Fire Island
National Seashore

National Park Service
U.S. Department of the Interior

Fire Island National Seashore
Long Island, New York

The Fire Island Wilderness Breach:

Ecological Resilience in Great South Bay

Change, including dramatic change caused by powerful storms, is constant across the complex and vital ecosystem of Great South Bay. Because everything within an ecosystem is interconnected, even small changes in the environment can produce ripple effects throughout the entire system.

Breaches are not uncommon. They come and go on barrier islands over time, allowing the free flow of water between the ocean and bay. In October 2012, Hurricane Sandy created a breach in the Otis Pike Fire Island High Dune Wilderness. This change altered water circulation patterns in eastern and central parts of the bay and caused higher salinity in eastern parts of the bay. It also increased the exchange of organisms between ocean and bay waters. As a result, the ecosystem of Great South Bay has matured. There is an increase in species diversity, leading to a better, more complex food web. The breach also improved water quality in Bellport Bay and eastern Great South Bay in the immediate vicinity of the wilderness breach by increasing water clarity, diluting the bay's harmful nitrogen levels with ocean water, and prompting a decrease in brown tides. The National Park Service will complete a Breach Management Plan/Environmental Impact Statement (EIS) to determine how best to manage the breach within Fire Island's wilderness area. The science summarized here and public input will support the planning process.

Brown Tides

Brown tides are caused by especially frequent and intense blooms of the single-celled phytoplankton species *Aureococcus anophagefferens*. The phytoplankton blooms are so dense that the water turns dark brown. In general, brown tides destabilize the vital balance of the Great South Bay ecosystem, decreasing the amount of light that is needed for the growth of valued seagrasses. Also, brown tide phytoplankton impact the feeding and growth of hard clams. And as phytoplankton decompose, dissolved oxygen levels can decline, affecting the bay's marine animal communities.

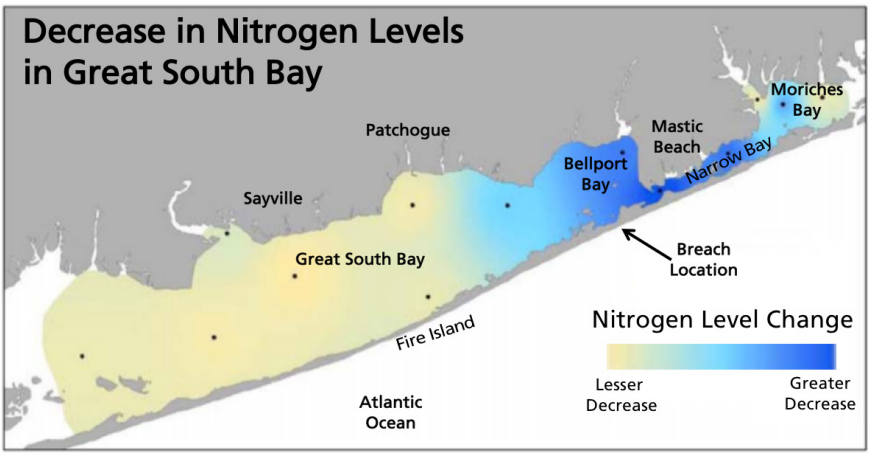
After the breach formed, harmful brown tides became less frequent and less intense in areas of eastern Great South Bay near the breach. This is largely a result of current water circulation patterns. The breach caused water, organisms, nutrients, pollutants, and other substances to spend less time in Great South Bay before being flushed out and replaced by new water flowing in from the ocean.

Phytoplankton in the bay are not always harmful. When blooms are not excessive, these marine plants serve as an important source of food for animals that live in the bay, such as hard clams, bay scallops, and other organisms.

These changes suggest that the breach had a positive influence on water quality in the vicinity of the breach, but brown tides simultaneously became more intense in areas of central Great South Bay. New water circulation patterns caused by the breach might play a role. However, because brown tides have been a regular occurrence in the bay for several decades, some uncertainty remains as to the breach's influence on the increasingly intense brown tides in central Great South Bay.

