The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The main title is centered in the upper half of the page.

UNIT 1: WATER SYSTEMS ON EARTH

CHAPTER 3

HEAT CAPACITY

- HEAT CAPACITY (**SPECIFIC HEAT CAPACITY**) IS THE AMOUNT OF HEAT THAT A SUBSTANCE CAN HOLD
- **WATER** HAS A HIGH HEAT CAPACITY – IT CAN TAKE IN A LARGE AMOUNT OF HEAT BEFORE ITS TEMPERATURE IS RAISED EVEN A LITTLE BIT.
- THIS MEANS THAT LARGE BODIES OF WATER (SUCH AS LAKES, RIVERS AND OCEAN) CAN ACT AS **HEAT RESERVOIRS** (I.E. THEY HOLD A LOT OF HEAT) IN THE WINTER BECAUSE THEY STAY WARMER THAN THE AIR/LAND AROUND THEM.
- THIS CAN CAUSE CHANGES IN THE OVERALL **CLIMATE** OF AN AREA: THE WEATHER SYSTEMS NEAR THE SHORELINE CAN PRODUCE BREEZES THAT CHANGE THE EVAPORATION/CONDENSATION NEAR THE SHORE.



OCEANS, CLIMATE, & CONVECTION CURRENTS

- AS THE SUN HEATS THE SURFACE OF THE OCEAN, HEAT IS TRANSFERRED TO THE AIR **ABOVE IT**, MAKING AIR LESS DENSE, SO IT WILL START TO RISE
- WHEN THE AIR RISES UP SO FAR IT WILL START COOLING DOWN, BECOME **MORE DENSE**, AND SINK
- ONCE IT REACHES THE OCEAN AGAIN IT STARTS TO HEAT UP, AND THEN THE WHOLE CYCLE STARTS OVER - THIS IS CALLED A **CONVECTION CURRENT**
- THIS AIR MOVEMENT (CALLED **TRADE WINDS**) CAN HAPPEN OVER HUGE DISTANCES, AIR THAT IS HEATED NEAR THE EQUATOR CAN DROP BACK DOWN MUCH FURTHER AWAY



NEWFOUNDLAND AND LABRADOR CLIMATE

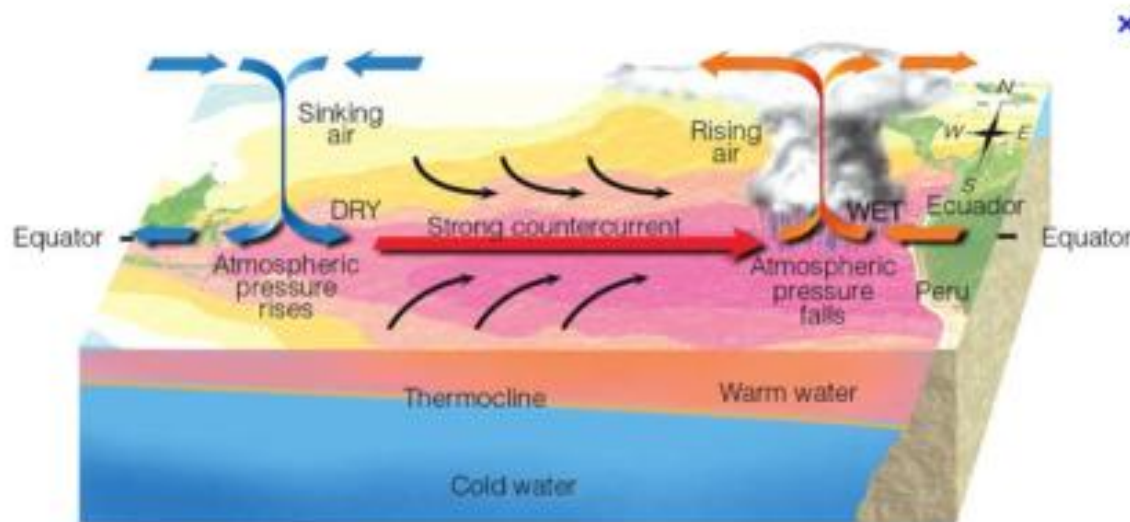
- THE RAPIDLY CHANGING WEATHER PATTERNS IN NEWFOUNDLAND AND LABRADOR ARE INFLUENCED BY THE INTERACTION OF THE **LABRADOR CURRENT** AND THE **GULF STREAM**
- WARM SURFACE CURRENTS **TRANSFER** TROPICAL HEAT TO THE ATMOSPHERE AND COLDER CURRENTS **REMOVE** HEAT FROM THE ATMOSPHERE - WHEN THE WARM, MOIST AIR ABOVE THE GULF STREAM BLOWS OVER THE COLDER WATER OF THE LABRADOR CURRENT, IT COOLS AND CONDENSES, PRODUCING **FOG!!!**
- THEREFORE, TEMPERATURE FLUCTUATIONS OCCUR RAPIDLY IN NEWFOUNDLAND AND LABRADOR DUE TO OUR LOCATION BETWEEN WARM, TROPICAL WINDS MOVING NORTH AND COLD, ARCTIC WINDS MOVING SOUTH
- LOCAL ATMOSPHERIC TEMPERATURES DEPEND ON WHICH OF THE WINDS PREVAIL

