Unit 8: Pollution: module 4.48 Eutrophication and thermal pollution

Bozeman science:

https://www.bozemanscience.com/ap-es-005-water-resources

https://www.bozemanscience.com/ap-es-029-air-pollution

https://www.bozemanscience.com/ap-es-030-water-pollution

https://www.bozemanscience.com/ap-es-032-health-impacts

Water carrying categories:

- **Levees**: raised banks of a river, meant to prevent flooding (see Nile river flooding and soils)
- **Dikes**: raised bank to prevent the ocean (tidal, storm or sea level), NL example 1953 dike failure
- **Dams**: stop flow of river, increased depth can be used for hydropower
- **Reservoir**: the body of water behind the dam-see also: Yangtze river, fish ladders (Ballard Locks)
- **Aqueducts**: long usually open lined pathways for water (loss about 55% on the way-evaporation)

- Catskill Aqueduct NYC: underground supplies water to NYC
- River diversion: (see also three gorges dam in China)

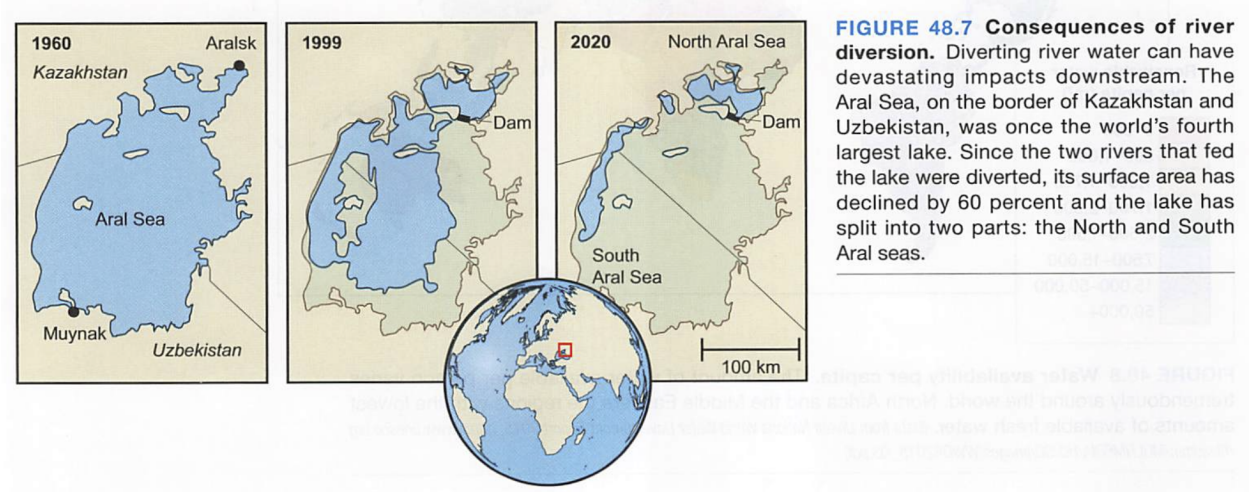


FIGURE 48.7 Consequences of river diversion. Diverting river water can have devastating impacts downstream. The Aral Sea, on the border of Kazakhstan and Uzbekistan, was once the world's fourth largest lake. Since the two rivers that fed the lake were diverted, its surface area has declined by 60 percent and the lake has split into two parts: the North and South Aral seas.

Screenshot 2023-03-06 at 4.21.18 PM.png

Water Purification and desalinization:

- **Distillation**: uses heat, either solar, fossil fuels or electrical (nuclear proposed), brine impact can be serious
- **Reverse Osmosis**: uses energy to force water under pressure through a membrane, fresher water passes through

Three types of waste water:

- white water: relatively clean, may be potable (drinkable)
- grey water: soapy water, not potable, can be used to water plants, may be recycled
- black water: raw sewage, not for watering, must be treated

Wetlands impact:

- fertilizers (nitrates, phosphates)
- development-increases runoff
- diversion (coastal diversion reduces resilience in storms)

Eutrophication: too much of a good thing (e.g. food)

