Water Quality Criteria

WATER QUALITY STANDARDS

Introduction

Water Quality Standards & Classifications

Designated Uses & Classification

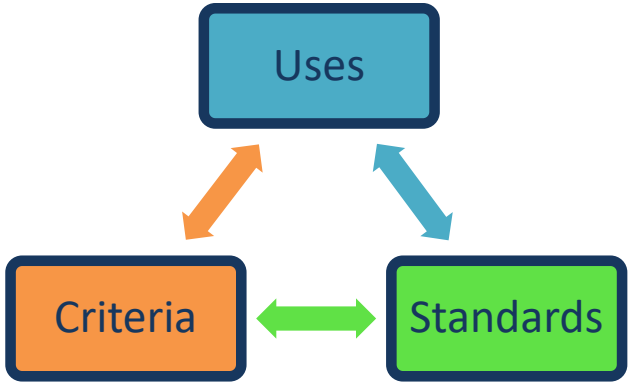
- Establishes existing and designated uses by class
- Assignment of designated uses to specific waters

Standards

- Overall Goals & Policies

Criteria

- Narrative & numeric criteria to sustain the use



Water Quality Criteria: Clean Water Act

CWA requires states to adopt WQS which "Serve the purposes of the Act":

- States/Tribes shall adopt criteria to protect designated uses into their WQS. (CWA 303(c)(1))
- *CWA 303(c)(2)(b)*States/Tribes shall adopt criteria for "toxic pollutants" (CWA 303(c)(2)(b))
- Toxic pollutants defined as Priority Pollutants in CWA 307(a)(1) and provided as a list in Appendix D of the CWA

Water Quality Criteria: Federal Regulations

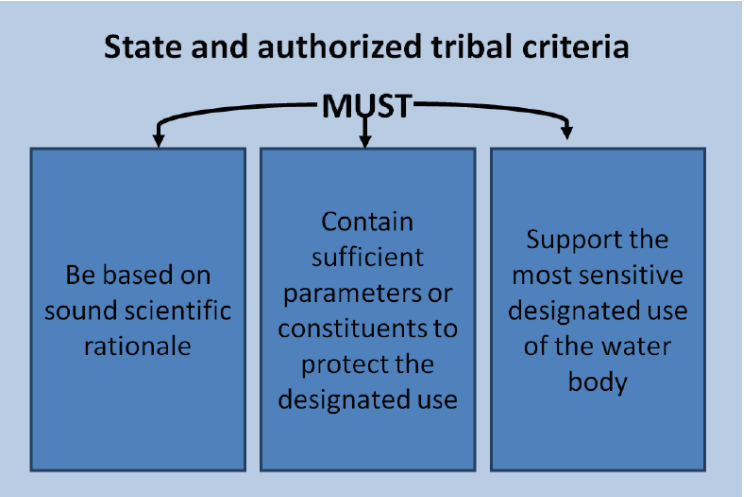
Addressed in 40 CFR 131 – Water Quality Standards

- Defined in 40 CFR 131.3
  - Criteria are elements of State WQS expressed as constituent concentrations, levels or narrative statement representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use.
  - Section 304(a) criteria are developed by EPA periodically under Section 304(a) of the CWA to provide guidance to States for use in developing criteria. EPA criteria based on latest scientific information on relationship between chemical and its effect on aquatic species and/or human health.

Water Quality Criteria: Practical Application

Adopting Criteria

- Requirements on States: Adopt Criteria to Protect Designated Uses
- At a minimum, this means adopting criteria for substances with EPA criteria guidance OR providing a rationale for not adopting or modifying
- If a states doesn't adopt a 304(a) recommended criteria EPA may promulgate the criteria for the State



Water Quality Criteria: Practical Application

Criteria Types

- Numeric Criteria: Numerical values based on:
  - 304 (a) criteria guidance
  - 304(a) criteria guidance modified to reflect site-specific conditions
  - Other scientifically defensible methods
- Narrative Criteria: A Description:
  - Based on Biomonitoring Methods where numeric criteria cannot be established or developed to supplement numeric criteria

Examples

- Numeric
  - To protect ALU, dissolved Cd shall not exceed 1.8 ug/l as a 1 hour average more than once every 3 years and applied at a total hardness of 100 mg/l
- Narrative
  - All water shall be free from toxic, radioactive, conventional, non-conventional, deleterious or other polluting substances in amounts that will prevent attainment of the designated uses specified.

Note: For CWA 307(a) toxics, a state/tribe must provide a method of translating a narrative criterion into something numeric from which a permit writer can derive effluent limits (40 CFR 131.11(a)(2)).

Risk Assessment

- In recent years, EPA has developed water quality criteria within a Risk Assessment paradigm

A Risk Assessment if a process that evaluates the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more stressors

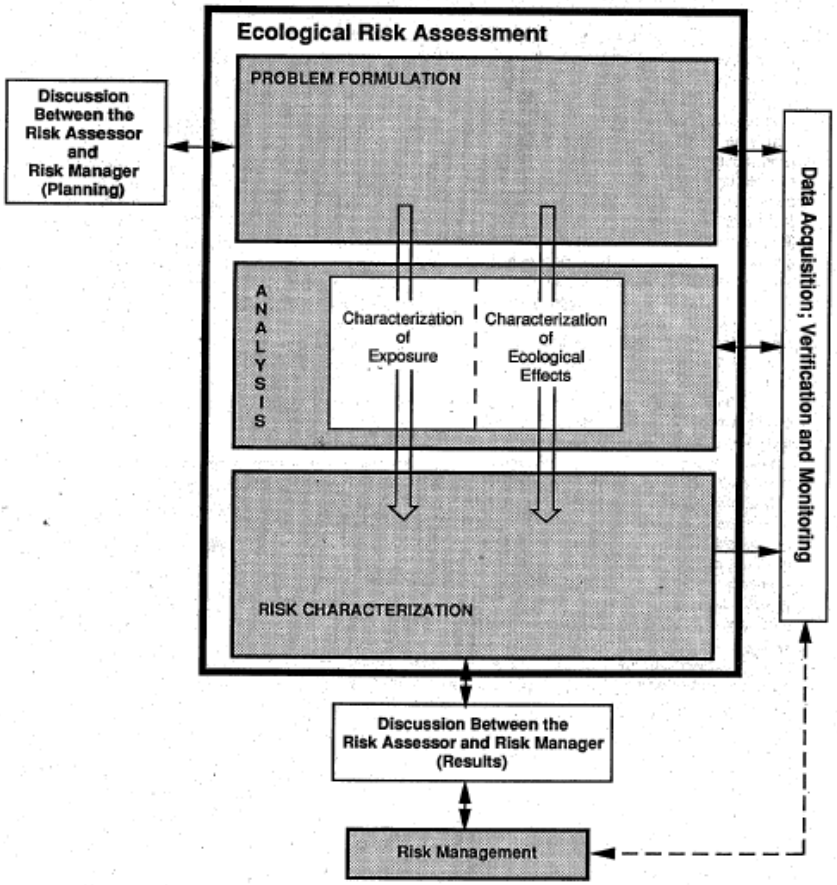


Figure 1. Framework for Ecological Risk Assessment

Major Components of Risk Assessment

Problem Formulation

- Assessment & Measurement Endpoints
- Conceptual Model
- Analysis Plan

Analysis

- Exposure
- Effects

Characterization

- Estimate Risks
- Describe Uncertainty

Aquatic Life Criteria

Aquatic Life Criteria Components

Acute: To protect ALU, dissolved Cd shall not exceed 1.8 ug/l as a 1 hour average more than once every 3 years and applied at a total hardness of 100 mg/l

- Magnitude = 1.8 ug/l
- Duration = 3 years
- Frequency = One time exposure of 1 hour

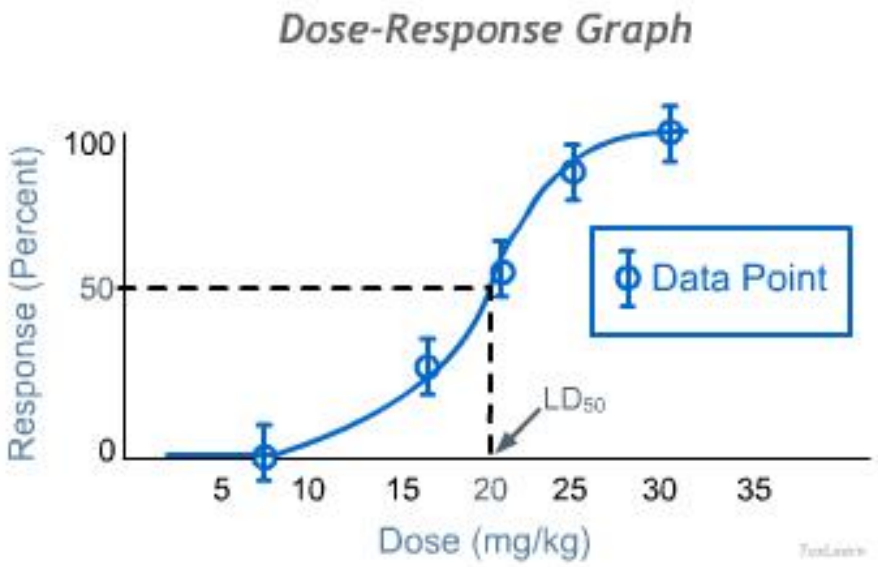
Chronic: To protect ALU, dissolved Cd shall not exceed 0.72 ug/l as a 4-day average more than once every 3 years and applied at a total hardness of 100 mg/l

- Magnitude = 0.72 ug/l
- Duration = 3 years
- Frequency = 4-day average, occurring one time

Terms to Know:

- "Magnitude" – the concentration of concern for the pollutant
- "Duration" – the time period over which the exposure to the pollutant would occur
- "Frequency"– how often the exposure would occur for the duration of concern

Dose Response Relationship



"Mg/kg" refers to the amount of the chemical in milligrams per kilogram of body weight of the subject.

http://toxlearn.nlm.nih.gov/htmlversion/module1.html#HowisDoseMeasured

Dose: The amount of a substance which an organism contacts

Response: The effect resulting from the exposure

LC50: The Lethal Concentration that results in mortality in 50% of test organisms

EC50: The Concentration that results in an observed effect in 50% of test organisms

Aquatic Life Criteria Types

Effect
- Acute
- Chronic

Water Type
- Fresh Water
- Marine Water

Criteria Form
- Water Concentration
- Tissue Concentration

An Aquatic Life Criterion is the highest instream concentration of a toxicant to which organisms can be exposed for a period of time without causing an unacceptable adverse effect.

