

NEWS MEDIA COVERAGE AND PUBLIC REACTIONS TO A RED TIDE AT THE ALGARVE COAST (SOUTHERN PORTUGAL)

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ABSTRACT

In June 2019, a red tide caused by the dinoflagellate *Lingulodinium polyedra*, whose toxins do not cause harm in humans, developed in the Algarve coast (southern Portugal). The occurrence of algal toxins and consequent interdiction of bivalve harvesting is common in this region, but harmful algal blooms that lead to water discolouration are rare. This study analyses the scientific accuracy of the information communicated by news media, and consequent public reactions, by analysing news pieces shared on Facebook by regional and national news media outlets, and comments to the news posted by individual users. Overall, news pieces had a sensationalized, negative tone, and many lacked scientific accuracy. For instance, some news referred that ingestion of contaminated water, fish, and shellfish leads to gastrointestinal problems, and the toxic substances that the algae produce may contaminate the air and cause respiratory difficulties – which is false in the case of a *L. polyedra* bloom. Many commenters showed an adverse reaction to the event, most likely influenced by the negative portrayal of the red tide by news media. Other Facebook users were quite knowledgeable about the red tide, due to their previous experience with these events. Individuals seemed to be aware of the lack of cooperation between authorities and scientists and expressed their mistrust in these stakeholders. As red tides may become a common feature in the Algarve coast, journalists, scientists, and authorities should strive to offer accurate and responsible information to the public.

Keywords: Red Tide, Dinoflagellate, Public Perceptions, Communication, Public Health.

JEL Classification: Q54, D83

1. INTRODUCTION

Harmful algal blooms (HABs) are natural events caused by microalgae that have negative impacts on ecosystem dynamics and human activities (Zingone & Enevoldsen, 2000). HABs have been expanding worldwide; consequently, their deleterious impacts on ecosystem functioning, public health, tourism and fisheries are becoming more pronounced (Anderson et al., 2012). Society's need for more information on HAB phenomena is more pressing than ever (McGillicuddy, 2010), but research on the socio-psychological aspects of HABs is still in its infancy. Understanding public perceptions and, in particular, risk perceptions towards HABs, is critical for a sustainable coastal management, as different risk perceptions can promote different motivations and behaviours from individuals and communities, from completely ignoring the risks, to actively avoiding, mitigating, and adapting to them (Roberts et al., 2016).

Risk perception is a complex process that involves, among others, gathering and interpreting information about the risk. It is mainly a subjective judgement driven by

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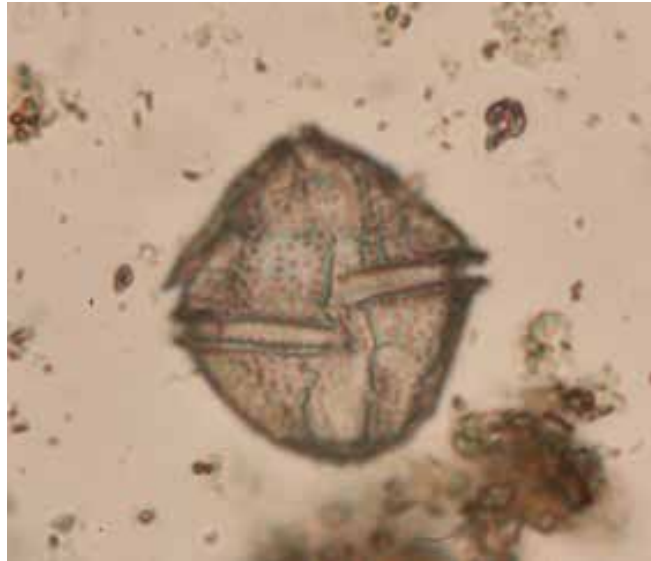
unconscious emotional processes made by an individual regarding the characteristics and severity of a risk (Slovic, 1987; Gifford, 2014), but risk perception is also influenced by the individual's cultural and social context. People's risk perception, knowledge and behaviour towards HABs may be incongruent with the actual risk, as observed for other coastal risks (Costas et al., 2015; Domingues et al., 2018), which can have extensive personal, social and economic impacts (Kuhar et al., 2009; Nierenberg et al., 2010). Indeed, a considerable lack of knowledge and misperceptions regarding HABs are the norm in coastal communities (Nierenberg et al., 2010). These misperceptions may be attributed to the negative media coverage of HAB events (Kuhar et al., 2009) and are further amplified by the socio-cultural context (Renn et al., 1992). News media in particular play a fundamental role in environmental risk communication and, thus, on the social construction of risk (Wakefield & Elliott, 2003).

