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Epizootic Ulcerative Syndrome in the Democratic Republic of Congo (2013–2025): Epidemiological Review, Risk Factors, and Implications for Aquatic Animal Health

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Abstract

Epizootic Ulcerative Syndrome (EUS), caused by *Aphanomyces invadans*, is an emerging aquatic fungal disease responsible for high mortalities among freshwater fish. In the Democratic Republic of Congo (DRC), the first confirmed cases were reported in 2013 in farmed *Clarias* species from Kasangulu (Kongo Central Province). This study synthesizes national data from 2013 to 2025, mapping confirmed outbreaks and identifying key risk factors such as floods, seasonal fish movements, and migratory birds. Findings emphasize the urgent need to strengthen diagnostic capacity, establish structured epidemiological surveillance, and enhance awareness among fish farmers and veterinary authorities to prevent further disease spread.

Keywords: Epizootic Ulcerative Syndrome; *Aphanomyces invadans*; Democratic Republic of Congo; Aquatic Animal Health; Surveillance; Fish Diseases

1. Introduction

Fishing and aquaculture play a crucial role in food security and livelihoods globally. In sub-Saharan Africa, fish account for about 22% of total animal protein intake, reaching up to 50% in vulnerable communities where alternative sources of animal protein are scarce [1,3]. Fish provide high-quality protein and essential micronutrients at a relatively low cost [2].

The expansion of aquaculture has been accompanied by the emergence and spread of infectious diseases of viral, bacterial, parasitic, and fungal origin—some of which have zoonotic potential [4]. Among these, Epizootic Ulcerative Syndrome (EUS), caused by the oomycete *Aphanomyces invadans*, is recognized as one of the most devastating diseases affecting global aquaculture [5]. The infection produces severe dermal ulcers and massive mortalities, rendering fish unsuitable for consumption and causing significant economic losses [14,20]. The disease is listed by the World Organisation for Animal Health (WOAH) as notifiable due to its epidemic potential [6,15].

First described in Japan in 1971 [7], EUS rapidly spread to Asia, Oceania, Africa, and the Middle East, sparing only Central and South America. Since its emergence, more than 160 fish species across 54 families have been identified as susceptible to *A. invadans* [10]. Economic losses are significant, with annual estimates of USD 0.7 million in Australia, USD 100 million over a decade in Thailand (1983–1993), USD 4.8 million in Bangladesh, USD 0.3 million in Pakistan, and USD 0.235 million in Indonesia [14,20].

In Central Africa—particularly within the Congo River Basin—several EUS outbreaks have been reported, indicating progressive spread through interconnected water systems [14]. However, unlike developed countries with structured surveillance, the DRC lacks a coordinated epidemiological monitoring system despite abundant freshwater resources. This study therefore aims to document and synthesize all available data on confirmed and suspected EUS cases, identify key risk factors, and propose context-adapted preventive and control strategies to support national aquatic health policy and food security.

2. Methodology

2.1 Study Design

A descriptive retrospective and prospective study was conducted covering the period from 2013 to April 2025. Data sources included national surveillance systems, field investigation reports, laboratory records from the Central Veterinary Laboratory (CVL), and provincial notifications.

2.2 Case Definition

Suspected case: Fish with ulcerative lesions compatible with EUS as described in WOAH and FAO manuals [6,12]. Confirmed case: Detection of *Aphanomyces invadans* via histopathology, PCR, or accredited expert analysis [5,11].

2.3 Variables Collected

Variables included fish species affected, health status, outbreak location, clinical signs, laboratory confirmation method, period of occurrence, and control measures.

