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Field Evaluation of Olfactory Attractants and Strategies Used to Capture Depredating Coyotes

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Field Evaluation of Olfactory Attractants and Strategies Used To Capture Depredating Coyotes[1]

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Abstract.--Forty-five experimental and commercial olfactory attractants (lures) were tested under field conditions over a 30-month period to evaluate attractiveness to coyotes, elicited behaviors, and responses with lethal and simulated lethal coyote capture devices. The top 7 lures evaluated in spring and summer test periods that produced the highest simulated coyote capture rates with trap rings, M-44 heads, and break-away snares were WU 15-20%, Sheep Liver Extract, and (Carman's) Canine Distance Call Lure; (Carman's) Final Touch, Rotten Meat Odor, and TMAD 10%; and Estrous Urine Fractions, respectively.

INTRODUCTION

Behavioral responses that experimental and commercial coyote and carnivore olfactory attractants (lures) elicit to coyotes have been conducted in controlled experiments using captive coyotes (Timm et al. 1975, 1977, 1978, Fagre et al. 1981a, 1981b, 1983, Kruse and Howard 1983, Scrivner et al. 1984, 1985, 1987). Skepticism as to the validity and application of these results to wild coyotes has been expressed by researchers and field personnel (Teranishi and Howard 1986). An extensive and quantifiable field evaluation of experimental lures with actual applications with leghold traps, M-44's, and cable snares was needed.

Turkowski et al. (1983) suggested several factors that could cause variation in predator responses to attractants. These factors included weather elements, ambient temperature, length of lure exposure, seasonal periods, and individual coyote behavior. The purpose of this project was to test some of these factors and develop a transportable, productive, and cost effective method of selective coyote control. The approach was to evaluate, by field tests, delivery materials and strategies, lure formulations, mechanisms and chemicals to increase the probability of capturing coyotes and other predators. The objective was to determine which lures increased the efficacy and selectivity of leghold traps, M-44 sodium cyanide (NaCN) ejectors, snares, and other control devices under field conditions.

STUDY AREA

Investigators (4) selected non-overlapping study sites that had viable coyote populations and a history of livestock/coyote interactions. Fall and winter data were collected on sites and elevations normally used as sheep (*Ovis aries*) wintering areas. The sites consisted primarily of short-grass prairies between elevations of 1364-1818 m with blue grama (*Bouteloua gracilis*) the dominant vegetation. Lower montane regions, primarily composed of cedar (*Juniperus* spp.), pine (*Pinus* spp.), and sagebrush (*Artemisia* spp.) vegetation from elevations of 1515-2576 m were also used. Spring and summer data were gathered from sites where sheep normally lambed and ranged during summer. Sites including short-grass prairies, lower montane, montane (mainly composed of *Pinus* spp.), subalpine (*Picea* and *Abies* spp.), and alpine areas of north-central and eastern Colorado were utilized.

METHODS

The study was conducted between 1 Nov. 1982 and 25 Aug. 1985. Data were collected on combinations of lures and capture devices during fall, winter, spring, and summer of each year. Each test period consisted of a minimum of 20 days of field applications within a season and a minimum of 30 treatment sites. A treatment site was

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defined as the placement of 1 lure with 1 capture device type at 1 location. Treatment sites were inspected approximately every 2 days (weather permitting). Data were collected on standardized data sheets.

Coyote capture devices were categorized as lethal and simulated lethal. Lethal devices used in the fall and winter (FW) test periods included leghold traps, M-44 NaCN ejectors, and cable snares. Leghold traps (usually 2 per treatment site) were placed in the soil, anchored, and covered to mimic standard practice following Boddicker (1980) and Hawthorne (1980). A capture was recorded if an animal was caught and held or caught but escaped before investigator arrived. Tracks and hair were evaluated to determine the species of escaped animals. Procedures used with M-44 NaCN ejectors were those prescribed by Beasom (1974), Shult et al. (n.d.), and Boddicker (1979). A capture was recorded if the M-44 NaCN ejector head was pulled whether or not an animal was recovered. Sign, such as tracks and teeth indentations on the head, was used to confirm the species. M-44 ejectors and NaCN capsules used were manufactured by and purchased from the M-44 Safety Predator Control Company, Inc., Midland, Texas[4]. Commercial cable snares, made from 0.16-cm twisted steel cable, were placed in locations that camouflaged their presence and near coyote trails and travelways. Cable snares were set following procedures prescribed by DeZarn (1984). A capture was recorded if an animal was caught and held or caught and escaped before investigator arrived.

Simulated lethal devices were utilized in the spring and summer (SS) test periods to maintain maximum opportunity for coyote-device interactions. Simulated lethal devices used were trap rings, M-44 heads only, and break-away snares. Trap rings were made from 1.25-cm cross sections of 15.0-cm diameter plastic pipe and placed in the ground in the same manner as were leghold traps. A simulated capture was recorded if an animal stepped inside 1 or both rings. M-44 heads, wrapped in hemp, but without beeswax or paraffin, were staked 8 cm above the ground by 20-penny nails placed through the head area that normally contained the NaCN capsule. A capture was recorded if the head was pulled upwards 2.5 cm or more from set height; head pulled out of soil, chewed, and dropped; or if the head was removed from the site. Break-away snares designed by G. Stewart, consisted of a 30-cm loop of 0.04-cm braided steel wire with a copper clip replacing the base ferrule. Break-away snares were placed using the same procedures as cable snares. Captures were recorded when snares were broken by an animal.