- Acute
  - Short duration exposures.
  - Example Effect: Mortality
- Chronic
  - Longer duration or repeated exposures
  - Example Effects: Impacts on growth or reproduction

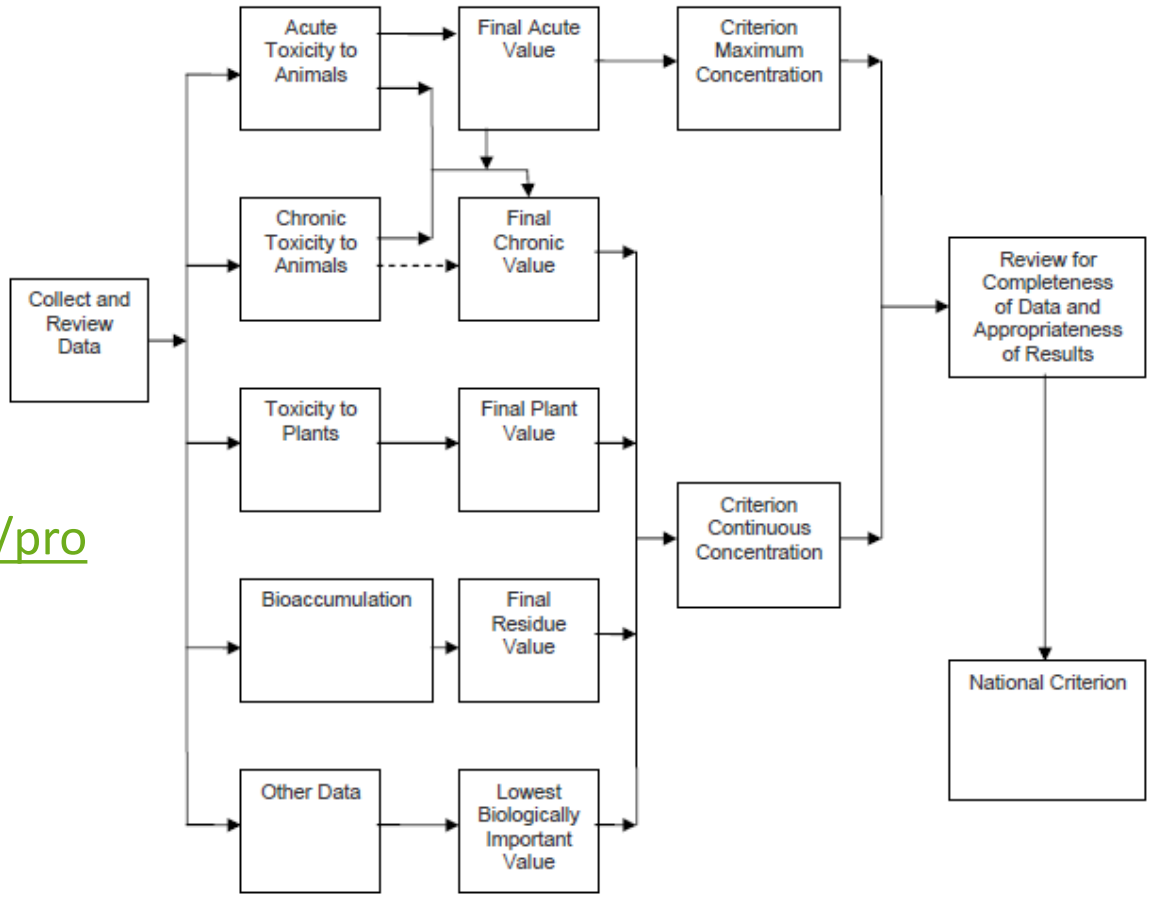
Aquatic Life Derivation Process

Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses

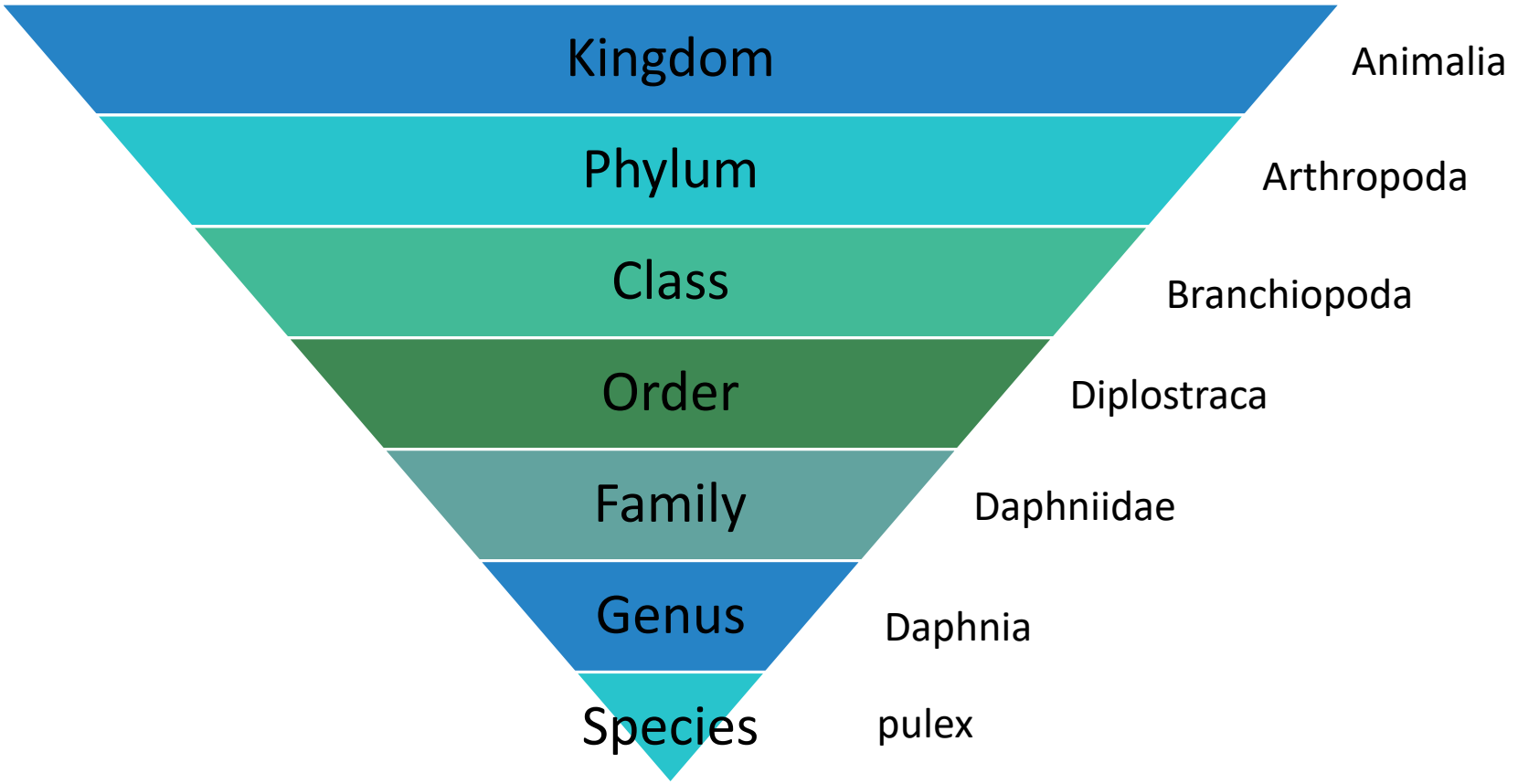
Stephen et al

PB85-227049

https://www.epa.gov/sites/production/files/2016-02/documents/guidelines-water-quality-criteria.pdf



Reminder: Taxonomic Classification System



Define Material of Concern

Identifying the Chemical for Criteria Derivation

- Each separate chemical that does not ionize substantially in surface water
  - Except possibly structurally similar organic compounds in commercial mixtures that have similar biological, chemical, physical & toxicological properties
- For chemicals that ionize, all forms that would be in chemical equilibrium
- Include definition of operational analytical component, such as total or dissolved

Gather Data

- Type of data: toxicity, bioaccumulation by aquatic animals & plants, FDA Action levels, Chronic feeding studies & long-term field studies with wildlife that consume aquatic organisms
- Quality of data: Available in published documents with sufficient supporting information to verify acceptable test procedures were used and results are reliable
- Questionable data: should not be used
- Chemical form: technical grade materials may be used if appropriate but formulated mixtures, etc. should not
- Flow through tests: may be needed for highly volatile, hydrolysable or degradable materials

