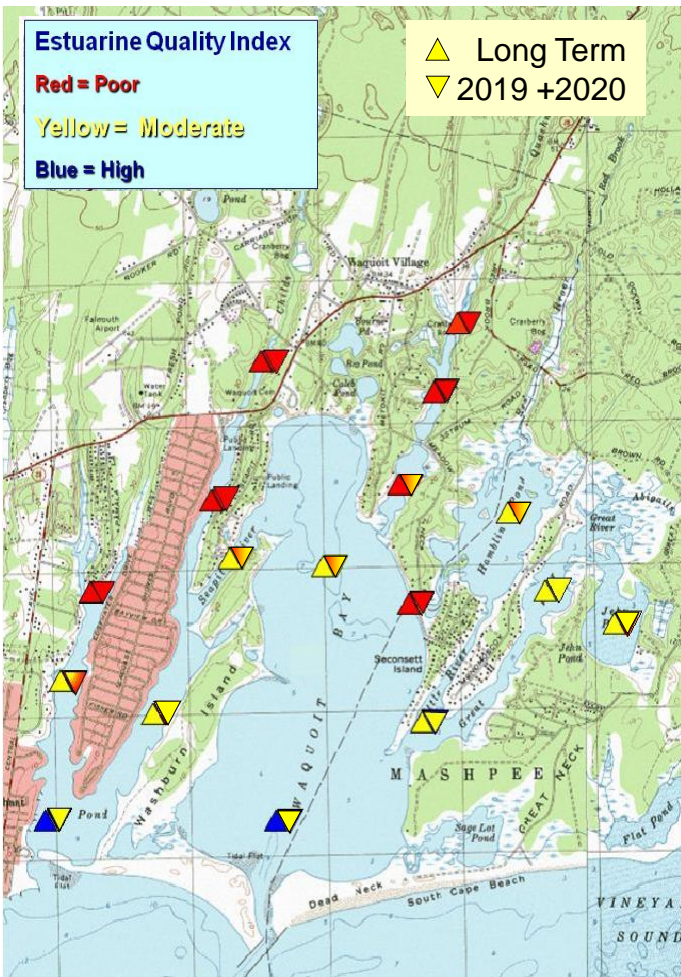
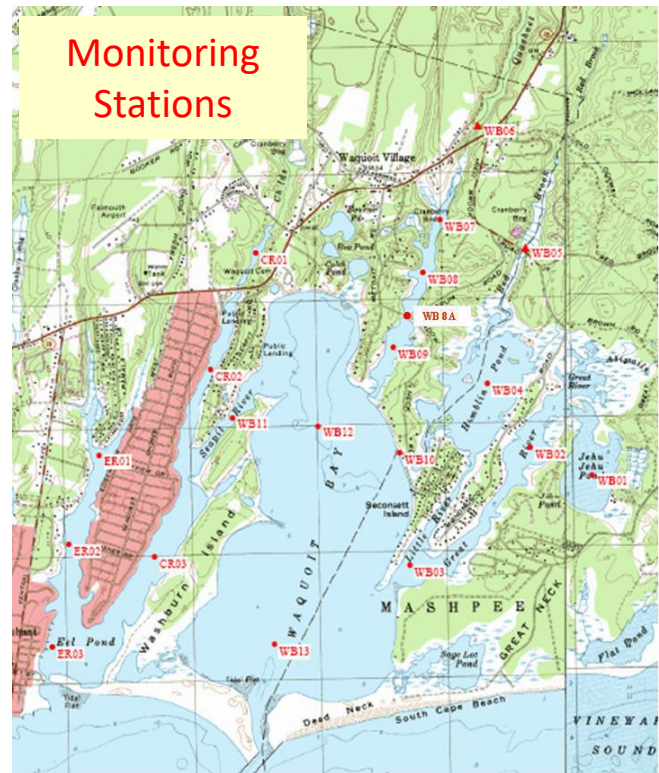


Waquoit Bay Water Quality Overview (2010-2020)

