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Disease Survey of Invasive Nutria in California (Abstract)

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ABSTRACT: Nutria (*Myocastor coypus*) are semi-aquatic rodents native to South America that were introduced into many countries outside their native range for fur-farming. Nutria are considered a pest species in many regions primarily because of their feeding and burrowing activities that damage water control structures, agricultural crops, and marsh vegetation, but they are also capable of supporting parasites and pathogens that could present health risks to humans and other animals (Howerth et al. 1994, Michel et al. 2001). Nutria populations in the United States are found in the Gulf of Mexico coast, the Atlantic coast, and the Pacific Northwest, where they are managed as invasive species or euthanized through local eradication efforts. Nutria in California were reportedly eradicated after a small-scale effort in the 1970s, but recently reappeared in the Central Valley in 2017. Nutria in California inhabit rivers, streams, lakes, and ponds where they exist alongside native aquatic mammals such as American beaver (*Castor canadensis*), common muskrat (*Odontra zibethicus*), and the North American river otter (*Lontra canadensis*). The re-emergence of nutria in the California Central Valley, nearly 50 years post eradication, necessitates further investigation into the impacts of this species.

In this study, we investigated whether nutria in California serve as hosts for infectious agents that present spillover risk to susceptible host populations including native wildlife, domestic animals, and humans. We used histopathology, PCR, immunoassays, and morphologic identification of ectoparasites to evaluate the presence of pathogens or arthropod vectors in a subset of 65 nutria dispatched as part of a statewide eradication effort. Most nutria with lung tissue submitted for histopathology in this survey had evidence of interstitial pneumonia. The etiology was undetermined based on microscopic evaluation, and few were severe enough to have clinical significance. Further study to identify the etiology in these cases and better understand the implications of pneumonia in nutria may include culture, PCR, or metagenomic techniques. Some nutria had histopathologic evidence of hepatitis with intralesional cestodes. Molecular identification is needed to identify the species in these cases, although they morphologically resembled *Taenia* sp. Other infrequent findings included myocarditis, nephrosis, renal fibrosis, and dermatitis and orthokeratotic hyperkeratosis with pediculosis. PCR amplification and DNA sequencing of a region of the small subunit ribosomal RNA gene positively identified *Giardia intestinalis* from one nutria fecal sample. The sequence was aligned to previously described 18S rRNA sequences from the NCBI GenBank database for each assemblage (A-G), and was determined to be most closely related to assemblage B. Assemblages A and B are found in humans and are reported to be zoonotic (Thompson 2004). Further testing is warranted to determine the role of nutria in California as potential reservoirs for zoonotic *G. intestinalis* transmission. Three nutria were seropositive for *L. interrogans*, serovars Canicola and Pomona. We did not detect pathogenic *Leptospira* spp. by RT-PCR. Leptospirosis is common in California wildlife (Straub and Foley 2020) and the current role of nutria in the epidemiology of this disease is unclear.

As the nutria population expands into new waterways with susceptible species including humans and native wildlife, continued monitoring is recommended to investigate nutria as a potential reservoir for Leptospirosis. Nutria had few ectoparasites overall. Ticks were identified as *Dermacentor variabilis*, a widely distributed North American tick species that been implicated in transmission of several bacterial pathogens, including *Rickettsia* spp. and *F. tularensis* (Eisen et al. 2017, Hecht et al. 2019). Fleas were identified as *Pulex* sp. and *Orchopeas* sp. *Pulex* sp. are a cosmopolitan species that may be a source of zoonotic pathogens, such as *Bartonella* spp. (Gabriel et al. 2009). *Orchopeas* sp. are common rodent fleas found in squirrels and woodrats and may be vectors for pathogens including *Bartonella* spp., *Rickettsia* spp. (Reeves et al. 2005), and *Yersinia pestis* (Davis et al. 2002) . This surveillance effort highlights the potential for nutria in California to serve as hosts for pathogens that can result in disease in humans and other animals and the importance of monitoring pathogens and parasites of invasive species within management or eradication programs. Future efforts to evaluate the role of nutria in disease transmission might include investigating additional pathogens, seasonal variations in disease prevalence, larger sample sizes, and surveys of native species sharing habitats with nutria.

KEY WORDS: disease, nutria, *Myocastor coypus*, coypu, zoonoses, *Giardia*, *Leptospira*

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