A standardized volume of approximately 0.5 ml of each candidate lure was presented on a neutral material that varied with the device used. Lures evaluated with leghold traps and trap rings were placed directly on cotton q-tips, bleached bones, cow chips, grass tufts, animal fur, or feathers. Lures were placed upwind and directly behind the leghold traps or trap rings so an investigating animal would usually pass over the trap when exploring the lure. Removal of used delivery materials from the study site reduced contamination.

When used with cable and break-away snares, lure was presented in plastic vials elevated approximately 1.25 m from ground level. Vials were suspended by cotton string and attached to brush and other supports. Placement was intended to force animals to pass through the snare(s) in their attempt to investigate the lure. Lures were placed directly to the head of M-44 NaCN ejectors and M-44 heads.

Experimental lures (EL's) evaluated in the study (table 1) were those developed by R. Teranishi, USDA, Research Leader Food Quality, Western Regional Research Laboratory, ARS, Albany, Calif., and associates. Trimethylammonium Decanoate (TMAD) and WU (a mixture of acids,

Table 1.--Experimental lures evaluated in the study.

Experimental olfactory attractants (lures)	Designation
Trimethylammonium Decanoate[1]	TMAD
Rotten Meat Odor[2]	RMO
Synthetic Calf Crap[3]	SCC
Synthetic Porcupine Hair[4]	SPH
Sheep Liver Extract[4]	SLE
Estrous Urine Fractions[4]	EUF
WU[5]	WU
WU Acids[4]	WU Acids

[1] Two formulations of TMAD were mixed by the principal investigator and evaluated. One part TMAD mixed with 99 parts pork lard (PL) to formulate TMAD 1%. One part TMAD mixed with 9 parts PL to formulate TMAD 10%.

[2] One part RMO mixed with 9 parts PL.

[3] Two formulations of SCC lure were tested. Equal portions of SCC mixed with liquid lanolin and designated as SCC (this formulation was mixed by R. Teranishi). The other formulation, designated as SCC + sugar, was mixed at a ratio of 4 parts SCC plus 1 part sugar.

[4] SPH, SLE, EUF, and WU Acids were used as received from R. Teranishi.

[5] Four formulations of WU were mixed by the principal investigator and evaluated. One part WU mixed with 99 parts PL to formulate WU 1%. One part WU mixed with 9 parts PL to formulate WU 10%. Four parts WU 10% mixed with 1 part sugar to formulate WU 10% + sugar. One part WU mixed with 5-7 parts PL to formulate WU 15-20%.

[4] Mention of manufacturer and trade names does not constitute endorsement by the U.S. Government.

sulfides, and trimethylamine) lures were diluted and formulated by M. Boddicker. Other EL's were used as received by R. Teranishi.

Fourteen commercial lures (CL's) (table 2) and 18 combinations of lures (Combos) were also evaluated. CL's were selected by M. Boddicker because of above average reputations as coyote attractors, or had been used in previous research conducted by Linhart et al. (1977), Turkowski et al. (1979, 1983), and Fagre et al (1983). CL's were used as received from the supplier. Combo lures resulted from the use of 2 or more EL's and/or CL's presented at 1 treatment site. In a Combo, lures were administered separately on delivery materials (usually q-tips) and placed within a 225 cm^2 area. Combo lures were only used with leghold traps and cable snares and predominately used in FW test periods.

Responding animals were classified as coyote, other carnivores, herbivores, and birds. Behaviors were categorized according to Turkowski et al. (1979). Investigators were trained to interpret behaviors exhibited by coyotes and other animals responding to the lures. Ambient temperature was taken between 7-8:00 a.m., recorded each day and at each study area, and assumed the low temperature for that day. Temperatures were grouped into range classes of 5 C each starting with -23.3 C and ending with 37.2 C. Barometric pressure was obtained from meteorological monitoring facilities located nearest to each study site and recorded as rising, falling, or stable. Lunar phases were recorded as either new or full. New moon was defined as the time duration beginning with the first day of the third quarter through the last day before the first quarter. Full moon duration comprised of the remaining time period not

Table 2.--Commercial lures evaluated in the study.

Commercial lure[1]	Designation
(Carman's) Canine Distance Call Lure	CDCL
(Carman's) Final Touch	CFT
(Carman's) Pro's Choice	PC
Olmstead Coyote Lure	OCL
Olmstead Bait	OB
Stokers Bounty	SB
Mast #6 (Coyote #6)	M#6
(O'Gorman) Gov't Call	OGC
(O'Gorman) Long Distance Call	OLDC
(O'Gorman) Wolfer Scent	OWS
(O'Gorman) Powder River Paste	PRP
Johnson's Bait	JB
Kents Coyote Butter	KCB
Fish Oil (Commercial)	FO

[1] Commercial lures were evaluated as received by the supplier.

covered by new moon. Duration of lure presentation in days was recorded at each inspection. If reapplication of lure was necessary, duration was reset at 0 days and increased until a capture was made, lure reapplied, or site removed. Lure presentation or "lure age" was grouped into 2-day age classes.

