*Tools for effective science communication*

# Interpreting your data

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CMC Introduction to Data Interpretation Workshop

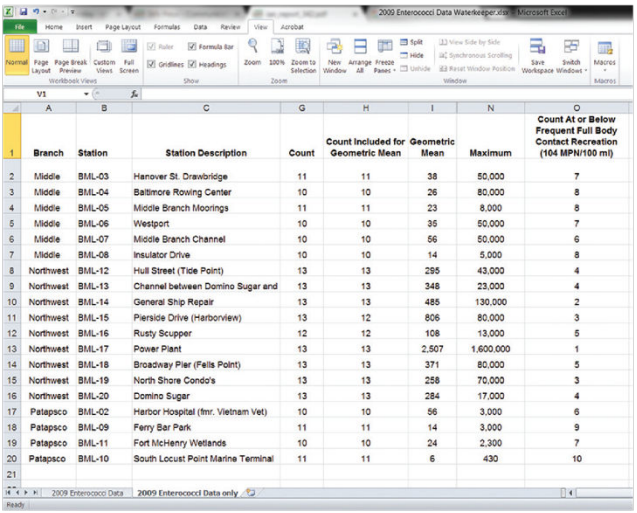
January 30, 2018

University of Maryland
Center for Environmental Science
Integration and Application Network

# Interpretation

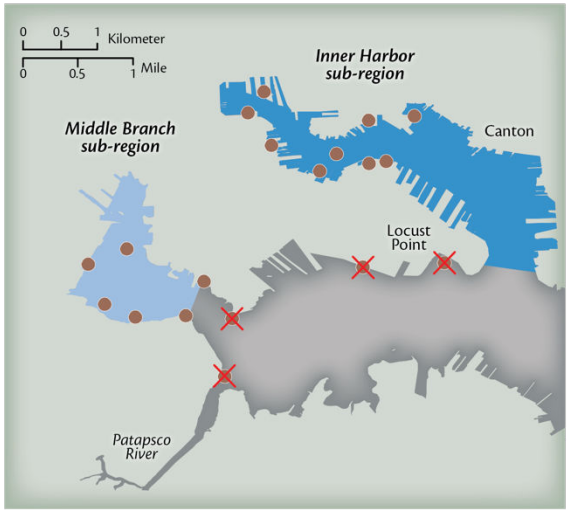
- Evaluating and analyzing your data in order to communicate it in a meaningful way with your selected audience

## Data

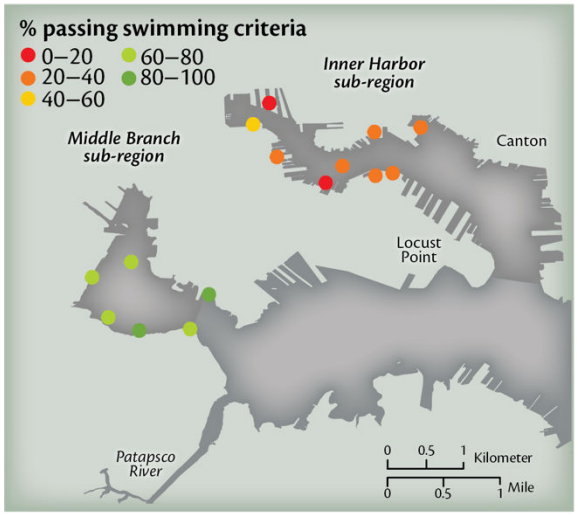


| Branch | Station | Station Description | Count | Count Included for Geometric Mean | Geometric Mean | Maximum | Count At or Below Frequent Full Body Contact Recreation (104 MPN/100 ml) |
|---|---|---|---|---|---|---|---|
| Middle | BML-03 | Hanover St. Drawbridge | 11 | 11 | 38 | 50,000 | 7 |
| Middle | BML-04 | Baltimore Rowing Center | 10 | 10 | 26 | 80,000 | 8 |
| Middle | BML-05 | Middle Branch Moorings | 11 | 11 | 23 | 8,000 | 8 |
| Middle | BML-06 | Westport | 10 | 10 | 35 | 50,000 | 7 |
| Middle | BML-07 | Middle Branch Channel | 10 | 10 | 56 | 50,000 | 6 |
| Middle | BML-08 | Insulator Drive | 10 | 10 | 14 | 5,000 | 8 |
| Northwest | BML-12 | Hull Street (Tide Point) | 13 | 13 | 295 | 43,000 | 4 |
| Northwest | BML-13 | Channel between Domino Sugar and | 13 | 13 | 348 | 23,000 | 4 |
| Northwest | BML-14 | General Ship Repair | 13 | 13 | 485 | 130,000 | 2 |
| Northwest | BML-15 | Pierside Drive (Harborview) | 13 | 12 | 806 | 80,000 | 3 |
| Northwest | BML-16 | Rusty Scupper | 12 | 12 | 108 | 13,000 | 5 |
| Northwest | BML-17 | Power Plant | 13 | 13 | 2,507 | 1,600,000 | 1 |
| Northwest | BML-18 | Broadway Pier (Fells Point) | 13 | 13 | 371 | 80,000 | 5 |
| Northwest | BML-19 | North Shore Condo's | 13 | 13 | 258 | 70,000 | 3 |
| Northwest | BML-20 | Domino Sugar | 13 | 13 | 284 | 17,000 | 4 |
| Patapsco | BML-02 | Harbor Hospital (fmr. Vietnam Vet) | 10 | 10 | 56 | 3,000 | 6 |
| Patapsco | BML-09 | Ferry Bar Park | 11 | 11 | 14 | 3,000 | 9 |
| Patapsco | BML-11 | Fort McHenry Wetlands | 10 | 10 | 24 | 2,300 | 7 |
| Patapsco | BML-10 | South Locust Point Marine Terminal | 11 | 11 | 6 | 430 | 10 |

## Interpretation

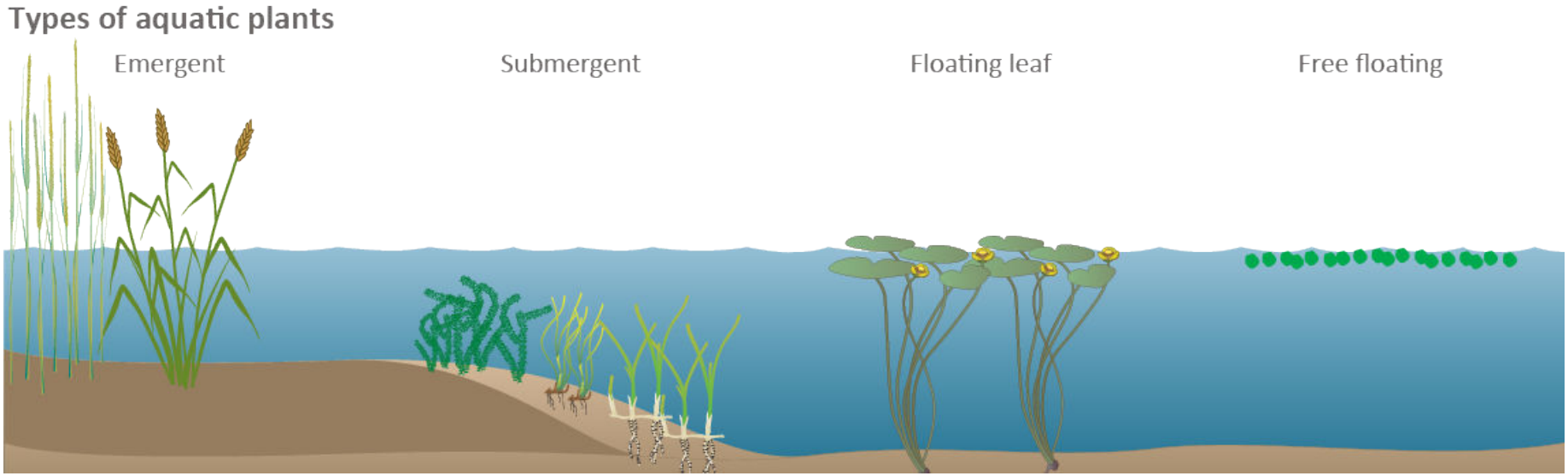



## Synthesis



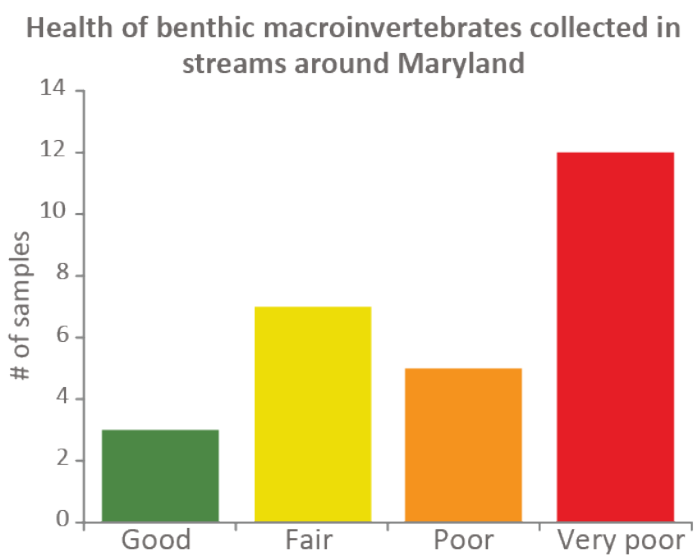
# Kinds of data

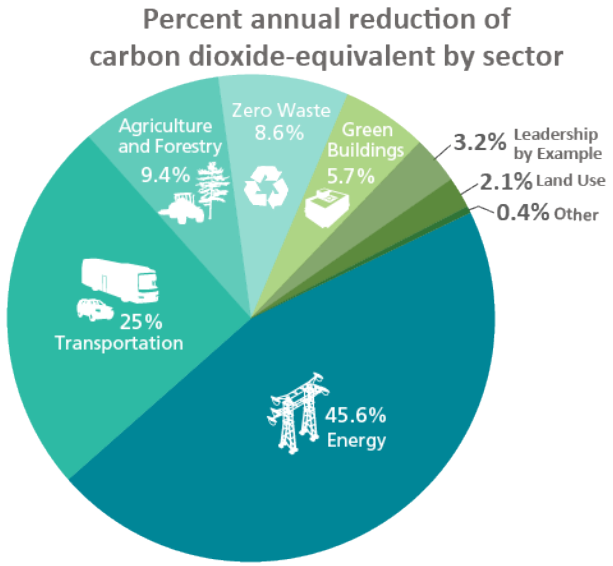
- Nominal
  - Non-numerical
  - Qualitative



