

Using Hoosier Riverwatch Data for Assessment and Planning

**Monitoring and Assessment for Watershed Plans
November, 2007**

Volunteers are Great



Hoosier Riverwatch

- **Emphasis: TRENDS**
- **Groups (not individuals) get kits if:**
 - **Adopt a half-mile section of stream**
 - **Monitor 200-foot section at least 2x/year for 2 or more years**
 - **Complete 8-hour training course**

Hoosier Riverwatch. 2005. Volunteer stream monitoring training manual, Indianapolis.

Hoosier Riverwatch

- **Equipment kits**
 - **Chemical monitoring:** DO, BOD, temperature, orthophosphate, nitrate, nitrite, pH, transparency
 - **Biological monitoring:** sampling nets and identification keys for benthic macroinvertebrates

Methods

D.O. and B.O.D.

- CHEMetrics DO Test Kit K-7512
- Range: 1-12 mg/L DO

Indiana Criteria

Aquatic Life Use Support - Rivers and Streams

- 3 or more measurements
- Key cutoff values:
 - Less than 4 mg/L - OK
 - Less than 5 mg/L - OK
 - Between 4 mg/L and 5 mg/L - OK
 - Greater than 12 mg/L (CHEMetrics kit stops at 12 mg/L)
- Should have 10 or more samples: e.g., <10% of all measurements can be <5mg/L

Orthophosphate

- CHEMetrics Phosphate Test Kit K-8510
- Range:
 - 0-1.0 mg/L in 0.1 & 0.2 mg/L increments OR
 - 1-10 mg/L in 1 & 2 mg/L increments

Indiana Criteria

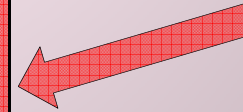
Aquatic Life Use Support - Rivers and Streams

- 3 or more measurements
- Key cutoff values:
 - Total Phosphorus: One or more measurements >0.3 mg/l
 - Increments suitable: 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0 mg/L
- Kit measures orthophosphate, not TP

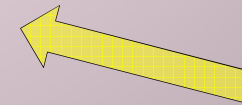
Forms of P

Variable	Details
Total P	All P forms converted to dissolved ortho-PO ₄ and measured.
Ortho-PO ₄	Most stable PO ₄ . Filterable and particulate.
SRP	Orthophosphate; filterable (soluble, inorganic) fraction.
Acid-hydrolyzable P	Condensed PO ₄ forms. Filterable & particulate.
Organic P	Phosphate fractions converted to orthophosphate by oxidation.

Use
Support
Criterion



HRW
Variable



Indiana Criteria

Recreational Use Support

- 3 or more measurements
- Key cutoff values:
 - Less than or greater than 54 ug/L TP (Natural Lakes)
 - Less than or greater than 51 ug/L TP (Reservoirs)
 - *Should have* 10 or more samples: e.g., <10% of all TP values are <54 ug/L
- Kit measures orthophosphate, not TP
- Kit resolution insufficient for low levels

Nitrate/Nitrite

- **WaterWorks Nitrate/Nitrite Test Strips (#480009): Semi-quantitative**
- **Nitrite: 0.15, 0.3, 1, 1.5, 3, and 10 mg/L**
- **Nitrate: 0, 0.5, 2, 5, 10, 20, and 50 mg/L**

