Monitoring and Assessment

Water Quality Standards Academy

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What Does This Session Cover?

- Monitoring and assessment under the Clean Water Act
  - States & Tribes have prime responsibility
  - Monitoring assumed throughout (ʹ106(e))
- Monitoring objectives & elements
  - What should be monitored
  - Tools for monitoring & assessment
- Reporting on water quality

Clean Water Act/Monitoring & Assessment

- States/Tribes/Territories have major role to assess & report if waters meet the fishable & swimmable goals of the CWA
  - Report on condition of <u>all</u> waters, esp. extent that support healthy aquatic life and recreation (Section 305(b))
  - List impaired waters that do not meet water quality standards and need a TMDL (Section 303(d))
  - Set & refine water quality standards
  - Issue and ensure compliance with NPDES permits
  - Manage NPS to meet WQS
  - States must have adequate monitoring to be eligible for grants and to carry out program activities (Section 106(e))

Critiques of Water Monitoring Programs

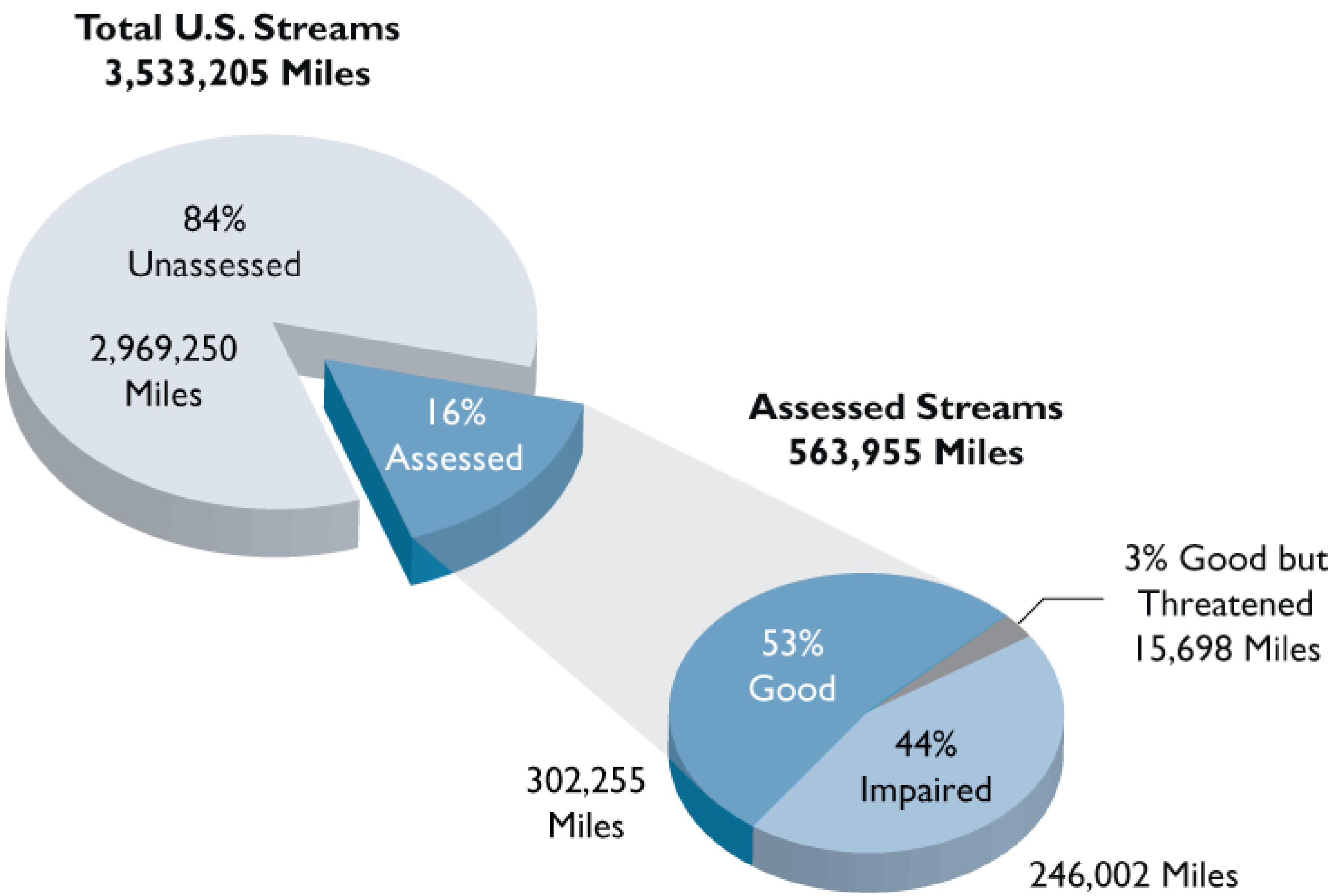
- Many studies* find that EPA and States need better data to:
  - Support all management decisions
    - Develop and refine water quality standards
    - Implement measures to protect and restore waters
    - Evaluate the effectiveness of management actions
  - Make scientifically defensible of the condition of all waters, similar to reports on economic indicators

*GAO, National Research Council, National Academy of Public Administration, EPA's Report on the Environment, and others

