STUDENT NOTEBOOK

Four Lakes

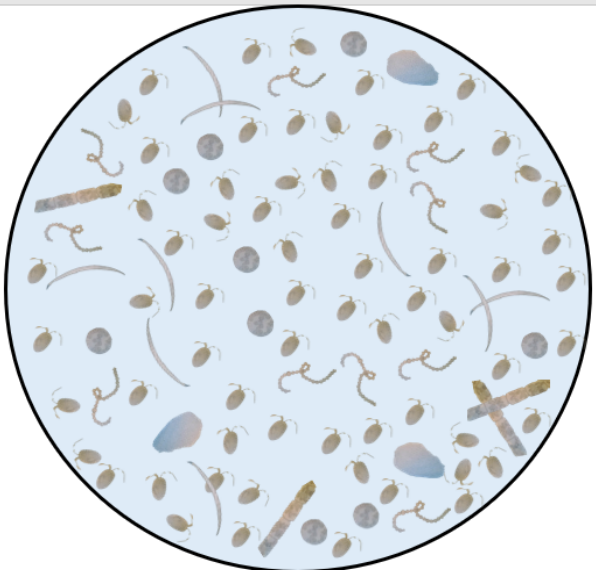
These photographs show water from four different lakes in Central Oklahoma. The photos were all taken on the same day in July, about 30 or 45 minutes apart. The lakes are all within an area of about 300 km^2; the greatest distance between two lakes is approximately 37 km.

I Notice, I Wonder

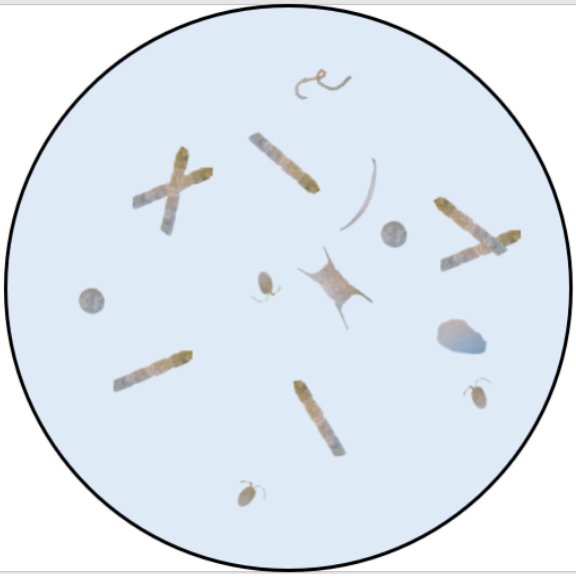
I Notice... (Observations)	I Wonder... (Questions)

Four Lakes' Phytoplankton Communities

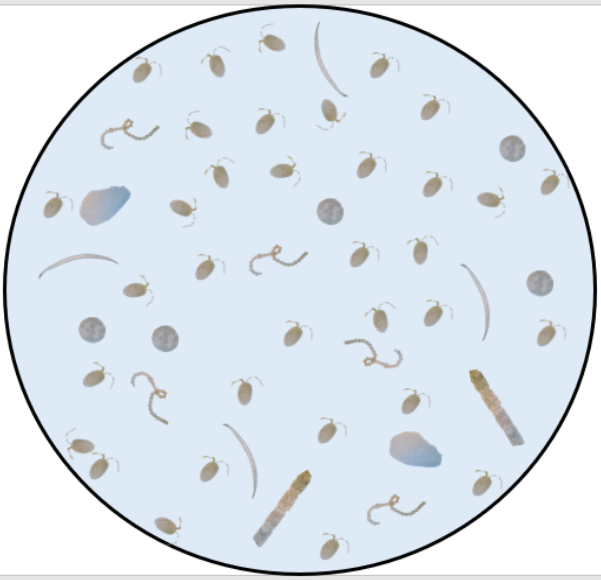
Look at these sketches of phytoplankton samples from each of the four lakes, as seen under a microscope. There are many different types of phytoplankton; the ones shown here are some of the most common species found in Oklahoma lakes.



