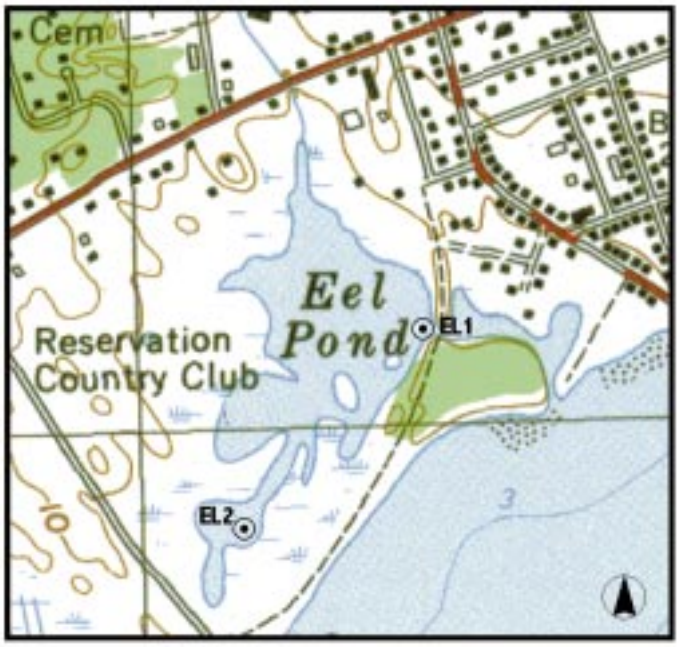
Eel Pond

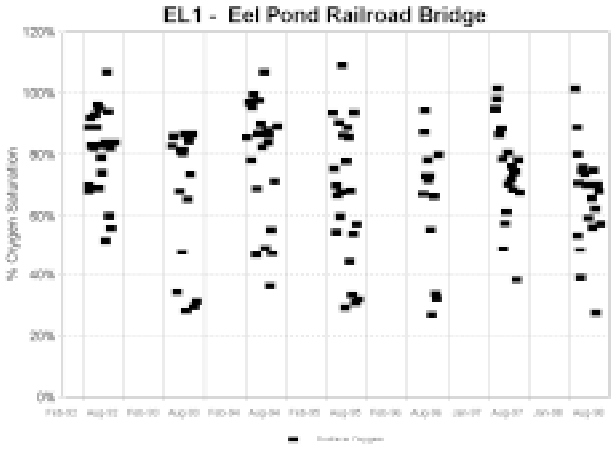


Embayment and Watershed Characteristics

Eel Pond is a small coastal salt pond, 24 acres, at the head of Mattapoisett Harbor. The pond is located between the Mattapoisett village center and the mouth of the Mattapoisett River, the two most focused nitrogen sources to the Harbor. Eel Pond receives freshwater and nutrient inputs primarily by surface water inflow from Tub Mill Brook and through groundwater discharges (primarily recharged from land south of Route 6). As for many coastal salt ponds, the land area contributing to the Pond, 680 acres, is relatively large (28X) compared to the pond area.