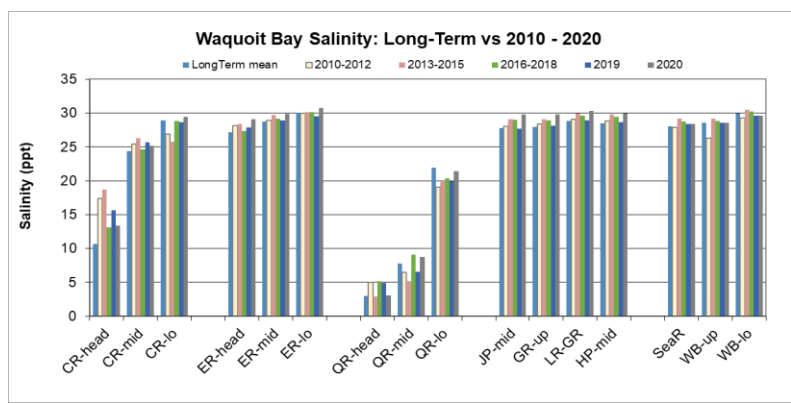
The Mashpee Water Quality Monitoring Program is an on-going collaborative effort between the Mashpee Wampanoag Tribe, the Town of Mashpee and the Coastal Systems Program (CSP) within the University of Massachusetts – Dartmouth, School of Marine Science and Technology (SMAST). The project has a two-fold goal: 1) to sustain a continuing assessment of the nutrient related water quality of the Waquoit Bay Estuary relative to regulatory standards (TMDL's) and 2) monitor improvements in water quality resulting from restoration efforts (e.g. shellfish propagation, dredging, nitrogen removals by freshwater systems, wastewater treatment, etc.) as undertaken by the Town, Tribe and others. The program goals are achieved through the collection and analysis of water samples at specific monitoring locations distributed throughout the system (map to right) and associated field parameters relevant to assessing the health of estuarine habitats within the Waquoit Bay Estuary inclusive of Eel Pond, Cape Cod.



As a simple guide for water quality assessment, key nutrient related parameters collected as part of the monitoring program are integrated into a single Index. This combined metric, the Bay Health Index (map to left), was constructed based on the multi-year monitoring results (long-term, 2010-2012, 2013-2015 and 2016-2018, 2019-2020). Waquoit Bay shows generally consistent water quality conditions in 2010-2012 and 2013-2015 compared to the baseline years of 1997-2009. Results from 2016-2020 indicate a decline in some tributary basins and the loss of the remaining high quality sites. Regions of significant impairment did show some slight improvement (but still poor water quality). Moderately impaired areas (3) showed declines from long-term levels reversing slight improvements from 1997-2009 to 2010-2015. The high TN and phytoplankton bloom years of 2016-2018 and 2019 and 2020 yielded a significant reduction in the water quality Index from 2010-2015 to 2016-2019 and a return to the baseline conditions of 1997-2009. Most significant is the loss of the high water quality areas nearest the inlets. Presently, there are no high water quality areas remaining in this system.

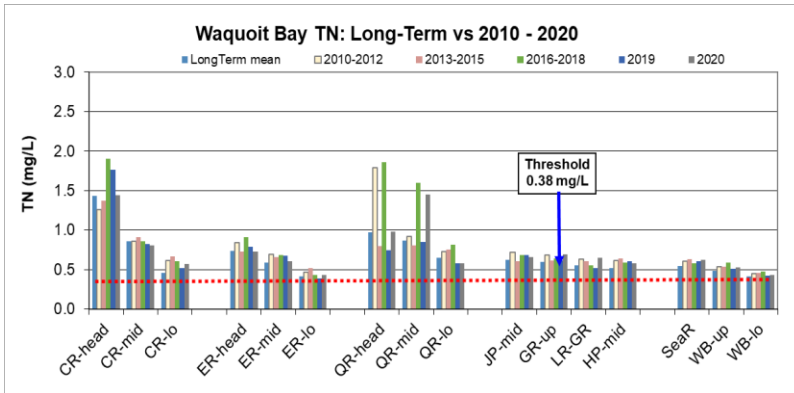


The **salinity gradient** in Waquoit Bay (2010-2020) is consistent with historical patterns but with slightly lower levels observed in upper tidal reaches during the high rainfall year of 2017. The gradient shows the effect of large freshwater discharges to the headwaters of the upper tributary basins. The Childs Rivers shows significant inter-annual variation in salinity in response to rainfall and groundwater levels. The Quashnet River has been consistently very brackish, ≤ 5 ppt, declining to 3 ppt in some years (e.g. 2020). At the mid-station of

