frontiers | Frontiers in Mammal Science

TYPE Case Report
PUBLISHED 26 November 2025
DOI 10.3389/fmamm.2025.1634280

OPEN ACCESS

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RECEIVED 24 May 2025
ACCEPTED 31 October 2025
PUBLISHED 26 November 2025

CITATION
Soresini G, Foerster N, Somma AT, da Silva FA, Ribas C, Leuchtenberger C and Mourão G (2025) Case Report: Ophthalmic and associated systemic disorders in free-ranging giant otters (*Pteronura brasiliensis*) documented through video frames and photographs.
Front. Mamm. Sci. 4:1634280.
doi: 10.3389/fmamm.2025.1634280

Case Report: Ophthalmic and associated systemic disorders in free-ranging giant otters (*Pteronura brasiliensis*) documented through video frames and photographs

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The present study aims to report the occurrence of ophthalmic and associated systemic disorders in giant otters (*Pteronura brasiliensis*) from the Brazilian Pantanal. This mustelid species is classified globally as Endangered and faces increasing threats from various human activities and diseases from domestic animals across most of its range, including Brazil. Over a 10-year period, we recorded 12 wild giant otters showing signs of ophthalmic diseases, as well as other systemic abnormalities. In this study, we describe the ocular conditions based on an analysis of digital-video frames and photographs, discuss potential causes, and highlight the concern that the long-term survival of the giant otter population in a specific area of the southern Brazilian Pantanal may be at risk.

KEYWORDS

conservation threats, eye, lutrinae, mammal, ophthalmology, wildlife health status

Introduction

Giant otters (*Pteronura brasiliensis*, Zimmermann 1780) are semiaquatic mammals and the largest among the fourteen mustelid species in the subfamily Lutrinae. They primarily feed on fish and inhabit freshwater ecosystems near tropical forests and floodplains (Duplaix, 1980). Endemic to South America, the species originally had a wide range of distribution of occurrence. However, intensive hunting for the fur trade between the 1940s and 1970s led to a range reduction of nearly 40% by the 1980s (Colodetti, 2014). Currently, populations persist in several countries, including Brazil, where it inhabits the Amazon, Cerrado, and Pantanal ecoregions (Rodrigues et al., 2018). Nevertheless, there is still no reliable estimate of the total population size, as available estimates are restricted to specific regions, and overall population trends remain uncertain (Wallace et al., 2025).

Many large carnivores, including giant otters, face significant threats leading to population declines, reductions in their geographic ranges, and habitat fragmentation (Ripple et al., 2014). In Brazil and across most of their range, the main threats to this top predator of aquatic ecosystems include water pollution, competition with human fisheries, diseases transmitted by domestic animals, and habitat degradation (Leuchtenberger et al., 2018). Climate change alters rainfall patterns and river flow, reducing fish availability and degrading denning sites (Groenendijk et al., 2021; Wallace et al., 2025). As a result of these threats, the species is classified as Endangered by the IUCN since 2000 (Groenendijk et al., 2021) and as Vulnerable on Brazil's national Red List (Rodrigues et al., 2018).

Information on ophthalmic abnormalities in mustelids, including otters, is mostly limited to isolated cases (Williams, 1989; Williams et al., 2000; 2004; Dubey and Thomas, 2011). Some conditions linked to ocular diseases in wild animals include trauma (e.g. Kumar et al., 2015), nutritional factors (e.g. Williams et al., 2004; Lange et al., 2017), aging (e.g. Roth et al., 2004; Kumar et al., 2015), poor environmental or water quality (e.g. contamination through dieldrin pesticide as reported by Williams et al., 2004), parasites and infectious agents (Pinto et al., 2005; Dubey and Thomas, 2011).

Research on ophthalmic disorders (as well as epidemiological studies) in free-ranging giant otters remains limited, largely due to the challenges involved in capturing this species. The only published method employs a funnel-shaped net trap installed at den entrances (Silveira et al., 2011). While effective, this technique does not allow researchers to choose which individual from the group will be captured and they need to avoid groups with pregnant or lactating females. Additionally, its success also relies on specific environmental conditions, such as the dry season (when dens are more accessible), and certain den characteristics, like having few entrances, no submerged entry points, and entrances that are neither too close to the water nor too wide for effective trapping.

Conducting a detailed ophthalmic examination typically requires specialized optical devices or techniques to properly describe eye lesions. However, certain anatomical features of the eye, such as changes in the color of ocular tissues (e.g. opacity), can be easily detected through standard photography. Ophthalmic imaging has long been a crucial tool for documenting ophthalmic diseases (Bennett and Barry, 2009). External eye photography is a relevant approach for examining the ocular surface, eyes adnexa, and surrounding facial structures. It is often used in veterinary ophthalmology studies (Bennett and Barry, 2009; Colitz et al., 2010; Simeone et al., 2017) and is particularly useful when physical restraint of the animal is not achievable.

This study aims to document evidence of ophthalmic and associated systemic disorders in free-ranging giant otters using images and discuss potential causes.

Methods

Study area

The Pantanal, one of the earth's largest wetlands, harbors a significant population of giant otters and spans parts of Brazil, Bolivia, and Paraguay (Harris et al., 2005; Tomas et al., 2020). All data were collected in the Brazilian Pantanal, covering both the southern region (including the Miranda and Negro rivers, and pools along the Estrada Parque Pantanal road) and the northern region (Cuiabá and Mutum rivers). Rivers are the primary and most suitable habitat for giant otters, whereas the lentic water bodies formed along the Estrada Parque Pantanal are considered less favorable for the species (Schweizer, 1992; Ribas et al., 2012; Tomas et al., 2015).

