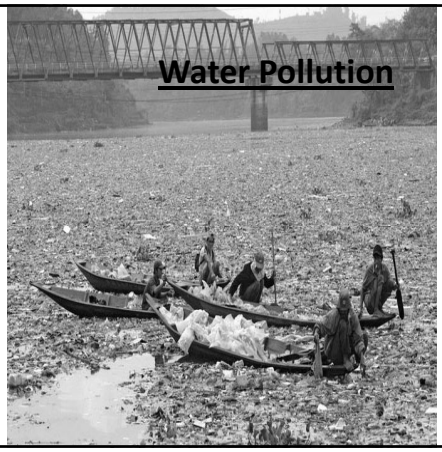
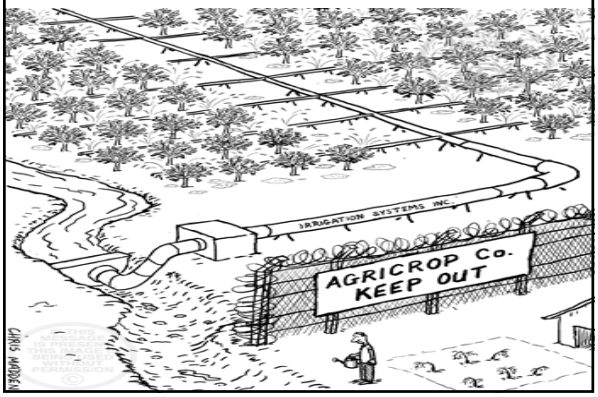
Water Pollution



Why should we care about water?



Why should we care about the Ocean?

Pollution

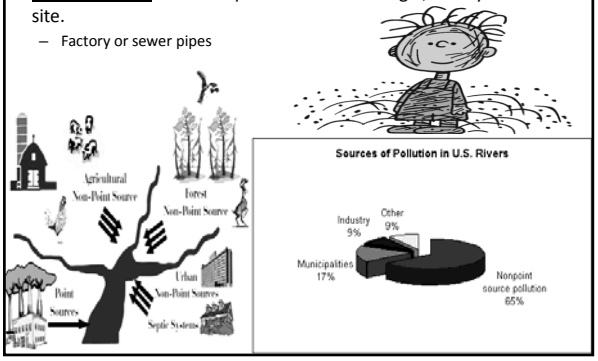
- The introduction of harmful substances or products into the environment:

Major Pollutants

- Fossil Fuels
- Domestic and Industrial Waste
- Manufacturing and Agricultural Systems

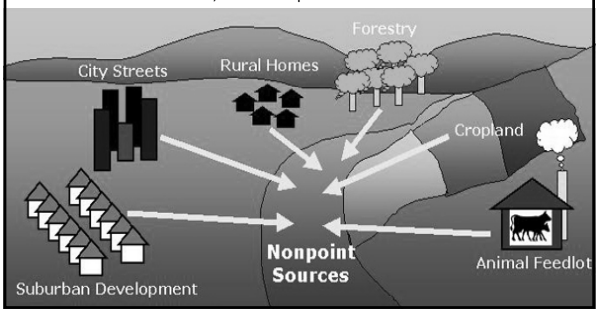
Types of Pollution

- **Point source –** release of pollutants from a single, clearly identifiable site.
  - Factory or sewer pipes



Types of Pollution

- **Nonpoint source water pollution** = pollution from numerous, widely dispersed origins.
  - Gases from car exhaust, chemicals spread on fields.



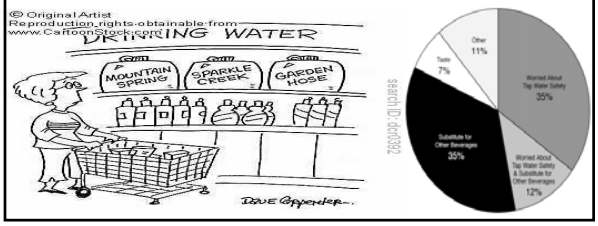
The U.S. Clean Water Act

- Addressed point sources
- Targeted industrial discharge

- In the U.S., nonpoint sources have a greater impact on quality
  - Limit development on watershed land surrounding reservoirs

