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# Identifying nutrient thresholds for sustainable local management of British Columbia seagrass beds

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# Identifying nutrient thresholds for sustainable management of seagrass beds

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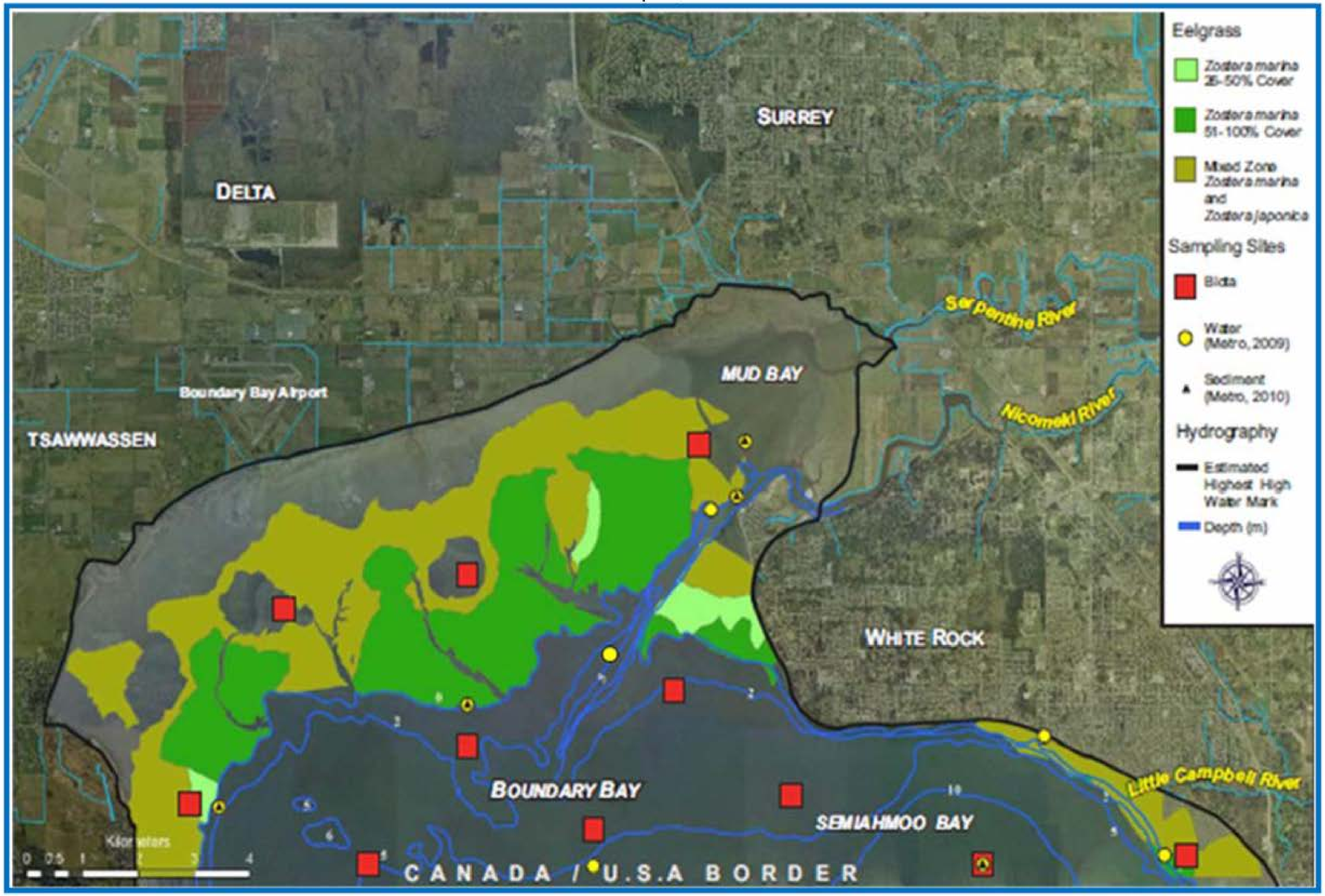
# Boundary Bay Eelgrass

