# Educator Packet for A Day in the Life of the Hudson River (Snapshot Day)
## Event Date ____________Year____________

## http://www.ldeo.columbia.edu/edu/k12/snapshotday/

**The Packet is designed for educators & teachers with information on a range of data gathering activities that are a part of A Day in the Life of the Hudson River. Any combination of these activities can be completed as part of the day's events. Additional activities are available on the Day in the Life website. Student data recording sheets are available on the website.**
**Please be sure to submit your results to Margie Turrin (845-365-8179 (fax) or e-mail mkt@ldeo.columbia.edu) within 24-48 hours of collection! Questions? 845-365-8494.**

**PLEASE BE SURE TO RECORD TIME & UNITS OF MEASURE FOR EACH SAMPLING ITEM SO THAT COMPARISONS CAN BE MADE THROUGHOUT THE RIVER**



## Site Background Information.

1. Coordinator/contact person______________________________________
   Organization______________________________________
   Street______________________________________________________
   City________________________State____Zip___________
   phone______________fax________________email______________________
2. School/group name______________________________________District____________
   Name of teacher/group leader___________________________________
   Street______________________________________________________
   City_____________________State_______ Zip_______________
   phone_______________fax__________________email______________________
   Number of student participants_______ grade level/age__________ Number of Adults_____
3. Please tell us where you are sampling. Be as specific as possible. (Example: swimming beach, Kingston Point, City of Kingston, Ulster County.)

4. Using the map included with your packet, give your location along the Hudson estuary in river miles. (The Battery at the southern tip of Manhattan is River Mile 0; the Federal Dam at Troy is River Mile 153.)
River mile ______

If you have a way to determine the latitude and longitude of your site, enter that data here.

GPS Latitude_________________________ Longitude______________________________

## Activity I - Tides and currents

**TIDES:** The tide is the up and down motion of the water, the rising & falling. There are several ways to measure tide.
**Simple Measure:** ***At a beach*** use two slender, strong sticks as tide markers. At the start, place one stick at the water's edge. Push it deep into the ground or pile rocks at its base to hold it in place. Every 15 or 30 minutes check your marker If the level has changed, place the second stick to mark the new position of the water's edge on a beach so through time you see the total change. Record on your sheet the water level as rising, falling, or unchanged. ***Pier or bulkhead*** choose a distinct, immoveable feature on or near the bulkhead to see whether the water level is rising or falling. If there are waves, use your judgment in deciding where the water's edge/surface is. Record on your sheet the water level as rising, falling, or unchanged.
**Intermediate Measure:** Use a dowel marked in 10cm increments to set firmly in the sediment in the water OR if measuring off a bulkhead use a tape measure to measure from the dock to the water surface. Have the students record the water level once the marker is set (record in column 3). Then every 15 to 30 minutes check your marker and record actual measures so that a total tidal change can be calculated over a total time available for the activity. NOTE: measuring down to the water means the distance will get smaller as the tide rises – be sure you talk through this with students.
**Extra Activity:** If your students have time at this station they can calculate how quickly the tide is rising or falling by dividing the change in height by the time between recordings. Think of the basic definition of speed as distance traveled divided by the time of travel. Calculation: Subtract the time from prior reading from the time of this reading for 'time of travel' (or time elapsed). Next calculate the change in height from your prior reading (for the distance traveled) by subtracting these two numbers. Now divide the change in height by the time elapsed. This is the rate (speed) of tidal change (column 4)

| **TIDES** | | | |
|---|---|---|---|
| **Time** | **Rising, Falling, Unchanged** | **Height in cm (if recording)** | **Rate of Tidal Change (cm/min)** |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**CURRENTS:** Currents are the internal movement in the water sometimes described as a push and pull in the water. After recording the tide level, determine the direction of the current. Using a mid sized stick (large enough so the wind can't easily push it), or an orange, toss it as far as you can out into the river. Note which direction it moves. The current moving downriver towards the sea is called the ebb; the current moving upriver is the flood. Don't confuse the direction of waves with the direction of the current; waves and current are different things.

**Basic Measure:** Every 60 minutes toss an orange (or stick) as far out into the water as you can. Record the direction of travel as North (towards Albany) or South (towards the Atlantic) in column 5. Next record incoming as Ebb, outgoing as Flood, or if there is no movement record it as Slack in column 6.

**Intermediate Measure:** For a more exact measure you can calculate the speed (distance traveled divided by time traveled) by using a tape and a stopwatch to measure how fast the current is moving. Toss the stick or orange into the water at a marked starting point (use a student to align with the start). Stop your watch after 30 seconds on a stop watch and place a student at the end point. Now have your students measure the distance between the two student markers with a measuring tape. Record this in column 2. Calculate distance per second by dividing the total distance by 30 secs. Record in column 3.

**Extra Activity: Calculate KNOTS:** If your students want to calculate the rate of travel in knots use the distance in cm for 60 seconds to compute this. Let's think this through.

1 kt. = 6076 ft. per hr. But we have cm so we need to convert ft. to cm. 1 ft. = 30.48 cm. so multiple these two to compute cm/hr or 185196.5 cm/hr. Now divide by 60 for cm per minute (3086.6 cm/min.) now by 60 again for cm/sec. What you find is that 1 kt =51.44 cm/sec.

SO to compute Knots from cm/sec use the following equation:

kts = cm/sec divided by 51.4. Record this as knots in fourth column over.

