

# What It All Means:

What we monitor

Why we monitor those things

Why it matters to monitor those things

How to use the data

Water Quality and Volunteer Monitoring: A  
Workshop for Water Education Professionals

December 15-16, 2004

Yuma Crossing State Park, Yuma, AZ



# What's monitored?

- Chemical
- Physical
- Biological



# Top Parameters Lakes & Rivers

## River/Streams

- **Water Temp. (88%)**
- **pH (78%)**
- **Macroinverts (76%)**
- **Diss. Oxygen (73%)**
- **Nitrogen (53%)**
- **Flow/water level (51%)**

## Lakes

- **Secchi trans. (88%)**
- **Water Temp. (74%)**
- **Phosphorus (66%)**
- **Diss. Oxygen (58%)**
- **Chlorophyll (51%)**
- **pH (45%)**

# Stream Flow

## What values you might find

- Measured in cubic feet per second (cfs)
- Colorado River below Laguna Dam: mean is 1726 cfs (31 years of records); median is between 400-500 cfs
- Verde River (Scottsdale): mean is 344 cfs; median is between 290-320 cfs
- Little Colorado (Woodruff): mean is 19.2 cfs; median is between 7 and 9 cfs

## Affected by

- Weather patterns; irrigation; water use

## Affects

- Shape, size and course of stream/river



# Turbidity

## What values you might find

- 10-50 NTU (Nephelometric turbidity units) (often exceeds 1000 NTUs with runoff)

[Note AZ repealed turbidity standard of 50 NTU in 2002]

## Affected by

- Erosion from construction, tillage and stream banks
- Algal growth
- Organic particles
- Point sources – industrial wastes, municipal wastewaters

## Affects

- Light transmission and algal and aquatic plant growth
- Water taste
- Transport of nutrients and toxins
- Spawning beds



# Total Suspended Solids

## What values you might find

- 50-50,200 ppm (beyond 150,000 in runoff water from erosion events in Little Colorado River at Joseph City)

## Affected by

- Erosion from construction, tillage and stream banks
- Algal growth
- Point sources – industrial wastes, municipal wastewaters

## Affects

- Light transmission and algal and aquatic plant growth
- Water taste
- Transport of nutrients and toxins
- Spawning beds



# Dissolved Oxygen

## What values you might find

- Depends on temperature; 6 – 10 mg/L oxygen; 80-100% saturation is good

## Affected by

- Time of day
- Groundwater – base flow inputs - geology
- Organic matter in the stream – wastes, plant parts, etc.
- Riffles, turbulence, falls; Algal activity

## Affects

- Fish and macroinvertebrate health
- Algal and aquatic plant growth rates
- Rates of microbial activity



# pH

## What values you might find

- pH 6 – 9; 5.6 in equilibrium with atmosphere

## Affected by

- Groundwater – base flow inputs - geology
- Nutrient inputs
- Point sources
- Algal activity – up to pH 10 in blooms

## Affects

- Ammonia toxicity to aquatic organisms
- Nutrient uptake
- Heavy metal toxicity to aquatic organisms



# Temperature

## What values you might find

- Groundwater – 50F

## Affected by

- Groundwater – base flow inputs
- Shade
- Point sources; Runoff ; Snow melt
- Depth – in lakes

## Affects

- Amount of oxygen water can hold
- Rate of photosynthesis
- Metabolic rates of aquatic organisms
- Sensitivity of organisms to wastes, parasites, diseases



# Conductivity - salinity

## What values you might find

- 500-3000 micro mhos/cm

## Affected by

- Groundwater – base flow inputs - geology
- Snow melt, runoff from soil
- Point sources – human wastes, manures, industrial wastes

## Affects

- Health of fish
- Plant growth, at high levels
- Nutrient and toxin solubility
- Coagulation of particles



# Nitrogen

## What values you might find

- $<1$  mg/L  $\text{NH}_4$  as N;  $< 0.5$  mg/L  $\text{NO}_3^-$

## Affected by

- Groundwater – base flow inputs - geology
- Snow melt, runoff from soil
- Point sources – human wastes, manures, industrial wastes

## Affects

- Health of fish
- Plant growth, at high levels
- Nutrient and toxin solubility
- Coagulation of particles



# Phosphorus

## What values you might find

- Less than 0.5 mg/L

## Affected by

- Groundwater – base flow inputs - geology
- Snow melt, runoff from soil
- Point sources – human wastes, manures, industrial wastes

## Affects

- Health of fish
- Plant growth, at high levels
- Nutrient and toxin solubility
- Coagulation of particles



# Macroinvertebrates

## Which ones are present

- Mayflies, stoneflies, caddisflies, crayfish, snails, worms, true bugs, damselflies, dobsonflies, beetles, etc.