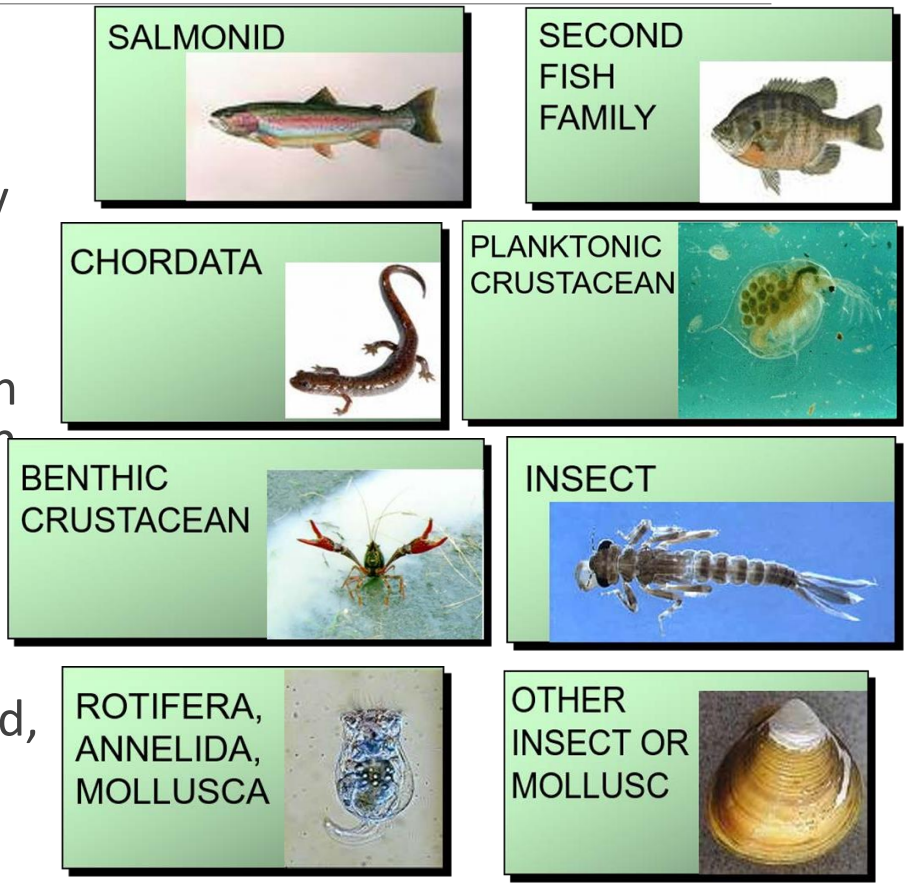
Gather Data

- Reject the following data
  - Brine shrimp, because they usually only occur naturally in water with salinity greater than 35 g/kg
  - Species that do not have reproducing wild populations in North America (EPA provides list)
  - Organisms that were previously exposed to substantial concentration of test material or other contaminants
- Any data that are rejected may be used to provide supporting information but should not be used in criteria derivation

Results of Acute & Chronic toxicity tests with representative species are the most important type of data. Data on aquatic plants are needed to a lesser degree. Bioaccumulation data for aquatic organisms only needed if relevant data are available on significant of tissue residues in aquatic organisms

Required Data

- Family Salmonidae in class Osteichthyes
- Second Family in Class Osteichthyes, preferably a commercially or recreationally important warm water species (e.g. bludegill, channel catfish, etc.)
- Third Family in Phylum Chlrdata (may be in Class Osteichthyes or may be an amphibian etc.)
- A planktonic crustacean (e.g. cladoceran, copepod, etc.)
- A benthic crustacean (e.g. ostracod, isopod, amphipod, crayfish, etc.)

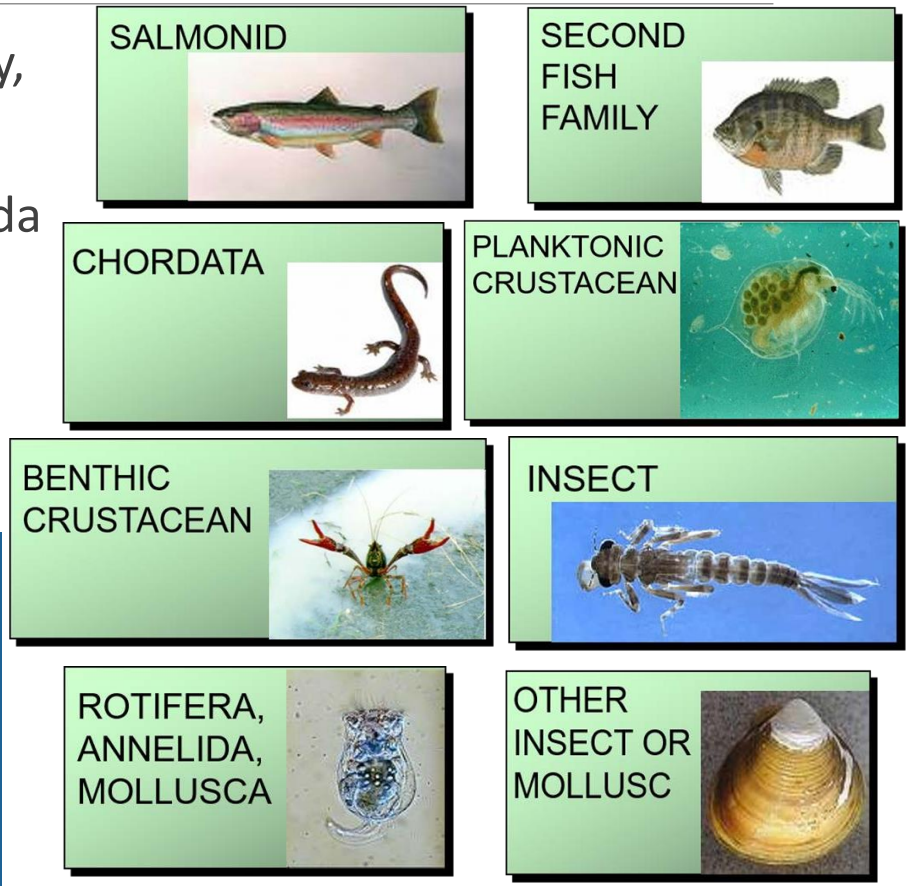


Required Data

- An Insect (e.g. mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge, etc.)
- A family in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca, etc.)
- A family in any order of insect or any phylum not already represented

Helpful website: Integrated Taxonomic Information System (ITIS). ITIS is a partnership of federal agencies to promote scientifically credible taxonomic information

https://www.itis.gov/



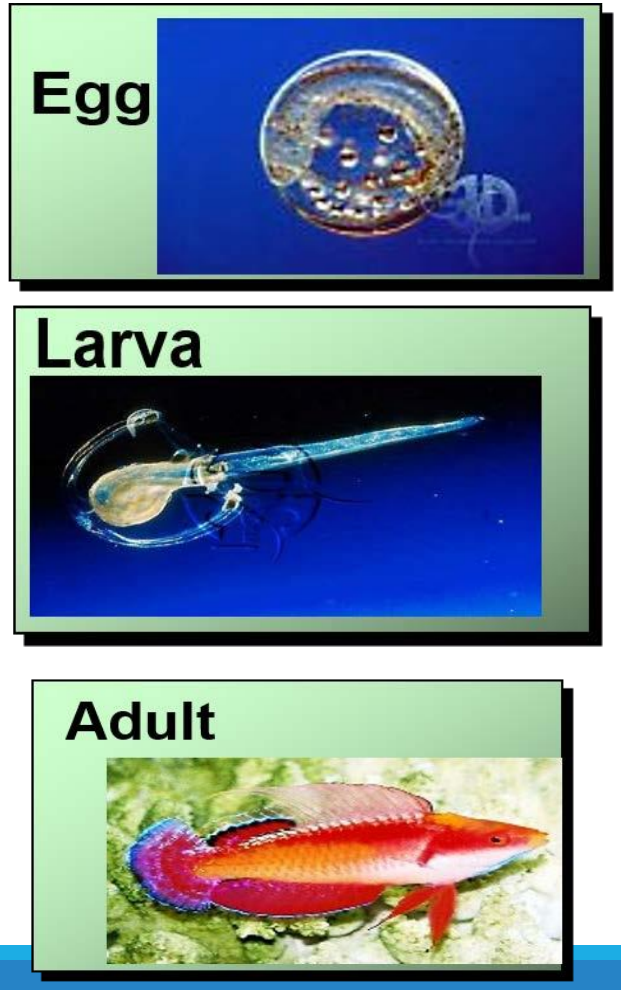
Required Data

- Acute-Chronic ratios with species in at least three different families including
  - 1 fish
  - 1 invertebrate
  - 1 acutely sensitive freshwater species
- Results of at least one acceptable test on freshwater alga or vascular plant
- At least one acceptable bioconcentration factor if maximum permissible tissue concentration is available

Data is collected from ecological toxicity database (ECOTOX, maintained by EPA). This is constantly updated, on a compound specific basis, from literature. https://cfpub.epa.gov/ecotox/

Other Data Considerations

- Use data from most sensitive life stage
- Use data from valid tests under representative conditions
- Use Acute 96 hour toxicity test results for all species except for Daphnia, for which 48 hour LC50 or EC50 values must be used



Calculating Final Acute Value

- Rank the GMAVs from high to low and assign ranks (R)
- Calculate the cumulative probability as r/(N+1)
- Select 4 GMAV with cumulative probabilities closet to 0.05 (typically 4 lowest GMAV)
- Calculate FAV:

$$S^2 = \frac{\sum((\ln GMAV)^2) - ((\sum \ln GMAV))^2 / 4}{\sum (F) - ((\sum(\sqrt{P}))^2 / 4)}$$

$$L = (\sum (\ln GMAV) - S(\sum(\sqrt{P}))) / 4$$

$$A = S(\sqrt{0.05}) + L$$

$$FAV = e^A$$

The FAV is an estimate of the concentration of material corresponding to a cumulative probability of 0.05 for acute toxicity test results.