Monitoring & Assessments Needed at Multiple Scales

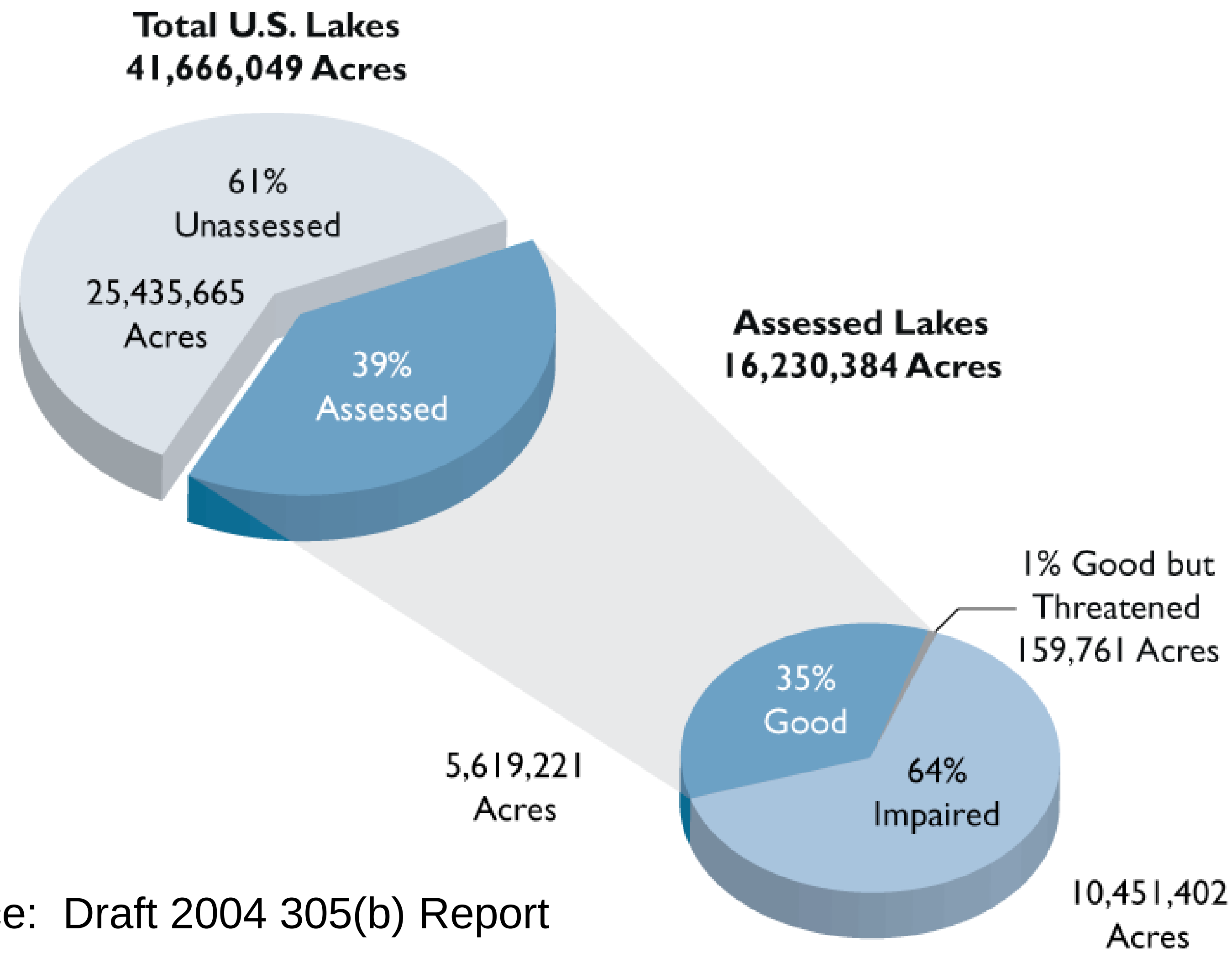
- Monitoring programs should be able to answer questions at different geographic scales
  - Water conditions nationwide, statewide, and across jurisdictional boundaries
  - Water quality at sub-state, watershed and segment scales
- Limitations on use of 305(b) and 303(d) reports
  - Small portion of water resources are assessed
  - Indicators, parameters, and sampling procedures vary
  - Methods to define amount of water assessed vary

