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Town of Hull

Memo

To: Phil Lemnios
From: Chris Krahforst, Conservation Administrator
CC: Straits Pond File
Date: 5/27/2020
Re: Straits Pond Midge issues

The Conservation Department has been investigating potential causes to the recent outbreak of midges on Straits Pond this spring. The midges reappeared in August of 2019 after a decade of absence of any swarms. This spring, their occurrence has been most severe. As you are aware, the strategy to improve saltwater exchange between the Pond and the Estuary was successfully implemented by the installation of new tide gates with a greater aperture to improve tidal flushing and increasing the salinity in the Pond. Midge activity was nearly completely eliminated 2009 when changes in tide gate operation was in place which allowed the salinity in the Pond to reach levels observed in the Weir River Estuary (~ 27-30 ppt).

The flushing and water exchange plan for the Pond was developed and defined per the adaptive management protocol from the tide Gate O&M plan 2010. The initial high tide elevation was set at EI 3.3 FT (NGVD 29) and the low water elevation was set at about EI 2.0. Under the direction of a Tide Gate Advisory Committee, the high water level was incrementally raised to a level of +/- EI 3.8 and the low water closure was eliminated entirely as the upstream ledge and flood tide delta imposed a low water elevation in the pond. This effectively maximized the tidal prism in the pond and the ecological continuity between the pond and the estuary for water quality and habitat benefits.

The automatic component of the tide gates served to protect a few low-lying homes along the Pond's parameter from flooding. In the event of higher than average tides, the gates are triggered to close at a set water level and remain closed until the water level in the estuary is low enough to allow the gates to open and flooding has been averted. Manual operation is being done consistent with the 2010 O&M plan while the automated component is being repaired. This manual operation is conducted when as the water levels observed from NOAA's water level tide gauge in Boston Harbor (NOAA Station #8443970) indicate the potential for flooding from higher than average tides. ***It is important to note that the automated component of the tide gates is to prevent flooding during higher high tide events and that flushing of the Pond has not changed by these manual operations.***

Our office is pursuing other avenues to better understand potential causes for recent intense outbreak of midges and to guide effect management strategies if they are available. These are:

1. One suggestion by those affected by the midge swarms recently is that the exposed tide flats during low tide in the Pond could be an area where midge larvae are residing. After the mudflats

are exposed, the overlying salinity is removed due to the flushing and the midge larvae can then pupate into flying adults that swarm. This is unlikely in that the water in the sediments remain as if as a sponge where water is retained by the naturally high surface tension of water. My research into the Straits Pond files show that the sediments where the larvae are located are in organic rich muddy sediments. These sediments were found to be ~ 80% water. I suppose after an intense rain, the porewater in the sediments may become “fresher” but not to the degree necessary (<18 ppt) to allow the larvae to pupate. Also note that only a small area of the pond is exposed at Pond low tides as exposed “flats” represent ~ 10% of the total Pond area. Some citizens have proposed that flooding the Pond with saltwater and closing the gates for ~2 weeks would help solve the infestation if the mudflats are a source of the adult midges. Jason Burtner of CZM wrote “The amount of intertidal flats in the pond is relatively modest and trying to hold back water in the pond would decrease tidal exchange between the pond and estuary and impose a low water interruption in the ecological continuity between the pond and the rest of the estuary. This was considered by the tide gate advisory committee way back when and dismissed based on water quality and ecological considerations.” However, we conducted a quick experiment to test if the flats were an important source of adult midges by collecting a sediment sample in the mudflat adjacent to 187 Atlantic Ave along the fringe of the pond during low tide on 25 May 2020. This sample was split in two, one used to sieve the mud to collect larvae by repeated rinsing and the other half was placed in a bottle with fresh water (Britta-filtered to remove chlorine and other potential contaminants in tap water), shaken, and allowed to stand overnight and a day to see if any larvae – if present – would pupate into flying adults. There were no midge larvae found in the half that was sieved nor where there any adults that emerged from the freshwater-added experiment. These preliminary results suggest that tidal flat exposure may not be important to the midge outbreak. Volunteers could test this theory using similar methods in other areas of the Pond where mudflats are observed during Pond low tide.

