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Authors: Kelly, Terra R., and Sleeman, Jonathan M.

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Morbidity and Mortality of Red Foxes (*Vulpes vulpes*) and Gray Foxes (*Urocyon cinereoargenteus*) Admitted to the Wildlife Center of Virginia, 1993–2001

Terra R. Kelly,[1,2,3] **and Jonathan M. Sleeman**[1] [1] Wildlife Center of Virginia, P.O. Box 1557, Waynesboro, Virginia 22980, USA; [2] Current address: Environmental Medicine Consortium and Department of Clinical Sciences, North Carolina State University, 4700 Hillsborough Street, Raleigh, North Carolina 27606, USA; [3] Corresponding author (email: terra_kelly@hotmail.com)

ABSTRACT: The medical records of 48 red foxes (*Vulpes vulpes*) and 35 gray foxes (*Urocyon cinereoargenteus*) examined at the Wildlife Center of Virginia (Waynesboro, Virginia, USA) from 1993 to 2001 were reviewed. The most common diagnosis in red foxes was orphaned (33%), followed by trauma (27%), undetermined diagnosis (23%), and sarcoptic mange (17%). Trauma (46%) was the most frequent cause of morbidity and mortality in gray foxes followed by orphaned (23%), undetermined (20%), toxoplasmosis (6%), presumptive canine distemper (3%), and rabies (3%). One gray fox had concurrent toxoplasmosis and presumptive canine distemper (3%). Similar diseases were detected in previous studies at a diagnostic laboratory; however in this study, trauma and orphaned animals were more common than infectious diseases. The lack of diagnostic information on some cases limited the usefulness of this study, and more emphasis should be placed on performing postmortem examinations of wildlife presented to wildlife rehabilitation centers.

Key words: Gray fox, morbidity, mortality, red fox, *Urocyon cinereoargenteus*, Virginia, *Vulpes vulpes*.

Red foxes (*Vulpes vulpes*) and gray foxes (*Urocyon cinereoargenteus*) are widely distributed throughout much of the southeastern United States and are found in a variety of habitats (Linzey, 1998). Many of the common diseases of red and gray foxes in the USA have previously been described. Specifically, sarcoptic mange was identified as a major cause of morbidity and mortality of red foxes (Little et al., 1998); whereas canine distemper was the most prevalent condition in gray foxes (Davidson et al., 1992). Recent studies reviewing morbidity and mortality of wildlife presented to wildlife centers and universities have provided useful information on the health status of wildlife populations (Deem et al., 1998; Morishita et al., 1998; Gulland, 1999). However, these data are hypothesized to be biased toward conditions associated with human activities (Spalding and Forrester, 1993). The objective of this retrospective study was to determine the causes of morbidity and mortality in red and gray foxes admitted to the Wildlife Center of Virginia (WCV) between 1993 and 2001.

Clinical diagnoses were obtained from medical records of 48 red foxes, and 35 gray foxes admitted to the WCV (38°02′N, 78°55′W) between 1993 and 2001. Data extracted from the records included species, gender, location, and clinical diagnosis. The diagnoses were classified into morbidity and mortality categories that consisted of trauma, orphaned animals, sarcoptic mange, rabies, presumptive canine distemper, toxoplasmosis, and undetermined. These diagnoses were determined by the attending clinician and were based on the case history, physical examination findings, ancillary diagnostic tests, gross postmortem examination, and histopathology. Diagnosis of trauma was based on case history and physical examination findings consistent with trauma. Animals that were removed from the wild and considered unable to survive unassisted due to young age, but otherwise seemed healthy on physical examination were classified as orphaned. Diagnosis of sarcoptic mange was based on physical examination findings and microscopic examination of skin scrapings revealing *Sarcoptes scabiei* mites (Georgi and Georgi, 1990). Rabies cases were defined as animals that tested positive for rabies by the Augusta County

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Health Department using the direct fluorescent antibody test. The presumptive diagnosis of canine distemper virus was based on identification of characteristic intranuclear and intracytoplasmic virus inclusion bodies on histopathology, and toxoplasmosis was diagnosed based on visualization of *Toxoplasma gondii* tachyzoites on histopathology (Thomson, 1984). Cases that did not have a definitive diagnosis were classified as undetermined. Histopathology was performed in some cases suspicious of an infectious etiology, but was not performed in most cases where trauma was evident due to limited resources. The prevalence of traumatic injuries and orphaned foxes by species and sex was evaluated statistically using the Chi-square test (with a 95% confidence interval and 1 degree of freedom). A P value ≤ 0.05 was considered significant (http://www.georgetown.edu/cball/webtools/web_chi.html).