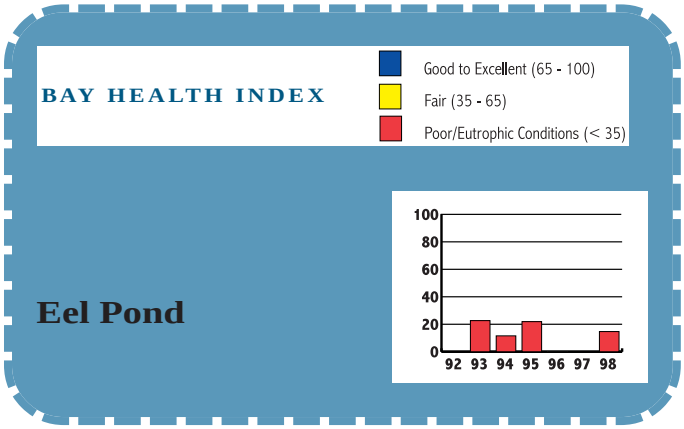
The Pond supports fringing wetlands which at one time had better access to Bay waters. Before road and railway construction the head of Mattapoisett Harbor supported a larger and more integrated wetland system than today, produced primarily by the confluence of the Mattapoisett River and Tub Mill Brook. Consistent with its salt pond-wetland structure, Eel Pond is shallow, generally about 3 feet (1 meter) deep. Although there has been no eelgrass within the Pond in recent times, it is possible that at one time that Eel Pond supported eelgrass, as does a similar system on Cape Cod (Hamblin Pond in Waquoit Bay). However, Eel Pond's shallow basin and associated wetlands do currently maintain important shellfish resources, including what was historically, a sizeable Oyster population. Unfortunately, the Pond remains closed to shellfishing, due to high fecal coliform levels. The main inlet to the Pond is restricted in 2 locations, but primarily by the construction of a railway bed. These restrictions have lowered the flushing of the Pond, thus lowering its ability to tolerate land-based nitrogen inputs and clear-out bacterial contamination, likely entering from surface water inflows and the surrounding tidal marsh. A second inlet has begun forming at the western end of the barrier beach. If this new inlet increases in size it may result in a closure of the historic inlet and possibly a major change in the flushing of the Pond.

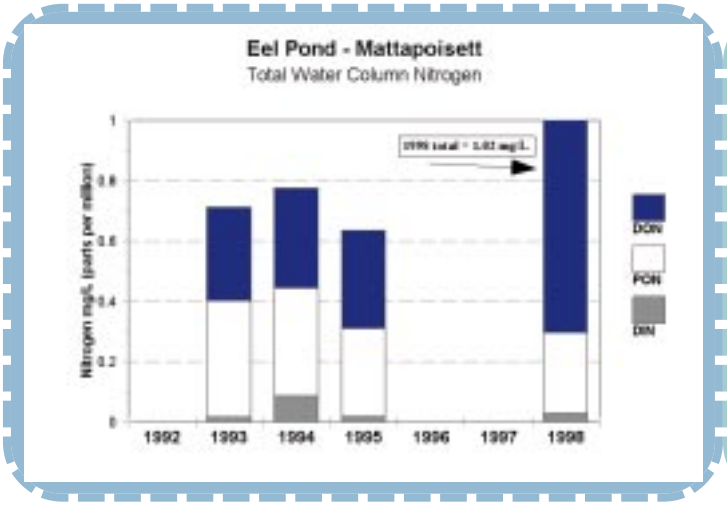
Unlike the greater watershed to Mattapoisett Harbor, the sub-watershed to Eel Pond is significantly developed and includes portions of Mattapoisett Village, Route 6 Commercial Area, and the Park Street neighborhood. Eel Pond receives nitrogen inputs from some of the most heavily developed portions of the Mattapoisett River drainage basin. At present, however, most of the residences are sewered so that nitrogen input from these areas is associated with non-wastewater sources. These non-wastewater sources generally account for about 30%-50% of the total loading from residential development. The major nitrogen sources to Eel Pond include a golf course, lawn fertilizers, runoff and stormwater discharges. At their present level, these loadings, coupled with the restricted tidal exchange, are sufficient to produce eutrophic conditions within the Pond

