THE TAXONOMIC DETERMINATION OF THREE WILD CANIDS FROM TODD COUNTY, KENTUCKY

BY

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THE TAXONOMIC DETERMINATION OF THREE WILD CANIDS FROM TODD COUNTY, KENTUCKY

A Research Paper

Presented to

the Graduate Council of

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Karle Julian Dyer

July, 1978

To the Graduate Council:

I am submitting herewith a research paper written by Karle Julian Dyer entitled "The Taxonomic Determination of Three Wild Canids From Todd County, Kentucky." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Biology.

Marvin M. Brown
Major Professor

Accepted for the Council:

William H. Ellis
Dean of the Graduate School

ACKNOWLEDGEMENTS

The author wishes to express appreciation to Dr. Marvin M. Provo, Professor of Biology, Austin Peay State University, for his aid and valuable suggestions offered throughout the research and writing of the manuscript; to Dr. David H. Snyder, Professor of Biology, Austin Peay State University, for his aid and assistance during the research; to Dr. Floyd M. Ford, Professor of Biology, Austin Peay State University, and Mr. Floyd L. Brown, Associate Professor of Biology, Austin Peay State University, for their suggestions and constructive criticism of the manuscript.

Sincere gratitude is extended to Dr. William H. Elder, Rucker Professor of Fisheries and Wildlife, University of Missouri-Columbia, for the considerable amount of time and effort he contributed to the computer analysis and for his comments and suggestions; to Mr. Curtis J. Carley, Project Leader, Red Wolf Recovery Program, and Mr. John Dorsett, United States Fish and Wildlife Service Biologist, for their analysis of the specimen skulls and for the valuable information furnished by them.

Gratitude is also extended to Mr. Jim Durell, Assistant Director of Game, Kentucky Department of Fish and Wildlife Resources, for providing information on the wild canids of Kentucky and for granting

permission to the author to reproduce and use his distribution map in this manuscript.

The author wishes to thank his wife for her encouragement and understanding and for her assistance in the preparation of this manuscript.

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CHAPTER I

INTRODUCTION

Purpose of Study

The purpose of this study was to attempt to determine the taxonomic status of three wild canids shot by Mr. Tom E. Dye, 24 October 1976, on a south Todd County farm. The farm, owned by his father, Mr. H. T. Dye, is located between Trenton and Guthrie, Kentucky, approximately one mile north of the Kentucky-Tennessee border.

Importance of the Study

This type of study is beneficial to both the taxonomist who is interested in species determination and range distribution to game management personnel who are interested in both of these factors plus protection of game animals and domestic livestock from depredation by these carnivores.

Livestock destruction by feral dogs is a growing problem in Kentucky as well as in most of the agricultural areas throughout the United States. However, in recent years there has been an increasing number of reports of coyote or wolf-like animals from various counties throughout the Commonwealth (Figure 1).

