

Clam Survey and Mud pH Field Studies Lesson Plan

Overview:

Ocean and coastal acidification is affecting Maine's shellfish. Dr. Mark Green of St. Joseph's College studies the effect of mud pH on the juvenile clams. He found that their shells dissolve almost completely over a 2-3 day period in mud with a pH of 7.5. (See <http://youtu.be/kwZxq5sKLuI?t=1m49s>)

Friends of Casco Bay has studied mudflat pH and found that mudflats below 7.8 are generally not productive. Marine Environmental Research Institute measured the pH of mud in Blue Hill at six transects at varying tide heights. They found that the pH decreased as tide height decreased. Chris Petersen at College of the Atlantic has also done similar studies at various sites around Mount Desert Island with similar results.

Students at the MDIBL 2014 Student Marine Science Symposium did field studies modeled on FOCB, MERI and COA's studies. They found that the pH was lower at lower tide heights, and that clams were more prevalent in the higher intertidal area. What will you find in your area?

Materials/ Prep Needed:

Intro Presentation	Shovels
GPS units (optional)	Sieves
Measuring tapes	Large cups for scooping water
Transects (30-40 ft)	Clipboards with data sheets (waterproof paper)
pH meters	Pencils
sample vials (3 per group)	Rulers or calipers
Buckets (1 per group)	Distilled water
PVC cores marked on inside at 1 inch	Containers for distilled water

Activity	Time for 90-min class	Alternate times
I Introduction	10	
II Travel to study site	5	
III Distribute materials/ measure 6 transect locations	15	
IV Clam survey and pH measuring	30	
V Wrap up	10	
VI Clean up	15	
VII Travel	5	

I Introduction:

Show students background and methods presentation (here). Or, tell students about Dr. Green's findings and explain the methods as follows:

"We will be measuring the acidity of mud on the shore at different tide heights and looking for where juvenile clams are settling. We will set up transects at regular intervals from the water line to the high tide line. To set up a transect, stretch a rope parallel to the water so it's the same distance from the water at both ends. Measure the distance from the water and record it on the data sheet. Next measure two feet along the transect from one end, and insert the PVC pipe into the mud at that point so that it is as deep as the 1-inch mark on the pipe. Slide a small shovel under the pipe and then lift, trying to prevent any of the mud inside the pipe from falling out. Empty it into a sieve. Pour sea water into the sieve to wash out the mud. Count and measure any clams that are in the sieve and record on the data sheet. Then return them to the hole. Measure another two feet down the transect and repeat. Repeat this process until you get to the end of the transect.

"In the meantime, other members of each group should measure the pH of the mud along the transect in three places. To do this, combine a teaspoon (use a plastic spoon) of surface mud with distilled water in a small plastic container and combine by capping the container and swirling the mixture. Then insert a calibrated pH meter into the mixture and wait. Record the number the meter settles on onto your data sheet."

II Field Studies

Students put on boots, head to study site at low tide. Distribute clipboards and materials to 6 groups.

Procedure:

1. Students go to their sites (tide heights 1-6) and set up a transect each
2. One or two members of each group get buckets of seawater.
3. Every two feet along the transect, group members use 4-inch PVC pipes to core 1 inch of mud, and dump the core into the sieve. Scoop sea water wash to mud through sieve.
4. Students count and measure clams, enter data on data sheets. Record zero on one line if there are no clams in a core.
5. Take a mud sample at each end and in the middle of the transect, add distilled water to each and test the pH of each, entering the readings onto their data sheets (3 per transect).

Wrap up: Students gather into a group or circle and share their measurements. Where was pH the highest? Lowest? Where were the most clams? Least clams?

Clean up: Students help carry materials to vehicle, hand in data sheets.

EXTRA

Prepare an area of the mud by sprinkling crushed shells thickly over an area two or more weeks before the students' field trip. On the day of the study, each group should take a sample of mud from the crushed shells area, measure pH and record on data sheet. Also measure pH of mud in a nearby area at the same tidal height and record on data sheet. Is there a difference in pH?

III Wash off boots and materials.