Hudson River Estuary Snapshot Day
October 2, 2007

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

The Packet contains a variety of data gathering activities that are listed here. Any combination of these activities can be completed as part of Snapshot Day. Additional activities are available on the Snapshot Day 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 UNITS OF MEASURE SO THAT COMPARISONS CAN BE MADE THROUGHOUT THE RIVER

Recording Sheet I - Background Information.

1. Coordinator/contact person_____
   Organization_____
   Street_____
   City_____State____Zip_____
   phone_____fax_____email_____
2. School/group name_____
   Name of teacher/group leader_____
   Street_____
   City_____State_____ Zip_____
   phone_____fax_____email_____
   Number of participants_____ grade level/age_____

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_____

Snapshot Day Activity I - Tides and currents

TIDES: At a beach you need 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. If the shore is bulkheaded, choose a distinct, immoveable feature on or near the bulkhead as a marker of whether the water level is rising or falling. If there are waves, use your judgment in deciding where the water's edge/surface is.
Using a watch, check your tide marker every 15 minutes. Record the water level as rising, falling, or unchanged. If the level has changed, place the second stick to mark the new position of the water's edge on a beach, or - if there's a bulkhead - choose a new water level marker.

(For a more exact measure use a dowel marked in 10cm increments.. If measuring off a bulkhead use a tape measure. Measure from the dock to the water surface. Have the students record the water level once the marker is set. Then follow above procedures but record actual measures so that a total tidal change can be calculated over a total time available for the activity.)

TIDES		
Time	**Height in cm (if noting)**	**Rising & falling Tide**

CURRENTS: After recording the tide level, determine the direction of the current. Find a stick and

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. On a windy day, choose a stick large enough that the wind can't easily push it against the current.

(*If you want to, and are able to at your site, calculate knots you can adjust this as follows: Use a tongue depressor or popsicle stick for a standard unit of measure, and starting your stopwatch, place or toss the stick at a marked starting point (use a student to align with the start). Stop your watch after 60 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 metric measuring tape. To calculate knots find the distance in cm for 60 seconds and divide by 50. Knots = cm/sec divided by 50).*

Example: If the stick traveled 125 cms in 60 seconds divide 125/50 = 2.5kts

CURRENT				
Cm/60 secs	**Cm/sec**	**North/ South**	**Knots (cm/sec)/50**	**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?

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. THE DATA FROM THE MAIN CHANNEL IS THE BEST DATA TO RECORD SO PLEASE BE ALERT TO DIFFERENCES THAT MIGHT EXIST.

Snapshot Day Activity II – Weather and Wind

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

1. Record weather conditions at the start of sampling.

a. Time_____ Air temperature _____^{o}F _____^{o}C

b. .Time_____ Air temperature _____^{o}F _____^{o}C

2. Wind speed (use Beaufort chart) _____(Record in knots) direction (coming from) _____

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

Any precipitation? What kind? How much?

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

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

BEAUFORT WIND SPEED SCALE

Beaufort Force Number	Wind Speed in:		Term	Indications on Land and Sea
	km/hr	knots		
0	calm	calm	Calm	Land: Smoke rises vertically. Sea: Sea like mirror.
1	2-5	1-3	Light Air	Land: Smoke drifts slowly downwind. Sea: Ripples with appearance of scales: no foam crests.
2	6-11	4-6	Light Breeze	Land: Leaves rustle. Sea: Small wavelets; crests of glassy appearance, not breaking.
3	12-18	7-10	Gentle Breeze	Land: Leaves are in motion. Sea: Large wavelets; crests begin to break; scattered whitecaps.
4	19-30	11-16	Moderate Breeze	Land: Small branches on trees move. Sea: Small waves, becoming longer; numerous whitecaps.
5	31-39	17-21	Fresh Breeze	Land: Small trees sway. Sea: Moderate waves, taking longer form; many whitecaps; some spray.
6	40-50	22-27	Strong Breeze	Land: Large branches sway. Sea: Larger waves forming; whitecaps everywhere; more spray.
7	51-61	28-33	Near Gale	Land: Whole trees in motion.