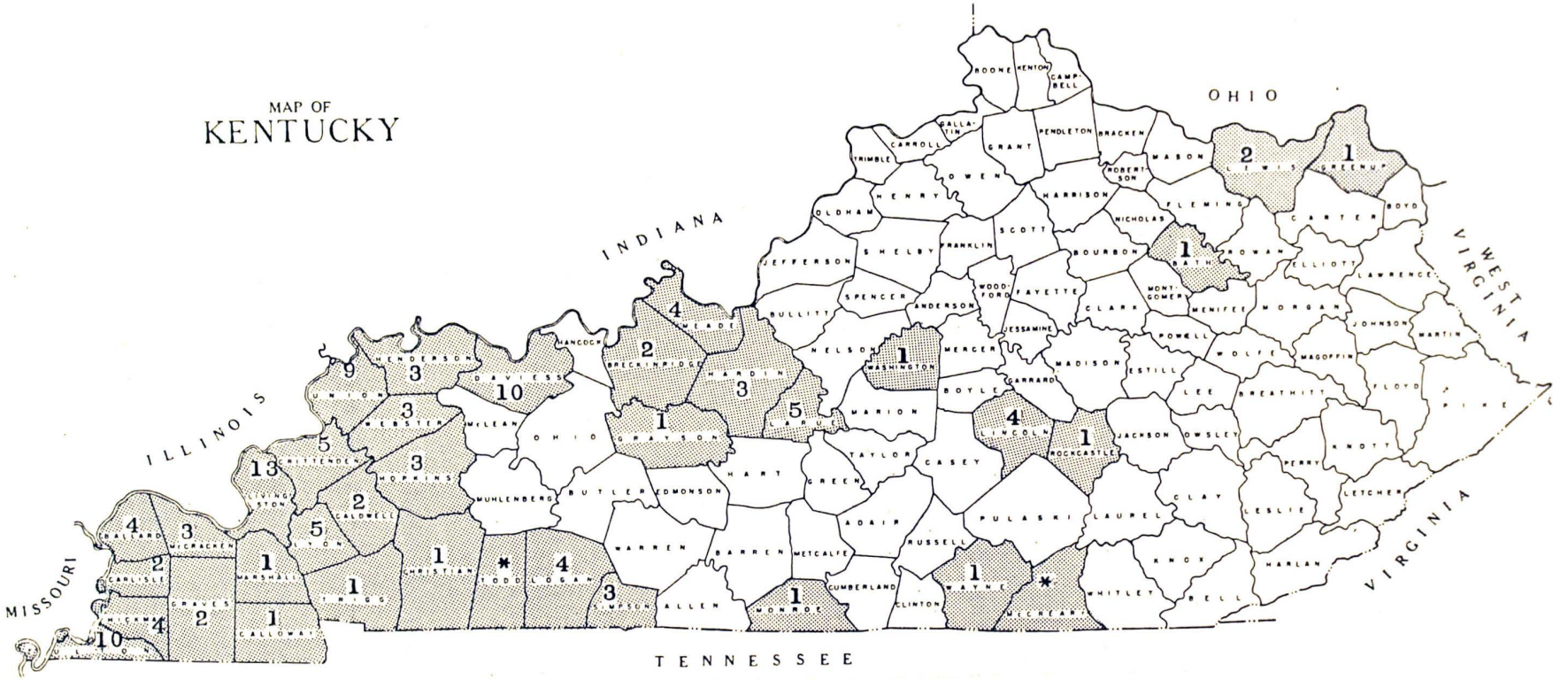

Figure 1. Distribution map showing counties in Kentucky (shaded area) where coyote or wolf-like canids have been reported. Numerals represent years since first reported sighting was made. (Map and data reproduced through the courtesy of Mr. Jim Durell and the Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.)

*These counties were not included in the original map.

According to Mr. Jim Durell, Assistant Director of Game, Kentucky Department of Fish and Wildlife Resources (pers. comm. 2 Feb. 1978; 11 May 1978) a large female wolf-like canid has been taken in McCreary County. Because of its large size this animal was not considered to be a coyote.

A list of Kentucky's rare and endangered species includes both the coyote (Canis latrans) and the red wolf (Canis rufus).

The red wolf is thought to have been extirpated in all states east of the Mississippi River and is known to exist, in pure form, only in southeastern Texas and southwestern Louisiana. Since March, 1965, it has been included by the United States Fish and Wildlife Service on its list of rare and endangered species and is presently in danger of extinction due to its interbreeding with other canid species.

However, Mr. Durell states there have been persistent reports of red wolves in Crittenden County since 1968. One such animal or a coyote has been collected and others seen in 1975 by Mr. J. D. Boss, Manager of the West Kentucky Wildlife Management Area, in western McCracken County.

No recent positive identification has been made of a red wolf in Kentucky, and only two pure coyote specimens have been taken in the state. In 1973, a specimen taken in Lincoln County was identified as a high percentage coydog (est. 90%+ coyote) and other

animals which appear to be coyotes have been taken in Bath, Hardin, Henderson, and McCracken Counties. A specimen taken in the winter of 1977, in Daviess County, was recently identified at the Smithsonian Institute as a pure coyote.

According to information obtained from the Kentucky Department of Fish and Wildlife Resources (pers. comm., Mr. Jim Durell, 2 Feb. 1978) a small number of coyotes is reported to exist in Western Kentucky and growth in this population could be expected.

CHAPTER II

LITERATURE REVIEW

The North American members of the family canidae have been studied extensively. The most comprehensive work on the subject is a monograph on the wolves of North America by Young and Goldman (1944) and a monograph on the coyote by Young and Jackson (1951).

Engle (1946) and Paul (1970) studied the breeding cycle of the domestic dog (Canis familiaris) and Whitney (1927) studied the breeding cycle of the coyote (Canis latrans).

Hybridization between members of the genus Canis has been demonstrated in several instances. Dice (1942), Hall (1943), Bee and Hall (1951), Kennelly and Roberts (1969), and Mengel (1971) have shown that the coyote and the domestic dog can interbreed. The fact that the gray wolf (Canis lupus) and the coyote can cross was shown by Kolenosky (1971) when he successfully mated a female gray wolf with a male coyote, producing two hybrid litters.