Streams Assessed for 2004



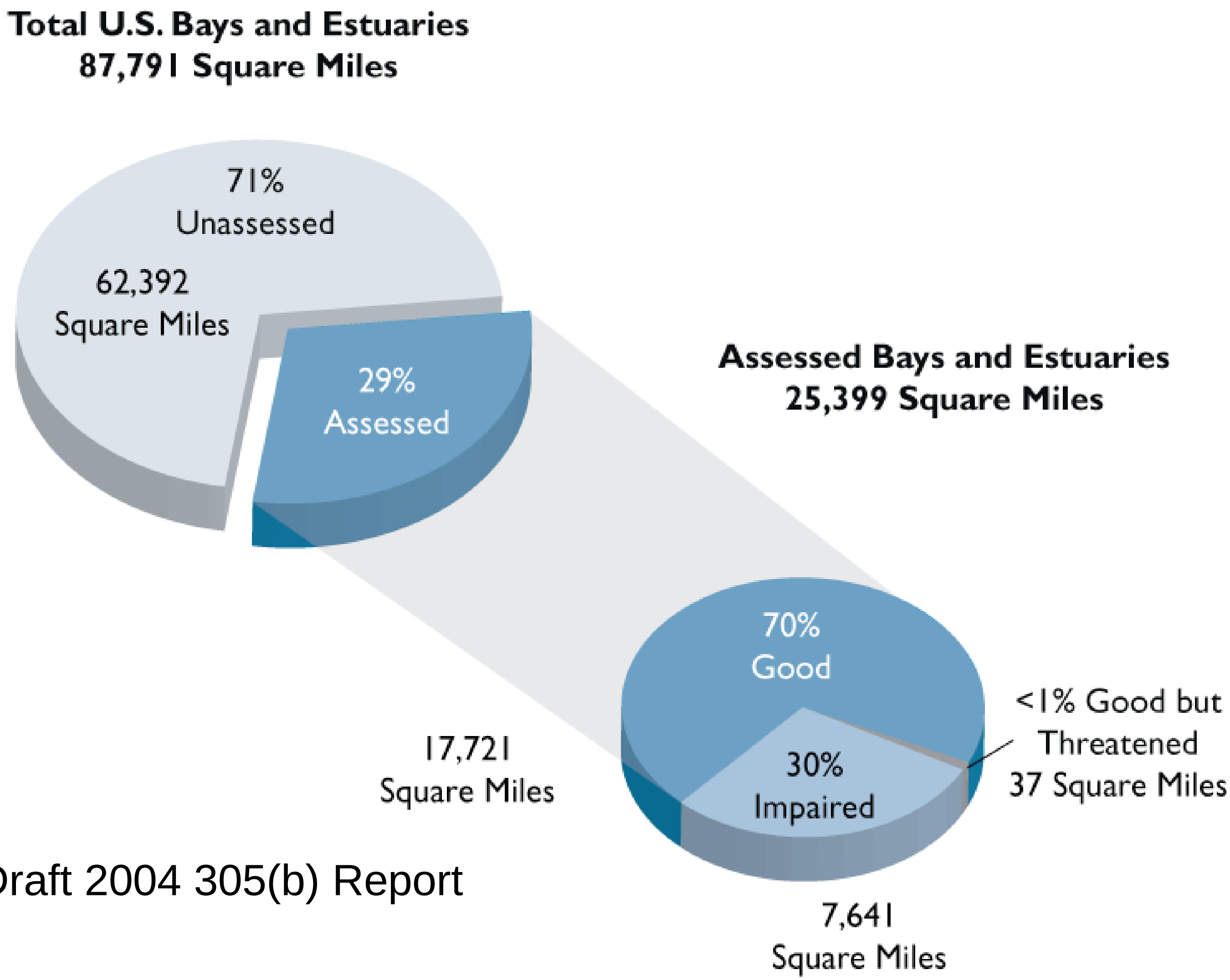
Source: Draft 2004 305(b) Report

Lakes Assessed for 2004



Source: Draft 2004 305(b) Report

Bays and Estuaries Assessed for 2004



Source: Draft 2004 305(b) Report

Actions to Improve Monitoring

- Strengthen State, Tribal and Interstate programs

Elements of a State Water Monitoring and Assessment Program
March 2003
EPA 841-B-03-003

Final Guidance on Awards of Grants to Indian Tribes under Section 106 of the Clean Water Act
For Fiscal Years 2007 and Beyond
EPA 832-R-06-003

Actions to Improve Monitoring

- Collaborate to produce statistically-valid assessments of the nation's waters
- Expand accessibility to and use of data

Critical Monitoring Elements

Identify monitoring objective
(e.g., WQS attainment in stream reach/lake acre, report on all waters of the state, determine results of control actions- NPDES/NPS)

Design monitoring project
(e.g., Site-specific, fixed station, statistical survey)

Collect field data & provide for lab analyses
(Use core & supplemental indicators, select methods, and develop quality assurance plan)

Manage data
(Use accessible electronic data system for analyses; allow data to be used for other monitoring/assessment needs)

Interpret data
(Assessment methodology describes indicators/methods used to assess WQ - interpreting chemical, biological, & physical data against designated uses & criteria)

Convey information and results ((305(b), 303(d), Integrated Report; State legislature, Tribal council, & public)

Understanding
Our Water Resources

Identify Monitoring Objectives

- What question(s) does your program, State or Tribe, the public or others want to answer?
- Monitoring objectives are broad
  - Are waters getting better over time?
  - Are the streams healthy?
    - Do they support Aquatic Life Uses? Recreational Uses? Drinking Water Supply?
  - Are the fish safe to eat?
  - Are protection and restoration efforts working?
- Monitoring designs vary depending upon the objectives

Design Monitoring Project

- This is a critical step
  - The **who, what, how,** and **where** of monitoring
- Translate objectives into specific monitoring goals
  - Specify what needs to be measured (or modeled or assessed in some way).
  - Select indicators/parameters
    - For example, translating "Is it safe to swim in the stream?" to measuring pathogens, nutrients, flow, macroinvertebrates, taxa richness
- Are new data needed? Or will it need to be collected?
- Costs are a major consideration

Approximate Costs

Field sampling costs per site

$1000/site	$5000/site
- Seasonal employees	- Permanent Staff
- 2 person field crews	- 3 to 4 person field crews
- Consumables	- Consumables + equipment
- Sites close-by, easy access	- Remote sites, difficult access
- Simple reporting	- Glossy reporting

Plus

Lab costs (per sample):