Table 1. Temporal and spatial distribution of EUS outbreaks in the DRC (2013–2025)

Period of occurrence	Province	Location / Water body	Fish species	Status
Apr–May 2013	Kongo Central	Kasangulu / Pond	Clarias spp.	Confirmed (histopathology)
Dec 2015	Bas-Uélé	Buta / Streams and rivers	Catfish and others	Non-confirmed
Dec 2015	Haut-Uélé	Aketi / Streams and rivers	Catfish and others	Non-confirmed
Dec 2015	Nord-Ubangi	Gbadolite / Ubangi River	Catfish and others	Non-confirmed
Sept 2015	Tshopo	Ubundu	Catfish and others	Non-confirmed
Sept 2015	Ituri	Ituri River	Catfish and others	Non-confirmed
Mar 2015	Gemena	—	Catfish and others	Non-confirmed
Mar 2016	Tshopo	Kisangani / Congo River	Catfish and others	Non-confirmed
Mar 2016	Haut-Lomami	Kabongo / River	Tilapia spp. and others	Non-confirmed
Mar 2016	Haut-Lomami	Kamina / River and ponds	Tilapia spp. and others	Non-confirmed
Mar 2016	Haut-Lomami	Bukama / Congo River	Tilapia spp. and others	Non-confirmed
Mar 2016	Haut-Lomami	Malemba-Nkulu /	Tilapia spp. and others	Non-confirmed

		Rivers and ponds		
Jun 2016	Maniema	Mpangi–Kayuyu / Barrage ponds and Mabibi stream	Tilapia spp. and others	Confirmed (clinical observation)
Jun 2016	Lualaba	Sandoa / River	Tilapia spp. and others	Non-confirmed
Jul 2016–Mar 2017	Tshuapa	Ikela, Lofome, Botayi, Sengele / Rivers	Various	Non-confirmed
Mar 2017	Kinshasa	N'sele / Congo River (Maluku)	Wild fish with and without scales	Non-confirmed
Jul 2022	Kinshasa	Kimpoko / Ponds	Tilapia spp.	Non-confirmed
Jun 2022	South Kivu	Uvira / Streams near Lake Tanganyika	Clarias spp., Heterobranchus spp.	Confirmed (clinical observation)
Jan 2022	Kongo Central	Kisantu	Clarias spp.	Non-confirmed
Sept 2019	Kinshasa	Mont Ngafula	Clarias spp.	Non-confirmed

2.4 Data Analysis

Data were cleaned in Excel and analyzed using Epi Info™ 7 software. Results were presented as frequencies, temporal trends, and spatial distribution maps. Seasonality and species susceptibility were also assessed.

3. Results and Discussion

3.1 Seasonality of Outbreaks

Outbreaks were concentrated during rainy seasons, with strong correlation to hydrological patterns [14,20].

Table 2. Seasonality of EUS outbreaks by province

Province	Rainy season	Dry season	Period of outbreak
Kongo Central	Oct–May	Jun–Sept	Apr–May 2013
Bas-Uélé	Apr–Nov	Dec–Mar	Dec 2015
Haut-Uélé	Mar/Apr–Nov	Dec–Feb	Dec 2015
North Ubangi	Apr–Nov	Dec–Mar	Dec 2015
Tshopo	Year-round (peaks Mar–May, Sep–Nov)	Troughs Jan–Feb, Jun–Jul	Sept 2015
Ituri	Year-round (peaks Mar–May, Sep–Nov)	Mild trough Dec–Feb	Sept 2015
Gemena	Apr–Nov	Dec–Mar	Mar 2015
Haut-Lomami	Oct–Apr/May	May–Sept	Mar 2016
Maniema	Almost year-round (peaks Mar–May, Sep–Nov)	Short dry Jan–Feb, Jun–Aug	Jun 2016
Tshuapa	Year-round (peaks Mar–May, Sep–Nov)	Troughs Jan–Feb, Jun–Aug	Jul & Mar
Kinshasa	Oct–May	Jun–Sept	Mar, Jul, Sept
Lualaba	Oct–Apr/May	May–Sept	Jun 2016

3.2 Confirmed vs. Unconfirmed Cases

Only three outbreaks were confirmed by laboratory methods. Others were based on clinical signs alone [5,9].

