

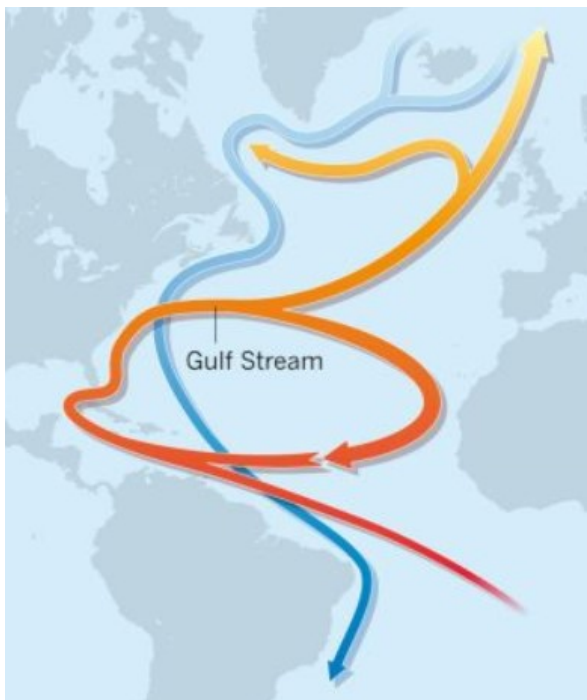
Changing Currents 6-8

Program Description:

How are ocean currents formed and how do they impact marine organisms? Ocean currents are moved around the planet predictably by gravity and wind and help contribute to our global climate. Everything on Earth depends on the harmonious movement of the currents including the smallest microorganisms. Students will consider how currents are formed and how they directly affect microorganisms, which in turn affects marine food webs.

At the end of program, students can...

- Describe how ocean currents are formed.
- Discuss the importance of ocean currents on the planet's climate.
