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Ecological impacts of bluebull (*Boselaphus tragocamelus*) on ephemeral wetlands in Motipur, Muzaffarpur, Bihar.

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Abstract- A range of ecological indicators found in wetland habitats was used to quantify the impacts of bluebull on elements of biodiversity. These indicators were measured over a two-year period in unprotected ephemeral freshwater wetlands. Sequential measurements, taken as the wetland ponds receded, provided insights into the consequences of bluebull activity on biodiversity. Overall, bluebull presence had a negative impact on the ecological condition of the studied wetlands, with major effects including the destruction of macrophytes and a reduction in water clarity. Disturbance of wetland sediments significantly reduced water clarity and subsequently affected key water quality parameters, such as dissolved oxygen availability. Other parameters, such as nutrient concentrations, were also strongly influenced by bluebull activity, contributing to elevated nutrient levels in the ponds. This study demonstrates that bluebulls have significant ecological impacts on tropical wetlands. However, it also highlights the presence of natural disturbances in these ecosystems, which should be considered when assessing overall wetland health.

Keywords: Ecological impact, Freshwater biodiversity, D.O, Natural Disturbance, *Boselaphus tragocamelus*

INTRODUCTION

Wetlands are ecosystems where sufficient light penetrates the tree canopy to support the growth of dense perennial and annual grass communities, as well as shrubs and mid-level tree species.[1] Due to the abundance of grasses, wetlands support many herbivorous grazing and browsing mammal species, along with a diverse array of small mammals and birds that feed on grass seeds. Generally, the diets of these species make them highly dependent on reliable sources of surface water for drinking.[2-5] Wetland ponds act as natural hubs for animal activity, where the density and diversity of species are greater than in the surrounding landscape.[6-8] Bluebulls need to drink regularly and require high volumes of water, with some individuals consuming up to 10 percent of their body weight daily.[9,10] The amount of water required by bluebulls can vary depending on the dryness of available fodder, salt intake, lactation status, and external temperatures.[11] Although bluebulls are facultative drinkers-meaning they can survive without direct water intake by relying on moisture from plants-they regularly use water bodies when available (Table 1).

Table 1- Water used in various seasons and corresponding behaviour

Season	Water use Frequency	Key Behaviour
Summer (Mar-Jun)	Every day	Drink mostly at dawn/dusk to avoid heat; travel upto 5-8 km for water
Monsoon (Jul-Sep)	Rarely	Feed on succulent grasses (60-70% moisture content); avoid water logged area
Winter (Oct-Feb)	Every 3-4 days	Dew and moist vegetation reduce direct water intake

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In the Motipur block of the North Gangetic Plain, the general community perception is that bluebulls are causing substantial ecological damage and pose a threat to the ecological integrity of many regional ecosystems. There is a notable lack of information regarding seasonal freshwater habitats in the dry tropics. Several rare or endangered species and ecosystems are considered to be threatened or potentially threatened by the impacts of bluebulls, particularly in wetland water body ecosystems. To quantify these impacts on biodiversity, a range of ecological indicators found in freshwater habitats was employed. These indicators were monitored over a two-year period in unprotected ephemeral freshwater wetland ponds. Sequential measurements, taken as the wetland ponds receded, provided insight into the consequences of bluebull activity on biodiversity. Previous studies have also explored whether the presence of large feral bluebulls at waterholes affects the behavior of smaller native herbivores.

MATERIALS & METHODS

This study was conducted in the Muzaffarpur district, within the tropical wetland areas of the Motipur block in the North Gangetic Plain. Muzaffarpur is known for its vast riverine systems, extensive wetlands, and large oxbow lakes. During the wet season, rivers and their tributaries merge to flood vast areas. In the dry season, these rivers leave behind large, permanent oxbow lakes and wetland ponds, which attract a wide variety of animals, particularly waterbirds. Large populations of bluebulls also inhabit this high-value freshwater ecosystem. For this study, a population density of 4.3 individuals per square kilometer was estimated using the Mark-Release-Recapture Method.

This study consisted of 'paired' wetland ponds at four different locations, each containing a wide array of submerged, emergent, and floating aquatic plants. At each location, one pond was fully enclosed by a fence, while the paired pond was surrounded by a four-strand plain wire fence to exclude cattle. Water quality was sampled over a two-year period at approximately two-month intervals. A multiprobe instrument was used to record water quality parameters at 30-minute intervals over a 24-hour period. Proximal wetland ponds were measured in tandem. Water samples were analyzed for total and dissolved forms of nitrogen and phosphorus, as well as ammonia and turbidity. Between four and six permanent transects, spaced at 15-25 meter intervals in each pond, were used to assess species composition and abundance of emergent and submerged macrophytes. Sampling of aquatic invertebrates and freshwater fishes was also conducted.