Indiana Criteria

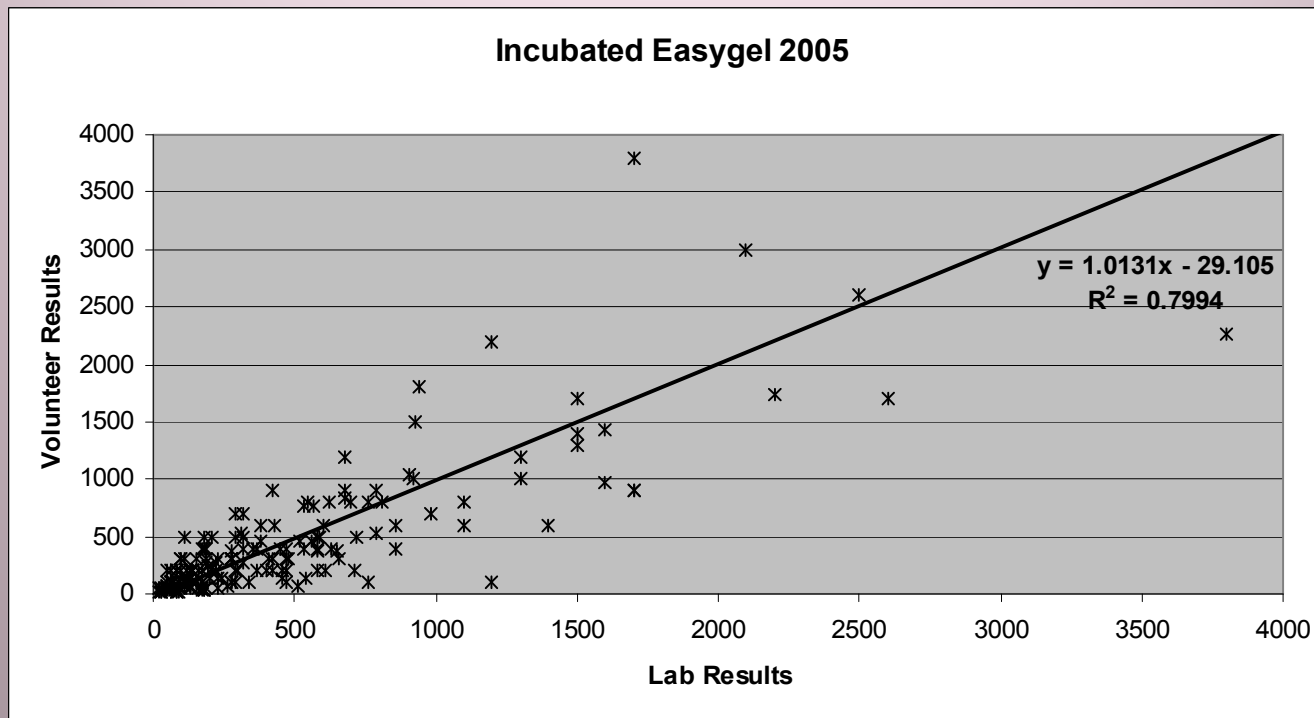
Aquatic Life Use Support - Rivers and Streams

- 3 or more measurements
- Key cutoff values:
 - Nitrogen (measured as $\text{NO}_3 + \text{NO}_2$) --
One/more measurements >10.0 mg/l
- Kit measures above and below 10 mg/L nitrate, but resolution is not great. Nearest increments are 20 mg/L above and 5 mg/L below.
- Kit measures *EITHER* NO_3 or NO_2 but not both.

E. coli

- **Micrology Laboratories Coliscan Easygel**
- **Lower limit: 20/100 mL**
- **One of two best in Univ. MN study of bacteria field test kits (Liukkonen, et al., 2006)**

IA & IN - Easygel Incubated



- Lab vs volunteer-collected data, all samples
- $R^2 = .79$

Liukkonen, et al., 2006

Indiana Criteria

Swimmable Use Support -All Waters

- Two criteria based on two sampling options:
 - 5 equally-spaced samples over a 30-day period
 - 10 or more grab samples where no five of which are equally spaced over a 30-day period

Indiana Criteria

Swimmable Use Support -All Waters *E. coli*

Sampling Option	Fully Supporting	Not Supporting
5 or more equally spaced samples over 30 days	Geometric mean <125 cfu/100ml and not more than one sample >576 cfu/100ml	Geometric mean exceeds 125 cfu/100mL
10 or more grab samples	Not more than 10% of measurements >576 cfu/100ml and not more than one sample >2400 cfu/100ml.	More than 10% of samples >576 cfu/100ml or more than one sample >2,400 cfu/100ml

(cfu = colony forming units)

