

Mass Mortality of Water Buffalo *Bubalus bubalis* (Artiodactyla: Bovidae) in Indonesia: A Two-Decade Retrospective

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Abstract

Water Buffalo *Bubalus bubalis* are an essential livestock species in Indonesia. However, mass mortality events have been reported in recent years, highlighting the need for better understanding and management of the causes of these cases. This study presents the first comprehensive retrospective analysis of *B. bubalis* mortality events in Indonesia between 2010 and 2025. Data were compiled from scientific reports, government records, media coverage, and citizen science platforms. A total of 34 documented events were identified, with most attributed to infectious diseases, particularly *Septicemia Epizootica* (SE) caused by *Pasteurella multocida*. Environmental stressors such as floods and droughts, along with parasitic infections like Surra, were also contributing factors. Mortality peaks occurred in 2013 and 2023, each involving hundreds of deaths in single outbreaks. These findings underscore the urgent need for region-specific disease surveillance, vaccination programs, and improved husbandry practices.

Keywords: *Bubalus bubalis*, disease outbreak, Indonesia, *Pasteurella multocida*, *Septicemia Epizootica*.

Introduction

Wetlands are habitats with saturated or flooded soils that sustain a wide variety of plant and animal life (Setiawan *et al.* 2020; Arya 2025). These environments, which include marshes, swamps, and floodplains, are critical to maintaining ecological balance and providing essential services like water filtering, flood control, and habitat for a wide range of species (Halls 1997; Setiawan *et al.* 2019). In Indonesia, Water Buffalo *Bubalus bubalis* are frequently found in wetland areas, as they feed on aquatic vegetation and contribute to environmental balance (Minervino *et al.* 2020; Prihandini *et al.* 2023). The presence of buffalo in wetlands additionally concurs with nutrient cycling since their excrement functions as a natural fertilizer, promoting vegetation growth (Doan *et al.* 2014; Fusco *et al.* 2025).

Water Buffalo *Bubalus bubalis* are widely distributed across Indonesia, with significant populations found in rural areas of Sumatra, Kalimantan, Java, Bali, and Sulawesi (Murni *et al.* 2020; Suhardi *et al.* 2023). The interaction between *B. bubalis* and wetland ecosystems in Indonesia is complex and mutually beneficial (Muhakka *et al.* 2019). The wetlands provide *B. bubalis* with a suitable habitat

and a rich source of food, supporting the livestock industry and the livelihoods of local communities (Tsuji *et al.* 2022). They are often kept in smallholder farms and are an integral part of the agricultural landscape, providing meat, milk, and draft power for rural communities (Indrayani *et al.* 2023).

In recent years, Indonesia has witnessed multiple mass mortality incidents in *B. bubalis*, emphasizing the need for a better knowledge and control of the root causes (Tarmudji 2023). Mass mortality events in *B. bubalis* can have serious economic and social consequences for farmers, communities, and the Indonesian livestock industry (de Vries 1979). The unforeseen elimination of a large number of *B. bubalis* might cause financial losses for farmers, threatening their livelihoods and may lead to poverty (Budiono *et al.* 2018). Furthermore, large death events might raise food security problems, as *B. bubalis* provide an essential supply of meat and milk for local communities (Maheswarappa *et al.* 2024). Evidence-based research may reduce the effects of mass mortality occurrences while also promoting the long-term viability of *B. bubalis* populations in Indonesia. This research will preserve and analyze records of mass mortality in *B. bubalis* in Indonesia, with an emphasis on historical causes and contributing variables.

