§ 180.335 [Removed]

c. Section 180.335 is removed.

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Finding on a Petition to Delist the Red Wolf (Canis rufus)

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of finding on petition.

SUMMARY: The U.S. Fish and Wildlife Service (Service) announces a 90-day finding for a petition to amend the Lists of Endangered and Threatened Wildlife and Plants. A finding has been made for the red wolf (*Canis rufus*) that substantial information has not been presented to indicate that delisting the species is warranted.

DATES: The finding announced in this notice was made on December 19, 1991. Comments and information may be submitted until further notice.

ADDRESSES: Information, comments, or questions regarding this petition may be submitted to the Red Wolf Coordinator, U.S. Fish and Wildlife Service, 330 Ridgefield Court, Asheville, North Carolina 28806. The petition, finding, supporting data, and comments are available for public inspection, by appointment, during normal business hours at the above address.

FOR FURTHER INFORMATION CONTACT: V. Gary Henry (704/665-1195) at the above address.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(A) of the Endangered Species Act of 1973, as amended in 1982 (Act) (16 U.S.C. 1531 *et seq.*), requires that the Service make a finding on whether a petition to list, delist, or reclassify a species presents substantial scientific or commercial information to demonstrate that the petitioned action may be warranted. To the maximum extent practicable, this finding is to be made within 90 days of receipt of the petition, and the finding is to be published promptly in the Federal Register. If the petition is found to present the required information, the Service is also required to promptly commence a review of the status of the involved species.

The Service has received and made a finding on a petition to delist the red wolf (*Canis rufus*). The petition, dated August 30, 1991, was submitted by the American Sheep Industry Association and was received by the Service on September 4, 1991.

The petition presents the contention that the red wolf is a wolf/coyote hybrid. The petition references two literature citations to support the discussion of wolf/coyote hybridization.

The petition makes the following three requests:

1. Remove the red wolf from the U.S. Endangered Species List pursuant to Fish and Wildlife regulations 50 CFR 424.11 and section 4 of the Endangered Species Act.

2. Suspend all release programs for the red wolf into the wilds of Alabama, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee until a decision is made on delisting the red wolf.

3. Suspend all Endangered Species Act funding to the red wolf program until a decision is made on delisting the red wolf.

The Service has reviewed the petition, the literature cited in the petition, other available literature and data, and consulted with wolf experts and molecular genetic analysis researchers. After evaluating all the available information, the Service finds that the petition does not present substantial information indicating that the requested actions may be warranted. The following points summarize the reasons for this finding:

1. Neither the submitted data nor other available data provide substantial support for the contention that the red wolf is a wolf/coyote hybrid.

The petition included an attached literature reference (Wayne and Jenks 1991), and the petition text included information from an additional publication that was not attached. The Service has reviewed the references,

along with other data, to determine their content, significance, and relevance to the petitioned action. The Service views the data presented in the petition as a selective presentation of the information contained in the cited references. The petition stated that Nowak (1979) raised serious questions as to whether the red wolf was a species, a subspecies, or a hybrid and concluded that:

> In nearly all measurements and other features in which *C. rufus* differs from *C. lupus* the former approaches *C. latrans*. Indeed, available specimens of the red wolf almost bridge the morphological gap between the proximal extremes of the other two species. Hybrid origin for *C. rufus* thus seems to be one possibility. * * *

This was not a conclusion of Nowak but is found in the Systematic Description of the red wolf under "Remarks." The remainder of the quoted paragraph states:

> * * * but there are other solutions to the problem. The most reasonable explanation is that *C. rufus* represents a primitive line of wolves that has undergone less change than *C. lupus*, and has thus retained more characters found in the ancestral stock from which both wolves and coyotes arose.

Indeed, the fossil evidence reported by Nowak indicates the red wolf is a separate species. Red wolf fossils up to 750,000 years old pre-date gray wolf fossils in North America and also pre-date coyote presence in the Southeastern United States. Fossils and historical museum specimens of North American *Canis* can be sorted into three distinct groups corresponding to the three species (gray wolf, red wolf, coyote) with no gradations between the groups that would be expected if the red wolf were a hybrid form.