				Sea: Sea heaps up; white foam from breaking waves begins to be blown in streaks.
8	**62-74**	**34-40**	**Gale**	**Land: Twigs and small branches break off trees. Sea: Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks.**
9	**75-87**	**41-47**	**Strong Gale**	**Land: Large branches break off trees; slight structural damage. Sea: High waves; sea begins to roll; dense streaks of foam; spray may reduce visibility.**
10	**88-102**	**48-55**	**Storm**	**Land: Trees broken; minor structural damage. Sea: Very high waves with overhanging crests; sea takes white appearance as foam is blown in very dense streaks; rolling is heavy and visibility is reduced.**
11	**103-117**	**56-63**	**Violent Storm**	**Land: Widespread damage. Sea: Exceptionally high waves; sea covered with white foam patches; visibility further reduced.**
12	**108-132**	**64-71**	**Hurricane**	**Land: Violent movement of trees and much destruction. Sea: Air filled with foam; sea completely white with driving spray; visibility greatly reduced.**
13	**133-148**	**72-80**		
14	**149-165**	**81-89**		
15	**166-183**	**90-99**		
16	**184-200**	**100-108**		
17	**201+**	**109+**		

1 knot equals 1.15 statute miles per hour

Snapshot Day 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. 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 ☐	Covered with vegetation ☐	Banks altered ☐	Shoreline RipRap (large rocks) ☐
Bulkhead (wood timbers/metal plates) ☐	Collected wood/debris in area? ☐	Piping entering the river - (size) (North or South or sampling site & estimate distance) ☐	

3. Describe the water area in which you are sampling. How deep is it? Is the bottom sandy, muddy, weedy, or rocky?

WATER DEPTH (be sure to list unit of measure)	RIVER BOTTOM TYPE: Sandy, Weedy, Rocky?	WATER CHOPPY	WATER CALM

4. Are there plants growing in or on the water? Do they cover more than half of the area you are sampling? Less than half? 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.

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:

Clasping Pondweed_____ % vegetation_____ Water Milfoils_____ % vegetation_____

Sago Pondweed_____ % vegetation_____ Water Celery_____ % vegetation_____

Water Chestnut_____ % vegetation_____

Tidal Marshes:

Arrow Arum_____ % vegetation_____

Arrowhead_____ % vegetation_____

Big Cordgrass _____ % vegetation_____

Broad leaved Cattail____ % vegetation_____

Bur-reed_____ % vegetation_____

Chairmaker's Rush

(Three-square)____ % vegetation_____

Dotted Smartweed____ % 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_____

Saltmeadow Cordgrass____ % vegetation_____

Spatterdock _____ % vegetation_____

Spotted Joe-Pye Weed____ % vegetation_____

Swamp Rose-Mallow_____ % vegetation_____

Sweet Flag_____ % vegetation_____

Wildrice_____ % vegetation_____

Yellow Flag_____ % vegetation_____

Yellow Pond Lily_____% vegetation_____

OTHER_____ % Vegetation_____

Snapshot DayRecording Sheet IV - Sketch Map of the Sampling Site

Include a compass rose and rough scale. Label landmarks or notable features. Indicate specific locations where you sampled.

Snapshot Day Activity V - Other Physical Factors

1. **Water temperature**

If possible, record water temperature in degrees Celsius and degrees Fahrenheit. If you don't have both ^{o}C and ^{o}F thermometers, then convert whichever reading you do have to the other 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 or currrent changes. You will also need to take temperature readings as part of some chemical tests.

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**

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
		_____	_____	_____	_____	meters
sight tube	____	_____	_____	_____	_____	JTUs
turbidimeter	____	_____	_____	_____	_____	NTUs

Snapshot Day Activity IV – Chlorophyll Sampling

Chlorophyll

We were just looking at turbidity. In the Hudson River turbidity is made up of small bits of plankton, pieces of detritus or decomposing plant and animal matter, and suspended bits of sediment. 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 ccs of river water will be collected and filtered through a fine mesh filter to separate the detritus, sediments and chlorophyll from 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.

