Excel Tutorial

During this introduction you will learn the basics of how to use Excel—how to make a spreadsheet, create a graph from that spreadsheet, and interpret the data to answer some basic questions.

Creating a Simple Spreadsheet

A spreadsheet is a way to organize information so that you can create visualizations or interpret your data – it consists of a grid of columns and rows. A *column* is vertical, and a *row* is horizontal. The intersection of a column and a row is called a *cell*.   Open an Excel spreadsheet and type the headings "Year" and "Flow (m3/second)", as shown below. In this exercise, we'll look at data from the Hudson River to understand the average flow rate of water moving down the Hudson River at a monitoring station at Poughkeepsie, NY.

Now, copy the data below and paste them into rows A and B to fill in the chart.

1989	2647.01
1990	2029.38
1991	1021.96
1992	2304.53
1993	1242.96
1994	1348.17
1995	580.18
1996	2374.82
1997	1392.27
1998	1471.37

Your data should look like this →

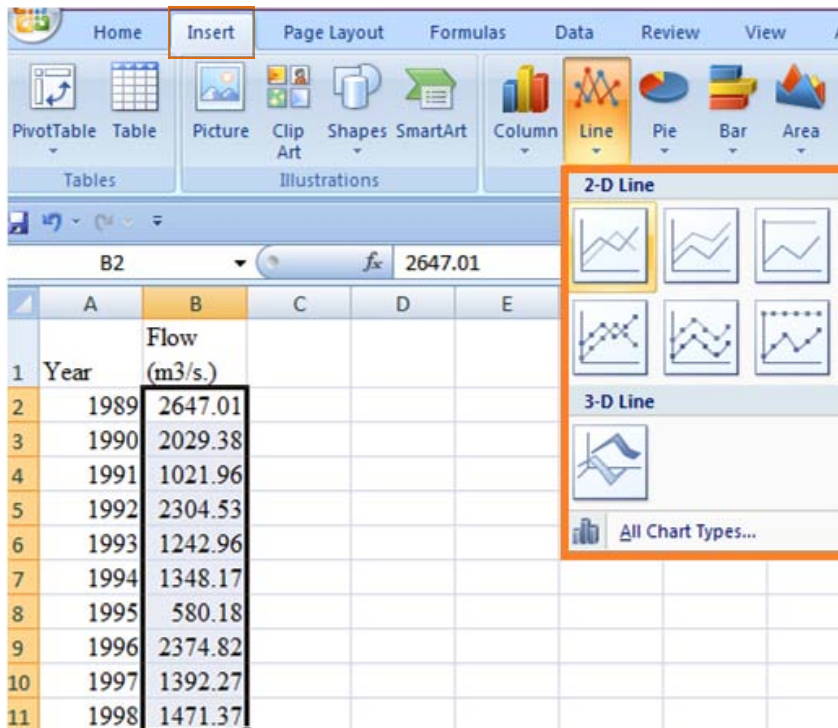|	A	B
1	Year	Flow (m3/second)
2	1989	2647.01
3	1990	2029.38
4	1991	1021.96
5	1992	2304.53
6	1993	1242.96
7	1994	1348.17
8	1995	580.18
9	1996	2374.82
10	1997	1392.27
11	1998	1471.37

We will put year on the x-axis, because it is the independent variable, and Flow (m³/second) on the y-axis, because it is the dependent variable. Remember, a dependent variable is something you are measuring, and an independent variable is what you are in control of or what you can manipulate. In this case, we can choose the years we want to measure, but we can't control the flow.
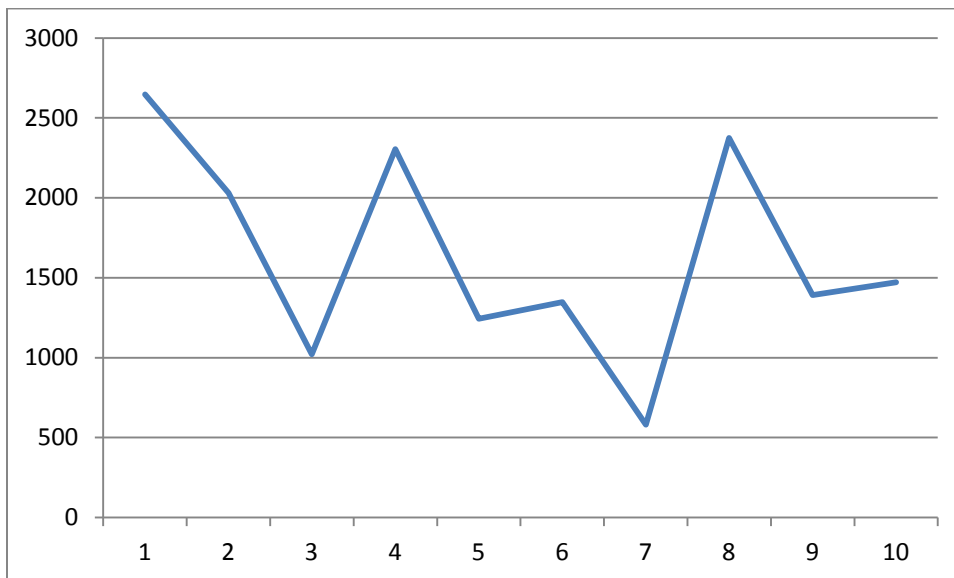
Making a Graph