The calculation of capture rate for each lure and variable was necessary to standardize the data. Capture rate for each lure was obtained by dividing the total number of coyotes captured by the total trapnights exposed (Turkowski et al. 1979). Analysis of variance (ANOV) was used to determine if significant differences exist between coyote and simulated coyote capture rates of variables for individual lures. Lures used in ≥ 5 test periods within a season and generating responses or captures of ≥ 5 coyotes in at least 1 test period were considered as having sufficient data for analysis. Bivariate linear regression was used for additional analysis of temperature data. The slope inclination of the plotted data provided the relative stability of the lure and the R^2 value provided the relative precision and fluctuation in capture rates.

RESULTS AND DISCUSSION

Investigators presented 44 lures at 2,328 treatment sites involving 46,164 trapnights. A total of 609 coyotes was captured in 15 FW test periods combining 25,478 trapnights. Leghold traps were used in 44.4% of total trapnights and captured 185 coyotes, M-44 NaCN ejectors composed of 48.7% of the total trapnights and resulted in 372 captured coyotes, and cable snares generated 6.9% of the total trapnights, capturing 52 coyotes. A total of 731 coyote-visits was recorded at simulated lethal capture devices from 15 SS test periods that generated 20,686 trapnights. Trap rings produced 64.5% of simulated coyote captures (N = 472) in 50.8% of total trapnights. M-44 heads were used in 45.3% of total trapnights and accounted for 33.5% of simulated coyote captures (N = 245), and break-away snares produced 1.9% of simulated coyote captures (N = 14) in 3.9% of total trapnights.

Devices

No one lure produced consistent FW coyote captures with all 3 lethal capture devices. Combos were effective in capturing coyotes when used with leghold traps, but not snares (table 3). CL's generated higher coyote capture rates than EL's when used with M-44 NaCN ejectors, but EL's produced higher coyote capture rates than CL's when used in conjunction with cable snares. Four lures, Synthetic Calf Crap (SCC), (Carman's) Canine Distance Call Lure (CDCL), WU 15-20%, and WU Acids (a mixture of C_2, C_4, C_5, C_9, and C_{10} acids) were analyzed using ANOV to determine if differences exist between coyote capture rates of lethal devices used. Coyote capture rates of

Table 3.--The top 12 lures evaluated in FW producing the highest coyote capture rates when used in conjunction with lethal capture devices. Lures used with capture devices generating <5 captured coyotes are not given.

Leghold traps			M-44 NaCN ejectors			Cable snares		
Lure	N coyotes captured	Capture rate	Lure	N coyotes captured	Capture rate	Lure	N coyotes captured	Capture rate
[1]CFT-C	11	0.093	OLDC	10	0.083	OCL	7	0.064
[2]Combo 5	20	0.048	CDCL	207	0.054	EUF	9	0.037
[3]Combo 6	6	0.044	OWS	13	0.054	WU 15-20%	8	0.031
[4]CDCL-C	25	0.037	SB	24	0.041	CDCL	17	0.026
[5]TMAD-CDCL-C	5	0.032	WU 15-20%	42	0.024			

[1] CFT-C consisted of Carman's Final Touch and coyote urine.
[2] Combo 5 consisted of SCC, CDCL, sugar, and coyote urine.
[3] Combo 6 consisted of RMO, CDCL, and coyote urine.
[4] CDCL-C consisted of CDCL and coyote urine.
[5] TMAD-CDCL-C consisted of TMAD 10% and CDCL.

CDCL, when used with M-44 NaCN ejectors, was significantly different (P = 0.001) when compared with results from leghold traps and cable snares. WU 15-20% produced significantly higher coyote capture rates when used with cable snares (P = 0.01) than with M-44 NaCN ejectors and leghold traps. Coyote capture rates attained when using SCC and WU Acids did not differ (P >0.05) among the lethal devices.

SS results suggest EL's were successful in attracting coyotes to simulated coyote capture devices. SS data from 7 lures (TMAD 10%, RMO, SCC, EUF, WU 15-20%, WU Acids, and CDCL) were analyzed using ANOV to determine if differences exist between simulated coyote capture rates of trap rings and M-44 heads. The only lure showing significance (P = 0.03) was WU 15-20%, where trap rings produced higher simulated coyote capture rates than M-44 heads. RMO, when used with M-44 heads, produced a P-value very close to the 95% CI (P = 0.053) when compared with trap rings. The top 8 lures evaluated in SS producing the highest simulated coyote capture rates are presented in table 4.

Behavior

A total of 3858 behavioral responses from coyotes (N = 2357), carnivores (N = 284), herbivores (N = 1183), and birds (N = 34) was recorded. Coyote behaviors which showed the greatest seasonal variation from FW and SS were lure smelled, no other action (LS), rolling and/or shoulder rub (RSR), and licking, biting, and/or chewing (LBC) (fig. 1). The most frequently recorded coyote behavior and category was LBC behavior, producing 40.6% of FW and 35.6% SS responses (table 5). Coyote urination responses to EUF, WU 15-20%, WU Acids, and CDCL were analyzed using ANOV but no significance (P >0.05) was found in either FW and SS. Four of the top 5 lures eliciting the RSR behavior of coyotes were EL's. CDCL, the only CL, generated the least seasonal variation in this behavioral response. No statistical difference (P >0.05) was found in the FW or SS RSR behavior of coyotes elicited by TMAD 10%, SCC, EUF, WU 15-20%, and CDCL. An accelerated increase of 3.4-fold of the scratching and/or digging (SD) behavior of

Table 4.--The top 8 lures evaluated in SS producing the highest simulated coyote capture rates when used in conjunction with simulated lethal capture devices. Lures used with simulated capture devices generating <5 simuluated captured coyotes are not given.