Methods

This study used a retrospective approach to document and analyze records of mass mortality events in *Bubalus bubalis* in Indonesia. We compile and review all records of information on mass mortality *B. bubalis* in Indonesia. The methods were adopted from previous study regarding published information and use citizen science platform (Iqbal *et al.* 2024, 2025). The following methods were employed:

1. Data Collection: Records of mass mortality events in *B. bubalis* were collected from various sources, including: news articles and online reports, scientific literature and research papers, government reports and databases (e.g., Ministry of Agriculture, Ministry of Health), livestock associations and farmer organizations, and citizen science.
2. Inclusion Criteria: Mass mortality events were defined as incidences where at least 10 *B. bubalis* died in a short period (≤ 1 month) in a particular location. The analysis considered only those incidents with clear data on the number of morbidity and mortality location, along with probable causes.
3. Data Analysis: Collected records were analyzed to identify patterns and trends in mass mortality events, including: temporal and spatial distribution of events, the causes and contributing factors (e.g., disease, environmental factors, management practices), and demographic characteristics of affected populations.
4. Causal Analysis: Potential causes of mass mortality events were investigated through a review of existing literature and expert consultations. Causes were categorized into: infectious diseases (e.g., bacterial, viral, parasitic), environmental factors (e.g., heat stress, flooding, drought), and management-related factors (e.g., nutrition, husbandry practices)

By using a comprehensive approach to collect and analyze records of mass mortality events, this study aims to provide a robust understanding of the historical causes and contributing factors of these events in Indonesia, ultimately informing strategies to mitigate their impacts and promote the sustainability of *B. bubalis* populations.

Results and Discussion

The information on *B. bubalis* mass mortality events in Indonesia is summarized in Table 1. The study documented numerous mass mortality events *B. bubalis* across Indonesia from 2010 to 2025, revealing significant regional and temporal variability (Table 1 and Fig. 1). These events were driven by diverse causes, including infectious diseases, environmental stressors like droughts and floods, and poor management practices. The findings highlight the widespread impact of these occurrences on livestock populations, rural livelihoods, and wetland ecosystems. The table below summarizes the recorded incidents, including locations, dates, number of *B. bubalis* affected, and identified causes, providing a comprehensive overview of the challenges faced by *B. bubalis* populations in Indonesia.

Table 1. Documented causes of mass mortality events in Water Buffalo *Bubalus bubalis* from 2010-2025 in Indonesia. Number on the table refer to the map (Figure 1). Note: Ind (individual), SE (*Septicemia Epizootica*), Env (environmental factors) and Surra (An animal disease caused by *Trypanosoma evansi* and spread by blood-sucking flies).