**Example: If the stick traveled 63 cms in 30 seconds divide 63/30 = 2 cm sec. /51.4 = .04 kts.**

| **CURRENT** | | | | | |
|---|---|---|---|---|---|
| **Time** | **Cm/30 sec** | **Cm/sec** | **Knots (cm/sec)/51.4** | **North/ South** | **Ebb/Flood/Still (E/F/S)** |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Is there anything about the river or shoreline here that may cause the current near shore to flow in a different direction than the current out in the middle of the Hudson ( a protected embayment, a pier jutting out causing an unusual swirling)?

DATA FROM THE MAIN CHANNEL IS THE BEST DATA TO RECORD SO PLEASE BE ALERT TO DIFFERENCES THAT MIGHT EXIST. IF YOU NOTICE THAT THE CURRENT APPEARS TO BE DIFFERENT IN THE MAIN CHANNEL THAN IT IS IN THE SHORELINE AREA PLEASE RECORD THIS NOTATION USING "S" FOR SHORELINE AND "C" FOR CHANNEL.

## Activity II – Weather and Wind

Weather and wind are important pieces of physical data that help to provide context for the other data. Weather includes current conditions and conditions over the last few days that may have an impact on the data you collect today (such as rain, extremely hot or cold weather).
Wind levels can increase choppiness in the water thus adding oxygen and increasing levels of oxygen saturation. Wind can also affect movement on the top of the water surface which may make assessing currents difficult.

1. Record weather conditions at the start of sampling. Record changes every hour if possible.

   a. Time__________ Air temperature _______ $^{o}$F ______ $^{o}$C

   b. .Time__________ Air temperature _______ $^{o}$F ______ $^{o}$C

Cloud cover (check one) clear_______ partly cloudy___ mostly cloudy___ overcast___

Any precipitation? ______ How much? __________

If the weather changes over the time you are sampling, please note that here.

Briefly describe the weather for the last three days. Any rain, wind, or unusual temperatures?

2. Wind speed:

(PLEASE REFER TO BEAUFORT CHART ON PAGES 4-5)

Using the Beaufort chart record the FIRST COLUMN as Beaufort FORCE_________.

Optional additional information to record _____kts. and/or ________mph

Using an anemometer to record wind record ____. (Be sure to record as kts ,or mph (kts preferred)

Record wind direction as the direction the wind is coming (blowing) **from**. Face straight into the wind until it hits your face evenly – the direction you are looking is the wind direction _________

Water Choppy_________ Water Calm_______

# STORMFAX® WEATHER ALMANAC

# Beaufort Wind Scale

***Devised by British Rear-Admiral, Sir Francis Beaufort in 1805***
***based on observations of the effects of the wind***

| **Beaufort number (force)** | **Wind Speed** | | **Wave height (feet)** | **WMO* description** | **Effects observed on the sea** | **Effects observed on land** |
|---|---|---|---|---|---|---|
| | **knots** | **mph** | | | | |
| **0** | under 1 | under 1 | - | **Calm** | Sea is like a mirror |  |
| **1** | 1 - 3 | 1 - 3 | 0.25 | **Light air** | Ripples with appearance of scales; no foam crests |  |
| **2** | 4 - 6 | 4 - 7 | 0.5 - 1 | **Light breeze** | Small wavelets; crests of glassy appearance, not breaking |  |
| **3** | 7 - 10 | 8 - 12 | 2 - 3 | **Gentle breeze** | Large wavelets; crests begin to break; scattered whitecaps |  |
| **4** | 11-16 | 13-18 | 3½ - 5 | **Moderate breeze** | Small waves, becoming longer; numerous whitecaps |  |
| **5** | 17-21 | 19-24 | 6 - 8 | **Fresh breeze** | Moderate waves, taking longer form; many whitecaps; some spray |  |
| **6** | 22-27 | 25-31 | 9½-13 | **Strong breeze** | Larger waves forming; whitecaps everywhere; more spray |  |
| **7** | 28-33 | 32-38 | 13½-19 | **Near gale** | Sea heaps up; white foam from breaking waves begins to be blown in streaks |  |

## Activity III - The Environment at the Sampling Site

In completing the physical survey of your sample site please include a 200 ft. segment extending up and downriver from your sampling site (your site bisects the segment). Sketch a map of your sampling site on the next page and answer the following questions. If available, use a digital camera to photograph your site.

1. Using the list below describe the land at your site. Is it forested? Open and grassy? A parking lot? Used by people for picnics, launching boats, fishing, swimming, or other activities?

**Surrounding Land Use:**
Estimated % urban/residential_______
Estimated % Forested___________
Estimated % Beach___________
Estimated % Industrial/Commercial_________
Estimated % Other (specify)__________

2. Describe the shoreline. Is it a beach? A marsh? Is it sandy, muddy, or rocky? Is it lined with bulkheading - wooden timbers or metal plates that hold the shore in place? Has riprap (a line of large rocks) been piled along the shore? Do any pipes discharge into the river here?
DESCRIBE & USE CHECK FORM:

| **SHORELINE APPEARANCE: CHECK ALL THAT APPLY** | | | |
|---|---|---|---|
| Beach area ☐ | Pier ☐ | Shore with Bulkhead (wood timbers/metal plates) ☐ | Shoreline RipRap (large rocks) ☐ |
| Covered with vegetation ☐ | Debris in the Area such as broken concrete, docking ☐ | Piping entering the river - (size) (North or South or sampling site & estimate distance) ☐ | Brick Pieces ☐<br>Charcoal ☐<br>Slag ☐ |

3. Describe the water area in which you are sampling. Water Depth? _________(list units of measure)

4. River Bottom Type - Is the bottom sandy, muddy, weedy, or rocky

5. Plants provide fish habitat, filter out sediments and nutrients, and can assist with oxygen exchange in the water. Water chestnut REMOVES oxygen from under its beds while water celery adds oxygen to the water when it is photosynthesizing. Use the *Hudson River Field Guide to Plants of Freshwater Tidal Wetlands* to identify any plants you find growing in the water. List them here.

