

## INFORMATION FLOW DURING CULMINATION OF ONLINE PUBLIC DISCOURSE BASED ON THE ODER RIVER ENVIRON- MENTAL DISASTER

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### ABSTRACT

**Aim:** Determining the trend of changes of public discussions during an ecological disaster on the example of the Odra River disaster at the peak of attention.

**Methods:** Posts on news portals and social media published on August 10-12, 2022 were retrospectively monitored using the Brand24 tool for Internet and social media monitoring. The time period was chosen due to the highest activity of users publishing under the hashtag "Odra" (Oder river)/ "śnięte ryby" (fishkill). The 100 most popular mentions (according to Brand24 sorting algorithms) each day were qualified for analysis.

**Results:** The nature of the posts shows a pattern where initially the public looks for substantive information, then, after assessing the threat, humorous materials are created, and finally, they lose interest in the experts' positions and look for the culprits on their own. About 20% of data is clickbait content (not related to the topic but

just being in line with the fame). Most of them occur at the beginning of the topic's popularity, then their number gradually decreases. The majority (54%) of the data has negative sentiment (with greater engagement on social media). In addition to providing entertainment in humorous posts, they point out current problems and absurdities that make it impossible to help the population or may lead to a threat to life and health.

**Conclusions:** Understanding local risks and building resilience to natural and anthropogenic disasters requires greater engagement with the social sciences or ONE and public health. It is important to integrate knowledge of sociolinguistic processes and grassroots movements into the activities of crisis management teams and sanitary/veterinary services to more effectively monitor and respond to water and other biohazard emergencies.

**Keywords:** Oder river disaster, one health, health communication, crisis communication, infodemic

## INTRODUCTION

The death of approximately 360 tons of fish and lower organisms was caused by a significant toxic bloom of invasive algae (golden algae), the multiplication of which was probably made possible by the high salinity and high temperature of the Oder in the first half of August 2022 (Free et al., 2023). The disaster affected the region from the Opole region through Lower Silesia, Lubush, the Polish-German border, up to the Szczecin Lagoon, which is shared with Germany and connected to the Baltic Sea. Reports of the European Commission (Free et al., 2023) and Polish Control Institute (NIK, 2023) suggest, within the area of veterinary and sanitary competences: i) ensuring the flow of information between services and inspections and the public; ii) assessing water monitoring solutions, including the use of modern technologies; iii) introduction of a nationwide/regional system supporting management in a crisis situation, including communication. Additionally the Oder, or rather its tributaries, overflowed its banks, causing local flooding at the turn of 2023/24 on the Polish and German sides (Jarynowski et al., 2024), which also caused a small but noticeable discourse in the media in the context of One Health.



Fig. 1. Timeline of the whole catastrophe in Polish media before and during the investigated time period. Own research based on public information available.

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## SOCIO BIOLOGICAL BACKGROUND

However, European crisis management plans still mainly focus on known threats (Gawlik-Kobylińska, 2022; Urych et al., 2022). Our observations emphasise the need to develop comprehensive response strategies in water crisis situations, which, among others, include the protection of aquatic and terrestrial animals. The Oder river disaster was one the largest ecological water disasters in Europe in recent 10 years (Free et al., 2023), despite the low number of human casualties directly resulting from them. Climate change and anthropogenic factors such as war are making Europe a worse place of events unknown to the current or previous generations (Maksymowicz, 2023). On the one hand, biological and natural science studies develop a biomedical model of the world, e.g. how to create nature, stimulate natural resources so that they can serve humans, as well as how to manage this process from a purely operational perspective (Konczal & others, 2016). On the other hand, specialists from single health services and inspections (Kędzierski, 2022) encounter problems in communicating with lay people who do not have substantive knowledge but expect action at the same time. This gap has been known in sociomedical analyses for a long time, showing the difference in understanding medical problems between professionals, guided by academic knowledge and experience based on evidence, and laypeople who, in their assessment, refer to their own resources of common knowledge, mainly family and loved ones “lay referral system” (Freidson, 1988) and nowadays also based on information from the Internet (Zhao et al., 2022). Biological ignorance and the authorities’ implementation of social expectations without involving field experts in decision-making may lead to bizarre events involving animals, where strong emotions such as fear and panic prevail (Oelke et al., 2023).