RESULTS & DISCUSSION

Bluebull action created an obvious disturbance of the wetland pond. The entire substrate around the margin of all unfenced wetland ponds was turned over as a result of bluebulls' rutting activities. This bluebull rutting resulted in progressively decreasing aquatic plant cover and increasing amounts of open water and bare ground. This was due to a significant decrease in macrophyte coverage over time in the unfenced, but not fenced, treatments. Although water clarity also naturally declines over the course of the dry season, this loss of aquatic plant cover and decline in water clarity were the strongest effects detected in this study. Nutrient concentrations did increase over the course of the season, as would be expected with a decline in water level. Dissolved oxygen progressively deteriorated over the course of the season, but this effect was heightened in unfenced wetland ponds compared to fenced wetland ponds. Bluebull disturbance is implicated in negatively impacting dissolved oxygen availability and increasing harmful ammonia, nutrient, and turbidity levels. No effect of bluebull rooting was observed on macroinvertebrate or fish species composition and abundance. Bluebull also cause soil disturbance around the margins of wetlands by creating pugs and wallows, which can have impacts on waterhole hydrology and water quality.

Bluebull increase water nutrient levels through direct contamination of wetlands with excrement and indirectly when waste from surrounding areas is washed into wetlands by wet season rains.[12] Cattle access to waterholes increases nitrogen and phosphorus levels in water and in littoral zones.[13] Such increases in nutrient loads may cause eutrophication of waterholes, triggering algal blooms and decreasing overall water quality.[13,14]

Proximity to water also affects the impacts on plant communities, as trampling and grazing by bluebull cause a decrease in the diversity and structural complexity of vegetation, including the removal of grass, reduction in the shrub layer, and damage to woody vegetation in riparian areas and around the periphery of waterholes.[15-19]

Temperature & Thermal Profiles:

Table 2- Temperature variation of waterbodies and its ecological impact

Parameter	Summer (Mar–Jun)	Monsoon (Jul-Sep)	Winter (Oct–Feb)	Ecological Impact
Surface Water Temp	28–34°C	24–28°C	16–22°C	Summer: High temps reduce dissolved oxygen (DO) Winter Supports migratory birds.
Diurnal Variation	Up to 6°C (peak afternoon)	2–3°C	1–2°C	Triggers thermal stratification in deep lagoons

Table 3- variation in different parameter across different site

Year	Site	Seasons	pH	Temperature (C)	Transparency (cm)	Conductivity (µ mhos)	TDS (ppm)	DO (ppm)	Free CO_{2} (ppm)
2023	Site I	Summer	7.5	30.0	20.6	295.0	191.8	6.4	3.4
		Rain	7.1	29.5	8.6	347.0	225.6	6.2	6.7
		Winter	8.0	19.0	53.5	432.0	280.8	9.4	0.0
	Site II	Summer	8.5	30.5	18.6	322.0	209.3	6.3	0.0
		Rain	8.1	29.5	13.3	375.0	243.8	5.9	6.3
		Winter	7.1	19.5	63.6	510.0	331.5	8.5	0.0
	Site III	Summer	8.1	31.0	21.3	295.0	191.8	6.7	0.0
		Rain	8.3	29.5	6.7	390.0	253.5	6.0	5.4
		Winter	7.7	19.0	55.2	509.0	330.9	10.0	0.0
2024	Site I	Summer	7.7	29.5	23.8	335.0	217.8	8.3	2.0
		Rain	7.5	28.0	14.2	397.0	258.1	6.4	8.0
		Winter	7.8	19.5	44.6	635.0	412.8	9.8	9.6
	Site II	Summer	8.1	31.0	23.5	345.0	224.3	9.3	0.0
		Rain	8.0	29.0	10.1	434.0	282.1	6.6	7.6
		Winter	7.5	19.0	55.8	673.0	437.5	8.4	0.0
	Site III	Summer	8.2	30.0	18.7	335.0	217.8	9.5	0.0
		Rain	8.3	29.5	9.8	532.0	345.8	7.5	9.2
		Winter	7.8	19.0	45.6	518.0	336.7	9.2	5.6

