



Oceans and Estuaries

The Project and Beyond...What you need to know

Why is the Ocean Salty?

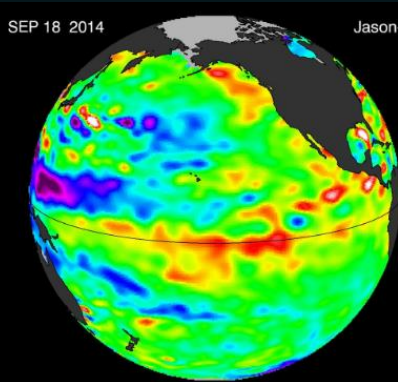
- Dissolved chemicals eroded from Earth's crust washed into the sea
- Solid and gaseous materials from volcanoes swept into the ocean by wind
- Materials dissolved from the ocean floor (hydrothermal vents)



What Affects Salinity?

- Increased by
 - Evaporation of ocean water
 - Freezing of ocean water
 - <https://www.youtube.com/watch?v=q7hkdiVuMb0>
- Decreased by
 - Rainfall on the ocean
 - Runoff from rivers into the ocean
 - Melting of ice caps/glaciers





Oceans and Global Climate

- Oceans collect, move and mix water, heat and CO₂ in huge amounts (more than the atmosphere)!
- Oceans regulate global temperature
 - Oceans store so much heat in the summer (and release it later when it's colder), it delays the seasons
 - Because of this, the seasons start later than the length of daylight tells us they should start - how much varies based upon the location
 - Climates near the ocean tend to be milder than the interior of continents.
- Ocean and atmosphere work together to create complex weather, like El Niño.

Ocean is Dynamic

- Important source of food and mineral resources
- Used for human recreation and transportation
- Largest reservoir of water on Earth
- Ocean currents distribute large amounts of energy and resources across the planet



Estuaries Mix Fresh and Salt Water

- Brackish water = not freshwater, but not as salty as ocean water
- Trap and mix nutrients and sediment carried by rivers and brought by ocean tides



Estuaries Support Life

- Fertile place for plant and animal life
 - One of the most biologically active ecosystems on Earth!
 - Fish, shrimp, crabs, clams, oysters, etc.
- Shallow, less than 30 feet deep in NC
 - You can see to the bottom
 - Promotes plant growth
- Rivers deposit sediments rich in nutrients
- Good nurseries
 - Protected environment for hatching and growing
 - Migrate to ocean to live adult life



Lots of Estuaries in NC

- Largest is Pamlico Sound (5 river basins and many marshes, swamps, forests, and grasslands provide water to this estuary).



Benefits of Estuaries

- Control erosion
- Reduce flooding of the mainland
- Sand bars (from sediment deltas) buffer ocean wave impact
- Swamps and marshes
 - Absorb impact of high ocean winds
 - Soak up heavy rain and storm surges
 - Release extra water into rivers and groundwater aquifers



Estuaries as a Filter

- Plants, animals and bacteria filter pollutants out of the water
 - Salt marsh plants trap some of the chemicals and pathogens carried by rivers and move them into the soil to be destroyed
 - Oysters filter impurities out of water as they feed (one oyster filters 25 gallons of water per day!)



Threats to Estuaries (thus also to oceans)