Water (Conventionals): $70 to $150

Water (Metals): $25 to $115

Water (Priority pollutants): $100 to $200

Water (Pathogens): $20 to $50

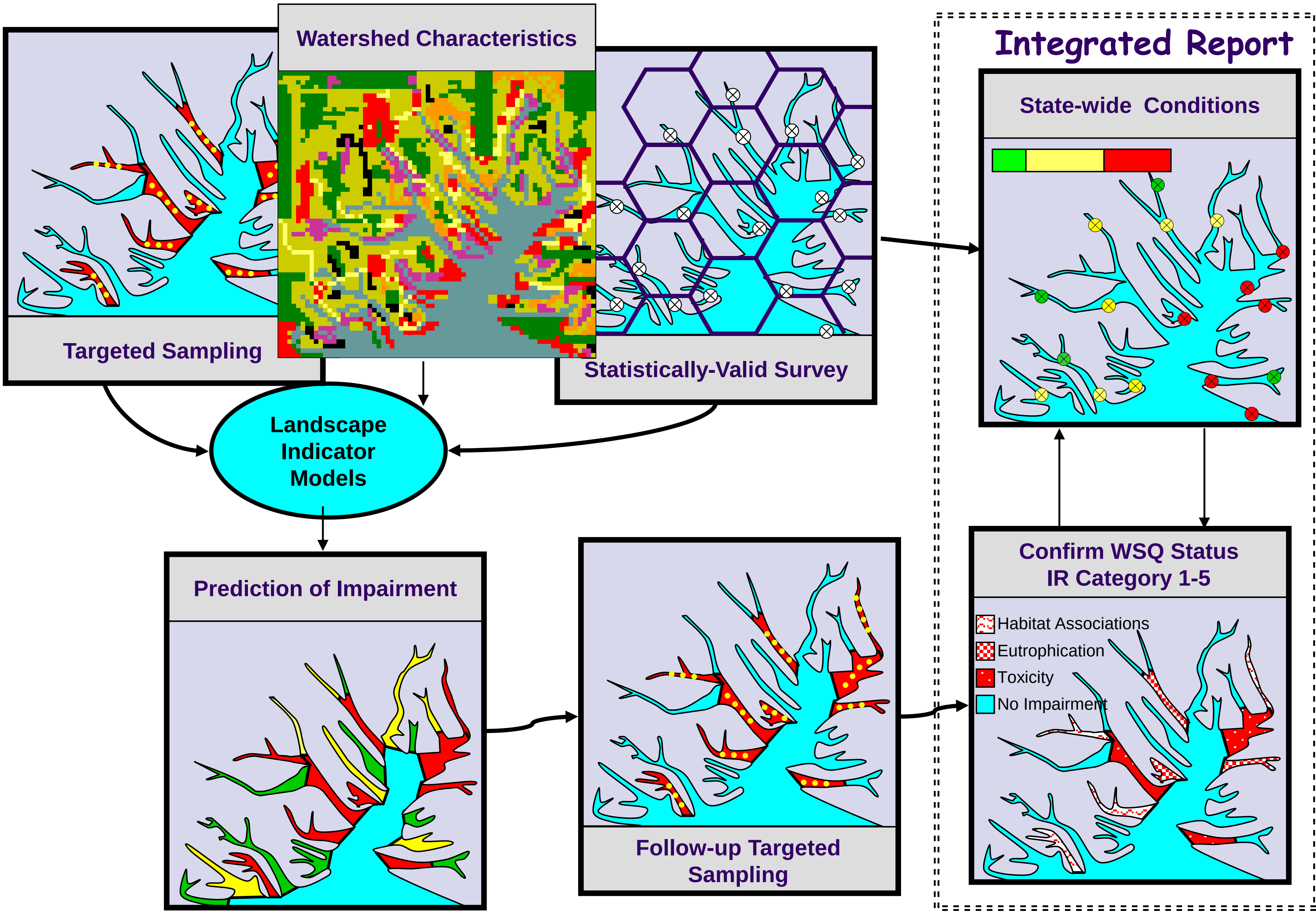
Fish Tissue Contaminants: $150 to $1500

Macroinvertebrates (identification & counting): $150 to $350

Monitoring Design—
Where to collect samples

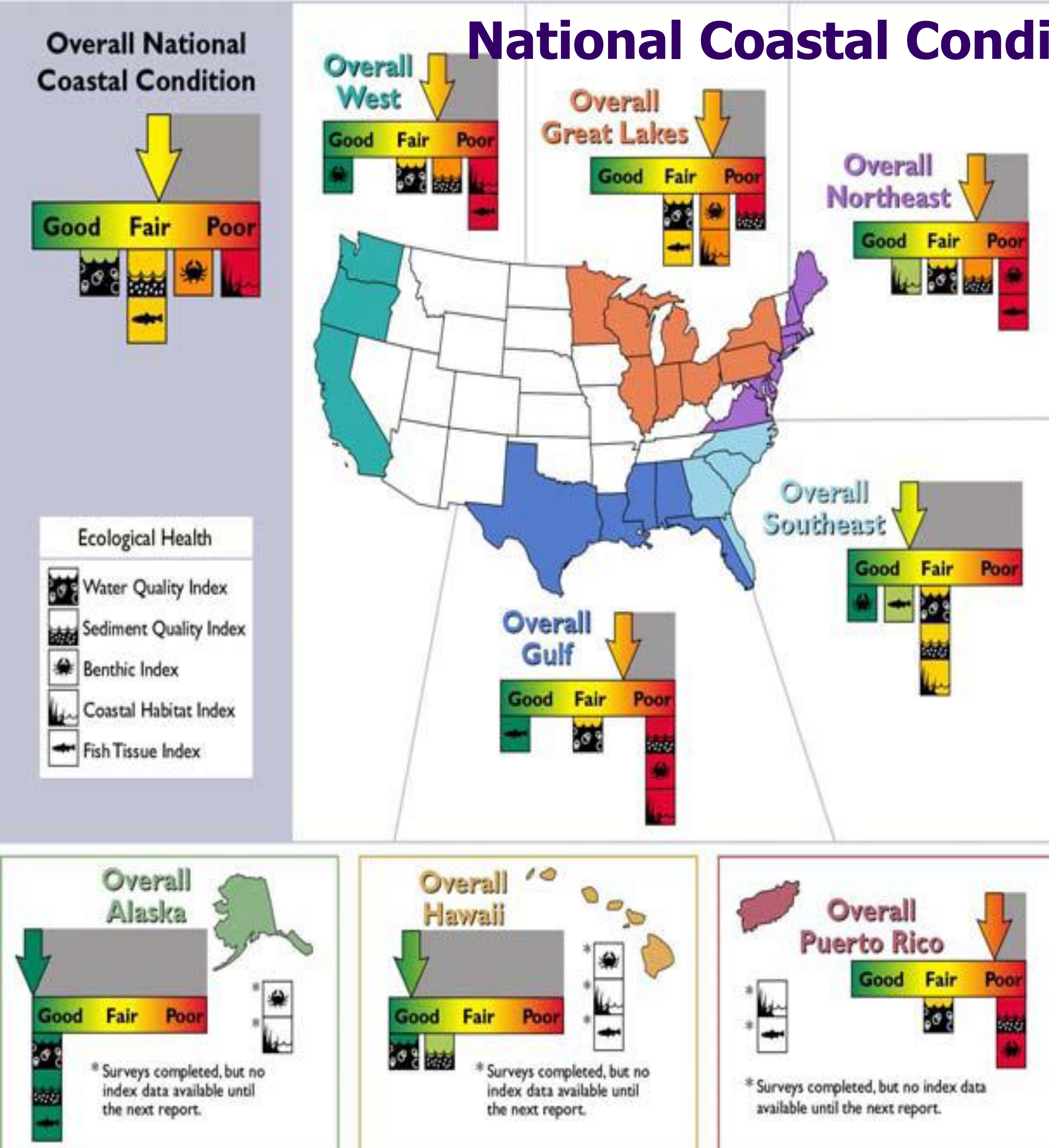
Monitoring Objectives	Scale
1) Assess a specific water quality improvement project	Stream reach, lake size or shoreline mile
2) Identify healthy and degraded streams within a watershed	Watershed scale (at what size?)
3) Determine baseline condition 4) Evaluate water quality trends	Region, State, Reservation or Nationwide

