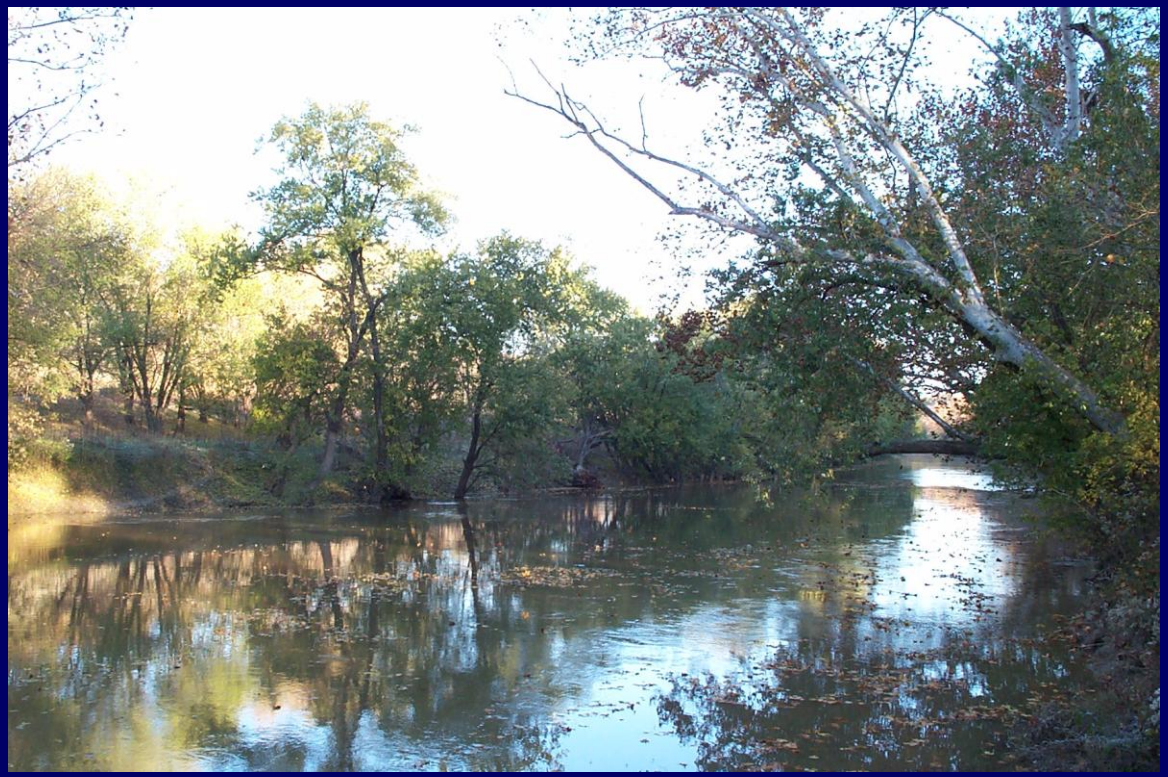
Welcome to the 1st Webinar in the Series
Monitoring & Assessment for Watershed Plans:
Identifying, Accessing, and Using Data to Protect and Restore Indiana's Waters
Each Monday in May at noon

Today's Webinar:

Types of Monitoring and Assessment Data and What They Mean

Presented by Barry Tonning, Tetra Tech

Types of Monitoring and Assessment Data and What They Mean



Top Two Questions for State Water Resource Agency Personnel:

- Where are the best places to fish?
  - *Aquatic life support*
- Is my water safe to drink?
  - *Human health considerations*

Watershed planning & management

- Watershed planning is a weight-of-evidence based cycle of assessments and actions to improve water quality
- What measures can we use for assessments?

What should we monitor?

- Indicators that:
  - Characterize the watershed
  - Define and/or refine your understanding of the problem(s), such as water quality criteria violations, etc.
  - Show changes in targeted water quality or habitat conditions

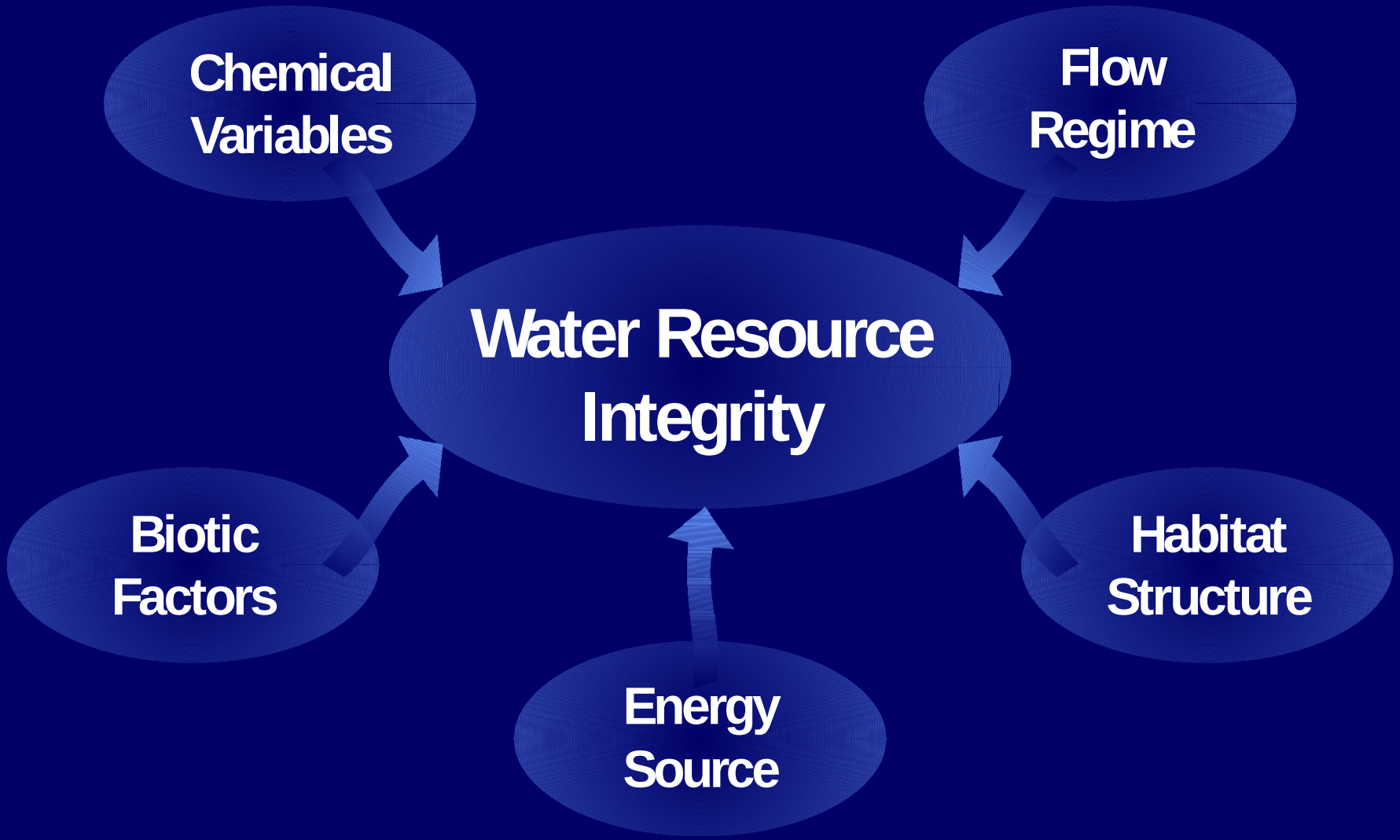
Measuring watershed health

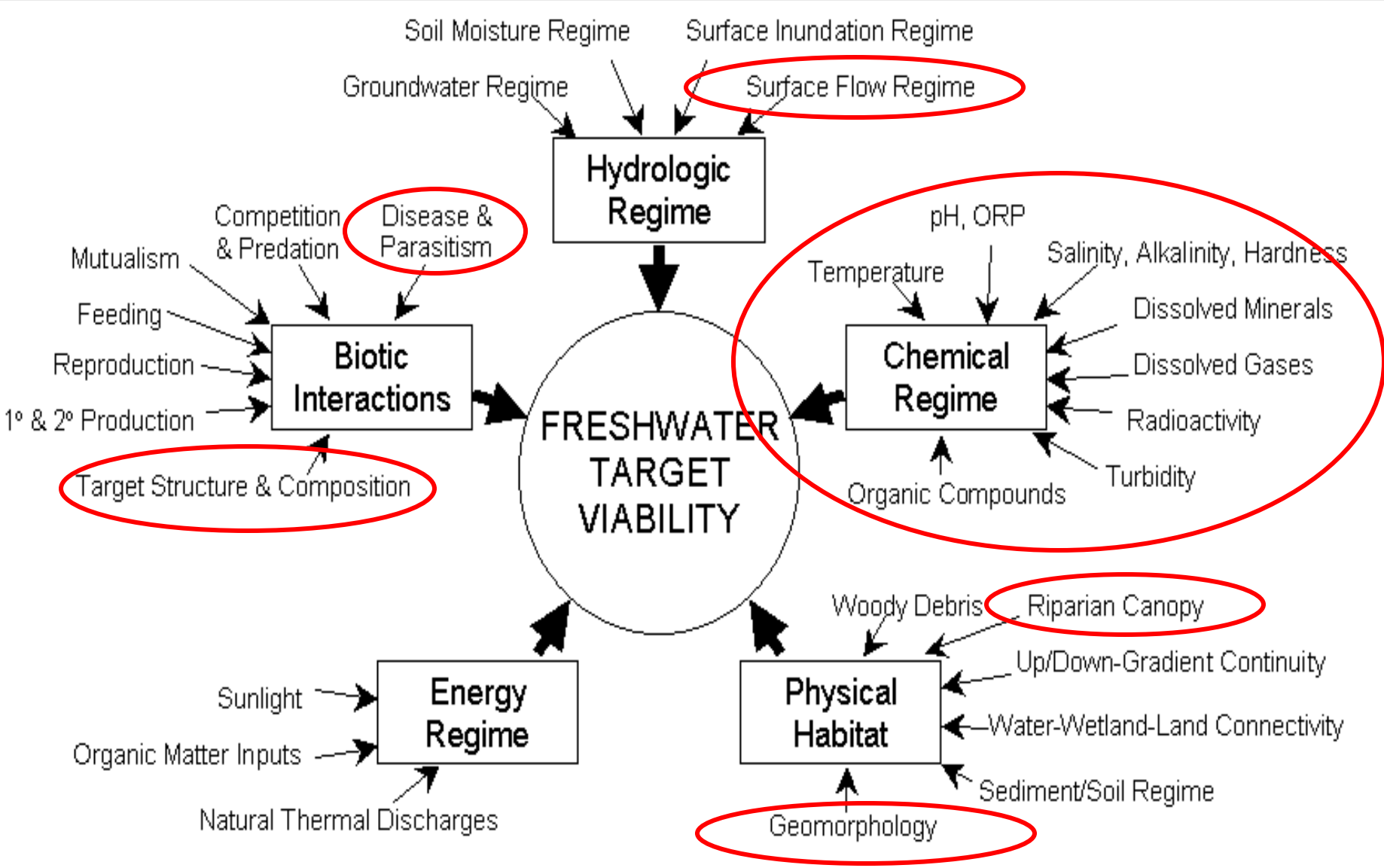
Measurements can be taken:

- In the stream, river, lake, or wetland
- Along the bank area
- Within the uplands regions
  - Land uses/cover/mgmt practices
    - Agricultural – crops & livestock
    - Logging and mining sites
    - Towns and cities

Measurements in the stream or river

How scientists conceptualize the variables affecting water quality:





* Modified from Karr et al. (1986).

Structural, functional, & other elements impacting water quality

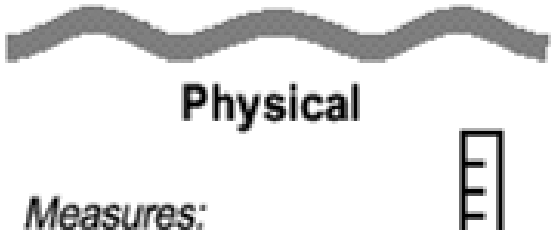
Quick review of the most common (and useful) in-stream water quality indicators

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

Biological

Assesses:

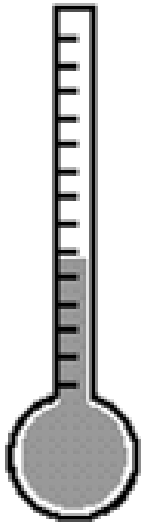
- Structure and function of aquatic communities
- Habitat, such as condition of riparian vegetation
- Health and abundance of aquatic species or fish populations



Physical

Measures:

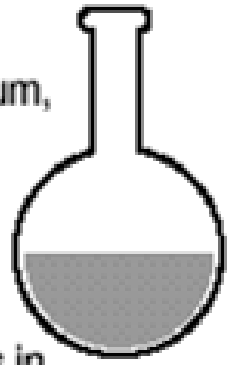
- Temperature
- Conductivity
- Transparency
- Total suspended solids