The decline in the population of the red wolf, together with the appearance of the coyote in several southeastern states where it never existed before, has resulted in numerous attempts to determine the present range, distribution, and status of the two species.

Notable among these studies are those by Paradiso (1966), Nowak (1967), Pimlott and Joslin (1968), Riley and McBride (1972), and Russell and Shaw (1971; 1972).

In recent years, several states have been invaded by wild canids of unknown identity. It is believed that most of these animals are hybrids resulting from the interbreeding of coyotes with feral dogs and, in some cases, the interbreeding of coyotes with red or gray wolves. Numerous attempts have been made to determine the identity of these animals and several techniques have been developed to facilitate these investigations.

Cytological studies have been applied by Benirschke and Low (1965), Hungerford and Snyder (1966), and Borgaonkar et al. (1968). However, cytological studies were found to be inconclusive because chromosome number and structure remain constant throughout the genus.

Atkins and Dillon (1971), in a study involving comparative brain anatomy, reported that a morphological study of the cerebellum in the genus Canis indicated the organ was of taxonomic and phylogenetic significance.

Dr. U. S. Seal, Metabolic Research Center, Minneapolis Veterans Administration Hospital, has developed a technique involving the biochemical analysis of blood proteins in which he has compared the blood sera of different canid species. He found biochemical

distinction between the blood of red wolves, gray wolves, and coyotes. It is believed that, when refined, this technique will be a valuable tool in the identification of wild canids. One important aspect of this technique is that it enables the animal in question to be identified without having to be sacrificed.

It has been found that different canid species exhibit slight, but significant, differences in skull and tooth measurements. To date, the most reliable technique for determining the identity of unknown canids is the comparison of specific skull and tooth measurements from unknown animals and those measurements taken from museum specimens of known identity.

Often museum material includes both pelts and skulls of specimens. If the skin or pelt of the unknown specimen is available, it is compared with that of the known specimen. However, skins or pelts alone are not reliable as a means of identifying canids due to individual variation in color and pattern of pelage. Regarding pelage coloration and pattern of the coyote, Young and Jackson (1951) indicate that the coyote displays an individual variation possibly greater than any other species of North American mammal, and certainly equaled by few. The identification of unknown canids by means of skull and tooth measurements has been demonstrated by McCarley (1962), Paradiso (1968), and Paradiso and Nowak (1972).

Lawrence and Bossert (1967) modified this technique and

subjected skull and tooth measurements to a computer analysis. Recent studies of this type have been published by Gipson et al. (1974) and Elder and Hayden (1977). Elder and Hayden, studying the wild canids of Missouri, subjected the skull and tooth measurements of 30 dogs (Canis familiaris), 29 coyotes (Canis latrans), 18 gray wolves (Canis lupus), 27 red wolves (Canis rufus), and 20 canids of unknown taxonomic position to a multivariate statistical analysis and were able to completely separate the known specimens into their correct groups. As for the unknowns, several fell within the parameter of definite species and others fell between and indicate hybridization.

CHAPTER III

METHODS AND MATERIALS

Preliminary data taken for each specimen included the following: place and date of capture, sex of animal, and collector's name. In addition, the following weights and measurements (Table I) were taken before the specimens were skinned: total length, length of tail vertebrae, length of hind foot, length of ear (height at notch), total weight of animal*, width of rhinarium (nose pad), and maximum claw-depth on front foot.

Each specimen was skinned according to the technique described by Knudsen (1966) in preparation for each skin being made into a cased pelt for the Austin Peay State University Vertebrate Museum. After skinning and fleshing, each skin was thoroughly salted, folded, placed in a plastic bag, and refrigerated in the Biology Department at Austin Peay State University.

Each skull was disarticulated from the vertebral column by cutting through the connective tissue. Care was taken so as not to damage the condyles located at the back of the skull. Next, the tongue, eyes, and excess tissue were trimmed away with a knife. The brain was removed by using a syringe with a large needle. By inserting the needle into the brain cavity and forcing a stream of

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*estimated weight since animals had viscera removed

TABLE I

Preliminary Weights and Measurements of the Three Todd County Wild Canid Specimens

Measurement	Specimen Number #1	#2	#3
Total length	1373 mm	1326 mm	1106 mm
Length of tail vertebrae	373 mm	382 mm	338 mm
Length of hind foot	215 mm	210 mm	197 mm
Length of ear from notch	127 mm	134 mm	125 mm
Width of nose pad	29 mm	29 mm	24 mm
Claw-depth on front foot	7.5+ mm	7.5+ mm	7.0 mm
*Weight	45 lb	51 lb	23.5 lb
Sex	male	male	young female

*All viscera had been removed from each specimen before they were brought to Austin Peay State University. Weights given above include the weights with viscera removed, plus an allowance of 6 lb for each of the adult male specimens and 4 lb for the juvenile female as recommended by Mr. Curtis J. Carley.

water into the cavity, the brain was flushed out of the skull. Compressed air was used to remove any remaining material from the braincase.