Florida red tides are probably the best studied case of news media shaping the public's perception of red tides. Although red tides are common in Florida, residents and tourists are not very knowledgeable about them (Li et al., 2015), and they perceive the risks as more prevalent than they really are (Hoagland et al., 2020). A negative portrayal of red tides in the media clearly contributes to this social amplification of risk (Kuhar et al., 2009; Li et al., 2015), based on a lack of accurate information or a misunderstanding of red tides and their effects (Hoagland et al., 2020).

In the Algarve coast (southern Portugal), the occurrence of HABs is common and their prevalence in this region has increased over the years (Oliveira et al., 2015). In central Algarve, HABs usually develop in the coastal zone and are imported by tidal currents into the Ria Formosa coastal lagoon, a shallow multi-inlet barrier island system, leading to the interdiction of bivalve harvesting. Interdictions are frequent in the Ria and adjacent coastal zone, and may extend for long periods; for instance, in 2019, harvesting of the wedge clam *Donax trunculus* in the coastal zone was prohibited for more than five consecutive months (IPMA, 2019). Given that 88% of bivalve production in Portugal comes from the Ria Formosa (INE, 2019) and supports 7,000 families (Newton et al., 2014), HABs in this system are a major concern. However, the public is mostly unaware of their occurrence, as HABs in the Algarve coast rarely cause the water discoloration known as red tide. The public is even oblivious regarding the prohibition of bivalve harvesting, given that alerts are not publicized through news media, to avoid potential negative effects on bivalve commerce (Vale et al., 2008). Thus, tourists and locals keep collecting bivalves in beaches along the Portuguese coast, and, consequently, cases of human poisoning by phycotoxins still occur (Vale et al., 2008).

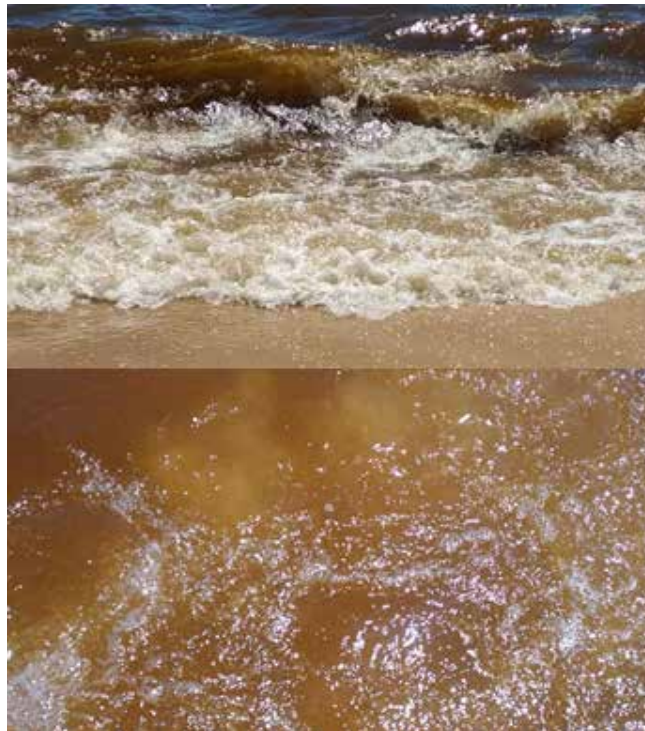
In June 2019, the dinoflagellate *Lingulodinium polyedra* (Figure 1) bloomed in central Algarve and caused an extensive red tide (Figure 2), leading to beach and bivalve fishing closure, and making headlines for a few days. In other coastal regions where red tides are common occurrences, the coverage of red tides has been inadequate, from alarmist stories to scientific inaccuracies (Kusek et al., 1999). Drawing on past research on red tide coverage and the inexistence of information on red tide perception in Portugal, the goal of this study is two-fold: firstly, to analyse the scientific accuracy of the information published by news media regarding the 2019 *L. polyedra* red tide, and, secondly, to examine the public's reactions to that information. To accomplish these goals, we analysed the news referring to the red tide published by news media outlets and shared on Facebook, and the comments to those news pieces posted by individual users.

