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A SURVEY OF THE RED WOLF (*Canis rufus*)

UNITED STATES DEPARTMENT OF THE INTERIOR
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Fish and Wildlife Service
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A SURVEY OF THE RED WOLF (Canis rufus)

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INTRODUCTION

This paper discusses the red wolf's (Canis rufus) status, distribution, and ecology; and describes and differentiates the red wolf from other closely related canids. Difficulties in distinguishing red wolves from coyotes (Canis latrans) and red wolf-coyote hybrids have resulted in much confusion over the range and status of the red wolf.

The paper is based on information gathered as part of the Bureau's red wolf program which began in 1968. The purposes of the program are:

- (1) to determine the red wolf's range, population size, food habits, and ecology;
- (2) to determine the actual extent of red wolf predation on livestock; and
- (3) to gain the understanding and cooperation of local people throughout the red wolf's range in the effort to preserve the species.

DISTRIBUTION

The red wolf formerly occurred from central Texas eastward to the coasts of Florida and Georgia, and along the Mississippi River Valley north to central Illinois and Indiana (Hall and Kelson, 1959). Presently the red wolf occurs in Liberty, Chambers, Jefferson, Brazoria, Galveston, and Harris Counties in southeastern Texas, and in Cameron Parish in southwestern Louisiana. (See Figure 1.)

Two of three described subspecies of the red wolf, (Canis rufus rufus) and (Canis rufus gregoryi), apparently occur over the present range (Paradiso and Nowak, 1971). Animals matching the description of the former subspecies occur in portions of Brazoria, Harris, and Galveston Counties. Animals matching the description of the latter subspecies occur in portions of Liberty, Chambers, and Jefferson Counties, and in portions of Cameron Parish. Galveston Bay and the Houston Metropolitan area restrict contact between the two populations.

The primary portion of the remaining red wolf range is found in Chambers, Jefferson, and southern Liberty Counties--an area of approximately 1,260,000 acres. Virtually all of this land is in private ownership. Much of the land is used for livestock grazing (521,874 acres), and for producing rice (248,657 acres) and other crops (39,370 acres). Forested areas encompass approximately 90,000 acres. We estimate that there are 300 red wolves in this area.

The present known range of the red wolf lies within the coastal prairie and coastal marsh areas--habitat markedly different from the forest habitat found over the majority of its historic range. Although the present range extends to the very edge of the heavily forested

