Impacts of Hurricane Irene on Maryland's Coastal Bays

Summary
The passage of Hurricane Irene off the Atlantic coast of Maryland on August 27-28, 2011 had significant impacts in MD, but did it effect the MD Coastal Bays? Data from U.S. Geological Survey stream gages in the Coastal Bays watershed showed peak flows from the heavy rains. These flows carry a high level of polluted runoff (stormwater) into the Bays which can increase algae and reduce water clarity that may result in impacts to the growth of aquatic grasses and fishing activities. Water from the storm surge increased water levels in Isle of Wight Bay and caused ocean water to cross over parts of Assateague Island.

Hurricane Irene departing the Delmarva Peninsula – August 28, 2011
Image courtesy of MODIS Rapid Response Project at NASA/GSFS (250m resolution, True color)

Background
On August 27-28, 2011, Hurricane Irene moved along the Mid-Atlantic coast just west of the Delmarva shoreline, producing the storm's highest winds and storm surge along the coast. The outer edge of the eye of the storm passed over Delmarva during the morning of August 28 as evident from a dramatic change in barometric pressure and change in wind direction. Wind gusts up top 46 mph were recorded. The Coastal Bays were spared the heaviest rainfall, although rainfall amounts of 4 to 8 inches were measured in the watershed (Figure 1). Assateague Island

National Seashore received 7.4 inches of rain in 24 hours (the monthly mean is 4.18 inches). Maximum hourly rainfall there was 1.8 inches, although the average throughout the storm event was only 0.26 inches, minimizing the impacts associated with flash flooding. Water levels at the Ocean City Inlet were up two feet.

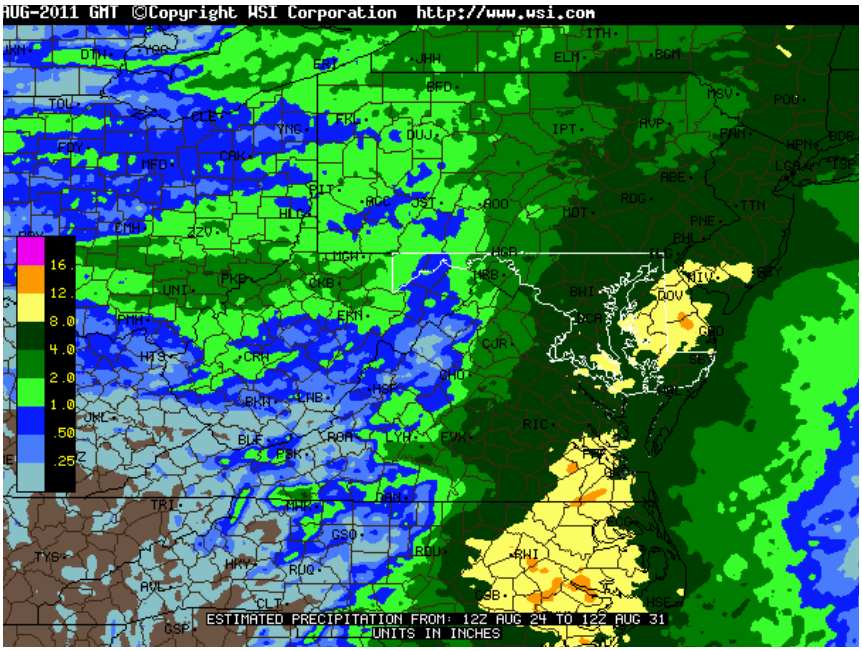


Figure 1*. One week rainfall estimate from radar from http://www.intellicast.com*

Stream impacts

Because of the small size of MD Coastal Bays catchments, runoff from these rains quickly entered nearby streams, dramatically increasing the volume and water level. US Geological Survey (USGS) has real-time surface water gages on 2 streams in the Coastal Bays watershed: Birch Branch at Showell and Bassett Creek near Ironshire. Both recorded stream flows rising rapidly during a 24-hour period, then falling over the course of the following week, but still remaining above long-term means more than a week later (Figure 2). At Birch Branch the mean daily flow on August 28th was the 4th highest since data collection began in 1999. (see: http://md.water.usgs.gov/waterdata/).

