Bay Planning Coalition

Dredging/LTMS and Nutrients: What are the Implications for the Bay's Future?

Wednesday, November 30, 2011
1333 Broadway, Suite 800, Oakland CA

Agenda

- Panel #1 – Bay Area Dredging: Addressing the Effects of Changing Regulations (8:05 a.m.—9:05 a.m.)
- Speaker: LTMS & Dredging (9:05 a.m. – 9:20 a.m.)
- Panel #2 – Dredging and LTMS – Can We Meet the Challenge? (9:20 a.m. – 10:20 a.m.)

Break (10:20 a.m. – 10:40 a.m.)

- Speaker: Nutrients (10:40 a.m. – 10:55 a.m.)
- Panel #3 – Nutrients – State of the Bay (10:55 a.m. – 11:55 a.m.)

Wrap-up and Closing Remarks (11:55 a.m. – 12:00 p.m.)

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Panel 1: Bay Area Dredging: Addressing the Effects of Changing Regulations

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LTMS Programmatic Consultation

2011 Consultation - covers all maintenance dredging projects

- Soft bottom habitat
- Reduce frequency of dredging
- Turbidity
- Invasive species
- Other submerged aquatic vegetation
- Contaminants
  - Bioaccumulation trigger levels
  - Residual surface (z-layer)
- Eelgrass
  - Indirect effects (250 meters)
  - Direct effects (45 meters)
- Reporting requirements

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Filbert Ct
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Bonita St
Caledonia St
Bridgeway
Bulkley Ave
Bay St
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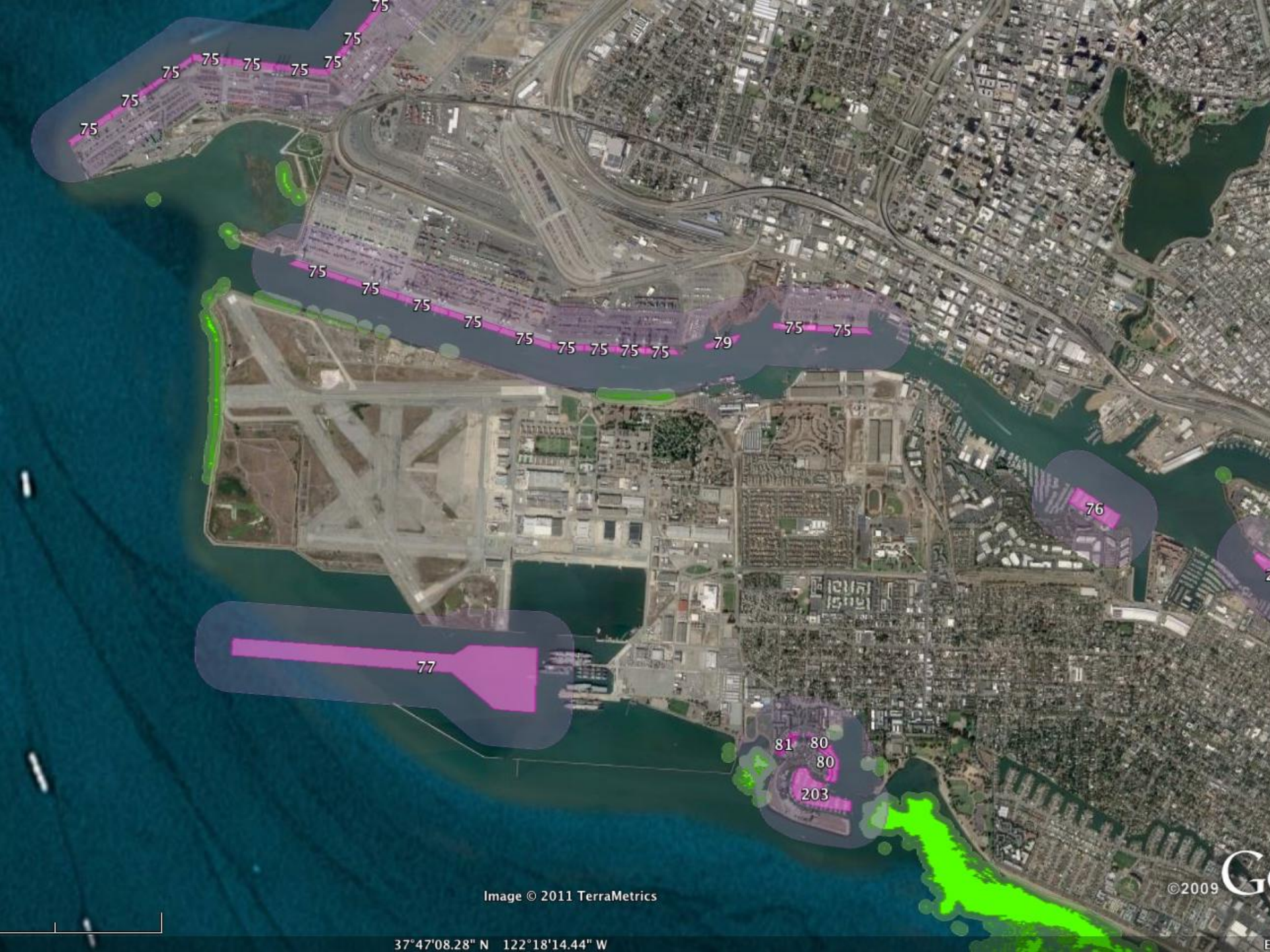
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SF Bay Mercury & PCBs TMDL Implementation for Dredging and Disposal Operations