The interconnections of water, food and human security are explored in the “socio- ecological systems” and “socio-hydrology” paradigms (Vanelli et al., 2022). Managing ecosystems with water features very often causes conflict between bio/ecocentrists, who focus on the functions of the entire biological system, and anthropocentrists, who put the system’s usefulness for people first. For example, an intense discourse between the camps concerns the acceptance of poisoning the water environment with pharmaceutical products due to the primacy of human health (which in the long run negatively affects human health, including through the development of antibiotic-resistant bacteria (Maksymowicz, 2023)), or in the context of regulating rivers and building hydrological structures, due to the primacy of shipping and energy (Zawadka, 2023). Modern research using modern modeling techniques or artificial intelligence leads to the creation of different definitions of ecosystems with water elements, which entails different actions towards them and establishes different networks of relationships with people (Jarynowski, 2014). Water creates a sense of interdisciplinarity and complexity of ecological considerations (Falkenmark, 2020). The name of the region Śląsk comes from the Proto-Slavic name of the Odra tributary Ślęza, meaning wet. The Proto-Slavics were a river- lake nation, which is why historically the use of fish protein gave them an advantage over other neigh-

bouring tribes being purely agricultural dependent on grains (Sauer, 1952). In addition, water ecological risk (Rosiek, 2015), to an obvious escalation due to climate change in the last few years, manifested itself in Poland in the form of flood risk/flooding and drought.

## METHODOLOGY

Data was extracted from the Brand24 programme in the form of an Excel file with links to mentions. The same tool was used to analyse the flooding phenomena in Poland in 2019 (Domalewska, 2019) and 2024 (Jarynowski et al., 2024). Using media monitoring and analysis tools, it was possible to trace the events of water state and mass fishkill on the Oder and its tributaries. Differences were noticed in the order of records when sorting in the extracted data and it was decided to adopt a popularity sorting system in the analysing programme, not in the extracted data.

The first 100 most popular records (according to the arbitrary sorting engines of Brand24) of a given day contain available posts have been analysed. This list did not include deleted or unavailable content. The contribution of this data was negligible.

Timeliness and precision for early warning One health event detection and its importance (infoveillance) and its impact on the society (infodemiology) from data left by people on the Internet is crucial for crisis management harm reduction (Springer et al., 2021). Our focus is the integration of human, animal, and ecosystem health with interactive computational social science and digital epidemiology approaches. Fluctuations in the popularity of particular types of information were examined as new facts became available to the public. Keywords selected were fish/fishes/fishkill (ryba/ryby/śnięte ryby), Oder (Odra). Data collection was performed prospectively in 2022, however analysis was performed in winter 2023/2024, thus some mentions were not available to retrieve (are counted in the total number of mentions and sentiment/reach were calculated, but were not included in qualitative analysis). Selected (non-representative, non-triangulated) material was qualitatively analysed. List of topics labelled manually in a first reading:

- experts (referring to experts)
- political charges
- looking for the guilty (who is responsible)
- clickbait/memes (memotics, humour)
- biological impact of catastrophic

After primary analysis of the selected material, the content was divided by a 3-person team into the following groups:

- Allegations against nationwide politicians
- Accusing local authorities

- Neutral (informational) communications
- Expert judgements
- Humorous content
- Clickbait

We have chosen the cumulation of the interest from 10.08 (when attention was mainly regional - Lubush and Lower Silesia) through 11.08 (escalation to all-country group of interest) and finally 12.08 (when most of literate Polish population heard the first time about the problem) [Fig. 2].

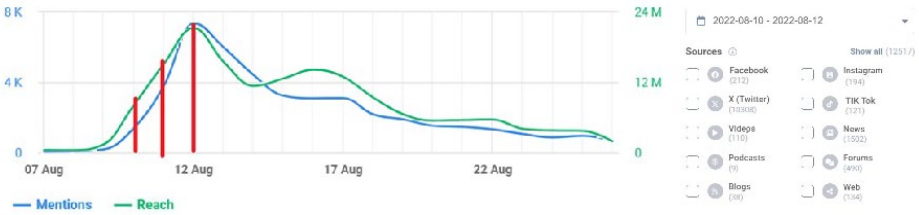


Fig. 2. Mentions timeline and their structure (given medium). Own research with use of Brand24 tool

A sample of the most popular 300 mentions contains multiple media sources from News/Forums to various social media mainly Twitter [Fig. 2]. Until 12.08 the cause of the fishkill had not been revealed yet so the public were playing at “detectives”.

