# SIREN-ELICITED RESPONSES OF COYOTES IN WESTERN KENTUCKY AND TENNESSEE

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*Abstract:* Three hundred eighty-eight stations were surveyed for siren-elicited responses from coyotes *(Canis latrans)* and dogs *(Canis familaris)*. Responses were received from coyotes at 15 of 388 station soundings (3.9%) whereas dogs were heard at 14 of 388 station soundings (3.6%). November had the highest rate for coyotes (5.8%) and February had the highest rate for dogs (5.3%). Two indices of relative abundance were determined by dividing the average number of individuals responding and average number of responses from 3 soundings at each station by the estimated area covered at those stations in 1 sounding. To correct for those coyotes that do not respond to the siren, this value was then multiplied by 2. Indices of coyote abundance so determined were 0.017 individual responses/km$^2$ and 0.010 responses/km$^2$, whereas indices of dog abundance were 0.011 individual responses/km$^2$ and 0.009 responses/km$^2$.

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The coyote has expanded its range throughout much of North America in recent years (Bekoff 1977). Man's knowledge of predators and their role in the ecosystem has also expanded in recent years. Many past management efforts directed toward canids involved their removal for reasons of economic and/or sporting interests. These same animals are now in demand for aesthetic and recreational purposes (Knowlton 1972).

Accurate, standardized, and economical methods of determining coyote population levels are needed in order to prescribe management guidelines for this species. A considerable amount of research has concentrated on this aspect of coyote management. However, problems inherent to censusing canids include their comparatively large home ranges, low population densities, the concentrating effect of packs or family groups, and the high mobility and secretive nature of canids.

Most of the development and application of coyote surveying methods has been done in the western United States. Two methods have come to the forefront as having the greatest potential as census techniques. These are the scent-post technique and the siren-elicited howling technique.

Both of these techniques have certain advantages and disadvantages depending on physiography of habitat surveyed, weather, distribution of the particular canid population, time and manpower available, and the land area to be surveyed. The scent-post technique has been used to survey a variety of animals throughout the United States, while the siren-elicited howling technique has been limited to surveying canids.

The siren-elicited howl, first reported by Alcorn (1946), has been utilized by Alcorn (1970), Russell and Shaw (1971), Knowlton (1972), Carley (1973), Wolfe (1974), and Woodin (1978) to monitor coyote populations in the western United States. The technique was also used extensively in locating and identifying canids

in the U.S. Fish and Wildlife Service Red Wolf Recovery Program in Texas and Louisiana (McCarley and Carley 1979). Guidelines for standardizing the technique have evolved from these works. A similar technique, utilizing taped howls, was used by Pimlott and Joslin (1968) to elicit responses from red wolves *(Canis rufus)* and coyotes in Texas, Louisiana and Arkansas. Further modifications of these techniques have been used to elicit canid responses for sonagram analysis by McCarley (1978).

This study was designed to evaluate the effectiveness of the siren-elicited howling technique as an index to the relative abundance of canids in TVA's Land Between The Lakes. The results obtained will provide baseline data for future use of the siren-elicited howling technique, since no published data were available for heavily forested areas with rolling topography, such as found in the southeast.

Land Between The Lakes provides a unique place to study coyote populations, since the coyote has just recently been reported there (L. S. Philpot, pers. commun.) and its water boundaries tend to reduce immigration of new animals.

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## METHODS

This study was conducted on the Tennessee Valley Authority's (TVA) Land Between The Lakes (LBL) which is located in Lyon and Trigg Counties, Kentucky, and Stewart County, Tennessee. The area is managed as a national demonstration of outdoor recreation, environmental education, and natural resource management. The 68,000-ha peninsula is formed between TVA's Kentucky Lake on the Tennessee River and the Corps of Engineers' Lake Barkley on the Cumberland River. A navigation canal connects the 2 lakes near each Lake's respective dam. The topography of LBL consists of a series of narrow ridges with moderate to steep slopes and narrow valleys. Forests make up 89% of the area, with oak-hickory being the predominant association. See Wright (1975) for a decription of soils, vegetation, and climate.