- Mass Allocation = 0 kg/yr
- LTMS In-Bay Disposal Goal = 80% of dredged material out-of-Bay by 2013
- Compliance with LTMS = **net loss** of Hg & PCBs = Compliance with TMDLs
- Hg & PCBs concentrations in dredged material disposed in-bay must be less than 99th percentile of RMP stations from previous 10 years

LTMS Progammatic EFH Consultation Contaminant Measures

DMMO Testing Program Changes

- Worked with San Francisco Estuary Institute (SFEI) to determine "regulatory" ambient conditions for Bay sediments
- Mercury, PCB, and PAH "ambient" will be calculated annually through the SFEI Regional Monitoring Program
- Bioaccumulation triggers for in-Bay disposal for:
  - Mercury
  - PAH
  - PCB
  - DDT
  - Chlordane
  - Dieldrin
  - Dioxins
- Inclusion of "z-layer" sampling and testing where warranted
- Dredger Webpage: http://www.sfei.org/content/dmmo-ambient-sediment-conditions

San Francisco District

Briefing To Bay Planning Coalition
30 November 2011

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U.S. Army Corps of Engineers
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San Francisco District
In-Bay Navigation Projects
Napa River
Petaluma River
Mare Island
SF-9
Hamilton Wetland Restoration
Pinole Shoal
Suisun Bay Channel
New York Slough
SF-10
San Rafael Creek
Larkspur
Richmond Harbor
SF-11 Alcatraz
Oakland Harbor
San Francisco Harbor Main Ship Channel
SF-8
Ocean Beach
San Leando Marina
San Bruno Shoal
Redwood City Harbor
0 5 10 20 Miles
N
Courtesy of eCoastal GIS-San Francisco District

Current Constraints

- EFH – Eelgrass & Sediment Testing
- ESA - Environmental Dredging Work Windows
- Reduced O&M Budget
- Funding Reprogramming Difficulties
- LTMS Goals
  - Few Permitted & Accessible Upland Sites
  - Limited Contractor Competition

Panel 2: Dredging and LTMS – Can we Meet the Challenge?

Bay Planning Coalition

Final Value Engineering Study Report

http://www.spn.usace.army.mil/project_programs/documents_notices.html

Purpose: Improve District O&M Dredging Program

Participants: Corps, Regulatory Agencies, Private Industry

Results: 88 ideas ≻ 26 action items ≻ 11 critical action items

Key Findings:

- Improve/streamline contracting procedures
- Identify new in-bay beneficial reuse opportunities
- Increase use of advance maintenance dredging
- Multiple disposal sites/separate reuse contracts
- Changes to improve construction timing

Components of Dredge Pricing:

1. **Mobilization**
   - Fixed cost, higher quantities drive mob cost per yard down
2. **Daily Cost**
   - Capital cost recover (capex, recovery period, days/yr)
   - Labor, Fuel, Maint & Wear, Overheads
3. **Daily Estimated Production**
   - Unit Cost = Daily Cost / Estimated Production
   - Example ($75,000/7,500 cys)= $10/cy, 3,250 cys= $20/cy
4. **Other Factors**
   - Risks
     - Production Variation
     - Downtime Variation (mechanical, weather, ship traffic)
     - Pay Volume / Acceptance Disputes
     - Regulatory Risks
   - Market Conditions (Competition)

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Funding Sources: [three but I can only remember] Two

Civil Works ("New Works")

Maintenance Dredging: (clearing the channels)

Sources of Dredged Material (also 2)

New work dredging

Maintenance

Wetland Restoration Current Model

(Hamilton)

[Status of Project]

Is there an alternate model?

["upland" disposal sites]

Dredging and LTMS: Can we meet the challenge?

Briefing to the Bay Planning Coalition
30 November 2011

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U.S. Army Corps of Engineers
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VE Study –Implementation

- Annual Program Kick-off meeting – Jan 2012 (T)
- Develop multi-year EA for all annual projects.
- Parallel processing of sediment testing with other tasks.
- Solicitations include alternate bid schedule for contractor identified sites.
- Increase communication with contractors with annual market research and pre-solicitation conferences.
- Developing alternate methods for addressing ‘speed-bumps’.

Meeting the LTMS Step-Down

- USACE participates as a regulator and dredging proponent.
- Collaboration with sponsor, stakeholders, regulatory agencies and industry will be key.
- Participating in the LTMS 12-year Review.

Break

Bay Planning Coalition

Building an Assessment Framework to Support Nutrient Management in San Francisco Bay

Martha Sutula

So. California Coastal Water Research Project

Dave Senn

San Francisco Estuary Institute

Bay Planning Coalition Workshop

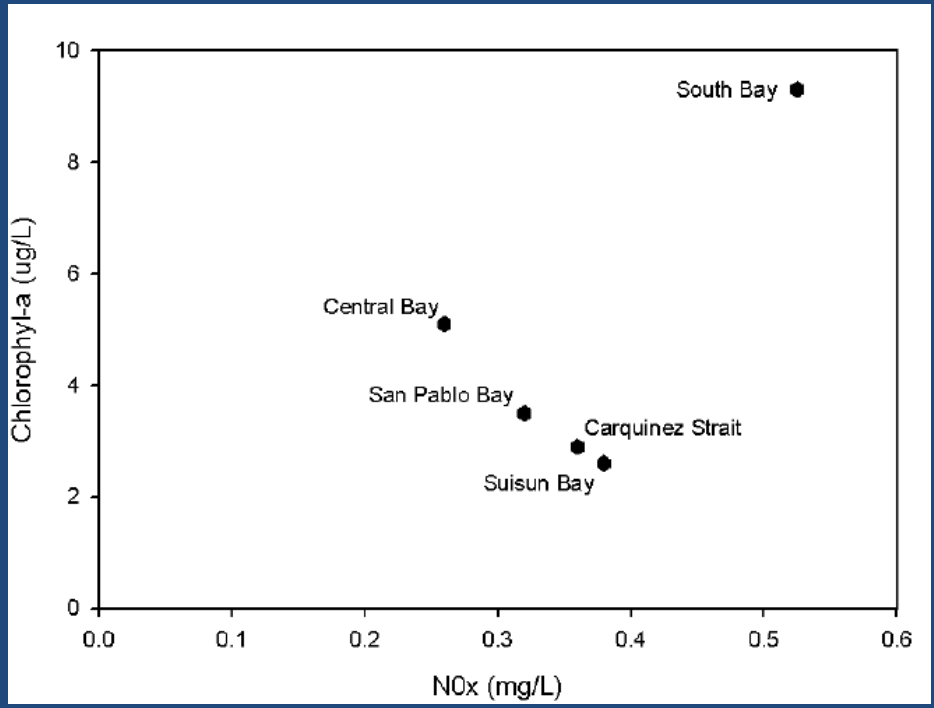
November 30, 2011

Need for A Nutrient Assessment Framework for San Francisco Bay

- Reports that SF Bay's resilience to nutrient overenrichment is decreasing
  - Significant increase in phytoplankton biomass and decreases in dissolved oxygen
- Abundance of data and synthesis of trends
  - But no framework exists to assess if Bay beneficial uses are being adversely affected by nutrient overenrichment & eutrophication
- Increased regulatory pressure from EPA to promulgate nutrient objectives
  - Lawsuit settlement requires EPA to develop nutrient criteria for Florida

