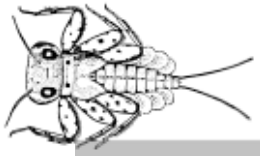
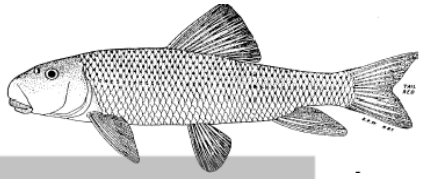
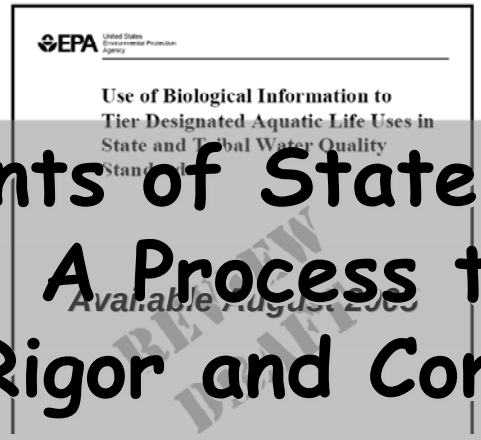
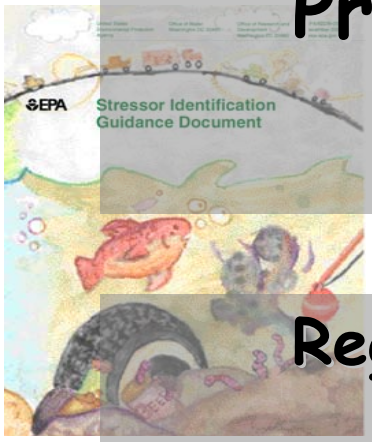


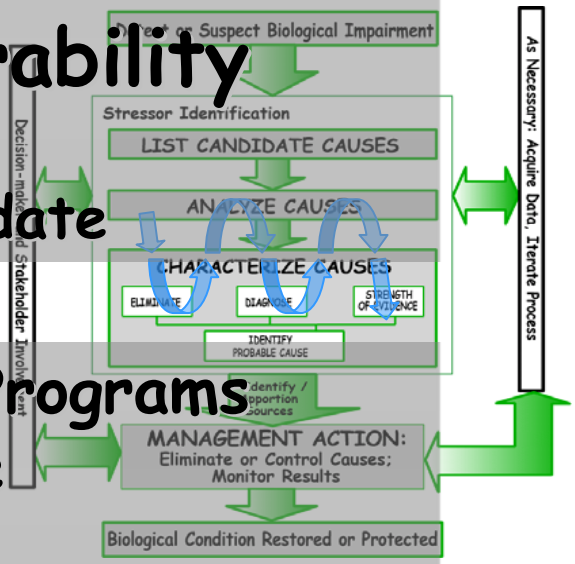


Critical Elements of State Bioassessment Programs: A Process to Evaluate Program Rigor and Comparability





State Program Evaluations Update



Region I States Bioassessment Programs

2010 NEAEB Conference

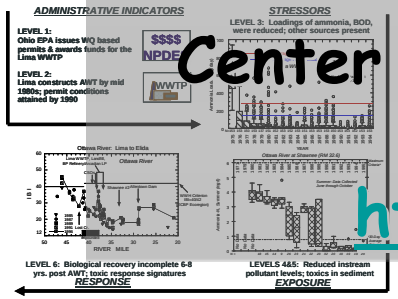
March 17, 2010

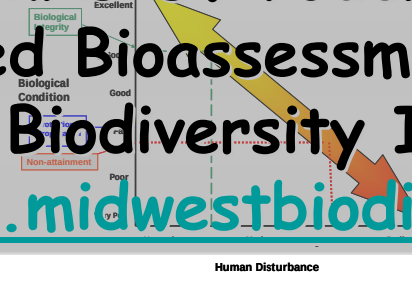
Chris O. Yoder

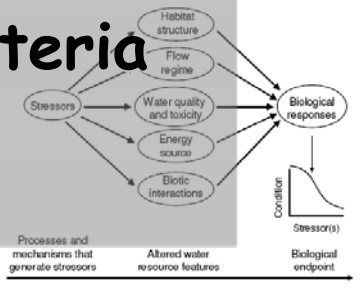
Center for Applied Bioassessment & Biocriteria

