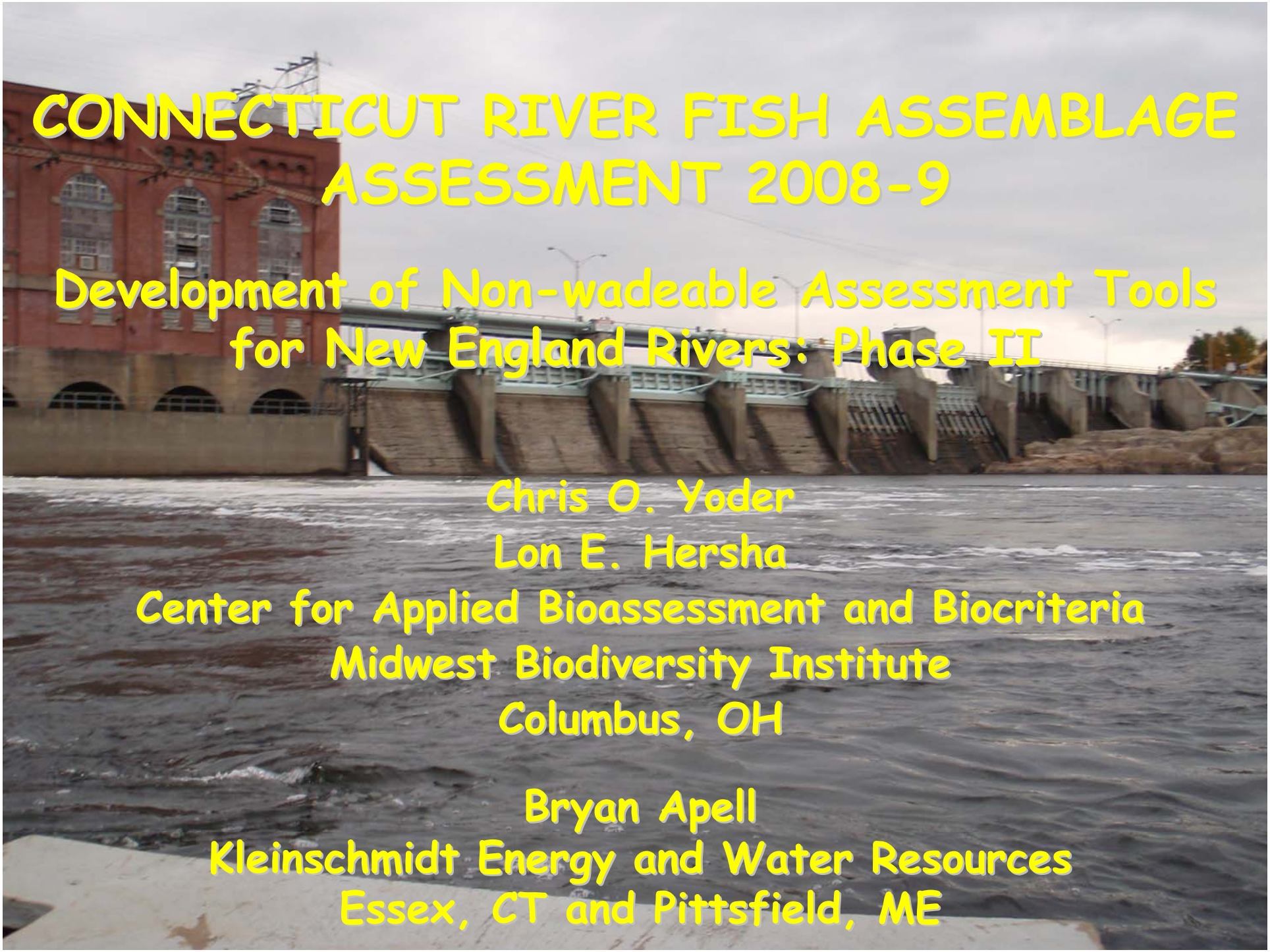

CONNECTICUT RIVER FISH ASSEMBLAGE ASSESSMENT 2008-9

Development of Non-wadeable Assessment Tools for New England Rivers: Phase II

Chris O. Yoder
Lon E. Hersha
Center for Applied Bioassessment and Biocriteria
Midwest Biodiversity Institute
Columbus, OH

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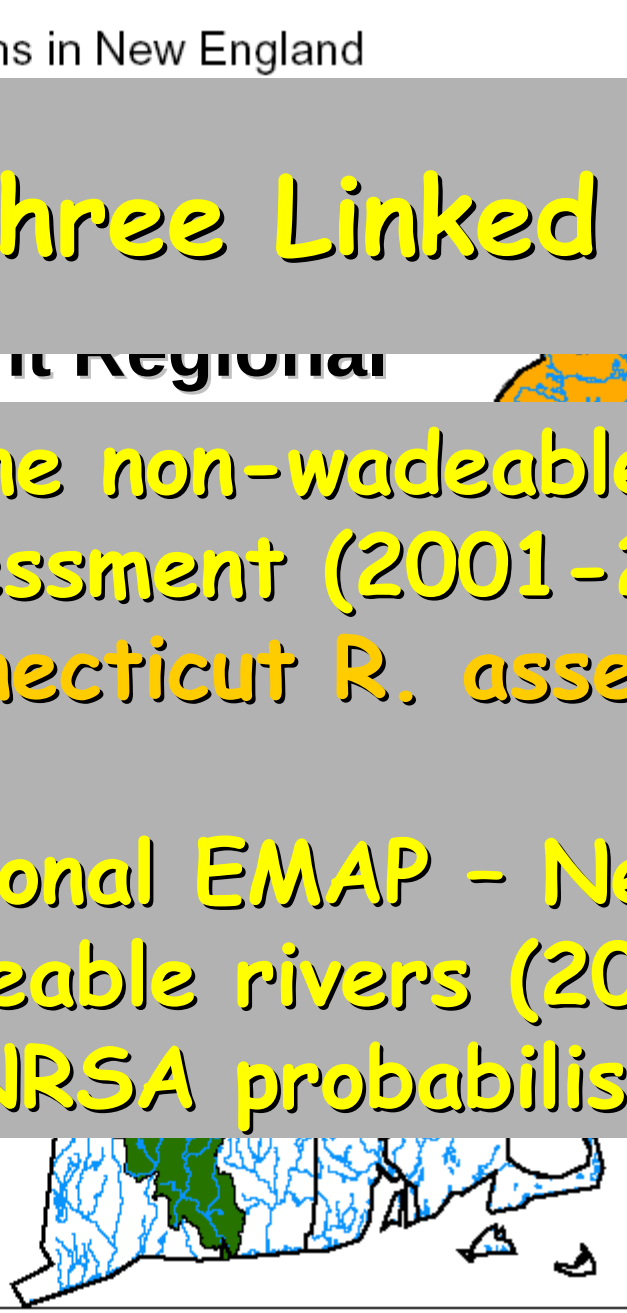
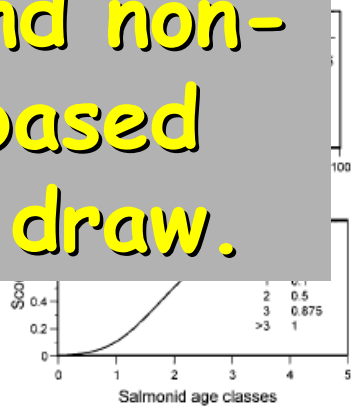
Kleinschmidt Energy and Water Resources
Essex, CT and Pittsfield, ME

Major River Basins in New England





Three Linked Projects:

1. Maine non-wadeable rivers assessment (2001-2007)
2. Connecticut R. assessment (2008-9).
3. Regional EMAP – New England non-wadeable rivers (2008-9); based on NRSA probabilistic sites draw.