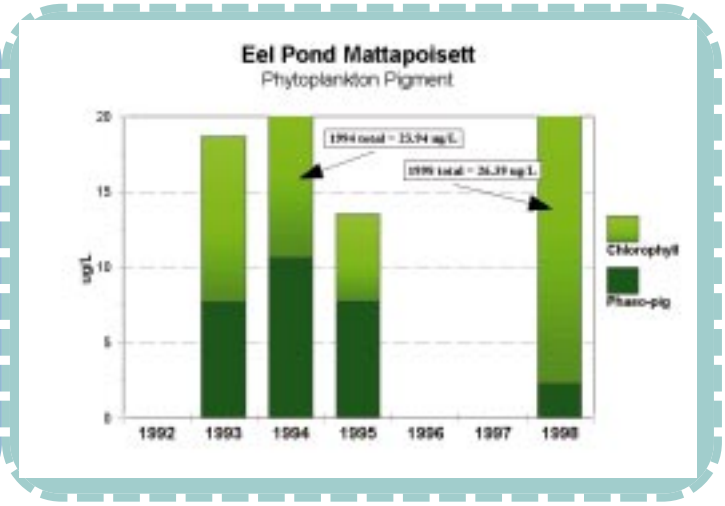


Water Quality

Eel Pond ranks among the most eutrophic embayments within the Buzzards Bay Monitoring Program. In each of the 7 years for which data is available, Eel Pond has shown evidence that it is receiving nutrient inputs sufficient to create conditions of poor water and habitat quality. While some level of nutrient enrich-







ment of Eel Pond waters over Buzzards Bay and Mattapoisett Harbor source waters can be beneficial, for instance increasing shellfish harvests, the level of enrichment in the Pond has caused degradation of its aquatic resources.

Levels of nitrogen and phytoplankton pigments within Eel Pond are consistently significantly enriched over adjacent Mattapoisett Harbor waters. The Pond versus inner Harbor is on average more than 2 fold higher for total nitrogen, 0.752 mg N/L versus 0.366 mg N/L, and 4 fold higher for chlorophyll a pigments, 19.8 ug/L versus 4.7 ug/L. In addition, throughout the study period the chlorophyll a pigments were consistently elevated, only about 15% of the measurements were less than 10 ug/L and about 50% were higher than 20 ug/L. These chlorophyll values suggest that Eel Pond serves as a phytoplankton culture system where nutrients enter from the watershed and are taken up in the Pond by algal growth and then the algae either decay within the pond, impacting dissolved oxygen levels, or are exported to the adjacent Harbor. These phytoplankton may help support some of the productive shellfish beds in the Harbor near the inlet to the Pond.

While the nutrient stimulated phytoplankton production within Eel Pond may support some associated shellfish beds, the levels are sufficient to impact fish, shellfish and potential eelgrass resources within the Pond basin. The high nutrient inputs in relation to flushing have resulted in eutrophic conditions. As clearly demonstrated by the monitoring data, during the summer months, Eel Pond is typically turbid, with secchi depths generally about 80 cm, and has frequent depletions of dissolved oxygen. Oxygen levels in Eel Pond frequently dropped to or below 50% of saturation in each year of sampling and below 30% in 4 of the 7 years. These are depletions which are stressful to animal and plant populations.

Several additional factors serve to increase the level of oxygen depletion within Eel Pond waters. The oxygen depletions are enhanced by the shallow nature of the Pond which tends to have elevated water temperatures, thus increasing oxygen uptake by biological processes. The Pond receives surface freshwater inflows which can result in a lessening of mixing of the watercolumn, hence the input of atmospheric oxygen to the oxygen depleted bottom waters. The Pond salinities occasionally are as low as 1-5 ppt and are commonly several ppt below the levels of the Harbor waters. These low salinities also suggest that tidal exchange with the adjacent marine waters of the Harbor periodically becomes greatly reduced, increasing the potential for eutrophic conditions within the Pond. In addition, the shallow nature of the Pond also increases the recycling of nitrogen from the bottom sediments which can be an important source for algae in summertime . In addition, it is likely that the Pond has always been enriched in organic matter, due to its surrounding tidal marshes. However, the current level of enrichment appears to be clearly related to watershed nutrient inputs.

Given the high levels of nitrogen and chlorophyll and observed oxygen depletions, it is not surprising that the Health Index for Eel Pond showed poor water quality conditions. In each of the 4 years for which an Index can be computed, including 1998, the index was among the lowest observed in Buzzards Bay. Based upon its consistently poor water quality, restoration of Eel Pond should be a priority within the Buzzards Bay System.