## RESULTS

Let us analyse the discourse day by day and synthesise all information gathered.

### Day 10.08

According to previous analysis, 10.08 is further propagation on local media and regional social media [Fig. 1]. Only now nationwide environmental organisations are getting involved. Thus, we can see a sharp increase in published material since that date. Political organisations from Western Poland have been activated [Tab. 1].

Table 1  
Examples of social media posts from August 10. Mentions: 1399, reach: 8 736 592

Allegations against central politicians	Accusing local authorities	Neutral (informational) communications	Expert judgements
Opposition politicians point out the mistakes of the ruling party's politicians (twitter.com <sup>1</sup> )	Recalling the failure of the "Czajka" sewage treatment plant (twitter.com <sup>2</sup> )	Information update by influencer (instagram.com <sup>3</sup> ) A Polish social media user publishes reports about the disaster in English to reach more people (tiktok.com <sup>4</sup> )	Dead fish in the Oder River. Expert: it could be toxic substances (wp.pl <sup>5</sup> ) Compilation of the most important information in a short, accessible form (instagram.com <sup>6</sup> )

Source: own adaptation of various media sources

- 1 [https://twitter.com/CrowdMedia\\_PL/status/1557622463902765056](https://twitter.com/CrowdMedia_PL/status/1557622463902765056)
- 2 <https://twitter.com/JakubWende/status/1557390276498440193>
- 3 [https://www.instagram.com/p/ChFW\\_ckI7tN/?img\\_index=1](https://www.instagram.com/p/ChFW_ckI7tN/?img_index=1)
- 4 <https://www.tiktok.com/@sleepylaurka/video/713021977959558682>
- 5 <https://wiadomosci.wp.pl/sniete-ryby-w-odrze-problem-powazniejszy-niz-zakladano-6799869134408672a>
- 6 [https://www.instagram.com/p/ChF9JgRjBWn/?img\\_index=7](https://www.instagram.com/p/ChF9JgRjBWn/?img_index=7)

Day 11.08

On 11.08 an infodemic started [Tab. 2]. Nationwide traditional media propagate fake news (i.e. rumour about Mercury or draining water from retention reservoirs by people in power who "knew" about leakage of toxic substances).

Table 2  
Examples of social media posts from August 11. Mentions: 3 771, reach: 15 074 301

Allegations against nationwide politicians	Accusing local authorities	Neutral (informational) communications	Experts judgements
Public and political figures' outrage and calls for accountability (twitter.com <sup>7</sup> ) Accusing the national authorities of shifting responsibility to local governments (instagram.com <sup>8</sup> )	Appeal to dismiss the president of the Wody Polskie (instagram.com <sup>9</sup> )	Sanitary warning: fish from Oder not suitable for consumption (rmf24.pl <sup>10</sup> )	Environmental and economic costs (money.pl <sup>11</sup> )

Source: own adaptation of various media sources.

- 7 <https://twitter.com/KraginsekZawadz3/status/1557772937284952066>
- 8 [https://www.instagram.com/p/ChIUyqwIPR9/?img\\_index=1](https://www.instagram.com/p/ChIUyqwIPR9/?img_index=1)
- 9 <https://www.instagram.com/p/ChIQsyiMPbC>
- 10 [https://www.rmf24.pl/regiony/wroclaw/news-sanepid-ostrzega-ryby-z-odry-nie-nadaja-sie-do-spozycia,nId,6214171#crp\\_state=1](https://www.rmf24.pl/regiony/wroclaw/news-sanepid-ostrzega-ryby-z-odry-nie-nadaja-sie-do-spozycia,nId,6214171#crp_state=1)
- 11 <https://www.money.pl/gospodarka/sniete-ryby-i-bobry-na-odrze-oto-na-co-wskazuje-uwage-ekspert-6800217115834880a.html>

Day 12.08

On 12.08 nationwide media storm erupts (mainly on social media) in Poland and the topic lost its regional character [Tab. 3].