You can make many different kinds of charts and graphs, but the most common are the bar, line, and scatter plot graphs. To make a graph, you have to highlight the data you want to graph. Click on cell B2, and drag down to cell B11. **Avoid highlighting the headings of your data.**

After you have highlighted the boxes, click on the "Insert" tab. You can choose what type of Chart you would like. For this first graph, let's choose a line graph.

| Home | Insert | Page Layout | Formulas | Data | Review | View | A |

| PivotTable Table | Picture | Clip Art | Shapes SmartArt | Column | Line | Pie | Bar | Area |
| Tables | | Illustrations | | | | | | |

2-D Line

3-D Line

All Chart Types...

| | B2 | | | f_x | 2647.01 |

|	A	B	C	D	E
1	Year	Flow (m3/s.)			
2	1989	2647.01			
3	1990	2029.38			
4	1991	1021.96			
5	1992	2304.53			
6	1993	1242.96			
7	1994	1348.17			
8	1995	580.18			
9	1996	2374.82			
10	1997	1392.27			
11	1998	1471.37			

You should get a graph that looks like this:

Note: if you have a "series 1" legend, you can just click on it and delete it. You don't need a legend right now since you only have one variable on your graph.

To get the years on the x-axis, right click anywhere within the graph box, and then click "Select Data".
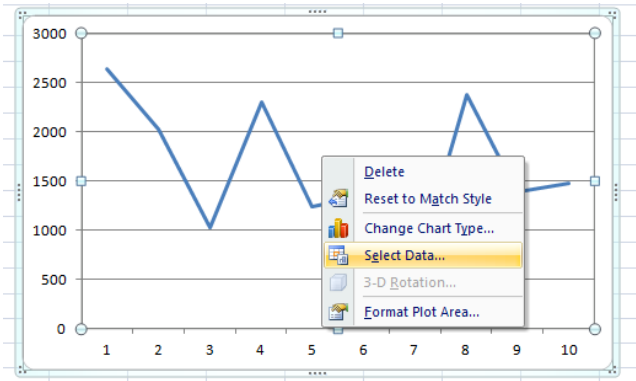
A drop box titled "Select Data Source" pops up.
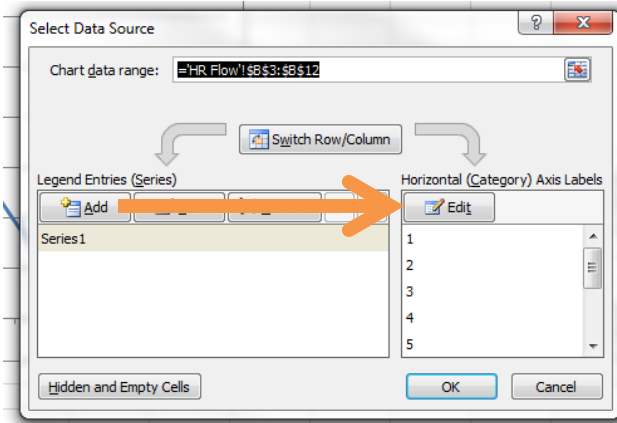
Click the "Edit" bottom directly under the text "Horizontal (Category) Axis Labels". Then another drop box pops up titled "Axis Labels". This box prompts you to provide an "Axis Label Rage". To do this, either type in the cell range of your x-axis or highlight the relevant cells (in our case, select A2 through A11, and click "OK").
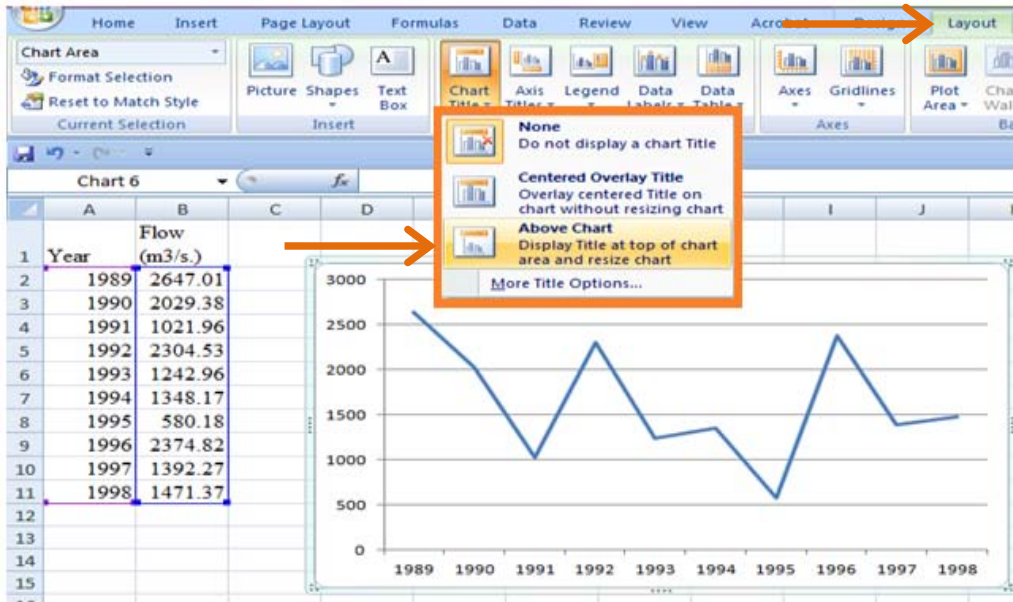
Then click "OK" again to exit the "Select Data Source" drop box.
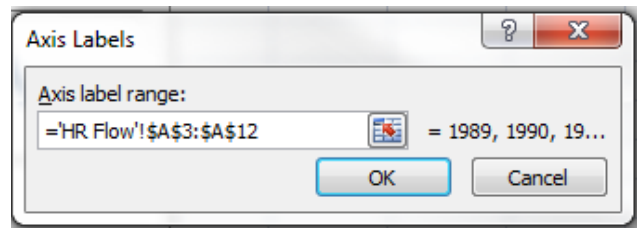

