

STATUS OF THE WOLF IN NORTH AMERICA

Thesis for the Degree of M. S.
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Richard John Aulerich
1964





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ABSTRACT

STATUS OF THE WOLF IN NORTH AMERICA

by Richard John Aulerich

This study was an attempt to investigate the present status of wolves in North America through a review of the literature and mail questionnaire survey of biologists and naturalists.

The data indicate that within the United States, timber or gray wolves (Canis lupus) are now possibly resident in only five states. Only in Minnesota and Alaska, and possibly in Michigan, are the remaining wolf populations not in danger of immediate extirpation. Timber wolves are still relatively numerous in Alaska, but reports from Canada and Mexico indicate a marked decrease in abundance during the last decade, believed primarily due to predator control practices.

The range of the red wolf (C. niger), originally widespread in the south-central United States, now appears restricted to Texas, Louisiana, Arkansas, Oklahoma and possibly Missouri.

Continued reduction in wolf abundance in the future appears inevitable unless a concerted effort is exerted to arrest the further extirpation of this interesting carnivore.

STATUS OF THE WOLF IN NORTH AMERICA

By

Richard John Aulerich

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INTRODUCTION

The wolf is a member of the carnivorous family Canidae, the phylogeny of which extends back in geologic time to the early Tertiary period (Matthew, 1930). Fossil remains from the Pleistocene era disclosed that prehistoric wolves were closely allied to present-day species (Young and Goldman, 1944). Except for the red wolf (Canis niger), the wolves of North America are closely related to those of Eurasia and are considered by Goldman (1937) and Anderson (1943) to be subspecies of Canis lupus.

At present, two species of true wolves are reported (Young and Goldman, 1944) inhabiting North America. These are the timber or gray wolf (Canis lupus) and the red wolf (C. niger). Species differentiation is based primarily on body size, and cranial and dental structure (Young and Goldman, 1944). Twenty-three subspecies of C. lupus and three of C. niger, as shown in Table I, are recognized by Young and Goldman (1944) and are reported to be the result of ". . . geographic variation in size, weight, color, and minor details of structure in response to environmental and genetic influences."

The coyote (C. latrans), frequently referred to as the brush wolf or prairie wolf, is not a true wolf (Young and Goldman, 1944) and is not considered in this study.

Prior to the settling of North America, the timber wolf had

Table I. Subspecies of North American wolves¹

Timber Wolf

- (Canis lupus tundrarum) Miller - Alaska Tundra Wolf
- (Canis lupus pambasileus) Eliot - Interior Alaskan Wolf
- (Canis lupus alces) Goldman - Kenai Peninsula Wolf
- (Canis lupus occidentalis) Richardson - Mackenzie Valley Wolf
- (Canis lupus hudsonicus) Goldman - Hudson Bay Wolf
- (Canis lupus arctos) Pocock - Melville Island Wolf
- (Canis lupus orion) Pocock - Greenland Wolf
- (Canis lupus labradorius) Goldman - Labrador Wolf
- (Canis lupus beothucus) Allen and Barbour - Newfoundland Wolf
- (Canis lupus lycaon) Schreber - Eastern Wolf
- (Canis lupus nubilus) Say - Great Plains Wolf; Buffalo Wolf
- (Canis lupus irremotus) Goldman - Northern Rocky Mountain Wolf
- (Canis lupus columbianus) Goldman - British Columbia Wolf
- (Canis lupus ligoni) Goldman - Alexander Archipelago Wolf
- (Canis lupus fuscus) Richardson - Cascade Mountains Wolf
- (Canis lupus crassodon) Hall - Vancouver Island Wolf
- (Canis lupus youngi) Goldman - Southern Rocky Mountain Wolf
- (Canis lupus mogollonensis) Goldman - Mogollon Mountain Wolf
- (Canis lupus monstrabilis) Goldman - Texas Gray Wolf
- (Canis lupus bailey) Nelson and Goldman - Mexican Wolf
- (Canis lupus bernardi) Anderson - Banks Island Tundra Wolf
- (Canis lupus mackenzii) Anderson - Mackenzie Tundra Wolf
- (Canis lupus manningi) Anderson - Baffin Island Tundra Wolf

Red Wolf

- (Canis niger niger) Bartram - Florida Red Wolf
- (Canis niger gregoryi) Goldman - Mississippi Valley Red Wolf
- (Canis niger rufus) Audubon and Bachman - Texas Red Wolf

¹ Taken from Young and Goldman, 1944. The Wolves of North America. Amer. Wildl. Inst. 636 pp.

an exceedingly large geographic distribution. Its immense range included all of Canada, the coastal areas of northern Greenland, and most of the United States and Mexico (Young, 1946), as shown in Figure 1.

The red wolf is a distinct American species which originally inhabited the south-central region of the United States (Young and Goldman, 1944), where in remote areas it still persists in limited numbers.

Although once fairly common throughout most of its range, the wolf's inability to survive in the presence of civilization appears to have been the determining factor in its departure or extermination from many areas within the continent (Young and Goldman, 1944). This large carnivore is so entirely dependent on big game for its existence that it is unable to survive for any length of time in areas devoid of large prey species (Anon., 1962). Thus, as man cleared the forests, cultivated the land and slowly pushed westward, the natural wild prey of the wolf was replaced by domestic herds and flocks to which this predator turned for its sustenance and so became a feared and hated enemy of the early settlers (Young, 1946; Young and Goldman, 1944). Young (1946), in his book The Wolf in North American History, cites numerous accounts of early struggles between the pioneers and this cunning predator.

Throughout history it has been noted many times that

whenever the interests of man have conflicted with those of wild species, the animals have either been exterminated or in some way have become compatible with man's activities. As a consequence, this interesting and magnificent carnivore is found today in only a few small isolated segments of its former domain. Shooting, trapping, the use of poisons and almost every conceivable means possible have been used in an attempt to annihilate it (Young and Goldman, 1944; Young, 1946; Leopold, 1959). Young (1946) writes, "These attempts to eliminate it from the country were only repetitions of similar treatment accorded the wolf previously in Europe for many centuries."

METHODS

The purpose of this study was to determine the present status of the wolves in North America. In relating the status of this wild carnivore, an attempt has been made to outline, as accurately as possible, present numbers, distribution and population trends in each remaining segment of its range. An endeavor to clarify the legal status of the wolf and to obtain information on the apparent effects of present legislation, land use and wildlife management practices on its abundance was undertaken. An effort was also made to determine public opinion held toward the wolf and to compare the present status of this mammal with reports of earlier investigations.

Through a mail questionnaire survey,¹ the states, provinces and local areas in which the wolf still occurs were determined and range maps constructed. Biologists and naturalists, within the areas of wolf habitancy, were sent a more detailed inquiry² which provided much of the material necessary to meet the objectives of this study. A review of the literature furnished additional data appearing in the report.

¹Questionnaire I, page 68

²Questionnaire II, page 70

DISCUSSION

Habitat of the Wolf

The wolf originally roamed over North America, except for the arid desert regions of California and Nevada (Seton, 1929; Young and Goldman, 1944). Its domain, as reported by Seton (1929), encompassed over 7,000,000 square miles of land which, according to Young and Goldman (1944), probably comprised the greatest range of any land animal in North America. Although this predator appeared compatible with almost every major type of land habitat on the continent, the heart of its range in North America consisted of the Great Plains of the West and the adjacent forests stretching eastward to the Atlantic Ocean (Seton, 1929).

In general, water barriers proved insignificant in restricting its movements because the wolf, like most other large carnivores, is an excellent swimmer (Young and Goldman, 1944). A varied diet composed of many species, from small rodents to large herbivores, also undoubtedly aided the wolf in expanding its geographic distribution. Few natural enemies are known to the wolf and during primitive days its numbers apparently were kept in check primarily by its food supply, moderate reproductive potential and disease.

Former Status of the Wolf in North America

During primitive times, when the wolf had its greatest distribution on this continent, Seton (1929) estimated a wolf population in North America of 2,000,000 animals, which constituted a density of one wolf per three and a half square miles of range.

By the turn of the last century, there had been a marked reduction in the number of wolves, and as Seton's range map (Figure 1) shows, the wolf probably was totally extinct in eastern and north-central United States and in southeastern Canada by 1900. Although this area of extirpation was barely one-fourth of the total wolf range, Seton (1929) stated it contained at least half of the surviving wolf population and that by this time wolves were not more than one-quarter of their primitive number. Between 1901 and 1905, he reported 498,000 pelts were taken in the United States and Canada, and he believed that there were probably over 1,000,000 wolves killed because both juveniles and adults were taken at every opportunity. If an average of 200,000 wolves were dispatched each year, it must have had a marked effect in reducing the wolf population, since this naturalist estimated that by 1908 there were only 200,000 wolves in the United States and Canada, including Alaska.

In spite of this rapid decline, wolves remained troublesome on the livestock ranges of western United States. Young (1946) reported

that over 1,800 wolves were taken from 39 forest reserves in the West by stockmen, rangers and special hunters in 1907.

The Federal Government soon became concerned with the predator problem and placed the control of wolves and other animals injurious to agriculture and animal husbandry under the direction of the Bureau of Biological Survey. Between July 1, 1915 and June 30, 1941, Young (1946) reports, this organization and its cooperators accounted for 24,132 wolves, most of which were taken from the states west of the one hundredth meridian.

Although Seton (1929) stated that wolves were rapidly disappearing from the cattle states west of the one hundredth meridian and estimated their numbers to have been reduced from 500,000 in 1893 to less than 3,000 in 1918, Baynes (1923) indicated they were still prevalent in many of the western states during the early 1920's. Table 2 gives an account by states of the wolves taken by the United States Fish and Wildlife Service and its cooperators from 1918 to 1922.

