FIELD EVALUATION OF CHEMICAL ATTRACTANTS FOR SUMMER USE ON M-44s[1]

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ABSTRACT: Responses of free-roaming coyotes (*Canis latrans*) to four chemical attractants (W-U lure, artificial beef liver flavor, artificial smoked fish flavor, and Fatty Acid Scent) used on M-44 tops were measured during the summer months in Colorado, Idaho, Montana, Washington, and Wyoming. Visitation and pull rates varied throughout the study period from area to area and appeared to be associated with weather, food abundance, and coyote densities. Fatty Acid Scent and W-U lure produced the highest visitation and pull rates.

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INTRODUCTION

The M-44 is an important control tool used in the management of coyote (*Canis latrans*) depredation problems in the western United States. In fiscal year 1992, Animal Damage Control Specialists (ADCSs) with the federal Animal Damage Control program took 25,239 coyotes with M-44s (M. Mendoza, personal communication), which represented 26% of the coyotes taken by all control methods. Despite the widespread use of this tool, there have been few published reports describing field research on attractants that will stimulate coyotes to pull M-44s during the summer months when natural foods are abundant. Some ADCSs do not use M-44s during this period due to low pull rates obtained with fetid attractants normally used during colder weather. Other ADCSs have learned to formulate non-fetid attractants that are effective in summer. Availability of more effective summer attractants would extend the use of M-44s and provide another control tool during this time of year when predation on livestock usually increases due to young lambs and calves occupying the same ranges where coyotes are raising their pups. The research described in this paper follows earlier work with captive coyotes which helped us to identify candidate chemical attractants showing potential for summer use on M-44s (Phillips et al. 1990). We identified four of the best attractants with high pull-response times from captive coyotes and selected these for field testing.

The objective of our study was to determine the response of free-roaming coyotes to applications of W-U lure (W-U), artificial beef liver (BLF), artificial smoked fish flavor (SMF), and Fatty Acid Scent (FAS) used on M-44 tops during the summer months.

STUDY AREA AND METHODS

Field tests were conducted from May to August, 1991, in study areas in Colorado, Idaho, Montana, Washington, and Wyoming (Figure 1). Temperatures ranged from a May low of 33°F in Montana to an August high of 101°F in southern Idaho. Habitat types represented included mixed sagebrush/grassland in Colorado, Idaho, Montana, and Wyoming and coniferous forest areas in Montana and Washington. No operational coyote control programs were conducted in these study areas and we believe they supported "normal" coyote densities for their respective habitat types.

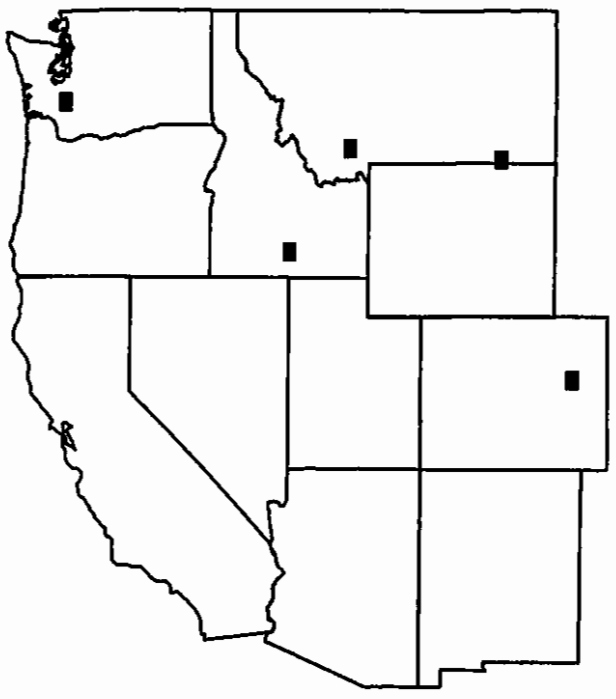

Figure 1. Locations of M-44 attractant evaluation study areas.

