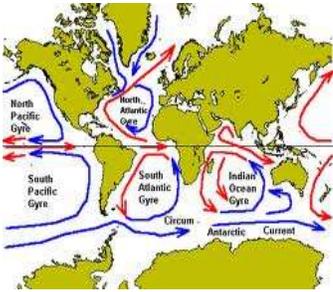


Ocean Circulation & El Nino/La Nina



OCEAN CIRCULATION PATTERNS

- An **ocean gyre** is a large system of circular **ocean** currents formed by global wind patterns and forces created by Earth's rotation.



- Home of 'The Great Pacific Garbage Patch'
- Estimated 5.2 million tonnes of trash
- About the size of Texas by some accounts
- Located between Hawaii and California
- Research trips between Bermuda and Azores document floating garbage
- Soup of micro-particles similar to the 'Great Pacific Garbage Patch'
- 44% of all seabird species documented with plastic in or around their bodies
- Plastics have entangled birds and turned up in fish bellies
- Searches for Malaysia Airlines Flight 370 have found ocean garbage instead of crash evidence

GYRES
Whirlpools of water trapping huge collections of trash in their currents

- There are 5 major gyres
- Trap trash in ocean

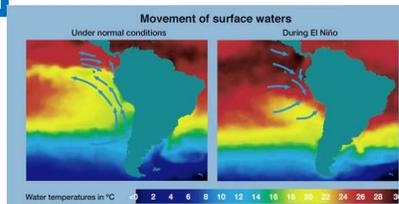
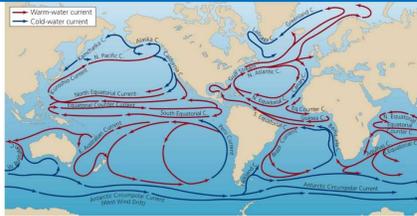


Ocean currents

- **Currents** = the upper waters of the ocean composed of vast riverlike flows
- Caused by winds and the movement of the earth
- The ocean currents move **heat** around the globe.
- **Gulf Stream** currents are rapid and powerful
 - The warm water moderates Europe's climate

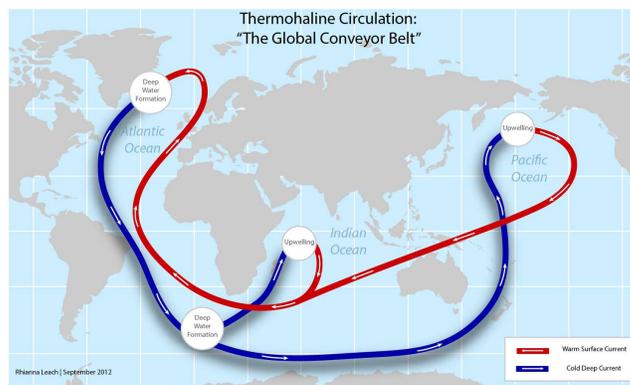


El Niño



OCEAN CIRCULATION PATTERNS

Thermohaline circulation is a part of the large-scale ocean circulation that is driven by global density gradients created by surface heat and freshwater fluxes.

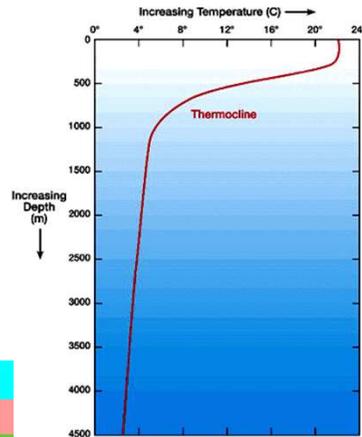


Ocean water is vertically structured

- Oceans regulate the earth's climate
 - They absorb and release heat
 - Ocean's surface circulation

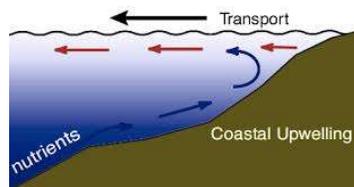
Thermal Stratification

- Epilimnion**- at the surface and warm water
- Thermocline**-transition layer between the mixed layer at the surface and the deep water layer.
- Hypolimnion**- deeper water and cold