The skull was then immersed in a pan of boiling water containing powdered laundry detergent where it remained until the remaining muscle tissue was boiled off the bone. Later the skull was placed in a weak solution of hydrogen peroxide for bleaching. Finally, the skull was allowed to dry, and a label was attached for later identification.

Fourteen skull and tooth measurements (Table II) were taken of each skull according to the series listed by Lawrence and Bossert (1967) and as used by Elder and Hayden (1977) in their study of Missouri canids. Lawrence and Bossert listed fifteen measurements which they found to be most discriminatory, but Elder and Hayden deleted the length of the posterior cusps of P_4 for they felt it was significant only when measured to a tolerance closer than they felt practical or reliable. Subsequently, this measurement was also deleted by the author.

Each measurement was then divided by the total skull length to reduce it to a ratio as did Lawrence and Bossert (1967).

A list of skull and tooth measurements was forwarded to Dr. William H. Elder, Rucker Professor of Fisheries and Wildlife, University of Missouri-Columbia, for completion of a multivariate

TABLE II

Skull and Tooth Measurements of the
Three Todd County Wild Canid Specimen

Measurement Number	Description of Measurement	Specimen Number #1	#2	#3
1	Total length from sagittal crest to alveoli of first upper incisor	215 mm	220 mm	183 mm
2	Minimum distance from alveolus of second upper molar to depression in front of bulla at base of styloid process	56 mm	58 mm	40 mm
3	Zygomatic width	108 mm	111 mm	89 mm
4	Maximum width of brain case at parieto-temporal suture	61 mm	58 mm	56 mm
5	Maximum crown width across upper cheek teeth	63 mm	66 mm	59 mm

TABLE II (Continued)

Skull and Tooth Measurements of the
Three Todd County Wild Canid Specimen

Measurement Number	Description of Measurement	Specimen Number #1	#2	#3
6	Minimum distance taken at right angles from alveolar margin of molars to orbit	29 mm	32 mm	26 mm
7	Crown length of upper cheek teeth from canine through upper second molar	89 mm	93 mm	84 mm
8	Crown length of fourth upper pre-molar externally	20 mm	20 mm	20 mm
9	Minimum crown width of fourth upper pre-molar taken between roots	7 mm	7 mm	7 mm
10	Maximum antero-posterior width of upper canine taken at base of enamel	9 mm	11 mm	9 mm

TABLE II (Continued)

Skull and Tooth Measurements of the
Three Todd County Wild Canid Specimen

Measurement Number	Description of Measurement	Specimen Number #1	#2	#3
11	Crown width of upper second molar	12 mm	13 mm	13 mm
12	Crown width across upper incisors	26 mm	28 mm	27 mm
13	Minimum height of jugal at right angles to axis of bone	14 mm	15 mm	12 mm
14	Minimum width between alveoli of first upper pre-molars	25 mm	27 mm	23 mm

analysis based upon the previous work of Dr. Elder and Dr. Charles M. Hayden in their study of Missouri canids.

According to Dr. Elder, computations were made through the discriminant function portion of the Statistical Analysis System (SAS)-76.5 program on an IBM 370-168 computer. The discriminant function was based on the use of the Mahalonobis D^2 value (Rao, 1952). The D^2 value, a unit of statistical distance, shows how much each skull deviates from the mean of each unknown group. From the D^2 value, a posterior probability was computed for each skull showing its chance of belonging to each of the known groups.

Upon receiving the final results of the multivariate analysis from Dr. Elder, the author contacted Mr. Jim Durell, Assistant Director of Game, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, and informed him of the determination of the specimens. Subsequently, the author was asked by Mr. Durell to submit the skulls to the United States Department of Interior's Red Wolf Recovery Program for examination. Shortly thereafter, the author received a telephone message from Mr. Curtis J. Carley, Project Leader, Red Wolf Recovery Program, Beaumont, Texas, asking that the skulls along with external body measurements of the specimens be sent to him for examination. The author agreed and within a few days submitted the Todd County specimens to him for his examination.

