Estuarine Nutrient Numeric Endpoint Coastal Stakeholder Advisory Group (Coastal SAG) Meeting

May 1, 2009, 1- 3:30 pm

Eutrophication in Estuaries: A Leading Cause of Impairment

Increased Nutrient Loads

Excessive Organic Matter

Low DO

Harmful Algal Blooms

Loss of Seagrass Beds

Impacted Beneficial Uses
(Habitat Loss, Odors, Fisheries Decline, Etc.)

Where is Effort Needed?

- Limited understanding of eutrophication in California
  - Extent and magnitude (how bad is it?)
  - What is the best way to measure it in California estuaries?
- Need tools to support regulatory and management programs
  - Science-based criteria to determine impacts
  - Tools to set limits for loading of nutrients from watershed (TMDLs)

Brief History of Nutrient Criteria Development in California

- In 1999, SWRCB staff and EPA Region IX began developing nutrient numeric endpoint (NNE) for streams and lakes (EPA 2005)
- In 2005, work began to expand NNE framework to Calif. estuaries (EPA 2007)
- In 2007, recommended work plan for NNE and TMDL tools development drafted (EPA 2008)
- In 2008, SWRCB staff initiate a project to develop estuarine NNE (E-NNE)

E-NNE Project: Long-term Goals

- To develop scientifically defensible nutrient numeric endpoints for California estuaries
- To develop TMDL tools link biologically-based endpoints with nutrient loads and other management controls.

E-NNE Work Plan Phases

- Phase 1: Stakeholder review of the conceptual framework and work plan
- Phase 2: Summarize science to support refinement of conceptual approach
- Phase 3: Develop a DO numeric endpoint.
- Phase 4: Conduct studies to develop endpoints for other biological response indicators.
- Phase 5: Develop Nutrient TMDL tools

E-NNE Work Plan Phases

- Phase 1: Stakeholder review of the conceptual framework and work plan
- Phase 2: Science to support refinement of conceptual approach
- Phase 3: Develop a DO numeric endpoint.
- Phase 4: Conduct studies to develop endpoints for other biological response indicators.
- Phase 5: Develop Nutrient TMDL tools

Project Organization

Stakeholder Advisory Group (SAG)

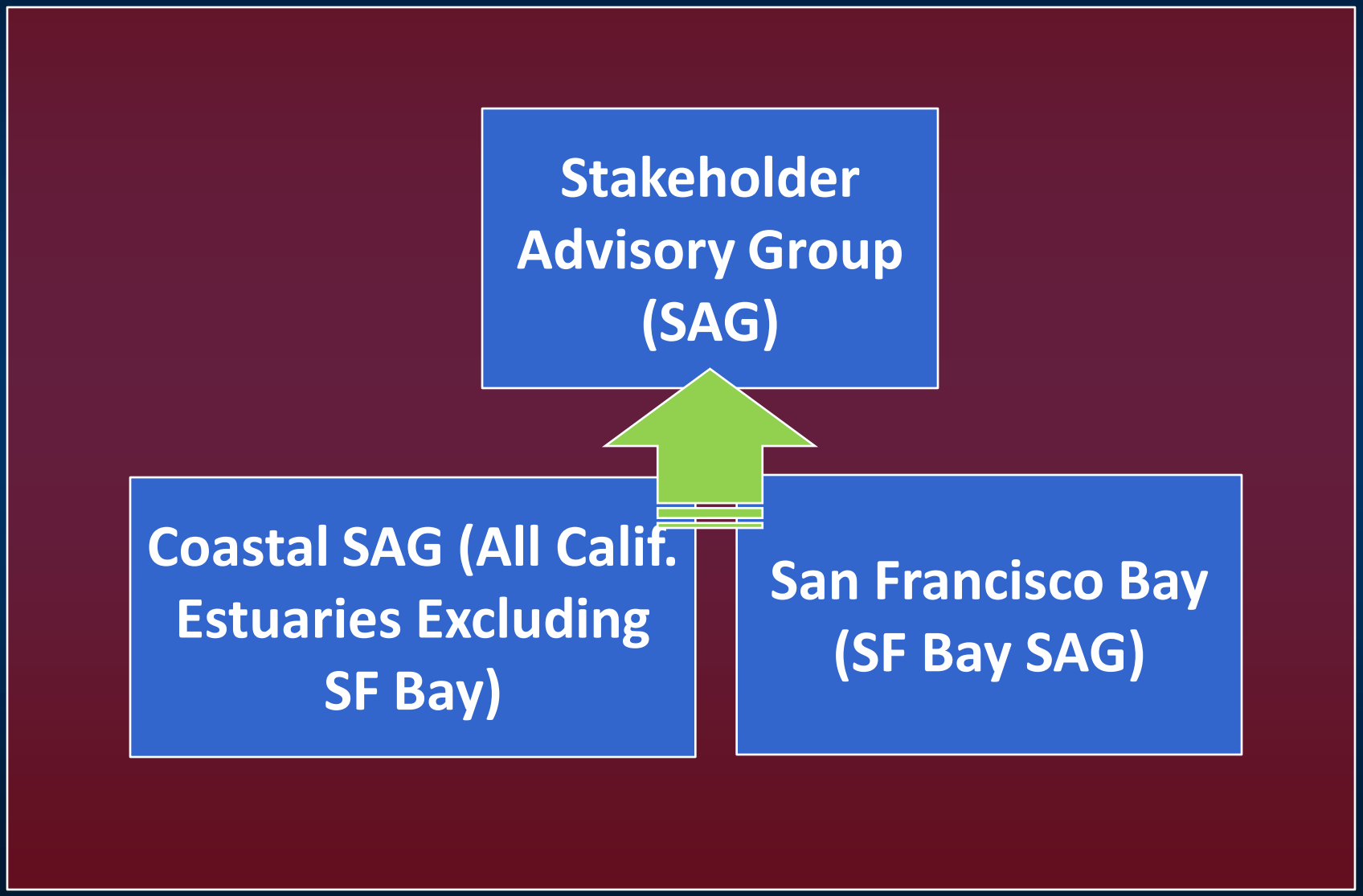
State Water Resources Control Board (SWRCB)

