EPA's Bioassessment Performance and Comparability "Guidance"

Why Develop this Guidance

- Previous NWQM Conferences expressed need
- Several states, tribes, and others want this guidance
- EPA views this as a critical component to strengthen existing bioassessment programs
- Credible data laws; over-interpreting results
- Links with other bioassessment programs: critical elements, reference condition criteria

Document Outline

- Background: Bioassessments and DQOs; Performance-based approach and comparability defined; lit review
- Performance-based Methods: Performance characteristics defined; relationship to comparability, data quality
- Documenting Performance: how to; challenges; examples
- Determining Comparability: at data, metric and assessment levels; rules; challenges; examples
- Documentation and Reporting: metadata; forms

EPA Bioassessment Guidance: Performance

Includes:

- Recommended performance characteristics that should be documented for a bioassessment protocol and its submethods (e.g., laboratory procedures, taxonomy)
- How to calculate performance characteristics
- Forms to help document performance and recommended metadata (water quality data elements)
- Examples of performance-based methods for different DQOs
- Case study examples that calculated performance for bioassessment protocols or submethods

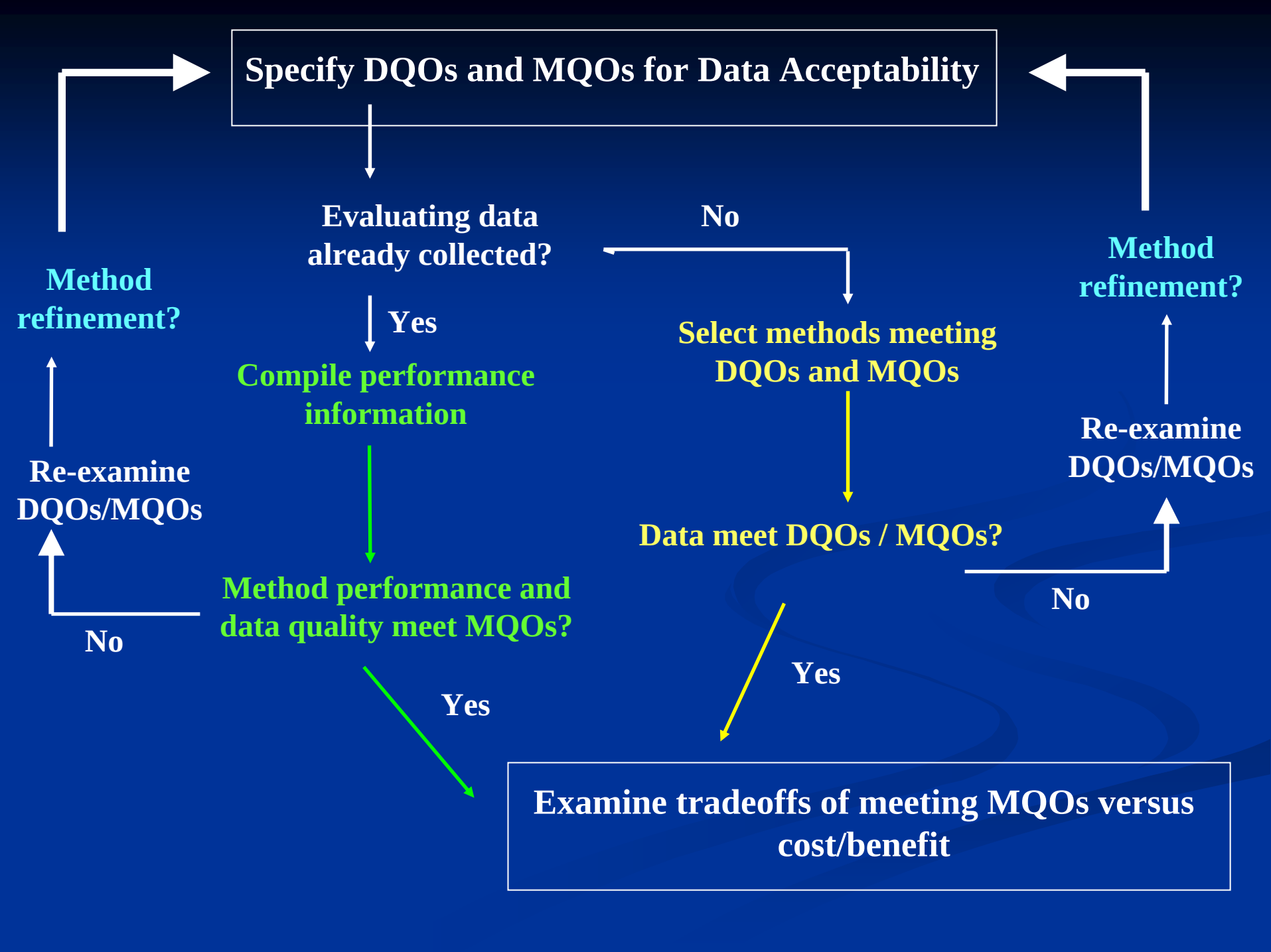
EPA Bioassessment Guidance: Comparability