Figure 1. The Causative Organism, the Dinoflagellate *Lingulodinium Polyedra* (Pictured is an Empty Theca, Photographed at the Inverted Microscope, 400x Magnification)



Source: Own Elaboration

Figure 2. Water Discolouration due to the *Lingulodinium Polyedra* Bloom at a Beach in Central Algarve



Source: Photo by Professor Ester Serrão

2. METHODS

Data were obtained by searching Facebook posts published by news media outlets between June 16th and June 20th, 2019, covering the red tide in the Algarve. Facebook was the only source of *vox populi*, given that this is the most popular social media in Portugal (Reis et

al., 2016); as of 2017, Portugal had 56.4% of Facebook penetration, corresponding to 5.8 million Facebook users (Salgado & Bobba, 2019). In addition, news pieces can be easily shared and commented using this platform. Although social media cannot replace surveys to evaluate public opinion, social media as a form of public opinion should not be ignored, as it provides a distinct representation of the public (McGregor, 2019).

Several Portuguese news media were searched, namely regional and national newspapers (Barlavento, Postal do Algarve, Jornal do Algarve, Observador), and national TV channels (SIC Notícias, TVI, TVI24). For each media post, the content of the news story was analysed, to understand the information that was available to the public and the scientific accuracy of that information. Comments to the news stories posted by Facebook users were also analysed using a qualitative content analysis, to extract the public's reaction to the red tide event as portrayed in the news.

3. RESULTS

3.1 On the News

The content of news published between 16th and 20th June 2019 on Facebook allowed the establishment of a timeline of events, as reported by the news media to the public. For each day, the main content of the news is described, with quotations from selected pieces.

Sunday, June 16th 2019

The typical dark blue colour of the waters of several beaches in the Algarve coast turned into a red-brownish colour. Red flags were hoisted in the affected beaches. On Sunday evening, people realized that the coloured patch was also glowing in a bright blue. Photographs and videos of the phenomenon made their way to social media. Water samples were collected and researchers at the University of Algarve quickly identified the dinoflagellate *Lingulodinium polyedra* as the responsible for the water discoloration (TSF, 2019).

Monday, 17th June 2019 – “Red tide leads to beach closure. Fishing is allowed, but fish consumption is dangerous”

News media picked up the story, with images of the “*dangerous sea of algae*” (Observador, 2019a) and headlines such as “*Red tide leads to beach closure. Fishing is allowed, but fish consumption is dangerous*” (Observador, 2019d). Scientists explain which dinoflagellate is responsible for the red tide and that this species is not toxic, or, at least, there are no known cases of toxicity in humans caused by *Lingulodinium polyedra*. Efforts to explain the biology and ecology of dinoflagellates and red tides are made by journalists.

News pieces explain that “*dinoflagellates may produce substances that are toxic to humans. Direct contact with skin is not a problem for human health, but ingestion of water contaminated with this organism may lead to severe cases of gastroenteritis. Eating fish or shellfish from a contaminated sea also leads to intestinal problems. Besides, if the algae get close to the shore and the rocks, the toxic substances that they produce may contaminate the air e cause respiratory difficulties. In severe cases, they may cause problems in the nervous system*” (Observador, 2019d).

