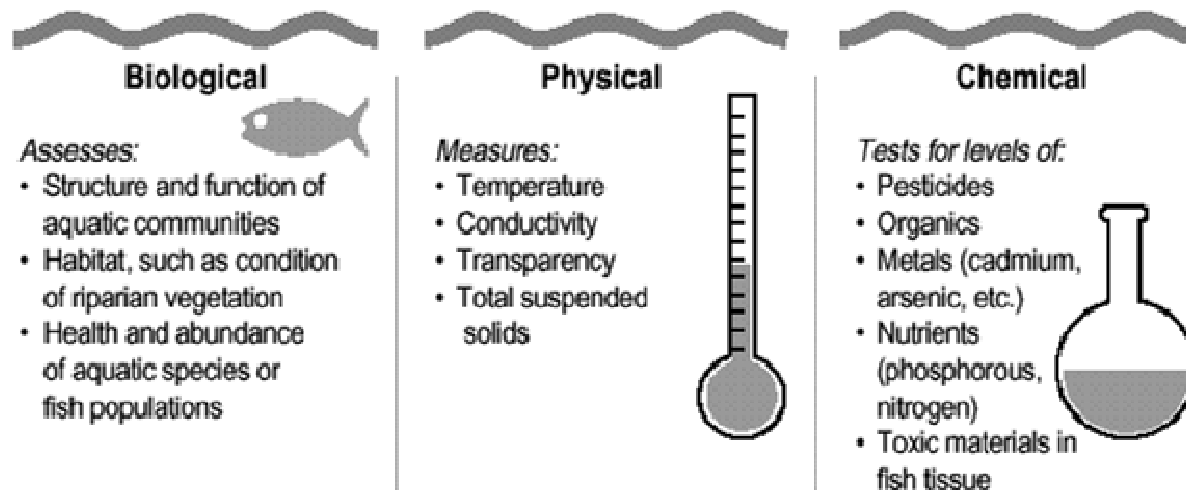


# Common Monitoring Parameters

Figure 6: Monitoring Types and Pollutants or Conditions That They Measure



# Step 1

## Consider purpose/objectives of monitoring

- Assess use attainment
- Characterize watershed
- Identify pollutants and sources
- Investigate fate & transport
- Measure effectiveness
- Determine changes and trends
- Assess compliance
- Modeling

# General classifications

- Physical
- Chemical
- Biological
- Habitat
- Stream morphology

# Pros & Cons

## Physical/chemical

- Quantitative, real number
- Sample collection and analysis usually straightforward
- Directly related to wqs, project goals
  
- Represent only instantaneous conditions
- Consider only one parameter at a time
- May be difficult to relate to use, public perception

# Pros & Cons

## Biological

- Organisms integrate effects of stressors over time
  - Indicate real ecological issues
  - Status of biological communities of direct public interest
  - May be inexpensive relative to complex chemical tests
- 
- High variability may make detection of change or trends difficult
  - Specific pollutants or sources causing impacts may not be revealed
  - Complex relationships with habitat, ecoregion
  - Collection may be inexpensive, but analysis is often expensive and time-consuming

# Physical

## Stage, flow

(ft, m, ft<sup>3</sup>/sec, m<sup>3</sup>/sec)



Staff gage, area/velocity measurements, electronic instruments

## Temperature

(°F, °C)

Thermometer, electronic instrument (manual or recording)

# Physical

Transparency  
(m, cm)

Conductance  
( $\mu\text{S}/\text{cm}$ )



Secchi disk (lakes)  
Transparency tube (streams)

Electronic meter (field or lab)



# Physical

## Total Dissolved Solids (TDS)

(mg/L, ppm)

Laboratory

(gravimetric, evaporation of filtered water sample)

## Turbidity

(NTU)

Electronic meter (field or lab)



# Physical

Suspended  
sediment

(mg/L, ppm)

Laboratory

(gravimetric, particulates captured on  
filter)



# Chemical

pH

Electronic meter (field or lab)

**Alkalinity, Acidity**  
(mg/L, ppm)

Laboratory (wet chemistry)

