California's Surface Water Ambient Monitoring Program (SWAMP)

Suisun Bay Studies

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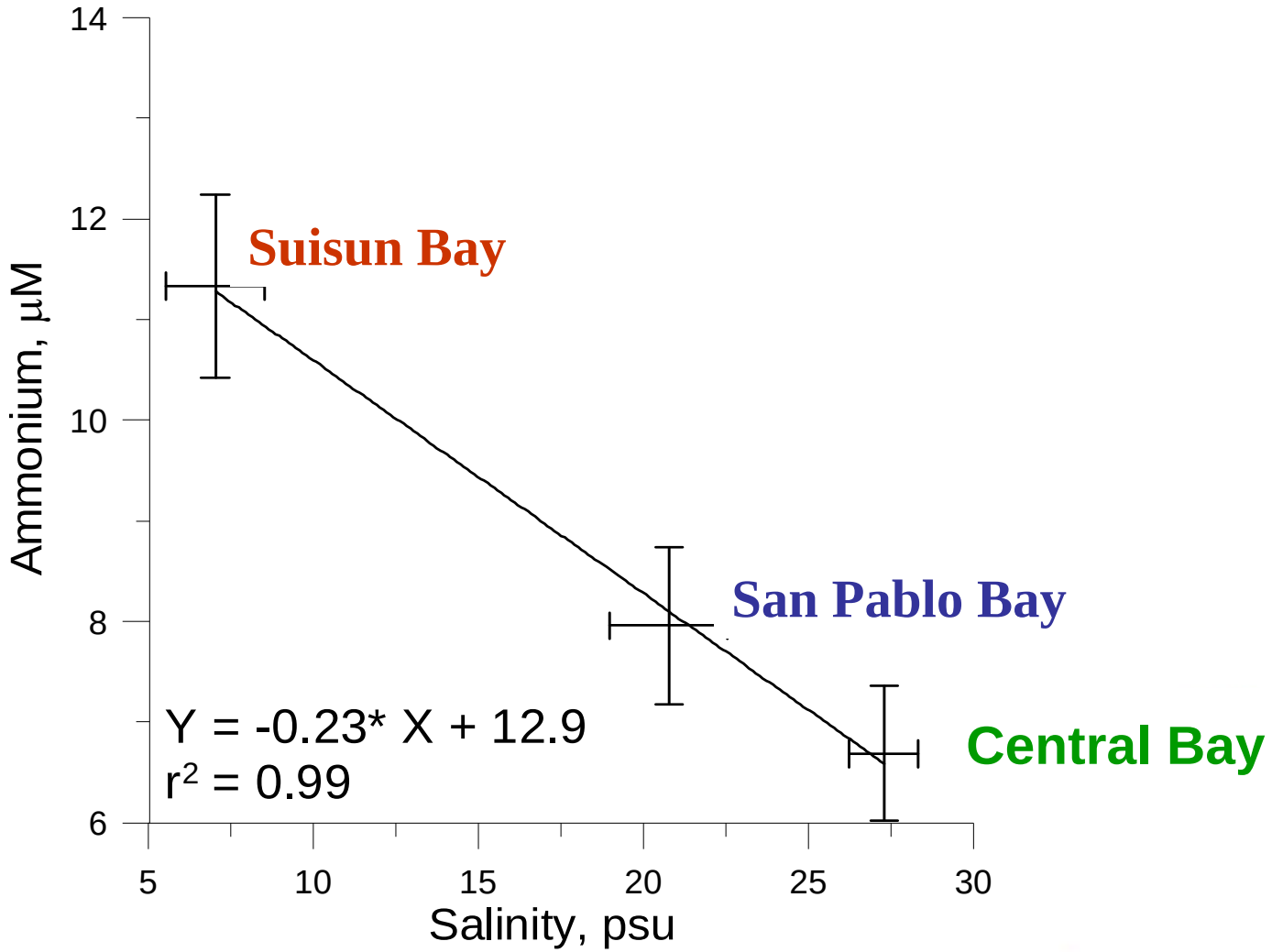
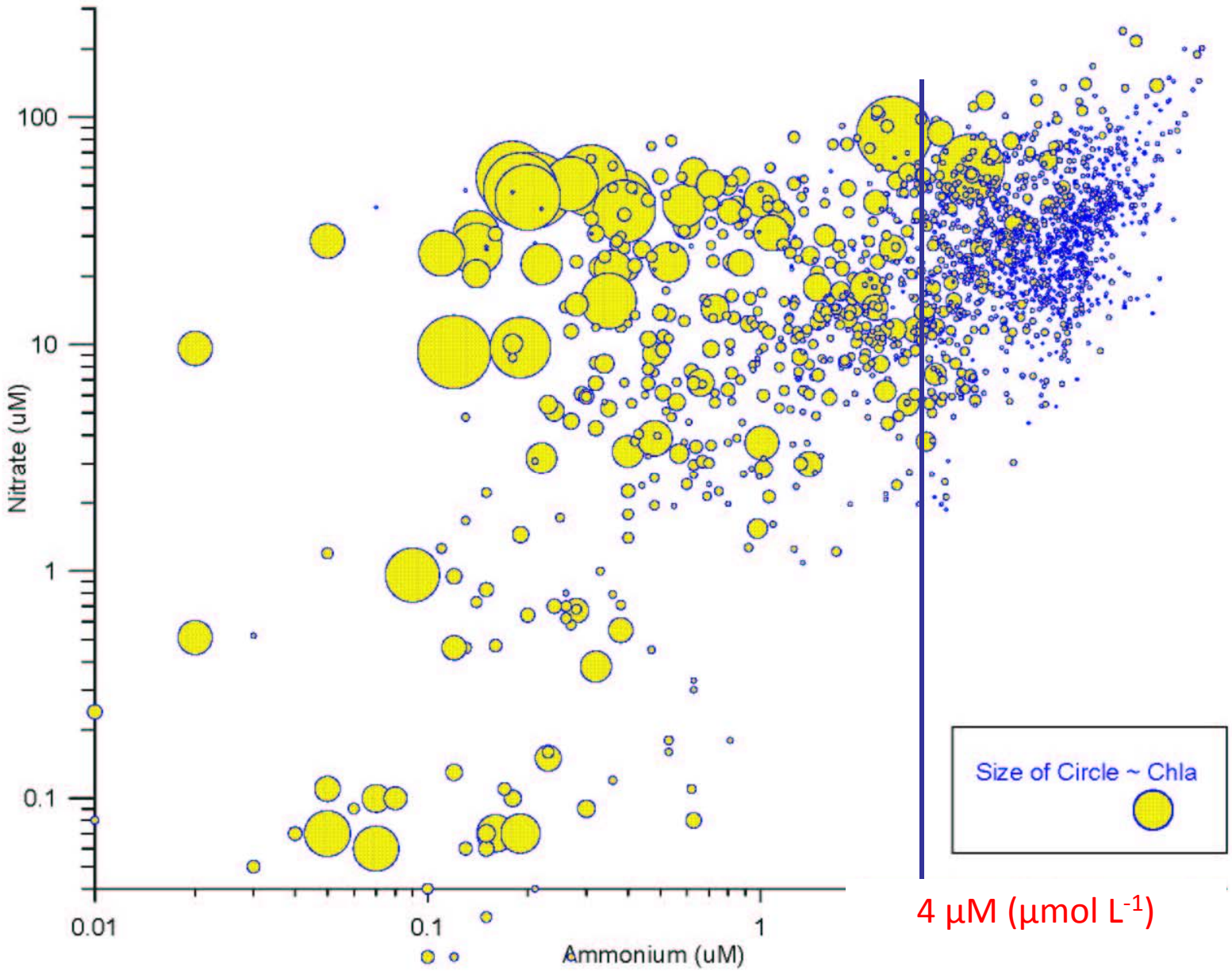
CALIFORNIA Water Boards

