RED TIDE by Joe Udwari

Preface: You may want to skip this article if you have read or heard ad-infinitum stories about red tide or been engaged elbow deep in PGI's fish kill cleanup effort. However, before you stop reading, know that your participation in the messy cleanup was greatly appreciated by many.

I was asked to put something together on this topic for our newsletter since I volunteer with water quality monitoring efforts conducted by the Charlotte Harbor Aquatic Preserves (CHAP) group under the Florida Department of Environmental Protection. Maybe this will serve as a primer on red tide, or just a reminder of a significant event. It's fairly rare for red tide to be as persistent as it has been this year (especially in upper Charlotte Harbor) and even more rare for the massive fish kills experienced in our canals. The exact reasons for all the recent fish kills may never be known, and it's possible that several causes contributed. I am not a red tide expert but hopefully this article will help lead you to useful resources and interesting information regarding Florida's effort to monitor harmful algal blooms and forecast bloom movement, and alert those potentially impacted. As you can imagine, it's a complex issue that is spearheaded by the Florida Fish and Wildlife Conservation Commission (FWC) in collaboration with many other State and local governmental agencies, universities, private entities, and volunteers.

Resources: Below are links to three pages on FWC's website in order to:

- Familiarize yourself with readily available resources.
- Register to obtain FWC red tide reports via email.
- Learn about various algal blooms in our local waters and their toxicity to finfish, shellfish, mammals (including pets), and birds.
- Understand the potential direct and indirect effects on humans.
- Consider volunteering to support this effort.

1. **FWC Red Tide Status Map:** http://myfwc.com/research/redtide/statewide/ (Figure 1 at the end of this article is an example of a statewide status map).
2. **Red Tide FAQ:** http://myfwc.com/research/redtide/faq/
3. **Some Algae fact sheets:**
   http://myfwc.com/media/3333198/Karenia-brevis-factsheet.pdf
   http://myfwc.com/media/3323419/Pseudo-nitzschia.pdf
   http://myfwc.com/media/3323422/Pyrodinium-bahamense-factsheet.pdf

Red Tide Characteristics: A brief synopsis of information contained in the above referenced web pages follows to provide a little background on red tide, before summarizing red tide sampling results and fish kills observed from mid-November to mid-December.

Florida red tide is caused by large quantities or blooms of the Karenia brevis (i.e., K. brevis) organism, typically occurring in late summer or early fall in the Gulf of Mexico and estuaries like Charlotte Harbor. Such blooms have occurred well before our coastline and harbors were developed, and there is no known correlation between such blooms and urban/agricultural nutrient pollution. Such nutrient pollution, along with sunlight and salinity can, however, aid the growth of the organism. Red tide typically develops 10 to 40 miles offshore, can extend from the seafloor to the surface, and can cover areas as large as 10,000 square miles. Currently, no known methods exist for killing such blooms occurring in salt or brackish water without causing other incidental environmental damages. Fresh water does, however, kill this organism.

Blooms can last a few weeks and even up to a year, and their migration is largely affected by wind and water currents. Large concentrations of K. brevis can impart a red-brown color to the water, but Gulf and Harbor water that has a more normal color can still contain large enough concentrations, causing irritation to humans and probable fish kills.

The toxins within K. brevis affect the central nervous system of fish and other vertebrates, and can accumulate in filter feeders like oysters and clams. Recreational harvests of oysters and clams are banned during red tide outbreaks, and local commercial supplies are closely monitored. Shellfish harvesting area status maps are issued by the Division of Aquaculture. Cooking or freezing seafood does not destroy these toxins and they cannot be seen or tasted. Eating the edible parts of cleaned, recreationally harvested crabs (i.e., not the tomally) and shrimp is not banned. Human consumption of freshly caught filleted fish is not poisonous since the toxins accumulate in the gut.

Toxins can be released when the K. brevis organism dies or breaks up due to wave action, which can lead to respiratory problems for asthmatics or people with emphysema. For information on red tide-related human health issues contact the Department of Health Aquatic Toxins Program. K. brevis-contaminated water is safe for most people, although respiratory irritation can occur as noted above. Pets should not be allowed to enter such water since they might eat contaminated fish or sea foam, or ingest toxins by licking themselves dry after contact with such water.

