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Porter Hoagland
Woods Hole Oceanographic Institution

Barbara Kirkpatrick
Texas A&M University

Di Jin
Woods Hole Oceanographic Institution

Gary Kirkpatrick
Mote Marine Laboratory

Lora E. Fleming
University of Exeter Medical School

See next page for additional authors

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Authors

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Lessening the Hazards of Florida Red Tides: A Common Sense Approach

Porter Hoagland^{1*}, Barbara Kirkpatrick², Di Jin¹, Gary Kirkpatrick³, Lora E. Fleming⁴, Steven G. Ullmann⁵, Andrew Beet¹, Gary Hitchcock⁶, Kate K. Harrison², Zongchao C. Li⁷, Bruce Garrison⁸, Roberto E. Diaz⁹ and Vince Lovko³

¹ Marine Policy Center, Woods Hole Oceanographic Institution, Woods Hole, MA, United States, ² Gulf of Mexico Coastal Ocean Observing System, Texas A&M University, College Station, TX, United States, ³ Phytoplankton Ecology Program, Mote Marine Laboratory & Aquarium, Sarasota, FL, United States, ⁴ European Centre for Environment and Human Health, University of Exeter Medical School, Truro, United Kingdom, ⁵ Department of Health Management and Policy, University of Miami, Coral Gables, FL, United States, ⁶ Rosenstiel School of Marine and Atmospheric Science, University of Miami, Coral Gables, FL, United States, ⁷ School of Journalism and Mass Communications, San José State University, San Jose, CA, United States, ⁸ School of Communication, University of Miami, Coral Gables, FL, United States, ⁹ Tetrad Graduate Program, University of California, San Francisco, San Francisco, CA, United States

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Patricia M. Gilbert,
University of Maryland Center
for Environmental Science (UMCES),
United States

*Correspondence:

Porter Hoagland
phoagland@whoi.edu

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In the Gulf of Mexico, especially along the southwest Florida coast, blooms of the dinoflagellate *Karenia brevis* are a coastal natural hazard. The organism produces a potent class of toxins, known as brevetoxins, which are released following cell lysis into ocean or estuarine waters or, upon aerosolization, into the atmosphere. When exposed to sufficient levels of brevetoxins, humans may suffer from respiratory, gastrointestinal, or neurological illnesses. The hazard has been exacerbated by the geometric growth of human populations, including both residents and tourists, along Florida's southwest coast. Impacts to marine organisms or ecosystems also may occur, such as fish kills or deaths of protected mammals, turtles, or birds. Since the occurrence of a severe *Karenia brevis* bloom off the southwest Florida coast three-quarters of a century ago, there has been an ongoing debate about the best way for humans to mitigate the impacts of this hazard. Because of the importance of tourism to coastal Florida, there are incentives for businesses and governments alike to obfuscate descriptions of these blooms, leading to the social amplification of risk. We argue that policies to improve the public's ability to understand the physical attributes of blooms, specifically risk communication policies, are to be preferred over physical, chemical, or biological controls. In particular, we argue that responses to this type of hazard must emphasize maintaining the continuity of programs of scientific research, environmental monitoring, public education, and notification. We propose a common-sense approach to risk communication, comprising a simplification of the public provision of existing sources of information to be made available on a mobile website.

Keywords: harmful algal bloom, Florida red tide, *Karenia brevis*, economic effect, policy response, social amplification of risk, risk communication

INTRODUCTION

In the Gulf of Mexico, especially along the southwest Florida coast, blooms of the dinoflagellate *Karenia brevis* (*Kb*) are a coastal natural hazard. The organism produces a potent class of toxins, known as brevetoxins, which are released into ocean or estuarine waters or, upon aerosolization, into the atmosphere following cell lysis. When exposed to sufficient levels of brevetoxins, humans may suffer from respiratory, gastrointestinal, or neurological illnesses (Kirkpatrick et al., 2004, 2006, 2010; Fleming et al., 2009, 2010; Diaz et al., 2019). Additionally, ecological impacts may occur, such as fish kills or deaths of protected mammals, turtles, or birds (Landsberg et al., 2009). Further, local commercial shellfish harvesting areas may be closed (Heil, 2009), and other local coastal businesses, especially those related to tourism, such as hotels and restaurants, may suffer lost sales (Larkin and Adams, 2007; Morgan et al., 2009, 2011; Bechard, 2019).

Also known as “Florida red tide,” *Kb* blooms occur naturally, and more than two dozen hypotheses have been suggested concerning the initiation and maintenance of *Kb* blooms in the Gulf (Vargo, 2009). It has been theorized—but it remains unresolved—that human actions such as nutrient pollution can trigger or worsen the blooms (Brand and Compton, 2007; Heil et al., 2014). In southwest Florida, *Kb* bloom magnitudes, as measured by cell abundances, are positively related to coastal precipitation and watershed discharges, but any causal association between these factors and the spatial and temporal patterns of bloom development is weak (Dixon and Steidinger, 2004; Hahlbeck et al., 2015).