Nutrient Objectives Are Scientifically Challenging

- Nutrients are required to support life
  - How much is too much?
- Direct toxicity is rarely the endpoint of interest
  - Adverse effects occur at much lower levels
- Ambient concentrations can give false positives or negatives



Mean chlorophyll-a concentrations relative to of mean nitrate+nitrite concentrations in SF Bay (1999-2009; Data Source: USGS)

EPA Guidance Suggests Three Basic Approaches to Nutrient Objectives

- Reference
  - e.g. 75th percentile of reference waterbodies
- Empirical stress-response models
  - Correlation between nutrient concentrations & response
- Mechanistic cause-effect models
  - Management endpoints are based on ecological response
  - Use model to link back to nutrient loads

SWRCB Staff Advocating Approach Focused on Cause-Effect

- Cause – effect approach has several advantages
  - Direct linkage with beneficial uses
  - More precise diagnosis of adverse effects
  - Response indicators are more integrative than nutrients
- Other approaches are problematic
  - Reference sites are unavailable for many waterbody types
  - Stress-response can have lots of unexplained variability, spurious correlation, poor precision

Tenets of California's Approach to Nutrient Objectives

- Narrative objective, with numeric guidance
  - Guidance coined as " Nutrient Numeric Endpoint or NNE"
- Diagnosis based on <u>response indicators</u> = NNE Assessment Framework
  - Assessing eutrophication et al. adverse effects of nutrients
  - <u>Multiple lines of evidence</u> for more robust diagnosis

Algae and Aquatic Plants

Dissolved Oxygen, pH

Tenets of California's Approach to Nutrient Objectives

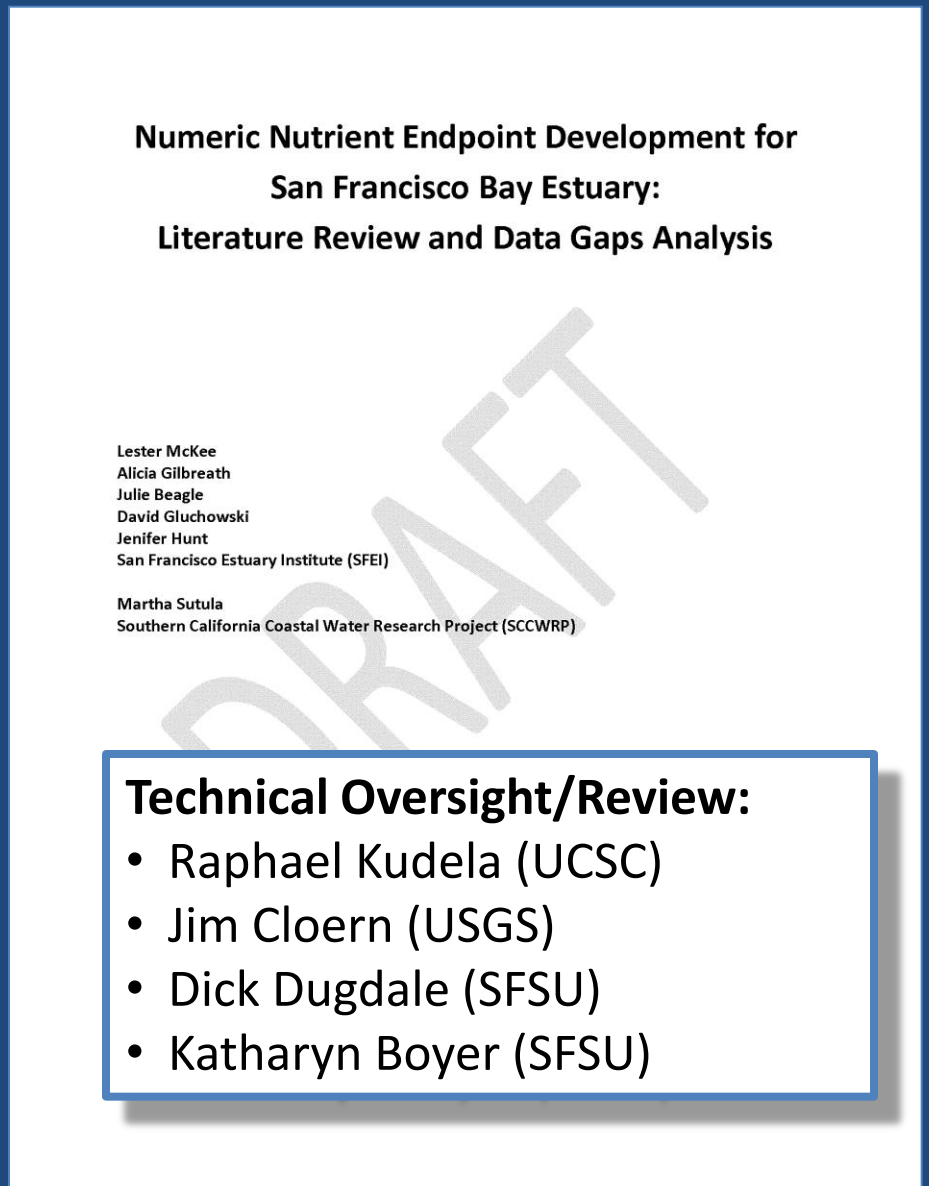
- Narrative objective, with numeric guidance
  - Guidance coined as " Nutrient Numeric Endpoint or NNE"
- Diagnosis based on response indicators = Assessment Framework
  - Assessing eutrophication et al. adverse effects of nutrients
  - Multiple lines of evidence for more robust diagnosis
- Models to link response indicators to nutrients et al. factors (e.g. hydrology, climate, etc.)
  - Can be empirical or dynamic simulation models
  - Nutrient loads rather than ambient concentration
  - Referred to as "load-response models"

