

# Nutrients Assessment Framework – Status Update

Naomi Feger

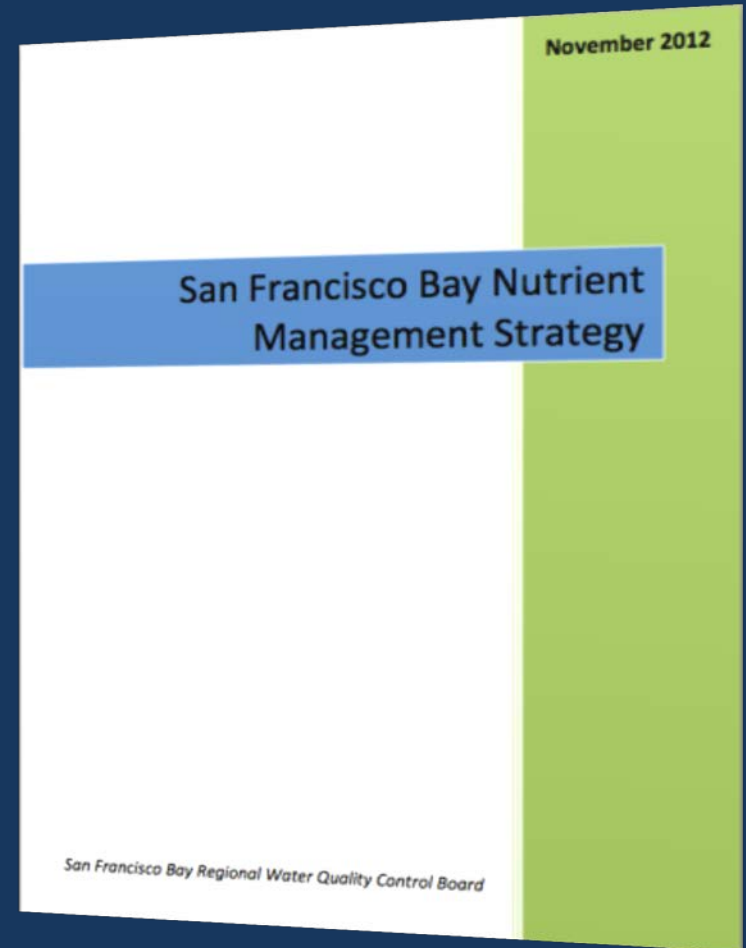
Chief Planning & TMDLs Division  
San Francisco Bay Water Board

June 12, 2015



# SF Bay Nutrient Strategy

- Element 4 – Establish Guidelines
- Nutrient Assessment Framework
- Review DO objectives



# What Is An Assessment Framework?

A decision support tool to assess and classify Bay segments by status of eutrophication and other adverse effects of nutrient overenrichment

- Condition assessment i.e., assess risk of impairment
- Provides management targets for use in modelling to determining “allowable loads”



# Assessment Framework

## Technical Team Members

### Experts in assessment frameworks and criteria:

- Suzanne Bricker, NOAA
- Larry Harding, UCLA
- James Hagy, EPA-ORD

### Local experts:

- James Cloern, USGS
- Richard Dugdale, SFSU
- Raphael Kudela, UC Santa Cruz
- Mine Berg, AMS

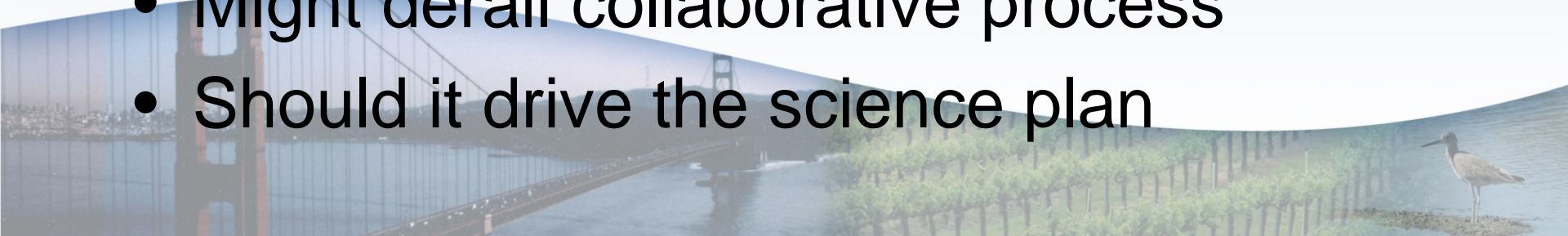
### Management Team:

- Naomi Feger, SF Water Board
- David Senn, SFEI
- Martha Sutula, SCCWRP



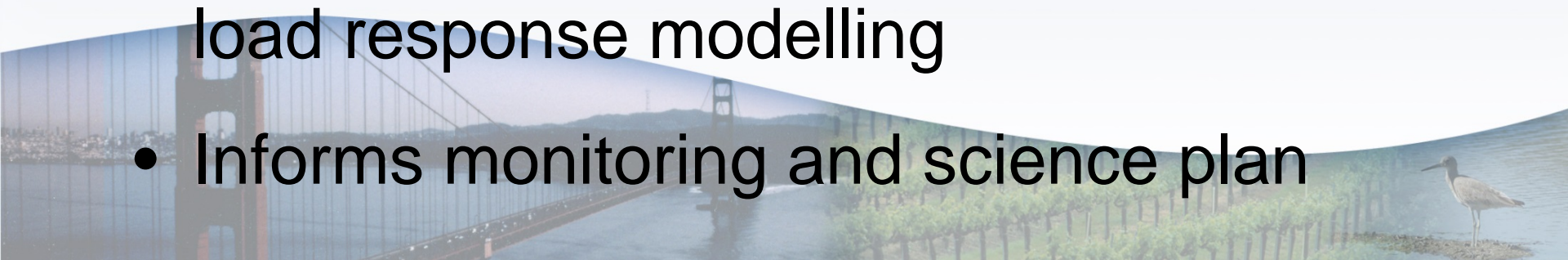
# Assessment Framework Stakeholder Concerns

- Not enough opportunity to comment on approach
- Any number proposed becomes a regulatory number
- Why focus on chla, rather than DO, HABs toxins, fish abundance
- Might derail collaborative process
- Should it drive the science plan



# Water Board Perspective

- Assessment framework not complete
- Assessment framework  $\neq$  permit limits
- Chlorophyll a - linkage to nutrients
- Confirms current condition assessment
- Need for future condition scenarios and load response modelling
- Informs monitoring and science plan



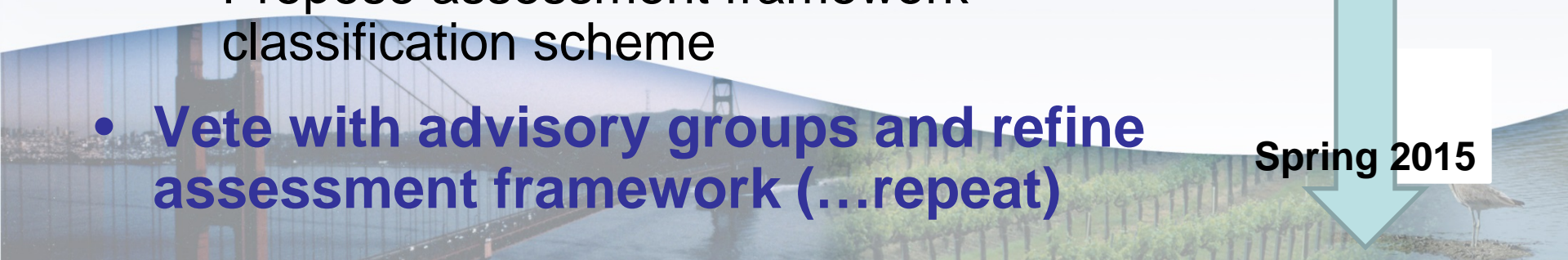
# Assessment Framework Development

- **Begin with conceptual models**
  - Review available approaches in white paper
- **Develop assessment framework with experts**
  - Develop assessment framework core principles
  - Conduct analyses to support discussion of classification boundaries
  - Propose assessment framework classification scheme
- **Vete with advisory groups and refine assessment framework (...repeat)**

