

Sustaining Lake Victoria by Navigating Environmental and Social Governance Dimensions of Cage Culture in Tanzania



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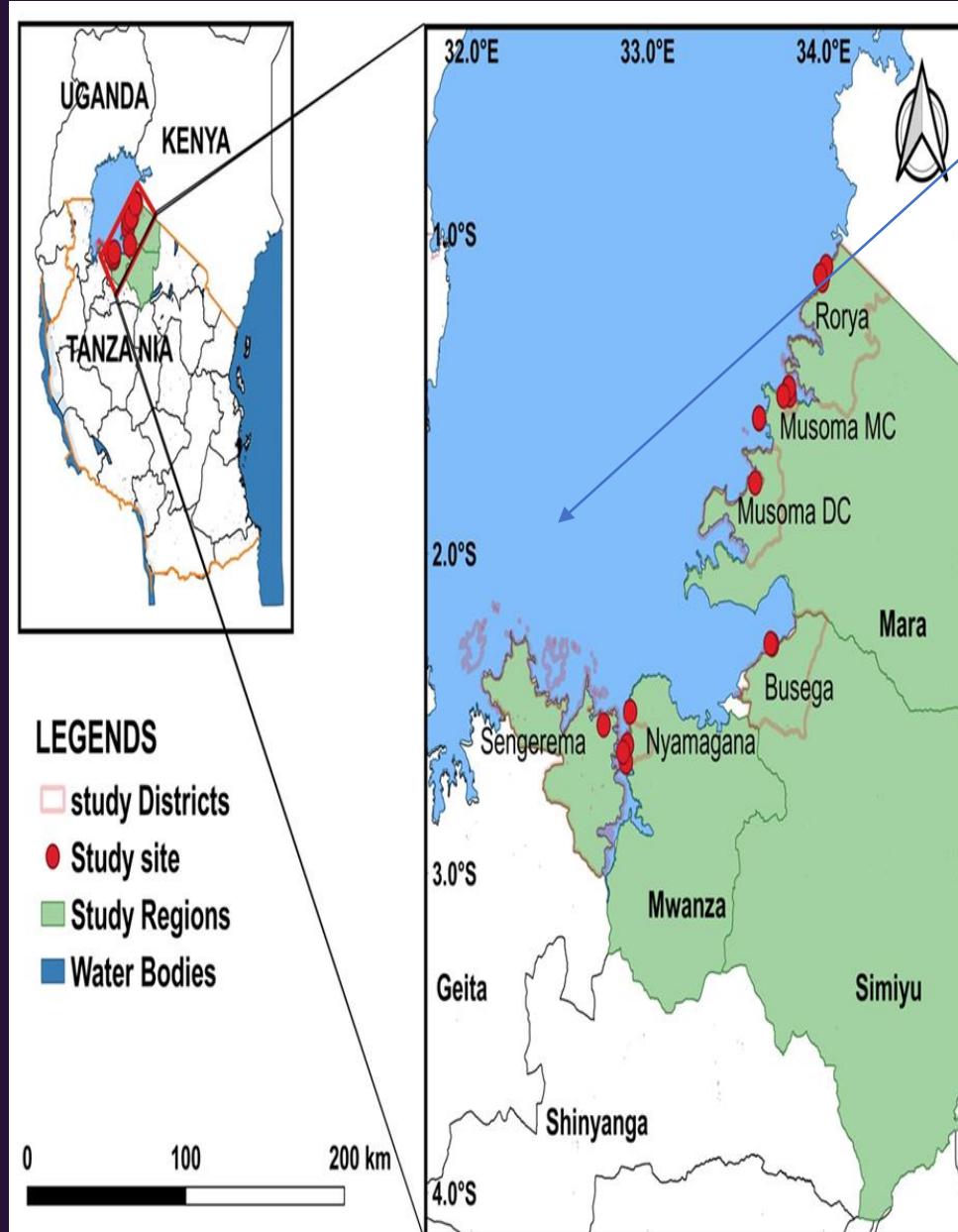
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Background