Your graph should look like this:
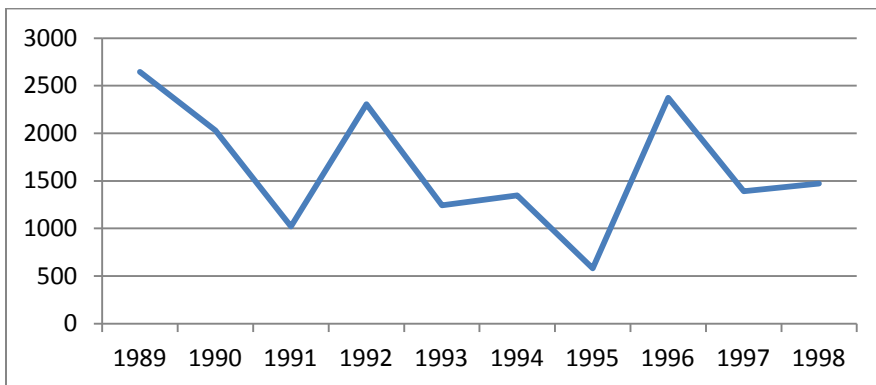
To add a title, x and y axis labels of the graph, click on the graph, and then use the "Layout" tab on the top of the screen. To edit the title of the graph click on "Chart Title" and select the "Above Chart" option, and type "Hudson River Flow" - the title of your graph.

To edit the x and y axis labels of the graph, click on "Axis Titles" (right next to "Chart Title") then click on "Primary Horizontal Axis Title" and "Primary Vertical Axis Title" respectively. For the horizontal axis choose the option "Below Axis" and type "Year" –the label of the x axis. For the vertical axis choose the option "Rotated Title" and type "Water flow (m^3/s)" –the label of the y axis.

You should now have a graph that looks like this:
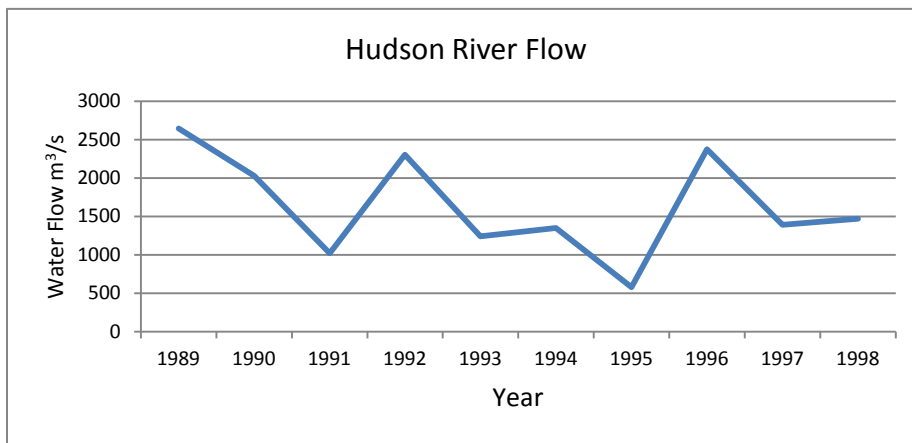
Based on this graph, answer the following questions:

1. What year was the flow in the Hudson the highest? _____ the lowest? _____

2. What are some of the reasons that flow might be higher or lower in different years?

_____

_____

_____

For homework, make a graph of these data:

| Sample	Chloride (mg/L)
1	17.34
2	16.69
3	15.2
4	13.94
5	14.36
6	15.61
7	14.96
8	15.16

Print the graph. When you are finished, answer the following on the back of your graph: Which variable is independent, and which variable is dependent? Why?

Making a Graph: Part 2

Now it's time to practice using Excel to make a more complicated graph, where we will show more information on the Hudson River. Looking at ten years of data, you will compare the number of rotifers per liter of water with the number of cladocerans per liter of water. Later, you will add information about zebra mussels.

Zebra mussels are an invasive mollusk that arrived in the Hudson River in the early 1990s. They are filter feeders and reproduce quickly.
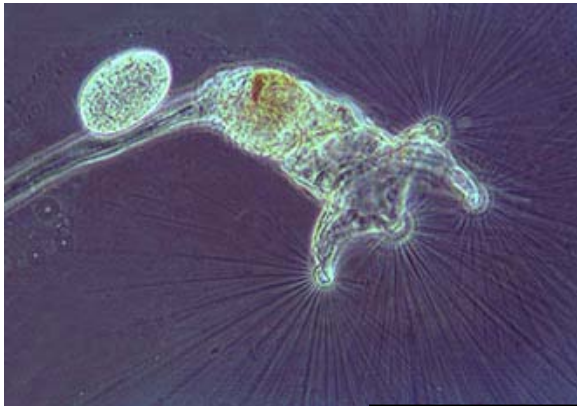
Microscopy-UK.org

A rotifer is a tiny microscopic animal that lives just about anywhere that there is water, including the Hudson River.


Cladocerans are also microscopic crustaceans; they are sometimes called water fleas.

Open an Excel spreadsheet and add the data below.

Year	Rotifers #/L
1989	401.38
1990	880.12
1991	1244.15
1992	505.67
1993	115.18
1994	40.00
1995	60.98
1996	36.92
1997	67.71
1998	8.82

If you have a spreadsheet designed and you forgot to include some important information, you can insert a column (or a row) into an existing spreadsheet.
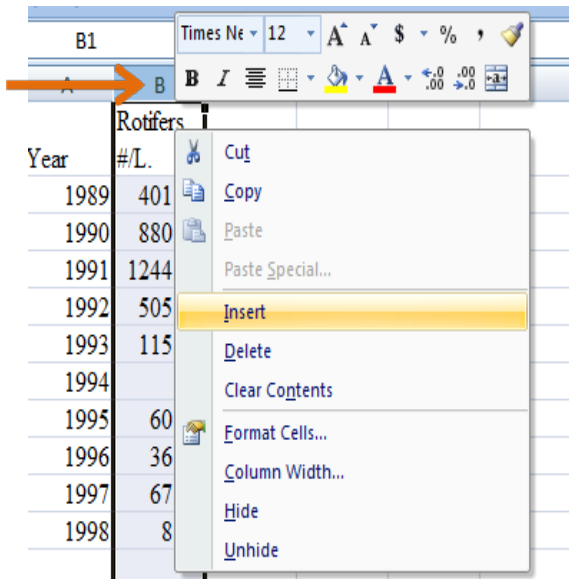
You have to right click on the column label (letter) and choose **Insert**. This will insert a column **immediately left** of the selected column. Likewise, we can also insert rows. With the row label (number) selected you choose Insert. This will insert a row above the row you have selected.

Now try inserting a column into the spreadsheet you have made! Insert a column between Letters A and B, and add the Cladoceran data on the right.

Cladocerans #/L
13.70
8.65
33.41
42.60
12.67
15.20
12.74
3.69
7.00
20.63

Your spreadsheet should look like this:

|	A	B	C
1	Year	Cladocerans #/L.	Rotifers #/L.
2	1989	13.7	401.38
3	1990	8.65	880.12
4	1991	33.41	1244.15
5	1992	42.6	505.67
6	1993	12.67	115.18
7	1994	15.2	40
8	1995	12.74	60.98
9	1996	3.69	36.92
10	1997	7	67.71
11	1998	20.63	8.82

Now you are ready to create a graph from these data. Highlight the data you want to graph on the y-axis; in this case highlight cells B2 to B11 and C2 to C11 at the same time, then click on the "Insert" tab. Again, click "Line".