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.

Label your vial with the following protocol:

Date – River Site –River Mile_ cc volume

Example

100207_PP_25_120cc

Record here -

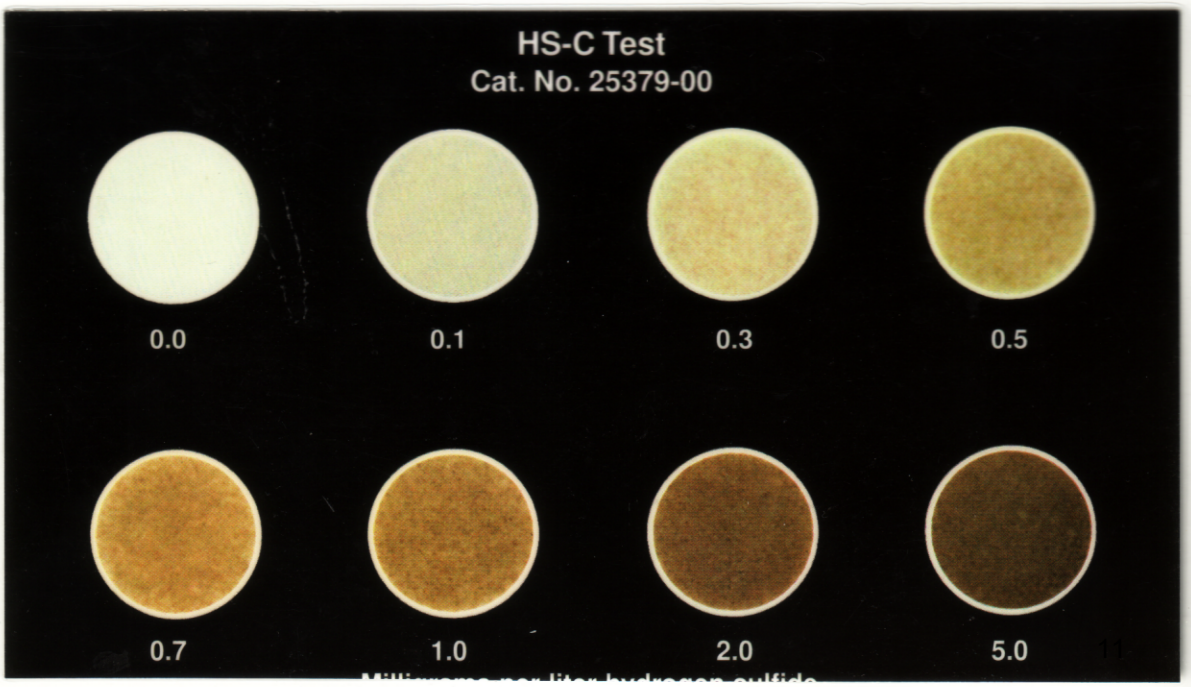
TIME_____ # ON THE COLOR CHART MOST CLOSELY MATCHING SAMPLE_____

2006 updated version

Chlorophyll "a" Sampling – You are helping in a science research project on the river. In 2005 we began collecting data on the chlorophyll measures in the river taken on the same day at multiple locations. This information is of value to us. Please help us in the careful collection of this data. Please carefully follow procedures.

PROJECT DESCRIPTION: 120 ccs of river water will be collected and filtered through a fine mesh spun glass filter to separate the detritus, sediments and chlorophyll using the following protocol.