As with all marine algae, the presence in the water column of sufficient levels of macro-nutrients (especially phosphorous, P, and nitrogen, N) is essential for cell growth. Ocean currents in the eastern Gulf of Mexico have been implicated in the control of *Kb* bloom initiation through the transport of nutrients from far-field sources to areas where blooms typically appear (Liu et al., 2016). Naturally occurring blooms of *Trichodesmium* spp., a marine blue-green algae that fixes N, may play a critical role in enhancing the supply of N for *Kb* blooms (Lenes and Heil, 2010). Links between releases of anthropogenic nutrients and the occurrences of *Kb* blooms have not been fully determined. Observations of both higher *Kb* bloom densities occurring in nearshore waters and blooms of longer duration suggest strongly, however, that human-sourced nutrients, including those originating from submerged groundwater or released from benthic storage, may be significant causal factors (Vargo, 2009; Charette et al., 2013; Heil et al., 2014).

For nearly three-quarters of a century, since the occurrence of a severe *Kb* bloom off the southwest Florida coast during 1946–1947 (Baldrige, 1977; Kusek et al., 1999), there has been an ongoing debate about the best way for humans to mitigate *Kb* bloom impacts. Here, we argue that policies to improve the public’s ability to understand the physical attributes of blooms, specifically risk communication policies, are to be preferred over physical, chemical, or biological controls. In particular, we argue that responses to this type of hazard must

comprise ongoing programs of scientific research, environmental monitoring, public education, and notification.

EXISTENCE OF A NATURAL HAZARD

The *hazard* to humans from *Kb* blooms has increased chiefly as a consequence of the geometric growth of human coastal populations along the Gulf coast during the last century (Hoagland, 2014). Regardless of whether anthropogenic nutrients ultimately are found responsible for bloom initiation and maintenance, more humans are now potentially exposed to the blooms when they happen. Further, the nature–human hazard swells and contracts with seasonal fluctuations of coastal tourists and part-time residents (“snowbirds” and “sunbirds”) (Smith and House, 2006).

The environmental conditions for the human respiratory and neurological effects of *Kb* blooms are becoming clearer, and, where blooms are of sufficient densities, they are related sensibly to atmospheric conditions that favor aerosols. For example, qualitative, subjective measures of human respiratory irritation during *Kb* blooms at southwest Florida beaches have been found to be associated with higher levels of relative humidity and ocean temperature, lower levels of barometric pressure, and winds blowing perpendicularly toward the coast (Kirkpatrick et al., 2015).

Persons with underlying respiratory and possibly neurologic disease are more vulnerable to the exposure to aerosolized brevetoxins (Fleming et al., 2010; Hoagland et al., 2014; Diaz et al., 2019). When exposed to aerosolized brevetoxins, however, all individuals likely experience some form of respiratory or neurological disorder, with longer exposures leading potentially to more serious effects. The most exposed, such as the lifeguards who must work the beaches of Florida’s southwest coast, exhibit higher than normal rates of work absences during *Kb* blooms (Nierenberg et al., 2010). In contrast, there is little evidence that K-12 students in Sarasota County are absent more frequently from school during *Kb* blooms, as they may be sufficiently distant from the coast and protected by the filtering effects of air conditioning systems (Moanga, 2015; Moore et al., 2015).

ASSESSMENT AND COMMUNICATION OF THE RISKS

For decades, a chief concern about *Kb* blooms has been their potential effects on the continued growth of Florida’s tourist industry. The authors of an early study of the economic impacts of a comparatively short (about 4 months), but moderately severe bloom in 1971 concluded that “[u]nquestionably, [the bloom’s] greatest impact on man is economic” (Habas and Gilbert, 1974). The study found that 30% of an estimated \$100 million impact (expressed in 2020 dollars) was borne by the hotel sector. More recently, the owner of a tourist business in the city of Sarasota observed during a 2015 bloom that “[w]ithout a doubt [Florida red tide] has some bearing on business. . .we do get worried because it spooks people away” (Short, 2015). Businesses that rely

on tourism also may be concerned that a *Kb* bloom could lead to a locational reputation for red tides that dissuades repeat or future tourist visits. These concerns create incentives for businesses that depend upon tourism and some public agencies, which depend upon tax proceeds from retail sales and hotel room bookings, to be reticent about communicating occurrences of *Kb* blooms or their severities to the public.

When the word of a Florida red tide inevitably gets out, and in the face of incentives to be less than fully forthcoming about bloom conditions, the risks faced by residents and visitors may become blurred, appearing to be more widespread and to last longer than what is actually the case. This is one example of a “social amplification” of risk, potentially intensified by the media (Kuhar et al., 2009; Li et al., 2015) and sometimes referred to as an “economic halo” (Jensen, 1975). Social amplification is a form of the miscommunication of risk. Miscommunication is based typically upon a lack of information or a misunderstanding about a natural hazard, the potential effects of which may be exaggerated initially across space, time, or human activities.

