Water Pollution
Types of pollutants- major categories

- Nutrients (N, P)
- O₂ Demanding Waste (Organic Matter)
- Toxins
  - Inorganics (Metals, Acids, CL)
  - Organics
    - Synthetic (Pesticides, PCB’s, Endocrine Disrupters)
    - Natural (HydroCarbons/Oil)
- Pathogenic Organisms (Cholera, E.Coli)
- Sediments
- Thermal Pollution
- Radioactive waste
- Solid Waste

Nutrients

Eutrophication

- Excessive growth of phytoplankton
- Decomposition uses DO
- Death of aerobic organisms

O₂ Demanding Waste (Organic Matter)

- Main sources: Sewage treatment plants, animal factory farms, pets, paper pulp, or food-processing wastes
- Organic Matter decays, stimulates growth of decomposers, which rapidly consumes the oxygen in water.
- Results in low oxygen concentration. Life in waters restricted to species that can tolerate high organic content and low dissolved O₂ (Fish kills)

Toxins: Inorganics

- Metals, such as mercury, lead, cadmium, and nickel are highly toxic.
  - Highly persistent
  - Bioaccumulate in food chains
    - Sources: Industrial - mining, manufacturing
    - Mercury - atmospheric deposition from coal combustion
    - Lead - Pipes, plumbing, and solder may contaminate drinking water.
- Acids - Mine drainage & leaching, acid rain from coal combustion
- Salts - Arsenic salts are added as a non-caking agent to road salt.
Many of the 100,000 synthetic compounds in use today are found in the aquatic environment and bioaccumulate in the food chain.

Most harmful are a group of chlorinated chemicals known as Persistent Organic Pollutants (POPs):

- Remain intact for decades/centuries
- Become globally distributed via air/water - now are found everywhere through the globe
- Accumulate in fatty tissues
- Extremely toxic at low levels

The “Dirty Dozen”

Nine are organochlorine pesticides, two are produced unintentionally in industrial processes (PCBs & Dioxins).

Toxic Organics - Synthetic

- Biological Magnification of Toxic Organics - Synthetic

- Oil pollution

  - Oil introduced into marine environment through variety of routes:
    - Major incidents: sinking tankers
    - Leaks at drill sites, ports - Over 45% of oil pollution is caused by illegal dumping - "operative discharge" - from ships
    - Land based non-point source inputs

- Pathogens: Most deadly form of water pollution

  - Infectious agents (bacteria/viruses/protozoa) nearly all from fecal contamination of water.
  - In less developed countries at least 2.5 billion people lack adequate sanitation, and about half of these lack access to clean drinking water.
  - Typhoid, Cholera, Dysentery
  - In developed countries, sewage treatment plants and pollution-control devices have greatly reduced pathogens.

- U.S. Coastal Waters

  - Shellfish beds closed after heavy rainfall

  - From staff reports

  All conditionally approved shellfish beds along the S.C. coast have been closed because of recent heavy rainfall, said S.C. Department of Health and Environmental Control officials.

  Runoff from rainfall frequently impacts oyster and clam harvesting areas by washing pollutants into the estuaries, said Charles Newton, manager of DHEC’s Shellfish Sanitation Program. These areas will remain closed for a minimum of two weeks and will be examined bacteriologically before reopening.
Pathogens

- *Coliform Bacteria* (*E. Coli*) - originate in the intestinal tract of warm-blooded animals. Sources: runoff from woodlands, pastures and feedlots; animal factory farms; septic tanks and sewage plants; and animals and wildfowl
- Easy to test and count coliforms
- Criteria:
  - Drinking Water - 0 coliforms (chlorinated water)
  - Swimming - 200/ml
  - Myrtle Beach Waters...

Sediments

- Turbidity is any kind of material, organic or inorganic, that clouds the water.
- A major type of turbidity is dirt, especially clay that runs off the land during and after a rainstorm. This occurs where there has been land-disturbing activity, such as timber cutting, agriculture, road building, or most types of new construction.
- Increased turbidity can block sunlight
- Increased turbidity can reduce visibility for sight-feeding fish, and reduce numbers or diversity of benthic prey items.
- Other types of pollutants can adhere to sediments and be transported far downstream

United States

- EPA has switched to focus on watershed-level monitoring and protection rather than individual water bodies.
- What stops us from achieving national goals in water quality?
  - Sediment, nutrients, and pathogens, especially from non-point discharges
  - About three-quarters of water pollution in the US now comes from soil erosion, air pollution fallout, and agricultural and urban runoff

Big Picture – U. S.

- Over two-thirds of U.S. estuaries and bays are severely degraded because of nitrogen and phosphorous pollution.
- Water quality reports indicate that 45% of U.S. streams, 47 percent of lakes, and 32 percent of bays are polluted by EPA definition.
- Forty percent of America’s rivers are too polluted for fishing, swimming, or aquatic life. Over 46% of U.S. lakes are too polluted for fishing, swimming, or aquatic life.
- Every year almost 25% of U.S. beaches are closed at least once because of water pollution.
- Americans use over 2.2 billion pounds of pesticides every year, which eventually washes into our rivers and lakes

Other Countries

Developed:
- Sewage treatment in wealthier countries of Europe generally equal or surpass the US.
- In Russia, only about half of the tap water supply is safe to drink.

Developing:
- In urban areas of South America, Africa, and Asia, 95% of all sewage is discharged untreated into rivers.
- Two-thirds of India’s surface waters are contaminated sufficiently to be considered dangerous to human health.
- On an average 250 million people worldwide succumb to diseases related to water pollution.