## Affected by

- Pollution inputs (organic and inorganic)
- Available habitat
- Velocity and volume of water (flow)

## Affects

- Fish health



# Habitat

## Scoring

- Assessment scores vary between programs – based on size, bottom substrate, sinuosity, riparian vegetation, bank stability, etc.

## Affected by

- Runoff
- Land use

## Affects

- Fish and macroinvertebrate survival/success
- Turbidity/TSS
- Nutrient concentrations (if erosion)



# Bacteria

## What values you might find

- <1 – TNTC cfu/100 mL
- 235 cfu/100 mL *E. coli* is standard

## Affected by

- Warm-blooded animals'
- Malfunctioning septic systems
- Snow melt
- Runoff
- Groundwater (dilution effect)

## Affects

- Potential health hazard with presence above standard



# Other

- Alkalinity
- Hardness
- Metals
- Plants
- Fish
- Pesticides
- Drugs



# Using the data: Local Use is essential

## Volunteer

- Track stream quality
- Establish long term trends
- Isolate sources of pollution problems
- Provide data to local planners
- Educate landowners about local water resources

## Regional Coordinator

- Compile watershed data to get overall watershed health assessment
- Alert state agency to pollution problems
- Provide data to different local users

Source: “Save Our Streams Volunteer Trainer’s Handbook” by Firehock



# Steps to Using Data Locally

## The data

- Entered into database
- Validated
- Backed up!
- Interpreted
  - **Minimum of 5 data points for statistics**