Includes:

- Recommended rules for combining bioassessment data
- Recommended rules for combining assessments
- Case study examples that examined comparability of different protocols or datasets
- Recommendations to enhance comparability evaluations and promote comparability of information derived from different programs

Bioassessment Protocols Consist of Several Steps, Each Benefiting From a Performance Assessment

Major Project Elements	Comparability Requirements
Identify objectives and design of monitoring project	▪ Study Objectives or Monitoring Question ▪ Data-Quality Objectives (DQO) (includes sampling design)
Collect field samples and on-site data	▪ Sampling Plan ▪ Field Certification and Training ▪ Quality-Assurance Plan ▪ Field-activities Safety Plan
Produce data from laboratory analyses	▪ Quality-Assurance Plan ▪ Specify Method Acceptance Criteria ▪ Laboratory Accreditation ▪ Taxonomic certification ▪ Method Verification
Manage Data	▪ Required Metadata (data elements), including data-quality documentation


Specify DQOs and MQOs for Data Acceptability
Evaluating data already collected?
No
Yes
Compile performance information
Select methods meeting DQOs and MQOs
Method refinement?
Re-examine DQOs/MQOs
Method refinement?
Re-examine DQOs/MQOs
Data meet DQOs / MQOs?
No
Method performance and data quality meet MQOs?
No
Yes
Yes
Examine tradeoffs of meeting MQOs versus cost/benefit

Generalized Flowchart

State management objectives

Specify data quality objectives (DQO)

Select indicators

Specify measurement quality objectives (MQO) (= acceptance criteria)

Collect data

Document protocol performance

Evaluate performance relative to MQOs

Exclude/reject data *not meeting* MQOs

“Calculate” indicators

Address management objectives

Bioassessment Example

Determine stream miles that are biologically impaired

Determine to a 90% degree of confidence whether or not a site is impaired or not

Metrics or index responsive to stressors and reliable, representative sampling methods

Precision of indicators for replicate samples ≤20% RSD or ≥80% similarity;

≥ 80% discrimination efficiency; stressor gradient MQOs? Sensitivity?

Collect field replicates; split lab samples; sort residue QC;

% taxonomic agreement

Using data meeting MQOs, calculate assessment values

Interpret findings in context of management objective

Performance Characteristics

- Tentatively: Precision, sensitivity, responsiveness and bias/accuracy
- Could pertain to both field and laboratory procedures
- Sampling method also includes representativeness
- Need replication at sites along a human disturbance gradient – HDG (from very best to very worst)
- Reference condition data are key
- Appropriate definition of the HDG is essential

Methods

?

Indicators

?

Performance;
Comparability:
What is it? What do we mean?

?

