National Biological Assessment and Criteria Workshop

Advancing State and Tribal Programs

Coeur d'Alene, Idaho
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LR 101

Section 3: Large River Bioassessment Design and Data Interpretation

Presented by

Chris O. Yoder, Midwest Biodiversity Institute & Center for Applied Bioassessment and Biocriteria

Monitoring & Assessment Should Be a Determinant in How WQ is Managed

- Problem identification and characterization.
- Policy/program and legislation development.
- Criteria development and application.
- Demonstrate WQ management program effectiveness - *manage for environmental results*.

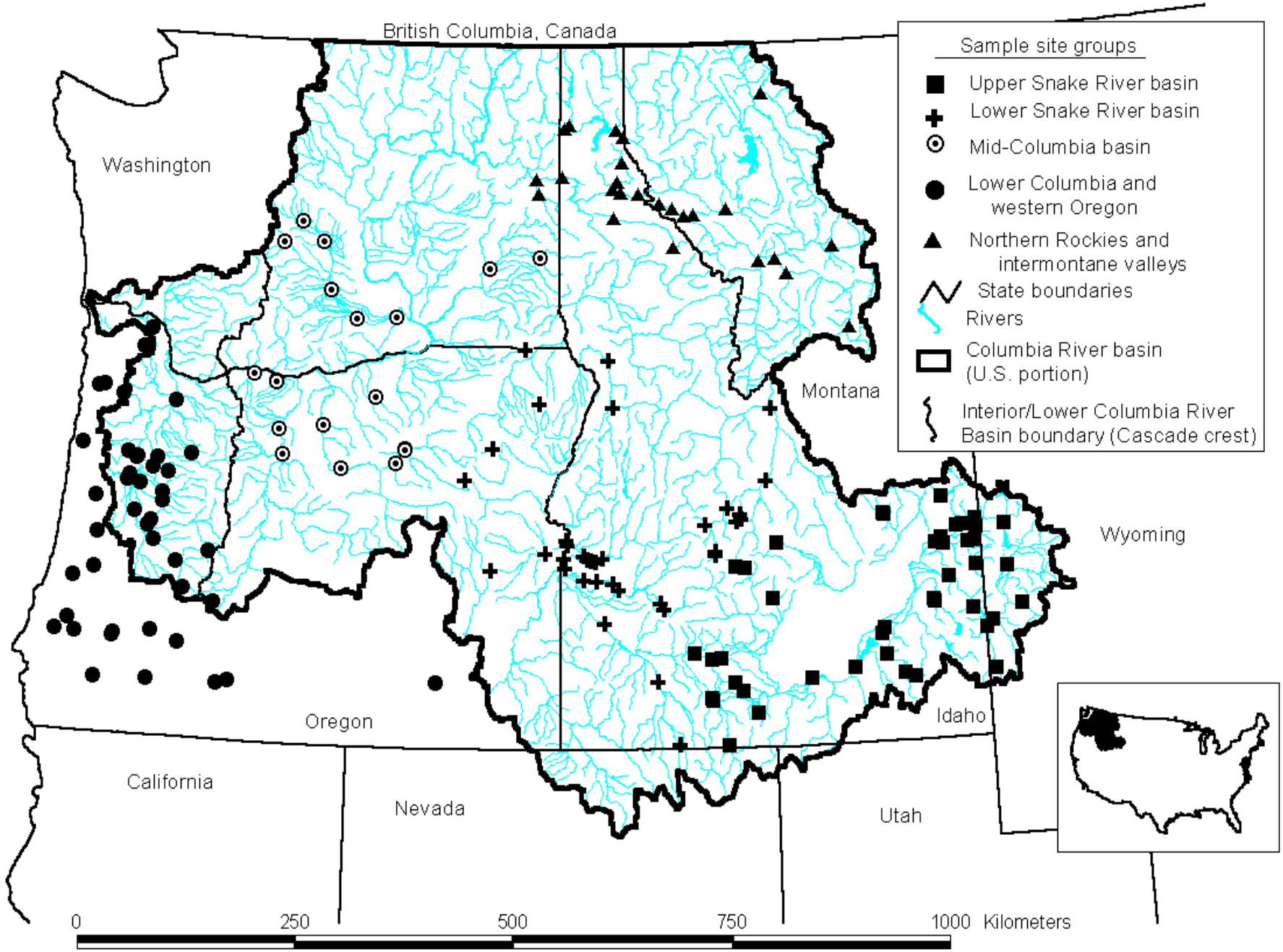
Develop monitoring & assessment as an overall function of WQ management, not on a piecemeal basis.

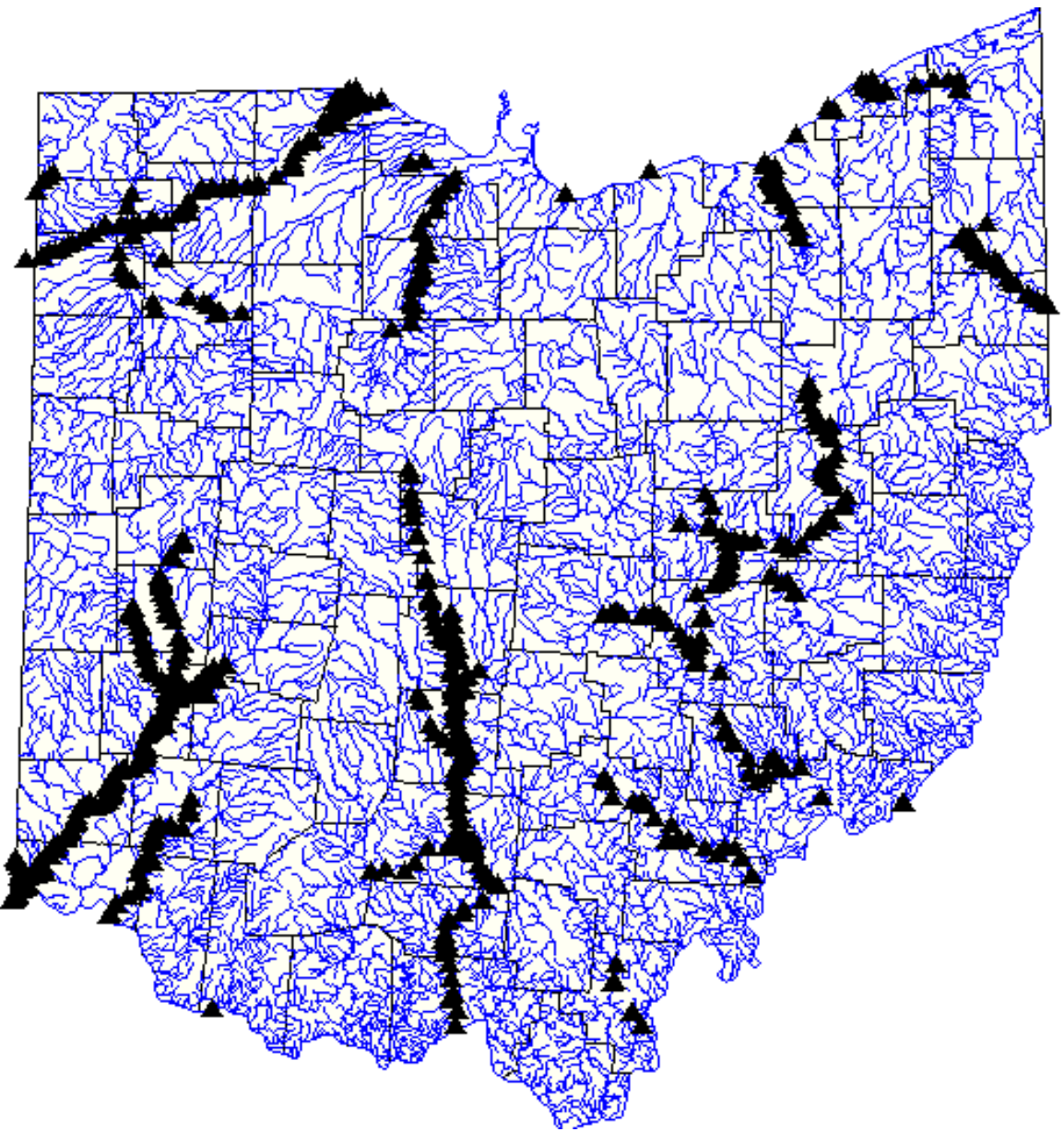
Recognizing the Strategic Role of Consistent and Systematic Monitoring and Assessment

- Develop essential relationships between biological response and stressor variables
- Ensures that indicators are developed from data and case studies encompassing the full gradient of regional quality and response to stressors
- When performed as a baseline program function, the tools and indicators are available when they are needed.