Average

Geometric mean

Median

Range

Quartiles

Abundance

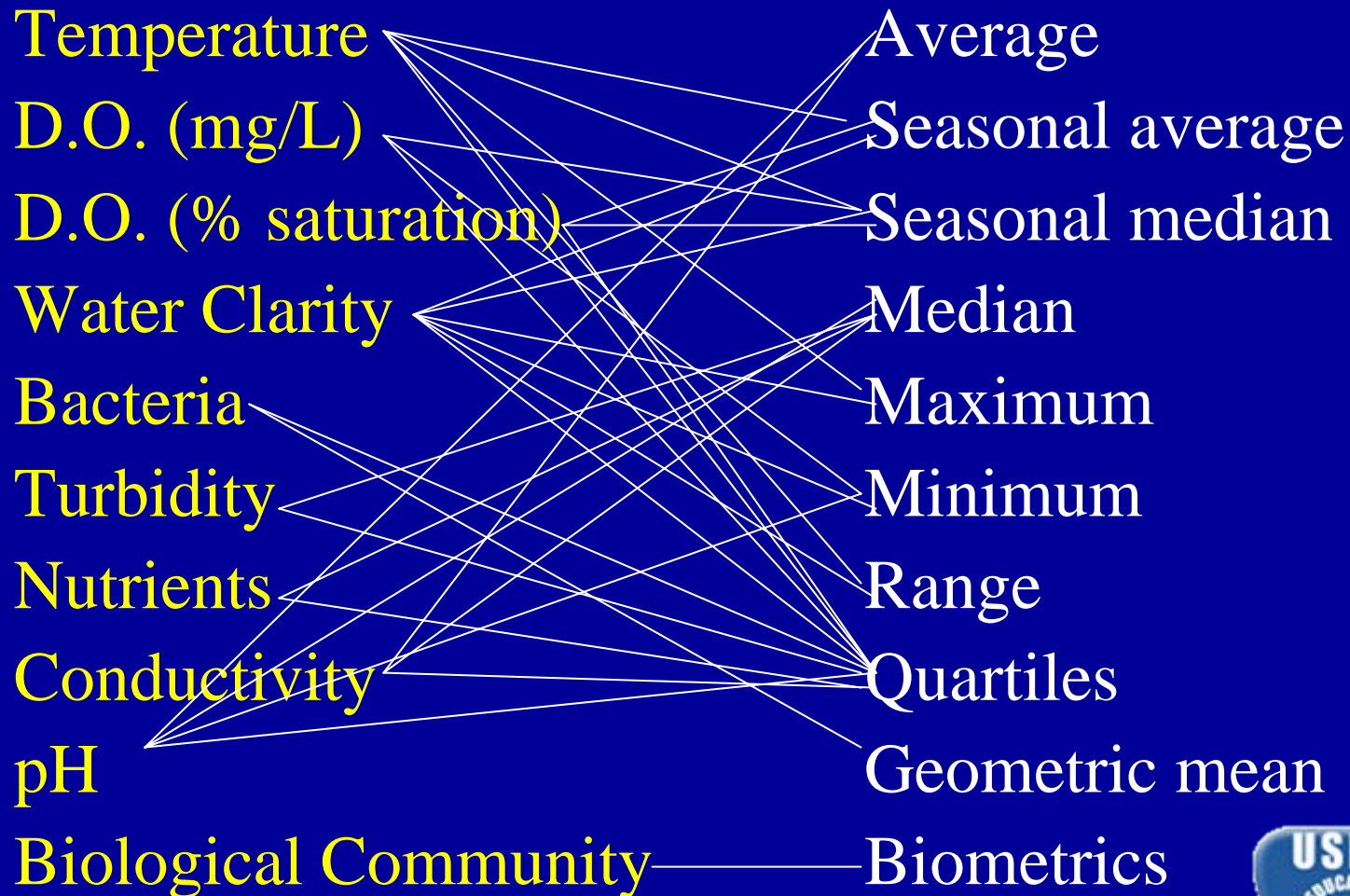
Biotic index

Pollution tolerance

Source: “Data to Information” by Schloss and Dates



# Suggested Data Summaries



Source: "Data to Information" by Schloss and Dates



# Steps to Using Data Locally

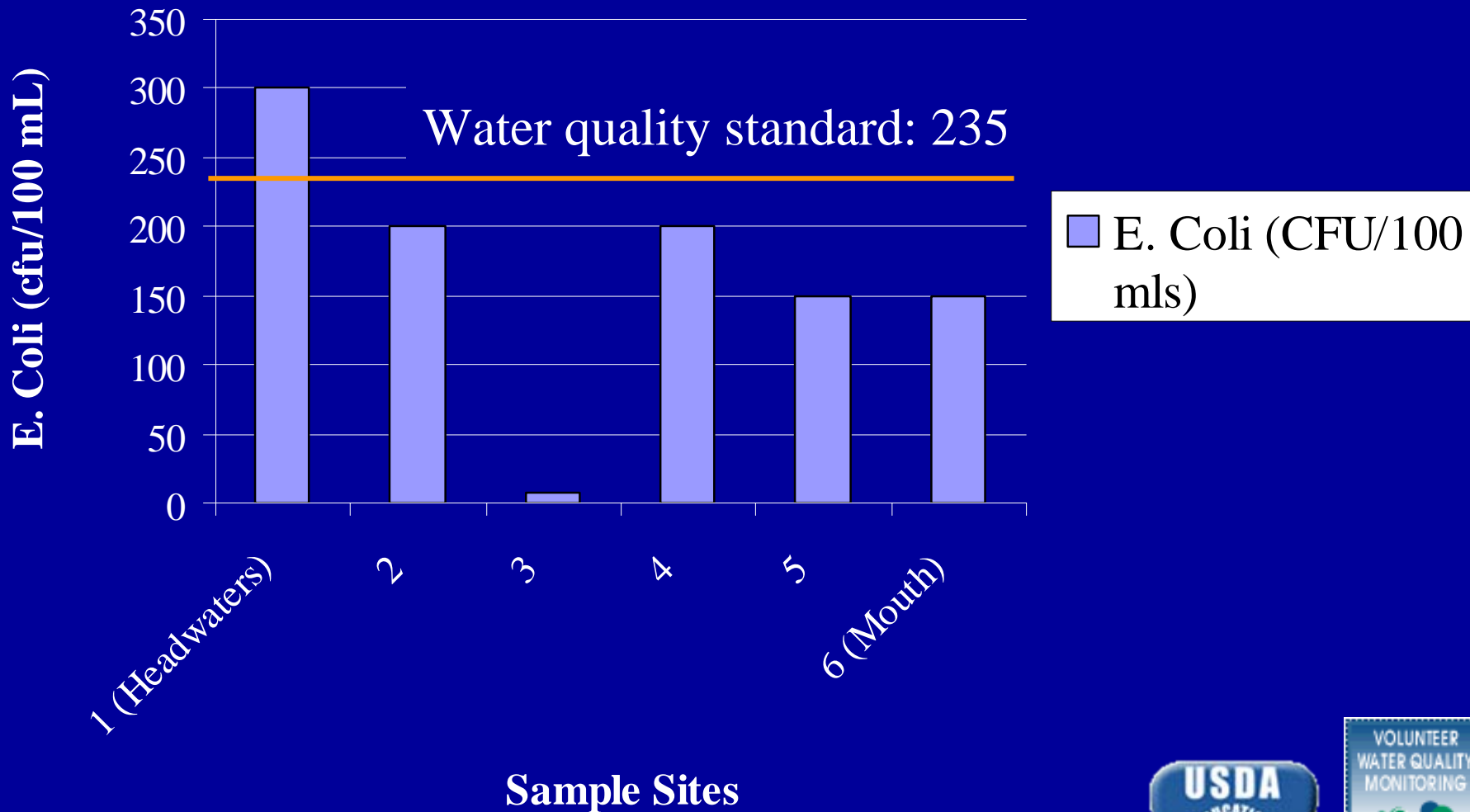
## The data

- Presented