CHAPTER IV

RESULTS

Assuming that the series of fourteen skull and tooth measurements taken for each skull specimen were accurate and correctly transcribed into the computer, the high posterior probability figures (Table III) derived through the multivariate analysis denote that the three Todd County, Kentucky, wild canid specimens are red wolves and not hybrid animals.

However, subsequent examination of these skulls by Mr. Curtis J. Carley, Project Leader for the Red Wolf Recovery Program, and United States Fish and Wildlife Service Biologist John Dorsett, failed to reveal any evidence that the specimens were red wolves. As a result of their examination, Mr. Carley and Mr. Dorsett concluded that the specimens were dog X coyote hybrids (coydogs).

TABLE III

Posterior Probability Figures for the Three Todd County Specimens

Specimen Skull Number	Coyote	Dog	Red Wolf
1	0.0000	0.0369	0.9631
2	0.0000	0.0024	0.9976
3	0.0238	0.0001	0.9762

CHAPTER V

DISCUSSION AND CONCLUSION

As previously mentioned, Elder and Hayden (1977), using multivariate analysis, were able to get complete separation of 104 known dog, coyote, gray wolf, and red wolf skulls. The series of measurements used in this study was taken from a study by Lawrence and Bossert (1967), who attempted to determine what combination of characters could be used to separate the coyote, gray wolf, and dog and to determine if this combination of characters, when used in conjunction with multiple character analysis, would separate the skulls of these species.

According to Lawrence and Bossert, "Brain case, rostral, and interorbital shape of a typical coyote are quite different from those of a typical wolf. The significance of cranial measurements in expressing these differences in proportion depends on the multiple relationship of each measurement with a number of others, when size has been eliminated as a factor." Lawrence and Bossert therefore attempted to eliminate size as a factor by relating all measurements to total length of skull. Thus, they divided all characters by greatest skull length. However, they failed to take into consideration that skulls of different canid species vary in width and height as well as length.

Therefore, they succeeded only in eliminating skull length as a factor. To entirely eliminate size, all characters would have to be related to greatest length, greatest width, and greatest height of skull. However, it has been found that skull size is an important factor in identifying wild canids. Paradiso (1968) found size to be the only characteristic that consistently separated skulls of coyotes and red wolves. Gipson et al. (1974) found that size was a valuable characteristic in separating canid skulls, and that it was therefore desirable in most cases to retain size as a factor, at least when working with mature specimens.

Lawrence and Bossert also pooled the data for their specimens rather than separate this data according to the sex of the animals. However, wild canids exhibit sexual dimorphism in regard to size and therefore, it is generally agreed that data should be kept separate according to the sex of the specimen. Gipson et al. (1974) tested and rejected the validity of pooling data when using multivariate analysis to identify wild canids.

Paradiso (1968) further questioned the validity of Lawrence and Bossert's work by pointing out that their sample size was too small (20 coyotes, 20 red wolves, 20 gray wolves, and 20 northeastern forest gray wolves) and could not possibly encompass the wide range of geographic, individual, sexual, and age variation existing in the species involved.

It appears that Elder and Hayden's work is questionable because

they pooled their data, used the same series of measurements, and had an inadequate number of samples, as did Lawrence and Bossert. Consequently, the author is skeptical of the determination of the Todd County specimens provided by Dr. Elder.

Other factors which create doubt in the author's mind with regard to the multivariate analysis technique and the determination made by Dr. Elder are: (1) This technique considers only measurable, and not unmeasurable characters. It is therefore unable to consider the presence of a prominent cingulum on the outer side of the first upper molar (M^1), the development of a distinct deuterocone on the fourth upper premolar (Pm^4), or the deeply cleft crowns and laterally compressed cusps of the large upper molariform teeth; (2) The specimen skulls were neither seen nor measured by Dr. Elder. All measurements were taken by the author according to a diagram provided by Dr. Elder, and then submitted to him for testing. The author has found that a person inexperienced in the use of vernier calipers may obtain varying measurements. A person using calipers must know the proper amount of pressure to exert upon the instrument, the proper angle to apply the instrument, and the exact points of measurement. Therefore it is the author's conclusion that, to avoid variation, the skulls should have been submitted to Dr. Elder, since he is experienced in measuring canid skulls; (3) The fact that the computer failed to recognize that Specimen #3 was a juvenile animal, indicates

