Summary of Tisbury Great Pond Water Quality Data From 2003

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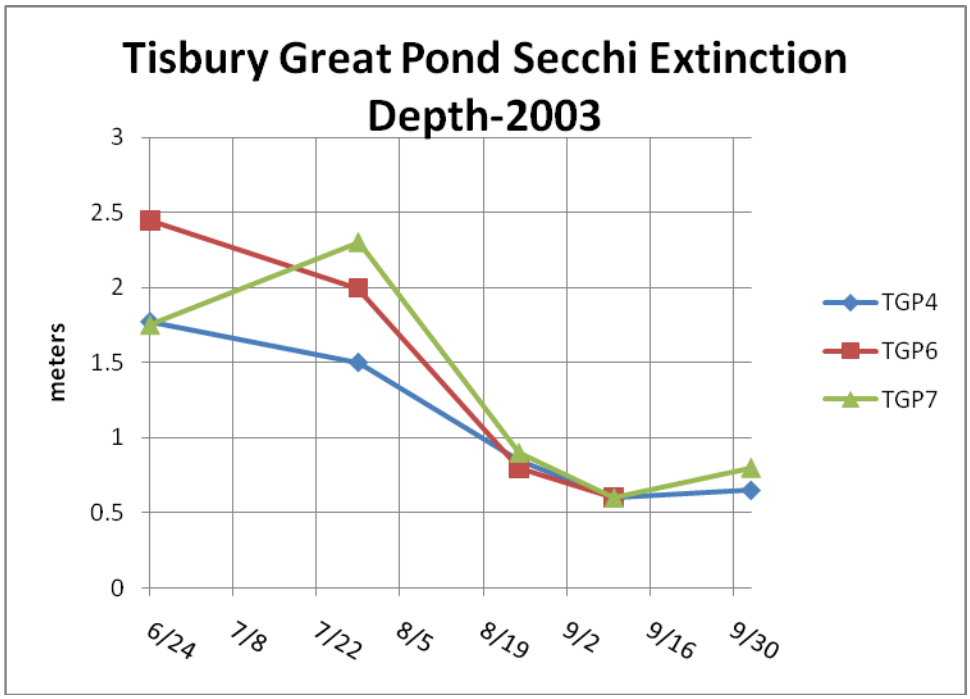
Openings to the Ocean:

During 2003, the Pond was opened on May 13 for about 10 days. It rebuilt head and was opened again on June 29 and was open for approximately 29 days. Pond station locations are shown in Figure 1.

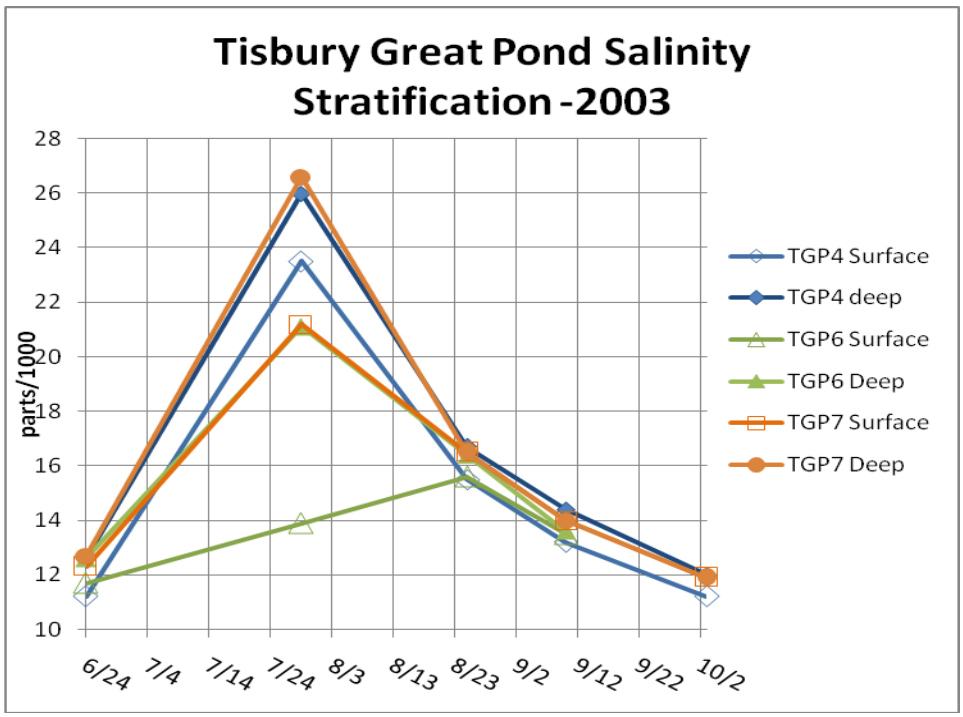
Field Data:

Water column transparency generally declined over the course of the summer. A slight improvement at the southern basin station (TGP7) followed the late June inlet. The values recorded in late summer are not acceptable for coastal waters (Buzzard's Bay Program awards a zero score for 0.6 meters or less).