- If the SMAV for a commercially or recreationally important species is lower than the calculated FAV, then that SMAV replaces the FAV to provide protection to that important species.
- EPA has procedures to adjust FAV for water quality characteristics that affect toxicity

Calculating Final Chronic Value

- Final Chronic Value is calculated in same manner as FAV if sufficient chronic toxicity data is available
- If sufficient chronic data is not available:
  - FCV = FAV / ACR
- Where ACR = Acute to Chronic Ratio

Calculating the Acute-Chronic Ratio

1. Acute & chronic tests using same species in same dilution water *(guidance on test matching and requirements in 1985 Guidelines)*

↓

2. Use results of tests to calculate Acute-Chronic Ratios (ACR)

$$ACR = \frac{\text{Acute Value}}{\text{Chronic Value}}$$

↓

3. Develop a Final Acute-Chronic Ratio (FACR) by taking a geometric mean of the appropriate ACRs *(3 minimum)*

Water Quality Criteria Calculation

Acute Criterion:

Criterion Maximum Concentration (CMC) = FAV/ 2

Chronic Criterion:

Criterion Continuous Concentration (CCC) = lowest of Final Chronic Value, Final Plant Value, Final Residue Value unless other data show that a lower value should be used.

Criteria are rounded to 2 significant digits

Tier 2 Criteria Protocol

- For use when a complete data set (8 minimum data requirements) is not available to derive aquatic life water quality criteria using full EPA protocol
- Overview:
  - Fulfill as many of the 8 minimum data requirements as possible
  - Calculate Secondary Acute Value as lowest GMAV multiplied by Adjustment Factor
  - Use a default ACR of 18 if other values not available
  - Use standard EPA procedures to calculate FCV and criteria

- Developed under the Great Lakes Water Quality Initiative
- Procedures in EPA Regulations at 40 CFR Part 132 Appendix A

MDR satisfied	Factor applied to lowest GMAV
1	20
2	13
3	8.6
4	6.5
5	5
6	4
7	3.6

Site-Specific Aquatic Life Criteria

States may adopt WQ Criteria that are modified to reflect site-specific conditions 40 CFR 131.11(b)(1)(ii)

Site-specific criteria developed when:

- The sensitivities of the site-specific species differ from the national data set used in the criteria document and/or
- The physical chemical characteristics of the site alter the bioavailability or toxicity of the pollutant

- Recalculation Procedure (species adjustment)
- Water Effect Ratios
- Biotic Ligand and Multiple Linear Regression Models
- Natural Background

- **Resident Species Recalculation Procedure.**
  - Takes into account differences between species used to calculate national recommended criteria and the waterbody in question.
    - Adjusts for the lack of a sensitive species (e.g., trout) that was included in national criteria calculations, but isn't found in this particular waterbody.
- **Reference water body approach.**
  - Compares the waterbody in question to a reference waterbody that may have similar physical, chemical, or biological conditions but is meeting the designated uses.
    - Used in cases where there is a natural component to the pollutant in question.
- **Site Water Chemistry Approaches.**
  - Helps make the translation of the criteria based on the differences in physical/chemical characteristics.
    - **Biotic Ligand Model.** Incorporates local water chemistry constituents into a model that predicts copper bioavailability.
    - **Water-Effect Ratio (WER).** Compares the lab water used to set the current criteria with the ambient water (e.g., water containing higher dissolved organic carbon) to set appropriate criteria.

Human Health Criteria

Human Health Criteria Types

Effect
- Nonthreshold (Cancer)
- Threshold (Non-cancer)

Exposures
- Ingestion of water and aquatic organisms
- Ingestion of aquatic organisms

Basis
- Risk based
- Organoleptic effects (taste & odor)

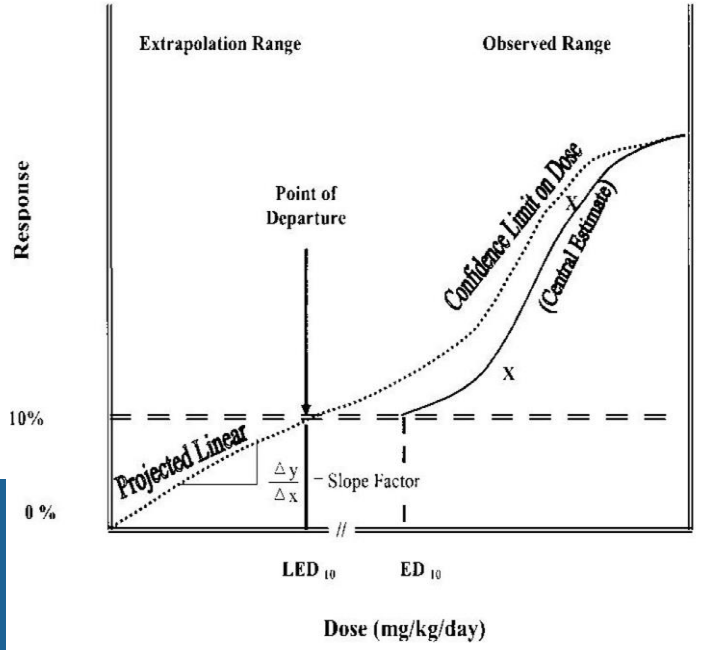
A Human Health Criterion is the highest concentration of a pollutant in water that is not expected to pose a significant risk to human health

Nonthreshold Effects

- All levels of exposure pose some probability of an adverse response
- Usually pertains to chemicals that interact with DNA
- Linear and Nonlinear Dose-Response Models Uses
- Incremental risk levels calculated
- EPA targets a risk level of 1 in 1,000,000 Excess Lifetime Cancer Risk

Excess Lifetime Cancer Risk means that if 1,000,000 people are exposed to chemical there is a statistical probability of 1 additional cancer caused by the exposure over the background cancer rate for the population

Dose-Response for Carcinogens (Linear)



Toxicity Value Terms: Cancer Slope Factor or Point of Departure

Cancer Designations

- Known human carcinogen
- Likely human carcinogen
  - Likely by all exposure routes
  - Likely at high doses but unlikely at low doses
    - Signifies a nonlinear mode of action
  - Likely by one route of exposure but unlikely for other exposure routes
- Suggestive evidence of carcinogenicity
  - In most cases the cancer dose response will not be quantified for chemicals with this designation.
- Unable to make a determination about possible carcinogenicity
- Note a likely carcinogen

Threshold Effects

- Exposures to some levels are expected not to cause an adverse affect
- There are physiological mechanisms for the body to handle the exposure which can get overwhelmed with higher concentrations or longer exposures
- Point of Departure: Exposure that is most protective of adverse impacts based on human or animal study
- Reference Dose (RfD) –

  Point of Departure / Uncertainty Factor

Point of Departure:

- Study Endpoints
  - No Observed Adverse Effect Level (NOAEL)
  - Lowest Observed Adverse Effect Level (LOAEL)
  - Benchmark Dose (BMD)
  - 95% Lower confidence bound on BMD (BMDL)
- Uncertainty Factory
  - Intraspecies
  - Interspecies
  - Study Duration
  - Use of LOAEL
  - Inadequate database

Sources of Toxicity Data

Toxicity Sources Uses to Derive National Human Health Water Quality Criteria

- EPA
  - Integrated Risk Information System (IRIS)
  - Office of Pesticide Programs
  - Office of Pollution Prevention & Toxics
  - Office of Water
  - Office of Solid Waste and Emergency Response
- U.S. Department of Health and Human Services, ATSDR
- Health Canada
- California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

In 2015 updates to HH WQS:

- EPA established a hierarchy for selection of toxicity value
- IRIS is the preferred source
- Other sources were used
  - if IRIS values were unavailable
  - If other studies were more current than IRIS
  - If chemical was a pesticide with toxicity value from registration

Bioaccumulation Factor

- Bioconcentration Factor
  - Reflects update by fish from water
- Bioaccumulation Factor
  - Reflects update by fish from all media (water, food, sediment)
- Adjusted for different trophic level fish (TL 2 -4)

$$BAF = \frac{\text{Concentration in Tissue}}{\text{Concentration in Media}}$$

- Sources of Bioaccumulation Factors
  - Field studies
  - Laboratory studies
  - Modeled based on Octanol-Water Partition Coefficient (Kow)

  Estimation Programs Interface (EPI)Suite
  https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface

Exposure Estimates

- There are two primary exposure sources of concern for deriving human health water quality criteria.
  - Direct ingestion of drinking water
  - Consumption of fish/shellfish
- These are the only sources considered for a carcinogen evaluated using a slope factor.
- Noncarcinogens and non-linear carcinogens consider other sources of exposure (e.g. foods or air through the application of the Relative Source Contribution).