   Are there plants growing in or on the water? _____ Do they cover more than half of the area you are sampling? ______Less than half?________

***What percent of your entire sampling area is covered with plants in the water?_________***

***Check if present and list estimated percentage of the total plant population for each plant:***

**Tidal Shallows:**

Water Milfoils_______ % vegetation_________ Water Celery_______ % vegetation_________

Water Chestnut ________% vegetation_______

Other_______ % vegetation______

**Tidal Marshes:**

Arrow Arum_______ % vegetation_________

Arrowhead_______ % vegetation_________

Big Cordgrass _______ % vegetation_________

Broad leaved Cattail____ % vegetation_______

Bur-reed_______ % vegetation_________

Golden Club_______ % vegetation_________

Jewelweed_______ % vegetation_________

Mud Wort_________% vegetation

Narrow-leaved Cattail____ % vegetation______

Pickerelweed_______ % vegetation_________

Phragmites /Common Reed___% vegetation___

Purple Loosestrife_____ % vegetation________

Reed Grass_______ % vegetation_________

Saltwater Cordgrass ____ % vegetation______

Spatterdock _______ % vegetation_________

Swamp Rose-Mallow_____ % vegetation_____

Sweet Flag_______ % vegetation_________

Wildrice_______ % vegetation_________

Yellow Flag_______ % vegetation_________

Yellow Pond Lily______% vegetation______

OTHER_______ % Vegetation________

## Activity IV - Sketch Map of the Sampling Site

Include a compass rose (N, S, E, W) and rough scale. Label landmarks or notable features. Indicate specific locations where you sampled.

## Activity V - Other Physical Factors

### 1. **Water temperature**

Water temperature is important for understand the amount of dissolved oxygen the water can hold, and for the fish communities that will use the area. Students will better understand Fahrenheit temperatures, but in science it is important to become familiar with Celsius, so if possible, record water temperature in BOTH degrees Celsius and degrees Fahrenheit. Have them look at the comparison between the two. If you don't have both $^{o}C$ and $^{o}F$ thermometers, students can convert between the two using the following formulas:

$^{o}C = 0.556 \times (^{o}F - 32)$    $^{o}F = (1.8 \times {}^{o}C) + 32$

It is best to take the water temperature several times in succession and then average. Over the day, you might want to see if there's any change, especially in shallow water and backwater areas, which may show more variation through the day due to sunlight, tide or current changes.

| Time | | Reading 1 | Reading 2 | Reading 3 | Average |
|---|---|---|---|---|---|
| ____ | $^{o}F$ | ________ | ________ | ________ | ________ |
| | $^{o}C$ | ________ | ________ | ________ | ________ |
| ____ | $^{o}F$ | ________ | ________ | ________ | ________ |
| | $^{o}C$ | ________ | ________ | ________ | ________ |
| ____ | $^{o}F$ | ________ | ________ | ________ | ________ |
| | $^{o}C$ | ________ | ________ | ________ | ________ |
| ____ | $^{o}F$ | ________ | ________ | ________ | ________ |
| | $^{o}C$ | ________ | ________ | ________ | ________ |

### 2. **Turbidity**

Turbidity is water clarity, an important feature of an estuary. In the Hudson River turbidity is made up of small bits of plankton, pieces of detritus or decomposing plant and animal matter, salt and suspended bits of sediment. Different techniques for determining turbidity use different units of measurement. Be sure to enter data on the correct line for the technique you use. Repeat several times in succession and average the results.

| | Time | Reading 1 | Reading 2 | Reading 3 | Average | |
|---|---|---|---|---|---|---|
| secchi disk | ______ | ________ | ________ | ________ | ________ | feet or cm |
| short site tube | ______ | ________ | ________ | ________ | ________ | JTUs |
| long sight tube | ______ | ________ | ________ | ________ | ________ | cm/meters |
| turbidimeter | ____ | ________ | ________ | ________ | ________ | NTUs |

## Snapshot Day Activity IV – Chlorophyll Sampling

**Chlorophyll**
The pigment Chlorophyll is what allows plants (and algae) to convert water and carbon dioxide to organic compounds in the presence of light, a process called photosynthesis. There are several types of Chlorophyll to assist plants to capture light at different wavelengths, but all plant cells have chlorophyll "a". This activity will allow us to measure the amount of Chlorophyll "a" in your area of the river.