Trap rings			M-44 heads			Break-away snare		
Lure	N coyotes captured	Capture rate	Lure	N coyotes captured	Capture rate	Lure	N coyotes captured	Capture rate
WU 15-20%	70	0.218	CFT	13	0.070	EUF	8	0.110
SLE	6	0.107	RMO	13	0.065			
CDCL	150	0.075	TMAD 10%	35	0.064			
CFT	31	0.047	CDCL	93	0.034			
EUF	40	0.028	TMAD 1%	16	0.030			

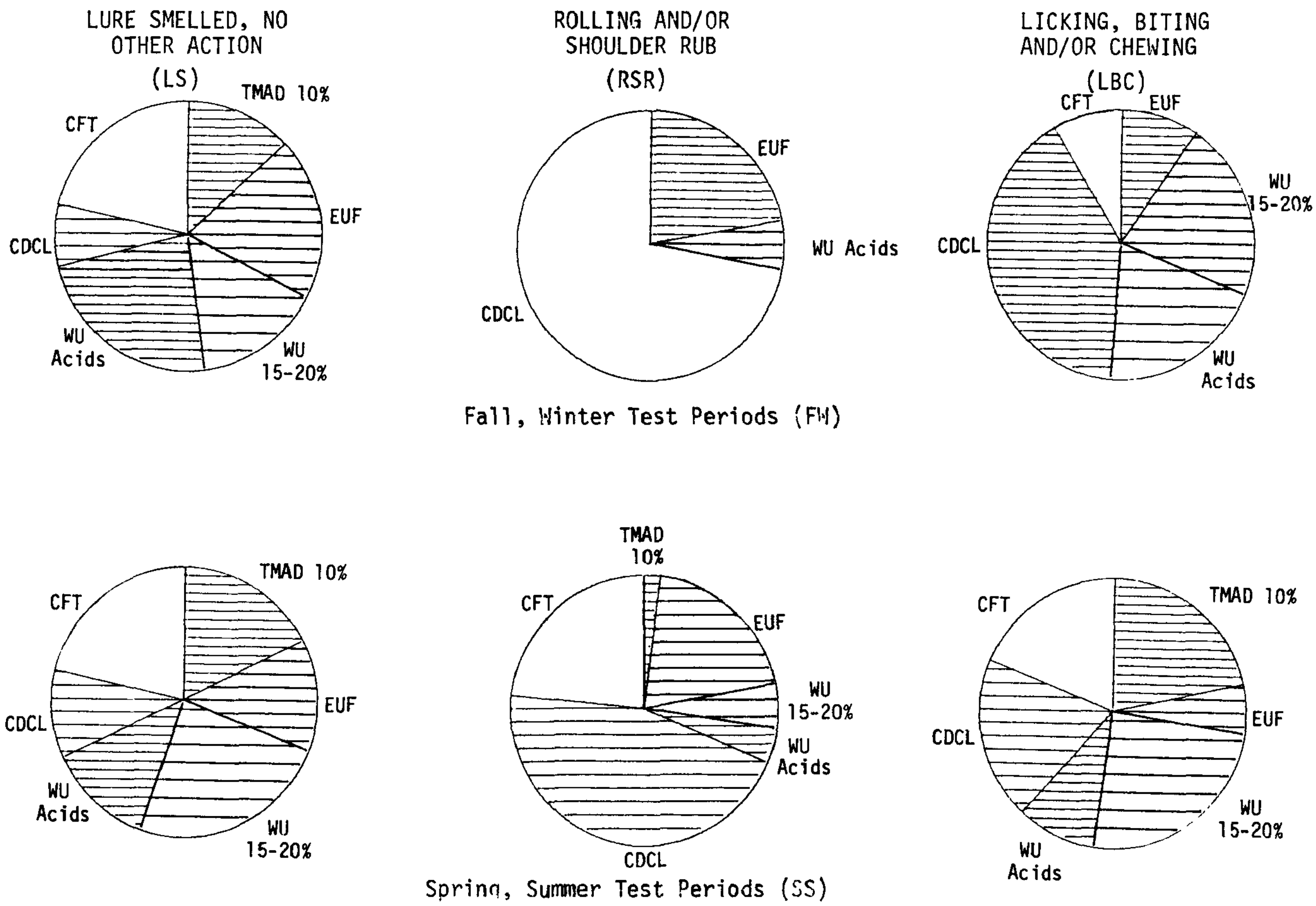

Figure 1.--Fall, winter (FW) and spring, summer (SS) seasonal variations of lure elicited coyote behaviors. Data provided in pie charts are from the comparison of 6 lures only; TMAD 10%, EUF, WU 15-20%, WU Acids, CDCL, and CFT.