Data collection

From December 2009 to October 2019, field surveys on giant otter ecology, behavior, health, and genetics were conducted using a motorized boat on the rivers and a 4x4 vehicle along the Estrada Parque Pantanal road. Data were collected using a high-definition digital video camera (Sony® HDR-CX220, Sony Brasil Ltda, São Paulo-SP) with a recording resolution of 1920×1080 pixels (Full HD). All videos were carefully analyzed, and frames showing otters with apparent ophthalmic affections were selected for analysis by two wildlife veterinarians (GS and AS). Occasionally, photographs were also taken using a Canon® Rebel T6i camera equipped with 70–200 mm L-series lenses, with a resolution of 24.2 megapixels.

Giant otters were individually identified by their distinctive white throat and chest patterns (Duplaix, 1980; Carter and Rosas, 1997). We recorded each otter's estimated age, sex, social hierarchy, group composition, and location. Otters were classified by age as subadults (1.5-2.5 years) or adults (>2.5 years), based on long-term monitoring (Groenendijk et al., 2015). Sex was determined by genitalia observation, while social hierarchy and reproductive status were assessed through behavioral patterns, particularly scent-marking (Duplaix, 1980; Leuchtenberger and Mourão, 2009). Locations were recorded using GPS.

Criteria proposed to assess systemic condition

The giant otters included in this study were not captured. Instead, we used visual inspection to classify each individual according to four criteria (Table 1):

TABLE 1 Categorical scores used to assess systemic condition of free-ranging giant otters (*Pteronura brasiliensis*).

Criteria	Categories/ scores	Description
Body Condition Score (BCS)	1-5	1 = emaciated, 2 = thin, 3 = optimal, 4 = heavy, 5 = obese (see Figure 1)
Physical Debilitation (PD)	0-2	0 = normal, 1 = mild, 2 = severe based on activity level and responsiveness
Trauma (Tr)	absent or present	fresh wounds, bleeding
Overall Health Status (OHS)	clinically healthy or clinically unhealthy	integration of all criteria

I. Body Condition Score: the BCS of each individual was visually assessed from all available images, applying a scale from 1 to 5 that is commonly used in different species of domestic (e.g. Ferguson et al., 2006) and wild animals (e.g. Clingerman and Summers, 2005; Harshaw et al., 2016), given the absence of a species-specific method for otters. On this scale: a score of 1 indicates a severely emaciated animal with very prominent bones (hips, ribs, and spinous processes); a score of 2 denotes a thin otter with minimal fat reserves and visible hip bones and spinous processes; a score of 3 is considered optimal, with no visible bony prominences; a score of 4 indicates a heavy otter, with fat deposits beginning to accumulate in the axillary, inguinal, or abdominal regions; and a score of 5 reflects an obese animal, with clearly visible fat deposits in the axillary, inguinal, and abdominal regions (Figure 1).

II. Physical Debilitation: giant otters were classified as "physically debilitated" based on clinical assessment through visual indicators, including lethargic behavior and minimal responsiveness to human presence. Categorized as normal, mildly debilitated (mild lethargy or reduced activity), or severely debilitated (marked lethargy or minimal responsiveness).

III. Trauma: presence of visible signs of recent injury (e.g. fresh wounds, bleeding), recorded as absent or present.

IV. Overall Health Status: integrated assessment combining the previous criteria, categorized as "clinically healthy" or "clinically unhealthy" based on the combination of body condition, behavior, and evidence of trauma. An individual was considered clinically unhealthy if any single parameter scored low, and clinically healthy only when all three were normal, ensuring a conservative health assessment. Previous traumatic injuries (e.g. cranial flattening) were not considered in the classification of individuals as clinically unhealthy.

Results

Between December 2009 and October 2019, we recorded a total of 12 adult giant otters with presumed ophthalmic disorders (affecting the eyes, eyelids, and surrounding skin) in the Pantanal

FIGURE 1
Body Condition Scores (BCS) of wild giant otters (*Pteronura brasiliensis*), ranging from 1 (emaciated) to 5 (obese): **(A)** BCS 1 (emaciated), Miranda River, May 2015; **(B)** BCS 2 (thin), Paraguay River, November 2018; **(C)** BCS 3 (optimal), Vermelho River, November 2022; **(D)** BCS 4 (heavy), Miranda River, August 2015; **(E)** BCS 5 (obese), Miranda River, August 2019.

wetland, Brazil. Sex was determined for nine individuals (75%), of which five were female and four were male. Most cases (83.3%, n=10) were observed in the southern region of the Pantanal. Of the 12 otters, seven animals presented bilateral ocular disorders, two had disorders affecting only the left eye (OS, oculus sinister), and three had disorders in the right eye (OD, oculus dexter). Detailed information available on each individual, as well as their ophthalmic and systemic conditions, is provided in Table 2. The images of the eyes exhibiting alterations are presented in Figure 2.

Southern Pantanal

Estrada Parque Pantanal road: Since monitoring started in 2002, individuals with an unhealthy appearance were first registered in December 2009 in the southern Pantanal (individuals B and C, geographic coordinates 19°19'7.34"S; 57° 3'15.20"W). Both had a BCS of 2 and exhibited swollen and hyperemic mucous membranes in the anus and mouth. Chronic blepharitis was observed in both eyes, as previously reported by Ribas et al. (2012).

Miranda River:

Several observations were made in the Miranda River across different years:

April-May 2015: A group composed of one adult male (D) and two adult females (E and F, 19°34'36.07"S; 57°2'45.05"W) showed ophthalmic disorders and signs of physical debilitation. Notably, two of these otters (E and F) had been recorded as clinically healthy in November 2014. All three otters exhibited ocular discomfort, including frequent eye scratching against each other and the ground. The male was severely debilitated and exhibited behaviors suggesting remarkably visual impairment, such as nearly colliding with our boat and failing to notice our presence at the group's campsite. He also had three cutaneous lesions on his cervical region (Supplementary Material S1). Although the images show only chronic blepharitis without obvious globe abnormalities, these behaviors indicate possible visual deficits. The underlying cause could involve the retina, optic nerve, or central visual pathways, but this cannot be determined from visual inspection alone.