Table 3

*Examples of social media posts from August 12. Mentions: 7 347, reach: 25 290 737*

Allegations against nationwide politicians	Accusing local authorities	Neutral (informational) communications	Expert judgments
The ruling party avoids answering because it is associated with the company responsible for poisoning the river (t.me <sup>12</sup> )	The Oder River was poisoned by a company with the permission of Wody Polskie? (t.me <sup>13</sup> )	Oder contamination: what's happening in national parks and in Szczecin (onet.pl <sup>14</sup> )	Dr. Paweł Oglecki: "The ecosystem will not recover in 10-15 years" (rmf24.pl <sup>15</sup> )

Source: own adaptation of various media sources

12 <https://t.me/ruchoporupolska/5305>

13 <https://t.me/wolnemediia/8176>

14 <https://www.onet.pl/turystyka/onetpodroze/co-sie-dzieje-w-parkach-narodowych-nad-odra-i-w-szczecinie/m88wwrj,07640b54>

15 <https://www.rmf24.pl/podcasty/rozmowy/audio,aId,3248281>

### Data Integration

We see the change in discourse with time [Tab. 4].

Table 4

*Leading topic in particular groups of mentions during the culmination of online public discourse*

Type of mention	10.08.2022	11.08.2022	12.08.2022
Allegations against nationwide politicians	criticism of the most important politicians in the country, accusations of failure to react - the same character during all three days		
Accusing local authorities	tagging state authorities responsible for the environment, calling to take a stand	allegations of procedural irregularities against various persons in managerial positions	
Neutral (informational) communications	information on probable sources of complaint, determination of toxicity to humans	information chaos about the mercury content in the Oder	
Expert judgments	identification of toxins, marking such information with the hashtag #mezytylen	discussion about the state of natural disaster	consequences of Oder contamination for the entire ecosystem
Humorous content	criticism of the government's lack of response	criticism of the government's defense strategy	criticism of government decisions; community states that they were taken too late

Source: own research

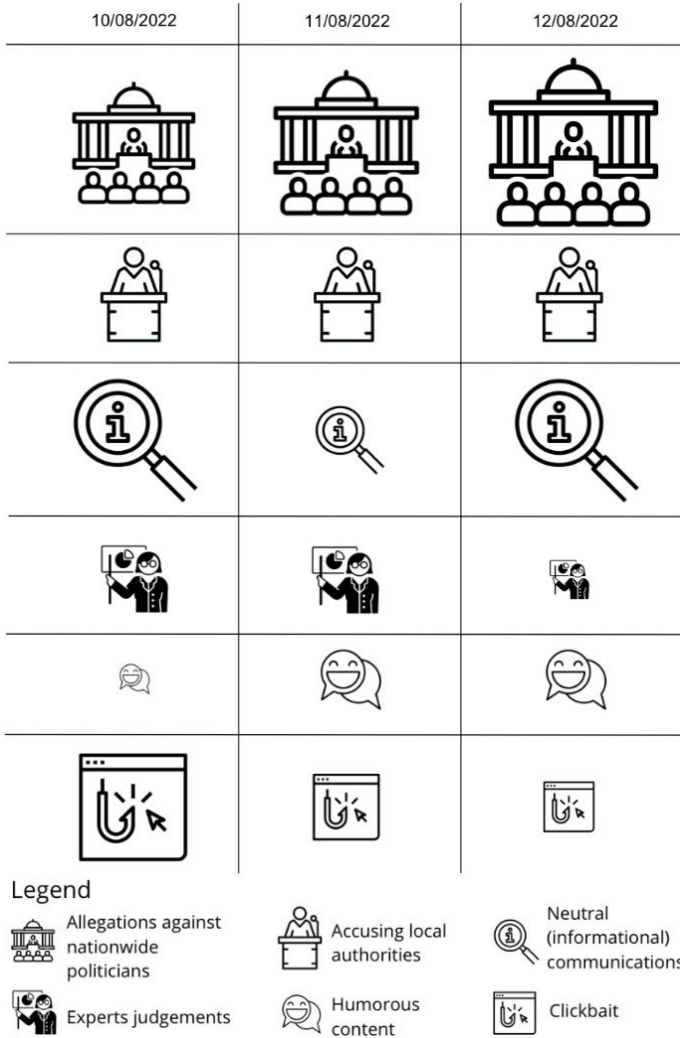


Fig. 3. Infographic. Proportions of public interest in various types of information. Own research based on analysed material.