[Fog Video Clip](#)



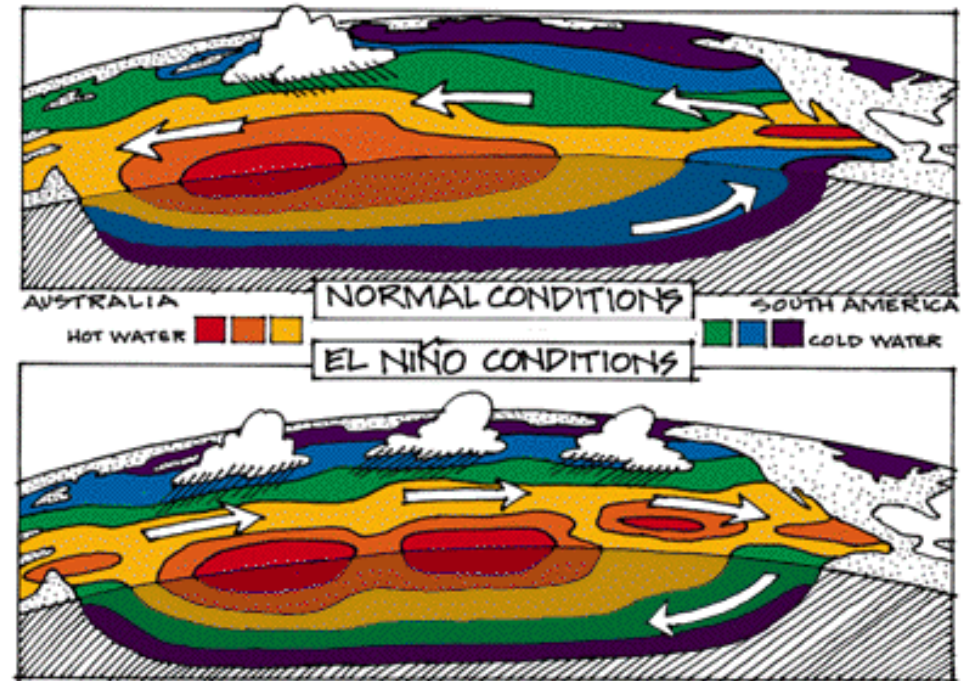
EL NINO

- **PACIFIC** TRADE WINDS MOVE **WARM** SURFACE WATER TO DIFFERENT PARTS OF THE WORLD, THIS CAUSES **COOLER** WATER TO RISE UP FROM THE BOTTOM TO TAKE IT'S PLACE
- SOMETIMES THE TRADE WINDS **SLOW DOWN**, LEAVING A LOT OF WARM WATER IN THE **TOP** LAYER OF THE OCEAN, THEN **SPEED** BACK UP AGAIN
- IF THE WINDS DO NOT SPEED BACK UP AGAIN, THE WATER GETS **WARMER AND WARMER**, AND DOES NOT MOVE AWAY CAUSING **WARMER** THAN NORMAL WEATHER