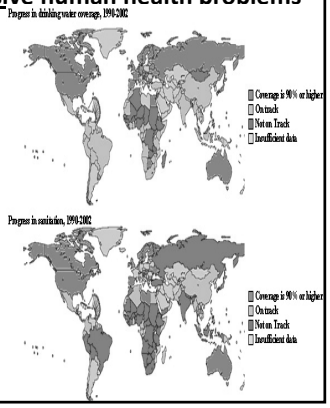
Bottle Water Article

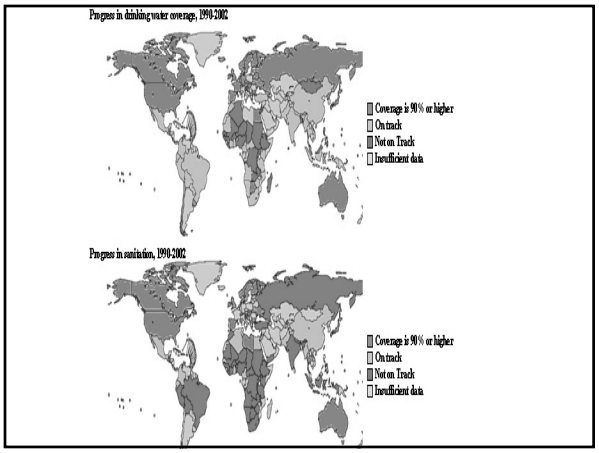
- How safe is your bottled water?
- Read the scenario and answer the following questions we are going to share them in 10 minutes.
- 20/20 – Tap water vs. Bottle Water
  - http://www.youtube.com/watch?v=_3QBZac3MSY



Pathogens cause massive human health problems

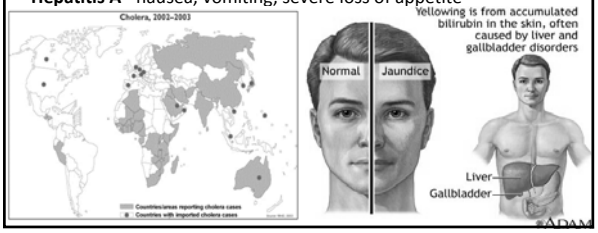
- Currently, 1.1 billion people are without safe drinking water
- 2.4 billion have no sewer or sanitary facilities
  - Mostly rural Asians and Africans
- An estimated 5 million people die per year
- Solutions:
  - Treat sewage
  - Disinfect drinking water
  - Public education to encourage personal hygiene
  - Government enforcement of regulations





Human Diseases Transmitted by Polluted Water

- **Cholera–** Severe diarrhea, vomiting, can lose up to 20 quarts of water a day.
- **Dysentery** – painful diarrhea, blood stools
- **Enteritis** – loss of appetite, abdominal cramps, diarrhea
- **Typhoid** – headache, loss of energy, fever,
- **Hepatitis A** - nausea, vomiting, severe loss of appetite

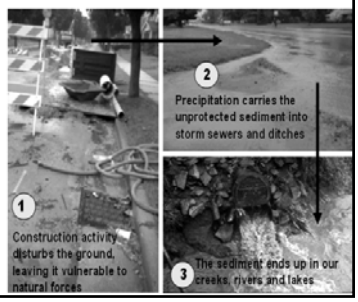


Sediment Pollution

- Excessive amounts of suspended soil particles that eventually settle out and accumulate at the bottom of a large body of water.

Block sunlight

Carry inorganic and organic toxic Chemicals.



Organic Compounds

- Chemicals that contain carbon atoms
- Most are produced by human activities; pesticides, industrial chemicals and plastics. Can come from landfills.

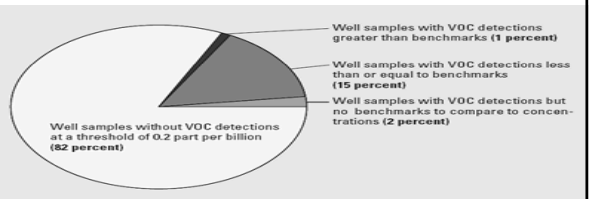
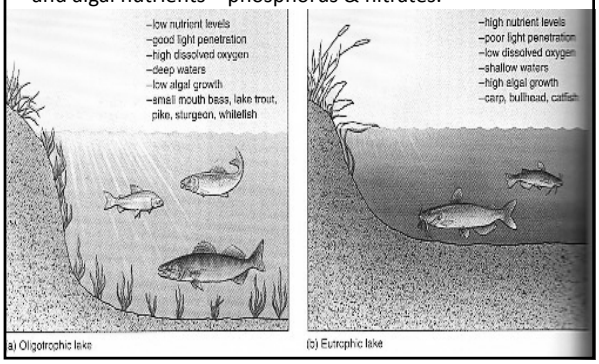
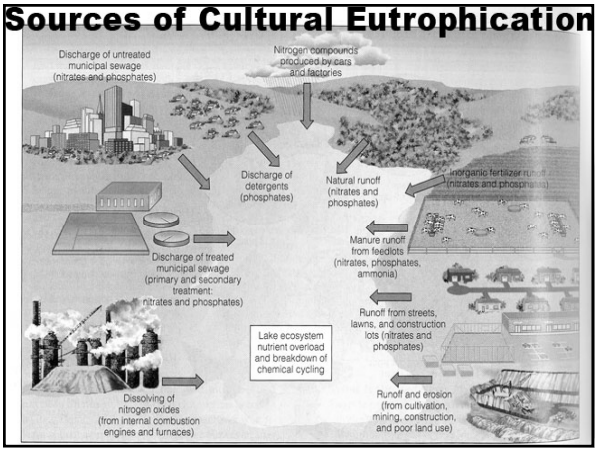