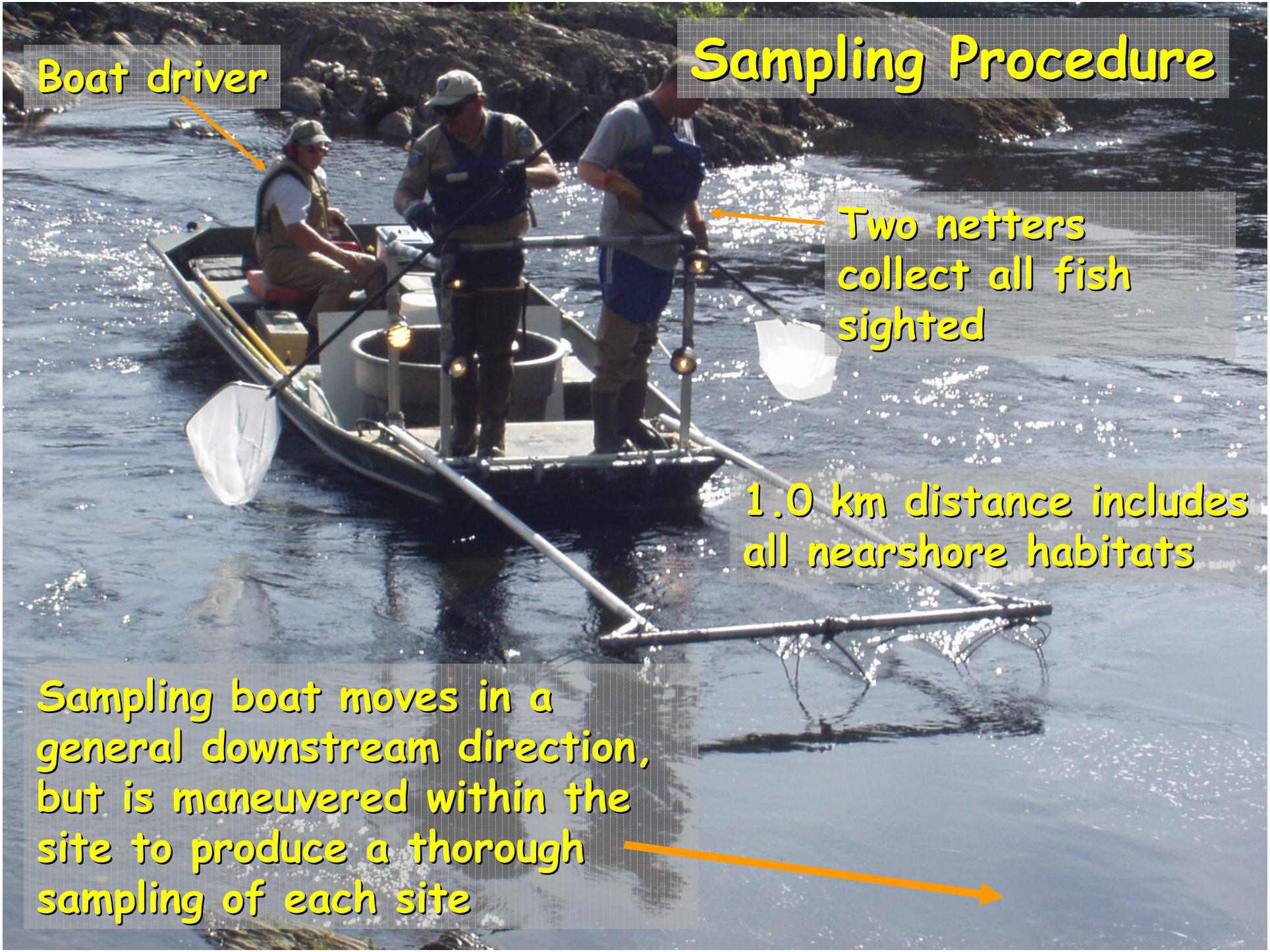
Sampling Methods

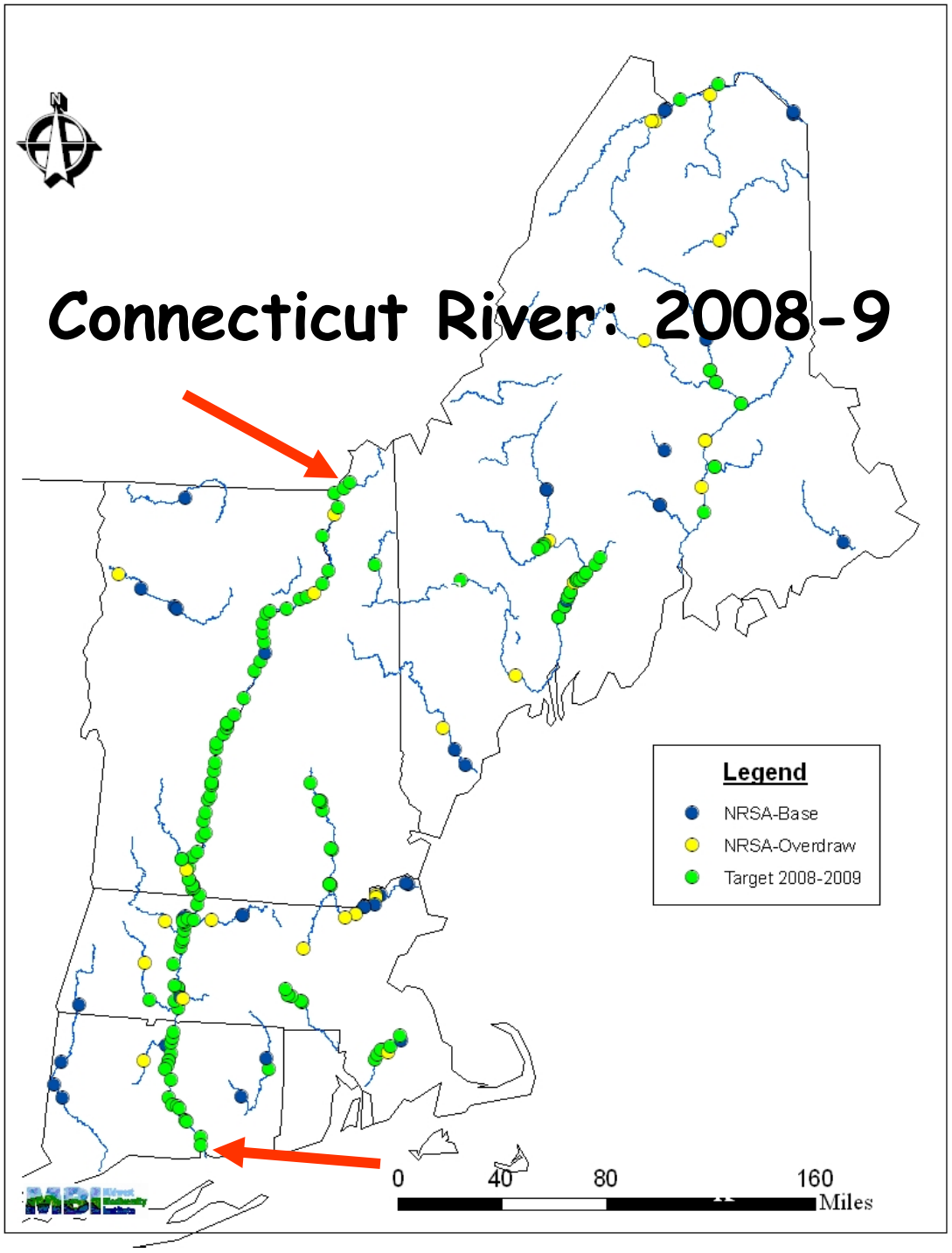
Developed & Tested in Maine

Standardized Approach:

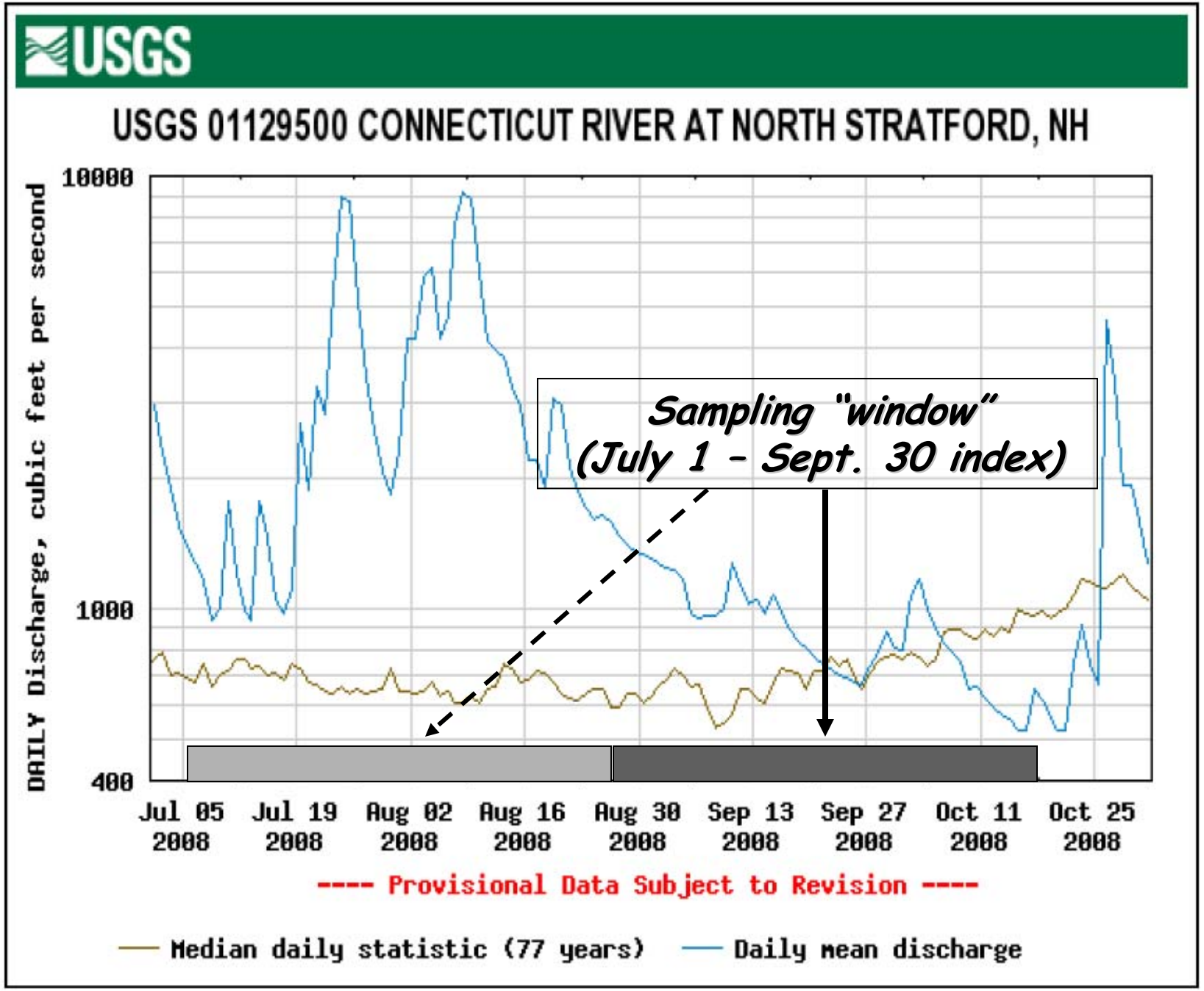
- Pulsed D.C. boat electrofishing – effort indexed to distance
- Electrode array customized for Maine river conditions
- Intensive survey design – mainstem & non-wadeable tribs.
- Field water quality and habitat data
- July 1 – September 30 index period

Sampling Procedure





- 84 sites – "intensive pollution survey" design w/18 NRSA& REMAP overlap + 15 re-samples
- Summer-fall index period (July 1 – Sept. 30)
- Standardized pulsed D.C. electrofishing & qual. habitat (QHEI)
- August 27-Oct. 15, 2008 (high flows early)
- August 15-September2, 2009
- Extended dst. into tidal reach I 2009
- Part of overall REMAP project



Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: ____

River Code: _____ *RM:* _____ *Stream:* _____

Site Code: _____ *Project Code:* _____ *Location:* _____

Date: _____ *Scorer:* _____ *Latitude:* _____ *Longitude:* _____

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐☐ -BLDR/SLBS [10]			☐☐ -GRAVEL [7]		
☐☐ -Lg BOULD [10]			☐☐ -SAND [6]		
☐☐ -BOULDER [9]			☐☐ -BEDROCK [5]		
☐☐ -COBBLE [8]			☐☐ -DETRITUS [3]		
☐☐ -HARDPAN [4]			☐☐ -ARTIFICIAL [0]		
☐☐ -MUCK [2]			☐☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2]

(High Quality Only, Score 5 or >) ☐ -3 or Less [0]

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)

☐ -LIMESTONE [1]
☐ -TILLS [1]
☐ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)

SILT:
☐ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]

EMBEDDEDNESS:
☐ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

Substrate ____ Max 20

COMMENTS: _____

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
_____ UNDERCUT BANKS [1]
_____ OVERHANGING VEGETATION [1]
_____ SHALLOWS (IN SLOW WATER) [1]
_____ ROOTMATS [1]

TYPE: Score All That Occur
_____ POOLS > 70 cm [2]
_____ ROOTWADS [1]
_____ BOULDERS [1]

_____ OXBOWS, BACKWATERS [1]
_____ AQUATIC MACROPHYTES [1]
_____ LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☐ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover ____ Max 20

COMMENTS: _____

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☐ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☐ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☐ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☐ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel ____ Max 20

COMMENTS: _____

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH

L	R	(Per Bank)
☐	☐	-VERY WIDE > 100m [5]
☐	☐	-WIDE > 50m [4]
☐	☐	-MODERATE 10 - 50m [3]
☐	☐	-NARROW 5 - 10m [2]
☐	☐	-VERY NARROW < 5m [1]
☐	☐	-NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*)

L	R	(Most Predominant Per Bank)
☐	☐	-FOREST, SWAMP [3]
☐	☐	-SHRUB OR OLD FIELD [2]
☐	☐	-RESIDENTIAL, PARK, NEW FIELD [1]
☐	☐	-FENCED PASTURE [1]

L	R	
☐	☐	-CONSERVATION TILLAGE [1]
☐	☐	-URBAN OR INDUSTRIAL [0]
☐	☐	-OPEN PASTURE, ROWCROP [0]
☐	☐	-MINING / CONSTRUCTION [0]

BANK EROSION

L	R	(Per Bank)
☐	☐	-NONE / LITTLE [3]
☐	☐	-MODERATE [2]
☐	☐	-HEAVY / SEVERE [1]

Riparian ____ Max 10

COMMENTS: _____

Is Sampling Reach Representative of the Stream (Y/N) Y If Not, Explain: ____________________

Lat/Long (Beg): ____________________

Lat/Long (Mid): ____________________

Lat/Long (End): ____________________

Lat/Long(X-Loc): ____________________

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Ag ☒
- Livestock ☐
- Silviculture ☒
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐
- Other: ____________

Subjective Rating (1-10): 7

Aesthetic Rating (1-10): 7

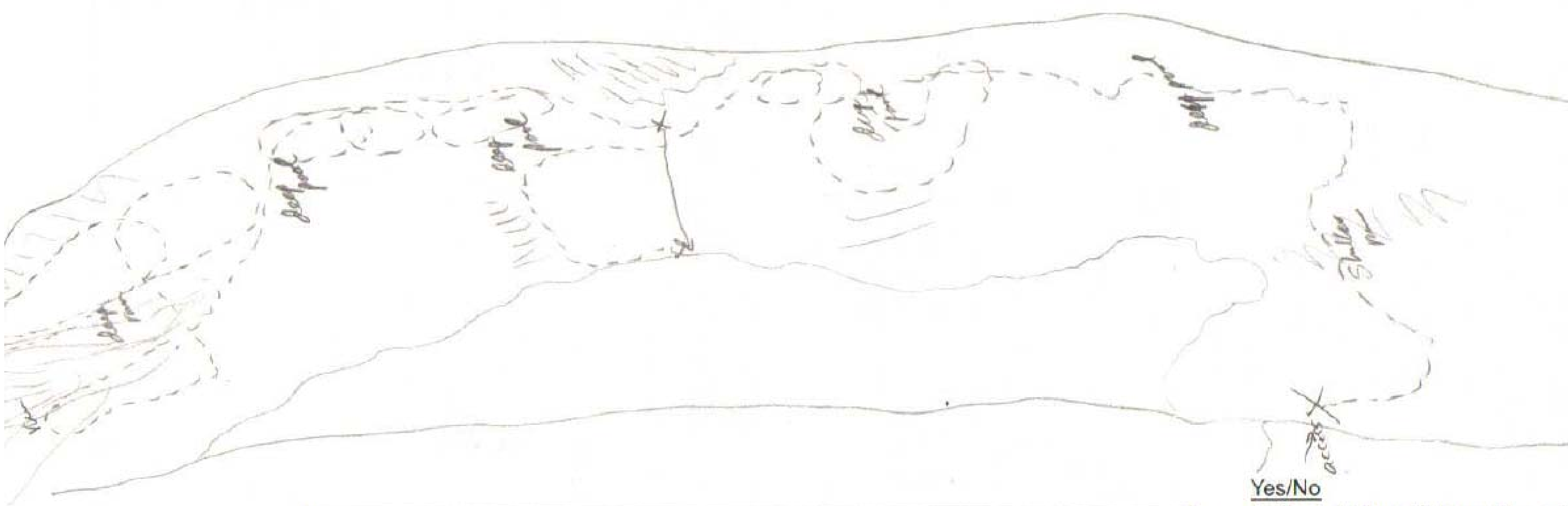
Gradient: ☐ - Low, ☒ - Moderate, ☐ - High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy -% Open
First Sampling Pass	A	1.0	clear	low	100

Stream Measurements:

Average Width	Average Depth	Maximum Depth	Av. Bankfull Width	Bankfull Mean Depth	W/D Ratio	Bankfull Max Depth	Floodprone Area Width	Entrench. Ratio