Table 3. Confirmed and unconfirmed EUS cases in the DRC (2013–2025)

Year	Locality	Fish species affected	Status (Confirmed/Unconfirmed)
2013	Kasangulu (Kongo Central, ponds)	Clarias sp.	Confirmed (histopathology)
2016	Mpangi (Maniema, river & Congo River)	Clarias sp., *Tilapia* sp.	Confirmed (clinical observation)
2018	Bas-Uélé (rivers & streams)	Various species	Not confirmed
2019	Haut-Uélé (rivers & streams)	Various species	Not confirmed
2021	South Ubangi (rivers & streams)	Various species	Not confirmed
2022	Uvira (South Kivu, streams near Lake Tanganyika)	Clarias sp., *Heterobranchus* sp., *Oreochromis niloticus*	Confirmed (clinical observation)

3.3 Clinical Manifestations

Figure 1. Clinical signs of EUS in fish: ulcerative lesions on flanks and head, hemorrhagic patches, necrosis [9,11].

3.4 Risk Factors and Spread

Seasonal flooding and water stagnation create favorable conditions for *A. invadans* proliferation [14,17]. Migratory birds may contribute to pathogen dissemination [23,26]. Lack of structured surveillance and diagnostic capacity remains a major limitation.

3.5 Regional Comparison

Patterns observed in the DRC mirror those in Nigeria, Zambia, and Botswana, where interconnected water systems facilitate pathogen spread [14,22].

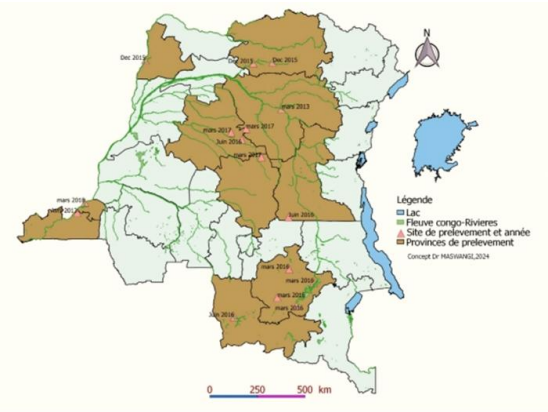

Figure 2. Map of confirmed and suspected EUS outbreaks in the DRC (2013–2025), produced in QGIS.

4. Conclusion

EUS is now endemic in the DRC, with outbreaks linked to seasonal hydrology and limited diagnostic capacity. The disease threatens aquaculture development and food security. A national response is urgently needed.

5. Recommendations

- Establish a national aquatic disease surveillance system
- Strengthen laboratory capacity for histopathology and PCR
- Promote best aquaculture practices and biosafety
- Foster regional collaboration to prevent transboundary spread
- Conduct socio-economic impact assessments

6. Author Contributions

P.M.M. conceived and designed the study, coordinated data collection, and wrote the first draft of the manuscript.

D.Y.N. and T.B.M. contributed to data analysis, field investigations, and the preparation of figures and tables.

T.T.A., M.T.S., and P.M. participated in laboratory confirmation and data verification.

T.M.C.G. and M.M.K.L. provided technical guidance and critical revision of the manuscript. M.A.B. and M.J. contributed to scientific validation, data interpretation, and final manuscript review.
All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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8. Conflicts of Interest and Funding Statement

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

1. Kurien J, Willmann R. Fisheries and food security. Rome: FAO; 2013.

2. Shankar D, Halls A, Barr J. Fisheries in sub-Saharan Africa: A critical review. J Afr Fish Sci. 2004;22(2):121–30.

3. Food and Agriculture Organization of the United Nations (FAO). The state of world fisheries and aquaculture. Rome: FAO; 2009.

4. Pathiratne A, Jayasinghe J, Amerasinghe P. Emerging fish diseases in aquaculture: A review. Aquacult Int. 2001;9(6):467–80.

5. Herbert R, Lilley J, Woo PTK. Epizootic ulcerative syndrome (EUS) in fish: biology, pathology and diagnosis. J Fish Dis. 2019;42(1):1–15.

