

The red wolf (*Canis rufus*) – hybrid or not?

The red wolf originally ranged over much of the southeastern U.S. By 1970, it was extinct from its original range and propagated in captivity. The USFWS has spent a great deal of money and effort on captive rearing and reintroduction in the SE United States.

Hybridization with coyote (*C. latrans*) suspected as early as 1940's. Hybridization was implicated in the decline of the red wolf.

(ohead – Roy et al. fig. 1)

Wayne & Jenks (1991) – analyzed mitochondrial DNA (maternal inheritance) and concluded that the red wolf ORIGINATED as a hybrid between coyote and grey wolf (*C. lupus*).

- also concluded that red wolf mitochondrial DNA is now predominantly coyote origin
- suggested that red wolf has never been a valid species or subspecies
- suggested that existing red wolf population is substantially coyote in origin (coyotes not protected)

Nowak (1992) – red wolf hybridized within last 100 years with coyote, but predates European colonization of N. America as a distinct species in the fossil record

- morphological analysis supports interpretation that red wolf is an intermediate stage of canid evolution from a small, coyote-like form to the modern gray wolf – and distinct from both [the evidence he presents could also be interpreted as indicating hybridization if the skull traits he used are subject to blending inheritance]

Roy et al. (1996) – more extensive analysis of mitochondrial DNA (coding for cytochrome) and nuclear microsatellites (neutral, non-coding, hypervariable).

- found red wolves had only 5% of their alleles unique from either gray wolves or coyotes [but, those unique from coyotes were also found in gray wolves and those unique from gray wolves were also present in coyotes---no unique alleles among the regions tested in red wolves(**strong evidence of hybridization**)

(ohead – Roy et al Table 4)

-genetic distance calculations indicate that red wolves are intermediate between coyotes and gray wolves

-red wolves are most similar to gray wolves known to be hybridizing with coyotes in southern Quebec & Minnesota

(ohead – Roy et al Figs 3 & 4)

-degree of differentiation from gray wolves is less than for Mexican wolf (*C.l.baileyi*), a recognized subspecies of gray wolf

-they conclude that the genetic evidence is consistent with a recent origin by hybridization between coyotes and wolves.

a) if of anthropogenic origin (e.g., habitat alteration), then no protection

b) if natural, than protect it as a hybrid species

Nowak & Federoff (1998) – fossil, historical, and archaeological evidence indicates the presence of a distinct canid (wolf) in the southeastern U.S.

-sharp morphological distinctions between historical red wolf and nearest populations of gray wolf or coyote until 20<sup>th</sup> century hybridization

## CONCLUSIONS?

1. Genetic data clearly support the notion that the red wolf is intermediate between gray wolf and coyote, but this is consistent with either

a) red wolf as intermediate evolutionary step (Nowak), or

b) red wolf as hybrid (Wayne, Roy et al.)

2. Lack of genetic divergence from either gray wolf or coyote supports hybrid hypothesis

3. Ongoing hybridization elsewhere - coyote introgression in wolves of Quebec, wolf introgression into coyotes of N.E. U.S. shows that hybridization is possible and likely under some ecological conditions (i.e., lack of niche distinction)

4. Existence of “red wolf” fossils consistent with either ancient hybridization or intermediate species hypotheses

Consensus – leans toward hybridization....conservation options?