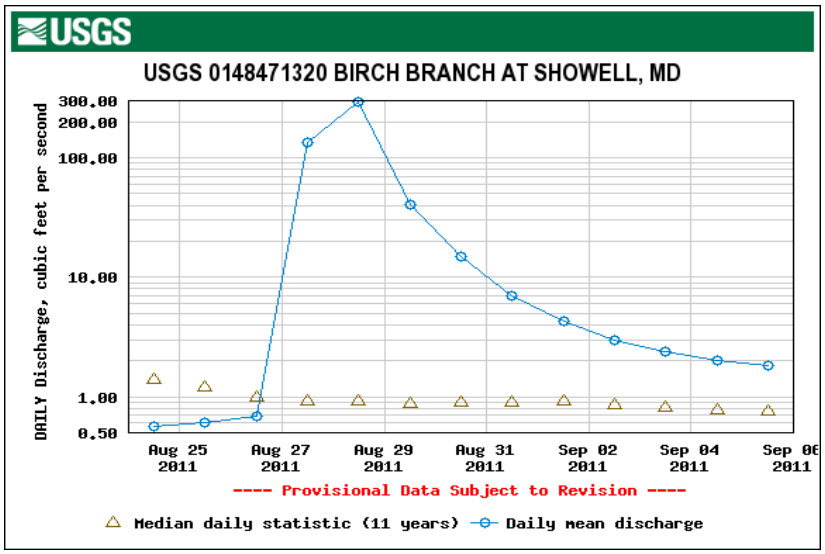


Figure 2*. Daily flows pre- and post-Hurricane Irene at USGS Birch Branch gaging station.*

These storm flows carry high loads of nutrient and sediment pollutants from the land into streams and to the Bays. Additional nutrients at this time of the year can fuel the growth of late season algal blooms. Until these materials settle, loads of suspended sediments can reduce water

clarity which can shade aquatic grasses and reduce their growth, and affect fishing success. The following satellite images show the Coastal Bays affected by suspended sediment as grey-tan color (Figure 3).