  - Tables
  - Maps
  - Graphs
    - Title
    - Axes labeled (don't forget units)
    - Scale that shows trends
    - Legend
    - Tells a story/lets reader understand meaning
    - Not too busy

Source: “Data to Information” by Schloss and Dates



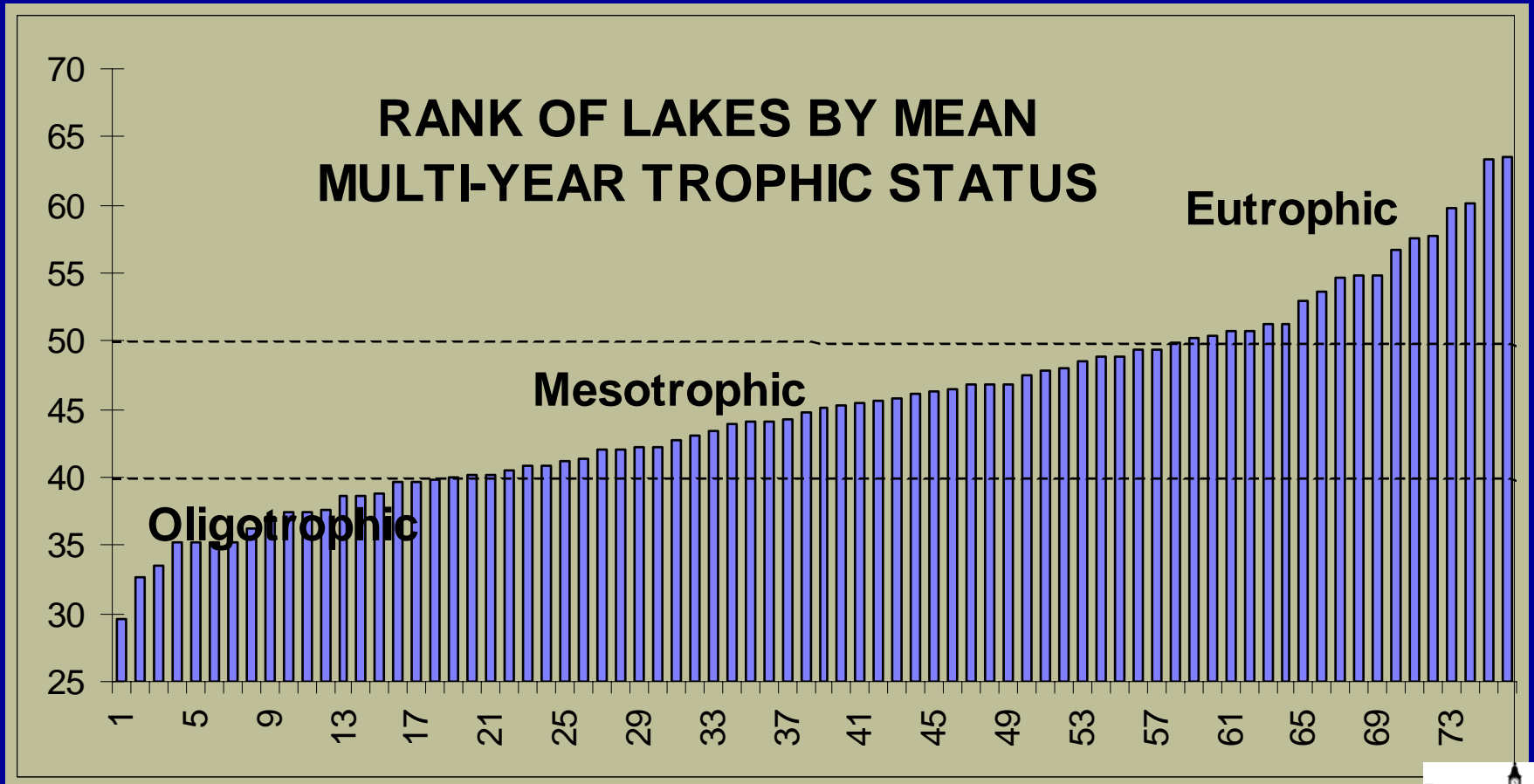
# *E. Coli* concentrations on Alakakat River June 12, 2000