FW LS behavior rates:
TMAD 10%=0.006 WU 15-20%=0.007 CDCL=0.003
EUF =0.009 WU Acids =0.011 CFT =0.010

FW RSR behavior rates:
TMAD 10%=0.000 WU 15-20%=0.000 CDCL=0.016
EUF =0.005 WU Acids =0.001 CFT =0.000

FW LBC behavior rates:
TMAD 10%=0.000 WU 15-20%=0.020 CDCL=0.037
EUF =0.009 WU Acids =0.018 CFT =0.007

SS LS behavior rates:
TMAD 10%=0.011 WU 15-20%=0.014 CDCL=0.006
EUF =0.008 WU Acids =0.008 CFT =0.013

SS RSR behavior rates:
TMAD 10%=0.001 WU 15-20%=0.003 CDCL=0.020
EUF =0.009 WU Acids =0.002 CFT =0.011

SS LBC behavior rates:
TMAD 10%=0.036 WU 15-20%=0.040 CDCL=0.032
EUF =0.010 WU Acids =0.016 CFT =0.031

Behavior rates are calculated by dividing the number of behavioral responses by the total number of presentations (or trapnights).

coyotes was generated in SS when comparing with FW. ANOV showed that Synthetic Porcupine Hair (SPH), TMAD 10%, WU Acids, CDCL, and (Carman's) Final Touch (CFT) significantly ($P < 0.05$) elicited the SD behavior more often in SS than in FW. Seven of 8 EL's increase the elicited LBC behavior of coyotes in SS while WU Acids decrease. Two of 3 CL's demonstrate a decrease of the LBC behavior in SS, but CFT produced higher LBC behaviors in SS.

EUF, WU 15-20%, WU Acids, and CDCL provided sufficient LBC behavior data for ANOV. FW coyote LBC behaviors from CDCL and WU Acids showed to be significantly higher than in SS, but no difference ($P > 0.05$) was found between seasons for LBC behavior elicited by EUF and WU 15-20%. EUF, WU 15-20%, WU Acids, and CDCL were analyzed using ANOV to determine if the FW LBC behavior was different among individual lures. The same lures, with the addition of CFT, were analyzed from SS. ANOV results indicate no statistical differences ($P > 0.05$) between LBC behaviors elicited in FW, but a difference was found in SS. CFT produced significantly higher LBC behaviors of coyotes than the other 4 lures ($P = 0.004$).

Table 5.--Coyote behavior response rates and seasonal ratios of experimental and superior commercial lures.[1]

Lure	[2]Presentations	[3]Behavior rate seasonal ratio					
		[4]LS	Urine	Defec	[5]RS	[6]SD	[7]LBC
TMAD 1%	199/1012	5:23	0:0	0:1	0:1	0:9	0:21
TMAD 10%	1188/1854	5:11	0:2	0:1	0:10	1:20	0:36
RMO	180/1045	11:23	0:0	0:1	0:3	6:9	0:22
SCC	814/2126	4:17	1:1	0:2	0:4	0:10	0:17
SPH	169/711	6:18	0:3	0:0	0:10	0:13	0:13
EUF	101/2114	30:8	4:9	3:3	5:9	5:12	4:9
WU 15-20%	2410/1592	7:14	5:9	0:1	0:3	0:10	20:40
WU Acids	1520/2564	11:8	4:9	0:1	1:2	1:10	18:16
CDCL	5228/4767	3:6	2:7	0:3	16:20	2:23	37:31
CFT	411/861	10:38	0:17	0:2	0:10	0:24	7:30
SB	783/661	3:2	0:0	0:0	6:2	2:0	31:12

[1] SLE, WU 1%, WU 10%, WU 10% + sugar, and SCC + sugar were not listed in Table 5 due to low presentation in FW and/or SS test periods.
[2] Sum of seasonal presentation. FW data is given first followed by SS data.
[3] Behavior rate seasonal ratio is calculated by dividing coyote responses by presentations and multiplying by 1000 to give behavior responses per 1000 presentations. FW rates are presented first in the ratio followed by SS rates.
[4] LS (lure smelled, no other action) was recorded if the coyote had entered the treatment site and approached the lure delivery material within a distance of no less than 30 cm without being captured.
[5] RSR = rolling and/or shoulder rub.
[6] SD = scratching and/or digging.
[7] LBC = licking, biting, and/or chewing.

Predator control techniques are most effective with lures which elicit either sniffing (lure smelled) or licking, biting and/or chewing response, and least effective with lures that elicit the rolling and/or shoulder rub (Scrivner et al. 1987). Coyote behavior required for efficient use of leghold traps and snares should be a compelling interest which interrupts other activities in which the coyotes are engaged, lowering coyote's normal caution, evoking approach, and ensuring interaction with the control device. The exhibited coyote behavior, which most likely represents the above list, was categorized into the LS behavior. All EL's evaluated in both seasons (FW and SS), except for EUF and WU Acids, generated higher LS coyote behaviors in SS. CL's generating the highest LS behavior and satisfying criteria for SS use with leghold traps and snares were CDCL and CFT. Turkowski et al. (1979, 1983) and Fagre et al. (1983) found similar results in testing CDCL with wild and captive coyotes respectively. In comparing CDCL with TMAD, Fagre et al. (1983) recorded higher coyote summer visit rates for CDCL. The results of this evaluation found the opposite in that TMAD 1% and 10% generated higher LS behavior rates than CDCL.