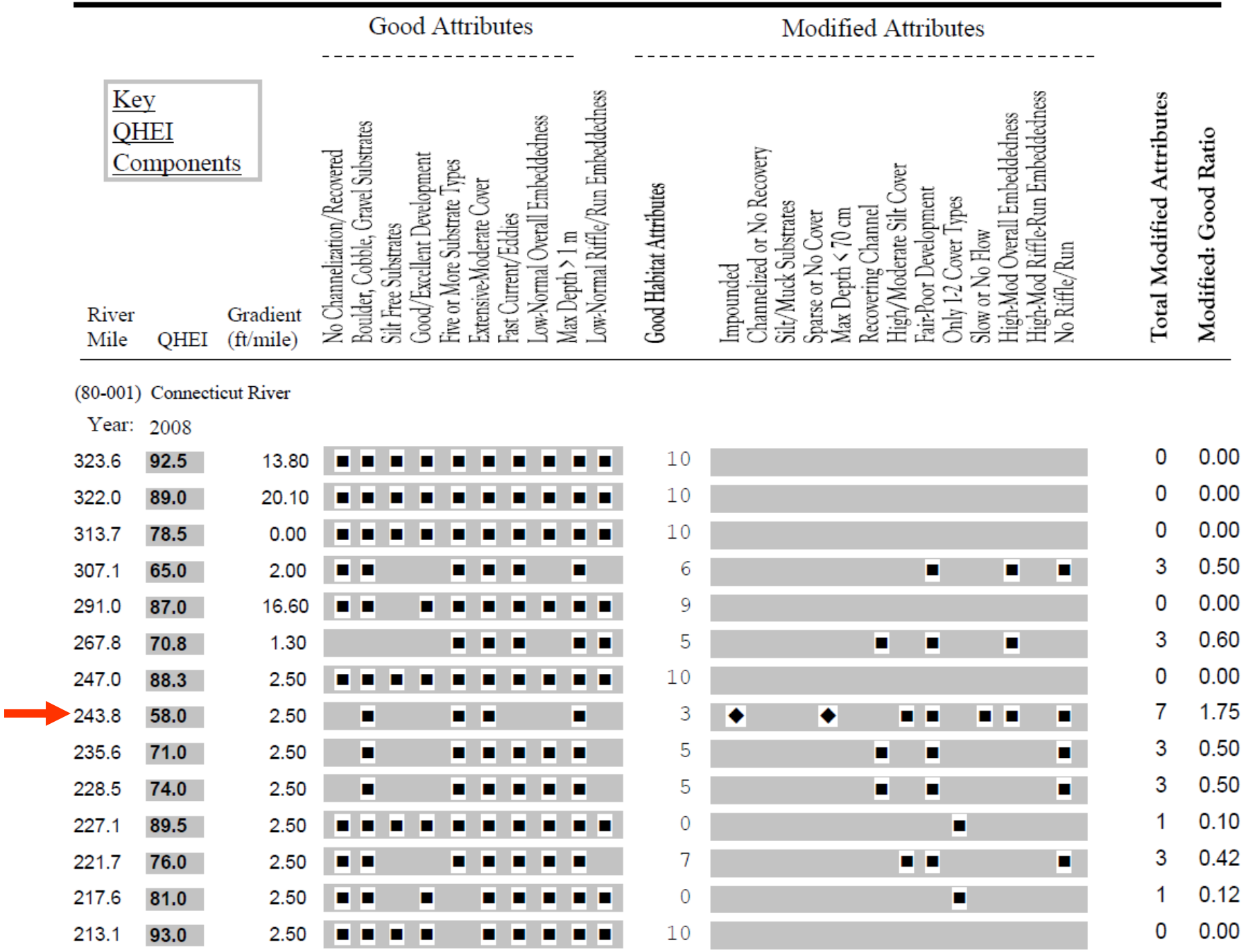
Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, Where: 0 - Cover type absent; 1 - Cover type present in very small amounts or if more common of marginal quality; 2 - Cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 - Cover type of highest quality in moderate or greater amounts. Examples of highest quality include very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep/fast water, or deep, well-defined, functional pools.

Yes	No	
☐	☐	Is Stream Ephemeral (no pools totally dry or only damp spots)?
☐	☐	Is there water upstream? How Far: ________
☐	☐	Is There Water Close Downstre How Far: ______
☐	☐	Is Dry Channel Mostly Natural?

Table 1. QHEI scores and metric values for sites in the Connecticut River during 2008.



Study Area

Zone 1: Murphy-Wyoming Dam

Zone 2: Wyoming Dam – McIndoe Dam

Zone 3: McIndoe-Wilder Dam

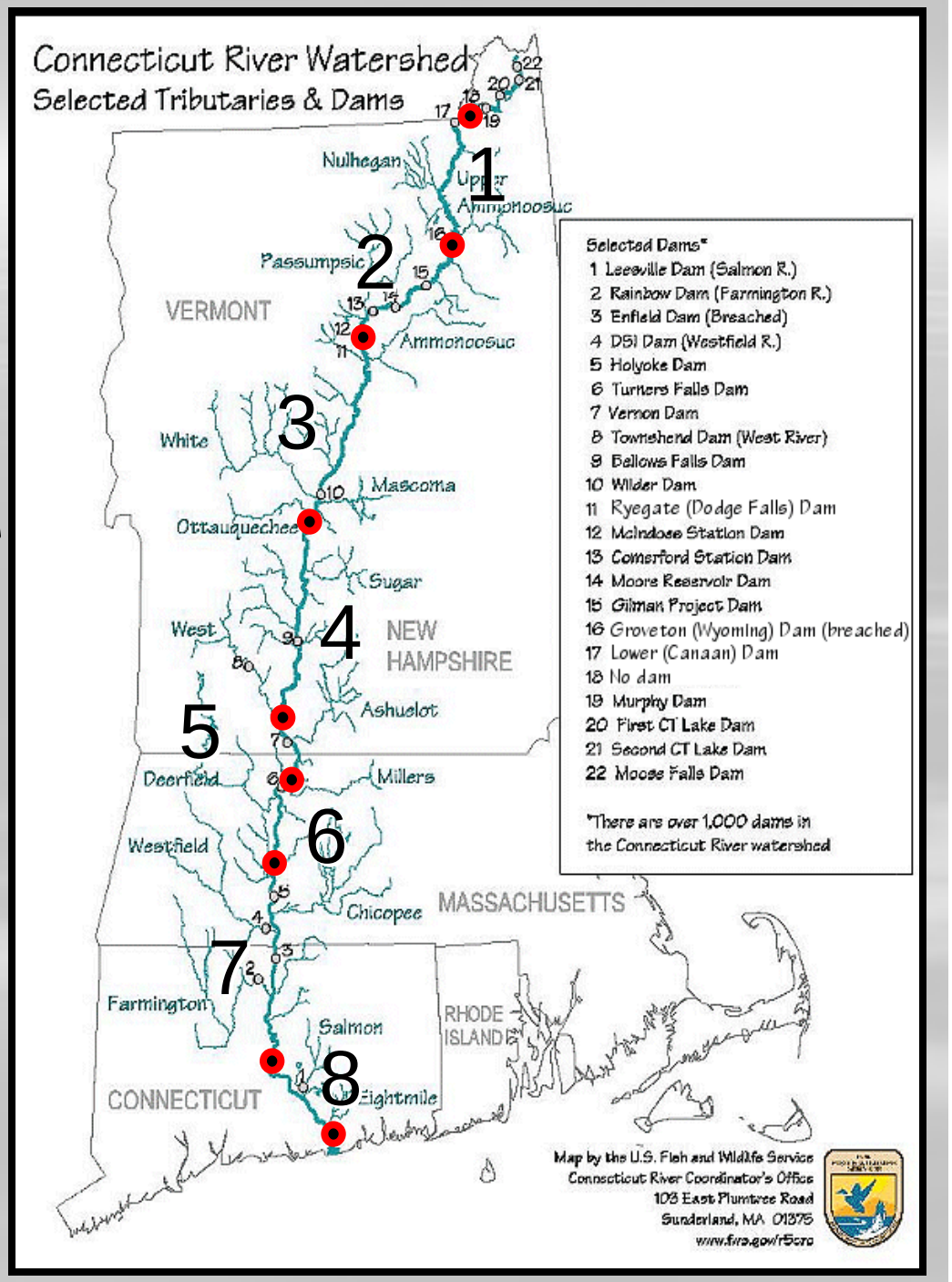
Zone 4: Wilder-West R.

Zone 5: West R.-Turners Falls Impoundment

Zone 6: Turners Falls-Holyoke Impoundment

Zone 7: Holyoke Dam-Hartford (head of tide)

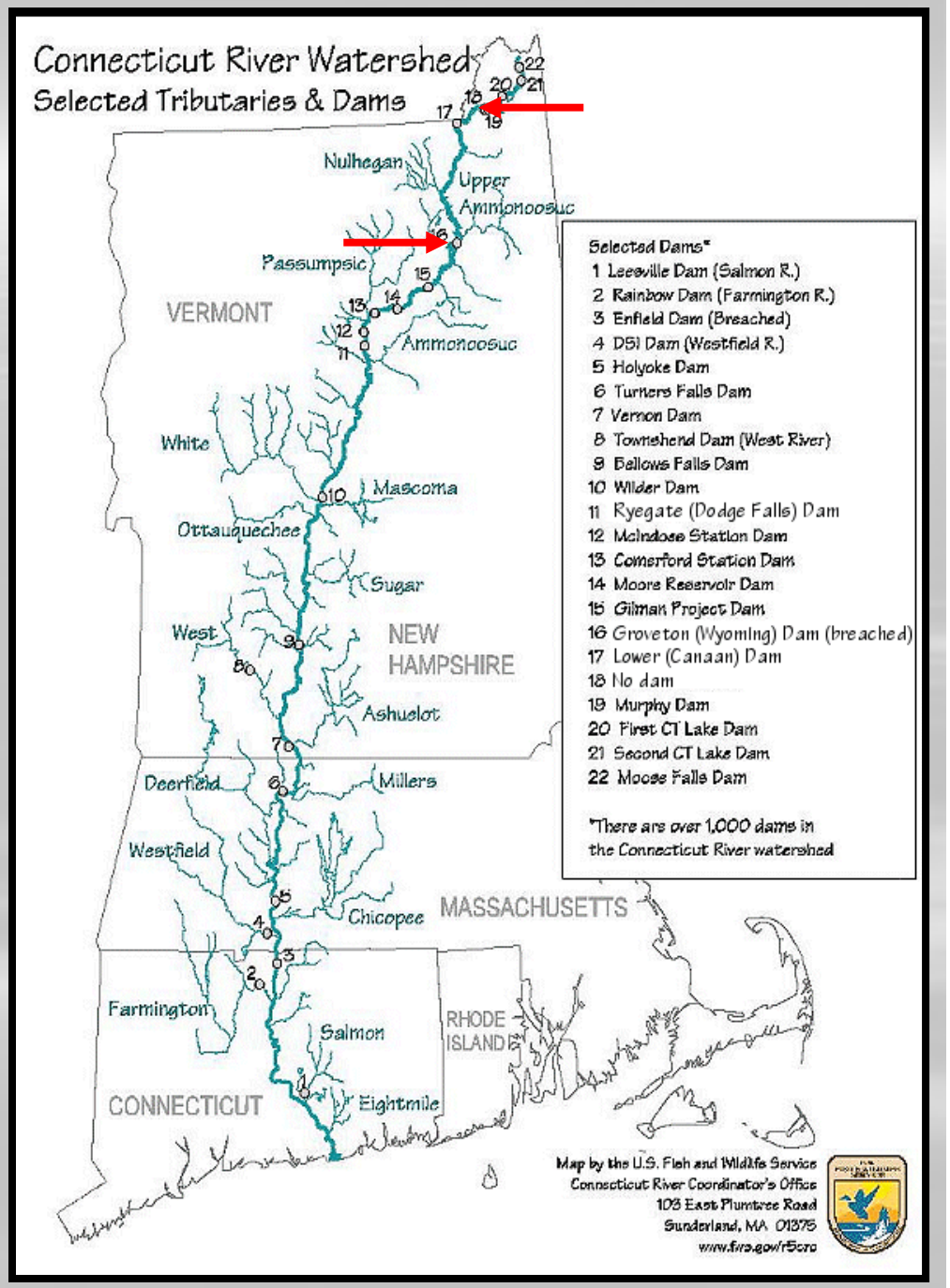
Zone 8: Tidal segment



Zone 1

Murphy Dam – Wyoming Dam

- 21 species
- Pre dominated (biomass) by stenothermic species including;
  - Atlantic salmon
  - Brook trout
  - Brown trout
  - Slimy sculpin
  - Burbot
  - Rainbow trout

