

**Breach Update, March 2022**  
Charles Flagg  
Stony Brook University

It has been nearly 9 ½ years since superstorm Sandy and the opening of a breach in the wilderness portion of Fire Island. During this time, we have seen big changes in the breach, the flood delta, water properties, alga blooms, fish and shellfish and currents in both Bellport Bay and farther west in Great South Bay. At the time when the breach was at its largest we saw pollution as indicated by nitrogen in Bellport Bay, drop from pre-breach conditions of as much as 1 mg/l to mostly less than 0.4 mg/l, marking the difference between eutrophic and non-eutrophic waters. Along with the reduced pollution the bay saw a gradual resurgence of shellfish growth, a spread in eel grass, reduced alga blooms and fish that had not been caught in these waters in decades. The root cause of these changes was the decrease in residence times in the Bellport Bay because of the exchange with ocean waters and the setting up of a mean east to west drift.

One of the best indicators of the changes over time has been the salinity record from the Bellport dock. As part of the Great South Bay Observatory program, water temperature, salinity and water level have been recorded at the dock since the summer of 2009. The salinity record up to the present in Figure 1 gives a clear picture of what has happened as a result of the breach and its evolution. Prior to the breach, salinities at Bellport were typically in the range of 24 to 25 psu (practical salinity units that are nearly equivalent to parts per thousand by weight). There were occasional excursions from these conditions when excess fresh water flowed out of the Carmans River and Beaver Dam creek or when saline waters flowed into the Bay from Moriches by way of the Smith Point Channel. Those excursions usually took a little over a week for conditions to return to the more normal range.

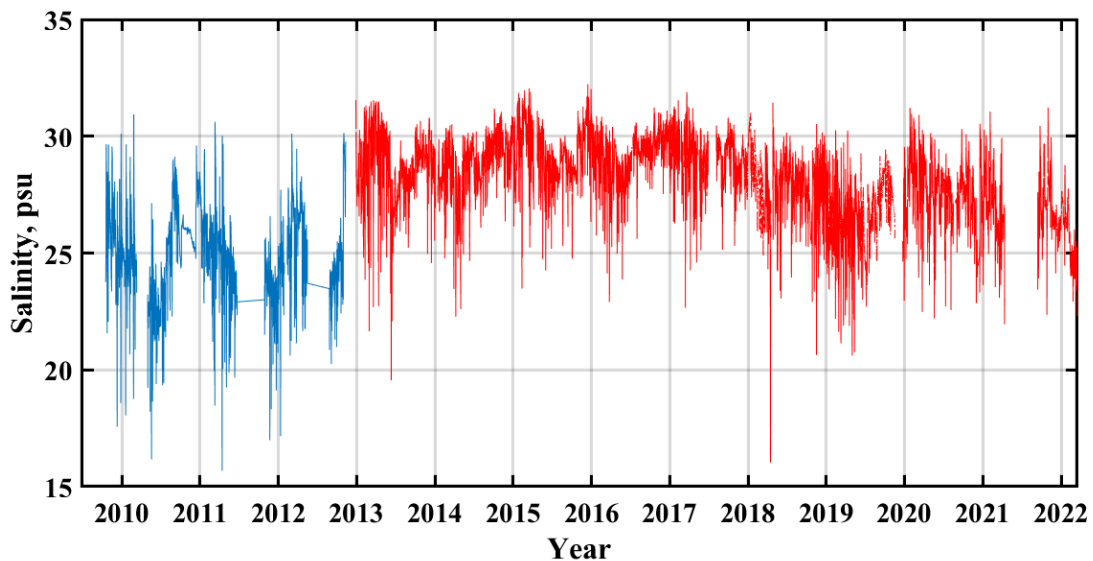
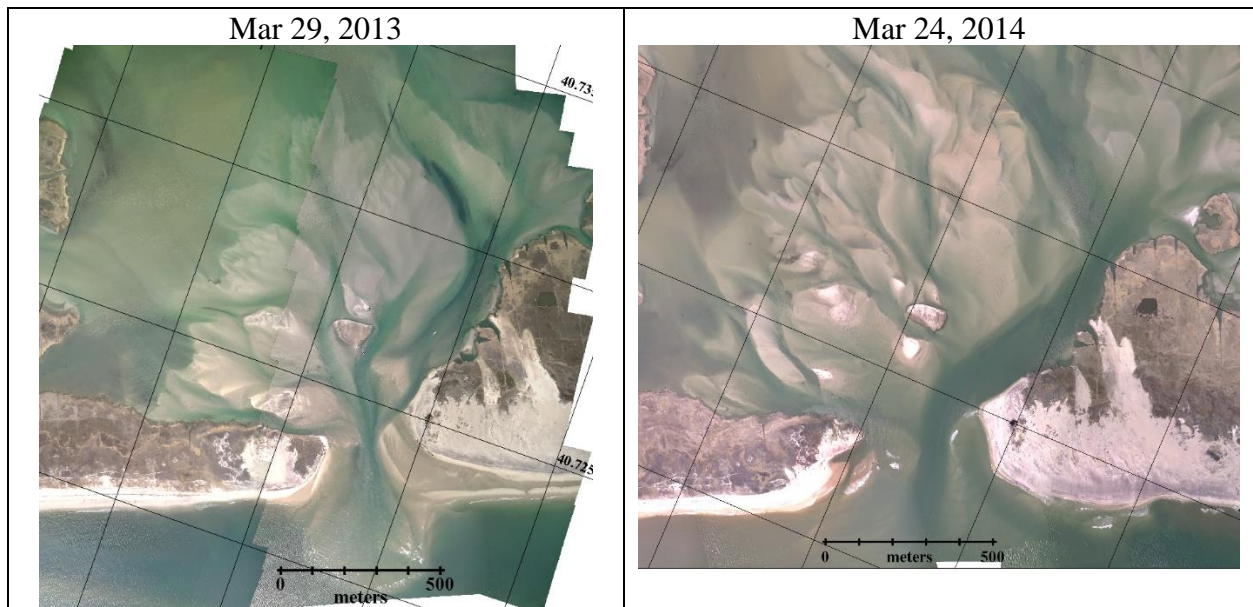