# Kinds of data

- Ordinal
  - Numerical
  - Quantitative

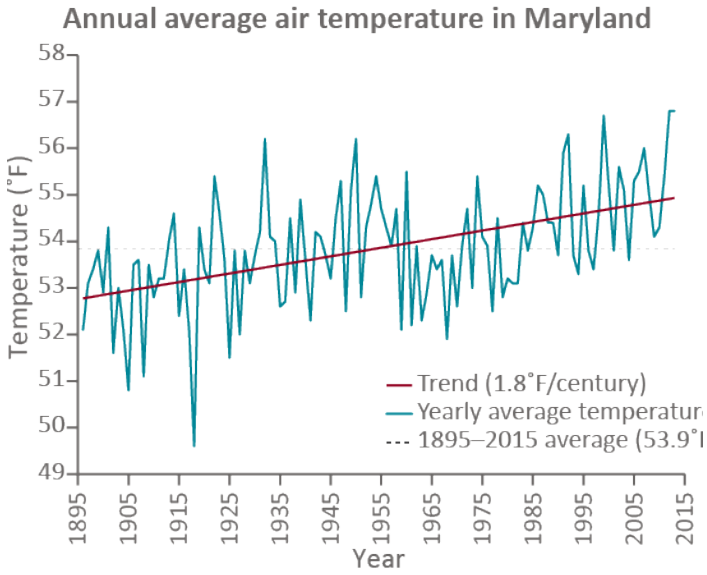


# Kinds of data

- Interval
  - Basic WQ data
  - Distance between numbers

- Ratio
  - Similar to interval
  - Absolute zero



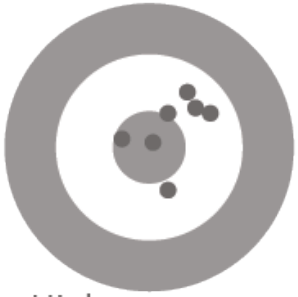

| Sampling Location | Dissolved Oxygen (mg/L) |
|---|---|
| Choptank River | 6.0 |
| Elizabeth River | 4.0 |
| James River | 6.3 |
| Lower Bay | 7.1 |
| Lower Eastern Shore | 6.3 |
| Lower Western Shore | 5.5 |
| Mid Bay | 4.2 |
| Patapsco River | 3.9 |
| Patuxent River | 4.2 |
| Potomac River | 5.7 |
| Rappahannock River | 6.1 |
| Upper Bay | 6.3 |
| Upper Eastern Shore | 6.9 |
| Upper Western Shore | 7.5 |
| York River | 5.4 |

# Precision vs Accuracy

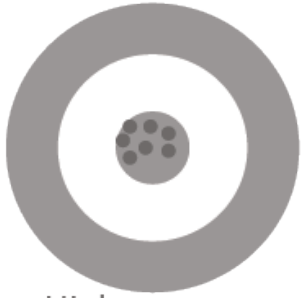
- Accuracy is how close a measurement is to a real value
- Precision is when repeated measurements closely match each other

Low accuracy
Low precision

Low accuracy
High precision



High accuracy
Low precision



High accuracy
High precision

# Precision vs Accuracy

- Accuracy is how close a measurement is to a real value
- Precision is when repeated measurements closely match each other

| WQ Parameter | Equipment | Precision | Accuracy | Range |
|---|---|---|---|---|
| Dissolved oxygen | LaMotte 5860 | 0.2 mg/L | | 0 – 10+ mg/L |
| Dissolved oxygen | Ex. LaMotte 1761 | 0.01 mg/L | ± 2% FS | 0 – 20 mg/L |
| Nitrate-nitrogen | Hach NI-14 1416100 | 0.01 mg/L (0 – 1 mg/L); 0.1 mg/L (1 – 10 mg/L) | | 0 – 1 mg/L; 1 – 10 mg/L |
| Nitrate-nitrogen | LaMotte 3110 | 0.25, 0.5, 1, 2, 4, 6, 8, 10 mg/L | | |
| Nitrate-nitrogen | LaMotte 3354 | 0, 1, 2, 4, 6, 8, 10, 15 mg/L | | 0 – 10 mg/L |

# Activity - Cleaning your data in excel

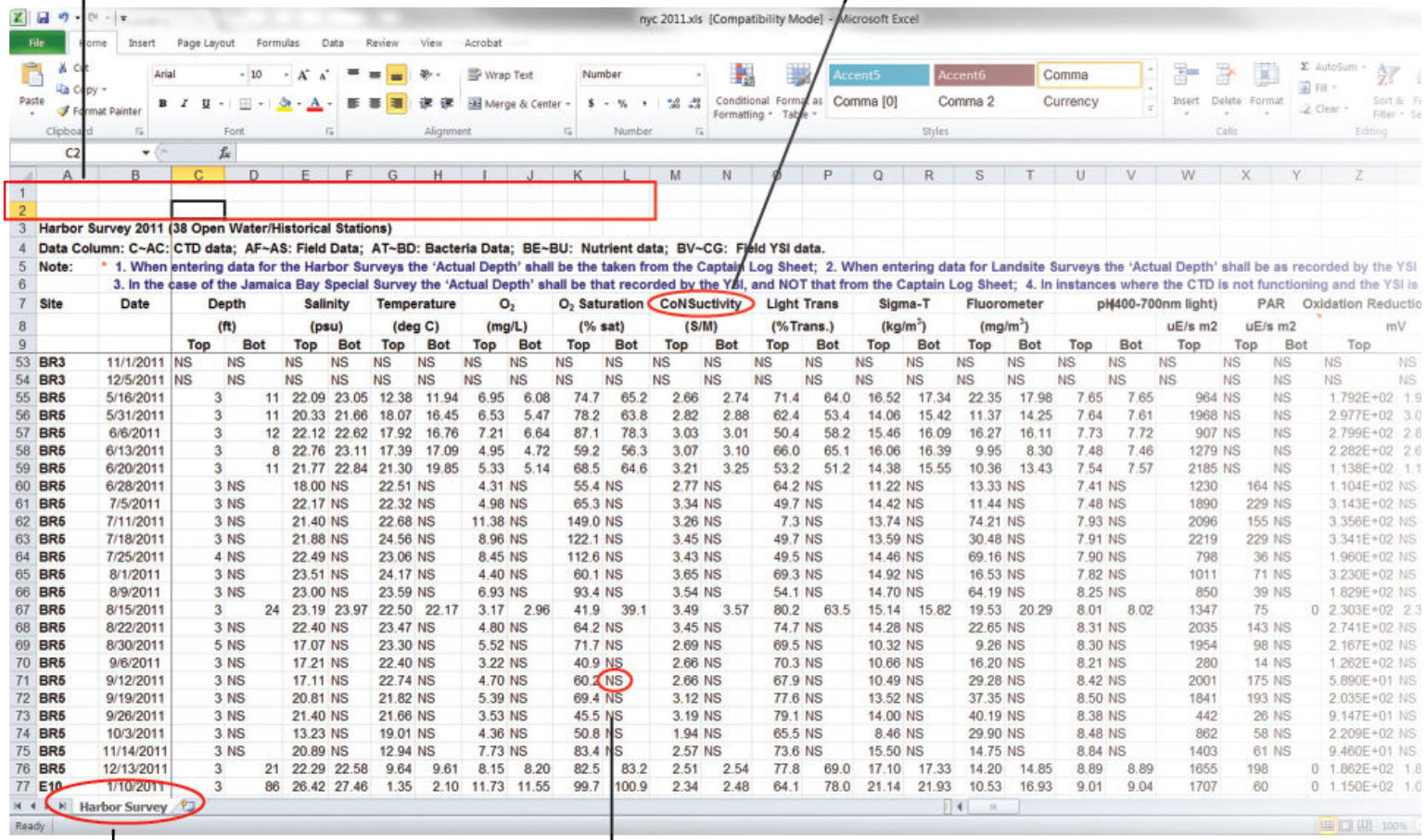
- Cleaning is required before you interpret your data
- What does cleaning my data mean?
  - Formatting your spreadsheet so it's consistent
  - Flagging unusual or duplicate data

# Excel activity – step 1

- Are there headers with units associated with the data values?
- Do the rows and columns have the right widths and heights to view all the data or is that even needed?
- Are there any missing data that are in another spreadsheet or on another tab that need to be incorporated here?

Why are there two blank lines?

Should this be Conductivity?



Harbor Survey 2011 (38 Open Water/Historical Stations)

Data Column: C~AC: CTD data; AF~AS: Field Data; AT~BD: Bacteria Data; BE~BU: Nutrient data; BV~CG: Field YSI data.

Note: * 1. When entering data for the Harbor Surveys the 'Actual Depth' shall be the taken from the Captain Log Sheet; 2. When entering data for Landsite Surveys the 'Actual Depth' shall be as recorded by the YSI
3. In the case of the Jamaica Bay Special Survey the 'Actual Depth' shall be that recorded by the YSI, and NOT that from the Captain Log Sheet; 4. In instances where the CTD is not functioning and the YSI is

