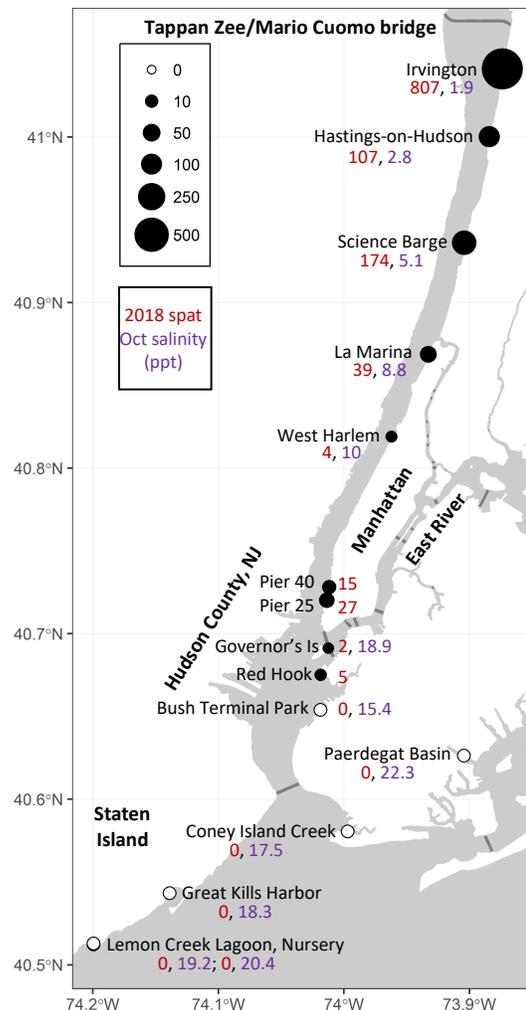


## Where will the next generation of NYC oysters come from?

With the goal of restoring oysters to the lower Hudson/Raritan Estuary (HRE), there are two potential sources of oysters for populating restored habitat. In general, when there is an existing population it is desirable to get contributions from those local, time-tested oysters. In the HRE the only known reproductive wild oyster population is near the Tappan Zee bridge (now Mario Cuomo bridge; see figure). Wild reproduction produces larvae that drift and feed in the water column for 2-3 weeks before finding hard substrate to permanently settle on and metamorphose into “spat”, or juvenile “wild-set” oysters (a process called population “recruitment”). If wild-set spat recruitment is too sporadic or sparse to reliably make a demographic contribution, the second source is hatcheries. Hatcheries can be used to produce millions of larvae, set them on shell, and “plant” these spat-on-shell in large numbers. Oyster restoration activity in NYC has largely been hatchery-based to date, with consistent wild-set recruitment only documented in the Tappan Zee area (McFarland and Hare 2018). It is an open question whether the remnant Tappan Zee population contributes to wild-set spat recruitment in the lower HRE (e.g. along Hudson County, NJ and Manhattan, Brooklyn, Staten Island NY). Answering these questions requires deliberate, careful measurement of wild-set spat recruitment throughout the estuary. The Hare Lab at Cornell recently collaborated with The Nature Conservancy and Billion Oyster Project (BOP) to measure this critical oyster population process at a large scale for the first time.

Our study hypothesized that most wild-set oysters in the HRE come from the remnant oyster population near the Tappan Zee bridge. [The East River is assumed to get larval settlement from Long Island Sound oyster populations, but was not considered in this study. Genomic differentiation between Hudson and East River oysters documented by the Hare Lab at Cornell suggests that gene flow between the two rivers is minimal in the recent past.] No other regularly reproducing population is known in the HRE. We deployed larval settlement material (2 bags of recycled BOP bivalve shell) in mid-August 2018 at 15 sites between Irvington, near the Tappan Zee bridge, and Staten Island (figure at right). All bags were retrieved and spat counted in early October.

A total of 1180 wild-set spat were found, mostly in the northern low-salinity portion of the estuary. The southernmost spat was found in Brooklyn. The site with highest wild-set abundance (807) was Irvington, proximal to the wild adult Tappan Zee oyster population. Interestingly, spat



abundance dropped precipitously to the south; there was 5 to 8-fold fewer spat at Hastings and Yonkers Science Barge (5 - 16 km away), then another 4-fold drop over 8 km to La Marina at the northern tip of Manhattan (39 spat) and a ten-fold drop to just 4 spat at West Harlem. There was a notable resurgence of wild-set found at Pier 40 (15 spat) and Pier 25 (27 spat) before dropping again to single digits and zeros below Manhattan (see figure).

These results reinforce previous findings of strong wild-set oyster recruitment near the Tappan Zee remnant population. Additional years of monitoring, including the full July – October larval settlement season, need to be combined with experimental work to distinguish several hypotheses explaining the rapid southward decrease in spat. Two possibilities include the physical retention of larvae upstream to a greater extent than current models suggest, or higher than expected mortality of larvae as they move downstream. It is noteworthy that a large waste-water treatment plant discharges large volumes of treated water at Yonkers. It is the first in a gauntlet of downstream discharges into the HRE. Some zooplankton are known to be stressed by pharmaceuticals that remain in treated water. On a happier note, the spat recruitment found along the West Manhattan piers may indicate a local reproductive population. Perhaps an 8.5" oyster recently discovered on subtidal West Manhattan pier pilings was one of many. Based on this large specimen, oyster longevity appears not to be a problem (in some HRE habitats), but spat recruitment may be.

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