



Watershed Watchdogs



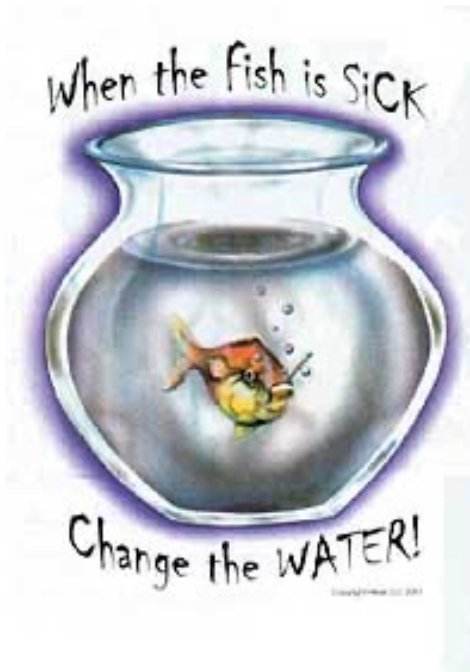
**Understanding the
Water Quality Index (WQI)
Parameters**

A Brief History of U.S. Water Quality

- 1970's – At least **65%** of water tested in U.S. waterways was unsafe for fishing or swimming
- 1972 – Clean Water Act passed by U.S. Congress
- ~2000 – Only about **33%** of the nation's waters are considered unsafe

WHY?

Efforts to reduce “point source pollution” have met with success (legislation regulating industry)



But, most of damaging pollution is “nonpoint source pollution” that comes from several places and reaches streams by way of *RUNOFF* – very difficult to control!

What is the point of testing water quality?

If we can't trace the specific source of pollution, how can we possibly stop it?

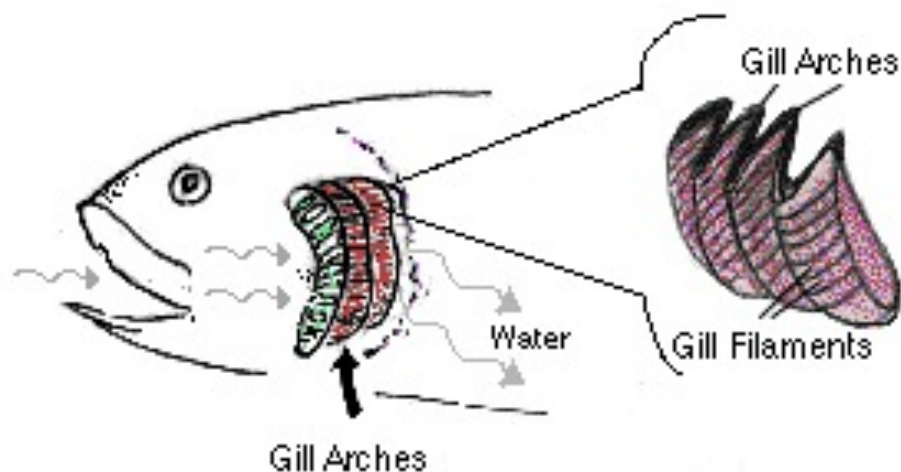
- We know which substances are largely responsible for decreasing water quality, because we understand *ecology*.
- By testing the chemistry of the water, we find out what pollutants are present and can propose possible sources.
- Creating an environmentally aware public through EE will promote a more environmentally friendly way of life.

Water Quality Index (WQI)

- We test for nine parameters outlined by the National Sanitation Foundation
- The data is analyzed and the product is a score between 0 and 100 (worst to best) to compare stream health.
- **Dissolved Oxygen (DO)**
- **Fecal Coliform**
- **pH**
- **Biochemical Oxygen Demand (BOD)**
- **Water Temperature**
- **Phosphates (Orthophosphates)**
- **Nitrates**
- **Turbidity**
- **Total Dissolved Solids**

Dissolved Oxygen (DO)

Fish need to breathe, just like humans do!



Oxygen comes from:

- Churning at surface
- Photosynthesis from aquatic plants

Oxygen is depleted by:

- High turbidity
- Increased temperature
- Decreased SAVs

Measured in:

mg/L *and* % Saturation

Acceptable limit:

At least 5-6 mg/L

If there is not enough dissolved oxygen...



A fish kill in Maryland

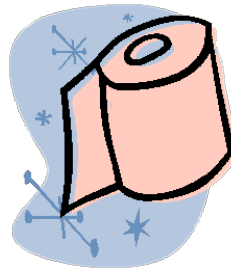
Fecal Coliform

Would you want to swim in your toilet?

...Neither do the fish!