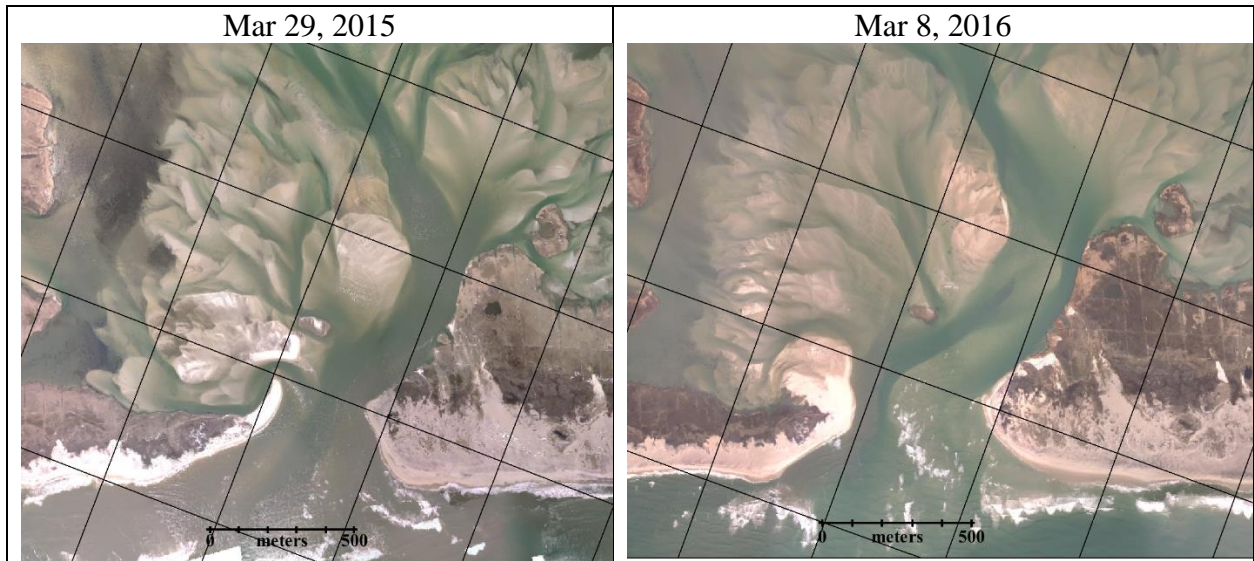
Figure 1. Bellport salinity record from August 2009 to the present. The breach in Fire Island happened on October 31<sup>st</sup>-November 1<sup>st</sup>, 2012. The blue curve shows that salinities prior to the breach, the red since the breach.