The study area was divided into 4 areas, with each area consisting of 3 survey routes (Fig. 1). Each route was 16 to 24 km long and consisted of 8 to 14 siren-sounding stations. Stations were located every 1.6 to 2.4 km along the route, taking advantage of topographic features to allow for greater sound coverage. One route was surveyed per evening beginning approximately ½ hour after sunset and continuing for approximately 2½ hours or until the route was completed. A minimum time lapse of 15 min occurred between stations.

Following the recommendations of Carley (1973), Wolfe (1974), and Woodin (1978) surveys were not conducted during periods of rain, snow, fog, or when wind speeds exceeded 15 to 20 km/hour. They found that coyotes did not readily respond under such conditions.

Howls were elicited with a Smith and Wesson Mark IV electronic siren. The siren was bolted to a 20- by 20- by 1.9-cm piece of plywood which was mounted on

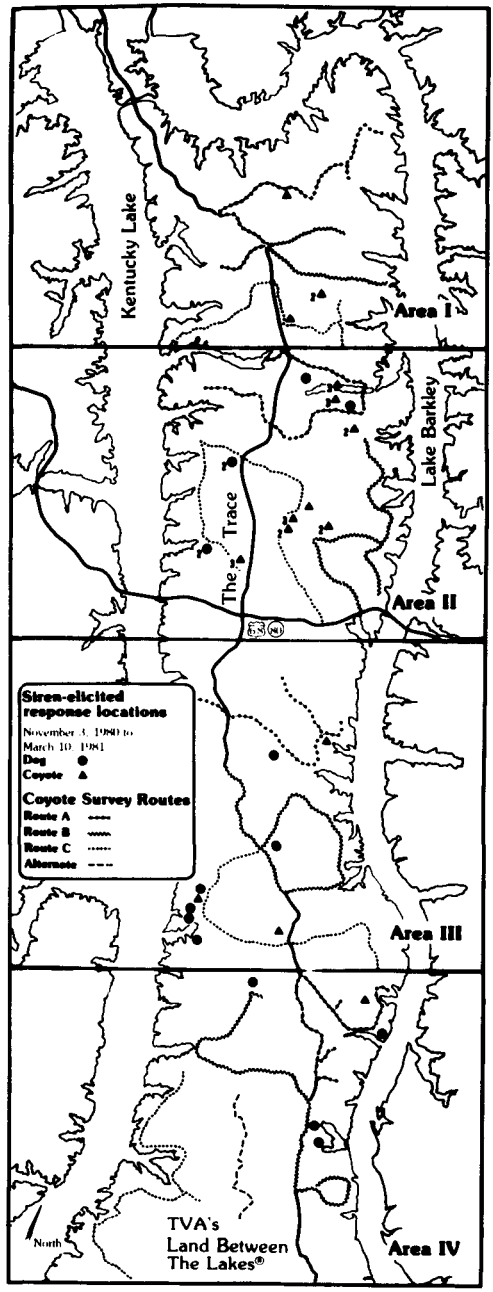


Fig. 1. Map of the study area showing survey areas, routes, and coyote and dog responses. Numbers beside symbols represent estimated number of individuals responding.

a pickup truck rack made from steel pipe 3.8 cm in diameter. The siren was directed vertically so that the sound generated would be transmitted equally in all directions. The siren was sounded at each station for 2 complete pitch cycles, approximately 20 sec followed by a 2-min listening period; and, sounded again for 2 pitch cycles followed by a 1 min listening period. Two survey operators conducted each route. Both operators were equipped with protective earphones which were removed immediately after each sounding. When howls were elicited, the station number, type of canid (coyote or dog), number of individuals and/or groups, direction of response, and estimated distance from the station were recorded. In addition, for future sonagram analysis, responses were recorded by a Uher 400 IC tape recorder using a Uher M517 microphone mounted in a 61-cm parabolic reflector. (Mention of commercial products does not constitute endorsement.)

Prior to initiating the surveys, taped coyote vocalizations were reviewed. Recordings of elicited responses were reviewed both indoors and outdoors, which proved valuable in distinguishing coyote and dog responses.

