

# Where the River Meets the Sea

## Activity Description

This activity shows students how the different densities of fresh and salt water allow for the water to be able to be stacked on top of each other.

## Take Home Message

Students should understand that freshwater floats on top of saltwater. Students should also understand that there are places where salt and fresh water mix, i.e. estuaries and herring runs.

## Massachusetts Frameworks

Physical Science

Properties of Matter #2

## Supplies

- Flat bottom glass tubes, 20 ml size
- Pipettes
- Salt
- Ice
- Source for hot water, electric kettle
- Mixing spoon
- 1 Tupperware container for mixing
- 1 Tupperware container for rinsing after activity is done.
- Food coloring
- Sponge
- Salt Wedge Estuary Picture
- Density bottle
- Bucket for dirty H<sub>2</sub>O



## Set-up

1. Set out two Tupperware containers on the table and add the following  
Container 1 – 3/4 cup salt per Tupperware of cold water  
Container 2 – no salt and warm water
  1. You can get the water from the electric tea kettle, you will want to add this shortly before the kids arrive, try not to make it too hot to burn. If it feels like it is, then just add some room temperature water to cool it down a little bit.
  2. This represents the water that is found on the top layer of the ocean and mixing in from the streams
2. Put a different color of food coloring into each of the containers to tell them apart and mix the salt in well.
3. Give one vial to each student.
4. There should be a Tupperware that you can use for clean room temperature water to clean the vials between groups as well as a larger pitcher. This pitcher is for the kids to discharge their vials after finishing or when they mess up. You should make it through a session with just the one discharge bucket and the mixtures you made up.

**Note – *The bigger the temperature and salt differences, the better results the students will get.***

***If the students ask why the water is hot/cold – explain that you’re trying to simulate the temperatures of rivers/seas respectively – rivers are shallow, thus sunlight can penetrate them to heat up the water – oceans are deeper and don’t allow sunlight to get through as easily.***

## Activity Procedure/Script

- When the students get to the table, start off by asking if they want to do an experiment with you.
- Ask them what the name of the table is (on the sign attached to the table).
- Pose the question to them: “What do you think happens where the river meets the sea?”
- After answers are given ask “what kind of water is in a river?” (fresh) “...and sea?” (salt). Ask which one of those two types of water is heavier.
  - They’ll say “salt”, ask “why”, they’ll say “because there is salt in it.” Say salt is a mineral and it makes the water heavier.
  - Explain that we don’t use the word “heavy” because it’s not a scientific term and clearly we’re scientists – tell the students that salt water isn’t “heavy”, it’s “more dense” than fresh water. Ask if any of them have heard of density – ask for definitions.
  - Higher density is when the molecules of the water are more closely compacted together than less dense water.
  - Give the analogy of making a snowball – pack snow more tightly
- Ask the students what the composition of water is: “H...?” they’ll say “2O!”
  - Explain that the fresh water is just “H<sub>2</sub>O”, but the salt water is “H<sub>2</sub>O plus the salt” – that H<sub>2</sub>O + salt has to fit into the same amount of space as just the regular H<sub>2</sub>O – this is why salt water is more dense – it’s got more stuff in the same space as fresh water.
- Return to the idea of the river and sea meeting – ask them, based on what they know about water densities, what they think will happen when the river and sea come together – they probably won’t know yet, so guide them to the idea of water layering by bringing out the density bottle – explain why the density bottle works (oil is less dense than water, even though it feels thicker) – tell the students that the experiment you’re going to do together is like the density bottle, except instead of oil and water, you’re going to use salt water and fresh water – hopefully you’ll get something that looks a little like the density bottle.
- Hand each of them a vial – tell them that you’re going to begin with two pipettes of fresh water (make sure they know what a pipette is – scientific term for “eye dropper”). You demonstrate first then let them put the fresh water in their own vials – telling them to stop after this first step, because the next step is when it gets a little tricky.
- Next get a pipette of the salt water – emphasize that this is the more dense water and ask them where they think it’s going to go, top or bottom?

- Talk them through: put the pipette all the way to the bottom of the vial without squeezing – slightly tilt the vial while holding it to form a “V” in the bottom corner edge – put the pipette in this “V” and squeeze gently, slowly, and consistently – don’t use your pipette like a plunger – NEVER LET GO OF THE SQUEEZE ON THE TOP OF YOUR PIPETTE – this will suck up all the liquid together and mix it – emphasize that it’s okay if they mess up the experiment – that’s what science is, a series of tries and fails – tell them to keep trying and, if need be, go through the process with them step by step. Once most of them have it, ask them why the waters are layering – make sure they understand key words like “density” – not “heavy” v. “light” water. Once they’re done with the experiment, have the students dump the excess liquid in the discard bucket and have a Tupperware of clean water in which they should put the dirty beakers.



## **Clean – Up**

### *During the festival*

- You will have to flip the vials upside down and dry them out as best as possible, making sure to remove the salt that may have gotten in the vials.
- Check to make sure the Tupperwares are full of the different colors and you can check on the temperature differences. If there seems to be only a small difference, you can add some ice or hot water to improve the differences
- If you found that the experiment wasn’t working too well, you may also want to increase the salt differences or just start from scratch.

### *After the festival*

- You will need to completely clean out the vials and dry them thoroughly. You also need to empty all the water down the drain. It works best if you can get it all into one or two containers or if you can dump it all into a bucket to bring to the bathroom. Everything is safe to dump down the drain!
- Make sure everything is dry and stacked neatly back in the container.