EFFECTS OF EL NINO

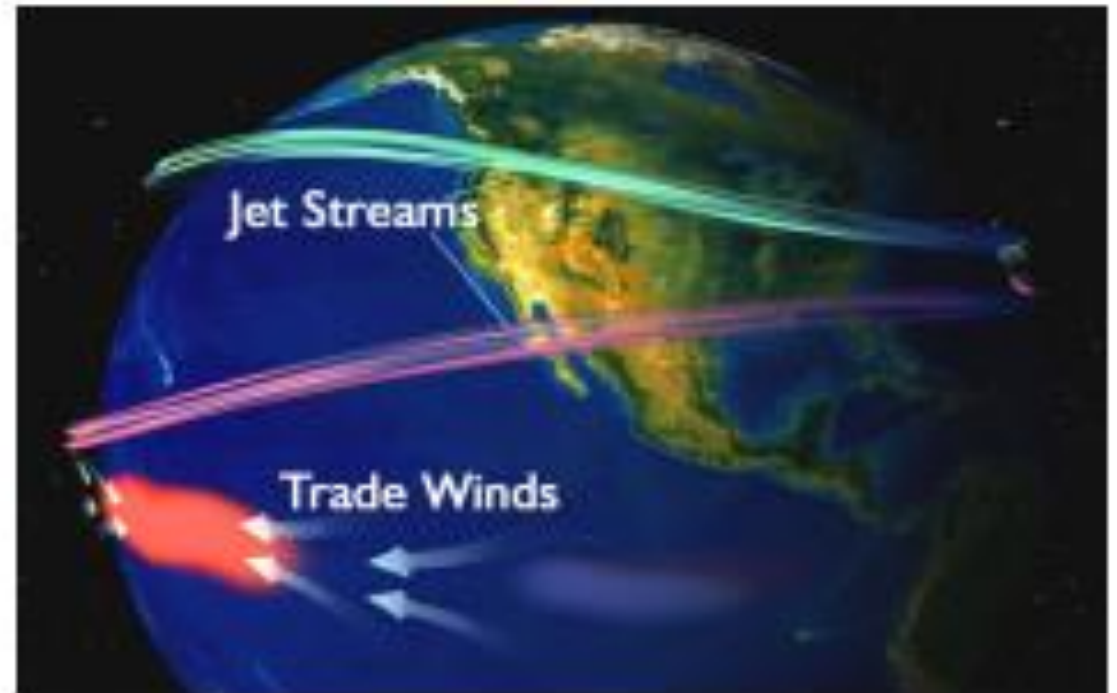
- THE WARMER THAN USUAL WATER CHANGES **WEATHER** PATTERNS
- EL NINO CAN CREATE **DROUGHTS** IN SOME AREAS OF THE WORLD (LIKE AUSTRALIA, AFRICA, AND CENTRAL AMERICA) AND **FLOODS** OR BAD STORMS IN OTHER AREAS (LIKE PERU, CHILE, AND THE WEST COAST OF NORTH AMERICA)
- THIS HAPPENS EVERY **3-7** YEARS!!!



LA NINA

- LA NINA OFTEN HAPPENS **AFTER** EL NINO.
- THE PACIFIC TRADE WINDS START TO **SPEED UP** AGAIN, AND CAUSES NONSTOP UPWELLING OF **COLD** WATER AS THE WARM WATER IS PUSHED AWAY
- **LA NINA** CAUSES HEAVY RAIN IN SOME AREAS (AUSTRALIA, AFRICA AND SOUTH AMERICA) AND REALLY GOOD FISHING BECAUSE OF THE INCREASE IN **UPWELLING**.