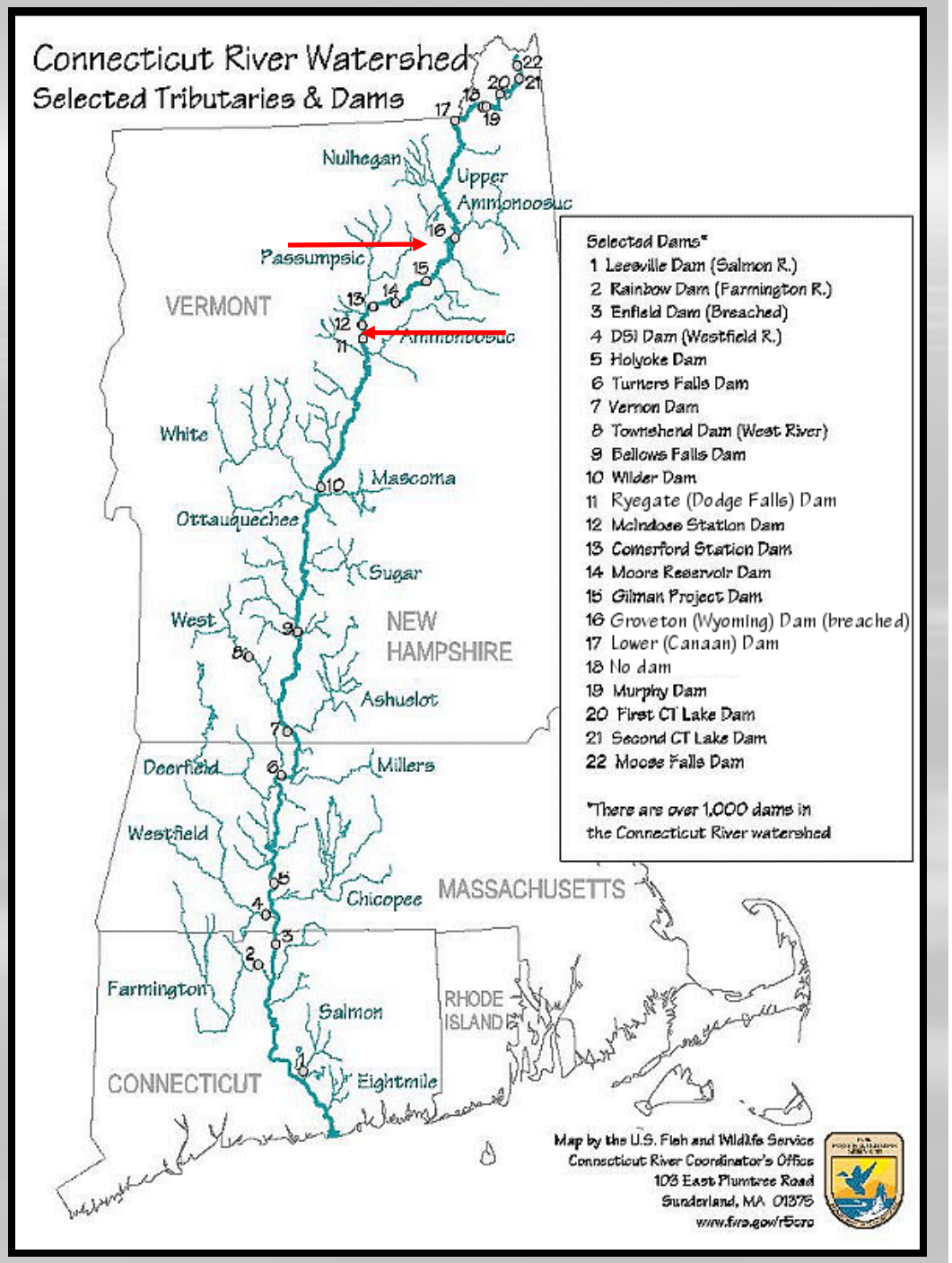


Zone 1

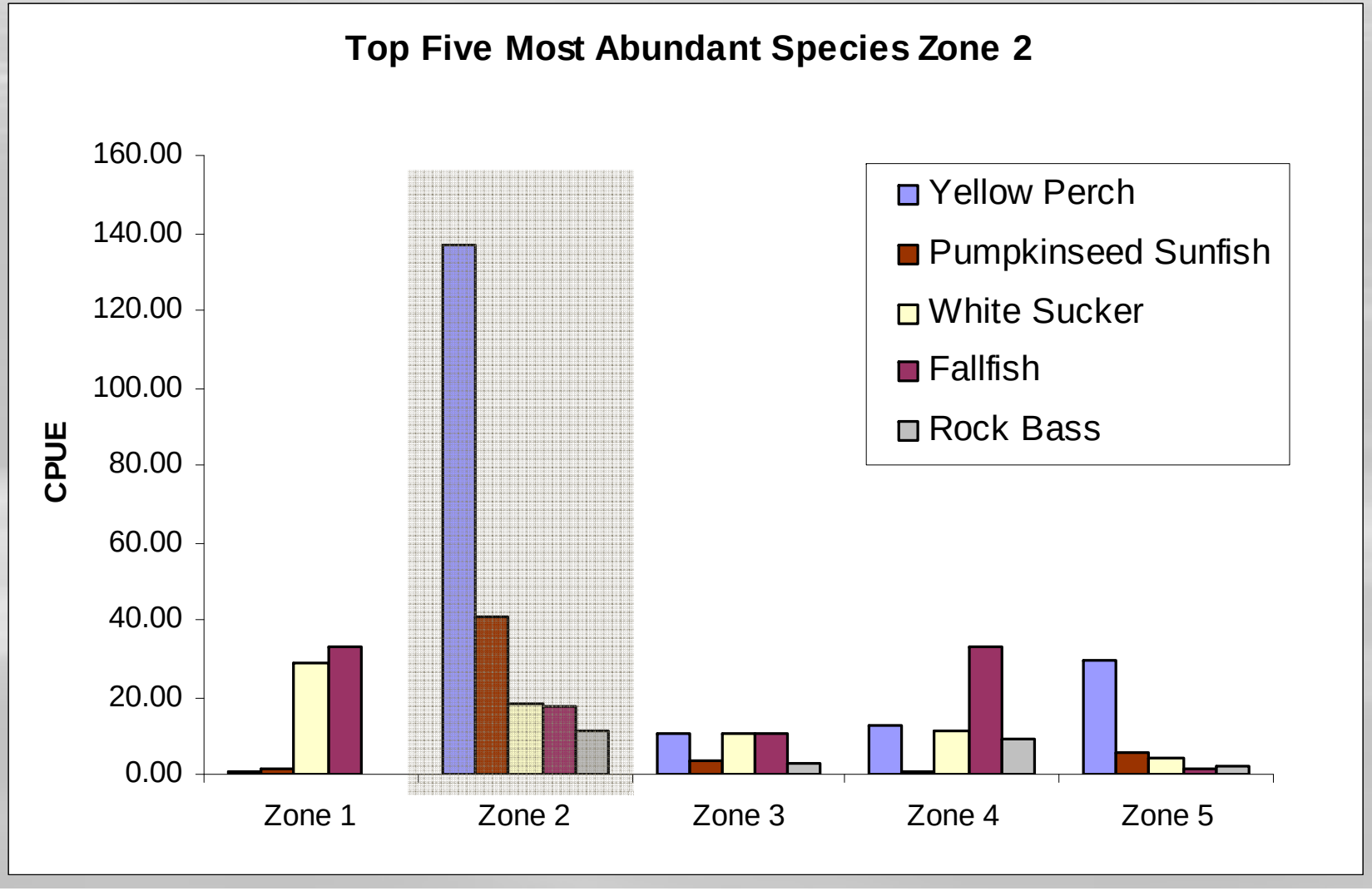
Zone 2

Wyoming Dam – McIndoe Dam

- 25 species
- Transition zone
- Reduction in stenothermic species (CPUE)
- Increase in mesothermic and eurythermic sp.
- Impounded habitat effects