Issues of Large River Bioassessment

- Status and trends – sites, reaches, segments
- Scale issues – how much of a large river needs to be assessed?
- Local vs. reach scale issues.
- Support of different water quality management objectives – requires consideration of multiple designs.


British Columbia, Canada
Washington
Montana
Wyoming
Oregon
Idaho
California
Nevada
Utah
Sample site groups
Upper Snake River basin
Lower Snake River basin
Mid-Columbia basin
Lower Columbia and western Oregon
Northern Rockies and intermontane valleys
State boundaries
Rivers
Columbia River basin (U.S. portion)
Interior/Lower Columbia River Basin boundary (Cascade crest)
0
250
500
750
1000 Kilometers



Ohio Large Rivers Bioassessment: 1979 - present

- Multiple stressors (point & nonpoint sources, habitat, hydromodification)
- Intensive survey design
- Repeat samplings >1 to 5-10 years; supports before & after assessments
- Aggregate assessment for waterbody subclass (>500 mi.^{2})

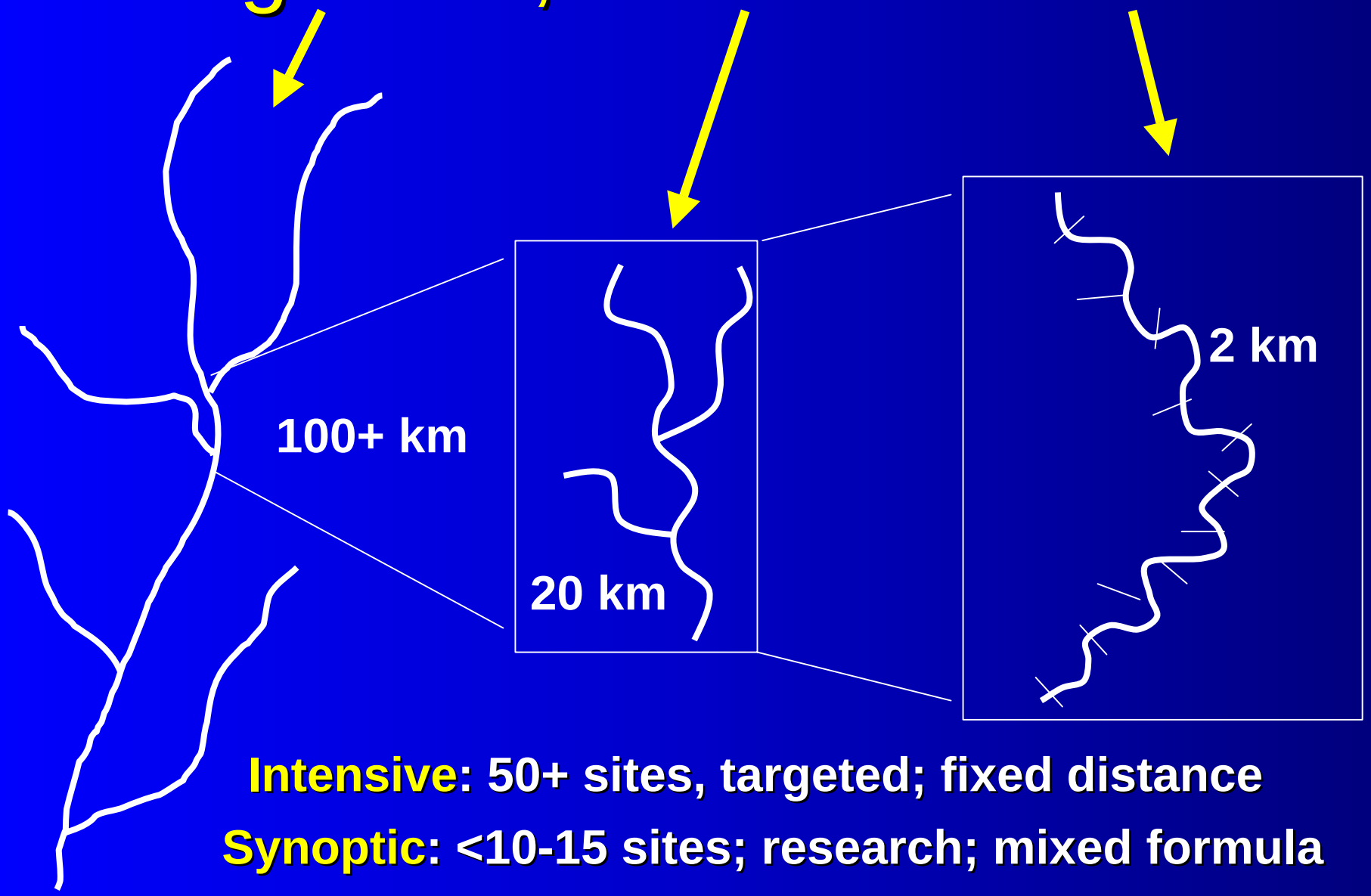
Segments, Reaches, and Sites

Segment – a major length of a riverine mainstem (hundreds of km); usually selected as part of a strategic M&A program.

Reach – a discrete length of a major river segment (tens of km); frequently the focus of stressor specific assessments.

Site – a sampling location (usually 100s or 1000s of meters) within which specific biological sampling methods are applied to produce relative abundance data.

Segments, Reaches & Sites



Intensive: 50+ sites, targeted; fixed distance

Synoptic: <10-15 sites; research; mixed formula

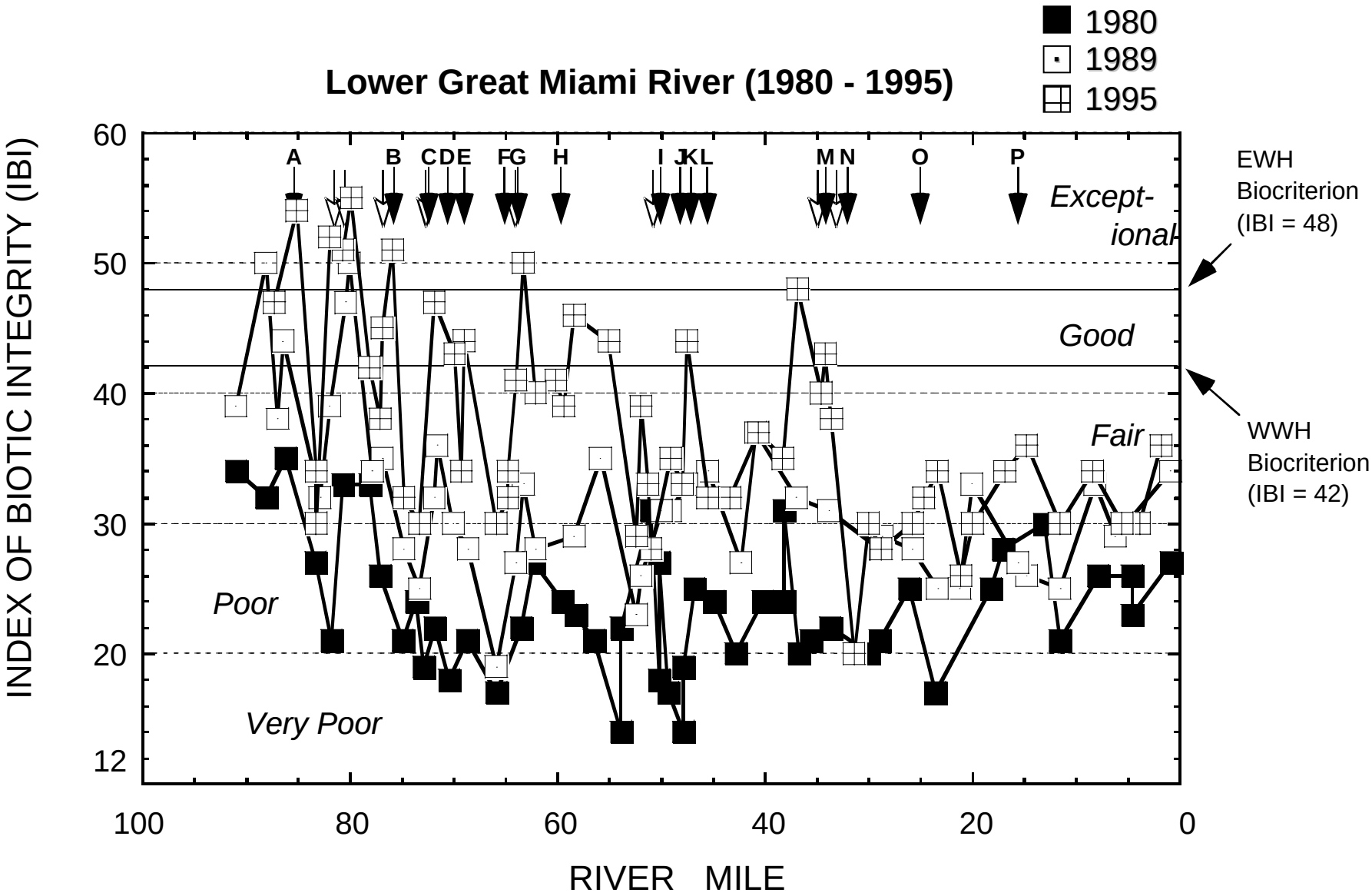
Probabilistic: <10 sites; probabilistic; width formula

