Session 1:
How do oceans move?

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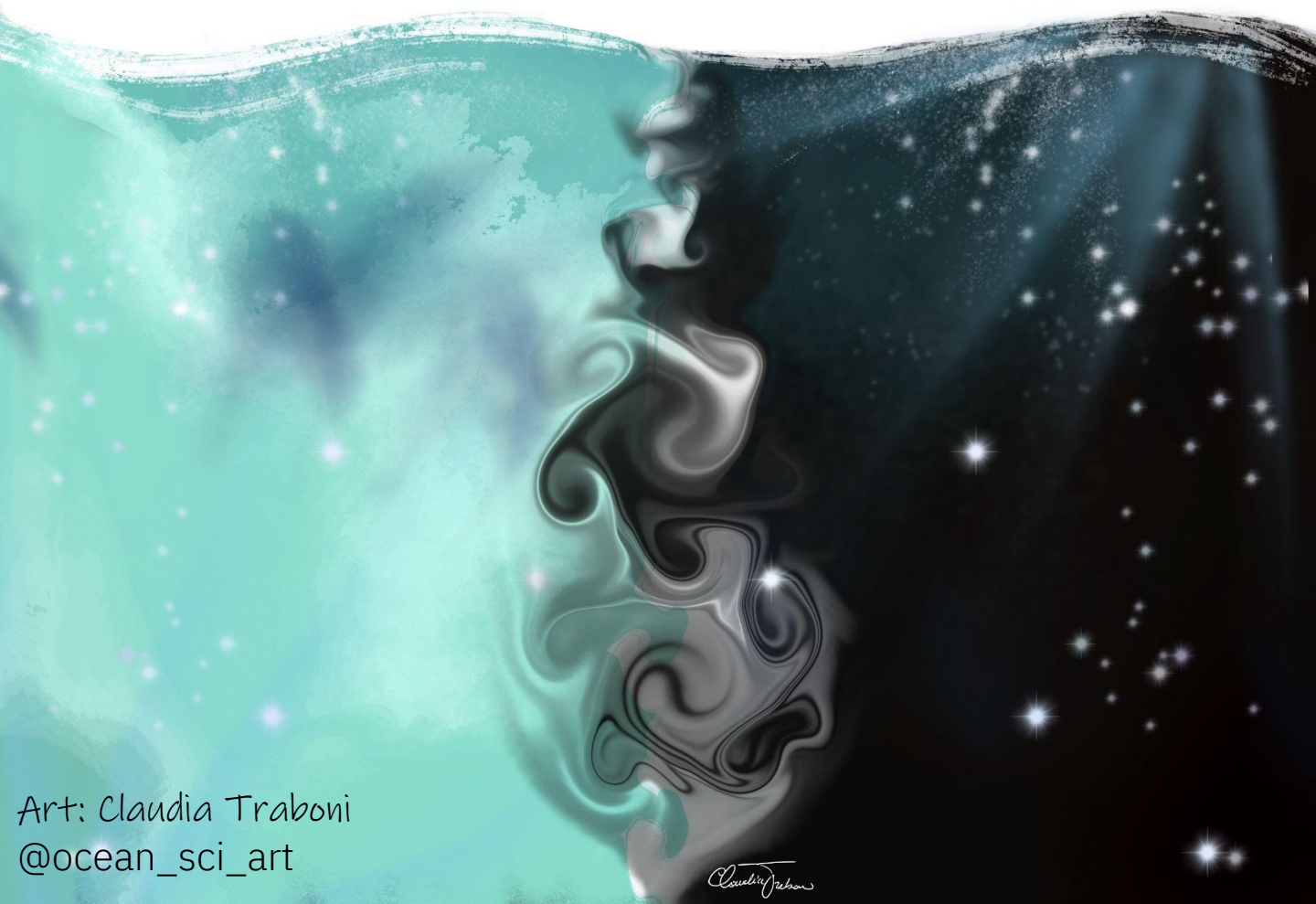


Art: Claudia Traboni
@ocean_sci_art

Experiment 1: saltwater versus freshwater

Food for thought:

Have you ever tried floating in a river and in the ocean? Where do you think it would be easier to float? To answer this, let's think about the main differences between rivers/lakes and the ocean!