Relative Source Contribution accounts for exposures from sources other than the water and fish/shellfish

Exposure Information

- Generally a lifetime.
- A mix of average values and high end values
  - 90th percentile: drinking water and fish
  - Average: body weight other exposure sources (e.g. food, air)
- Derived to protect the majority of the general population not the average consumer for media that EPA can control
- EPA Exposure Factors Handbook
- States can use state or site specific information (Usually Fish Consumption rates)

Default Exposure Assumptions:

- Body Weight: 80 Kg for avg. adult
- Drinking Water Intake: 2.4 L/day, 90th percentile, avg. adult
- Fish Intake: 0.022 kg/day, 90th percentile, avg adult
- Relative Source Contribution: 20%

When criteria is based on developmental effects, use exposure estimates for target population (women of childbearing age or children)

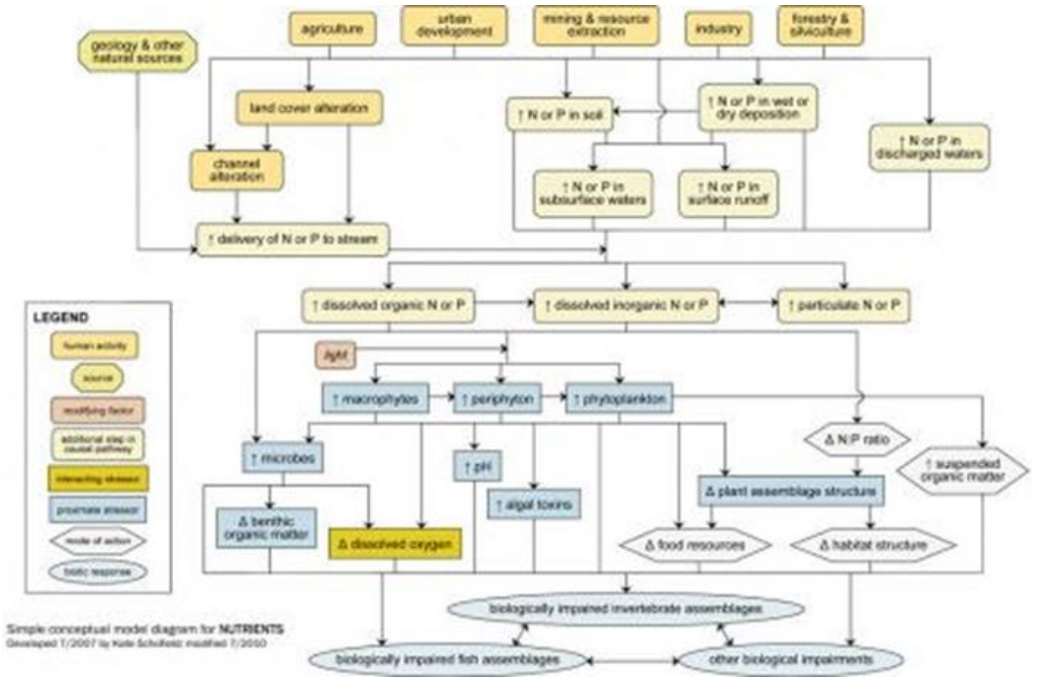
Equations for Deriving HH WQC

- Noncancer Effects: $$AWQC = RfD \cdot RSC \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \cdot BAF_i)} \right)$$
- Cancer Effects:
  - Nonlinear $$AWQC = \frac{POD}{UF} \cdot RSC \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \cdot BAF_i)} \right)$$
- Cancer Effects:
  - Linear $$AWQC = RSD \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \cdot BAF_i)} \right)$$

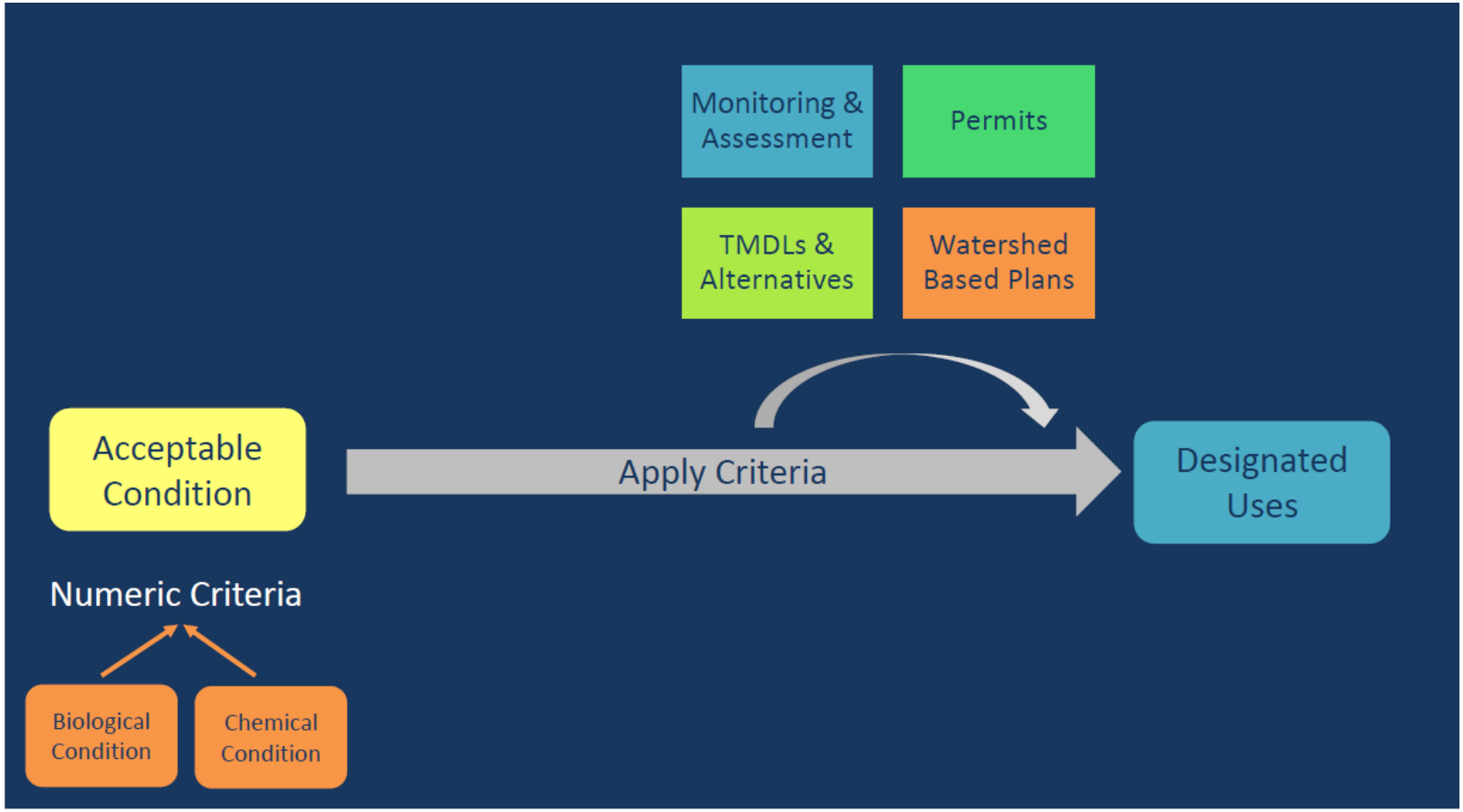
Nutrient Criteria

Nutrient Criteria

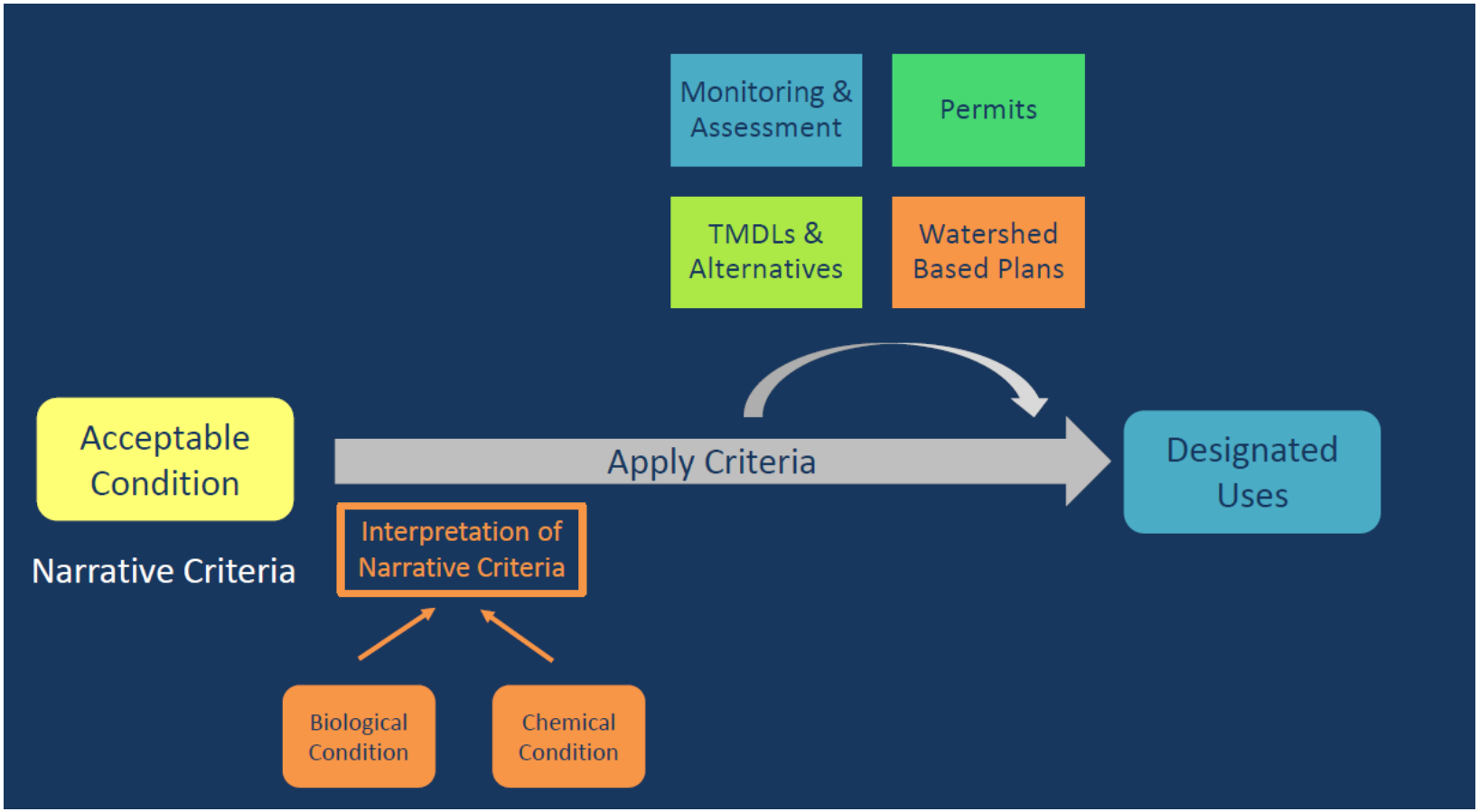
- Expressed either as narrative or numeric criteria
- EPA has a preference for numeric criteria
- Either approach must to scientifically defensible