Lake Victoria, the world's largest tropical lake, sustains 40 million East Africans but faces declining wild fish stocks (-30% since 2010) amid rising demand (+5%/year) and existing eutrophication pressures. Cage farming of Nile tilapia has tripled production in Tanzania's Mwanza Gulf as a blue economy solution, yet its open-water wastes threaten hypoxia, nutrient enrichment, and fisher conflicts in this shared, stressed ecosystem. This study quantifies environmental impacts at cages, social tensions (conflict reports), and governance gaps to identify science-based pathways ensuring cage culture delivers food security without compromising Lake Victoria's ecological integrity.

Methodology



Study Area & Design ; Nyamagana show of Mwanza Gulf; comparative cross-sectional, 3 zones.

Sampling Zones (SOP-AQ-WQ-001)

- Cage zone (≈ 8 m)
- 50 m away from cages (≈ 10 m)
- 100 m (away from cages ≈ 15 m)

Environmental Sampling

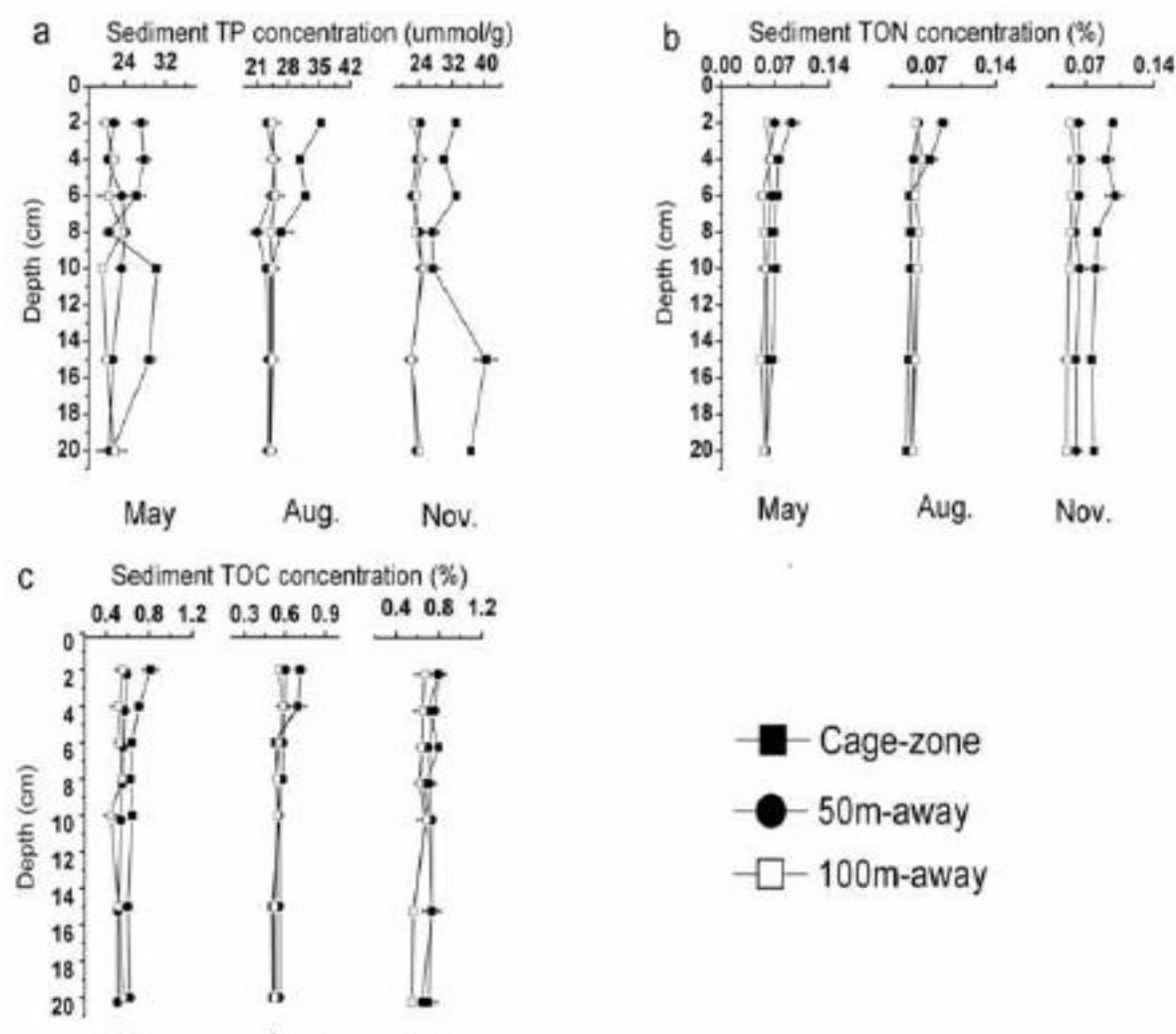
- ✓ Fish Health
- ✓ *Oreochromis niloticus* ($n=20$ / zone);



