

Effects of Utah's coyote bounty program on harvester behavior

Rebecca A. Bartel and Mark W. Brunson

Abstract The effectiveness of bounty programs for predator control has been questioned for decades, yet they remain popular with some constituencies. Utah reinstated a coyote (*Canis latrans*) bounty program in 2000. Ecological, economic, and sociological factors all influence the success of such management tools. Our goal was to assess the effects of the bounty program on coyote take and hunter participation. In 2001 we mailed a 5-page survey to 241 program participants and obtained 131 usable responses. Results showed few new participants (8%). Motivations cited for utilizing the program were to seek a positive outdoor experience and to increase big-game hunting opportunities. Most respondents turned in ≤ 5 coyotes for a bounty. Nearly half of respondents reported increasing expenditures for coyote harvest as a result of the bounty program. Understanding the behavior, incentives, and motivations for bounty program participation may help wildlife managers in develop more effective predator control programs.

Key words bounty, *Canis latrans*, coyote, harvester behavior, human dimensions, hunter behavior

The control of mammalian predators to protect livestock and increase game populations is a common practice worldwide (Knowlton et al. 1999). Some game hunters and livestock producers consider bounty programs a sensible method for controlling or reducing predatory species (Bennitt 1948, Michigan Department of Conservation 1960).

One such bounty program was initiated in Utah in 2000 to control coyotes (*Canis latrans*). The assumptions behind bounty programs are that private citizens would increase their harvest of predators in response to financial incentives, and that this increase in harvest would result in a meaningful reduction in predator populations and depredations. This report describes research on one of those assumptions: that Utah's bounty program has affected the number of coyotes removed by Utah hunters and trappers.

The bounty system has been used as a management tool in North America for over 150 years. Currently, coyote bounties are legal in Colorado, Idaho, Minnesota, South Dakota, Texas, Virginia, and

West Virginia, although these programs are not implemented statewide and are limited to specific counties. In Colorado, Minnesota, and Virginia bounties are illegal outside designated areas. Although several state and provincial case histories, including Utah, are available (Bennitt 1948, Latham 1951, Michigan Department of Conservation 1960, Nielsen 1973, Theberge 1973), there is no documented evidence indicating that bounty programs temporarily or permanently reduce coyote abundance or subsequently reduce livestock depredation. The lack of concrete evidence that coyote numbers have been reduced, or that population growth has been limited, has led wildlife biologists and the public to question the validity of bounty programs as successful management options (Buchheister 1966, Nielsen 1973, Theberge 1973).

Although bounties have been paid less frequently in recent years, the 2000 Utah Legislature appropriated \$200,000 for predator control, half of which was to go directly into a statewide coyote bounty fund. The remaining \$100,000 was appropriated to

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Wildlife Services (WS), a branch of the United States Department of Agriculture (USDA), for continuation of integrated predator management. The monies originally were gathered using a \$5 increase on all deer (*Odocoileus* spp.) permits through the Utah Division of Wildlife Resources.

The program allowed counties to sign contracts with the state, with the latter reimbursing half of the total bounties paid out (e.g., if Beaver County established a bounty fund of \$10,000, it could sign a contract for a \$5,000 reimbursement by the state). As of June 2001, 9 out of 29 counties signed agreements with the state (Table 1). Other counties could have bounty programs with alternative funding and without state participation. Although the initial appropriation was for fiscal year 2001, which began July 1, 2000, in practice the program did not begin until early 2001 because county budgets follow a calendar year. However, coyotes killed as far back as July 2000 could be bounty, to reflect when money was allocated by the state.

With the exception of one county in the mountainous central portion of Utah (Wasatch), the counties that chose to participate were largely rural and located in the western and south-central portions of the state, where hunting and extensive livestock production have economic significance and high social importance. The actual operation of the program varied across jurisdictions. Decisions such as amount of reimbursement, eligibility for participation, and collection procedures were made on an individual county basis. Differences among program protocols could vary widely among counties. The effect of such variation is not known. In Utah coyotes are considered a pest and are not legally protected. There are no laws governing specific methods for killing coyotes, except poisoning and

use of other toxicants, which were banned in 1972 according to Executive Order 11643 and subsequent Environmental Protection Agency decisions (United States Fish and Wildlife Service 1978).