Concentrated controls during the following years continually reduced the wolf population and by 1940, according to Young and Goldman (1944), most of the wolves remaining in the United States were in national forests. An estimation of the wolf population in the national forests of this country in 1939 is given in Table 3.

According to the Commission of National Parks of Canada (Seton, 1929), the number of wolves killed in that country during 1919-20,

Table II. Wolves taken by the United States Fish and Wildlife Service and its cooperators during the fiscal years 1918 to 1922¹

State	1918	1919	1920	1921	1922	Total
Arizona	31	39	64	37	51	222
Arkansas	--	--	17	57	82	156
California	--	--	--	1	--	1
Colorado	11	9	22	17	26	85
Idaho	17	16	20	25	19	97
Michigan	--	--	--	--	61	61
Montana	69	48	48	52	42	259
Nevada	--	--	--	--	--	--
New Mexico	92	74	67	56	28	317
North Dakota	--	--	--	1	--	1
Oklahoma	--	34	39	18	29	120
Oregon	2	2	1	5	1	11
South Dakota	1	15	3	10	--	29
Texas	516	242	198	282	240	1,479
Utah	55	17	18	28	1	119
Washington	--	--	--	--	--	--
Wyoming	<u>55</u>	<u>88</u>	<u>26</u>	<u>104</u>	<u>116</u>	<u>389</u>
Total	849	584	523	694	696	3,346

¹ Taken from Young and Goldman, 1944. The Wolves of North America. Amer. Wildl. Inst. 636 pp.

Table III. Estimated wolf numbers on the national forests of the United States in 1939¹

State	National forest	No. of wolves	State	National forest	No. of wolves
Alaska	Chugach	85	Montana	Bitterroot	1
	Tongass	1, 025		Cabinet	1
Arizona	Coronado	10		Deerlodge	12
	Crook	2		Flathead	2
	Kiabab	1		Gallatin	3
	Prescott	10		Kootenai	1
	Tonto	10		Lewis & Clark	7
Arkansas	Ouachita	20	Nevada	Lolo	1
	Ozark	37		Humboldt	10
California	Angeles	5	New Mexico	Apache	2
	Eldorado	12		Carson	6
	Lassen	16		Cibola	5
	Rogue River	5		Coronado	10
	Stanislaus	6	Oklahoma	Gila	5
	Tahoe	4		Lincoln	2
Idaho	Bitterroot	1		Ouchita	50
	Boise	5	Oregon	Deschutes	5
	Challis	10		Mt. Hood	20
	Coeur D'Alene	2		Rogue River	5
	Nezperce	10		Siskiyou	10
	Salmon	5		Umpqua	60
	Targhee	10	South Carolina	Williamette	30
	Weiser	5		Sumter	2
Louisiana	Kisatchie	95	Texas	Angelina	10
				Davy Crockett	200
Michigan	Huron	10		Sabine	2
	Ottawa	100		Sam Houston	25
	Upper Mich.	30	Utah	Cache	10
Minnesota	Chippewa	60		Manti	5
	Superior	550	Washington	Columbia	10
Missouri	Clark	350		Chequamegon	130
	Gardner	100	Wisconsin	Nicolet	100

¹ Taken from Young and Goldman, 1944. The Wolves of North America. Amer. Wildl. Inst. 636 pp.

1920-21, and 1921-22, were 10,608, 5,316, and 9,451 respectively. However, these were wolves for which bounties were claimed, and since poisoned animals are seldom recovered, Seton estimated the kill to be at least double the bounty figures or approximately 20,000 animals annually. Even though this predator was faced with relentless persecution, Seton (1929) wrote, "So far as can be judged, the Wolves in the North are holding their own. Therefore, not more than 20 percent are being killed, which means a Wolf population in Canada of 100,000."

By the middle of this century, the wolf was considered a very rare animal in the United States and its numbers and range had also been considerably diminished in Mexico and Canada. During 1931, in 11 of the most western states, approximately 57,000 large predators were killed. Included were 1,000 mountain lion, 700 bear, 14,000 lynx and bobcat, 41,000 coyote but only 6 wolves (Gilligan, 1954).

Today, the wolf can be found only in the most remote parts of the continent and even here, in the marginal areas, it appears to be losing in its constant conflict with civilization. Throughout most of the settled areas now inhabited by man, only the memory of this interesting carnivore remains.

Areas of Wolf Extirpation

Because of the immense geographic distribution that was once enjoyed by the wolf, it was thought that a division of its range into

states and provinces would assist in describing its past and present distribution. The following is an account of the areas in North America where the timber wolf has been extirpated.

United States

Arizona

Biologists' reports (5, 89, 124, 133, 140, 148, 168)¹ indicate that the timber wolf is extinct or nearly so in Arizona. The infrequent observations and records that have been reported during the last few years are thought to be accounts or sightings of animals that had wandered into the state from Mexico. According to the questionnaires (124, 148), in December, 1955 and again during the winter of 1956, wolves were active on the Papago Indian Reservation, located near the Mexican border. Part of this pack, consisting of six animals, was poisoned with cyanide pellets and the remaining wolves apparently left the area. A wolf was reported (questionnaire, 124) killed near Elgin in July, 1957 when it pulled a "coyote getter" and another was taken the same way near Redington in August, 1957. During 1959, wolf activity was observed at Tres Bellotas in Santa Cruz County and also in the Hauchuca and Chiricaha mountains (questionnaire report, 140). Hoffmeister and Goodpaster (1954) noted that wolves were not uncommon on

¹List of Cooperators, page 71.

the western side of the Huachuca Mountains. They reported that at least two wolves were taken from the Huachucas in the fiscal year 1944-1945, one in 1945-1946, two in 1949-1950 and two in 1950-1951. A large wolf, reported (questionnaire, 133) trapped near Nogales in June, 1959, was given to the Arizona-Sonora Desert Museum at Tucson.

Hoffmeister and Goodpaster (1954) pointed out that limited control practices in Mexico south of the Huachuca, Santa Cruz and Patagonia mountains allowed for the immigration of wolves into the United States. However, according to the questionnaires (89,148), present day trapping and poisoning campaigns carried on by federal and professional trappers along the southern border of Arizona appear to be quite effective in keeping the wolf population near zero.

Biologists agreed that the wolf's decline in Arizona was due mainly to the importance of the cattle industry and federal control of large predators. The wolf is granted no protection in the state, except within the existing sanctuaries which, as the questionnaires (89, 148) indicated, are either too small to be effective or out of wolf territory.

California

All questionnaire (16, 50, 104, 121) returns from California reported that wolves were never common and for years have been considered extinct. Young and Goldman (1944) cite several early accounts of the wolf's existence in the northeast corner of the state and the last

authentic record was from Lassen County, in northeastern California, where one was trapped in 1924 (Ingles, 1954; Grinnell et al., 1937). Two were dispatched in 1922; one in Modoc County, the other in San Bernardino County (Young and Goldman, 1944).

Colorado

Except for Denver County, timber wolves once inhabited the entire state (Warren, 1910) and, as indicated by the questionnaires (42, 151, 197), survived as residents until around 1930 when two of the last remnants were taken; one from Arapaho National Forest and the other from Gunnison National Forest. Warren (1942) relates that a wolf was killed on Cochetopa National Forest in 1932 and one inquiry (128) indicated that another was taken by government hunter J. Mercedes Ortiz in 1945 from Archuleta County.

It was also noted in several questionnaire reports (36, 42, 77) that during 1955 four captive wolves, which were brought into the state from Alaska, escaped in the vicinity of Lake George but were readily dispatched.

Connecticut

Wolves apparently survived in Connecticut until around 1837 when the last known survivor was killed near Bridgeport (Goodwin, 1936).

Idaho

Althouth a few sight and kill records have found their way into the literature during recent years, the gray wolf is now considered extinct in Idaho. Davis (1939) stated, "Wolves are now practically extinct in Idaho . . . They probably never were as abundant as the smaller coyotes, and their disappearance from much of their former range can be attributed for the most part directly to the extermination policy of the Bureau of Biological Survey." According to early day records as recorded by Edson (1956), two hired predator control men killed several hundred wolves in the Caribou National Forest, the Medicine Lodge area and along the headwaters of the Lemki River between 1916 and 1920.

The United States Fish and Wildlife Service, predator control division, reports the last known instance of a wolf killed in Idaho was near Aberdeen in 1930 (Edson, 1956). Another reliable report (questionnaire, 40) indicated that one of the last remnants was taken in 1928 in Caribou County by a predatory animal hunter. In view of these reports, it seems that within only ten years the wolf in Idaho went from a common animal to a very rare or possibly extinct species.

Indiana

Lyons (1936) recorded the wolf as being rare in Indiana since about the middle of the last century, but stated that reliable wolf

records were occasionally reported until around 1910.

Kansas

Questionnaire inquiries (63, 115, 159) generally agreed that both the red and gray wolf were extirpated from Kansas shortly after the beginning of the present century. Cockrum (1952), citing Allen, related that by 1871 wolves in central and western Kansas were rapidly decreasing in abundance due primarily to the use of strychnine. Cockrum (1952) mentioned that in 1905 gray wolves still persisted in a few diverse areas of the state and reported that one of the last red wolves was killed in Cherokee County in 1909.

Maine

Although Goodwin (1936) reported that a wolf was killed by J. W. White at Norway, Maine during the winter of 1908-09 and indicated that a few other specimens were also taken in Oxford County about this time, Allen's (1942) account of one of the last survivors taken in 1863 near Moosehead Lake more closely agrees with the questionnaire reports (38, 65, 145). Possibly the wolves referred to by Goodwin were stragglers which migrated down from Canada. Norton (1930) wrote that the last wolf in the vicinity of Portland was killed prior to 1850.

In reply to the questionnaires (38, 145), an account was

cited of a wolf killed in November, 1953 in Washington County but it was indicated that this animal had escaped from a traveling carnival.