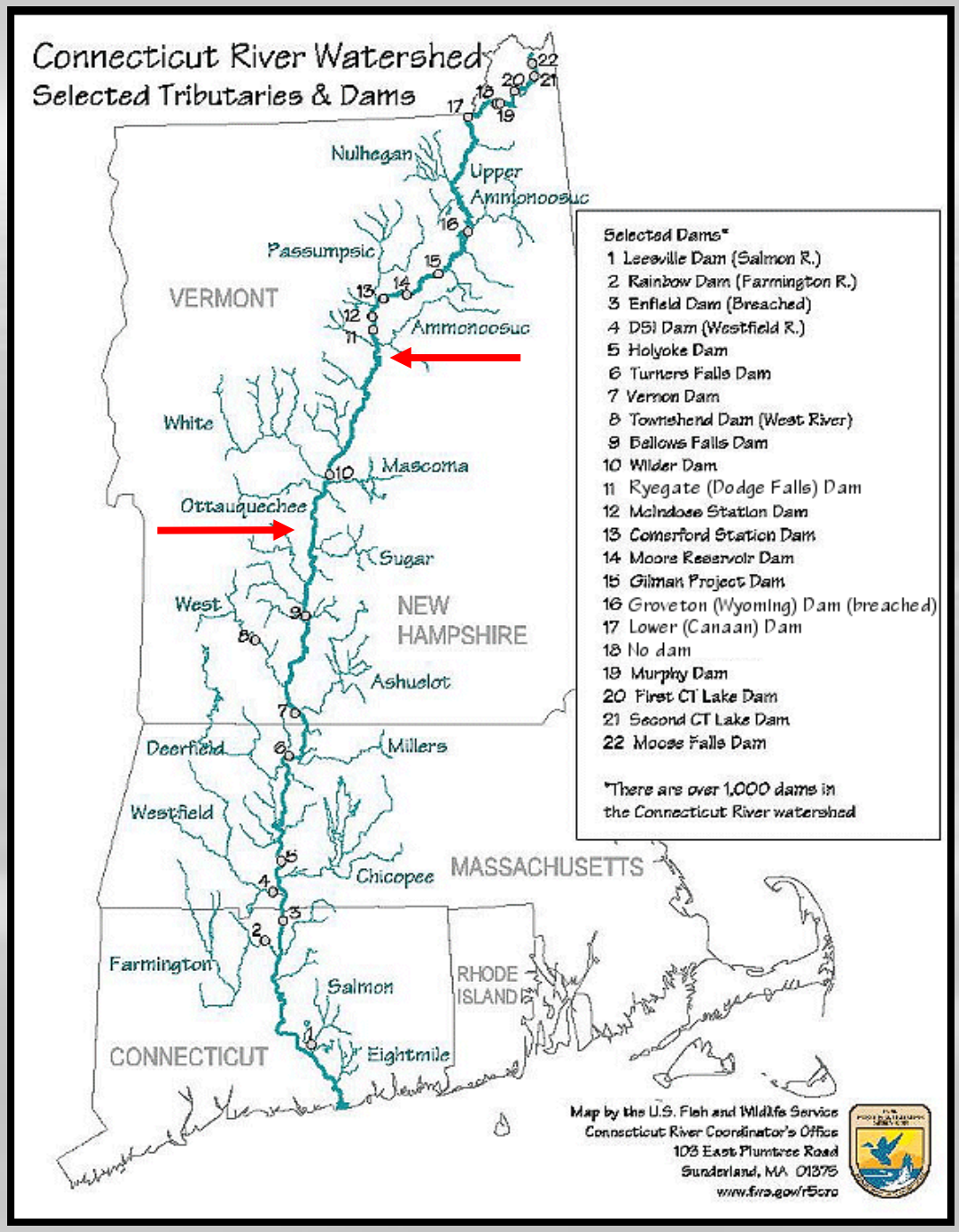
Zone 2



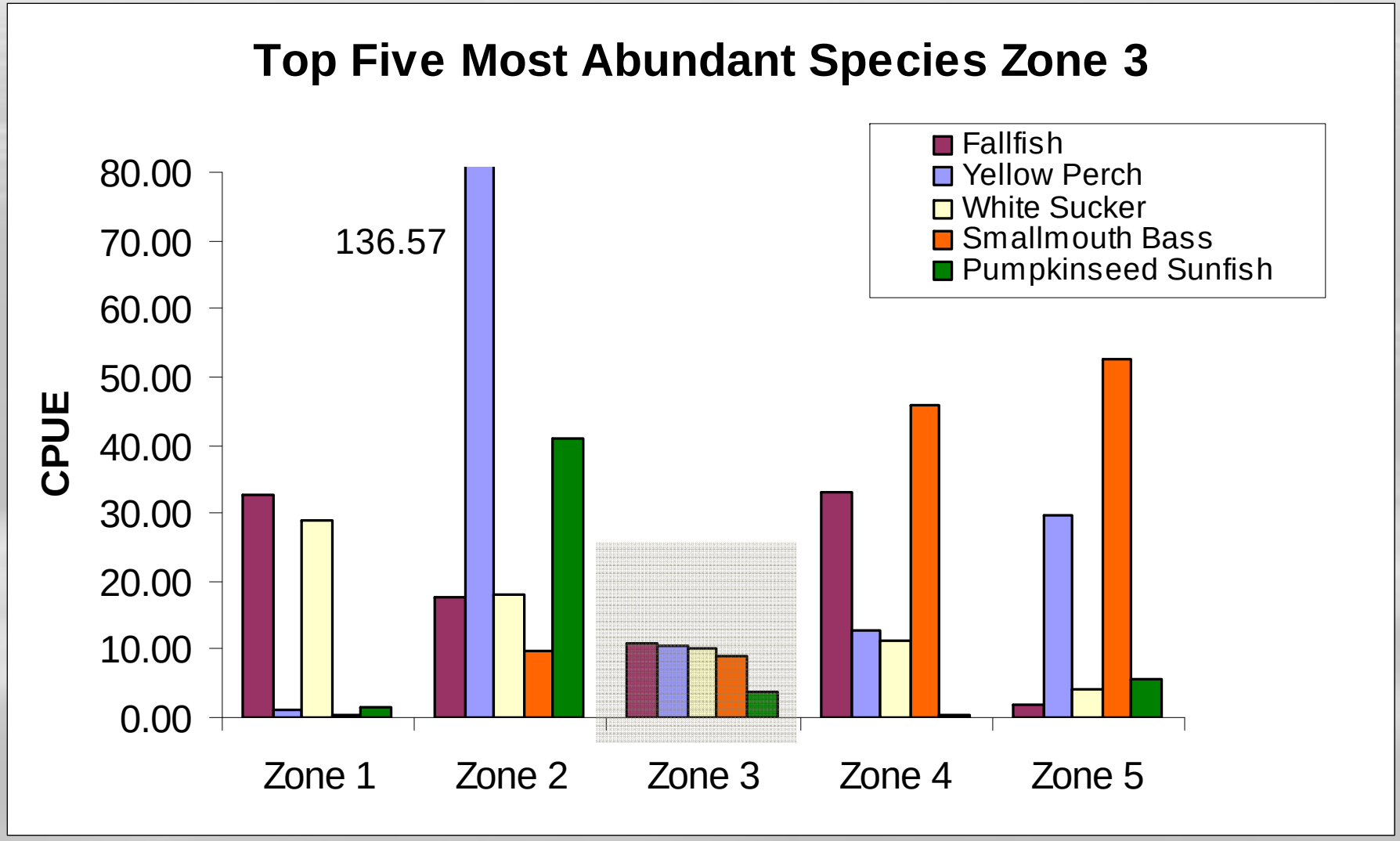
Zone 3

McIndoe Dam-Wilder Dam

- 21 species
- Predominated by mesothermic & eurythermic sp.
- Stenothermic species are absent
- First appearance of diadromous species (sea lamprey)



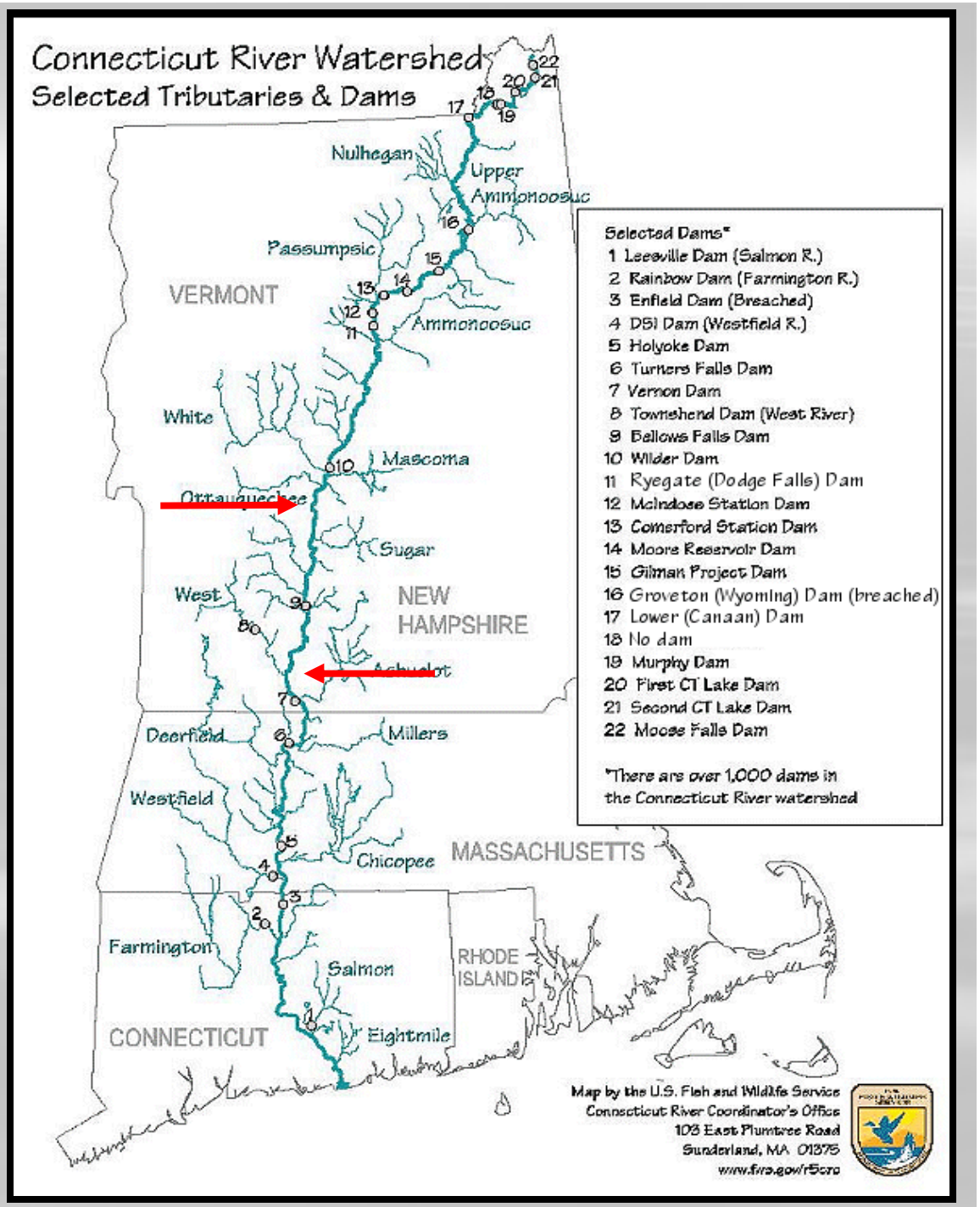
Zone 3



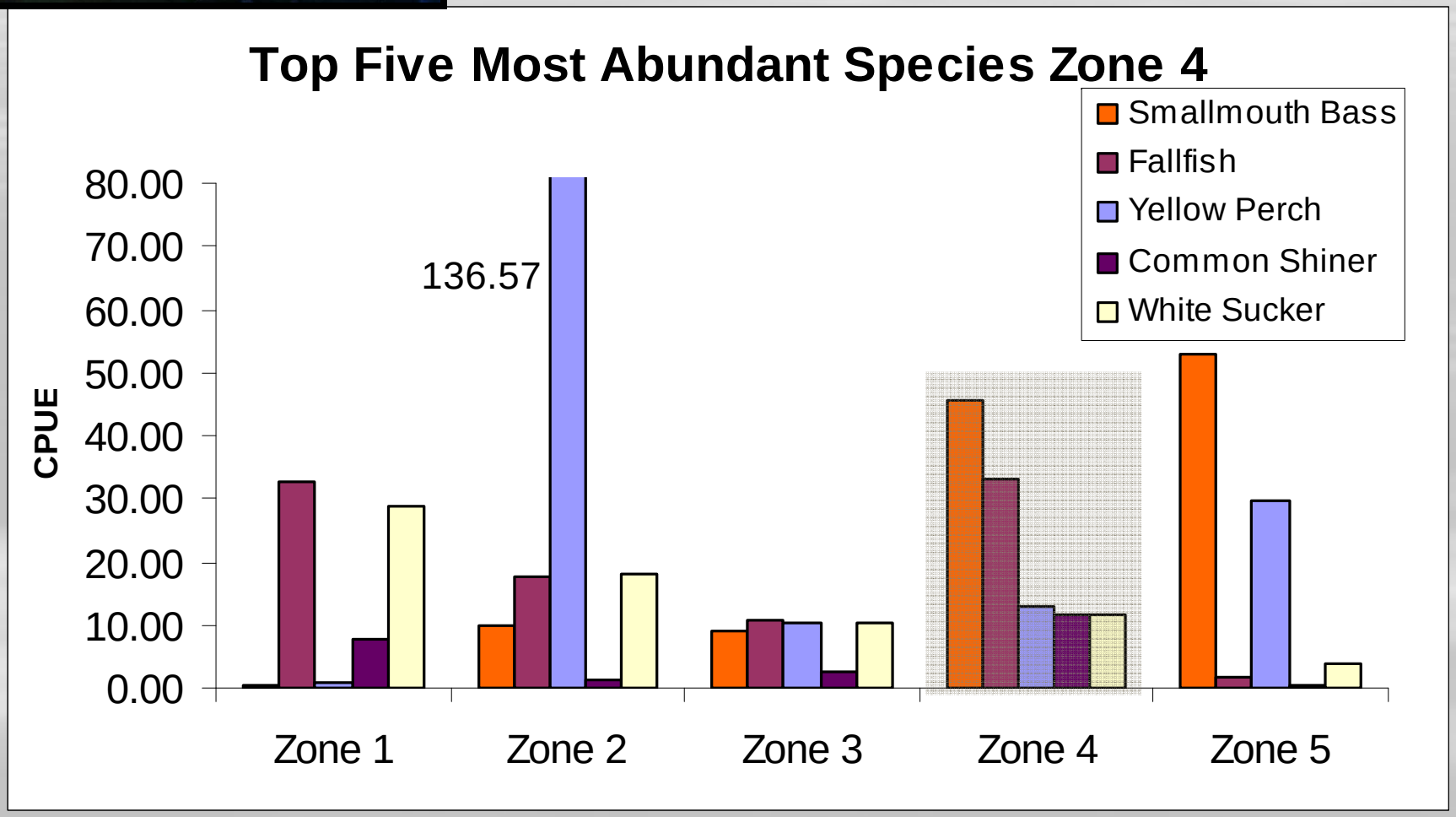
Zone 4

Wilder Dam- West River

- 27 species
- Assemblage predominated by Centrarchids
- American shad (y-o-y)