Midwest Biodiversity Institute

http://www.midwestbiodiversity.org







States Evaluated Since 2004:

Region I: CT, ME, RI, MA, NH, VT

Region IV: AL

Region V: IL, IN, MI, MN, WI, OH

Region VI: NM, TX, OK*

Region VII: MO, IA

Region VIII: CO, MT

Region IX: AZ, CA

plus selected Tribes

*- scheduled in 2010

Review Committee:

Reviews are conducted at the request of the State and/or EPA Region

Appendix A

Next Revision (2010) Will Merge the Process Into a Single Document & in Accordance With How the 3 Day Review is Structured

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Aquatic Life Use

ALUs inherently "drive" the determination of status & management responses, thus they are a critical determinant of overall program effectiveness.

How will (do) we assure accuracy in the process of setting and measuring attainment & attainability of ALUs?

State/Tribal Program Evaluation: Key Steps

- On-site evaluation of state and tribal bioassessment program, facilities, and capacities (2-3 days each).
- Interactive interview with state/tribal program managers and staff – includes bioassessment and WQS programs at minimum.
- Systematic compilation and analysis of all technical & programmatic aspects (methods, indicators, WQS (ALUs).
- Assess capacity to support all water quality management programs.
- Documents program strengths and fosters a continuous improvement process.

Table 6. Relative degree to which major water quality management program areas are supported by monitoring and assessment in each of the Region V states.

State	Basic Reporting		WQS Program					Watersheds/ NPS		TMDL/303d		NPDES/Other Permitting							
Agency	Status[21]	Trend[22]	Tiered Uses[23]	UAA[24]	Refined WQC[25]	Anti-deg.	Site-Specific Crit.Mod.[26]	NPS/BMP Effective-ness	Hab-itat[27]	List/ Delist	TMDL Dev.[28]	WQ BELs[29]	Priority Setting[30]	CSOs/ SSOs	Storm-water Ph. II&II	WET Limits/ Cond.[31]	Sever-ity/ Extent[32]	Enforce ment[33]	404/401 Dredge & Fill[34]
IL EPA	●	○	–	○	–	–	○	○	◐	◐	○	◐	○	○	–	–	○	◐	–
IN	●	○		○				○	○	○	○	○						○	

What really matters – how states use M&A and TALU to make WQ management decisions and set program direction.

● - Well developed and routine process for using monitoring & assessment for at least 5-10 years; based on an integrated indicators framework process and comprehensive watershed design.
◉ - Process and tools are available, but usage is no longer routine and occurs only on a project or issue specific basis.
◐ - Project or site-specific use of monitoring & assessment consisting of upstream/downstream studies, paired stream studies (no comprehensive watershed design).
○ - Occasional or infrequent usage or under development.
– No support from ambient monitoring & assessment.