A total of 83 foxes was included in this study. There were 48 red foxes (15 males, 13 females, and 20 of unknown sex) and 35 gray foxes (11 males, 12 females, and 12 of unknown sex). Forty-five percent of the foxes were from the four counties surrounding the WCV (Augusta, Albemarle, Nelson, and Rockingham). Two foxes were from West Virginia (USA), and one was from Maryland (USA). The remaining foxes were from various counties throughout Virginia. The most common cause of morbidity and mortality of red foxes was orphaned (33%), followed by trauma (27%), undetermined (23%), and sarcoptic mange (17%). One red fox had both trauma and sarcoptic mange (3%). Trauma was the most frequent diagnostic category in gray foxes (46%), followed by orphaned (23%), undetermined (20%), toxoplasmosis (6%), presumptive canine distemper (3%), and rabies (3%). One gray fox had concurrent presumptive canine distemper and toxoplasmosis (3%). There was a statistically significant higher prevalence of trauma in male red foxes compared to female red foxes ($\chi^2=3.87$, df=1), and orphaned male gray foxes compared to female gray foxes ($\chi^2=4.10$, df=1).

This study identified similar conditions to previous studies of foxes in the southeastern US (Davidson et al., 1992; Little et al., 1998). A study performed by the Southeastern Cooperative Wildlife Disease Study (University of Georgia, Athens, Georgia, USA) revealed that sarcoptic mange was the most common cause of death in red foxes in the southeastern US followed by trauma and other infectious diseases (Little et al., 1998). A similar study in gray foxes from the southeastern US revealed that the most common cause of mortality was canine distemper virus followed by trauma (Davidson et al., 1992). In our study, trauma and orphaned were more common causes of morbidity and mortality than infectious diseases.

The higher prevalence of traumatic injuries in male red foxes compared to female red foxes may be explained by the larger home range of the male red fox (Linzey, 1998), resulting in increased contact with human habitation and activities. The higher prevalence of orphaned male gray foxes compared to female gray foxes is more difficult to explain and may be the result of biased sampling.

A retrospective study of this type has value in contributing to disease monitoring through observation of trends in historical data. However, there are inherent biases associated with this study design. Potential biases in this example may be attributed to different attending clinicians over time, cases without a definitive diagnosis, and the lack of standardization of diagnostic tests performed. The high prevalence of undetermined cases is due to the lack of postmortem examinations and ancillary diagnostic tests performed. For example, it is possible that canine distemper is a more significant cause of morbidity and mortality in gray foxes presented to the WCV. All seven of the undetermined gray fox cases had seizures (20% of total gray fox cases), but did not have postmortem examinations performed, and no definitive diagnoses

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were made. This clinical presentation is very suspicious for canine distemper in this species (Davidson and Nettles, 1997). Lack of standardization of diagnostic tests may have resulted in foxes that had undiagnosed concurrent problems such as an infectious disease and therefore falsely increased the prevalence of trauma and orphaned as causes of morbidity and mortality. A prospective study should be used to further investigate hypotheses generated from the analysis of these historic data. This would reduce bias and allow for stronger conclusions to be made regarding morbidity and mortality in the red and gray fox populations of Virginia.

The traditional role of wildlife hospitals such as the WCV has been treatment and release of wildlife. However, they also have the potential to contribute to wildlife disease monitoring. In order for this potential to be realized, more emphasis should be placed on accurate record keeping, standardized health screening, and more thorough clinical examinations, ancillary diagnostic tests, and postmortem examinations on animals that die or are euthanized.

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LITERATURE CITED

DAVIDSON, W. R., AND V. F. NETTLES. 1997. Field manual of wildlife diseases in the southeastern United States. Southeastern Cooperative Wildlife Disease Study, College of Veterinary Medicine, The University of Georgia, Athens, Georgia, 417 pp.

———, V. F. NETTLES, L. E. HAYES, E. W. HOWERTH, AND C. E. COUVILLION. 1992. Diseases diagnosed in gray foxes (*Urocyon cinereoargenteus*) from the southeastern United States. Journal of Wildlife Diseases 28: 28–33.

DEEM, S. L., S. P. TERRELL, AND D. J. FORRESTER. 1998. A retrospective study of morbidity and mortality of raptors in Florida: 1994–1998. Journal of Zoo and Wildlife Medicine 29: 160–164.

GEORGI, J. R., AND M. E. GEORGI. 1990. Parasitology for veterinarians. W. B. Saunders Co., Philadelphia, Pennsylvania, 412 pp.

GULLAND, F. M. 1999. Stranded seals: Important sentinels. Journal of the American Veterinary Medical Association 214: 1191–1192.

LINZEY, D. 1998. The mammals of Virginia. McDonald and Woodward Publishing Co., Blacksburg, Virginia, 459 pp.

LITTLE, S. E., W. R. DAVIDSON, E. W. HOWERTH, P. M. RAKICH, AND V. F. NETTLES. 1998. Diseases diagnosed in red foxes from the southeastern United States. Journal of Wildlife Diseases 34: 620–624.

MORISHITA, T. Y., A. T. FULLERTON, L. J. LOWENSTINE, I. A. GARDNER, AND D. L. BROOKS. 1998. Morbidity and mortality in free-living raptorial birds of northern California: A retrospective study. Journal of Avian Medicine and Surgery 12: 78–81.

SPALDING, M. G., AND D. J. FORRESTER. 1993. Disease monitoring of free-ranging and released wildlife. Journal of Zoo and Wildlife Medicine 24: 271–280.

THOMSON, R. G. 1984. General veterinary pathology. W. B. Saunders Co., Philadelphia, Pennsylvania, pp. 6–99.

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