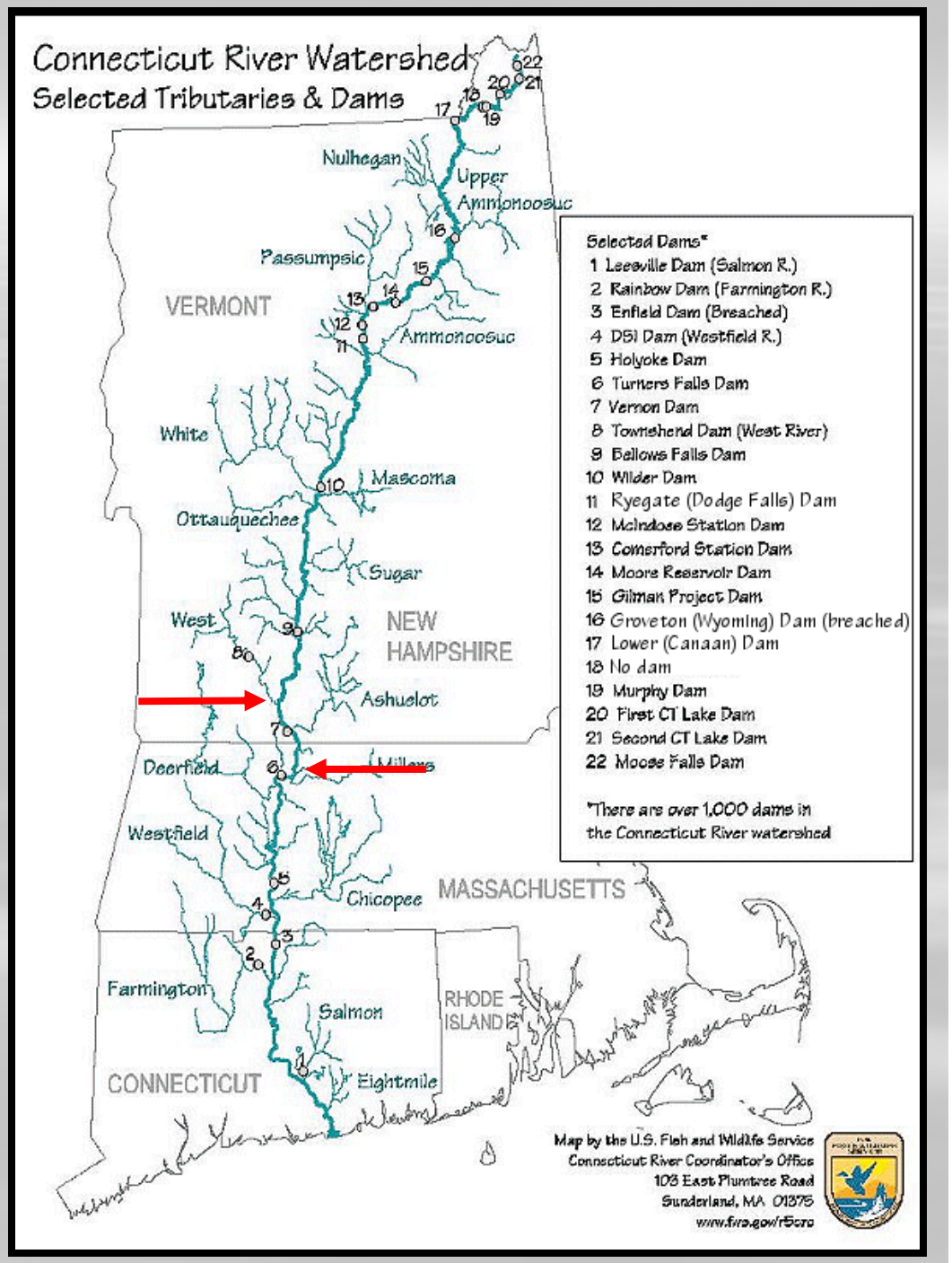
Zone 4



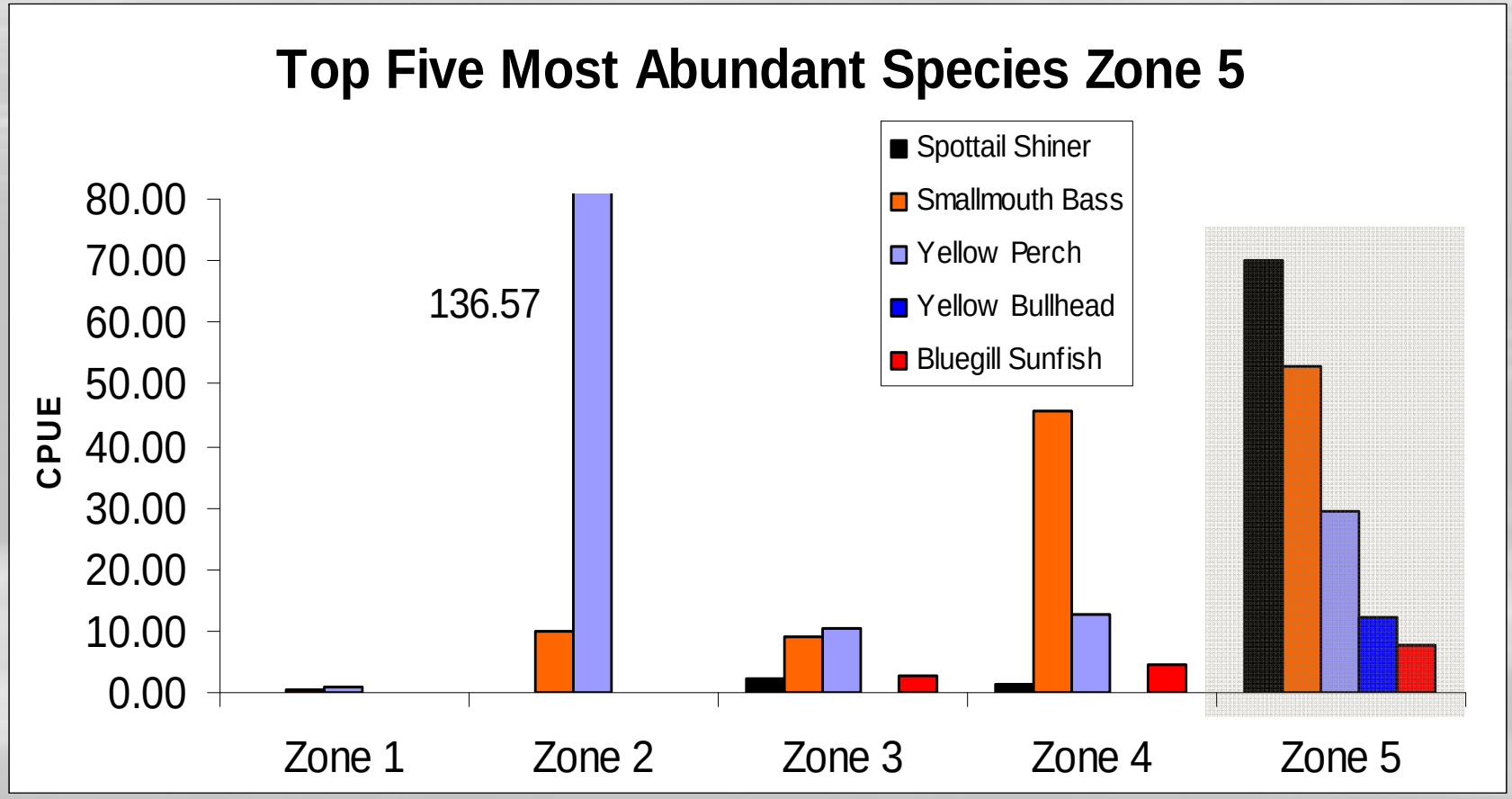
Zone 5

West River– Turners Falls Impoundment

- 19 species
- Increase in diadromous species:
  - American eel
  - American shad
  - Sea lamprey



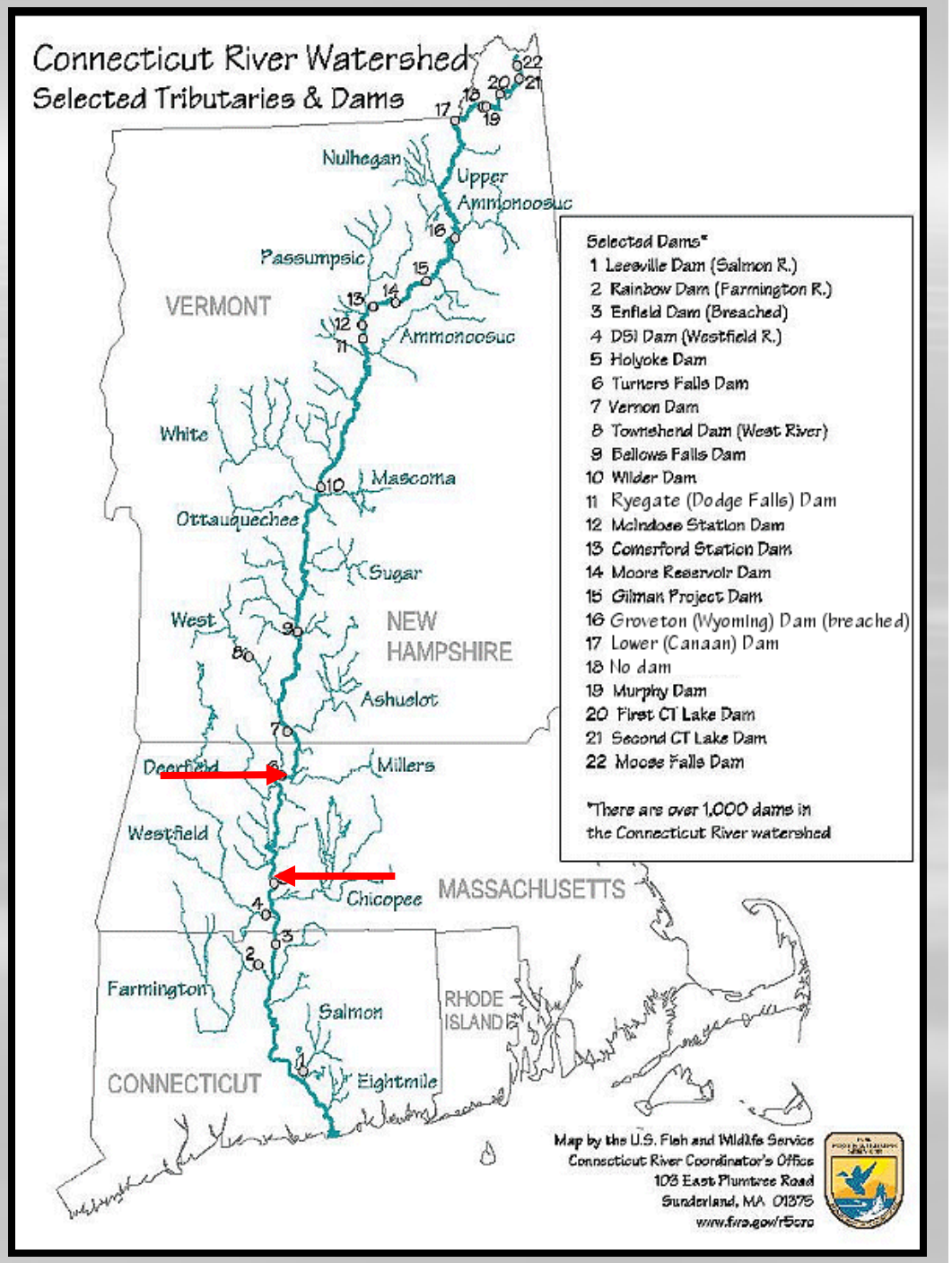
Zone 5



Zone 6

Turners Falls Dam to Holyoke Impoundment

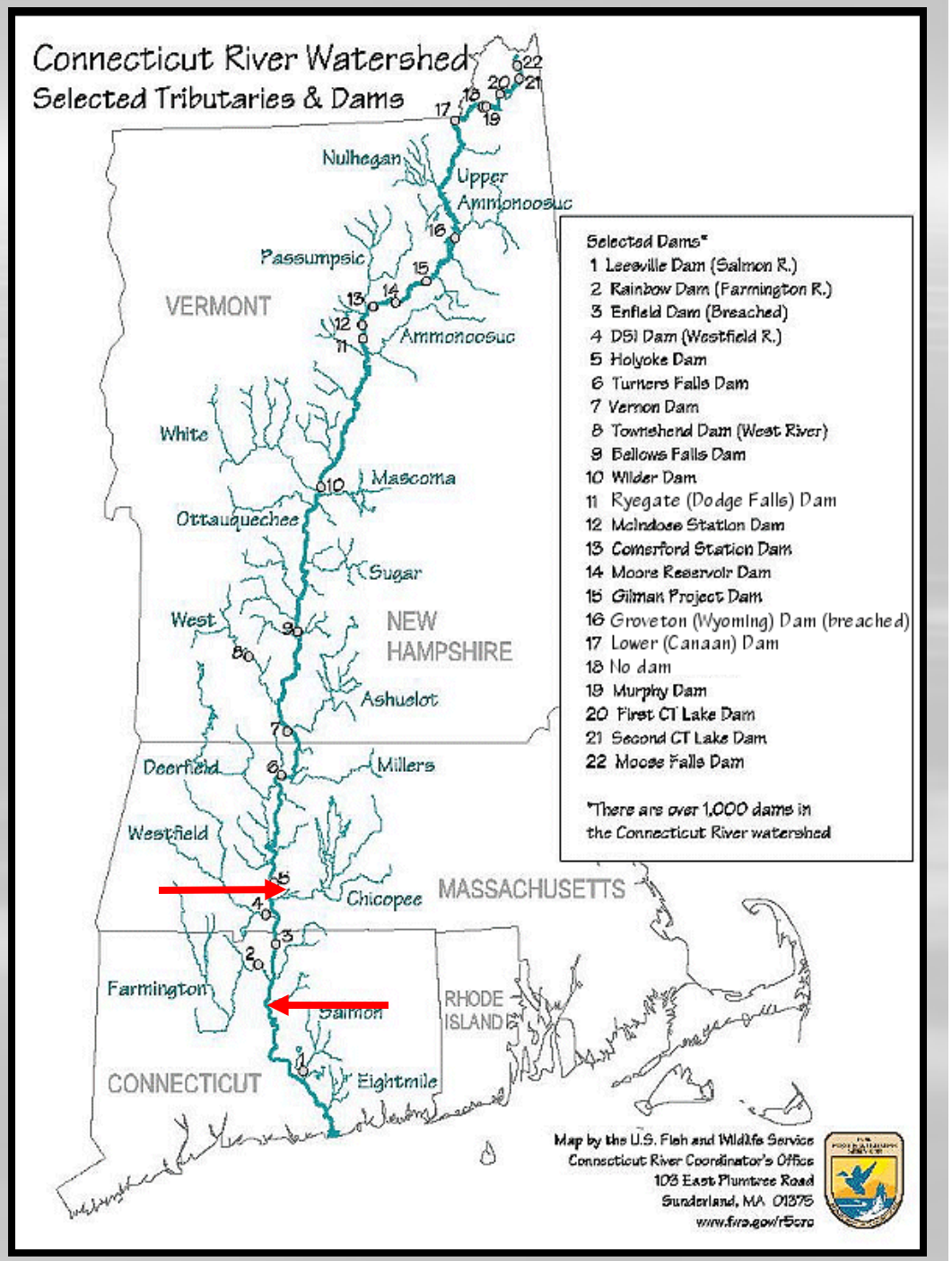
- 23 species
- Increase in generalists:
  - Fallfish
  - Smallmouth bass
  - Spottail shiner
  - Bluegill
  - Yellow perch



Zone 7

Holyoke Dam – Hartford (head of tide)