While researchers have measured public attitudes toward wildlife damage (McIvor and Conover 1994, Wywiałowski 1994) and animal damage management policy (Messmer et al. 1999, Reiter et al. 1999), little research has investigated the human dimensions of predator harvesting from the viewpoint of the harvester. While social characteristics of trappers have been examined (Glass et al. 1991, Siemer et al. 1994, Daigle et al. 1998), those studies focused on furbearer trapping rather than predator control. Due to the lack of information concerning bounty participants, we investigated the behavior and motivations of these participants.

The purpose of this study was to identify people who use the state-sponsored bounty program in Utah and to assess whether the incentive offered by bounties successfully attracted more hunters and trappers and increased the take of coyotes. We also wanted to examine whether hunter behavior changed from seasons without bounty programs to seasons with bounty programs (e.g., spending more time or money on coyote harvest activities and equipment), as well as harvester motivation. Our goal was to understand why people used the bounty and to investigate whether income, livestock protection, or increasing big-game populations were significant reasons. Last, we assessed how many coyotes were removed by this bounty effort.

Methods

To assess how participants are using the bounty program, we designed a mail survey and attempted to census the entire bounty participant population. Based on discussions with state and federal predator experts and a focus-group session with the Utah Trapper's Association, we constructed a questionnaire to be mailed to every bounty program participant. We obtained addresses through county records kept when individuals turned in coyotes for bounty payment. We were able to obtain bounty program participant lists from all counties except Kane and Wayne. In cases where counties did not collect address information, internet searches were used to acquire addresses based on name and county in which coyotes were turned in.

The survey was accompanied with a cover letter describing the intent of the questionnaire and

Table 1. Demographics of counties participating in Utah coyote bounty program during 2001.

County	Amount in total bounty fund	Land (km ²)	Human population
Beaver	\$10,000	6,708	6,005
Garfield	\$4,000	13,403	4,735
Iron	\$5,000	8,544	33,779
Juab	\$1,000	8,785	8,238
Kane	\$2,000	10,339	6,046
Millard	\$2,000	17,068	12,405
Wasatch	\$2,500	3,059	15,215
Washington	\$2,700	6,286	90,354
Wayne	\$2,500	6,374	2,509

explaining how its findings would be used. Participants were assured of the voluntary and confidential nature of completing the survey. Because minors might have participated, we attached a permission form to the cover letter for parents or guardians to sign before the questionnaire was completed. Surveys were accompanied with a self-addressed, postage-paid envelope.

The survey itself was divided into 3 sections. The initial section contained questions relating to the participant's history of harvesting coyotes and other predators. Many questions were open-ended, allowing respondents to answer in their own reference frame without influence of alternatives by the interviewer (Rossi et al. 1983, Dillman 2000). We used Likert-type scales throughout the survey to rate frequencies of use of particular tools in harvesting coyotes. These scales allowed respondents to numerically indicate the degree to which a question matched their ideas or behaviors. Likert-type scales are advantageous because they make few assumptions and are easily evaluated through item analysis, reliability analysis, and factor analysis (Rossi et al. 1983).

Section 2 of the survey asked questions regarding use of the current bounty program, again with Likert-type, categorical choice and open-ended questions. The survey included a corresponding map for participants to mark where they had harvested coyotes. Section 3 asked basic demographic questions.

We initially distributed surveys in July 2001. Two weeks later we issued reminder postcards to all participants, encouraging response and providing contact information concerning questions. One month from initial survey issue date, we mailed to all non-respondents a second copy of the entire survey, accompanied with a different cover letter.