Effective Monitoring – Using the Tools Together



Monitoring Design	**Types of questions they can answer -- Combination of tools can serve decisions at multiple scales**
Statistically-valid survey	• Predict proportion of all waters in good or poor condition • Measure broad-scale water quality trends • Prioritize targeted monitoring
Modeling and landscape analysis	• Determine where water quality is likely impaired • Predict water quality trends • Prioritize targeted monitoring
Targeted monitoring	• Assess WQS attainment for specific segments • Measure localized water quality trends • Identify sources of pollutants to specific waters • Support development of local management measures (TMDL, NPDES permits, NPS BMPs, WQS) • Assess performance of management measures

National Coastal Condition Report

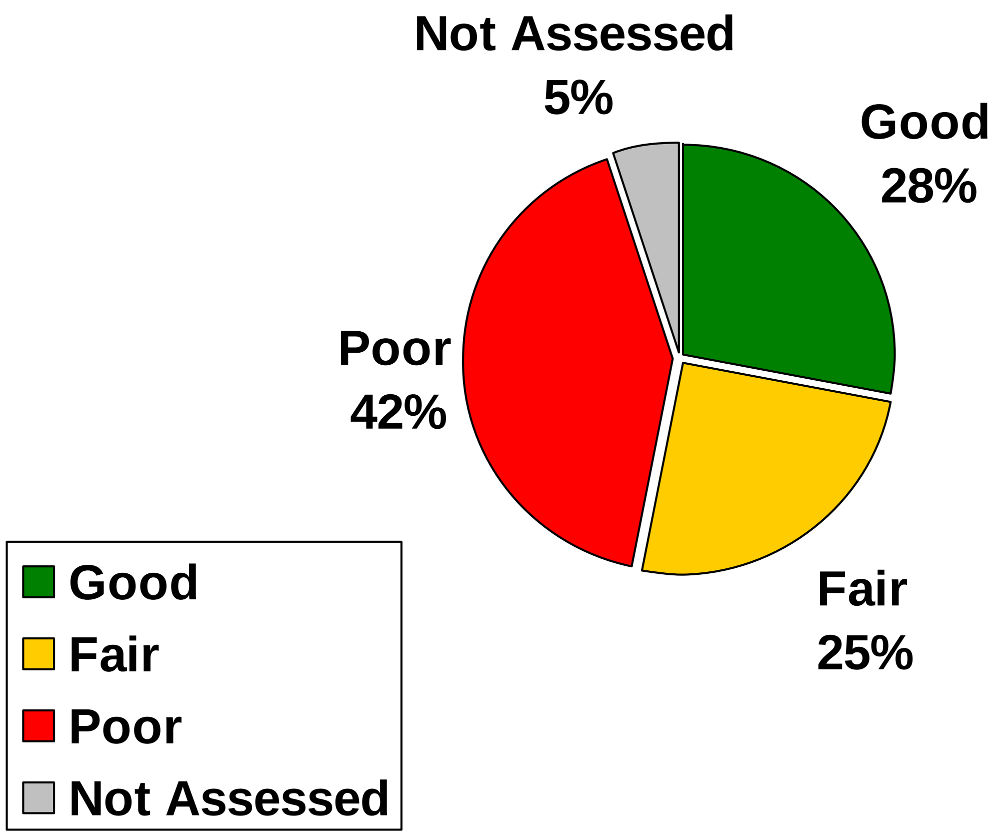


All coastal states and Puerto Rico participated in monitoring

Data support assessments at national, regional, state and local scales

Draft NCCR III found:
53% in good condition
35% in fair condition
6% in poor condition

