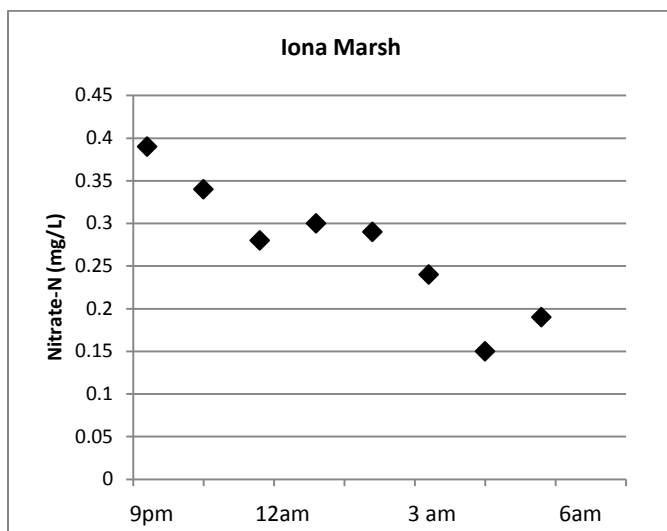


Name _____

Date _____

Why are wetlands important?

Part 1: The graph below shows the change in nitrates over a 9-hour period when the tide was ebbing (or leaving) Iona Marsh, a freshwater tidal wetland along the Hudson River. Using the graph, answer the questions below.



1. Explain the trend in nitrate-nitrogen levels.

Nitrate-nitrogen levels decline over time as the tide goes out. This means that something in the marsh is removing the nitrates, because the water had much higher levels at high tide.

2. What do you need to know in order to decide what caused the change in nitrate-nitrogen in the marsh? List at least two questions.

I would like to know what can cause changes to nitrate levels. I would like to know if the nitrate levels change in all marshes, during all tide changes. I would like to know where the nitrate comes from.

Part 2: During this lab, you will design and carry out an experiment that investigates the impacts of plants on nitrogen (nitrate-nitrogen) in wetlands. Do plants take nitrate out of the water? Do different aquatic plants affect nitrate levels differently?

Available materials: Aquatic plants, terrestrial plants, containers, aged tap water, fertilizer, soil, sand, gravel, measuring spoons, mixing containers, electronic balance, rulers, nitrate-nitrogen test kit

Hypothesis: Write a hypothesis for your study.

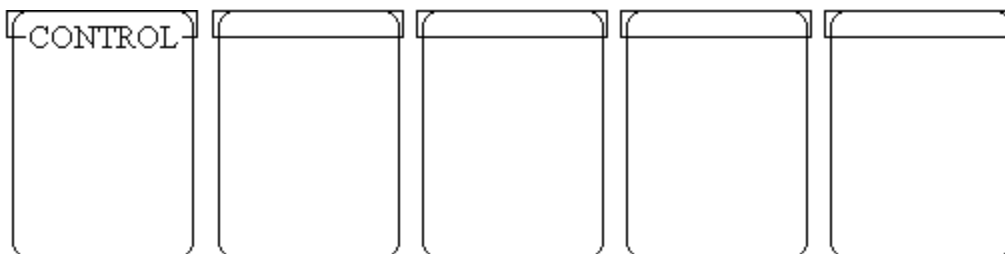
If aquatic plants affect nitrate-nitrogen levels, then the amount of nitrate-nitrogen in the water will decrease over time.

Once you decide on the following questions, design your experiment. *Things to think about:*

1. *Setup:* How many replicates? Where will you put the containers? How much water? What will your control be?
2. *Fertilizer:* What kind of fertilizer? How much fertilizer will you add? What concentration of fertilizer will you use? How often will you add fertilizer?
3. *Plants:* What kind of plants? How many plants in each container? How large will each plant be? How will you be sure to use the same amount of plants in each replicate?
4. *Measurements:* What will you measure? How often? How long will you run your experiment?

Procedure: Write your procedure here.

Design: Sometimes, it helps to create a diagram of your experiment. Use the jars below as an example – you may have more or fewer jars. Write what will be included in each jar. (Don't forget a control – you may have more than one!)



Part 2: Data collection – *sample data*

Plant Type	Nitrate Initial (ppm)	Nitrate Week 1 (ppm)	Nitrate Week 2 (ppm)	Nitrate Week 2.5 (ppm)	Nitrate Week 3 (ppm)	Nitrate Week 4 (ppm)	Nitrate Week 5 (ppm)
Double Arrowhead #1	20	10	2	2	0.5	0.5	0.5
Double Arrowhead #2	20	5	5	2	2	0.5	0.5
Cattail #1	20	10	5	2	2	2	0.5
Cattail #2	20	5	10	2	0.5	0.5	0.5
Arum #1	20	20	2	0.5	0.5	0.5	0.5
Arum #2	20	5	2	2	0.5	2	0.5
Water, sand & fertilizer	20	19	19	19	18	18	19
Water & fertilizer	20	20	20	19	20	20	20
Water only	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Observations:

Part 3: Analyze results

Using data from your class, answer the following questions.