August-September 2019: A new group of four giant otters was observed (19°33'36.48"S; 57°2'54.49"W), three of which later developed ophthalmic lesions. One individual (K) presented ocular opacity suspected to be corneal edema in the OS and mild third eyelid protrusion in the OD. In early September, two additional group members (L and M) developed ocular opacity: bilateral in L and unilateral in M. Individual L appeared thin, (BCS 2), with a dorsal cutaneous lesion, later declining to BCS 1 and showing difficulty climbing the riverbank to access the den. Additional cutaneous lesions developed on the right thoracic limb and shoulder (Supplementary Material S2). In contrast, M maintained a BCS of 3 at that time. By late September only three individuals were recorded; L was absent and M showed further health deterioration. Three days later, the group was sighted again, and M was markedly more emaciated and severely debilitated. This encounter represented the last time the group was observed in 2019. In July 2021, the dominant female, the only individual in the group without ophthalmic abnormalities (not included in this study), was observed again, accompanied by a new male.

August-October 2019 (neighboring group): Another group composed of three individuals had an adult otter, of undetermined sex, presenting bilateral ocular opacity, suspected to be corneal edema. Throughout August, the individual appeared clinically healthy despite the ocular findings. However, in September the OD started to present conjunctival hyperemia. By October, the otter showed partial paralysis and evident motor impairment suggestive of near-drowning behavior, characterized by an inability to swim and maintain buoyancy. During this period, the ocular disease had progressed, with both eyes becoming more opaque and prominently protruding, and the OD showing marked conjunctival hyperemia. The individual was observed for approximately two minutes before it submerged (Supplementary Material S3). Despite extensive efforts, we were unable to locate the animal or its carcass. Over several hours, no further traces were found. During this period, the remaining group members were observed engaging in search behaviors, including intense vocalizations and active patrolling the surrounding area. In subsequent monitoring sessions, the affected individual was no longer observed with the group (J1 and J2 refer to this same individual, in its first and last observations).

Negro River:

In August 2019, an adult otter (I, 19°34.676'S; 56°09.282'W) presented cutaneous lesions likely caused by intraspecific conflicts and active bilateral blepharitis. It was observed scratching its face on the ground multiple times, presumably due to pruritus or pain. The other two giant otters in the group appeared healthy. Seventy days later, the same otter was sighted again, showing significant recovery with post-inflammatory hyperpigmentation (darker areas at the lesion sites), consistent with a self-limiting infection.

Northern Pantanal

Mutum River:

In November 2015, a dominant adult male (G, 16°20'16.49"S; 55°51'50.38"W) presented with phthisis bulbi on the OS. Although overall clinically healthy, this individual exhibited cranial asymmetry, with a flattening of the upper third of the skull, which may indicate a history of previous cranial trauma.

Cuiabá River:

In July 2019, an adult giant otter of undetermined sex (H, 17° 17'1.30"S; 56°41'48.90"W) was recorded exhibiting unilateral ocular opacity.

Discussion

Ocular anatomy and normal ophthalmic parameters in mustelids are relatively well-documented in the literature (e.g. Montiani-Ferreira and Freeman, 2022). However, information on ocular disorders in free-ranging Lutrinae remains limited. Notable

TABLE 2 Chronological records of 12 adult free-ranging giant otters (*Pteronura brasiliensis*) with ophthalmic disorders in the Brazilian Pantanal, from December 2009 to October 2019, including associated systemic condition and ophthalmic findings.

Id	Sex[1]	Social status[2]	Location[3]	Study period	Body condition score (BCS)	Physical debilitation (PD)	Trauma (Tr)	Overall health status (OHS)	Ophthalmic findings[4] OD	Ophthalmic findings[4] OS
B	F	dom	EPP	Dec 2009	BCS 2	1	absent	unhealthy	chronic blepharitis	chronic blepharitis
C	M	dom	EPP	Dec 2009	BCS 2	1	absent	unhealthy	chronic blepharitis	chronic blepharitis
D	M	dom	MiR	Apr/May 2015	BCS 1	2	cutaneous lesions	unhealthy blindness	chronic blepharitis ocular pruritus	chronic blepharitis ocular pruritus
E	F	N/I	MiR	Apr/May 2015	BCS 3	0	absent	healthy	ocular opacity ocular pruritus	normal ocular pruritus
F	F	N/I	MiR	Apr/May 2015	BCS 3	0	absent	healthy	ocular opacity ocular pruritus	normal ocular pruritus
G	M	dom	MuR	Nov 2015	BCS 3	0	flattening of the cranium	healthy	normal	phthisis bulbi
H	N/I	N/I	CuR	Jul 2019	BCS 3	0	absent	healthy	normal	ocular opacity
I	F	dom	NeR	Aug 2019	BCS 2	1	cutaneous lesions probably due to intraspecific conflict, with purulent discharge	unhealthy	severe blepharitis ocular pruritus	severe blepharitis ocular pruritus
J1 and J2	N/I	N/I	MiR	Aug-Oct 2019	BCS 3	2	absent	unhealthy blindness neurological signs incoordination	ocular opacity	ocular opacity
K	F	sub	MiR	Aug 2019	BCS 3	1	absent	unhealthy blindness	mild protrusion of the third eyelid	ocular opacity periocular swelling
L	M	N/I	MiR	Sep 2019	BCS 2, then BCS 1	2	cutaneous lesions	unhealthy blindness	ocular opacity	ocular opacity
M	N/I	sub	MiR	Sep 2019	BCS 3, then BCS 2	0	absent	unhealthy	ocular opacity	normal

[1]F, Female; M, Male; N/I, not identified.
[2]dom, dominant (alpha); sub, subordinate; N/I, not identified.
[3]MiR, Miranda River; NeR, Negro River; EPP, Estrada Parque Pantanal road; CuR, Cuiabá River; MuR, Mutum River.
[4]OD, right eye; OS, left eye.