| Site | Date | Depth (ft) | | Salinity (psu) | | Temperature (deg C) | | $O_2$ (mg/L) | | $O_2$ Saturation (% sat) | | CoNSuctivity (S/M) | | Light Trans (%Trans.) | | Sigma-T ($kg/m^3$) | | Fluorometer ($mg/m^3$) | | pH | | (400-700nm light) | | PAR | | Oxidation Reductio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | uE/s m2 | | uE/s m2 | | mV |
| | | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | | Top | Bot | Top |
| BR3 | 11/1/2011 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | | NS | NS | NS |
| BR3 | 12/5/2011 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | | NS | NS | NS |
| BR5 | 5/16/2011 | 3 | 11 | 22.09 | 23.05 | 12.38 | 11.94 | 6.95 | 6.08 | 74.7 | 65.2 | 2.66 | 2.74 | 71.4 | 64.0 | 16.52 | 17.34 | 22.35 | 17.98 | 7.65 | 7.65 | 964 | NS | NS | | 1.792E+02 |
| BR5 | 5/31/2011 | 3 | 11 | 20.33 | 21.66 | 18.07 | 16.45 | 6.53 | 5.47 | 78.2 | 63.8 | 2.82 | 2.88 | 62.4 | 53.4 | 14.06 | 15.42 | 11.37 | 14.25 | 7.64 | 7.61 | 1968 | NS | NS | | 2.977E+02 |
| BR5 | 6/6/2011 | 3 | 12 | 22.12 | 22.62 | 17.92 | 16.76 | 7.21 | 6.64 | 87.1 | 78.3 | 3.03 | 3.01 | 50.4 | 58.2 | 15.46 | 16.09 | 16.27 | 16.11 | 7.73 | 7.72 | 907 | NS | NS | | 2.799E+02 |
| BR5 | 6/13/2011 | 3 | 8 | 22.76 | 23.11 | 17.39 | 17.09 | 4.95 | 4.72 | 59.2 | 56.3 | 3.07 | 3.10 | 66.0 | 65.1 | 16.06 | 16.39 | 9.95 | 8.30 | 7.48 | 7.46 | 1279 | NS | NS | | 2.282E+02 |
| BR5 | 6/20/2011 | 3 | 11 | 21.77 | 22.84 | 21.30 | 19.85 | 5.33 | 5.14 | 68.5 | 64.6 | 3.21 | 3.25 | 53.2 | 51.2 | 14.38 | 15.55 | 10.36 | 13.43 | 7.54 | 7.57 | 2185 | NS | NS | | 1.138E+02 |
| BR5 | 6/28/2011 | 3 | NS | 18.00 | NS | 22.51 | NS | 4.31 | NS | 55.4 | NS | 2.77 | NS | 64.2 | NS | 11.22 | NS | 13.33 | NS | 7.41 | NS | 1230 | 164 | NS | | 1.104E+02 |
| BR5 | 7/5/2011 | 3 | NS | 22.17 | NS | 22.32 | NS | 4.98 | NS | 65.3 | NS | 3.34 | NS | 49.7 | NS | 14.42 | NS | 11.44 | NS | 7.48 | NS | 1890 | 229 | NS | | 1.143E+02 |
| BR5 | 7/11/2011 | 3 | NS | 21.40 | NS | 22.68 | NS | 11.38 | NS | 149.0 | NS | 3.26 | NS | 7.3 | NS | 13.74 | NS | 74.21 | NS | 7.93 | NS | 2096 | 155 | NS | | 3.356E+02 |
| BR5 | 7/18/2011 | 3 | NS | 21.88 | NS | 24.56 | NS | 8.96 | NS | 122.1 | NS | 3.45 | NS | 49.7 | NS | 13.59 | NS | 30.48 | NS | 7.91 | NS | 2219 | 229 | NS | | 3.341E+02 |
| BR5 | 7/25/2011 | 4 | NS | 22.49 | NS | 23.06 | NS | 8.45 | NS | 112.6 | NS | 3.43 | NS | 49.5 | NS | 14.46 | NS | 69.16 | NS | 7.90 | NS | 798 | 36 | NS | | 1.960E+02 |
| BR5 | 8/1/2011 | 3 | NS | 23.51 | NS | 24.17 | NS | 4.40 | NS | 60.1 | NS | 3.65 | NS | 69.3 | NS | 14.92 | NS | 16.53 | NS | 7.82 | NS | 1011 | 71 | NS | | 3.230E+02 |
| BR5 | 8/9/2011 | 3 | NS | 23.00 | NS | 23.59 | NS | 6.93 | NS | 93.4 | NS | 3.54 | NS | 54.1 | NS | 14.70 | NS | 64.19 | NS | 8.25 | NS | 850 | 39 | NS | | 1.829E+02 |
| BR5 | 8/15/2011 | 3 | 24 | 23.19 | 23.97 | 22.50 | 22.17 | 3.17 | 2.96 | 41.9 | 39.1 | 3.49 | 3.57 | 80.2 | 63.5 | 15.14 | 15.82 | 19.53 | 20.29 | 8.01 | 8.02 | 1347 | 75 | 0 | | 2.303E+02 |
| BR5 | 8/22/2011 | 3 | NS | 22.40 | NS | 23.47 | NS | 4.80 | NS | 64.2 | NS | 3.45 | NS | 74.7 | NS | 14.28 | NS | 22.65 | NS | 8.31 | NS | 2035 | 143 | NS | | 2.741E+02 |
| BR5 | 8/30/2011 | 5 | NS | 17.07 | NS | 23.30 | NS | 5.52 | NS | 71.7 | NS | 2.69 | NS | 69.5 | NS | 10.32 | NS | 9.26 | NS | 8.30 | NS | 1954 | 98 | NS | | 2.167E+02 |
| BR5 | 9/6/2011 | 3 | NS | 17.21 | NS | 22.40 | NS | 3.22 | NS | 40.9 | NS | 2.66 | NS | 70.3 | NS | 10.66 | NS | 16.20 | NS | 8.21 | NS | 280 | 14 | NS | | 1.262E+02 |
| BR5 | 9/12/2011 | 3 | NS | 17.11 | NS | 22.74 | NS | 4.70 | NS | 60.2 | NS | 2.66 | NS | 67.9 | NS | 10.49 | NS | 29.28 | NS | 8.42 | NS | 2001 | 175 | NS | | 5.890E+01 |
| BR5 | 9/19/2011 | 3 | NS | 20.81 | NS | 21.82 | NS | 5.39 | NS | 69.4 | NS | 3.12 | NS | 77.6 | NS | 13.52 | NS | 37.35 | NS | 8.50 | NS | 1841 | 193 | NS | | 2.035E+02 |
| BR5 | 9/26/2011 | 3 | NS | 21.40 | NS | 21.66 | NS | 3.53 | NS | 45.5 | NS | 3.19 | NS | 79.1 | NS | 14.00 | NS | 40.19 | NS | 8.38 | NS | 442 | 26 | NS | | 9.147E+01 |
| BR5 | 10/3/2011 | 3 | NS | 13.23 | NS | 19.01 | NS | 4.36 | NS | 50.8 | NS | 1.94 | NS | 65.5 | NS | 8.46 | NS | 29.90 | NS | 8.48 | NS | 862 | 58 | NS | | 2.209E+02 |
| BR5 | 11/14/2011 | 3 | NS | 20.89 | NS | 12.94 | NS | 7.73 | NS | 83.4 | NS | 2.57 | NS | 73.6 | NS | 15.50 | NS | 14.75 | NS | 8.84 | NS | 1403 | 61 | NS | | 9.460E+01 |
| BR5 | 12/13/2011 | 3 | 21 | 22.29 | 22.58 | 9.64 | 9.61 | 8.15 | 8.20 | 82.5 | 83.2 | 2.51 | 2.54 | 77.8 | 69.0 | 17.10 | 17.33 | 14.20 | 14.85 | 8.89 | 8.89 | 1655 | 198 | 0 | | 1.862E+02 |
| E10 | 1/10/2011 | 3 | 86 | 26.42 | 27.46 | 1.35 | 2.10 | 11.73 | 11.55 | 99.7 | 100.9 | 2.34 | 2.48 | 64.1 | 78.0 | 21.14 | 21.93 | 10.53 | 16.93 | 9.01 | 9.04 | 1707 | 60 | 0 | | 1.150E+02 |

Should you add more tabs so that the data is organized by indicator? Or by surface vs bottom measurements? Or something else?

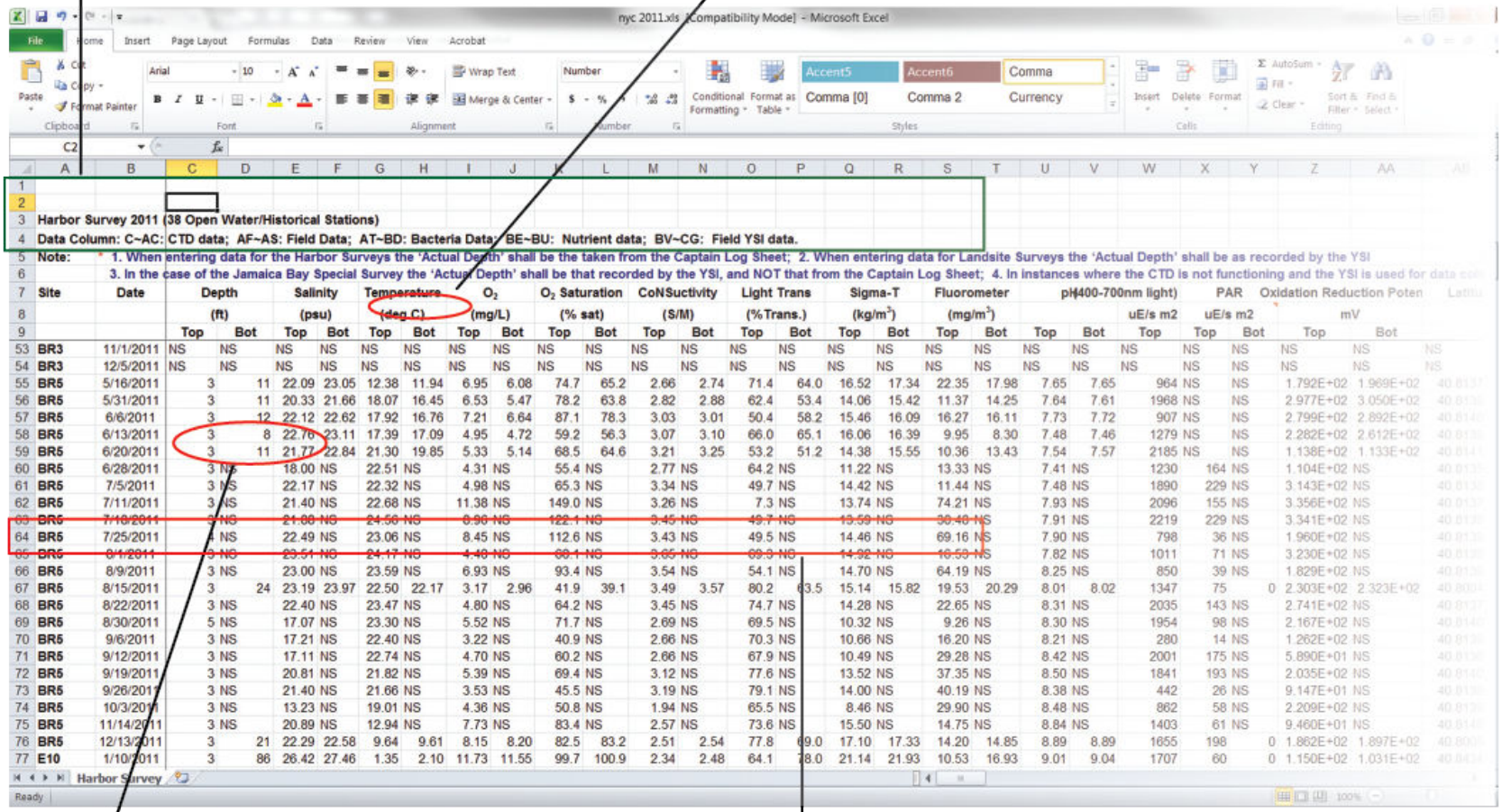
How are you going to address data values that are not numbers?

# Excel activity – step 2

- How are the data organized? By date or sampling station? Which way is the best way to look at and interpret the data?
- Are there any duplicate entries? Why? Do you delete them altogether or save them "just in case"? How do you organize and structure your files to do this?
- Are there any unusual data? You can sort the data from high to low and determine if any values are outside the expected range. This could be due to typing errors, instrument error, or they could be genuine outliers

The column headers are bolded and each label makes sense and has appropriate units