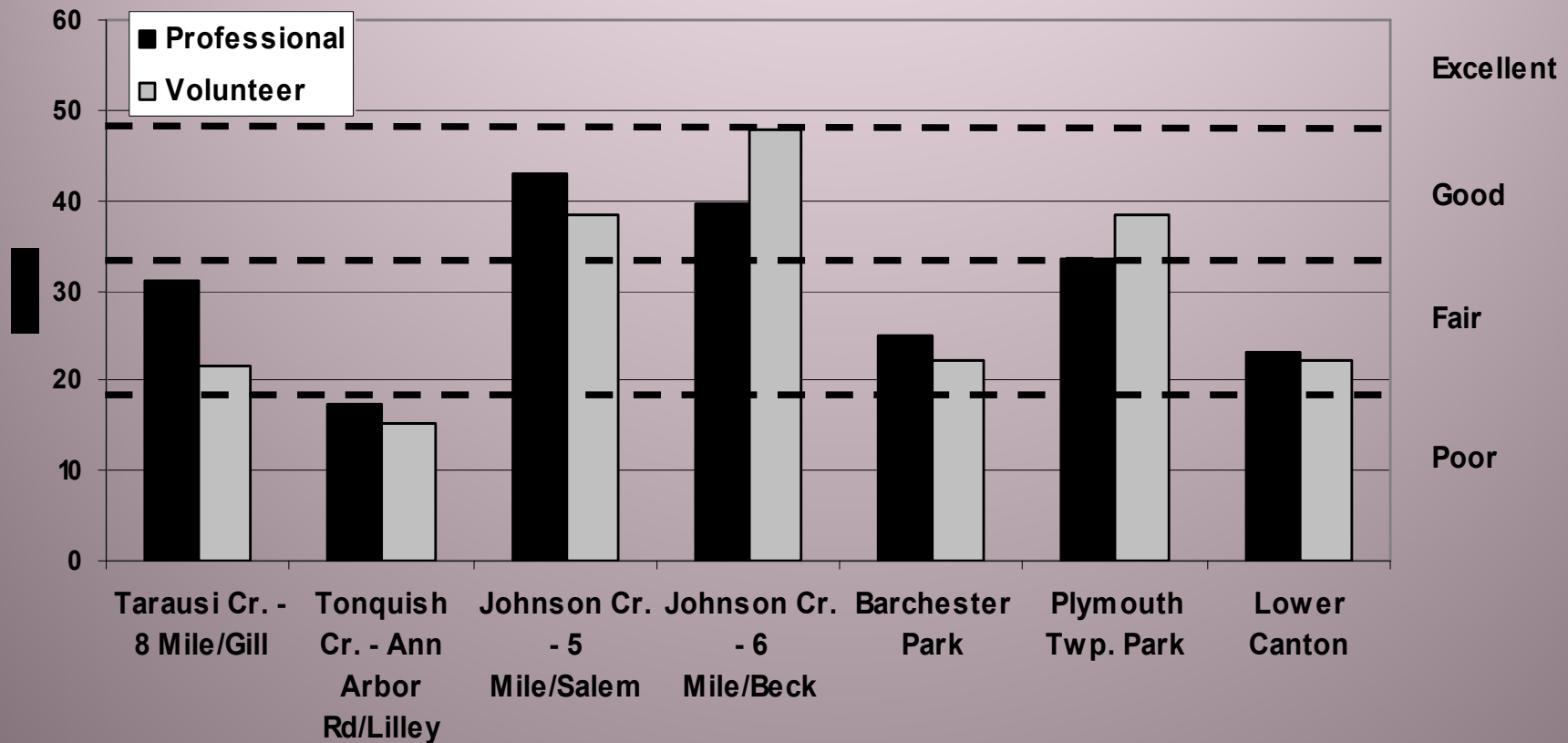
Indiana Criteria

Swimmable Use Support -All Waters

- **Bottom Line:**
 - HRW E. coli method is suitable provided sampling is either:
 - 5 equally-spaced samples over a 30-day period, OR
 - 10 or more grab samples where no five of which are equally spaced over a 30-day period.
 - QA/QC must meet state requirements

Volunteer vs. Professional Macroinvertebrate Monitoring

Macroinvertebrate Scores - Fall 2002 & Spring 2003
"Professional" vs. Volunteer



Rathbun, 2006

Benthic Macroinvertebrates

- **Kick Seine Sampling Method**
 - Riffle
 - Three 3'x3' areas within 200' location
 - Collect 200 organisms
 - Sort by body shape
 - Record number of each organism

Benthic Macroinvertebrates

- **Dip Net Sampling Method**
 - No riffles available
 - 20 “jabs” of dip net against stream bottom
 - Count as for Kick Seine sampling method
- **Combination Sampling Method**
 - If both riffles and pools in 200’ stretch
 - Kick Seine and Dip Net
 - Record equipment used and types of habitat

Pollution Tolerance Index

- Macroinvertebrates at order/family level
- Four Tolerance Level Groups
- Scores: Excellent (23+), Good (17-22), Fair (11-16), Poor (≤ 10)

Macroinvertebrate Diversity Index

- Organisms distinguished by color, size, and shape (no ID)
- Number of “runs”/Number of organisms
- Not useful

Indiana Criteria

Aquatic Life Use Support - Rivers and Streams

Benthic aquatic macroinvertebrate Index of Biotic Integrity (mIBI)
Scores (Range of possible scores is 0-8)

Sample Collection Method	Fully Supporting	Not Supporting
Artificial substrate sampler ¹	mIBI >1.4	mIBI <1.4
Kick methods ²	mIBI >2.2	mIBI <2.2

¹Not used by Hoosier Riverwatch

²Only Kick Seine method of HRW could apply, but HRW doesn't use mIBI.