Framed as a story of environmental risk (Li et al., 2015) or even of science fiction (Kusek et al., 1999) in the absence of comprehensive information about red tide as a hazard, the media present an incomplete picture, prompting the public to draw overstated conclusions about the actual risks. The scientific community can communicate more reasoned information about *Kb* blooms, but typically it may do so at a slower pace and in formats, such as through peer-reviewed publications, that may be more difficult for the public to access or grasp (Hoagland, 2014). Further, the science about *Kb* bloom development, transport, and fate is as yet inchoate, thereby appearing to be indeterminate and uncertain to the casual observer.

Governmental authorities, such as the US Environmental Protection Agency, have argued that *Kb* blooms are one consequence of anthropogenic nutrient releases, but such arguments have been undermined by incidences of asynchronous and spatially displaced blooms, leading to confusion among the public about the rationales for policies such as controls on the applications of fertilizers to lawns. Such policies also may work at cross-purposes with societal norms about boosting property values, including those that encourage lawn upkeep (Kirkpatrick et al., 2014).

Karenia brevis blooms are unusual among harmful marine algae in that the toxins can be aerosolized, leading to immediate and sometimes prolonged sneezing and coughing, tearing, headaches, or shortness of breath, and even asthma attacks (if underlying asthma) among those exposed. Further, on occasion, they may result in the deaths of charismatic megafauna. Yet, irrespective of the nature of adverse effects, the risks to most humans in coastal Florida of becoming ill or of losing incomes from *Kb* blooms remain slight, especially when compared with other coastal natural hazards. Although a potentially important topic for a future comparative study yielding relevant lessons, there are enormous differences between *Kb* blooms and most human infectious disease epidemics, such as that posed by the current COVID-19 pandemic, for example, including that the latter’s scales in terms of morbidities, mortalities, unemployment levels, imposed social distancing and isolation, and economic

impacts are many orders of magnitude larger than those arising from *Kb* blooms.

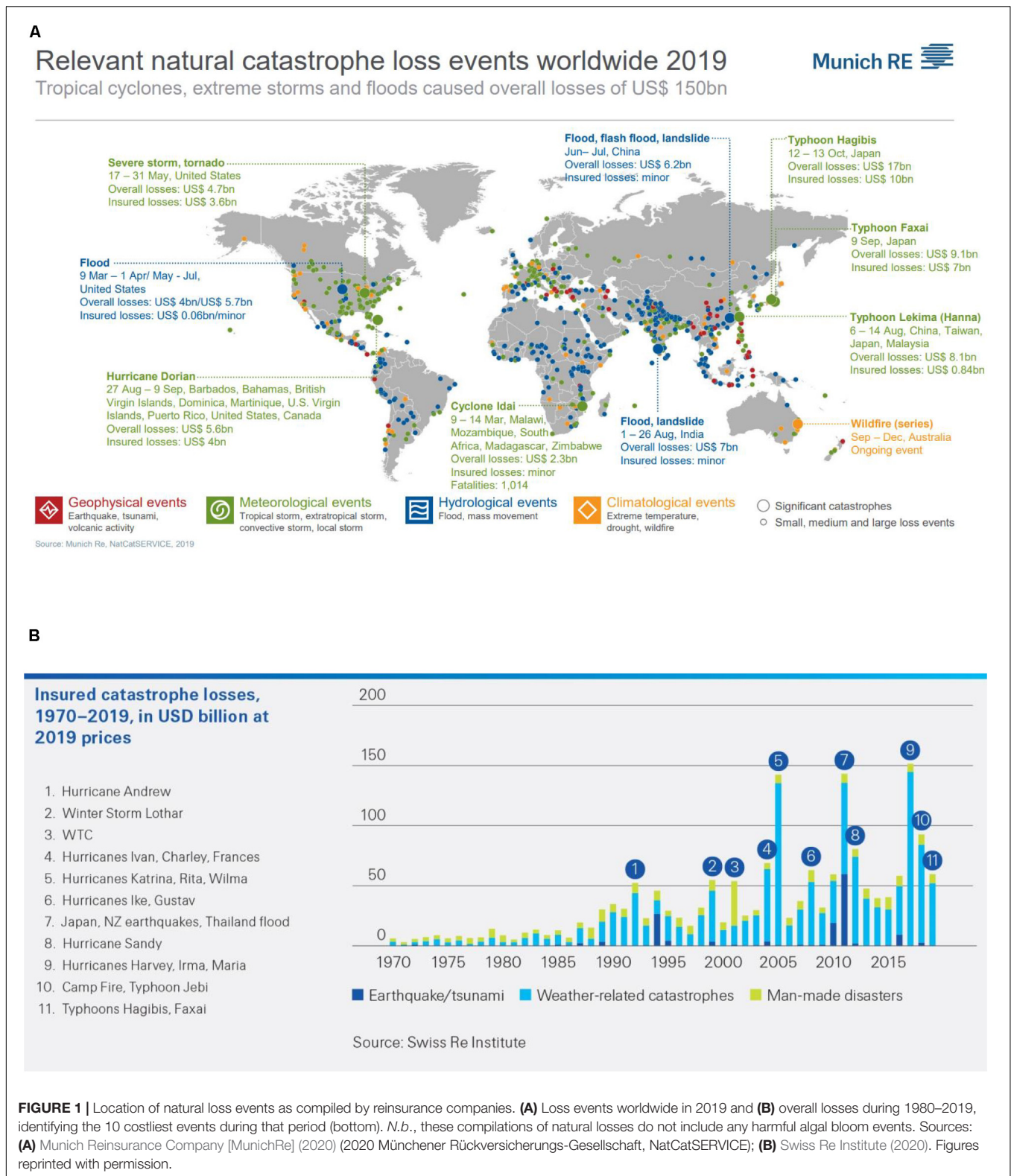
Unquestionably, whether measured in number of events, lives lost, or economic impacts (Figure 1), *Kb* blooms are orders of magnitude less perilous than other natural loss events (Munich Reinsurance Company [MunichRe], 2020; Swiss Re Institute, 2020). Along the Florida Gulf Coast, tropical cyclones may be the costliest type of natural event, leading to morbidities and lives lost and economic damages caused by high winds, coastal floods, power outages, structural damages, and shoreline erosion. Among coastal hazards, only floods, high surf, and rips, as extensions of extreme weather events, are tracked and plotted by the US National Weather Service through its “watches, warnings, and advisories” (National Weather Service [NWS], 2016). It is notable that *Kb* blooms are not even mentioned as a hazard in Florida’s 2018 Enhanced State Hazard Mitigation Plan (Florida Division of Emergency Management [FDEM], 2018).