**PLEASE FOLLOW THE PROTOTOL SHEET ON THE NEXT PAGE**

120 mls (or ccs) of river water will be collected and filtered through a fine mesh filter to separate any material in the water. Once the water is filtered, examine the filter to evaluate the amount of material that is filtered. This will be an accumulation of not just chlorophyll but any suspended matter that was large enough to be filtered out. Using the color chart included with your kit select the color that best matches your filter and record on this data sheet.
At some sites the filter paper will be removed using tweezers – folded to protect the sample and placed in a vial and put on ice for collection and analysis at Lamont.
If the sample is being collected for Lamont label your vial with the following protocol:
Date – River Site –River Mile_ cc volume
Example
100809_PP_25_120cc

Record here -
TIME________ # ON THE COLOR CHART MOST CLOSELY MATCHING SAMPLE______

## Activity IIV – Sediment Sampling

***Use the Step-By-Step directions sheet provided online on the resources page**
http://www.ldeo.columbia.edu/edu/k12/snapshotday/Resources.html

**Background Information:**

- **The sediments in the core represent a period of time**. The material at the bottom is older than the material on the top. This is an important principle of geology and much of Earth Science called 'superposition'.
- If material has been accumulating steadily, a sediment core will contain a record of the material transported by the river through time.
- One of the challenges faced by scientists who study sediment cores is determining the length of time represented by the sediments core. You can not tell how many years your core represents by simply looking at it. The amount of time represented by your core will vary depending on the specific place and processes of the river in each area. In sections with high deposition it could represent a very short amount of time (days to a year), while in other areas it could represent a much longer time (10s to 100s of years or longer).
- What you can tell from looking at a core is whether the color changes over the length of the core. You will note the color of the sediments at the very top of the core. If the color is light brown, this is an indication that the surface sediments are oxidized (in contact with oxygen in the water). The oxidized section is the top represents an unconsolidated recent deposition. You will measure this and record it to determine how active the deposition is in your area. Usually, the sediments change to a darker color below the oxidized layer, this is called anoxic (no oxygen) or reducing. It usually means that these sediments have been out of contact with the oxygen in the river water and are older. Often this section will have a sulfur smell noting bacterial decomposition. Extrude your core, then measure and record each section. Complete the core assessment sheet as you observe and describe it. Note anything else that you think is significant. Are there other visible layers? Color changes?

- **X-Ray Fluorescence (XRF) Spectrometer– What does this mean? Once you collect your core and describe it you will be sending one to Lamont for X-Ray Fluorescence**. This is done with a piece of equipment that can measure lead and other metal concentrations in the sediments. We focus on lead since it can be used as an indicator of time. There is a natural background reading of lead in the river (approx. 20ppm) but human (anthropogenic) influences such as early 20$^{th}$ century industry, leaded gas etc. have caused in increase in that level. Using the XRF we can look at what the readings of various metals are in different areas of the river. This information will be generated at Lamont and the results provided back to the group. The hope is to use this information to roughly constrain (locate the probably range) the age of sediments you collect. A straightforward interpretation of this data is that low levels of lead similar to natural background would indicate sediments that are older than (deposited prior to) approximately 1900, while sediments containing lead a levels elevated above the natural background would indicate sediments that are younger or deposited as part of industrialization.

- **Collect a sample for back in the classroom.** Collect and bag a sample to take back and analyze in the classroom to look at the history of the sediment in the river. See classroom activity sheet called "The sediments in our river".

# DAY in the LIFE PUSH CORE SEDIMENT LOG

| GRAB ID# | Site Name | DATE | FORM COMPLETED BY: | |
|---|---|---|---|---|
| | | | GROUP # | |
| TIME | LATITUDE | LONGITUDE | WATER DEPTH | LOCATION |
| | | | | |

| | Yes | No | | | Descriptors - Please note additional observations |
|---|---|---|---|---|---|
| $H_2S$ smell | | | | | $H_2S$ smells of rotten eggs, suggesting anaerobic bacteria |
| Oil | | | | | Oil creates a slight smell, a slickness and a sheen |
| Oxidized top* | | | | | *oxidation (reaction with oxygen) creates a distinctly lighter colored layer of sediment. |
| | | | | | estimate dimensions of oxided layer, etc. and draw below |
| | **Absent** | **Rare** | **Common** | **Abundant** | **Additional Comments** |
| Clay | | | | | very fine material - grey color & rich dense feel |
| Mud | | | | | smooth feel between fingers - brown color |
| Sand | | | | | gritty feeling between fingers |
| Gravel | | | | | pea sized pieces of stone |
| Pebbles | | | | | pieces of stone larger than pea |
| Leaves | | | | | |
| Wood | | | | | |
| Shells Oysters (dead/alive?) | | | | | |
| Freshwater mussels (except zebra) | | | | | |
| Zebra mussels | | | | | |
| macroinvertebrates | | | | | |
| Brick | | | | | |
| Coal | | | | | |
| Slag | | | | | industrial byproduct - chunky look, light, air filled |
| Living vegetation: | | | | | |
| Length of Core: | | | | | Length of Oxidized core top (if present): |
| If Bagged - Number On Core Collection Bag | | | | | |
| | | | | | |

Sketch of your core below with measurements for each section & total core (be sure to label the top and bottom):

<--BOTTOM TOP -->

form updated 8/11/13

**SEDIMENT SAMPLING –** push cores were distributed to a group of our participating stations for this process. If you don't have a corer you can skip this activity. Prior to sampling (i.e., before the bag gets wet), please use a permanent marker and label bag with the following information:

- **Date – River Site –River Mile**
- **Example:**
- **100809_PP_25 (for Piermont Pier)**
-
- You will be taking a core to examine and describe with your group using the form on the next page. Once the description is complete scoop the pieces into a Ziploc bag and return it to Lamont-Doherty Earth Observatory for X-Ray Fluorescence analysis (this will be picked up with your chlorophyll sample). The core will be homogenized for sampling so do not worry about squishing the sample.