[21] Basic attainment/non-attainment assessment for aquatic life use status including delineation of causes and sources of threat and impairment.
[22] Sufficient information to report aggregate status of ecotypes over at least a 10 year period; does not refer to analysis of fixed station chemical trends.
[23] Tiered uses that are developed based on assemblage assessments and which correspond to EPA's biological condition axis; does not include fishery based or general uses.
[24] Includes any use of ambient monitoring data to change designated uses, both "upgrades" and "downgrades".
[25] Ambient data is used to develop water quality criteria and/or influence the application or implementation of WQC (exclusive of pH, hardness, and other single modifiers).
[26] Ambient survey data is used to ground truth EPA's site specific criteria process (water effects ratio).
[27] Habitat assessment is linked to biological assessment and listed as a cause of impairment.
[28] Includes using ambient data to support TMDL development and determine success of TMDL implementation beyond basic calibration data.
[29] Water quality based effluent limits – ambient data is used to develop an assessment of the overall effect of the subject discharge on the receiving waters.
[30] Ambient data is used to influence priority setting for NPDES permitting and/or SRF funding priorities.
[31] Ambient survey data is used to develop WET testing requirements and/or effluent limits in NPDES permits.
[32] Assessment framework allows for determination of incremental departures and changes beyond pass/fail and communicates severity of problem over space & time.
[33] Direct use of ambient survey data to support enforcement in terms of demonstrating that action is both legal and reasonable.
[34] Direct support of general policy and site-specific decisions for the 401 certification of 404 dredge and fill permits.

