reports.

M-44 capsules are registered specifically to control coyotes, red fox, gray fox and wild dogs that depredate livestock and poultry (Figure 1), but the U.S. Fish and Wildlife Service (FWS) also used M-44s under emergency exemptions (Federal Insecticide, Fungicide, and Rodenticide Act, Section 18) to protect endangered whooping cranes, Aleutian Canada geese, and Mississippi sandhill cranes (Thomas 1986).

Efforts to protect whooping cranes were carried out or supervised by the Idaho ADC program and are included in this paper. However, M-44 use to protect endangered species in Alaska and Mississippi was excluded because the work was not conducted by ADC program employees and was not documented in ADC state annual reports. Thus, this paper summarizes all M-44 use by the ADC program but not by FWS, during 1976-86. The omitted activity was minor.

RESULTS AND DISCUSSION

Numbers of Animals Taken

ADC program M-44s took a total of 103,255 animals during the 11-year study period (Table 1). Target species (coyote, red fox, gray fox, and wild dog) comprised 95.3 percent of the total. The coyote was the most important target species; nearly 90 percent of all animals taken were coyotes. Even though M-44s were highly selective for target species, a few individuals of many nontarget species also were taken (Table 1, "Other" column). Most of the 60 fox (species not recorded) were taken in New Mexico. The 25 animals not identified were taken in Oklahoma. The grizzly bear, taken accidentally in Montana in 1978, had previously been relocated twice after it had killed sheep. FWS officials indicated that, based on the problems associated with this bear, the animal would have been removed from the population.

More animals were taken by M-44 in Texas than in all other states combined. Texas accounted for 59.4 percent of all animals and 59.3 percent of the target animals taken. Some reasons for this are: (1) the Texas ADC program is much larger than the others; (2) most Texas grazing lands are in private ownership, which is conducive to M-44 use; (3) dense vegetation in much of Texas precludes effective aerial hunting, which is the principal technique in most states; and (4) much control work in Texas is done in livestock pastures. Cattle, sheep and goats interfere less with M-44s than with steel traps.

After Texas, in declining order, the states that took the largest numbers of animals by M-44 were New Mexico, California, Montana, Nebraska, Oklahoma, and South Dakota. Relatively few animals were taken by M-44 in Wyoming and Nevada.

Relationship to Other Coyote Control Methods

During FY 1976-86, ADC programs in 15 western states took 755,143 coyotes. M-44s accounted for 92,843 coyotes, or 12.3 percent of the total (Table 2). The percentage of

Table 1. Numbers of animals reported taken by M-44 in the Federal-Cooperative Animal Damage Control program from July 1975 through September 1986.

	Target species				Nontarget species[a]						
State[b]	Coyote	Red fox	Gray fox	Wild dog	Sks	Op	Rac	Kit fox	Swift fox	Other[c]	Totals
AZ	1563	0	69	41	1	0	0	0	0	1	1675
CA	6750	3	155	26	38	2	126	0	0	43	7143
CO	1702	8	4	1	12	0	2	0	0	2	1731
ID	1045	26	0	0	0	0	0	0	0	6	1077
MT	3069	1086	0	0	12	0	2	0	0	3	4172
NE	3854	26	0	2	175	27	32	0	0	11	4127
NV	769	0	0	1	0	0	0	13	0	0	783
NM	9691	4	259	225	155	0	13	204	135	91	10777
OK	3297	1	1	60	343	241	22	0	1	29	3995
OR	1302	32	1	0	4	5	8	0	0	5	1357
SD	2790	575	0	10	13	0	6	0	0	3	3397
TX	55547	992	1224	578	1317	916	568	1	22	218	61383
UT	1093	19	1	4	1	0	0	39	0	0	1157
WY	371	110	0	0	0	0	0	0	0	0	481
Totals	92843	2882	1714	948	2071	1191	779	257	158	412[c]	103255

[a]Sks = striped, hognose, and spotted skunks; Op = opossum; Rac = raccoon.
[b]This table includes data for Fiscal Years 1979-86 in CO, 1977-86 in SD, and 1976-86 in other states.
[c]Includes 97 badger, 60 fox (species not recorded), 51 bobcat, 48 ringtail cat, 18 feral hog, 17 porcupine, 16 javelina, 14 black bear, 14 feral cat, 13 crow, 12 vultures, 10 raven, 5 Russian boar, 4 nutria, 2 beaver, 2 rabbits, 1 grizzly bear, 1 mountain lion, 1 hawk, 1 calf, and 25 animals not identified.

coyotes taken by M-44 varied between 6.3 and 17.7 percent in different years.

Starting with M-44 reregistration in September 1975, M-44 use increased through 1977 and then declined due to users personal perceptions that M-44 ejectors and capsules were unreliable. These perceptions led the program to make a concerted effort, beginning in 1981, to identify and correct the causes of poor M-44 performance (Connolly and Simmons 1984). Ejector and capsule improvements resulted in increased M-44 use, so that the number of coyotes taken by M-44s increased every year after 1981. The coyote take by M-44s more than doubled from 1981 through 1986, while the M-44 contribution to total ADC program coyote take rose from 10.4 percent in 1981 to 17.7 percent in 1986 (Table 2). It is important to look beyond the program-wide trends illustrated in Table 2, because M-44 importance varies widely from state to state. In FY 1986, for example, more coyotes were taken by M-44 than by any other method in Texas, Nebraska, and New Mexico (Table 3). Conversely, aerial hunting (helicopter and fixed wing) was most important in Colorado, Idaho, Montana, Nevada, North Dakota, Oklahoma, South Dakota, Utah, and Wyoming. Leghold traps took more coyotes than any other method used in Arizona, California, and Oregon. Program-wide in 1986, more coyotes were taken by aerial hunting than by any other method. Leghold traps were second and M-44s third.