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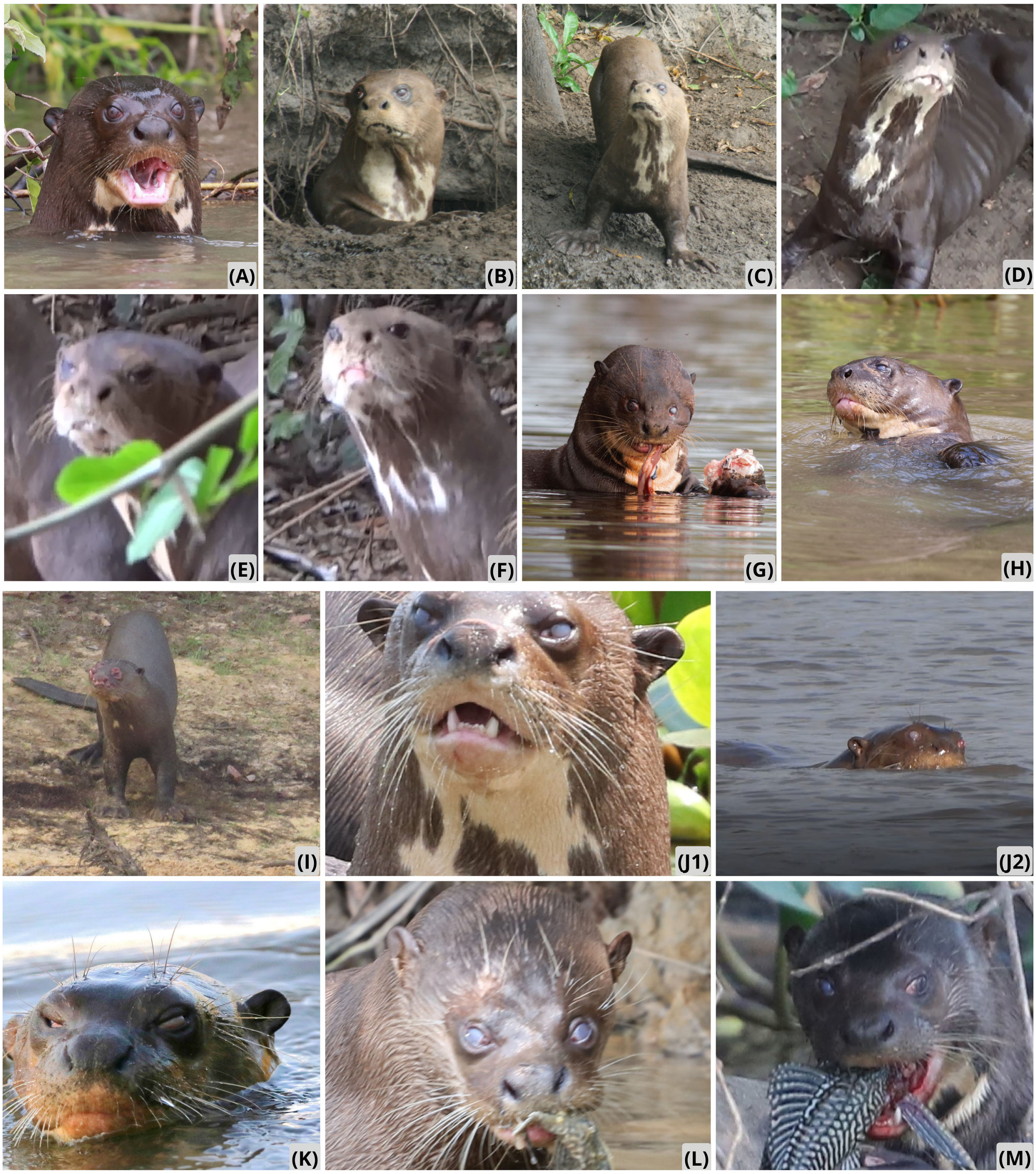

FIGURE 2
Giant otters (*Pteronura brasiliensis*) observed in the Brazilian Pantanal presenting ophthalmic disorders: **(A)** Giant otter eyes with normal appearance; **(B-D)** chronic blepharitis, characterized by thickening and hyperpigmentation of the periocular region; **(E, F)** normal appearance of the left eye (OS) and ocular opacity of the right eye (OD); **(G)** phthisis bulbi of OS with flattening of the cranium on the same side; **(H)** OS ocular opacity; **(I)** severe active bilateral blepharitis, characterized by palpebral ulcerations suspected to be excoriations from self-inflicted ocular pruritus or pain; **(J1, J2)** ocular opacity respectively bilateral and OD; **(K)** ocular opacity and periocular swelling noted in the OS and mild third eyelid protrusion in the OD; **(L, M)** – ocular opacity respectively bilateral and OD. Video frames: **(D-F, J2, L)**. Photographs: **(A-C, G-I, J1, K, M)**.

exceptions include cases of ocular chemical burns caused by oil spills in sea otters (*Enhydra lutris*) (Lipscomb et al., 1993), and retinal dysplasia observed in Eurasian otters (*Lutra lutra*) (Williams et al., 2004). To our knowledge, there is no published data on ocular diseases in giant otters, so far. This lack of information may be attributed to several factors, including the Endangered status of the species (Groenendijk et al., 2021), their low population densities (Duplaix et al., 2015), and the challenges of developing an effective method of capturing affected individuals from the social group.