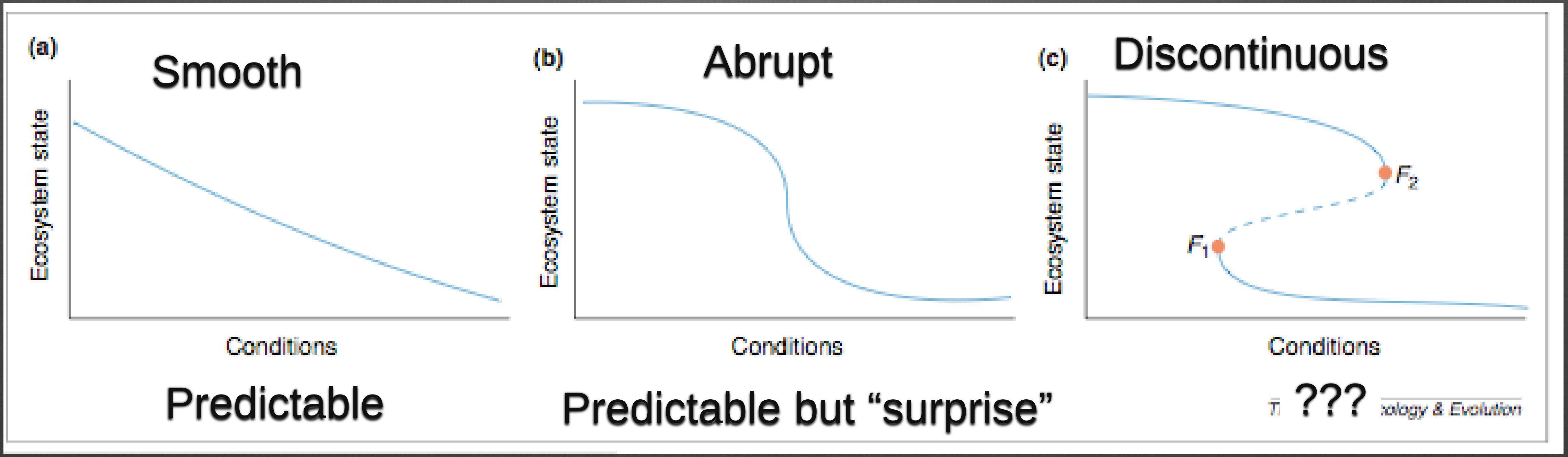
FIGURE 13.4: BOUNDARY BAY AMBIENT WATER, SEDIMENT AND BIOTA SAMPLING SITES




- July 2013, MetroVan Boundary Bay Ambient Monitoring Program

# Ecosystem Phase Shifts

Communities can shift in many ways:




- Why is it important to determine between these?
  - Predictability and when to take action

# Responses

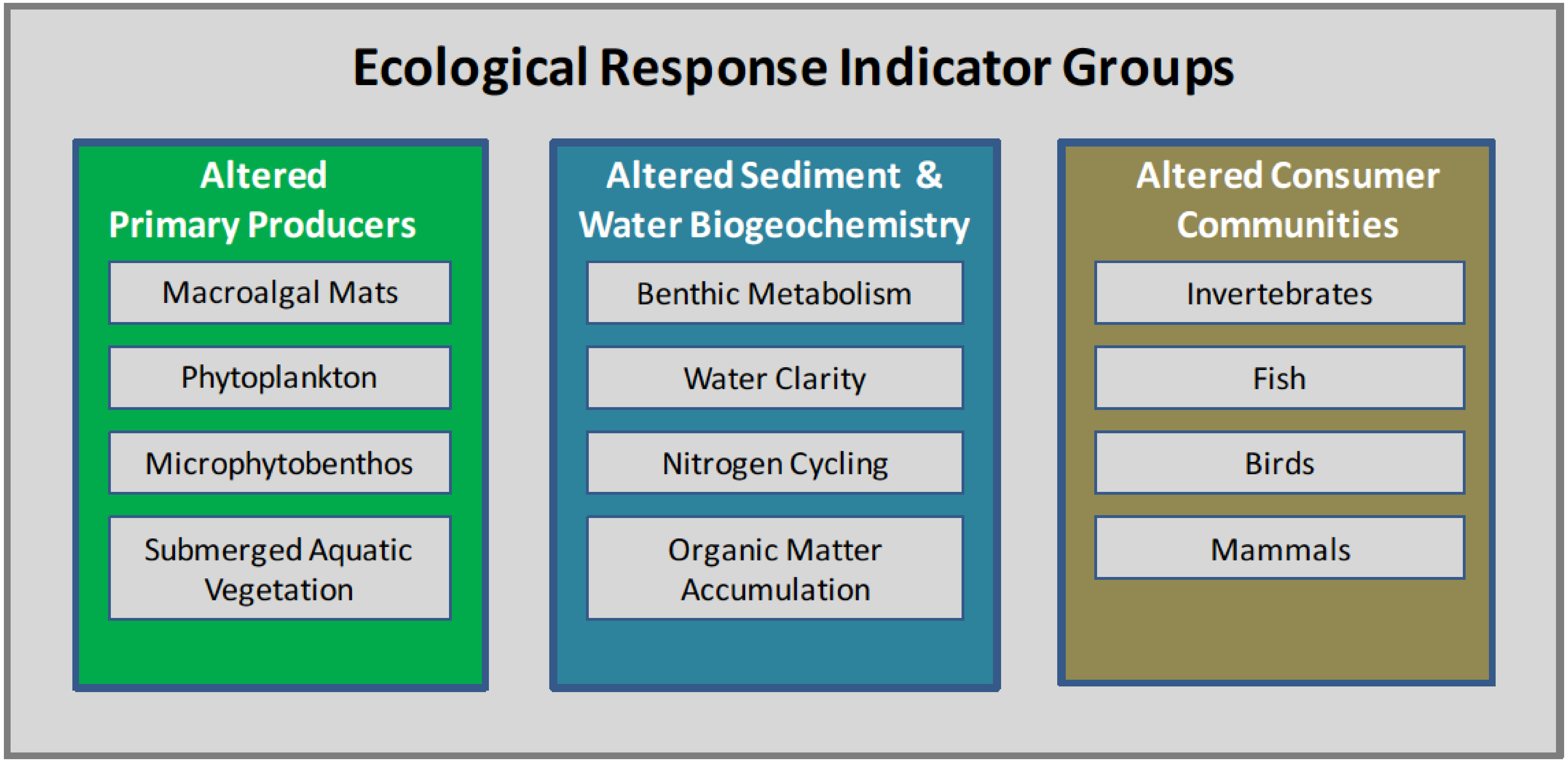



*Figure 2.5. Ecological indicator groups, which include altered primary producers, sediment and water biogeochemistry, and secondary & tertiary consumers. OM=sediment organic matter accumulation.*