Fall 2013

Spring 2014

Spring 2015



# Assessment Framework Core Principles

- Define geographic scope, habitats included, Bay segmentation
- Identify assessment framework metrics and specify how to measure them
- Define how metrics link to impairment of beneficial uses
- Define temporal and spatial elements of assessment framework
- Inform a “proto-monitoring program” required to support regular assessments of the Bay

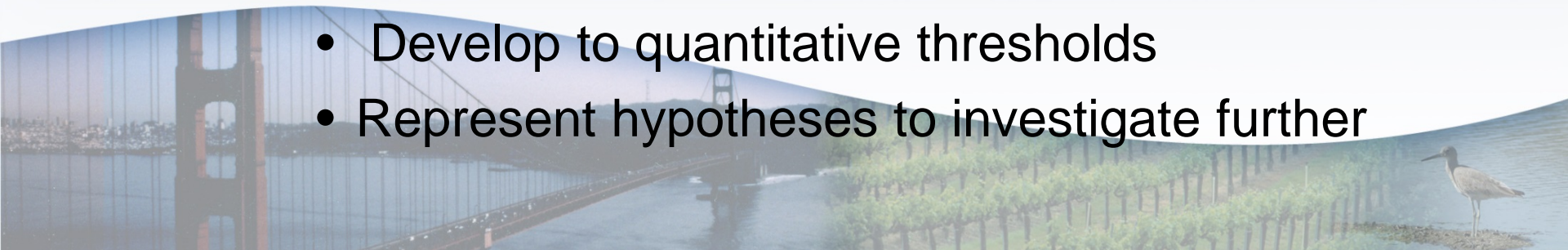




# Analyses

## Chlorophyll a and DO

- DO WQOs
  - 5 mg/L; 7 mg/L
  - 3-month median 80 percent saturation
- Temporal periods Chl-a evaluated
  - February to October recommended
  - Annual mean
- Statistical analysis
  - Develop to quantitative thresholds
  - Represent hypotheses to investigate further



# DO Analyses - Concentration

<b>Sub-embayment</b>	<b>10th Percentile of Summer Vertical Median DO (mg/L)</b>	<b>10th Percentile of DO Summer Vertical Minimum (mg/L)</b>	<b>% of Time Summer DO &lt; 5 mg/L</b>
<b>Lower South Bay</b>	5.7	5.6	2.9
<b>South Bay</b>	5.9	5.8	0.5
<b>Central Bay</b>	6.5	6.5	0.2
<b>North Central Bay</b>	6.8	6.4	1.9
<b>San Pablo Bay</b>	7.1	7	0
<b>Suisun Bay</b>	7.8	7.7	0



# DO Analyses - % Saturation

Julian Day	Lower South		South		Central		No. Central		San Pablo		Suisun	
	N	Count	N	Count	N	Count	N	Count	N	Count	N	Count
30-120	63	0	210	0	82	0	60	1	126	1	96	0
60-150	63	0	210	0	82	0	60	5	126	5	96	0
90-180	63	4	210	0	82	2	60	8	126	4	96	0
120-210	61	11	201	0	80	4	59	9	126	1	100	1
150-240	54	15	189	2	77	0	58	0	126	0	97	0
180-270	53	7	176	0	73	0	60	0	126	0	94	0
210-300	50	3	166	0	68	0	55	0	117	0	89	0