No.	Location	Date	Number of Buffalos	Cause of Mortality	Sources
1	Aceh Barat, Aceh	Jul 2019	5 Ind	SE	Detikcom 2019
2	Nagan Raya, Aceh	Apr 2019	>20 Ind	SE	Waspadaaceh 2019
3	Simeulue, Aceh	Aug 2021	15 Ind	SE	Agus 2021
4	Aceh Tengah, Aceh	Aug 2013	>10 Ind	SE	Lintasgayo 2013
5	Gayo Lues, Aceh	2013-2015	960 Ind	SE	Lintasgayo 2015
6	Aceh Singkil, Aceh	Aug 2019	>20 ind	SE	Jaya 2019
7	Padang Lawas, N. Sumatra	Jan 2023	332 Ind	SE	Analisdailly 2023
8	Mandailing Natal, N. Sumatra	Jan 2023	>10 Ind	SE	Romulo 2023
9	Rokan Hulu, Riau	Oct 2022	114 Ind	SE	Siregar 2022
10	Kampar, Riau	Sep 2024	c. 100 Ind	SE	Adha 2024
11	Kuantan Singigi, Riau	May 2023	c. 100 Ind	SE	Tanjung & Wismabrata 2023
12	Batanghari, Jambi	Sep 2011	55 Ind	SE	Wibisono 2011
13	Batanghari, Jambi	Jan 2013	17 Ind	SE	Supriyadi 2013
14	Batanghari, Jambi	Jan 2024	100 Ind	SE	Atrio 2024
15	Sarolangun, Jambi	Dec 2022	c. 100 Ind	SE	Sarolangunkab 2022
16	Sarolangun, Jambi	Jul 2025	>10 Ind	SE	Damanik 2025
17	Merangin, Jambi	Nov 2022	c. 100 Ind	SE	Fahrurozi 2022
18	Bengkulu Utara, Bengkulu	Jul 2025	232 Ind	SE	Firmansyah 2025
19	Bengkulu Tengah, Bengkulu	Feb 2025	>20 Ind	SE	Erwan 2025
20	Bengkulu, Bengkulu	Dec 2024	25 Ind	SE	Rismawarni 2024
21	Musi Rawas Utara, S. Sumatra	May 2023	c. 50 Ind	SE	Prasetyo 023
22	Empat Lawang, S. Sumatra	Apr 2024	50 Ind	SE	Farel 2024
23	Lahat, South Sumatra	Apr 2025	50 Ind	SE	Pahlevi 2025
24	Banyuasin, S. Sumatra	May 2024	16 Ind	SE	Maulana 2024
25	Ogan Komering Ilir, S. Sumatra	Apr 2024	431 Ind	SE	Baiduri 2024
26	Tulang Bawang, Lampung	Aug 2022	>50 Ind	Unknown	Triyono 2022
27	Kuningan, West Java	Jan 2022	16 Ind	SE	Mustawan 2022
28	Hulu Sungai Utara, S. Kalimantan	Dec 2010	>50 Ind	Env. factor	Kompas 2011
29	Hulu Sungai Utara, S. Kalimantan	Dec 2017	c. 10 Ind	Possibly SE	Farid 2017
30	Poso, Central Sulawesi	Oct 2022	50 Ind	Env. factor	Hassan 2022
31	Mandalika, W. Nusa Tenggara	Sep 2021	19 Ind	SE	Radarmandalika 2021
32	Sumba Timur, E. Nusa Tenggara	Feb 2018	>20 Ind	SE	Supartika & Dartini 2019
33	Sumba Timur, E. Nusa Tenggara	Jul 2012	79 Ind	Surra	Lodu 2012
34	Sumba Timur, E. Nusa Tenggara	Jun 2015	c. 20 Ind	Surra	Ndoen 2015

The documented cases of mass mortality events in *Bubalus bubalis* in Indonesia reveal a concerning trend of disease outbreaks and environmental factors contributing to significant losses in *B. bubalis* populations. According to the records, the majority of mass mortality events were attributed to infectious diseases, particularly those caused by bacterial pathogens such as *Pasteurella multocida*, which is known to cause *Septicemia Epizootica* (Fig. 2 and 3).