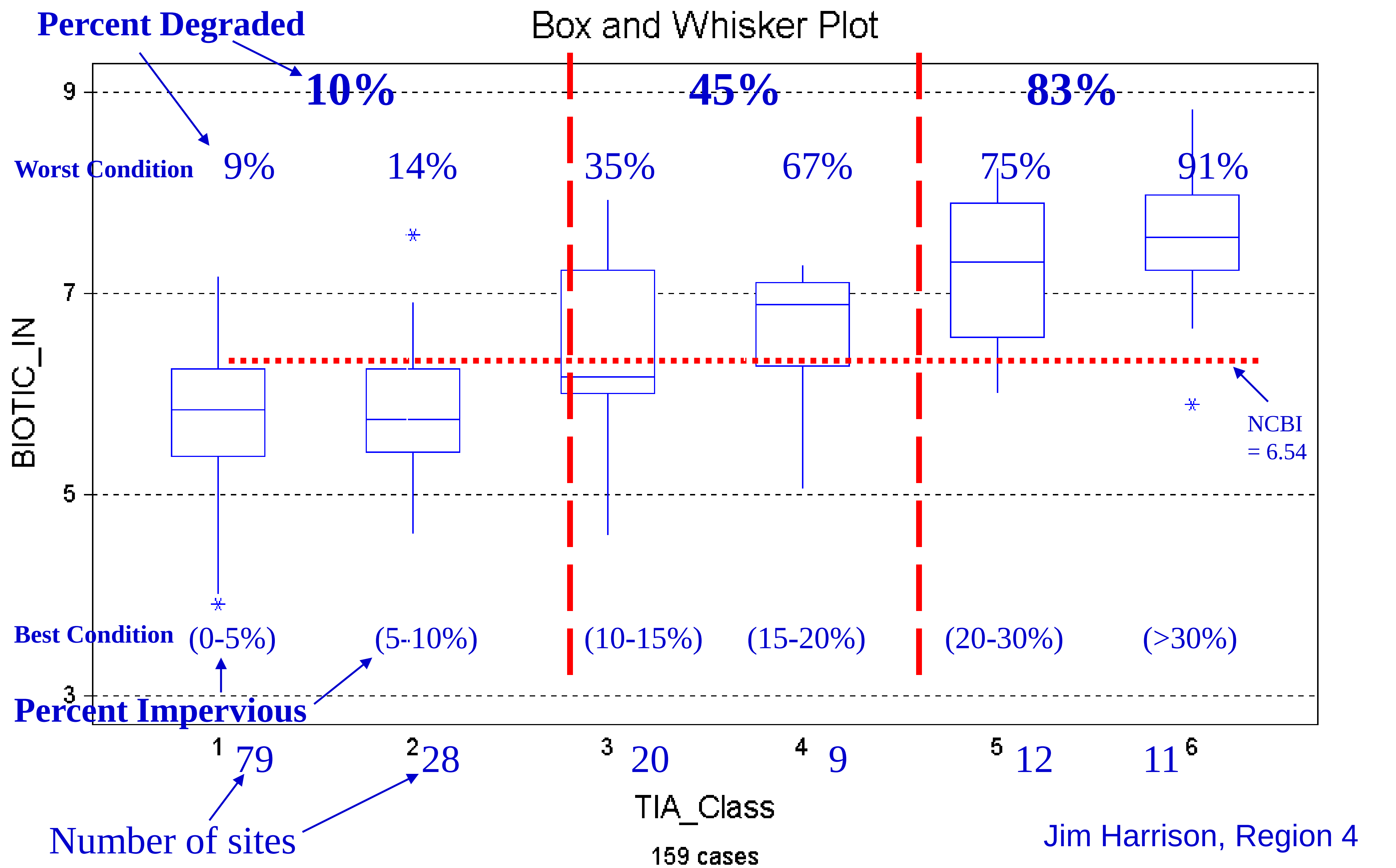
2006 Wadeable Streams Assessment



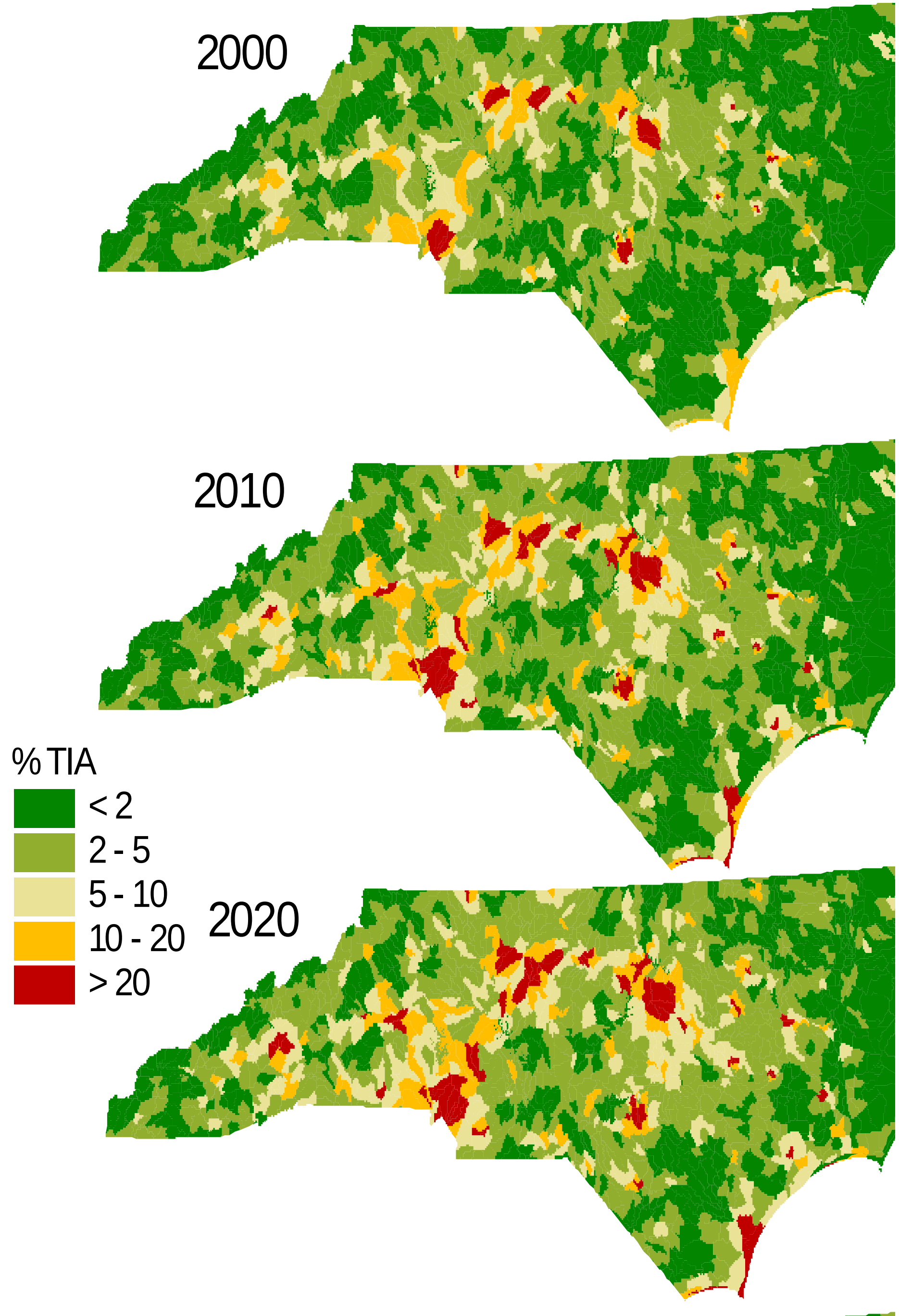
Biological Condition of Streams
(Index of Biotic Condition)

- The WSA found 28% of streams in good condition, compared to least-disturbed reference condition.
- Across the US 25-30% of streams have high levels of <u>nutrients</u> or excess <u>sedimentation</u>. **These streams are twice as likely to have poor biology**.