# Analyses Chlorophyll a and HABs

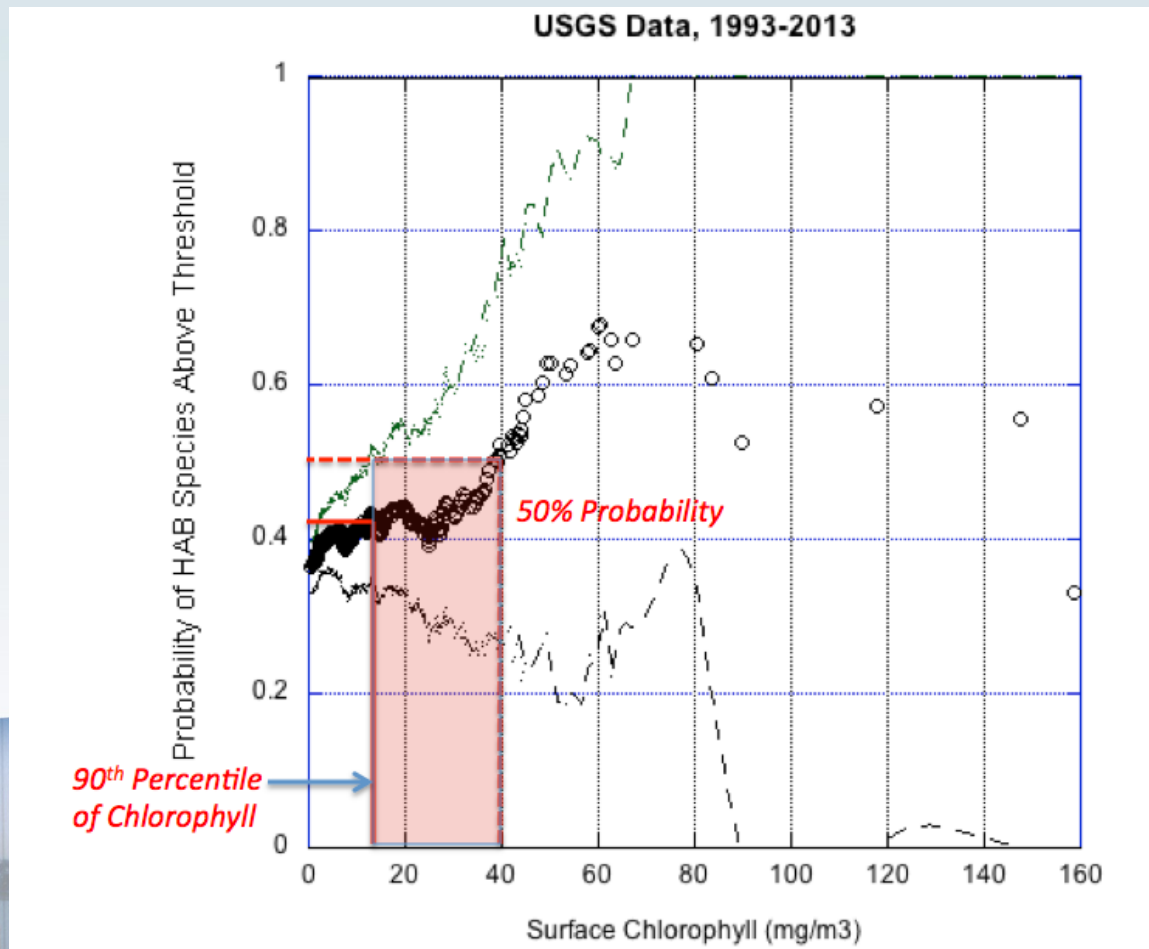
- HAB thresholds
  - HAB species cell densities
  - Toxin concentrations
    - SPATT and particulate
  - Mussel toxin concentration
- Temporal periods evaluated
  - April to November
  - Monthly



# HAB Cell Density Alert Levels

Organism	Alert Level	Effect	Reference
<i>Alexandrium</i>	Presence	Paralytic Shellfish Poisoning (PSP)	<a href="http://www.scotland.gov.uk/Publications/2011/03/16182005/37">http://www.scotland.gov.uk/Publications/2011/03/16182005/37</a>
<i>Blue-Green Algae</i>	40- 100x10 <sup>6</sup> /L	Hepatotoxins; neurotoxins	Guidelines for Safe Recreational Water Environment (World Health Organization 2003); California Guidance (OEHHA)
<i>Dinophysis</i>	100-1,000/L		<a href="HTTP://WWW.SCOTLAND.GOV.UK/PUBLICATIONS/2011/03/16182005/37">HTTP://WWW.SCOTLAND.GOV.UK/PUBLICATIONS/2011/03/16182005/37</a> ; Vlamis et al. 2014
<i>Karenia mikimotoi</i>	5,000/L	Neurotoxic Shellfish Poisoning (NSP)	National Shellfish Sanitation Program, Guidance for the Control of Molluscan Shellfish, 2013 Revision; <a href="HTTP://WWW.FDA.GOV/FOOD/GUIDANCEREGULATION/FEDERALSTATEFOODPROGRAMS/UCM2006754.HTM">HTTP://WWW.FDA.GOV/FOOD/GUIDANCEREGULATION/FEDERALSTATEFOODPROGRAMS/UCM2006754.HTM</a>
<i>Karlodinium veneficum</i>	5,000/L	Ichthyotoxic	--
<i>Pseudo-nitzschia</i>	10,000- 50,000/L	Amnesic Shellfish Poisoning (ASP)	Cal-HABMAP ; Shumway et al. 1995; Anderson et al. 2009