Two indices of relative abundance were calculated. One was derived from the average number of individuals responding from 3 soundings at each station, divided by the area ($km^2$) estimated to be covered by each station. This value was then multiplied by 2. This approach was used as a type of correction factor for those coyotes that do not respond. Alcorn (1971) and Wenger and Cringan (1978) both reported that only ½ of the coyotes surveyed would respond to the siren. The number of individuals responding was estimated for each response and expressed as 2 to 3, 3 to 4, etc. If there was any doubt as to the number of individuals responding, the conservative number was recorded. The area surveyed at each station was based on findings of Wenger and Cringan (1978), who found that elicited responses were heard at distances up to 1.6 km in northeastern Colorado and sounding trials conducted at LBL. Assuming an equal response distance in all directions then an estimated 8.04 $km^2$ would be covered at each station. The index is then expressed as the number of individuals responding/$km^2$. Since the number of individuals responding is an estimate, subject to a certain amount of observer variability, a similar index was calculated from the number of responses elicited.

## RESULTS

Each of the 12 routes was surveyed on 3 separate nights between November 3, 1980, and March 10, 1981. Fifteen coyote and 14 dog responses were heard from the 388 station soundings. Coyote responses were heard from 12 separate stations, whereas dogs were heard at 11 separate stations. The number of stations sampled per month ranged from 29 in March to 105 in January, and the number of stations sampled per area ranged from 87 in Area I to 108 in Area II (Table 1).

Responses were elicited from coyotes at 15 station soundings (3.9%), whereas dogs responded at 14 station soundings (3.6%). The greatest response from coyotes was recorded in November (5.8%), while the greatest response from dogs was recorded in February (5.3%). Area II had the greatest response from coyotes (7.4%), whereas Area III had the greatest response from dogs (6.8%). No responses were obtained from coyotes or dogs during March.

The estimated number of individual canid responses was 27 coyotes and 17 dogs. These figures do not represent the number of individual coyotes or dogs on

Table 1. Coyote and dog responses elicited by electronic siren in Land Between The Lakes from November 3, 1980, to March 10, 1981.

| | | Area I | | Area II | | Area III | | Area IV | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Station | Response | Station | Response | Station | Response | Station | Response | Station | Response |
| Nov. | Coyote | 11 | 0 | 36 | 6(15)[a] | 21 | 0 | 35 | 0 | 103 | 6(15) |
| | Dog | 11 | 0 | 36 | 0 | 21 | 1(1) | 35 | 3(3) | 103 | 4( 4) |
| Dec. | Coyote | 18 | 2(3) | 36 | 1( 1) | 5 | 0 | 35 | 0 | 94 | 3( 4) |
| | Dog | 18 | 0 | 36 | 2( 3) | 5 | 0 | 35 | 1(1) | 94 | 3( 4) |
| Jan. | Coyote | 29 | 1(1) | | | 41 | 3(3) | 35 | 1(1) | 105 | 5( 5) |
| | Dog | 29 | 0 | | | 41 | 4(4) | 35 | 0(0) | 105 | 4( 4) |
| Feb. | Coyote | | | 36 | 1( 3) | 21 | 0 | | | 57 | 1( 3) |
| | Dog | | | 36 | 2( 4) | 21 | 1(1) | | | 57 | 3( 5) |
| Mar. | Coyote | 29 | 0 | | | | | | | 29 | 0 |
| | Dog | 29 | 0 | | | | | | | 29 | 0 |
| Total | Coyote | 87 | 3(4) | 108 | 8(19) | 88 | 3(3) | 105 | 1(1) | 388 | 15(27) |
| | Dog | 87 | 0 | 108 | 4( 7) | 88 | 6(6) | 105 | 4(4) | 388 | 14(17) |

[a]Number in parantheses is the estimated total number of individuals responding.