Pre-scented M-44 tops were prepared by wrapping them with an absorbent, self-sticking bandage (VET-WRAP[3]) and then dipping them into a hot matrix of the attractant, plaster of paris, melted paraffin wax, and

[1]The M-44 is a tube-like spring-loaded device partially inserted into the ground; the exposed portion is baited with an attractant which, upon being pulled by a coyote, ejects a lethal dose of sodium cyanide into its mouth.

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[3]Mention of commercial products for identification does not imply endorsement by the authors or the federal government.

melted beeswax (Turkowski et al. 1983). The scented tops were then stored in sealed containers prior to placement in the field. A 10% concentration of W-U and FAS was used throughout the study. Smoked fish and beef liver flavors were used at the 10% concentration level for the initial field test in May, and then increased to 20% for the June to August test periods. Concentrations of these attractants were increased due to an apparent lack of odor retention at the 10% level. We used a modified scent-station survey method (Linhart and Knowlton 1975, Turkowski et al. 1979) to compare responses of coyotes to the four attractants.

Attractant test lines were run for three distinct periods during the warm-weather months between mid-May and late August. The Colorado, Montana, and Wyoming lines were run during all three periods while the Idaho and Washington lines were only run during the June, July and August periods. M-44 units (without cyanide capsules) were placed at locations adjacent to unpaved or unimproved roads that would regularly be traveled by coyotes. The four attractants were systematically alternated in series to reduce bias. Each unit was set at a distance >0.25 mile from the next closest M-44 location. Individual lines were checked daily for five consecutive days. Each observer usually set between 48 and 56 M-44s for an exposure of 240 to 280 M-44 nights[4], depending upon the length of the line and the time it took to establish it. Visitation and pulls by different animals were recorded by the presence of tracks or other sign in an area of sifted soil three feet around the M-44.

RESULTS

Two hundred-fifteen coyote visits and 58 pulls were recorded during the study period for an overall pull rate of 27%, or 1 pull per 69 M-44 nights (Table 1). Visitation rates were highest for FAS followed by W-U, SMF, and BLF. Pull rates followed a similar pattern except BLF and SMF were interchanged. FAS and W-U had equal pull rates of 36% followed by 21% for BLF and 9% for SMF. These results are similar to ratings given to these attractants when tested on captive coyotes (Phillips et al. 1990). In that study, however, coyote responses were measured quantitively by recording the total duration of their behavioral responses. Martin and Fagre (1988) also noted the attractiveness of W-U when comparing it to other attractants in south Texas.

Coyote visitation rates varied between study areas and among months when the scent stations were run (Table 2). The highest total visitation rate for the entire test period was recorded in Colorado followed by Idaho, Washington, Montana, and Wyoming. The highest total pull rates for the entire test period were recorded in Idaho, followed by Colorado, Montana, Wyoming, and Washington. Both total visitation and pull rates increased slightly as the summer season progressed and pups were added to local populations.

[4]M-44 nights are the total number of M-44s placed times the total number of nights they are operable.

Table 1. Summary of coyote responses to attractants placed on M-44s during May-August 1991 in Colorado, Idaho, Montana, Washington, and Wyoming.

Attractant	M-44 nights	No. of visits (%)	No. of pulls (%)	Visits/M-44 nights[a]	Pulls/M-44 nights[b]
Fatty Acid Scent	1005	70 (7.0)	25 (35.7)	1/14	1/40
W-U lure	1009	56 (5.6)	20 (35.7)	1/18	1/50
Smoke fish flavor	1006	47 (4.7)	4 (8.5)	1/21	1/252
Beef liver flavor	1006	42 (4.2)	9 (21.4)	1/24	1/112
Totals	4026	215 (5.3)	58 (27.0)	1/19	1/69

[a]The number of visits per M-44 nights is the number of M-44 nights divided by the number of visits.
[b]The number of pulls per M-44 nights is the number of M-44 nights divided by the number of pulls.

Table 2. Comparison of coyote visits and number of pulls on M-44s scented with four attractants during May-August 1991 in Colorado, Idaho, Montana, Washington, and Wyoming. Number in parentheses is the percent of visits that resulted in pulls.