Due to the small sample size of bounty program participants, we chose to census the population instead of random sampling. As a result, we used descriptive statistics instead of inferential statistics. We used SPSS statistical software in all analyses (Norušis 1992).

Results

County records listed the names of 358 bounty program participants in the 7 counties where surveys were administered. Addresses were available for 131 (36.6 %) of those participants from county records. Internet searches provided 110 additional

Table 2. Utah 2001 coyote bounty survey respondent information from participating counties.

County	Number of participants	Number of respondents	Percent of total respondents
Beaver	126	34	26.0
Garfield	49	19	14.5
Iron	52	13	9.9
Juab	44	12	9.2
Kane	0	0	0.0
Millard	45	30	22.9
Wasatch	9	5	3.8
Washington	33	18	13.7
Wayne	0	0	0.0
Totals	358	131	100.0

addresses. Consequently, we sent surveys to 241 people, or 67.3 % of the program participants. Of the 241 surveys, 28 were returned as undeliverable by the United States Postal Service. We received responses from 131 of the remaining 213 recipients, providing a response rate of 61.5%. Nearly half of the responses came from 2 counties, Beaver and Millard (Table 2).

History of coyote harvest

We initially asked survey participants about their history of harvesting coyotes in general, not only as part of the bounty program. We defined "harvesting" as any form of lethal disposal, including but not limited to trapping, shooting, poisoning, or hounding. Only 11 (8%) of the 131 respondents reported no previous coyote-harvest experience. Over 90% of respondents reported harvesting coyotes within the previous 5 years. We also asked participants whether they sold pelts of harvested animals. About half reported having done so. Respondents suggested that the price range for coyote pelts was \$5-\$100, with an average of \$30. The current local pelt price for coyotes was approximately \$15-20/pelt (Montgomery Fur Breeders, Utah, personal communication).

We asked participants to rate the frequency of use of several harvesting methods. We measured the responses by Likert-type scales with "1" representing a particular method being utilized "very often," "3" "sometimes," and "5" "never." Calling and shooting was the tool used most frequently in prior years, with 56% of respondents reporting using it "very often" (Table 3). Aerial gunning was used the least, with only 3% reporting frequent overall usage in previous years.

Table 3. Utah bounty survey results comparison of harvesting method usage between previous and current harvest years.

Method	Year	Very often	Often	Some-times	Seldom	Never
Calling and shooting	Previous	56.1	16.7	16.7	3.5	7.0
	2001	68.3	13.8	12.2	1.6	4.1
Live/long/coil spring trap	Previous	17.3	4.1	20.4	14.3	43.9
	2001	17.1	3.8	14.3	3.8	61.0
Denning	Previous	8.8	8.8	7.7	7.7	67.0
	2001	9.1	1.0	9.1	3.0	77.8
Neck snares	Previous	8.88	2.2	9.9	8.8	70.3
	2001	9.1	3.0	8.1	1.0	77.8
Dogs	Previous	4.5	5.7	1.1	1.1	87.5
	2001	5.1	5.1	2.0	1.0	86.9
Leg snares	Previous	1.2	1.2	4.7	4.7	88.2
	2001	1.0	2.0	2.0	1.0	93.9
Poisoning	Previous	3.5	1.2	0.0	1.2	94.1
	2001	0.0	0.0	0.0	1.0	99.0
Aerial gunning	Previous	3.4	0.0	0.0	0.0	96.6
	2001	4.0	0.0	2.0	0.0	93.9

In the last question of the survey, concerning previous harvest activities prior to the bounty program, we asked participants what other furbearers besides coyotes they harvested. Respondents reported also taking red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), and badger (*Taxidea taxus*) in the previous harvest year, in addition to coyotes. In Utah red fox and striped skunk are not covered by hunting or trapping regulations and are legally unprotected species. Bobcats are trapped commercially for their fur, which is generally more valuable than coyote fur (Montgomery Fur Breeders, Utah, personal communication).