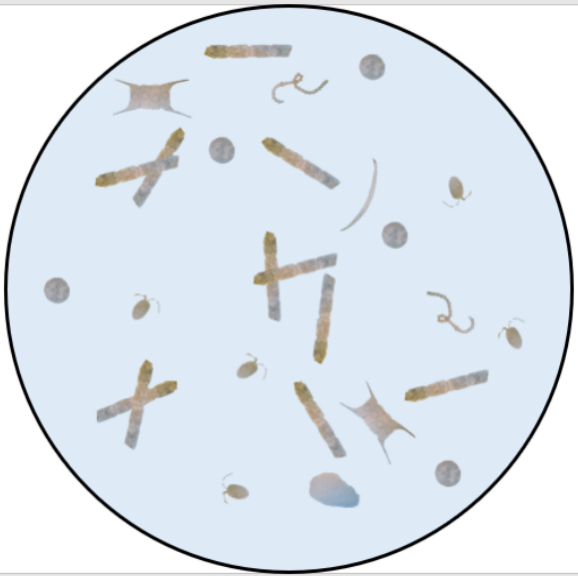
Lake Thunderbird
June 3, 2016
40x



Lake Stanley Draper
June 3, 2016
40x



Shawnee Twin Lake #1
June 3, 2016
40x



Tecumseh Lake
June 3, 2016
40x

I Notice, I Wonder

I Notice... (Observations)	I Wonder... (Questions)

Reflection Questions

1. What patterns do you notice in the phytoplankton communities?

2. If the number of phytoplankton increases, what do you think happens to water clarity?

3. Remember that phytoplankton are plants. What things help plants grow?

Initial Phytoplankton Growth Model

Draw and label a diagram that shows the direct and indirect cause-and-effect relationships among plant growth factors, number of phytoplankton, and water clarity.

Roles in Phytoplankton Communities

Use the Phytoplankton Cards to identify the types of phytoplankton in each lake. Then, count how many of each phytoplankton type are in each lake water sample.

	Number of Phytoplankton in Lake Water Sample			
Phytoplankton Type	**Lake Thunderbird**	**Lake Stanley Draper**	**Shawnee Twin Lake #1**	**Tecumseh Lake**
Flagellate				
Diatom (single cell)				
Diatom (colony)				
Green algae (single cell)				
Green algae (colony)				
Blue-green algae (filament)				
Blue-green algae (colony)				

Classifying Phytoplankton Based on Roles

Read the information on each card and pick one of the characteristics listed. Separate the phytoplankton into at least two groups based on the characteristic you picked.

Characteristic 1

1. What characteristic did you choose?
2. How do you think the characteristic you chose affects phytoplankton growth?
3. What are the categories based on that characteristic?
4. List the phytoplankton in each category.
5. Compare the phytoplankton in each category with the phytoplankton in each lake. What patterns do you notice?

Choose a different characteristic and re-categorize the phytoplankton based on the new characteristic. Repeat this process twice.

Characteristic 2

1. What characteristic did you choose?
2. How do you think the characteristic you chose affects phytoplankton growth?
3. What are the categories based on that characteristic?
4. List the phytoplankton in each category.
5. Compare the phytoplankton in each category with the phytoplankton in each lake. What patterns do you notice?

Characteristic 3

1. What characteristic did you choose?
2. How do you think the characteristic you chose affects phytoplankton growth?
3. What are the categories based on that characteristic?
4. List the phytoplankton in each category.
5. Compare the phytoplankton in each category with the phytoplankton in each lake. What patterns do you notice?

Class Discussion Notes

Revised Phytoplankton Growth Model

Draw and label a diagram showing the direct and indirect cause-and-effect relationships among plant growth factors, number of phytoplankton, and water clarity. Use a different color of pencil or highlighter to show the changes you made to your initial model.