Other bacteria or algae may exist in red tide, and potentially cause similar or other health concerns to humans and wildlife. For example, Pseudo-nitzschia can kill marine mammals and seabirds, and Pyrodinium bahamense can also kill fish and lead to poisoning of people eating contaminated shellfish or puffer fish. These are not the subject of this article, although information on such organisms and bacteria can also be found on the FWC website.

Observations, Test Results, and Impacts: This section is based on analytical data as well as empirical evidence. Areas of red tide were reported to the north along the southwest Florida coast in late October and early November, about a month after Hurricane Matthew whipped up 25-foot waves in the Gulf. Perhaps it helped stir up bottom sediments offshore that contained the K. brevis organism. Periods of net southerly nearshore surface flow in the Gulf, along with net easterly offshore subsurface flow, likely helped move the bloom into our area. Similar conditions along the southwest coast still exist through December 15, as shown in Figure 2.

Scattered dead fish started showing up nearshore and at several locations in Charlotte Harbor by mid-November. These were mostly pinfish, a few black drum, and some catfish. Some members noticed them just off Boca Grande, in Turtle Bay, and along the East Wall. On November 14, I remember seeing dying bait fish swimming in circles between Fisherman's Village and Colony Point (perhaps neurotoxins at work). A sample taken just south of Hog Island on November 28 had the highest concentrations of K. brevis (1,318,600 cells/liter) detected in the harbor during the recent sampling and testing effort reported herein (see Figure 3). Figure 3 also shows the locations of other samples taken in our area as well as a key to corresponding test results. Samples from Pirate Harbor and Burnt Store Marina taken on December 1 had K. brevis concentrations of 721,256 and 60,333 cells/liter, respectively. The concentration in samples collected on December 5 from Gilchrist Park Pier, the Ponce boat ramp, and Pelican Bay were 569,333, 340,667 and 556,000 cells/liter, respectively. Salinity, dissolved oxygen, and pH values at Gilchrist Park Pier on December 5 were 27 parts per thousand, 6.2 mg/l, and 7.9, respectively. Almost all of the locations had K. brevis concentration sufficiently high enough to cause possible or probable fish kills and respiratory irritation in some people. The lack of rain in our watershed since mid-October substantially reduced the flow of freshwater coming out of the Myaka and Peace Rivers. We were at or close to a record drought for our area during this time of year, which allowed high tides, especially during full and new moons, to push the red tide as far up into our harbor and canals as it did.

Unfortunately, this all coincided with our annual canal mullet congregation as they were preparing to spawn. The likely effects of this confluence of events are shown in Figure 4. Dead mullet by the thousands were observed in our canals, which precipitated a call for volunteers to assist the City of Punta Gorda in quickly and safely disposing of the rotting carcasses before they presented other environmental and health issues (not to mention aesthetic and foul odor concerns). Birds such as osprey, cormorants, and vultures, observed feeding on the rotting fish, can also fall prey to the brevetoxins released by K. Brevis. Therefore, the speedy disposal of dead fish was paramount.

Red tide sampling results from December 8 through 15 show the persistence of K. brevis in our waters (see Figure 5). Reported concentrations were still consistent with probable fish kills in parts of Charlotte Harbor and Gasparilla Sound, and at 6 miles west of Boca Grande Pass (two dozen spunky bait fish, including sand perch, grunt, and cigar minnows I caught in about 40' of water on December 14, all died after being in my live well for about 30 minutes; all bait I caught 15 minutes later at 9 miles out survived). Lower concentrations were typically observed in Pine Island Sound and Matlacha Pass, and I hope this downward trend of K. brevis concentrations continues. Better yet, I hope red tide disappears altogether from our 'radar' by the time you read this article. Wishing you a healthy and bountiful 2017.

Figure 1 - Example of Florida Red Tide Status Map prepared by the HAB Group of FWC's Research Institute (FWRI)