Management Needs

Eel Pond probably receives less of a nitrogen load than the area at the mouth of the Mattapoisett River, but it shows significant degradation because of its reduced flushing and small volume. In the Baywatchers Report I (1996), it was strongly recommended that the first step for the restoration of nutrient related water quality in Eel Pond was to delineate its watershed and assess present and build-out nitrogen loadings. Subsequently, during the summer 1997, the Buzzards Bay Project National Estuary Program supported a flushing study of Eel Pond as part of a grant to the Town of Mattapoisett. Following the flushing study, a report entitled, Eel Pond Water Quality Analysis and Nitrogen Loading Evaluation, was completed in April 1998. The results of these initiatives provided additional water quality monitoring data, an understanding of the flushing restrictions of the pond, and an assessment of nitrogen sources and management options for this small estuary.

During the summer of 1997, sampling indicated that watershed nitrogen entering through Tub Mill Brook was likely a major source to the pond. In addition, measurements of nitrogen con-

centrations in Brook waters showed lower nitrogen in the waters upstream of Route 6 versus downstream, likely due to inflow of high nitrate groundwaters downstream and possibly due to stormwater and other runoff from Route 6. Direct groundwater discharges to the Pond are also an important pathway for input of watershed nitrogen. This is seen in the 1997 Study which reported higher inorganic nitrogen levels in nearshore pond waters adjacent to the golf course, suggesting that nitrogen from fertilizers used on the Reservation Country Club are leaching into the Pond. Individual septic systems are a less dominant source than in most other watersheds around the Bay, due to sewering. However, additional hook-ups to the sewerage system still represents a mechanism for Pond nitrogen management. Fertilizer applications and road runoff comprise secondary nitrogen sources. Eel Pond is the only Buzzards Bay salt pond directly abutting an actively managed golf course, making turf management practices an important part of Eel Pond's restoration. There are no major point sources of nitrogen discharging to Eel Pond.

Eel Pond is beyond its ability to adequately assimilate nitrogen, as evidenced by the clear eutrophication already occurring in the Pond. Given its present status of nutrient overenrichment, any further loading to the Pond will cause further declines in water quality. While it has been estimated that 17 new homes on septic systems can be built in the watershed before serious impacts to Pond health and biota are experienced (H&W 1998), the point of serious health impacts appears to have already been passed prior to the 1993 monitoring season. At full buildout, the analysis completed by Horsely & Witten, Inc. further found the Eel Pond watershed to be "overprogrammed," such that approximately 352 more homes on septic systems could be built under current zoning. Any reduction therefore in future development would require major rezoning to greatly increase minimum lot size. The report is careful to note that while increasing minimum lot size would be a major benefit to nitrogen management, it is questionable whether such a major re-zoning is practical. Other land-use options might be more workable, such as additional sewer extensions, open space acquisitions, and improved turf management practices. Perhaps the most immediate option is to evaluate the degree of restoration to be achieved by the restoration of tidal flushing to the embayment either by work on the historic inlet or maintenance of the newly formed inlet.

It is important to note that, with the exception of nitrogen entering Eel Pond through atmospheric deposition, all sources of nitrogen in the watershed can be managed by the Town of Mattapoisett.

In addition to pursuing potential alterations to the circulation of the Pond which requires some additional engineering evaluations, current nitrogen source reduction efforts need to be expanded. Additional sewering of the watershed can reduce the extent of nitrogen loading impacts to the pond. If feasible, sewering the entire watershed would significantly reduce the total nitrogen load at buildout. Acquisition of open space, either in fee or restriction, provides significant protection to the pond as undeveloped land contributes virtually no nitrogen to receiving waters. In fact, forests and wetlands work to attenuate nitrogen from surface waters and atmospheric deposition, thereby serving as nitrogen sinks within the watershed. A targeted acquisition program could be extremely successful in reducing overall nitrogen loading. Although the Reservation Golf Club on the western shore of Eel Pond is privately owned, the Town should work with the club owner to develop programs to reduce fertilizer use and minimize direct runoff of nitrogen into the Pond. This can be accomplished through reduction in fertilizer applications (either application rate or area), using high nitrogen discharges within the watershed for fertilization (water recycling), and maintaining a natural buffer between managed turf areas and the pond. Eel Pond is an important aesthetic and potential shellfish resource to the Town, which can support improved water quality with the application of present technologies.

T.Williams 1998