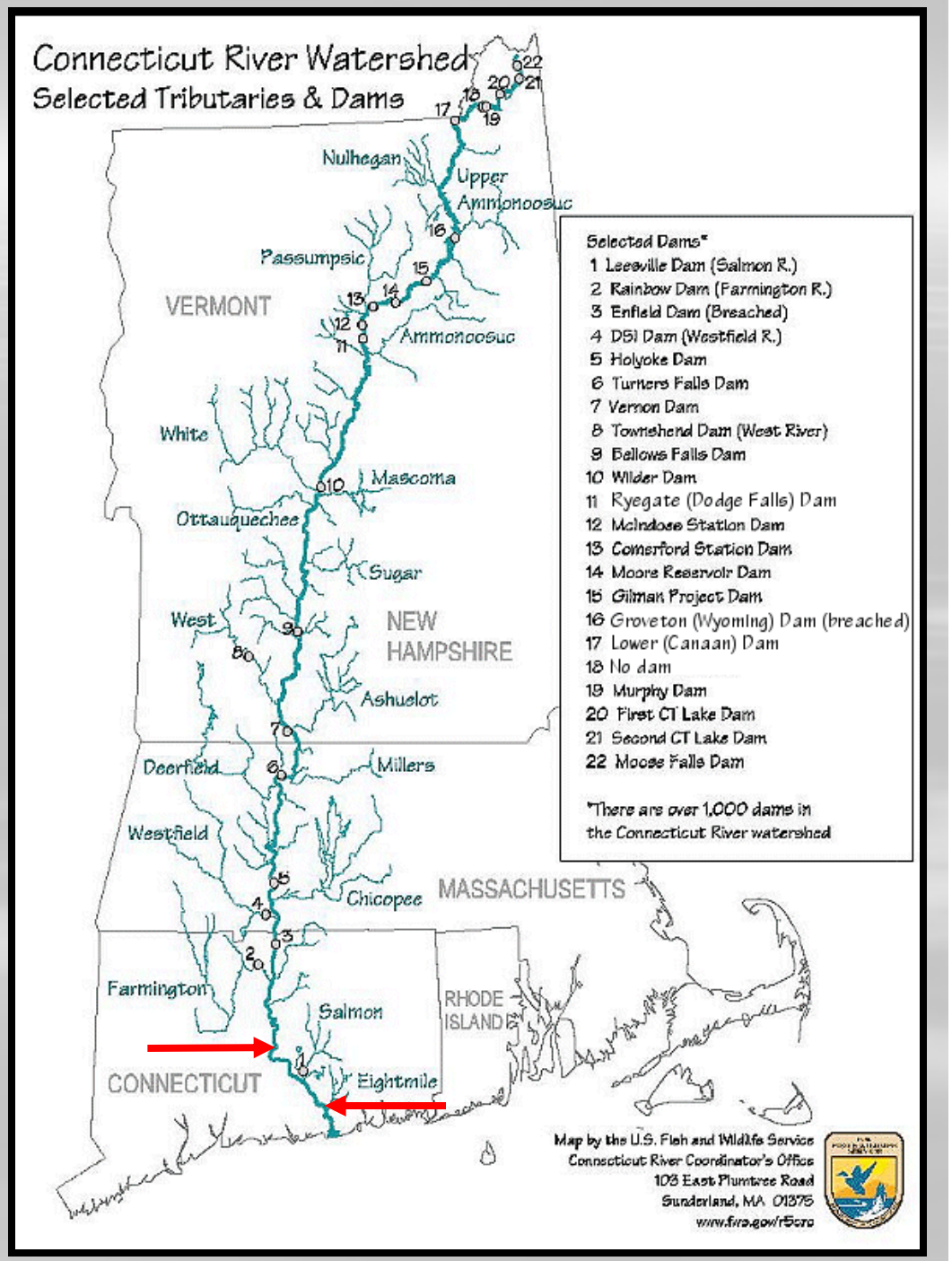
- 29 species
- Increase in diadromous species:
  - American eel
  - Fallfish
  - Spottail shiner
  - Smallmouth bass
  - American shad (yoy)



Zone 8

Tidal Influenced Segment

- 29 species
- Increased presence of tidal species:
  - Spottail shiner
  - American shad (yoy)
  - American eel
  - White perch
  - White sucker



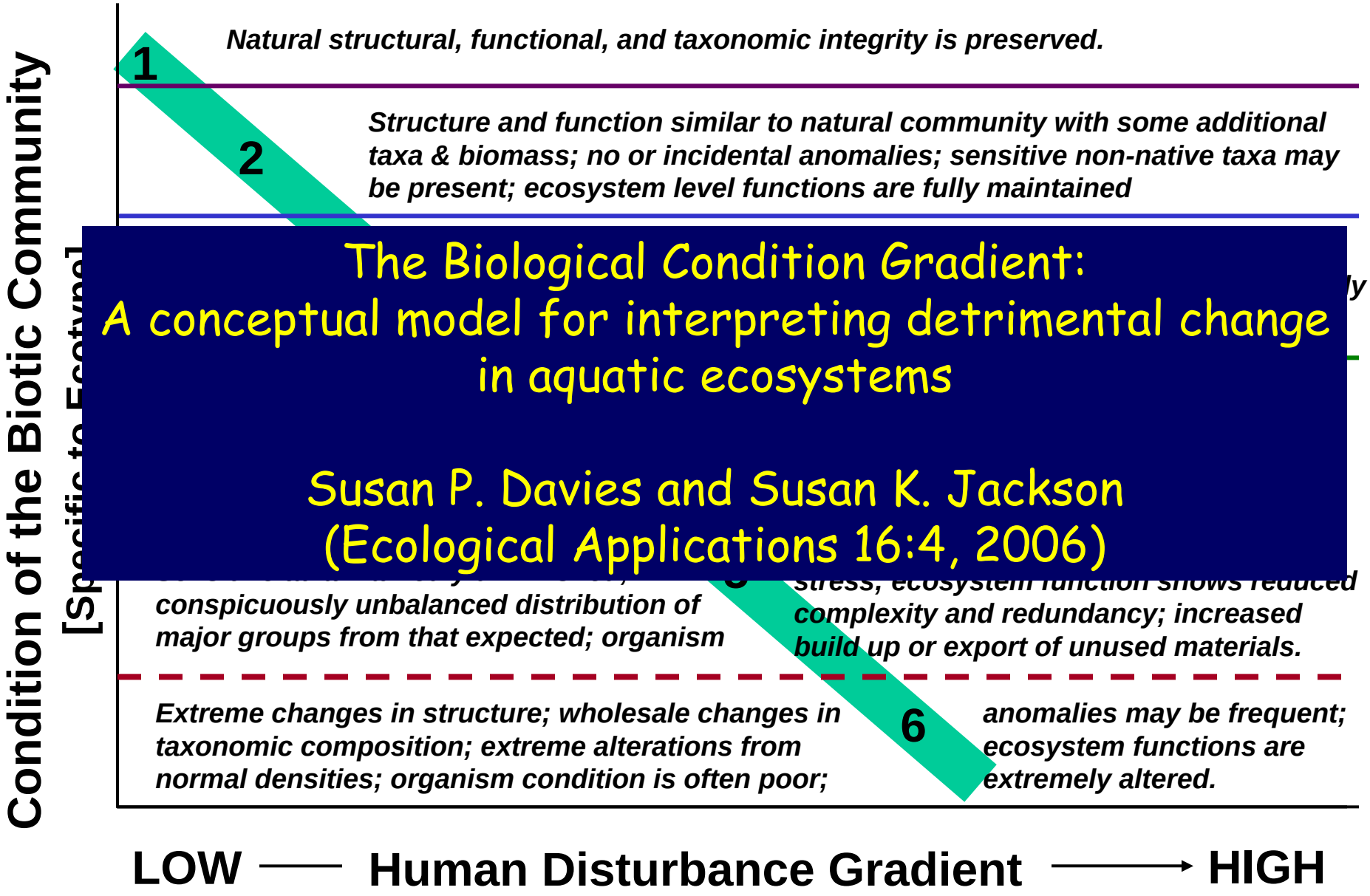
Patterns

- Brook trout absent & other stenothermic species severely reduced in zones 3-8.
- CPUE reductions (%) in Zone 2
  - Salmon -57%
  - Brown trout -83%
  - Rainbow trout -62%
  - Slimy sculpin -96%

- Species richness increases dst. Turners Falls
- Generalist and eurythermic species on the rise downstream with flow & habitat modifications
- Effects of blackbass?
- % increase in CPUE in Zone 2
  - Smallmouth bass +3000%
  - Pumpkinseed +3100%
- Generalist warmwater & tidal species in zones 6-8

Tiered Aquatic Life Use Conceptual Model: Draft Biological Tiers

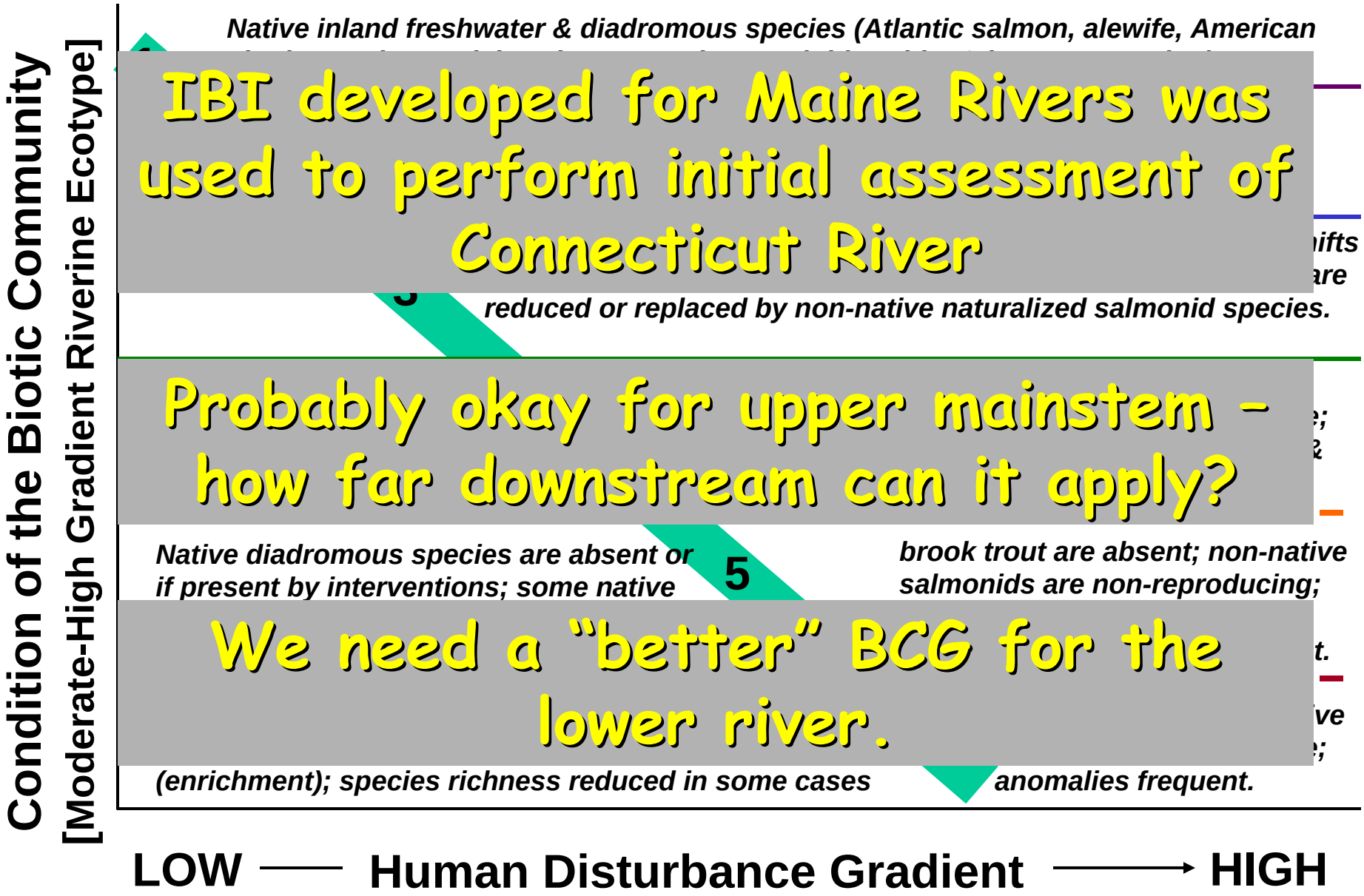
(10/22 draft)



Cold Water & Mixed Assemblages

We need an "assumed baseline" for the Biological Condition Gradient applicable to NE large rivers