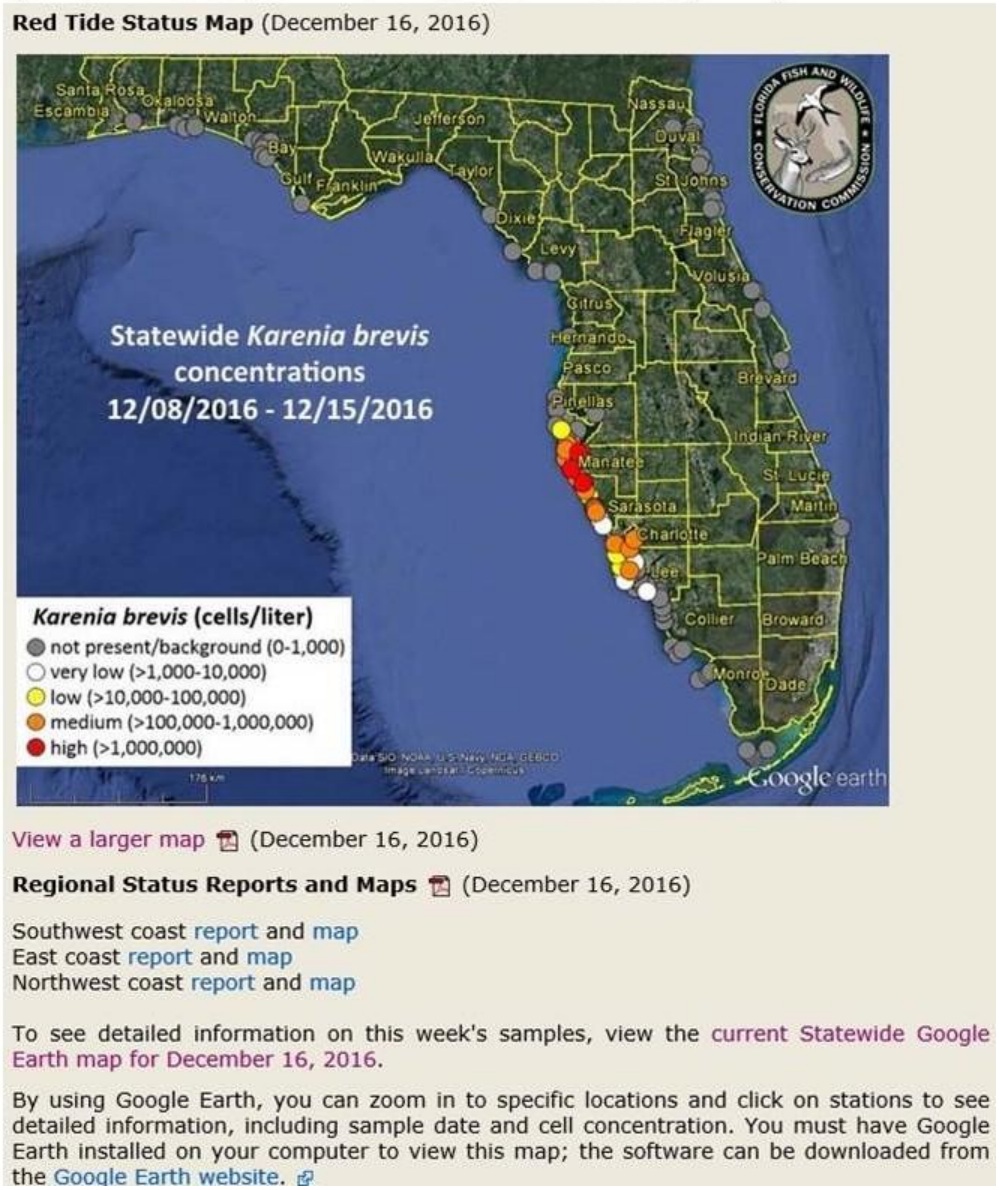


Figure 2 - Example of Red Tide Status Report by FWC & University of South Florida (showing sample test results along with offshore surface areas of potential red tide distribution based on satellite imagery)