Nowak (Service, personal communication, 1991) elaborates as follows:

> * * * the earliest large series of museum specimens from southeastern North America, taken about 1890–1930, do not show the overall blending of gray wolf, red wolf, and coyote that would be expected if the red wolf had originated a hybrid. Complete blending is restricted to central Texas and even there is limited to red wolf and coyote; the gray wolf is present in the same area but is easily distinguishable and not part of the hybridization process (see pages 41–43 of my paper). Elsewhere, the red wolf and coyote are sympatric or in close proximity, with hybrid individuals having appeared at but a few localities.
>
> It has been said that since the red wolf is in most respects morphologically intermediate to the gray wolf and coyote, it must have resulted from hybridization between the two. This point is meaningless. In the family Canidae, as in many groups of animals, there is a morphological progression of species, there being numerous cases in which one species or population may seem to fall between two others. Rather than hybridization, such a situation probably indicates evolutionary stages. In this regard, I think the red wolf represents a stage that developed after the coyote but before the gray wolf; it thus would be expected to be intermediate to the other two. There are other small wolves in southern Eurasia, and they also are in some respects morphometrically intermediate to North American gray wolves and coyotes, but of course there are no coyotes in that region.

Parker (1989) summarized red wolf taxonomy beginning with the first description of the red wolf in Florida by Bartram (1791), based on observations made in 1774. By contrast, the coyote, whose distinctiveness is unquestioned, was not named until 1823, based on observations made in 1819 (Young and Jackson 1951). The first publication of a valid scientific name was by Audubon and Bachman (1851); they described two varieties of wolves in the Southeast that were structurally different from other wolves and described the coyote as a full species uniquely different from wolves. Bangs (1898) stated that the Florida wolf should be elevated to full species level; Miller (1912) named it *Canis floridanus*. Bailey (1905), in the meantime, had elevated the red Texan wolf described by Audubon and Bachman to a full species with the name *Canis rufus*. Goldman (1937, 1944) consigned all wolves of the Southeast to one species—*C. rufus*—and recognized three subspecies—*C. r. rufus* for the small Texas subspecies, *C. r. floridanus* for the eastern subspecies, and *C. r. gregoryi* for the lower Mississippi valley subspecies. Most authors, including Atkins and Dillon (1971), Kurten and Anderson (1980), Elder and Hayden (1977), Ferrell *et al.* (1980), Nowak (1970, 1972, 1979), Paradiso (1968), and Paradiso and Nowak (1971, 1972), accepted species status for the red wolf.

A minority view that the red wolf was a subspecies of the gray wolf was presented by Lawrence and Bossert (1967) based on results from a multiple character analysis of North American *Canis*. The sample included 20 gray wolves, 20 coyotes, 20 domestic dogs (*C. familiaris*) and a small number of red wolves collected before 1920. Paradiso (1968) and Nowak (1979) suggested that the sample size was too small and did not truly represent the great geographic and individual variation of the canids. By contrast, a large sampling of canid skulls by Paradiso and Nowak (1971) and Nowak (1979) concluded that the red wolf is a distinct species.

Until this year there was only one published suggestion of hybrid origin (Mech 1970), and this provided no supporting data. Wayne and Jenks (1991) provide the only data suggesting a hybrid origin, while O'Brien and Mayr (1991) and Gittleman and Pimm (1991) accept the hybrid origin hypothesis of Wayne and Jenks but present no data regarding the issue.

