Cloudy With a Chance of Sediment

Overview:
This is an activity that teaches how to use a common piece of scientific equipment over a period of time while collecting data. Students will make a Secchi Disk and use it to measure the turbidity of the water near their program.

Ocean Literacy Principles:
1. The Earth has one big ocean with many features
2. The ocean and life in the ocean shape the features of Earth
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

Key Concepts:
- As a longer-term project, this will teach students to think about changes in their environment over longer time scales and understand the fluctuation of measurements over a period of time.
- It will get kids brainstorming about the things that humans contribute to the water that can affect the ecosystem in a negative way.

Materials:
- 30 feet of non-stretch line (longer if your water tends to be clearer)
- permanent markers in red and black (or any 2 colors)
- 3 aluminum pie plates
- glue
- black and white acrylic paint
- 1-2 pound weight (whatever can be securely tied)

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Duration:
The ideal timeline for this kit is 2 weeks or longer with individual measurements being taken every few days. At the end of the time period you should have 5-10 measurements.
- 30 minutes for the introduction and the first measurement
- 10 minutes for each subsequent measurement
- 40 minutes for the last measurement and the discussion.

Physical Activity:
Low

Background:
Turbidity is essentially the amount of "stuff" in the water (that stuff is more properly called the total suspended solids -TSS). These are particles that are not dense enough to have settled on the floor of the basin (bay, lake, estuary, etc). A Secchi Disk measures the turbidity of the water by dropping a weighted black and white disk into the water and measuring how deep it goes before "disappearing." This distance is called the Secchi Depth. Having low turbidity, and therefore a deeper Secchi Depth, often indicates a healthier ecosystem in your home waters. When turbidity is low, it means there are less suspended solids and the water will be clearer and cleaner looking. When turbidity is high, there are more suspended solids in the water and it will be cloudier and dirtier looking. Most of the time, higher turbidity comes from man-made sources. Things like mining, construction, and agriculture will all put a lot of sediment (small rock fragments, dust and dirt) into the water. Coal mining in particular creates a lot of dust particles that enter the water ecosystem. When turbidity is high, plants on the basin-floor have trouble getting enough light to survive, which can affect the local food web. Additionally, fish will have trouble getting oxygen from filtering water through their gills because of the added suspended solids in the water.

Secchi Depth can also change dependent on changes with local conditions. An extended period of higher wind conditions or faster currents (as can be found during a full or new moon) will "stir up" the bottom more and can re-suspend some particles that have settled on the bottom of the basin. Additionally, heavy rains will usually introduce more particles into the basin with runoff from the land. Both of these conditions will result in a smaller Secchi Depth, and therefore water with a higher turbidity. For more information on how Secchi Disks are used by scientists and how results vary around the world, check out Plymouth University's Secchi Disk project: www.secchidisk.org

Activity:
Preparation (with students – more time or prior to activity):
1. Cut the sides off the pie plates and glue three of them together.
2. Paint the plates white and set aside for drying.
3. Paint two quarters black so you end up with four equal sized "slices" in alternating white and black (refer to the images below).
4. Cut a hole through the plates and run the line through so there is about a foot out the bottom (the painted side is the top). Tie a knot at the base of the plates.
5. To mark the line, start at the top-side of the disk and use the permanent marker to color a

red line every 5 centimeters and a black line every 50 centimeters.
6. Tie the weight off securely at the bottom end of the line.
7. Print out measurement charts. You will want one chart for each site you want to measure.
8. Select the ideal site or sites. The site should be somewhere that you can easily return to, such as off a dock or at a permanent buoy (not a channel marker). The place of measurement should be reasonably close to water level (within 3 feet). Do not measure from a beach.