Extra decimal point



nyc 2011.xls [Compatibility Mode] - Microsoft Excel

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | uE/s m2 | uE/s m2 | | mV | | |
| | | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Bot | Top | Top | Top | Bot | Top | Bot | |
| 53 BR3 | 11/1/2011 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | |
| 54 BR3 | 12/5/2011 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | |
| 55 BR5 | 5/16/2011 | 3 | 11 | 22.09 | 23.05 | 12.38 | 11.94 | 6.95 | 6.08 | 74.7 | 65.2 | 2.66 | 2.74 | 71.4 | 64.0 | 16.52 | 17.34 | 22.35 | 17.98 | 7.65 | 964 | NS | NS | 1.792E+02 | 1.989E+02 | |
| 56 BR5 | 5/31/2011 | 3 | 11 | 20.33 | 21.66 | 18.07 | 16.45 | 6.53 | 5.47 | 78.2 | 63.8 | 2.82 | 2.88 | 62.4 | 53.4 | 14.06 | 15.42 | 11.37 | 14.25 | 7.64 | 1968 | NS | NS | 2.977E+02 | 3.050E+02 | |
| 57 BR5 | 6/6/2011 | 3 | 12 | 22.12 | 22.62 | 17.92 | 16.76 | 7.21 | 6.64 | 87.1 | 78.3 | 3.03 | 3.01 | 50.4 | 58.2 | 15.46 | 16.09 | 16.27 | 16.11 | 7.73 | 907 | NS | NS | 2.799E+02 | 2.892E+02 | |
| 58 BR5 | 6/13/2011 | 3 | 8 | 22.76 | 23.11 | 17.39 | 17.09 | 4.95 | 4.72 | 59.2 | 56.3 | 3.07 | 3.10 | 66.0 | 65.1 | 16.06 | 16.39 | 9.95 | 8.30 | 7.48 | 1279 | NS | NS | 2.282E+02 | 2.612E+02 | |
| 59 BR5 | 6/20/2011 | 3 | 11 | 21.77 | 22.84 | 21.30 | 19.85 | 5.33 | 5.14 | 68.5 | 64.6 | 3.21 | 3.25 | 53.2 | 51.2 | 14.38 | 15.55 | 10.36 | 13.43 | 7.54 | 7.57 | 2185 | NS | NS | 1.138E+02 | 1.133E+02 |
| 60 BR5 | 6/28/2011 | 3 | NS | 18.00 | NS | 22.51 | NS | 4.31 | NS | 55.4 | NS | 2.77 | NS | 64.2 | NS | 11.22 | NS | 13.33 | NS | 7.41 | NS | 1230 | 164 | NS | 1.104E+02 | NS |
| 61 BR5 | 7/5/2011 | 3 | NS | 22.17 | NS | 22.32 | NS | 4.98 | NS | 65.3 | NS | 3.34 | NS | 49.7 | NS | 14.42 | NS | 11.44 | NS | 7.48 | NS | 1890 | 229 | NS | 3.143E+02 | NS |
| 62 BR5 | 7/11/2011 | 3 | NS | 21.40 | NS | 22.68 | NS | 11.38 | NS | 149.0 | NS | 3.26 | NS | 7.3 | NS | 13.74 | NS | 74.21 | NS | 7.93 | NS | 2096 | 155 | NS | 3.356E+02 | NS |
| 63 BR5 | 7/18/2011 | 3 | NS | 21.88 | NS | 24.56 | NS | 6.96 | NS | 122.1 | NS | 3.45 | NS | 49.7 | NS | 15.53 | NS | 30.48 | NS | 7.91 | NS | 2219 | 229 | NS | 3.341E+02 | NS |
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| 66 BR5 | 8/9/2011 | 3 | NS | 23.00 | NS | 23.59 | NS | 6.93 | NS | 93.4 | NS | 3.54 | NS | 54.1 | NS | 14.70 | NS | 64.19 | NS | 8.25 | NS | 850 | 39 | NS | 1.829E+02 | NS |
| 67 BR5 | 8/15/2011 | 3 | 24 | 23.19 | 23.97 | 22.50 | 22.17 | 3.17 | 2.96 | 41.9 | 39.1 | 3.49 | 3.57 | 80.2 | 63.5 | 15.14 | 15.82 | 19.53 | 20.29 | 8.01 | 8.02 | 1347 | 75 | 0 | 2.303E+02 | 2.323E+02 |
| 68 BR5 | 8/22/2011 | 3 | NS | 22.40 | NS | 23.47 | NS | 4.80 | NS | 64.2 | NS | 3.45 | NS | 74.7 | NS | 14.28 | NS | 22.65 | NS | 8.31 | NS | 2035 | 143 | NS | 2.741E+02 | NS |
| 69 BR5 | 8/30/2011 | 5 | NS | 17.07 | NS | 23.30 | NS | 5.52 | NS | 71.7 | NS | 2.69 | NS | 69.5 | NS | 10.32 | NS | 9.26 | NS | 8.30 | NS | 1954 | 98 | NS | 2.167E+02 | NS |
| 70 BR5 | 9/6/2011 | 3 | NS | 17.21 | NS | 22.40 | NS | 3.22 | NS | 40.9 | NS | 2.66 | NS | 70.3 | NS | 10.66 | NS | 16.20 | NS | 8.21 | NS | 280 | 14 | NS | 1.262E+02 | NS |
| 71 BR5 | 9/12/2011 | 3 | NS | 17.11 | NS | 22.74 | NS | 4.70 | NS | 60.2 | NS | 2.66 | NS | 67.9 | NS | 10.49 | NS | 29.28 | NS | 8.42 | NS | 2001 | 175 | NS | 5.890E+01 | NS |
| 72 BR5 | 9/19/2011 | 3 | NS | 20.81 | NS | 21.82 | NS | 5.39 | NS | 69.4 | NS | 3.12 | NS | 77.6 | NS | 13.52 | NS | 37.35 | NS | 8.50 | NS | 1841 | 193 | NS | 2.035E+02 | NS |
| 73 BR5 | 9/26/2011 | 3 | NS | 21.40 | NS | 21.66 | NS | 3.53 | NS | 45.5 | NS | 3.19 | NS | 79.1 | NS | 14.00 | NS | 40.19 | NS | 8.38 | NS | 442 | 26 | NS | 9.147E+01 | NS |
| 74 BR5 | 10/3/2011 | 3 | NS | 13.23 | NS | 19.01 | NS | 4.36 | NS | 50.8 | NS | 1.94 | NS | 65.5 | NS | 8.46 | NS | 29.90 | NS | 8.48 | NS | 862 | 58 | NS | 2.209E+02 | NS |
| 75 BR5 | 11/14/2011 | 3 | NS | 20.89 | NS | 12.94 | NS | 7.73 | NS | 83.4 | NS | 2.57 | NS | 73.6 | NS | 15.50 | NS | 14.75 | NS | 8.84 | NS | 1403 | 61 | NS | 9.460E+01 | NS |
| 76 BR5 | 12/13/2011 | 3 | 21 | 22.29 | 22.58 | 9.64 | 9.61 | 8.15 | 8.20 | 82.5 | 83.2 | 2.51 | 2.54 | 77.8 | 69.0 | 17.10 | 17.33 | 14.20 | 14.85 | 8.89 | 8.89 | 1655 | 198 | 0 | 1.862E+02 | 1.897E+02 |
| 77 E10 | 1/10/2011 | 3 | 86 | 26.42 | 27.46 | 1.35 | 2.10 | 11.73 | 11.55 | 99.7 | 100.9 | 2.34 | 2.48 | 64.1 | 78.0 | 21.14 | 21.93 | 10.53 | 16.93 | 9.01 | 9.04 | 1707 | 60 | 0 | 1.150E+02 | 1.031E+02 |

Harbor Survey

Ready

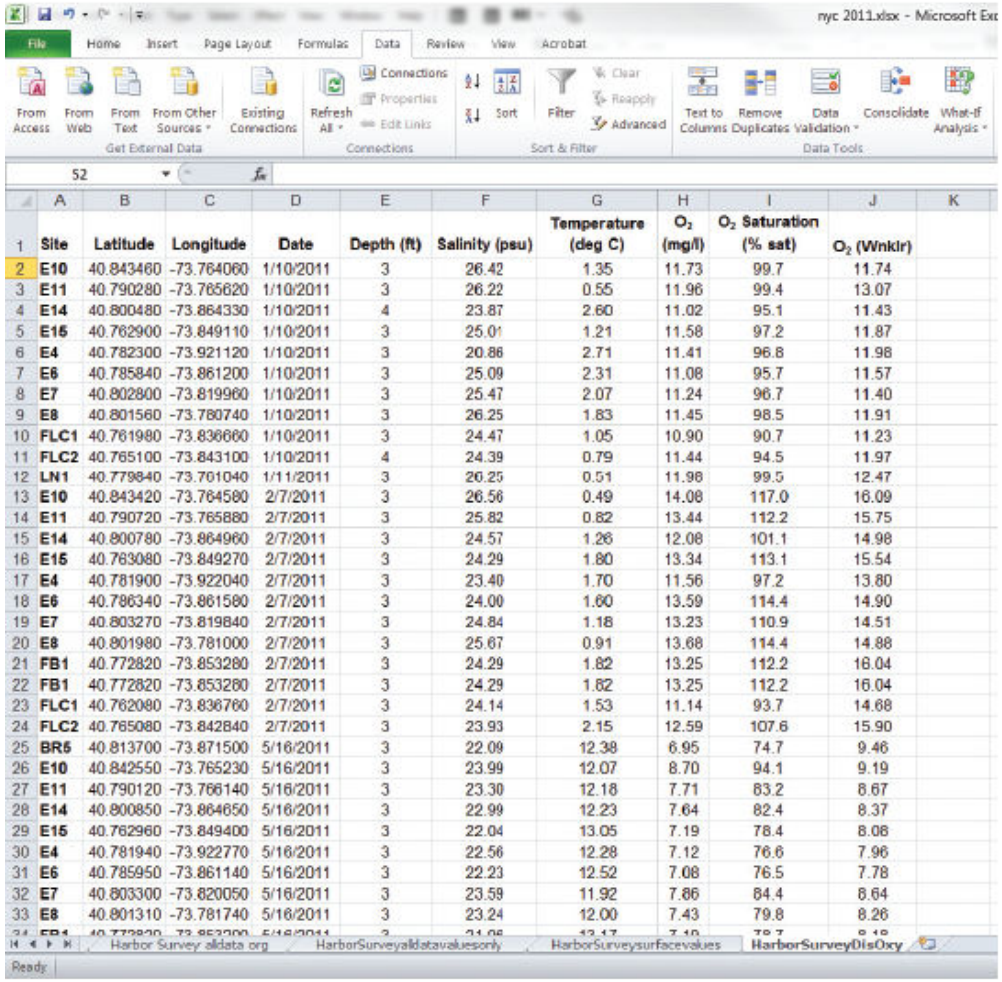
Is this the correct sampling date? Check original fieldsheets or verify with field staff/volunteer monitor.

This row is duplicated. Do you delete it or keep it and flag it?

# Excel activity – step 3

- Are there any cells that need to be changed from numbers to text or vice versa so that Excel can read them correctly?
- How are your latitude and longitude written? Is it in a format that works for you or for someone who will be doing GIS mapping?

This spreadsheet has been cleaned and simplified. Only columns pertaining to dissolved oxygen were kept. The tab is labelled appropriately. The columns have been sorted first by date, then by station.



nyc 2011.xlsx - Microsoft Exc

File | Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

From Access | From Web | From Text | From Other Sources | Existing Connections | Refresh All | Connections | Properties | Edit Links | Sort | Filter | Clear | Reapply | Advanced | Text to Columns | Remove Duplicates | Data Validation | Consolidate | What-If Analysis