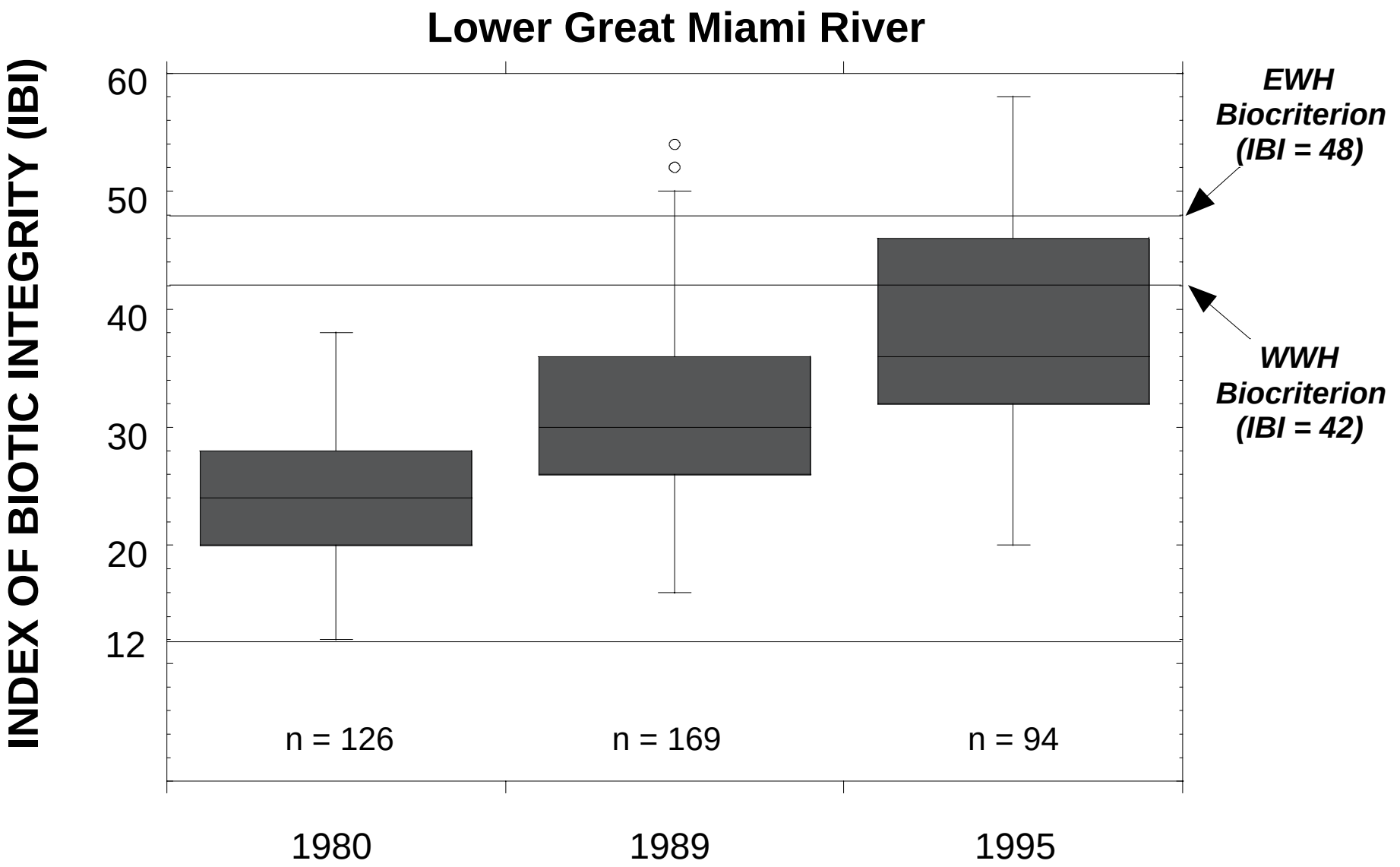
Segment, Reach, and Site Selection

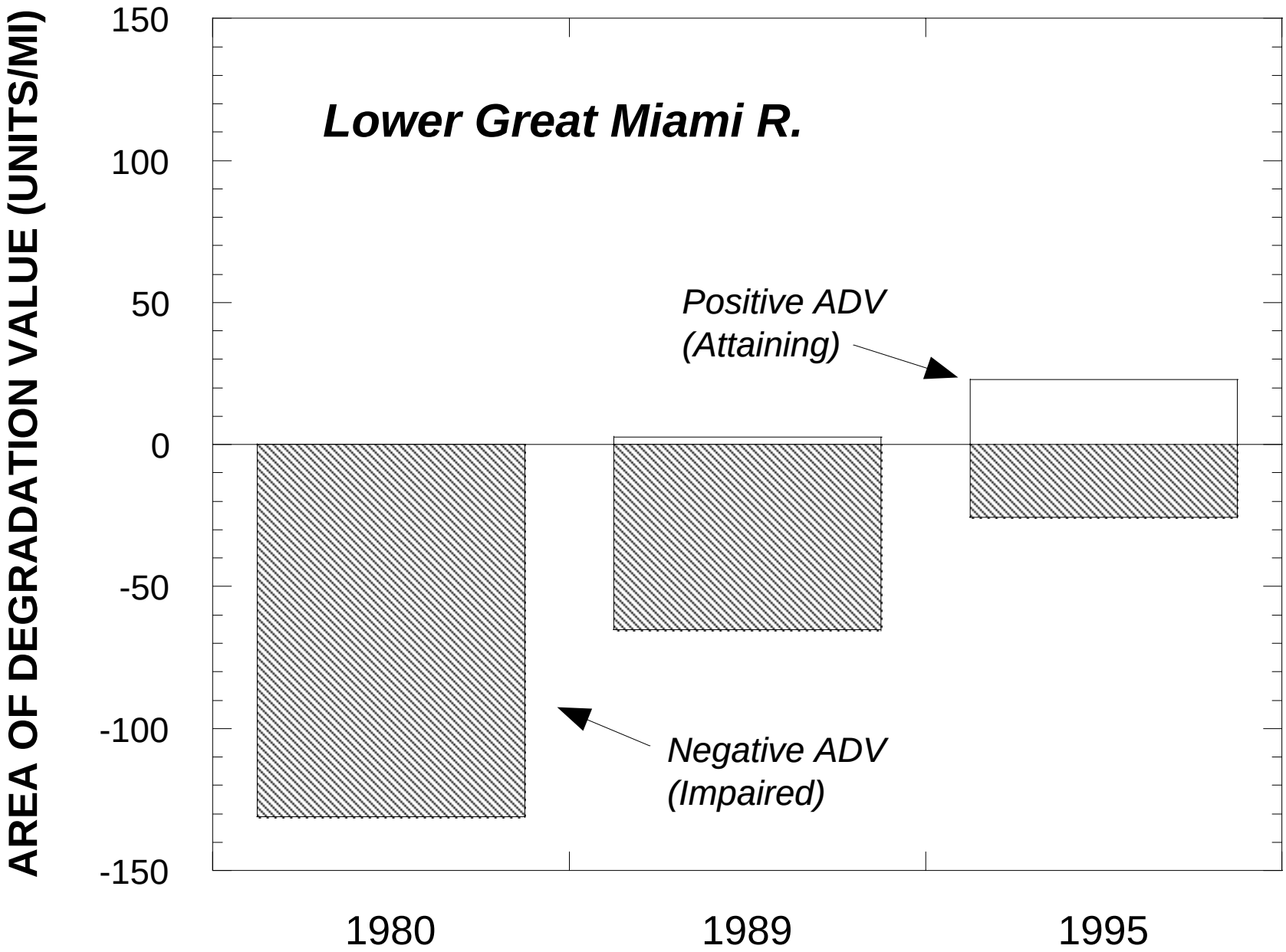
Segment Selection – governed by the overall objectives of the M&A program (e.g., statewide monitoring strategy); extent based on meeting multiple management and assessment objectives (e.g., full range of condition & response).