1. COLLECT YOUR WATER SAMPLE AND PLACE **IT IN THE SHADE**.
2. Open the filter holder (unscrew) – and using tweezers pick up a piece of filter paper and CAREFULLY place it in the **very center** of the holder and reseal the holder. Make sure the filter is **centered perfectly** and does not get caught on the threads while resealing. Put the holder aside while you complete step #2.
NOTE: DO NOT LOOSE THE SMALL "O" RING SEALER IN THE HOLDER.
3. STIR YOUR SAMPLE and then "suck" 60 ccs of water into the syringe.
4. Screw the filter holder on the end of the syringe and empty the syringe pushing the water through the filter at a steady stream. DO NOT USE EXCESSIVE FORCE.
(NOTE: the water you push through should not be added back to your sampling water).
5. Unscrew the filter holder. Refill the syringe a second time and repeat to push an additional 60 ccs of water through for a total of 120ccs through the filter.
6. Unscrew the filter holder. Look at the filter paper without touching it. Be sure it is not ripped or torn. If it is repeat the process. Compare the coloration to the chart and record the number most closely resembling the filter color.
7. USING THE TWEEZERS remove the filter paper and fold it without touching the sample surface. Slide it into the 5mm vial and seal it.
8. Label your vial with the following protocol – USE A PERMANENT MARKER:
Date – River Site –River Mile_ cc volume EXAMPLE:
101206_PP_25_120cc
9. **Place the vial on ice** for pick up by one of the traveling Snapshot Day helpers.



Snapshot Day Activity IIV – Sediment Sampling Background

SEDIMENT SAMPLING – hand cores were distributed to a group of our participating stations to test this process. If you don't have a corer you can skip this activity.

You will take two cores. The first one you will examine and describe with your group; the second one will be collected in a Ziploc bag and returned to Lamont-Doherty Earth Observatory for X-Ray Fluorescence analysis (this will be picked up with your chlorophyll sample). 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:
100207_PP_25 (for Piermont Pier)

Discussion items before extruding:

- The sediments in the core represent a period of time. The material at the bottom is older than the material on the top.
- 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 range 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 it is whether the color changes over the length of the core. 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 usually represents the most recent deposition. Measure this and record it to determine how active the deposition in your area is. 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 like smell. Measure and record this section as well. Take a few additional minutes to observe the core and describe anything else that you think is significant. Are there other visible layers? Color changes? Before you extrude your core, make sure you measure the total length of the core.

  Length of entire sediment sample core**:** _____ **(**units used)

  Length of top layer of sediment sample core: _____ (units used)

  Length of second layer of sediment sample core: _____ (units used)

  Anything else you notice about the core? (colors, layers, etc.)

TO extrude a core follow the directions on the next 2 pages. Once you push the core out of the tube use the additional sheet captioned "Snapshot Grab_Log" to complete your examination.

DIRECTIONS: SEDIMENT SAMPLING PUSH CORER ACTIVITY

Your push-corer kit should contain 3 pieces:
1. The push corer, which is the long white PVC pipe with the valve on the end.
2. The clear plastic sampling tube.
3. The solid white dowel to be used to extrude or push the sediment sample out of the clear tube.

You will take two cores. The first one you will examine and describe with your group; the second one will be extruded into a Ziploc bag and returned to Lamont-Doherty Earth Observatory for X-Ray Fluorescence analysis (this will be picked up with your chlorophyll sample). 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:
1002070_PP_25 (for Piermont Pier)

ASSEMBLE THE SAMPLER: The sampler will need some **MINOR** assembly.
1. Loosen the plastic nut located on the end of the push corer. A few turns is all that is necessary; there is no need to completely unscrew the nut from the push-corer.
2. Insert the clear plastic tube in the opening until it seats in the end of the push corer. It should go in a few inches.
3. After the tube is inserted, tighten the nut firmly, this is necessary to hold the core tube **firmly** during sampling.
4. Once the push corer is assembled, make sure the red valve is **open** (valve handle is in line with the corer). It is closed when the valve handle is perpendicular to the corer.

SAMPLING:
1. Find an area in the water where the sediment is soft enough for you to push the clear end of the sampler straight in. You might have to try several times to find an area you can penetrate. (NOTE THE CLEAR TUBE IS STURDY BUT NOT INDESTRUCTABLE SO DON'T MUSCLE TOO HARD.)
2. Once the sampler has been pushed into the sediment, reach down in the water and close the red valve. (If the water is too deep to reach the valve, you can pull up the corer carefully and close the valve once it is within reach. The valve closing provides pressure to hold the sample in the tube – in deeper water the water pressure over the sample will do this.)
3. Once the valve is closed, gently pull straight up on the corer.
4. Keeping the sample upright bring it in to do your discussion/descriptions.