You should get a graph that looks like this:
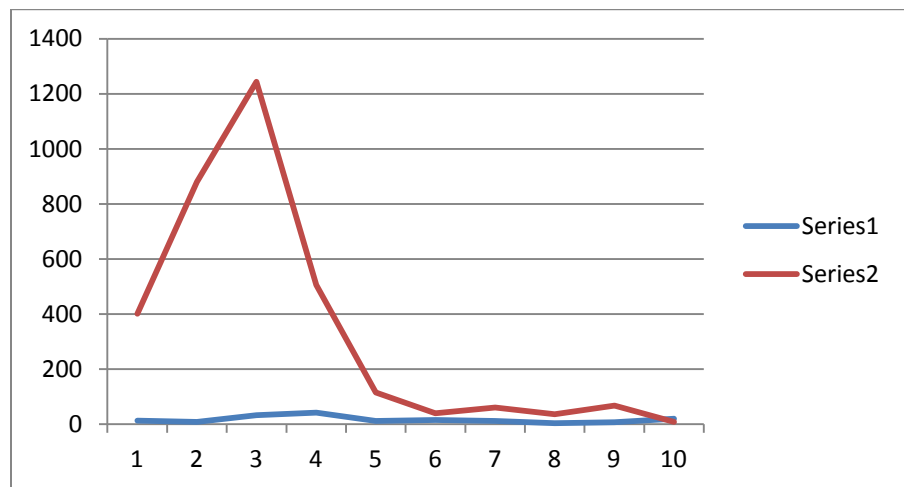
To get the years on the x-axis, follow the same procedure as earlier by clicking on "Select Data", adding the years to the Horizontal Axis Labels, and selecting "OK".

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To add labels to the series, go back to the Select Data box. Then, click on the "Edit" button under "Legend Entries".
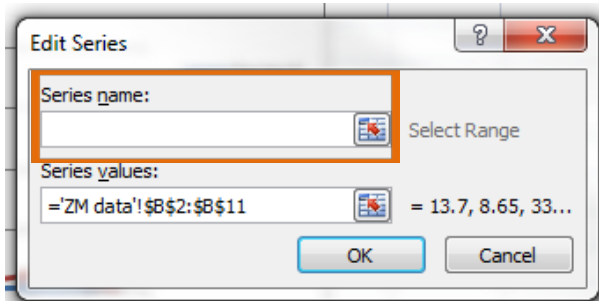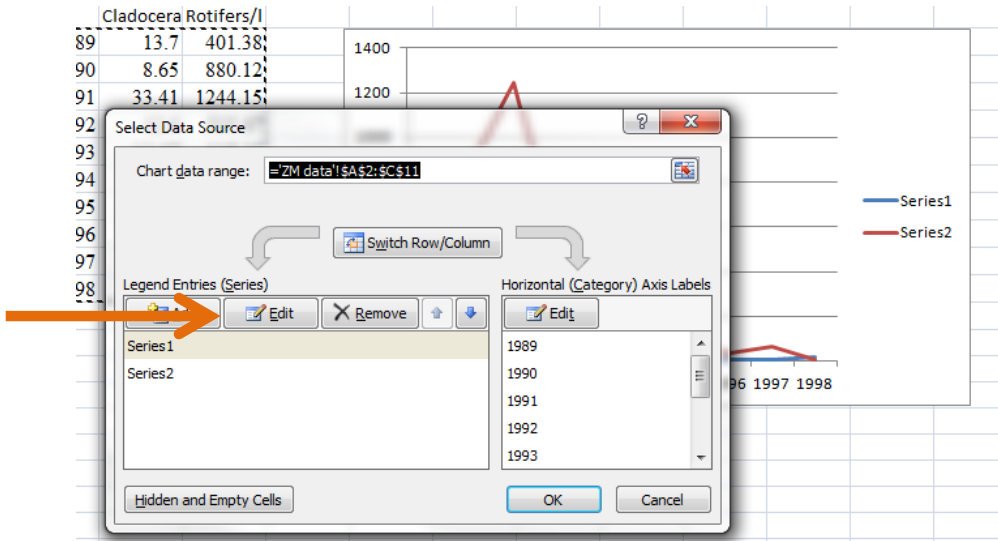
You'll see a small box pop up that includes a place for "Series Name" and "Series Values" (this refers to the values that you've already selected for the y-axis). Type the name of the series in the "Series Name" box, and then select Ok.