**DISCUSSION:** Once you have the core for group analysis use the sheet that is in your protocols to look through and analyze it with the group. Discuss how any unusual items might have ended up in the river and the role they play there.

(**Note** if the area you are coring is primarily sand the corer may not work and the sand may fall out when you lift the corer from the water. In this case if you would still like to examine the bottom of the river with your students you might be able to slide a flat piece of something under the base of the corer and still extract a sample to look at. If that isn't possible, consider using a jar to scoop out a section trying to obtain a sample that goes down 3-4 inches. The same activities can be completed with this type of sample. When you bag your sample please note it was not obtained with the corer.)

## Snapshot Day Recording Sheet VIII - Chemical Measurements

1. **pH** **pH has no units listed with it. Neutral Range is 7**

A measure of the acidity of an area. Repeat several times in succession and average the results.

| Time | Reading 1 | Reading 2 | Reading 3 | Average |
| --- | --- | --- | --- | --- |
| ____ | ________ | ________ | ________ | ________ |

How was it determined? (check one)

litmus paper___ indicator solution___ meter___ pH pen___ other___

2. **Salinity**

Most studies measure the concentration of chloride ($Cl^-$) to determine salinity, however different instruments measure salinity as 'total salts', 'chloride' or even conductivity. Therefore it is essential that you mark down what instrument you used to measure the salinity. In freshwater parts of the river, the units of measurement may be parts per million (ppm) or milligrams per liter (mg/l), which are equivalent.

| **One ppm is like** | | |
| --- | --- | --- |
| One second in 11.5 days | One minute in two years, | One cent in $10,000 |

In saltier parts of the river, you may also see measurements expressed in parts per thousand (ppt); one part per thousand equals 1000 mg/l. Background level of $Cl^-$ in the freshwater part of the estuary is typically 20 - 30 mg/l (.020 - .030 ppt). In the seawater of the open Atlantic Ocean, $Cl^-$ concentration is roughly 35,000 mg/l (35 ppt).

Repeat several times in succession and average the results. Specify the units of measurement.

| Time | Reading 1 | Reading 2 | Reading 3 | Average | Units |
| --- | --- | --- | --- | --- | --- |
| ____ | ________ | ________ | ________ | _______ | _____ |

How was it determined? (check one)

drop count test kit___ meter___ refractometer___ test strips___ hydrometer____

(If reading conductivity please record with appropriate unit uS/cm (microsiemens) or mS/cm (milliseimens and then convert to salinity )

3. **Dissolved oxygen.**

The amount of dissolved oxygen (DO) in a river is one of the most important factors determining its health. Many variables influence DO, including temperature, time of day, presence of plants, and wind conditions. DO measurements are given in mg/l and as percent saturation. At 100% saturation, water of a given temperature cannot hold more DO. If more is added - by wind or turbulence, saturation may temporarily exceed 100%, but in this case oxygen will diffuse from the water into the air. Saturation levels below 100% are not necessarily the result of pollution. At night, when plants aren't producing oxygen through photosynthesis, saturation may fall below 100% as living things use up the available DO.

| time | temperature in $^oC$ | DO (mg/l) | % saturation |
|---|---|---|---|
| _____ | _______ | ________ | __________ |

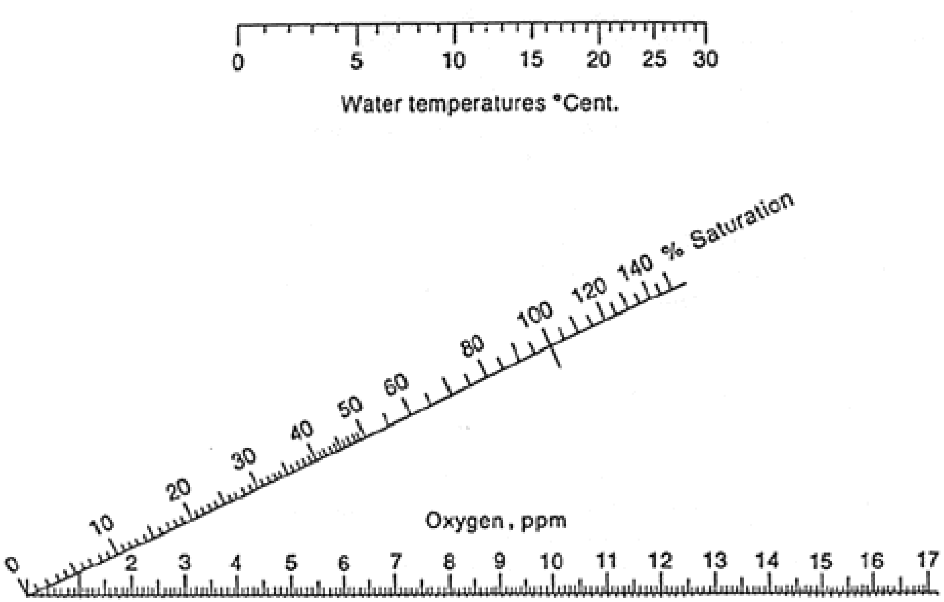
How was it determined? (check one)

Drop count test kits___ ampules___ digital titrator___ meter___ other____

## DETERMINING PERCENT SATURATION THE "QUICK AND EASY" METHOD

Source of chart: http://waterontheweb.org/under/waterquality/oxygen.html

**For a quick and easy determination of the percent saturation value for dissolved oxygen at a given temperature, use the saturation chart above. Pair up the mg/l of dissolved oxygen you measured and the temperature of the water in degrees C. Draw a straight line between the water temperature and the mg/l of dissolved oxygen. The percent saturation is the value where the line intercepts the saturation scale. Waterways with a saturation value of 90% or above are considered healthy.**




ADDITIONAL CHEMICAL TESTS IF DESIRED

The following tests typically require more complex methods than those described above. There is no requirement to do these, but if you have the equipment and ability, the data would be welcome.