Reach Selection – dependent on extent and diversity of stressors, management needs and issues.

Site Selection – based on jurisdictional protocol developed to support assessment framework; density of sites reflects baseline design (probabilistic, targeted, census, etc.).


Lower Great Miami River (1980 - 1995)
1980
1989
1995
INDEX OF BIOTIC INTEGRITY (IBI)
60
50
40
30
20
12
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Except-
ional
Good
Fair
Poor
Very Poor
EWH
Biocriterion
(IBI = 48)
WWH
Biocriterion
(IBI = 42)
100
80
60
40
20
0
RIVER MILE
Ohio EPA Data


Lower Great Miami River
INDEX OF BIOTIC INTEGRITY (IBI)
60
50
40
30
20
12
EWH
Biocriterion
(IBI = 48)
WWH
Biocriterion
(IBI = 42)
n = 126
n = 169
n = 94
1980
1989
1995


AREA OF DEGRADATION VALUE (UNITS/MI)
150
100
50
0
-50
-100
-150
Lower Great Miami R.
Positive ADV
(Attaining)
Negative ADV
(Impaired)
1980
1989
1995

Aquatic Life Use Attainment

Definition:

The condition when a waterbody has demonstrated, through use of ambient biological and/or chemical data, that it does not significantly violate biological or water quality criteria for that use.

Determining Use Attainment Status With Biocriteria

FULL ATTAINMENT

- **ALL biological indices are at or within non-significant departure of the applicable biocriterion**

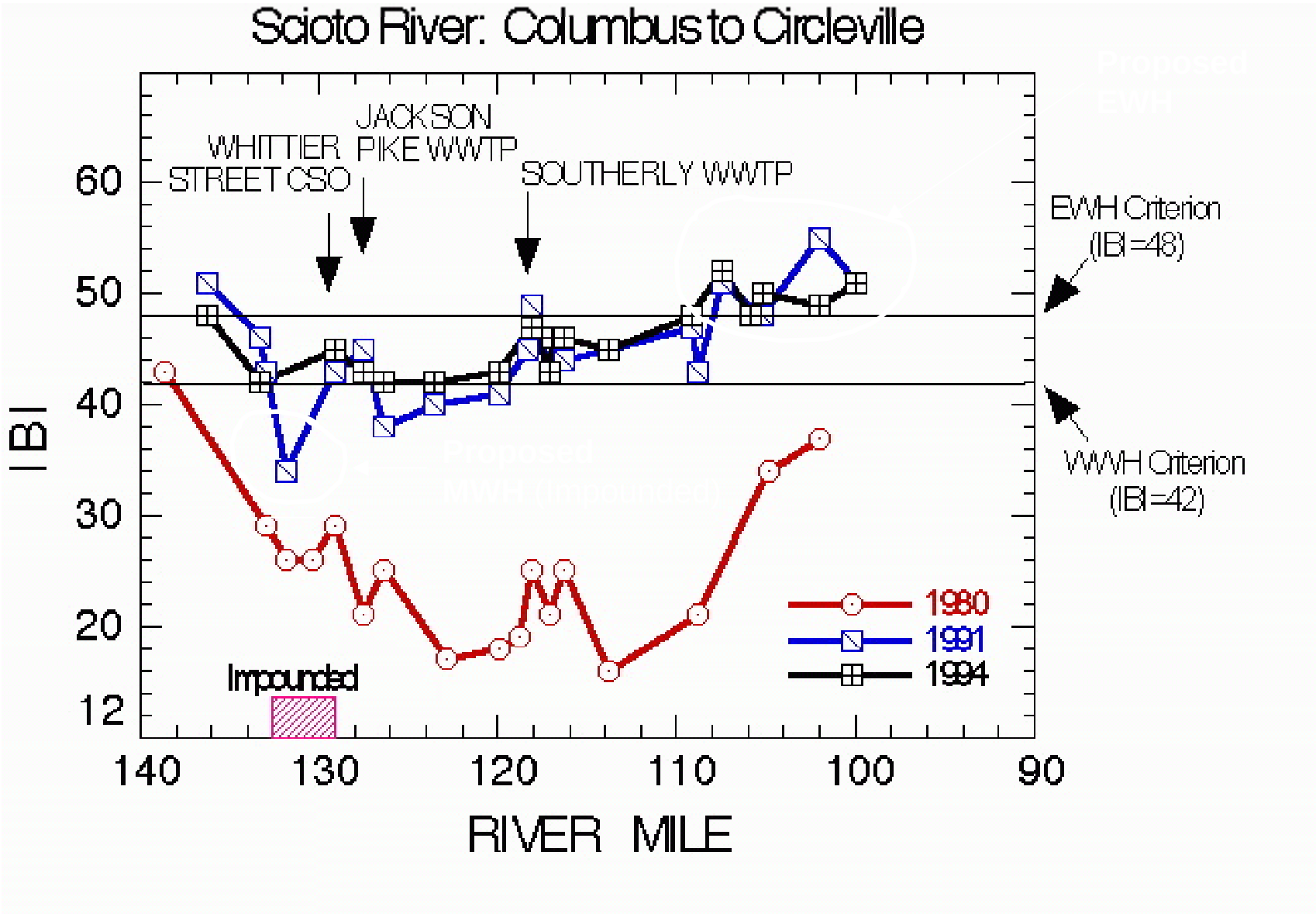
PARTIAL ATTAINMENT

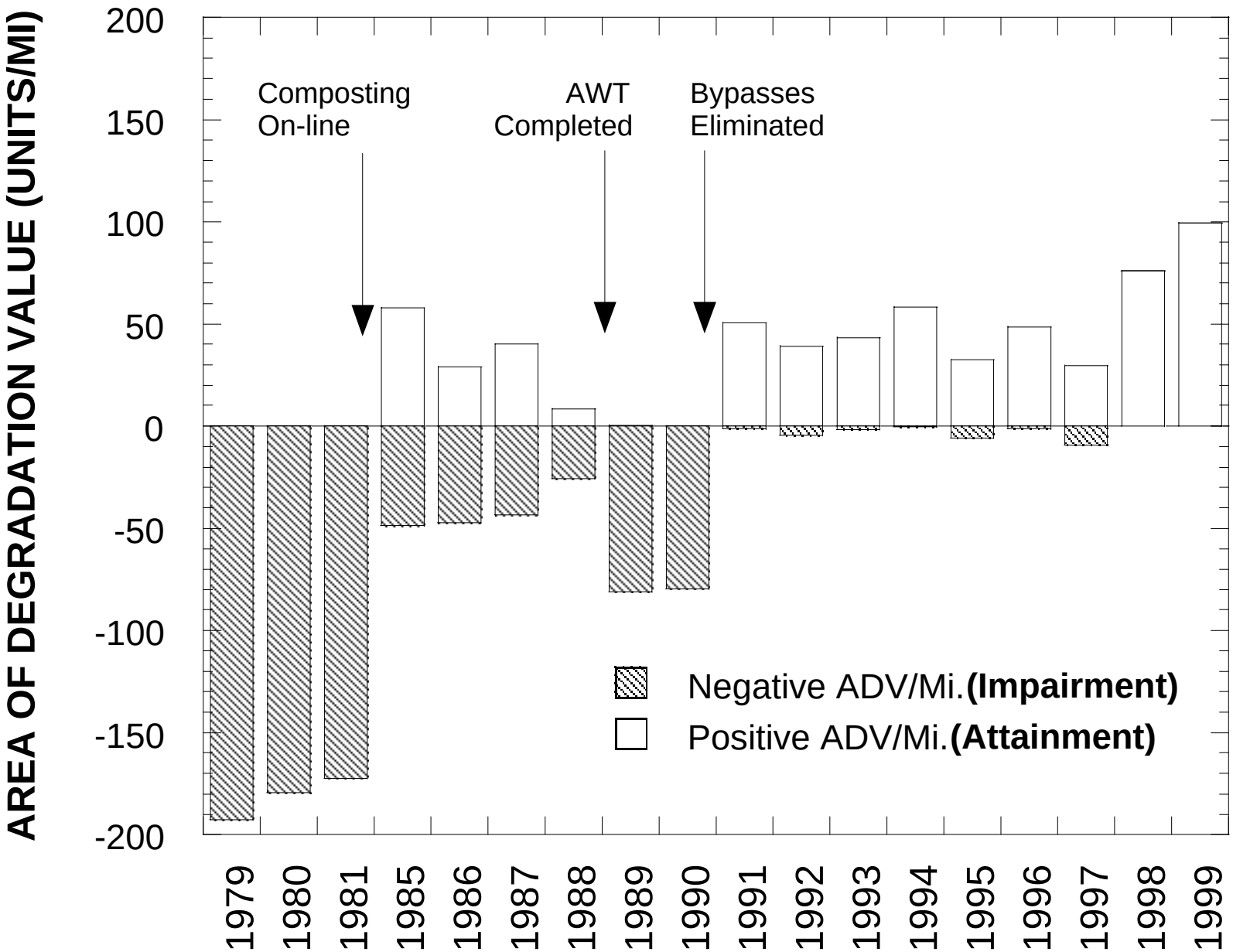
- **A MIX of biological index scores at or within non-significant departure and below the applicable biocriterion**