Nebraska

Seton (1929) estimated a population of 10,000 wolves inhabited Nebraska in 1895. However, the questionnaire (157, 178, 192) survey indicated that wolves disappeared from the state shortly after the turn of the century. One of the last known specimens was reported (178) taken from Banner County in 1911.

Nevada

As in practically all of the western states, the wolf has also been extirpated from Nevada. One of the last survivors was taken in the northwestern part of the state in 1923 (Hall, 1946).

Wolves apparently have always been rare in Nevada. Young and Goldman (1944) mentioned that only six had been taken through predatory control operations in over two decades. Four of these six animals were taken from Elko County, one from White Pine County and the other from Washoe County. These records are all from the northern part of Nevada, which is in close agreement with Hall (1946), who described the range of this species as being confined to about the northeastern quarter of the state.

New Hampshire

No wolves have been reported in New Hampshire since the repeal of the bounty law in 1895 (Silver, 1957). Two were bountied during that year and biologists' reports (156, 163, 165) indicated that a few may have persisted for a little longer. Jackson (1922) and Goodwin (1936) reported that the last known wolf in New Hampshire was taken in the White Mountains in 1887.

New Jersey

Wolves were reported by Trefethen (1959) occurring along the Delaware River in New Jersey until 1842. The last known record was in 1887, when a pack of dogs chased a lone wolf into the state from New York (Allen, 1942).

New Mexico

Timber wolves were abundant and troublesome during the days when New Mexico was being settled (Young and Goldman, 1944) but, according to a questionnaire report (32), as livestock and poultry raising developed and became major industries, more emphasis was placed on control and the wolf was gradually crowded into smaller areas until now the only wolves in the state are those which occasionally stray in from Mexico. Fifteen years ago from 10 to 20 wolves were reported each year but predator control operations in Mexico

have practically eliminated this (questionnaire report, 32). Halloran (1946) related the last wolf taken from the Jornada Range Reserve in the San Andres Mountains was caught in 1917.

New York

In New York, the wolf made its last stand in the northern part of the state (Young and Goldman, 1944) where it persisted until around the close of the nineteenth century (Young, 1946). According to Allen (1942), the last six wolves bountied were taken from the northern part of the state and were thought to have been immigrants from the Ontario side. Goodwin (1936) shares this opinion and states that the last remnant of the Adirondack packs was killed at Brandreth Lake in Hamilton County in 1893. He also mentioned three later wolf records, one in 1902, another in 1906 and the last in 1923, which were thought to have been from animals that strayed into the state from Canada. A more recent account was given by Bump (1941) who reported a wolf that was imported by local residents of southern Franklin County escaped around 1930.

Although native wolves survived in the mountains and wooded areas of northern New York until the 1890's, Young and Goldman (1944), citing DeKay, reported that by 1842 they had been nearly extirpated from some of the southern counties and Seton (1929) stated that the last wolf from Niagara County was taken about 1840. Prior to

this time, wolves were apparently quite abundant. In the five years preceding 1820, over \$38,000 was spent in New York for wolf bounties (Hays, 1871).

North Dakota

In spite of the fact that only a few wolves remained in the state in 1925 (Bailey, 1926), they managed to exist as a resident population for many years. Only recently have they been considered extinct (questionnaire reports, 27, 83, 103). Adams (1961) classified the wolf as a visitor to North Dakota, even though occasional stragglers have recently been reported. The questionnaires (1, 31, 83, 84, 107) supported Adams' classification and indicated that most recent wolf reports come from along the Canadian border in the area of Turtle Mountains and Pembina Hills, where it is thought there may be a small influx of wolves from Canada and northern Minnesota.

Ohio

Young and Goldman (1944) cite several accounts of the presence of wolves in Ohio during the early 1800's but Allen (1942) reports they were rare by 1838 and nearly extinct a decade later. The last authentic wolf report comes from Carroll County where the last member of a pack of six wolves was dispatched in 1943 (Stewart and Negus, 1961). The history of these wolves was unknown.

Oregon

No wolves have been killed in Oregon since 1946 when the last known survivor, taken from the Cascade Range just east of Eugene, was bountied (questionnaire reports, 96, 105). One questionnaire (96) report indicated that the last stronghold of the wolf in Oregon was near the headwaters of Cow Creek, south of Roseburg, where 11 were caught by one trapper in 1933. Concerning the Cascade Mountains, Jewett (1923) reported the only known occurrence of the Cascade timber wolf (C. gigas) east of these mountains and estimated that the wolf population of Oregon at that time did not exceed 100 animals.

Pennsylvania

During pioneer days, wolves were so plentiful and troublesome in Pennsylvania that a bounty was initiated in 1682, and in 1705 professional "wolf killers" were employed in an effort to subdue them (Walker, 1960). One such veteran wolf hunter, Bill Long, is reported by Walker (1960) to have taken approximately 2,000 wolves from what is now Clearfield County. A Jefferson County hunter, George Smith, is credited with killing 500 wolves (Seton, 1929).

Wolves remained prevalent in the unsettled parts of Pennsylvania until about the middle of the last century when the population showed evidence of decline (Allen, 1942). Goodwin (1936) wrote that wolves were ". . . not uncommon in the eighties," and Young and

Goldman (1944) reported that they survived in the state until around 1890, when the last wolf bounty was paid by Potter County. According to Walker (1960), the last known wolf was taken by Seth Irdell Nelson from Clearfield County in 1892.

South Dakota

Wolves were reported in the questionnaire (18, 93, 107) as being very rare in South Dakota during the last thirty years. As in North Dakota, there are no known resident populations and it is thought that the occasional "straggler" wanders into the state from the North.

Southeastern United States

According to Seton (1929), wolves were still found in Florida, Georgia, Alabama, Mississippi, Tennessee, North Carolina and West Virginia during the early 1900's.

They survived in the Okefenokee swamp of southeastern Georgia until the late 1920's (Young and Goldman, 1944), and their last stronghold in Alabama was in the northwest corner of the state where they held out even longer (Allen, 1942). Allen (1942) expressed the opinion that they were present in North Carolina until about the beginning of the present century. Young and Goldman (1944), citing Brooks, related that the last wolf in West Virginia was killed in 1900,

in Randolph County, while the last survivor from Tennessee was taken in 1895.

Utah

With the exception of the Great Salt Lake Desert, the wolf formerly ranged throughout the state (Durrant, 1952) and its prevalence during the beginning of this century was noted by Barnes (1927) who reported that during 1915 and 1916 bounties were paid on 72 and 79 wolves respectively. By 1923, however, the success of the paid trapper became evident as Barnes (1927) indicated that only two wolf pelts were presented for bounty that year. He further stated that six wolves were bountied in 1924, four in 1925 and one in 1926. By 1925, Barnes (1927) estimated that only 23 wolves remained on the national forests of Utah.

The questionnaire survey (53, 94, 194) indicated no authentic records within the state during the last 20 years. The most recent accounts were of a wolf killed near Monticello in 1937, and another taken during 1941 on the south slopes of the Uintah Mountains in Duchesne County.

Washington

The timber wolf was once fairly abundant in many parts of Washington. According to Dalquest (1948), they inhabited all of the

state except the Columbian Plateau.

Dalquest (1948) did not report any authentic records of wolves in the state after 1920, but implied that they might have existed in small numbers in the more remote areas. However, according to an inquiry (186), only three have been taken since the federal predatory animal control program was initiated in 1915. It is possible that wolves might occasionally wander into Washington from Canada, since a questionnaire reply (25) indicated that one was trapped during 1925 in Ferry County in the northeastern part of the state.

Wyoming

It appears that by 1920, the wolf was making its last stand in Wyoming. Although more recent accounts have been reported, a questionnaire (68) indicated that the last resident wolves were killed around 1923 near Lusk, Wyoming and the upper Gros Ventre River area. Nevertheless, they were undoubtedly prevalent during the earlier days, for as Seton (1929) pointed out, in the 11 years prior to 1908 almost 21,000 wolves were bountied from an estimated population of 12,000 to 15,000 animals.

There have been no authentic wolf reports from Yellowstone National Park in recent years, and the park superintendent's annual reports indicate that the last wolf was killed in the park about 1923. This carnivore is also considered extinct in Grand Teton National Park

as biologists report (81) there have been no wolf records since the park was established in 1929.

Canada

New Brunswick

Morris (1948), citing Gesner, stated that the wolf was originally reported in New Brunswick in 1818 and, according to Morris (1948), was ". . . common during the early part of the 19th century." Adams reported, as related by Young and Goldman (1944), that by 1873 this carnivore remained only in the northern portion of the province and, although a straggler was reported taken in 1921 (Seton, 1929), a recent account (195) indicated that the timber wolf was extirpated from the province around 1870.

Newfoundland

The timber wolf was prevalent in Newfoundland during the early 1800's, especially in the interior of the island where it remained plentiful until after 1875 (Young and Goldman, 1944). It was considered rare by 1906 and almost extinct by 1913 (Allen and Barbour, 1937). The last known resident wolf, as indicated by a questionnaire report (51), was shot in 1911 at Gaff Topsails. The more recent wolf reports during the 1930's and 1940's were thought to have been mainland animals

which reached the island on drift ice.

Nova Scotia

Several scattered accounts indicate that the wolf has long been extinct within the province. Young and Goldman (1944), citing J. B. Gilpin, reported wolves were frequently sighted at the extremities of Nova Scotia between 1800 and 1870, but that they were uncommon prior to 1800 and had practically disappeared by 1870. Sheldon (1936) also recorded the wolf as being scarce during the latter part of the last century but commented that they probably survived until the caribou disappeared around 1900. Seton (1929), likewise, listed the wolf as being extinct in Nova Scotia.