# Indicators: Macroalgae

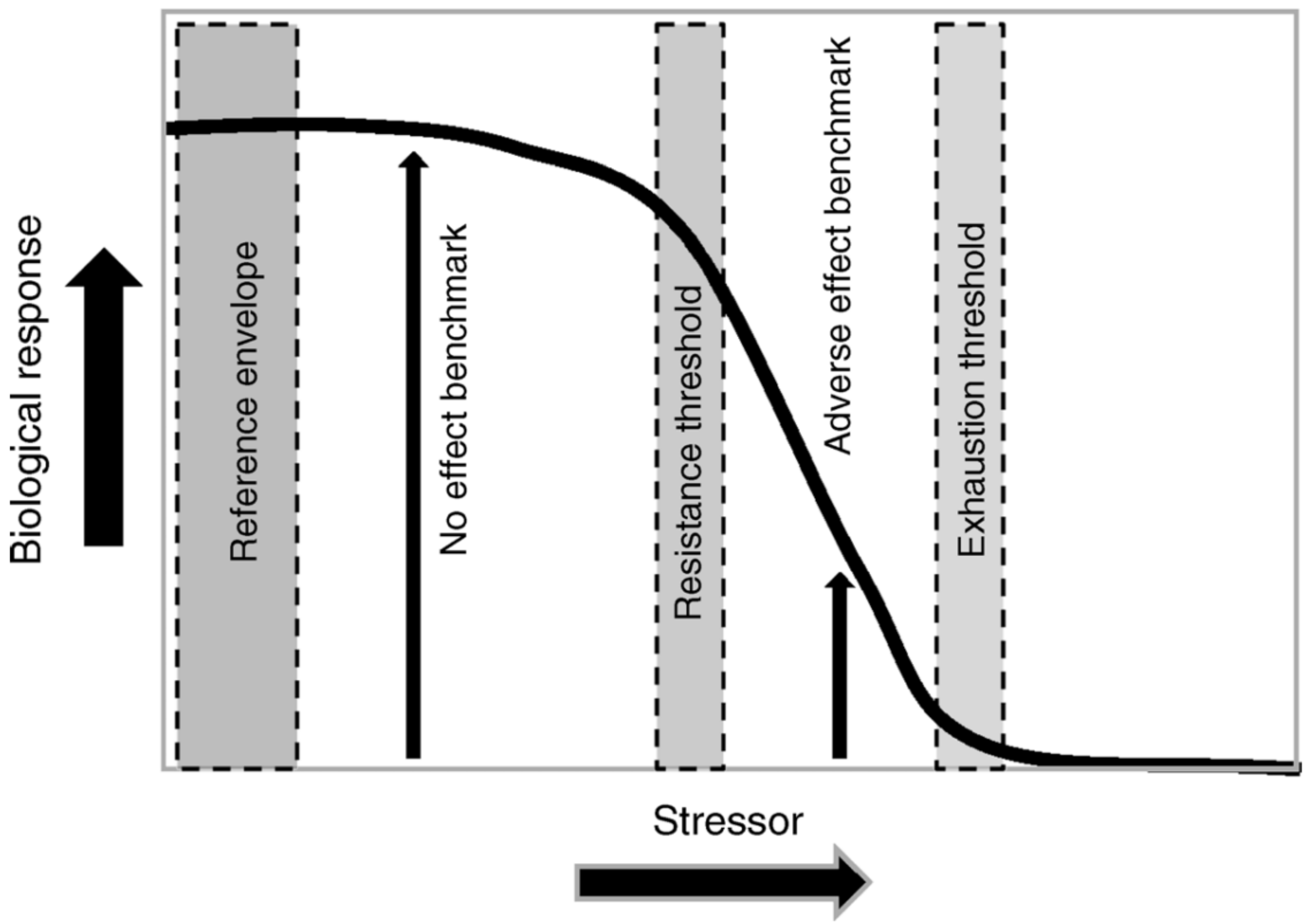
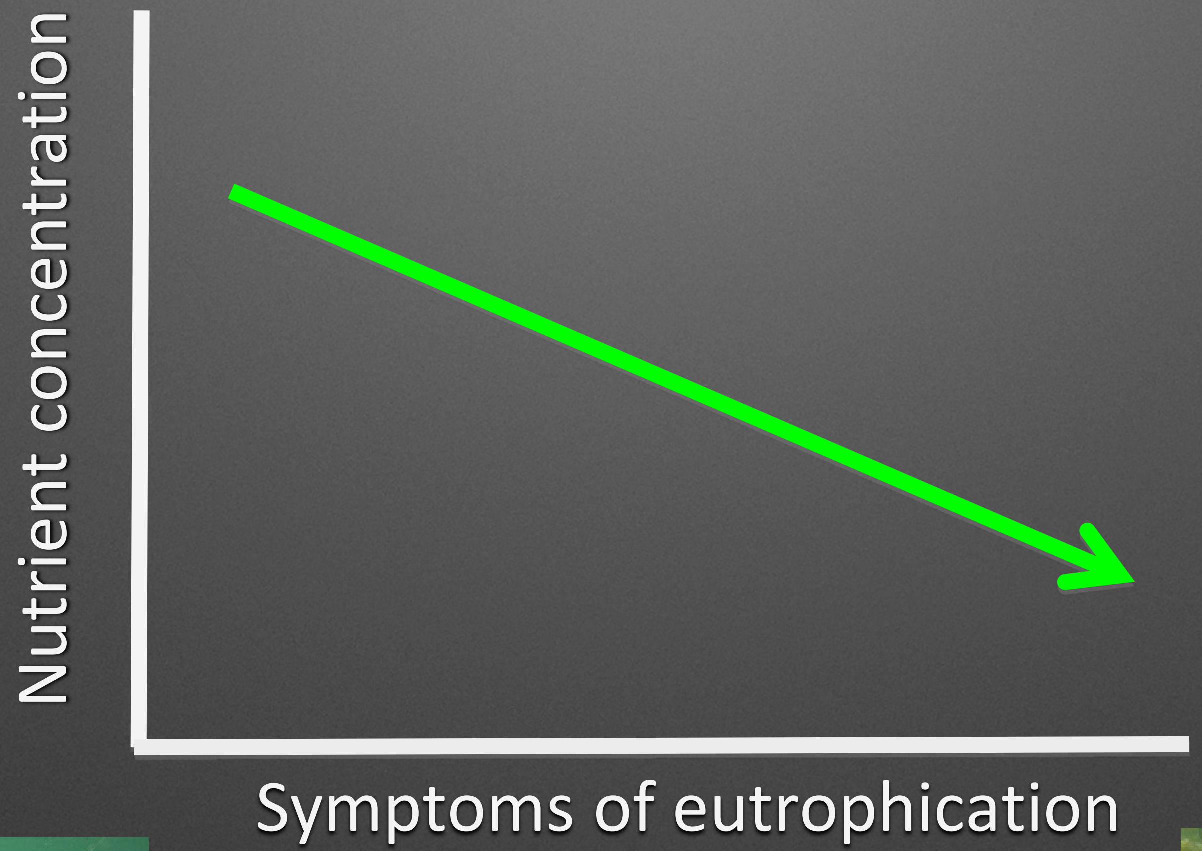