Giant otters are territorial social mammals that interact playfully and aggressively, particularly during agonistic encounters between groups, which can be extremely aggressive and often result in wounds and scars (Rosas and Mattos, 2003; Ribas and Mourão, 2004). This could explain the lesions observed in a giant otter in this study (I). Cases of myiasis in free-ranging giant otters likely resulted from intraspecific fights and ultimately led to the death of the affected individuals (Foerster et al., 2022; Gonchoroski et al., 2025). In aquatic mammals, such as cetaceans, playful behavior can lead to blunt or sharp trauma to the eyes and surrounding structures (Colitz et al., 2016), suggesting that similar mechanisms of injuries may also occur in otters, although no specific records currently exist.

Epidemiological studies on giant otters are limited, although, like other otter species, they are vulnerable to various pathogens commonly spread by domestic animals (Foster-Turley et al., 1990), such as canine distemper virus (White et al., 2013), leptospirosis (White et al., 2018), and canine parvovirus (Echenique et al., 2018). Systemic infections caused by *Toxoplasma gondii* can lead to significant morbidity and mortality in mustelids, as observed in southern sea otters (*Enhydra lutris nereis*) and black-footed ferrets (*Mustela nigripes*) (Burns et al., 2003; Conrad et al., 2005). In southern sea otters, *T.gondii* was detected in 52% of necropsied and 38% of live-captured animals (Conrad et al., 2005). Recently, a specific strain of *T. gondii* was identified as the cause of death in several sea otters in California (Shapiro et al., 2019). Clinical signs of toxoplasmosis in otters can include a range of neurological (ataxia, head tilt, tremors), ocular (corneal edema, uveitis, blindness), respiratory (nasal discharge, dyspnea), and general systemic signs (weight loss, lethargy, weakness) (Conrad et al., 2005; Shapiro et al., 2019). Based on observed clinical presentation, toxoplasmosis may be a potential diagnosis for individuals from giant otter groups inhabiting the same area of the Miranda River (D-F and K-M). However, these animals were not captured or sampled, preventing diagnostic confirmation. These groups inhabited areas near a large bridge adjacent to a riverside community, where increased proximity to humans and domestic animals might increase the risk of exposure to contaminated water or prey containing oocysts from feline feces.

Another infectious disease of concern is caused by canine adenovirus type 1, which can lead to incoordination, generalized ataxia, and bilateral ocular opacity, a condition known as the “blue eye” phenomenon. This pathology was recently described in a hoary fox (*Lycalopex vetulus*) from Brazil, co-infected with canine distemper virus (Silva et al., 2023). In otters, canine adenovirus type 1 infection can be fatal, as observed in a Eurasian otter showing anorexia, lethargy, and weight loss (Park et al., 2007). Sea otters can also be infected by this viral agent (Foster-Turley et al., 1990). Additionally, an outbreak of adenovirus infection causing acute hepatitis was reported in otariids (Inoshima et al., 2013). These studies suggest that semiaquatic mammals are susceptible to this pathogen, which is commonly found in unvaccinated domestic dogs. One giant otter in our study (identified as J1 and J2) presented systemic signs resembling that observed in the hoary fox, suggesting canine adenovirus as another potential etiological agent. In Brazil, canine adenovirus infection has become less common in urban areas due to widespread vaccination programs. However, in the Pantanal, domestic dogs are generally not vaccinated, and when vaccination occurs, it is usually limited to rabies.

The avian eye trematode *Philophthalmus lachrymosus*, which inhabits the palpebral conjunctiva, has been associated with severe conjunctivitis and blindness in capybaras (*Hydrochoerus hydrochaeris*), a species that frequently comes into close contact with avian definitive hosts (Pinto et al., 2005). Although we identified four apparently blind giant otters (D, J1/2, K, and L), there are no confirmed records of *P. lachrymosus* occurrence in the Pantanal or in other mammalian species. However, its presence in shared aquatic habitats may pose a risk to other susceptible mammals.

Cases of blindness in Eurasian otters in Britain have been linked to population declines potentially caused by exposure to organochlorine insecticides (Williams, 1989; Jefferies and Hanson, 2000). These compounds are known to induce hypothyroidism, which affects vitamin A metabolism leading to hypovitaminosis A (Jefferies, 1975). In mammals, vitamin A deficiency is associated with ocular discharge, conjunctivitis, keratitis, and corneal hyperkeratosis, conditions that could explain the blindness observed in British otters (Jefferies and Hanson, 2000).

In the Brazilian Pantanal, agricultural activities are increasing over recent years. According to MapBiomas, a platform for mapping land use and cover in Brazil, agricultural land for crops increased by approximately 100,000 hectares between 2021 and 2023. These data underscore growing pressure on the Pantanal and the urgent need to implement sustainable land use practices to protect this ecoregion. Although agrochemical residue studies in giant otters are lacking, elevated mercury concentrations have been reported in fur samples from giant otters living in the same area where blind otters were observed in the southern Pantanal (Miranda River), suggesting potential toxicological risks (Soresini et al., 2021). While high concentrations of mercury are known to contribute to neurological effects, including central blindness, there is no evidence that mercury causes the specific ophthalmic abnormalities observed in Pantanal otters. Nonetheless, other environmental contaminants, such as pesticides, may contribute to ocular alterations, as reported in Eurasian otters (Williams et al., 2000). However, more detailed studies, including clinical evaluation and a complete ophthalmic examination are necessary to identify the prevalence and etiology of ocular pathologies in giant otters.

