

Reports

---

12-1-2012

## Harmful Algal Bloom (HAB) Primer For the Virginia Shellfish Industry

Kimberly S. Reece  
*Virginia Institute of Marine Science*

Karen Hudson  
*Virginia Institute of Marine Science*

Follow this and additional works at: <https://scholarworks.wm.edu/reports>



Part of the [Aquaculture and Fisheries Commons](#)

---

### Recommended Citation

Reece, K. S., & Hudson, K. (2012) Harmful Algal Bloom (HAB) Primer For the Virginia Shellfish Industry. Marine Resource Report No. 2012-14; VSG-12-14. Virginia Institute of Marine Science, William & Mary. <http://dx.doi.org/doi:10.21220/m2-rxsx-rj28>

This Report is brought to you for free and open access by W&M ScholarWorks. It has been accepted for inclusion in Reports by an authorized administrator of W&M ScholarWorks. For more information, please contact [scholarworks@wm.edu](mailto:scholarworks@wm.edu).

# Harmful Algal Bloom (HAB) Primer For the Virginia Shellfish Industry

*Prepared By:*  
**Dr. Kimberly Reece and Karen Hudson**  
**Virginia Institute of Marine Science**  
**Gloucester Point, VA**



Aerial view of the York River near Sarah's Creek during an algal bloom. Aug. 3, 2012. Photo by Kimberly Reece.

**VIMS Marine Resource Report No. 2012-14**  
**VA Sea Grant Publication No. VSG-12-14**  
**December, 2012**

This work is a result of research sponsored in part by NOAA Office of Sea Grant, U.S. Department of Commerce, under Grant No. NA10OAR4170085 to the Virginia Institute of Marine Science and Virginia Sea Grant. The views expressed herein do not necessarily reflect the views of any of those organizations.

Additional copies of this publication are available from:

Virginia Sea Grant Communications  
Virginia Institute of Marine Science  
P.O. Box 1346  
Gloucester Point, VA 23062  
804-684-7167  
[vsgpubs@vims.edu](mailto:vsgpubs@vims.edu)  
[www.vims.edu/map/aquaculture](http://www.vims.edu/map/aquaculture)

## Abstract

Harmful algal blooms have been increasing in Virginia over the past several years with the expansion of new species into the area that have the potential to be toxic. To date, the biggest concern for shellfish growers has been survival of larvae and small nursery seed as these are the life stages most vulnerable to bloom conditions. But the emerging concern, as we learn more, is the potential for human illness from consuming shellfish exposed to a bloom. Toxins can impact larval and seed survival and/or pose a risk to human health if concentrated in shellfish and consumed. Much about the toxicity of Virginia blooms is unknown, however, particularly regarding any human health effects, but shellfish mortality and occasionally human toxicity are a problem for other shellfish growing regions across the country and abroad.

Research is ongoing at the Virginia Institute of Marine Science to identify bloom species and the geographic “hot-spots” in Virginia. Shellfish growers have been fundamental in these efforts by reporting and sampling bloom events, as well as reporting any associated shellfish mortalities. This document is meant to provide a contemporary summary of harmful algal bloom information as it relates to commercial and non-commercial shellfish growers in Virginia.

## What are harmful algal blooms (HABs)?

Other names: red tides, mahogany tides, brown tides, “bad water”

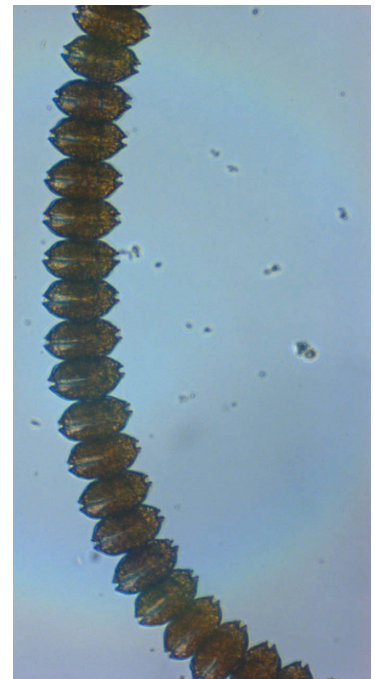
- A bloom is a rapid increase in the number of algal cells (single celled marine plants) in a body of water
- Usually blooms are dominated by a single type (species) of cells with 10,000’s to 100,000’s of cells per milliliter of water
- Many species can produce toxins harmful to animal and human health
- Particular environmental conditions such as temperature, salinity, nutrient levels etc. influence when blooms occur, where they occur and what species dominates

## Where do they occur?

- Algae blooms are found all over the world in freshwater and saltwater
- Specific problem areas in the US include Florida and the Gulf of Mexico, Northern California, the Pacific NW and Alaska, and New England with recent expansion to all coastal areas

## Virginia Blooms

- Some occur in the spring, but most are in the late summer and early fall (Aug – Sept)
- Algal cell die-off can lead to low dissolved oxygen (DO) events (also known as hypoxia/anoxia)
- Some blooms are associated with offensive odors and respiratory irritation, and/or with fish, shellfish or crab kills due to low DO or toxins
- Several potentially harmful algal species are found in Virginia waters



*Alexandrium monilatum*.  
100X magnification.  
Photo by Bill Jones / VIMS.