In contrast to Wayne and Jenks' data, several studies and unpublished data contain substantial data as evidence in support of the red wolf as a distinct species. Nowak's (1979) monograph, entitled "North American Quaternary Canis," has already been referenced. Mechanisms that would have produced hybrids throughout the red wolf's historical range are not supported by any published accounts reinterpreting either the fossil evidence or the historical distributions of either the coyote or gray wolf. Ferrell *et al.* (1980) found a unique electrophoretically determined allele (not present in other *Canis*) with a distribution congruent with the geographical distribution of the red wolf, thus suggesting the survival of a gene originating in the red wolf. D.C. Morizot (University of Texas System Cancer Center, personal communication, 1981), one of the coauthors of Ferrell *et al.*, concludes that the red wolf is a separate form which should be recognized as a small wolf that evolved in North America, thus supporting Nowak's (1979) work. Another study, covering the brain of canids, confirmed the distinctiveness of the red wolf in its cerebeller features and concluded that the red wolf is more primitive in several aspects than the other *Canis* species considered (Atkins and Dillon 1971).

The red wolf populations currently existing are descendants of animals carefully selected based on the best morphological and taxonomic information available at that time. Subsequently, preliminary nuclear DNA findings (Ferrell *et al.* 1980) were considered in the selection of breeding pairs. From the fall of 1973 to July 1980, over 400 wild canids from the last remaining range of the species in southeastern Texas and southwestern Louisiana were examined through the recovery program. Of that number, only 43 were admitted to the breeding/certification program as probable red wolves. Final proof of the genetic integrity of the animals was determined through the captive-breeding process and resulted in only 14 animals becoming the founding stock of the red wolves existing today (Service 1990). Nowak (personal communication, 1991) recently carried out a canonical discriminant analysis of measurements of relevant skulls, including coyotes, gray wolves, pre-1940 red wolves, and founders of the existing red wolf

population and their descendants utilized in the recovery program. Results show the three species—coyote, red wolf, and gray wolf—to be distant from one another. The founders of the existing red wolf population and their descendants are statistically near the original red wolf; i.e., they are breeding true, with no detectable hybridization. Visual observations of phenotype also confirm this conclusion.

Behaviorally and ecologically the red wolf differs from Southeastern coyotes. McCarley (1977) found consistent differences between the vocalization of red wolves and coyotes. Riley and McBride (1972) and Shaw (1975) noted behavioral and ecological differences between red wolves and coyotes after studying free-ranging populations in Texas and Louisiana and concluded that *Canis rufus* is a valid taxon.

Preliminary results from the Alligator River National Wildlife Refuge reintroduction shed additional light on red wolf behavior and ecology (Service, unpublished data). Reintroduced red wolves are very social, with most of the animals belonging to packs which occupy territories. It is not unusual for yearling and 2-year-old red wolves to associate with their parents, assist with pup rearing, and restrict movements to their natal home range. Reintroduced red wolves are relatively intolerant of strange conspecifics; intraspecific aggression is an important source of mortality that led to the death of seven wolves. Thus, in terms of sociality, red wolves are similar to gray wolves (Mech 1970). In contrast, coyotes are often more asocial, with animals belonging to breeding pairs or small family groups. Pups often disperse before their second summer. Home ranges of the groups sometimes evince overlap, and intraspecific aggression is not believed to be an important source of mortality (Gier 1975, Andrews and Boggess 1978, Bekoff and Wells 1982, Danner and Smith 1980, Althoff and Gipson 1981, Roy and Dorrance 1985, Windberg *et al.* 1985, Harrison 1986, Gese *et al.* 1989, Person and Hirth 1991).

The ecological role of the red wolf is largely defined by its food habits. Analysis of 1,300 scats indicates that white-tailed deer (*Odocoileus virginianus*) and raccoons (*Procyon lotor*) are the primary year-round food items for reintroduced red wolves (Service, unpublished data). Although some of the deer are probably eaten as carrion, wolf predation of apparently healthy adult deer has been documented. Most raccoons are probably taken as live prey.

In contrast, deer and raccoons are of tertiary or lesser importance to coyotes in the Southern States; use of deer tends to be seasonal (greatest during fawning period and hunting season), and adult deer are often eaten as carrion (Korschgen 1957, Fooks 1961, Wilson 1967, Gipson 1974, Meinzer *et al.* 1975, Michaelson and Goertz 1977, Smith and Kennedy 1983, Wooding *et al.* 1984, Lee 1986, Leopold and Krausman 1986, Blanton and Hill 1989, Windberg and Mitchell 1991).