This study represents the first documented series of ocular disorder cases in free-ranging giant otters. Although limited by the absence of clinical diagnosis confirmed through detailed ophthalmic examinations, these findings presented here expand current knowledge of health issues affecting this endangered species. Furthermore, these conditions may be linked to multiple causes, including trauma, infections, parasitism, and exposure to environmental contaminants such as organochlorine insecticides. These observations highlight the need for comprehensive clinical and ecotoxicological investigations, especially considering the increasing anthropogenic pressures in the Pantanal. Future studies should aim to develop more effective capture techniques for this species, which would allow the safe collection of biological samples and enable accurate clinical and laboratory diagnoses, thereby improving understanding of the causes and prevalence of ocular and systemic disorders in giant otters.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Ethics statement

The animal study was approved by Embrapa Pantanal Committee on Ethics for the Use of Animals in Research. The study was conducted in accordance with the local legislation and institutional requirements. Written informed consent was obtained from the participant/patient(s) for the publication of this case report.

Author contributions

GS: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing – original draft, Visualization. NF: Data curation, Investigation, Methodology, Writing – review & editing, Visualization. AS: Data curation, Writing – review & editing, Validation. FD: Writing – review & editing, Investigation. CR: Writing – review & editing, Investigation. CL: Writing – review & editing. GM: Project administration, Resources, Supervision, Writing – review & editing.

Funding

The author(s) declare financial support was received for the research and/or publication of this article. This study was partially financed by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001, Doctoral Scholarship 1461215, and by the National Council for Scientific and Technological Development (CNPq), through project n. 485890/2013–5 and the CNPq/Fundect Pronex project n. 006/2015.

Acknowledgments

We thank the Federal University of Mato Grosso do Sul and Embrapa Pantanal for their logistical support. We also thank Stefan Grol for his invaluable help in providing information and pictures of one of the giant otters.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmamm.2025.1634280/full#supplementary-material

References

Bennett, T. J., and Barry, C. J. (2009). Ophthalmic imaging today: an ophthalmic photographer's viewpoint – a review. *Clin. Exp. Ophthalmol.* 37, 2–13. doi: 10.1111/j.1442-9071.2008.01812.x

Burns, R., Williams, E. S., O'Toole, D., and Dubey, J. P. (2003). *Toxoplasma gondii* infections in captive black-footed ferrets (*Mustela nigripes*), 1992–1998: clinical signs, serology, pathology, and prevention. *J. Wildl. Dis.* 39, 787–797. doi: 10.7589/0090-3558-39.4.787

Carter, S. K., and Rosas, F. C. W. (1997). Biology and conservation of the giant otter *Pteronura brasiliensis*. *Mamm. Rev.* 27, 1–26. doi: 10.1111/j.1365-2907.1997.tb00370.x

Clingerman, K. J., and Summers, L. (2005). Development of a body condition scoring system for nonhuman primates using *Macaca mulatta* as a model. *Lab. Anim.* 34, 31–36. doi: 10.1038/laban0505-31

Colitz, C. M. H., Renner, M. S., Manire, C. A., Doescher, B., Schmitt, T. L., Osborn, S. D., et al. (2010). Characterization of progressive keratitis in Otariids. *Vet. Ophthalmol.* 13, 47–53. doi: 10.1111/j.1463-5224.2010.00811.x

Colitz, C. M., Walsh, M. T., and McCulloch, S. D. (2016). Characterization of anterior segment ophthalmologic lesions identified in free-ranging dolphins and those under human care. *J. Zoo Wildl. Med.* 47, 56–75. doi: 10.1638/2014-0157.1

Colodetti, A. F. (2014). Distribuição geográfica histórica e recente da ariranha *Pteronura brasiliensis* (Carnivora, Mustelidae). [Masters Dissertation]. Espírito Santo, Brazil: Universidade Federal do Espírito Santo.

Conrad, P. A., Miller, M. A., Kreuder, C., James, E. R., Mazet, J., Dabritz, H., et al. (2005). Transmission of Toxoplasma: clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment. *Int. J. Parasitol.* 35, 1155–1168. doi: 10.1016/j.ijpara.2005.07.002

Dubey, J. P., and Thomas, N. J. (2011). *Sarcocystis neurona* retinochoroiditis in a sea otter (*Enhydra lutris kenyoni*). *Vet. Parasitol.* 183, 156–159. doi: 10.1016/j.vetpar.2011.06.022

Duplaix, N. (1980). Observations on the ecology and behavior of the giant river otter *Pteronura brasiliensis* in Suriname. *Rev. Ecol. (Terre Vie)* 34, 495–620. doi: 10.3406/revec.1980.4073

Duplaix, N., Evangelista, E., and Rosas, F. C. W. (2015). Advances in the study of giant otter (*Pteronura brasiliensis*): ecology, behavior, and conservation: a review. *Lat. Am. J. Aquat. Mamm.* 10, 75–98. doi: 10.5597/lajam00200

Echenique, J. V., Soares, M. P., Mascarenhas, C. S., Bandarra, P. M., Quadros, P., Driemeier, D., et al. (2018). *Lontra longicaudis* infected with canine parvovirus and parasitized by *Dioctophyma renale*. *Pesq. Vet. Bras.* 38, 1844–1848. doi: 10.1590/1678-5150-PVB-5744

Ferguson, J. D., Azzaro, G., and Licitra, G. (2006). Body condition assessment using digital images. *JDS* 89, 3833–3841. doi: 10.3168/jds.S0022-0302(06)72425-0

Foerster, N., Soresini, G., Paiva, F., Silva, F. A., Leuchtenberger, C., and Mourão, G. (2022). First report of myiasis caused by *Cochliomyia hominivorax* in free-ranging giant otter (*Pteronura brasiliensis*). *Rev. Bras. Parasitol. V.* 31, e009522. doi: 10.1590/S1984-29612022058

Foster-Turley, P., Macdonald, S. M., and Mason, C. F. (1990). *Otters: An Action Plan for their Conservation* (Gland, Switzerland: IUCN Otter Spec Group).