Current participation

We examined reported tool use for the current harvest year (2001) in the same manner as prior tool use (Table 3). Calling and shooting was the most frequently used tool, with 82% of respondents using this method “often” or “very often.” Poisoning was the least-used method, with only 1% of respondents reporting “4—seldom” use. This was not surprising, given the restrictions on use of predacides since 1972. Presumably, with a coyote bounty program in place, participants may use more specialized tools than previously, but our findings indicated that individual tool use did not change significantly.

We asked participants to use Likert-type scales to indicate the importance of various motives for participation in the current year’s coyote bounty pro-

Table 4. Relative importance of motivations for capturing coyotes in Utah, as indicated by bounty participants (1 = very important, 3 = somewhat important, 5 = not important) during 2001.

Motivation	Mean	Std. dev.
Enjoy the outdoors	1.40	0.78
Big game protection	1.51	0.95
Hunting rights	1.73	1.12
Recreation	1.95	1.23
Test outdoor skills	2.04	1.26
Livestock protection	2.06	1.26
Participate in conservation	2.10	1.15
Additional income	3.32	1.50

gram, with 1 indicating that a motive was “very important,” 3 “somewhat important,” and 5 “not important” (Table 4). The mean importance ratings suggested that enjoying the outdoors, big-game protection, and ensuring hunting rights were more important than other motives. The next 4 motives (recreation, testing outdoor skills, livestock protection, and participation in conservation) were roughly equal in importance. Gaining additional income was identified as the least-important motive.

When asked how many coyotes they bountied in the 2000–2001 season, most respondents (61%) reported turning in ≤ 5 , while 26% reported turning in ≥ 10 coyotes to the program. The maximum reported harvest by one person was 43 animals, and the total reported harvest was 931 animals. County records show a range of 1–52 coyotes being turned in by the same individuals, with 77.5% turning in ≤ 5 animals. Only 8.6% of all participants turned in >10 coyotes to the program. According to the county records, the total number of coyotes turned in for bounty was 1,035 animals (Table 5). Some participants had been utilizing the program a year before they received the survey (particularly Beaver County—see Table 5).

Accompanying this section of the survey was a map on which bounty participants could mark where they collected animals turned in for bounty. Only 3% reported hunting outside of counties participating in bounty programs. In these cases the locations were in neighboring counties. The area with the highest reported use was Beaver County (28%). Of the counties with bounty programs, the least-used area was Wasatch County (4%). These results may reflect the amount of money available in a particular county bounty fund, but it also may reflect the smaller size and higher human population density of Wasatch County.

Table 5. Areas of participation, dates coyotes were bountied, number of coyotes taken, and cost per county of counties participating in the Utah coyote bounty in 2001.

County	Number of participants	Dates	Number of coyotes	Price per coyote (\$)	Total amount paid (\$)
Beaver	126	7/00–3/01	332	20	6,480
Garfield	49	1/01–6/01	170	20	3,400
Iron	52	10/00–12/00	176	25	4,400
Juab	44	1/01–1/01	100	20	2,000
Millard	45	3/00–2/01	125	20	2,500
Wasatch	9	1/01–/01	22	20	440
Washington	33	NA	110	25	2,700
Totals	358		1,035		21,920

One potential consequence of a bounty program was an increase in theft of bounty-eligible animals from traplines. However, survey results found little evidence of theft of animals or equipment in current or previous harvest seasons, with 13% of respondents observing theft incidents.

A benefit cited by bounty program proponents was that the opportunity to collect a bounty can provide local economic benefits by encouraging additional investment in harvesting equipment (traps, ammunition, etc.). Forty-one percent of respondents reported spending more money to pursue animals as a result of the bounty program. Of those respondents who reported increased spending, 26% said the increased amounted to \$51–\$100, while 20% reported increased spending of >\$250. Only 12% of respondents reported selling pelts in addition to collecting bounty on the animals.