The state’s tourism promotion agency, VisitFlorida, does list *Kb* blooms among several potential “crisis situations” that could affect the desirability of the state as a tourist destination, including *Vibrio* infections, blooms of blue-green algae, shark encounters, oil spills, rips, hurricanes, and 12 others. As a coastal natural hazard, *Kb* blooms might well be compared to such risks, especially low-likelihood events, such as rips (Leatherman, 2013), shark attacks (Amin et al., 2015), jellyfish stings (Cegolon et al., 2013), or stingray barbs (Diaz, 2008). These hazards attract the public’s attention because they are infrequent—and therefore unusual—but they also may involve the high impact consequences of physical debilitation or even lethality.

Economic impacts of *Kb* blooms can occur (Larkin and Adams, 2007; Morgan et al., 2009, 2011), but, especially where coherent information about bloom conditions is distributed broadly and in timely fashion, impacts tend to be confined to areas contiguous to a bloom (Bechard, 2019). For example, our recent unpublished analyses show that the “average daily rate,” which is a measure of the economic return per available hotel room, can decline in proximate coastal counties during *Kb* blooms.

The economic impacts of *Kb* blooms disappear rapidly and are difficult to observe at broader geographic levels. Tourism across the state appears to be largely unaffected by anything but temporary slowdowns in the national or world economies (VisitFlorida, 2018). For the last three decades, tourism in Florida has been growing virtually uninterrupted, adding on average almost three million tourists per year and attracting more than 116 million tourists who spent \$112 billion in the state in 2017. Too, the permanent population of the southwest Florida counties continues to grow rapidly. The state has been resilient to other coastal hazards that can lead to much larger economic losses. For example, to date, cyclone damages, which can be measured in the billions of dollars for a single storm, still are manifesting in census data only at local or regional levels (Strobl, 2011).

Losses to some localities where *Kb* blooms take place may be offset by gains to others that are bloom-free. For example, from September 2006 to July 2014, the odds that all monitored beaches in Sarasota County simultaneously



exhibited high levels of respiratory irritation were 150:1 in the morning and 100:1 in the afternoon (Hoagland et al., 2015). On any particular day, with twice daily reports available

from a service in which lifeguards report beach conditions, residents of and visitors to southwest Florida are able to choose easily among beaches along 180 miles of coast from

Pinellas to Lee counties where there are no apparent health effects from brevetoxins (Sarasota Operations Coastal Oceans Observation Lab [SO-COOL], 2020). Travel costs are certain to constrain such choices in the short term, but enhanced notification of the spatial distribution of the hazard would reveal proximate choices and facilitate trip planning over longer time horizons.