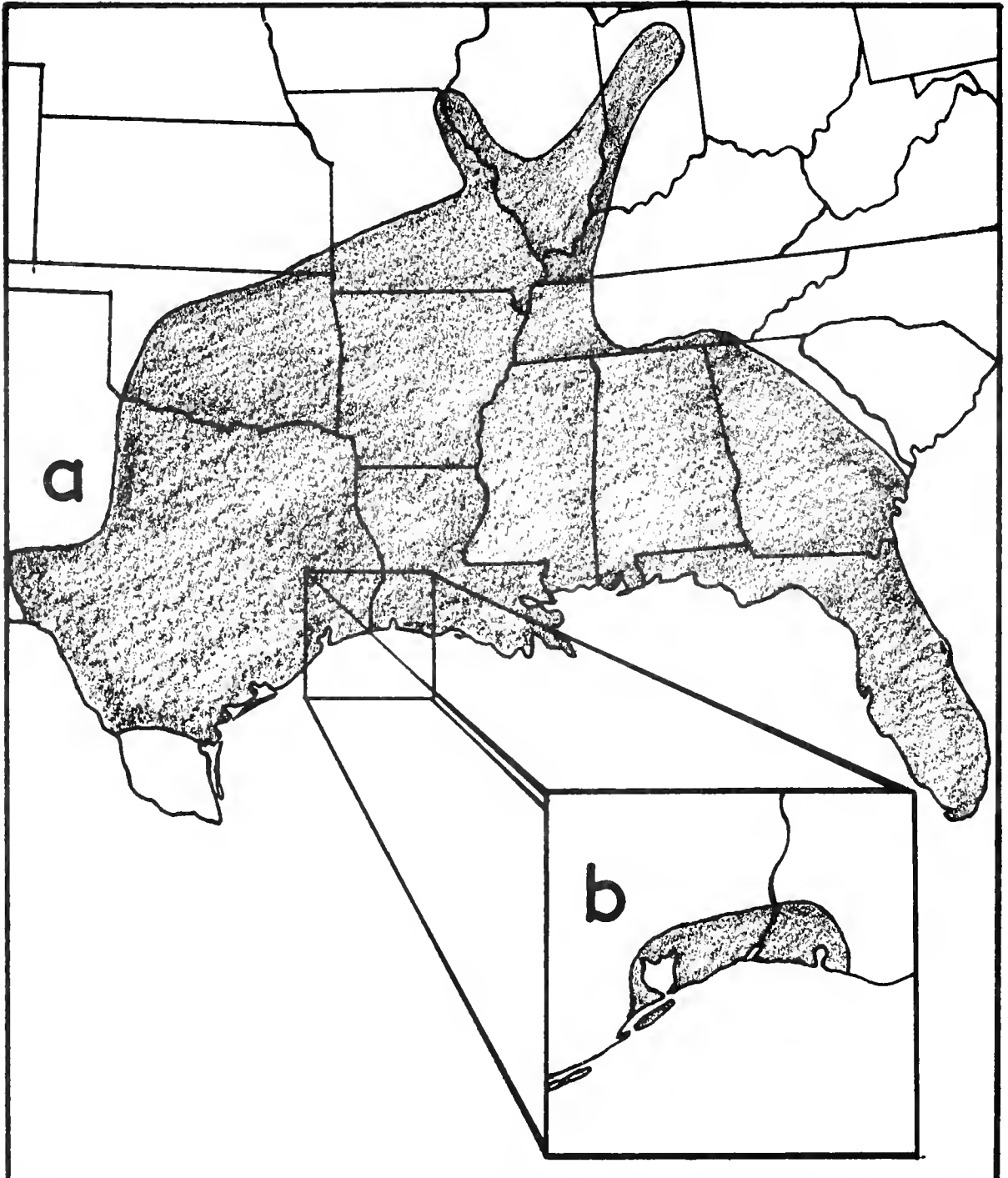


Figure 1. Historic range (a) and present known range (b) of the red wolf (Canis rufus).

"Big Thicket" area of southeast Texas, we have not yet located any red wolves within that area.

Vegetation on the prairie consists of tall bunchgrasses such as big bluestem (Andropogon gerardi), little bluestem (Andropogon scoparius), Indiangrass (Sorghastrum nutans), eastern gamagrass (Tripsacum dactyloides), switchgrass (Panicum virgatum), and gulf cordgrass (Spartina spartinae). Marsh vegetation is composed of various species of (Carex), (Scirpus), (Rhynchospora), and (Juncus) and marshhay cordgrass (Spartina patens).

There are also "islands" of loblolly pine (Pinus taeda), mixed with hardwoods. The predominant hardwood species are oaks (Quercus) magnolia (Magnolia grandiflora), and sweet gum (Liquidambar styraciflua). (See Figure 2.)



Figure 2. Photograph of coastal prairie red wolf habitat. An "island" of brush in the background. (Photo by R.W. Clapper, BSWF).

DESCRIPTION

Even the most complete accounts of the external characteristics of the red wolf (Young and Goldman, 1944) are sketchy, and may give the impression that this animal closely resembles the coyote except for size and color variations. However, there are certain definite characteristics which we believe are so pronounced that the two species can be readily distinguished in the field.

This proposition is supported by: (1) data gathered in the field, and through examinations of skeletal material and skins in the National Museum of Natural History and in private collections; (2) evidence

gathered from interviews with persons who were familiar with red wolves when they were more common in southeast Texas and Louisiana; and (3) reviews of photographs of known red wolves from Texas, Louisiana, and Arkansas.

Coloration

The term "Red Wolf" is misleading, and suggests an animal with a distinct red color. Residents of areas that have been inhabited by red wolves have seldom referred to the animals as "red," but rather as "gray," "yellow," or "black" wolves. Goldman (Young and Goldman, 1944) describes the color of the red wolf as a varying mixture of "cinnamon-buff," "cinnamon," or "tawny" with gray and black; the dorsal area more or less overlaid with black. Recent observations of red wolves in the coastal prairies of southeast Texas and southwest Louisiana reveal that present populations vary from tawny to grayish. The black phase is probably non-existent at the present time--even though it was reported occasionally in the historic range of the animal.