Areas of Timber Wolf Survival

Although the timber wolf formerly ranged throughout most of this continent, today it can be found only in a few remaining wilderness areas within the United States (Figure 2). The wolf is still present throughout much of Canada and northern Mexico, but its numbers have been considerably reduced during the last few decades. The following is a brief account of the status of the timber wolf in the areas it currently inhabits in North America.

United States

Alaska

Wolves inhabit the entire state of Alaska, except for a few areas which are thought by biologists to be uninhabited due to physical barriers or lack of suitable prey.

Although wolves were relatively numerous on the Kenai Peninsula during the first decade of this century, questionnaire replies (28, 167, 169) pointed out they are now extinct or very rare in the area, as only two have been taken since 1948. Clark (1958) recorded that the wolf is uncommon in islands near Kodiak and Kelly (1954) stated the wolf was absent from the Aleutian Islands beyond Unimak Pass.

Throughout southeastern Alaska, the wolf is considered common, except on the Admiralty, Baranof, and Chichagof islands where they do not occur (questionnaire reports, 62, 98, 102). Kelly (1954) is of the opinion that the water barrier between the mainland and the A.B.C. islands (above) has been too great to allow wolf movements.

Wolves of the Arctic region are extensive travelers and, as Kelly (1954) relates, their distribution closely follows the movements of migrating caribou herds.

An accurate estimation of wolf numbers is difficult to obtain, but several biologists (28, 98, 102, 167) reported the present population to be the highest since 1948-49. A particular increase was

noted in the Tanana River drainage.

A report (149) from Mount McKinley National Park gives the impression that the present wolf population within the park is rather low, consisting of only four family groups totaling approximately 16 to 20 animals. Murie (1944) is of the opinion that in the past wolf density within the park conformed closely with that of the wolf elsewhere in interior Alaska. His records indicate that a sizeable wolf population inhabited the interior from 1880 until about 1908 when wolf numbers decreased. After 1925, wolves were again prevalent and only minor fluctuations occurred until 1941 (Murie, 1944) when the population was again reduced, possibly due to control practices outside the park boundary (Murie, 1962).

In addition to the various national parks and monuments of Alaska, the wolf is also protected in the Nelchina Caribou Range. This area, lying north of Anchorage, consists of 16,000 square miles of land and has an estimated population of 50 wolves (questionnaire report, 167).

A bounty on wolves has been paid in Alaska since 1917 (Tanana Valley Sportsmen's Assoc., 1959) and at present, according to recent inquiries (24, 28, 49, 62, 98, 102, 167, 169), is \$50 per wolf. A wolf hide, according to a questionnaire (169), will bring from \$25 to \$50 and this coupled with the bounty, makes a wolf worth from \$75 to \$100 to the bounty trapper. From questionnaire replies

(24, 28, 49, 62, 98, 102, 169), it is apparent that farmers, ranchers and many sportsmen denounce the wolf, favor a bounty and prefer strict predator control when wolves are abundant. Other groups, however, realize the trophy value of this animal and many wolves are reported taken for that reason.

The trapping and shooting campaigns conducted by bounty hunters have seldom been effective in eliminating wolves. This is mainly because professional hunters and trappers operate mostly where trapping is profitable and their warfare ceases before the last breeders are taken (Tanana Valley Sportsmen's Assoc., 1959). The use of poison by the Fish and Wildlife Service has proven more destructive, especially when the effort is concentrated in local areas. Wolf populations on several small islands in southeastern Alaska were reported (questionnaire, 62) to have been at least temporarily removed by the use of poison. Many Alaska Game and Fish Department and United States Fish and Wildlife Service personnel, however, favor wolf control only where it had been deemed necessary after careful investigation by trained biologists. To the resource biologist, the wolf has great value in controlling big game numbers in areas where hunting by humans does not harvest the ungulate crop. It also is a valuable trophy resource in itself.

Biologists agree that a change in the wolf's status does not appear likely within the near future. It is believed that through

education and sound biological practices the wolf will continue to be a prominent symbol of the Alaskan wilderness.

Michigan

Wolves once roamed the entire state (Dice, 1927) and were reported to be abundant in southern Michigan during the first part of the 19th century by Smits (1959) and Stebler (1944). The latter stated that during that time wolves may even have been more prevalent than coyotes.

The first bounty on wolves in Michigan was in 1838 in Lapeer County (Stebler, 1951; Schofield, 1959). This step toward wolf control spread quickly and by 1839 (Stebler, 1951), ten additional counties were offering bounties. From 1838 to the end of 1950, \$16,511 were spent for wolf bounties (Arnold, 1952). During recent years, wolf numbers have decreased considerably and between 1951 and 1959, when the law authorizing the wolf bounty was repealed, \$2,855 in bounties were paid on 172 wolves (Schofield, 1959).

The rapid spread of civilization brought about the extirpation of the wolf from the Lower Peninsula in 1909 (Arnold, 1952). Even in the more wild Upper Peninsula, wolves are on the brink of extinction (Burroughs, 1954). The 20-30 animals still present (Smits, 1963) inhabit the most remote areas. These regions include the Porcupine Mountains, the Peshekee River area, and the Tahquamenon-Two-Hearted River drainage.

Isle Royale National Park provides sanctuary for a wolf pack of 22 or 23 animals which recently (1940) invaded the islands (Allen and Mech, 1963; Smits, 1963). It will probably continue to support this species so long as the island has a substantial moose population.

All present reports indicate that the wolf is slowly but surely losing its battle for survival in Michigan and it appears doubtful that it can be saved from extinction there, except possibly for those animals on Isle Royale.

Minnesota

With the exception of Alaska, northern Minnesota appears likely to be the last stronghold of the timber wolf in the contiguous United States (Olson, 1938; de Vos, 1964). According to the inquiries (8, 35, 112, 153), this region supports an estimated 400 to 600 wolves.

Although the wolf has been absent from central Minnesota for many years (Bailey, 1929), its range in the northern part of the state is still rather extensive, covering about 12,000 square miles. It is described by Stenlund (1955) as follows: "The southern boundary begins just above Two Harbors on Lake Superior in Lake County. It runs west to Highway No. 4, then north to the region of Aurora, thence north along the south shore of Lake Vermillion to the region

of Orr and Nett Lake. Here it jogs south to Effie, west and north to Waskish and Four Towns and finally north to the Canadian border through Skime and Salol in Roseau County." This region encompasses most of the Superior National Forest and (Vogt, 1948) this forest contains the largest concentration of wolves of any national forest in the United States.

A bounty of \$35 per adult and \$25 per pup is offered in Minnesota (questionnaire reports, 8, 112, 153, 173). However, some protection is afforded the wolf by virtue of the Air Space Reservation of 1953, which prevents hunting from the air over the wilderness area, and by trapping restrictions in the Superior National Forest (Stenlund, 1955).

Improvements in transportation, with a subsequent opening of even remote areas to hunting, and a decrease in the major prey species of the wolf as forests mature, are factors which, according to the questionnaires (8, 153, 173), may lead to a reduction in wolf numbers and habitat. If the wolf is recognized as an integral part of the wilderness wildlife community, however, and is managed in the best interest of the species, and if northern Minnesota remains wild, this region could remain a refuge for this denizen of the wild.

Montana

Craig (1961) wrote, "The era of the lobo is gone from

Montana . . . Except for an occasional drifter, they are now seen mostly in the memories of old-timers who enjoy spinning yarns of renegade lobos." Brittan (1953), however, noted the presence of wolves in Glacier National Park after they had apparently been absent for many years. Inquiries of several biologists (20, 67, 82, 137, 161, 188, 191, 196), also indicated that the wolf may still be represented in Montana by a few individuals in and around Glacier National Park.

Although now apparently on the verge of extirpation, wolves were once numerous in Montana. During 1906 and 1907, Craig (1961) reported they were so prevalent that large wolf drives were organized by stockmen in an attempt to halt depredations on their stock. But, according to Grand, as recorded by Craig (1961), the most effective method of controlling wolves in this area was the destruction of their dens. Undoubtedly, other control practices, such as steel traps, set guns and poison also took their share of wolves.

The decline in wolf numbers is evident from reports of the United States Fish and Wildlife Service, as noted by Craig (1961), which indicate that 88 wolves were taken in 1924, 29 in 1925, 28 during 1926, only two in 1927, and none in 1928. The last authenticated record known to Craig (1961) was of an 86-pound wolf killed by two ranchers on Tomato Creek near Nashua in 1956.

Wisconsin

Wisconsin is presently faced with the problem of preserving the last remnants of its wolf population. Although wolves were still plentiful in the northern part of the state after the turn of the century (questionnaire, 97), Allen (1942) and Scott (1939) reported that they were becoming scarce by 1939. In 1946, Barger (1946) estimated that less than 100 wolves remained in the state and in 1952, Thompson (1952) noted that resident wolves were confined to less than a dozen suitable areas of undeveloped, cutover forest land. Keener (1955) estimated that the wolf population had been reduced to 50 animals in 1955 and that their range consisted of less than 1,000 square miles of suitable habitat. According to questionnaire reports (97, 142), the wolf's present range is composed primarily of Bayfield, Ashland, Iron, Vilas, Oneida, Forest and Florence counties where less than 30 are thought to remain.

In an effort to check the extirpation of this species, the wolf bounty, which according to Thompson (1952) existed practically since statehood, was repealed in 1957 and the wolf placed on the protected list (questionnaire reports, 46, 97). A refuge was created for them in one area of the Nicolet National Forest (questionnaire, 97) but biologists still fear that as roads open new areas to hunters, trappers, loggers and tourists, the wolf will be eliminated in its wilderness abode. More "limited access" areas will have to be set aside or the

wolf will soon be among the extinct mammals of Wisconsin.