Numeric Nutrient Criteria



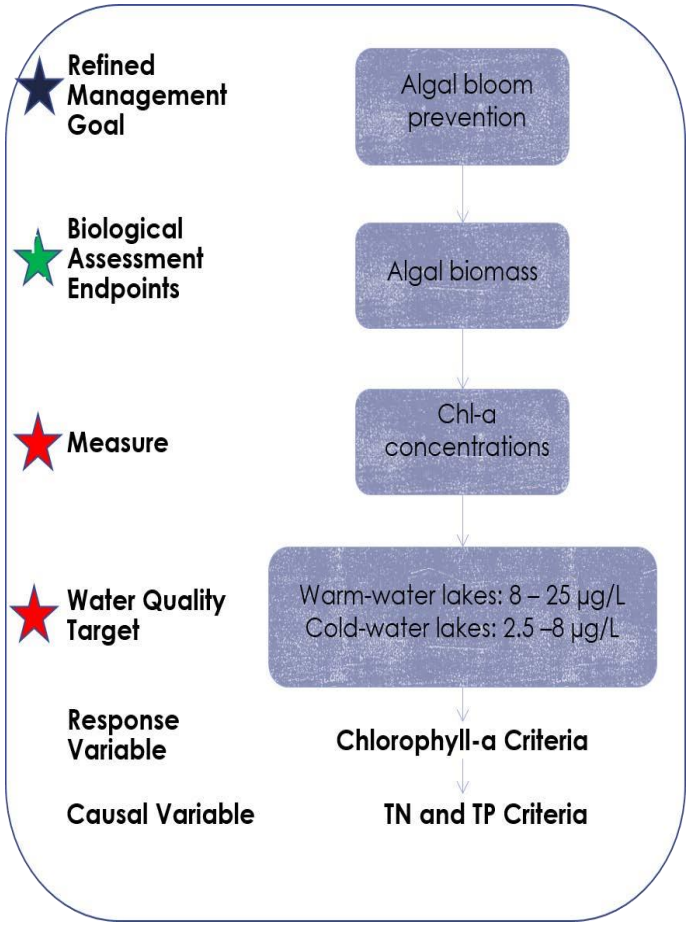
Narrative Nutrient Criteria



Deriving Numeric Nutrient Criteria

Risk Assessment Approach

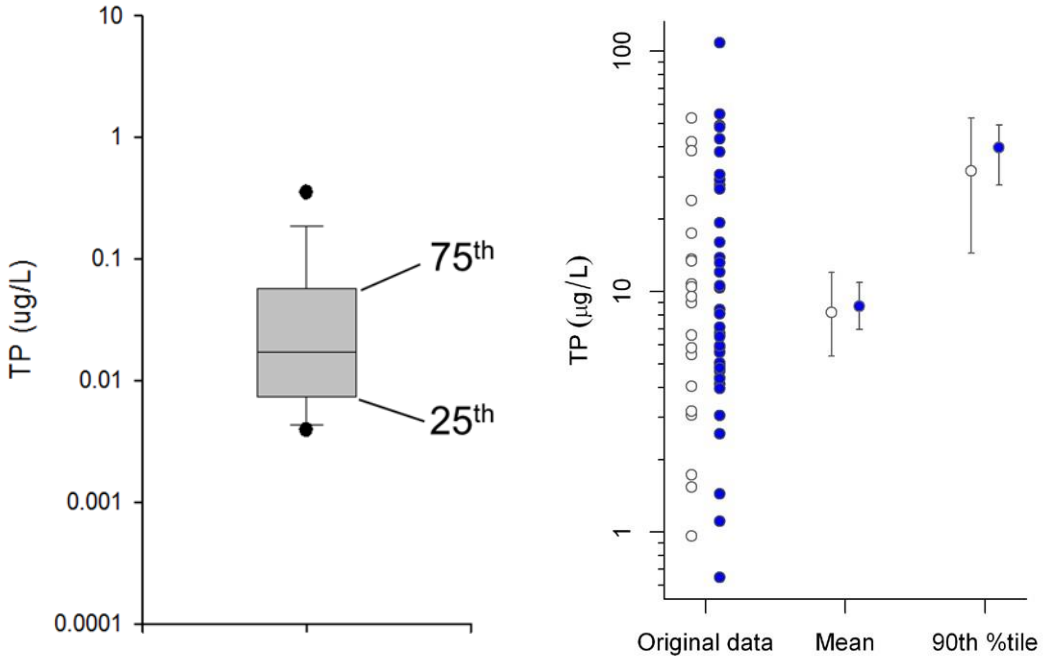
Term	Definition
Management Goal ★	Narrative criteria or statement reflective of protecting a designated use
Assessment Endpoint ★	Ecological entity and its attributes to be protected to support designated use
Measure ★	Measurable attributes of an assessment endpoint
Water Quality Target ★	Numeric value that indicates attainment of the management goal



Reference Conditions

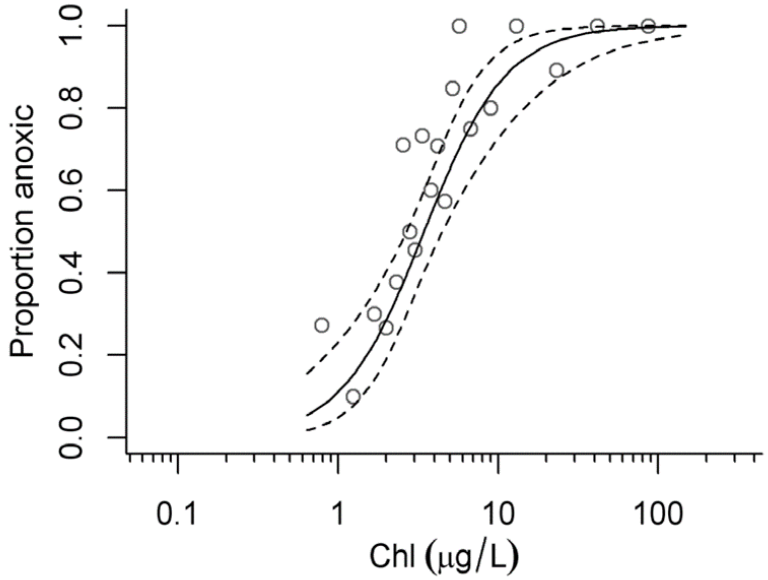
- Spatial Reference: identify Reference Waters
- Temporal Reference: Identify Reference Time Periods
- Classification: Reduce Variability

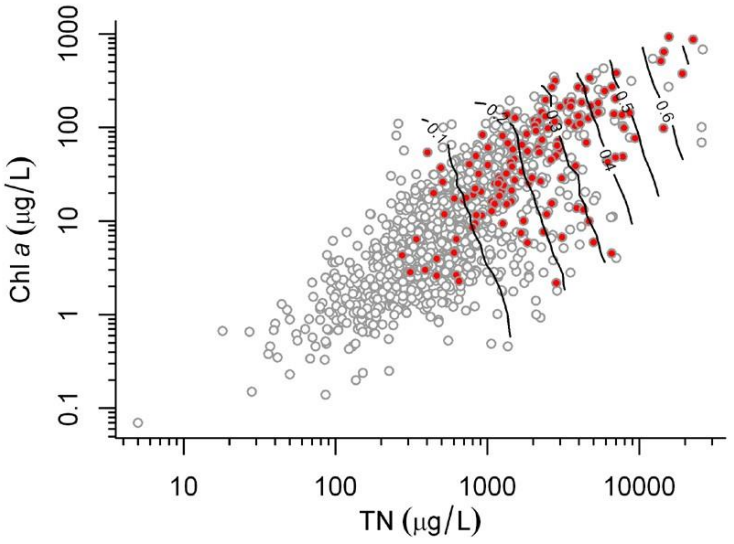
Often uses some form of statistical evaluation



Stressor Response Relationships

- Empirical models that relate stressors (nutrients) to assessment and measurement endpoints (e.g. chlorophyll a)

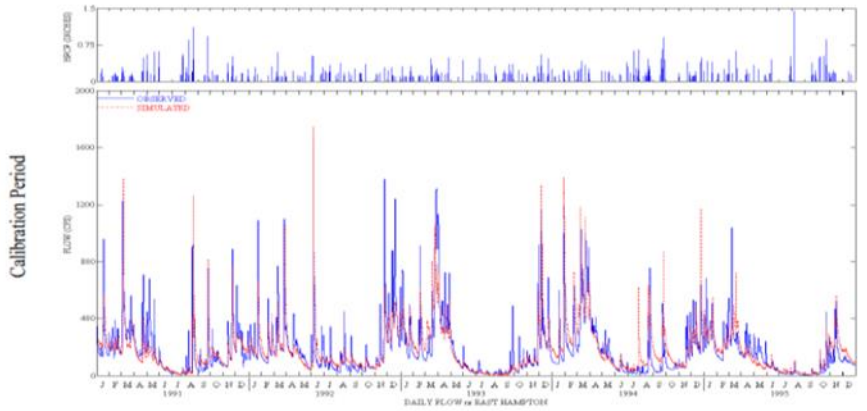




Mechanistic Models

- Models simulate water quality and hydrology
- Include ambient and source conditions
- Relate nutrient loads to water quality goals
- Extend data sets
- Develop WLA and LA
- Allows for scenario analyses
- Supports Implementation Plan Development

Figure 4.2 **Observed and Simulated Daily Flow for the Salmon River near East Hampton - Calibration and Verification.** (Top curves are Daily Precipitation)