John Knight, a retired trapper from Segno, Texas, who trapped in the southeast Texas area from the late 1920's to the early 1940's, and T. E. (Doc) Harris, supervisor of predator control operations for the State of Louisiana since 1952, both report that the black phase was never common on the coastal prairies (pers. comm.). We have been able to locate records of only three black wolves from that area. One was recorded in Chambers County in 1935, and two in Cameron Parish in 1963. Evidently the red wolf of the coastal prairie and marshland is a lighter colored animal than its forest-oriented counterparts.

Facial color patterns of red wolves often resemble those of gray wolves (Canis lupus) and are distinctive:

(a) Muzzle coloration:

Like the gray wolf, the muzzle of the red wolf often tends to be very light. The area of white around the lips may extend well up on the sides of the muzzle, leaving only the bridge of the nose with a tawny to cinnamon coloration. In contrast, the area of white around the lips of coyotes is thin and sharply demarcated.

(b) Coloration around eyes:

On many red wolves, light areas occur around the eyes. A light tan spot may be present over each eye adding to the almond or slanted eye effect.

Because of a deeper profile and broader head, the facial appearance of the red wolf is more massive than the more fox-like coyote. While the red wolf has a less prominent ruff than the gray wolf, the almond-shaped eyes, broad muzzle, and wide nose pad contribute to its wolf-like appearance. (See Figure 3.)



Figure 3. Photograph of a red wolf (top) and a coyote (bottom). Notice the facial markings, the length of the ears, and the width of the nose pad and muzzle. (Photos by C. J. Carley, BSW).

Measurements and Weight

Young (Young and Goldman, 1944) quotes Andy Ray of the U.S. Fish and Wildlife Service, who reported that red wolves from Arkansas averaged between 45 and 65 pounds. T. E. (Doc) Harris reports that red wolves from Louisiana have averaged between 40 and 65 pounds; the largest individual male red wolf he recalls weighed 74 pounds (pers. comm. Oct. 5, 1971). John Knight reports that red wolves from the southeastern Texas area averaged between 40 and 60 pounds; a few very large males weighed as much as 80 pounds (pers. comm. July 7, 1970).

Weights of recently collected red wolves from the Texas Gulf Coast prairies fall within the 40- to 60-pound range. Individuals weighing over 60 pounds are rare, the heaviest recorded being 76 pounds. Of 14 adult red wolves captured in Chambers County, Texas, between 1968 and 1970, weights of males ranged from 46 to 62 pounds (average 52.25 pounds) and those of females ranged from 45 to 54 pounds (average 46.71 pounds).

Our observations agree with Young's (Young and Goldman, 1944) description of the red wolf as a long-legged, rangy animal. Of all the distinguishing external characteristics, the long legs are one of the most striking. Persons familiar with North American wild canids invariably notice and remark on the "legginess" of the animal. Ranchers differentiate between coyotes and red wolves in the same manner, referring to the latter as "long-legged" or "tall" wolves. This feature appears to be due to the increased length of the tibia and fibula in the red wolf.

Observations of gray wolves and red wolves suggest the "legginess" of the red wolf may stem from differences in body conformation as well as the length of the legs. Measurements from the tip of the toes to the top of the shoulders indicate red wolves may be as tall as the gray wolf; but because they are not as massive through the thoracic region, they have a rangy, long-legged appearance. Five gray wolves from Minnesota--eastern timber wolf subspecies (Canis lupus lycaon)--weighed from 57 to 84 pounds (average 65.4 pounds), and ranged from 27 to 30 inches (average 28.4 inches) from the tip of the toes to the top of the shoulders. Ten red wolves from Liberty and Chambers Counties weighed from 40 to 76 pounds (average 53.9 pounds), and ranged from 24.5 to 29.5 inches (average 27.6 inches) from the tip of the toes to the top of the shoulders.

Another distinctive characteristic of the red wolf is its proportionately large ears and the angle at which they are normally carried. (See Figure 3.) Although the ears of a gray wolf may equal those of a red wolf, they are less prominent because the head of the gray wolf is more massive. Also, the angle at which the red wolf carries its ears creates an accentuated triangular facial appearance markedly different from that of the gray wolf or coyote, whose ears are more erect. Table 1 compares the ear lengths of these three species.