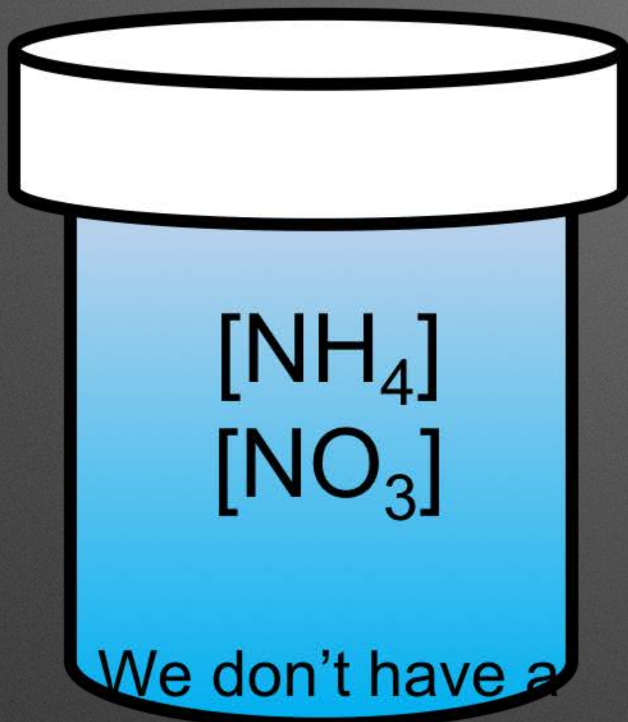

FIG. 1. Conceptual diagram illustrating biological response, resistance threshold, exhaustion threshold, and adverse benchmarks along a stressor gradient. The curve represents the level of a biological response variable in regard to the level of stressor.