POLICY RESPONSES

Given the characteristics of *Kb* blooms and their human impacts, we argue that policies such as Mote Marine Laboratory’s Beach Condition Reporting System (BCRS) (Sarasota Operations Coastal Oceans Observation Lab [SO-COOL], 2020) that improves the public’s ability to understand the dynamic physical attributes of blooms, including their spatial and temporal aspects and the likely scale of impacts to health, recreation, and the economy, are to be preferred over physical, chemical, or biological controls. Although it is possible to compare policies on a quantitative, analytical basis (Hoagland, 2014), in this case, such a comparison is unnecessary because the infeasibility of many theoretical policy responses implies that

the emphasis must be on policies of scientific research, environmental and public health monitoring, public education, and notification.

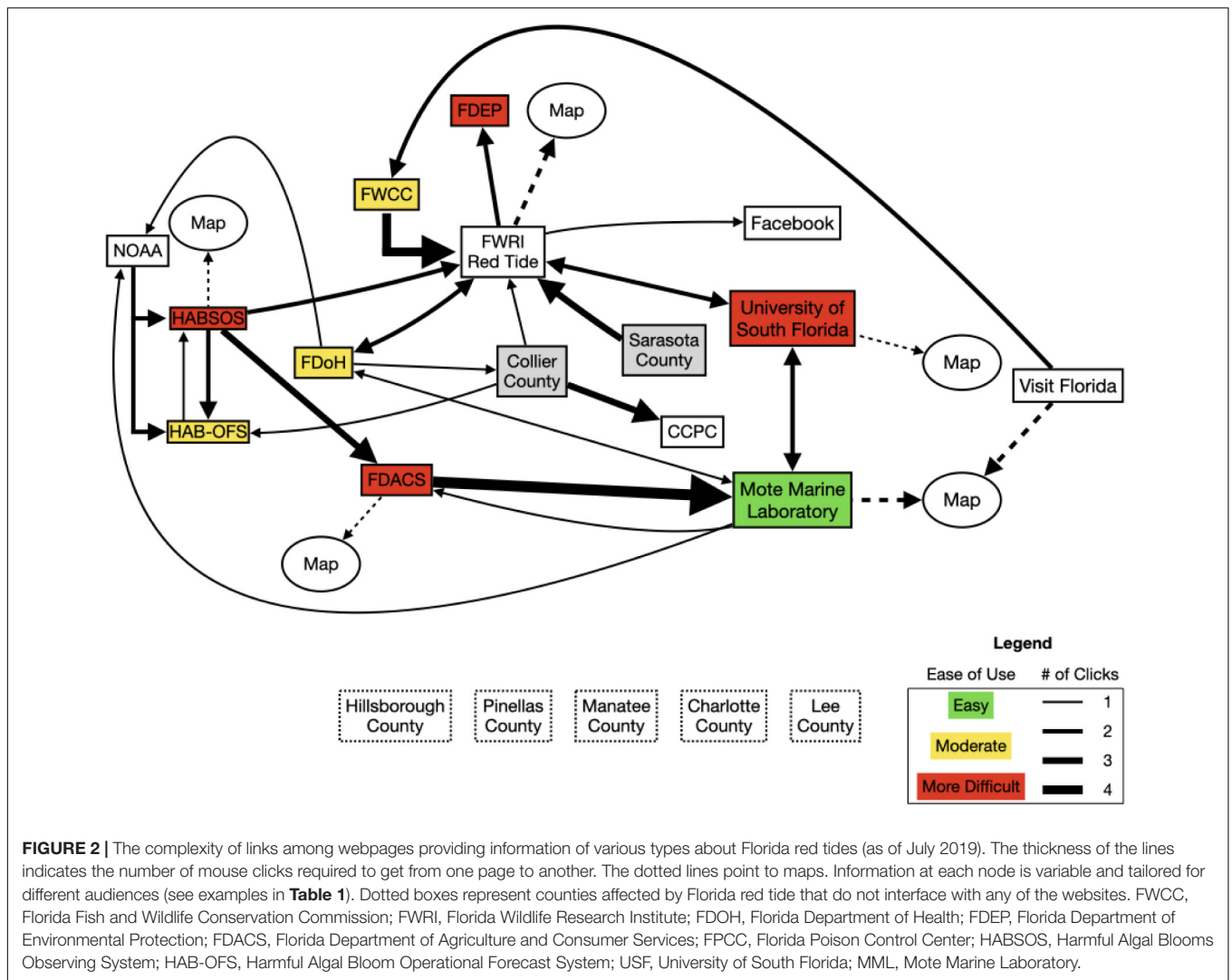
More specifically, policies to control releases of human-sourced macro-nutrients are unlikely to be justified on the basis of mitigating *Kb* blooms *per se*. The control or mitigation of *Kb* blooms through physical, chemical, or biological methods may involve unexpected and unintended side effects on other features of the environment, resulting in uncertain outcomes on the density or toxicity of the targeted bloom (Sengco, 2009). Many of the factors hypothesized as causes for the initiation or expansion of *Kb* blooms, including oceanic current flows, N-fixation by *Trichodesmium* spp., zooplankton grazing and excretion, decomposing finfish, iron-laden Saharan dust, among others, clearly are too costly to control or may even be beyond human capabilities to control (Vargo, 2009). As a consequence, monitoring of *Kb* blooms and public health and economic impacts and ongoing and open public notification of the timing and scale of blooms is to be preferred over prevention or control options.