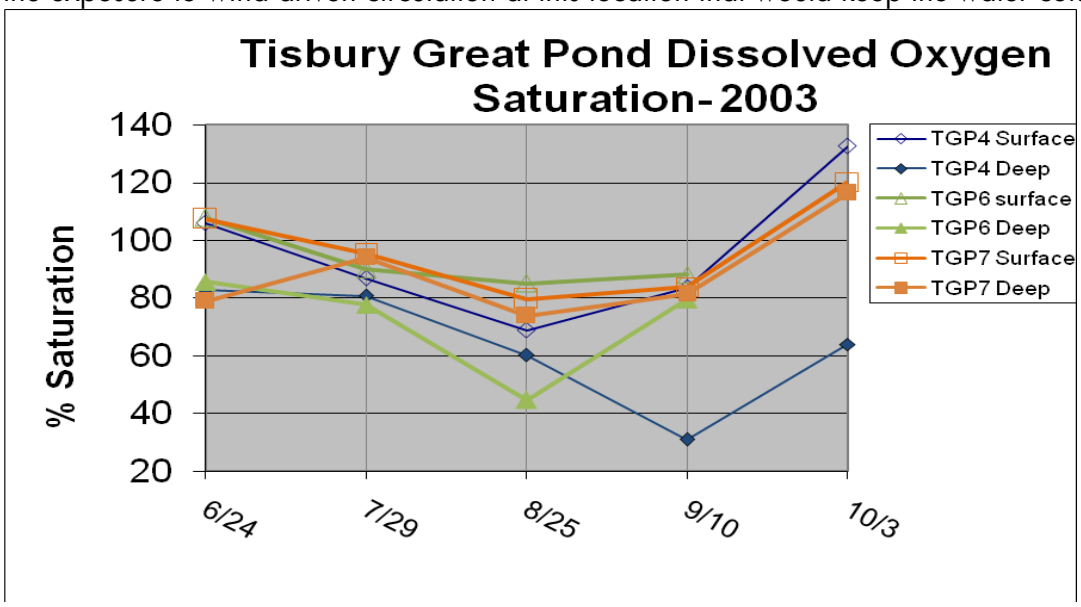


There are several striking aspects to the salinity data collected. The Pond starts and ends with relatively uniform salinity both horizontally and vertically in the water column. Following the late June inlet, there is a substantial spread (about 8 parts per thousand maximum) between the surface salinity and the deep water salinity at stations TGP4, 6 and 7. The water column has mixed by the time of the August 25 sampling round.

Another interesting condition is that the deep water at TGP6 has a nearly identical salinity value to the surface water at station TGP7. This probably results from southwest winds blowing water from TGP7 toward TGP6 where the Deep Bottom bar excludes the deeper water from TGP7. The lack of persistence of the stratified condition played a role in the dissolved oxygen content by allowing the deep water access to the air adding dissolved oxygen.

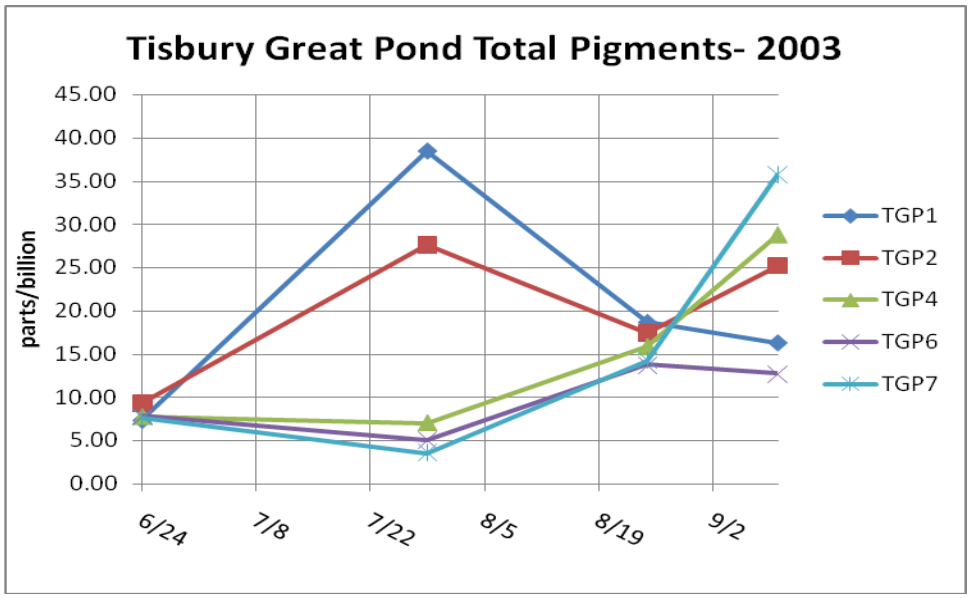


Dissolved oxygen saturation decreased in the deeper water at station TGP4 over the course of the sampling season remaining at 60% saturation or lower from late August through mid-September. The 30% saturation record at this station on September 10 is lower than desirable but this condition had improved on or before early October. Saturation probably remained low for some time at TGP4 as there is excessive primary production in the overlying water at this location (see total nitrogen and pigment data discussed below). In Deep Bottom Cove, a similar drop in oxygen saturation in the deep water occurred on August 25 but the saturation recovered by September 10. In the main basin, saturation in the deep water held up probably as a result of the exposure to wind driven circulation at this location that would keep the water column mixed.

