Whale Watch – Teacher Notes

What follows is a suggested outline to follow with the *Whale Watch* activity. The elements of the activity are presented in several components so that the teacher can make adjustments for grade level and/or time constraints. The teacher's role should be to guide students through the problem solving process. Allow them time to think and to make mistakes. The intended grade levels are 5-8; however, the materials could be used with lower or higher grades. The materials can be used in the classroom or provided to students to examine at home. There are no prerequisite math skills necessary for Whale Watch.

Introduction to the problem

Begin the activity by providing students with some facts about the North Atlantic Right Whale [see suggested links]. Use the ***Right Whale Migration kmz*** to show the route the whales follow along the coast. Present the problem to students. Right whales are an endangered species and are threatened by commercial ship strikes and entanglement in fishing gear. Unlike the whale hunting from the past, these deaths are accidental. *Do you think there is anything that can be done to solve this problem? What information would you need to know?* Brainstorm a list on the board. You can modify it as the activity progresses.

Examine a sample of data

This is a good time to start using the vocabulary of statistics. Examine a portion of the problem by focusing on a particular region where whales come into contact with humans: Massachusetts Bay. Present students with the ***Right Whale Sightings Data*** in the spreadsheet format and explain that this is a sample that could represent a population. Compare the information presented with the list the students produced. Allow the students to examine the spreadsheet and make observations. The data is arranged chronologically; could it be arranged differently? This would be a good time cover some spreadsheet skills. Averages could be found for group size and coordinates, or the entire sheet could be re-arranged by a particular column (i.e. group size).

Visual Representation

Present students with the ***Whale Watch kmz*** in Google Earth and gather observations. Note that there are interactive elements presented in the map, including several movies, information on how the data was gathered, and a collection of ports. Each of the 250+ pieces of data are mapped and their values can be read if you click on the icon. Double-click on any item for a snapshot view. The Stellwagen Bank is an area where many species of whales frequent. It is important to note that this only data on the right whales.

Allow lots of time for students to explore the map. The picture is clearer now, but are they any closer to a solution? Most likely, at some point someone will suggest that these areas should just be avoided. Remind students that this is a sample of several months within one year. Additionally, a thousand commercial ships pass in and out of Boston each year and many people rely on the Bay for their jobs.

Take a closer look

This would be a good time to bring students back to mathematical terms. Averages could be examined including mean, median and mode. Keep using statistical terms like sample and population so that the students understand what the data represents. Another idea to present is that numbers take different forms. There are ideas of number theory and measurement that can be found in the Whale Watch activity. Students look for patterns in numbers; is this any different? Would more data help? Can anything more be accomplished with the data they have?

Share the kmz files for ***Sightings Data by Group Size*** and ***Sightings Data by Month*** with students. These, and the original data placemarks, are best viewed individually. Uncheck the box in front of the file as it appears in the sidebar menu to remove it from view. (The original Sightings Data is found in the Whale Watch folder.) I had originally intended for the students to create these variations but it is extremely time consuming so I wouldn't recommend it. Still, they may have suggestions for other ways the data can be presented in Google Earth. The polygon tool can be used to map regions, for instance.

What observations can they draw now? When the data is represented by group size, you can see where large groups of whale congregate. Perhaps these areas are rich sources of food? By examining the data by month, a pattern showing where the whales travel seems to emerge. Students may presume that the whales are travelling north but it is possible some are already migrating south. I don't have any information on the travel pattern of a specific whale, but perhaps that is something you can find.

Formulate a plan and share it

Now that students have examined the data sample thoroughly, they should be able to suggest a plan of action. I'll leave this to you to determine what form this takes but I would imagine you would want them to share their ideas with the class. You may want them to work in groups, suggest solutions in an essay or presentation, or even make a modification of the Google Earth file. I would take the approach that there is no wrong idea as long as it is based upon the data. References to the data characteristics should be important.

Real world solutions

I think one theme you should touch upon with this activity is that there are lots of problems like this in the world. Not just with endangered species, but problems with poverty, the environment, school budgets, or marketing for the next blockbuster movie. What these all have in common are that information is gathered and assembled so that a course of action can be suggested. Data analysis is a common math problem in the real world.

Data collection is an ongoing process with right whales. Surprisingly, it wasn't until 2007 that one solution was put into practice in Massachusetts Bay. By shifting the shipping lanes slightly to the North, researchers determined that ship strikes on right whales could be reduced by more than 50% and as much as 80% for all whale species in the region. Additionally, a network of listening buoys is established now that alerts ship captains to the presence of whales in their vicinity. These are presented in the *Some Solutions* kmz file, which includes the shipping lane and additional placemarks and movies. Most likely, you would withhold this material from students until the conclusion of the unit.

Final Thoughts

At times *Whale Watch* may seem more like a science activity than one for the math classroom. I would encourage you not to make a differentiation between the two. Math and science should be partners so why not approach the Science department or other subject areas and make this a cross-curricular unit. Perhaps the students can tackle a local problem with a similar approach.

Whale Watch can be done in class over the course of several days, or you can have students investigate it at home with follow ups in the classroom. As with all Real World Math activities, teachers should first download material from the site and then distribute it to students. Google Earth kmz's can be sent as an email attachment or shared via a flash drive.

The movies included with the material are found on YouTube. This may be a problem if YouTube is blocked at your school. Presumably, students could view the clips at home.

Suggested Links
Right Whale Facts - http://goo.gl/Q4rbo
Northeast Fisheries Sightings Advisory System - http://goo.gl/1CEXU
Reducing Ship Strikes - http://www.nmfs.noaa.gov/pr/shipstrike/
Shipping Lanes - http://sanctuaries.noaa.gov/news/features/0906_whalewatch.html
New England Aquarium - http://www.neaq.org/index.php
Right Whale Research Blog from NEA - http://rightwhales.neaq.org/