Canada

Alberta

The primary wolf range in Alberta includes some 150,000 square miles of land north and west of Edmonton (questionnaire inquiry, 190). Occasionally wolves are found south of the North Saskatchewan River in the eastern part of the province but control practices in this region are reported (questionnaire, 172) to be too intensive for wolves to thrive.

According to national park personnel, the wolf has been absent from the fauna of Elk Island National Park and Waterton Lakes National Park for many years. Banff National Park was reported to have maintained a substantial wolf population prior to the anti-rabies campaign of 1952-54. Between 1944 and 1946, Cowan (1947) estimated that the park contained from 12 to 18 wolves. The current wolf population has been estimated at about six animals (questionnaire report, 59).

Conditions in Jasper National Park appear similar to those in Banff. The wolf population has been reduced from an estimated 45 to 50 animals in 1942-43 (Cowan, 1947) to 25 to 30 animals (questionnaire, 59).

Soper (1942) reported that the wolf was still numerous in

Wood Buffalo National Park, even though its numbers had been considerably reduced since 1932. He further noted that wolves were generally permanent residents of the park and did not follow the migrations of the barren ground caribou. In the smaller sanctuaries, wolves move freely across park boundaries and control measures in adjacent areas are believed by biologists to be important factors presently limiting their numbers within these parks.

The wolf bounty, which had existed since 1899, was abandoned in 1955 in favor of the governmental control program which was initiated in 1951 (Pimlott, 1961) and, according to a questionnaire (190), accounted for an estimated 4,200 wolves during the rabies epidemic of 1952-54. Prior to the epidemic, bounties were paid on from 500 to 1,300 wolves per annum since 1939 (questionnaire report, 190).

It was the opinion of several biologists (130, 172, 190) that sportsmen feel that this predator is competing with them for the game surplus and, therefore, they are outspoken for wolf control in areas that are heavily hunted. Farmers and ranchers also favor wolf control, especially in the sub-marginal farming areas where these animals are reported (questionnaire, 172) to be a menace to livestock.

British Columbia

Although now absent or very rare in the southern portions of British Columbia, wolves once inhabited the entire province except

for Queen Charlotte Islands (questionnaire report, 54).

Swarth (1936) reported wolves, which were previously rare in the Atlin area of northwestern British Columbia, were on the increase. Recent inquiries (54, 187) indicated they are presently common throughout the entire northern portion of the province and packs of from 20 to 40 wolves are not unusual. Control measures in this region are not intensive and biologists report (questionnaires, 39, 187) that there appears to be no immediate danger of a severe reduction in wolf numbers.

In the central region of the province and on Vancouver Island and other large coastal islands, controls have been stabilized during the past few years allowing a moderate wolf population to exist. According to predator control personnel, population estimates in these areas are about 40 percent of those reported 10 years ago.

Control practices remain intensive over most of southern British Columbia due mainly to the wolf's depredations on domestic stock (questionnaire, 187). In this region, predator control records indicate that wolves have been reduced to about 10 percent of their previous numbers. In the extreme southern segment, they are reported to be quite rare and only occasional transients, usually along the isolated areas close to the coast, are noted (questionnaire report, 187).

Prior to 1955, when the wolf bounty was discontinued

(Pimlott, 1961), \$40 was paid on wolves in the central portion of the province and a \$25 bounty was offered throughout the remainder of British Columbia (questionnaire report, 187).

The increase in cattle ranching in the southern areas greatly increased the pressure for wolf and coyote control and in 1947 the Predatory Control Division of the Department of Recreation and Conservation was established in an effort to obtain more effective control of these predators (Pimlott, 1961). A large scale poisoning campaign was initiated in 1950 (questionnaire, 187) and control operations were expanded during the next few years. Pimlott (1961) reports that the 768 "1080" (sodium fluoroacetate) bait stations in operation in 1953 were increased to 2,101 in 1955. By 1960, however, the number had declined to 1,200. In the more remote areas of the province, the "1080" baits were scattered by airplane (Pimlott, 1961).

Labrador

Banfield and Tener (1958), citing the 1897 work of Low, related that, as caribou were extirpated from southern Labrador, wolves also became rare in that region but persisted in the northern barrens where caribou were more abundant. Strong (1930) also reported a scarcity of wolves in southern Labrador during 1928. However, Banfield (1958) stated that, "At present wolves appear to be more common in southern Labrador than in northern Ungava." These

reports indicate a reversal in wolf abundance during the last decade or so, and at present they are probably more abundant in southern Labrador than further north.

Manitoba

The timber wolf is found throughout all but the southwest corner of Manitoba. As indicated in the inquiries, its numbers range from very scarce, in the southern more heavily populated areas, to plentiful, in the wild, unsettled areas of the northern part of the province.

In the farming and ranching areas of Manitoba, there is an all-out desire for extermination of the wolf. Even though game biologists favor wolf control rather than extermination, public pressure demands that the wolves be removed (questionnaire report, 150).

For many years, a bounty was paid in Manitoba but it was discontinued in 1955 due to its ineffectiveness in reducing the wolf population (questionnaire report, 150). In its place, poisoning campaigns have been initiated and from 1956 through 1958 over 2,500 wolves were reported (questionnaire, 150) taken. In wolf denning areas in the extreme northwestern part of the province, native hunters are paid \$10 for each wolf (pup or adult) killed during April, May or June. This special type of control is in conjunction with the government poisoning program and is directed towards wolves of the north where they are

believed to be responsible for the low number of caribou (questionnaire reply, 150). According to an inquiry (150), present control practices have had a significant effect in decreasing the wolf population, which now approximates 1,500 animals. However, an accurate appraisal of wolf numbers is difficult because of the migrating wolves which follow the caribou herds into the Keewatin District of the Northwest Territories during the summer and then return with them to northern Manitoba as winter approaches.

Park personnel from Riding Mountain National Park estimate that the park presently supports a population of 15 wolves.

Northwest Territories

Two distinct groups of wolves occur in varying degrees of abundance throughout this vast wilderness of the North (questionnaire report, 116). One group of wolves, locally referred to as "timber wolves" because they reside in the timbered areas, are largely non-migratory. The other group, called "tundra wolves," are a nomadic population which breed on the tundra and are in close association with the migrating herds of caribou (questionnaire report, 116).

As indicated in the questionnaires, wolf trapping and shooting programs are not widely practiced but extensive poisoning programs during the last few years have succeeded in removing a large portion of the wolf population. One reporter (116) cited an account of

a predatory animal hunter who killed over 400 wolves during the winter of 1957-58 and indicated that approximately 1,200 wolves were taken in the District of Mackenzie in 1958; 90 percent of which were "tundra wolves" or intergrades. This reporter was of the opinion that there are probably not more than 1,000 breeding pairs of "tundra wolves" and only several hundred breeding pairs of "timber wolves" remaining in the District.

Reporting on the status of the wolf on south and central West Baffin Island, Manning (1943) related that wolves were generally present wherever caribou were numerous, except on the flat land where sparse cover and soft marsh were believed to account for their paucity. For West Baffin Island, he estimated a caribou population of 10,000 and a wolf population of 150 to 200 animals, which constituted a density of less than one wolf per 100 square miles of habitat.

It was reported (questionnaire, 116) that many sportsmen are becoming interested in wolf shooting as a sport and someday the wolf may, as a game species, justify its right to survival in the minds of these people.

Ontario

The timber wolf has been extinct for some time in the more densely populated southeastern portion of this province (Seton, 1929; de Vos, 1964). Its present range in Ontario, according to a

questionnaire inquiry (141), includes all the area north of a line from the southern tip of Georgian Bay west to Ottawa.

Wolves are reported (questionnaire, 141) as being relatively numerous in many areas of the province. DeVos (1950) mentioned that the wolf appeared to be increasing in abundance in northwestern Ontario and Cahn (1937) stated that they were common in Quetico Provincial Park. With reference to Algonquin National Park, Seton (1929) reported that 47 wolves were killed by park rangers in 1911, but later Allen (1942) implied that wolves no longer inhabited the park. Recent observations (East, 1959; Anon., 1962), however, indicated that the wolf has probably expanded its range and is again present in moderate numbers within the park and is even frequently sighted south of the park.

Farmers and sportsmen are usually outspoken for wolf control, while biologists and naturalists are generally more sympathetic towards the wolf (questionnaire inquiry, 141). Although government sponsored poisoning, shooting and trapping programs have not recently been in operation, wolf hunting and trapping are undertaken by local sportsmen and flying hunters are especially active in the western section of Ontario, particularly in the Kenora District (questionnaire report, 141).

Although the wolf bounty in Ontario was recently repealed (Chiappetta, 1964), it had been in effect since 1859 when \$6 was

paid for any wolf regardless of sex or age (Omand, 1950). According to the inquiries, the more recent bounty value of a wolf was \$30 but in certain instances exceeded \$100 due to additional township and county bounties. Pimlott (1961) pointed out that Ontario had spent over \$1,000,000 in bounty payments during this century. Between 1,100 and 1,200 wolves were bountied each year (Anon., 1961) but this appeared to have little value, if any, in reducing their numbers. Omand (1950) has shown that bounty records give account of a relatively stable wolf population in Ontario during recent years.

Quebec

Wolves have never been reported from the Gaspé Peninsula and have long been exterminated from the St. Lawrence Valley and southward but they occur in varying degrees of abundance almost everywhere north of the St. Lawrence Valley (questionnaire reports, 129, 131).

Throughout this province, as throughout most of Canada, the wolf is regarded as a savage killer and is given no protection except within provincial and national parks. Even within the parks, some poisoning is reported (questionnaire, 131) on a local basis when wolves are known to harass moose and deer in the winter yards. Wolf trapping and shooting programs are seldom practiced but, according to the inquiries (129, 131), the Ministry of Colonization offers a bounty of \$20

and approximately 600 wolves are bountied each year. But, as in so many other areas, biologists believe the payment of bounties has had little, if any, effect in reducing the abundance of this predator.