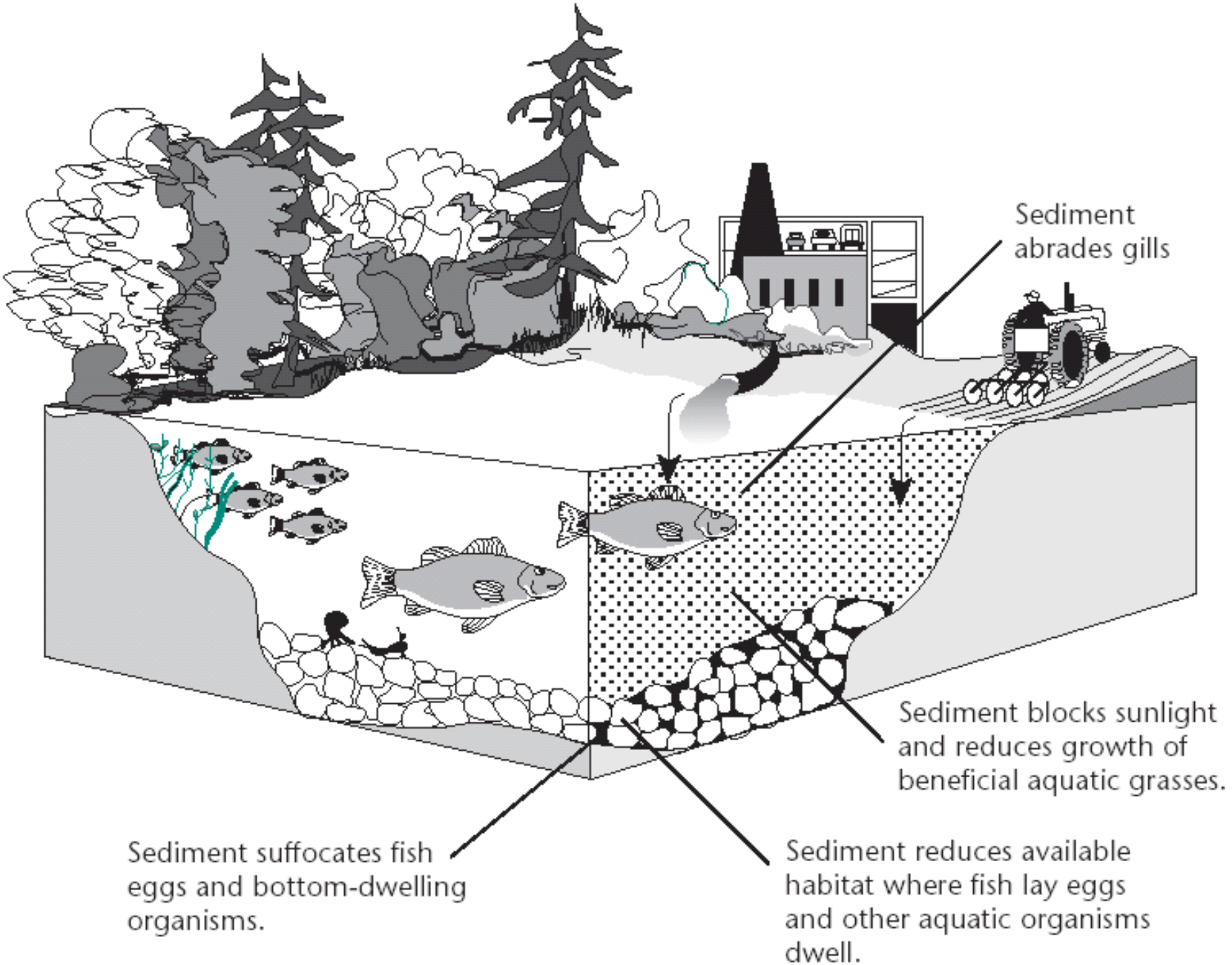
Chemical

Tests for levels of:

- Pesticides
- Organics
- Metals (cadmium, arsenic, etc.)
- Nutrients (phosphorous, nitrogen)
- Toxic materials in fish tissue



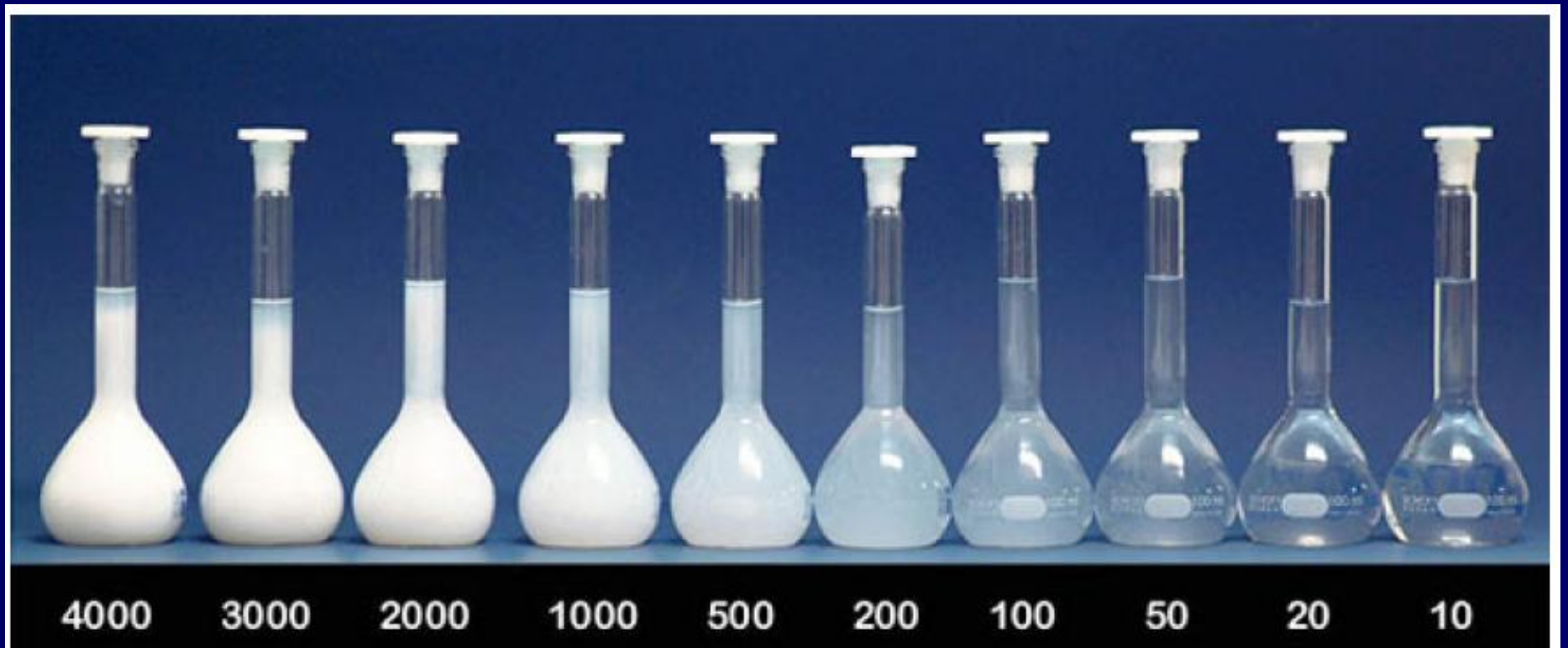
The Effects of Siltation in Rivers and Streams



How sediment is measured

- Total suspended solids: part of sample filtered; ~ 0.45 microns (μm) and larger weighed (mg/L)
- Suspended sediment concentration: same, but all of sample filtered
- Settleable solids: Imhoff cone, 1 hr
- Bedload sediment: Scour chains, volumetric estimates
- Suspended and bedload sediment: both are added together

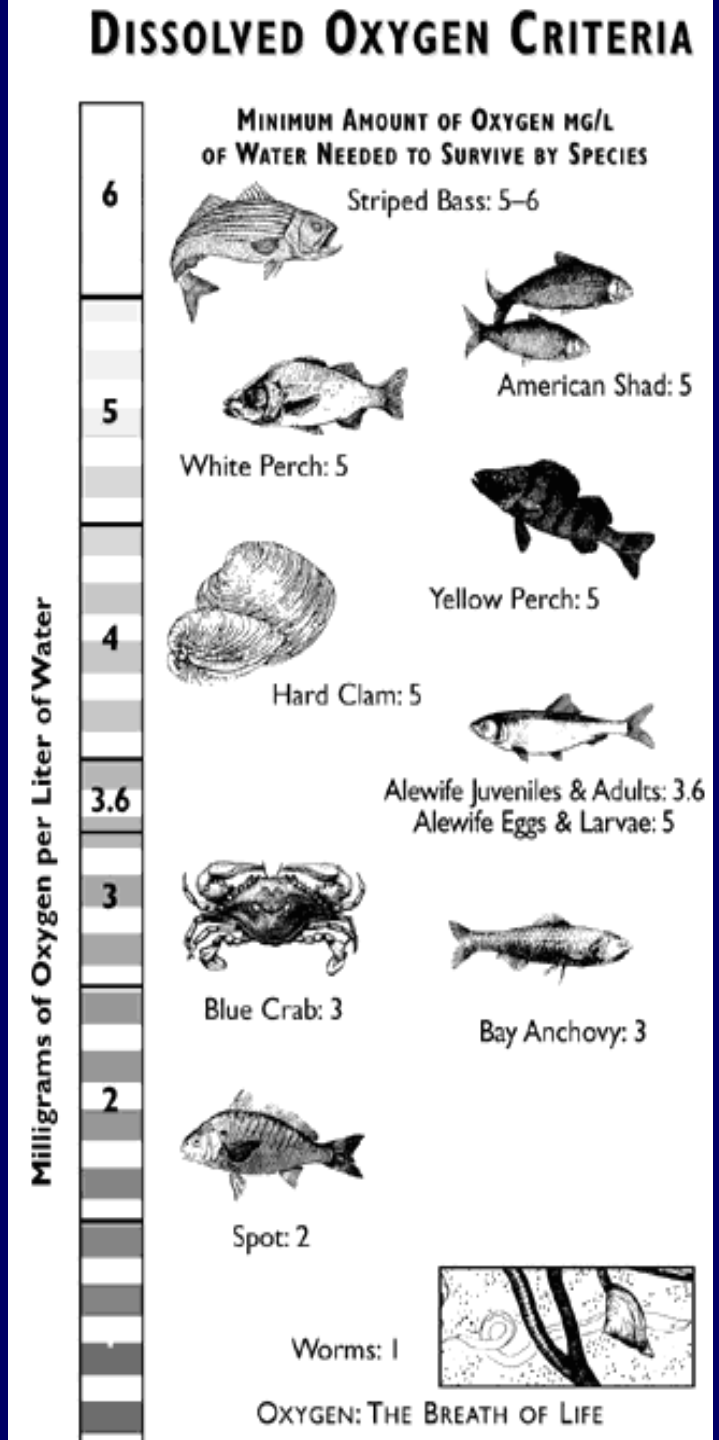
We can also measure water "cloudiness," or turbidity



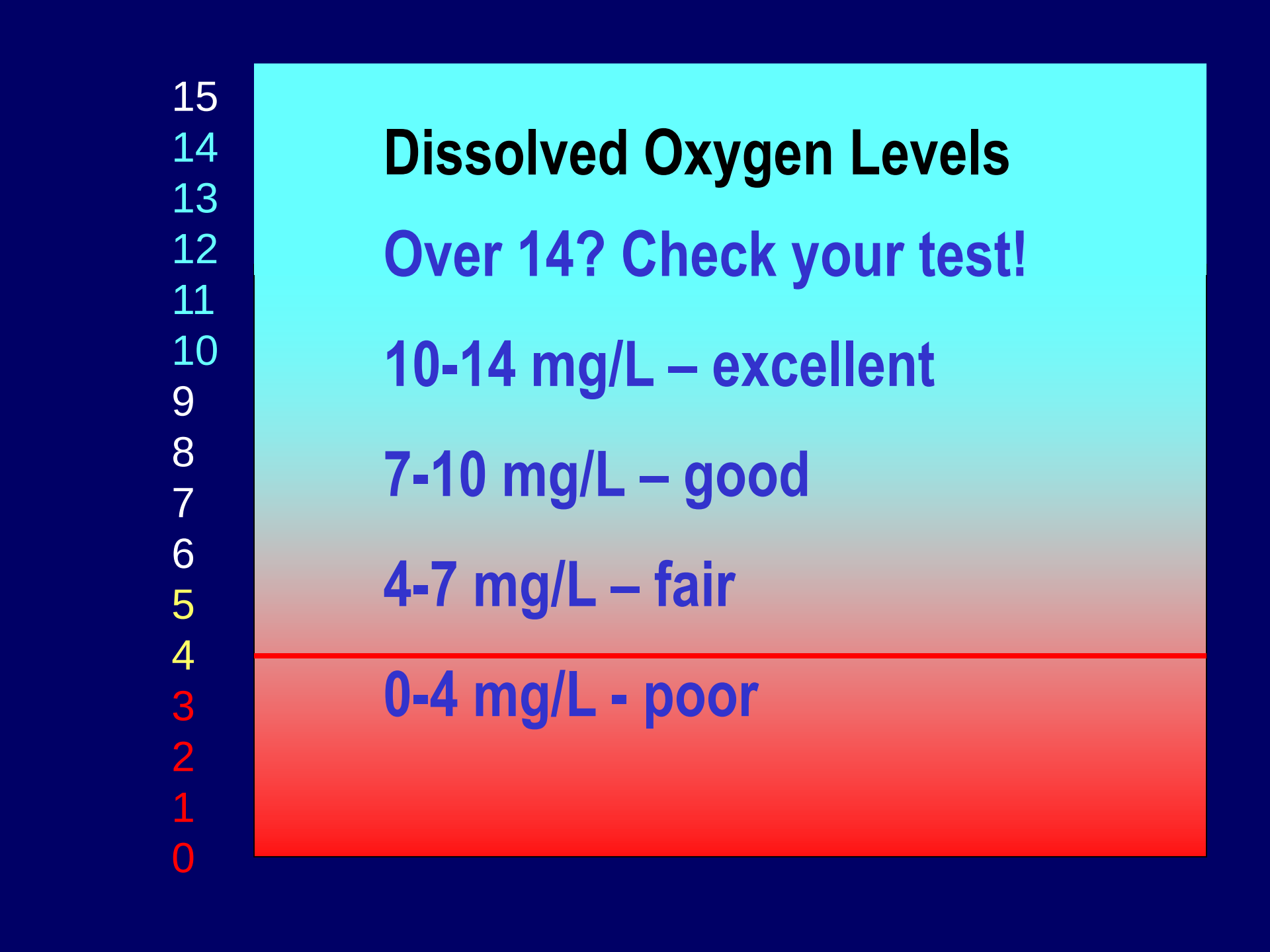
Measured Sample	Measured Value
Waste Water	70-2000 NTU
Final outlet sewage treatment plant	4-20 NTU
Well Water	0.05 - 10 NTU
Potable water	0.05 - 1.5 NTU
Milk	> 4000 NTU
Orange juice	300 - 900 NTU
Primary sludge	6-3%(60 - 30 g/l)
Activated sludge	3-7 g/l
Recirculated sludge	6-8 g/l
Digested sludge	5-8%(50-80 g/l)