[Video Clip on El Nino & La Nina](#)



EL NINO VS. LA NINA

	El Nino	La Nina
Trade Winds	Decrease	Increase
Ocean Temperature	Warming (decrease Upwelling)	Cooling (Increase Upwelling)
Marine Productivity	Decreases (Decreased Nutrients)	Increases (Increased Nutrients)

PRACTICE

- BOOKWORK: PAGE 89 - Q'S 1, 2, 5, 6, 7, 8, 9, 10
- WATER AND CLIMATE ASSIGNMENT

BIOINDICATOR SPECIES

- SPECIES THAT ARE FOUND IN AND AROUND WATER SYSTEMS CAN HELP US DETERMINE HOW **HEALTHY** THE WATER IS (THE **QUALITY** OF THE WATER)
- WE CALL THESE SPECIES **BIOINDICATOR SPECIES** BECAUSE THEY HELP TO “INDICATE” THE HEALTH OF THE WATER SYSTEM



EXAMPLES OF BIOINDICATOR SPECIES:



- FOR EXTRA INFO ON BIOINDICATORS... GO TO [HTTP://WWW.SCIENCELEARN.ORG.NZ/CONTEXTS/ENVIRO-IMPRINTS/SCIENCE-IDEAS-AND-CONCEPTS/BIOINDICATORS](http://www.sciencelearn.org.nz/contexts/enviro-imprints/science-ideas-and-concepts/bioindicators)

ABIOTIC (**NON-LIVING**) FACTORS THAT AFFECT PLANT AND ANIMAL DISTRIBUTION:

1. **TEMPERATURE**

- DIFFERENT SPECIES PREFER DIFFERENT TEMPERATURES.



2. **DISSOLVED OXYGEN**

- COLDER WATER CONTAINS **MORE** DISSOLVED **OXYGEN**.



3. **PHOSPHATES**

- ESSENTIAL NUTRIENT FOR LIVING THINGS BUT TOO MUCH (FROM POLLUTION) CAN BE DETRIMENTAL.



4. INCREASED ACIDITY

- ACID PRECIPITATION (DUE TO AIR POLLUTION) FALLS INTO THE WATER.