As the long record in Figure 1 makes clear the advent of the breach at the end of 2012 produced a radical change in the salinity and water conditions within Bellport Bay. With the breach, typical salinities at Bellport increased from 24 to 25 psu; to 28 to 30 psu with occasional periods when salinities increased to ~32 psu, a value one would see in the ocean south of Fire Island. These conditions indicating a relatively easy exchange of Bay and ocean waters through the breach lasted for about 5 years, that is through about 2017. Beginning around early 2018 the salinity range dropped to between 27 and 28 psu with fewer and shorter-lived excursions to ~30 psu. And this situation seems to have lasted until perhaps near the end of 2021. Beginning in early 2022 the salinities have dropped again, this time to values between 24 and 25 psu which is close to the values seen prior to the breach.

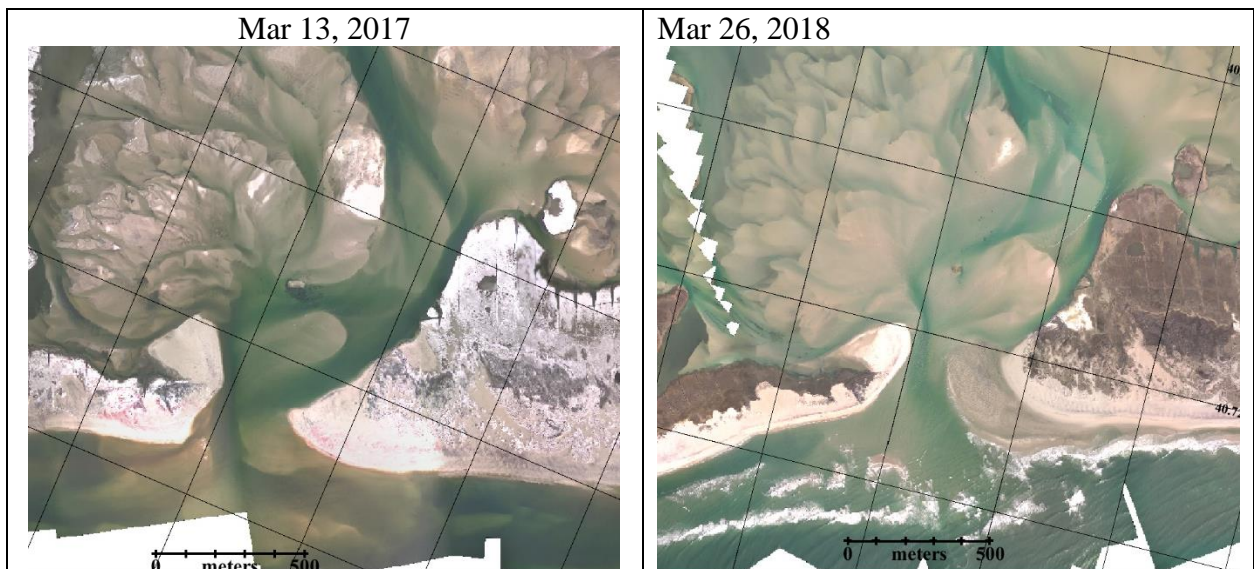
With the help of Rich Giannotti, his Legend Cub and now a Cessna 170, and the Long Island Soaring Association's Super Cub, we have been able to make nearly monthly photo overflights of the breach and surrounding area since the breach opened. All the oblique photos and photo mosaics that Mark Lang produced from videos files are shown on the Great South Bay's web page (<http://po.msrc.sunysb.edu/GSB/>). Several other local pilots have also contributed to the photo record of the breach as well (see the webpage).

The latest overflight took place on March 16<sup>th</sup> which showed a much-reduced channel into the Bay that corresponds to the low salinities recorded at Bellport. To get an idea of the long-term changes that have led up to the present condition, below is a series of photo mosaics of the breach taken every March for the past nine years, with the exception of March 2020. The March 2013 mosaic was produced just five months after the breach opened and was the first for which there were bench marks to determine the spatial scale. This first image shows the inlet in its earliest stage when the main channel was significantly less than 100m wide and the distance between the shorelines was a little less than 300m. The early flood delta at five months covered an area of about 0.86 km<sup>2</sup>, or ~200 acres.

