HARMFUL ALGAL BLOOM SCIENCE – SEA GRANT TIP SHEET FOR EXTENSION PROGRAMS

ATTRIBUTES OF HABS

Algae are aquatic, plant-like organisms that encompass a variety of simple structures, ranging from single-celled phytoplankton floating in the water to large seaweeds (macroalgae) generally attached to the ocean floor. An *algal bloom* is defined as the rapid increase or accumulation in the population of algae in an aquatic system. Some blooms discolor the water (e.g., red tides as seen in figure 1). Some can be invisible, and some can be harmful. While most algal blooms are not harmful, some negatively affect fish and humans, as well as other animals including birds and marine mammals. These are known as *Harmful Algal Blooms* (HABs). Some algae are harmful because they can produce toxins, however, the presence of such algae does not mean that they are. Toxic concerns for humans include shellfish toxicity, skin and respiratory irritation, and contamination of drinking water. Aquatic and non-aquatic animals can likewise be directly affected, and these impacts can further affect the environment as they move through successive trophic levels, accumulating up the food chain. Algae may also be harmful when dense blooms clog the gills of fish and invertebrates or result in hypoxic or anoxic conditions due to respiration and decay. HABs often have negative economic consequences to individuals and communities including health care costs due to toxin exposure, beach clean-up activities following fish kills, and losses in tourism revenues. HABs, unlike temporally short disasters (e.g., hurricanes), present unique communication challenges due in part to their high variability in species and toxins, uncertain bloom extent and duration, and unpredictable human response.

Figure 1: A Karenia brevis (red tide) bloom in Florida. Credit: P. Schmidt, Charlotte Sun

RISK COMMUNICATION

The aim of crisis and disaster communication is to control and mitigate harm during an event by creating a shared understanding of risks and encouraging self-efficacy actions.[1,2] Key factors in HAB risk communication are balancing science-based facts with empathy, and developing action-based messaging that encourages

[1] Veil, S.R., Reynolds, B., Sellnow, T.L., & Seeger, M.W. (2008). Crisis & emergency risk communication as a theoretical framework for research and practice. *Health Promotion Practice*, 9(4), 26S-34S.

[2] Coombs, T.W. (2015). What equivocality teaches us about crisis communication. *Journal of Contingencies and Crisis Management*, 23(3), 125-128.

self-efficacy[3,4]. As a non-management, non-regulatory, non-advocacy program, Sea Grant serves a unique role by connecting people to information, tools, and assistance; gathering user information needs and stimulating new research to meet those needs; and translating science for practical application.

POTENTIAL SEA GRANT AUDIENCES

- State resource management agencies
- Local government agencies
- Tribes
- State and community institutions and organizations
- Tourism and visitor convention bureaus
- Traditional media
- Hospitality industries
- Resource-dependent businesses
- Commercial harvesters
- Recreational and subsistence harvesters
- Residents and visitors

POTENTIAL ACTIONS

BEFORE A BLOOM

- Identify relevant audiences.
- Identify HAB experts and responsible agencies.
- Identify relevant communicators of HAB information and their connections to their audiences.
- Identify the people and agencies responsible for closures and reopening processes (e.g., fisheries, beaches).
- Identify trusted members of the community.
- Identify HAB communications mechanisms.
- Gather information on common HABs in the region.
- Anticipate questions (see potential questions on page 3).
- Determine what languages are important and methods for reaching non-English speaking individuals/communities.
- Develop relationships and processes for sharing information and resources.

DURING A BLOOM

- Work with leaders of industries most impacted to understand their needs and questions (e.g., tourism, fisheries, health care) and develop science-based responses.
- Educate about the HAB science – including the organism responsible and bloom dynamics.

[3] Staugler, E.A., Simoniello, C., & Monaghan, P. (2021). Insights from the public on key elements of red tide messaging and modes of communications. Gainesville, Fla.: Florida Sea Grant College Program. SGR-146.

[4] Krimsky, L.S., Staugler, E.A, Simoniello, C., Montes, N., Monaghan, P. & Hecker, F. (2021). Development of a red tide communications plan for Florida: Final report. Gainesville, Fla.: Florida Sea Grant College Program. SGR-148.