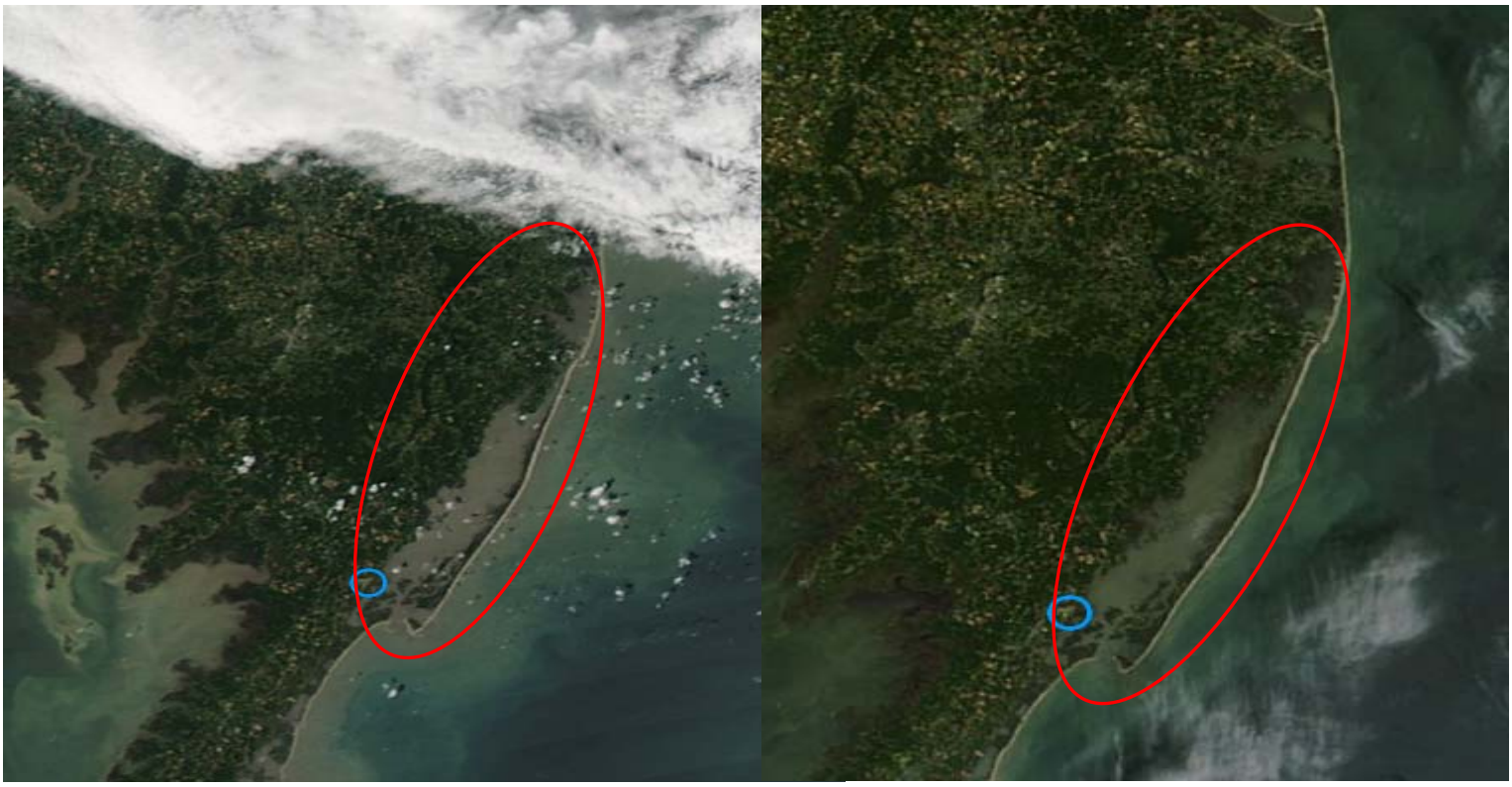


Figure 3. *August 28, 2011* *August 31, 2011*

Images courtesy of MODIS Rapid Response Project at NASA/GSFS (250m resolution, True color). Blue circle is Wallops Station near Chincoteague, VA.

Continuous monitoring data collected at Bishopville Prong before and after the storm show a strong decline in salinity that is a direct result of runoff and high stream flow (Figure 4). Within days, an algae bloom occurred, shown by chlorophyll a concentrations nearly 6-fold above those measured throughout August before the storm. This phenomenon is a direct response to elevated nutrient concentrations carried in runoff from Irene's rains. Chlorophyll concentrations remain high more than a week after the storm's departure, showing that the bloom is persisting.