Figure 1. Volatile organic compounds (VOCs) were not detected in samples from 82 percent of the 3,497 domestic or public wells at a threshold of 0.2 part per billion. VOC concentrations were greater than human-health benchmarks in 45 well samples (about 1 percent of all well samples).

- **Oligotrophic** - minimal levels of nutrients
- **Eutrophication** – enrichment of a lake by inorganic plant and algal nutrients – phosphorus & nitrates.

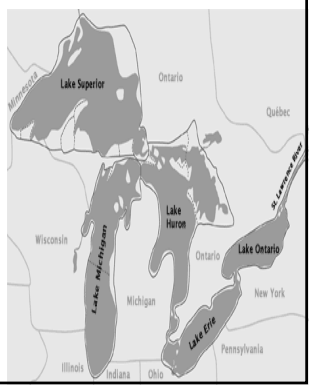


Sources of Cultural Eutrophication



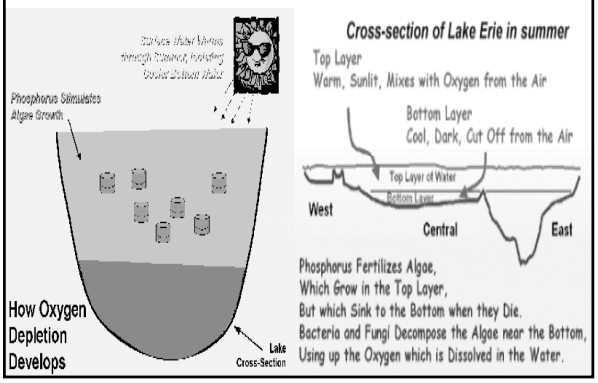
The Great Lakes

- Great Lakes Toxic Substance Control Agreement. (1986)
- DDT levels have declined
- Invasive Species are still a problem – zebra mussels.
- http://www.youtube.com/watch?v=0qZ-FVEnFkw&feature=related