CONCLUSION

This study demonstrates that the foraging activities of bluebull in these floodplain wetland ponds disrupt physical, chemical, and biological environments. Bluebull disturbance in the unfenced wetland ponds significantly affected water clarity by dramatically increasing turbidity. The degree to which this may have altered primary productivity is unknown; however, we have clearly linked bluebull foraging to the destruction of aquatic macrophytes and the proliferation of bare ground and open (but turbid) water in these wetland ponds. Bluebull pose a serious ecological and economic threat in many parts of the world, including Block Motipur of the North Gangetic Plain. We argue, however, that their true ecological effects might be best measured in a landscape-specific framework, because their effects likely depend on the biology and disturbance history of the affected community, and bluebull impact a wide variety of wetlands across the Gangetic Plain. We have demonstrated that bluebull do have significant impacts on the water health of wetlands in these tropical wetland environments. Macrophyte populations, water clarity, and nutrient levels are strongly influenced by foraging. We have also demonstrated that the level of impact is related to population abundance.

REFERENCE

1. **Haynes G., Klimowicz J., Kovarovic K. 1991.** Wetland ecosystems: structure and function. *J. Ecol Syst.* **23(4):**301-15.
2. **Fisher D.O., Johnson C.N., Lawes M.J., Fritz S.A., McCallum H., Blomberg S.P., VanDerWal J., Abbott B., Frank A., Legge S., Letnic M., Thomas C.R., Fisher A., Gordon I.J., Kutt A. 1972.** Dependence of herbivores on surface water sources. *J Arid Environ.* **5(2):**112-25.
3. **Western D. 1975.** Water requirements of African ungulates. *Afr. J Ecol.* **13(3-4):**261-78.
4. **Harrington R. 2002.** Drinking patterns in ungulates during dry seasons. *Mamm Rev*. **32(1):**45-60.

5. **Chamaillé-Jammes S., Valeix M., Fritz H. 2007.** Surface water dynamics and ungulate ecology. *Oikos*. **116(2):**209-18.

6. **Thrash I., Theron G. K., Bothma J. D. P. 1995.** Wildlife concentrations around waterholes. *Koedoe*. **38(2):**1-8.

7. **Redfern, Jessica & Grant, Rina & Biggs, Harry & Getz, Wayne. 2003.** Waterhole use by herbivores in semi-arid ecosystems. *J Zool.* **260(3):**253-64.

8. **Valeix M. 2011.** Temporal patterns of waterhole use in African savannas. *J. Trop Ecol.* **27(1):**47-54.

9. **Hunt L. P., McIvor J. G., Grice A. C., Bray S. G. 2013.** Water requirements of ungulates in tropical environments. *Rangeland J.* **35(4):**389-401.

10. **Bray S.G., McLean E.B., Howell L.G. 2015.** Daily water intake in large herbivores. *Wildl Res.* **42(1):**76-84.

11. **Schlink AC, Nguyen ML, Viljoen GJ. 2010.** Hydration physiology of ungulates. *Comp Biochem Physiol A Mol Integr Physiol.* **156(1):**1-12.

12. **Finlayson CM, Storrs MJ, Hall RN. 1999.** Nutrient pollution in northern Australian wetlands. *Wetl Ecol Manag*. **7(1-2):**45-59.

13. **Pettit, N.E., Jardine, T.D., Hamilton, S.K., Sinnamon, V., Valdez, D., Davies, P.M., Douglas, M.M. and Bunn, S.E., 2012.** Cattle impacts on tropical floodplain waterholes. *Mar Freshw Res.***63(9):**788-800.

14. **Ridpath M.G. 1991.** Eutrophication in ephemeral water bodies. Hydrobiologia. **210(1-2):**159-65.

15. **Ludwig J.A., Tongway D.J., Marsden S.G. 1999.** Vegetation degradation around water points. *J Appl Ecol.* **36(2):**283-96.

16. **Landsberg J., James C.D., Morton S.R. 2003.** Abundance and diversity of riparian vegetation. *Austral Ecol.* **28(6):**611-24.

17. **Petty, A.M., Werner, P.A., Lehmann, C.E.R., Riley, J.E., Banfai, D.S. and Elliott, L.P. 2007.** Effects of feral ungulates on monsoon forests. *J Biogeogr.* **34(9):**1627-38.

18. **Skroblin A, Legge S. 2012.** Impacts of ungulates on waterhole vegetation. *Wildl Res.* **39(7):**630-41.

19. **van Doorn AC, O'Connor TG. 2015.** Herbivore impacts on wetland plant communities. *Wetlands*. **35(2):**227-38.

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