Phytoplankton Investigation

Choose one factor that causes phytoplankton to grow. How can you test if this factor causes phytoplankton growth?

Investigation Question

*How does (**type the factor you will test here**) affect phytoplankton growth?*

Investigation Prediction

Use your model to predict what will happen to the number of phytoplankton if the factor you are testing increases.

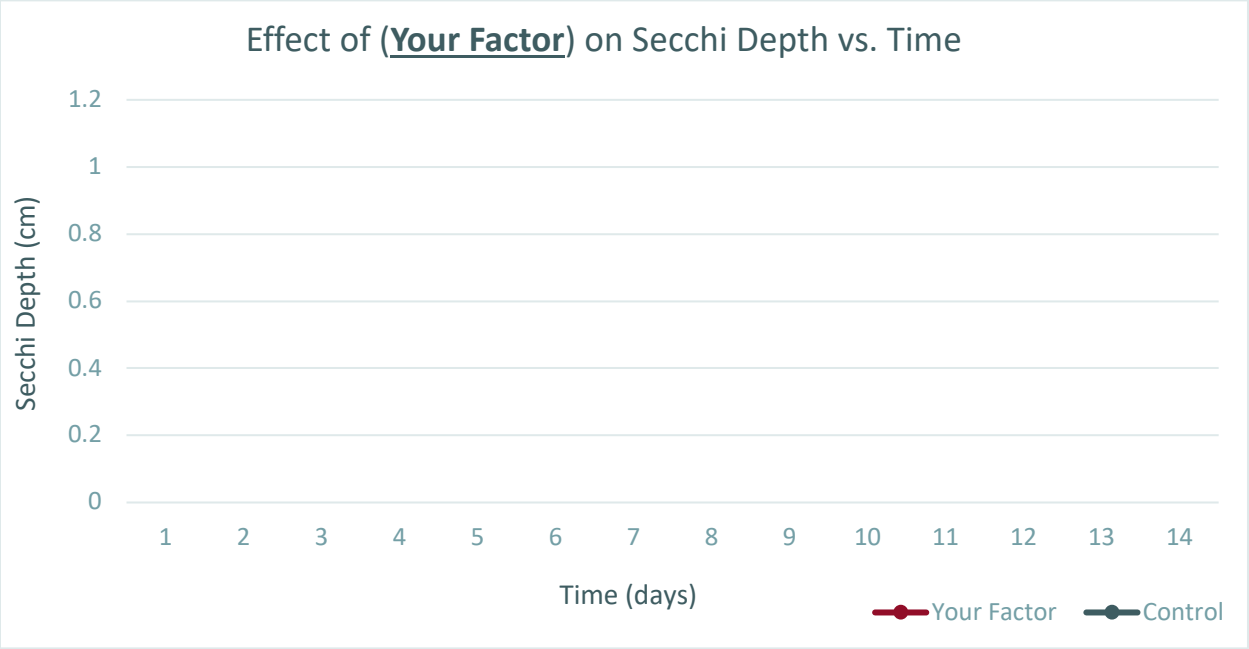
*If (**type the factor you will test here**) increases, the number of phytoplankton will (**increase, decrease, stay the same**).*

Data Collection

- Replace "(***Your factor***)" in the second column with the factor you are testing.
- Measure and record the Secchi depth and any changes in the water's color and smell every day. If the Secchi disk touches the bottom of the bottle and you can still see it, record your Secchi depth measurement as "bottom."

Time (d)	(*Your factor*) Secchi Depth	Control Secchi Depth	Water Color	Water Smell
1	bottom	bottom		
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Data Analysis



What changes did you observe in the water's color and smell over time?

What other changes did you observe over time?