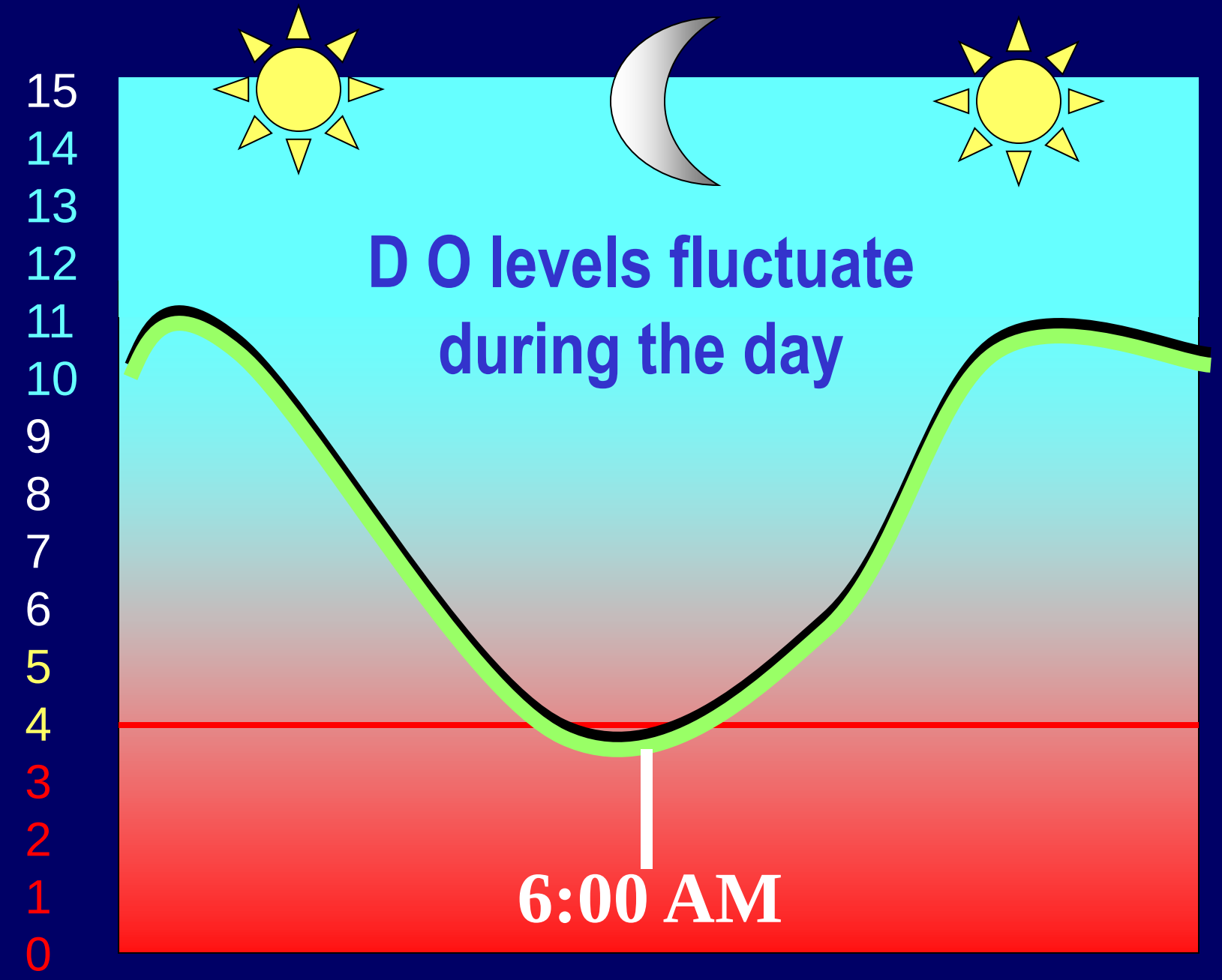
Target values for solids & turbidity

Parameter	Target	Reference/Other Information
Suspended Sediment Concentration (SSC)	Max: 25.0 mg/L	U.S. EPA recommendation for excellent fisheries
	Range: 25.0-80.0 mg/L	U.S. EPA recommendation for good to moderate fisheries
Total Suspended Solids (TSS)	Max: 80.0 mg/L	Wawasee Area Conservancy Foundation recommendation to protect aquatic life in lake systems
	Max: 30.0 mg/L	IDEM draft TMDL target
	Range: 25.0-80.0 mg/L	Concentrations within this range reduce fish concentrations (Waters, 1995)
	Max: 40.0 mg/L	New Jersey criteria for warm water streams
	Max: 46.0 mg/L	Minnesota TMDL criteria for protection of fish/macroinvertebrate health
Turbidity	Max: 25.0 NTU	Minnesota TMDL criteria for protection of fish/macroinvertebrate health
	Max: 10.4 NTU	U.S. EPA recommendation



Dissolved oxygen: a key water quality measure


15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Dissolved Oxygen Levels
Over 14? Check your test!
10-14 mg/L – excellent
7-10 mg/L – good
4-7 mg/L – fair
0-4 mg/L - poor


15
14
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11
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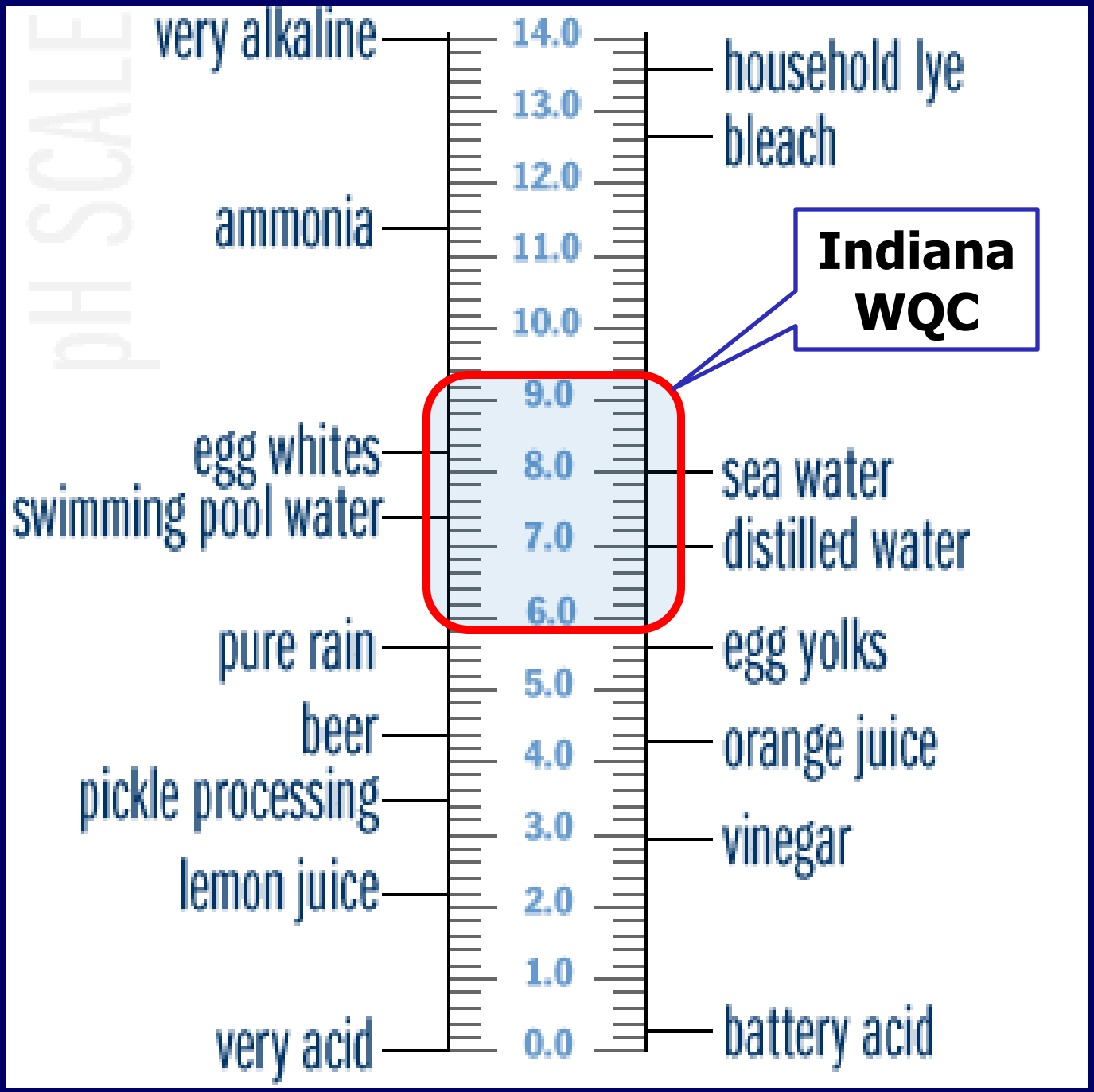
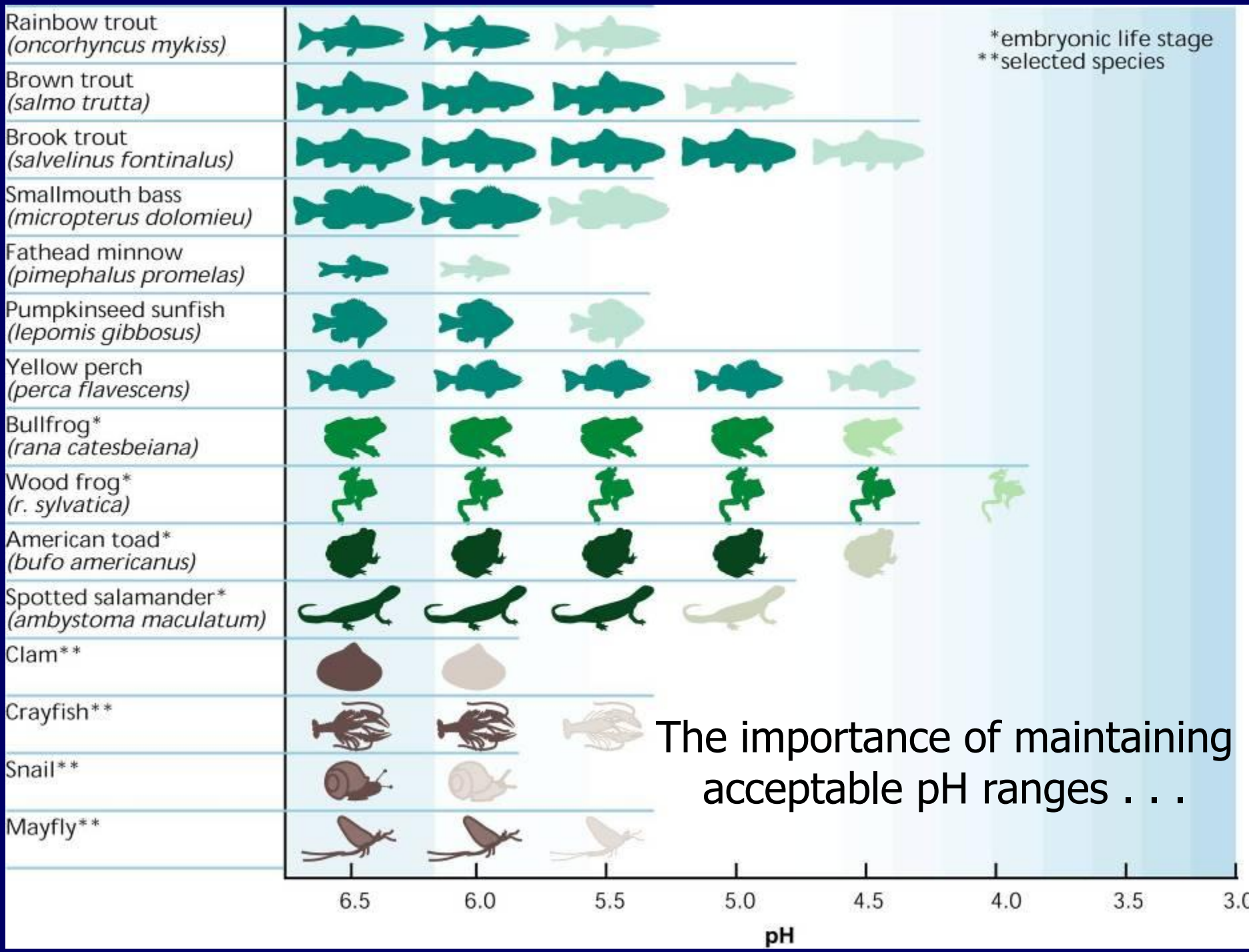
2
1
0
D O levels fluctuate during the day
6:00 AM

pH: an important parameter!

- **Measures hydrogen ion strength**
- **Indicates acidity or alkalinity**
- **pH is affected by:**
  - **Geology (e.g., limestone)**
  - **Acidic precipitation**
  - **Disturbances (mine wastes)**
  - **Polluted runoff**
  - **Discharges**

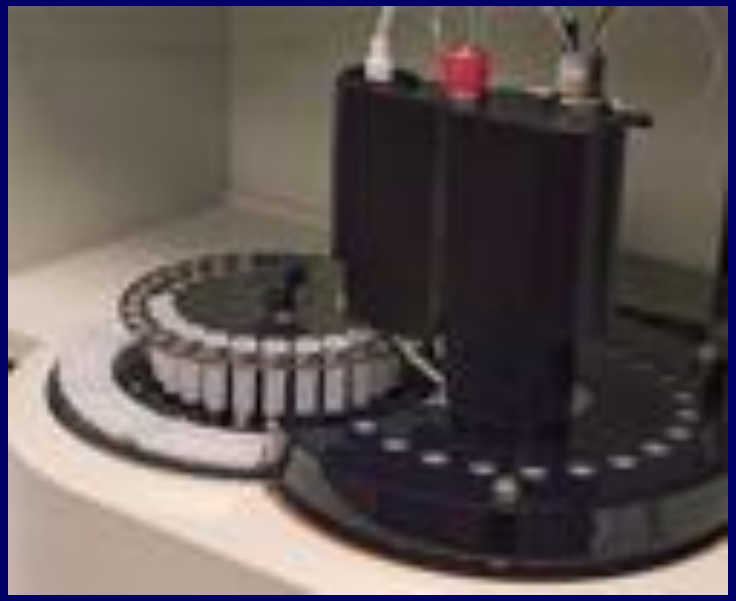

pH SCALE
very alkaline
ammonia
egg whites
swimming pool water
pure rain
beer
pickle processing
lemon juice
very acid
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
household lye
bleach
Indiana WQC
sea water
distilled water
egg yolks
orange juice
vinegar
battery acid



The importance of maintaining acceptable pH ranges . . .