# Chlorophyll and HAB Species Probability Analysis



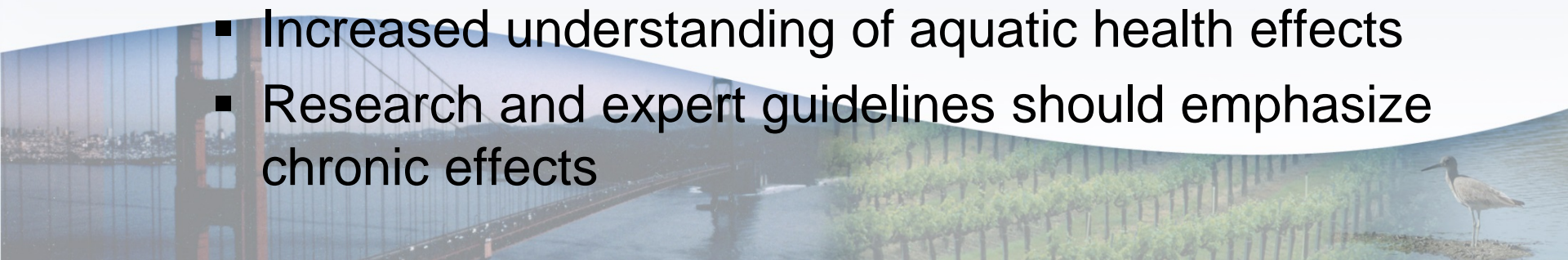
# Assessment Framework Example

Segment Monthly Mean Chlorophyll a Linked to HAB Abundance ( $\mu\text{g L}^{-1}$ )	Ecological Condition Based on Annual Frequency of Occurrence in Monthly Samples			
	1 of 12	2-3	4-6	6+
$\leq 13$	Very high	Very high	Very high	Very high
>13-25	Good	Moderate	Moderate	Low
>25- 40	Moderate	Moderate	Low	Very Low
>40-60	Moderate	Low	Very Low	Very Low
>60	Low	Very low	Very low	Very low



# Preliminary Recommendations for HABs

- **Increased monitoring of HAB abundance and toxins**
  - Improved understanding of risk of toxic HABs with increasing chlorophyll-a
  - Monitoring of water column and biota
  - Continue to validate SPATT vs particulate concentrations
- **Current guidelines emphasize human health; acute effects**
  - Increased understanding of aquatic health effects
  - Research and expert guidelines should emphasize chronic effects





# Other HAB Issues

- Need to understand baseline risk
- Better understand nexus to coastal waters for marine species
- Source and fate of microcystin – Delta and South Bay



# Assessment Framework

## Next Steps

- Last (?) expert science team meeting
- Finalize draft assessment framework report
- Stakeholder Meeting(s)
- Continue review of DO WQOs
  - Focus LSB – natural conditions
  - Continue to evaluate other indicators
    - Gross Primary Productivity
    - Food quality – community composition

An aerial photograph of the Golden Gate Bridge in San Francisco, California. The bridge is a prominent red-orange suspension bridge spanning the Golden Gate Strait. The city of San Francisco is visible in the background, with its dense urban landscape and skyscrapers. The water is a deep blue-green color. The word "Questions" is overlaid in white text in the center of the image.

Questions