- Analyze the affect that ocean currents have on microorganisms.



Background:

Currents are a large movement of water in one direction. Currents can be temporary or long-lasting; they can be near the surface or in the deep ocean. The largest ones shape the Earth's global climate patterns (and even local weather conditions) by moving heat around the world. Microorganisms live in every corner of the planet, from inside other animals, to extreme environments like hydrothermal vents and are directly affected by the behavior of currents.

What to Know Before



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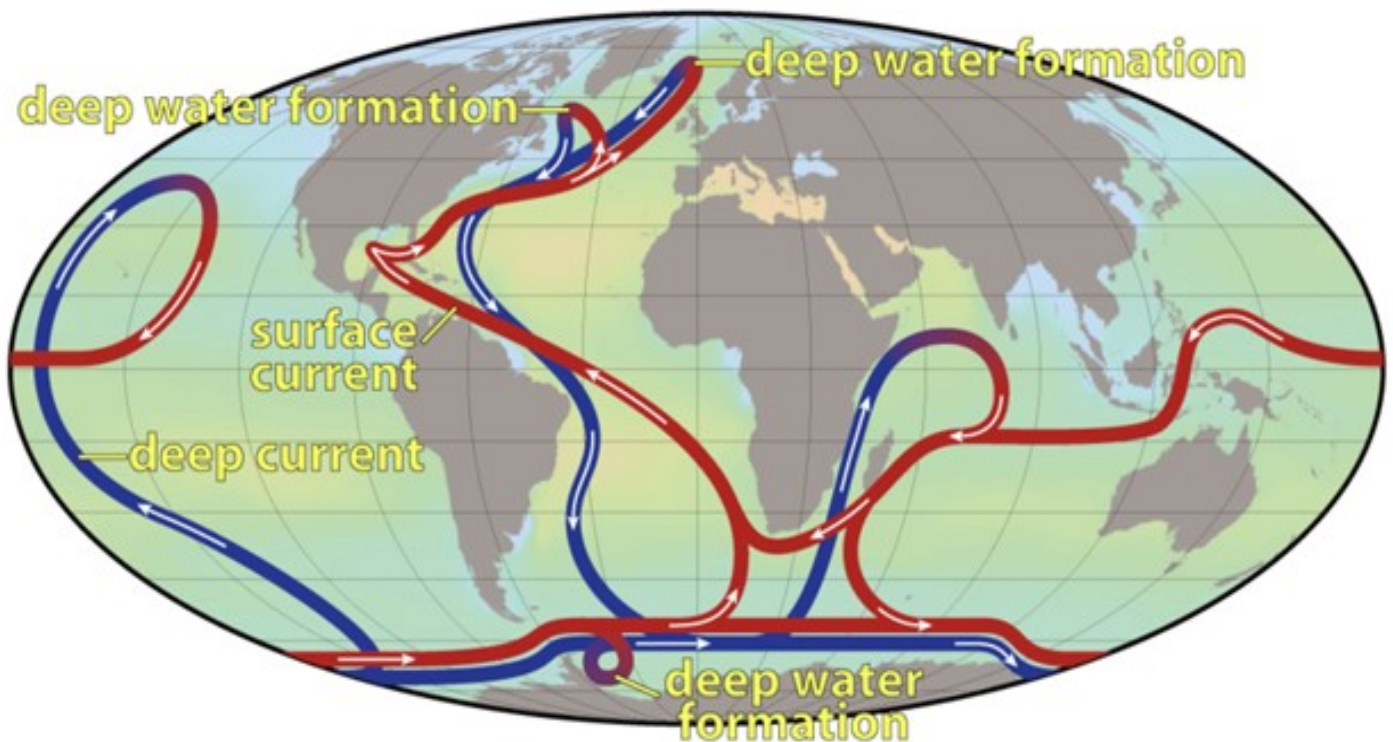
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All About Currents!