Landscape/Predictive Tools -- Percent Degraded vs. Total Impervious Area



Jim Harrison, Region 4


2000
2010
2020
% TIA
< 2
2 - 5
5 - 10
10 - 20
> 20

Who Monitors Water Quality?

- States, territories, tribes and interstate organizations implement monitoring programs under CWA 106
- Federal agencies monitor to support their management and research needs
- Volunteer and citizen groups monitor to understand local conditions
- Other organizations include local government, academic organizations…

What Should be Monitored?

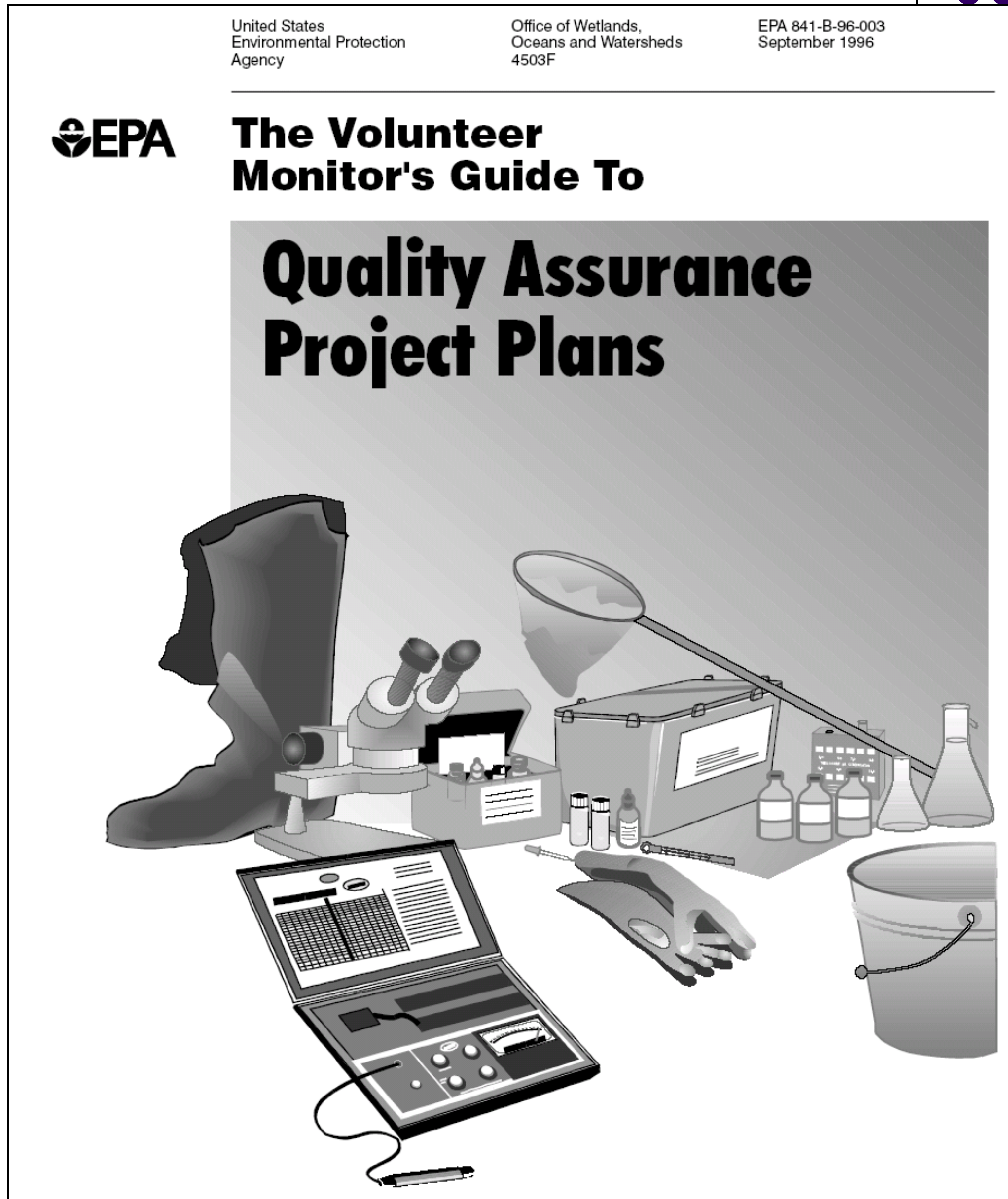
	Aquatic Life	Recreation	Drinking Water	Fish / Shellfish
C O R E	Biological communities Basic chemistry(e.g. DO, pH) Nutrients Flow Habitat assessment Landscape condition	Pathogen indicators (*E. coli,* enterococci) Nuisance plant growth Nutrients Chlorophyll Flow Landscape condition	Trace metals Pathogens Nitrates Salinity Sediments/TDS Flow Landscape condition	Pathogens Mercury Chlordane DDT PCBs Landscape condition
O T H E R	Ambient toxicity Sediment toxicity Other chemicals of concern in water or sediment Health of organisms	Other chemicals of concern in water or sediment Hazardous chemicals Aesthetics	Other chemicals of concern in water or sediment VOCs (in reservoirs) Hydrophylic pesticides Algae	Other chemicals of concern in water or sediment

<u>How?</u> – Protocols, Field and Laboratory Methods

- Chemistry
  - Usually well documented field and lab methods
- Biology
  - Usually well documented, sometimes generally accepted field and lab methods (depends on the waterbody type…i.e. lakes, streams, wetlands, etc.).
- Habitat/Physical Parameters
  - Usually well documented, sometimes generally accepted field methods (depends on the waterbody type…i.e. lakes, streams, wetlands, etc. and the geographic location.)

Before you go out in the field….