## Major concerns for VA shellfish growers

- Survival of larvae and nursery seed due to:
  - » low dissolved oxygen (algal cell die off which lowers available oxygen)
  - » reduction of water flow to the nursery system (physical clogging of screens)
  - » physical impairment of filter feeding by the algal cells
  - » toxic effects
- Emerging concerns include the potential for human illness from consuming shellfish that have accumulated toxins from a bloom. More research is needed to determine if there is a potential for human health issues from Virginia blooms.

*\*To date there have been no reported cases of HAB-related illness from consuming shellfish from Virginia waters.*

## History of Virginia Department of Health (VDH) shellfish growing area closures from HABs

- 1997 in the Pocomoke River as a proactive measure for *Pfiesteria*. No toxins were found in shellfish.
- Feb - Mar 2002 in tributaries of the Potomac River from the Rt 301 bridge to the mouth, including the Little Wicomico River. Maryland Department of the Environment also closed the Potomac from the Rt 301 bridge to Smith Point. The concern was diarrhetic shellfish poisoning (DSP) from *Dinophysis*<sup>1</sup>. FDA found trace amounts of toxin in shellfish meat samples, but they were below food safety levels and not considered a risk to humans.

## Impacts on shellfish survival and possible solutions to minimize mortality

### Adults

- Reported adult shellfish mortality in the field to date is minimal. Adults will typically close up and stop feeding during harmful bloom conditions. When the bloom passes, they will resume feeding. Starvation and low DO are concerns if the bloom persists. In most cases blooms will not linger long enough to impact survival. Temporary relocation of shellfish grow-out is a possibility, but not usually practical from an economic standpoint.
- Adult oyster mortality has been observed in laboratory trials when animals continued to feed during exposure to some HAB species.

### Seed

- There have been frequent reports of shellfish seed mortality in nursery systems during HAB blooms. The best strategy is to clean the nursery silos daily with fresh water to limit the amount of exposure to the HAB; prevent loss of water flow; and remove dead and dying algal cells that will deplete oxygen.

---

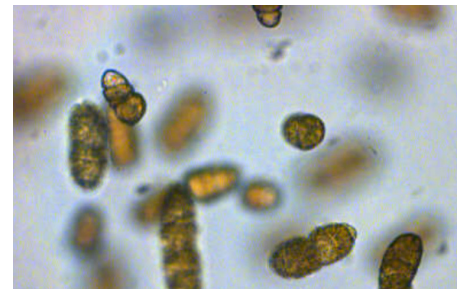
<sup>1</sup> [http://research.myfwc.com/images/articles/25973/358\\_tango.pdf](http://research.myfwc.com/images/articles/25973/358_tango.pdf)

## Larvae

- Remote setting stations have reported low larval survival and poor setting success during bloom conditions. The best strategy is to try and avoid setting during a bloom event but it is difficult when blooms appear after larvae have been introduced to the tank. In this case, cut off flow-through water during the peak bloom times and turn on air to the tank. Limit drawing water at a time when the bloom is most abundant and if possible, pump water from an area outside the bloom.
- HAB species have also been known to pass through shellfish hatchery filtration and cause larval mortality. The assumption is mortality is a result of toxin exposure. Mitigation here is more challenging and would require testing different methods of filtration.
- Larvae mortality has been observed with exposure to several Virginia HAB species during laboratory studies.

## Dominant Virginia bloom formers (currently) that are *potentially* toxic

- *Cochlodinium polykrikoides*
- *Alexandrium monilatum*
- *Chattonella subsalsa*
- *Heterosigma akashiwo*



*Cochlodinium polykrikoides*.  
100X magnification. Photo by  
Bill Jones / VIMS.

