Seas of Change: The Restoration of Ecosystem Services in Long Island Sound

by Jennifer H. Mattei, Ph.D.

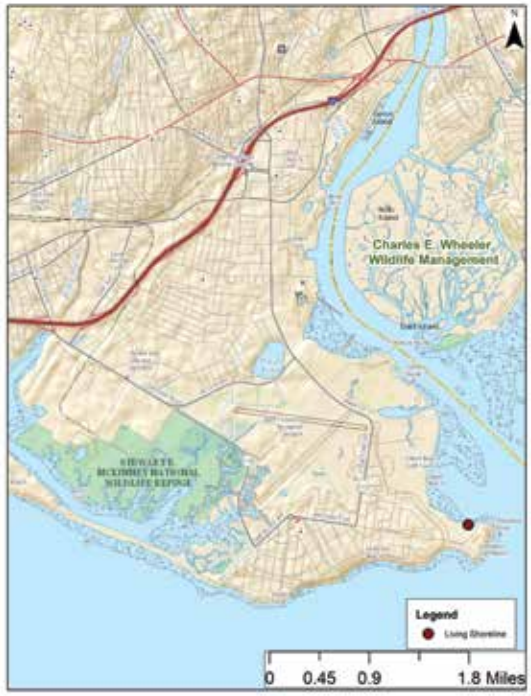
When Adriaen Block entered Long Island Sound (LIS) from the East River for the first time in 1614, what he experienced would have been a feast for our tired urban eyes. Estuaries rimmed by shellfish reefs and beds, acres of eelgrass dotted with scallops, salt marsh grasses embedded with tenacious mussels, dunes and bluffs blanketed with grasses, and towering coastal forests behind them. These complex highly structured estuaries teaming with a diversity of invertebrates have come to be appreciated for their role as the nursery for the fry of hundreds of fish species.

By the end of the 19th century, the habitat structure had changed dramatically. Shellfish, particularly oysters, the ecological engineers of the intertidal zone, had been overharvested and mounds of shell removed resulting in a trampled structure and less habitat. Pollution, development, and nearly constant trawling had taken its toll. The big picture reveals Long Island Sound is similar to other urban estuarine and coastal habitats – some of the most heavily utilized and most threatened natural systems across the globe.

Today, the sea level of our now urban Sound is rising. Average annual water temperature is increasing, and seasonal hypoxic (i.e. low oxygen) events continue to occur in parts of the western Sound. Also in late summer, when nutrient loads, bacterial and algal counts are high, the pH of the water declines. These varied factors due to human activity can slow shellfish growth and disrupt other life processes within the estuarine food web.

People living by the sea have attempted to block rising waters and prevent subsequent coastal erosion by armoring the shoreline. One common method of armoring is the construction of seawalls, bulkheads, and riprapped shorelines. This activity cuts the connectivity of the land to the sea, causing loss of sandy beaches and marsh grasses seaward of the wall, and still may not adequately protect homes and businesses behind the wall from flooding during large storm events like hurricanes and Nor'easters.

It was not until the back-to-back occurrence of Hurricane Irene (2011) and Superstorm Sandy (2012) that some coastal homeowners began to realize the structural importance of estuarine habitats such as shellfish beds and reefs, salt marshes, sandy beaches, dunes, grasslands, and coastal forests. What Adriaen Block never realized and only now we have begun to understand are the ecosystem



Map showing location of the Stratford living shoreline. Credit: Trey Chabot.

services (i.e. benefits) of intact functioning estuaries. In our search for resiliency, stability, and renewable resources in the face of climate change, the answer comes from our long forgotten natural history, a fully functional estuarine ecosystem, a 'living shoreline'!

These various estuarine habitats do not exist in isolation. The coastal resources are ecologically and synergistically connected; that is, there are physical and biological interactions between them. It is difficult to restore a sand dune as a stand-alone habitat and expect it to be stable and resilient without the adjoining saltmarsh and reef in front of it and grassland, shrub, and forest mosaic behind it. At Stratford Point, the first stage of a long-term, collaborative living shoreline restoration project has begun. Partners in this effort include: Sacred Heart University, Audubon CT of the National Audubon Society, National Fish and Wildlife Foundation, and DuPont. The purpose of our study is to examine how to speed the recovery of the interconnected habitats of an estuary and examine the sequencing of the installment of each habitat. Thus, stop shoreline erosion, allow for sediment accretion, abate damaging waves, and allow the migration of the coastal habitats upland as sea levels rise. So far we have learned that the reef structure needs

to be in place first and is important for salt marsh grass establishment and dune protection. The upland coastal shrub/forest habitats are equally important as part of the structure of the coastal ecosystem that acts as a windbreak and shelter for wildlife. In addition, restoring pollinator meadows/grasslands and at least one freshwater pond will help to increase species diversity of the site.

The living shoreline restoration activity has already included a prescribed burn and some upland planting. In May 2014, with State, federal and local approval, we installed 64 cement Reef Balls™ each 1m high by 1.2m wide (3ft X 4ft) in two equal length rows of 49m (~161ft). The reef was placed in the intertidal zone approximately 27 m (~90 ft) from the high tide line to abate wave energy, allow for sediment deposition and protect newly transplanted *Spartina alterniflora*. Milford Point, which harbors a dozen homes and a federal wildlife refuge, just across the Housatonic River from Stratford Point, is serving as the reference site for our management plan as well as historical records of the Sound. Both Stratford and Milford Points are subjected to natural and anthropogenic disturbances (e.g. flooding from hurricanes and sea level rise, fires, human activities, invasive species, etc.) but have very different land use histories with varying levels of intensity and duration of disturbances. The differences in disturbance regimes have led to ecological communities characterized by different flora and fauna. We intend to have this restoration project serve as a model for ecological restoration in other degraded coastal zones, both within and outside of Long Island Sound.

Due to its location, Stratford Point is an integral component of the fragmented matrix of coastal habitats located near the intersection of the Housatonic River and LIS. As the restored habitats mature, they will become increasingly important as a migratory stop-over site for a variety of wildlife, including the monarch butterfly that has recently suffered from a dramatic population decline. It will also provide valuable shelter, stopover and wintering habitat for migratory birds, waterfowl and, most recently, snowy owls. The intertidal habitats including the reef structure and fringing saltmarsh will eventually become important nursery areas for fish, shellfish and crabs. If this area remains undisturbed by human activity, it would naturally supply recruits to harvestable stocks elsewhere in the Sound.

In April 2016, with the support from our partners, we will be restoring the upland vegetation and cutting back invasive plants. If you would like to get involved check the Audubon Connecticut website (https://www.audubon.org/content/audubon-connecticut) for dates when volunteers will be needed; tours of the site will be offered by the author in early June 2016, check www.projectlimulus.org for dates.

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One of the first living shorelines in Connecticut constructed with Reef Balls and newly planted (July 2015) salt marsh grass at Stratford Point (poles and flagging are part of the goose excluder fencing system). Photo credit: J. Mattei.

To learn more about living shorelines, attend the **Living Shorelines Technology Transfer and Regional Workshop** in Hartford, CT on **Dec. 1 & 2.**

On Dec. 3rd, the author will lead a field trip to the Stratford living shoreline. The workshop is sponsored by the Connecticut Institute for Resilience and Climate Adaptation and Restore America's Estuaries.

For more information on the workshop contact jessica.leclair@uconn.edu or see http://s.uconn.edu/shoreline. For field trip information, contact matteij@sacredheart.edu.