Status of NNE Development by California Waterbody Type

- Lakes and streams
  - Assessment framework and models are drafted
  - CEQA scoping and policy development has begun
- Estuaries
  - Under development statewide
  - SF Bay &Delta will need to have a unique nutrient management strategy and assessment framework

Development of the NNE For SF Bay: Literature Review and Data Gaps Analysis

- Recommends a suite of indicators to assess eutrophication/nutrient overenrichment
- Assesses data availability and status/ trends in eutrophication using these indicators
- Evaluates data available to assess nutrient loads
- Summarizes data gaps and recommended next steps



Numeric Nutrient Endpoint Development for San Francisco Bay Estuary: Literature Review and Data Gaps Analysis

Lester McKee
Alicia Gilbreath
Julie Beagle
David Gluchowski
Jenifer Hunt
San Francisco Estuary Institute (SFEI)

Martha Sutula
Southern California Coastal Water Research Project (SCCWRP)

DRAFT

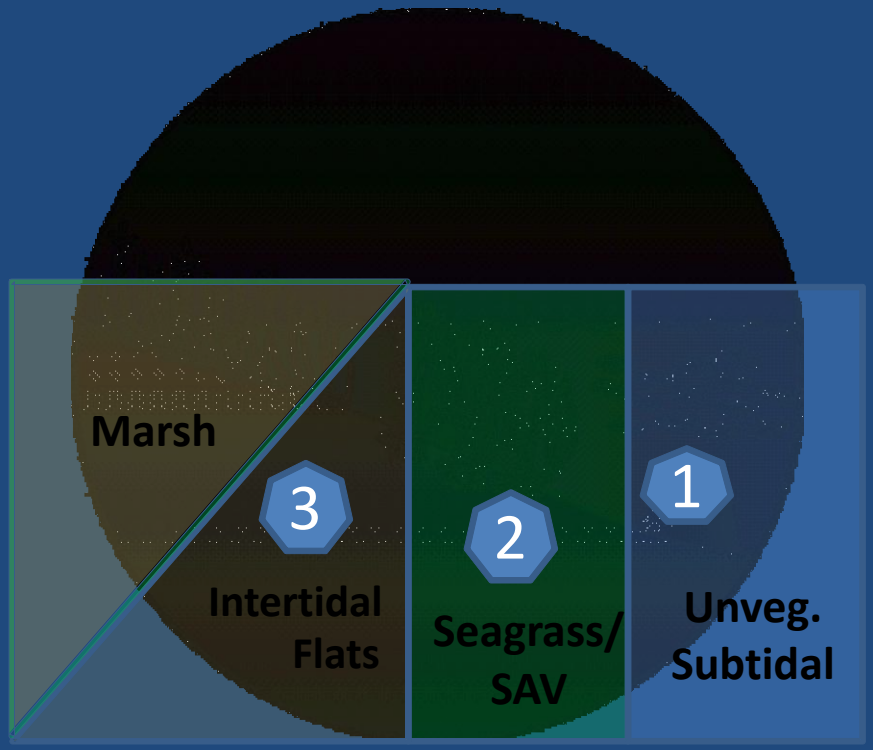
Technical Oversight/Review:

- Raphael Kudela (UCSC)
- Jim Cloern (USGS)
- Dick Dugdale (SFSU)
- Katharyn Boyer (SFSU)

Evaluation of Candidate Response Indicators

- Evaluated candidate indicators vis-à-vis review criteria
  - Clear link to beneficial uses
  - Predictive model to link to nutrients
  - Scientifically sound & practical measure
  - Reliably use to diagnose eutrophication (signal: noise acceptable)
- Reviewed studies to establish thresholds
  - Identifies data gaps and next steps

Habitat Types Considered in SF Bay NNE Framework



Include:

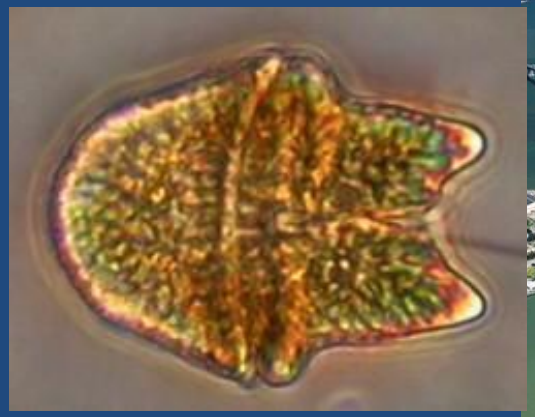
- Intertidal flats
- Seagrass et al. submerged aquatic vegetation
- Unvegetated subtidal

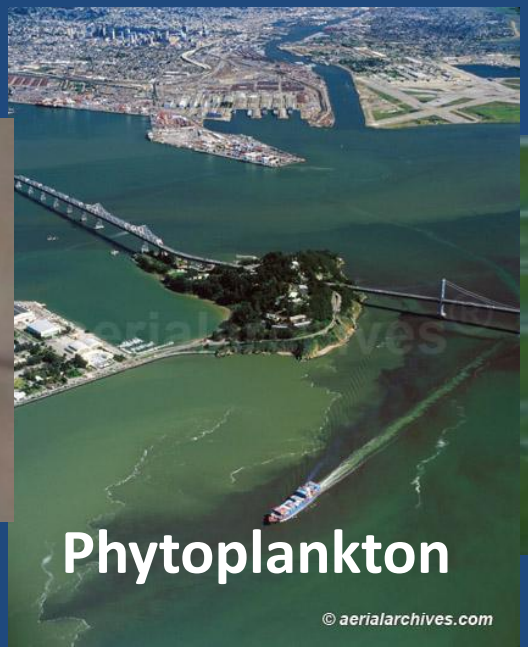
Exclude:

- Emergent marsh

Recommended Indicators : Subtidal Habitat

Primary Indicators	Secondary Indicators
Phytoplankton Biomass, Productivity, and Taxonomic Composition Cyanobacteria cell counts and toxin concentration Dissolved oxygen	Water column nutrient concentrations a and forms (e.g. ammonium) Other HAB species cell counts and toxin concentrations





Recommended Indicators: Other Habitat Types

All Subtidal	Intertidal Flats and Shallow Subtidal	Seagrass
Dissolved oxygen Phytoplankton Biomass and Assemblage Harmful algal species cell counts & toxin conc. -- Cyanobacteria	Macroalgal Biomass and Cover	Phytoplankton Biomass Macroalgal Biomass and Cover Light attenuation Epiphyte load