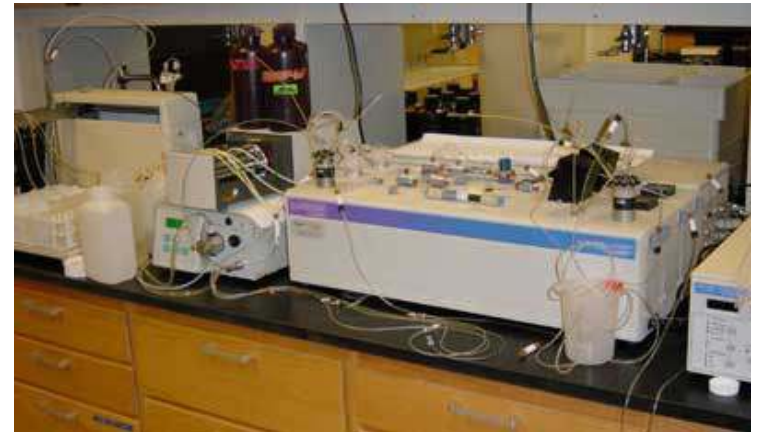
# Chemical

Dissolved  
oxygen  
(mg/L, ppm)

Electronic meter (field)



# Chemical



**Total P**  
(mg/L, ppm)

Laboratory (whole sample; wet chemistry, ICP)

**Dissolved P**  
(mg/L, ppm)

Laboratory (filtered sample; wet chemistry, ICP)

\*Other P form sometimes reported:

particulate P, soluble reactive P, bioavailable P, organic P

# Chemical

## Total Nitrogen

(mg/L, ppm)

Laboratory (whole sample; wet chemistry, ICP)

Addition: TKN + NO<sub>2</sub>+NO<sub>3</sub>

## Total Kjeldahl Nitrogen

(mg/L, ppm)

Laboratory (whole sample; wet chemistry)

# Chemical

Ammonia  
Nitrogen

(mg/L, ppm)

Laboratory (whole sample; wet  
chemistry, electrode)

Organic Nitrogen

(mg/L, ppm)

Difference: TKN - ammonia

# Chemical

Nitrite + Nitrate  
Nitrogen

(mg/L, ppm)

Laboratory (filtered sample; wet  
chemistry, ion chromatography)  
Sometimes determined separately

# Chemical

Toxics, pesticides

(mg/L,  $\mu$ g/L)

Laboratory (GC/MS, ELISA)

Metals, ions

(mg/L, ppm)

Laboratory (AA, ICP, Ion chromatography)



# Chemical

Organic Carbon  
(TOC, DOC)  
(mg/L, ppm)

Laboratory (carbon analyzer, infrared detector)

# Biological

Chlorophyll a

(mg/L, ppm)

Laboratory (filtration, wet chemistry)

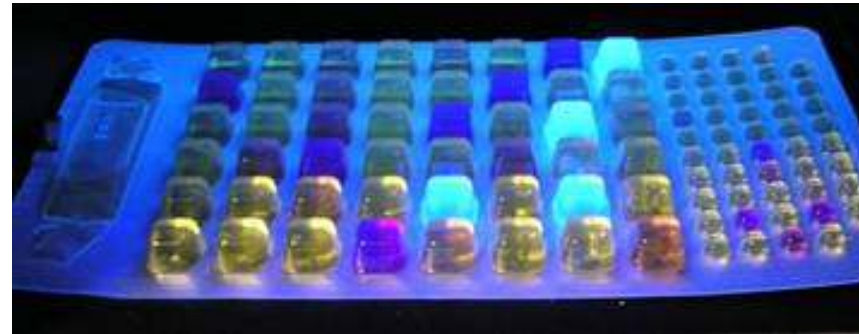
Biological  
Oxygen Demand

(mg/L, ppm)

Laboratory (D.O. before/after  
incubation under standard conditions)



# Biological



## Fecal bacteria

Fecal coliform

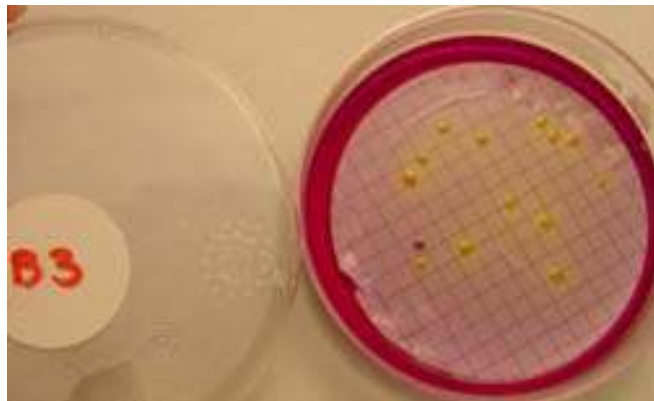
E. coli

Enterococci

(MPN, cfu/100 ml)

Laboratory (multiple tube fermentation, membrane filtration, enzyme substrate)

Field test kits (variable accuracy)



# Biological



Benthic  
macroinvertebrates

Field collection (dip net, D-net, kick  
seine, surber sampler)