1. How much nitrate-N in mg/l did you add to your experimental group at the start of the experiment? How much nitrate was left at the end of experiment?

Answers will vary.

2. What happened to your ecosystem with the addition of excess nitrogen fertilizer? Discuss growth and general appearance of the plants.

Although answers will vary, students may have observed an improvement in plant vigor (size, color of leaves, height), or a decline in vigor if too much fertilizer was added.

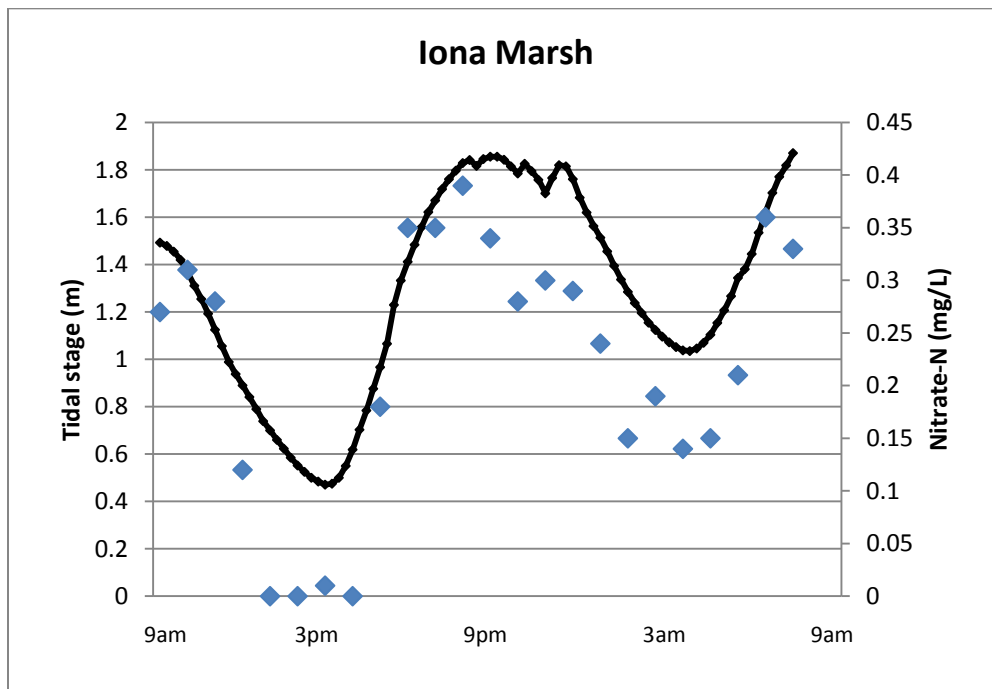
3. Where did the nitrate go? Why do you think this?

Plants removed the nitrate-nitrogen. If too much fertilizer was added and the plants died, it is possible that there was no change in nitrate levels.

4. Look back at the graph on the first page of the handout. Now that you have finished the experiment, explain why the nitrate-nitrogen levels in Iona Marsh changed.

Nitrate-nitrogen levels changed because plants took up the nutrient over the course of the tidal cycle.

5. Use the graph below to answer the following questions. The black line shows the tidal stage, or height of the water – high levels indicate high tide, low levels indicate low tide. The nitrate-nitrogen levels are shown with the diamonds.