that the computer may have been inadequately programmed. If the computer cannot distinguish between juvenile and adult specimens, it is questionable, whether it can separate different species of wild canids or hybrid animals; (4) In comparison with photographs of red wolf skulls, the specimen skulls appear to lack the massiveness in the jaws and broadness in the rostrum that is exhibited by the red wolf. The skulls appear to be intermediate in size between that of the red wolf and the coyote and resemble the coyote except for a broader rostrum and greater length and width of the skull; (5) Evidence that the red wolf is extirpated east of the Mississippi River and exists only in southeastern Texas and southwestern Louisiana (Pimlott and Joslin, 1968; Nowak, 1970; Paradiso and Nowak, 1972; Riley and McBride, 1972) where it is on the verge of extinction, would indicate the improbability of the red wolf existing in Kentucky at this time. However, there is a remote possibility that one or more red wolves were brought into the state as pets and either were released or escaped captivity. Another possibility is that red wolves were unintentionally released by fox hunters who import and release fox pups for restocking purposes. Young and Jackson (1951) gave evidence that this has happened in the case of the coyote whereby young coyote pups, which are not readily distinguishable from fox pups, have been mistakenly shipped and released in areas where the coyote previously did not exist.

In an attempt to verify these possibilities, the author contacted

the Kentucky Department of Fish and Wildlife Resources and the Tennessee Wildlife Resources Agency.

The T.W.R.A. confirmed the presence of a substantial coyote and coydog population within the southern portion of Middle Tennessee. According to the Agency, it is believed that these animals became established from coyotes released by fox hunters. It seems that a past release at Redstone Arsenal (near Huntsville, Alabama) accounts for large numbers of the animals in Northern Alabama, and more recently in southern Middle Tennessee.

For the past two years, red wolf reports have flowed in from Lawrence, Giles, Lincoln, and Marshall Counties. However, most of these animals were identified as mixed redbone hounds or chows. Others which are not readily identifiable are being sent to the Smithsonian Institute for identification.

The Kentucky Department of Fish and Wildlife Resources reports that foxes have been imported and released, but that most of the released animals were adults.

The western half of the state is known to have a well-established wild canid population, but the Daviess County specimen and another from Clark County in Eastern Kentucky (Barbour, 1974) are the only two pure coyote specimens known in the state. Other wild canids taken in Kentucky have been identified as coydogs or wild domestic dogs.

Although reports of red wolf sightings have been recorded

since 1968, no evidence has been found to substantiate these reports.

In making their determination of the Todd County specimens, Mr. Carley and Mr. Dorsett, of the Red Wolf Recovery Program, measured each skull and compared these measurements with a list of minimum standards for red wolves (Table IV). To be eligible for consideration as a red wolf and for captive preservation by the Red Wolf Recovery Program, a specimen must meet or exceed each of these standards.

Specimen #1, an adult male estimated to be between two and three years of age, exceeded the minimum requirements for total length (1346 mm) and ear length (120.6 mm) with respective scores of 1373 mm and 127 mm, but fell below the minimum requirements for skull length (215 mm), zygomatic width (110 mm), hind foot length (229 mm), and weight (50 lb) with respective scores of 214.25 mm, 108.50 mm, 215 mm, and 45 pounds.

Specimen #2, an adult male estimated to be between three and four years of age, exceeded the minimum requirements for skull length (215 mm), zygomatic width (110 mm), ear length (120.6 mm), and weight (50 lb) with scores of 221.70 mm, 111.28 mm, 132 mm, and 51 pounds respectively. However, the specimen fell below the minimum requirements for total length (1346 mm) and hind foot length (229 mm) with respective scores of 1326 mm and 210 mm.

Specimen #3, a juvenile female estimated to be between five

TABLE IV

Minimum Standards for Adult Male and Female Wild Red Wolves Selected for Captive Preservation by the Red Wolf Recovery Program

Measurement	Male	Female	Specimen Number #1 Male	#2 Male	#3 J. Female
Skull length	215*	210	214.25	221.70	184.67
Zygomatic width	110	110	108.50	111.28	89.42
Weight	50 lb	42 lb	45 lb	51 lb	23.5 lb
Total length	1346	1295	1373	1326	1106
Hind foot length	229	222	215	210	197
Ear length	120.6	114.3	127	132	125
Shoulder height	685.8	673.1	N.A.	N.A.	N.A.

*Millimeters

and six months old, was not eligible for testing since the minimum standards were for adult animals. However, comparison of the specimen with these standards reveal that, even at this young age, the specimen exceeded the minimum score for ear length (114.3 mm) with a score of 125 mm. In all other measurements, the specimen fell below the minimum standards.