6. World Organisation for Animal Health (WOAH). Aquatic Animal Health Code. Paris: WOAH; 2023.

7. McKenzie RA, Hall WF. Ulcerative disease of fish in Japan. Bull Jpn Soc Sci Fish. 1976;42(3):247–52.

8. Baldock FC, Blazer V, Callinan R, Hatai K, Karunasagar I, Mohan CV, et al. Outcomes of a short expert consultation on epizootic ulcerative syndrome (EUS). FAO Fish Tech Pap. 2005;(402):1–55.

9. Roberts RJ, Willoughby LG, Chinabut S. Mycotic aspects of epizootic ulcerative syndrome (EUS) of Asian fishes. J Fish Dis. 1994;17(6):273–7.

10. Lilley JH, Callinan RB, Chinabut S, Kanchanakhan S, MacRae IH, Phillips MJ. Epizootic ulcerative syndrome (EUS) technical handbook. Bangkok: AAHRI; 1992.

11. Huchzermeyer KDA, Van der Waal BC. Epizootic ulcerative syndrome: histopathology and differential diagnosis. J S Afr Vet Assoc. 2017;88(1):1–9.

12. World Organisation for Animal Health (WOAH). Manual of diagnostic tests for aquatic animals. Paris: WOAH; 2023.

13. Lilly JH, Roberts RJ, Chinabut S. Differential diagnosis of ulcerative fish diseases. Aquaculture. 1998;158(3–4):191–202.

14. Chinabut S, Roberts RJ, Willoughby LG, Pearson M. Spread of epizootic ulcerative syndrome in Africa. Fish Pathol. 2009;44(3):137–42.

15. OIE. Epizootic Ulcerative Syndrome (EUS). In: Manual of Diagnostic Tests for Aquatic Animals. Paris: World Organisation for Animal Health; 2018.

16. FAO. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome: Food and Agriculture Organization; 2020.

17. Subasinghe RP, Arthur JR, Bartley DM. Aquatic Animal Health Management: Emerging Risks and Challenges. FAO Fisheries Circular. Rome: FAO; 2021.

18. Lilley JH, Phillips MJ. Responsible Movement of Live Aquatic Animals. FAO Fisheries Technical Paper. Rome: FAO; 2017.

19. Chinabut S, Roberts RJ, Willoughby LG, Pearson MD. Histopathology of epizootic ulcerative syndrome in fish from southeast Asia. J Fish Dis. 1995;18:41–47.

20. Haque MM, et al. Socio-economic impacts of epizootic ulcerative syndrome in Bangladesh. Aquaculture. 1999;188(1–2):147–159.

21. Roberts RJ, Campbell B, MacRae IH. Epizootic ulcerative syndrome—the current position. In: Aquatic Animal Health and the Environment. Manila: Asian Fisheries Society; 1992. p. 431–436.

22. Callinan RB, Paclibare JO, Bondad-Reantaso MG, Chin JC. *Aphanomyces invadans* sp. nov., the etiological agent of epizootic ulcerative syndrome in Asian and Australian fish. J Fish Dis. 1995;18(3):273–276.

23. Fraser GC, Callinan RB. *Aphanomyces* species associated with red spot disease in estuarine fish in eastern Australia. Dis Aquat Org. 1993;16:163–170.

24. Blazer VS, Dethloff GM, Braham RP, et al. Ulcerative mycosis in Atlantic menhaden from estuaries of the eastern United States. Dis Aquat Org. 2002;50:57–65.

25. van West P. *Saprolegnia parasitica*, an oomycete pathogen with a fishy appetite: new challenges for an old problem. Mycologist. 2006;20(3):99–104.

26. Bondad-Reantaso MG, McGladdery SE, East I, Subasinghe RP. Asia diagnostic guide to aquatic animal diseases. FAO Fisheries Technical Paper 402. Rome: FAO; 2001.