Nitrogen Pollution

Nitrogen pollution is one of the primary causes of poor water quality in Great South Bay, and it may also stimulate brown tide blooms. Nitrogen levels decreased in some areas since the wilderness breach formed, particularly in Bellport, Narrow, and western Moriches bays. However, because of the impacts of septic systems, urban development, and fertilizers on nitrogen levels, nitrogen pollution is likely to remain an issue regardless of the breach's effects on water quality.



DATA SOURCE GOBLER ET AL. 2014

This map compares data from 2000 and 2008 to data from 2013 to illustrate how nitrogen levels decreased across Great South Bay since the wilderness breach formed. Greater decreases, in blue, are likely the result of ocean water diluting nitrogen-rich bay waters.

Seagrass

As a result of breach-related water quality changes, seagrass in Great South Bay, including eelgrass and widgeongrass, increased in abundance in isolated clusters east of the wilderness breach and in areas west of the breach where it has been absent for more than a decade. Between the 1930s and 2003, Great South Bay lost an estimated 90 percent of its seagrass beds. The decline of eelgrass was a matter of special concern because it is the most ecologically valuable submerged aquatic vegetation in the bay, providing habitat for small fish, crustaceans, and the economically important bay scallop. The wilderness breach caused cooler summer water temperatures in close proximity to the breach, as well as improved water clarity and higher salinity, all of which are beneficial for eelgrass.

Hard Clams

Hard clams thrive in habitats with high-quality food sources, so they showed improved growth rates in areas near the breach. As brown tides became less frequent and less intense near the wilderness breach, larger forms of phytoplankton, which are a high-quality food source for hard clams, started to take the place of smaller phytoplankton. It is unclear how they will respond over the long term, as other changes could adversely affect hard clam populations. For example, low density of hard clams in Great South Bay may limit the success of this species during spawning. Water temperatures near the breach might become too cold for hard clam growth. Also, increased salinity in some areas of Great South Bay could encourage the growth of the hard clam parasite QPX (Quahog Parasite Unknown). Likewise, there may be increased predation of hard clams by lady crabs, which became more abundant in the area since the breach.

Finfish, Crabs, and Shrimp

Finfish, crabs, and shrimp are affected by the influx of ocean water from the wilderness breach. Finfish such as bay anchovy, silverside, three-spine stickleback, killifish, and pipefish became more abundant near the breach and east of it. Alewives, which migrate from salt water to fresh water to spawn, increased in abundance as well. They may enter the bay through the breach to find spawning grounds in rivers along the Long Island south shore. Juvenile summer flounder and tropical fish species that favor higher salinities have also been found in eelgrass beds near the breach. The abundance of finfish following the formation of the breach is linked, in part, to the recovery of eelgrass beds, which provide crucial habitat and foraging and nursery grounds. Finfish also seem to be finding food sources, such as species of grass shrimp. After the breach formed, lady crabs, which prefer higher salinities, increased in numbers by 500 percent near the wilderness breach. In this part of the bay, blue crabs have declined by 80 percent in response to the salinity change. Scientists believe blue crabs prefer more brackish water and have migrated away from the breach.

We Want to Hear from You

The Draft Breach Management Plan/Environmental Impact Statement (EIS) will be released for a 45-day public review and comment period. Please submit your comments:

Online: parkplanning.nps.gov/FireIslandBreachManagementPlan

By mail: Attn: Superintendent
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Jamie Remillard, Paul McDivitt, and Caroline Gottschalk Druschke
Acquisition, Coordination, Compilation, Data Management and Change Analysis of LiDAR and Other Geospatial Data Collected Pre- and Post-Hurricane Sandy
Task Agreement P13AC00875 of Cooperative Agreement Number P09AC00212