Saskatchewan

The wolf population in Saskatchewan is confined primarily to the wilderness areas of the northern half of the province (questionnaire reports, 57, 75, 91, 106, 136, 147). On the barren grounds of the Precambian Shield, wolves are reported (questionnaire, 147) to be fairly common and tend to travel with the migrating caribou herds.

Commenting on the status of the wolf in Prince Albert National Park, Banfield (1951) noted that they had not been continual residents of the park. He reported that they were very rare in the area during the 1920's but gradually increased in number until 1942-43. Since then, their numbers have fluctuated with the intensity of control practices and, according to a questionnaire (59), an estimated 20 to 25 wolves presently inhabit the park.

The regular wolf bounty of \$25 was discontinued in 1951 and at present the only wolf bounty in Saskatchewan is paid by the Department of Indian Affairs to treaty-protected Indians in the far North (questionnaire report, 75). After 40 years of bounty payment, biologists agreed that predators were as plentiful as ever and that the bounty system had no effect, whatsoever, in reducing wolf numbers.

An outbreak of hydatid disease during 1952 prompted a large-scale poisoning program in an effort to protect the large herbivores from this disease in which wolves and coyotes may serve as the intermediate host (questionnaire report, 57). Wolf controls are still practiced in the northern portions of the province and, as indicated in the questionnaires (136, 147), the kill from poisons is usually from 250 to 500 animals per year. The inquiries (75, 91, 106, 147) pointed out that wolf shooting and trapping are uncommon in Saskatchewan, as both strychnine and "1080" poisoning programs have greatly decreased wolf numbers and have almost eliminated the coyote from some of the southern areas of the province.

It appears from the questionnaires (75, 91, 106, 147) that changes in land use practices have had only a minor effect on wolf abundance. Apparently some wolves were driven into the more remote areas as settlements moved northward but the greatest wolf concentrations were beyond these inhabited areas. The presence of wolves in cultivated areas is promptly reported by farmers and ranchers with a request that they be destroyed (questionnaire reports, 75, 91, 147). Sportsmen also feel that wolves should be extirpated because they prey on big game (questionnaire reports, 57, 75, 91, 147). Most biologists, however, believe that further efforts to reduce the wolf population are not worth the time and money and may even be unwise from an ecological standpoint.

Yukon Territory

This sparsely populated, unsettled, wilderness area of northwestern Canada might appear to be a haven for large carnivores. Wolf numbers at present, however, are reported (questionnaires, 18, 60) as being considerably less than twenty years ago. The decrease in the wolf population during recent years is thought to be due to natural causes as well as to the use of poison ("1080") baits distributed by airplane (questionnaire reports, 18, 60). According to an inquiry (60), at one time wolves killed hundreds of caribou during the winters but presently only moderate predation on big game is reported.

In general, residents of the territory look on the wolf as a predator which savagely destroys game, and thus there are strong representations to re-establish bounty payments which were discontinued in the early 1950's (questionnaire report, 60).

Mexico

Prior to the settling of Mexico by the Spanish, the timber wolf had its greatest distribution and abundance in this country (Leopold, 1959). It originally ranged ". . . throughout the plateau region of northcentral Mexico, south at least to the Federal District, in the Sierra Madre Oriental and the Sierra Madre Occidental and on the northernmost part of the Gulf Coastal Plain" (Baker and Villa, 1959). The red wolf, according to Baker and Villa (1959), never inhabited the coastal plain in northeastern Mexico.

As the land became settled and domestic stock began to replace native wildlife, the wolf modified its natural habits and began to prey on the increasing abundance of livestock. Thus, it became a dreaded enemy of the settler. Leopold (1959) reported that almost every possible means of extermination was employed by the Spanish settlers in their attempts to destroy the wolves. These early methods of wolf control included such devices as the pit trap described by Young and Goldman (1944). Firearms, steel traps, poisons and later cyanide guns were also used in an attempt to subdue this cunning predator (Baker and Villa, 1959). Yet, as Leopold (1959) pointed out, in spite of these early efforts designed to eradicate the wolves, they ". . . persisted throughout nearly all of their original range until fifty to seventy-five years ago, when technological improvements in firearms, traps and poisons finally gave a conclusive advantage to the settler. Now the range of the wolf is shrinking rapidly." By 1929, wolf numbers apparently had been drastically reduced, as Seton (1929) stated that, "In Mexico, it is believed that the Gray-wolf is nearly, if not quite, extinct." Nelson and Goldman (1929) reported that the wolves formerly inhabiting the southern end of the tableland of Mexico had been extinct for many years but that wolves were ". . . still numerous in the Sierra Madre and as far south at least as Durango." According to Baker and Greer (1962), wolves were abundant in the foothills of the Sierra Madre Occidental in northcentral Durango in 1946 but were

nearly extinct in that area by 1960. A small population of wolves, however, was reported (Baker and Greer, 1962) to presently inhabit the most remote areas of the Sierra Madre Occidental.

The present wolf range in Mexico is reported by Leopold (1959) to consist primarily of two areas--the Sierra Madre Occidental and the arid mountains of western Coahuila and eastern Chihuahua. Dalquist (1953) had previously reported wolves inhabiting an area in western San Luis Potosi. With reference to the abundance of wolves in the Coahuila-Chihuahua region, Baker (1956) expressed the opinion that, even though wolves once ranged throughout much of Mexico, they were never abundant.

Recent accounts (Baker and Villa, 1959 and Leopold, 1959) indicate that the wolf is a rare animal in Mexico and unless the present policy toward wolf control is modified and a definite place set aside for this large carnivore, its shrinking population will soon fade and only the folklore of the past will remain.

Greenland

The distribution of the wolf in Greenland appears to correspond closely with the range of musk ox (Young and Goldman, 1944; Allen, 1942). They are found primarily along the narrow strip of land between the inland ice and the sea on the northern coast and on the northern part of the east coast as far south as the Scoresby Sound

region (Young and Goldman, 1944; Allen, 1942). Allen (1942) reports that in former times wolves probably ranged further south, preying on caribou which are now extinct.

Areas of Red Wolf Survival

The red wolf is a distinctive North American species found only in south-central United States (Young and Goldman, 1944). This species is intermediate in size between the larger timber wolf and the smaller coyote (Halloran, 1957). The exact boundary of its former range appears questionable. Young and Goldman (1944) describe its early distribution as follows:

Formerly Mississippi River Valley and affluents, north at least to Warsaw, Ill., and Wabash, Ind., south through southern Missouri, eastern Tennessee to the Gulf Coast in Louisiana and Mississippi; west from the coastal region to the Pecos River Valley in Texas, and east through Alabama to the Atlantic Coast in Georgia and Florida; exact limits undetermined.

The present survey indicated that the range of this species is now restricted to remote areas in five states--Texas, Oklahoma, Louisiana, Arkansas and Missouri. The following is an account of the red wolf in each of the states in which it is still represented.

Arkansas

The inquiries indicated a diffuse population of red wolves existed throughout the western half of the state but only occasional

stragglers occurred in the Mississippi Delta and southeastern areas of Arkansas. Carroll, Newton and Washington counties in the north, Logan, Yell, Conway and Pulaski counties in west Arkansas and Miller and Ashley counties in the south have all recently reported red wolf kills (questionnaire report, 3).

Regarding the red wolf in northwestern Arkansas, Black (1936) wrote, "Although rare, this animal still ranges throughout southern Washington and Madison counties, the northern part of Franklin and Crawford counties, and through the more inaccessible portions of the Ozarks." In 1940, Dellinger and Black (1940) reported that wolves were present on game refuges throughout the state and were rather common in the Ozarks.

In Arkansas, and throughout much of the present range of the red wolf, the coyote appears to be replacing the wolf in many areas and seems to adapt itself to existing conditions more readily than does this smaller species of true wolf (McCarley, 1963; questionnaire reports, 3, 79). Since kill records for wolves and coyotes are not separated, it is virtually impossible to estimate the number of red wolves remaining in the state. However, as one reporter (160) indicated, a recent trend in the agricultural practices of the state, with emphasis on livestock raising rather than crop farming, coupled with urbanization of the population, may be a factor favoring the preservation of the wolf.

Louisiana

Prior to 1940, northeastern Louisiana was considered an area of red wolf abundance (questionnaire report, 117). At that time, wolves were also reported inhabiting the parishes lying east of the Mississippi River and north of Lake Pontchartrain. Lowery (1936) gives an account of a wolf taken six miles north of Baton Rouge in 1929. However, a questionnaire (117) indicated that no authentic wolf records were known for the parishes east of the Mississippi River during the last 15 years, but that they are still occasionally reported from the northeastern and east-central portion of the state. McCarley (1962) reported that this species is also extant in some of the alluvial swamps in the eastern and southern part of the state.

Recent accounts of red wolves include a specimen taken from Terrebonne Parish in 1956 and another from Madison Parish in 1957 (questionnaire reports, 117, 135). The two specimens mentioned above are now in the Museum of Zoology, Louisiana State University. Biologists were of the opinion that the wolf taken from Terrebonne Parish probably wandered down from northern Louisiana, as no wolves had been recorded in south-central Louisiana in over 50 years.

According to an inquiry (79), trapping and shooting were of major importance in reducing the wolf population and, although control operations and bounty payments have not been in effect during recent years, there is still much public resentment displayed toward the wolf.

Missouri

Although both gray and red wolves once roamed throughout the state, Schwartz and Schwartz (1954) wrote, "The only wolf occurring in Missouri at the present time is the Red Wolf (Canis niger), but because authentic records of its occurrence are so few, it is considered only a rare wild mammal resident of the state."