Macroinvertebrate Sampling QA/QC

- **Three-star quality rating**

- **NOT REPORTED**

- ★ **Note organisms but don't count and/or <45 minutes**

- ★★ **Count organisms and <45 minutes**

- ★★★ **Count organisms (>200) and >45 minutes**

Questionable for use support analysis.

Hoosier Riverwatch. 2005. Volunteer stream monitoring training manual, Indianapolis.

Data Quality Objectives for Biological Measurements

- **Calls for**
 - Precision (quantitative or qualitative) and completeness (%)
 - A qualitative statement regarding accuracy in sampling, identification, and habitat assessments (accuracy cannot be quantified).
- **If using the HRW 3 Star Rating, indicate the highest rating that applies.**

IDEM, 2001. Guidelines for preparing quality assurance project plans (QAPPs) for section 319 projects.

Habitat

- **Citizens Qualitative Habitat Evaluation Index**
 - Substrate
 - Fish cover
 - Stream shape and human alterations
 - Stream forests and wetlands
 - Depth and velocity
 - Riffles/Runs
 - Measurement a bit “loose”

Indiana Criteria

Qualitative Habitat Evaluation Index (QHEI)

- NOT used to determine aquatic life use support.
- Used with mIBI and/or IBI data to evaluate role habitat plays in waterbodies where impaired biotic communities (IBC) have been identified
- Substrate, instream cover, channel morphology, riparian zone, pool/riffle quality, and gradient
 - Range of possible scores is 0-100
 - <51 indicates poor habitat
- Despite “loose” nature of CQHEI, it could serve same purpose as QHEI

Data Quality Concerns

- Site selection guidance is minimal
- Sampling schedule & frequency
 - Left to preferences of volunteers
 - 2 to 4 times/year
 - OK for benthic macroinvertebrates
 - Limited value for water chemistry