- Communicate information about unknown aspects of the bloom and uncertainties associated with forecasting duration and impacts.
- Identify self-efficacy actions to share with others to reduce public health risks.
- Broadly disseminate consumer-friendly, location-specific HAB-related environmental data.
- Share mitigation actions being taken during the bloom.
- Share partner resources.

AFTER THE BLOOM ENDS

- Develop and/or participate in community forums.
- Discuss successes, lessons learned, and identify opportunities for future bloom events.
- Distribute messaging focused on HAB research and mitigation, including uncertainties and actions to resolve these uncertainties.
- Review educational materials, resources, and messages and update them to reflect the current state of the science.

POTENTIAL QUESTIONS FROM SEA GRANT AUDIENCES

GENERAL

- What is a harmful algal bloom, red tide, cyanobacterial HAB, blue-green algae, etc.?
- Why is this bloom occurring? What is causing it?
- Where will the bloom move? What is driving the growth of the bloom? Are there ways to influence that?
- How long will it last?
- Is there a way to stop it?
- What can I do?
- Can we predict when and where a harmful algal bloom will occur to have proactive responses?

PUBLIC HEALTH

- Is it ok to eat the local seafood?
- How do I know if there is a closure for swimming or fishing?
- How do I protect myself and family from exposure?
- Can my pet go into the water?
- Is it safe for my workers to be in or near the water?
- What are symptoms of exposure and what do I do if I think I've been exposed?
- Is it safe to harvest shellfish?
- How do HABs affect drinking water?
- What triggers a water contact advisory or beach closure?

MANAGEMENT

- Are tools available to help me identify when to move fishing equipment/adjust aquaculture systems?
- What will trigger a fisheries closure? What are protocols to reopen?
- How do I communicate beach closures or water contact advisories? Do I need to enforce them?
- Is it safe for staff to remove dead animals from the beaches? How can they do it safely? How and where do they put the debris? Are there legality issues (e.g., closed seasons/restricted species)?

- What is the most efficient way to remove dead animals?
- Are there laws or regulations that inform certain actions at different levels of HABs presence?
- Who is the responsible agency/agencies for closures?
- Can the algae/toxins be removed from the water?
- Is funding available for event response?

MONITORING

- Who is responsible for monitoring?
- What monitoring is occurring?
- Where can monitoring data be found?
- What should a proactive monitoring program look like?
- How often should we/do they sample the water for safety reasons?
- What labs can test the water for presence of the toxins or HABs?
- How long does it take to process a sample?
- How long will toxin be around? What is the half-life of the toxin?
- Should sediment samples be taken? Should we monitor different habitats?
- For shellfish aquaculture operations, should/how can I implement a sampling program to prevent bringing contaminated water into my hatchery?

Figure 2: A cyanobacteria (AKA Blue-green algae) bloom. Credit: Michigan Sea Grant

RESOURCES FOR ADDITIONAL INFORMATION

- U.S. National Office for Harmful Algal Blooms: https://hab.whoi.edu/
- Centers for Disease Control and Prevention (CDC): https://www.cdc.gov/habs/general.html
- Environmental Protection Agency (EPA) FAQs: https://www.epa.gov/sites/default/files/2016-11/documents/harmful_algal_blooms_and_cyanotoxins_frequently_asked_questions.pdf
- National Oceanic and Atmospheric Administration: https://www.noaa.gov/what-is-harmful-algal-bloom

Betty Staugler, NOAA/Sea Grant HAB Liaison – staugler@ufl.edu

Betty Staugler serves as NOAA Harmful Algal Bloom liaison, where she provides a link between NOAA's Sea Grant, National Centers for Coastal Ocean Science, CoastWatch, and Integrated Ocean Observing System. Housed within Florida Sea Grant, Staugler forges and enhances partnerships by providing expertise, research, and extension services that leverage partners' work to efficiently meet the needs of coastal and Great Lakes communities threatened by harmful algal blooms.

ACKNOWLEDGEMENT

The following people informed this publication: Betty Staugler, Steve Sempier and Sherry Larkin.

This publication was supported by the National Sea Grant College Program of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), Grant No. NA21OAR5280154 – AWD10069. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of these organizations.