State & Regional Technical Advisory Group (STRTAG)

Technical Team (TT)

Science Advisory Board (SAB)

SAG Organization



Meeting Goals

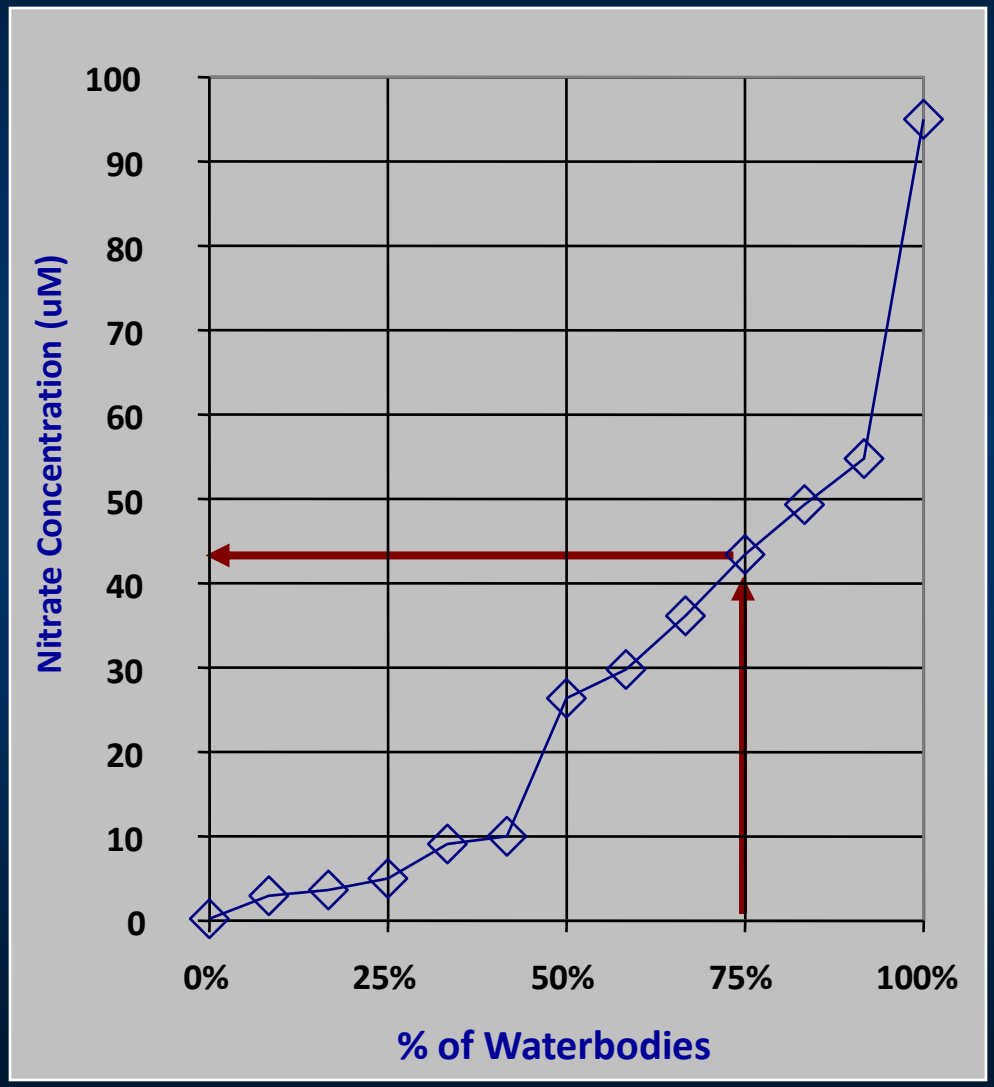
- Introduce the Estuarine NNE conceptual framework and work plan
- Discuss the role of the Coastal SAG
- Select Coastal SAG members and alternates