- Too much Sedimentation
- Too much Chemical pollution



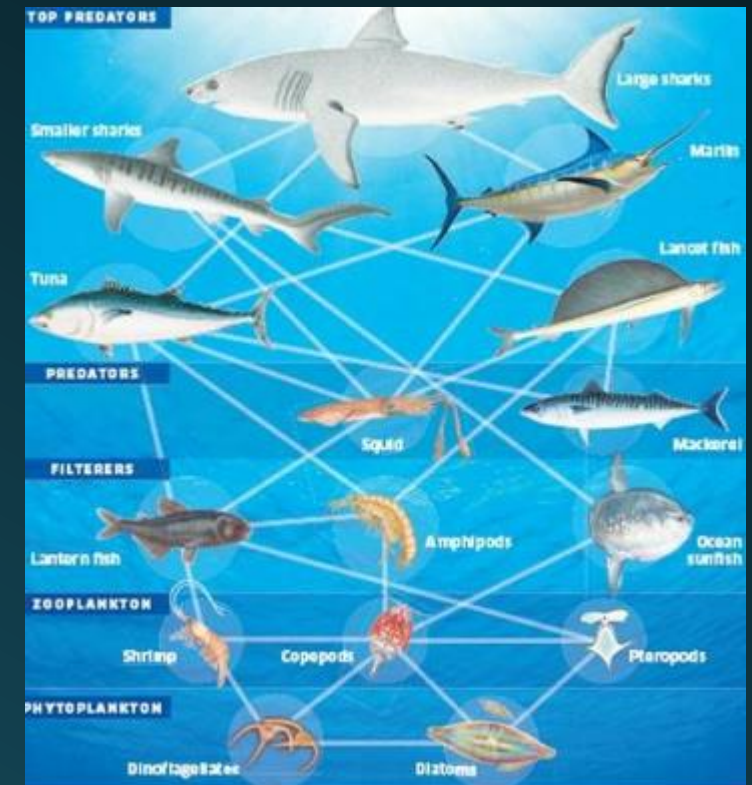
Ocean's Diversity

- From the seashore to its greatest depth, oceans have great diversity of life
- All life in the oceans, as on land, depends ultimately on plants



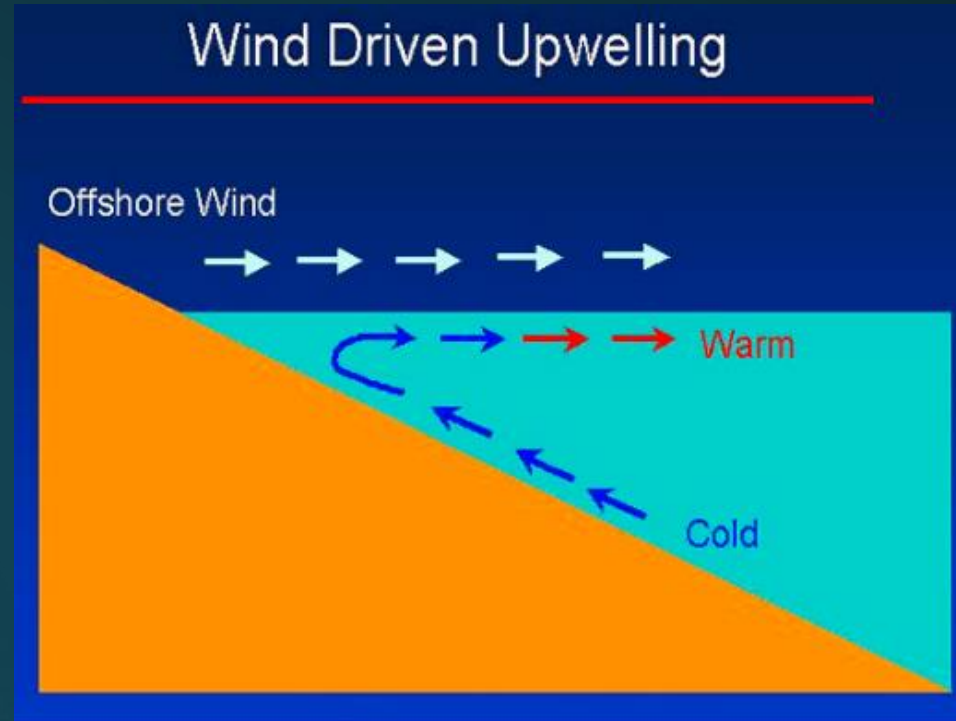
Ocean's Diversity

- Ocean currents circulate lots of nutrients, making them available to life far from the source of nutrients
- Many, many food webs