## Common marine HAB toxins in shellfish and associated human illnesses

Toxin	Human Illness	HAB Species	Problem Areas Nationally
Brevetoxins	Neurotoxic shellfish poisoning (NSP)	<i>Karenia brevis</i> <i>Chattonella subsalsa</i> <i>Scrippsiella trochoidea</i>	Gulf
Saxitoxin	Paralytic shellfish poisoning (PSP)	Some <i>Alexandrium</i> species	Northeast coast, West coast, Alaska
Domoic Acid	Amnesic shellfish poisoning (ASP)	<i>Pseudo-nitzschia</i> species (diatoms)	Northeast Coast, West Coast, Alaska
Okadaic Acid	Diarrhetic shellfish poisoning (DSP)	<i>Dinophysis</i> <i>Prorocentrum</i> species	West Coast, Northeast coast

## Routes of human exposure to HAB toxins

- Direct contact with water through wading, swimming, boating or other employment or recreational activities
- Consumption of shellfish or fish that have been exposed to the bloom and have accumulated toxins

## Important considerations regarding toxicity

- Not all species produce toxins
- Not all blooms of HAB species that can produce toxin actually produce the toxin
- Toxins can be harmful to larvae and seed, but not pose a human health risk

## Procedure for Sampling Blooms

1. Note the date, time, and location specifics of the bloom area  
Also helpful are salinity, water temperature and any other information such as how long the bloom has been present and if there are any associated fish, crab or shellfish mortality.
2. Collect ~4 ounces of water from the bloom in a clean container  
Any clean container will do - soda bottles, etc.
3. Store sample at 15-20° C (59-68° F)  
This is very important! If the sample gets too hot, algae cells will burst open and if too cold they will encyst leaving them unidentifiable.  
\*Suggestions for storage in the heat of the summer - wrap sample container in wet paper towels and place in a cooler with a gel pack making sure the gel pack doesn't come in direct contact with the container. You can add newspaper or something handy to keep the sample separate.
4. Deliver the sample to Kim Reece at VIMS (Gloucester Point campus) as soon as possible  
Include a written document with your contact information and the specifics in step 1. Sample may be brought to the reception desk at the front of Watermen's Hall during normal business hours Monday – Friday providing it is properly labeled. If delivery is not an option, contact Kim Reece directly and someone may be able to pick up the sample.

Kim Reece, 804-684-7407, kreece@vims.edu (email subject line: HAB bloom sample).



SEM of *Cochlodinium polykrikoides*. Photo by Patrice Mason / VIMS.

## Reporting Blooms

The following form is available online at: [http://www.vims.edu/bayinfo/habs/hab\\_form/index.php](http://www.vims.edu/bayinfo/habs/hab_form/index.php)

# VIMS Algal Bloom & Fish Kill Reporting Form

Please use this form report a bloom or fish kill.

### Who Reported this Incident?

\* Name of Individual

Affiliation

Agency Name

\* Location of Person Reporting Incident

Contact Information (email and/or phone number)

### Information Being Reported

\* What are you reporting?

Fish Kill     Algal Bloom

\* Location of the Incident

Bloom Description and Comments (e.g. color, time first notices, etc.)

4500 characters maximum

Fish Kill Description and Comments. Are fish currently dying or already dead?

4500 characters maximum



## **Additional Resources Online**

### **Virginia Institute of Marine Science**

<http://www.vims.edu/bayinfo/habs/index.php>

### **Virginia Department of Health / Division of Shellfish Sanitation**

<http://www.vdh.virginia.gov/EnvironmentalHealth/Shellfish/>

### **Virginia Department of Health – What are Harmful Algal Blooms**

<http://www.vdh.virginia.gov/epidemiology/DEE/Waterborne/HABS/>

### **National Shellfish Sanitation Program (NSSP)**

2009 Section II Chapter IV – Shellstock Growing Areas

@.04 Marine Biotoxin Control

<http://www.fda.gov/Food/FoodSafety/Product-SpecificInformation/Seafood/FederalStatePrograms/NationalShellfishSanitationProgram/ucm046988.htm>

### **National Oceanic and Atmospheric Administration (NOAA)**

- National Centers for Coastal Ocean Science / Center for Sponsored Coastal Ocean Research  
*Regional HAB research, Federal Legislation, Programs, fact sheets, Economic impacts*  
<http://www.cop.noaa.gov/stressors/extremeevents/hab/current/HABReg08.aspx>
- Northwest Fisheries Science Center – Harmful Algal Blooms  
<http://www.nwfsc.noaa.gov/hab/>
- NOAA Harmful algal Bloom Operational Forecast System, Additional HAB Resources-  
*Resources by region*  
<http://tidesandcurrents.noaa.gov/hab/resources.html>

### **Centers for Disease Control and Prevention – Marine Toxins**

[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins_g.htm)

### **Woods Hole Oceanographic Institute - Harmful Algae**

*Regional Distribution maps, FAQs, Photos*

<http://www.whoi.edu/redtide/home>

### **Harmful algae and Marine Aquaculture in the Northeastern United States**

NRAC Publication No. 209-2010

<http://nrac.umd.edu/files/Factsheets/NRAC%20209-2010.pdf>