

## Mapping a Study Site (Water Body)

*This is lesson #1 in a series of 3 lessons developed by 1000 Herons 501(c)(3) and adapted for use with the Maine heron tracking project.*

### Overview

Animals, plants, fungi and people exist in time and space. To be able to understand the importance of place in the study of ecosystems it is critical to begin with an accurate map. The surface of the Earth is not uniform and has many amazing and fascinating features. Animals must navigate along this surface to meet their needs. Thus, as a student of ecology you must begin by making, or using, a map. The purpose of this exercise is to map a water body that will be the focus of further studies.

### Grades

7-12th

### Objectives

Learners will:

- Make a map of a water body used by herons or egrets
- Learn about map scales
- Measure water temperature
- Use Google Earth to find the water body
- Measure distance and area with Google Earth
- Learn to work with ratios

### Materials

100m tape measure (2 per pair of students)  
Clip boards (1 per student)  
Waders or hip boots (depending on number of students) optional  
Graph paper (as much as needed)  
Tracing paper (as much as needed)  
Light table, bright computer screen or overhead projector (2) (if needed)  
Pencils (per student)  
Water thermometer (2-3)  
Computer with Google Earth and Excel (per student, if possible)  
Magnetic compass (1 per student)  
Ruler (1 per student)  
Meter stick (2-3)

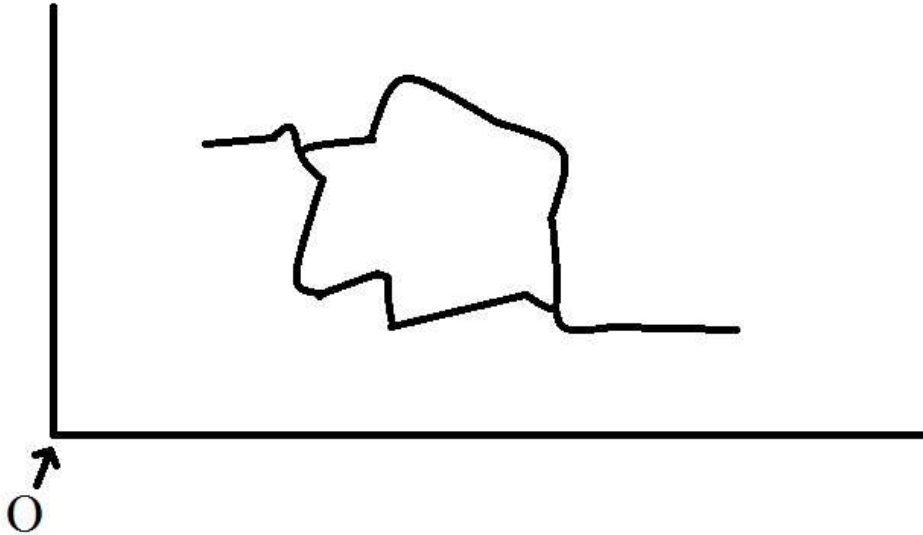
### Group size

A minimum of 2 students are required for the field mapping portion. Ideal size for the field portion is 10-12 students. Students may work in pairs depending on limits of equipment.

### Background

Ecological events happen in time and space. To describe where events occur, a realistic map is required that is a miniature representation of a real geographic feature. Since our goal is to trap a great blue heron, we must be able to indicate where one spends its time. Places where birds spend their time are related to the life processes engaged in by all animals: foraging, resting, transportation, and

reproduction. Water bodies are important for a heron since they are the source of its food. Heron prey are not randomly distributed in a water body. The prey must also navigate the water body and attend to their own life functions. Thus an accurate map is the beginning of a successful study. It will also be used as a data sheet in the next exercise.



### Activities

#### In the field (Day 1): Refer to the diagram above

1. Once you arrive at the site, write your arrival time in the corner of your graph paper.
2. Next, determine the limits of your area. You will be mapping a specific area and you must know how far to go.
3. Where is magnetic north? Use the compass to find out. Where are east, south & west?
4. Orient your graph paper so it represents the area in which you are working. Draw an arrow to indicate north. Write east, south, and west on your graph paper to represent the other cardinal directions.
5. Mark the area where you are standing with a dot. Label it "O". Put something on the ground to mark that spot.
6. As you stand facing the water body, identify an axis that runs from your left to your right. Measure the length of this distance with your tape measure. If possible, leave this tape measure on the ground.
7. Write down the distance in meters at the right end of the axis as: "X real distance". If your study area is longer than 100m, you will need to mark the 100m mark with a recognizable object, and measure again from there.
8. Orient your graph paper so that it runs parallel to this axis. Draw the axis you just measured on the graph paper. Call this the "X axis"
9. Count the number of boxes along the axis you just drew. Write this number next to the axis as: "# boxes X"
10. Next, as you stand at "O" facing the water body, identify an axis that is perpendicular to the left-right axis you just measured.
11. Measure this axis with the other tape measure. If possible leave it on the ground.
12. Write down the distance in meters at the bottom of the axis as: "Y real distance."
13. Draw the axis on the graph paper. Call it the "Y axis."
14. Count the boxes and write this number down next to this axis as: "#boxes Y."