Measurements:
1. Measurement with a Secchi Disk should be taken near the middle of the day when the sun is more directly overhead. Do the first measurement to show your students how it is done and let them all try after you demonstrate.
2. Keeping your back to the sun, lower the disk down into the water. Keep lowering the disk until it disappears.
3. Pull the disk up and down a few inches to find the exact depth where the disk disappears. The distance from the top of the disk to the water line is your Secchi Depth.
4. Using the marks, figure out the depth and record it on the chart.
5. Record the recent weather along with the date and location of the measurement. You will want one chart for each location you use.
6. Let the students pair up for each subsequent measurement and ensure that all of the relevant data gets recorded onto the chart.
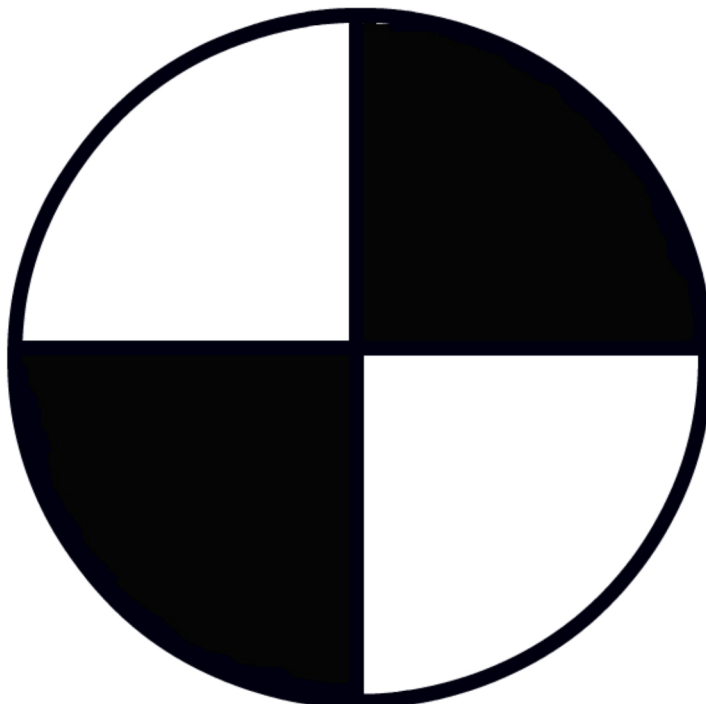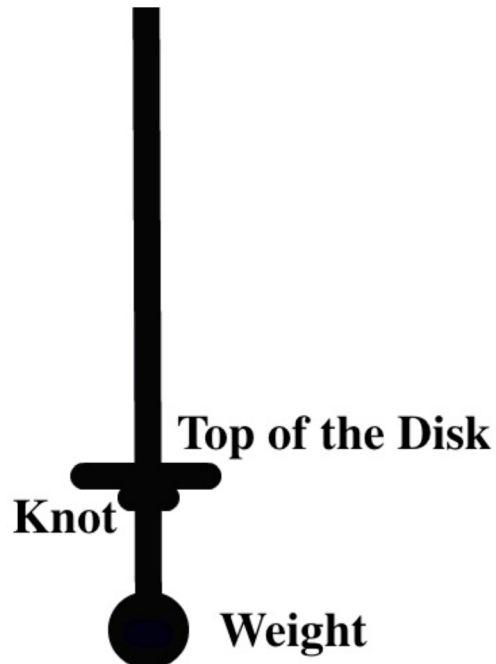
Discussion:
1. Why was it important to record the recent weather when taking the readings?
2. What kinds of conditions will make the turbidity of the water higher?
3. Are there any conditions that would reduce turbidity of the water?
4. What are some things that will cause there to be more suspended solids in the water?
5. Why do we use meters instead of inches or feet?
6. What are some things that humans add to the water that will increase turbidity? Where do these things come from?
7. What are some negative effects of increased turbidity?

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Diagrams

Top of the Disk

Knot

Weight

KIDS ENVIRONMENTAL LESSON PLANS
Cloudy with a Chance of Sediment (cont.)

SAILORS
FOR THE
SEA
POWERED BY OCEANA

Secchi Data Chart

Location:_____

Measurement	Date	Secchi Depth	Recent Weather
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			