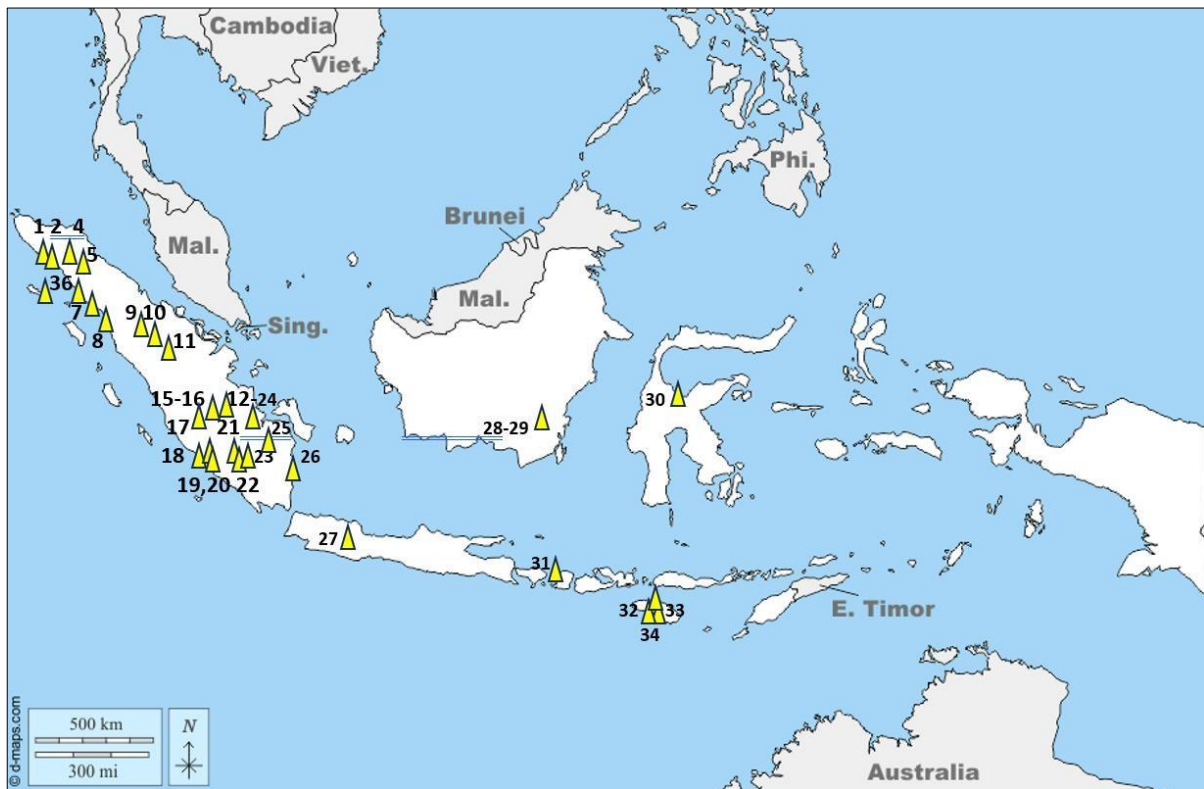


Figure 1. The map illustrates distribution of mass mortality events Water Buffalo *Bubalus bubalis* in Indonesia. Numbers on the map correspond to those listed in Table 1.



Figure 2. A buffalo that abruptly died due to *epiticia epizootica* in April 2024 in Ogan Komering Ilir District, South Sumatra Province, Indonesia (Photograph: Arfan Abrar).