Reference Condition

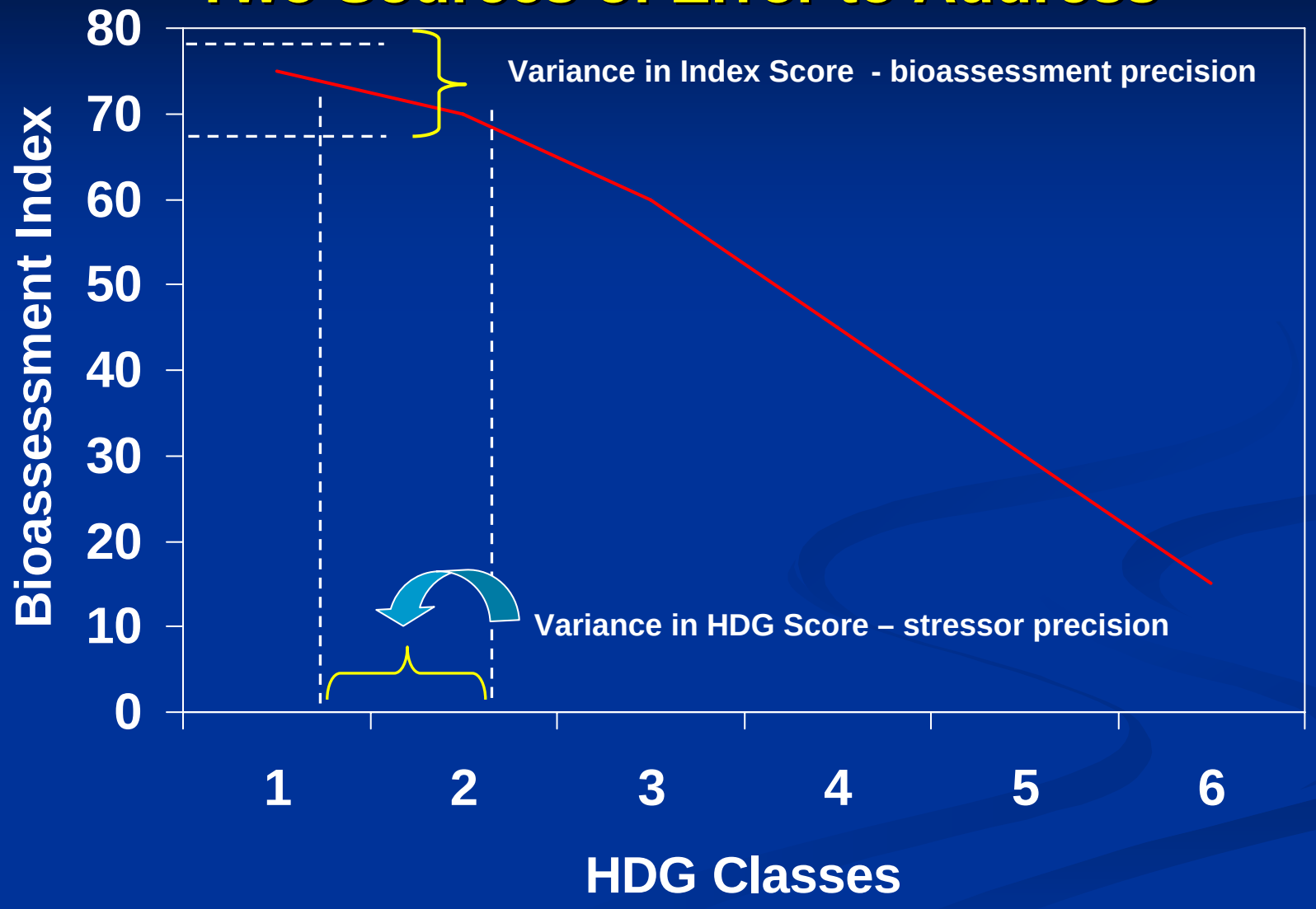
Sampling Design

We Need Your Input

Definitions: Performance Characteristics

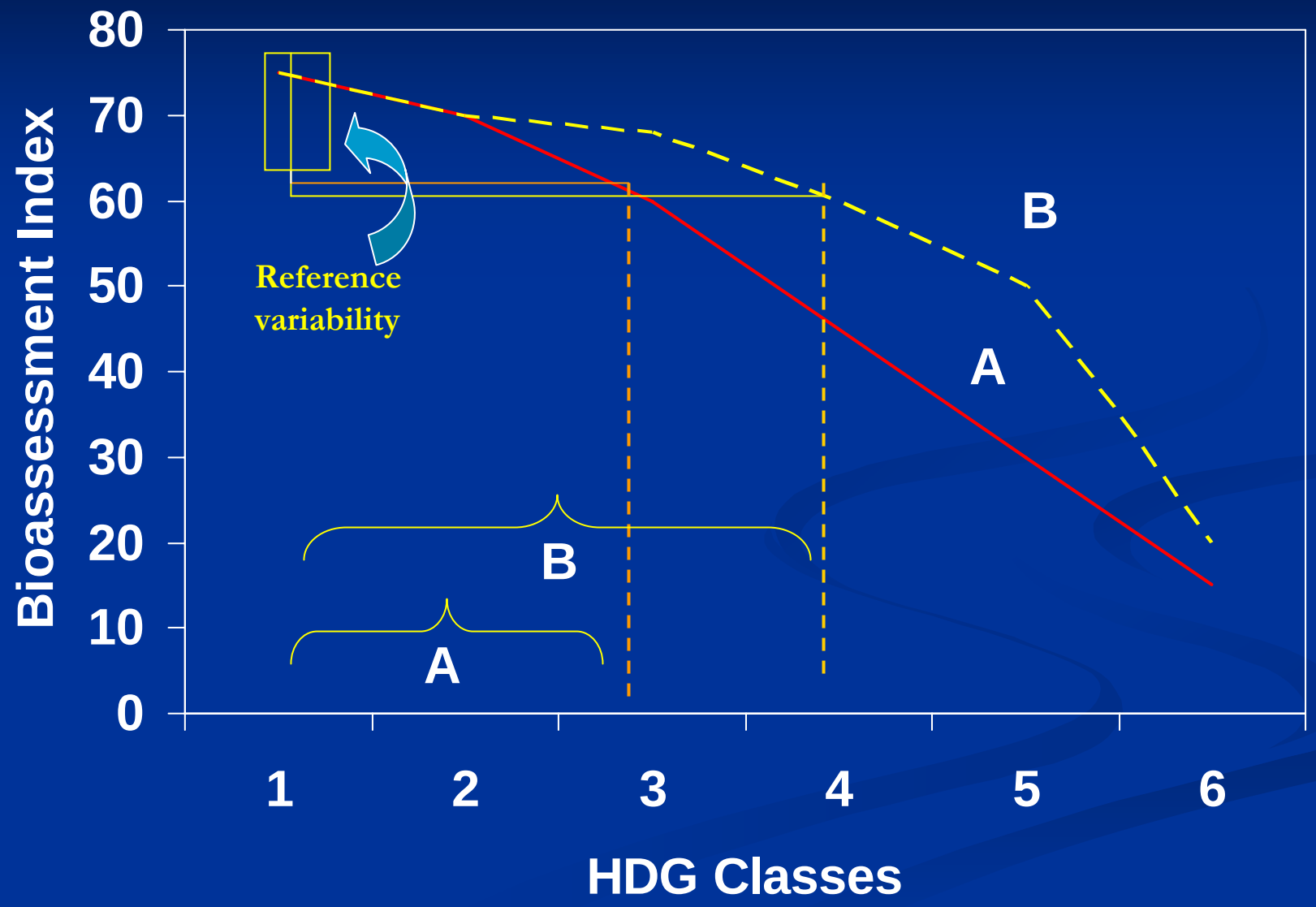
Performance Characteristic	Definition
Precision (Repeatability and reproducibility)	Repeatability – variability in biological index or indicator measure using split samples. (lab error) Reproducibility – variability in biological index or indicator measure using duplicate field samples. (measurement error – includes lab error)
Sensitivity	Level of generalized stressor gradient (or HDG) at which the biological index or indicator is statistically different from reference condition.
Bias/Accuracy (False positive or false negative rate)	Degree to which truly stressed sites are systematically classified as unimpaired (false negative) , or truly non-stressed sites are systematically classified as impaired (false positive).
Responsiveness	Degree to which a biological index or indicator measure decreases monotonically with increasing stress.