4. **Nitrates**.

Nitrate ($NO_3^-$) is relatively plentiful in freshwater ecosystems but less so in saltwater ecosystems, where it is typically the limiting nutrient.

Repeat several times in succession and average the results.

| Time | Reading 1 | Reading 2 | Reading 3 | Average | |
|---|---|---|---|---|---|
| _____ | _________ | _________ | _________ | ________ | $NO_3^-$(mg/l) |

5. **Phosphate**
Phosphate ($PO_4^{-3}$) is usually the nutrient least available in freshwater ecosystems.

Repeat several times in succession and average the results.

| Time | Reading 1 | Reading 2 | Reading 3 | Average | |
|---|---|---|---|---|---|
| _____ | ________ | ________ | ________ | _______ | $PO_4^{-3}$ mg/l |

6. **Alkalinity**
Alkalinity is a measure of water's ability to neutralize acids such as those that might be found in acid precipitation. Don't confuse it with pH. pH measures how strongly acidic or alkaline the water is; the alkalinity test determines the concentration of alkaline compounds in the water – or water hardness. In pure water small amounts of acid or alkaline substances will cause dramatic shifts in pH – however with the addition of small particles of water hardness substances in the system causes a buffering that absorbs or soaks up small changes to the system.
Alkalinity results are given in mg/l of calcium carbonate ($CaCO_3$).

Repeat several times in succession and average the results.

| Time | Reading 1 | Reading 2 | Reading 3 | Average | |
|---|---|---|---|---|---|
| _____ | ________ | ________ | ________ | _______ | $CaCO_3$ mg/l |

## Snapshot Day Activity IX - Fish & Macroinvertebrates

The data section below is set up for fish and invertebrates such as crabs and crayfish that are easily visible without magnification. This sheet can be adapted if you plan to capture and study plankton. If making repeated collections, record data for each haul and then add the catch totals together. If you have trouble identifying organisms to the species level, list them at the most specific level of classification possible. Young of the year herring - alewife, blue-back herring, and American shad - look very similar to one another, as do very young sunfish. Group them together as herring or sunfish. Measure the **largest** individual of each species. It will not be possible to tell males from females for most of what you catch, but for a few - blue crabs for instance - it is possible and very useful to distinguish gender.
***So that we can compare data from site to site please list LENGTH OF SEINE NET, LENGTH OF SEINE PULL and TOTAL NUMBER OF fish caught PER SEINE. If you site used traps please note catches per trap. If your group would like to compute Catch Per Unit of Effort please see directions on back.***
***Length of seine net______ Length of seine pull _______ Total number of fish in pull_____***

***Total number of seines or catches you ran during your study period________***

Type of equipment used:

seine (list dimensions & mesh size) ____________________________________________________

eel pot___ minnow trap___ dip net____ plankton net__ __ other:______________

**FISH SPECIES CAUGHT**

**Use separate sheet for each seine OR note what was caught in each seine by noting seine #.**

**TIME**________________

| Fish Species: | # of individuals: | Size of largest | (unit) |
|---|---|---|---|
| 1. ______________________________ | _____________ | ____________ | ____ |
| 2. ______________________________ | _____________ | ____________ | ____ |
| 3. ______________________________ | _____________ | ____________ | ____ |
| 4. ______________________________ | _____________ | ____________ | ____ |
| 5. ______________________________ | _____________ | ____________ | ____ |
| 6. ______________________________ | _____________ | ____________ | ____ |
| 7. ______________________________ | _____________ | ____________ | ____ |
| 8. ______________________________ | _____________ | ____________ | ____ |
| 9. ______________________________ | _____________ | ____________ | ____ |
| 10. ______________________________ | _____________ | ____________ | ____ |
| 11. ______________________________ | _____________ | ____________ | ____ |
| 12. ______________________________ | _____________ | ____________ | ____ |

Macroinvertebrates: For crabs please note type (blue, mud, Asian etc.) and sex (M/F)

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

**To Compute Catch Per Unit Equivalent (CPUE)** – Let's use a 50 ft. net for the example. Take length of net (50 ft.) X length of pull (example 7 yards X 3 = 21 ft.) then convert it to meters - 50 ft. X 21ft X 12 (for inches per foot) = total inches. Divide by 39.37 inches for inches in a meter = 320 meters. Then divide your catch by 320 to get catch per meter seined. This figure should be computed for each seine event.