Meeting Agenda

- Introductions, meeting goals
- E-NNE conceptual approach, project organization, and workplan
- Coastal SAG formation (breakout groups to select members and alternates)
- Summary, dates of upcoming meetings, and next steps

Past Efforts to Develop Criteria

- National Nutrient Criteria Strategy (1998) based on distribution of ambient nutrient concentration data
- Many factors affect nutrients, so not necessarily linked to beneficial use impairment.



Alternate Approach: Nutrient Numeric Endpoints (NNE)

Based on NNE framework developed for CA streams and lakes by EPA Region IX

Estuarine Framework:

1. Biological response indicators provide a risk-based linkage to beneficial use impairment
2. Use multiple indicators in a "weight of evidence" approach
3. Classify estuaries based on similar physical and hydrological parameters

E-NNE Candidate Biological Response Indicators

- Surface Water Dissolved Oxygen
- Toxin-forming Harmful Algal Blooms (HABs)
- Macroalgal Biomass/Cover
- Phytoplankton Biomass (Chlorophyll *a*)
- Submerged Aquatic Vegetation Biomass
- Water Clarity
- Benthic infauna community structure
- Bad odor/taste/aesthetic

Effects-Based, Multi-Metric Approach Favored By Other States

Program	DO	Chlorophyll a	Water Clarity	Nutrients	SAV	Benthic Communities
Virginia Province*	X					
Chesapeake Bay*	X	X	X			
Puget Sound*	X			X	X	
Long Island Sound*	X	X		X		
Gulf of Maine*	X					
Maryland	X		X			
Delaware		X	X	X		
Texas	X	X	X	X		
North Carolina		X		X		
New Jersey	X		X		X	X
Massachusetts	X	X	X		X	X
Florida		X				
Virginia	X	X	X			

*Programs with established numeric criteria

BURC Thresholds

BURC I: beneficial uses sustained; not exhibiting nutrient impairment

BURC II: beneficial uses may be impaired; additional information and analysis required to determine the extent of impairment and whether regulatory action is warranted

BURC III: exhibiting nutrient impairment; regulatory action is warranted

Estuarine Classification

- Enclosed Embayment
- Open Embayment
- Perennially Tidal Lagoon
- Seasonally Tidal Lagoon
- Nontidal Lagoon
- Perennial River Mouth
- Seasonal Creek Mouth
- San Francisco Bay

Estimated Number of Estuaries by Class

Class	RB 1	RB 2	RB 3	RB 4	RB 8	RB 9	Total
Enclosed Embayment	2	1	1	8	2	4	18
Perennially Tidal Lagoon	4	3	5	5	3	6	26
Seasonally Tidal Lagoon	5	4	29	3	0	5	46
Nontidal Lagoon	9	3	10	2	0	7	31
Perennially Tidal River Mouth	4	0	0	6	2	6	18
Seasonally Tidal River Mouth	68	5	61	13	2	1	150
SF Estuary		1					1
Total	92	17	106	37	9	29	290

Application of Biological Response Variables to Estuarine Class

Estuary Class	Key Biological Response Variables						
	DO	Macro-algae	Water Clarity	HABs	Benthic Quality	Phyto-plankton	SAV
Enclosed Embayment	X	X	X	X	X	X	X
Perennially Tidal Lagoons	X	X	X	X	X		X
Seasonally Tidal Lagoons	X	X	X	X	X		X
Non-Tidal Lagoons	X	X	X	X	X	X	X
Open Embayments	X	X	X	X		X	X
River and Creek-mouth Estuaries	X	X		X	X	X	X
San Francisco Bay	X	X	X	X	X	X	X

Status of Existing Science to Implement E-NNE Framework

Toolkit Components:

- Numeric endpoints for each indicator
- TMDL tools linking biological response to management controls (nutrient loads, etc.)