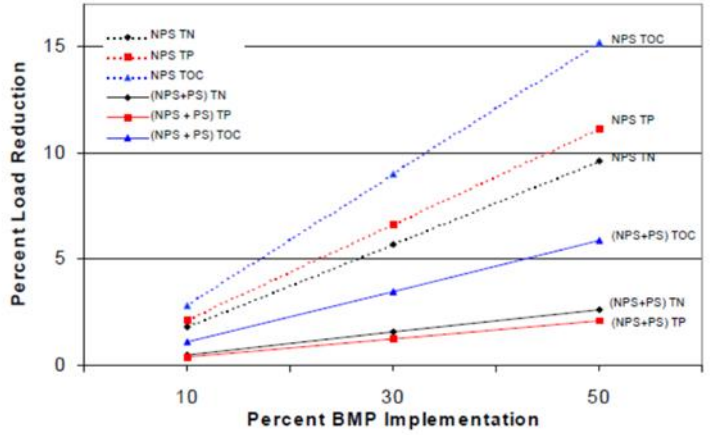
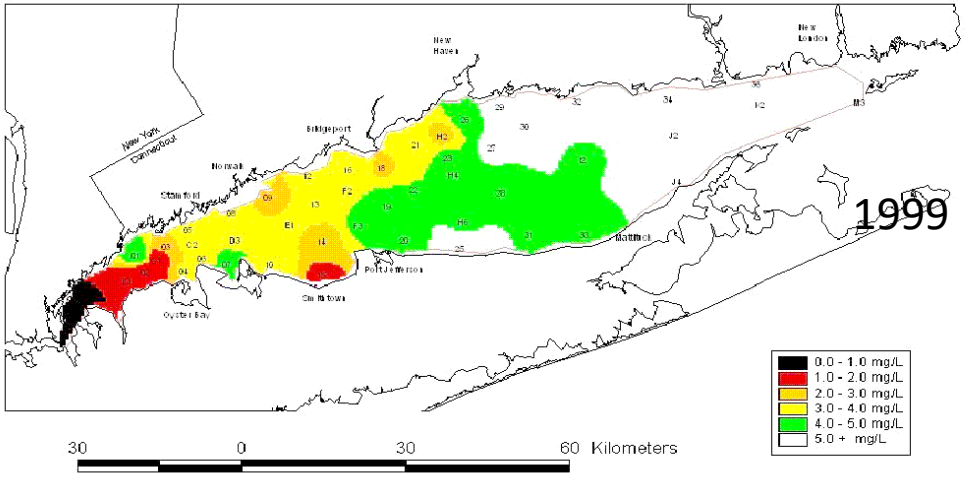


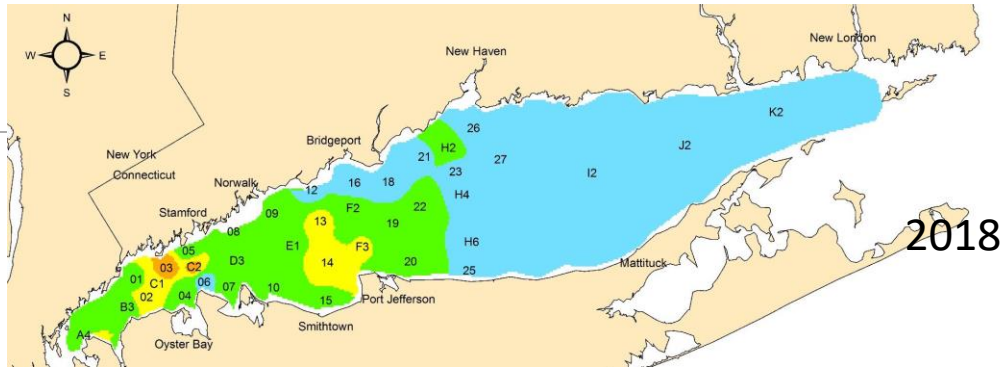
Figure 4. **Relationship Between Percent Reduction in Nonpoint Source (NPS) and Total Loads (NPS+PS) Delivered to LIS and Percent BMP Implementation on Urban and Agricultural Land**

Applying Narrative Criteria In CT

Long Island Sound TMDL
(December 2000)
Basis: WQ Model linking DO to N

Nitrogen	lbs/day
# Facilities	79
% WQB Permit	100%
Baseline	57,589
Goal	21,023
2016	17,488
2017	16,775
2018	22,246
% Reduction Achieved	67%
% Reduction Goal	63%





NPDES trading program implemented through a general permit & Nitrogen Credit Trading Board

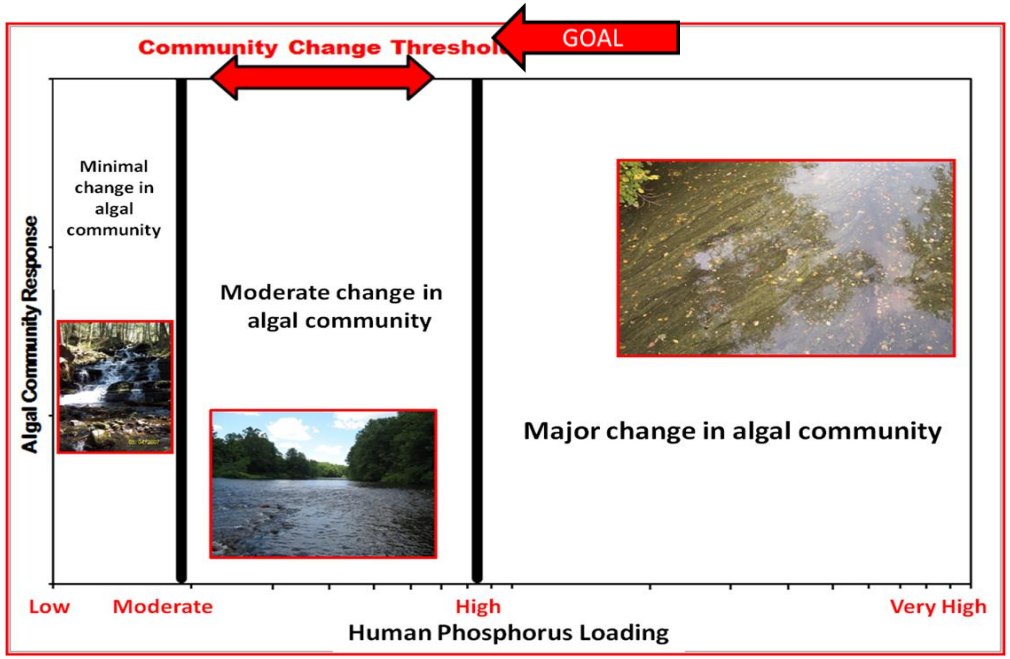
Nitrogen Control Program for Long Island Sound
www.ct.gov/deep/nitrogencontrol

Applying Narrative Criteria in CT

Phosphorus Reduction Strategy for Inland Non-Tidal Waters

(April 2014)

Basis: Relating periphyton community health to phosphorus loads



Will be developed into a TMDL Alternative

Phosphorus	lbs/day
# Facilities	45
% WQB Permit	100%
Baseline	10,531
Goal	3,611
2018	9,233
% Reduction Achieved	12%
% Reduction Goal	66%

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day)} + \text{Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

Phosphorus Reduction Strategy
www.ct.gov/deep/phosphorus

Applying Narrative Criteria in CT

2018 ASSESSMENT METHODOLOGY

LINK PHOSPHORUS CONCENTRATIONS TO PERIPHYTON COMMUNITY CONDITIONS

Measure				
AQL assessment using bugs &/or fish	IMPAIRED	IMPAIRED	SUPPORTING	IMPAIRED
TP Concentration Threshold	+	-	+	-
Inferred Diatom TP Tolerance Classification	++	--	++	++
Combined Evidence	+++	---	+++	++-
Management Outcome	***List TP as a cause***	***TP not a cause***	***Target for further study***	***Target for further study***

+++, - - -	Convincingly supports or weakens
++, - -	Strongly supports or weakens
+, -	Somewhat supports or weakens
0	No effect (neutral or ambiguous)
NE	No evidence

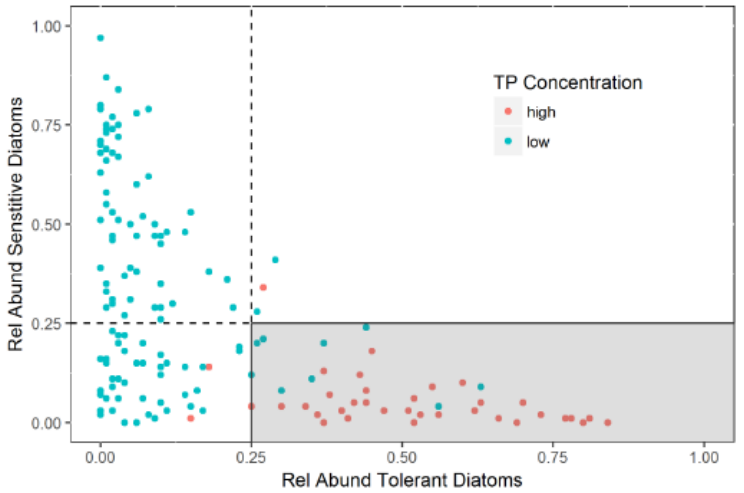


Figure 1: The grey shaded area contains sites likely to have altered conditions due to TP based on the CT diatom metrics (Becker et al 2018). These sites have >= 25% relative abundance of tolerant TP diatom species and < 25% sensitive TP diatom species, as depicted by the lines. The lines are positioned at the optimized point of separation between sites with high TP concentrations (>=0.065 mg/L) where most sensitive taxa are lost (Smucker et al 2013) and low/mid TP concentrations (<0.065 mg/L).