Get External Data | Connections | Sort & Filter | Data Tools

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| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Site | Latitude | Longitude | Date | Depth (ft) | Salinity (psu) | Temperature (deg C) | $O_2$ (mg/l) | $O_2$ Saturation (% sat) | $O_2$ (Wnklr) | |
| 2 | E10 | 40.843460 | -73.764060 | 1/10/2011 | 3 | 26.42 | 1.35 | 11.73 | 99.7 | 11.74 | |
| 3 | E11 | 40.790280 | -73.765620 | 1/10/2011 | 3 | 26.22 | 0.55 | 11.96 | 99.4 | 13.07 | |
| 4 | E14 | 40.800480 | -73.864330 | 1/10/2011 | 4 | 23.87 | 2.60 | 11.02 | 95.1 | 11.43 | |
| 5 | E15 | 40.762900 | -73.849110 | 1/10/2011 | 3 | 25.01 | 1.21 | 11.58 | 97.2 | 11.87 | |
| 6 | E4 | 40.782300 | -73.921120 | 1/10/2011 | 3 | 20.86 | 2.71 | 11.41 | 96.8 | 11.98 | |
| 7 | E6 | 40.785840 | -73.861200 | 1/10/2011 | 3 | 25.09 | 2.31 | 11.08 | 95.7 | 11.57 | |
| 8 | E7 | 40.802800 | -73.819960 | 1/10/2011 | 3 | 25.47 | 2.07 | 11.24 | 96.7 | 11.40 | |
| 9 | E8 | 40.801560 | -73.780740 | 1/10/2011 | 3 | 26.25 | 1.83 | 11.45 | 98.5 | 11.91 | |
| 10 | FLC1 | 40.761980 | -73.836660 | 1/10/2011 | 3 | 24.47 | 1.05 | 10.90 | 90.7 | 11.23 | |
| 11 | FLC2 | 40.765100 | -73.843100 | 1/10/2011 | 4 | 24.39 | 0.79 | 11.44 | 94.5 | 11.97 | |
| 12 | LN1 | 40.779840 | -73.761040 | 1/11/2011 | 3 | 26.25 | 0.51 | 11.98 | 99.5 | 12.47 | |
| 13 | E10 | 40.843420 | -73.764580 | 2/7/2011 | 3 | 26.56 | 0.49 | 14.08 | 117.0 | 16.09 | |
| 14 | E11 | 40.790720 | -73.765880 | 2/7/2011 | 3 | 25.82 | 0.82 | 13.44 | 112.2 | 15.75 | |
| 15 | E14 | 40.800780 | -73.864960 | 2/7/2011 | 3 | 24.57 | 1.26 | 12.08 | 101.1 | 14.98 | |
| 16 | E15 | 40.763080 | -73.849270 | 2/7/2011 | 3 | 24.29 | 1.80 | 13.34 | 113.1 | 15.54 | |
| 17 | E4 | 40.781900 | -73.922040 | 2/7/2011 | 3 | 23.40 | 1.70 | 11.56 | 97.2 | 13.80 | |
| 18 | E6 | 40.786340 | -73.861580 | 2/7/2011 | 3 | 24.00 | 1.60 | 13.59 | 114.4 | 14.90 | |
| 19 | E7 | 40.803270 | -73.819840 | 2/7/2011 | 3 | 24.84 | 1.18 | 13.23 | 110.9 | 14.51 | |
| 20 | E8 | 40.801980 | -73.781000 | 2/7/2011 | 3 | 25.67 | 0.91 | 13.68 | 114.4 | 14.88 | |
| 21 | FB1 | 40.772820 | -73.853280 | 2/7/2011 | 3 | 24.29 | 1.82 | 13.25 | 112.2 | 16.04 | |
| 22 | FB1 | 40.772820 | -73.853280 | 2/7/2011 | 3 | 24.29 | 1.82 | 13.25 | 112.2 | 16.04 | |
| 23 | FLC1 | 40.762080 | -73.836760 | 2/7/2011 | 3 | 24.14 | 1.53 | 11.14 | 93.7 | 14.68 | |
| 24 | FLC2 | 40.765080 | -73.842840 | 2/7/2011 | 3 | 23.93 | 2.15 | 12.59 | 107.6 | 15.90 | |
| 25 | BR5 | 40.813700 | -73.871500 | 5/16/2011 | 3 | 22.09 | 12.38 | 6.95 | 74.7 | 9.46 | |
| 26 | E10 | 40.842550 | -73.765230 | 5/16/2011 | 3 | 23.99 | 12.07 | 8.70 | 94.1 | 9.19 | |
| 27 | E11 | 40.790120 | -73.766140 | 5/16/2011 | 3 | 23.30 | 12.18 | 7.71 | 83.2 | 8.67 | |
| 28 | E14 | 40.800850 | -73.864650 | 5/16/2011 | 3 | 22.99 | 12.23 | 7.64 | 82.4 | 8.37 | |
| 29 | E15 | 40.762960 | -73.849400 | 5/16/2011 | 3 | 22.04 | 13.05 | 7.19 | 78.4 | 8.08 | |
| 30 | E4 | 40.781940 | -73.922770 | 5/16/2011 | 3 | 22.56 | 12.28 | 7.12 | 76.6 | 7.96 | |
| 31 | E6 | 40.785950 | -73.861140 | 5/16/2011 | 3 | 22.23 | 12.52 | 7.08 | 76.5 | 7.78 | |
| 32 | E7 | 40.803300 | -73.820050 | 5/16/2011 | 3 | 23.59 | 11.92 | 7.86 | 84.4 | 8.64 | |
| 33 | E8 | 40.801310 | -73.781740 | 5/16/2011 | 3 | 23.24 | 12.00 | 7.43 | 79.8 | 8.26 | |

Harbor Survey alldata org | HarborSurveyalldatavaluesonly | HarborSurveysurfacevalues | HarborSurveyDisOxy

Ready

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE
INTEGRATION AND APPLICATION NETWORK

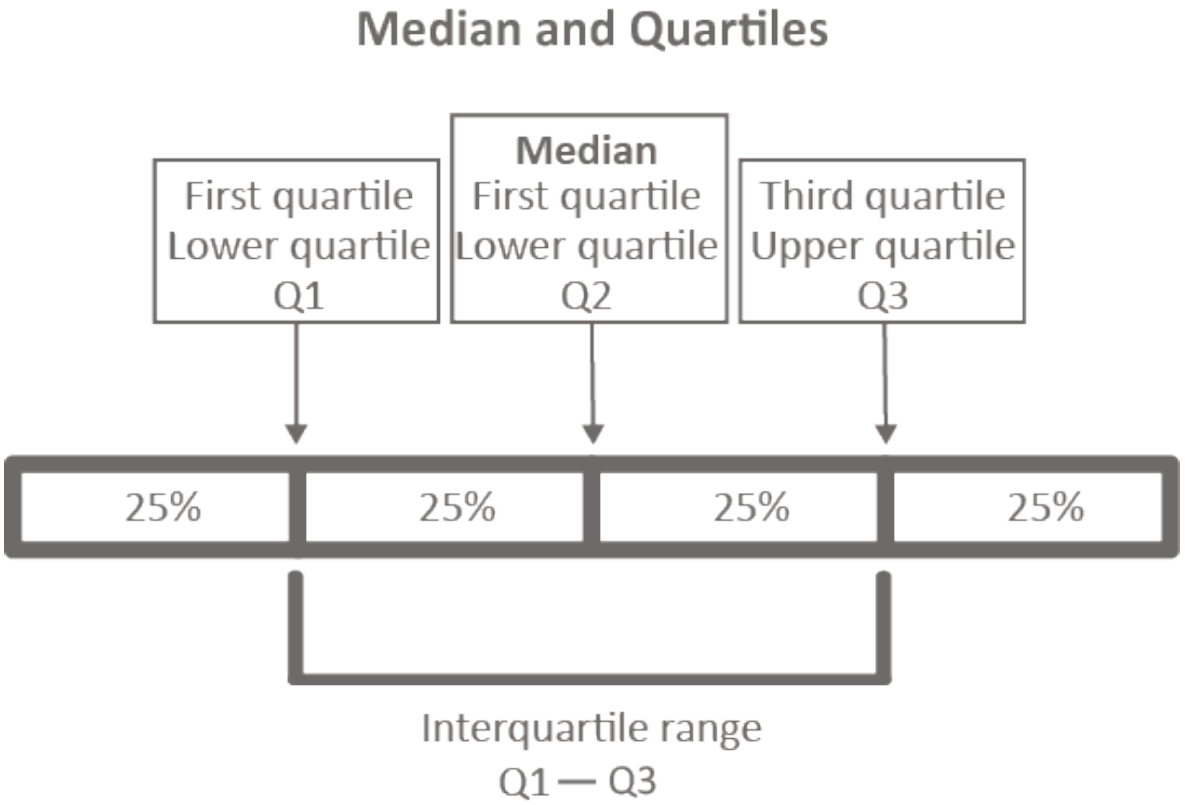
# Using statistics to describe your data

- What are descriptive statistics?
  - Tools to provide basic summarized information about your data
  - Mean, median and mode

| Sample site | Caddisfly (count) | Mayfly (count) | Stonefly (count) | Clams (count) | Aquatic worms (count) | Crayfish (count) | % Sensitive to Pollution |
|---|---|---|---|---|---|---|---|
| A1 | 2 | 3 | 1 | 15 | 2 | 4 | 22 |
| A2 | 1 | 1 | 1 | 5 | 7 | 11 | 12 |
| GP1 | 0 | 0 | 0 | 13 | 16 | 9 | 0 |
| GP2 | 4 | 7 | 4 | 8 | 12 | 3 | 40 |
| GP3 | 4 | 5 | 2 | 12 | 10 | 9 | 33 |
| D1 | 6 | 6 | 9 | 11 | 7 | 4 | 49 |
| B11 | 0 | 1 | 2 | 8 | 9 | 12 | 1 |
| **mean** | 2.4 | 3.3 | 2.7 | 10.3 | 9.0 | 7.4 | 22.4% |
| **median** | 2 | 3 | 2 | 11 | 9 | 9 | 22% |
| **mode** | 0 | 1 | 1 | 8 | 7 | 4 | N/A |

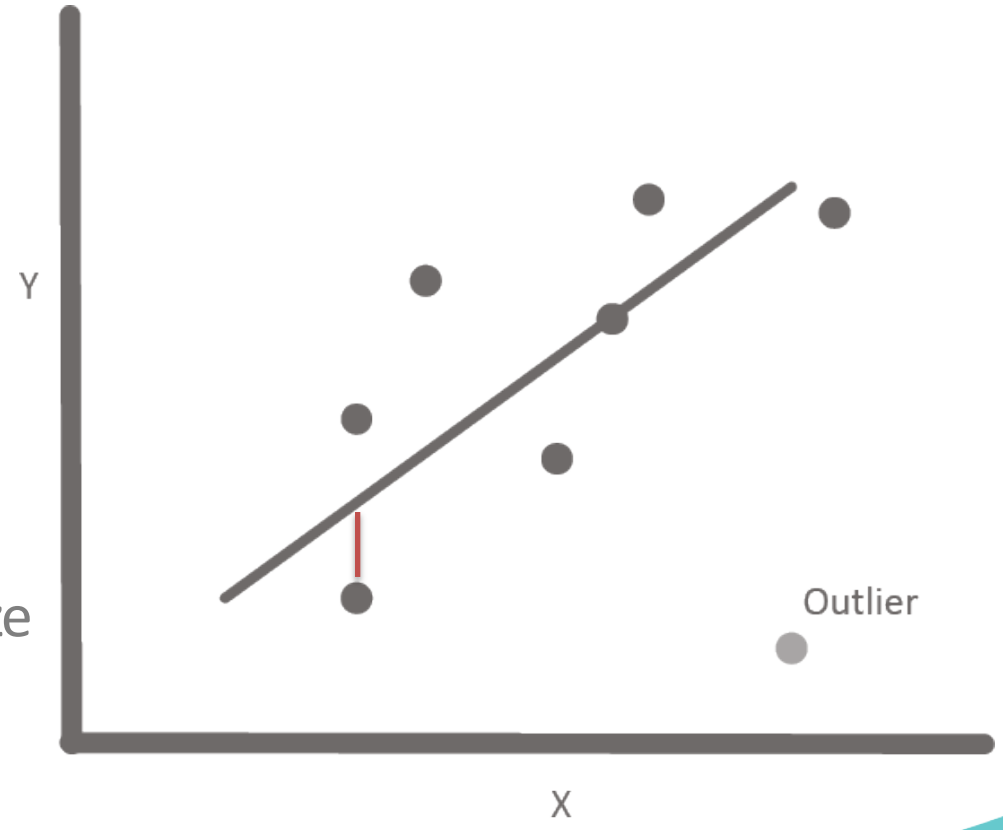
# Using statistics to describe your data (cont.)