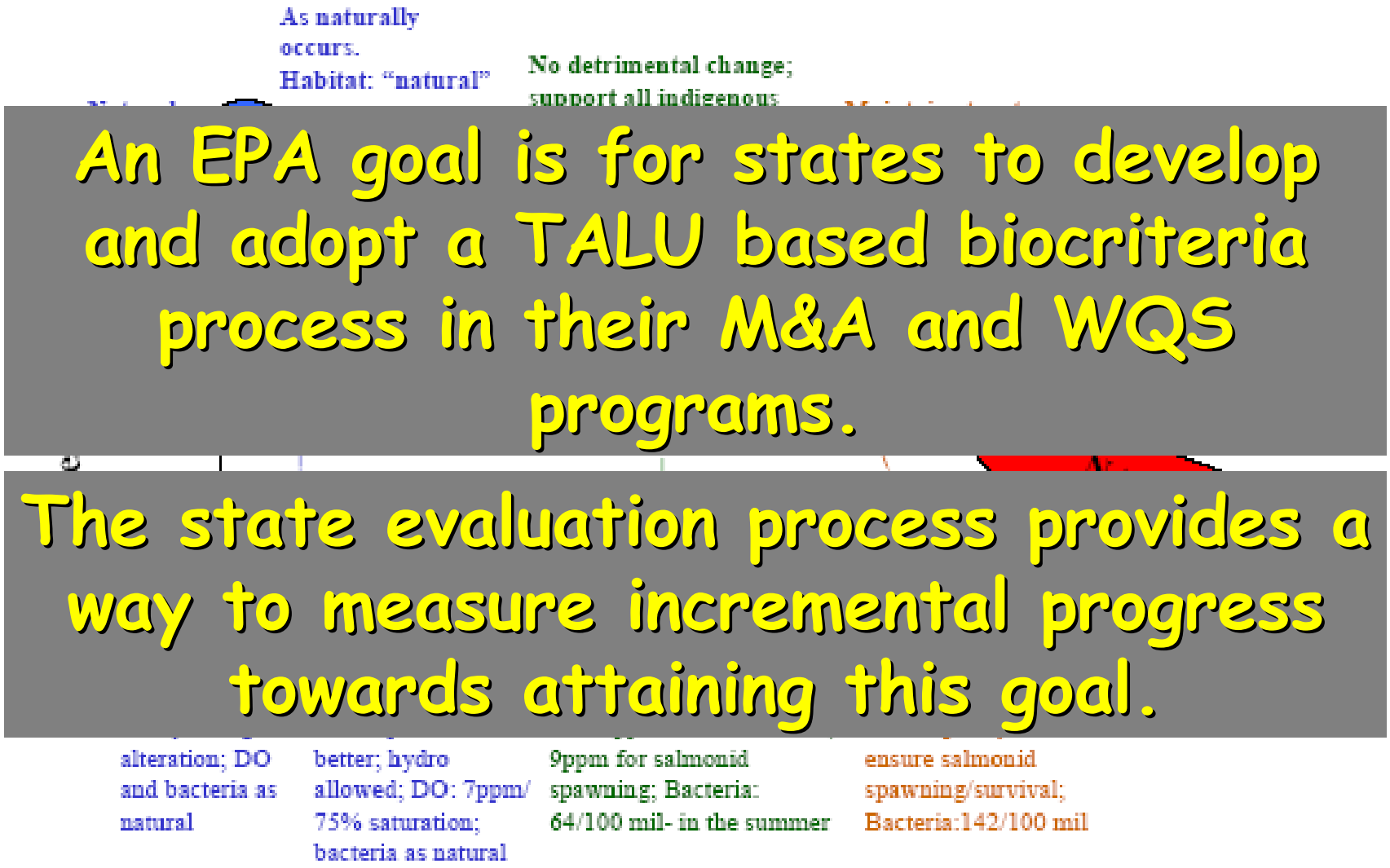


FIGURE A-3. Relation between Maine TALUs and other water quality standards and criteria.