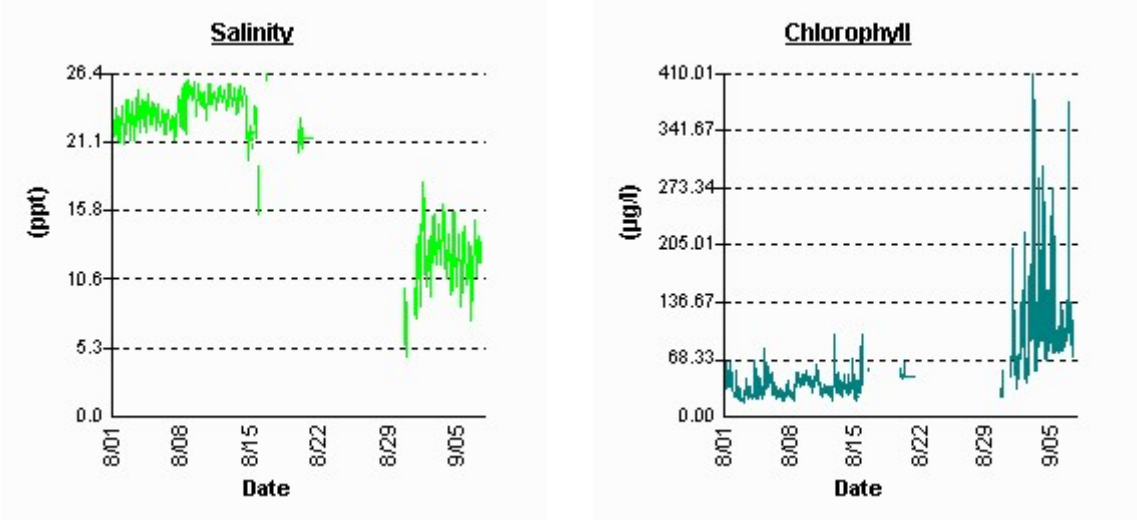


Figure 4. *August and early September 2011 salinities and chlorophyll concentrations at Bishopville Prong*
(*http://mddnr.chesapeakebay.net/newmontech/contmon/eotb_results_graphs.cfm?station=Bishopville*)

Initially this will increase the oxygen from the algae producing oxygen during photosynthesis (Figure 5). However, once the bloom begins to die back, decomposition of algal cells may produce low dissolved oxygen conditions that are unfavorable to fish and shellfish. Continuous monitoring data collected since the Irene's passage shows that these conditions are beginning to manifest themselves at Bishopville Prong.

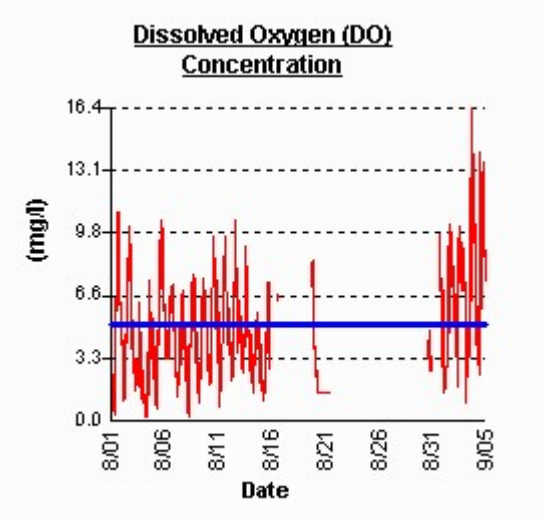
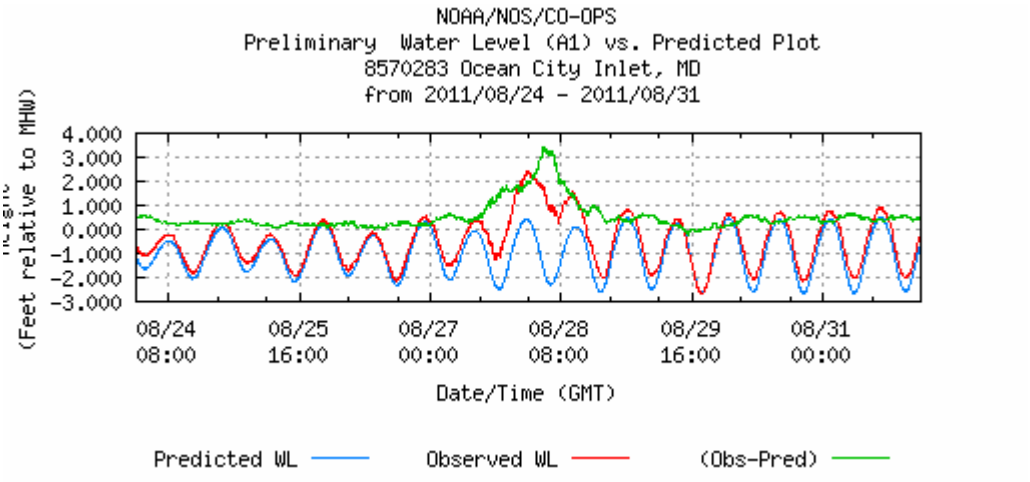


Figure 5. *Post Hurricane Irene dissolved oxygen concentrations at Bishopville Prong*
(*http://mddnr.chesapeakebay.net/newmontech/contmon/eotb_results_graphs.cfm?station=Bishopville*)

Ocean Changes:

Storm surge was evident along with large waves on the coast. Storm surge is the offshore rise of water associated with a low pressure weather system and is caused primarily by high winds pushing on the ocean's surface. The wind causes the water to pile up higher than the ordinary sea level. Below is a graph showing the storm surge associated with Hurricane Irene was 2 feet above mean hight water in MD which pushed water onto beaches and kept water in the bays.