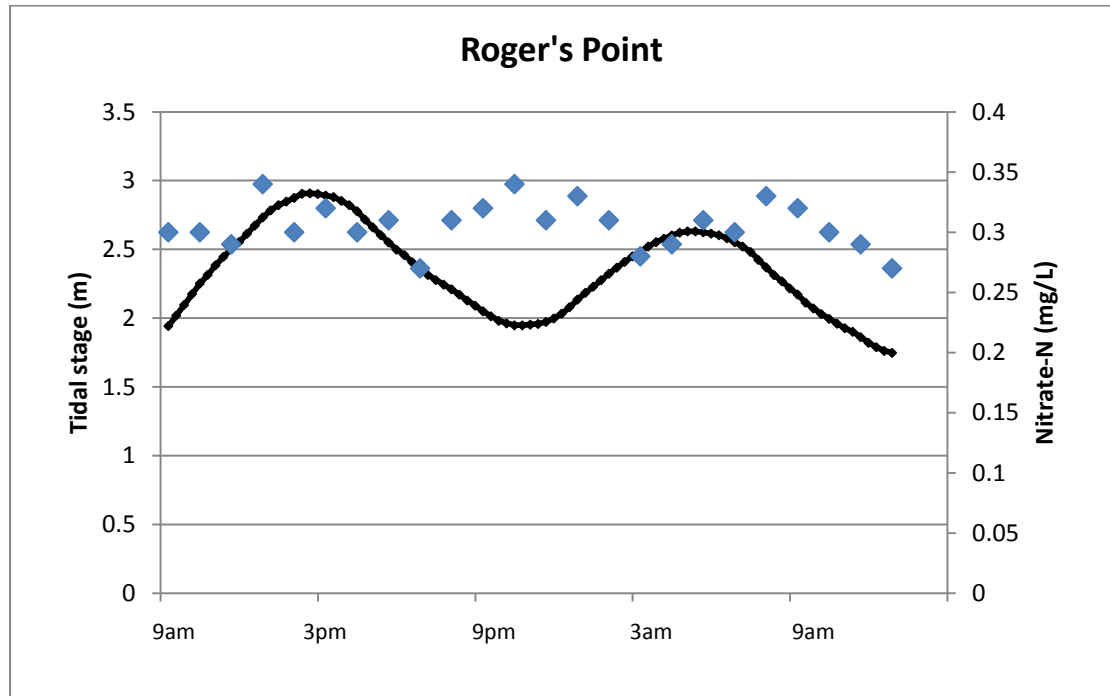
- a. Describe what happened to nitrate-nitrogen levels over the course of the 24-hour tidal cycle at Iona Marsh.

Nitrate-nitrogen levels are high at high tide, and decrease over the course of the ebbing tide. In the daytime, the nitrate levels reach zero (or close to zero), while at night the nitrate levels decreased less.

- b. Explain why you think this happened, based on what you learned during the lab investigation.

Plants use nitrate-nitrogen as a nutrient for growth. They use more during the day when they are more active (ie doing photosynthesis).

6. Now, compare these data from Iona Marsh with data from Roger's Point.



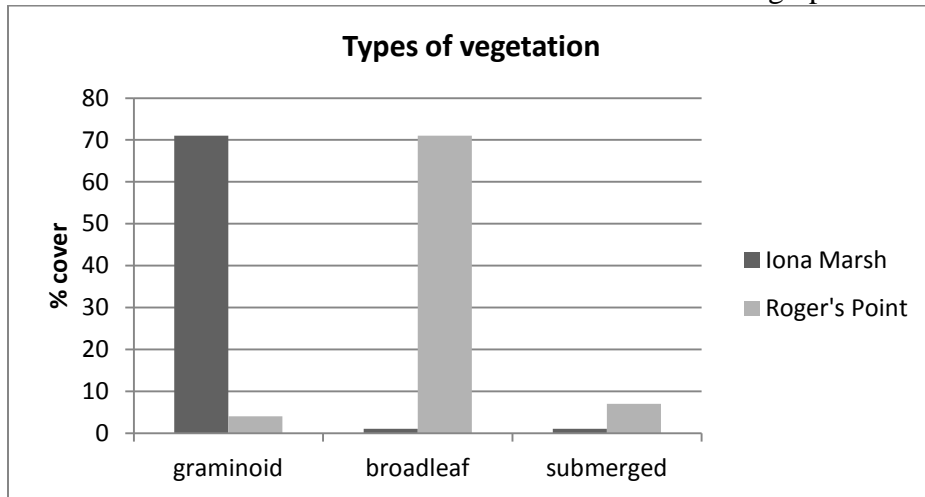
a. How are the nitrate-nitrogen levels at Roger's Point different from those at Iona Marsh?

There is no large change in nitrate levels at Roger's Point when comparing to Iona.

b. What might cause these differences?

Students may not be sure – but they may think about the fact that the plant community could be different.

7. Here are some additional data about the two marshes in the graphs above:



a. How does this information help explain the differences you noticed between the two marshes?

In Iona Marsh, the high percentage of graminoid vegetation led to the change in nitrate levels. Graminoid plants are more efficient at removing nitrate pollution than broadleaf plants.

b. Relate these results to what you learned from your own investigation.

Answers will vary.

8. Imagine you are managing a local watershed. You need to make sure that the reservoir within your watershed remains viable as a drinking water source without building a new water treatment plant. Explain your recommendations.

Recommendations will vary depending on management goals – if nitrate removal is the main objective, then adding graminoid plants would be the best option.