Numeric Endpoint Development

- Shortage of monitoring data to guide endpoint development
- Status of science and amount of research required to identify endpoint varies by indicator
- Two examples

Status of Science: Dissolved Oxygen

- Physiological impacts of low DO are well documented, if not specifically for CA species

<u>Recommended Actions</u>:

- Assemble expert panel to recommend indicator species and assess applicability of existing data
- Set preliminary endpoints and define critical data gaps

Status of Science: Macroalgal Biomass

- Impacts of macroalgae on benthic infauna and seagrass beds suggested, but not well characterized.

<u>Recommended Action:</u>

- Conduct experiments to characterize impacts of macroalgal biomass on benthic infauna and seagrass

TMDL Tool Development

- TMDL tools link biological response to nutrient loads
  - Models to predict watershed loads from land-use
  - Model to link loads to estuarine response (water quality models)
- Tools developed through individual TMDLs are sometimes poor performers
  - Encumbered by lack of data
  - Regional approach more cost-effective
- Tools can help to refine endpoints

Status of Science– Watershed Loading Models

- Development of watershed loading models hampered by lack of wet weather loading data.

Recommended Actions:

- Acquire data characterizing wet weather nutrient loads from a variety of land uses.
- Develop regionally calibrated models of nutrient wet weather loading.

Summary of Existing Science

NNE Development

- DO endpoint possible with interpretation of existing literature
- Other indicators require additional studies to identify threshold of impairment

TMDL Tools

- Currently done through individual TMDLs – SLOW and poorly supported by data
- Regional approach needed to make process more cost-effective, scientifically sound

Recommendations

- Develop consistent application of definition of “estuary” and refine classification scheme
- Develop DO endpoint, based on existing science
- Conduct studies to support development of other endpoints
- Review science of eutrophication in SF Bay and develop work plan to develop NNEs
- Facilitate regional development of TMDL tools, with consistent conceptual approach statewide

E-NNE Work Plan Phases

- Phase 1: Stakeholder review of the conceptual framework and work plan
- Phase 2: Summarize science to support refinement of conceptual approach
- Phase 3: Develop a DO numeric endpoint.
- Phase 4: Conduct studies to develop endpoints for other biological response indicators.
- Phase 5: Develop Nutrient TMDL tools

Project Organization

Stakeholder Advisory Group (SAG)

State Water Resources Control Board (SWRCB)

State & Regional Technical Advisory Group (STRTAG)

Technical Team (TT)

Science Advisory Board (SAB)

State and Regional Technical Advisory Group (STRTAG)

- Role: Review science and policy and give guidance to the SWRCB on NNE development
- Composed of six RWQCBs, SWRCB and EPA Region 9

Technical Team

- Role: Synthesize available science relevant for NNE development
- Composed of experts on the ecosystem components impacted by eutrophication

Macroalgae	Submerged aquatic vegetation
Fisheries	Benthic ecology
Hydrodynamics	Phytoplankton/nekton
Biogeochemistry/water quality	

- Team composition can change as a function of focus of the particular product

Science Advisory Board

- Role: review products and recommendations of the technical team
- Composed of 3-4 nationally recognized experts in eutrophication (outside of California)
- Operate completely independent of technical team

Stakeholder Advisory Groups (SAGs)

- Role: Provide feedback to SWRCB on NNE science and policy
- Composed of members of regulated community, land owners, environmental NGOs, and interested public

E-NNE Work Plan Phases

- Phase 1: STRTAG and SAG review of the existing conceptual framework and work plan (Months 1-3)
- Phase 2: Science to refine conceptual framework (Year 1)
- Phase 3: Develop a DO numeric endpoint (Year 2)

Refining E-NNE Framework and Summary of Existing Science

- Refine estuarine classification
- Select final list of E-NNE indicators
- Detailed status of existing science for endpoint development
  - Dissolved oxygen + other finalized E-NNE indicators
- Develop work plan for San Francisco Bay

Expectations for Coastal SAG Participation

Year 1:

- 3 monthly meetings in Summer 09 to review existing conceptual framework
- Approx. quarterly meetings thereafter for updates and to review technical team products

Meeting Agenda

- Introductions, meeting goals
- E-NNE conceptual approach project organization, and workplan
- Coastal SAG formation (breakout groups to select Coastal SAG members and alternates)
- Summary and next steps

Meeting Agenda

- Introductions, meeting goals
- E-NNE conceptual approach project organization, and workplan
- Coastal SAG formation (breakout groups to select Coastal SAG members and alternates)
- Summary and next steps