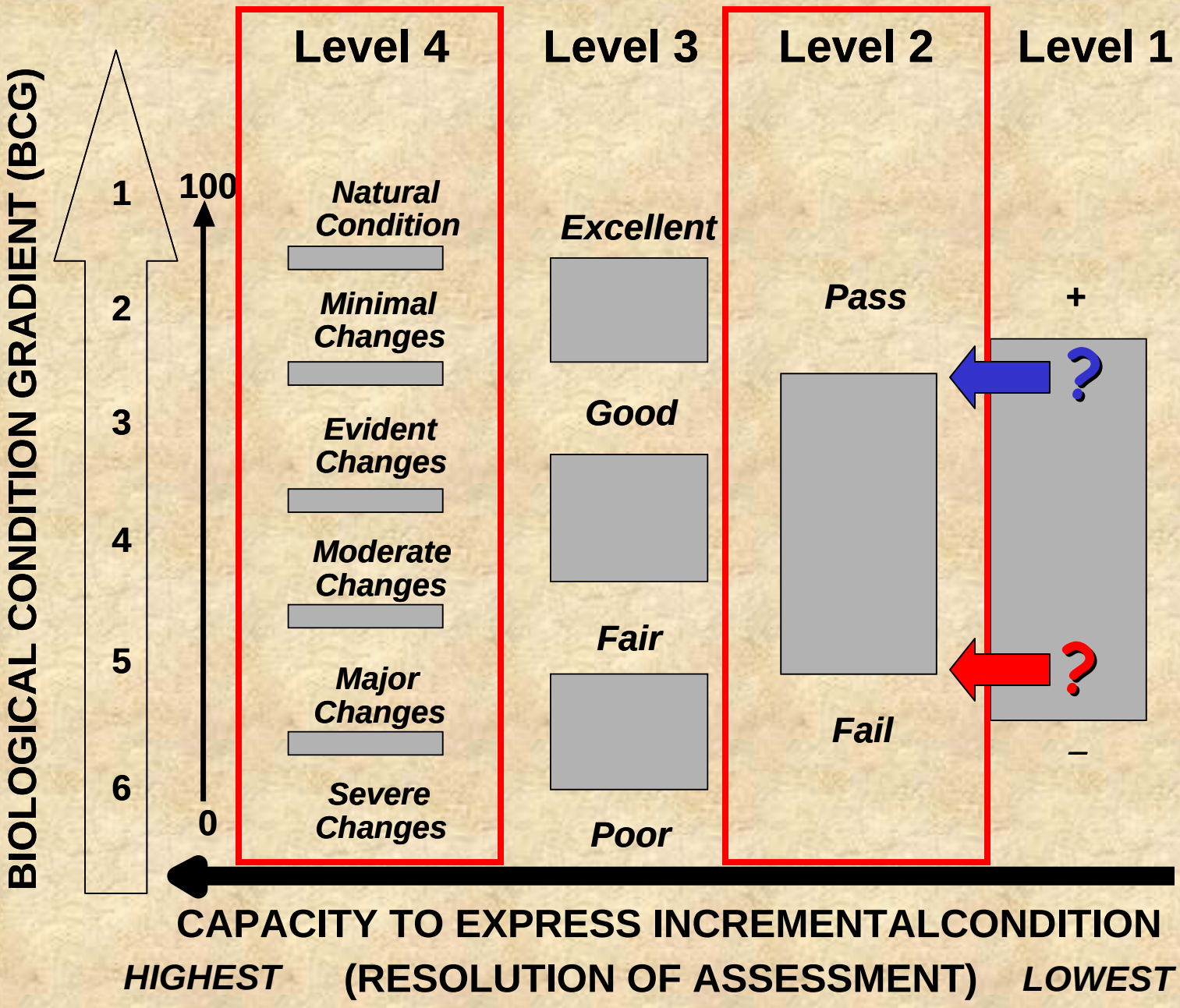
Key Concepts

Accuracy: Biological assessments should produce sufficiently accurate delineations to minimize Type I and II assessment errors.

Comparability: technically different approaches should produce comparable assessments in terms of condition ratings, impairments, & diagnostic properties.

Comprehensiveness: biological response is evaluated in conjunction with other stressor/exposure information to understand the key limiting factors.

Cost-Effectiveness: having reliable biological data to support management decisions outweighs the intrinsic costs of development and implementation (NRC 2001).


Level 4
Level 3
Level 2
Level 1
BIOLOGICAL CONDITION GRADIENT (BCG)
1
2
3
4
5
6
100
0
Natural Condition
Minimal Changes
Evident Changes
Moderate Changes
Major Changes
Severe Changes
Excellent
Good
Fair
Poor
Pass
Fail
+
–
?
?
CAPACITY TO EXPRESS INCREMENTALCONDITION
HIGHEST (RESOLUTION OF ASSESSMENT) LOWEST

What Do the Levels Mean?

Level 1 produces general assessments - not amenable to supporting most tasks *i.e.,* status, severity/magnitude, causal associations.

Level 2 includes pass/fail to multiple condition assessments (3-4 categories); capable of general causal determinations.

Level 3 is capable of incremental condition assessment along the BCG and for most causal associations; single assemblage limitations.

Level 4 provides full program support & reasonably robust, accurate, & complete assessments including scientific certainty, accuracy, relevancy of condition, severity & extent, and causal associations.

Critical (Key) Technical Elements

		Foundation Elements	Building Blocks	Dependent on Other Elements
Design	1. Temporal coverage		✓	
	2. Spatial coverage		✓	
	3. Natural Classification	✓		
	4. Criteria for reference sites	✓		
	5. Reference conditions			✓
Methods	6. Taxonomic Resolution	✓		
	7. Sample collection	✓		
	8. Sample processing	✓		
	9. Data Management	✓		
Interpretation	10. Ecological attributes	✓		
	11. Biological endpoints			✓
	12. Diagnostic capability			✓
	13. Professional review		✓	

Critical (Key) Technical Elements

			LOW → HIGH			
Design	1.	Temporal coverage	1.5	2.5	3.5	4.5
	2.	Spatial coverage	1.5	2.5	3.5	4.5
	3.	Natural Classification	2	3	4	5
	4.	Criteria for reference sites	2	3	4	5
	5.	Reference conditions	1	2	3	4
Methods	6.	Taxonomic Resolution	2	3	4	5
	7.	Sample collection	2	3	4	5
	8.	Sample processing	2	3	4	5
	9.	Data Management	2	3	4	5
Interpretation	10.	Ecological attributes	1.5	2.5	3.5	4.5
	11.	Biological endpoints	1	2	3	4
	12.	Diagnostic capability	1	2	3	4
	13.	Professional review	1.5	2.5	3.5	4.5
		Total Score	**21**	**34**	**47**	**60**

Development of Thresholds for Determining Levels of Rigor: Max. Loss of Points Allowed