Green et al. 2014, *Ecological Applications*

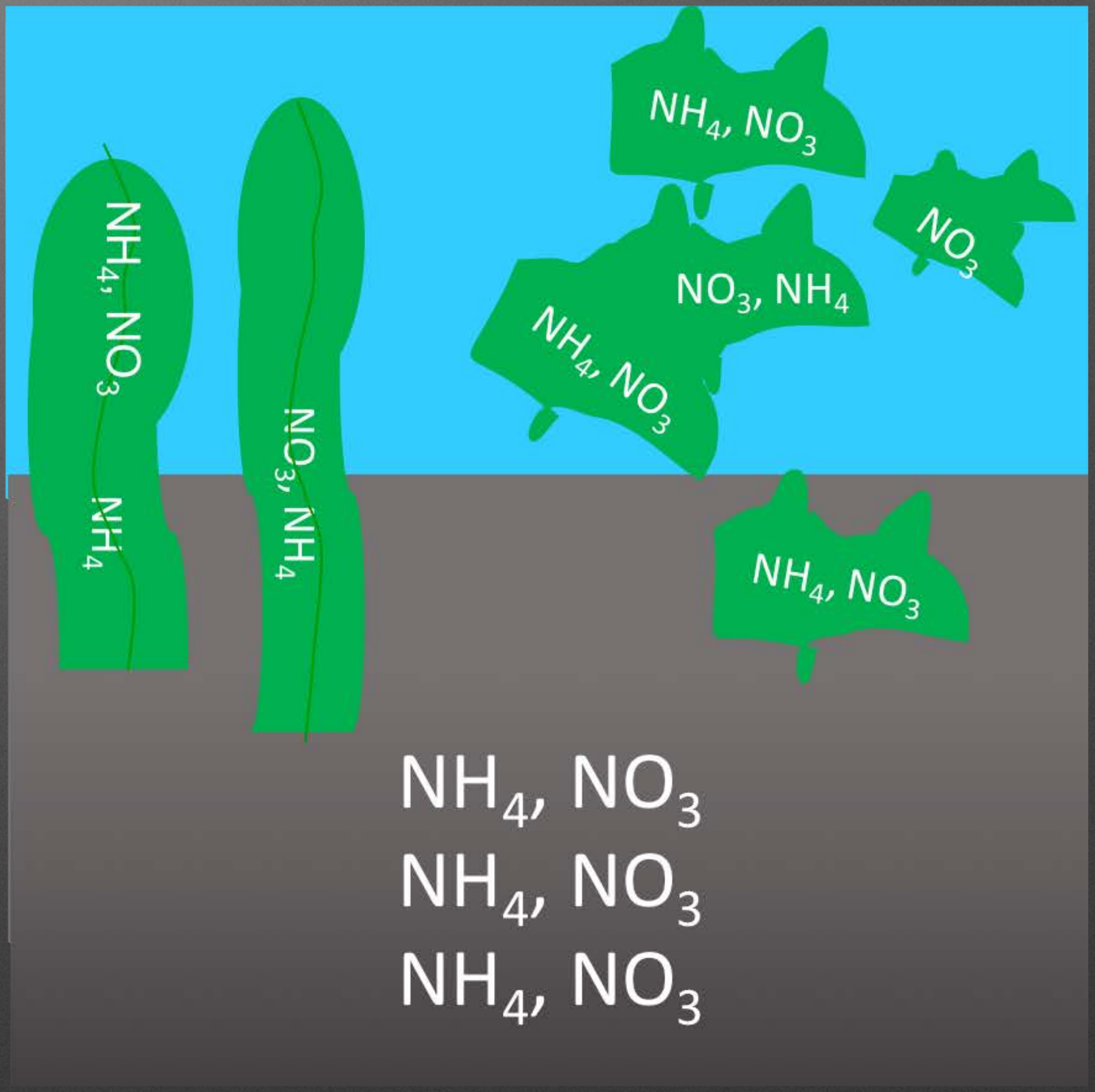
# Paradox of Enrichment




# Nutrients Are Masked



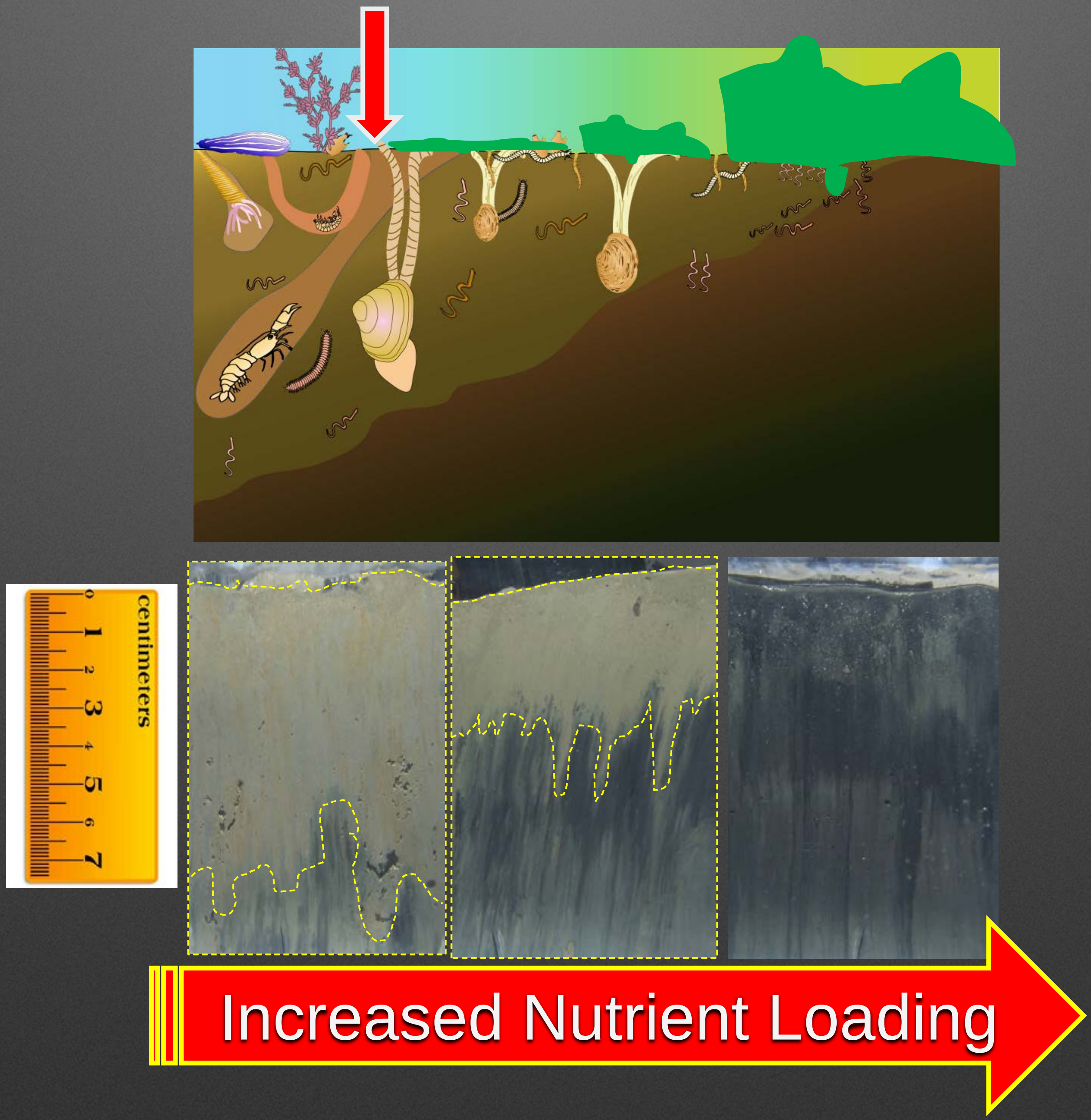

We don't have a nutrient problem!




Hard to rely on water column nutrients alone

Slide by Lauri Green

# Macroalgal Assessment Framework




Lauri Green et al, 2014

# Macroalgal Assessment Framework

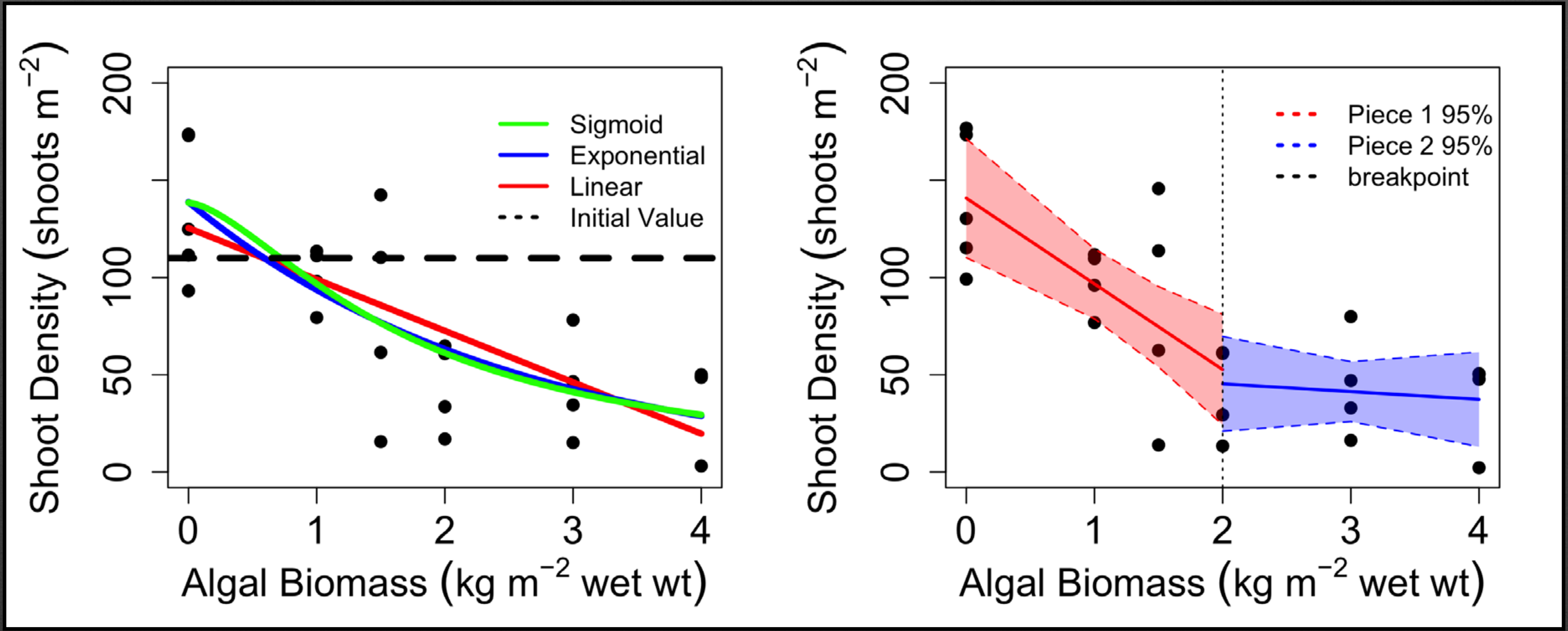
| Biomass | (g dw m$^{-2}$) | Percent Cover | | | | |
|---|---|---|---|---|---|---|
| | | < 10 % | 10 - 25 % | 25 - 40 % | 40 - 70 % | > 70 % |
| | >175 | Moderate | Low | Low | Very Low | Very Low |
| | 100 - 175 | Moderate | Moderate | Low | Very low | Very Low |
| | 70-100 | Moderate | Moderate | Low | Low | Low |
| | 50 - 70 | High | High | Moderate** | Moderate** | Low |
| | 15 - 50 | Very High | High | High | Moderate | Moderate |
| | < 15 | Very High | Very High | High | High | High |