To edit the title, x and y axis labels of the graph, click on the graph, and then use the "Layout" tab on the top of the screen. To edit the title of the graph click on "Chart Title" and select the "Above Chart" option, and type "Hudson River Biodiversity Changes" - the title of your graph.
You should now have a graph that looks like this:
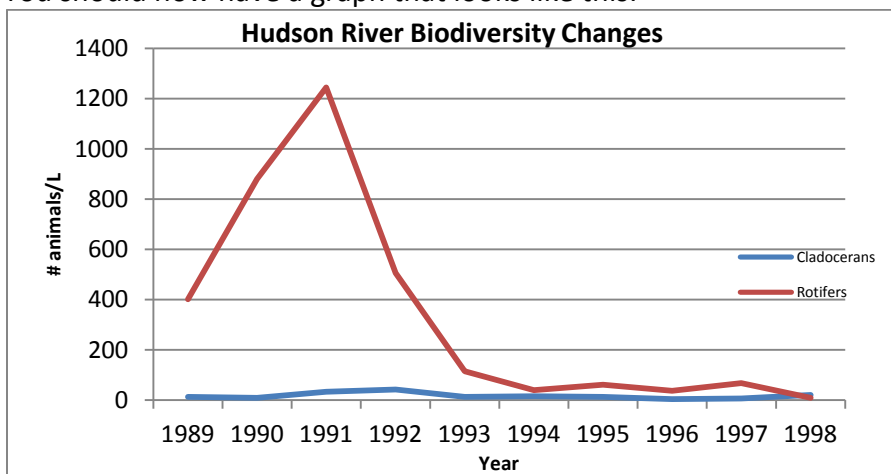
You should be able to answer the following questions based on this graph:

1. Which animal population changed the most? _____
2. When did this change occur? _____

3. What could be a reason for the dramatic change in the rotifer population?
   _____
   _____
   _____

4. What other kind of information do you need to know in order to decide what caused this change?
   _____
   _____
   _____
   _____

Go on to the next part of the tutorial to learn how to change things about your graph!

Changing Your Graphs
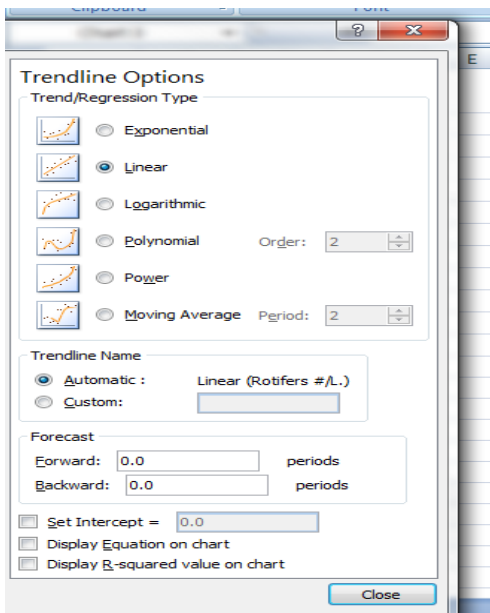
Using the same graph from the previous exercise, try working with the graph to change some things.
Let's try adding a trendline. This is a line that can show you the potential future path of your variable.

Click on one of the **data points** for the Rotifers on the graph. The color and shape of the points will change. Then right click. You will see a small box with some options. Highlight and then click on "Add Trendline…" A box labeled "Trendline Options" pops up. Select "Linear" and then click "Close".

Your graph should now look like this:

Hudson River Biodiversity Changes
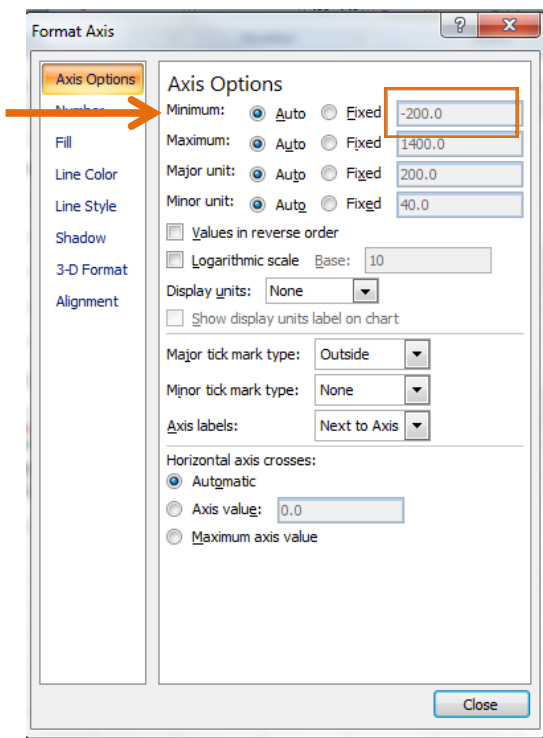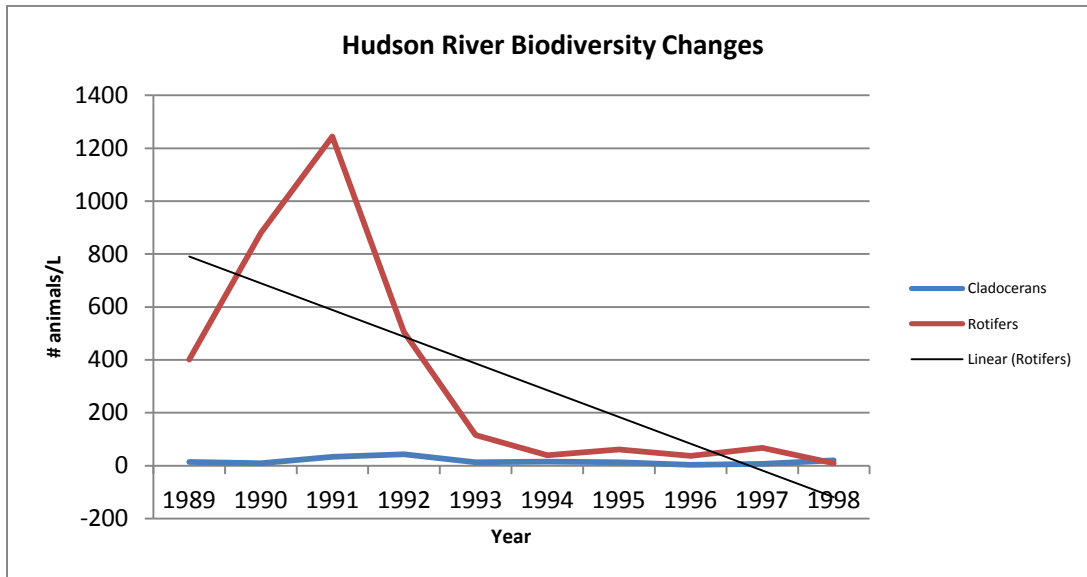
Notice that the y-axis values go to -200; this doesn't make any sense, since numbers of animals can't be a negative, only zero. To correct the scale, right click on any number on the y axis, then click "Format Axis" In the "Axis Options" tab that pops up, change the "Minimum" from "Auto" to "Fixed". This allows you to change the highlighted value; change this value to 0, and click "Close". You'll see that the y-axis values changed from -200 to 0.

Your graph should now look like this:

Hudson River Biodiversity Changes
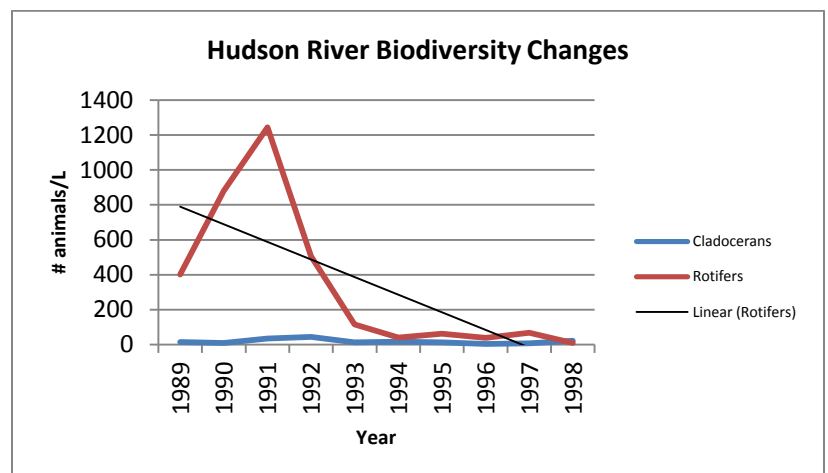
The black line is your trendline. You can use trendlines to "predict" what might happen in the future, or what could have happened in the past. You can remove the trendline by clicking on the trendline, then clicking with the right mouse key, and selecting "Delete". You can also get some basic statistics about your trendline, such as the equation for the line. If you are looking at a trend over time, you can use the linear regression and find out about whether the R^2 value explains the amount of variation in your data set. If your R^2 value is very high, that means that most of the points fall along the line (or are "explained" by your trendline).