Habitat Impacts:

Barrier Islands are not stable land. These sandy land masses are meant to move north/south as well as migrate toward land. Overwash, the process of water moving over a barrier island during a storm and carrying sand from the ocean side to the bay side, is a natural process that helps form new habitat in our coastal bays. During Hurricane Irene overwash occurred in several areas along Assateague Island including on the north end in the area across from Snug Harbor as well as in the Chincoteague Wildlife Refuge on the southern part of the island (Figures 6a and b). Such barren sandy habitat is preferred by the threatened piping plover. It may also become a source of new habitat for clams and seagrasses.

Figure 6a: Overwash at the north end of Assateague Island. *Photo by Assateague Coastkeeper.*

Figure 6b: Overwash at the south end of Assateague Island at Chincoteague Wildlife Refuge. *Photo by Assateague Coastkeeper.*

Erosion was noted by the Assateague Coastkeeper behind the seawalls at the north end of Assateague Island (Figure 7). This area has already experience severe erosion and accelerated movement towards land due to the stabilization of the Ocean City inlet and tightening of the Rt. 50 bridge.

Figure 7: Erosion noted behind the seawalls at the north end of Assateague Island on 8/29/11. *Photo by Assateague Coastkeeper.*

In Ocean City proper little damage occurred that impacted the Coastal Bays. A large quantity of seafoam was generated by wave action, which is normal, although in several cases it was mistaken for raw sewage. No sewage spills occurred as a result of Irene at any of the treatment plants in the watershed. The storm arrived at low tide and moved through quickly at 25 mph, which minimized flooding and erosion. Beach grasses were flattened by the wind and rain, but recovered within hours. Regular nor'easters that affect the area typically create more impacts to human and natural assets than Hurricane Irene did.

Living Resources Impacts:
While NJ residents have reported lizardfish left behind by Irene, few immediate impacts have been noted on fish within the MD Coastal Bays. Recreational anglers have noted a decline in water temperature and murky water, that have slowed fishing action somewhat, but there have been no reports of unusual fish species washed in by the storm. Fisheries Service personnel described the storm as "just like a Nor'easter".

One unusual species that made an appearance is the fig sponge, *Suberites ficus* (Figure 8). Many individuals were seen floating and washed ashore in Sinepuxent Bay, and in one case were mistaken for clumps of pony manure because of their coloration and foul smell. On the East Coast it is found from the Arctic to Virginia and has been documented growing in the coastal bays this year by MD DNR. The sponge is abundant in Cape Cod Bay in New England and is a frequent invertebrate prey for Atlantic Bluefin Tuna in that area. It usually grows on hard surfaces including rocks and mollusk shells, from the lower shore down to a depth of two hundred meters, and prefers locations with strong tidal flows. It is also found on harbor structures and wreckage, although it is rarely seen in the Coastal Bays. These animals may have been broken loose by storm surge and currents and washed over Assateague Island with the storm surge. Some were even seen washed up preceding the storm. Interestingly, one subspecies is being investigated as a potential source of antibiotics, anti-fouling and other biologically active compounds, because when the shells of cultivated scallops are covered with this sponge, no other animals attach to the shells.

Figure 8. Fig sponge. *Image courtesy Roman Jesien, Maryland Coastal Bays Program*

Effects on seagrasses may not be evident until the 2012 growing season, when annual mapping overflights will determine the extent of the beds and any changes from this year.

For more information:
• Real-time Maryland Tidal Water Quality Conditions: *www.eyesonthebay.net*
• Maryland Coastal Bays Program*: www.mdcoastalbays.org/*