Two Sources of Error to Address

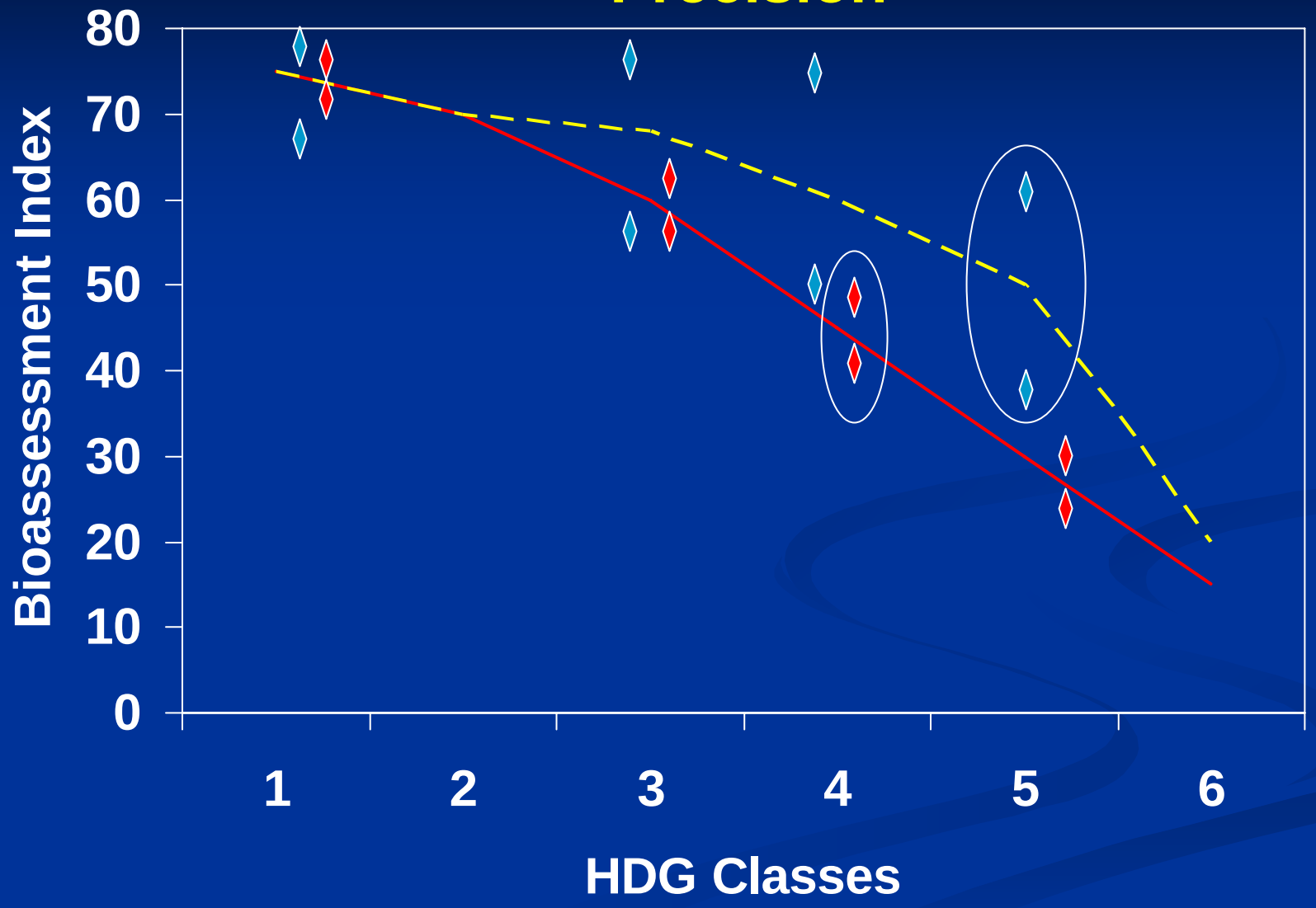


Sensitivity