Tiered Aquatic Life Use Conceptual Model: Maine Rivers

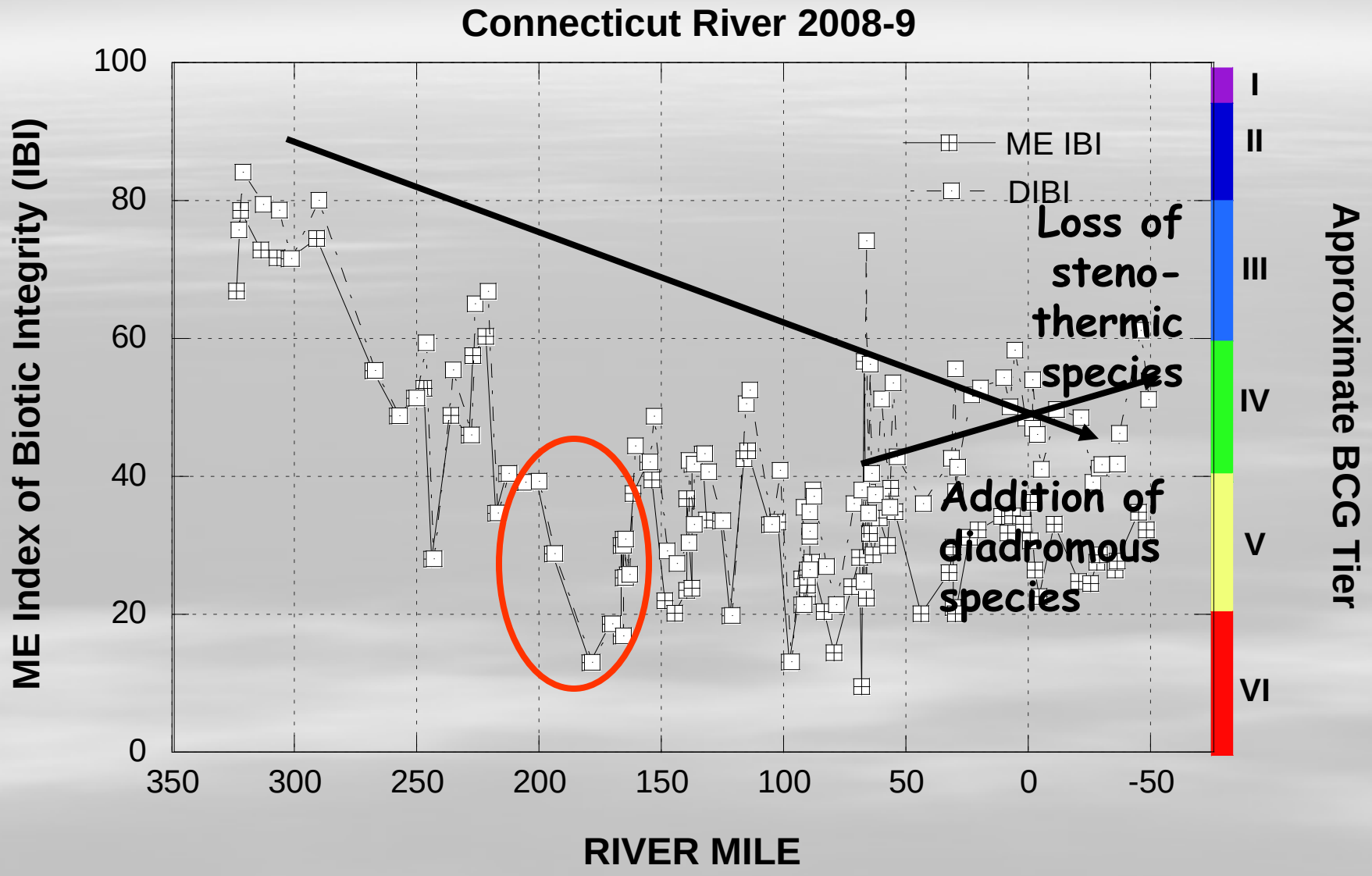


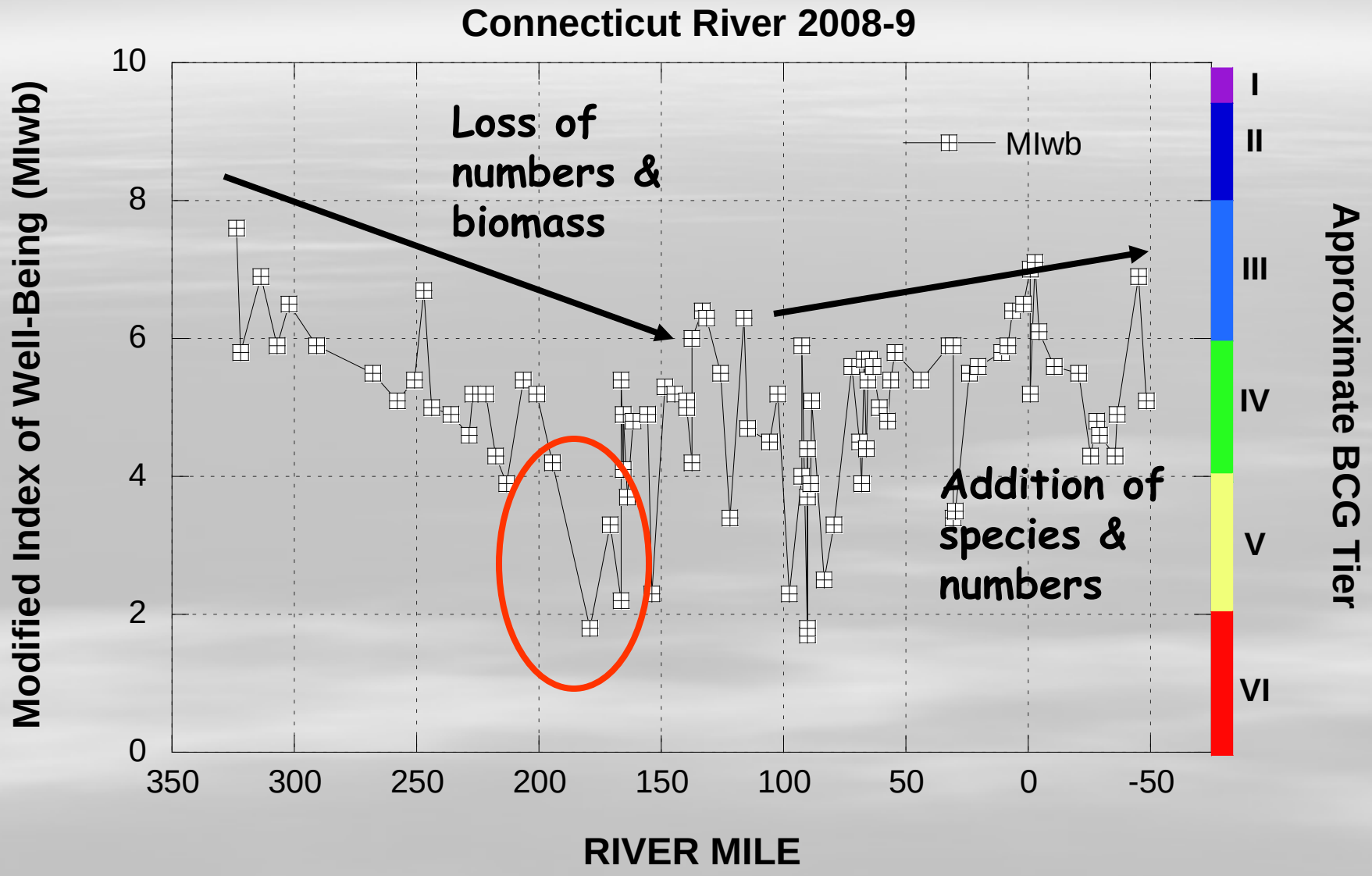
Interim Maine Rivers IBI Metrics & Scoring

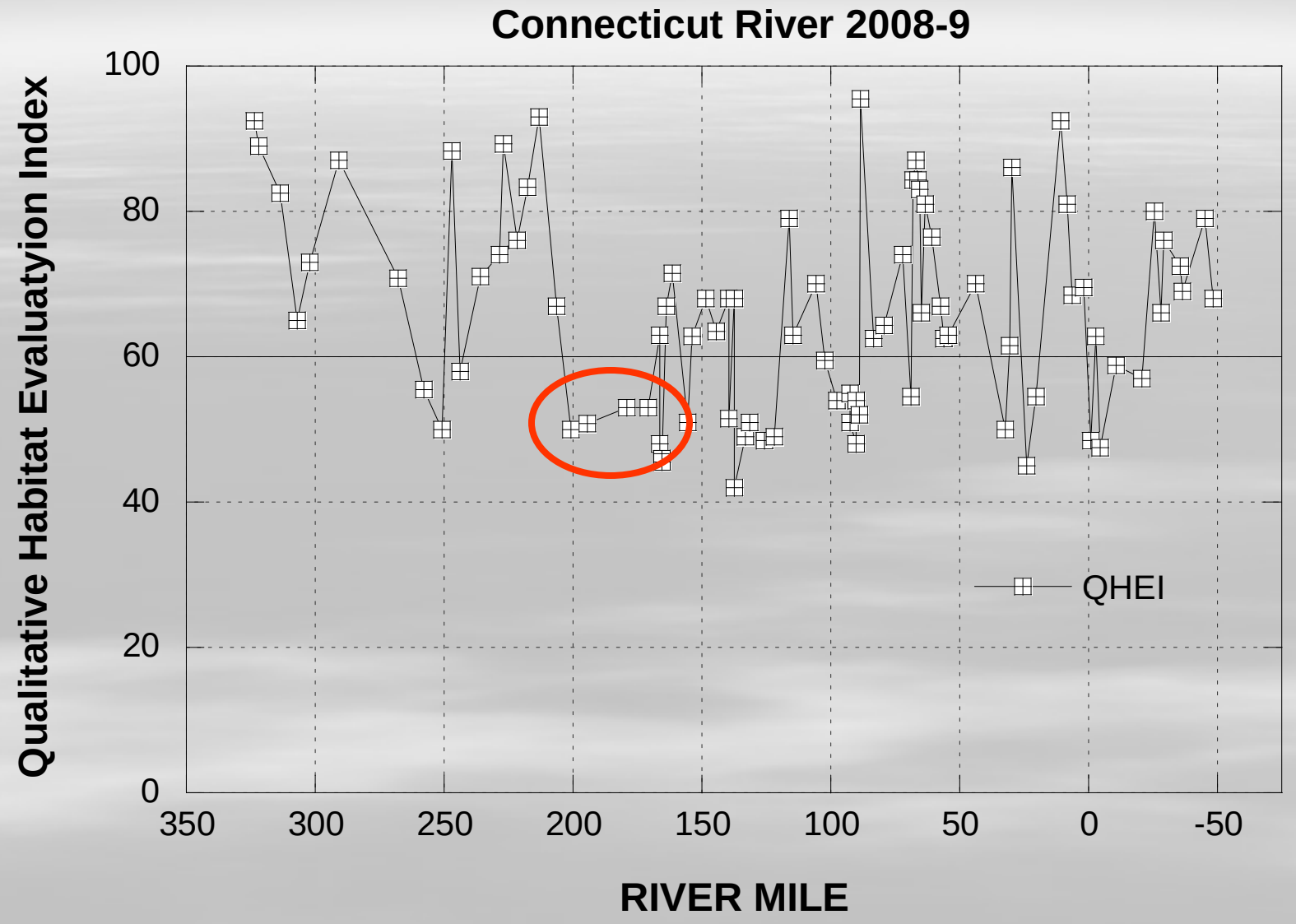
Metric	Scoring Equation	Scoring Adjustments	
		Score = 0	Score = 10
Native Species Richness	10 * (-0.2462 + (0.0828*numspec2)))	<3 sp.	≥15 sp.
Native Cyprinid Species (excluding fallfi	(10 * (0.4457 + (0.0109*allcyp_ff) - (0.00005629 *	Eq[1]	Eq
Adu bion			
%Na			
%Benthic Insectivores	10 * (0.010966*benth_pc_n)	0	≥91.2%
%Blackbass	10 - (10 * (-0.09684 + (0.5638*log10(blackbass))))	Eq	0
%Fluvial Specialist/Dependent	(10 * (0.2775 + (0.0073*fluv_pc_n)))	0%	Eq
%Macrohabitat Generalists	10 - (10 * (0.1017 + (0.0096*macro_gen)))	>90%	Eq
Temperate Stenothermic Species	(10 * (0.7154 + (0.4047*(log10(steno)))))	0 sp.	>5 sp.
Non-guarding Lithophilic Species	(10 * (0.2979 + (0.8975*log10(lith_ng))))	<1	>10
Non-indigenous Species	10 - (10 * (0.1063 + (0.3271*Non-indigenous_sp) - (0.029*(Non-indigenous_sp^2))))	≥5	0
%DELT Anomalies	10 - (10 * (0.8965 + (0.1074*log10(delta))))	Eq	0

Developmental details will be given in the Maine presentation

[1] No scoring adjustments are necessary; scoring determined by equation (Eq) across entire metric scoring range of 0-10.







Next Tasks

- Proximal analysis of changes with respect to major stressors and sources – dams, impoundments, diversions, point sources, urban areas, etc.
- Incorporate flow based indicators.
- QHEI attribute matrix.
- "Hope" that REMAP project produces a more refined BCG leading to more appropriate assemblage assessment.
- Final report to EPA and state agencies.