What you will need:

- ❑ 2 small ducks
- ❑ 2 plastic cups
- ❑ Table salt
- ❑ 1 short paper straw
- ❑ Tap water

Step 1:

Fill one cup with tap water.

Step 2:

Gently, place one of the ducks on top of the water surface and observe. What happens?

Step 3:

Fill the second cup with tap water.

Step 4:

Add the table salt to the second cup.

Step 5:

Stir it well with your short paper straw.

Step 6:

Gently, place the other duck on top of the water surface and observe. What happens?

How it works?

As you place the ducks in cups with different waters (freshwater versus saltwater), you will learn that the saltwater is denser than the freshwater, since the ducks will float in one cup and sink in the other.

Now let's think about the ocean! Would you expect saltier waters in the surface or in the deeper ocean? **Add your findings here!**

Experiment 2: cold water versus warm water

Food for thought:

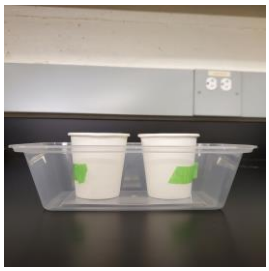
Have you ever noticed how the seawater changes across seasons? What is the most obvious change that we can feel when we swim during winter or by the end of a long summer day?

What you will need:

- ❑ 2 food coloring
- ❑ 2 paper cups
- ❑ 2 plastic cups
- ❑ 1 plastic tray
- ❑ 1 short paper straw
- ❑ Cold & warm water

Step 1:

Put the paper cups inside the tray, side by side.



Step 2:

Add cold water to one of the paper cups + 6 drops of the cold food coloring and stir it well.

Step 3:

Add warm water to the other paper cup + 12 drops of the warm food coloring and stir it well.

Step 4:

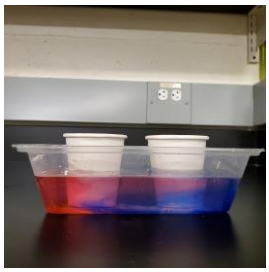
Add tap water to the plastic tray until it is half full (make sure it does not surpass the level of water in the paper cups).

Step 5:

Gently remove the tapes of the warm cup and then of the cold cup.

Step 6:

Observe the colored flows you created for a few minutes. What happens?



How it works?

As you release the water from the paper cups into the plastic tray, you will learn that cold waters are denser than warm waters, because once the colored flows meet, the cold water will flow downwards and the warm water will flow upwards.

Now let's think about the ocean, would you expect colder waters in the surface or in the deeper ocean? **Add your findings here!**

Experiment 3: turbulence in the water

Food for thought:

Depending on the day, the ocean can be very flat or very turbulent, with many messy waves that look like little clouds. What do you think is the major force that causes that?

What you will need:

- ❑ 2 plastic cups
- ❑ 1 plastic funnel
- ❑ 1 food coloring
- ❑ 1 paper straw
- ❑ 1 short paper straw
- ❑ Cold & warm water

Step 1:

Fill ¼ of the plastic cup with cold water, add 6 drops of food coloring and stir it well.

Step 2:

Fill 2/3 of the other cup with warm water and gently position the plastic funnel in it.

Step 3:

Gently add a little bit of the cold colored water through the funnel.

Step 4:

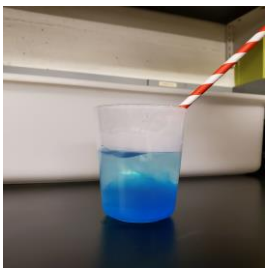
Gently remove the funnel and check what happens at the bottom of the cup.