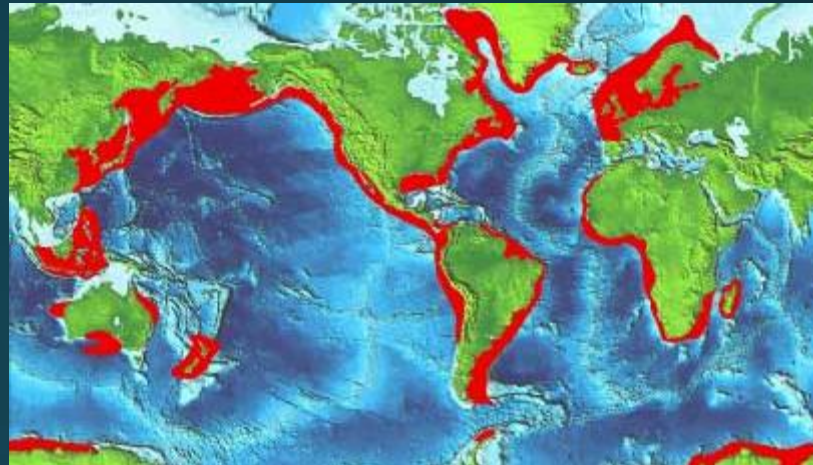
Upwelling

- STEP 1: Warm surface water near the coast is pushed away by wind.
- STEP 2: Cold water at the bottom of the ocean moves up to take its place



Upwelling

- STEP 3: Cold water carries sediment and nutrients to the surface, where many species live and use them to reproduce
- Lots of plants attract organisms that eat them, etc.
- Areas of upwelling are areas of life!
 - Half the fish caught in the world are from areas of upwelling



Ocean Dissolves Gases

- Wind and ocean waves dissolve gases from the atmosphere, and vice versa
 - Nitrogen, Oxygen, Carbon Dioxide
- Plants use CO₂ for photosynthesis, adding Oxygen to the ocean



Ocean Dissolves Gases

Dissolves More Gas

Cold Water

Fresh Water

Deeper Water

Dissolves Less Gas

Warm Water

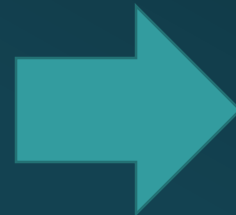
Salt Water

Shallow Water



Ocean and Carbon Dioxide

- Some CO_2 is dissolved in ocean water as gas
- Most reacts to form bicarbonates, which removes extra CO_2 from the water.
 - Many organisms use bicarbonate to form their shells
 - When these organisms die, their shells fall to the bottom of the ocean, locking the carbon away for a long time
- The more CO_2 in the atmosphere, the more CO_2 in the oceans



Oceans as Natural Resources

- Marine (ocean) Resources
 - Living things (food, medicine)
 - Minerals
 - Energy



Oceans as Natural Resources

- Human Uses
 - Travel
 - Shipping (literally refers to moving stuff using a ship on the ocean)
 - Recreation
 - Mined for minerals
 - Drilling for oil
 - Tourism