Gonchoroski, G. Z., Martin, A., Raphael, G., Rodrigues, L. A., Furtado, M. M., Mourão, G. M., et al. (2025). Intergroup conflict and myiasis-induced mortality in a giant otter from the Brazilian Pantanal: implications for population conservation. *IUCN Otter Spec. Group Bull.* 42, 63–70.

Groenendijk, J., Hajek, F., Schenck, C., Staib, E., Johnson, P. J., and Macdonald, D. W. (2015). Effects of territory size on the reproductive success and social system of the giant otter, south-eastern Peru. *J. Zool.* 296, 153–160. doi: 10.1111/jzo.12231

Groenendijk, J., Marmontel, M., Van Damme, P., Schenck, C., Schenck, C., and Wallace, R. (2021). *Pteronura brasiliensis* (The IUCN Red List of Threatened Species). doi: 10.2305/IUCN.UK.20213.RLTS.T18711A164580466.en

Harris, M., Tomas, W., Mourão, G., Silva, C. J., Guimarães, E., Sonoda, F., et al. (2005). Safeguarding the Pantanal wetlands: threats and conservation initiatives. *Conserv. Biol.* 19, 714–720. doi: 10.1111/j.1523-1739.2005.00708.x

Harshaw, L. T., Larkin, I. V., Bonde, R. K., Deutsch, C. J., and Hill, R. C. (2016). Morphometric body condition indices of wild Florida manatees (*Trichechus manatus latirostris*). *Aquat. Mamm.* 42, 428. doi: 10.1578/AM.42.4.2016.428

Inoshima, Y., Murakami, T., Ishiguro, N., Hasegawa, K., and Kasamatsu, M. (2013). An outbreak of lethal adenovirus infection among different otariid species. *Vet. Microbiol.* 165, 455–459. doi: 10.1016/j.vetmic.2013.04.013

Jefferies, D. J. (1975). "The role of the thyroid in the production of sublethal effects by organochlorine insecticides and polychlorinated biphenyls," in *Organochlorine Insecticides: Persistent Organic Pollutants*. Ed. F. Moriarty (Academic Press, London), 131–230.

Jefferies, D. J., and Hanson, H. M. (2000). "The role of dieldrin in the decline of the otter (*Lutra lutra*) in Britain: The analytical data," in *Abstract retrieved from Proceedings of the First Otter Toxicology Conference*. 95–143.

Kumar, V., Sankhyan, V., and Thakur, A. (2015). Ophthalmic diseases and disorders in free ranging rhesus macaque (*Macaca mulatta*) of Shivalik hill area of Himachal Pradesh, Northern India. *J. Med. Primatol.* 44, 89–96. doi: 10.1111/jmp.12165

Lange, R. R., Lima, L., Frühvald, E., da Silva, V. S. N., de Souza, A. S., and Montiani-Ferreira, F. (2017). Cataracts and strabismus associated with hand rearing using artificial milk formulas in Bengal tiger (*Panthera tigris* spp *tigris*) cubs. *Open Vet. J.* 7, 23–31. doi: 10.4314/ovj.v7i1.4

Leuchtenberger, C., Barocas, A., Thoisy, B., Ward, C., Evangelista, E., Michalski, F., et al. (2018). "Giant otter," in *The Global Otter Conservation Strategy*. Eds. N. Duplaix and M. Savage (IUCN/SSC Otter Specialist Group, Oregon), 74–81.

Leuchtenberger, C., and Mourão, G. (2009). Scent-marking of giant otter in the Southern Pantanal, Brazil. *Ethology* 115, 210–216. doi: 10.1111/j.1439-0310.2008.01607.x

Lipscomb, T. P., Harris, R. K., Moeller, R. B., Pletcher, J. M., Haebler, R. J., and Ballachey, B. E. (1993). Histopathologic lesions in sea otters exposed to crude oil. *Vet. Pathol.* 30, 1–11. doi: 10.1177/030098589303000101

Montiani-Ferreira, F., and Freeman, K. (2022). "Ophthalmology of mustelidae: otters, ferrets, skunks, raccoons, and relatives," in *Wild and Exotic Animal Ophthalmology: Volume 2: Mammals* (Springer International Publishing, Cham), 311–339.

Park, N. Y., Lee, M. C., Kurkure, N. V., and Cho, H. S. (2007). Canine adenovirus type 1 infection of a Eurasian river otter (*Lutra lutra*). *Vet. Pathol.* 44, 536–539. doi: 10.1354/vp.44-4-536

Pinto, R. M., Santos, L. C. D., Tortelly, R., Menezes, R. C., Moraes, W. D., Juvenal, J. C., et al. (2005). Pathology and first report of natural infections of the eye trematode *Philophthalmus lachrymosus* Braun 1902 (Digenea, Philophthalmidae) in a non-human mammalian host. *Mem. Inst. Oswaldo Cruz* 100, 579–583. doi: 10.1590/S0074-02762005000600012

Ribas, C., Damasceno, G., Magnusson, W., Leuchtenberger, C., and Mourão, G. (2012). Giant otters feeding on caiman: evidence for an expanded trophic niche of recovering populations. *Stud. Neotrop. Fauna E.* 47, 19–23. doi: 10.1080/01650521.2012.662795

Ribas, C., and Mourão, G. (2004). Intraspecific agonism between giant otter groups. *IUCN Otter Spec. Group Bull.* 21, 26–29.