By comparison, gray wolves are essentially large ungulate predators, including very large species (such as elk, moose, and bison), although they will concentrate on smaller ungulates, where available, and will take other medium-sized mammals (such as beaver and Arctic hare) (Mech 1970). Red wolves do not have these very large ungulates available within their current range and may not be capable of predation on such large animals. Therefore, based on food habits, red wolves are most similar to gray wolves in their ecological role but do differ somewhat in the significance of medium-sized mammal prey, such as raccoons.

2. The petition misinterprets recent mitochondrial DNA (mtDNA) data by considering mtDNA to be equivalent to nuclear DNA.

The petition contains a single reference (Wayne and Jenks 1991) that bears directly on hybridization in the red wolf. That reference reported no identifiably unique red wolf mtDNA in present or historical specimens of the red wolf. Their results show only coyote mtDNA in existing red wolves and coyote and gray wolf mtDNA in historical specimens. Based on these results, one hypothesis offered is that the red wolf is a hybrid form resulting from coyote/gray wolf interbreedings. The authors also present the following alternative situations that could account for their results: (a) The red wolf could have been a distinct species with unique mtDNA genotypes that were missed in their survey or had become extinct through genetic drift or (b) the red wolf could have been a Southeastern subspecies of the gray wolf that was morphologically, but not genetically, distinct from other gray wolves.

Wayne (University of California at Los Angeles, *in litt.*, 1991), has provided the following additional statements regarding the petition:

This summation of our results is misleading and incorrect. We show only that red wolves at some time in their past have bred with coyotes and gray wolves in the wild, such interspecific hybridization is common among closely related vertebrate species and hundreds of 'hybrid zones' have been defined (Barton & Hewitt, 1985, 1989). Our results do not show that all sampled red wolves were a cross between coyotes and gray wolves as implied by the letter. In the text we provide three possible explanations of our data * * * (see previous page). Our data, however, cannot resolve among the three hypotheses.

Our conclusion in the Nature paper is that the red wolf has hybridized with coyotes and gray wolves. We cannot estimate the frequency or number of interbreeding events from our data and our conclusion does not bear directly on the species status of the red wolf. The interbreeding between red wolves and other canids likely reflected the absence of potential same-species mates due to predator control programs employed by the U.S. government and livestock industry.

I regard statements in this letter as a serious misrepresentation of our results * * *.

Refsnider (1990) provided a very thorough discussion of DNA significance in a finding on a previous petition to delist the gray wolf, and that discussion is repeated herein:

The petition clearly but erroneously, equates mtDNA with nuclear DNA (the DNA found in the nucleus of cells) and bases its conclusions upon that error. Mitochondrial DNA differs substantially from nuclear DNA in both its function and in its method of inheritance.

Mitochondrial DNA does not occur in the cell nucleus and does not function in the production of observable traits. It codes only for proteins made and used within the mitochondria of individual cells. It does not code for the inherited physical and behavioral characteristics of the organism upon which natural selection can act. It is solely (mostly) nuclear DNA that carries the genetic codes for the physical and behavioral traits of the offspring.

Mitochondrial and nuclear DNA are inherited differently because mtDNA is not located in the cell nucleus. Male sperm are essentially mobile nuclei carrying half of the male's genetic code in the nuclear DNA; sperm carrying no mtDNA. Female eggs are complete female cells, including mtDNA outside the nucleus, and with nuclei containing half of the female's genetic code in the nuclear DNA. At fertilization the hybridization of mtDNA cannot occur because the sperm lacks mtDNA to join with the mtDNA of the egg.