Literature Review and Data Gaps Analysis: Recommended Next Steps

- Create a SF Bay assessment framework
  - Initially focused on subtidal habitat
- Develop & validate load-response models
  - Establish nutrient loads that estuary can sustainably assimilate
  - Explore efficacy of management scenarios and influence of factors outside of human control
- Develop & implement a nutrients monitoring program
  - Regular NNE assessments of SF Bay and linkage with Delta
  - Develop & validate models
- Coordinate SF Bay nutrient strategy with Delta management

What Happens Next? Thoughts on Process

- Consensus on a nutrient management strategy over next 6 months
  - Identify 10-20 yr vision
  - Establishes 5-yr goals, objectives, tasks & timing
  - Identifies key cooperating institutions, roles and funding sources
- Find funding for high priority activities
  - Develop broad conceptual models of linkage between load, response and beneficial uses
  - Develop assessment framework
  - Develop elements monitoring program
  - Develop modeling strategy, plus simple box models of Bay load-response

NNE Provides Scientifically-Valid and Flexible Framework for Nutrient Management in SF Bay

- Scientifically –valid
  - Superior to approach based on ambient nutrient concentrations
  - Stronger linkage to beneficial uses
- Flexible approach, adaptable to ecology and management culture of SF Bay
  - But scientifically -consistent statewide
- Acknowledges uncertainty in science of nutrient management
  - Recognizes the need for adaptive management

Panel 3: Nutrients: State of the Bay

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Managing Nutrients In San Francisco Bay

Water Board
Nutrient Numeric Endpoint (NNE)
(Management/Regulatory)
Indicators linked to Objectives

Suisun Bay Study
Ammonia Effects
Primary Production
Inhibition

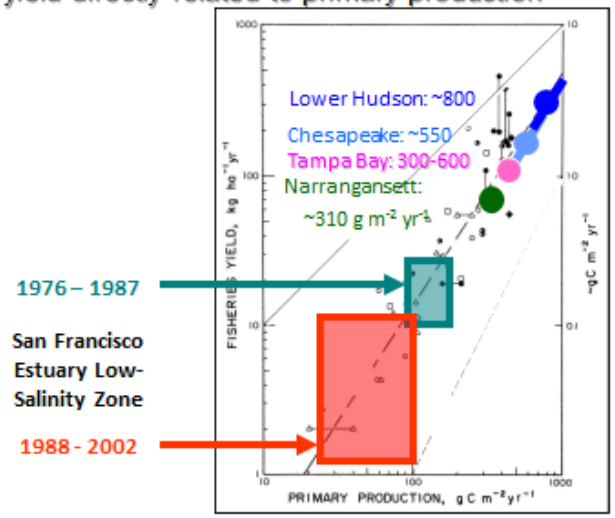
Regional Nutrient Strategy

BACWA
Control Actions
Management
Scenarios

Regional Monitoring Program
Monitoring Program
Conceptual models

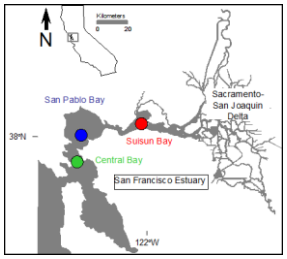
Other Partners/Projects
IEP, USGS
e.g., microcystis, studies

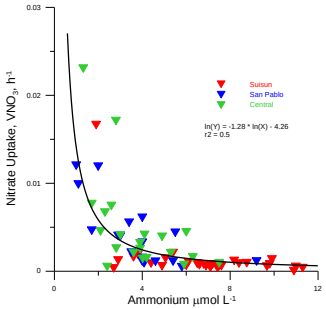
Biological Relevance - primary productivity is the foundation of a healthy estuary:
Fishery yield directly related to primary production