- Many large currents are driven by differences in temperature and salinity. In the Arctic, cold salty water is left behind when ice freezes, and this denser water sinks towards the sea-floor.
- This starts off a planetary current pattern called the Global Conveyor Belt that slowly moves around the world, taking 1000 years to make a complete circuit.
- In the northern hemisphere the rotation is clockwise and in the southern hemisphere the rotation is counterclockwise.
- Earth's rotation cause the currents to rotate in a circular pattern called the Coriolis Effect.

Thermohaline Circulation?

- These deep-ocean currents are driven by differences in the water's density, which is controlled by temperature (*thermo*) and salinity (*haline*). This process is known as *thermohaline circulation*.
- In the Earth's polar regions ocean water gets very cold, forming sea ice. As a consequence the surrounding sea-water gets saltier, because when sea ice forms, the salt is left behind. As the sea-water gets saltier, its density increases, and it starts to sink.
- Surface water is pulled in to replace the sinking water, which in turn eventually becomes cold and salty enough to sink. This initiates the deep-ocean currents driving the global conveyor belt.



What to Know Before

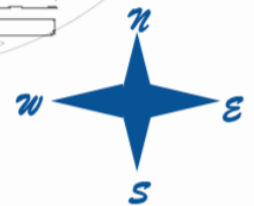
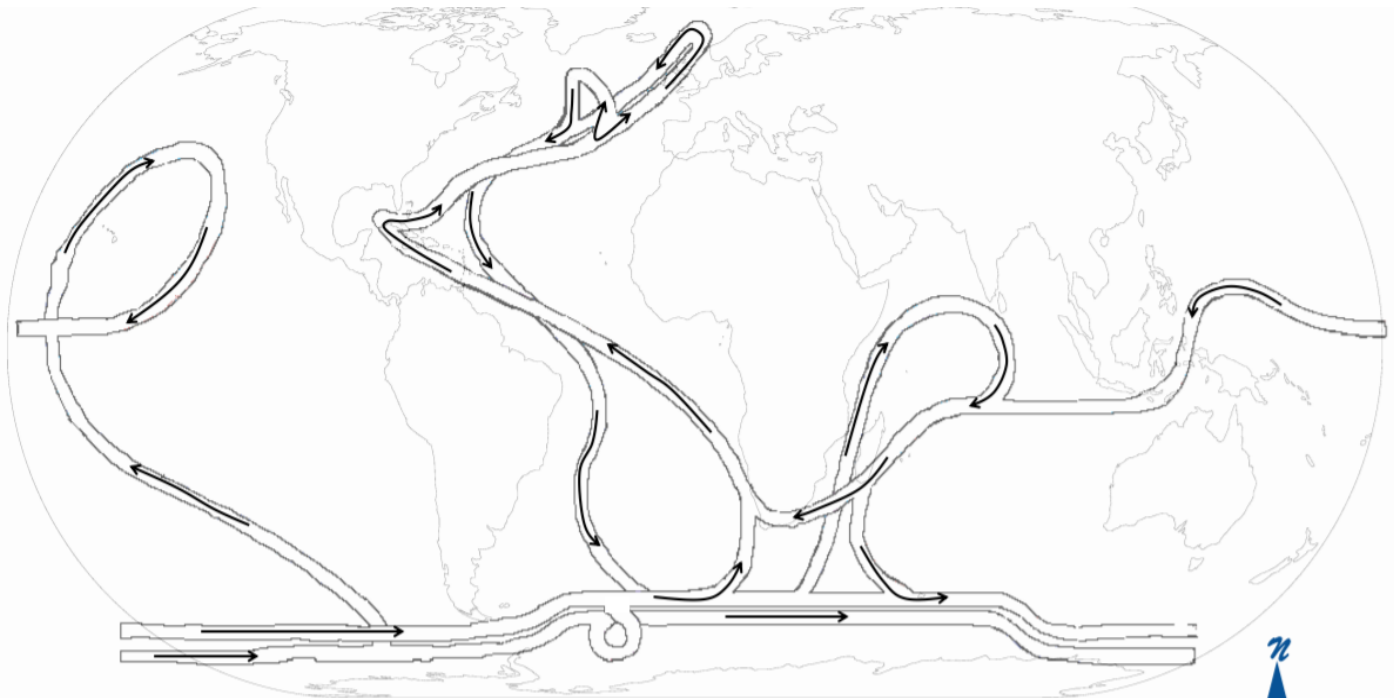


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Changing Currents 6-8

Instructions: Color the Global Conveyor Belt and note where the water temperature shifts from cold to warm and vice versa. In the space below, answer the following question with a short answer: Where are the current temperature shifts located and why do you think they change there? Does the temperature change with the depth of the current as well?



Color the Thermohaline to indicate where the conveyor belt is moving through **deep (blue)** or **surface (red)** currents:



Changing Currents 6-8

Instructions: Answer the fill in the blank questions below about microorganisms and plankton affected by ocean currents!

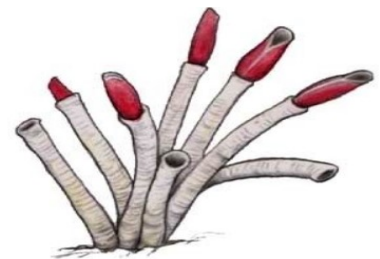
- What can cause a higher density level in water? _____

- What is the difference between phytoplankton and zooplankton?

- What are potential human causes of "Jelly Blooms" (Hint: there are four in total)? _____

- How does coral depend on the current to survive (Hint: there are two major ways)?