NON-ATTAINMENT

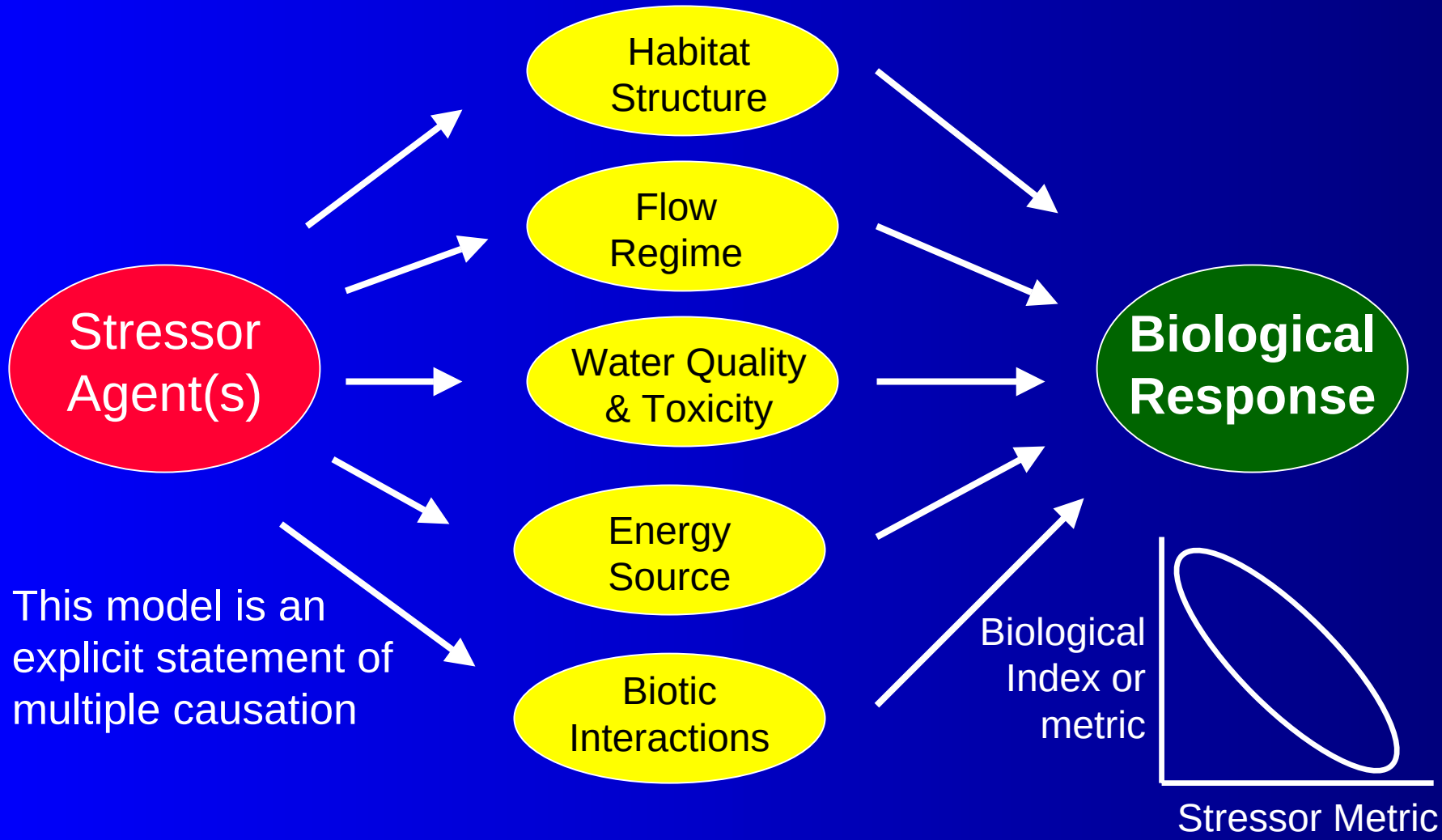
- **NONE of the biological indices are at or within non-significant departure of the applicable biocriterion OR one organism group reflect poor or very poor quality.**

Demonstrating Changes Through Time: Scioto River 1980 - 1994




Middle Scioto R.
AREA OF DEGRADATION VALUE (UNITS/MI)
200
150
100
50
0
-50
-100
-150
-200
Composting On-line
AWT Completed
Bypasses Eliminated
Negative ADV/Mi.(Impairment)
Positive ADV/Mi.(Attainment)
1979
1980
1981
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999