- Range
  - The total spread of all values in a dataset



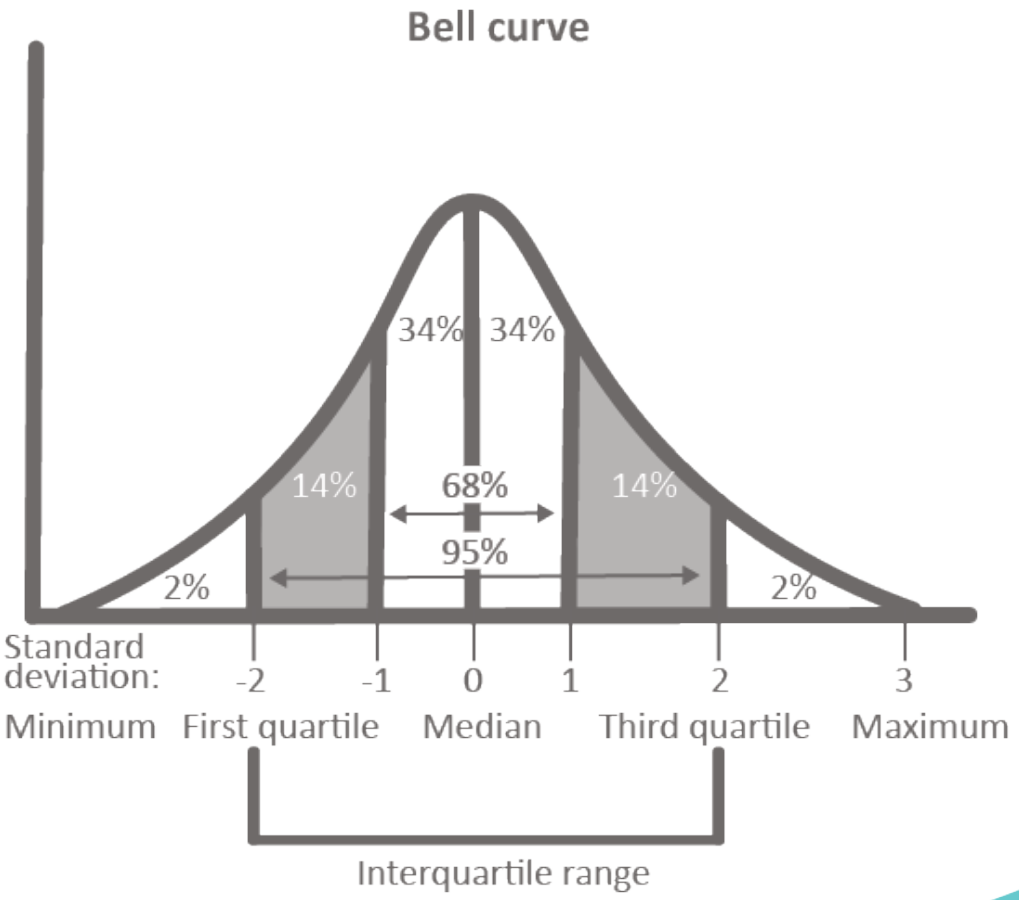
# Using statistics to describe your data (cont.)

- Outliers
  - Data values that fall outside the general distribution of the data
- Standard deviation
  - Distance from mean
  - Variability
- Standard error
  - Type of SD
  - Depends on sample size



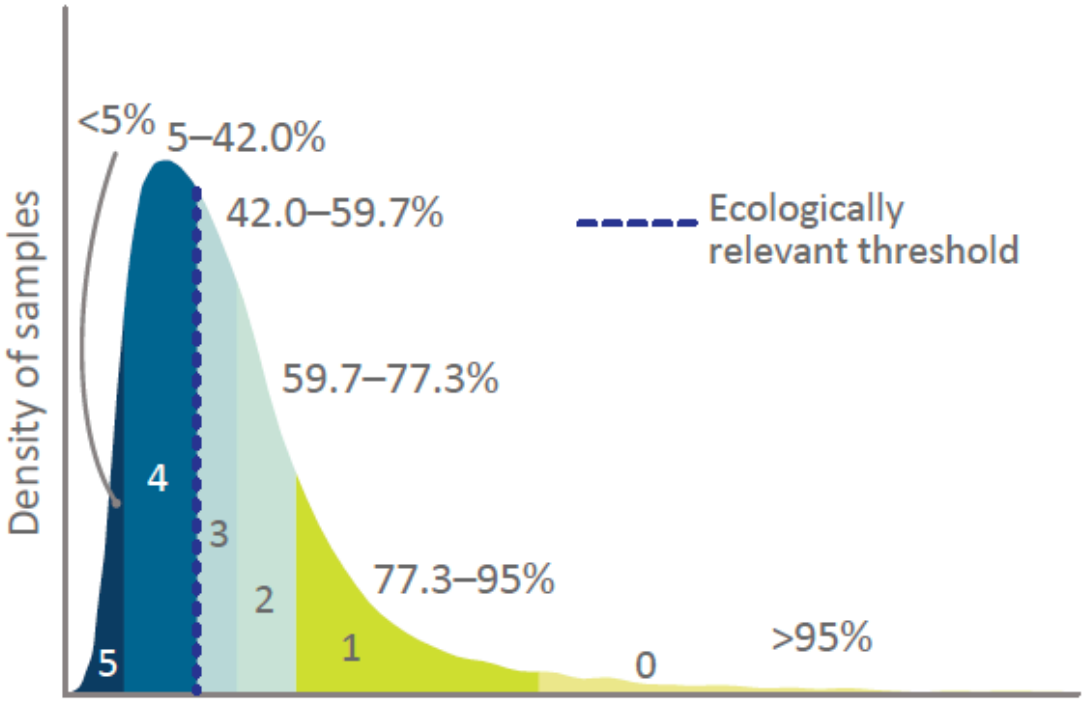
# Using statistics to describe your data (cont.)

- Bell curves
  - Normal distribution
  - 95% of data within 2 SD



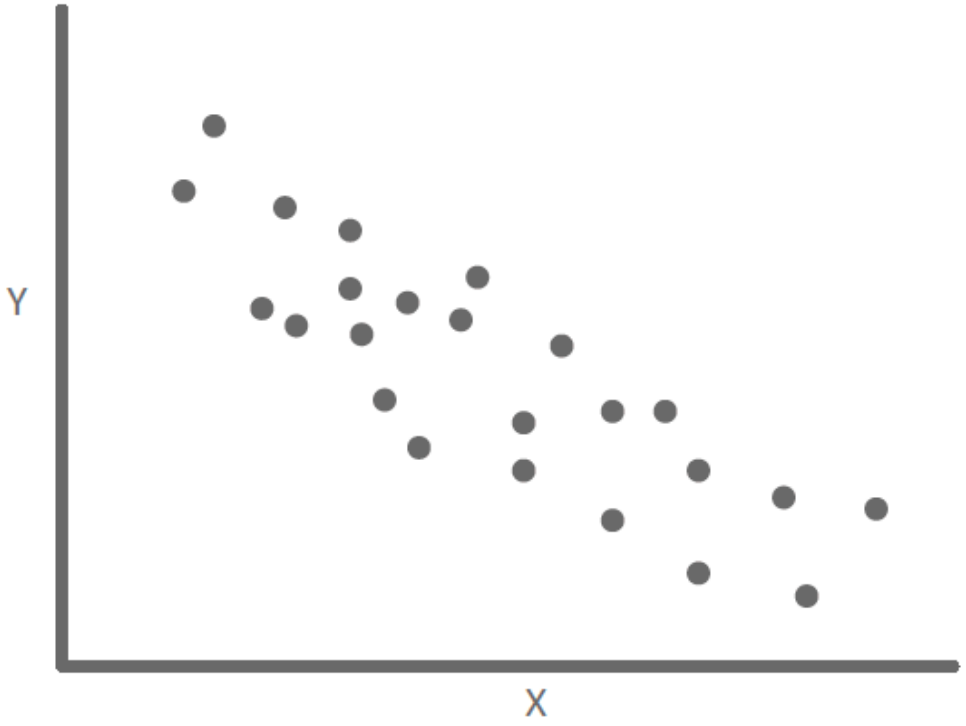
# Using statistics to describe your data (cont.)

- Non-normal distribution



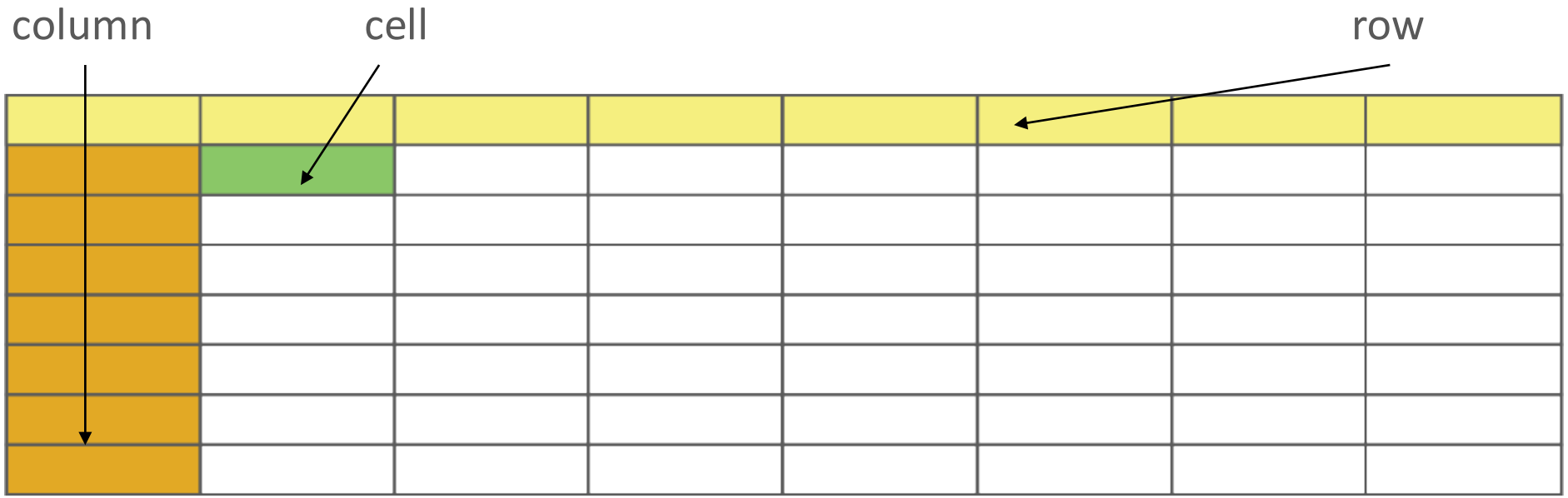
# Using statistics to describe your data (cont.)