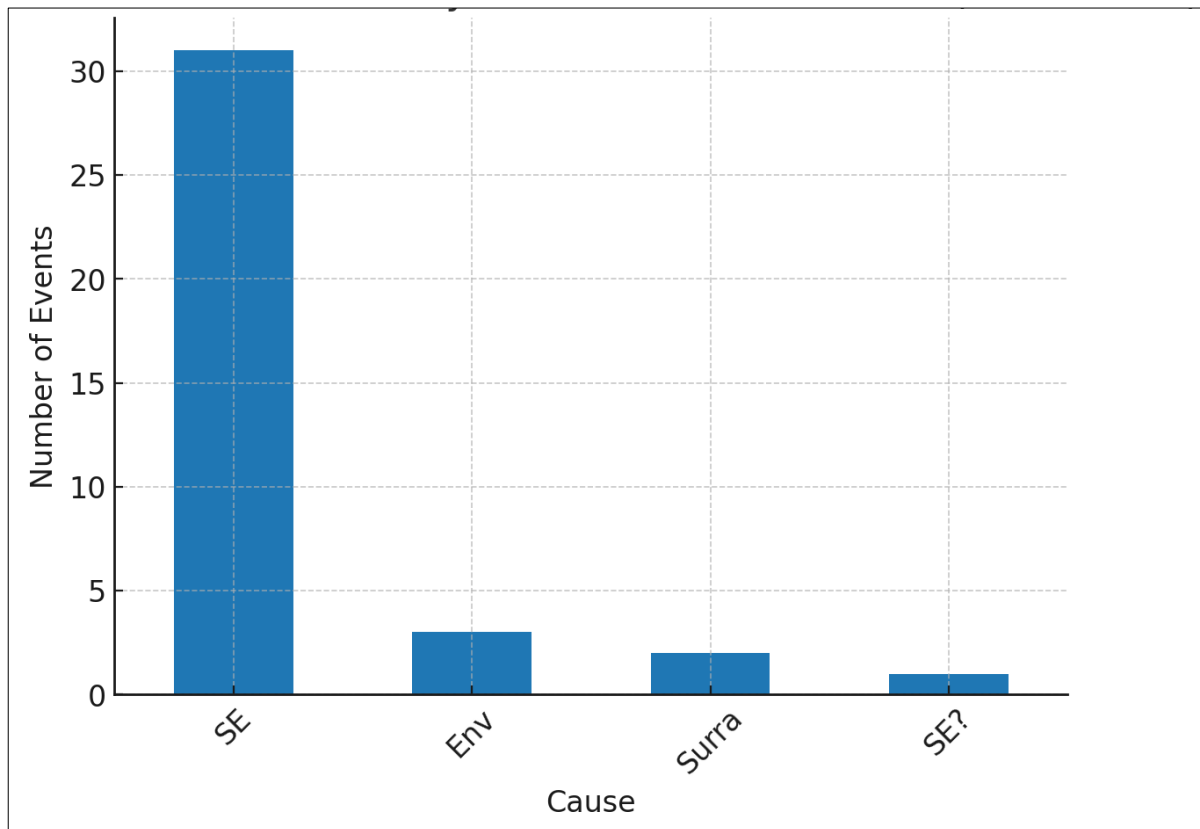


Figure 3. Causes of mass mortality events in Water Buffalo *B. bubalis* in Indonesia (2010-2025). Note: SE (*Septicemia Epizootica*), Env (environmental factors) and Surra (An animal disease caused by *Trypanosoma evansi* and spread by blood-sucking flies).

The retrospective analysis of *B. bubalis* mortality events in Indonesia between 2010 and 2025 demonstrates a fluctuating but alarming trend. As shown in the time-series graph, mortality peaks occurred in 2013 and 2023, with more than several hundred deaths recorded in single outbreaks (Fig. 4). Particularly severe incidents were documented in Aceh (2013–2015) and South Sumatra (2024), where large herds were lost due to *Septicemia pizootica* (SE) (Lintasgayo 2015; Baiduri 2024). These recurrent peaks indicate that despite awareness of *B. bubalis* disease threats, preventive measures and management strategies remain insufficient in many regions (Tarmudji 2023).

The distribution of causes, illustrated in the bar chart, highlights that infectious diseases—especially SE caused by *Pasteurella multocida*—dominate as the leading contributor to mass mortality events. Similar observations have been reported in earlier studies of livestock diseases in Indonesia (de Vries 1979; Payne *et al.* 1991). Environmental factors such as droughts and floods, although less frequent, also played a significant role in exacerbating *B. bubalis* deaths, particularly in flood-prone areas of Kalimantan and Sulawesi (Kompas 2011; Hassan 2022). Interestingly, parasitic diseases such as Surra were recorded mainly in eastern Indonesia (Sumba), confirming previous accounts of *Trypanosoma evansi* outbreaks in the region (Lodu 2012; Supartika & Dartini 2019). These findings suggest that *B. bubalis* mortality is not merely a veterinary concern but also an ecological and socio-economic issue tied to landscape and climate variability (Muhakka *et al.* 2019; Arya 2025).

From a management perspective, the patterns underline the urgent need for region-specific disease surveillance and vaccination programs. Farmers in wetland-rich areas face higher risks of bacterial outbreaks following seasonal flooding, while drier regions may encounter vector-borne diseases such as Surra. Improved husbandry practices, early-warning systems, and stronger veterinary extension services are critical in reducing the frequency and severity of such events (Minervino *et al.* 2020; Prihandini *et al.* 2023). Given the buffalo's cultural and economic importance, particularly for smallholder farmers (Indrayani *et al.* 2023; Tsuji *et al.* 2022), mitigating mortality risks is essential for food security and rural livelihoods in Indonesia.