Table 1: Ear Length of Canis lupus, Canis rufus, and Canis latrans in Inches

<u>Canis lupus</u>		<u>Canis rufus*</u>		<u>Canis latrans</u>	
Length	Sample size	Length	Sample size	Length	Sample size
5.5	1	5.5	2	4.5	6
5.0	1	5.0	10	4.25	10
4.9375	1	4.75	1	4.125	1
4.75	1	4.5	1	4.0	4
4.3125	1			3.75	2
				3.875	1
				3.5	1
Average Lengths					
4.90		5.01		4.18	

* Measurements for this species are mainly from animals from Liberty and Chambers Counties, and some from Galveston County.

Voice

The voice of the red wolf has never been adequately described. The only early description of the vocalizations known to us is an unpublished field note written by Vernon Bailey (Biological Survey) while at Sour Lake, Hardin County, Texas: "They howled repeatedly not far from our camp. Their voice is a compromise between that of the coyote and lobo, or rather a deep voiced yap-yap and howl of the coyote. It suggests the coyote much more than the lobo." Interviews with people familiar with the red wolf during the first half of the century seem to support Bailey's description. John Knight stated: "They howl long and mournful but break off into yapping. I kept one for seven years, raised it from a pup (1928-1935), he would howl a deep coarse howl and break off into a yap-yap." (pers. comm. July 7, 1970)

Using sirens, Dennis Russell and Jim Shaw of the Texas Parks and Wildlife Department elicited a prolonged coarse howl from red wolves that was similar to, but of a higher pitch than that of the gray wolf (J. H. Shaw, pers. comm. July 1971). Using sirens, we have elicited a bark, a howl ending with one or two short barks, and a prolonged howl.

A recent recording of spontaneous vocalizations of a group of red wolves in southwestern Louisiana indicates that elicited and spontaneous vocalizations differ from one another. The group vocalizations consisted of a series of blended coarse yaps and prolonged howls of different tone and pitch. The harmony seemed more controlled and deliberate than that of coyotes, yet was not blended as well as the vocalizations of gray wolves.

Tracks and Signs

Since red wolves are larger and heavier than coyotes, it is not difficult to distinguish between the tracks and scats of the two; experienced field people familiar with the tracks and signs of coyotes immediately notice the difference.

A red wolf track is larger, the stride longer, and the pattern different from that of a coyote. In fact, they closely resemble those of the gray wolf. Red wolf tracks measured in Liberty and Chambers Counties, Texas, and Cameron Parish, Louisiana, ranged from 3.5 to 5.0 inches from the back of the heel pad to the end of the longest claw (average 4.0 inches); the stride ranged from 22 to 30 inches (average 25.9 inches). Coyote tracks measured in west Texas varied from 2.25 to 2.85 inches (average 2.6 inches); the stride ranged from 12.75 to 19 inches (average 16.3 inches). The tracks of red wolves are more compact than those of the average domestic dog, being proportionately narrower with a more elongated heel pad. Differences in the track pattern further differentiate between red wolves and domestic dogs.

Thompson (1958) notes that coyote scats rarely exceed one inch in diameter, while most eastern timber wolf scats range from one to one and one half inches. Our data indicate that red wolf and eastern timber wolf scats are of comparable size.

Behavior

Trapped red wolves are more aggressive than trapped coyotes or gray wolves. With tail in an upright position and canine teeth bared, they often attempt to attack. They frequently bark or howl as they are approached. This may occur when the trapper is 100 yards or more distant. Coyotes bark under similar circumstances, but they rarely howl. When in similar situations, gray wolves seldom bark or howl (L. D. Mech, pers. comm. Oct. 1971; Robert Himes, pers. comm. Oct. 1971).

The threat postures of red and gray wolves differ from those of coyotes. Wolves bare their canine teeth and raise the fur along their neck and back. Coyotes, on the other hand, assume a wide-mouthed posture with teeth showing, back arched, and tail held between the legs. The fur along their neck and back may or may not be raised. (See Figure 4).

Red wolves readily swim. Nilo Esquivel, a wolf hunter from Alvin, Texas, relates that they frequently take refuge in water when pursued by hounds (pers. comm. August 1970).



Figure 4. Red wolf (left) and coyote (right) threat behavior. A red wolf's tongue does not normally protrude as shown here.

Sociability

Red wolves are more sociable than coyotes, but probably less so than gray wolves. It is not unusual to find three or more traveling throughout their range as a group. Numerous observations of groups and group signs convince us that red wolves maintain a group structure throughout the year. There is little reason, however, for them to hunt in packs since their food is composed of small prey species..