Nutrients: phosphorus & nitrogen

Lab analysis required



Phosphorus

- Major concern for inland fresh waters
- Sources include wastewater plants (~ 1 – 5 mg/l) and polluted runoff (variable)
- Runoff sources: dissolved & particulate
- Major portion from cultivated fields (~ 75-90%) is soil-based

Phosphorus

- Dissolved form is usually less, but is IMMEDIATELY bio-available to algae
- Dissolved phosphorus increases in pastures, reduced tillage fields
- Concentrations of >0.3 mg/l linked to water quality impairment (.05 mg/l for lakes)

Nitrogen

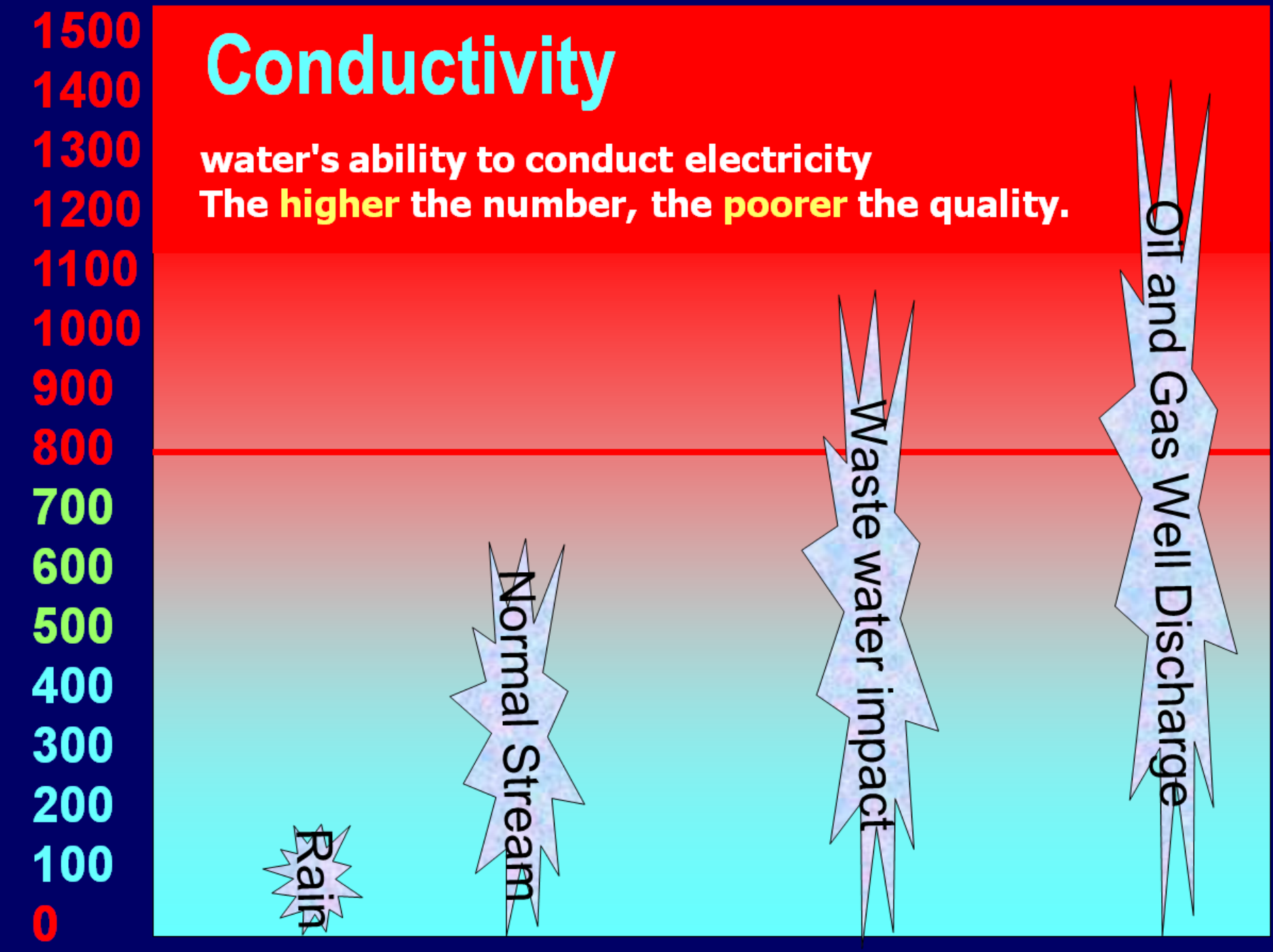
- Nitrogen is measured as nitrate (NO3) plus nitrite (NO2)
- Supports algae growth; mostly a concern in coastal waters
- Drinking water limit is 10 mg/l (nitrate)
- Ammonia toxic at very low (~ .02 - .2 mg/l) concentrations (higher temp & pH = more NH3 ammonia, less NH4 ammonium)

Target values for nitrogen & phosphorus

Parameter	Target	Reference/Other Information
Nitrate-nitrogen (NO3)	Max: 0.633 mg/L	U.S. EPA recommendation *
	Max: 1.0 mg/L	Ohio EPA recommended criteria for Warm Water Habitat (WWH) headwater streams and Modified Warm Water Habitat (MWH) headwater streams
	1.5 mg/L	Dividing line between mesotrophic and eutrophic streams (Dodd et al. 1998)
	10.0 mg/L	IDEM draft TMDL target
Ortho-Phosphate; a/k/a Soluble reactive phosphorus (SRP)	Max: 0.005 mg/L	Wawasee Area Conservancy Foundation recommendation for lake systems
Total Kjeldahl Nitrogen (TKN)	Max: 0.591 mg/L	U.S. EPA recommendation *
Total Phosphorus	Max: 0.076 mg/L	U.S. EPA recommendation
	0.07 mg/L	Dividing line between mesotrophic and eutrophic streams (Dodd et al. 1998)
	Max: 0.08 mg/L	Ohio EPA recommendation to protect aquatic biotic integrity in WWH
	Max: 0.3 mg/L	IDEM draft TMDL target

Conductivity

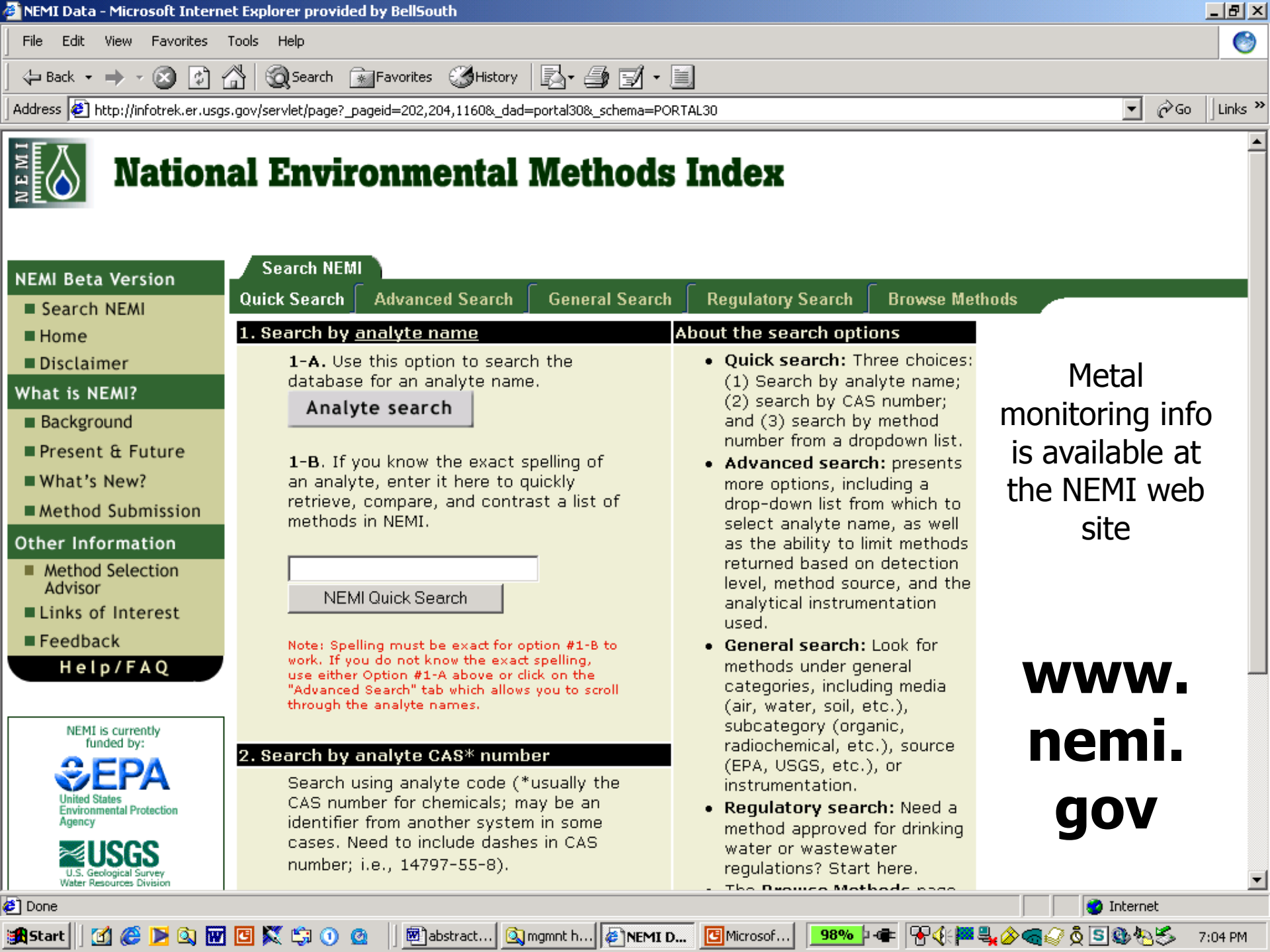
water's ability to conduct electricity
The higher the number, the poorer the quality.



Conductivity meter (and you get a thermometer!)

Temperature: different ranges for different biological functions

Species	Max. Weekly Average Temp. for Growth (Juveniles)	Max. Temp. for Survival of Short Exposure (Juveniles)	Max. Weekly Average Temp. for Spawning[a]	Max. Temp. for Embryo Spawning[b]
Common carp			70°F	91°F
Channel catfish	90°F	95°F	81°F	84°F[c]
Largemouth bass	90°F	93°F	70°F	81°F[c]
Rainbow trout	66°F	75°F	48°F	55°F
Smallmouth bass	84°F		63°F	73°F[c]


NEMI Data - Microsoft Internet Explorer provided by BellSouth
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://infotrek.er.usgs.gov/servlet/page?_pageid=202,204,1160&_dad=portal30&_schema=PORTAL30
Go Links
National Environmental Methods Index
NEMI Beta Version
Search NEMI
Home
Disclaimer
What is NEMI?
Background
Present & Future
What's New?
Method Submission
Other Information
Method Selection Advisor
Links of Interest
Feedback
Help/FAQ
NEMI is currently funded by:
EPA United States Environmental Protection Agency
USGS U.S. Geological Survey Water Resources Division
Search NEMI
Quick Search
Advanced Search
General Search
Regulatory Search
Browse Methods
1. Search by analyte name
1-A. Use this option to search the database for an analyte name.
Analyte search
1-B. If you know the exact spelling of an analyte, enter it here to quickly retrieve, compare, and contrast a list of methods in NEMI.
NEMI Quick Search
Note: Spelling must be exact for option #1-B to work. If you do not know the exact spelling, use either Option #1-A above or click on the "Advanced Search" tab which allows you to scroll through the analyte names.
2. Search by analyte CAS* number
Search using analyte code (*usually the CAS number for chemicals; may be an identifier from another system in some cases. Need to include dashes in CAS number; i.e., 14797-55-8).
About the search options
Quick search: Three choices: (1) Search by analyte name; (2) search by CAS number; and (3) search by method number from a dropdown list.
Advanced search: presents more options, including a drop-down list from which to select analyte name, as well as the ability to limit methods returned based on detection level, method source, and the analytical instrumentation used.
General search: Look for methods under general categories, including media (air, water, soil, etc.), subcategory (organic, radiochemical, etc.), source (EPA, USGS, etc.), or instrumentation.
Regulatory search: Need a method approved for drinking water or wastewater regulations? Start here.
Metal monitoring info is available at the NEMI web site
www.nemi.gov
Done
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Fish consumption advisories – based on fish tissue analysis

EATING FISH

Is It Safe to Eat Your Fish?

Bluegills can make a tasty—and healthy—meal.

Eating recreationally caught fish from Indiana waters can be a healthy and tasty activity when you have the proper information. The following section should alleviate most anglers' concerns about eating wild-caught fish.