The Linkage From Stressor Effects to Ecosystem Response



STRESSORS + → **STRESS/EXPOSURE** = → **RESPONSE**

ADMINISTRATIVE INDICATORS

LEVEL 1:
Ohio EPA issues WQ based permits & awards funds for Columbus WWTPs

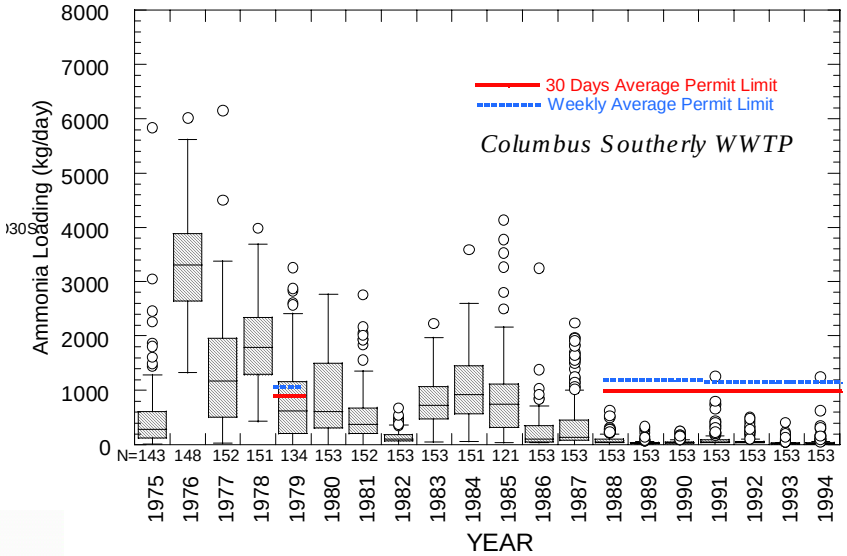
$$$$

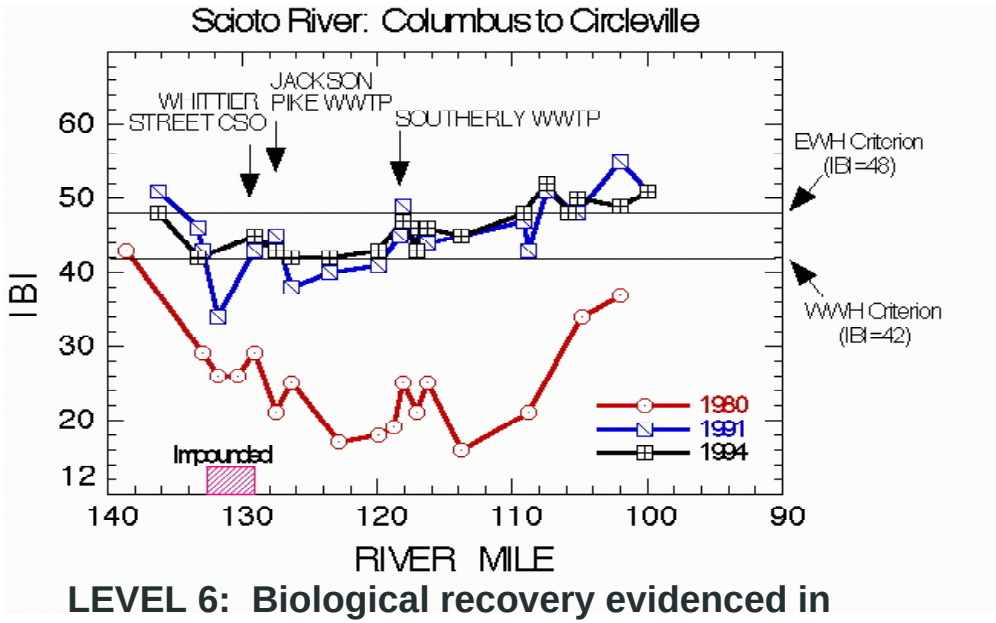
NPDES

LEVEL 2:
Columbus constructs AWT by July 1, 1988; permit conditions attained

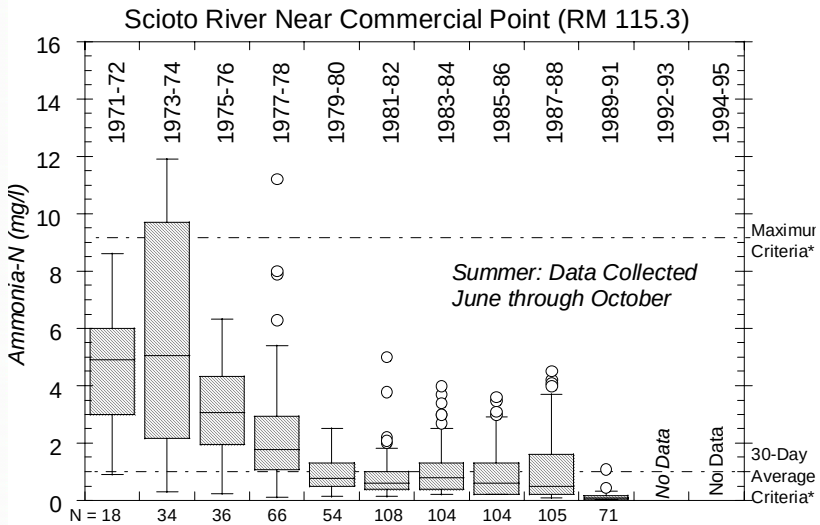
STRESSORS

LEVEL 3: Loadings of ammonia, BOD, etc. are reduced





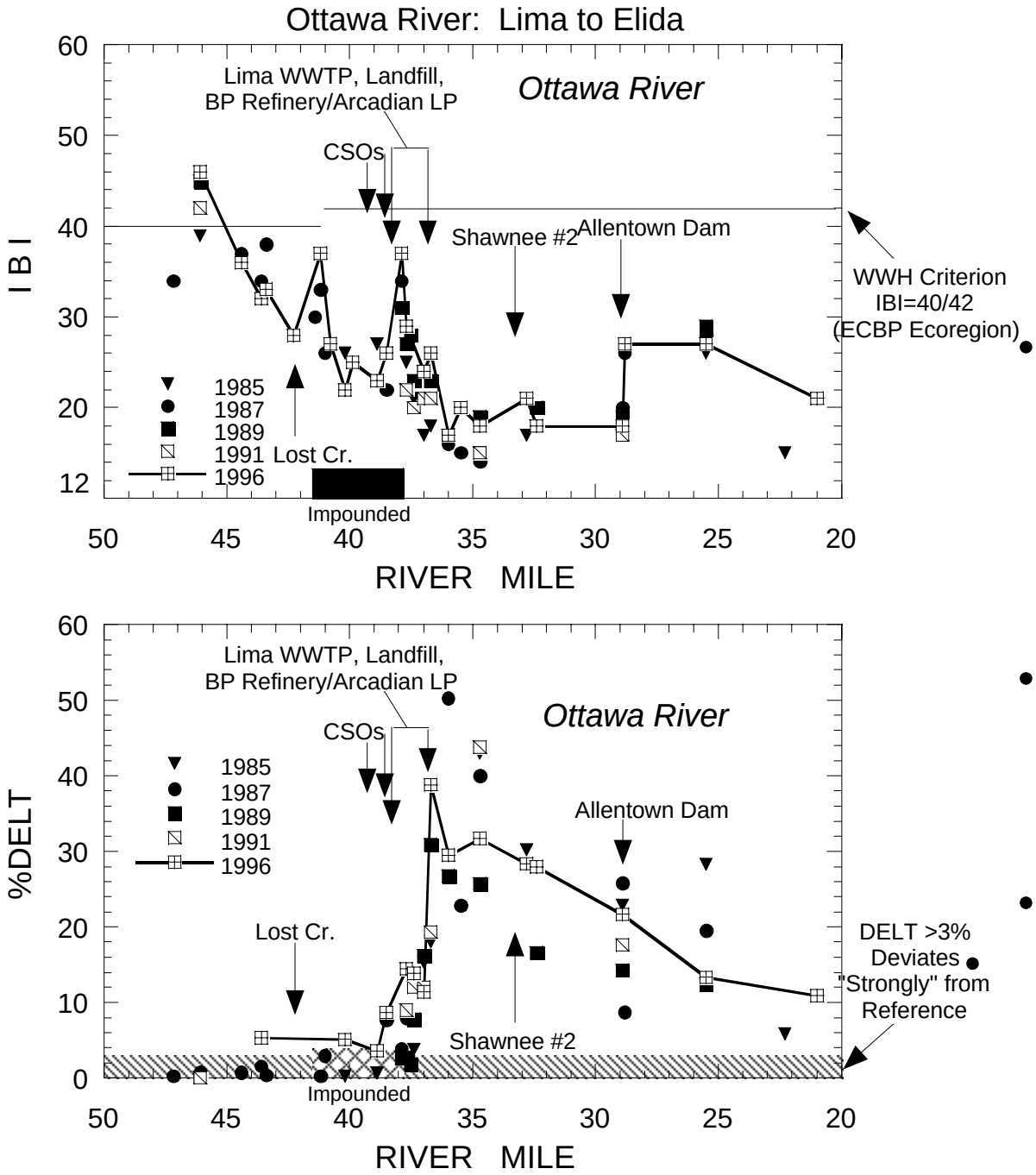
LEVEL 6: Biological recovery evidenced in biocriteria; 3 yrs. post AWT