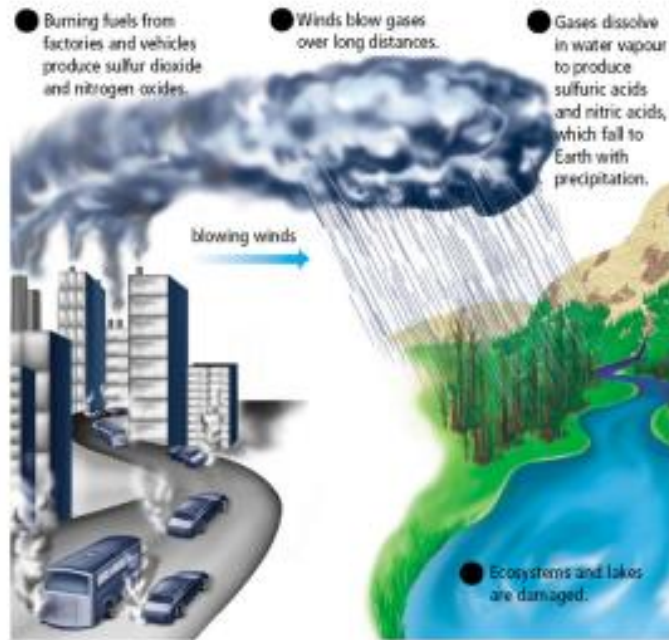
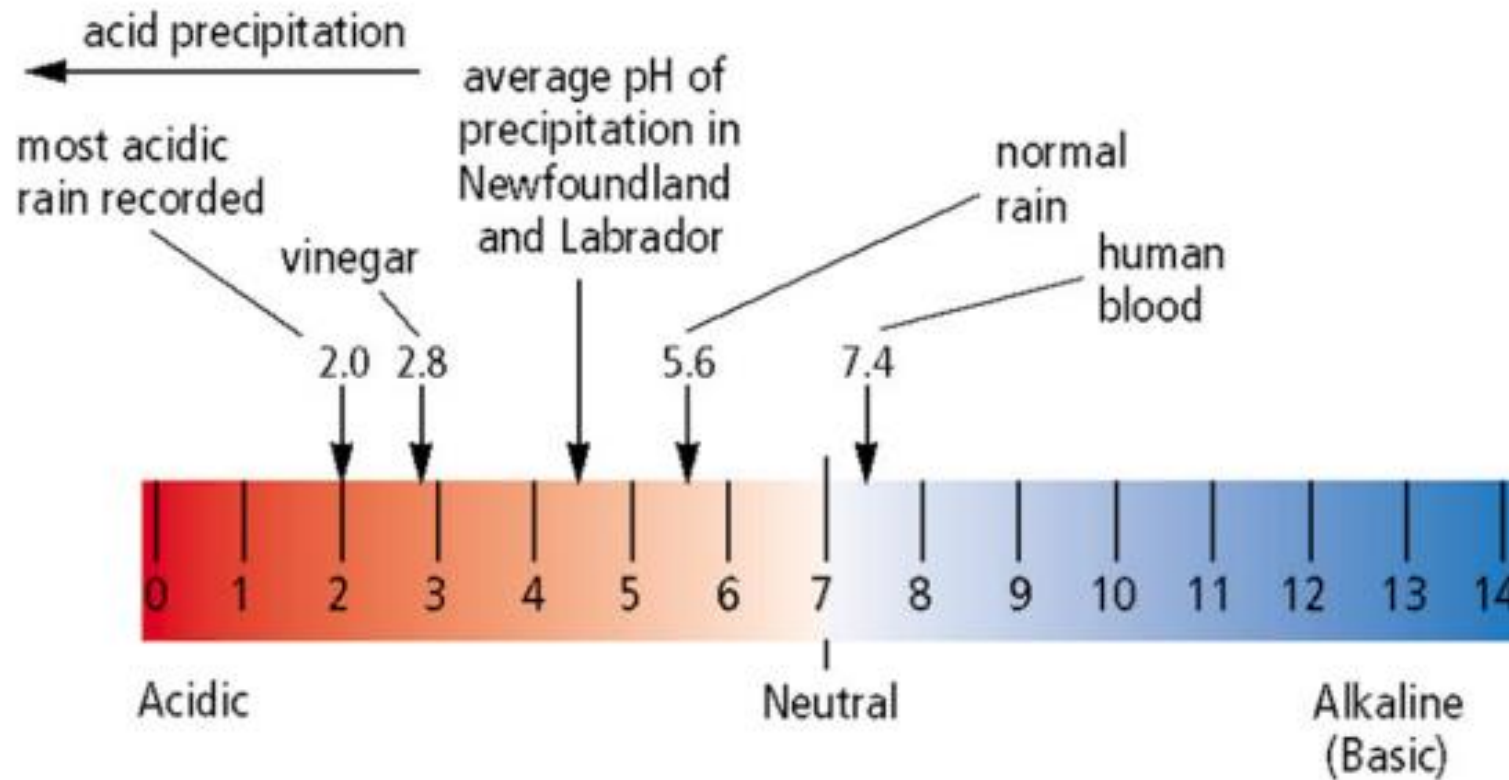


Figure 3.14 Polluting gases enter water systems when acid precipitation is produced.

- ORGANISMS HAVE AN ACIDITY COMFORT-LEVEL AND CAN DIE IF THE WATER BECOMES TOO ACIDIC.

	pH 6.5	pH 6.0	pH 5.5	pH 5.0	pH 4.5	pH 4.0
TROUT	Survives	Survives	Survives	Survives	Does not survive	Does not survive
BASS	Survives	Survives	Survives	Does not survive	Does not survive	Does not survive
PERCH	Survives	Survives	Survives	Survives	Survives	Does not survive
FROGS	Survives	Survives	Survives	Survives	Survives	Survives
SALAMANDERS	Survives	Survives	Survives	Survives	Does not survive	Does not survive
CLAMS	Survives	Survives	Does not survive	Does not survive	Does not survive	Does not survive
CRAYFISH	Survives	Survives	Survives	Does not survive	Does not survive	Does not survive
SNAILS	Survives	Survives	Does not survive	Does not survive	Does not survive	Does not survive
MAYFLY	Survives	Survives	Survives	Does not survive	Does not survive	Does not survive

ACID/BASE pH SCALE



5. **TURBIDITY – CLOUDINESS OF THE WATER**

- (HOW MUCH DIRT IS STIRRED UP) CAN AFFECT FISH'S ABILITY TO TAKE UP OXYGEN FROM THE WATER.