It remains unclear that human activities, such as anthropogenic nutrient releases, are always a direct cause of *Kb* blooms. However, the weakness of the linkage between

TABLE 1 | Some means of public notification, audiences, and user-friendliness *Karenia brevis* blooms.

Service	Website	Owner*	Main purpose	Target audience(s)	Public's ease of use
Beach Condition Reporting System (BCRS)	https://visitbeaches.org/	MML	Twice-daily subjective beach conditions reports from a subset of Southwest Florida and Florida panhandle beaches	Public	Easy
Harmful Algal Bloom Operational Forecast System (HAB-OFS)	https://tidesandcurrents.noaa.gov/hab/gomx.html	NOAA	7-day advance forecast of respiratory irritation	Environmental Managers	Moderate
Red Tide Current Status (RTCS)	https://myfwc.com/research/redtide/statewide/	FWC	Regional status reports and maps based upon the previous week's <i>Kb</i> sampling	Environmental Managers	Moderate
Harmful Algal Blooms Observing System (HABSOS)	https://habsos.noaa.gov/	NOAA	Daily and historical record of <i>Kb</i> occurrence; integrated with weather and oceanographic measurements	Scientists; Environmental Managers	More difficult
Shellfish Harvesting Area (SHA) Status	https://www.fdacs.gov/Agriculture-Industry/Aquaculture/Shellfish-Shellfish-Harvesting-Area-Maps	FDACS	Closure status of local shellfish harvesting areas as a consequence of pathogens or <i>Kb</i> toxicity	Shellfish industry; Environmental Managers	More difficult
Algal Bloom Sampling Status	https://fdep.maps.arcgis.com/apps/webappviewer/index.html?id=d62c3487e8de49f6b3a6559cdf059e14	FDEP	Daily and weekly record of Microcystin levels at freshwater monitoring stations from 2017 to date	Environmental Managers	More difficult
Red Tide Prediction and Tracking	http://ocgweb.marine.usf.edu/hab_tracking/	OCG; FWRI	Seasonal predictions and 3.5-day surface and bottom forecasts using the regional West Florida Coastal Ocean Model (WFCOM) and the Tampa Bay Circulation Model (TBCOM) and FWRI <i>in situ</i> sampling	Scientists; Environmental Managers	More difficult

*Key: FDACS, Florida Department of Agriculture and Consumer Services; FDEP, Florida Department of Environmental Protection; FWC, Florida Fish and Wildlife Conservation Commission; FWRI, Florida Fish & Wildlife Research Institute; MML, Mote Marine Laboratory; NOAA, National Oceanic and Atmospheric Administration; OCG, University of South Florida, College of Marine Science Ocean Circulation Group.



human-sourced nutrients and *Kb* blooms should not be used as a reason to avoid nutrient reduction policies, which have significant ancillary benefits (Vargo, 2009). Indeed, it is sensible to implement controls on the releases of anthropogenic nutrients for the resulting benefits from reductions in other high-biomass algal blooms, including blooms of toxic cyanobacteria in freshwater and in estuarine settings, and in hypoxic or anoxic conditions.

The dynamic characteristics of *Kb* blooms as a natural hazard imply that timely and frequent public notifications, including those provided by NOAA through its 7-day Harmful Algal Bloom Operational Forecast System (HAB-OFS) predictions, are a practical form of risk communication. Approaches to disaster risk reduction at international levels, such as those recommended by the World Meteorological Organization (WMO), suggest that alerts, watches, and warnings are preferred policies for hazards with short lead times and durations (World Meteorological Organization [WMO], 2016). As hazard lead times and durations increase, preferred policies also may include forecasting and preparedness planning.

Where feasible, the public should be notified about the timing and locations of blooms so that they can take actions to avoid impacts to personal health and the economic costs of medical treatments. Certain human gastrointestinal, respiratory, and neurological illnesses appear to be linked to *Kb* blooms, and these illnesses can be of such severities that they may require visits to hospital emergency departments or inpatient admissions (Kirkpatrick et al., 2004, 2006, 2010; Fleming et al., 2009, 2010; Diaz et al., 2019). Persons with underlying respiratory (e.g., asthma) and possibly neurologic diseases, and particularly older individuals (≥ 55 years of age), appear to be among those most seriously at risk of illness during *Kb* blooms (Fleming et al., 2009; Hoagland et al., 2014; Diaz et al., 2019).