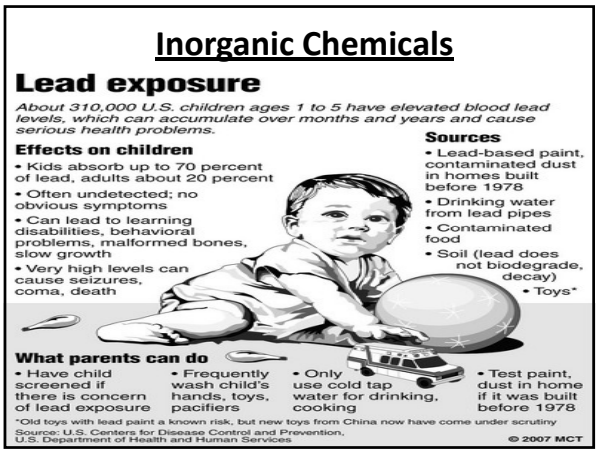


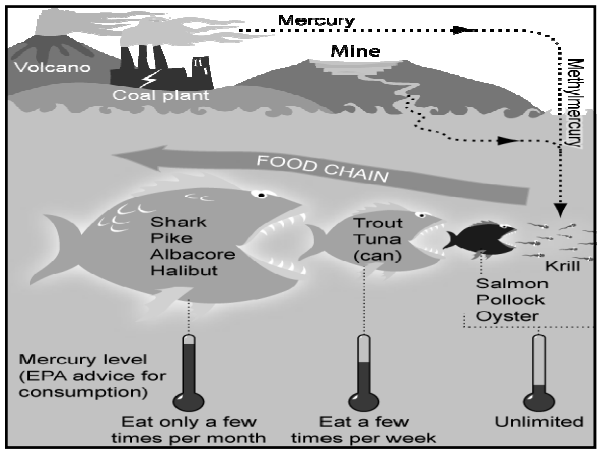
Lake Erie

Play video

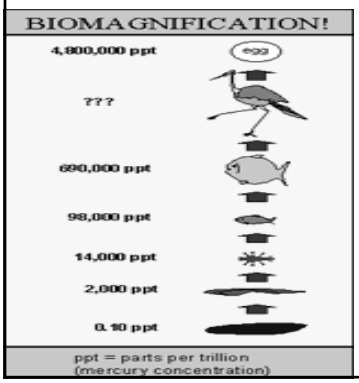


Inorganic Chemicals





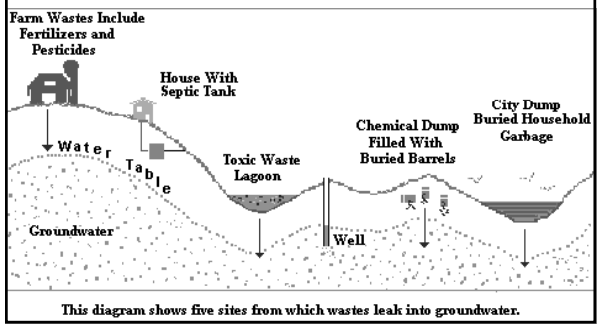
Biomagnification!



- Mercury - Bioaccumulates because the body can not break it down naturally and then in MAGNIFIES up the food chain to the highest trophic level!

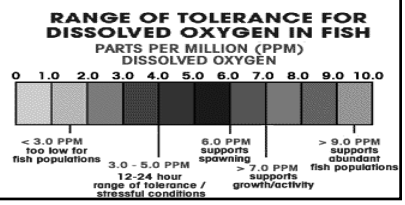
Groundwater Pollution

- 72% of water pollution is from agriculture.



Ways to measure (Chemical Indicators) Water Quality

- * Dissolved Oxygen
- * pH
- * Phosphate
- * Nitrate
- Salt
- Ammonia



BOD (Biological Oxygen Demand)

- Determined by:
  - The number of aerobic organisms in that area
  - Their rate of respiration
  - Take a sample of water, measure the DO,place in a dark area around 20 degrees Celsius and take a DO measurement again.
    - The BOD is the difference between the first and the second measurement.
- Organic Pollutants cause a high BOD.
  - Organisms that break down the pollutant require a lot of oxygen.

"Trent" Biotic Index

- Based on the "disappearance" of the indicator species as the level of the organic pollutant increases.
- This can lead to a change in diversity.
- See handout on the different groups for the biotic index.

Table 2: Biotic Index

Example from Table 2:

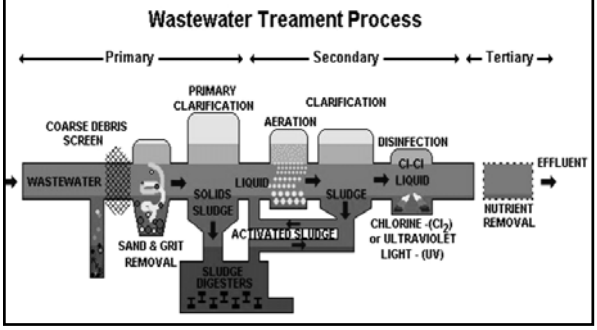
1. Total # of each Taxon x Pollution Tolerance Value = Total Tolerance Value
2. Sum the Total Tolerance Value column = 23,047.2
3. Divide: Total Tolerance Value = 23,047.2 / Total # of Individuals 4,980 = 4.63
4. Look up the Biotic Index Value on Table 3.
5. Biotic Index = 4.63 = Good Water Quality

Table 3. Evaluation of Water Quality from Biotic Index

BIOTIC INDEX	WATER QUALITY	DEGREE OF ORGANIC POLLUTION
< 3.75	EXCELLENT	ORGANIC POLLUTION UNLIKELY
3.76 - 5.0	GOOD	SOME ORGANIC POLLUTION
5.1 - 6.5	FAIR	SUBSTANTIAL POLLUTION LIKELY
6.6 - 10.0	POOR	SEVERE ORGANIC POLLUTION LIKELY

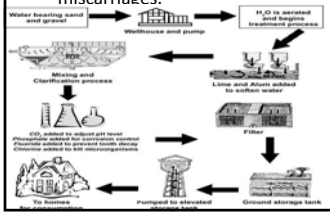
Improving Water Quality

- The US has nearly 60,000 municipal water facilities that serve 232 million people.



Purification of Water

- Chlorine Dilemma
  - Kills waterborne, disease causing organisms.
  - Can be linked to rectal, pancreatic and bladder cancer and increased miscarriages.
- Fluoridation
  - Small amounts has been added to drinking water to prevent tooth decay.
  - Dentists think that fluoride is the main reason for the 50-60% decrease in tooth decay.
  - 66% of public water supplies contain fluoride.



Soil Pollution

- Salinization – irrigation of agricultural fields often results increased amount of salt in soils.
- Eventually can be toxic for plants and will reduce plant productivity.