Home Range

Roads, canals, flooded rice fields, and bayous constitute travel barriers of varying degrees. Large canals and bayous seem to isolate certain family groups to some extent. In some cases, the wolves do not complete a circle in their nightly hunting forays, simply returning over the same route taken earlier in the night, which explains why their tracks are often found coming and going on the same trail.

Based on the systematic tracking of three adult red wolves (one for one year, the others for two years), we estimated the home range of a red wolf to be approximately 25 to 50 square miles. James H. Shaw has found, through radio telemetry, that the home range of an adult red wolf averages 35 square miles (pers. corr. April 1972).

Reproduction

Breeding occurs in January and February, and the pups are born in March and April. Based on litters born in captivity, the average litter size seems to be 3 or 4.

Red wolves normally rear their young in dens dug in the slopes or crests of the low natural sand mounds common in the coastal prairie. Dens have also been found in drain pipes and culverts, and in the banks of irrigation and drainage ditches. The dens average about eight feet in length and are normally no deeper than three feet. The den entrance varies from two to two and one-half feet in diameter, and is normally fairly well concealed.

Both male and female take part in rearing the young. Frequently, young of the previous year are found in the vicinity of dens; but they do not appear to participate in the guarding, feeding, or training of the pups.

Evidence suggests that the pups actually spend more time in "beds" located in areas of good cover than in the den--especially after they are six weeks of age.

Food Habits

From scat analyses and observations, we find that the predominant prey species are: nutria (Myocastor coypus), swamp rabbit (Sylvilagus aquaticus), and cottontail rabbit (Sylvilagus floridanus). Other common prey species are: rice rat (Oryzomys palustris), cotton rat (Sigmodon hispidus), and muskrat (Ondatra zibethicus). Scat analyses by Russell and Shaw (1971) and by Stutzenbaker (1968) also indicate that rabbits and nutria are major prey species. We believe that the nutria is a buffer species between red wolves and domestic livestock.

With constant exposure to large herds of cattle, it is to be expected that cattle will sometimes be killed and eaten by red wolves. Predation upon newborn calves occurs occasionally. Actually, there is much disagreement among local ranchers regarding the seriousness of red wolves as killers of cattle, a disagreement that never existed with the gray wolf. This disagreement is, in itself, an indication that red wolves are not as serious a predator on cattle as were gray wolves.

It is interesting to note that it was not predation on cattle that precipitated large-scale reduction efforts against the red wolf, but predation upon smaller, more easily obtained domestic prey such as hogs--which in earlier times were allowed to run free.

LIMITING FACTORS

Human activities appear to be a major limiting factor of the red wolf. Each year agricultural and commercial use of the land intensifies, and little by little more wolf habitat is lost. Prime denning areas are plowed and converted to rice fields, and industrialization creeps across the land. A favored red wolf rendezvous site in a given year may be an industrial development the next year. The habitat changes have been most drastic in Brazoria, Harris, and Galveston Counties.

Commercial hunting and shooting preserves flourish on the coastal prairies. On the opening day of waterfowl season, hundreds of hunters may be afield on portions of prime red wolf habitat. Each year some wolves are killed by these hunters. On the northern edge of the range, deer hunters also kill a few wolves each year. With these pressures and the high natural mortality, the red wolf faces a dim future unless it receives help from its greatest enemy--man.

Since man and his activities are constantly within sight or hearing, the red wolf is conditioned to man's presence and may be very tolerant of him. Red wolves are unquestionably easier to capture than gray wolves or coyotes. On several occasions we have seen where wolves traveled within easy rifle shot of residences and farm buildings. They exhibit little fear of farm tractors, at times following them in search of rodents plowed out of the ground, and exhibit little fear of men on horseback.

Parasites appear to be another major limiting factor on red wolves. Heartworms (Dirofilaria immitis) have been present in all 27 wolves examined for internal parasites during our study. Infestation probably increases with the age of the host due to the constant exposure to the mosquito vectors. Red wolves three years of age and older usually were heavily parasitized by heartworms--sometimes to the point that the heart valves could not close. Such animals cannot tolerate stress situations and may die from incidents that would be of little or no consequence to animals with a lesser degree of parasitism. Other internal parasites commonly found include hookworms (Ancylostoma), tapeworms (Taenia), and occasionally spiny headed worms of the class Archiancathocephala.