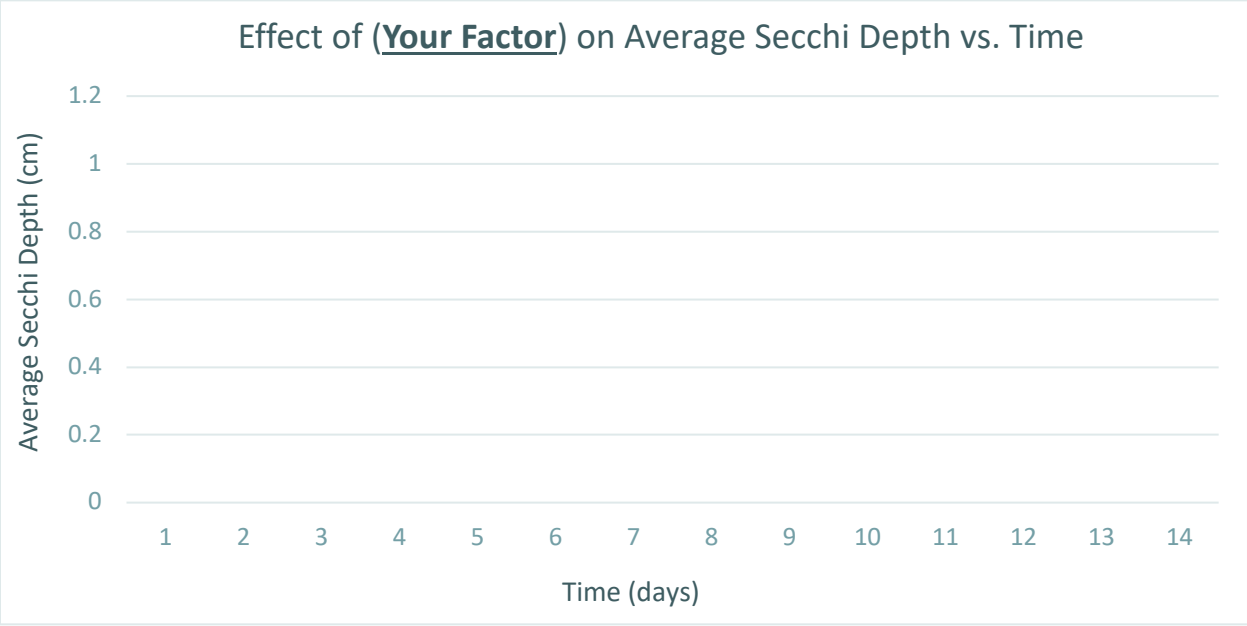
Claim

*Increasing (**the factor you tested**) caused the number of phytoplankton to (**increase, decrease, stay the same**) because the Secchi depth (**increased, decreased, stayed the same**) over (**number of days**) days.*

Expert Panel Discussion

Join other groups that tested the same factor and enter each group's Secchi depth data below. Enter *only* numerical measurements; if any data point is "bottom," leave that cell blank.

Time (d)	Group 1	Group 2	Group 3	Group 4	Group 5	Avg. Secchi Depth (cm)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						



Group Claims

As a group, agree on a claim that answers your investigation question: "How does the factor you tested affect phytoplankton growth?"

> *Increasing (**the factor you tested**) caused the number of phytoplankton to (**increase, decrease, stay the same**) because the Secchi depth (**increased, decreased, stayed the same**) over (**number of days**) days.*

As a group, compare your phytoplankton classifications.

- What patterns do you notice among the phenotypes?

- Make a few claims about these patterns.

Class Concept Map

Revised Phytoplankton Growth Model

Draw and label a diagram showing the direct and indirect cause-and-effect relationships among plant growth factors, number of phytoplankton, and water clarity. Use a different color of pencil or highlighter to show any *new* changes you made to your model.

Evaluate Your Phytoplankton Growth Model

Predict

Using your phytoplankton growth model and what you know about the four Oklahoma lakes, make a prediction about the factors that affect phytoplankton growth for each lake.

In **Lake Thunderbird**, (*nutrient or other factor*) is (*average, high, low*).