You need to develop a Quality Assurance Project Plan (QAPP)


United States Environmental Protection Agency

Office of Wetlands, Oceans and Watersheds 4503F

EPA 841-B-96-003 September 1996

EPA

The Volunteer Monitor's Guide To

Quality Assurance Project Plans

Managing Data

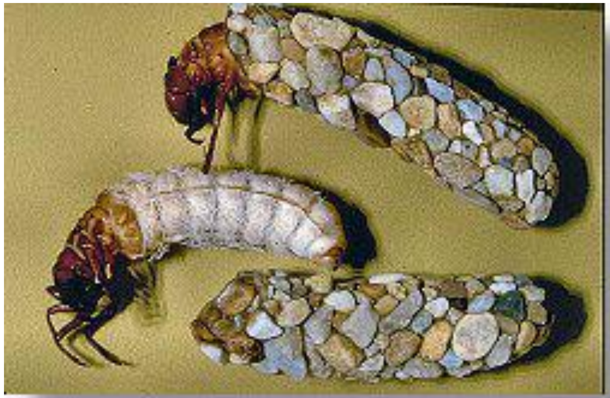
- Data should be managed for analysis and storage in electronic format and should be georeferenced
- EPA's STORET warehouse/Water Quality Exchange provides the framework for the sharing of water quality monitoring data. Allows EPA, States, and Tribes to effectively share information across jurisdictional or organizational lines.
  - Redesigned STORET to facilitate easier upload and download of water quality data
  - New webservice tools for retrieving data at the watershed scale and for small users, such as watershed groups and Tribes
    - (www.epa.gov/storet)
  - Hint – make sure that your contract Lab sends data in a STORET ready format

Managing Data

- Monitoring Data in STORET can be used by EPA and the States to:
  - Support CWA decision making
    - Use Attainability Analyses
    - Models
    - Beach Monitoring
    - Assess condition of waters under Section 305(b)
    - Evaluate existing and available data to identify impaired waters: 303(d)
  - Implementing CWA programs
    - Setting protection and restoration priorities
    - Setting Water Quality Criteria
    - Support Reasonable Potential Analysis for NPDES permits
    - Develop and implement TMDLs and Watershed Plans
  - Maximize value of monitoring investment

Turning Data into An Assessment

Aquatic Life Indicators	Recreation Indicators
Dissolved Oxygen	E. coli
pH	Nutrients
Temperature	Chlorophyll
Macroinvertebrates	



Applying Water Quality Criteria

- Narrative or numeric expressions of parameters designed to protect designated uses
  - Temperature, pH, toxics
- Biological criteria
  - Numeric or narrative expressions that describe the "desired" aquatic communities inhabiting a waterbody.

Assessment Methodology

- Describes the hierarchy of indicators, methods, and tools used to assess water quality
  - Establishes a record and provides for consistency from one reporting period to the next
- Documents procedures
  - For collecting and reviewing all readily available and existing data and information
  - For making WQS attainment decisions for all applicable criteria
    - Address numeric criteria, narrative criteria, and designated uses
    - Define data quality and documentation needs
    - Describe analytical approaches for interpreting data and information

Assessment Methodology

- Example assessment methodology contents:
  - Number of exceedances of magnitude, duration and frequency needed to determine impairment
  - Age of data (e.g. less than 5 years old for conventionals, habitat and biological, less than 10 years old for toxics)
  - What biological/habitat data will be used? (e.g. it must be collected with a certain protocol, during an index period and identified to genus)
  - For parameters without numeric criteria, what is “degraded” (e.g. an Benthic Index score of 48)
  - Data must have been collected under an approved QAPP

Communicating Results

- Summarize the information
  - Few people understand the raw data
  - Provides an interpretation of the data tailored to specific audiences
  - For example, State and Tribal decision-makers, program managers, state legislators, watershed and environmental organizations, newspapers, etc.
  - Presentations and written documents are both needed
    - Maps and graphics are most effective

305(b), 303(d), and Integrated Reports

- Integrate CWA water quality assessments & reports
- Describe assessment methodology for WQS attainment decisions
  - 303(d) asks states to describe their assessment methodology when submitting their impaired waters list
- Categorize state waters based on WQS attainment status
- Present results of probability-based design at state or watershed scale
- Establish monitoring priorities for next 2 years
- Establish TMDL development priorities for all Category 5 waters (impaired waters needing a TMDL)

Integrated Report Categories

305(b) Report

1. Attaining all designated uses
2. Attaining some designated uses, and insufficient or no data and information to determine if remaining uses are attained
3. Insufficient or no data and information to determine if the standard is attained
4. Impaired or threatened for one or more designated uses but not needing a TMDL because --
   a. TMDL has been completed
   b. Expected to meet standards
   c. Not impaired by a pollutant
5. Impaired or threatened by pollutant(s) for one or more designated uses and requiring a TMDL

303(d) List

Information Sources- Monitoring and Assessment

- General Monitoring Information
- http://www.epa.gov/owow/monitoring/
- Consolidated Assessment and Listing Methodology guidance
- http://www.epa.gov/owow/monitoring/calm.html
- Clearinghouse on methods/procedures for monitoring for water, sediment, air and tissues
  http://www.nemi.gov/
- Information on Biological Assessments
- http://www.epa.gov/owow/monitoring/bioassess.html
- 2006 Integrated Report Guidance
- http://www.epa.gov/owow/tmdl/2006IRG/#documents
- National Water Quality Reports (under Section 305b)
- http://www.epa.gov/owow/monitoring/reporting.html
- Section 303d Lists of Impaired Waters
- http://oaspub.epa.gov/waters/national_rept.control
- Probability Surveys of the Nation's Waters
- http://www.epa.gov/owow/monitoring/reporting.html
- National Coastal Condition Reports
- http://www.epa.gov/owow/oceans/nccr/
- Wadeable Streams Assessment
- http://www.epa.gov/owow/monitoring/wsa/index.html
- National Lakes Fish Tissue Study
- http://epa.gov/waterscience/fishstudy/

Water Quality Assessment and Total Maximum Daily Loads Information (ATTAINS)

The Assessment Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) provides information reported by the states to EPA about the conditions in their surface waters. This information is required every two years under Clean Water Act Sections 305(b) and 303(d).

Because of differences in state assessment methods, the information in this site should not be used to compare water quality conditions between states or to determine water quality trends. Check out the Frequent Questions box on the right to learn more.

[Which state reports are available?]

[National Summary of State Information]