***E. Coli* is a naturally occurring intestinal bacteria**

- Not usually harmful
- May **indicate** other harmful microorganisms



Measured in:

of bacterial colonies per 100mL of water

Sources:

- Sewage contamination
- Natural mammal population

Acceptable Limits:

Drinking: 0, 0

Primary: <200, <1,000

Secondary: <1,000, <5000



**Raw sewage
enters a
stream**

pH

**A change in the aquatic atmosphere can
STRESS out aquatic life!**

pH affects chemical and biological processes

- Cellular respiration
- Stresses body systems of most organisms

Optimal Range: 6.5 – 8.2

Most Rainwater: 5.6

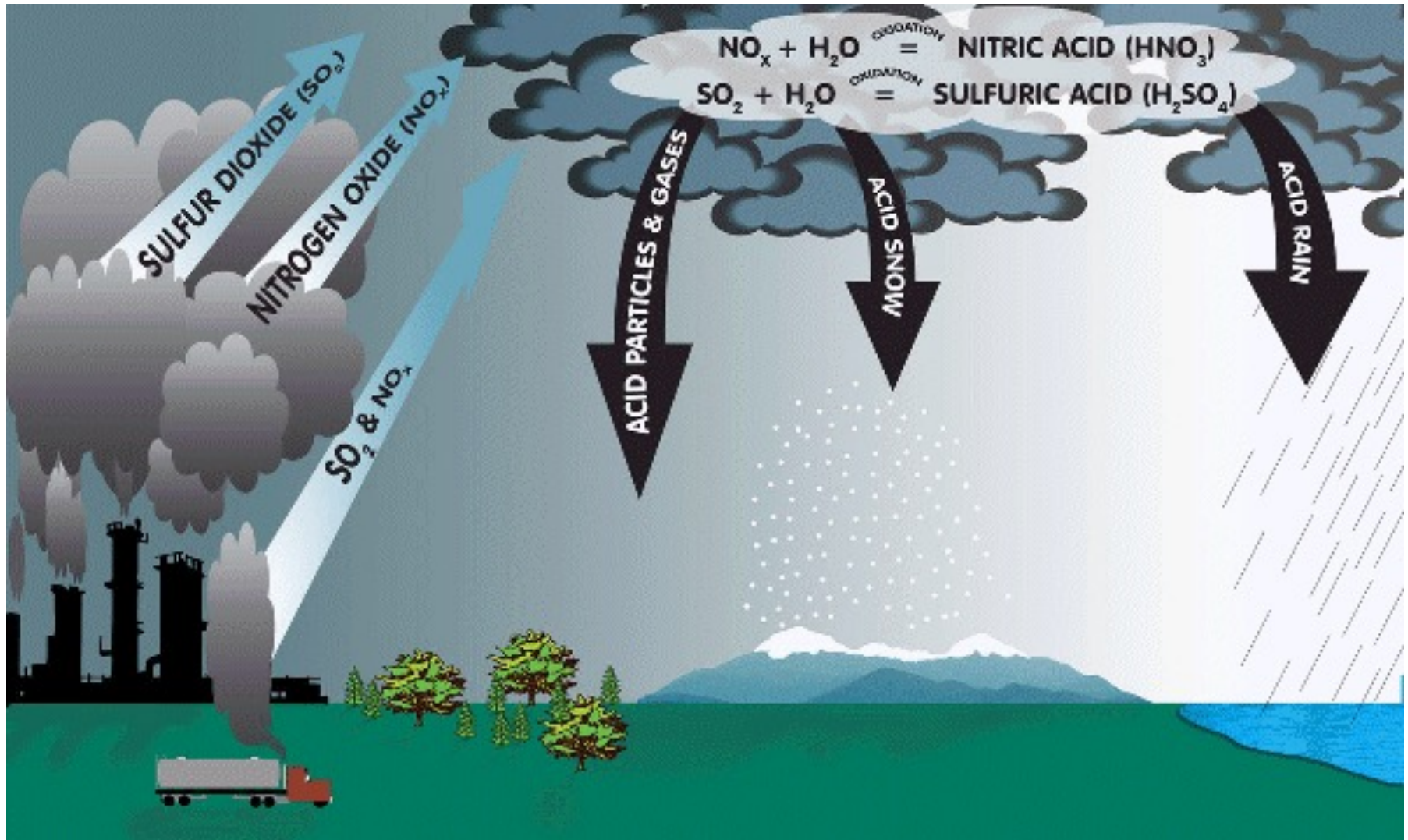
DC Rainwater: 4.2 – 4.4

Factors:

- Acid rain
- Heavy precip
- Sewer overflow
- Melting snow
- Ag runoff
- Dissolved
- Accidental spills
- minerals