Concluding, approximately 20% of the content is clickbait, not directly relevant to the subject but rather aiming to attract attention due to its sensational nature. This type of content is most prevalent at the onset of a topic's popularity, with its frequency diminishing over time. A significant portion of the analysed data, 54%, carries a negative sentiment, attracting more engagement on social media, while 42% is perceived as neutral and a mere 4% conveys a positive sentiment.

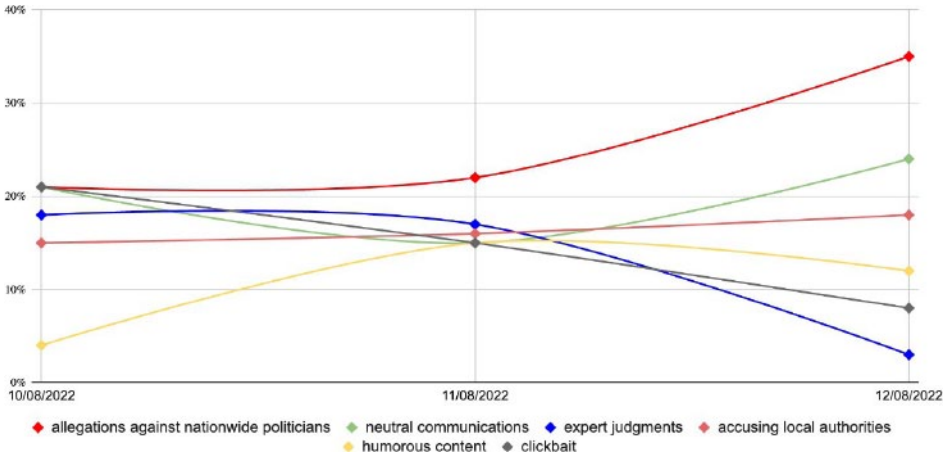


Fig. 4. Proportions of public interest in various topics. Own research based on analysed material.

Posts with humour often employ irony, serving not only as a source of amusement but also highlighting ongoing issues and absurdities that could hinder assistance to communities or even pose health and safety risks. The progression of public interest typically begins with a search for factual information, shifts to the creation of humorous content once the threat is evaluated, and eventually, the focus moves away from expert advice towards independently identifying those at fault [Fig. 3, 4].

## DISCUSSION

In the article, we show where gaps in information between the sanitary and veterinary services and the general public can occur (e.g., regarding the complex links between biology and consequences). E.g., fish and water were the main “on-time” keywords between August 10 and 22, 2022 in Poland as measured by the CLARIN tool developed in Wrocław, Poland (Jarosz, 2021). Disaster is called differently in Poland (“Ecological Disaster”) and Germany (“Environmental Disaster”), with the popularity of each term changing over time with different dynamics of interest and narrative (Szymańska, 2023). Such sociolinguistic differences may result in differences in the perception of reality by one health inspectorate (here on both sides of the Oder River) through which the need for international and especially cross-border cooperation should be emphasised. Similar conclusions were drawn from an ethnological study of ASF control in the Polish-German borderland (Oelke & Jarynowski, 2024).

## CONCLUSIONS

As we could expect, golden algae have become a permanent presence in geographical Silesia (Jarynowski & Maksymowicz, 2024). At the beginning of May 2024, they bloomed in the Gliwice Canal. We will find out whether there will be favourable conditions for blooms on the Oder during summer 2024. Situation at Odra/Oder river shows a potential of media monitoring in infoveillance (early warning) infodemiology (analysis of the discourse) within. Crisis management (Kowalkowski et al., 2023) requires international and interdisciplinary cooperation in this case. A medical sociologist or veterinary anthropologist would better manage social listening. These disciplines can better tailor and filter keywords in real time, allowing for more effective crisis communication and community action planning, as well as identifying and understanding differences in hazard perception between different groups and cultures. The development of crisis communication skills and community action plans should be an integral part of biomedical training (medical doctors, veterinarians, public health officers, etc) and emergency management training. We proved that professional opinions are in decline during public discourse and showed society prefers its own emotional speculations over experts' judgements. The most popular are political references. If possible, people prefer simple information and easy accusations over consideration.