Commenting on Missouri, Young and Goldman (1944) reported that 59 wolves were taken in connection with predator control work during the fiscal year ending June 30, 1940. The majority of these were captured from the counties south of the Missouri River. Their abatement appears to have been almost instantaneous. Leopold and Hall (1945) noted that the last two known red wolves taken in Missouri were collected from the southern part of the state in 1941 and 1942. One of the wolves, weighing 35 pounds, was killed in Ozark County. The other was from Oregon County and weighed 46 pounds.

A bounty (currently \$15) has been offered on wolves and coyotes in Missouri for over 130 years, but only coyotes have recently been presented for payment (Nagel et al., 1955). Considering the paucity of evidence pertaining to the presence of the wolf since 1942 and the possibility of crossbreeding with the coyote, biologists believe it is quite possible that the red wolf, as a pure species, may no longer be present in Missouri (questionnaire report, 154). If any do survive, their range is apparently limited to southern Missouri.

Oklahoma

The range of the red wolf in Oklahoma is generally considered to be the eastern and southern portion of the state (Halloran, 1958). Within this region, the following counties have recently reported wolf kills: Grady, Okfuskee, Wagoner, Cherokee, Adair, Muskogee, Sequoyah, Pontotoc, Coal, Pittsburg, LeFlore, Johnston, Atoka, Pushmataha, McCurtain and Choctaw (Halloran, 1958). It is interesting to note, as Halloran (1958) pointed out, that all of the red wolf records of the state have been from the wooded region or roughly the eastern half of Oklahoma. None has been reported from the plains of western Oklahoma where both trees and rainfall are sparse. The specimen reported taken from the Wichita Mountains in Comanche County by Young and Goldman (1944) appears to have been at the westward extent of its range. McCarley (1962) noted that the marked reduction of the red wolf in Oklahoma and eastern Texas coincided with the expansion of lumbering and agricultural practices in these areas.

The timber wolf, which once inhabited the Oklahoma Panhandle and semi-arid western half of the state, has been extinct for many years (questionnaire report, 66). Halloran and Glass (1959) reported that one of the last timber wolves taken from the Wichita Mountains was shot in 1933.

A \$2.50 bounty on coyotes and wolves was paid until 1957 (Halloran, 1957) but it is believed by biologists to have been quite

insignificant in reducing the wolf population. As indicated in an inquiry (66), trapping is still practiced as a means of control where the wolf is conflicting with man's activities but poison, which is used on coyotes in the western part of the state, is rarely employed in wolf control.

Large tracts of land devoted to lumbering, recreation and game reserves, where all hunting is prohibited, offer asylum for the wolf, which is constantly threatened by sportsmen and those engaged in animal husbandry (questionnaire report, 66).

Texas

The red wolf is probably the only species of true wolf presently inhabiting Texas. Taylor and Davis (1947) stated that the gray wolf formerly occurred in the southern and western portions of the state and according to Young and Goldman (1944), they were quite common in the earlier days.

During the early 1900's the red wolf was considered a prominent member of the fauna of the central and northern part of east Texas, but today they are believed to be extinct or very rare in that region of the state (McCarley, 1959). Peterson (1946) reported that they once occurred in the counties surrounding Brazos County, but that they have been rare in this area for several years. The questionnaire reports (7, 55, 111) indicated that they are presently found in Jasper, Trinity, Harris, Brazoria, Fort Bend, Wharton, Matagorda, Lavaca, Colorado

and Austin counties in southeastern Texas. Within the last couple of years, red wolves have also been reported (questionnaire, 37) on the Aransas National Wildlife Refuge near Austwell and on the Welder Wildlife Foundation Refuge north of Corpus Christi.

This species apparently persists along the Gulf coastal prairie of southern Texas because of the large ranches and less intensive agricultural practices of the area. The questionnaires (7, 37, 111) indicated that wolves are often a menace to livestock and poultry operations but control practices have not been systematic throughout its range and wolves from the outside soon re-invade the trouble areas where the guilty animals have been removed by traps or cyanide guns. Commissioners courts in a number of counties pay bounties up to \$25 on wolves, but this practice is not state-wide (questionnaire report, 48).

Human competition and the expansion of agriculture, which consequently reduces wolf habitat, along with predator control programs are believed by biologists to be responsible for the continued reduction of the wolf population in Texas (questionnaire reports, 37, 48, 55).

A taxonomic study of the red wolf by McCarley (1962) indicated that all recent specimens of C. niger examined from Arkansas, Oklahoma and Texas were indistinguishable from C. latrans frustror on the basis of skull size. These observations suggested the possibility that in these areas the red wolf may now be a population of natural hybrids between C. latrans and C. niger rather than a true taxonomic entity.

Proposed Program for the Preservation of the Wolf

A program for the preservation of the diminishing wolf population in North America must be a flexible plan to cope with the various problems that exist in each remaining area of wolf habitancy. Wolves are not compatible with livestock and, in areas where animal husbandry is practiced, the presence of wolves creates a serious problem. In many unsettled areas, hunters are outspoken for wolf control because they feel that this carnivore is competing with them for game; yet, there are still areas where protected game has become so plentiful that it is destroying its own food supply (Pimlott, 1961). Most biologists are aware that a carefully managed wolf population can be a natural check in controlling big game numbers, especially in wilderness areas that are inaccessible to hunters. Thus, specific controls and protective measures must be carefully formulated by competent personnel for each segment of the wolf's present range.

Since the wolf cannot cope with civilization, it seems that only through the establishment of large preserves and wilderness areas can we hope to sustain this animal in its native habitat. Small parks or preserves are of limited value, as wolves are extensive travelers and often circuit many miles in search of prey.

Inherent prejudices, beginning with fairy tales like Little Red Riding Hood and enhanced by folklore and the bounty system, have

blackened the average American's concept of the wolf. The average person sees the wolf as a savage and ruthless killer of livestock and game animals. And, even though the wolf is an ancestor of man's best friend--the dog--they cannot, in their own minds, justify the existence of this carnivore. Perhaps, through long range educational programs, the present public hate and contempt for the wolf can be changed into an appreciation for this animal and a realization of its esthetic value as a wildlife species. The howl of the wolf in its native habitat is a sensation which will long be remembered by those fortunate enough to hear it.

In the North, the wolf has not yet been severely persecuted by the systematic campaigns of extermination which has extirpated it from the more settled areas of this continent. But, even in the Arctic, wolves are killed freely and it will probably only be a matter of time before these northern wolves are threatened with extinction.

The wolf has been a prominent figure in the history of this country and has gallantly fought for its existence. It would be most regrettable if we cannot find a place for the last remnants of this magnificent carnivore in our way of life.

SUMMARY AND CONCLUSIONS

The past and present status of the wolves of North America was studied through a review of the literature and a mail questionnaire survey of biologists and naturalists. Range maps were constructed and information on wolf abundance, distribution and population trends was presented by states and provinces. An endeavor was made to clarify the legal status of the wolf and to ascertain the effects of legislation, public opinion, land use and wildlife management practices on its abundance.

The survey indicated that within the United States, the timber wolf (Canis lupus) has been extirpated from all but five states. Alaska, Minnesota and possibly Michigan appear to be the only states that presently support timber wolf populations that are not in immediate danger of extirpation. Although timber wolves are still present throughout much of Canada and Mexico, there has been a marked decrease in their abundance during the last decade.

The range of the red wolf (C. niger), which was once widespread throughout south-central United States, now appears to be restricted to Texas, Louisiana, Arkansas, Oklahoma and possibly Missouri. Recent evidence suggests that Canis niger as a species may be even more endangered than the survey indicated due to hybridization with other species of Canis.

Land use practices and public animosity are primary factors which presently threaten the preservation of the remaining wolves on this continent. Unless a concerted effort is exerted to arrest the further needless extirpation of this carnivore, it may soon be extinct from those areas it presently inhabits.

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APPENDIX

Questionnaire I

Department of Fisheries and Wildlife
Michigan State University
East Lansing, Michigan

April 30, 1959

Dear

We are conducting a survey to determine the status of the timber wolf (Canis lupus) in the United States and Canada. It is believed that you are familiar with this animal and qualified to provide us with some of the needed information. It is hoped through this questionnaire to outline, as accurately as possible, the present distribution and population status of the timber wolf. It is also hoped to determine present public opinion toward the wolf in the areas in which it still survives and to compare the present status of this mammal with the reports of earlier workers. The red wolf (Canis niger) of the south-central United States is being considered simultaneously.

It is the feeling of many people here in the East, that the West is the true home of these magnificent animals. While biologists know this to be less than true, recent documentation is lacking. It seems increasingly apparent too, that wolves are becoming scarce in parts of Canada and Alaska. A more detailed mail survey for places in which this vanishing American still survives will follow to meet the other objectives of the study.

If possible could you please fill out and return the enclosed questionnaire by May 20 using the enclosed envelope. This is to permit time for the follow-up surveys. If you have information to add which is not in the questions, please do not hesitate to include it on the reverse side.

Your help in making this study a success would be greatly appreciated.

Sincerely,

Richard Aulerich
Graduate Fellow

Enc.

Department of Fisheries and Wildlife
Michigan State University
East Lansing, Michigan
April 1959

TIMBER WOLF SURVEY

Reporter's Name _____

State, Province or Area _____

Please consider only the timber (Canis lupus) and red (Canis niger) wolves. This survey is not concerned with the coyote (Canis latrans). Please check whether your comments apply to the timber ____ or red ____ wolf.

Are you familiar with the wolf in your area? _____

Please record below any recent locality reports of the wolf in your state or area. Literature or newspaper references would be helpful.

Please state your estimate of the present number of wolves within your state or area and give some indication of the type of information on which you base your estimate.

If the wolf is present in your state, province or area please sketch an outline map or mark on a road map the area still occupied by the animal.

If wolves are known to be extinct in your area please indicate whether this has happened recently or is of long standing. Recent literature references would be helpful, if they are at hand.