In particular, individuals with pre-existing respiratory conditions, such as asthma, chronic obstructive pulmonary disease, pneumonia, among others, may be at heightened risk, and they and their healthcare providers would benefit significantly from advance and continuing notifications of nearby *Kb* blooms. Both teenage and adult asthmatics can experience diminutions in respiratory functions during active *Kb* blooms,

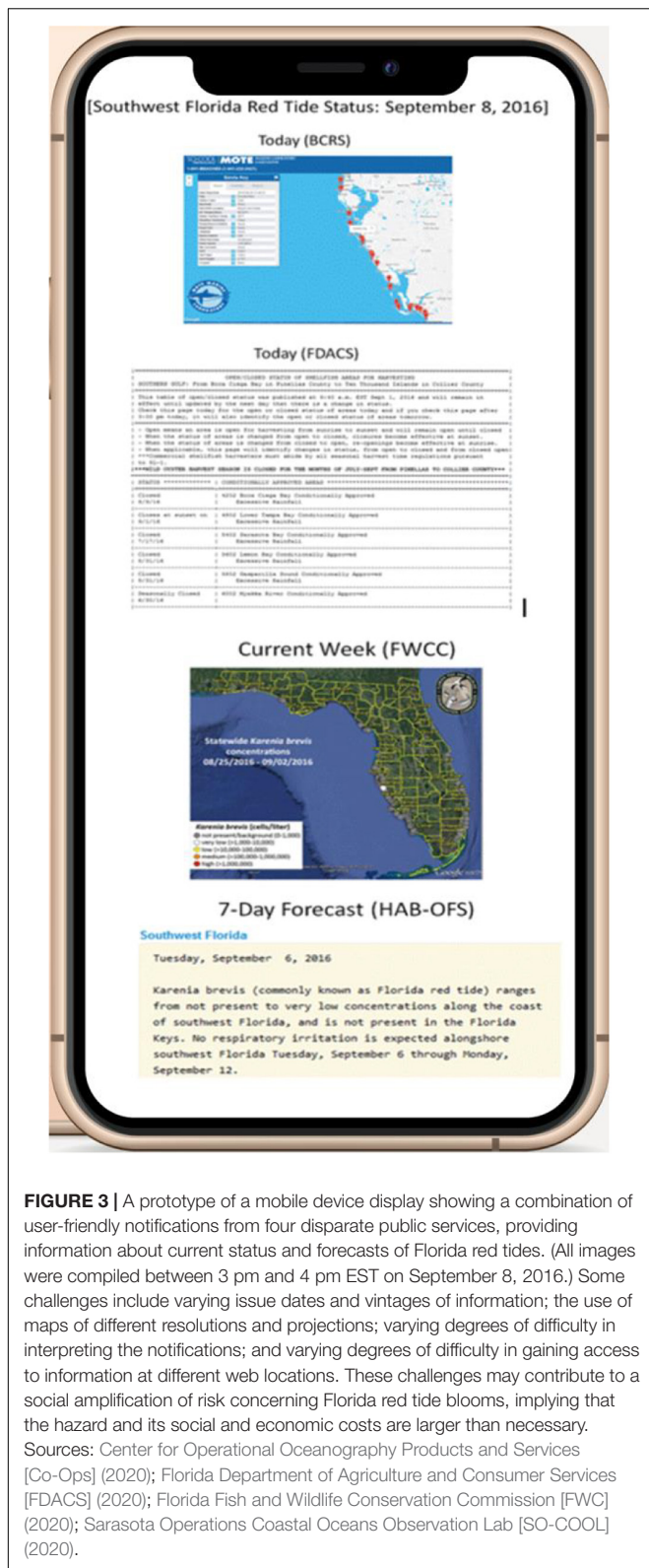


FIGURE 3 | A prototype of a mobile device display showing a combination of user-friendly notifications from four disparate public services, providing information about current status and forecasts of Florida red tides. (All images were compiled between 3 pm and 4 pm EST on September 8, 2016.) Some challenges include varying issue dates and vintages of information; the use of maps of different resolutions and projections; varying degrees of difficulty in interpreting the notifications; and varying degrees of difficulty in gaining access to information at different web locations. These challenges may contribute to a social amplification of risk concerning Florida red tide blooms, implying that the hazard and its social and economic costs are larger than necessary. Sources: Center for Operational Oceanography Products and Services [Co-Ops] (2020); Florida Department of Agriculture and Consumer Services [FDACS] (2020); Florida Fish and Wildlife Conservation Commission [FWC] (2020); Sarasota Operations Coastal Oceans Observation Lab [SO-COOL] (2020).

with acute symptoms that can last up to 5 days (Kirkpatrick et al., 2006). Emergency department visits for *asthma* appear to be unrelated to *Kb* blooms, however, perhaps because of

the familiarity of affected individuals with self-treatment for asthmatic attacks (Hoagland et al., 2009).

Current notifications of *Kb* bloom occurrences and concomitant closures of shellfish beds may be ignored or misunderstood by visitors collecting and eating shellfish recreationally (Reich et al., 2015). Notably, although human mortalities linked to *Kb* blooms are plausible, especially through the eating of contaminated shellfish [i.e., neurotoxic shellfish poisoning (NSP)] or possibly finfish, there is no firm evidence of their occurrence (Kirkpatrick et al., 2004; Watkins et al., 2008; Fleming et al., 2009).