- Correlation
  - Two variables related
  - Temperature & DO



# Displaying data

- Data in tables – why use a table?
- Parts of a table



# Formatting a table for your audience

## EXAMPLE 3: BASIC TABLE WITH SCIENCE COMMUNICATION PRINCIPLES EMBEDDED

| Sample site | Caddisfly  | Mayfly  | Stonefly  | Clams  | Aquatic worms  | Crayfish  | % Sensitive to Pollution |
|---|---|---|---|---|---|---|---|
| Anacostia 1 | 2 | 3 | 1 | 15 | 2 | 4 | 22 |
| Anacostia 2 | 1 | 1 | 1 | 5 | 7 | 11 | 12 |
| Gunpowder 1 | 0 | 0 | 0 | 13 | 16 | 9 | 0 |
| Gunpowder 2 | 4 | 7 | 4 | 8 | 12 | 3 | 40 |
| Gunpowder 3 | 4 | 5 | 2 | 12 | 10 | 9 | 33 |
| Davis Branch 1 | 6 | 6 | 9 | 11 | 7 | 4 | 49 |
| Big Elk 11 | 0 | 1 | 2 | 8 | 9 | 12 | 1 |

# Data in graphs

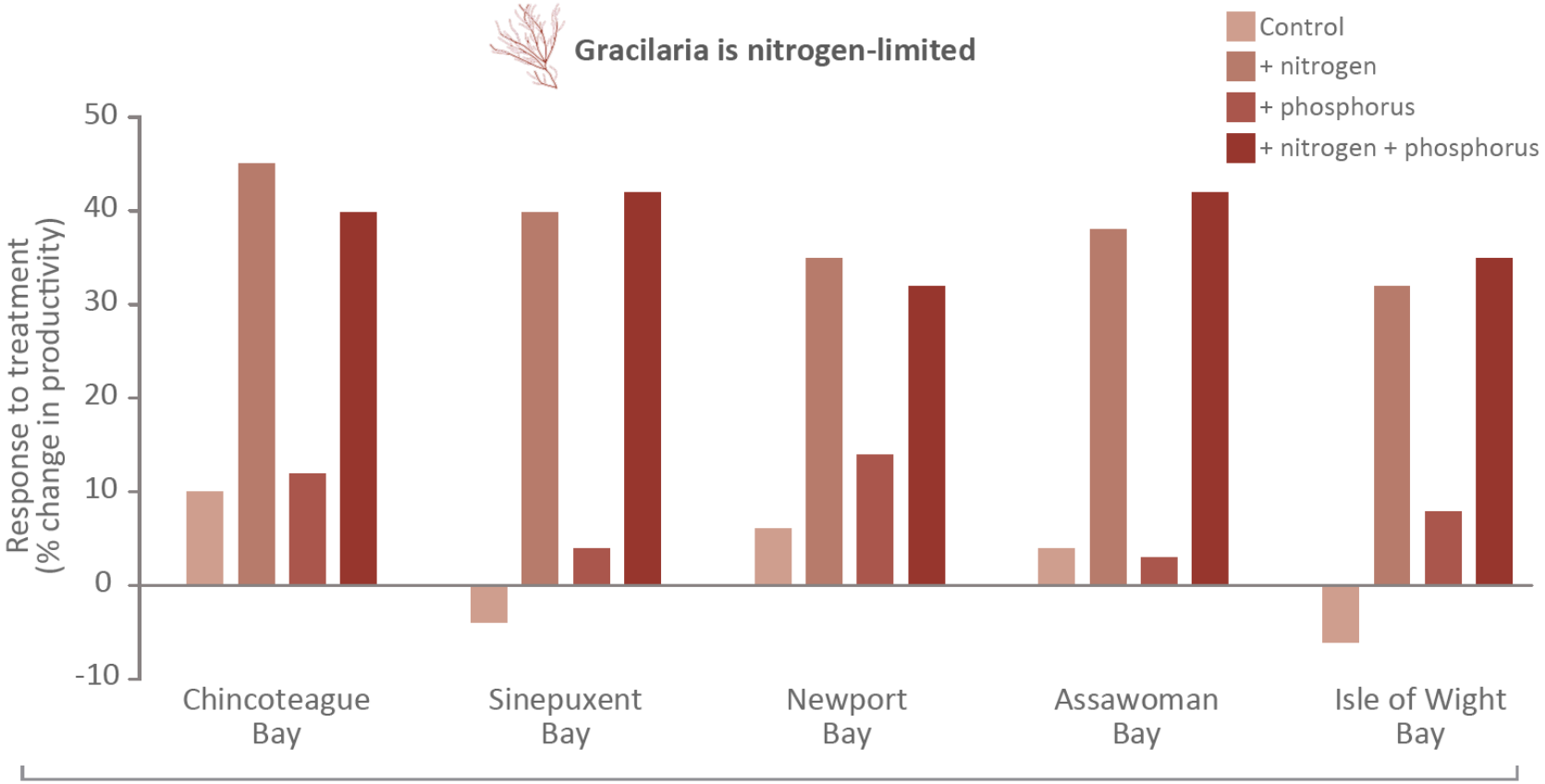
- Graphing data is the easiest way to visualize your data
- Help you too:
  - See relationships between different measurements in the data
  - Identify outliers
  - Visualize and identify trends

# Types of graphs

- Bar graph
- Line graph
- Pie graph
- Comparison bar graph

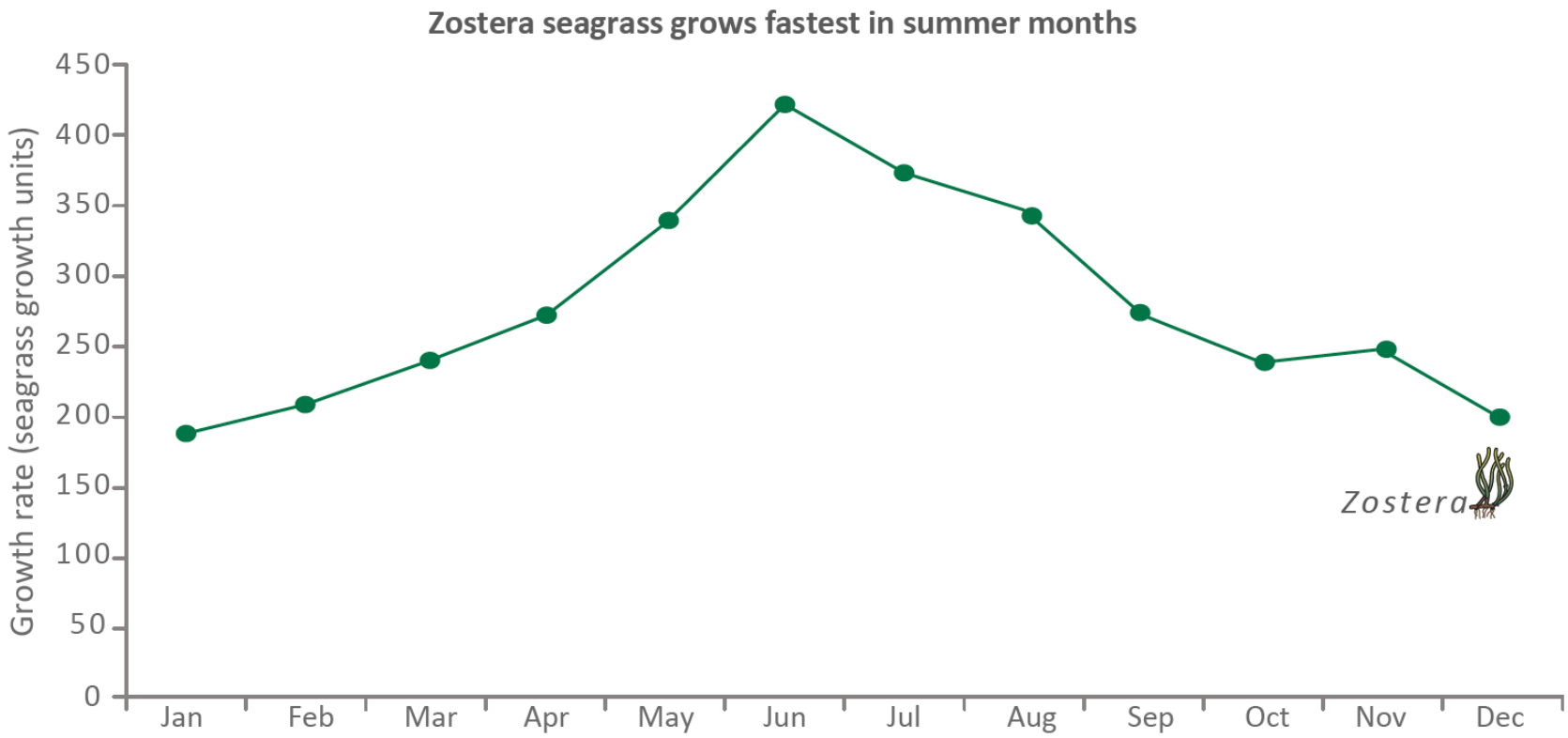
# Choosing a graph and formatting – bar graph