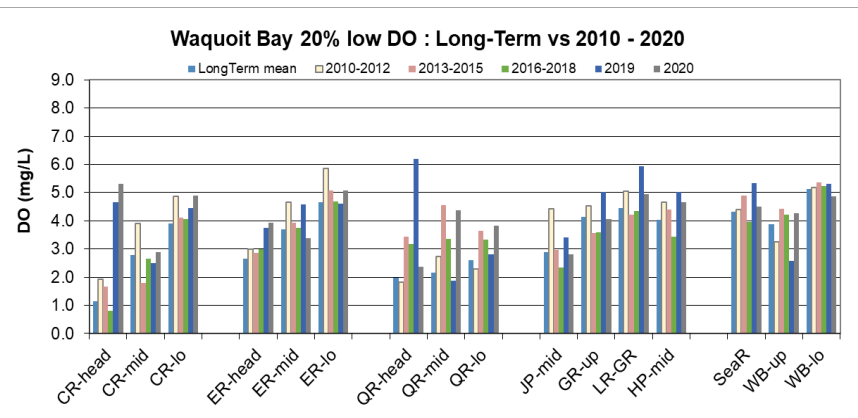
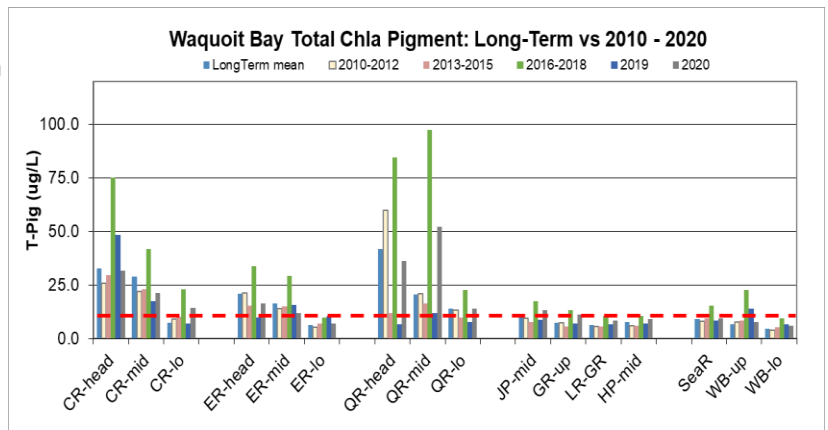


Quashnet River the salinity appears to have returned to long-term levels or even slightly higher after being low in 2010-2015. The salinity increase from the mid station to the lower basin is mainly due to lower tidal exchange in the mid versus lower basins.

Total nitrogen levels throughout Waquoit Bay are significantly enriched over the high quality inflowing waters of Nantucket Sound (0.28 mg/L TN) entering during flooding tides. TN data are generally consistent with prior historical data except for periodic spikes in the semi-enclosed small tidal river basins. The pattern of nitrogen gradients across the system roughly follows the salinity gradients, as the major source of the "excess" nitrogen is from groundwater and surface freshwater inflows



The consequences of elevated TN levels can be seen in the high amounts of phytoplankton biomass (measured as **chlorophyll-a** pigments), which saw bloom conditions in 2016-2019 (most basins), and associated depletion of bottom water oxygen. In 2016-2020 CHLA levels are generally higher than the long-term historical data in some basins (Waquoit Bay: Childs River, Quashnet River, Seapit River, Jehu Pond), supporting the contention that the overall estuary is presently nitrogen enriched, resulting in high levels of phytoplankton production and blooms when environmental conditions are right. The western basins of Waquoit Bay tend to have relatively high TN & chlorophyll-a levels, while the eastern basins show moderate levels.



Oxygen depletion of bottom water was variable but still not meeting water quality standards within the system in 2010-2020 and data were generally consistent with historical record, except for the low 2018 DO levels in Upper Childs River. Observed low DO at specific stations in the Waquoit Bay system (Childs River, Eel River) follow the distribution of higher total CHLA and TN levels.