POTENTIAL BENEFITS UNREALIZED

The potential benefits of enhanced notification of public health effects are significant. After controlling for temperature as a proxy for seasonal viral illness, pollen counts, and the numbers of exposed individuals, environmental exposure-response models can be used to predict the numbers of human illnesses and to estimate the economic costs of hospitalizations associated with *Kb* blooms of different scales. Conservative estimates of the costs of medical treatments can be in the millions of dollars for an extreme event (a bloom of long duration and with high cell abundance). If such events were to become commonplace, the capitalized costs of medical treatments could rise to the tens of millions of dollars (Hoagland et al., 2009, 2014; Adams et al., 2016). Importantly, these estimates were derived from *Kb* blooms that took place when many of the existing means of public notification were already in place, suggesting that the communication of risks to those most in danger has not yet been fully effective.

Several federal and state agencies and academic or research institutions now are involved in providing information about *Kb* blooms on their own webpages (Table 1). However, this information is distributed across many institutional providers, produced mainly for specific commercial or government audiences, such as shell fishermen or natural resource managers, and it is often very difficult for members of the public to access or construe. Figure 2 characterizes the linkages among information providers, including estimates of the number of connections needed to move between relevant sources of information. This figure describes some of the challenges of the existing system of public notification, which may lead to a social amplification of risk. Consequently, these notifications do not at present fully solve the problems of the miscommunication of risk.

A COMMON-SENSE APPROACH

Research and financial resources could be directed usefully at improving the effectiveness of public notification about *Kb* blooms. Scientific research needs to be funded on a more consistent basis to improve the ability to forecast blooms, in contrast to the historical pattern of only fleeting spikes in funding that follow severe bloom events. Notification should be focused mainly on those mostly at risk, in real-time and on an ongoing basis. A common-sense approach would target

those residents and visitors who derive significant benefits from coastal recreation, especially beachgoers and recreational fishers, vulnerable coastal visitors or residents with underlying health conditions, and their healthcare providers.

A prototype of a mobile website, to be made accessible mainly for smartphones but available also on other platforms such as laptops, tablets, or personal computers, can be found in **Figure 3**. An existing analogous example is the clearinghouse for data related to ocean sewage outfalls maintained by the Clean Ocean Foundation in Wonthaggi, Australia (Gemmill et al., 2019). The mobile website should be found easily through the use of standard internet search engines, using keywords such as Florida red tide, *Karenia brevis*, or other common descriptors. It would also be expedient if each of the information providers identified in **Figure 2** could point to the mobile website as a user-friendly source of information at the top of their homepages. To the limited number of individuals or communities still without access to smartphones, the mobile website also could be made readily available in public fora, including community centers, libraries, schools, town halls, or post offices.

Using information describing beach conditions from the Mote Marine Laboratory's BCRS, which relies on reports from municipal lifeguards, near-term bloom predictions from NOAA's HAB-OFS, shellfish harvesting area status reports from Florida's Department of Agriculture & Consumer Services (FDACS), and environmental sampling results from Florida's Fish & Wildlife Research Institute (FWRI), improved notification would comprise a single mobile webpage with a map showing the results of recent samples, the closure status of shellfish beds, the qualitative levels of respiratory irritation at individual beaches, and the 7-day regional forecast. While this information exists currently, it is spread across disparate websites, some of which are more difficult to access or to interpret than others. **Table 1** lists the leading information sources, and subjective—but educated—interpretations of the ease of use of the different websites have been incorporated into the table. Because some governmental providers may be prohibited from targeting specific user groups for their products, it is suggested that a private, non-profit organization could be funded jointly by interested institutions to serve as the central provider of these notifications.

Even with publication on the mobile website of data from federal, state, and municipal authorities, an uncertain—but likely small—potential exists for the manipulation of data or its presentation in ways that may mislead users or be inconsistent with the promotion of public health. For example, questions have been raised regarding the presentation of Florida health data on a dashboard (Division of Disease Control and Health Protection

[DCHP], 2020) to depict the morbidities and mortalities associated with the COVID-19 pandemic, especially concerning whether the data favor plans to reopen the Florida economy (Axelbank, 2020; Fang, 2020). Recommendations to mitigate the potential for misrepresentation of data for the proposed mobile website include both its provision by an impartial non-profit organization and the identification of clear links to the agencies supplying underlying data. Further suggested safeguards would comprise periodic peer-reviews of the data and its presentation by an independent, scientific advisory board and opportunities for public review and comment on the integrity of the mobile website.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Miami Internal Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors participated in discussions concerning the central thesis and designed the research and gave final approval for publication. PH, BK, and DJ conceived and wrote the manuscript.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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