*If you pull the net in just to close a circle the formula is: Net Length (ft.) ___X 12 = total inches / 39.37 (inches in a meter) =_____ Then divide your catch by this number for your CPUE.*

Seine #____ Time_______ Catch Total ______ Length of Pull_______computed CPUE_________
Seine #____ Time_______ Catch Total ______ Length of Pull_______computed CPUE_________
Seine #____ Time_______ Catch Total ______ Length of Pull_______computed CPUE_________

# *Hudson River Fish Fauna Check List*

1 ______ lamprey, silver
2 ______ lamprey, American brook (n)
3 ______ lamprey, sea (n)
4 ______ shark *(bull shark?)* (n)
5 ______ dogfish, smooth (n)
6 ______ dogfish, spiny (n)
7 ______ skate, little (n)
8 ______ skate, barndoor (n)
9 ______ stingray, bluntnose (n)
10 ______ sturgeon, shortnose (n)
11 ____ sturgeon, Atlantic (n)
12 ______ gar, longnose
13 ______ bowfin
14 ______ ladyfish (n)
15 ______ bonefish (n)
16 ______ eel, American (n)
17 ______ worm eel, speckled (n)
18 ______ eel, conger (n)
19 ______ herring, blueback (n)
20 ______ shad, hickory (n)
21 ______ alewife (n)
22 ______ shad, American (n)
23 ______ menhaden, Atlantic (n)
24 ______ herring, Atlantic (n)
25 ______ shad, gizzard
26 ______ herring, round (n)
27 ______ anchovy, striped (n)
28 ______ anchovy, bay (n)
29 ______ stoneroller, central
30 ______ goldfish
31 ______ dace, redside
32 ______ chub, lake (n)
33 ______ carp, grass
34 ______ shiner, satinfin (n)
35 ______ shiner, spotfin
36 ______ carp, common
carp, mirror *(var.)*
37 ______ minnow, cutlips (n)
38 ______ minnow, brassy (n)
39 ______ minnow, eastern silvery (n)
40 ______ shiner, bridle (n)
41 ______ shiner, common (n)
42 ______ dace, pearl (n)
43 ______ chub, hornyhead
44 ______ shiner, golden (n)
45 ______ shiner, comely (n)
46 ______ shiner, emerald
47 ______ shiner, blackchin
48 ______ shiner, blacknose
49 ______ shiner, spottail (n)
50 ______ shiner, rosyface
51 ______ shiner, sand
52 ______ dace, northern redbelly (n)
53 ______ dace, finescale (n)
54 ______ minnow, bluntnose
55 ______ minnow, fathead
56 ______ dace, eastern blacknose (n)
57 ______ dace, longnose (n)
58 ______ bitterling
59 ______ rudd
60 ______ chub, creek (n)
61 ______ fallfish (n)
62 ______ sucker, longnose (n)
63 ______ sucker, white (n)
64 ______ chubsucker, creek (n)
65 ______ hog sucker, northern (n)
66 ______ buffalo hybrid (black *x* smallmouth)
67 ______ redhorse, shorthead
68 ______ weatherfish, Oriental
69 ______ pirapitinga (black pacu)
70 ______ catfish, white (n)
71 ______ bullhead, yellow (n)
72 ______ bullhead, brown (n)
73 ______ catfish, channel
74 ______ stonecat
75 ______ madtom, tadpole (n)
76 ______ madtom, margined (n)
77 ______ madtom, brindled
78 ______ pickerel, redfin (n)
79 ______ pike, northern (n)
muskellunge, tiger *(norlunge)*
80 ______ pickerel, chain (n)
81 ______ mudminnow, central
82 ______ mudminnow, eastern (n)
mudminnow (hybrid)
83 ______ smelt, rainbow (n)
84 ______ herring, lake *(cisco)* (n)
85 ______ whitefish, lake (n)
86 ______ trout, rainbow
87 ______ kokanee *(sockeye)*
88 ______ salmon, chinook
89 ______ whitefish, round (n)
90 ______ salmon, Atlantic (n)
91 ______ trout, brown
92 ______ trout, brook (n)
93 ______ trout, lake (n)
94 ______ lizardfish, inshore (n)
95 ______ trout-perch (n)
96 ______ rockling, fourbeard (n)
97 ______ cod, Atlantic (n)
98 ______ hake, silver *(whiting)* (n)
99 ______ tomcod, Atlantic (n)
100 ______ pollock (n)
101 ______ hake, red *(ling)* (n)
102 ______ hake, spotted (n)
103 ______ hake, white (n)
104 ______ cusk-eel, striped (n)
105 ______ toadfish, oyster (n)
106 ______ goosefish *(anglerfish)* (n)
107 ______ needlefish, Atlantic (n)
108 ______ houndfish (n)
109 ______ minnow, sheepshead
110 ______ killifish, eastern banded (n)
111 ______ mummichog (n)
112 ______ killifish, striped (n)

