Water Pollution
Chapter Twenty

Water Pollution
- _____ source pollution is discharged from a single source
  - wastewater treatment plant
  - oil tanker
- _____ source pollution comes from many sources
  - farm runoff
  - storm sewers
- Water pollution is the introduction of chemical, physical, or biological agents into water that degrades the quality of the water and affects the organisms that depend on it

Types of Pollutants
- Water-Soluble Inorganic Chemicals
  - Acids, salts, toxic metals & chemicals
  - Endocrine _____ lead to birth defects, developmental disorders & gender imbalances
- Organic Chemicals
  - Oil, gasoline, plastics, pesticides, detergents
- Oxygen-Demanding Wastes (organic wastes that are decomposed aerobically)
  - Measured by the Biological Oxygen Demand (BOD), which is the amount of oxygen needed for _____
  - An Oxygen Sag Curve is a plot of dissolved oxygen levels versus the distance from a source of pollution, usually excess nutrients and biological refuse.
  - Oceanic _____ Zones are areas of low oxygen caused by increased nutrient pollution
- Inorganic Plant Nutrients
  - Nitrates, _____
- Pathogens (disease-causing agents)
  - Bacteria, viruses, protozoa, parasitic worms
- Endocrine Disruptors
  - Chemicals that can lead to birth defects, developmental disorders and gender imbalances
- Sediment (suspended material)
  - Measured by turbidity
- Heavy Metals
  - Harm through _____
- Thermal Pollution (thermal shock)
  - Lowers DO and organisms immune response

Pollution of Streams & Rivers
- Streams and Rivers have the ability to rapidly recover from pollution events because of their continuous _____ and dilution resulting from surface runoff.
- Problems occur when the influx of pollutants is large (ex. hog pit break) or the stream flow is reduced (ex. dams, sedimentation)

Pfiesteria
- Livestock sewage is of great concern in North Carolina estuaries, leading to degraded ecosystems and the immergence of *Pfiesteria piscicida*. *Pfeisteria* is a toxic _____ that thrives in the high nutrient loads commonly originating from livestock, and is responsible for immense fish kills in NC waters.

Pollution of Lakes
- Lakes and reservoirs are particularly vulnerable to pollution because they often contain _____ layers that undergo little mixing. This may result in accumulation of pollutants and significant reductions in dissolved oxygen.
- Lakes receive inputs of nutrients and silt from the surrounding land. This natural nutrient enrichment is called _____. Cultural eutrophication, however, is the accelerated input of nutrients by human activity.

Ocean Pollution

- The Law of the Sea Treaty (1982)
    - 134 nations participated
    - laws of a coastal nation extend 22 km from its coastline (_____ sea)
    - nations control of economic activity, environmental preservation and research extend 370 km from its coastline (_____ zone)
- 85% of all ocean pollution originates from _____ activities, with coastal areas taking the most damage. This is not surprising because half the world's population lives within 160 miles of the coast.

Oil Pollution

- Oil pollution in the seas results primarily from land runoff.
- However, the most preventable sources may be oil rigs and oil tankers. Oil may be cleaned up by the use of
    - Floating _____ that contain the spill
    - Skimmers that vacuum up the oil
    - Absorbent pads
    - Coagulation agents that cause the oil to clump
    - _____ agents that break up the slick

Exxon Valdez

- Until 2010, the largest offshore oil spill in U.S. history occurred in _____, when the *Exxon Valdez* tanker ran aground in Prince William Sound, Alaska. The spill of almost 11 million gallons affected the Alaskan coastline equivalent of New York City to Miami.

Gulf Oil Spill of 2010

- On April 20, 2010, BP's Deepwater Horizon oil rig sank of the coast of Louisiana after an explosion. The aftermath left broken wellheads one mile deep that leaked for _____ days. The total numbers make it the largest offshore oil spill in U.S. history.
    - 206 million gallons of oil
    - 1.84 million gallons of dispersant (_____ 9500)
- 33% of the oil was recovered (skimming), burned, or dispersed
- 25% evaporated or dissolved
- 16% biodegraded
- 26% (42 million gallons) was never recovered (on shore or below the surface)

Groundwater Contamination

- Groundwater contamination is of particular concern because groundwater flows very slowly, limiting _____ and dispersion. Therefore, it can take tens to thousands of years for groundwater to cleanse itself.
- Sewage Treatment
- In rural and suburban areas, sewage from each house is discharged into a _____ tank, which is emptied every 3 – 5 years.
- In urban areas, wastes travel to wastewater treatment plants through a network of sewer pipes.

Sewage Treatment Plants

- Primary sewage treatment is a _____ process that uses screens to filter out debris.
- Secondary sewage treatment is a _____ process in which aerobic bacteria are used to remove up to 90% of biodegradable, oxygen-demanding organic wastes.
- Advanced sewage treatment is a series of specialized chemical processes that remove specific pollutants left in the water after primary and secondary treatment.

Groundwater Protection Methods

- Pumping polluted groundwater to the surface to clean and return is not economically feasible. Therefore, prevention of groundwater pollution is the only effective way of protecting the resource.
- Monitoring aquifers near _____ and underground tanks
- Requiring leak detection systems for underground tanks
- Banning disposal of hazardous wastes in deep injection wells and landfills
- Storing hazardous liquids above ground

Clean Water Act

- The Clean Water Act of 1972 was based on the Water Pollution Control Act of 1948. These laws and subsequent amendments set standards for allowed levels of key water pollutants and requires polluters to get _____ limiting how much of various pollutants they can discharge into aquatic systems.

Sustainable Water Use

- Methods for Sustainable Water Use
    - Source reduction to reduce the toxicity or volume of pollutants
    - _____ of wastewater
    - Recycling pollutants