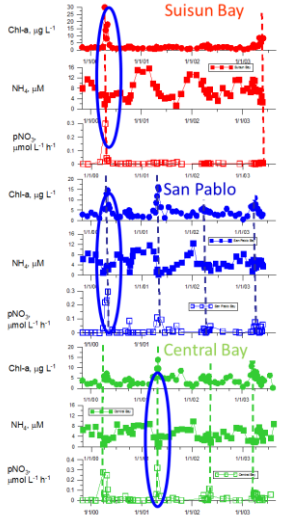


From Nixon 1988

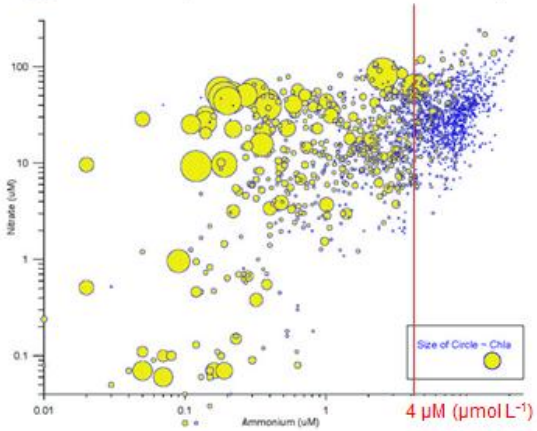
Chlorophyll increases occur when ammonium is low and results from nitrate uptake by the phytoplankton



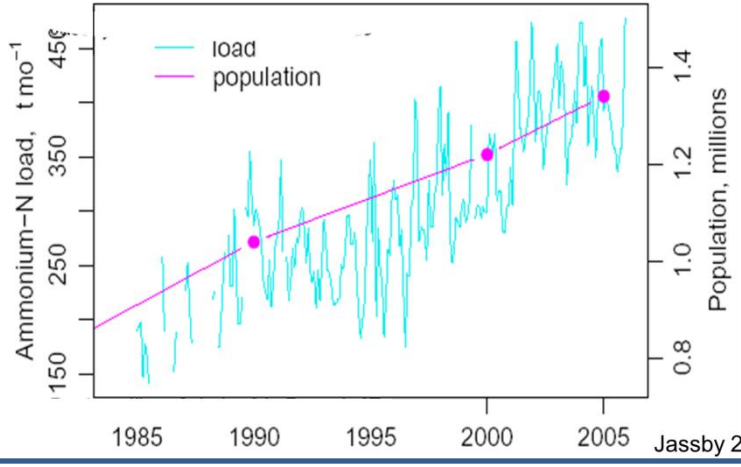




Cloern data for SFE – more algae (chlorophyll: bigger circles) with less ammonium (NH_4)



Ammonium loading has increased into Sacramento River along with population



Jassby 2008

Nutrients in Lake Mead

- Issue: Clarity v. fish productivity
- Success
  - Chlorophyll levels attained
- Advice: Keep your eyes on the goal
  - Lower chlorophyll, skinny fish
- Be careful about stormwater loading
- Spend money up front
- What can lawyers do?

SFB Nutrients – Is the Sky Falling?

- Nine County Bay Area Population and Wastewater Nutrient Loading Doubled from 1960 – 2010
- Bay Nutrient (N) Concentrations ~ Unchanged
- No Chronic Fish Kills, Low Dissolved Oxygen, or Harmful Algal Blooms
- Phytoplankton Concentrations Low; but Increasing
- Multiple Control Factors Other than Nutrients
  - Strong tides and mixing (residence time)
  - High turbidity from sediments (light attenuation)
  - Grazing by clams (but predation on clams)
  - Five bay segments respond differently
- Nutrient Strategy versus Nutrient Removal

Nutrient Limits – The Cost and Unintended Consequences

- Technical feasibility
- Factors that influence unit cost of removal
- Costs can vary widely
  - Capital: $2-10/gpd
  - O&M: $250-880/mg treated
- Impacts
  - less solids production
  - operational problems (foaming)
  - formation of undesirable by-products
  - increased greenhouse gas production
  - improved trace organics and heavy metal removal
  - potential for nutrient harvesting

Science and Policy Demand a New Approach for Bay Nutrient Management

- New Understanding of Bay Requires New Management Strategies
- Major Sources of Nutrients to Bay Have Quite Different Management Options that Need Careful Integration
- Nutrient Loading is One of Many Challenges Facing Wastewater Managers in Next Decade
- Changing Understanding, Multiple Sources, and Competing Priorities Require a Nutrient Management Strategy Like "Flexible Permitting"

Mike Connor
East Bay Dischargers Authority

Wrap-up & Closing Remarks

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