Results

Time	Parameter	Cage-zone	50m-away	100m-away
MAR 2025	WT (°C)	25.6 ± 0.9	25.4 ± 0.8	25.3 ± 0.8
	pH	7.7 ± 0.3	7.6 ± 0.2	7.5 ± 0.2
	DO (mg/L)	5.4 ± 0.5	5.7 ± 0.4	5.8 ± 0.4
	TP (mg/L)	0.09 ± 0.02	0.07 ± 0.01	0.06 ± 0.01
	NH ₃ (mg/L)	0.05 ± 0.01	0.04 ± 0.01	0.03 ± 0.01
MAY 2025	WT (°C)	25.4 ± 0.7	25.2 ± 0.6	25.1 ± 0.6
	pH	7.6 ± 0.2	7.5 ± 0.2	7.4 ± 0.2
	DO (mg/L)	5.2 ± 0.6	5.9 ± 0.4	6.0 ± 0.4
	TP (mg/L)	0.08 ± 0.02	0.06 ± 0.01	0.05 ± 0.01
	NH ₃ (mg/L)	0.08 ± 0.02	0.03 ± 0.01	0.02 ± 0.01
AUG 2025	WT (°C)	25.2 ± 0.8	25.0 ± 0.7	24.9 ± 0.7
	pH	7.8 ± 0.3	7.6 ± 0.2	7.5 ± 0.2
	DO (mg/L)	4.8 ± 0.7	5.5 ± 0.5	5.7 ± 0.5
	TP (mg/L)	0.10 ± 0.02	0.07 ± 0.01	0.06 ± 0.01
	NH ₃ (mg/L)	0.10 ± 0.03	0.04 ± 0.01	0.03 ± 0.01

Nutrient loading was confirmed: NH₄⁺ 0.08-0.10 mg/L
Hypoxia risk: DO 4.8-5.2 mg/L < 5 mg/L threshold (May-Aug 2025)
Feed waste dominant: 60% uneaten feed + fish feces drive pollution
TP critical: 0.10 mg/L (90% EIA limit) across seasons



- Sediment impact: OM $\uparrow 33\%$ under cages ($2.35 \pm 0.37\%$)
- Phytoplankton shift: Cyanophytes 85-95% \rightarrow hyacinth resurgence risk
- Human waste unmonitored: Additional N/P loading unidentified
- Monitoring gap: Only 28% have equipment
- Biosecurity failure: 22% compliance
- Carrying capacity: 0% site limits defined



CHALLENGES

- Nutrient loading \rightarrow hypoxia, cyanophyte blooms, hyacinth risk
- Pathogen spillover threatens wild fish health
- Social-governance gaps limit monitoring & biosecurity
- Carrying capacity undefined

WAY FORWARD

- Real-time water quality monitoring
- Science-based cage density limits
- Precision feeding waste reduction
- Mandatory biosecurity training

ACKNOWLEDGEMENTS