** downgrade if moderate for 2 consecutive sampling periods

*Figure 3.7 Proposed assessment framework to diagnose eutrophication using macroalgae for macroalgae in intertidal and shallow subtidal habitat for California estuaries that are "open" to surfacewater tidal*

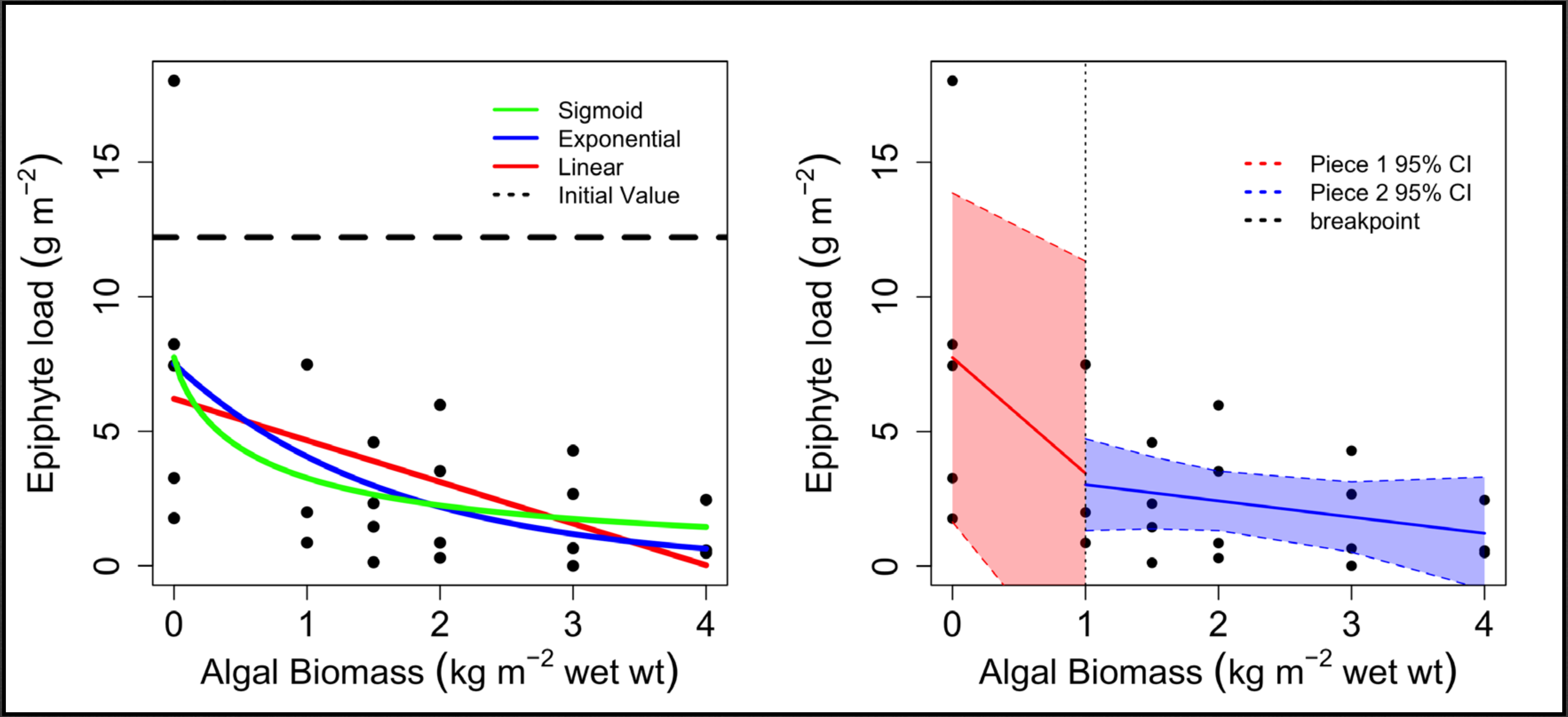
Review of Indicators for Development of Nutrient Numeric Endpoints in California Estuaries, Martha Sutula et al. report for California EPA, State Water Resources Board

# Predictable decline in habitat structure




- Predictable **exponential decay** model preferred (by AICc)
- Shoot density declines in response to *Ulva*