It's all about a person's exposure to contaminants over time. The two contaminants that drive the fish consumption advisory are mercury and polychlorinated biphenyls (PCBs). Both contaminants are generally persistent in the environment at very low levels where they do not pose a health risk from direct contact with the water; however, both contaminants accumulate in fish tissue. *The fish tissue contaminant amounts are not nearly high enough to make humans sick from just one meal or even several meals. If it was perceived that they were, there would be a ban on consuming fish, not just an advisory.*

The risk of eating contaminated fish manifests itself over time. The contaminants accumulate in human tissue like they do in fish

Fish Cons

Wild Fish Consump

Group	Adult Advisory
1	Unlimited consu
2	1 meal per week
3	1 meal per mont
4	1 meal every 2 m
5	Do not eat

*Women of childbearing years,

All Sampled State L

Lake	Ca
Center Lake	Ko
Hovey Lake	Po
J. Edward Roush Lake	Hu
Lake James	Ste
Lake Shafer	Wh
Marquette Lagoon	Lak
Palestine Lake	Ko
Sylvan Lake	No
Wolf Lake	Lak
Lake Michigan	Lak

Indiana State Department of Health

ISDH Home > Reports and Statistics - A-Z >> > Fish Consumption Advisory

Fish Consumption Advisory

2009 Indiana Fish Consumption Advisory Complete Report

Indiana Department of Natural Resources
DNR's 2009 Fishing Guide

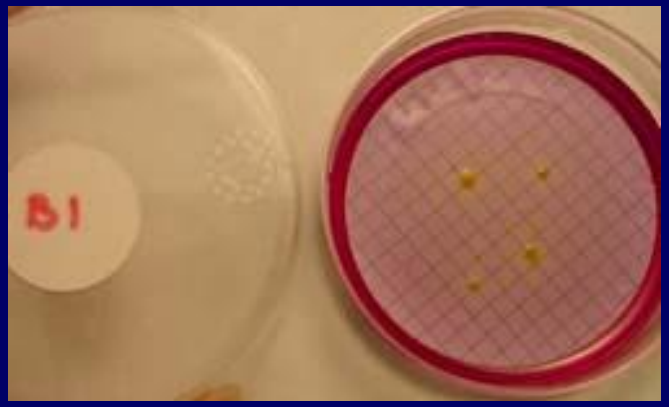
EPA
Interactive site with games and educational materials to help children and their parents choose the healthiest fish to eat.

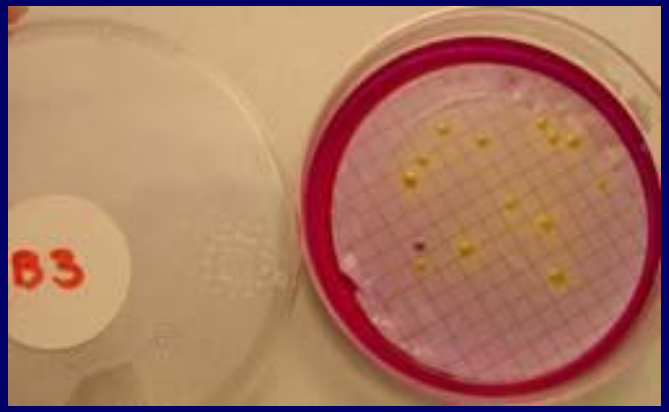
Purdue University
Nutrition experts at the West Lafayette campus provide health education materials to the public, with an emphasis on targeting the sensitive population of childbearing age women and young children.

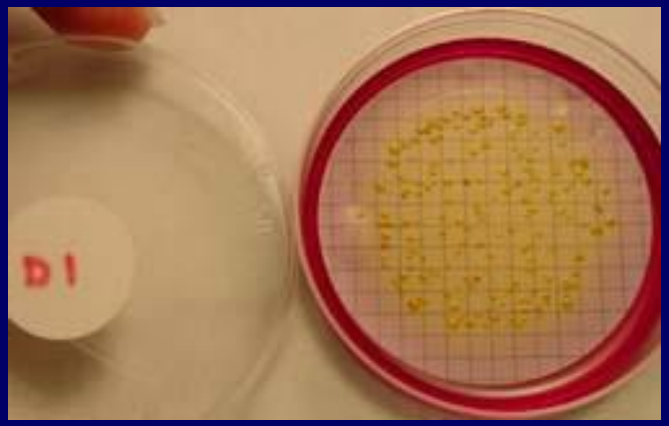
2009 Safe Eating Guidelines for Selected Sport Fish from Most of Indiana's Inland Waters*

Sensitive Population	General Population
Women of childbearing years, nursing mothers, and all children under age 15 may eat:	**Men and women beyond their childbearing years may eat:**
Unlimited consumption: None	**Unlimited consumption:** Any species under the size class listed as a Group 1 in the site-specific guidance table.
1 meal per week: largemouth bass <12 inches smallmouth bass <12 inches spotted bass <10 inches rock bass <8 inches crappie species sunfish species <9 inches walleye/sauger <14 inches channel catfish <22 inches flathead catfish <18 inches northern pike <20 inches freshwater drum <14 inches buffalo species <18 inches redhorse species <19 inches white/striped bass <13 inches Any fish species listed as Group 1 for the sensitive population from a waterbody in the site-specific guidance table	**1 meal per week:** All black bass (smallmouth, largemouth, and spotted) walleye or sauger <25 inches channel catfish flathead catfish northern pike freshwater drum <23 inches rock bass crappie species sunfish species buffalo species redhorse species white bass striped bass carp (rivers and streams) <15 inches Any fish species listed as Group 2 for the general population from a waterbody in the site-specific guidance table
1 meal per month: largemouth or smallmouth bass >12 inches spotted bass >10 inches walleye/sauger >14 inches	**1 meal per month:** walleye/sauger >25 inches northern pike >41 inches freshwater drum >23 inches

Bacteria – a human health threat. Most programs now measure E. coli bacteria "colony-forming units" per 100 milliliters of raw water







Water quality criteria for Indiana surface waters

Parameter	Target
Total Ammonia (NH3)	Range between 0.0 and 0.21 mg/L depending upon temperature and pH
Dissolved Oxygen (DO)	Min: 4.0 mg/L Max: 12.0 mg/L Min: 6.0 mg/L in coldwater fishery streams Min: 7.0 mg/L in spawning areas of coldwater fishery streams
E. coli	Max: 235 CFU/ 100mL in a single sample Max: Geometric Mean of 125 CFU/ 100mL from 5 equally spaced samples over a 30-day period
Nitrite-N + Nitrate-N	Max: 10 mg/L in waters designated as a drinking water source
Temperature	Dependent on time of year and whether stream is designated as a cold water fisheries

Assessing biota and habitat

Macroinvertebrate analysis: inexpensive & comprehensive

Hellgrammite Larva

Dobsonfly Adult

Mayfly Adult

Mayfly Larva

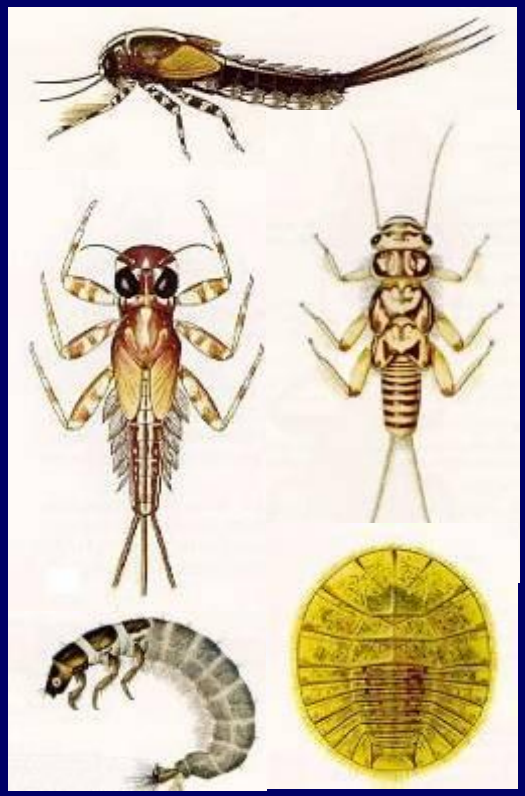
Stonefly Larva

Dragonfly Larva

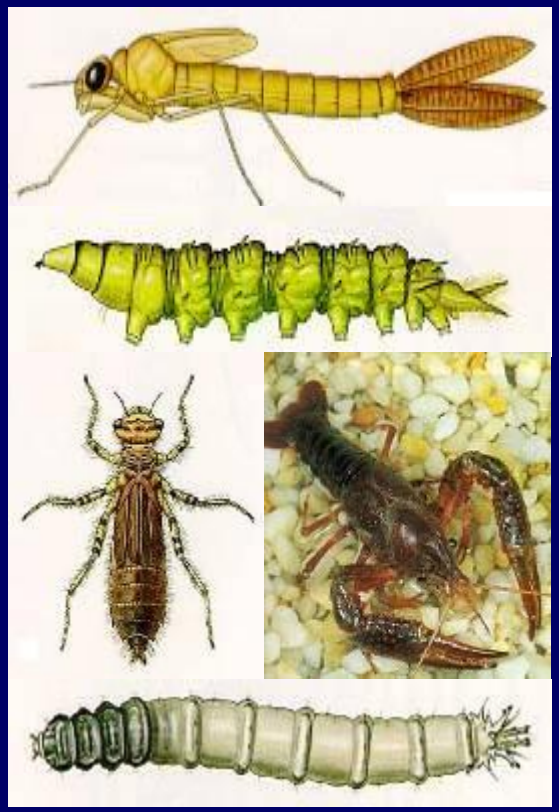
Dragonfly Adult

Stonefly Adult

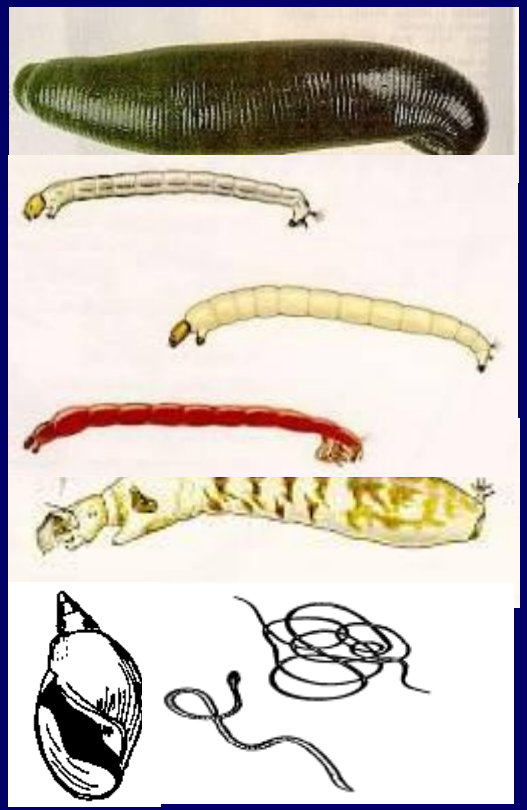
Organisms can be categorized according to their tolerance for pollution or poor habitat conditions



