National Estuarine Research Reserve System

Estuary Data Mystery

Title: Why is there salinity variability in Nag Creek?

Reserve, State: Narragansett Bay Research Reserve, Rhode Island

SWMP Stations: Water Quality (WQ) Nag Creek and Meterological Station (MET) Potters Cove

Parameters: Salinity, precipitation

Start and End Dates: November 12, 2018, to November 16, 2018

Data: Available and easy to graph at *nerrsdata.org*

Investigate This: Nag Creek is a tidal creek that runs through Nag Marsh. The creek is influenced by twice-daily tides with a direct opening into Narragansett Bay. On the eastern side of Nag Marsh is a red maple freshwater swamp. Nag Creek is very dynamic due to a number of factors, as the water quality parameters indicate. One parameter of particular variability is salinity.

Map of Nag Marsh

The salinity remained very low for two full days following a rain event November 14-16, 2018, in Nag Creek, which is longer than we would expect the salinity to remain that low. What other factors may be contributing to this extended period of low salinity? Use **figure 1** and the map of the area (on Page 1) to determine what factors could be influencing salinity.

Figure 1: Salinity and precipitation

Explanation: Rain event on November 13, 2018. Here is some helpful background information about the salinity in Nag Creek from our water quality scientist, Dr. Daisy Durant.

It is likely that some of the variability in specific conductivity at Nag Creek is due to freshwater entering the marsh from the red maple swamp abutting it to the east (across the road). The amount of fresh groundwater inflow has not been quantified, but evidence for it comes in the form of 1) the presence of brackish vegetation species along the upland borders of the marsh in areas abutting the swamp, and 2) new data from a salinity mapping project conducted by Dr. Rick McKinney (EPA Atlantic Ecology Division) that quantifies lower salinities along those same borders. The variability is surely exacerbated due to the shallow nature of the creek in which the sonde is located. After rain events, salinities are likely to be relatively high at high tide due to the influx of bay water, and then correspondingly low at low tide when the surface freshwater predominates.

In addition to the high variability in salinity at Nag, rain affected it even more during the period 11/13/18, 16:45 to 11/15/18, 13:45. Low salinities were recorded at Nag Creek for almost two consecutive days. Even though Nag Creek's salinity is typically variable due to the continued freshwater input from the marsh and the red maple swamp abutting the creek to the east, this

low salinity event lasted more than we typically record at Nag with our sondes. One possible explanation could be the rain event of 11/13/18, 00:45 to 12:30, when our weather station recorded 1.7 inches of uninterrupted rain during this period. Our data showed a decrease in salinity at Nag during the rain event, but it stayed low even after the event, implying that runoff from the marsh and red maple swamp was still affecting the creek.

Extension Idea:

1. How might an increase in storm events and precipitation impact the salt marsh, including the tidal creeks?
2. How might species or the ecosystem, or both, change or adapt to this change in precipitation and freshwater input?
3. Let's pretend that the red maple swamp gets cut down and developed. How might this alter the flow of freshwater into the upper marsh, and what changes could that mean for the marsh plants and animals?

Next Generation Science Standards Alignment

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

LS2.C: Ecosystem Dynamics, Functioning, and Resilience ▪ Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

Stability and Change ▪ Small changes in one part of a system might cause large changes in another part. (MSLS2-4)