## EXAMPLE 2: AFTER FORMATTING, BAR GRAPH

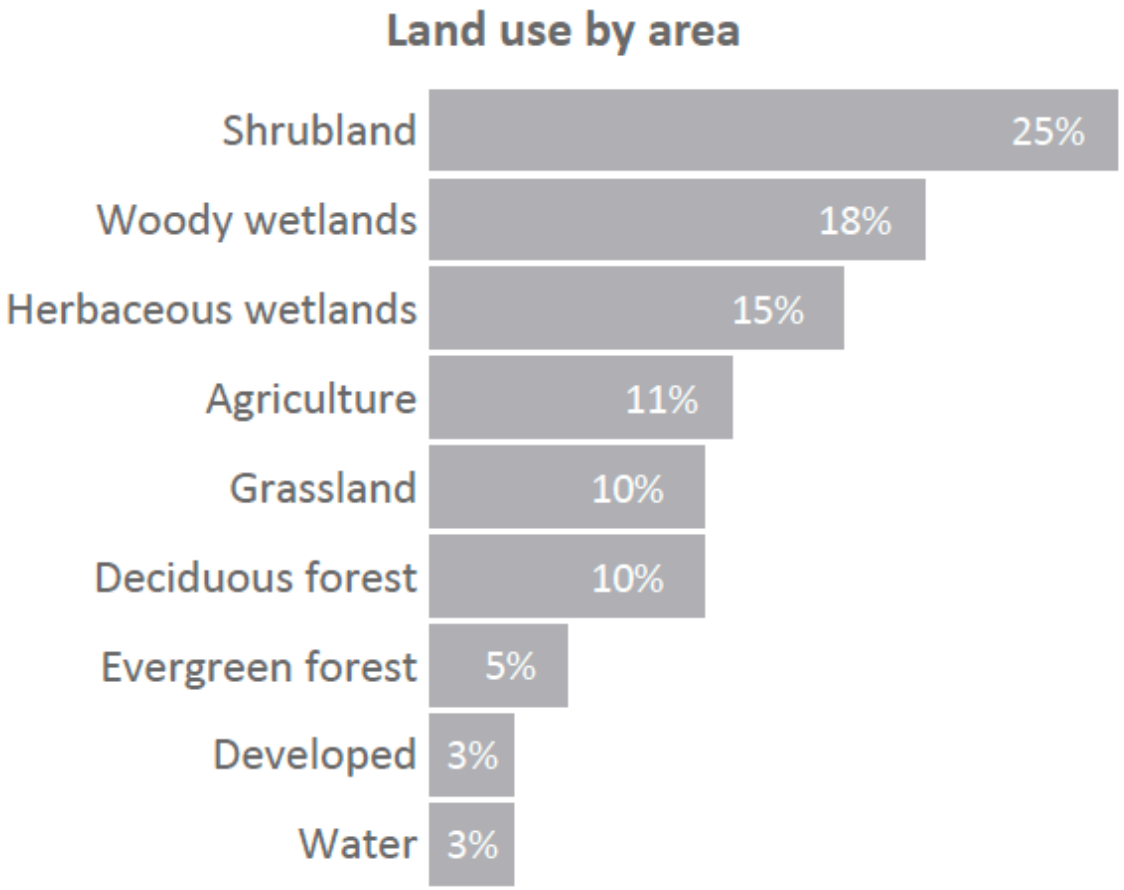


# Choosing a graph and formatting – line graph

## EXAMPLE 4: AFTER FORMATTING, LINE GRAPH

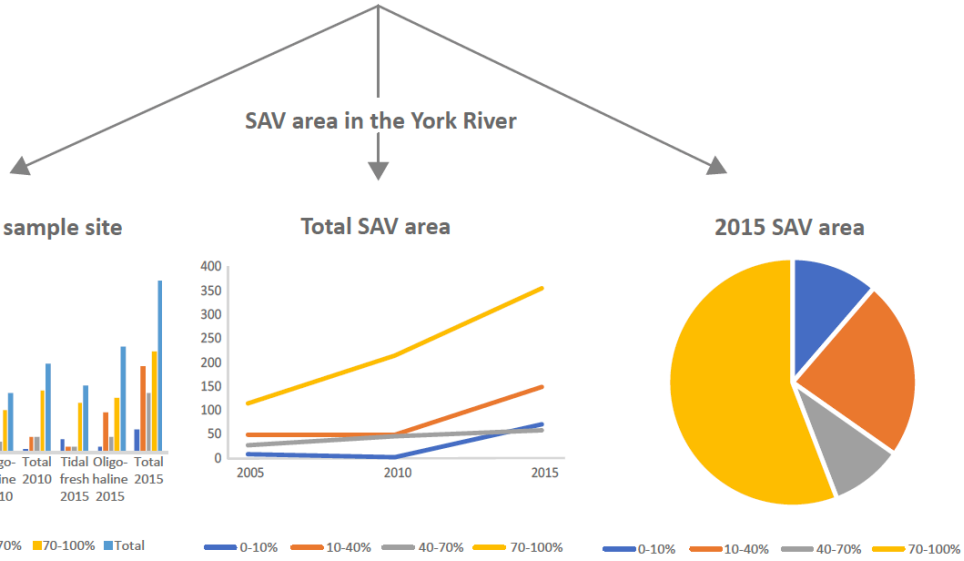


# Choosing a graph and formatting – pie graph



## Submerged aquatic vegetation (SAV) area (hectares) in the York River

| | Bed density | | | | |
|---|---|---|---|---|---|
| Sample site and year | 0-10% | 10-40% | 40-70% | 70-100% | Total |
| York tidal fresh 2005 | 7 | 16 | 21 | 81 | 125 |
| York oligohaline 2005 | 1 | 10 | 8 | 34 | 53 |
| York total 2005 | 8 | 50 | 29 | 115 | 178 |
| York tidal fresh 2010 | 2 | 22 | 13 | 73 | 110 |
| York oligohaline 2010 | 0 | 28 | 32 | 143 | 203 |
| York total 2010 | 2 | 50 | 45 | 216 | 313 |
| York tidal fresh 2015 | 37 | 14 | 16 | 167 | 234 |
| York oligohaline 2015 | 15 | 135 | 44 | 188 | 367 |
| York total 2015 | 72 | 149 | 60 | 355 | 601 |



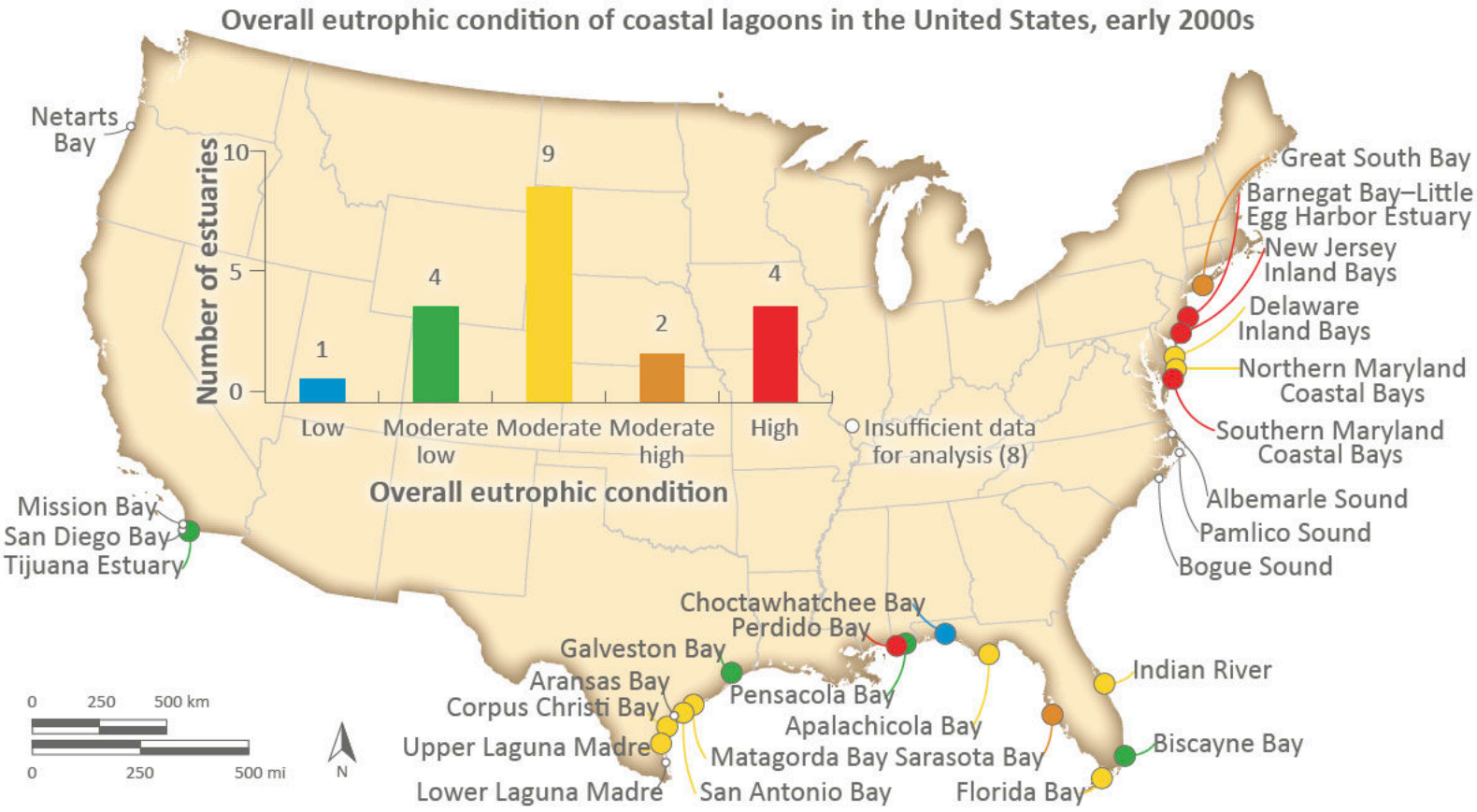
# Data in figures

- Help readers visually connect information
- Connect numbers from graphs to general patterns and trends or show information on a geographic scale

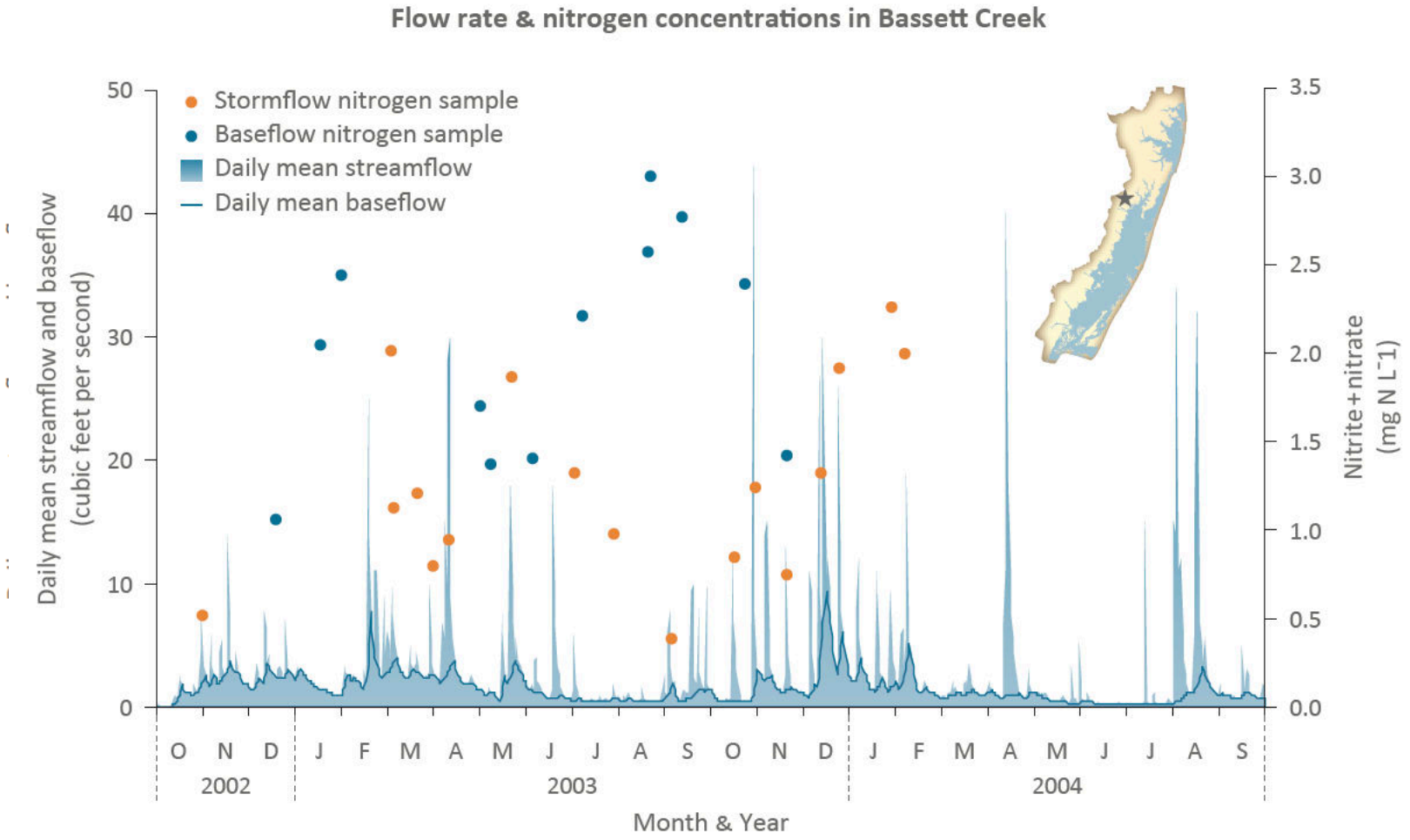
# Data in figures

- Parts of a figure
  - Maps
  - Graphs
  - Photos
  - Text
  - Caption
  - Title

# Figure example



# Figure example



# Summary

- Start small, let the data lead you
  - What kind of data are you collecting?
  - What is the best way to organize your data?
  - What is the best graph for your data?
  - Will a figure help explain your data?
- Thanks for joining us and let Caroline and I know if you have any questions!

# Now go back and choose the best display type for your parameter!