LEVELS 4&5: Reduced instream pollutant levels; enhanced assimilation

RESPONSE

EXPOSURE

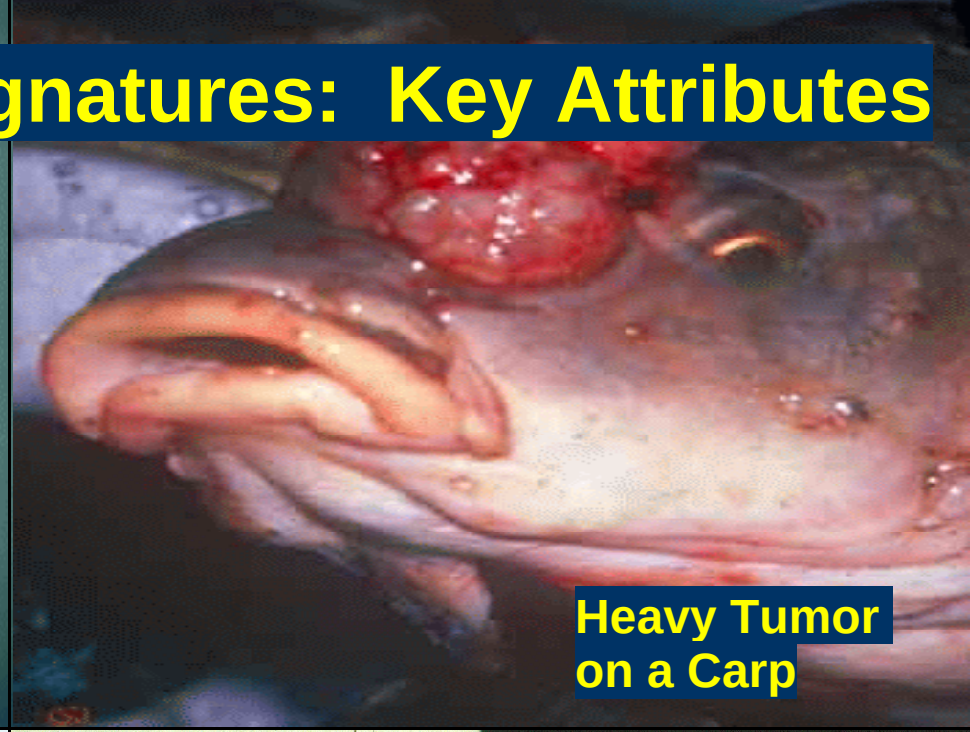


Ottawa River: Toxic Response Signatures

- **Extremely elevated DELT anomalies in combination with poor and very poor IBI scores is a signature of complex toxic conditions.**
- **Little change has taken place since 1985 despite reduced loadings of conventional pollutants.**
- **Far-field improvements were observed 25-30 miles downstream in 1996; lower 5 miles attain the WWH biocriteria.**

Biological Response Signatures: Key Attributes

Heavy Erosion on a Silver Redhorse

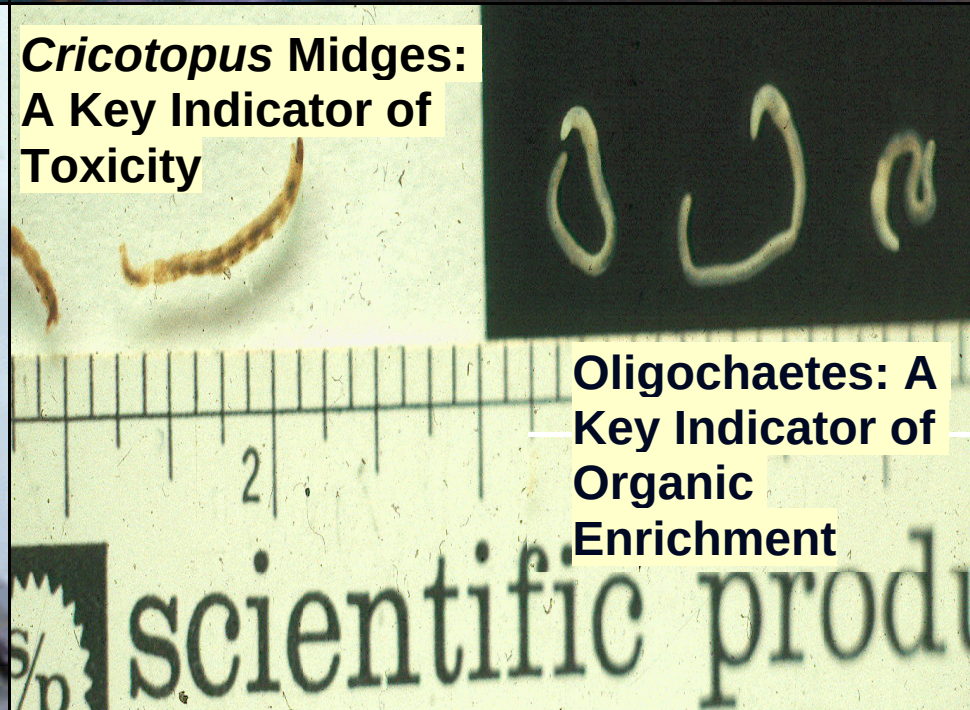


Heavy Tumor on a Carp

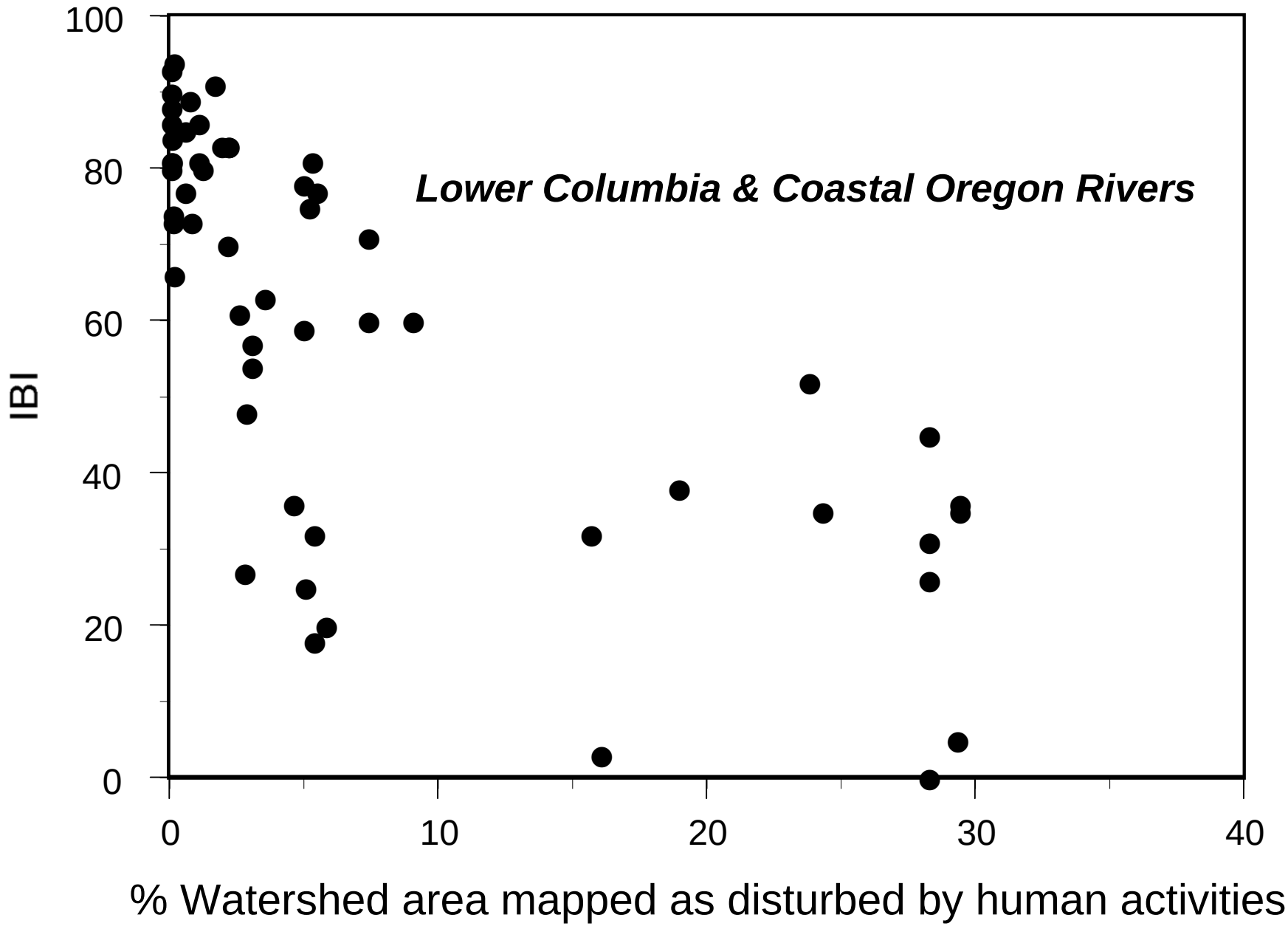
Heavily Eroded Barbels & Deformities on a Yellow Bullhead