Perhaps you know of other persons who could possibly provide additional information on the status of the wolf. Please give their names and addresses below.

Please use the reverse side of this sheet for further comments and feel free to enclose other information at will.

Questionnaire II

Department of Fisheries and Wildlife
Michigan State University
East Lansing, Michigan

June 15, 1959

Dear

This is a follow up of our first Wolf Survey which gave a good picture of the present restricted distribution of both the timber (Canis lupus) and red (Canis niger) wolves in the United States and Canada. Many thanks to the biologists and naturalists who kindly filled out the questionnaire.

The results of the survey indicate that the red wolf of south-central United States occurs now only in several small isolated segments of Texas, Oklahoma, and Louisiana. In the United States excluding Alaska, resident populations of the timber wolf remain in only a few areas in the extreme northern portion of its once vast domain. Timber wolves in western and northern Canada have recently undergone a marked decrease due to extensive control measures, but wolves in Alaska seem to be still relatively numerous.

This second inquiry is being sent to previous reporters, and persons suggested by them, in the areas where the wolf still survives. This is to make the study more complete by determining, as best as possible, the apparent factors presently limiting wolf abundance and attitudes of local residents toward the preservation of remnant populations.

I hope that you will find it possible to help again by filling out the questionnaire (pages 2 and 3). Please return it by July 10 using the enclosed envelope. If you have additional information of interest, please send it along too.

Your cooperation is greatly appreciated.

Sincerely,

Richard Aulerich
Graduate Fellow

Enc.

Department of Fisheries and Wildlife
Michigan State University
East Lansing, Michigan
June 1959

WOLF SURVEY

Reporter's Name

State, Province or Area

Please check whether your comments apply to the timber (Canis lupus)
_____ or red (Canis niger) _____ wolf.

Please briefly describe the general types of habitat for the wolves of
your region.

Is there local protection for the wolf in your state, or are there any
areas there where this animal is given sanctuary?

Is the bounty system now in effect in your area as a control measure for
wolves? Please give the amount paid per wolf and the number of wolves
presented for bounty during recent years (or indicate if this information
is obtainable in the annual reports of the state game department).

Was a wolf bounty ever offered in your area? Can you estimate its
importance in reducing the wolf population?

What has been the importance in your area of:

- (1) Wolf trapping campaigns.
- (2) Wolf poisoning campaigns.
- (3) Wolf shooting programs.

In connection with these, have any particular groups of people
(Indians, Flying sportsmen, etc.) been especially effective in
depleting the wolves of your region?

WOLF SURVEY

What has been the effect of changes in land use practices during recent years on wolf populations?

Can you recall any authentic records of wolves attacking man in your area? Please give any available details or references to the event.

Please state briefly the opinions and attitudes held in your area toward the wolf by:

- (1) Farmers and ranchers.
- (2) Sportsmen.
- (3) State Game Department.
- (4) U.S. Fish and Wildlife Service personnel.
- (5) Others.

Please list in the order of importance for your area:

- (1) The major factors which led to the decline of the wolf.
- (2) The major factors currently preventing an increase in the wolf population.
- (3) The major factors permitting wolf survival (and increase?) in your area.

Do you feel that there is any hope in your area of public support for saving the wolf as a wild species?

What program could you suggest for furthering the preservation of the wolf?

Please feel free to use the reverse side of this sheet for any further comments.



Fig. 1 Distributional status of the wolf in North America in 1900
 (Taken from Seton, E. T. 1929. Lives of game animals. vol. 1.
 Doubleday, Doran and Co., Garden City, New York.)

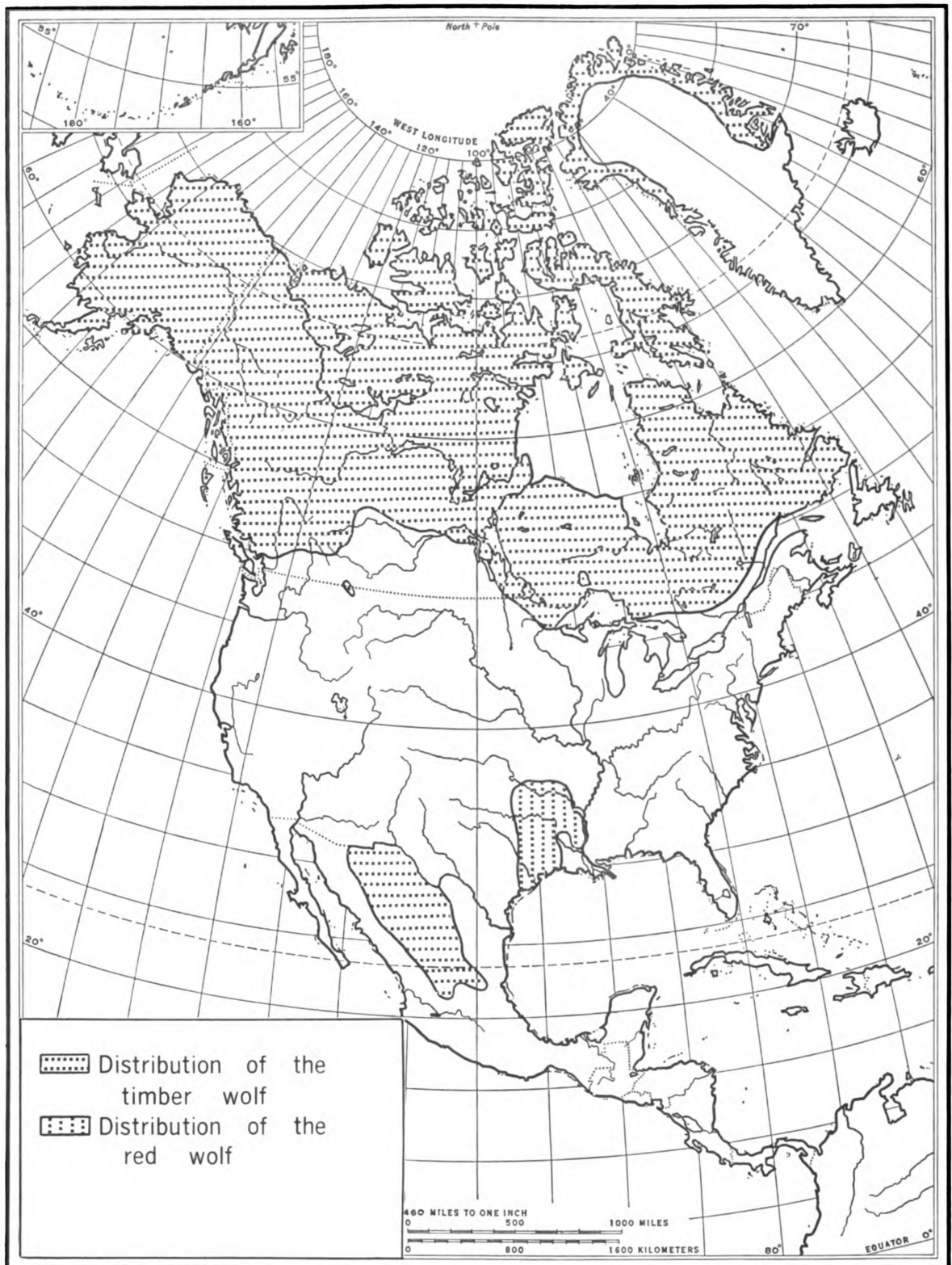


Fig. 2 Distributional status of the wolf in North America

LIST OF COOPERATORS

Names	Area
1. Adams, Arthur W.	North Dakota
2. Aldous, M. C.	Nevada
3. Alexander, Harold E.	Arkansas
4. Andrews, Ralph	Montana
5. Arrington, Orville N.	Arizona
6. Baker, H. R.	Alberta
7. Baker, Rollin H.	Mexico, Texas
8. Balser, Donald	Minnesota
9. Banfield, A.W.F.	Ontario
10. Banko, Winston E.	Montana
11. Bardalow, Fred S., Jr.	North Carolina
12. Bertlett, Charles O.	New Brunswick
13. Basile, Joseph V.	Idaho
14. Baskett, T. S.	Missouri
15. Baumgartner, F. M.	Oklahoma
16. Berg, Paul F.	California
17. Bergerud, Arthur T.	Newfoundland, Labrador
18. Bever, Wendel	British Columbia, South Dakota, Yukon
19. Black, Leo	Idaho
20. Bloys, Warren D.	Montana
21. Borell, Adrey E.	New Mexico
22. Bradle, Bernard J.	Wisconsin
23. Brohn, Allen	Missouri
24. Brooks, James W.	Alaska
25. Brown, Elworth R.	Washington
26. Bryant, Joseph E.	North West Territories
27. Buck, Ray L.	North Dakota
28. Burkholder, Robert	Alaska
29. Burt, William H.	Michigan
30. Cagle, Fred R.	Louisiana
31. Carufel, Louis H.	North Dakota
32. Cates, E. C.	New Mexico
33. Chase, Greenleaf	New York
34. Chase, Henry B., Jr.	Louisiana
35. Clem, Everett E.	Minnesota
36. Coleman, A. D.	Colorado
37. Cottam, Clarence	Texas
38. Coulter, M. W.	Maine
39. Cowan, Ian McTaggart	British Columbia
40. Crawford, C. E.	Idaho

41. Cross, Donald L.	Alaska
42. Cummings, Maynard	Colorado
43. Dahlberg, B. L.	Wisconsin
44. Dalke, Paul D.	Idaho
45. Dart, F. Sheldon	Idaho
46. Davis, John R.	Wisconsin
47. Dawson, D. C.	Alberta
48. Dawson, E. T.	Texas
49. Dean, Fred	Alaska
50. DeWitt, J. W.	California
51. Dodds, Donald G.	Newfoundland
52. Duncan, Gerald E.	Oklahoma
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