LEVEL OF RIGOR	FOUNDA-TION	BUILDING BLOCKS	DEPEN-DENT	MIN. SCORE	%
4	-1	-1	-1	57	95%
3	-3	-3	-3	51	84%
2	-6	-6	-6	42	70%
1	-	-	-	21	<70%

Key Tasks for State Reviews

- Discuss aspects of M&A and WQS programs especially as they relate to support for WQ Management programs and tasks (annotated list of discussion topics).
- Complete Critical technical Elements checklist and determine current CE score and level of rigor.
- Conduct state self-assessment exercises – determine how the present program would deal with commonly encountered M&A and WQ management situations.

Table 1. A checklist for evaluating the degree of development for each technical element of a bioassessment program and associated comments on the elements for the New Hampshire bioassessment program. The point scale for each element ranges from lowest to highest resolution.

Element 1	(Lowest) 1.5	2.0	2.5	3.0	3.5	4.0	4.5 (Highest)	Comments
od	Collection times are variable throughout the year, and sampling is performed without regard to seasonal influences.	An index period is conceptually recognized, but sampling may take place outside of this period for convenience or to match existing programs; sampling outside of the index		A well-documented seasonal index period(s) is calibrated with data for reference conditions, but sampling may take place outside of this period for convenience or to		Same as Level 3, but administrative needs and index periods fully reconciled. Scientific basis of temporal sampling influences management decision framework.		July 1 – September 30 for fish; August – September for macroinvertebrates (8 week colonization period). No internal accommodation for
				minimize natural variability, maximize gear efficiency, and maximize the information gained about the assemblage.				Points 4.5

Checklist is completed with state staff – consensus based process

TECHNICAL MEMORANDUM

Critical Technical Elements Evaluation of the Connecticut DEP Bioassessment Program

Connecticut DEP
Hartford, CT
October 31 – November 2, 2006

A major product of the review process is a technical memorandum that communicates program strengths and documents specific areas for improvement. These have evolved since 2004 from "a few" pages to 40-50 pp.

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Susan Davies, Maine DEP/MBI (Susan.P.Davies@maine.gov) (207) 287-7778

Table 2. Summary of the critical technical elements evaluation for the New Hampshire DES statewide bioassessment program conducted March 4, 2009. This applies specifically to wadeable streams. Point values in brackets indicate the expected CE score change with ongoing developments.

Element	Comment
Element 1: Index Period Maximum score = 4.5 Score assigned = 4.5	Strict adherence to a standardized two-stage index period is practiced (March 15 – October 15; July 1 – September 30 critical period). No exceptions are current spatial design. NRSA will elevate score to 5.5. Multiple designs including watershed scale assessments are needed to elevate score to 4.5. [+0.5]
Element 3: Natural Classification Maximum score = 5.0 Score assigned = 4.5	Ongoing efforts to regionalize macroinvertebrate assemblage assessment coupled with existing fish assemblage assessment tool should elevated CE score to 5.0. [+0.5]
Element 4: Criteria for Reference Sites Maximum score = 5.0 Score assigned = 4.5	The development of quantitative reference site screening method is needed to elevate CE score to 5.0. Current method is based on a BPJ approach that is adequate for intended purposes. [±0.0]

Key step in process of developing a "blueprint" for overall program development to elevate level of rigor.

Incorporating Tiered Aquatic Life Uses Into State and Tribal WQS

As a key component of State and Tribal water quality standards, designated uses define the goals for a waterbody, determine the criteria to protect it, guide management outputs, and, ultimately, environmental outcomes. Aquatic life tiers couple descriptive narratives (tiered uses) with supporting numeric criteria. The specificity of designated uses greatly influences the level of precision at which a water quality management program operates. Incorporating more refined, or tiered, aquatic life uses into water quality

Tiered aquatic life uses are descriptive narratives of designated uses that are supported with numeric biocriteria and chemical/physical criteria

The implementation chapter of the EPA TALU document was written so that states could perform a self-assessment.