Step 5:

Position the straw in a diagonal angle (but do not touch the water surface).

Step 6:

Now blow through the straw and look to the side of the cup! What happens?



How it works?

As you know, cold water is heavier than warm water. For this reason, the cold water stays at the bottom of the cup. Blowing through the straw creates whirl, bringing the cold water near the surface.

Now let's think about the ocean, what do you think creates whirl and can cause waters to move in the surface ocean? **Add your findings here!**

The movement of the global ocean

From your experiments, you learned that:

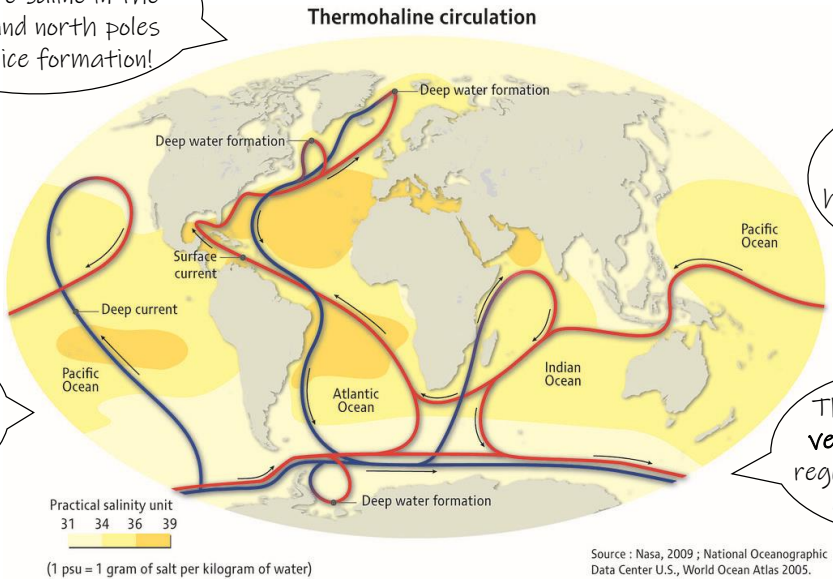
Salt, temperature and winds are the main drivers of ocean movement!

Salinity is the word used to describe how salty the seawater is.

Did you know that... local temperature and salinity can tell us about different water types, which ocean scientists call **"water masses"**!

Temperature & salinity controls the density of the water driving deep ocean circulation, also known as: **"thermohaline circulation"**.

Waters will be colder and more saline in the south and north poles due to ice formation!



Source : Nasa, 2009 ; National Oceanographic Data Center U.S., World Ocean Atlas 2005.

Surface currents (in red) transport heat from the tropics to the poles.

Deeper currents (in blue) transport colder waters back to the tropics.

This circulation is **very** important to regulate the climate of the planet!

Winds drive surface ocean circulation.

Did you know that... strong winds along the **California Coast** are responsible for a phenomenon called **"upwelling"**, which brings cold and nutrient rich waters from the depth to support a vibrant and diverse marine life!

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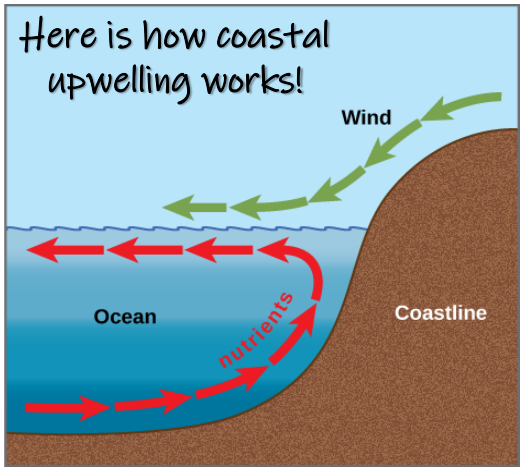

Now that you know how ocean circulation works, think about how global warming can affect it, marine life, and ourselves. **Add your thoughts here!**