

Human Influences on Water Quality

POLLUTION

- Harmful materials entering the environment
- Point source pollution – from a clearly identifiable source
- Nonpoint pollution comes from many different sources.
- Four main categories – industrial, residential, commercial, and environmental

WATER POLLUTION



Water Pollution



Sources of pollution

- **organic pollution** – decomposition of living organisms and their bi-products
- **inorganic pollution** – dissolved and suspended solids as silt, salts, and minerals
- **toxic pollution** – heavy metals and other chemical compounds that are lethal to organisms
- **thermal pollution** – waste heat from industrial and power generation processes
- **radiation pollution** - radioactive materials

Types of water pollutants:

Table 12.1 General Types of Water Pollutants

Class of pollutant	Significance
Trace Elements	Health, aquatic biota, toxicity
Heavy metals	Health, aquatic biota, toxicity
Organically bound metals	Metal transport
Radionuclides	Toxicity
Inorganic pollutants	Toxicity, aquatic biota
Asbestos	Human health
Algal nutrients	Eutrophication
Acidity, alkalinity, salinity (in excess)	Water quality, aquatic life
Trace organic pollutants	Toxicity
Polychlorinated biphenyls	Possible biological effects
Pesticides	Toxicity, aquatic biota, wildlife
Petroleum wastes	Effect on wildlife, esthetics
Sewage, human and animal wastes	Water quality, oxygen levels
Biochemical oxygen demand	Water quality, oxygen levels
Pathogens	Health effects
Detergents	Eutrophication, wildlife, esthetics
Chemical carcinogens	Incidence of cancer
Sediments	Water quality, aquatic biota, wildlife
Taste, odor, and color	Esthetics

a) Spills or Dumping in Water Bodies

Chemical spills and dumping of waste in the oceans or near coral reefs and ocean shelf areas causes major environmental problems.

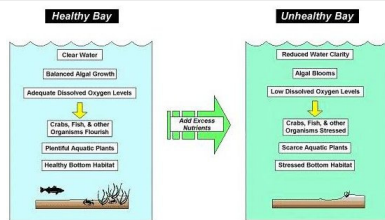


b) Plant nutrients

- Phosphates, nitrates, potassium, etc.
- Affect lakes, drainages and streams
- Sources:
 - Fertilizers application in farming
 - Sewage treatment plant effluents
- Leading to eutrophication and algal blooming

Habitat Loss Due to Poor Water Quality: Threatens Populations

1. Algae bloom coats submerged aquatic vegetation (SAV) which reduces their photosynthetic output.
2. SAV provides food, shelter, & nursery areas for blue crabs
3. Blue crabs, but are major predators of benthic communities and are prey for many other fish species.



Excess nutrients lead to excess algae, which leads to poor water quality and low oxygen, thereby reducing the habitat for living resources. Excess nutrients kill SAV which provide food, shelter and nursery areas for crabs.

Eutrophication



Eutrophication – bodies of water becomes enriched with nutrients. This can be a problem in marine habitats such as lakes as it can cause algal blooms.

- run-off from fertilizers, into nearby water causing an increase in nutrient levels.
- It causes phytoplankton to grow and reproduce more rapidly, resulting in algal blooms.
- This bloom of algae disrupts normal ecosystem functioning and causes many problems.
- The algae may use up all the oxygen in the water, leaving none for other marine life. This results in the death of many aquatic organisms such as fish, which need the oxygen in the water to live.
- The bloom of algae may also block sunlight from photosynthetic marine plants under the water surface.
- Some algae even produce toxins that are harmful to higher forms of life. This can cause problems along the food chain and affect any animal that feeds on them.

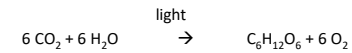
c) Inorganic chemicals:

manufacture has the potential to contaminate water with trace elements (The most harmful of the elemental pollution). Among these industries are those producing: **chlor-alkali, hydrofluoric acid, sodium dichromate, aluminum fluoride, chrome pigments, copper sulfate, nickel sulfate, titanium dioxide, and hydrogen cyanide.**

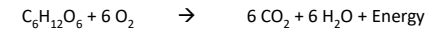
d) Dissolved Oxygen Depletion

• Processes Affecting Dissolved Oxygen in Water

- Photosynthesis



- Respiration

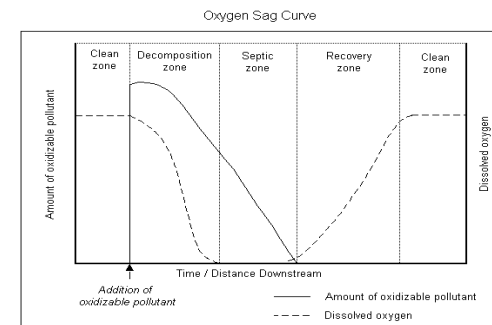


- Re-aeration
- Decomposition

• Factors Affecting Dissolved Oxygen in Water

- Temperature
- Light
- Turbidity
- Color
- Salinity
- Turbulence
- Aquatic organisms

• Oxygen Sag Curve



e) Organic pollutants

- **Synthetic organic compounds**

- Pesticides, plastics, solvents, detergents, PCBs, paints, pharmaceuticals, etc.
- **Sources:**
 - discharges of these compounds from domestic, agricultural, industrial and commercial operations, etc.
- Resistant to biological breakdown and persist and accumulate in the environment
- Directly toxic to aquatic life

f) Petroleum Pollution

- Municipal and industrial wastewater discharges (31.1%)
- Tanker operations (22%)
- Other marine transportation (12.5%)
- Tanker accidents (12.5%)
- Atmospheric fallout (9.4%)
- Natural seepage and erosion (7.8%)
- Refinery wastewater discharges (3.1%)
- Offshore oil production (1.6%)

g) Sediments

- Release of weathered sediments through runoff to water bodies
- **Sources:**
 - Clearing and developments adjacent to water bodies
 - Natural weathering of soils
 - Sewage discharge
 - Littering in water bodies
- Directly kill aquatic life
- Directly destroy habitats and spawning areas
- Reduce the sunlight penetrating into water

Thermal Pollution

- Discharge of cooling water
- **Sources:**
 - Industrial and commercial operations
 - Power Plants
- Heating up the aquatic environment
 - Aquatic organisms may become physiologically stressed or even be killed
 - Interference of the natural life processes, e.g. reproduction, growth rates, distribution of species
 - Decreasing dissolved oxygen (DO) in water