waterbodies and their aquatic life uses. These next two chapters discuss the underlying principles and processes involved in developing tiered aquatic life uses and applying them in water quality management based on "lessons learned" from State experiences. Maine and Ohio are two states that have adopted tiered aquatic life uses in their WQS and have implemented them through systematic monitoring and assessment. The experiences of Maine and Ohio provide a sequence of steps, or milestones, that can serve as a template for other States to follow. These milestones are:

1. **Establish conceptual foundation**
2. **Merge scientific and policy foundations**
3. **Establish monitoring program**
4. **Develop and validate quantitative thresholds**
5. **Apply tiered uses in water quality management**

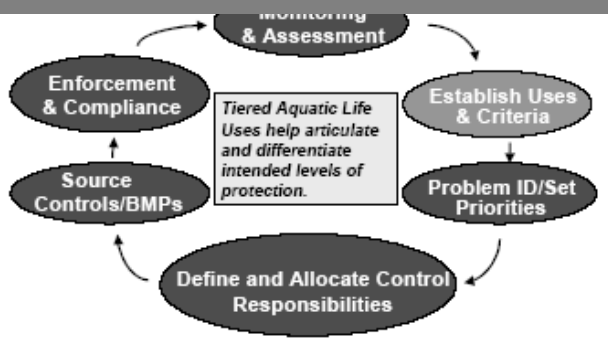
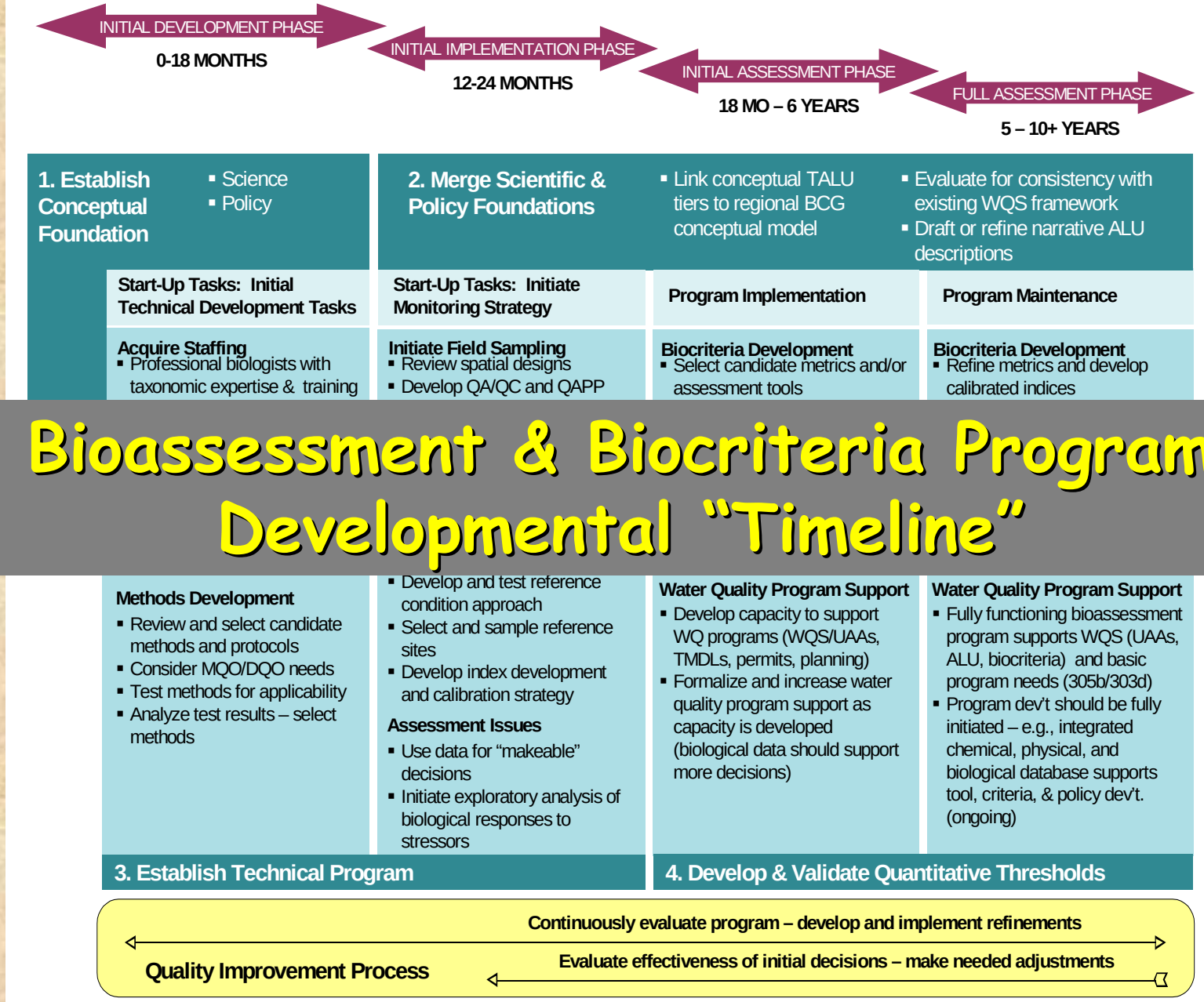