15. Next walk along the X axis from the origin. As you reach places where you see changes in the shape of the water body, mark these along the axis and record the distance from the origin where you are standing. Start sketching the water body. Continue until you reach the end of the axis.
16. Do the same along the Y axis.
17. You should now have a rough sketch of the water body with important distances recorded on your map.
18. Before you leave, take 10 water temperature measurements. Record the depth of the water where you took the measurements with the meter stick.
19. Record your departure time. How long did this exercise take?

### **In the class (Day 2): Calculations**

#### **Scale**

1. Let the #boxes  $X=X_b$ , and let the length of the X axis you measured with the tape measure = T.
2. Divide  $X_b/T$ . This number is the scale of your map. Let  $S$  = Scale.  $S$  is represented in boxes/meter.
3. Calculate the scale for the Y axis.
4. Is the scale the same for the X and Y axes?
5. If not, why not.
6. Each map can have only one scale.
7. What is the maximum length of the water body?
8. What is the maximum width of the water body?

#### **Area**

1. Examine one of your boxes on the graph. What is the real-world length (in meters) of the side of one of the boxes? Area of a square is  $L \times L$ . What is the area of this single box? The units are  $m^2$ .
2. Count the number of boxes in the water body you sketched?
3. What is the area of the water body?

#### **Computer exercises**


1. Open Google Earth.
2. Find your city/town.
3. Find the water body.
4. Find "O".
5. Rotate the Google Earth map (using the compass icon in the upper right corner) so that the horizontal (X) axis on Google Earth is parallel to the X axis you drew on your map.
6. Click on the ruler icon on the top menu bar.
7. Set the units to meters.
8. Measure the length of the water body.
9. Measure the width of the water body.
10. Subtract the length you measured with Google Earth from the length you measured in the field;  $T - \text{len}_{GE} = \text{error}$ , where  $\text{len}_{GE}$  is the length as measured on Google Earth.
11. What value for the error?
12. What are some sources for this error? "We did it wrong" is not a valid answer.
13. Next click the "Add Polygon" icon along the upper left part of the menu bar.

14. Move the cursor to the shoreline of the water body and click the first point. Continue clicking until you have encircled the whole water body. Get your points right on the shoreline.
15. Name the water body in the "Add Polygon" box. Click OK.
16. Put your cursor on the water body, right click the mouse and choose "Copy".
17. Open Earth Point (<http://www.earthpoint.us/Shapes.aspx>).
18. Put your cursor in the first big empty box under "Paste into the text box below" and right click. Choose "Paste".
19. Next scroll down to #4. Under Coordinates choose UTM. Under Area choose Sq Meters. Under Length choose Meters.
20. Scroll down and click on Export to Excel.
21. Read your results once Excel loads.
22. What is the perimeter of the water body
23. What is the area?
24. Subtract the area you estimated on your map with the area you measured with Google Earth. Take the absolute value of this number.
25. Think of the errors that may have occurred while estimating area.

**Data sheets: The class should use just one map for all further observations.**

1. On Google Earth, zoom in so the water body takes up most of the screen. Rotate the map so north is up.
2. Choose File from the top left corner, choose Save, choose Save image. Type in a file name and choose a location to save the water body image.
3. Minimize Google Earth and open the file you just created.
4. Print the image on 8.5" X 11" paper.
5. Lay tracing paper over the map you just printed and trace the outline of the water body and any other significant features on the map. Use a bright computer screen, overhead projector, or light table if necessary.
6. In one of the corners of the map write:
  - "Date \_\_\_\_\_"
  - "Time begin \_\_\_\_\_"
  - "Time end \_\_\_\_\_"
  - "Water temp(°C). \_\_\_\_\_"
  - "Water turbidity ( clear, medium, cloudy)"
  - "Water color (none, brown, green, milky, other \_\_\_\_\_)"
  - "Wave height \_\_\_\_\_"
  - "Air temp.(°C) \_\_\_\_\_"
  - "% cloud \_\_\_\_\_"
  - "Sheet # \_\_\_\_\_"
  - " Name \_\_\_\_\_"

Comments may be written on the map and on the back.
7. Draw an arrow on the map to indicate north.
8. Draw a scale. This should be a straight line that shows the real-world length of the line such as:
 



100m
9. Have your leader make multiple copies of this completed map. It will be your data sheet for upcoming exercises.