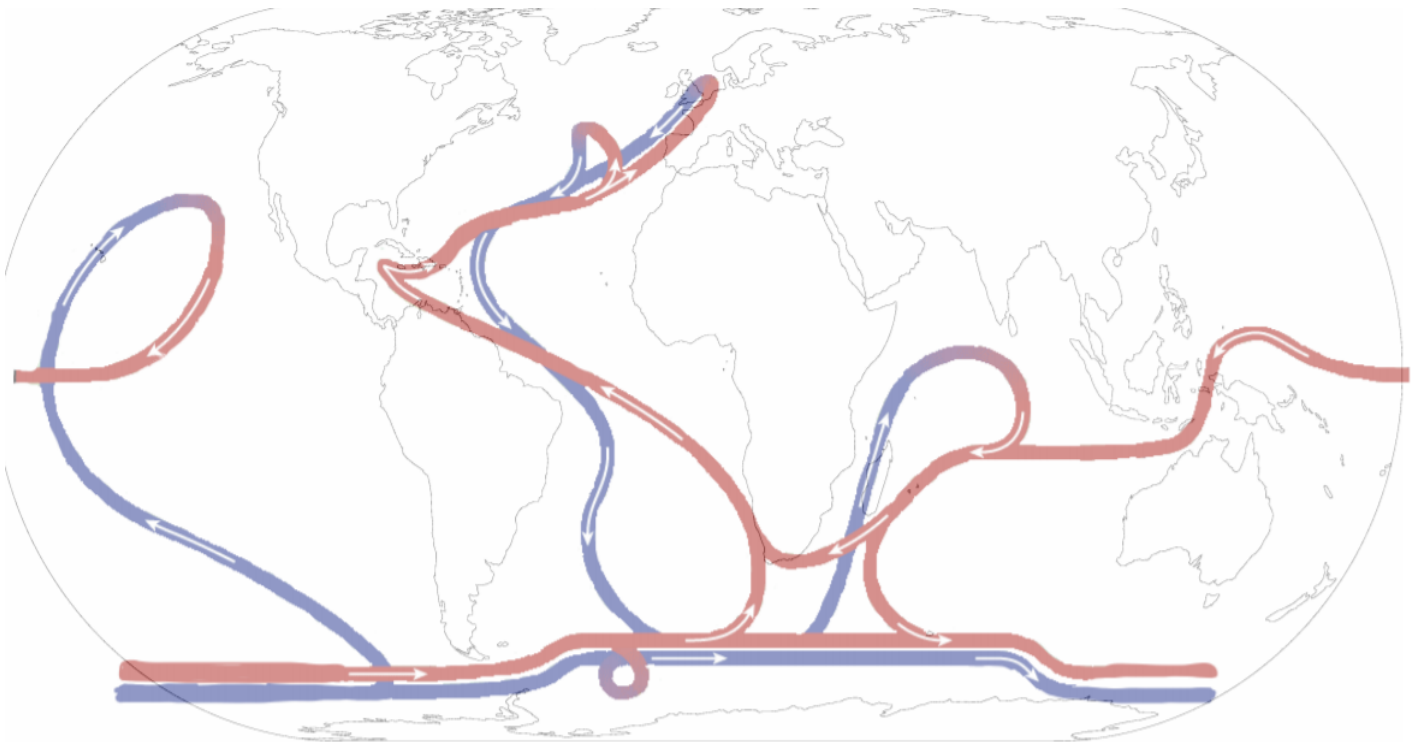
- What happens during a coral bleaching event?





Changing Currents 6-8

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The temperature shifts of the currents are located near the equator and the poles because of the extreme temperature difference there. The depth of the current flow also changes here with the temperature of the water. Colder and higher salinity water will sink to the bottom and warmer, fresher water will be introduced to make the flow rise.



Changing Currents 6-8

Instructions: Answer the fill in the blank questions below about microorganisms and plankton affected by ocean currents!

- What can cause a higher density level in water? **Higher salinity or Lower temperature.**
- What is the difference between phytoplankton and zooplankton? **Phytoplankton is plankton that is a plant. Zooplankton is plankton that is an animal.**
- What are potential human causes of "Jelly Blooms" (Hint: there are four in total)? **Overfishing, nutrients or fertilizer run-off, warming ocean temperatures and ocean sprawling.**
- How does coral depend on the current to survive (Hint: there are two major ways)? **Coral depends on currents to survive because the water movement pushes microorganisms to the coral for food as coral cannot move from their planted skeletons. Additionally, coral depends on currents to spread gametes during sexual reproduction to have the sperm and egg meet together to produce offspring.**
- What happens during a coral bleaching event? **The environment becomes inhospitable to zooxanthellae and they expel themselves from the coral tissue. This can be because of climate change, alterations in salinity, pH, sediments, etc. Nei-**