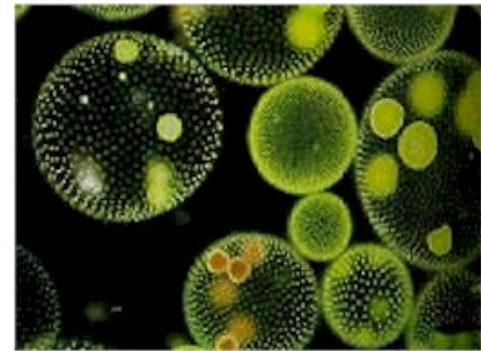
Acid Rain



Biochemical Oxygen Demand

Tells us how much micro-organic matter is floating around in a stream

Measures how much oxygen is used by bacteria that help to decompose dead organic matter



Algae

Factors that affect BOD:

- Algae, organic matter, blooms when nutrients are in excess
- Raw sewage, adds organic matter to water

If BOD is high:

- Too much O₂ is consumed
- Fish cannot survive

Acceptable limit:

- 5 mg/L or less is ideal
- > 30 mg/L is unsafe



Algae Bloom

Temperature Change

Aquatic organisms can't pull on a sweater like we can – they need consistent temperatures!

- Affects chemical properties of water
- Affects biological and physical processes in the aquatic ecosystem

Acceptable limit:
< 4-5 degrees
Celsius change
per mile of stream



Examples:

Oxygen content
Photosynthesis rates
Metabolic rates
Sensitivity to toxics, parasites,
diseases

Factors:

- Bank vegetation removal
- Impounding water
- Discharge of heated water



Ohio



Costa Rica

Phosphates (Orthophosphates)

Orthophosphates are the limiting factor for plant growth!

Aquatic plants and algae use phosphates for metabolic reactions and growth



Source:

- Fertilizers
- Detergents
- Industrial wastes

Acceptable Limits:

- 1 mg/L is ideal
- >4 mg/L causes eutrophication

Extra Nutrients → More Algae → More Turbidity → Less Photosynthesis
→ More Algae + Bacteria that Decompose Organic Matter
= Less Dissolved Oxygen!

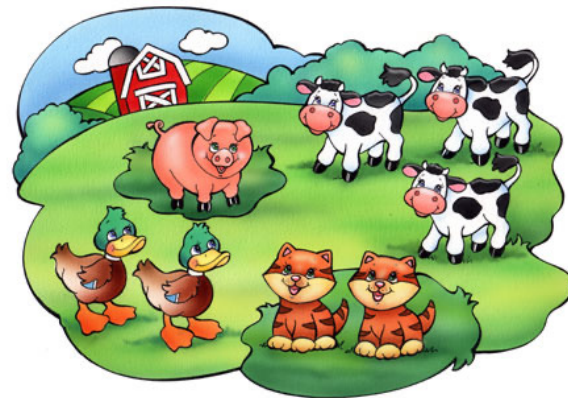


Nitrates

Nitrogen is an indicator nutrient!

Measured because:

- Extremely high levels can indicate harmful pollution sources
- Can make groundwater unsafe for humans



Acceptable Limits:
< 4.4 mg/L

Sources:

- Animal waste, esp. duck and goose droppings
- Decomposing organic matter
- Air pollution, esp. commuters





How nitrates get from automobiles into the water supply.

Nitrates in Groundwater



Powdered baby formula, mixed with tap water could contain nitrate

Turbidity

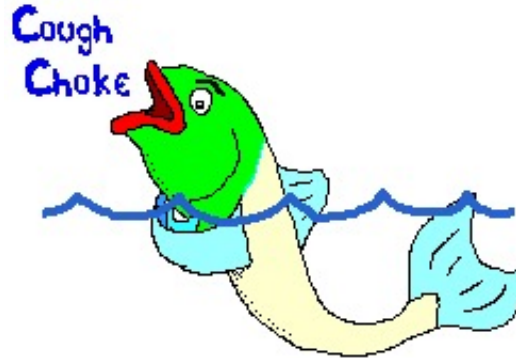
Imagine that “LA Smog” happens underwater

Effects:

- Higher water temperatures
- Blocks photosynthesis
- Clogs gills of fish

Acceptable Levels:

- Drinking water < 0.5 JTU
- Groundwater < 1 JTU
- Stream water < 40 JTU



Major Factors:

- Soil particles from erosion
- Plankton and microbes from eutrophication



Fitzroy River Estuary

Total Dissolved Solids

Exactly how much “stuff” is dissolved in this water?