In addition to comparing skull measurements of the specimens with minimum standards for red wolves, Mr. Carley and Mr. Dorsett also X-rayed the skulls to study internal skull characteristics. As a result of this study, numerous indications of dog hybridization were found. Recorded below is the description, provided by Mr. Carley, of the dog characteristics found for each skull.

> Specimen #1: "Marginal dog indicators are a mild curve to the posterior edge of the coronoid process; and the center of the hard palate is slightly behind the posterior edge of the last molar of the upper tooth row (even with or within posterior margin of molar in wild canids). Distinct dog characters are that the lower tooth row is flared outward; the auditory bullae are relatively small, the sinus is inflated with the frontals and nasals steep and with a concave appearance when viewed laterally (sinus reduced, slope of frontals and nasals gradual and not concaved in wild canids); and the brain case appears to drop posteriorly from level of supra-orbital ridges when viewed laterally (tends to remain level in wild canids)."

> Specimen #2: "Marginal dog indicators are a mild curve to the posterior edge of the coronoid process; and the center of the hard palate is slightly behind the posterior edge of the last molar of the upper tooth row. Distinct dog characters are that

the lower tooth row is flared outward; the auditory bullae are relatively small, the sinus is greatly inflated with the frontals and nasals quite steep and having a concave appearance when viewed laterally; and there is an extra molar in the upper right tooth row (dental anomalies can be an indicator of hybridization)."

Specimen #3: "At this stage of development (5-6 months) the specimen appears coyote-like; however, dog characters would probably have become more evident once the animal had matured. The slope of the frontals is marginal, but probably would have become more pronounced with age. The brain case is wild canid-like at this time as is the hard palate. The brain case might have changed with age, it is not likely that the hard palate would change. The lower tooth row is flared and probably would have become more pronounced with age. The auditory bullae are relatively small for the age of the animal. They tend to appear oversized for the skull of pups. The anterior edge of the ramus of the coronoid process is curved and the posterior edge is 'hooked,' both being dog characters; however, this condition is typical in wild canid pups. It is not possible to determine what final shape these features would have achieved by the time the animal had matured."

The Todd County specimens were found to be too small to be red wolves, and their skulls revealed both domestic dog and wild canid characteristics.

Although Mr. Carley and Mr. Dorsett (pers. comm. 27 June 1978) have seen instances of hybridization between dogs and red wolves, they concluded that the Todd County specimens were dog X coyote hybrids. This conclusion was based upon the fact that the range of

the coyote as indicated by range maps shows that it has adapted to the presence of man and has extended its original range from Texas and Oklahoma eastward until it now inhabits most of the southeastern United States (Figure 2). The red wolf, however, has been unable to co-exist with man and has steadily declined in number until its range, which once extended from the Gulf of Mexico northward to Indiana and Illinois and from Texas eastward to the Atlantic coast of Georgia and Florida (Figure 3), now includes only portions of southeastern Texas and southwestern Louisiana. Therefore, the wild canid most likely to be available for hybridization with the dog in Kentucky is the coyote. However, the remote possibility of hybridization between a dog and a red wolf still exists because of the possibility that one or more red wolves were brought into the state, either intentionally or unintentionally from the known range of the red wolf, and escaped captivity or were released, making it available for hybridization with the dog.

However, until a red wolf or a dog X red wolf hybrid is taken in Kentucky or an adjacent state thus confirming its existence there, the author must agree with Mr. Carley and Mr. Dorsett and conclude that the three Todd County wild canid specimens are probably the result of hybridization between the dog (Canis familiaris) and the southeastern coyote (Canis latrans frustror) or possibly the northeastern coyote (Canis latrans thamnos) rather than dog X red wolf hybrids, or red wolves as determined by Dr. Elder.

Figure 2. Distribution map showing the range of the coyote (Canis latrans). Dots designate areas where occasional coyote sightings have occurred.