DISCUSSION:
HOLDING the sample upright, examine the core and discuss it with your students while it is still in the tube. **Turn to the prior page on your protocol sheet for points to focus on before extruding.**

EXTRUDING THE CORE:
1. When you are ready to extrude your core, loosen the plastic nut holding in the clear core tube. This should release the tube. Placing the white solid dowel in the bottom of the tube, gently pull the core out of the push corer.
2. Once the core tube has been removed from the push corer, GENTLY pour excess water of the

top of the core (tip slowly so as not to loose any sediment).
3. Once the water has been removed, turn the core on its side and push the white plastic dowel into the bottom of the core tube, forcing the sediments out the top. If this is the sample for group examination push it onto a tray or a plate or other flat surface. If this is the sample for XRF analysis, push it into a ziploc bag and seal it. Do not worry about it being squished – we will be mixing the sample to analyze it.

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. Using the sheet record your findings on smell, rocks, shells etc. Discuss how these items might have ended up in the river and the role they play there.

X-Ray Fluorescence (XRF) Spectrometer– What does this mean – This piece of equipment can be used to measure lead and other metal concentrations in the sediments. There is a natural background reading of lead in the river (approx. 20ppm) but 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 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 after 1900.

(**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 SEDIMENT GRAB 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					H2S smells of rotten eggs
Oil					
Oxidized top*					oxidation is a destinctly lighter color sediment
					estimate dimensions of oxided etc. and draw below

	Absent	Rare	Common	Abundant	Additional Comments
Clay					dense feel
Mud					smooth feel between fingers
Sand					gritty feeling between fingers
Gravel					pea sized pieces of stone
Pebbles					pieces of stone larger than pea
Leaves					
Wood					
Shells Oysters (dead/live?)					
Fresh water mussels except zebra)					
Zebra mussels					
macroinvertebrates					
Brick					
Coal					
Slag					
Living vegetation:					
Length of Core:					Length of Oxidized core top (if present):
If Bagged - Number On Core Collecion Bag					

Use this area to sketch the sample - show total measurement, amount of the oxidized top any other noted features.

Snapshot Day Recording Sheet VIII - Chemical Measurements

1. **Ph**

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. 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. 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 a waterfall, - 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)

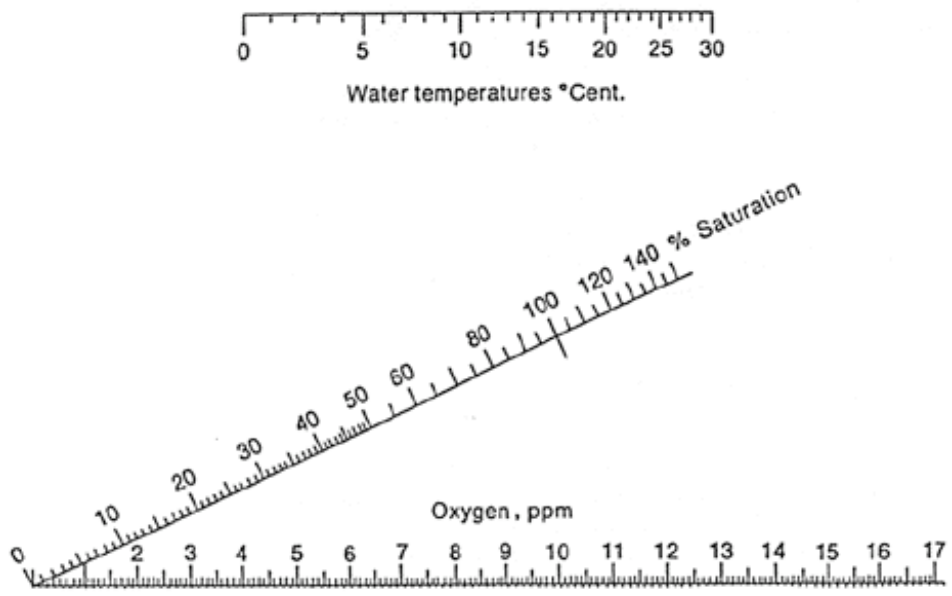
Drop count test kits___ ampules___ digital titrator___ meter___ other____