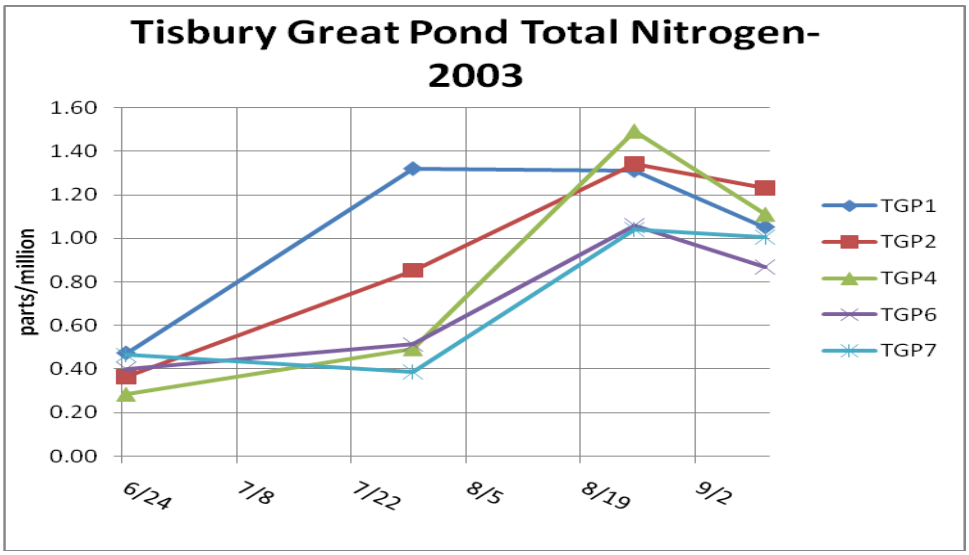


The dissolved oxygen drop off between surface and deep water at station TGP4 continues through the early October sampling round. At that time the deep water saturation has rebounded somewhat to get above 60%. In the surface water, the saturation is well over 100% indicating significant productivity and photosynthesis adding oxygen to the surface water.

The analyses for chlorophyll *a* and phaeopigment indicate the level of primary production when added together (total pigment). It is an indicator of a major group of the phytoplankton that bear chlorophyll. Desirable levels of pigment are around 5 ppb and anything at or over 10 ppb is rated as a zero score on the Buzzard's Bay water quality rating (Costa et al, 1996). In 2003, the Great Pond had excessive production of phytoplankton at the upper Town Cove stations and in late August and September further down the pond at Flat Point (TGP4) and in the main basin (TGP7).



Another indicator of productivity as well as including watershed sources of inorganic forms of nitrogen is total nitrogen. For south shore coastal ponds, the concentration should average at 0.5 ppm or less. While that concentration may not promote healthy eelgrass, it should support a moderately healthy infauna population with the possibility of eelgrass. During 2003, TN values became excessive following the late June inlet and continued at all stations for the remainder of the sampling period.



Discussion:

Water quality during the 2003 summer sampling was not good as indicated by high levels of phytoplankton pigment, total nitrogen and limited light penetration through the water column. This is the case despite a successful mid-May opening that remained open for 11 days and a late-June inlet that persisted for 29 days. The explanation for the poor water quality is not clear.

Precipitation during the spring was near normal. June was wet having just over 6 inches (record from Edgartown National Weather Service station, Lovewell). The rainfall came primarily in the first half of the month before the inlet was cut. July was very dry with less than 1 inch of rain while August was near normal. Groundwater elevations were above average in observation wells located in the watershed supporting a somewhat higher rate of groundwater discharge into the Pond (Wilcox, 2009).

The recent Massachusetts Estuaries Project recommendation for Edgartown Great Pond (Howes, 2007) is for a summer opening (probably targeting the late July through August period). This is suggested as a means of flushing out nitrogen-rich pond water and replacing it with nitrogen-poor ocean water to yield an average total nitrogen concentration during the summer months of 0.5 ppm. The late-June inlet did keep the concentration of pigment and total nitrogen down to desirable levels in the stations south of the Town Cove area as seen at stations TGP4, 6 and 7 in late July. However, the concentrations of both parameters actually increased at the upper Town Cove stations during this time frame supporting an increase of biomass in that area during and after the inlet.

Our understanding of the pond response to an inlet is that when the pond is opened, the lower pond level draws in more groundwater and stream flow to the system leading to a short term freshening, particularly at the upper ends of the coves and bringing nitrogen into the system. As the inlet persists, tidal exchange removes the nitrogen from the upper ends of the coves out to the ocean. During 2003, the flushing action apparently was not successful in lowering total nitrogen concentrations at the head of the cove and there was an increase at stations TGP1 and 2 from the

concentration before the inlet was cut even after 29 days of tidal action. This is so despite salinity reaching into the low to mid 20's at both stations on July 29.

Acknowledgements:
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