According to a health authority interviewed for a news piece, “*these dinoflagellates produce a paralytic toxin*” that “*affects the peripheral nervous system*”, causing “*numbness sensations*” (NotíciasAoMinuto, 2019). The news piece continues, warning the reader that these “*effects can be observed after inhalation or ingestion, and this can happen when people swim in the water or even when fishing*”. In another piece, the health authority refers that problems caused by the microalgae are “*enhanced by accumulation*” and not by the simple contact with the water;

however, “*people who bathe in the water in the last days should pay attention to numbness and tingling sensations*”. The health authority warns that there is “*danger caused by ingestion, for instance, for someone who have eaten shellfish contaminated with this toxin for two or three days in a row*” (RegiãoSul, 2019).

Tuesday, 18th June 2019 – “Red tide may hurt tourism in the Algarve”

According to the authorities, the dinoflagellate species causing the red tide is not known yet, but water and bivalve samples have been collected and are under analysis to determine the species and its toxicity, and whether or not is necessary to interdict bivalve harvesting in the Ria Formosa days (Observador, 2019b). Another problem emerges on the news – the potential impacts of the red tide, the closed beaches and the interdiction of bivalve harvesting on economic activities, particularly tourism, with headlines reading, “*Red tide may hurt tourism in the Algarve*” (TVI24, 2019).

Some attempts are made to provide scientifically accurate explanations about the red tide. For instance, an article tried to explain the specificities of *Lingulodinium polyedra* by interviewing scientists, but still mentioned that this organism “*in theory, can kill a human*” and that “*eating contaminated shellfish is like taking a pill of toxins*” (Observador, 2019e).

Wednesday, 19th June 2019 – “You can bathe in the beaches of Algarve”

The red tide has now dissipated. The authorities lifted the bathing interdiction at the affected beaches, but they still advise against bathing. Bivalve harvesting is still prohibited.

Thursday, 20th June 2019 – “Red tide leaves a trail of losses”

The red tide is over. Restaurant owners complain about the economic losses they suffered due to the red tide. Many reservations were cancelled due to people’s fear of contamination, even though the seafood being served at these restaurants was not harvested in the Ria Formosa (SIC, 2019). On a positive note, beaches are open again, just in time for the long weekend ahead, although the water temperature is very low (17°C) (Observador, 2019c).

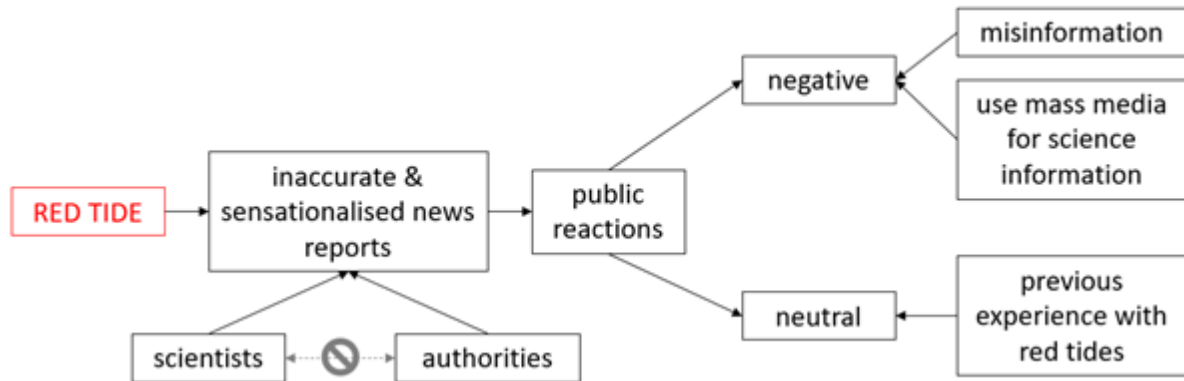
3.2 Public Reaction

The content analysis of people’s comments to news published on Facebook that covered the red tide in the Algarve allowed the identification of three main themes: 1) public’s awareness of risks associated with the red tide, 2) knowledge about causes and consequences of red tides, and 3) attribution of responsibility for the occurrence of the red tide (Figure 3). Selected quotations from the comments are presented to illustrate each theme.