# Predictable decline in trophic Support




- Predictable **exponential decay** model preferred
- Epiphyte load declines in response to *Ulva*

# Macroalgal assessment framework: eelgrass

| Biomass | (g dw m$^{-2}$) | Condition Category |
|---|---|---|
| | >140 | Very low |
| | 70-140 | low |
| | 30 - 70 | Moderate |
| | 15 - 30 | High |
| | < 15 | Very high |

Review of Indicators for Development of Nutrient Numeric Endpoints in California Estuaries, Martha Sutula et al. report for California EPA, State Water Resources Board

# Nutrient "Tipping-Points" in Boundary Bay

- Water quality monitoring
- +/- Nutrient manipulation experiment at multiple sites in BB
- Nutrient loading model
  - Comparison with East Coast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CANADIAN HEALTHY OCEANS NETWORK

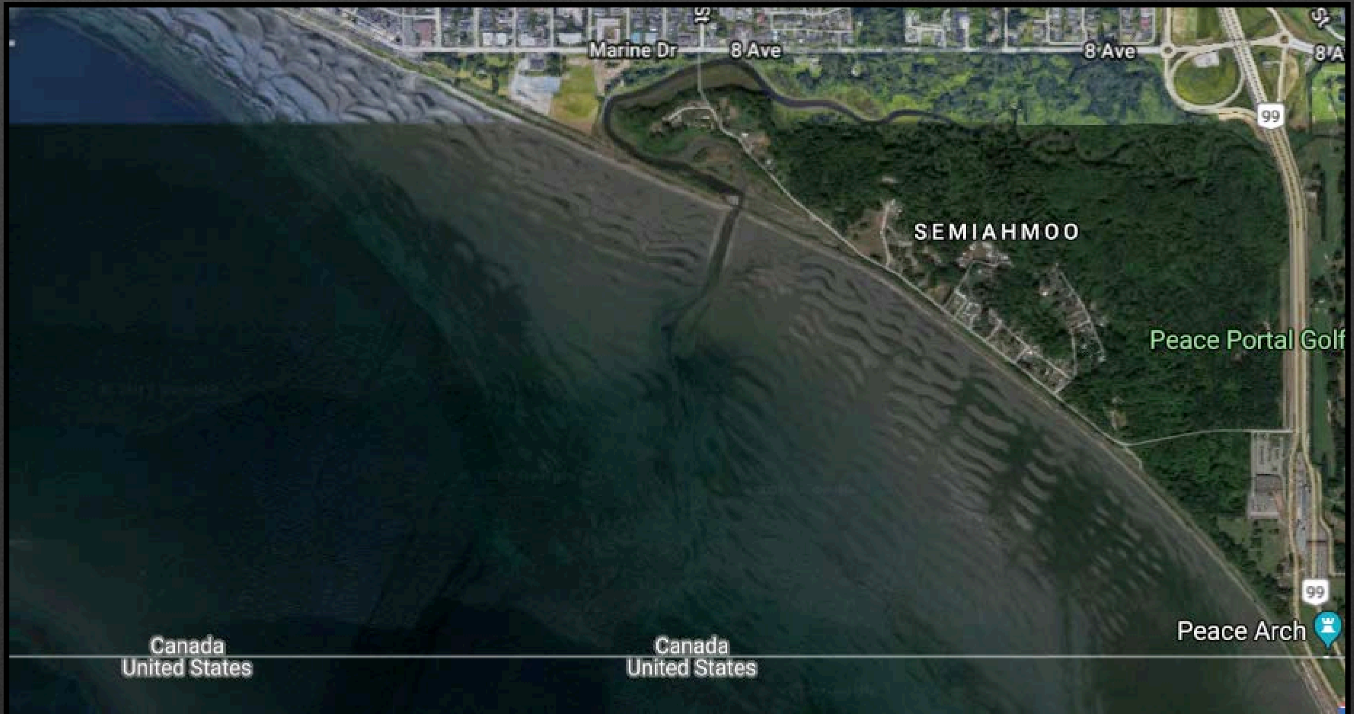
# Indicator of shifts: invertebrate community

- Experiments in Boundary Bay to identify threshold levels of nutrient enrichment before invertebrate diversity shifts


PC: Matthew Whalen (L,M) , Lauri Green (R)

# Approach: Community Engagement

- Shared Waters
  - Transboundary watershed management
- Local stakeholders
- Community citizen science
  - Water quality monitoring
  - Invertebrate community ID

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STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

SCCWRP Established 1969

UCLA
Division of Life Sciences
Ecology and Evolutionary Biology

Ducks Unlimited Canada

Sea Change
MARINE CONSERVATION SOCIETY

CITY OF SURREY
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Friends of Semiahmoo Bay Society

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# Art Credits

- Tracey Saxby  
- Diane Kleine 
- Dylan Taillie 
- Kim Kraeer, Lucy Van Essen-Fishman 

# General Overview

1. Context of eelgrass in Boundary Bay, BC
2. Ecosystem responses to human stressors
3. Nutrients & Macroalgal Indicators
4. Macroalgal Assessment Framework
5. Nutrient “tipping-points” in BC eelgrass beds