2. I have reached out to Jason Burtner of CZM and Sara Grady, an ecologist at the North and South River Watershed association, to see if they had any insight on what may be causing this midge outbreak. Jason is reaching out to neighboring communities to see if any of their coastal ponds are experiencing something similar to the outbreak observed for Straits Pond. Sara, Jason, and I will be meeting to go over any new information that may guide how we can manage, if possible, these current midge outbreaks.
3. I have contacted Dr. Betsy Colburn, an Aquatic Ecologist and associate of Harvard Forest who was involved in midge outbreaks on salt ponds on Cape Cod a number of years ago. She is assisting me in locating an entomologist who may be able to identify the species of midge that currently is swarming about the Pond. Last year we sent an insect sample to a graduate student at UMass and she was able to confirm that these critters are indeed midges. She was unable to get to the species level though. It may be that a more salt-tolerant species or variant has populated the pond (e.g., *Chironomus salinarius*) so identification of midge adult samples would be an important early step to help understand the current midge ecology of the Pond.
4. We have conducted salinity surveys each year, usually in the late summer or early fall. Each time the salinities have been at or near the levels found in the Estuary and in Boston Harbor (~30 ppt). We conducted a survey of salinity in the Pond, the Estuary, Hull Bay in Boston Harbor, and along the adjacent shore of the Atlantic on May 26th. All salinities were high and of similar values which demonstrates the effective flushing of the pond with the Estuary and Harbor. I've attached a map showing the results we observed on May 26th.
5. It is possible that changes in the dynamics of ground water to the underlying sediment may have occurred and could be important and related to the recent outbreak. Sea level rise may contribute to a shallowing of the groundwater table. Recent peer-reviewed literature (Masterson et al., 2014; Rotzoll et al., 2014, Hoover et al., 2017) have shown that shallowing of ground water can be caused by sea level rise. If this is occurring in the Straits Pond system, such that fresher groundwater may be reaching the sediment water interface in the pond, this could provide enough of a

low salinity environment to allow the larvae to pupate and thus give rise to the recent swarms. To test this idea, we would need to know where in the sediment the larvae are located. Once that has been determined, the sediment porewater should be tested for salinity. In the past, the midge larvae were found in the sediment of the Pond's interior, so sediment would have to be collected in a manner that would not contaminate the pore water from the overlying salt water which would be somewhat challenging, but could be done with ample planning. The first step is to sample sediment at a number of places in the Pond (possibly following the original larvae sampling transect during the later 2000's) to find where the larvae are and then to collect sediment for porewater salinity analysis.

6. Application of chemicals to control midges: This approach was done by the Town for a number of years using Abate which was applied in April to reduce the number of midge larvae in the Pond's sediment. Reviewing some of the historical information in our files, the effectiveness of this approach remained unclear. Chemical application would need to be approved by a joint Conservation Commission decision with Hingham, Hull, and Cohasset and would also be required to meet state regulations. Pesticides are poisonous substances that can have an adverse effect on the environment or impair human health if handled improperly. If misused, they could kill untargeted plants and animals or leave excess residues on food crops or in drinking water. Pesticides are regulated by Federal and State Laws: The Federal Government regulates pesticides through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). FIFRA gives the federal Environmental Protection Agency (EPA) the power to register pesticides and to regulate the use, storage and disposal of containers and manufacturing wastes. Massachusetts regulates pesticides under the authority of the Massachusetts Pesticide Control Act (MPCA, Chapter 132B of the Massachusetts General Laws). A good reference about the challenges and limitations of this approach is well-captured in a technical bulletin that can be found at:
<http://www.techletter.com/Archive/Technical%20Articles/midgechemicalctrl.html>