For many commenters, the red tide is a common event that has no consequences to public health. They regard the red tide as “*a part of sea life, we have to respect it*” and “*it’s not the first time, and unfortunately, it will not be the last*”. Many individuals remember the occurrence of red tides from their youth, “*when I was a child, we had these red tides... we’ve always swam in the ocean, no problem*”, and reiterate, “*there have always been these red tides, nothing that older people don’t know*”. Commenters refer that red tides are a common occurrence not only in the Algarve, but in other coastal waters in Portugal as well, “*it’s normal for this to happen, I remember this happening many years ago at Costa da Caparica and Carcavelos (in the Lisbon bay area)*”. In Africa, red tides also happen “*regularly, and fishing and beach life go on as usual*”. Given that red tides are seen by these individuals as normal and recurrent, “*this happens for years*”, some of them don’t understand why “*this is news now*”. Despite being a natural occurrence, “*people are always willing to create panic – it’s the ‘climategate’ in action*”.

In contrast, other commenters believe that the red tide is “*terrifying; authorities must take measures immediately, this is a danger for public health*”. Yet, other commenters devalue the event and even make fun of worried people, “*Are you pussies? Go to the water, cut the crap, enjoy*”. Some people express concern for tourism, which is a main economic activity in the Algarve; they say the red tide is “*very bad for tourism*” and that it is “*better not to say that (the red tide) is dangerous for health, so that tourism doesn’t suffer*”.

Figure 3. Relationships between News Reports on the Red Tide and the Public’s Reactions



Source: Own Elaboration

Some commenters expressed curiosity in learning more about the red tide, “*Is this normal? What causes this?*”, but other individuals are clearly misinformed about the causes of the event: “*Water smells weird and some people say that the algae turn red because they’re dead*”, “*This is the result of pollutant discharges to the beach; then, it spreads to other beaches with the tides and wind*”, or “*those algae come with the high water*”. Many people attributed the blame for the red tide to climate change, saying that this is a “*consequence of global warming*” and “*ocean waters are getting warmer and dragging these phenomena to our coast*”.

Finally, commenters expressed their mistrust in scientists and authorities, saying “*Sea of blood? Where have I heard this before? I know... scientists have an ‘explanation’ for everything*”. People also demonstrated that they are aware of the lack of communication between scientists and authorities. A commenter asked, “*Why didn’t the university and APA (the governmental agency responsible for coastal management) come to an agreement?*”, given that University researchers promptly declared that the bloom was not dangerous, but the authorities closed the beaches and interdicted bivalve harvesting. One commenter further expressed their mistrust and disapproval of scientists, saying, “*Yesterday the red tide was not harmful, according to a ‘researcher’ from the University... clearly she was in need of funding and lied... normal in ‘scientists’ dependent on grants*”. Other people blamed the authorities for the event, as “*they should monitor the coast, (the algae) didn’t fall from the sky*”.

4. DISCUSSION

This study aimed to analyse the information communicated by news media and subsequent public reactions regarding a red tide event that occurred in June 2019 in the Algarve coast, southern Portugal. Overall, some information published was not scientifically accurate and the news pieces had a negative tone. Many commenters were knowledgeable about the red tide and were aware that it is a common event with no serious consequences to public health, but others demonstrated lack of knowledge and an adverse reaction to the event, most likely influenced by the negative portrayal of the red tide by the news media. Some of

them attributed the responsibility for the red tide to the authorities and manifested their mistrust in scientists.