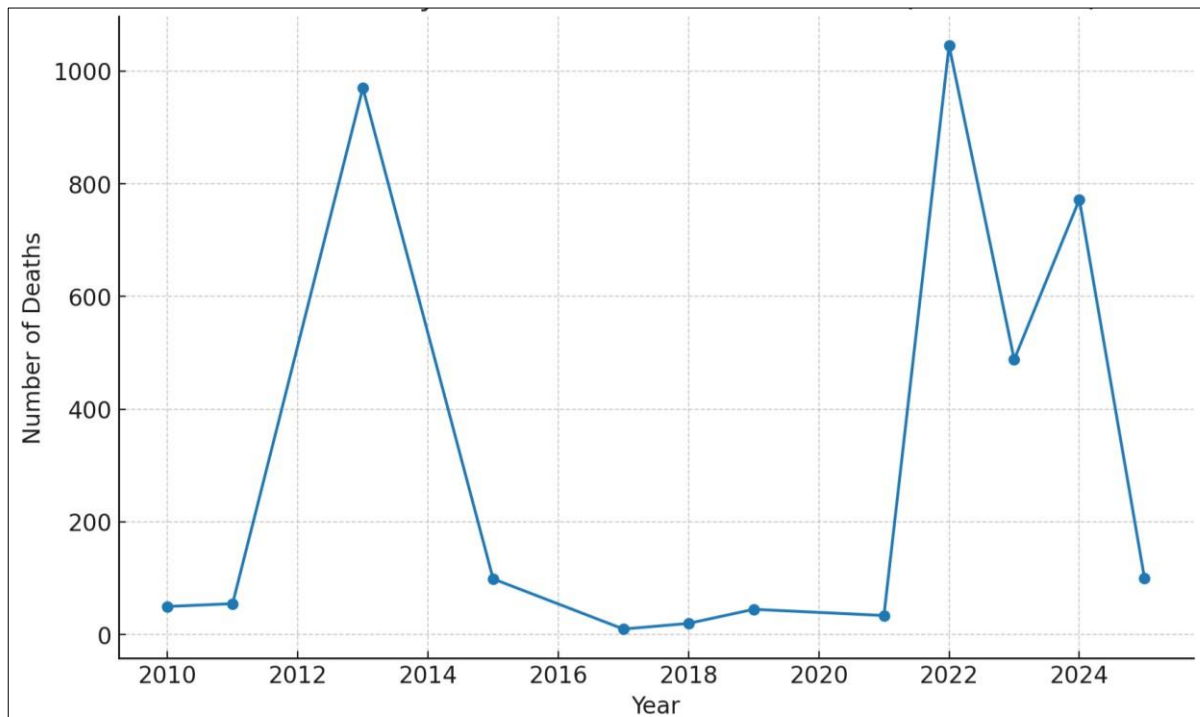


Figure 4. Mass mortality of Water Buffalo *B. bubalis* Indonesia (2010-2025).

This is the first complete retrospective review of mass mortality episodes in *B. bubalis* in Indonesia during the last two decades. The research clearly shows that infectious diseases, particularly *Septicemia epizootica*, are still the leading cause of death, with environmental stresses and parasite infections also playing important roles. These findings highlight the critical need for integrated disease surveillance, improved veterinarian services, and adaptive management techniques that take into account both ecological and socioeconomic factors. Protecting *B. bubalis* populations is crucial not only for preserving Indonesian livestock diversity, but also for supporting rural communities' livelihoods, food security, and cultural legacy. The study underscores the urgent need for a multidisciplinary approach to mitigate mass mortality events by addressing root causes such as infectious diseases and environmental stresses, providing a foundation for more effective policies, veterinary practices, and community-based programs. Future research will focus on developing predictive models for mass mortality events by integrating disease epidemiology, climate data, and socioeconomic variables, while also piloting programs for disease surveillance, vaccination campaigns, and capacity building among local farmers and veterinarians. Collaboration with policymakers will be prioritized to translate findings into actionable strategies that enhance the resilience of *B. bubalis* populations across Indonesia and prepare them to face future challenges.

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