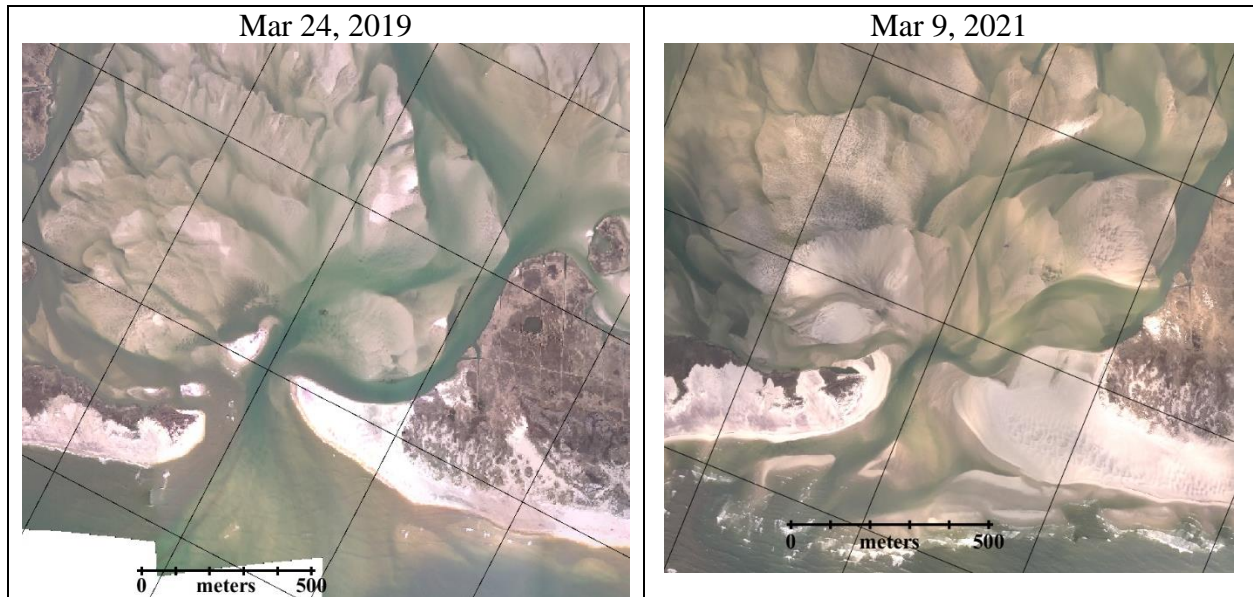




A year later, by March 2014, the breach had widened so that the main channel was ~100m wide, the western shore had retreated nearly 200m and the distance between the shores was ~400m. The main channel remained in its earlier position, more or less along the eastern shoreline, while the flood delta had nearly doubled in size. The March 2015 mosaic shows a wide-open breach with a broad channel through the flood delta into Bellport Bay. This period corresponds to some of the longest periods of high salinities in the Bay. By 2016 the main channel had shifted westward while shoals in the breach and in the channel through the flood delta began to form. This shoaling became more and more prominent in the following years, and by 2018 the shoaling became even more prominent, beginning the period of reduced exchange and lower salinities in the Bay. Earlier in 2015 there were short periods of sand accretion along the western shoreline; by 2018 these projections into the flood delta area became larger and longer lasting. Also, at this time we began to see episodes when the eastern shore sand spits expanded into the breach as the March 2017 mosaic shows.







It is interesting that after the early westward migration of the channel in 2014 that either the soil or brush along the western shore was tough enough to prevent farther migration. And this was/is true even though there were over-washes that crossed the island farther west. As a result, in 2021 the western shore was pretty much in the same location as it was in 2014. However, on the other side of the channel, by 2019 the sand spit extending from the eastern shoreline became ever more present with the effect of making the channel through the breach and through the flood delta more serpentine. This spit was low-lying and appeared and disappeared depending upon the state of the tide. But by the end of 2021 that spit increased in elevation and so was dry even during normal high tides.

The latest flight took place on March 16, 2022 and the photo mosaic for the entire breach and flood delta area from that flight is shown in Figure 2. At this point the flood delta covers an area of close to 3 km<sup>2</sup> or ~750 acres with a series of shoals extending into the Bay, northward farther than John Boyle Island (upper right in photo). The breach channel is now only about 60m across and the photo was taken shortly after high tide which would tend to make the channel appear wider. The western shoreline is still holding its own although there is no longer a narrow sand beach. The channel through the flood delta is heavily impacted by shoaling to the extent that a path for the water to flow back and forth is hard to discern. A last interesting item is the extent of the sand spit from the east. This spit looks like an extension of the beach to the east. And that suggests that the flow of sand into the breach has been cut off or greatly reduced. If so then the alongshore movement of sand would now be able to bypass the breach and resume the pre-Sandy beach replenishment farther west.



Figure 2. Photo-mosaic from the March 16, 2022 flight. This flight took place around 0930 EDT and shortly after high tide in the ocean.