On the first day of the red tide, researchers promptly identified the dinoflagellate responsible for the event; *Lingulodinium polyedra* has been associated with water discoloration and bioluminescence events along the Atlantic coast of the Iberian Peninsula. In Portugal, the first *L. polyedra* red tide was observed in 1944 in the Peniche area (Pinto, 1949). Blooms of this dinoflagellate are common along the Portuguese coast, particularly in upwelling regions (Amorim et al., 2004). The lipophilic yessotoxins produced by *L. polyedra* have been detected in shellfish along the Portuguese coast, but levels are below regulatory limits (Vale et al., 2008). Oral toxicity of yessotoxins is low and there are no reported cases of human poisoning by yessotoxins (see review by Alfonso et al., 2016 and references therein).

Despite being a well-known event in Portuguese waters with distinct characteristics, the media coverage of the red tide suffered for inadequacies. The stories and headlines were alarmist, had a negative tone, and were not scientifically accurate. It is well known that negative news are more arousing and attention grabbing (Soroka & McAdams, 2015), thus increasing users' engagement with the post. Indeed, this was recognized by one commenter, that used the term "climategate" to refer to the panic that people create around the red tide. The major inaccuracy in the news was the fact that neither journalists nor authorities considered the specificities of the causative organism, the dinoflagellate *Lingulodinium polyedra*. Instead, news focused on dinoflagellates and red tides in general, and the potential serious effects that certain HABs can pose to the ecosystem and to human health. In Florida, local news about the red tide have also been focused on the negative consequences (Li et al., 2015), and the skewed media content acts as a risk amplifier, contributing to a higher risk perception in individuals that are highly exposed to the news (Cahyanto & Liu-Lastres, 2020).

Many commenters reacted negatively to the news and were worried about the red tide, demonstrating that they rely on mass media for science information. Indeed, news posted on social media have become the main source of science news for the general public (Brossard, 2013), but they may also be a source of scientific misinformation (Liang et al., 2014), hampering public's trust in science due to lack of quality control (Weingart & Guenther, 2016). Other commenters were quite knowledgeable about red tides and were aware that HABs are a common occurrence in coastal waters. This accurate knowledge probably stems from their personal experience, as many individuals referred that they have seen red tides since their childhood. Greater awareness of red tides was also associated with life experience in fishermen that have lived for more than 30 years on the coast of Ecuador, where red tides are common (Borbor-Córdova et al., 2018). In Florida, residents have more knowledge about red tides than out-of-state visitors, due to their direct experience with the phenomenon and the extensive local news coverage (Cahyanto & Liu-Lastres, 2020). Past experience with coastal hazards is indeed the most effective source of knowledge and a main driver of risk perception across a variety of coastal hazards (Pagneux et al., 2011; Kung & Chen, 2012; Domingues et al., 2018).

Some commenters expressed their concern with the impacts of the red tide on tourism, given that tourism is a main economic activity in the Algarve, oriented to the specific market of "sun and beach" (Andraz et al., 2015). Thus, closed beaches and interdictions of bivalve harvesting may drive tourists away, although seafood served at local restaurants during the red tide was not harvested in the affected areas. Still, restaurant owners complained about economic losses due to the fear of contamination by consumers. Indeed, red tides, particularly long-lasting events such as *Karenia brevis* red tides in Florida, may have profound effects on tourism and coastal businesses reliant on tourism (Bechard, 2020). Bivalve fishermen are probably the most affected by harvesting interdictions; due to the 5-month harvesting

interdiction of the wedge clam *Donax trunculus* in 2019 in the coast of Algarve, due to the presence of diarrheic toxins (IPMA, 2019), hundreds of fishermen lost their income (SulInformação, 2019).

It was clear from some news pieces that communication between scientists and authorities barely exists. The most appalling example is the fact that scientists identified the dinoflagellate species responsible for the red tide on the first day, whereas authorities claimed, two days after the onset, that samples were still under analysis, the species was not yet identified, and results would be known within a few days. Health authorities also painted a dramatic picture of the potential dangers of the red tide, warning that people who swam in the water in the last days should pay attention to numbness and tingling sensations. Given the lack of an official “culprit” species, authorities and journalists referred to the general dangers of toxic dinoflagellate blooms – instilling fear in less informed public.