Ocean Minerals Mined

- For Retail

- Diamonds
- Gold
- Silver
- Manganese



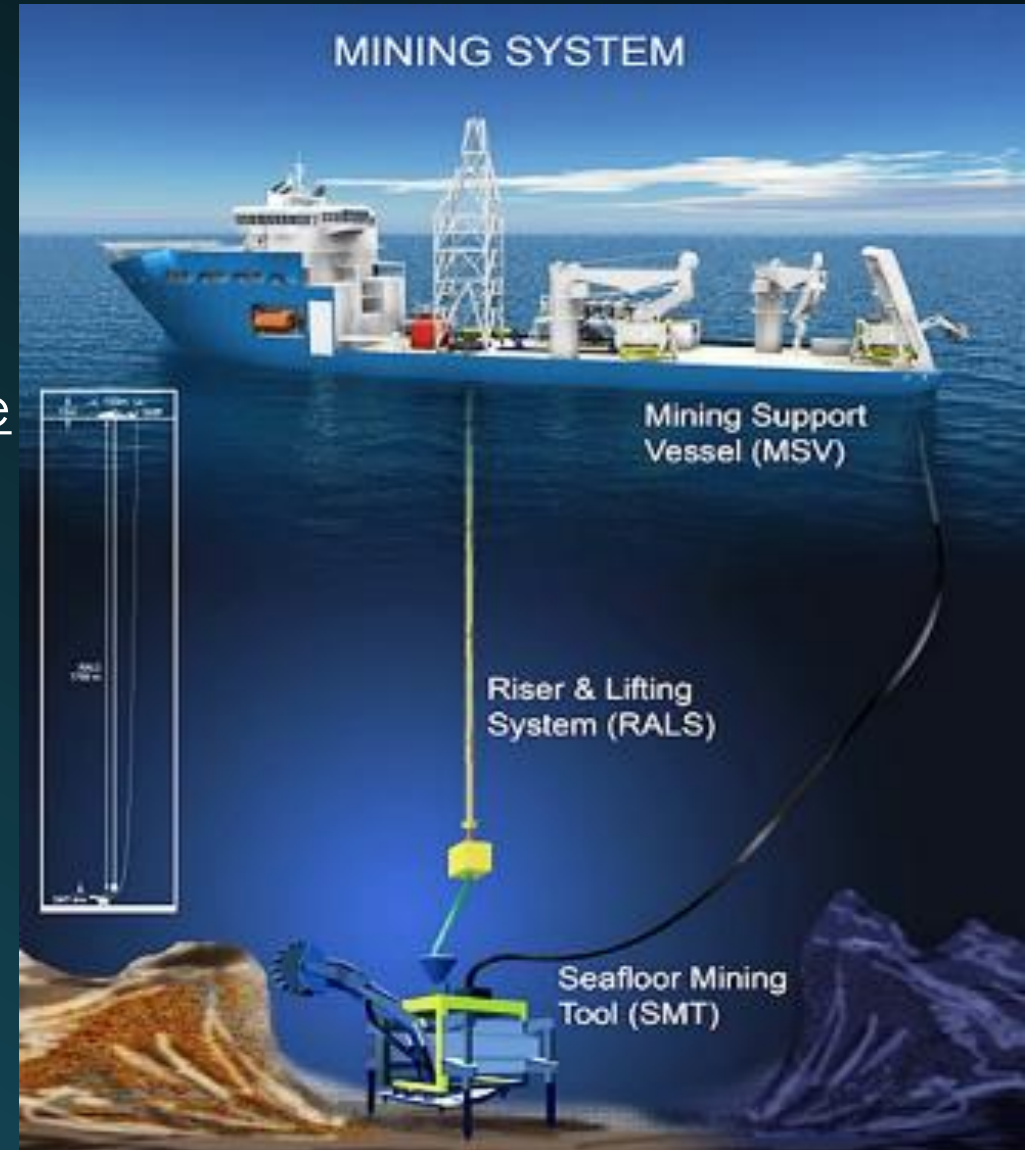
- To Protect beaches from erosion

- Gravel
- Sand



Damaging the Ocean

- Mining
 - Pulls up the ocean floor, creating a cloud of sediment that blocks out the sun
 - Puts toxic metals into the water, and therefore our food



Damaging the Ocean

- Tourism
 - Overdevelopment of coastal areas destroys entire ecosystems
 - Garbage/sewage ends up untreated in the oceans, causing Eutrophication and disease epidemics