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. Waters 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:_____

FRESHWATER SPECIES

# of this Species	**Species Type**
	Alewife
	American Eel
	American Shad
	Amphipods
	Banded Killifish
	Blue Crab
	Blueback Herring
	Bluegill
	Damselfly Nymph
	Dragonfly Nymph
	Golden Shiner
	Grass Shrimp
	Herring
	Hogchoker
	Isopod
	Leech
	Mayfly Nymph
	Mud crab
	Pumpkinseed
	Sculpin

	Shore Shrimp
	Smallmouth Bass
	Snail
	Spottail Shiner
	Stonefly Nymph
	Striped Bass
	Sunfish
	Tesselated Darter
	Threadworm
	Water Flea
	Water Penny
	Water Strider
	White Perch
	White worm
	Yellow Perch
	Zebra Mussel

BRACKISH & SALTWATER SPECIES

# of this Species	Species Type
	American Eel
	American Shad
	Amphipods
	Aquatic Isopods
	Asian Shore Crab
	Atlantic Menhaden
	Atlantic Silversides
	Atlantic Tomcod
	Barnacles
	Bay Anchovy
	Bivalves (mussels)
	Blackfish (tautog)
	Blue crab
	Blueback Herring
	Bluefish
	Bluegill sunfish
	Carp
	Comb Jellies
	Elver
	Grass shrimp

	Hogchoker
	isopods
	Menhaden (Bunker)
	Minnow
	Mummichog
	Northern Kingfish
	Pumpkinseed
	River Herring
	Scuds
	Sea Squirt
	Shore shrimp
	Striped Bass
	Striped Killifish
	Tautog
	Weakfish
	White Perch
	Yellow Perch
	Zebra Mussel

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

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

Taxonomic diversity:

Class	**4**
Order	**26**
Families	**73**
Genera	**150**
Species	**212**

Fish taxonomy list compiled and contributed by:

Tom Lake
NYSDEC Hudson River Estuary Naturalist
trlake7@aol.com
September 2005

Snapshot Day Activity X- Other Observations

1. **Shipping.**

Should you see large ships, tugs, or barges pass your site, note the following information if possible. 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.

Time	Type of ship	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. For whatever reason, this year's crop of striped bass is running 2-3 times the average size for this time of the year. 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:

Scientific or Naturalist Journaling

How do we learn about our natural environment? We **observe.**
Direct observation and careful description helps us compare species, habitats and different geographical regions.
John Muir, a famous naturalist and conservationist, wrote "When we try to pick out anything by itself we find that it is bound fast by a thousand invisible cords that cannot be broken, to everything in the universe."
Through journaling we hope to observe, record and better understand some of these relationships.

We can learn about plants (flora) and animals (fauna) by looking at some of the following factors and then recording our findings, complete with drawings or sketches, in our journals.
Examine:

1. Their appearance. How big are they? How are they shaped? What appendages, if any, do they have? What color are they?
2. How they relate to each other.
    a. Do they cluster together or are they found alone?
    b. Are large and small, young and full grown, samples found together?
    c. Are they often found with one or two other specific types of plant or animal?
3. What is the water temperature like where they are found? The water chemistry?
4. Are they always found in the same type of habitat? (dry, wet, sandy, rocky)

You will be keeping a journal during Snapshot Day. Use the front and back of is sheet to record anything you feel is noteworthy or important. Take time to sketch, write or put down a few notes at each station or activity, not just the facts. Describe what you see, sketch things, and try and write down WHY you think something is of interest.