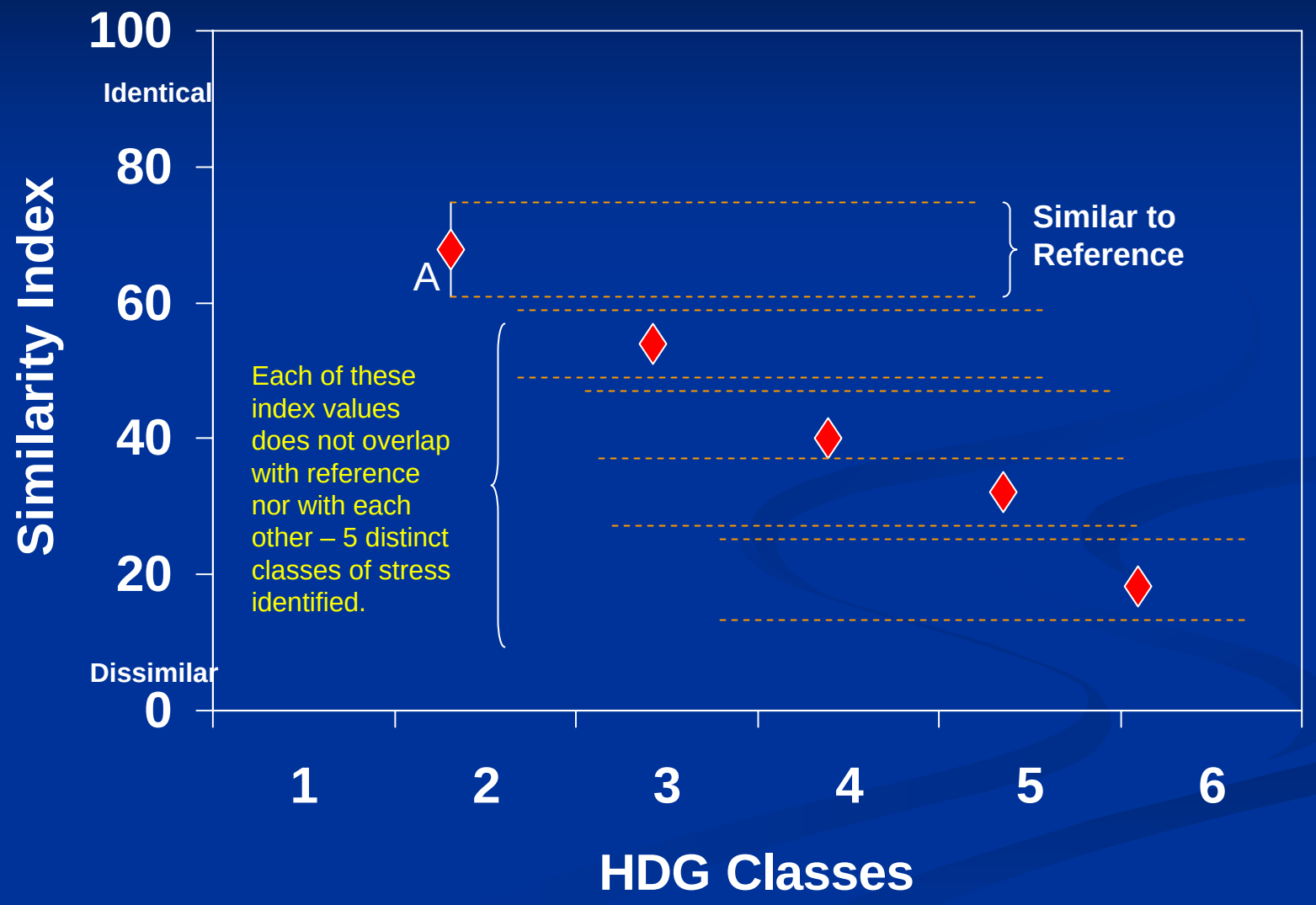
Method A distinguishes HDG 3 from HDG 2
Method B distinguishes HDG 4 from HDG 2



