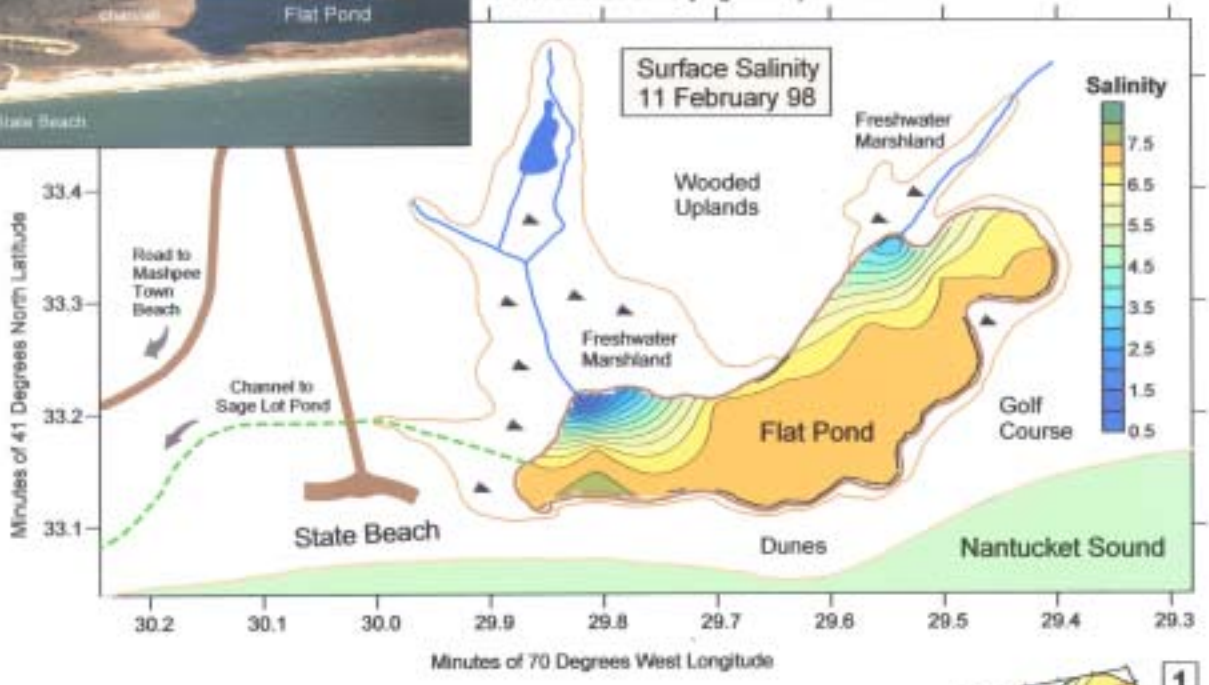
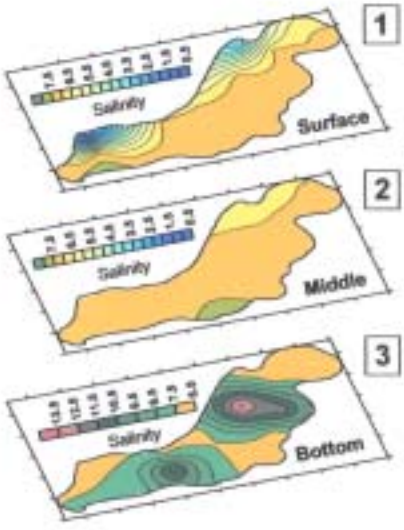
Variable Groundwater Flows Trigger Environmental Variation in Flat Pond

When groundwater levels are high from frequent precipitation events, freshwater springs flow into Flat Pond (blue lines). These flows are frequent enough to support the existence of the largest freshwater marshlands in the Waquoit Bay Reserve. Salt water enters Flat Pond when tides are high enough to carry seawater up the channel from Sage Lot Pond. The fresh and salt waters mix and create a brackish water habitat of varying salinity in Flat Pond.



The mixing of fresh and salt water is slow, especially when there is little wind. Because fresh water is less dense than salt water, it flows from the springs out across the surface of the pond, on top of the more dense higher salinity waters beneath (1). As a result, the pond waters stratify and there is a salinity gradient both in the horizontal and vertical directions (1, 2, 3). Lowest salinity waters (almost fresh) occur at the mouths of the streams at the pond's surface (1). Denser, higher salinity water pools in the deepest areas at the bottom (3, 4).

Because the freshwater is actually groundwater, which is at a relatively constant temperature of 7 to 10 degrees Celcius all year, there may also be a slight temperature gradient as well. In the February example, the freshwater was slightly warmer than the saltier water in the pond (5).



When groundwater levels are low, as in this example, freshwater flows are reduced. Salinity is higher (20 - 22 PSU) compared to 6 - 8 PSU at similar depths in the other example (2) because there is less dilution of salt water.

Changes in groundwater flow cause quite a variation in the salinities that plants and animals experience in Flat Pond.