Ideal lures used with M-44 NaCN ejectors should elicit the LBC behavior of coyotes (Timm et al. 1977), possess the compelling holding interest properties, and be selective and highly attractive to coyotes during all seasons (Fagre et al. 1983). Results from lure evaluations conducted by Fagre et al. (1983) and Scrivner et al. (1984) found no lures that consistently elicited all behavioral properties required for M-44 NaCN ejectors in all seasons. EL's evaluated in this study meeting the above criteria and exhibiting high SS LBC behaviors of coyotes were WU 15-20%, TMAD 10% and 1%, Rotten Meat Odor (RMO), and SCC. However, lures producing consistent LBC behaviors of coyotes in all seasons (FW and SS) were WU Acids and CDCL. Turkowski et al. (1979) found the same results for CDCL and listed it as a superior coyote lure consistently eliciting the LBC behavior during all seasons.

Temperature

ANOV found no significance ($P > 0.05$) between FW temperature ranges of coyote capture rates for EUF, WU 15-20%, WU Acids, CDCL, and Stokers Bounty (SB). However, SS data for the same lures were analyzed, and results found that WU Acids was the only lure that showed significant differences ($P = 0.003$) in simulated coyote capture rates and temperature ranges. The temperature range of 10.0 - 15.0 C produced higher simulated coyote capture rates than other temperature ranges. Lures producing high simulated coyote capture rates in SS at high temperatures (21.1 - 26.1 C) were TMAD 10%, and SB. Lures producing high coyote capture rates in FW at low ambient

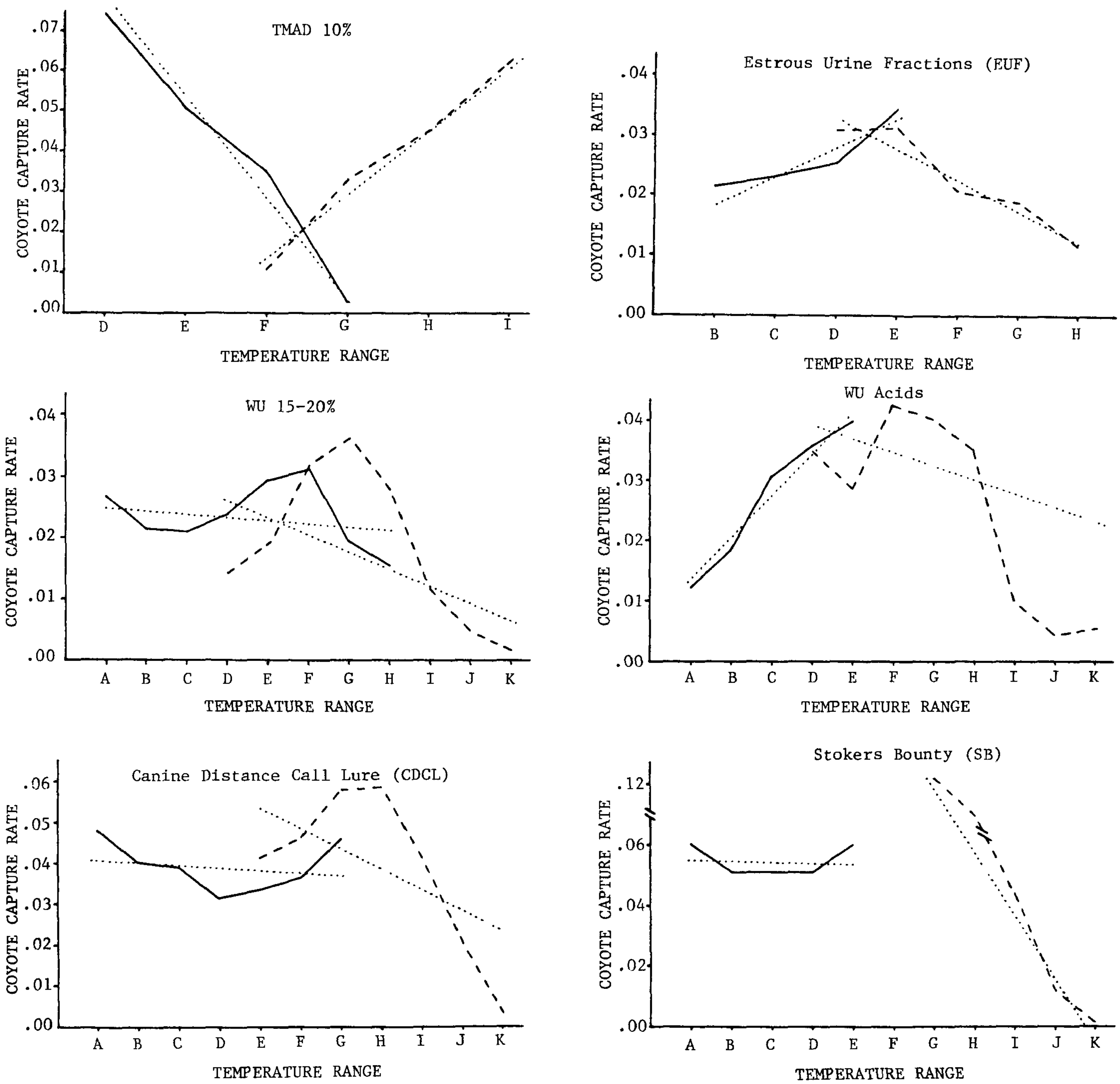

Figure 2.--Bivariate linear regression analysis for TMAD 10%, EUF, WU 15-20%, WU Acids, CDCL, and SB capture and simulated capture rates for temperature ranges. Solid, dashed, and dotted lines represent fall and winter (FW) data, spring and summer (SS) data, and predicted regression line respectively. Symbols for temperature ranges are: A=-23.3 to -18.3, B=-17.8 to -12.8, C=-12.2 to -7.2, D=-6.7 to -1.7, E=-1.1 to 3.9, F=4.4 to 9.4, G=10.0 to 15.0, H=15.6 to 20.6, I=21.1 to 26.1, J=26.7 to 31.7, K=32.2 to 37.2 C. Predicted regression equations are presented below.