Detection Limit and Resolution

- **Orthophosphate**

- IN average: .05 mg/L
- P test range: .05-1 mg/L

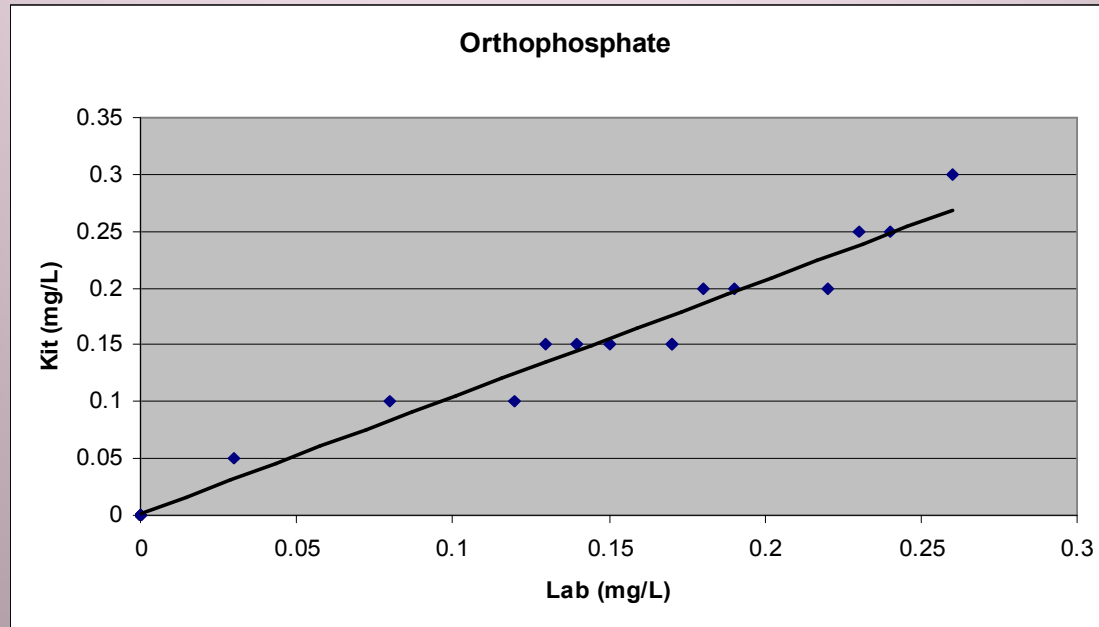
- **Nitrate**

- IN average: 12.32 mg/L
- NO₃ test range: 0, 0.5, 2, 5, 20, 20, 50

- **Transparency**

- Typical range: 0-173 NTU
- Transparency tube range: 0-100 NTU

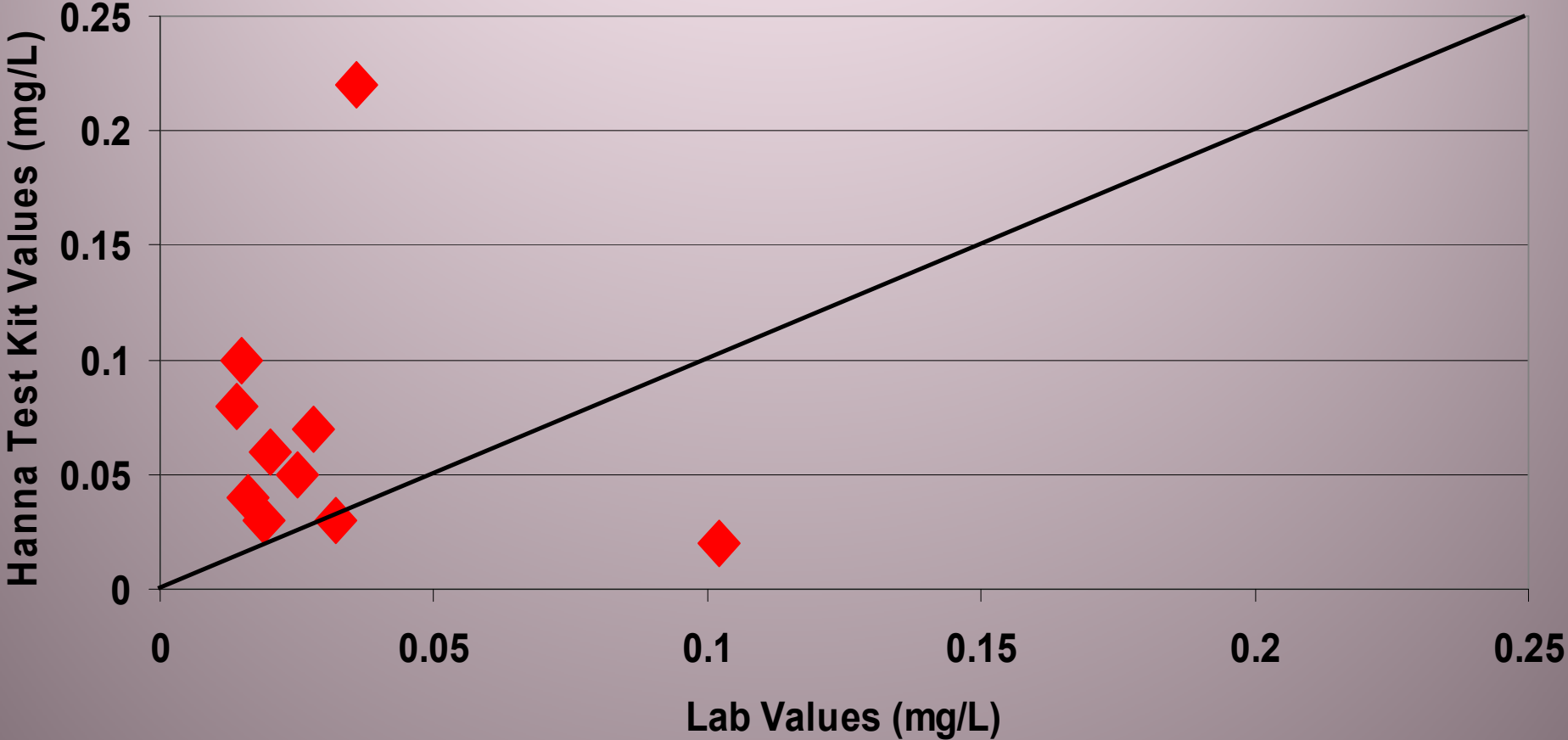
This is Possible*



***IFF: (1) Kit is accurate, and (2) Volunteer uses kit correctly.**

This Often Happens

Phosphorus



Rathbun, 2006

Summary

- HRW methods suitable for use support analysis
 - E. coli
- HRW methods close
 - D.O.
 - CQHEI
- HRW methods not suitable
 - Benthic macroinvertebrates
 - Orthophosphate
 - Nitrate/Nitrite

All potentially suitable for screening analysis and source identification

References

- Liukkonen, B. USEPA Region 5 SWIMS meeting, February 2006, University of Minnesota Water Resources Center,
<http://www.usawaterquality.org/volunteer/EColi/ResultsProducts.htm>.
- Rathbun, J. 2006. *QA/QC Issues with Screening-Level Monitoring Methods*, Michigan, DNR, Presentation at 14th National Nonpoint Source Monitoring Workshop, September 24-28, 2006, Minneapolis.