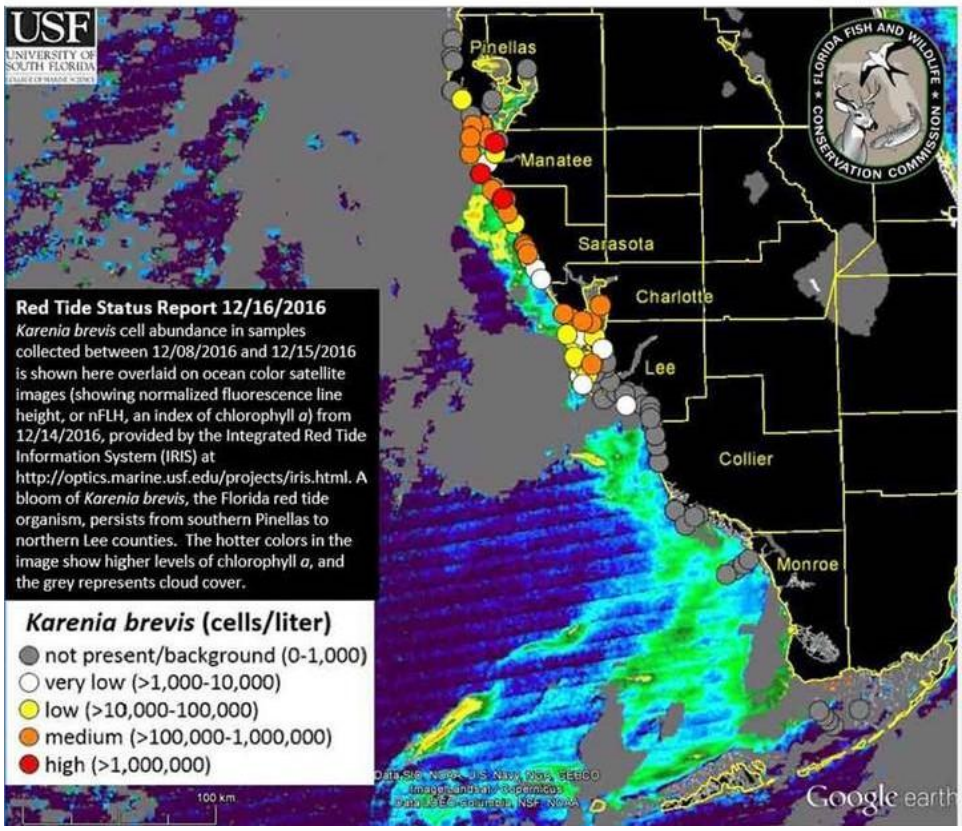
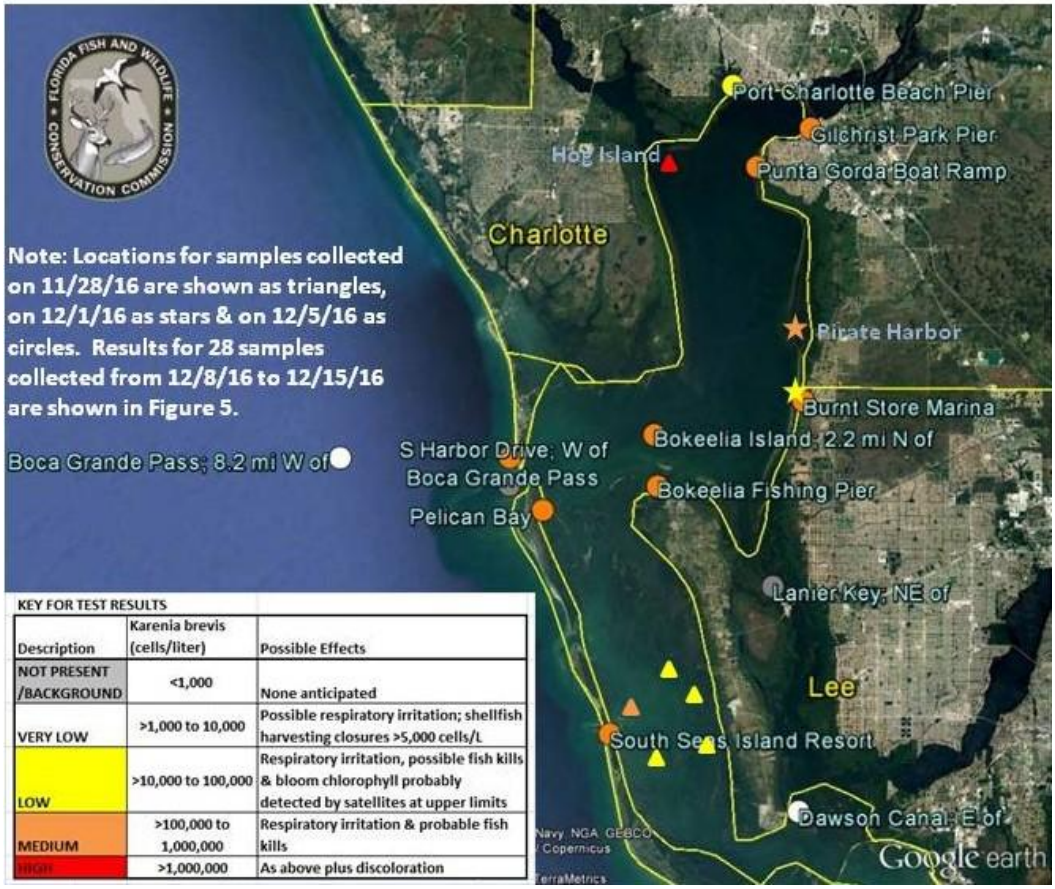