Source: "Data to Information" by Schloss and Dates



# Distribution of Lakes by TSI



URIWW Locations with 3 or more years of data only

# It's not (too) difficult

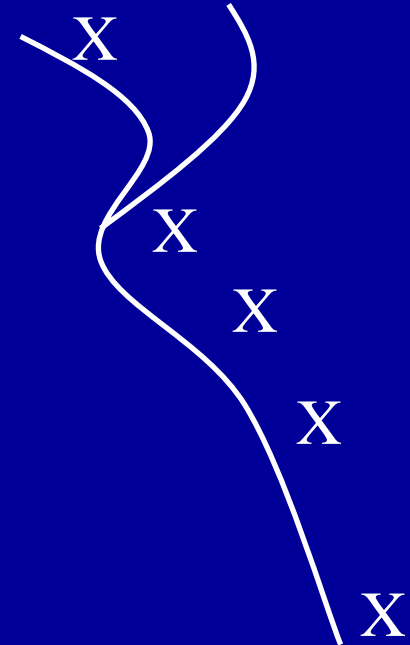
## Hardest parts

- Deciding what you want to show
- Organizing the data
- Time to run analyses and create tables/graphs
- Consistent presentation



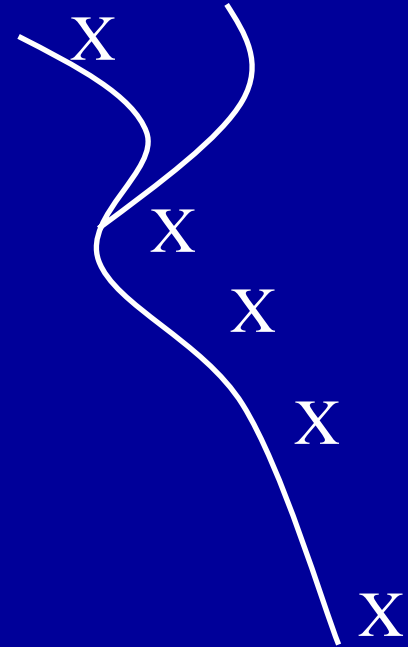
# Let's Try It

1. Map of Cooper River Watershed
2. Data for 4 sampling dates
3. Question for you: What do you want to show?
  - A. Site over time
  - B. Watershed snapshot on different days



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# Your Tasks

- Display data how you think it's best to tell the story -- use large paper
- What additional information may be useful to know that you don't currently know (to tell your story)?
- Present back to the group

The idea is to get you thinking about what data you need to be able to tell the story you want to tell.



# Summary

- There are many variables that can be monitored
- Choose equipment that will provide answers your desire
- Decide how much data are needed to tell the story
- Decide how its best to tell the story



“We monitor because we care; We care because we are informed; We are informed because we monitor.”

-- Cassie Champion