113 ______ killifish, spotfin (n)
114 ______ mosquitofish, western
115 ______ silverside, brook
116 ______ silverside, rough (n)
117 ______ silverside, inland (n)
118 ______ silverside, Atlantic (n)
119 ______ stickleback, fourspine (n)
120 ______ stickleback, brook (n)
121 ______ stickleback, threespine (n)
122 ______ stickleback, ninespine (n)
123 ______ cornetfish, bluespotted (n)
124 ______ seahorse, lined (n)
125 ______ pipefish, northern (n)
126 ______ gurnard, flying (n)
127 ______ sea robin, northern (n)
128 ______ sea robin, striped (n)
129 ______ sculpin, slimy (n)
130 ______ sea raven (n)
131 ______ grubby (n)
132 ______ sculpin, longhorn (n)
133 ______ lumpfish (n)
134 ______ seasnail, Atlantic (n)
135 ______ perch, white (n)
136 ______ bass, white
137 ______ bass, striped (n)
138 ______ sea bass, black (n)
139 ______ gag *(grouper)* (n)
140 ____ bass, rock
141 ______ sunfish, bluespotted (n)
142 ______ sunfish, banded (n)
143 ______ sunfish, redbreast (n)
144 ______ sunfish, green
145 ______ pumpkinseed (n)
146 ______ warmouth
147 ______ bluegill
148 ______ bass, smallmouth
149 ______ bass, largemouth
150 ______ crappie, white
151 ______ crappie, black
152 ______ darter, greenside
153 ______ darter, rainbow
154 ______ darter, fantail
155 ______ darter, tessellated
156 ______ perch, yellow (n)
157 ______ logperch, northern
158 ______ darter, shield
159 ______ walleye
160 ______ bigeye, short (n)
161 ______ bluefish (n)
162 ______ cobia (n)
163 ______ sharksucker (n)
164 ______ jack, crevalle (n)
165 ______ scad, round (n)
166 ______ moonfish, Atlantic (n)
167 ______ lookdown (n)
168 ______ banded rudderfish (n)
169 ______ permit (n)
170 ______ schoolmaster (n)
171 ______ snapper, gray *(mangrove)* (n)
172 ______ mojarra, spotfin (n)
173 ______ pigfish (n)
174 ______ sheepshead (n)
175 ______ pinfish (n)
176 ______ scup *(porgy)* (n)
177 ______ drum, freshwater *(sheepshead)*
178 ______ perch, silver (n)
179 ______ weakfish (n)
180 ______ spot *(Lafayette)* (n)
181 ______ kingfish, northern (n)
182 ______ croaker, Atlantic (n)
183 ______ drum, black (n)
184 ______ butterflyfish, foureye (n)
185 ______ butterflyfish, spotfin (n)
186 ______ mullet, striped (n)
187 ______ mullet, white (n)
188 ______ sennet, northern (n)
189 ______ guaguanche (n)
190 ______ tautog *(blackfish)* (n)
191 ______ cunner *(bergall, chogy)* (n)
192 ______ gunnel, rock (n)
193 ______ sand lance, American *(sand eel)* (n)
194 ______ stargazer, northern (n)
195 ______ blenny, feather (n)
196 ______ blenny, freckled (n)
197 ______ skilletfish (n)
198 ______ sleeper, fat (n)
199 ______ goby, naked (n)
200 ______ goby, seaboard (n)
201 ______ goby, highfin (n)
202 ______ cutlassfish, Atlantic (n)
203 ______ mackerel, Atlantic (n)
204 ______ mackerel, Spanish (n)
205 ______ butterfish (n)
206 ______ snakehead, northern
207 ______ flounder, Gulf Stream (n)
208 ______ flounder, smallmouth (n)
209 ______ flounder, summer *(fluke)* (n)
210 ______ flounder, fourspot (n)
211______ windowpane (n)
212 ______ flounder, winter (n)
213 ______ flounder, yellowtail (n)
214 ______ tonguefish, northern (n)
215 ______ hogchoker (n)
216 ______ filefish, orange (n)
217 ______ filefish, planehead (n)
218 ______ burrfish, striped (n)
219 ______ puffer, smooth (n)
220 ______ puffer, northern (n)
221 ______ cowfish, scrawled (n)

(n) = Native Species (169 - 76%)

Taxonomic diversity:

| | | | |
|---|---|---|---|
| Class | 4 | Order | 27 |
| Families | 77 | Genera | 158 |
| *Species* | 221 | | |

Tom Lake, NYSDEC Hudson River Estuary Program
lake@sunydutchess.edu August 31, 2014

## Snapshot Day Activity X- Other Observations

1**. Boating & Shipping.**

Should you see boats and large ships, tugs, or barges pass your site, note the following information if possible. We are mainly interested in shipping to show the working river, but information on how the river is being used is important also. If recreation use dominates the river we should note this as well.
Shipping Details: A loaded ship or barge is full of cargo, and rides lower in the water than a light - empty - vessel. Binoculars are helpful in gathering the information requested here. Note recreational ships if you like in order to note the different types of usage of the river.

| Time | Type of ship *Recreational (R)* *Commercial (C)* | Name | Northbound Southbound/ | light loaded/ | cargo |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

2. **Other items of interest.**
Feel free to record any other observations. This could include birds seen, items found on the beach, or any other things you find interesting

## Snapshot Day Activity XI- Journaling & A Hudson River Almanac Entry

How do we learn about our natural environment? We **observe.**
Through this activity we are focusing on developing skills of observation that play such an important role in science and Earth systems. Direct observation and careful description helps us compare species, habitats and different geographical regions. Through journaling we hope to observe, record and better understand some of the relationships that exist in the natural world.

Students have a sheet for recording observations during the day. In addition to their personal observations, at the end of the day the space below can be used for drafting a Hudson River Almanac entry from each site, which will be submitted with your data (use additional paper as needed, but keep them to 4-6 sentences please). Sample entry:
***September 29 - Dobbs Ferry -*** *Our beach seine was filled with nearly 600 fish-snapper blues, white perch, a vast school of silverside, and several 4"-7" striped bass. Low flying monarchs passed in twos and threes, dipping within inches, brushing against us as they beat into strong southerlies. The students from Irvington were thrilled to be so close to so much loveliness. As they passed, the students called out the tally; they were moving past us at the rate of fifty an hour. Christopher Letts*

**Hudson River Almanac Entry**