The scarpotic mange mite (Scarpotes scabiei) infests a considerable portion of the red wolf population. Several red wolves observed in the field were 90 percent devoid of fur. These animals were in very poor physical condition and probably did not survive very long. Dr. U. S. Seal of the Veterans Administration reports that all of the 27 red wolves he has received from us for blood studies have been affected by mange (pers. comm. Oct. 19, 1971).

HYBRIDIZATION

Genetic barriers which separated (Canis rufus) from (Canis latrans) undoubtedly have eroded. This has resulted in the red wolf being genetically swamped by coyotes. Dr. Howard McCarley (1962) reports that hybridization had taken place over most of the original range of the red wolf.

Hybridization with coyotes poses one of the greatest threats to the remaining red wolf population. Our understanding of the dynamics involved is not clear, however, we do know that coyotes and hybrids are found along the periphery of the remaining range of Canis rufus and apparently are progressively invading the remaining range.

The controversy over identification of red wolves is due in part to the former lack of knowledge as to the identity of hybrids. Recent efforts to correct this matter have dealt with brain morphology, chromosome analysis, and electrophoretic tests of blood samples. To date none of these methods have provided a means of positively confirming identification of live specimens. We state again that the confusion can be resolved because coyotes, hybrids, and red wolves are distinguishable by certain external characteristics which, in the final analysis, can be supported by skull examination.

In dealing with hybrids (Canis rufus x Canis latrans) one must expect an occasional phenotype that approaches that of Canis rufus. However, only where populations of canids are uniform in phenotype may the genotype be considered pure. When an occasional phenotype approaching that of Canis rufus appears in a group of apparent hybrids, it must be assumed that it is a hybrid.

Hybrids can be distinguished from the red wolf by the following characteristics:

- (1) Smaller feet and legs, both in length and breadth.
- (2) Shorter ears.
- (3) Less massive muzzle.
- (4) Overall generally smaller in size.
- (5) Coyote-like threat posture.

The sizes of the feet, legs, and ears appear to be the first external characteristics to change with hybridization. Table 2 gives comparative weights and external body measurements of red wolves, coyotes, and hybrids.

Table 2: Comparative Weights and Measurements of Red Wolves, Hybrids, and Coyotes from East Texas, 1969-1972

	<u>RED WOLF*</u>	<u>HYBRID</u>	<u>COYOTE</u>
Sample Size	26	21	17
Weight (lbs.):			
$\bar{x} \pm$ s.d.	50 \pm 8.6	40 \pm 4.2	33 \pm 4.4
Range	38 - 76	30 - 45	22 - 38
Total Length (in.):			
$\bar{x} \pm$ s.d.	55.9 \pm 2.6	52.7 \pm 1.9	50.1 \pm 1.7
Range	52.0 - 63.0	48.0 - 56.0	47.5 - 53.0
Hind Foot Length (in.):			
$\bar{x} \pm$ s.d.	9.1 \pm .29	8.5 \pm .37	8.1 \pm .28
Range	8.3 - 9.8	8.0 - 9.5	7.5 - 8.4
Ear Length (in.):			
$\bar{x} \pm$ s.d.	5.0 \pm .24	4.5 \pm .32	4.6 \pm .44
Range	4.5 - 5.5	4.5 - 5.0	4.2 - 4.8

* These specimens were from Liberty and Chambers Counties, except 2 from Galveston County.

SUMMARY

In this paper we have described the red wolf as it occurs today. The animal's relationship to its environment is discussed briefly. We stress that the red wolf is a strikingly different animal from the coyote. We feel the difficulties described in the literature in distinguishing this animal from coyotes or hybrids are exaggerated from the true situation in the field.

Canis rufus still exists as a separate entity, but its numbers have been reduced. Evidence from a recently completed computer based multivariate analysis of skulls indicates that Canis rufus still survives as a pure species in Chambers County--and probably in southern Liberty County (R. M. Nowak, pers. comm. June 1972). We believe that this is the gregoryi subspecies and that it also survives in portions of Jefferson County and Cameron Parish. Also, there are the populations of canids in portions of Brazoria, Harris, and Galveston Counties matching the description of (Canis rufus rufus). While the identity of Canis rufus is still being pondered by some, the future of the animal is in a delicate balance which could be tipped by chance. The Bureau is presently expanding its red wolf recovery program in cooperation with others to restore the species to secure population levels. The State of Louisiana has granted the species a protected status.

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