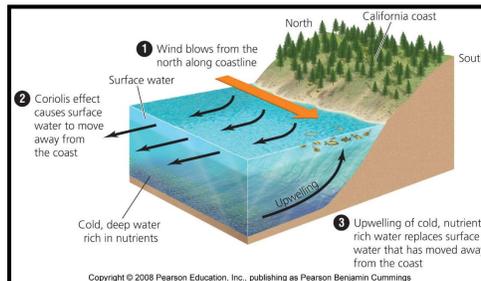


Ocean currents

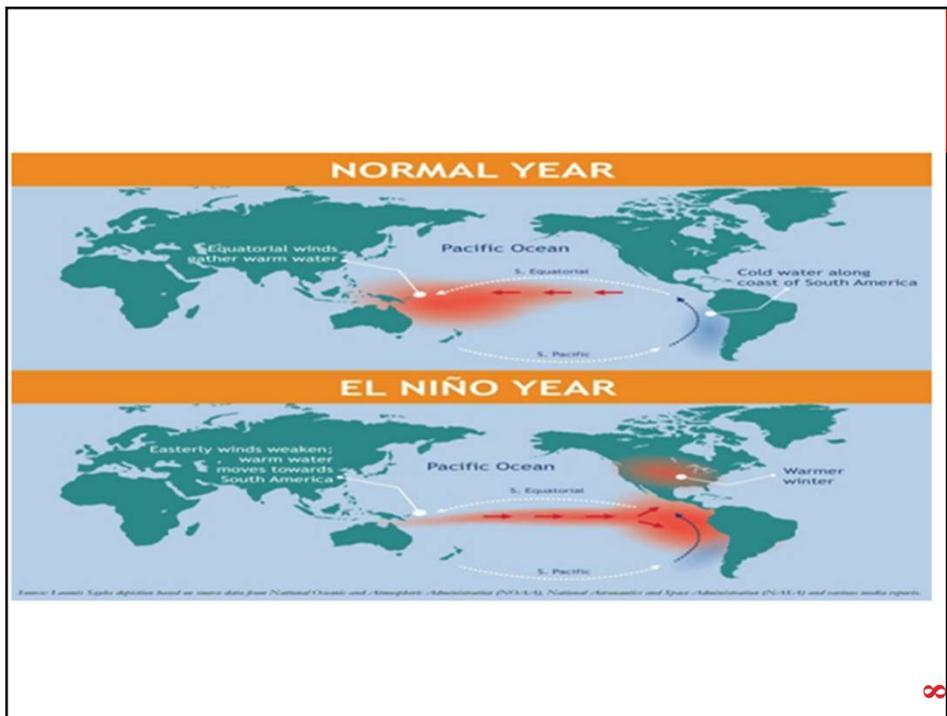
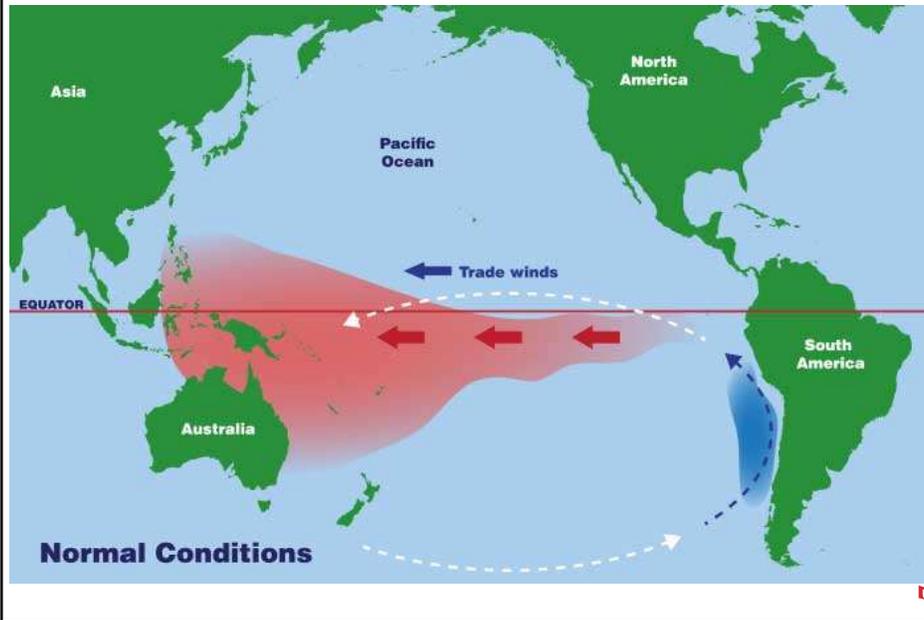
- Surface winds and heating create vertical currents**
- Upwelling** = the vertical flow of cold, deep water towards the surface
 - High primary productivity and lucrative fisheries
 - Also occurs where strong winds blow away from, or parallel to, coastlines

