Remote Sensing Harmful Algal Bloom Workshop
CHESAPEAKE AND COASTAL BAYS REGION
Thursday, May 1, 2014
O'Callaghan Hotel, 174 West Street, Annapolis, Maryland

NOAA Sea Grant Maryland

HARMFUL ALGAL BLOOM MANAGEMENT

IN THE CHESAPEAKE AND COASTAL BAYS

The assessment of algal blooms in the Chesapeake and coastal bays is led by state agencies. In Maryland, the Department of Environment (MDE), the Department of Health and Mental Hygiene (DHMH), and the Department of Natural Resources (DNR) collaborate to manage a state-wide harmful algae bloom (HAB) surveillance program. Virginia's HAB program includes the Virginia Department of Environmental Quality, the Virginia Department of Health (VDH), and other state partners who routinely monitor the main bay and tributaries and respond to and investigate causes of fishkills. **The Chesapeake and coastal bays HAB surveillance programs focus on protecting public health and the environment by protecting beaches and recreational waters as well as growing areas for shellfish from effects associated with toxins produced by harmful algae.**

Table 1: FDA's action levels for toxins associated with marine biotoxins that can accumulate in shellfish**.** *Since test methods for marine biotoxins in shellfish meats are expensive and our region has not seen action levels or reported illnesses, cell counts are used instead of toxin assays to monitor potentially harmful blooms***.** The last column shows the bloom levels that raise the level of concern in MD and VA.

Algal species	**Main Toxin**	**Shellfish Related Illness**	**Action Level**	**Food Commodity**	**Bloom Level of Concern**
Alexandrium. tamarense species complex	Saxitoxin	Paralytic Shellfish Poisoning	80 µg/100g	All Fish	≥ 500 cells/ml
Karenia brevis, Chattonella	Brevetoxins	Neurotoxic Shellfish Poisoning	20 MU/100g	Clams, mussels, oysters, fresh frozen or canned	*Chatt sp* >10,000 cells/ml
Dinophysis	Okadaic acid, dinophysis toxins, yessotoxins, pectenotoxins	Diarrhetic Shellfish Poisoning	0.16 mg/kg	Clams, mussels, oysters, fresh frozen or canned	≥10 cells/ml
genus *Pseudo-nitzschia*	Domoic Acid	Amnesic Shellfish Poisoning	20 mg/kg	All Fish (except viscera of Dungeness crab)	≥1,000 cells/ml

Both state HAB programs employ field response, phytoplankton identification, laboratory analysis, and management actions as appropriate to protect public health and the environment. State agencies coordinate with local health departments and researchers at regional universities. Analytical support is provided by DNR, MDE, and the University of Maryland Center for Environmental Science Institute of Marine and Environmental Technology in Maryland and Old Dominion University and the Virginia Institute for Marine Science in Virginia. Both states also work closely with the U.S. Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention. FDA has provided guidance for states to use through the Fish and Fishery Products Hazards and Controls Guide and the National Shellfish Sanitation Program (NSSP) (Table 1). Through this program, FDA has established action

levels, tolerances, and guidance levels for poisonous or deleterious substances in seafood, including marine biotoxins in fish and shellfish. For Maryland and Virginia, marine biotoxins pose the greatest concern for molluscan shellfish, and both states have biotoxin contingency plans that outline surveillance and management procedures. FDA's action levels for diarrhetic shellfish poisoning, paralytic shellfish poisoning, neurotoxic shellfish poisoning, and amnesic shellfish poisoning are presented in the NSSP Model Ordinance included in the Guide for Control of Molluscan Shellfish.

No federal regulatory guidelines for cyanobacteria or their toxins currently exist in the United States. Maryland has issued advisories against water contact in certain lakes and streams due to microcystin produced by blue green algae. Maryland uses a microcystin threshold of 10 µg/l to issue "no contact" advisories while Virginia uses 6 µg/l. Virginia also uses > 100,000 *Microcystis aeruginosa* cells /mL, or agency confirmed blue-green algal "scum" or "mats" on water surfaces to issue no contact advisories. Drinking water guidelines are based on the World Health Organization provisional value of 1.0 µg/L microcystin-LR.

Other regional HABs are known to starve shellfish (*Aureococcus anophagefferens*), kill fish without apparent harm to people (*Karlodinium veneficum*), produce toxins whose effects have not yet been described (*Cochlodinium polykrikoides*), or disrupt ecosystem function (*Prorocentrum minimum* and dense macroalgae blooms). These blooms continue to be monitored by Maryland, Virginia, and their University partners to document their extent and impacts (Table 2).

When significant HAB events occur in Maryland, DHMH, MDE, and DNR coordinate with local health departments to inform the public through media advisories, posted signs, and postings on multiple websites including DNR's Eyes on the Bay[1], MDE's Healthy Beaches webpage[2], and DHMH's HAB webpage[3]. In Virginia, advisories are also coordinated with local health departments and are issued through media releases, posted signs, and VDH's website[4]. Generally, advisories do not impact fishing, because HAB-related toxins tend to accumulate in internal organs rather than fish parts that are consumed.

Table 2: Algae species, toxins, and bloom levels of concern for ecosystem impacts.

Algal species	**Main Toxin**	**Impacts**	**Action Level**	**Bloom Level of Concern (cells/ml)**
Alexandrium monilatum	Goniodomin A; saxitoxins & gonyautoxins	Lethal to fish	N/A	500
Aureococcus anophagefferens	None	Starve shellfish Shade seagrasses	N/A	35,000
Cochlodinium polykrikoides	Reactive oxygen species	Lethal to early life stages of fish and shellfish	N/A	3,000
Karlodinium veneficum	Karlotoxins	Lethal to fish	N/A	10,000
Microcystis aeruginosa	Microcystin	Liver toxin Can bioaccumulate	VA: 6 µg/l MD: 10µg/l in recreational waters	VA: 100,000 MD: 40,000
Prorocentrum minimum	None	Contributor to dead zones	N/A	10,000

[1] http://mddnr.chesapeakebay.net/eyesonthebay/habs.cfm
[2] http://www.marylandhealthybeaches.com/
[3] http://phpa.dhmh.maryland.gov/OEHFP/EH/SitePages/harmful-algae-blooms.aspx
[4] www.vdh.virginia.gov/epidemiology/DEE/HABS/HABmap.htm