These differences between mtDNA and nuclear DNA have several very significant implications. First, a developing embryo (typically) contains only its mother's mtDNA, none is inherited from its father. In contrast, nuclear DNA is passed on by both parents, and the nuclear DNA carried by an embryo originates equally from both parents. Second, once new mtDNA is introduced into a population, it (or possibly a mutated version of it) will persist indefinitely (or until altered by mutation) as long as that matriline (i.e., an unbroken series of female descendants) exists. The action of natural selection will modify the frequency of organisms having particular physical and behavioral traits; that also will change the frequency of the causative nuclear DNA in a population by

changing the frequency of carriers of the nuclear DNA. However, mtDNA is not phenotypically expressed and is largely unaffected [probably less affected] by natural selection. It can persist in a population despite the total elimination of nuclear DNA that originally came from the same source.

Nuclear and mitochondrial DNA differences mean that mtDNA data cannot be treated like nuclear DNA data when one is studying hybridization. For example, over a number of generations the frequencies of particular types of mtDNA in a population have no reliable correlation with the number of hybridization events, their frequency, or their timing. Further, the existence of a type of mtDNA in a population cannot be used to predict the presence or frequency of nuclear DNA that may have come from the same source.

The cited mtDNA study used recently developed techniques and is the first to look at mtDNA in red wolves, so the results of the study may be subject to further reinterpretation. Thus, the findings should not be viewed as conclusive at this point in time. The data need to be expanded, replicated, and evaluated in additional studies. However, a reasonable interpretation of all the existing DNA data relating to this petition and that is compatible with other lines of existing evidence is as follows:

(1) Interbreeding among all three species of North American *Canis* [gray wolf, red wolf, coyote] has occurred in the past, leading to the exchange of nuclear and mtDNA. The number of hybridization events, their frequency, and their timing is unknown. The Ferrell *et al.* study indicates that the red wolf is a unique species or subspecies separate from the coyote or other gray wolf subspecies.

(2) Due to the maternal inheritance of mtDNA, any coyote-type mtDNA passed on in red wolves from hybridization events is not recombined, or diluted, over time in the recipient red wolf population. Mitochondrial DNA is passed on from a mother to her offspring in its entirety (subject to normal mutation), and its frequency depends solely upon the survival and spread of the matriline in the population. In contrast, any nuclear DNA that is subject to selection and is received from coyotes can be "bred out" by natural or artificial selective pressures over succeeding generations, and this may have happened with the individuals used in the red wolf captive-breeding program. There are no data showing phenotypic, morphological, or behavioral expression of coyote traits in the current red wolf populations. This suggest that female offspring from any past hybridizations were successfully backcrossed with male red wolves, and their offspring did the same. These backcrossings may have produced decreasing proportions of any coyote nuclear DNA in individual wolves, while maintaining the entire mtDNA complement. Thus, any coyote traits coded by nuclear DNA have disappeared from the red wolf population, even though the mtDNA persisted.

(3) The locations and dates of collections for all wild canids examined by Wayne and Jenks were in previously known areas of species overlap and indicate widespread pockets of hybridization among the three *Canis* species in the early twentieth century (about 20 years earlier than indicated by widespread appearance of morphologically intermediate specimens). However, this information has no bearing on the historic genetic makeup of red wolves away from areas of known contact with coyotes and gray wolves prior to 1930. Over half of the red wolf's historic geographical distribution remains unsampled, mostly east of the Mississippi River, where red wolves were largely extirpated by 1900 and where coyotes were absent until the 1970s.

In summary, the mtDNA study (Wayne and Jenks 1991) referenced in the petition supports the hypothesis of past hybridizations between the three *Canis* species. However, mtDNA data do not show the extent of hybridization between wolves and coyotes. Also, the data do not provide evidence of any current coyote influence from nuclear DNA in red wolves, and selective captive breeding provides a likely scenario for the elimination of such coyote nuclear DNA from existing red wolves. The study does not provide any evidence of coyote phenotypic, morphological, or behavioral traits persisting in red wolves.

3. The best scientific and commercial data available support continued listing for the red wolf.

The Service is required to use the best scientific and commercial data available when making a listing/delisting decision. As discussed above, the scientific data supporting hybridization in red wolves currently came from a single study. That study suggests past hybridizations, but provides no support for current hybridization in the existing red wolf populations. The remainder of the relevant scientific data show that historic and current red wolves lack coyote, gray wolf, or hybrid phenotypic and morphological traits.