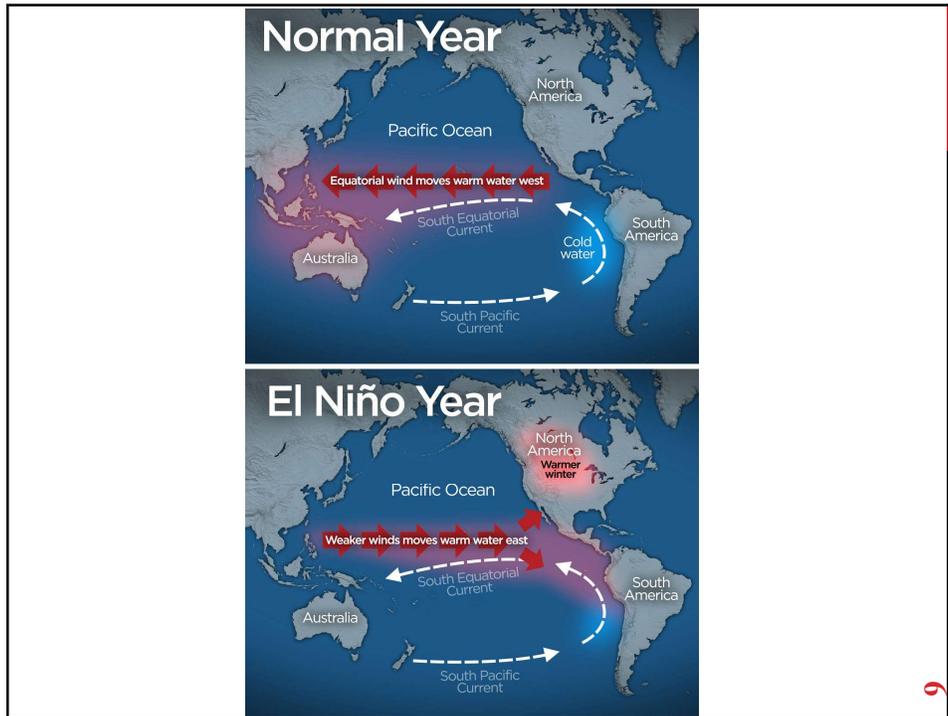


[Simulation](#)



WHERE DOES EL NINO OCCUR

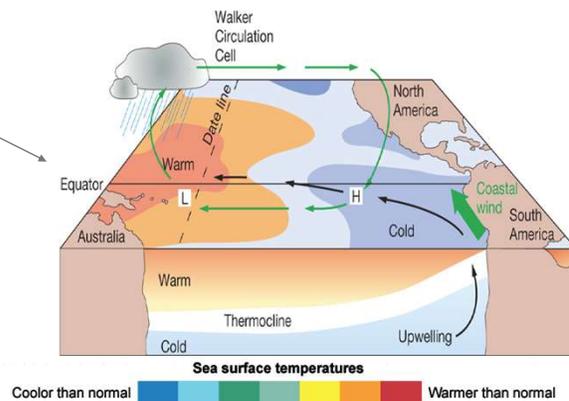




Normal Ocean currents

- **Strong trade winds** keep warm water near New Guinea and Australia
- Nutrient-rich water **upwells** along the west coast of the Americas
- **Heavy rains** are concentrated in the western Pacific Ocean.

Normal conditions—Walker Circulation



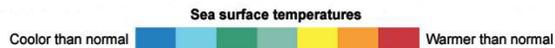
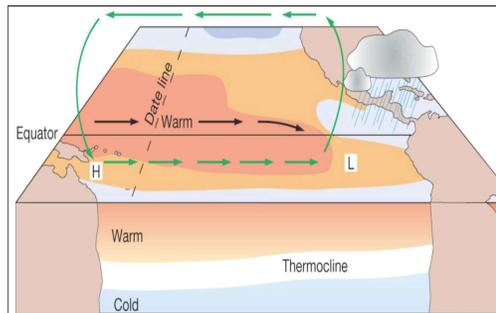
- These nutrients support large populations of phytoplankton, zooplankton, fish, and fish-eating sea birds.
- El Niño and La Niña are changes in climate patterns that can trigger mild to extreme weather changes over at least $\frac{2}{3}$ of the globe.

ENSO

El Niño/Southern Oscillation

- Warm pool migrates eastwards
- High pressure in eastern Pacific weakens
- Weaker trade winds
- Thermocline deeper in eastern Pacific
- Downwelling
- Lower biological productivity
 - Corals particularly sensitive to warmer seawater
- Occur every two to seven years

El Niño southern Oscillation-Pacific Ocean



[Simulation](#)

[El Niño Animation](#)

La Nina

- Trade winds increase, blowing stronger from east to west
 - Western Pacific Ocean becomes warmer
 - Eastern Pacific Ocean near coast of South America becomes colder
 - Warm ocean waters, clouds and moisture are pushed away from North America. Causes hurricanes and tornadoes in US.
- Causes
 - Hot, dry weather with droughts in southern US
 - Cold weather and excess rainfall in the northeastern US.
 - Enhanced upwelling
 - Enhanced trade winds
- **Similar to normal conditions, just enhanced.**
- Occur every few years and can persist for as long as two years

La Nina conditions