Let's try another type of change: adding a second Y-axis to your graph. Doing this allows you to see data more clearly, because it can create a scale for one of your variables on the second Y-axis. This is particularly helpful in these types of situations when one group of data (the rotifers) have such a different scale from the other (cladocerans).
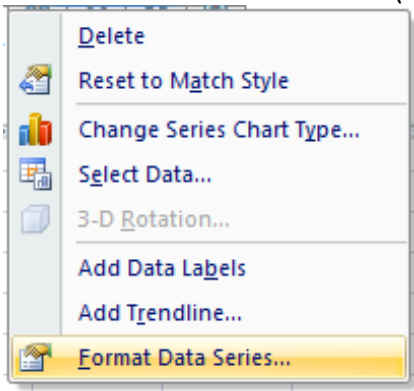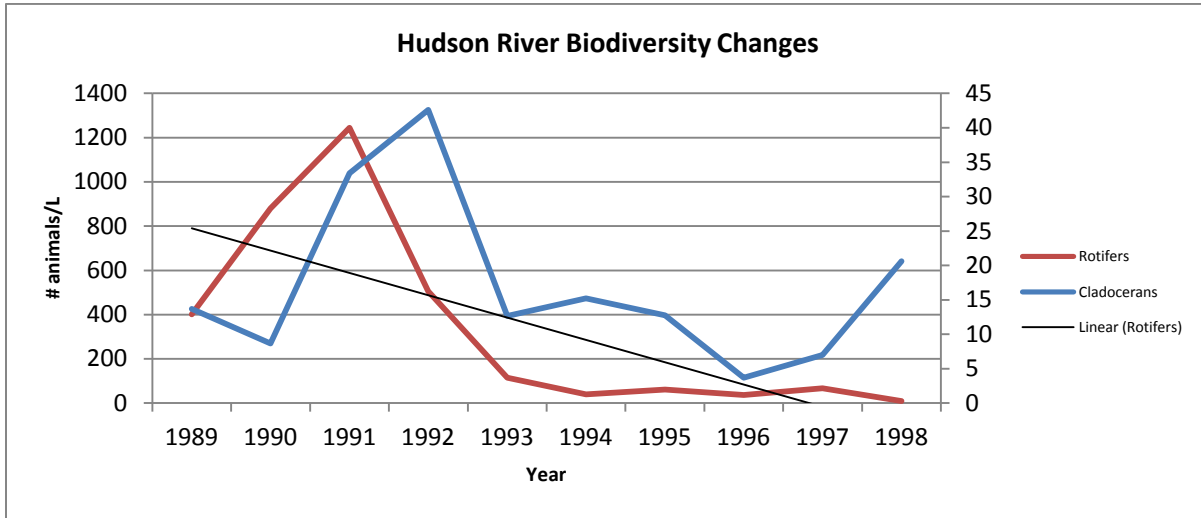
Do this by right clicking on the data points for "Cladocerans". Make sure that multiple data points are highlighted instead of just one! Then, click on "Format Data Series".

Click on the "Series Options" tab, click on "Secondary Axis", and then click "Close".
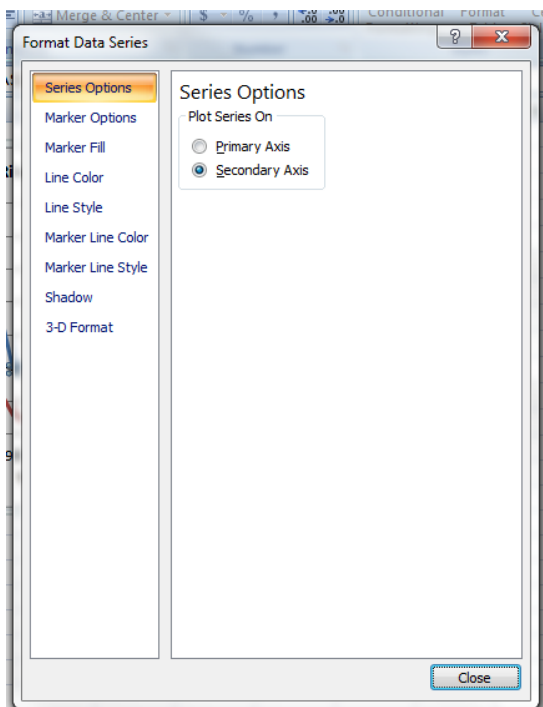
You should see your graph change dramatically:

Hudson River Biodiversity Changes

1. Explain why this graph now looks so different:

_____

_____

_____

_____

2. Does this change your answer to the earlier question about which animal species showed the most dramatic change? Why or why not? What else would you need to know before you can answer this question?

_____

_____

_____

_____

Extra credit: Add a linear regression trendline for both populations – rotifers and cladocerans. Using the equation for each line, explain which population is changing more quickly.

For homework, make a graph of the following data:

Year	Zebra Mussels Density (number/m^2)	Rotifers #/L
1989	0.00	401.38
1990	0.00	880.12
1991	7	1244.15
1992	3929	505.67
1993	2571	115.18
1994	1357	40.00
1995	627	60.98
1996	346	36.92
1997	2792	67.71
1998	865	8.82

Then, answer these questions:

1. In what year did zebra mussels arrive in the Hudson Valley?
2. What happened to the rotifer population numbers after the arrival of the zebra mussels?
3. Why do you think this happened?
4. What other information do you need to know to decide why the rotifer population reacted in this way to the zebra mussels?
5. Add a trendline to your graph. What do you think will happen in ten years to the rotifer population? To the zebra mussel population?