Reasonable caution, an understanding of the classic scientific method, and the Endangered Species Act itself all argue for a conservative approach in applying new data and methodologies to the delising of endangered and threatened species. The Wayne and Jenks study raises important questions that should stimulate further investigation but should not be considered strongly supportive of a significant change in listing and protection for an endangered and threatened species. The red wolf recovery program funded the Wayne and Jenks study and is currently funding additional work by them on nuclear DNA.

It is incumbent upon the Service to avoid a possible premature and unwarranted removal or relaxation of protection for a listed species. Given the current "state of the art" of DNA analysis and interpretation in wild canids, the Service must adopt a conservative approach in the absence of other substantial data supporting delisting of the red wolf.

It must also be pointed out that possible changes in the taxonomy of the red wolf are unlikely to result in delisting. The Act defines species to include any subspecies and any distinct population segment that interbreeds when mature. Therefore, if the red wolf were determined to be a subspecies of the gray wolf, its endangered status would continue. If the red wolf were determined to be entirely a hybrid, delisting may or may not result, depending on the results of current Service reviews of the species concept and its application to canids. It is significant that Wayne and Jenks (1991) and O'Brien and Mayr (1991), while favoring a hybrid origin for the red wolf, favor continued protection under the Act because of the red wolf's uniqueness as a population.

On the basis of the best scientific information available, the Service finds that this petition does not present substantial information indicating that the action requested may be warranted. The Service recognizes the possibility of past and present hybridization among canids in certain geographic localities and will continue to encourage scientific research in the area. In addition, the Service recognizes that recent advances in molecular genetics have made it difficult to interpret such data in light of the classic biological species concept. However, several different species concepts, including a revised biological species concept, are now dominating taxonomic thinking. These alternative concepts incorporate the idea of limited genetic interchange with other recognized species if there are clear selective pressures working against the persistence of intermediate types. The Service is currently reviewing and

evaluating possible alternate species concepts, with possible ramifications for the Service's approach to the protection of endangered and threatened species when infrequent interbreeding occurs with other taxa.

Wayne and Jenks (1991) support the continued protection of red wolves. They state:

> Even if the red wolf is entirely a hybrid, it filled the role as top predator throughout its former geographic range and was thus an integral part of the ecosystem. The captive population of red wolves seems to be morphologically and genetically representative of the canid that existed in the southeastern United States, and so its reintroduction there would restore an essential component of the fauna.

O'Brien and Mayr (1991) also support continued protection of the red wolf as the only available descendants of the historically occurring canid in the Southeast.

The debate over the origin and current taxonomic status of the red wolf is not likely to be resolved soon, if ever. One major obstacle to resolving this issue is that there are very few pelts from red wolves east of the Mississippi River prior to 1930, where hybridization with coyotes would have been unlikely based on known distribution at that time. However, the red wolves of today are representative of the canids that roamed the Southeast historically and are morphologically and behaviorally distinct from coyotes and gray wolves. Therefore, there will be no change in emphasis or commitment for recovery of the red wolf as a top predator, whether or not this species' taxonomic position is resolved. The recovery of the red wolf is most important for reestablishing this canid's unique ecological and evolutionary role that has been vacant for some time in ecosystems of the Southeast. This position is supported by Wayne (personal communication, 1991), who states that even if partially a hybrid form, the red wolf's genetic makeup would be difficult to reconstruct by interbreeding gray wolves and coyotes, and, if the captive-breeding program were discontinued, a living representative of the canid that historically occupied the Southeast could not be regenerated.

References Cited

A complete list of all references cited herein is available upon request from the author of this notice at the below address.

Author

This notice was prepared by V. Gary Henry, Red Wolf Coordinator, U.S. Fish and Wildlife Service, 330 Ridgefield Court, Asheville, North Carolina 28806 (704/665–1195).

Authority: The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531–1544).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, and Transportation.

Dated: January 6, 1992.

Richard N. Smith,

Acting Director, Fish and Wildlife Service.

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