Lure	Season	Regression equation	R^2 value
TMAD 10%	FW	Y=0.1650 - 0.0227(X)	98.1%
TMAD 10%	SS	Y=0.0890 + 0.0165(X)	98.6%
EUF	FW	Y=0.0123 + 0.0040(X)	90.3%
EUF	SS	Y=0.0529 - 0.0050(X)	92.7%
WU 15-20%	FW	Y=0.0266 - 0.0007(X)	8.2%
WU 15-20%	SS	Y=0.0387 - 0.0027(X)	26.9%

Lure	Season	Regression equation	R^2 value
WU Acids	FW	Y=0.0057 + 0.0073(X)	95.1%
WU Acids	SS	Y=0.0635 + 0.0051(X)	60.1%
CDCL	FW	Y=0.0418 - 0.0007(X)	5.7%
CDCL	SS	Y=0.0893 - 0.0064(X)	48.7%
SB	FW	Y=0.0540 - 0.0006(X)	1.3%
SB	SS	Y=0.3410 - 0.0322(X)	95.5%

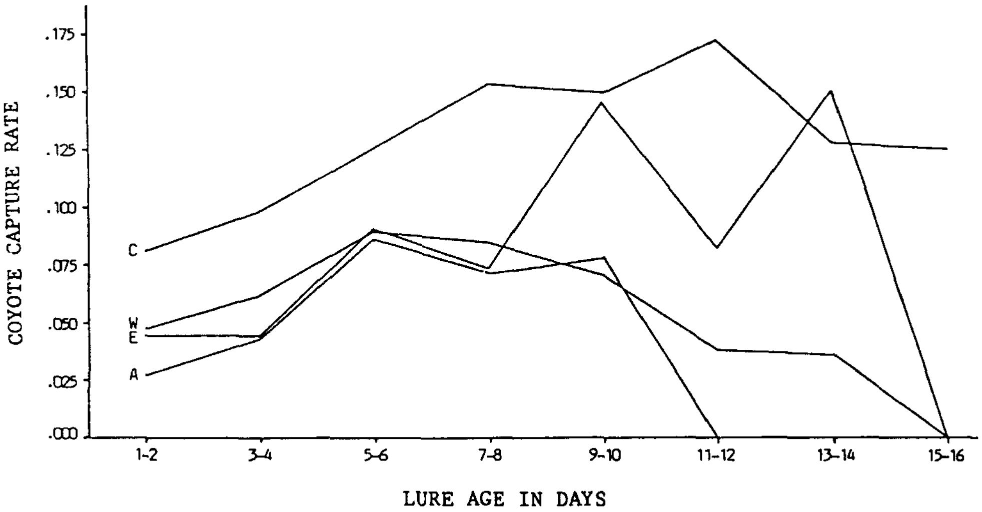

Figure 3.--FW coyote capture rates of WU 15-20%, WU Acids, EUF, and CDCL plotted against lure age. W=WU 15-20%, A=WU Acids, E=EUF, and C=CDCL.

temperatures (-23.3 to -18.3 C) were WU 15-20%, CDCL, and SB.

Bivariate linear regression analysis was conducted on TMAD 10%, CDCL, EUF, WU 15-20%, WU Acids, and SB data from FW and SS to determine stability of coyote capture and simulated capture rates of temperature gradients (fig. 2). FW analysis suggest that the temperature fluctuation had very little effect on WU 15-20%, CDCL, and SB in attracting coyotes. SS regression analysis for TMAD 10%, EUF, WU 15-20%, WU Acids, CDCL, and SB indicate a varying degree of stability and that simulated coyote capture rates decreased as temperature increased. However, TMAD 10% exhibited a positive slope and simulated coyote capture rates increased as temperature increased. Regression analysis for TMAD 10% provided a R^2 value of 98.6% which suggests very little fluctuation and precision in simulated coyote capture rates. In comparing lures with overall annual stability of capture rates, (FW and SS), EUF, WU 15-20%, and CDCL appear to be broad based and least affected by changes in temperatures.

Lure Age

FW test periods produced 8 lure age classes with 28.1% of coyotes (N = 52) being captured in the 5-6 day lure age class, followed by 25.9% (N = 48) captured in the 3-4 day lure age class. ANOV was conducted to determine if a difference exists between coyote capture rates and lure age classes. Three lures were evaluated from FW, and no significant difference (P >0.05) was found between capture rates of coyotes and lure age classes for WU 15-20%, WU Acids, and CDCL. Capture rates from WU 15-20%, EUF, WU acids, and CDCL were plotted against lure ages (fig. 3). A 3 point running average was applied to the mean in an effort to reduce graphic fluctuations.