Some individuals that commented on the news pieces were aware and critical about the lack of cooperation between scientists and authorities. Other commenters expressed their mistrust in scientists. These reactions are driven by gaps in communication that persist in many contexts and for different types of hazards, eventually leading to mistrust between the public, scientists, and authorities. Indeed, the chain of transmission, understanding, and integration of information is often not effective (Andre et al., 2020). Scientists are in a privileged position to communicate the most accurate information about red tides, but the typical format of peer-reviewed publications is more difficult for the public to access and understand (Hoagland, 2014). Also, scientists may not recognise which information is the most relevant for decision-makers (von Winterfeldt, 2013). Therefore, it is important for scientists to foster collaborative and participatory relationships with the other actors (Marín et al., 2020), given that public’s mistrust in risk situations may have adverse impacts not only on risk perception and preparedness, but also on individuals’ mental health. One such example are the long-term negative effects on mental health associated with public’s mistrust in authorities following the 2011 Fukushima nuclear power plant accident (Fukasawa et al., 2020). News media also played a significant role in people’s risk perception and anxiety levels (Guo et al., 2020), and the use of internet sites as source of information was associated with increased anxiety (Nakayama et al., 2019). More recently, and in the context of COVID-19 pandemic, it was observed that mass media contributed to an increase in anxiety and other negative emotions in TV viewers (Basch et al., 2020).

As red tides may, and probably will, happen again in the Algarve coast, journalists, scientists, and authorities should join efforts and strive to offer scientifically accurate and responsible information to the public. Drawing from decades of inaccurate red tide coverage in Florida, Kusek et al. (1999) make several recommendations that should be considered by media professionals for improving coverage of red tide events, of which we highlight:

1. Provide as much explanation as possible. Kusek et al. (1999) advise that it is better to assume that the readers do not know much about red tides; therefore, thorough information should be given in news pieces. For instance, instead of focusing the pieces on dinoflagellates in general, the specificities of the causative organism, *Lingulodinium polyedra*, should have been taken into consideration.
2. Write accurate, non-alarmist headlines, as well as accurate and specific captions to accompany photographs. Headlines such as “*Images of the dangerous sea of algae that covers the Algarve*” (Observador, 2019a) are alarmist and untrue.
3. Avoid being alarmist. Even in the articles that provided scientifically accurate information to the readers, alarmist sentences were still present (e.g., “*in theory, (the dinoflagellate) can kill a human*”).
4. Make sure the science is correct and ensure that the sources are credible, and not alarmist. This can only be achieved by getting the facts right through expert knowledge.

Scientists that study this type of phenomenon should be the preferred source of scientifically sound information.

5. CONCLUSION

This study provided a first insight into the way red tide events are communicated by news media to the public and the consequent public perceptions of red tides in Portugal. News pieces covering the June 2019 red tide in central Algarve used a sensationalised, negative tone, and many pieces were not scientifically accurate. Social media users commented on the news about the red tide, showing an adverse reaction, most likely influenced by the negative portrayal of the red tide in the news. Other commenters were quite knowledgeable about the red tide, due to their previous experience with these events. The public also showed awareness regarding the lack of cooperation between authorities and scientists and expressed their mistrust in these stakeholders.

Although this study provides a first account into red tide perception in Portugal, some limitations apply, the most significant of which is the sole use of Facebook as *vox populi*. Other social media channels, mainly Twitter, should be included in future analyses. In addition, other media outlets should also be explored.

As harmful algal blooms are becoming a common feature in the Algarve coast, journalists, scientists, and authorities should strive to offer accurate and responsible information to the public. Information provided to the public should be the most accurate as possible, headlines should not be alarmist, and sources should be reliable. In an age of misinformation, it may be a challenge to distinguish between facts and fiction, but all stakeholders should embrace future red tide events as opportunities to educate people about harmful algal blooms, their causes and consequences and, thus, contribute not only to ocean literacy, but also to the protection of marine ecosystems.

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