Ripple, W. J., Estes, J. A., Beschta, R. L., Wilmers, C. C., Ritchie, E. G., Hebblewhite, M., et al. (2014). Status and ecological effects of the world's largest carnivores. *Science* 343. doi: 10.1126/science.1241484

Rodrigues, L. A., Leuchtenberger, C., and Silva, V. C. F. (2018). "*Pteronura brasiliensis* (Zimmermann 1780)," in *Livro Vermelho da Fauna Brasileira Ameaçada de Extinção: Volume II - Mamíferos* (ICMBio/MMA, Brasília), 370–375.

Rosas, F. C. W., and Mattos, G. E. (2003). Notes on giant otter (*Pteronura brasiliensis*) behavior in the lake of the Balbina hydroelectric power station, Amazonas, Brazil. *Lat. Am. J. Aquat. Mamm.* 2, 127–129. doi: 10.5597/lajam00042

Roth, G. S., Mattison, J. A., Ottinger, M. A., Chachich, M. E., Lane, M. A., and Ingram, D. K. (2004). Aging in rhesus monkeys: relevance to human health interventions. *Science* 305, 1423–1426. doi: 10.1126/science.1102541

Schweizer, J. (1992). *Ariranhas no Pantanal: Ecologia e comportamento da Pteronura brasiliensis* (Curitiba, Paraná: Edibran-Editora Brasil Natureza Ltda).

Shapiro, K., VanWormer, E., Packham, A., Dodd, E., Conrad, P. A., and Miller, M. (2019). Type X strains of *Toxoplasma gondii* are virulent for southern sea otters (*Enhydra lutris nereis*) and present in felids from nearby watersheds. *Proc. R Soc. B.* 286, 20191334. doi: 10.1098/rspb.2019.1334

Silva, M. L., Caiaffa, M. G., Da Costa, A. L. M., Teixeira, R. H. F., Ervedosa, T. B., MaChado, E. F., et al. (2023). Canine distemper virus and canine adenovirus type 1 co-infection in a free-living hoary fox (*Lycalopex vetulus*) from Brazil. *Braz. J. Microbiol.* 54, 587–595. doi: 10.1007/s42770-023-00921-7

Silveira, L., Furtado, M. M., Rosas, F. C. W., Silva, L. C. L. C., Cabral, M. M. M., Tôrres, N. M., et al. (2011). Tagging giant otters (*Pteronura brasiliensis*) (Carnivora, Mustelidae) for radio-telemetry studies. *Aquat. Mamm.* 37, 208–212. doi: 10.1578/AM.37.2.2011.208

Simeone, C. A., Colitz, C. M., Colegrove, K. M., Field, C. L., Rios, C., Chandler, H. L., et al. (2017). Subconjunctival antimicrobial poloxamer gel for treatment of corneal ulceration in stranded California sea lions (*Zalophus californianus*). *Vet. Ophthalmol.* 20, 441–449. doi: 10.1111/vop.12447

Soresini, G., da Silva, F. A., Leuchtenberger, C., and Mourão, G. (2021). Total mercury concentration in the fur of free-ranging giant otters in a large Neotropical floodplain. *Environ. Res.* 198, 110483. doi: 10.1016/j.envres.2020.110483

Tomas, W. M., Camilo, A. R., Ribas, C., Leuchtenberger, C., Borges, P. A. L., Mourão, G., et al. (2015). Distribution and conservation status of giant otter *Pteronura brasiliensis* in the Pantanal wetland, Brazil. *Lat. Am. J. Aquat. Mamm.* 10, 107–114. doi: 10.5597/lajam00202

Tomas, W. M., de Oliveira Roque, F., Morato, R. G., Medici, P. E., Chiaravalloti, R. M., Tortato, F. R., et al. (2020). Sustainability agenda for the Pantanal wetland: perspectives on a collaborative interface for science, policy, and decision-making. *Trop. Conserv. Sci.* 12, 1–30. doi: 10.1177/1940082919872634

Wallace, R. B., Reinaga, A., Groenendijk, J., Leuchtenberger, C., Hoops, H., Auccacusi Choque, L. V., et al. (2025). *Assessing an Aquatic Icon: A Range Wide Priority Setting Exercise for the Giant Otter (Pteronura brasiliensis)* (La Paz, Bolivia: Wildlife Conservation Society), 276 pp.

White, C. L., Lankau, E. W., Lynch, D., Knowles, S., Schuler, K. L., Dubey, J. P., et al. (2018). Mortality trends in northern sea otters (*Enhydra lutris kenyoni*) collected from the coasts of Washington and Oregon, USA, (2002–15). *J. Wildl. Dis.* 54, 238–247. doi: 10.7589/2017-05-122

White, C. L., Schuler, K. L., Thomas, N. J., Webb, J. L., Saliki, J. T., Ip, H. S., et al. (2013). Pathogen exposure and blood chemistry in the Washington, USA population of northern sea otters (*Enhydra lutris kenyoni*). *J. Wildl. Dis.* 49, 887–899. doi: 10.7589/2013-03-053

Williams, J. (1989). Blindness in otters. *IUCN Otter Spec. Group Bull.* 4, 29–30.

Williams, D. L., Flindall, A., and Simpson, V. (2000). "Ocular pathology in wild otters," in *Abstract retrieved from Proceedings of the First Otter Toxicology Conference*. 57–61.

Williams, D. L., Simpson, V. R., and Flindall, A. (2004). Retinal dysplasia in wild otters (*Lutra lutra*). *Vet. Rec.* 155, 52–56. doi: 10.1136/vr.155.2.52