Demographics

Questions concerning age, gender, residence, income sources, and organization memberships provided measures for evaluating who was using the bounty program. Respondents ranged from 15–76 years of age, with a reported mean of 37.6 years old. Age distribution was normal, with 8.4% being 15–19, 6.9% over 60, and each 10-year increment (20–29, 30–39, 40–49, 50–59) of about 20% each. There were only 3 female respondents for the entire survey (2.3%). Only 6% of all respondents reported fur trapping as an important source of income. Thirty-one percent of our respondents raised some type of livestock for a living, mainly cows (28%) or horses (22%). Forty-eight percent belonged to ≥ 1 hunting or sportman's organiza-

tions, covering 18 different groups. Forty percent belonged to sportsman groups, 5% to hunting groups, 3% trapping groups, and 2% to local organizations (e.g., Southern Utah Predator Callers).

Discussion

In 2000 Utah's legislature reauthorized a bounty on coyotes in participating counties to increase incentive for private citizens to harvest predators and thereby provide greater protection to livestock and big-game populations. This study examined the effects of the program in its first year by evaluating how the existence of a bounty influenced the activities of hunters and trappers. Our findings suggest that the program did not produce the desired results, in terms of either increasing hunter participation or reducing coyote populations.

We mailed surveys to nearly two-thirds of the program participants, who were asked about their motives, methods, and expenditures pertaining to coyote harvest. Demographic data indicated that participants were young to middle-aged adult males from rural Utah who were avid hunters. More than 90% had hunted or trapped previously. We found little evidence that new coyote hunters or trappers were recruited as a result of the bounty program.

The data suggested that the bounty program resulted in increased harvest of coyotes by active predator hunters. Some 41% of respondents reported spending more money as a result of the bounty program, and there was a reported increase in the frequency of use of calling and shooting as a harvesting method. However, we do not know whether these differences truly reflected an influence of the bounty program or simply reflected normal year-to-year variation in harvester behavior as a result of weather, changes in economic conditions, or other factors.

One finding that seemed to contradict the suggestion that investing in bounties led to increased harvest activity was that hunters and trappers themselves listed income as the least-important reason for participating. Historically, bounty programs were intended to control disease, particularly rabies, and protect livestock and game resources (United States Department of Agriculture 1953). Today, in addition to livestock protection, sportsmen's groups are seeking financial support from legislatures to encourage sport hunting and trapping. Our survey results suggest that enjoying the outdoors, big-game protection, and ensuring

hunting rights were more important than other motives. The latter motive is a complex one, according to Zwick et al. (2002), who reported that Vermont trappers were often motivated by a need to maintain contact with landowners in order to ensure hunting and trapping access, and also believed they perform a valuable wildlife management function by reducing predator populations. Recreational use, testing outdoor skills, livestock protection, and participation in conservation were less important. It was surprising that livestock protection was not reported as a more important motivation. Annual statewide sheep and lamb losses as a result of coyote predation reportedly were >21,000 animals (United States Department of Agriculture 2001). Kill rates did not decrease significantly between 1999 (pre-bounty) and 2000, when the bounty was initiated (United States Department of Agriculture 2001). Additional income was ranked as the least-important motive. This was interesting because the theory behind bounty programs suggests that predator harvesters would be motivated to take more animals by the opportunity to gain additional income. Moreover, in preliminary focus-group meetings, participants (all avid trappers) indicated they considered the additional income as motivation to use the bounty program. Overall, these results were similar to previous studies (Glass et al. 1991, Siemer et al. 1994, Daigle et al. 1998) showing that nature appreciation, interaction with nature, and personal achievement were the most important motivations for participating in trapping activity.