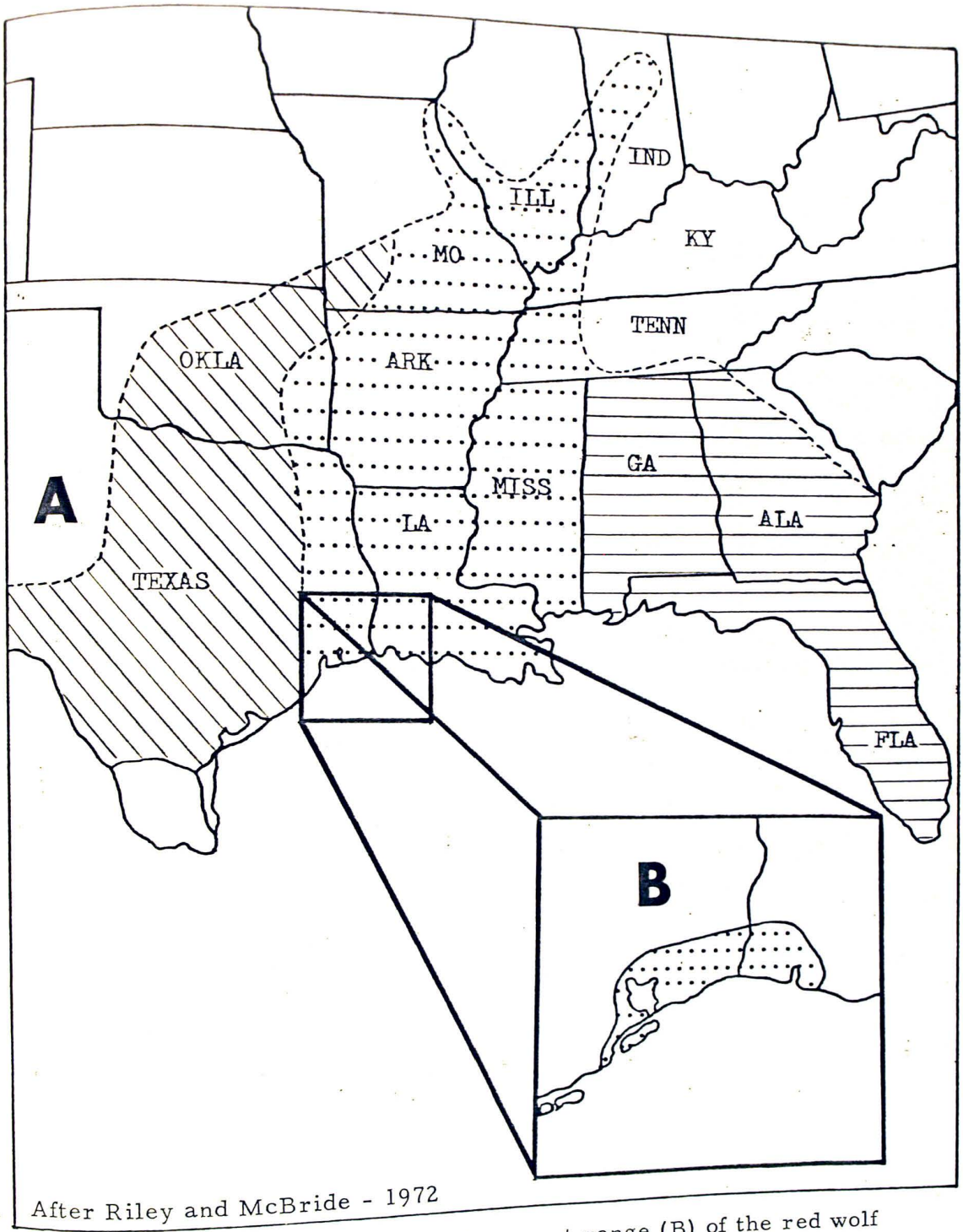

Figure 3. Historic range (A) and present range (B) of the red wolf (Canis rufus).

C. r. rufus C. r. gregoryi C. r. floridanus

CHAPTER VI

SUMMARY

Three wild canid specimens taken in Todd County, Kentucky, on 24 October, 1976, and brought to the Austin Peay State University Biology Department for identification were measured, weighed, and skinned. Skull and tooth measurements taken for each specimen were submitted to Dr. William H. Elder at the University of Missouri-Columbia for use in a multivariate computer analysis to determine the identity of the specimens.

Posterior probability figures resulting from the analysis indicated that all three specimens were red wolves. However, a subsequent examination of the skulls by Mr. Curtis J. Carley and Mr. John Dorsett of the United States Department of Interior's Red Wolf Recovery Program revealed that the specimens were too small to be red wolves and that the skulls exhibited numerous dog and wild canid characteristics. Mr. Carley and Mr. Dorsett therefore concluded that all three of the Todd County specimens were dog X coyote hybrids.

Based upon the findings of Mr. Carley and Mr. Dorsett, along with information obtained during the course of a literature search conducted by the author, the author concurs with their decision that the three Todd County specimens are probably dog X coyote hybrids,

although the remote possibility exists that the specimens resulted from dog X red wolf hybridization. However, all indications are that the red wolf was extirpated east of the Mississippi River long ago and is therefore unavailable for hybridization with the dog in the southeastern United States.

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