FIGURE 4-1. U.S. EPA Water Quality Based Approach to Pollution Control based on Chapter 7, Water Quality Standards Handbook.

TABLE 4-1. Expertise and tasks for key TALU milestones.

Conceptual Foundations	Technical Foundations	Policy/Legal Foundations
Professional Expertise Required		
✓ Senior professional biologists ✓ Regional ecological experts	✓ Professional biologists ✓ Taxonomists ✓ Field support staff ✓ Statistician ✓ Database managers	*Initial concept formulation:* ✓ Senior professional biologists ✓ WQS managers *Later stages*: All of the above plus… ✓ Senior management ✓ State legal counsel ✓ Legislature or WQS board ✓ Stakeholders
Milestones 1, 2 and 4	**Milestones 3 and 4**	**Milestones 1, 2 and 4**
Essential Elements		
▪ Literature review of stress ecology studies for locale ▪ Develop regional BCG model ▪ Determine expected biological assemblage response to typical stressor scenarios; ▪ Identify ecological attributes necessary to maintain a functioning ecosystem (that TALU must protect or restore)	▪ Clarify classification issues (confounding natural gradients of locale); ▪ Define reference conditions ▪ Determine monitoring approach and strategy ▪ Exploratory data analyses to validate/refine BCG model ▪ Best available, best tested metrics to assess status of ecological attributes of interest ▪ Set thresholds that correspond to BCG tiers, that protect essential ecological attributes	▪ Determine management objectives; ▪ Identify priority aquatic resources ▪ Cross-walk BCG to WQS context- (how good a fit is provisional BCG/TALU conceptual model to existing use classes and WQ criteria) ▪ Seek early review of the legal standing of any proposed changes to WQS- strengthen and clarify language ▪ Account for public values and economic constraints/realities



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TALU Timeline Framework

We are finding that states are "somewhere" along the way towards full TALU program development.

General Observations

- All states have bioassessment programs.
- All states are building towards full WQ management program support.
- CE Levels are improving with time and effort.
- Regional projects have been very useful to some aspects of state program development (BCG, NEWS, etc.).
- Resources – quantity and "dedication" are issues.
- Level of rigor reflects an important "synergy" of the key TALU building blocks.

Next Steps

- Complete outstanding technical memos – 2 to go.
- Summary report of baseline state visits to Region I – by Sept. 2010.
- Continue Region I Bioassessment working group at NEAEB 2011.
- Conduct second round of on-site visits as a follow-up to the baseline evaluations in 2010-11.
- Focus on state-specific needs and issues – emphasize WQS aspects.