Normal Barbles on a Yellow Bullhead

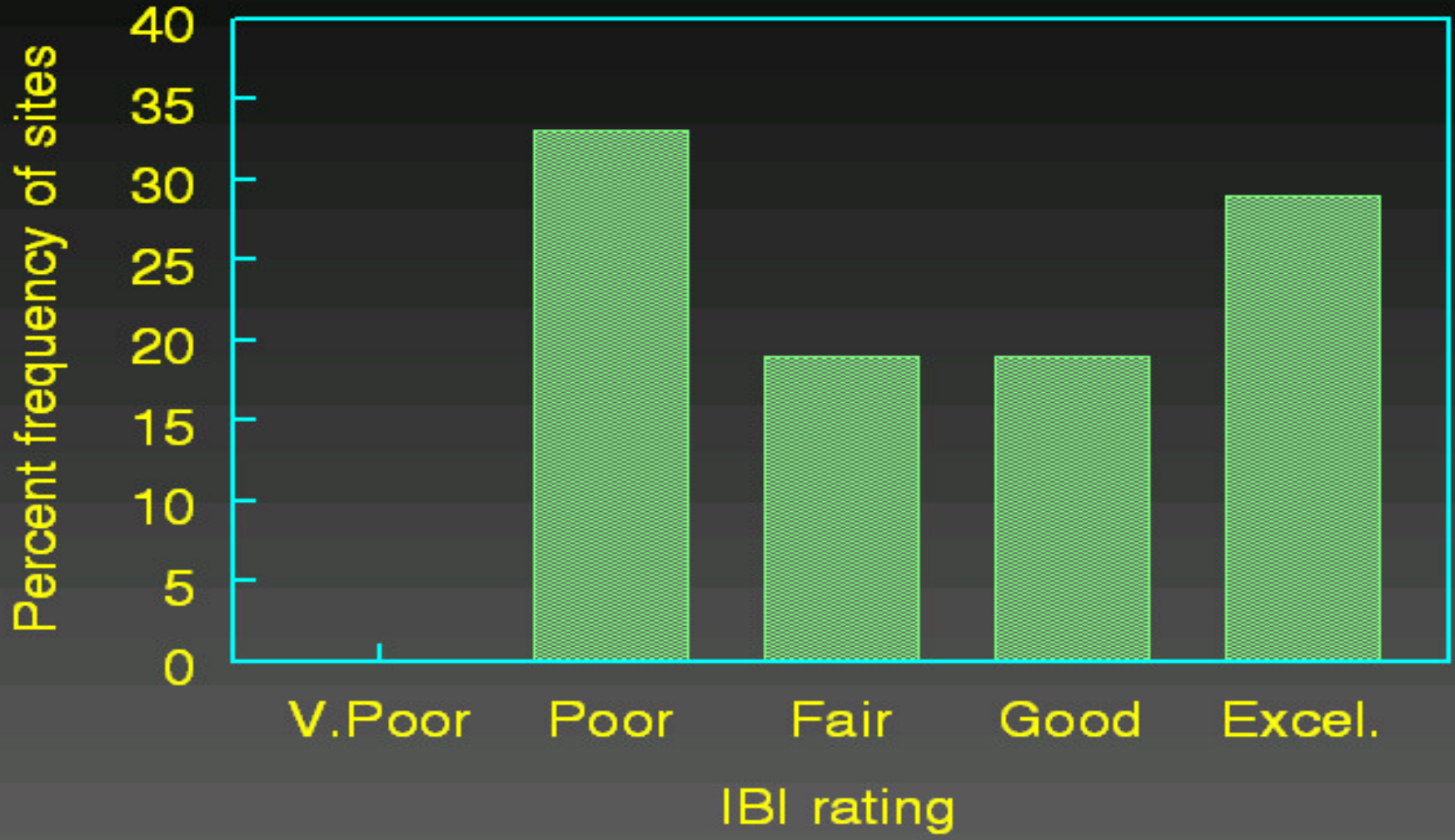
***Cricotopus* Midges: A Key Indicator of Toxicity**



Oligochaetes: A Key Indicator of Organic Enrichment


Lower Columbia & Coastal Oregon Rivers
IBI
100
80
60
40
20
0
0
10
20
30
40
% Watershed area mapped as disturbed by human activities

Distribution of IBI ratings for hydropower peaking sites (N = 21)



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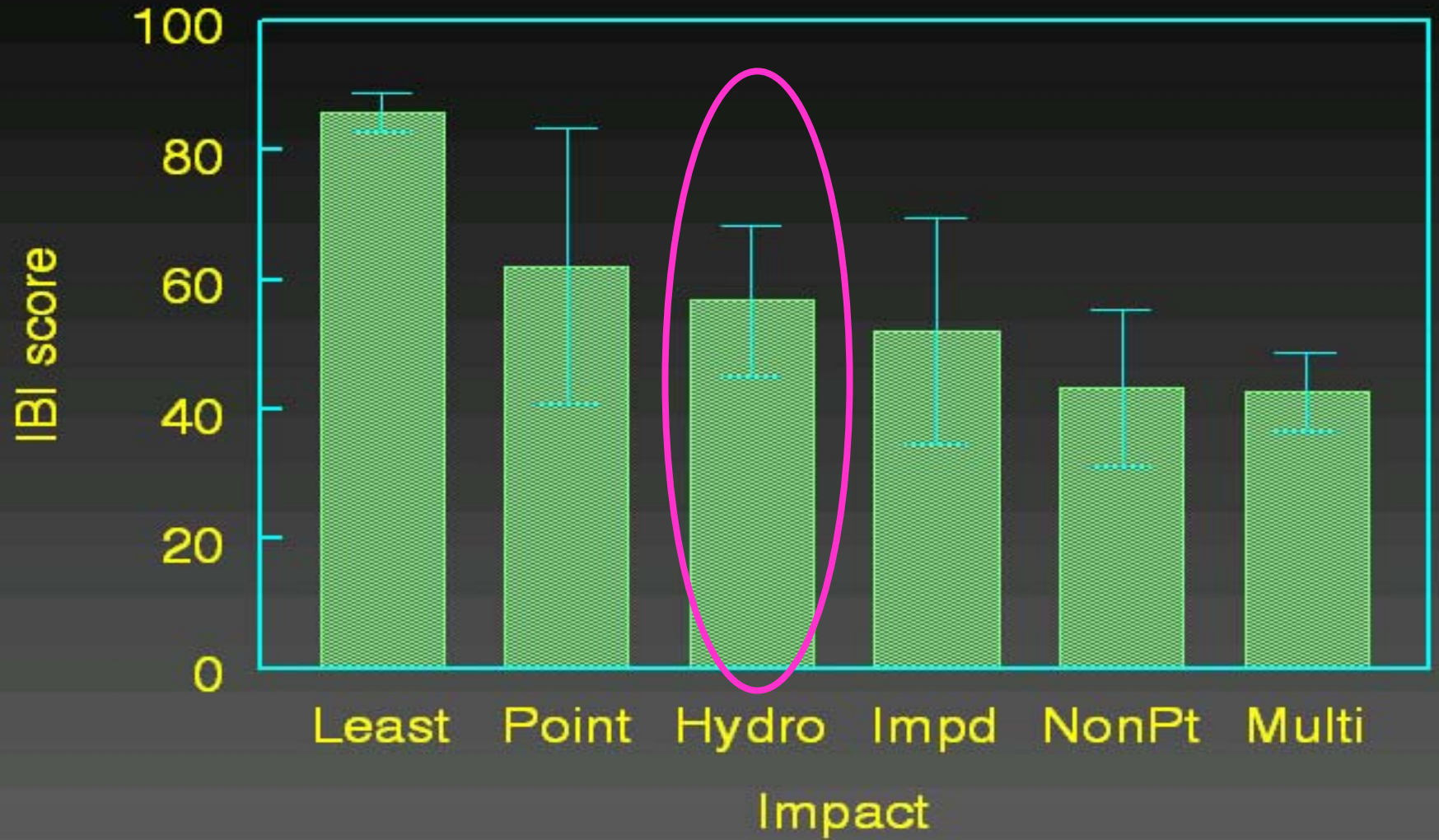
Mean IBI score vs. impact type



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Hydropower Peaking

Major effects on short (< 5 km) riverine tailwaters; reduced effects on long (> 35 km) riverine tailwaters

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