SS results generated 11 lure age classes with 28.8% of simulated coyote captures (N = 119) from the 1-2 day age class. ANOV results of WU 15-20%, WU Acids, and CDCL data show no difference (P >0.05) between simulated coyote capture rates and lure age classes. Simulated coyote capture rates from SCC, CDCL, EUF, WU 15-20%, and WU Acids were plotted against lure age classes (fig. 4) after applying a 3 point running average to the mean rates. All lures illustrate a pattern of (a) increase, (b) leveling off, and (c) decrease of simulated coyote capture rates, with EUF, SCC, and WU Acids exhibiting prolonged patterns of b.

Lunar Phase and Barometric Movements

No statistical differences (P >0.05) were found for lunar phase and barometric movements of lures, suggesting that these 2 variables have little relative effect on attractiveness of lures to coyotes or coyote selectivity. Although ANOV found no significant relationship between FW barometric movements for lures and capture rates of coyotes, an overall trend was apparent. The FW rising and falling barometric categories consistently generated higher coyote capture rates than did the stable barometric movement. These trends were not evident in SS.

SUMMARY AND CONCLUSION

The probability of eliminating a specific depredating coyote is increased by optimizing the interaction of coyote behavior, chemicals, capture devices, and lures. Forty-five experimental and commercial lures were evaluated in the field to increase the efficacy and selectivity of leghold traps, M-44 NaCN ejectors, snares, and other control devices. A total of

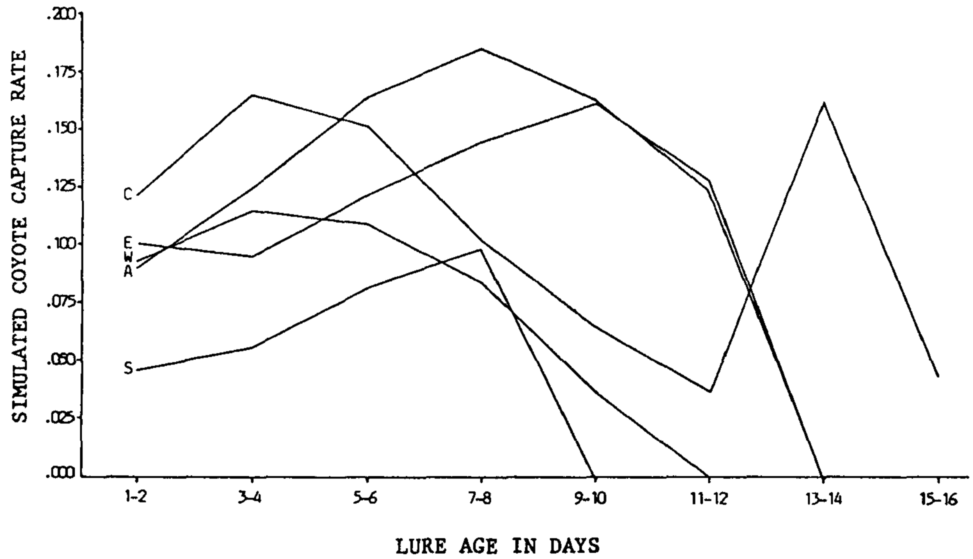

Figure 4.--SS simulated coyote capture rates of SCC, WU 15-20%, EUF, WU Acids, and CDCL plotted against lure age. S=SCC, W=WU 15-20%, E=EUF, A=WU Acids, and C=CDCL.

609 coyotes were captured in 15 FW test periods containing 25,478 trapnights. The top 9 lures representing the highest coyote capture rates when used in conjunction with (a) leghold traps, (b) M-44 NaCN ejectors, and (c) cable snares were (Carman's) Final Touch Combo (CFT-C), Combo 5, and Combo 6; (O'Gorman) Long Distance Call (OLDC), (Carman's) Canine Distance Call Lure (CDCL), and (O'Gorman) Wolfer Scent (OWS); Olmstead Coyote Lure (OCL), Estrous Urine Fractions (EUF), and WU 15-20% respectively. A total of 731 coyotes responded to simulated coyote capture devices from 15 SS test periods consisting of 20,686 trapnights. The top 7 lures producing the highest simulated coyote capture rates when evaluated with (a) trap rings, (b) M-44 heads, and (c) break-away snares were WU 15-20%, Sheep Liver Extract (SLE), and CDCL; (Carman's) Final Touch (CFT), Rotten Meat Odor (RMO), and TMAD 10%; and EUF respectively.

EL's produced the widest seasonal variance in individual elicited behaviors of coyotes, while the superior CL's educed somewhat consistent seasonal coyote behaviors. Ambient temperature is considered to be the most influential weather variable regarding lure attractiveness to coyotes and efficacy of capture devices. Analysis of lunar phase and barometric movement data suggests these variables have little influence in the attractiveness of lures to coyotes and efficacy of capture devices. Lure age suggests that certain EL's and CL's produce a short-time limit in coyote attractiveness, while others are effective up to and beyond 2 weeks in FW and SS.

EL's worked efficiently with leghold traps, snares, and M-44 NaCN ejectors in a well planned and delivered program, year round. CL's used in conjunction with EL's were also effective in year round applications of control devices.

CL's and EL's elicited different behaviors at different seasons in different coyotes, and the behaviors can be predicted. This makes all of the CL's and EL's potentially valuable when coupled with the optimum equipment and placement. The key is to be able to evaluate the depredation situation, present and prescribe the proper lure, optimum equipment, location, and arrangement of equipment to produce the maximum probability of removing depredating coyotes.

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