Good



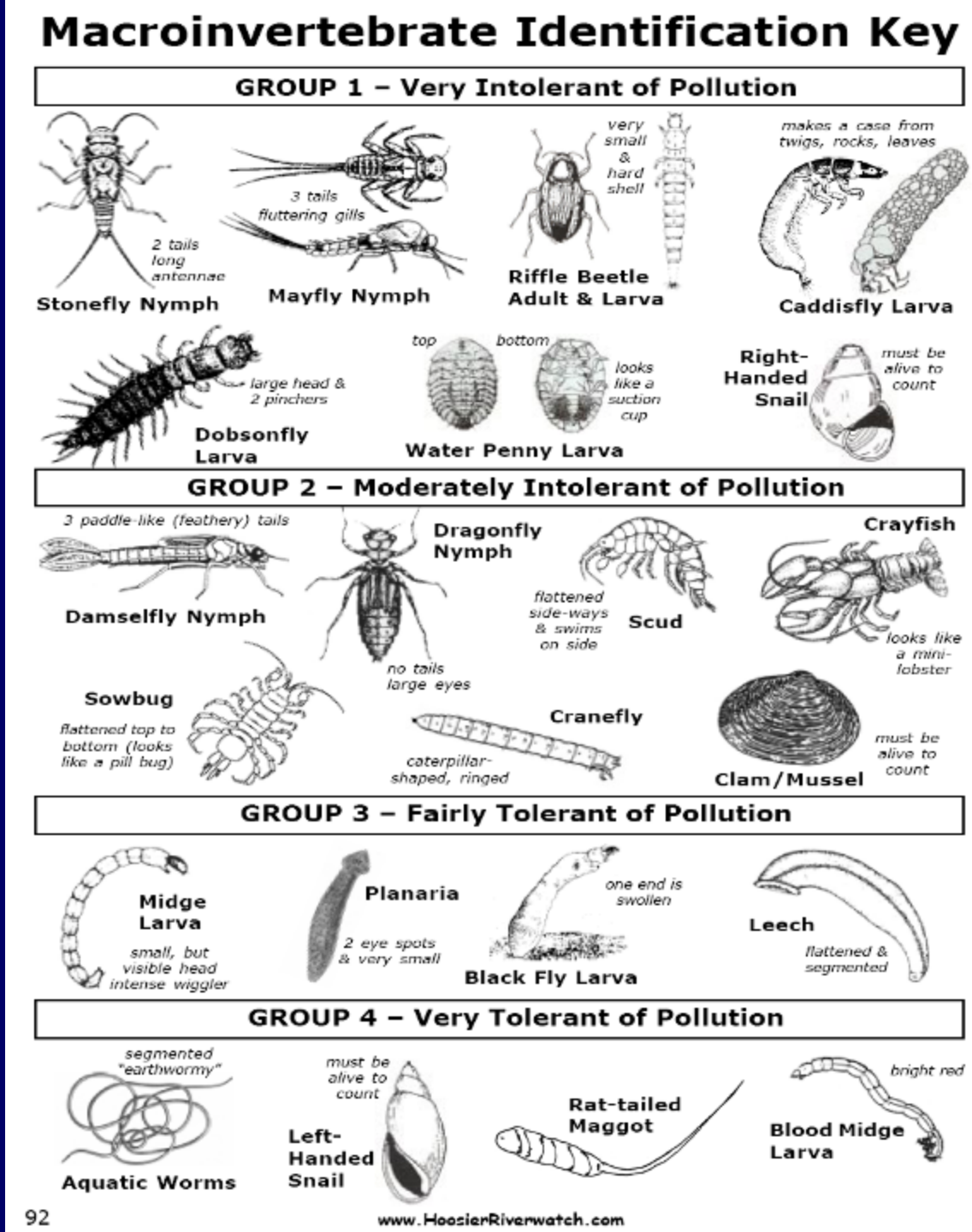
Mid Range

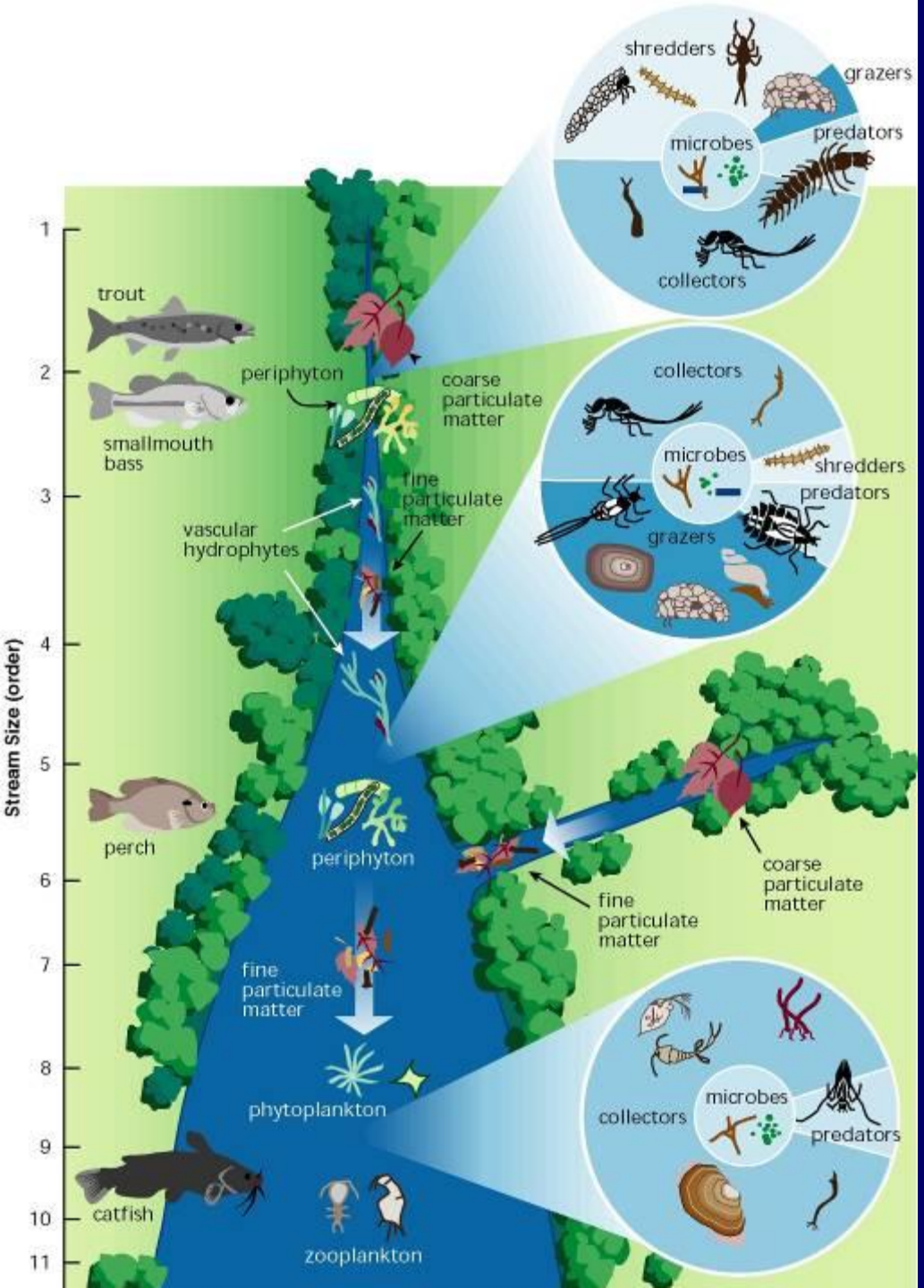


Poor

Hoosier Riverwatch Summary ID Key

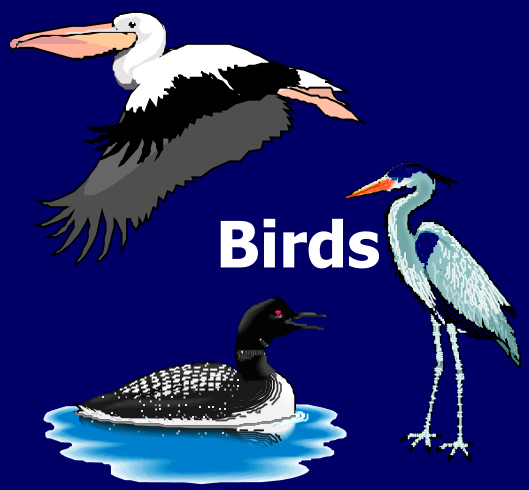
Method is simple & volunteer-friendly



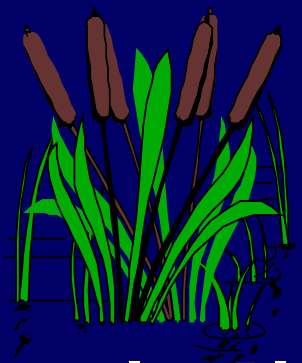


Note: Organisms in the river or stream will vary . . . small headwaters streams are different from large rivers!

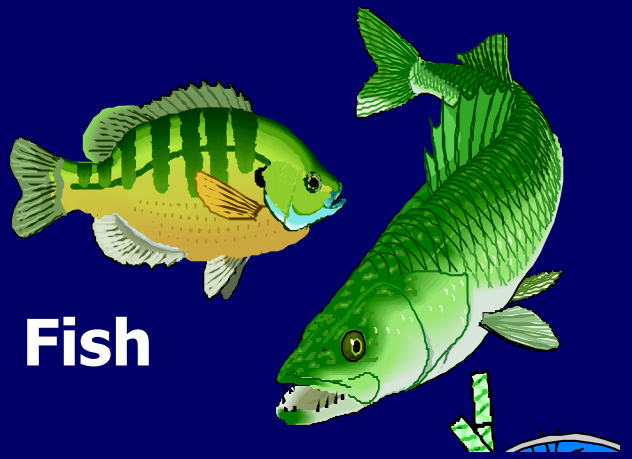
Other biological indicators



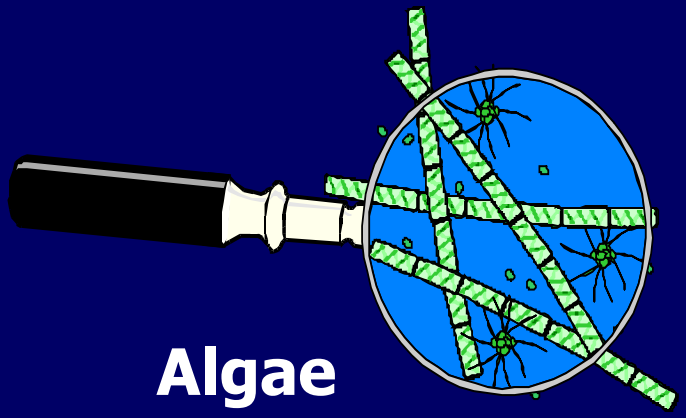
Birds



Vascular Plants



Fish



Algae

Amphibians

Symptoms of lower quality

- Bigger percentage of tolerant species
- Lower proportion of predators
- Higher numbers of "generalists”
- Greater proportion of exotics (invasive species)
- More DELTs – deformities, eroded fins, lesions, tumors

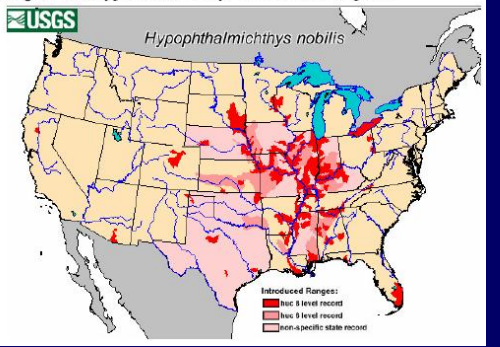
AIS
Aquatic Invasive Species

BIGHEAD CARP

COMMON NAME: Bighead Carp
This fish may also be referred to as noble fish, speckled amur, or lake fish.

SCIENTIFIC NAME: *Hypophthalmichthys nobilis*
The bighead carp was formerly known as *Aristichthys nobilis* but that is no longer its accepted scientific name. It belongs to the Cyprinidae family, which is the carp and minnow family.

DISTRIBUTION: The bighead carp native to China. Currently this fish has expanded its range to include the United States. Bighead carp are found throughout much of the Mississippi River basin and apparently reproducing in much of this area as well. There are relatively few isolated reports of bighead carp outside of the Mississippi basin.



News New Mapper and Experimental Real-Time Web Service - updated August 2009

USGS Real-Time Water Data for Indiana

NOTE:USGS Indiana historic, recent, and real-time data will continue to be provided in Eastern Standard Time.

Flow-duration tables and other streamflow statistics for selected gaging stations are available on another web page by clicking this link!

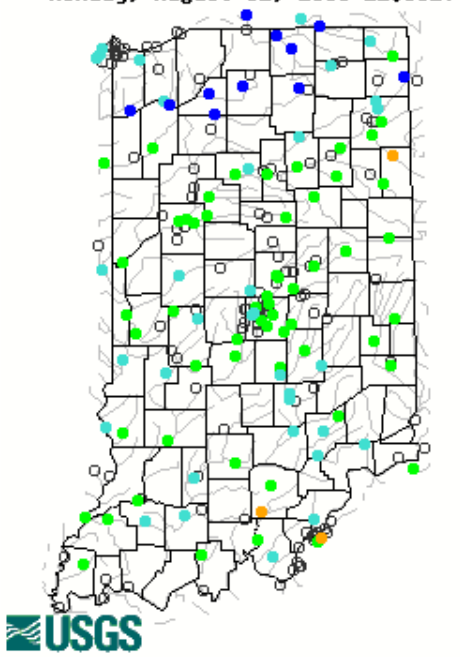
Why is flow important?

--- Predefined displays ---	Group table by	Select sites by number or name
Introduction	-- no grouping --	go

Daily Streamflow Conditions

Select a site to retrieve data and station information.

Monday, August 31, 2009 12:30ET



The colored dots on

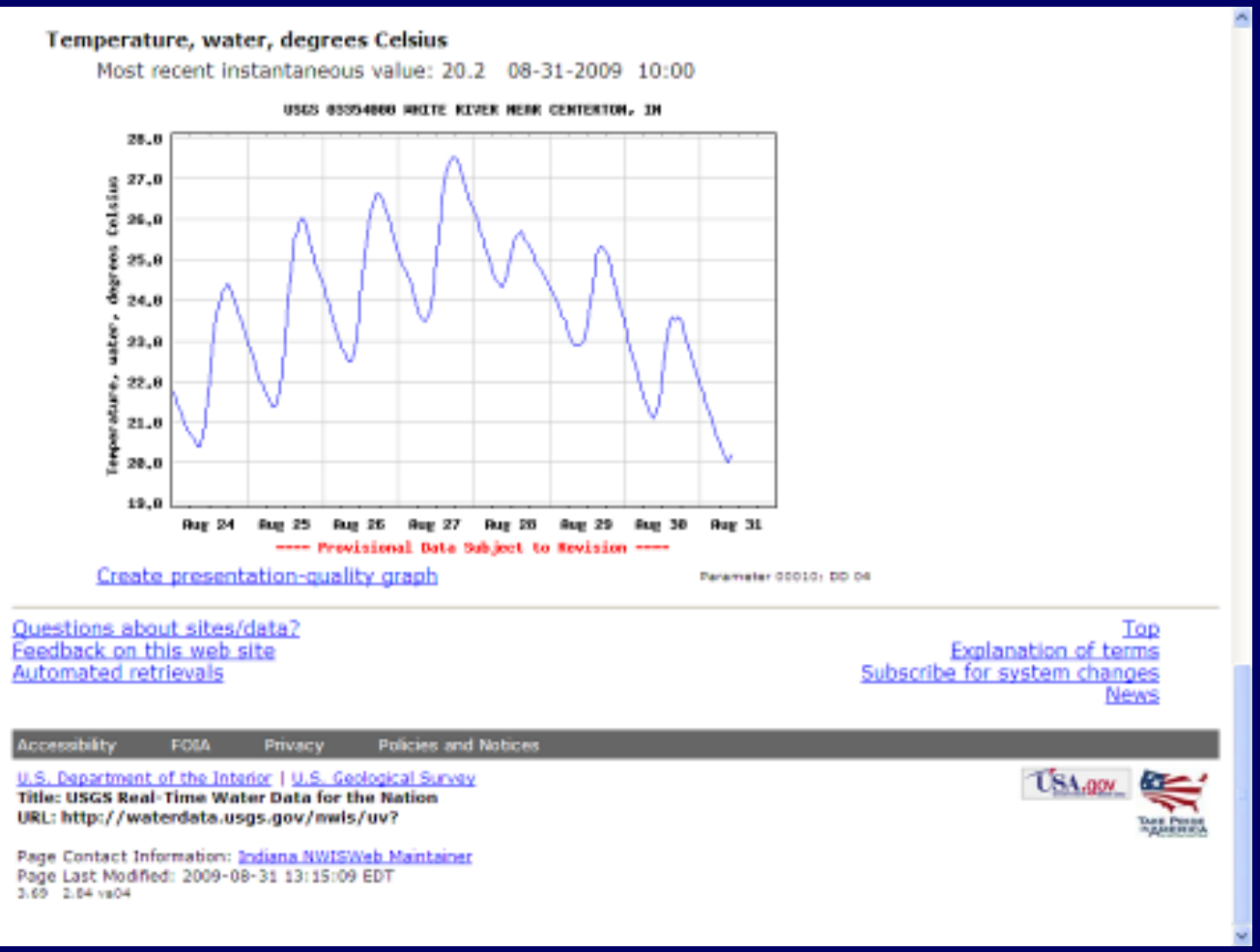
Statewide Streamflow Table

Real-time data typically are recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from real-time sites are relayed to USGS offices via satellite, telephone, and/or radio and are available for viewing within minutes of arrival.

All real-time data are **provisional and subject to revision**.

Build Table	Build a custom summary table for one or more stations.
Build Sequence	Build a custom sequence of graphical or tabular data for one or more stations.