LBL due to the likelihood of multiple responses from the same individual. The results show the average number of individuals to be 1.8 coyotes per response and 1.2 dogs per response. Area II had the highest number of individuals per response for both coyotes and dogs, 2.4 and 1.8, respectively. February had the highest number of individual coyotes per response (3); however, only one response was obtained in February. The 6 coyote responses recorded in November represented 2.5 individuals per response. The number of dogs per response was also greatest in February when 1.6 dogs per response were recorded.

The 27 individual coyote responses represent a relative index of 0.017 individual responses/km$^2$ and the 17 individual dog responses represent 0.011 individual responses/km$^2$. Since the number of individuals responding is an estimate subject to a certain amount of observer variability, similar indices were calculated from the number of responses elicited. These were 0.010 responses/km$^2$ and 0.009 responses/km$^2$ for coyotes and dogs, respectively.

## DISCUSSION

The percentage of stations with coyote responses was lower than those reported by Carley (1973) for areas with high, moderate, and low coyote populations in Texas. The areas of moderate and low coyote population densities had responses of 10 to 18% respectively under favorable atmospheric conditions in his study. However, the 0.95 to 7.4% response rates obtained for areas in LBL may well be indicative of the coyote population. The coyote was not reported in LBL until very recently and ingress into LBL, which has a significant water boundary on 3 sides, should be minimal. Therefore, present population density in this area may be very low.

Area II had the highest response rate for coyotes. This rate compares with the higher number of actual coyote sightings collected in LBL for Area II. Since October of 1978, 18 of 40 reported coyote sightings have occurred in Area II. Dog response rates were highest in Areas III and IV, which are next to the land-connected end of LBL. Lost coon hounds appear to make up the majority of dog responses, in view of the increased response rates during January and February which corresponds with the peak of raccoon *(Procyon lotor)* hunting activity. The Tennessee portion of LBL (Area III and IV) has traditionally had more problems with lost coon hounds than other areas of LBL (M. E. Cope, pers. commun.). Free-roaming dogs may also contribute to the higher response rate in Areas III and IV, considering the close proximity of urban dwellings.

The higher response rate for coyotes in November would correspond with the population model presented by Knowlton (1972) in which coyote numbers show a decline beginning in November and continuing until the following whelping season.

The use of values based on the number of individuals per response is not without a certain amount of variation among observers, particularly when more than 3 animals respond in a group. However, this approach appears to be meaningful since coyotes are usually observed as lone individuals or as pairs. (Bekoff 1977).

Indices of relative abundance were derived using both the number of individuals responding and the number of responses. The average of both for the 3 survey trials was divided by the estimated area (km$^2$) surveyed in 1 trial and then multiplied by 2. This approach was used as a type of correction factor for those

coyotes that do not respond. Alcorn (1971) and Wenger and Cringan (1978) both reported that only ½ of the coyotes surveyed would respond to the siren. The index for coyotes from the estimated number of individuals was 0.017/km$^2$ while use of responses yielded 0.010/km$^2$. If these indices are projected to number of individuals in the 688 km$^2$ LBL, an estimated coyote population of between 6.6 and 11.8 coyotes per 688 km$^2$ is obtained. This estimate is considered to be fairly accurate in view of the recent immigration into the study area, the number of sightings since October of 1978, and the water boundary found on 3 sides of LBL which very likely keeps immigration to a low level.

Although these results are only preliminary, the siren-elicited response technique shows promise as a coyote survey method in the southeast. In areas where free-roaming or stray dogs are common, the siren-elicited response may be a more reliable survey than the scent-post stations, due to the difficulties encountered when trying to distinguish between coyote and dog tracks. It is realized that late winter months are not the best time to conduct the siren survey, however, I feel the results obtained are indicative of the coyote and dog populations in LBL. Ideally the siren survey should be conducted in September and October. These months coincide with stable peak coyote populations and surveys would be completed prior to hunting seasons which contribute to the number of dogs. The percentage of coyotes that will respond to the siren and the area surveyed at each station both lack supportive data. Therefore the indices derived must be considered as relative indices, which will help determine coyote population trends and distribution. Considering the habitat differences between the west and southeast, it is felt that studies designed to measure these variables in the heavily forested portions of the southeast would improve the accuracy of the siren-elicited response technique.

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