An important question was whether the bounty program affected predator populations in a meaningful way. A main assumption of bounty programs was that the amount of damage caused by predators would decrease as the predator population declined. Several studies have examined the legitimacy of this claim (Bennitt 1948, Michigan Department of Conservation 1960). Bounty hunters are generally indiscriminate in the animals they kill (Nielsen 1973), although it is possible that calling and shooting methods (when coyote calls, not prey distress calls are used) resulting in alpha animals responding. Territorial, dominant coyotes are usually responsible for most depredations (Till and Knowlton 1983, Sacks et al. 1999). Therefore, contemporary predator management theory suggests that the goal should be controlling "problem" individuals in order to reduce reported damage. Local population reduction can be selective to a

damage site but not necessarily to particular problem coyotes (Connolly 1978). In addition, removing territorial, dominant animals (alphas) has only a short-term effect as they are replaced in about 3 months (Blejwas et al. 2002).

If bounty programs cannot target specific coyotes, they can reduce or control predation levels only by significantly reducing the overall population. In Utah this does not appear to be likely. Current estimates of coyote density range from 0.2-2.3 coyotes/km², with increasing densities from north to south in the United States (Knowlton et al. 1999). The 9 counties participating in the bounty program cover a total of 80,566 km² (Table 1). Assuming an average coyote density of 1.25/km², the estimated population in the bounty counties was 100,707 animals. A total of 1,035 coyotes were taken in the bounty program (from county records of total participants, not just respondents). Thus the bounty program reduced the coyote population in those areas by 1%. Wildlife Services takes approximately 4,500 coyotes annually (M. Bodenchuk, personal communication). Recreational trappers kill an additional (assuming these coyotes are not also being bountied) 4,300 coyotes on average (Utah Division of Wildlife Resources 1997). In other words, the maximum annual Utah coyote harvest was ≤10,000 animals, about 10% of which were turned in for bounty in 2001. Total coyotes taken comprise 10% of the entire coyote population. Even when these other mortality sources are considered, this additional reduction in mortality is unlikely to have an effect on coyote populations or predation.

Pitt et al. (2001) examined canid population dynamics through an individual-based computer simulation model. They found that when animals are removed randomly from a population, all populations recovered within a year if <60% of the animals were removed. Even after a 90% simulated removal, the coyote population recovered within 5 years. These simulations suggested that coyote populations resist change and that one way they demonstrate this resilience is in higher survival rates for remaining individuals. Exploited populations of coyotes can potentially exhibit compensatory demographic responses such as greater survival of juveniles, increased reproduction by young juveniles, and greater natality (Windberg 1995).

Under current rules, most harvesting of bountied coyotes was done by people seeking a positive outdoor experience (motives #1 and #4 in importance)

or wanting to protect big game in order to increase hunting opportunities (#2 and #3). Harvesters did not seem to participate in the bounty program primarily for the money. While that could change if the bounty payments were higher, such an increase might not be fiscally or politically feasible. There was a reported increase in harvest-related expenditures in 2001, but this may be a short-term phenomenon. It is noteworthy that the only method of harvest that increased in 2001 was calling and shooting, which requires little additional investment by those who have already hunted coyotes.

Conclusions

Bounties have been used to control coyote populations in North America for over 150 years, despite a lack of evidence that they lead to long-term reductions in populations. In 2000 Utah appropriated \$100,000 for coyote bounty programs. We designed a mail survey to evaluate who was participating in Utah's coyote bounty program and to investigate hunter behavior and motivation. Our results suggest that the bounty program did not lead to substantial recruitment of new participants. While nearly half of respondents reported increased spending as a result of the program, the method most commonly used (calling and shooting) produced relatively little investment or local economic activity when compared to trapping, snaring, or aerial gunning. Participants said their most important motives for taking part were to enjoy the outdoors and protect big-game species, while additional income was minimally important. Based on county records, a total of 1,035 coyotes were harvested during the program in 2000, probably less than 1% of the coyotes in participating counties. Population models suggest this is far below the level necessary to reduce coyote abundance for even one year. Overall, these results suggest that while Utah's coyote bounty may provide an enhanced, subsidized recreation program for a small segment of Utah citizens, it is unlikely to have any beneficial effect on populations of livestock or big game.

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