Flow data at US Geological Survey web site:
http://waterdata.usgs.gov/nwis/rt



Temperature, flow, and some water quality data is available at the USGS web site

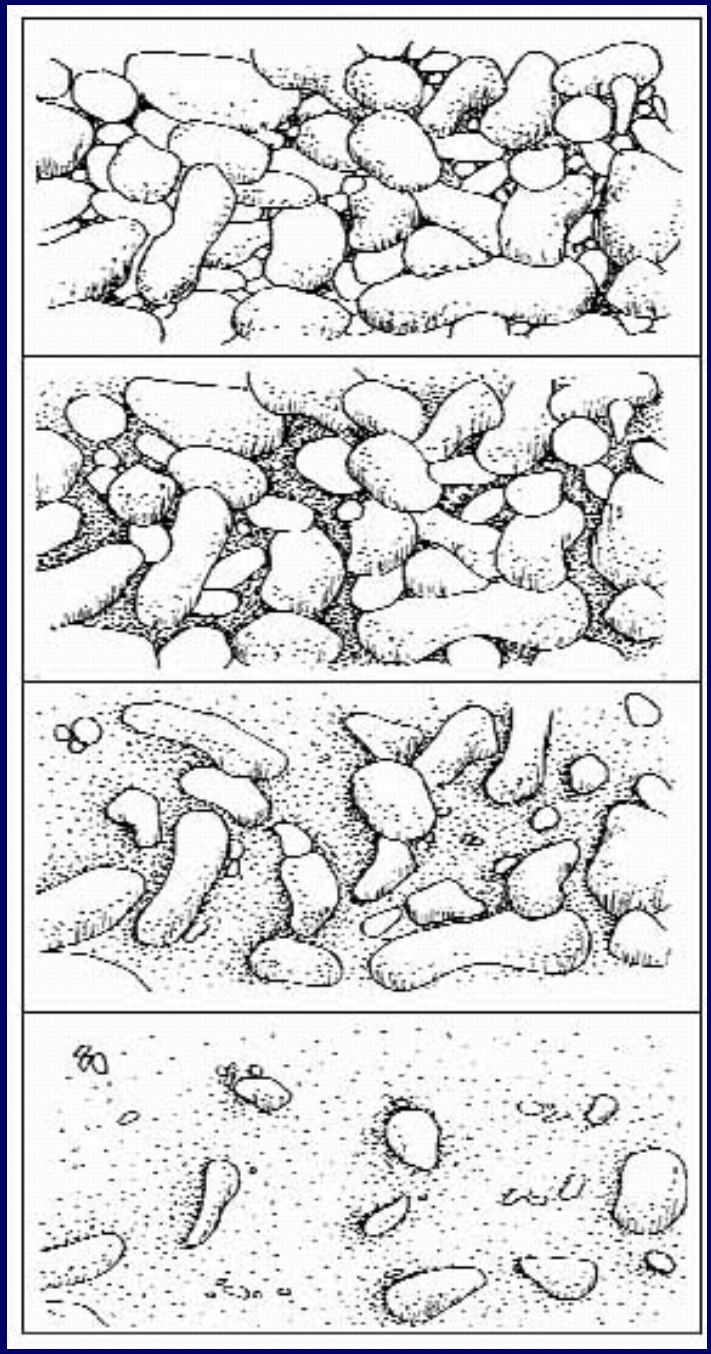
Siltation and other structural (physical) aspects of the stream affects habitat

Optimal

Suboptimal

Marginal

Poor



Stream Bottom Structure & Critter Cover

Embeddedness

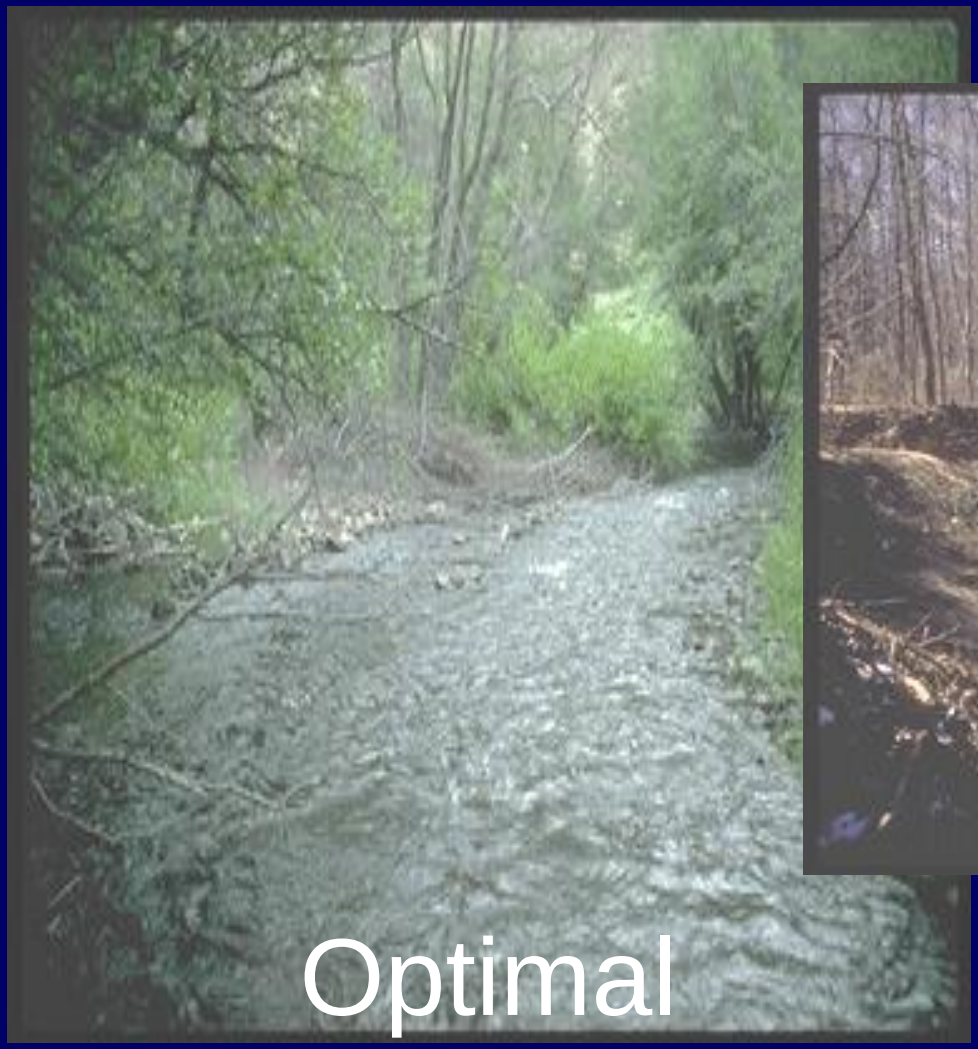
Optimal

Poor Range

Velocity-Depth Combinations

Poor Range

Sediment Deposition



Optimal

Poor Range

Channel Flow Status

Optimal

Poor Range

Channel Alteration

Optimal

Poor Range

Frequency of Riffles

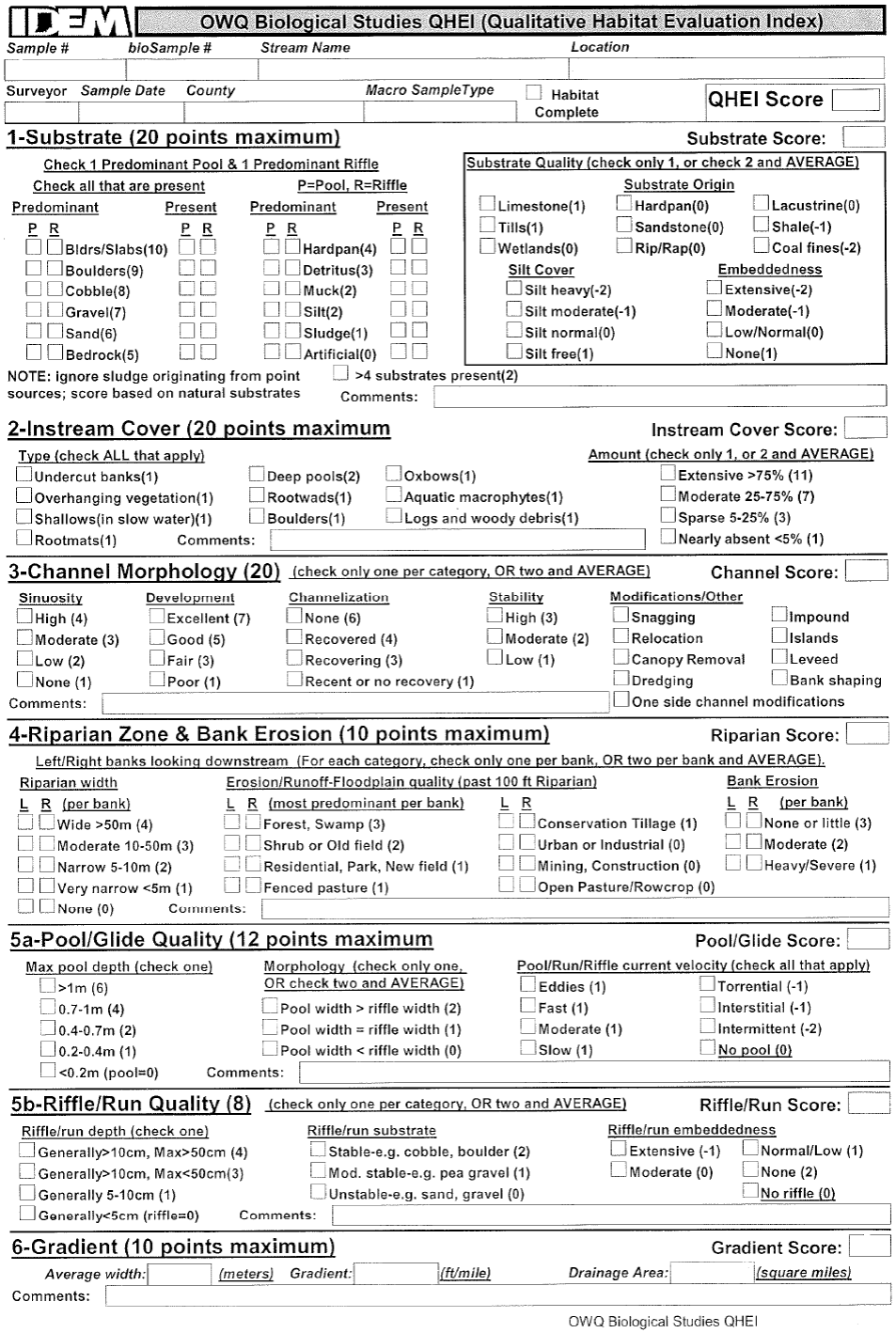
Optimal

Poor Range

Indiana's **Qualitative Habitat Evaluation Index**

is based on Ohio's approach

http://monitoring protocols.pbworks.com/f/IDEM+QHEI+SOP.pdf



IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name | Location

Surveyor | Sample Date | County | Macro SampleType | ☐ Habitat Complete | QHEI Score

1-Substrate (20 points maximum) — Substrate Score:

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

Predominant P	Predominant R	Present P	Present R		Predominant P	Predominant R	Present P	Present R
☐	☐	☐	☐	Bldrs/Slabs(10)	☐	☐	☐	☐ Hardpan(4)
☐	☐	☐	☐	Boulders(9)	☐	☐	☐	☐ Detritus(3)
☐	☐	☐	☐	Cobble(8)	☐	☐	☐	☐ Muck(2)
☐	☐	☐	☐	Gravel(7)	☐	☐	☐	☐ Silt(2)
☐	☐	☐	☐	Sand(6)	☐	☐	☐	☐ Sludge(1)
☐	☐	☐	☐	Bedrock(5)	☐	☐	☐	☐ Artificial(0)

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: ☐ Limestone(1) ☐ Hardpan(0) ☐ Lacustrine(0) ☐ Tills(1) ☐ Sandstone(0) ☐ Shale(-1) ☐ Wetlands(0) ☐ Rip/Rap(0) ☐ Coal fines(-2)

Silt Cover: ☐ Silt heavy(-2) ☐ Silt moderate(-1) ☐ Silt normal(0) ☐ Silt free(1)

Embeddedness: ☐ Extensive(-2) ☐ Moderate(-1) ☐ Low/Normal(0) ☐ None(1)

NOTE: ignore sludge originating from point sources; score based on natural substrates

☐ >4 substrates present(2)

Comments:

2-Instream Cover (20 points maximum — Instream Cover Score:

Type (check ALL that apply)

☐ Undercut banks(1) ☐ Deep pools(2) ☐ Oxbows(1)
☐ Overhanging vegetation(1) ☐ Rootwads(1) ☐ Aquatic macrophytes(1)
☐ Shallows(in slow water)(1) ☐ Boulders(1) ☐ Logs and woody debris(1)
☐ Rootmats(1) Comments:

Amount (check only 1, or 2 and AVERAGE)

☐ Extensive >75% (11)
☐ Moderate 25-75% (7)
☐ Sparse 5-25% (3)
☐ Nearly absent <5% (1)

3-Channel Morphology (20) (check only one per category, OR two and AVERAGE) — Channel Score:

Sinuosity	Development	Channelization	Stability	Modifications/Other	
☐ High (4)	☐ Excellent (7)	☐ None (6)	☐ High (3)	☐ Snagging	☐ Impound
☐ Moderate (3)	☐ Good (5)	☐ Recovered (4)	☐ Moderate (2)	☐ Relocation	☐ Islands
☐ Low (2)	☐ Fair (3)	☐ Recovering (3)	☐ Low (1)	☐ Canopy Removal	☐ Leveed
☐ None (1)	☐ Poor (1)	☐ Recent or no recovery (1)		☐ Dredging	☐ Bank shaping
				☐ One side channel modifications	

Comments:

4-Riparian Zone & Bank Erosion (10 points maximum) — Riparian Score:

Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and AVERAGE).