Table 2. M-44 coyote take in relation to total coyote take in the ADC program in 15 western states, 1976-1986.

Fiscal year	Coyote take M-44	Coyote take Total	M-44 take as percent of total
1976	5328	84499	6.3
1976 TQ[a]	793	14731	5.4
1977	8094	69109	11.7
1978	7206	61823	11.7
1979	6033	66199	9.1
1980	6282	58861	10.7
1981	6123	58896	10.4
1982	6874	56914	12.1
1983	9680	61927	15.6
1984	11577	73306	15.8
1985	11896	75514	15.8
1986	12957	73364	17.7
All years	92843	755143	12.3

[a]TQ = Transition Quarter (July - September 1976).

Target Animals Taken per Unit of M-44 Effort

ADC state annual reports record M 44 effort in years: 1 M-44 year equals 365 unit set nights. Estimates of M-44 effort were incomplete for some states, but program wide estimates were available for FY 1977-81 (Table 4). M-44 effort varied widely from state to state. In general, the levels of effort in different states corresponded with numbers of animals taken by M-44. The 3 states that reported the most M-44 effort were Texas, New Mexico, and California. These states also took the largest numbers of animals by M-44 (Table 1).

Numbers of target animals taken per M-44 year varied little from year to year. The aggregate value for all 5 years was 1.2 animals per M-44 year (Table 4), similar to the 1.1 target animals per M-44 year reported from the FWS experimental program that preceded reregistration (Matheny 1976). These data imply that, for the program overall, M-44 efficiency varied little over time.

CONCLUSIONS

The M-44 was an important predation control technique prior to its withdrawal from the Federal-Cooperative ADC

Table 3. Numbers of coyotes taken by method in 15 western state ADC programs, FY 1986.

State	Coyotes Taken By Method: Shot from aircraft	Trap	M-44	Snare	Den	Called & shot	Other[a]	All methods
AZ	752	977	150	22	7	36	77	2021
CA	274	3776	747	521	499	616	1054	7487
CO	1161	126	322	106	461	280	109	2565
ID	2115	737	74	71	136	352	76	3561
MT	2242	633	542	337	86	0	382	4222
NE	88	313	491	56	74	96	31	1149
NV	2378	1114	58	29	133	82	264	4058
NM	1172	1387	1472	780	95	382	151	5439
ND	977	259	0	41	95	20	29	1421
OK	913	682[b]	720	196	111	557	104	3283
OR	2134	2152	208	551	374	280	257	5956
SD	1810[c]	187	372	152	28	152	185	2886
TX	2900	3478	7359	3912	237	854	428	19168
UT	2120	474	384	71	656	271	140	4116
WY	3394	233	58	71	1103	699	474	6032
Totals	24430[c]	16528[b]	12957	6916	4095	4677	3761[a]	73364
% Total	33.3	22.5	17.7	9.4	5.6	6.4	5.1	100.0

[a]Includes 3505 shot, 222 taken with dogs, 33 by spotlight, and 1 not specified.
[b]Includes 1 taken in live trap.
[c]Includes 617 taken by private aircraft under ADC supervision.

Table 4. Annual M-44 effort in 15 western ADC programs. FY 1977-81.

	M-44 Years[a]					
State	1977	1978	1979	1980	1981	1977-81
AZ	371	82	93	8	38	592
CA	225	272	398	1918	370	3183
CO	0[b]	0[b]	0	22	182	204
ID	57	53	28	21	42	201
MT	411	307	276	144	176	1314
NE	147	172	120	189	224	852
NV	89	6	4	0	21	120
NM	1366	1254	945	720	940	5225
ND	0	0	0	0	0	0
OK	123	60	68	30	18	299
OR	82	85	111	106	86	470
SD	193	182	193	192	230	990
TX	3944	2903	2333	2157	3437	14774
UT	9	2	4	0	0	15
WY	0	0	0	0	0	0
Totals	7017	5378	4573	5507	5764	28239
Target animals[c] taken (all states)	8393	7344	6169	6432	6324	34662
Target animals per M-44 year	1.2	1.4	1.3	1.2	1.1	1.2

[a]One M-44 year equals 365 unit nights.
[b]Colorado program was not Federally supervised in 1977-78. Data for these years were not available. Colorado was Federally supervised in 1979 but M-44s were not used in that year.
[c]Target animals include coyote, red fox, gray fox, and wild dog.

program in 1972. Following reregistration in 1975 it has again become one of the most important techniques for controlling damage by wild canids, particularly coyotes. The coyote take by M-44 has increased each year since 1981. The 1986 take of 12,957 was the largest number of coyotes taken in any year since reregistration, but was well below the 1971 peak. It remains to be seen whether the M-44 will again become as important as it was before the 1972 predacide ban.

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