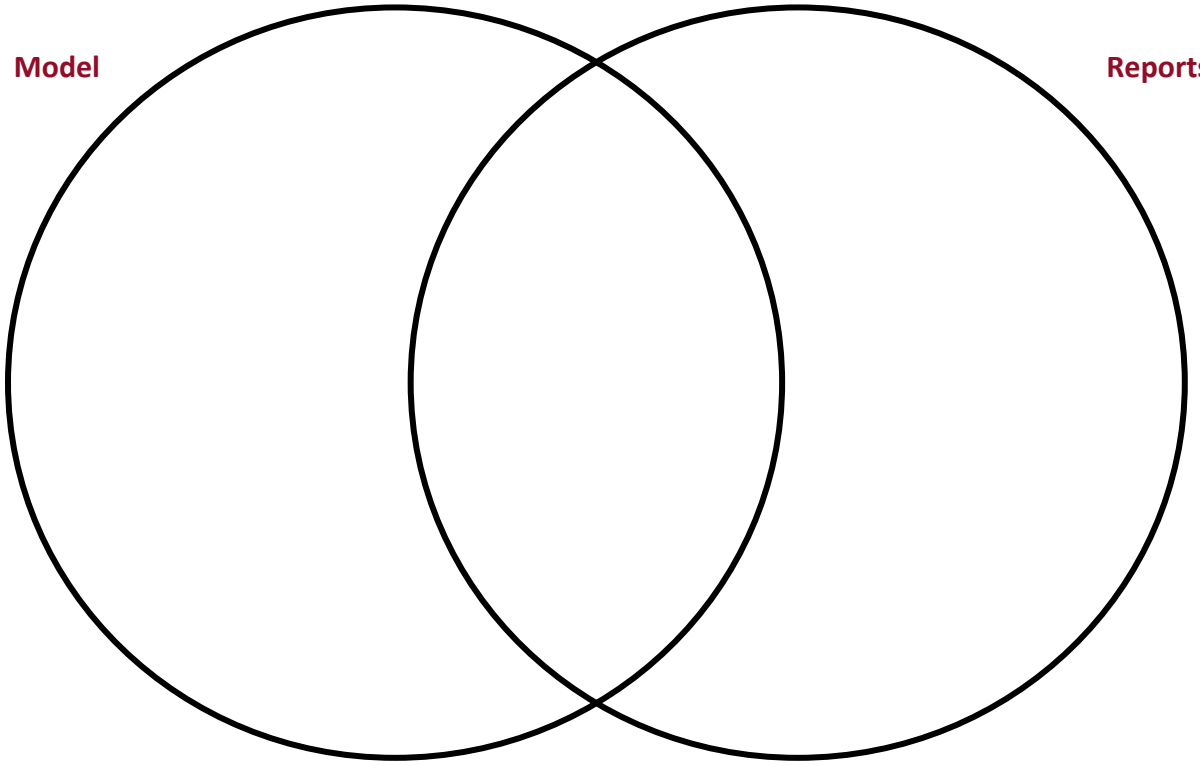
In **Lake Stanley Draper**, (*nutrient or other factor*) is (*average, high, low*).

In **Shawnee Twin Lake #1**, (*nutrient or other factor*) is (*average, high, low*).

In **Tecumseh Lake**, (*nutrient or other factor*) is (*average, high, low*).

Analyze

Compare and contrast the parts of your phytoplankton growth model with the claims and ideas in the OWRB lake data reports.



Are there any elements of your phytoplankton growth model you would revise based on your evaluation and analysis?

Compare your predictions with the data in each report. Did your predictions match the actual data?

My prediction for **Lake Thunderbird** (*did, did not*) match the actual data because (*explain the reason here*).

My prediction for **Lake Stanley Draper** (*did, did not*) match the actual data because (*explain the reason here*).

My prediction for **Shawnee Twin Lake #1** (*did, did not*) match the actual data because (*explain the reason here*).

My prediction for **Tecumseh Lake** (*did, did not*) match the actual data because (*explain the reason here*).