Figure 3 – K. Brevis Test Results by HAB of FWRI



KEY FOR TEST RESULTS

Description	Karenia brevis (cells/liter)	Possible Effects
NOT PRESENT /BACKGROUND	<1,000	None anticipated
VERY LOW	>1,000 to 10,000	Possible respiratory irritation; shellfish harvesting closures >5,000 cells/L
LOW	>10,000 to 100,000	Respiratory irritation, possible fish kills & bloom chlorophyll probably detected by satellites at upper limits
MEDIUM	>100,000 to 1,000,000	Respiratory irritation & probable fish kills
HIGH	>1,000,000	As above plus discoloration

Figure 4 - Mullet cleanup in PGI canal by Frank Wyatt & his loyal crew

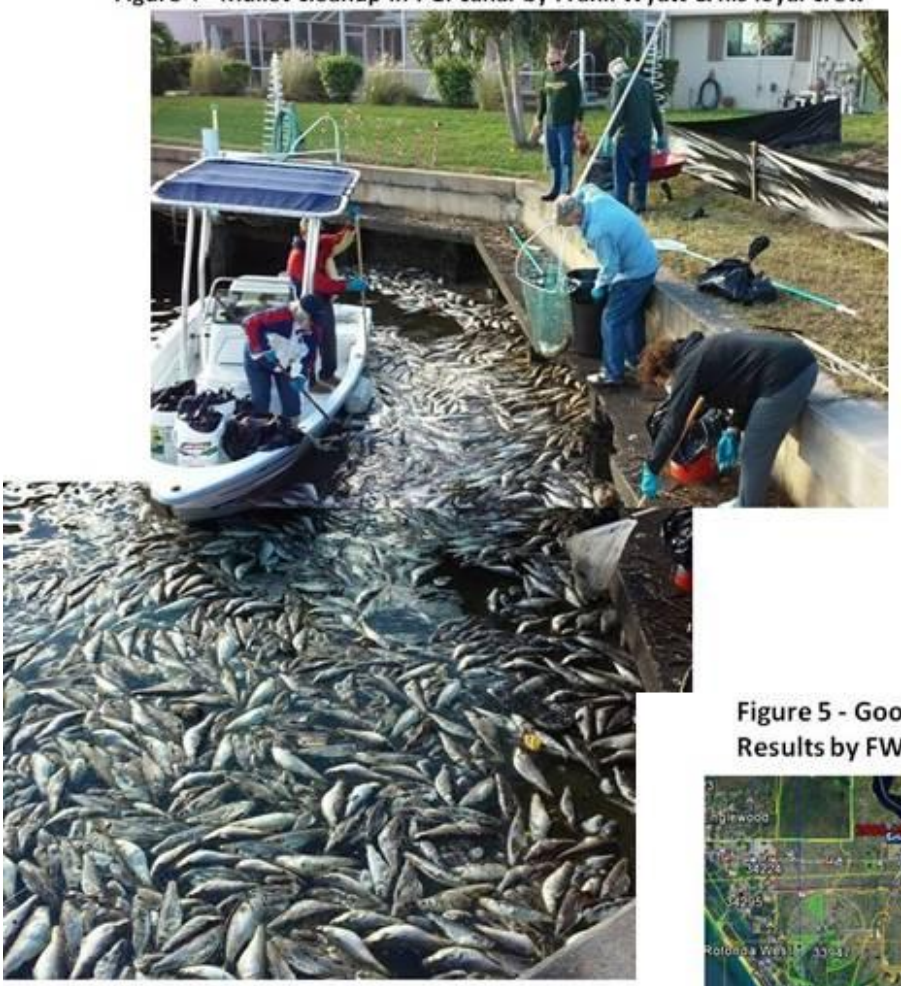


Figure 5 - Google Earth Mapping of Red Tide Sample Results by FWRI (for samples from December 8-15, 2016)

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[illegible]	>1,000,000	As above plus discoloration