Due to changes in perceptions of the environmental crises, we will experience more and more in the future because climate change is observable globally, but locally, more research using the social science apparatus is needed (Kuhlicke et al., 2023) to understand local vulnerabilities and resilience. In order to mitigate the effects of water disasters on One Health, it is important that those responsible have not only emergency plans, but also crisis communication skills and community action plans on the issue (Mariański, 2021). This includes early warning systems and media monitoring during a disaster event. Social listening can be used to assist emergency services, authorities and individual users during every stage of the emergency management cycle (Domalewska, 2019), but particularly in the peak flow of information phase (Meletis et al., 2024). Since local sanitary/ veterinary services, nature prevention organisations and users of the river can play a key role in rescue and relief efforts during emergency events, the above issues should be included in the biomedical curriculum. On the other hand, emergency management teams involved in monitoring biological (e.g. water-related) events are lacking people with backgrounds in the social sciences who understand sociolinguistic processes and have mapped citizen movements (Jarynowski, 2021) in their area.

The use of new data tools such as infodemiology, which studies and analyses the spread of health information in society and its impact on public health (Jarynowski, 2022)), and the One Health approach in the WHO concept of calling on all services to work together to address key public health issues (Skubała, 2022) is useful for understanding the relationship between human public health and the surrounding ecosystem. Monitoring actual and declara-

tive attitudes should be a priority for local decision-makers, according to WHO (Jarynowski, 2022).

One Health assumes that all phenomena and creatures on earth are closely interconnected. The health of one element affects the health of the others, making this approach consider the entire ecosystem (Mackenzie, Jeggo, 2019). Only through an integrated approach is it possible to understand the full causal sequence of various processes. Research on the effects of environmental pollutants on human and animal health points to the vital importance of maintaining the balance of ecosystems. How even distant parts of the world interact indicates that individual ecosystems are strongly connected (Destoumieux-Garzón, 2022). Therefore, the dependence of human health on the health of the environment seems all the more important.

As an example of the application of new data tools such as infodemiology in the context of the ecosystem, a study by a group of Stanford University researchers analysed how information about the impact of neonicotinoid pesticides on bee populations was disseminated on social media such as Twitter and Facebook, and how this information influenced public opinion and agricultural policy (Stuligross, Williams, 2020). In recent years, growing concerns about the decline in bee numbers and its potential effects on ecosystems and agricultural production have been the subject of much discussion in social media and traditional media (Kleinman, Suryanarayanan, 2013)). Infodemologists analyse how this information is disseminated, the dominant narratives, and how it influences public awareness and political action. The study found that negative information about pesticides and their impact on bees had a greater reach and was shared more often than neutral or positive information. (Stuligross, Williams, 2020) Through these analyses, it was possible to identify key influencers and the channels through which this information was most often disseminated, allowing better targeting of educational campaigns to raise awareness about sustainable pesticide use.

Google Flu Trends is a classic example of the application of infodemiology in monitoring the spread of infectious diseases (Lazer, et al., 2014). Launched by Google in 2008, this project aimed to predict flu epidemics based on analysis of users' search patterns (algorithm). Google Flu Trends used Google search data to track the frequency of searches related to flu symptoms and compared them with epidemiological data from the Centers for Disease Control and Prevention (CDC) (Kandula, Shaman, 2019). The system was intended to provide early warning of outbreaks, allowing health services to respond more quickly. Although initially successful, the project encountered challenges with overestimating or underestimating the number of flu cases and changing user search patterns. During the 2009-2010 flu season, Google Flu Trends quickly identified increased H1N1 cases in the U.S., enabling more rapid preventive action (Dugas et al., 2013). The project illustrates the potential and challenges of using big data in public health.

These examples show how public health monitoring translates into concrete actions to improve population health and prevent disease. The effectiveness of

these efforts relies on accurate and timely data to make informed decisions and allocate resources effectively. Infodemiology is a powerful tool that allows faster and more accurate monitoring of public health. By analysing data from the Internet, public health authorities can make better-informed decisions, conduct more effective education campaigns, and respond more quickly to new health threats. All this is to promote health at all levels - from the individual to the community to entire ecosystems. Thus, a holistic approach makes it possible to level many threats at once, taking advantage of the fact that they are somewhat interconnected.

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