Riparian width L	Riparian width R (per bank)	Erosion/Runoff-Floodplain quality (past 100 ft Riparian) L	Erosion/Runoff-Floodplain quality R (most predominant per bank)	L	R	Bank Erosion L	Bank Erosion R (per bank)
☐	☐ Wide >50m (4)	☐	☐ Forest, Swamp (3)	☐	☐ Conservation Tillage (1)	☐	☐ None or little (3)
☐	☐ Moderate 10-50m (3)	☐	☐ Shrub or Old field (2)	☐	☐ Urban or Industrial (0)	☐	☐ Moderate (2)
☐	☐ Narrow 5-10m (2)	☐	☐ Residential, Park, New field (1)	☐	☐ Mining, Construction (0)	☐	☐ Heavy/Severe (1)
☐	☐ Very narrow <5m (1)	☐	☐ Fenced pasture (1)	☐	☐ Open Pasture/Rowcrop (0)		
☐	☐ None (0)	Comments:					

5a-Pool/Glide Quality (12 points maximum — Pool/Glide Score:

Max pool depth (check one)
☐ >1m (6)
☐ 0.7-1m (4)
☐ 0.4-0.7m (2)
☐ 0.2-0.4m (1)
☐ <0.2m (pool=0)

Morphology (check only one, OR check two and AVERAGE)
☐ Pool width > riffle width (2)
☐ Pool width = riffle width (1)
☐ Pool width < riffle width (0)

Pool/Run/Riffle current velocity (check all that apply)
☐ Eddies (1) ☐ Fast (1) ☐ Moderate (1) ☐ Slow (1)
☐ Torrential (-1) ☐ Interstitial (-1) ☐ Intermittent (-2) ☐ No pool (0)

Comments:

5b-Riffle/Run Quality (8) (check only one per category, OR two and AVERAGE) — Riffle/Run Score:

Riffle/run depth (check one)
☐ Generally>10cm, Max>50cm (4)
☐ Generally>10cm, Max<50cm(3)
☐ Generally 5-10cm (1)
☐ Generally<5cm (riffle=0)

Riffle/run substrate
☐ Stable-e.g. cobble, boulder (2)
☐ Mod. stable-e.g. pea gravel (1)
☐ Unstable-e.g. sand, gravel (0)

Riffle/run embeddedness
☐ Extensive (-1) ☐ Normal/Low (1)
☐ Moderate (0) ☐ None (2)
☐ No riffle (0)

Comments:

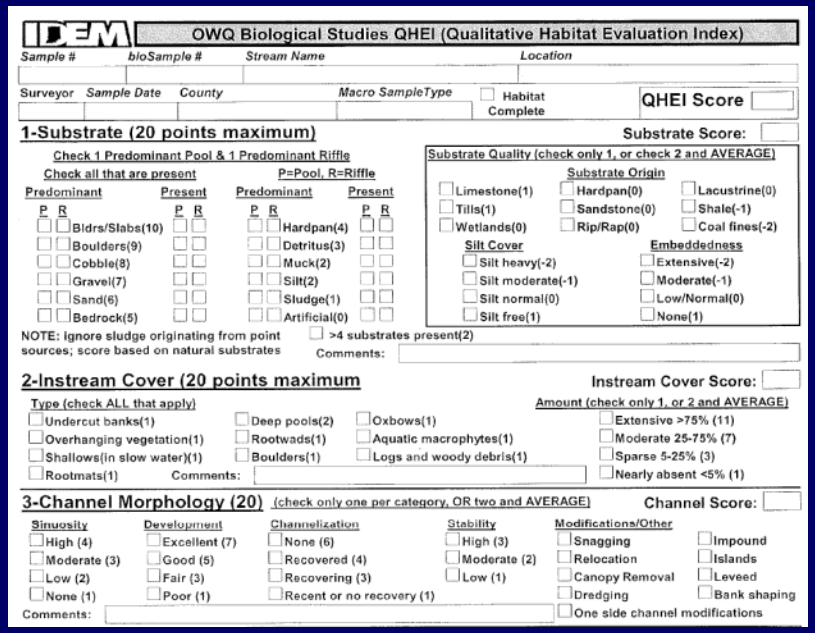
6-Gradient (10 points maximum) — Gradient Score:

Average width: (meters) Gradient: (ft/mile) Drainage Area: (square miles)

Comments:

Qualitative Habitat Evaluation Index

- Substrate – stream bottom & composition
- Instream cover
- Channel morphology – shape and alterations
- Bank erosion & riparian zone
- Pool and glide quality
- Riffle quality
- Gradient
- Human impacts



IDEM — OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name | Location

Surveyor | Sample Date | County | Macro SampleType | Habitat Complete | QHEI Score

1-Substrate (20 points maximum) — Substrate Score:

Check 1 Predominant Pool & 1 Predominant Riffle

Check all that are present — P=Pool, R=Riffle

Predominant		Present		Predominant		Present	
P	R	P	R	P	R	P	R
Bldrs/Slabs(10)				Hardpan(4)			
Boulders(9)				Detritus(3)			
Cobble(8)				Muck(2)			
Gravel(7)				Silt(2)			
Sand(6)				Sludge(1)			
Bedrock(5)				Artificial(0)			

Substrate Quality (check only 1, or check 2 and AVERAGE)

Substrate Origin: Limestone(1); Hardpan(0); Lacustrine(0); Tills(1); Sandstone(0); Shale(-1); Wetlands(0); Rip/Rap(0); Coal fines(-2)

Silt Cover: Silt heavy(-2); Silt moderate(-1); Silt normal(0); Silt free(1)

Embeddedness: Extensive(-2); Moderate(-1); Low/Normal(0); None(1)

NOTE: Ignore sludge originating from point sources; score based on natural substrates

>4 substrates present(2)

Comments:

2-Instream Cover (20 points maximum — Instream Cover Score:

Type (check ALL that apply)

Undercut banks(1); Deep pools(2); Oxbows(1); Overhanging vegetation(1); Rootwads(1); Aquatic macrophytes(1); Shallows(in slow water)(1); Boulders(1); Logs and woody debris(1); Rootmats(1)

Comments:

Amount (check only 1, or 2 and AVERAGE)

Extensive >75% (11); Moderate 25-75% (7); Sparse 5-25% (3); Nearly absent <5% (1)

3-Channel Morphology (20) (check only one per category, OR two and AVERAGE) — Channel Score:

Sinuosity	Development	Channelization	Stability	Modifications/Other	
High (4)	Excellent (7)	None (6)	High (3)	Snagging	Impound
Moderate (3)	Good (5)	Recovered (4)	Moderate (2)	Relocation	Islands
Low (2)	Fair (3)	Recovering (3)	Low (1)	Canopy Removal	Leveed
None (1)	Poor (1)	Recent or no recovery (1)		Dredging	Bank shaping

Comments:

One side channel modifications

Hoosier Riverwatch QHEI form summarizes the same parameters ...

Date: | **Citizens Qualitative Habitat Evaluation Index** | CQHEI Total

Vol ID: | Site ID: | River and Watershed:

I. Substrate (Bottom Type) — Score:

a) Size

- 14 pt — Mostly Large (Fist Size or Bigger)
- 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

- NO 5 pt — Are Fist Size and Larger Pieces Smothered By Sands/Silts?
- YES 0 pt — Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

- NO 5 pt — Are Silts and Clays Distributed Throughout Stream?
- YES 0 pt — Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score:

- 2 pt — Underwater Tree Roots (Large)
- 2 pt — Boulders
- 2 pt — Downed Trees, Logs, Branches
- 2 pt — Water Plants
- 2 pt — Undercut Banks
- 2 pt — Underwater Tree Rootlets (Fine)
- 2 pt — Backwaters, Oxbows or Side Channels
- 2 pt — Shallow, Slow Areas for Small Fish
- 2 pt — Deep Areas (Chest Deep)
- 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

III. Stream Shape and Human Alterations — Score:

a) "Curviness" or "Sinuousity" of Channel

- 8 pt — 2 or More Good Bends
- 6 pt — 1 or 2 Good Bends
- 3 pt — Mostly Straight Some "Wiggle"
- 0 pt — Very Straight

b) How Natural Is The Site?

- 12 pt — Mostly Natural
- 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score:

a) Width of Riparian Forest & Wetland - Mostly:

- 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- 0 pt — None

b) Land Use - Mostly:

- 5 pt — Forest/Wetland
- 2 pt — Conservation Tillage
- 4 pt — Shrubs
- 1 pt — Suburban
- 3 pt — Overgrown Fields
- 1 pt — Row Crop
- 2 pt — Fenced Pasture
- 0 pt — Open Pasture
- 2 pt — Park (Grass)
- 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- 4 pt — Stable Hard or Well-Vegetated Banks
- 2 pt — Combination of Stable and Eroding Banks
- 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- 3 pt — Mostly
- 2 pt — Partly
- 0 pt — None

V. Depth & Velocity — Score:

a) Deepest Pool is At Least:

- 8 pt — Chest Deep
- 4 pt — Knee Deep
- 6 pt — Waist Deep
- 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- 2 pt — Very Fast: Hard to Stand in the Current
- 1 pt — Moderate: Slowly Takes Objects Downstream
- 0 pt — None
- 3 pt — Fast: Quickly Takes Objects Downstream
- 1 pt — Slow: Flow Nearly Absent

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score:

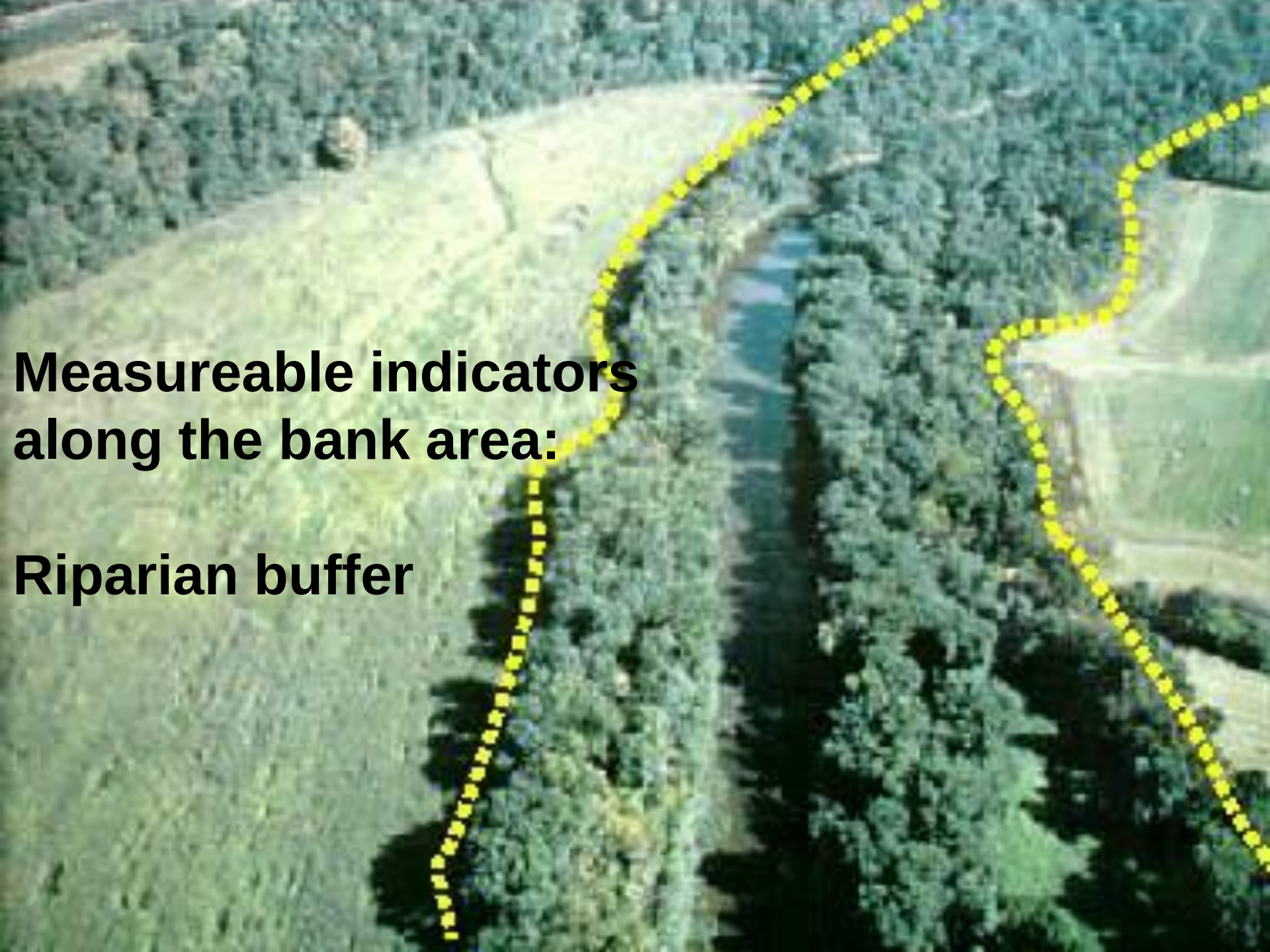
a) Riffles/Runs Are:

- 8 pt — Knee Deep or Deeper & Fast
- 4 pt — Ankle Deep or Less & Slow
- 6 pt — Ankle/Calf Deep & Fast
- 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- 7 pt — Fist Size or Larger
- 0 pt — Smaller Than Your Fingernails or Do Not Exist
- 4 pt — Smaller Than Fist Size, but Larger Than Fingernail

Measurements along the bank area



Measureable indicators along the bank area:

Riparian buffer

Bank Stability

Bank Vegetative Protection

Optimal

Poor Range

Riparian Vegetative Zone Width

Optimal

Poor Range

Summary: types of data needed for holistic assessments

- Chemical
  - DO, pH, nutrients, metals, pesticides
- Physical
  - Flow, temp, turbidity, habitat, pool/riffle
- Biological
  - Indices of biological integrity, macro invertebrates, bacteria, riparian cover

Future Webinars in this Series

May 10: Which Data Are Important and Why?

May 17: Using Data to Support Watershed Protection and Restoration Decisions

May 24: Dealing With Uncertainty in Watershed Assessments

Information and Registration at http://www.purdue.edu/watersheds; Click on the “Webinars” tab