6. **POLLUTION**

- (I) **POINT SOURCES** (SPECIFIC SOURCE)
EX: LANDFILL LEAK, FACTORY WASTE WATER



Figure 3.11 Point sources of pollution, such as this factory's waste water, are easier to identify than non-point sources.

- (II) **NON-POINT SOURCES** (MANY SOURCES)

EX: PESTICIDES, RUNOFF FROM CITY STREETS



Figure 3.12 When human activities negatively impact the environment, all species suffer.



7. **UPWELLING (MARINE ONLY)**

- VERTICAL MOVEMENT OF WATER FROM THE OCEAN FLOOR CAUSED BY WIND ON THE SURFACE. STIRS UP **NUTRIENTS**

8. **OCEAN CURRENTS (MARINE ONLY)**

- CURRENTS AFFECT ON WHAT LIVES WHERE, TEMPERATURE, NUTRIENTS, AND OTHER FACTORS.

9. **SALINITY**

- THE SALTIER THE WATER IS, THE **LESS** PLANTS AND ANIMALS WILL BE ABLE TO SURVIVE IN IT. THIS CREATES POOR-QUALITY OCEAN WATER (E.G. THE DEAD SEA).

*** Water Quality Assignment***

OVER-FISHING:

- WHEN MORE FISH ARE REMOVED FROM THEIR ENVIRONMENT THAN CAN BE REPLACED BY REPRODUCTION



NEW TECHNOLOGIES HAVE MADE IT MUCH EASIER FOR PEOPLE TO OVER-FISH THE OCEANS:

1. **FACTORY FREEZER TRAWLERS** ARE LARGE SHIPS THAT CAN FREEZE FISH ON THE SHIP - THIS MEANS THEY CAN STAY OUT ON THE WATER LONGER, CATCH MORE FISH, AND DON'T HAVE TO GO BACK UNTIL THEY ARE FULL
2. **SONAR TECHNOLOGY** USES SOUND WAVES TO LOCATE FISH TO CATCH
3. **TRAWLERS** ARE BOATS THAT DRAG NETS THROUGH THE MIDDLE OF THE WATER OR ON THE BOTTOM OF THE CONTINENTAL SHELF - THEY CATCH A LOT OF FISH AT ONCE BUT ALSO THINGS THAT THEY DIDN'T MEAN TO CATCH ARE ALSO CAUGHT IN THEIR NETS AND THEY CAN DAMAGE HABITATS ON THE SEA FLOOR WITH THEIR STEEL FRAMES :(

OFFSHORE OIL

- LEAKS FROM THE OIL RIGS POLLUTE THE ENVIRONMENT AROUND THEM
- MOST OIL IN THE OCEANS COMES FROM **CITIES, FARMS, FACTORIES AND BUILDINGS**
- ANY OIL IN THE OCEANS IS DANGEROUS TO THE THINGS THAT LIVE IN IT



- **SEISMIC TESTING:** A METHOD USED TO FIND OIL DEPOSITED, IT INVOLVES SENDING OUT A HIGH PRESSURE BURST OF AIR DOWN TO THE SEA FLOOR. THESE SHOCK WAVES CAN DESTROY **FISH EGGS** AND **LARVAE**, CAUSE FISH TO LEAVE THEIR **HABITATS**, AND DISRUPT THE **MIGRATION** OF WHALES

NEWFOUNDLAND AQUA CULTURE

- SPECIES INCLUDE:

- RAINBOW TROUT
- SALMON
- COD
- SHELLFISH
- SOME AQUATIC PLANTS