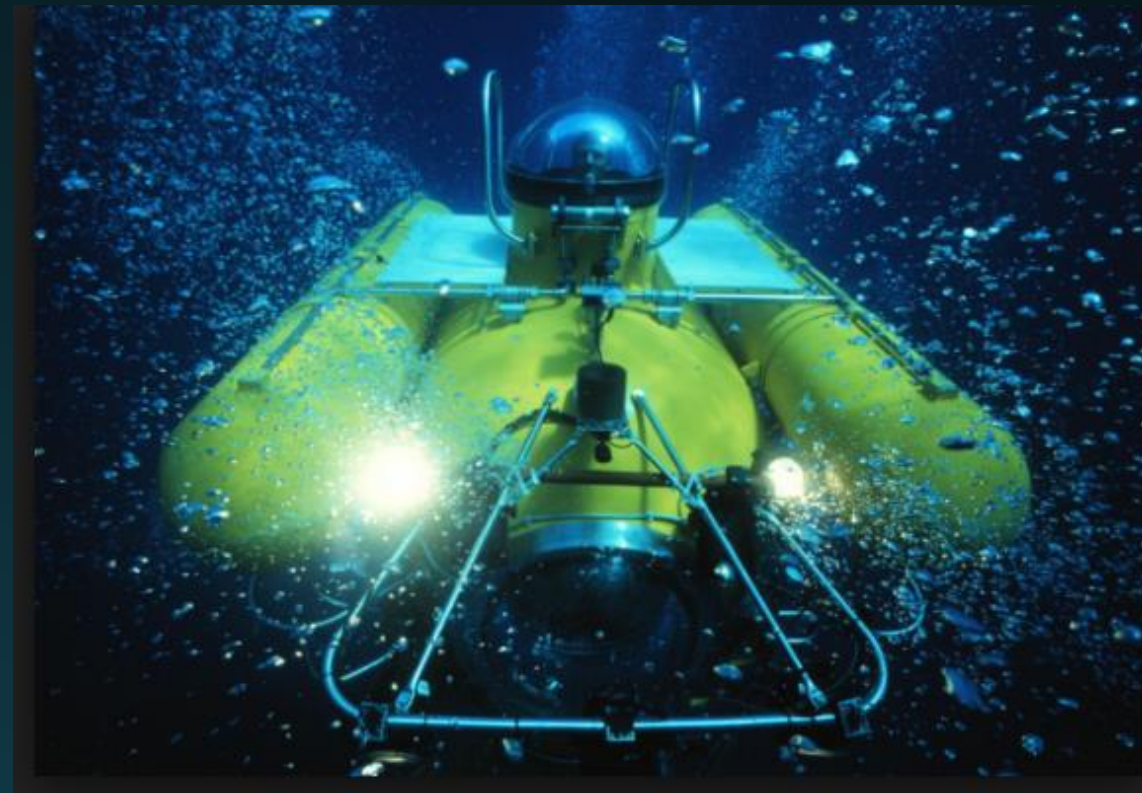
Damaging the Ocean

- Drilling for Oil
 - Ocean creatures lives (i.e. migration and feeding) are disrupted
 - Oil spills
 - Exploratory drilling confirms or denies presence of oil
 - <https://www.youtube.com/watch?v=-OVNd6Fa9fg>



Oceanic Discovery

- Technology (Depth)
 - Vessels/Ships (all)
 - Sonar (all)
 - Floats and Drifters (Surface, low)
 - Human-occupied submersibles (Medium)
 - Satellites (medium)
 - Remote-controlled vehicles (High)
 - Autonomous robots (High)
- In 1977, scientists discovered that life could live on the deep ocean floor near hydrothermal vents
 - Extremophiles
 - Revolutionized how scientists thought about how and where life can exist



Hydrothermal Vents

- Places on the ocean floor where chemical-rich, super-heated water flows up from the seafloor.
 - Provides energy to sustain communities of life without the sun
 - No sunlight for photosynthesis, so they use chemicals in water from vents to make energy and food
 - Magma beneath the seafloor heats water, causing it to rise and pick up chemicals



<https://www.youtube.com/watch?v=D69hGvCsWgA>