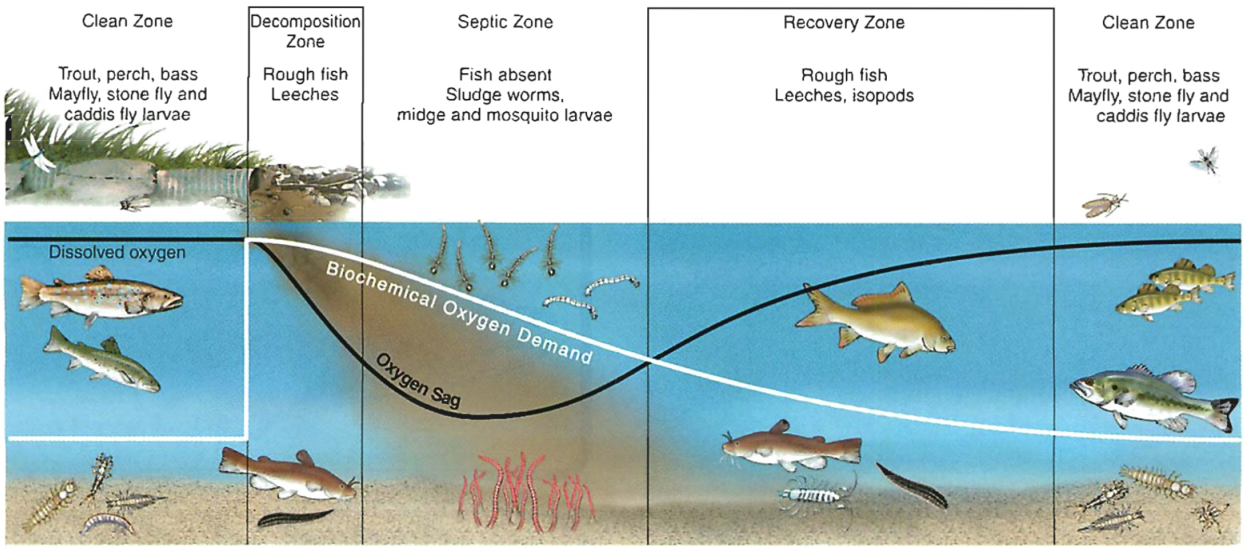
- usually associated with nitrates (e.g. fertilizers) or phosphates (manure)
- If caused by humans, "anthropogenic" or "cultural" eutrophication
- BOD (biochemical oxygen demand) refers to anything that can be decomposed with oxygen (e.g. manure, sewage)
- algal bloom has three steps:

1. 1. nitrate and phosphates cause algae to grow: "bloom"
   2. algae runs out of food, then dies
   3. algae settles to the bottom, decaying and using up dissolved oxygen there (dead zone)

Oxygen sag curve: in a river, when biological matter is added:

1. sewage or other microbial food is introduced into the river

2. BOD (biochemical oxygen demand) increases
3. dissolved oxygen (DO) drops (dead zone again) as microbes decompose the material, using dissolved oxygen in the water
4. agitation, photosynthesis eventually improves DO levels



Screenshot 2023-03-06 at 4.37.35 PM.png

Thermal Pollution

- Since DO is dependent on water temperature, warm water has less dissolved oxygen
- Power plants and other thermal waste sources reduce DO
- Other locations include sediment filled shallow basins like Chesapeake bay (dark water absorbs solar radiation)

"Perfect storm" for low dissolved oxygen: (see Chesapeake Bay example)

- high phosphates: algal bloom, high BOD
- high nitrates: algal bloom with toxins
- shallow: solar heating of water, low DO
- low agitation: no waterfalls
- sediment: no photosynthesis (ties to BOD test: brown bottles)
- BOD: sewage added (manure)

Noise Pollution:

- Airborne or waterborne
- Airborne: tour helicopters, industry
- Waterborne: military sonar, explosions (BBC piece on whales 3.28.24)
- OSHA sets limits on noise levels based on dB scale
- Exposure time limit is halved for every 10dB increase

Migrated from Apple Server Wiki. Original page ID: K9x4p90

Revision #2
Created 2026-09-29 15:58:15 UTC by Admin
Updated 2026-09-29 16:19:32 UTC by Admin