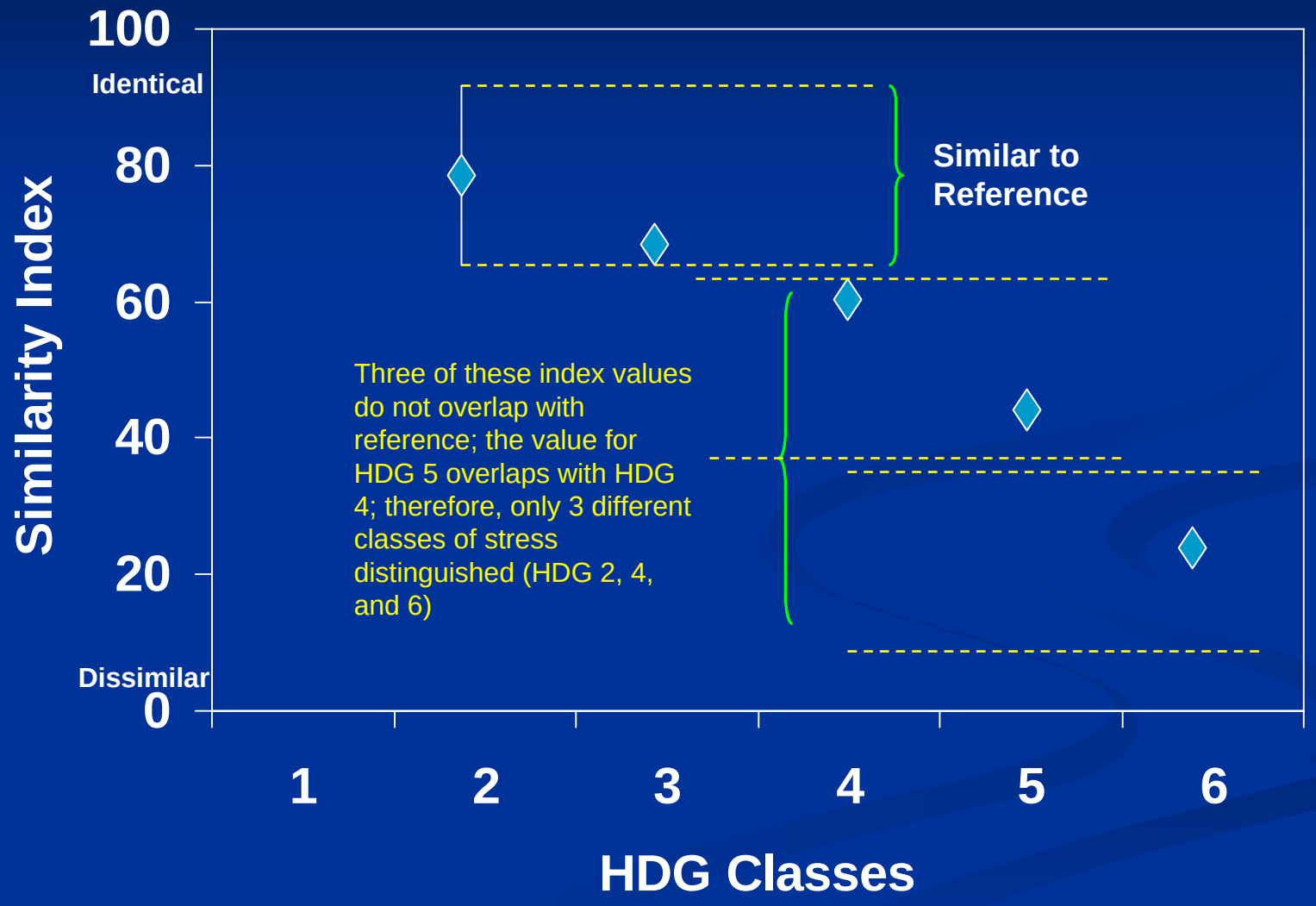
Precision

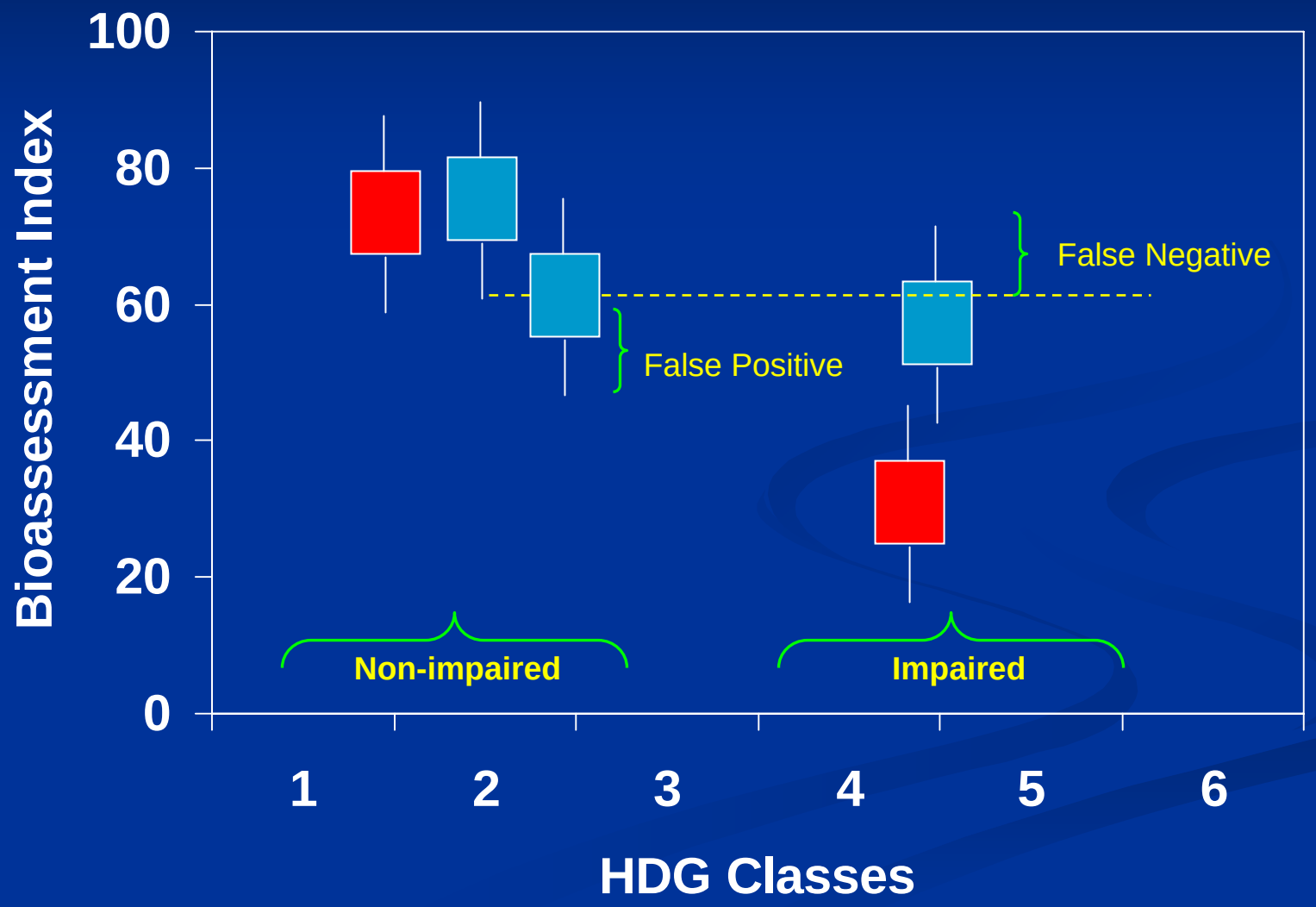

Bioassessment Index
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
HDG Classes

Responsiveness



Responsiveness



Bias / Assessment Accuracy

Non-impaired mean and 95% CI based on bioassessment data from several reference sites; need several test sites in the HDG 1-3 classes and in the HDG 4-6 classes to test for false positive and negative rates.