Sources:

HUMAN ACTIVITY

Runoff carrying street salts

Lawn fertilizers

Wastewater treatment outflow

Acceptable Limits:

Drinking water <500 mg/L

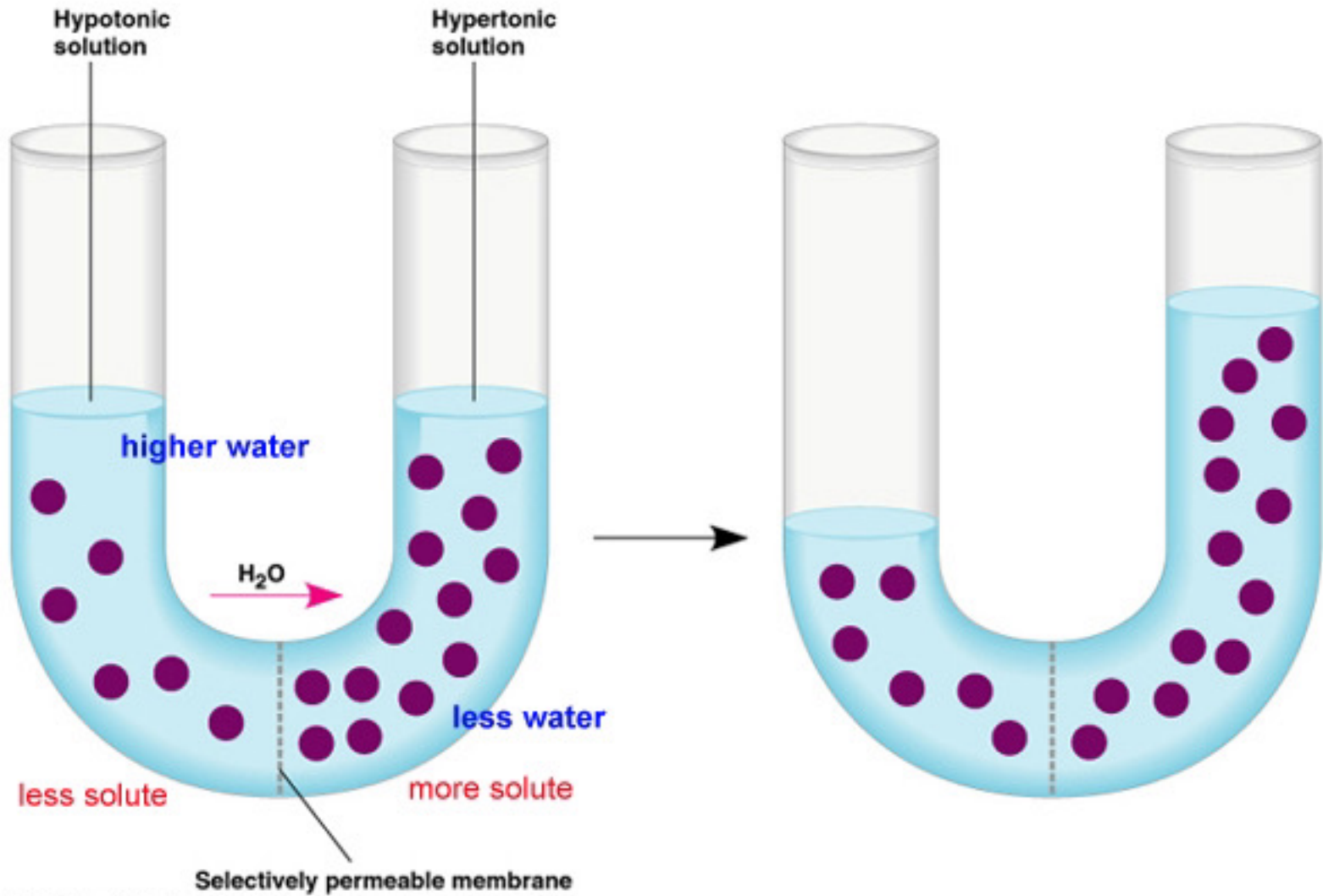
Stream water 100-2000 mg/L
(average is ~600 mg/L)

Effects:

Water balance problems for organisms
(example: dissolved calcium)

Low levels limit growth of aquatic life





References:

- BTW Watershed Watchdogs Resource Booklet
- MDE website:
http://www.mde.state.md.us/Programs/MultimediaPrograms/environmental_emergencies/FishKills_MD/index.asp
- Earth Justice website:
<http://www.earthjustice.org/urgent/print.html?ID=17>
- NY State Dept of Env'tal Conservation:
<http://www.dec.state.ny.us/website/dar/ood/acidrain.html>
- Australian Government (OzEstuaries):
http://www.ozestuaries.org/oracle/ozestuaries/indicators/In_turbidity_f.html
- Biology Corner:
<http://www.biologycorner.com/bio1/diffusion.html>