CT 2018 Integrated WQ Report Appendix A-5

www.ct.gov/deep/iwqr

Critieria for Pathogens

Recreational Water Quality Criteria

- Intended to be used by states to protect primary contact recreation
- Does not address secondary contact recreational uses
- Help protect against illness caused by fecal pathogens
- Exposure occurs through direct contact and incidental water ingestion during recreation
- Fecal contamination enters surface waters from point & nonpoint sources
- Bacteria such as *Enterococcus* and *Escherichia coli* are used as indicators of fecal pathogens

Basis for Criteria

- National Epidemiological and Environmental Assessment of Recreational Waters (NEEAR)
  - EPA conducted 9 epi studies between 2003 - 2010.
  - Compared rates of various symptoms (ex: gastrointestinal (GI) illness) in non-swimmers to swimmers at waters impacted by wastewater effluent.

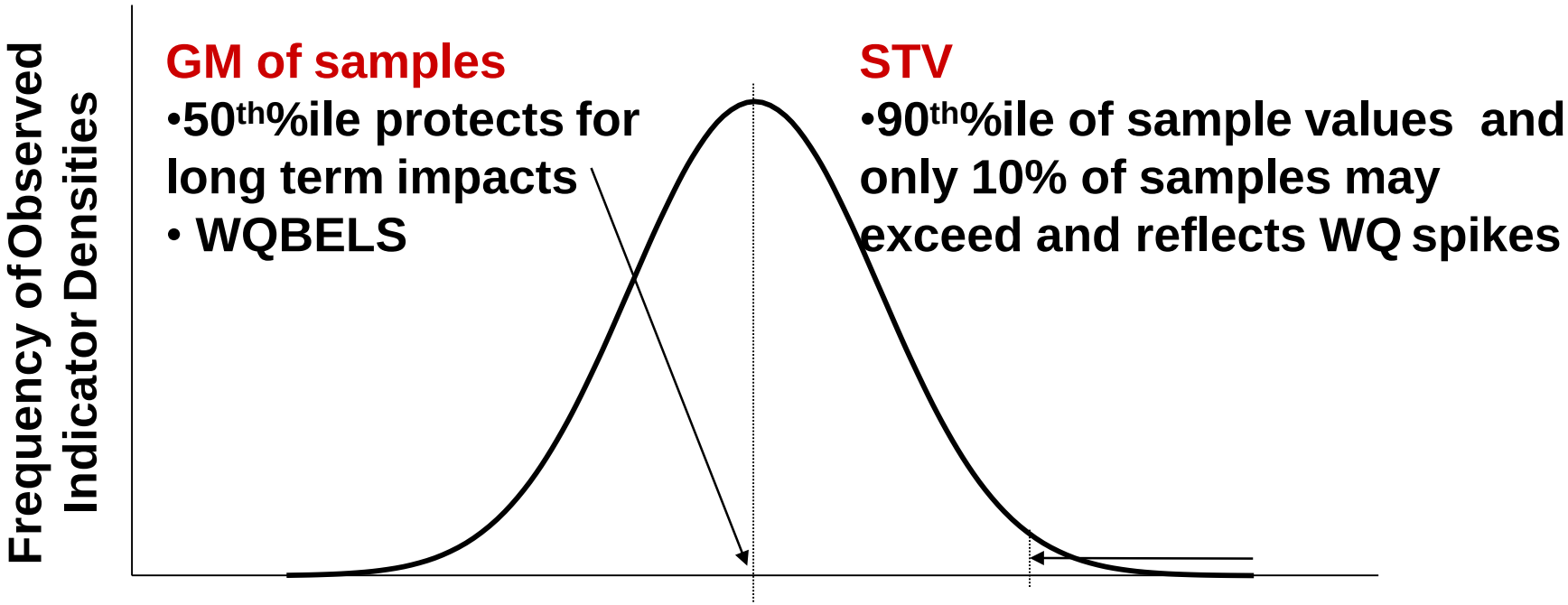
- Goal of the studies:
  - Evaluate new rapid analytical methods (for bacteria).
  - Collect health and water quality data.
    - Together, health and water quality data determine the strength of the relationship between fecal indicators and health effects (specifically GI illness).

Basis for Criteria

- Based on the results of NEEAR studies, EPA was able to update the RWQC.
- Key elements:
- Recommended culture methods:
  - Enterococci in marine and freshwaters, and *E. coli* in freshwaters.
- Recommended uniform illness rates in marine and freshwaters (previously different).
  - NEEAR marine and freshwater data sets were similar enough to combine.
- Provided a rapid method – quantitative polymerase chain reaction (qPCR) and values that correlate to the illness rates of the enteroccoci culture values.
  - New method can provide results in 4-6 hours.

Magnitude of Criteria

- *E. coli* and enterococci values derived from NEEAR studies and expressed by both a Geometric Mean (GM) and Statistical Threshold Value (STV).



Duration and Frequency

- Waterbody's GM should not be greater than the adopted, recreational WQS GM in any 30-day interval (zero exceedance) and there should not be a greater than 10% excursion frequency of the selected STV in the same 30-day interval.
- The 30-day duration with limited excursions above the STV, allows for the detection of transient fluctuations in water quality in a timely manner.
  - The 30-day duration can be either static or rolling.
- Magnitude, duration and frequency apply regardless of the number of samples within the 30-days.

2012 RWQC

Criteria Elements	Estimated Illness Rate (NGI): 36 per 1,000 primary contact recreators			Estimated Illness Rate (NGI): 32 per 1,000 primary contact recreators	
	Magnitude			Magnitude	
Indicator	GM (cfu/100 mL)[a]	STV (cfu/100 mL)[a]	OR	GM (cfu/100 mL)[a]	STV (cfu/100 mL)[a]
Enterococci – marine and fresh	35	130		30	110
OR				**OR**	
E. coli – fresh	126	410		100	320

Duration and Frequency: The waterbody GM should not be greater than the selected GM magnitude in any 30-day interval. There should not be greater than a ten percent excursion frequency of the selected STV magnitude in the same 30-day interval.

[a] EPA recommends using EPA Method 1600 (U.S. EPA, 2002a) to measure culturable enterococci, or another equivalent method that measures culturable enterococci and using EPA Method 1603 (U.S. EPA, 2002b) to measure culturable *E. coli*, or any other equivalent method that measures culturable *E. coli.*

Implementation of 2012 RWQC

- Waters designated for primary contact recreation would be protected if either set of magnitude value sets (GM and STV) are adopted into state WQS and approved by EPA.
- EPA recommends states apply their risk management decision/WQS statewide.
- EPA recommends states select the set of criteria values most appropriate for their waters based on a risk management decision regarding illness rate.
- EPA has allowed a 90- day period for application of criteria

Supplemental Elements for Enhanced Protection

- In addition to the RWQC values, the 2012 RWQC provides supplemental tools for states' consideration:
- qPCR method: RWQC provides GM and STV values for states interested in adopting the *Enterococcus* qPCR method (Method 1609) into their WQS.
  - The qPCR method allows for timely same-day beach notification (~4-6 hours).
  - EPA encourages a site-specific analysis of the method's performance prior to use.
- Beach Action Values (BAV): values for making precautionary beach notification decisions.
  - BAVs correspond to the 75th percentile of the water quality distribution of the RWQC.
  - BAVs are available for the *Enterococcus* qPCR method (rapid method).

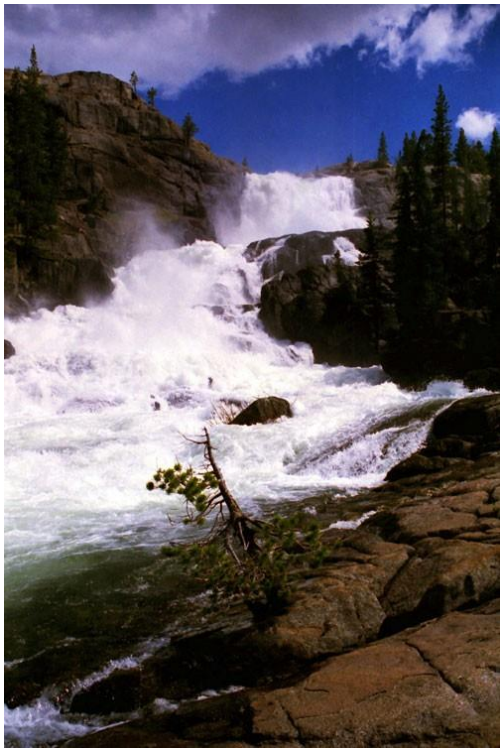
Biocriteria

Biological Criteria

- Describe the desired biological condition of surface waters for a specific aquatic life designated use.
- Based on the premise that the structure and function of an aquatic biological community within a specific type of waterbody provide critical information about the quality of surface waters.
- Usually developed based on an appropriate reference condition.
- Expressed as narrative or numeric (numeric preferred).

Biocriteria Forms

- Narrative:
  - "Waters shall be free from substances in concentrations or combinations that would adversely alter the structure and function of aquatic communities, as defined by the reference condition."
- Numeric:
  - Class I: Cool Water Aquatic Life
    - Taxa Richness: 5
    - EPT Index: 3



EPA Planned Criteria Activities in 2020

From Sept 2019 WQSMA Meeting

- Missing Parameters Document for Model-based Metals Criteria (Dec 2019)
- PFOA & PFOS: EPA working on HH and AL criteria and will share information with states
- Updated criteria for chloride / sulfate
- Metals Cooperative Research & Development Agreement
- Aquatic Life Criteria for Toxics Outreach Workshop
- Recreational Criteria for Coliphage
- Updated numeric nutrient criteria for lakes
- Biocriteria technical support
- Biosolids (including PFOA and PFOS)