STATE	ATTRACTANT									
	FAS		W-U		SMF		BLF		All Attractants	
	Visits	Pulls	Visits	Pulls	Visits	Pulls	Visits	Pulls	Visits	Pulls
					May					
Colo.	9	3 (33)	9	3 (33)	2	0 (0)	6	4 (67)	26	10 (38)
Mont.	2	1 (50)	0	0 (0)	4	0 (0)	2	1 (50)	8	2 (25)
Wyo.	2	0 (0)	1	0 (0)	3	0 (0)	0	0 (0)	6	0 (0)
Subtotal	13	4 (31)	10	3 (30)	9	0 (0)	8	5 (63)	40	12 (30)
					June-July					
Colo.	6	2 (33)	4	1 (25)	5	0 (0)	4	1 (25)	19	4 (21)
Idaho	9	6 (67)	9	5 (56)	6	1 (17)	3	0 (0)	27	12 (44)
Mont.	2	1 (50)	1	0 (0)	1	0 (0)	1	0 (0)	5	1 (20)
Wash.	5	1 (20)	5	0 (0)	4	0 (0)	3	0 (0)	17	1 (6)
Wyo.	0	0 (0)	3	0 (0)	1	0 (0)	1	1 (100)	5	1 (20)
Subtotal	22	10 (46)	22	6 (27)	17	1 (6)	12	2 (17)	73	19 (26)
					August					
Colo.	5	2 (40)	6	4 (67)	3	0 (0)	5	1 (20)	19	7 (37)
Idaho	10	6 (60)	7	3 (43)	4	1 (25)	3	0 (0)	24	10 (42)
Mont.	10	3 (30)	2	2 (100)	5	1 (20)	3	0 (0)	20	6 (30)
Wash.	7	0 (0)	7	0 (0)	7	1 (14)	9	0 (0)	30	1 (3)
Wyo.	3	0 (0)	2	2 (100)	2	0 (0)	2	1 (50)	9	3 (33)
Subtotal	35	11 (31)	24	11 (46)	21	3 (14)	22	2 (9)	102	27 (27)
TOTAL	70	25 (36)	56	20 (36)	47	4 (9)	42	9 (21)	215	58 (27)

Attractant stations were visited by a wide variety of nontarget species during the course of this study (Table 3). Visitation rates by species or groups of species were undoubtedly related to their abundance in a particular study area. M-44s were pulled by deer (1), elk (5), cattle (15), swift fox (5), and red fox (2) suggesting that these devices can pose a hazard to these species when these particular attractants are used.

DISCUSSION

The results of this field test confirm what has long been known about the reduced responsiveness of coyotes to attractants during the summer months. The overall low visitation rate of 5.3%, or 1 visit per 19 M-44 nights, is probably indicative of natural food abundance and low-to-moderate coyote densities within these test areas. ADCSs have long noted that coyotes are less active during hot

Table 3. Visits to M-44 scent stations by nontarget species in Colorado, Idaho, Montana, Washington, and Wyoming, May-August 1991; the number in parentheses indicates the number of pulls, if they occurred.

Species	State				
	Colo.	Idaho	Mont.	Wash.	Wyo.
Deer (*Odocoileus* spp.)		27	44	81	30 (1)
Elk (*Cervus canadensis*)		3	45 (5)		
Pronghorn (*Antilocapra americana*)	14		1		2
Cattle (*Bos tarus*)	15 (1)		79 (14)		80
Burro (*Equus asinus*)	1				
Black bear (*Ursus americanus*)			1		
Bobcat (*Felis rufus*)		4			
Swift fox (*Vulpes velox*)	36 (5)				
Red fox (*Vulpes vulpes*)			5 (1)		4 (1)
Domestic dog (*Canis familiaris*)				4	
Badger (*Taxidea taxus*)	5	14			
Skunk (*Mephitis mephitis*)		35			
Porcupine (*Erethizon dorsatum*)		4	1		
Opossum (*Didelphis virginianus*)				2	
Lagomorphs	17	52	1		33
Rodents			36 (1)		
Birds	2 (1)	1	2		13

and dry periods and are more active during cooler and wet weather.