Laboratory enumeration and  
taxonomy

Fish

Field collection (dip net, seine,  
electrofishing)

Field enumeration and taxonomy



# Biological

## Metrics for biomonitoring data: Macroinvertebrates

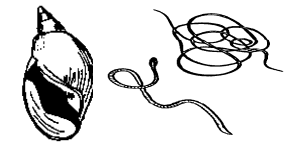
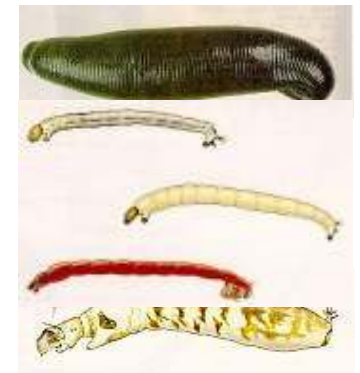
- Taxa richness
- Community Composition
- Tolerant/intolerant
- Functional feeding groups
- Index of Biotic Integrity

## Fish

- Diversity indices
- Tolerant/intolerant
- Index of Biotic Integrity (IBI)



Intolerant



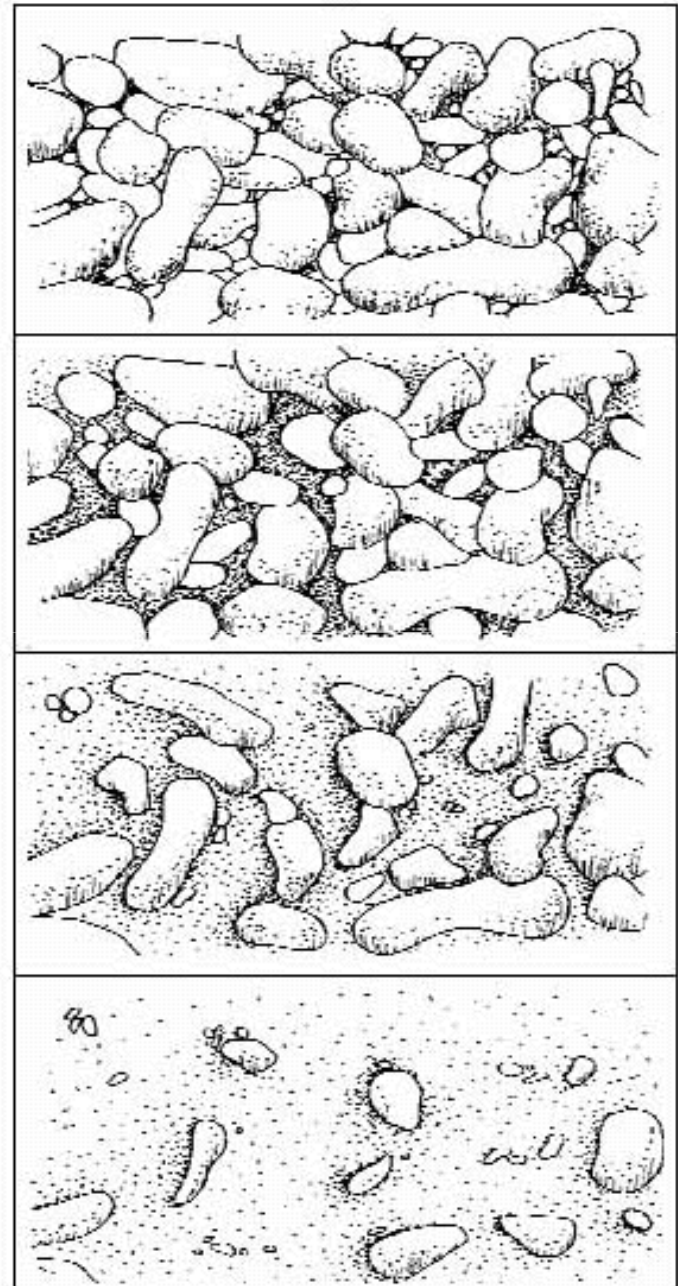
Tolerant

# Habitat

- Channel morphology (width, depth, sinuosity)
- Substrate (type, diversity, embeddedness)
- Aquatic vegetation
- Riparian vegetation (type, canopy cover)
- Riffle/pool distribution

Velocity

Temperature, D.O. regime



# Stream Morphology

Vertical bank stability

Floodplain form

Bankful stage

Channel form (Rosgen classification)

Width/depth ratios

Sinuosity

Channel slope

Meander length, amplitude, radius

Channel materials (clay, silt, sand, gravel, cobble)



# Other Considerations

- Project objectives
- Pollutant sources
- Land treatments implemented
- Cost
- Logistics
- Correlations/surrogates