There are relatively few published reports that identify coyote pull rates. Table 4 compares coyote pull rates for M-44s and Coyote Getters[5] (CGs) that have been reported in the past 50 years. The coyote pull rate for this study of 1 per 69 M-44 nights is within the range of pull rates that have been reported elsewhere. Higher pull rates were generally reported for areas with high coyote densities such as south Texas. Also, most of the pull rates reported by other investigators were recorded during the fall and winter months when most M-44 attractants are historically more attractive to coyotes. Besides our study, the only other tests cited that employed daily checks were the 1968 and 1969 coyote census lines conducted in Texas (USDI 1978) where M-44s were checked for 10 consecutive days. The lower pull rates listed in the 1940s were recorded from actual field lines where the frequency of checks were much lower, probably once every 7 to 14 days. If an ejector was pulled, only one pull would been recorded even though additional coyotes could have visited and attempted to pull on the unit before it was checked and reset.

Using these chemical attractants on M-44s during the spring and summer months may help resolve predation problems faster than if they were not used. These chemical attractants also provide an alternative to conventional fetid attractants that may not work at all during this time of year and they will provide variety to accommodate the wide preference of individual coyotes to attractants as discussed in our previous paper (Phillips et al. 1990).

The attraction of deer, elk, and cattle to these attractants may have resulted in part from the presence of the mineral, calcium sulfate (plaster of paris), used in the pre-scented M-44 tops as well as the attractants themselves. These animals usually crave salts and minerals during this time of year and can detect them in small proportions. Another possible explanation may be just the curiosity factor to the M-44 tops protruding from the ground. No effort was made to make the M-44s less accessible to these nontargets such as placing them in

[5]A Coyote Getter is a device similar to the M-44, but it explosively fires sodium cyanide into the coyote's mouth by a firing pin, primer, and a small amount of gunpowder. It was discontinued from ADC program use in 1970, and the registration was canceled by EPA in 1972.

Table 4. Comparison of cyanide ejector pull rates by coyotes for this study and previous studies.

Year(s) of study	Reference	Location	Unit Type	Time of year	Pull rate (coyote pulls per unit nights)[a]
1941	Sears 1941	CO	CG	Aug-Nov	1/248
1940-41	Robinson 1943	CO, NM, WY	CG	Sep-Oct	1/184
1947-48	Cummings 1948	CO	CG	Winter	1/95
1965-71	USDI 1978	TX	M-44	Oct-Nov	1/32
1974-75	Clark 1976	CA	M-44	Oct-Jun	1/578
		CA	M-44	Oct-Jun	1/922
1978	Keenan 1979	CA, NE, NM OK, OR, TX	M-50[b]	Winter-Spring	1/96
1982	Connolly et al. 1986	TX	M-44	Feb-Apr	1/29
1983-84	Fletcher 1984	NM	M-44	Oct-Jan	1/82
1991	This study	CO, ID, MT WA, WY	M-44	May-Aug	1/69

[a]Unit nights are the total number of CGs or M-44s times the total number of nights they are operable.
[b]The M-50 was developed in 1978 to replace M-44. It was a larger unit that used a larger capsule. Because of mechanical and material problems that prevented the M-50 from functioning properly (Connolly and Simmons 1984), it did not replace the M-44 as intended. Manufacture of M-50 equipment was discontinued in 1983.

shallow holes, between rocks or cacti, or covering them with a cow chip or piece of bark. These methods of diversion are commonly used by ADCSs to reduce tampering of M-44s by nontargets.

The pre-scented M-44 tops worked very well during this field test under a variety of weather conditions, providing a reliable controlled-release and durable odor dispersion system for chemical attractants with minimal disturbance by insects and rodents. This research suggests that M-44s could continue to be an effective control tool during the summer months if appropriate attractants were used.

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