SWAMP Surface Water Ambient Monitoring Program

Average Ammonium Concentrations for SF Estuary Embayments



(F.P. Wilkerson et al. 2006)


100
10
1
0.1
Nitrate (uM)
0.01
0.1
1
Ammonium (uM)
Size of Circle ~ Chla
4 µM (µmol L-1)

Suisun Bay ammonia study (2010) Objective/management question

- Objective: Document relationships between nutrients (especially ammonium), chl a & phytoplankton species composition during spring/summer in Suisun Bay
- Management question:

  Does ammonium concentration above 4uM inhibit diatom blooms?

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Suisun Bay 2010 Study Design

- Sample for nutrients (dissolved NO3, NO2, NH4, PO4, Si(OH)4, DOC, TDN), chl a, and phytoplankton species composition in Suisun Bay
- Measure DO, temp, salinity, flow, turbidity at all stations
- 7 stations: east of Suisun, in Suisun and west of Suisun
- Frequency : once a week for 12 weeks
- Coordination:
  - USGS- 5 overlapping sample locations: share data
  - DWR – 2 overlapping sample locations: share data
  - Romberg Tiburon Center - contractor
- Thresholds: 4uM for ammonium and bloom = 30ug/L chl a

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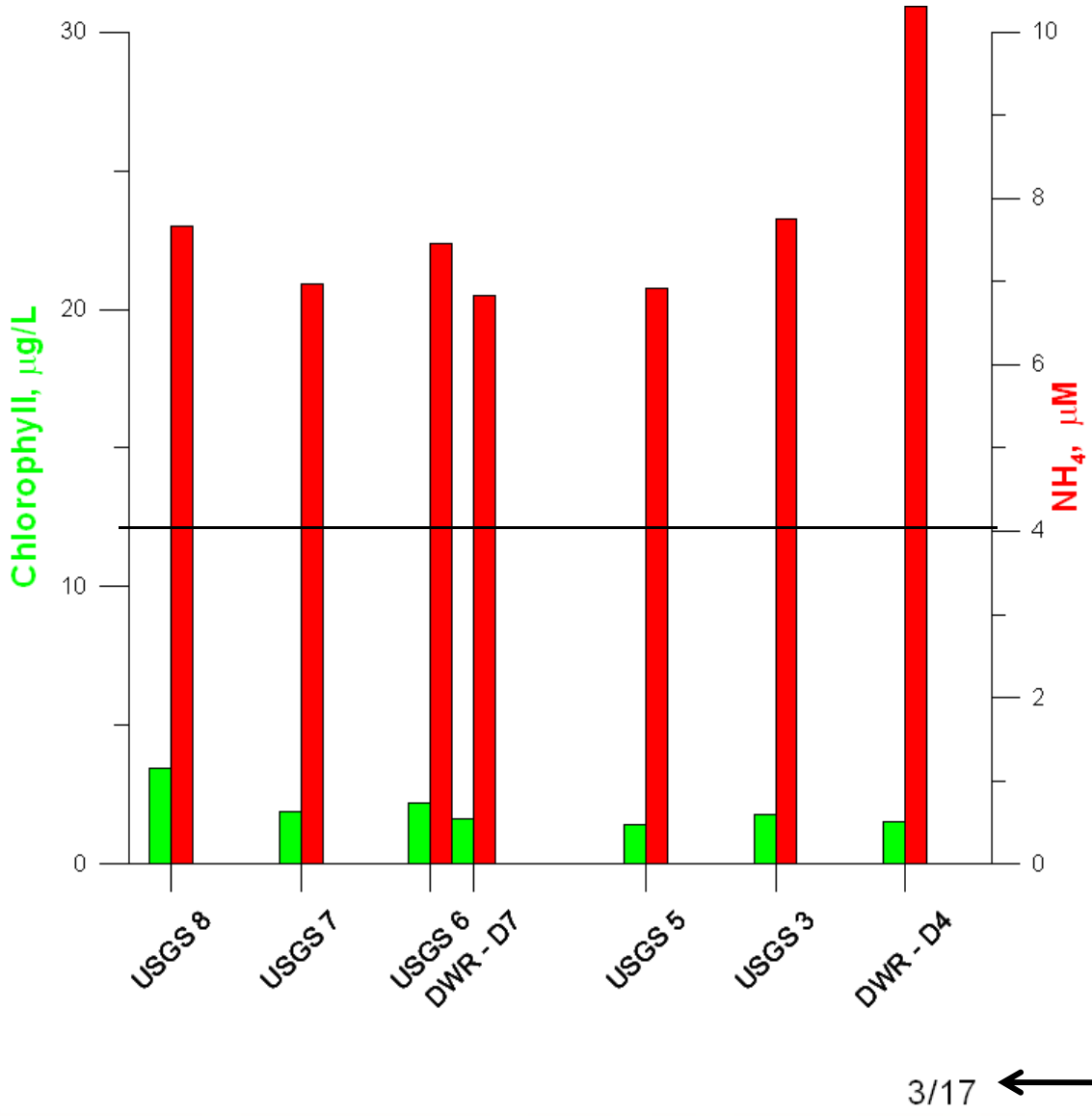
Fairfield-Suisun SD
207SNB0D7
Grizzly Bay
Suisun Bay
Sanitation od Cont.
C&H Sugar
Contra Costa SD #5
City of Benicia
Valero Refining
Central Conta Costa SD
207SNB007
207SNB008
207SNB006
207SNB005
Rhodia Inc.
Tesoro Refining
Shell Oil Co.
Mt. View SD
General Chem Corp, Pittsburg
207SNB003
510SAC0D4
Pittsburg Power Plant
Delta Diablo SD
USS-Posco Industries
Dow Chemical Co.
Industrial Dischargers
POTW's
SWAMP sites

2010 Suisun Bay Time Series



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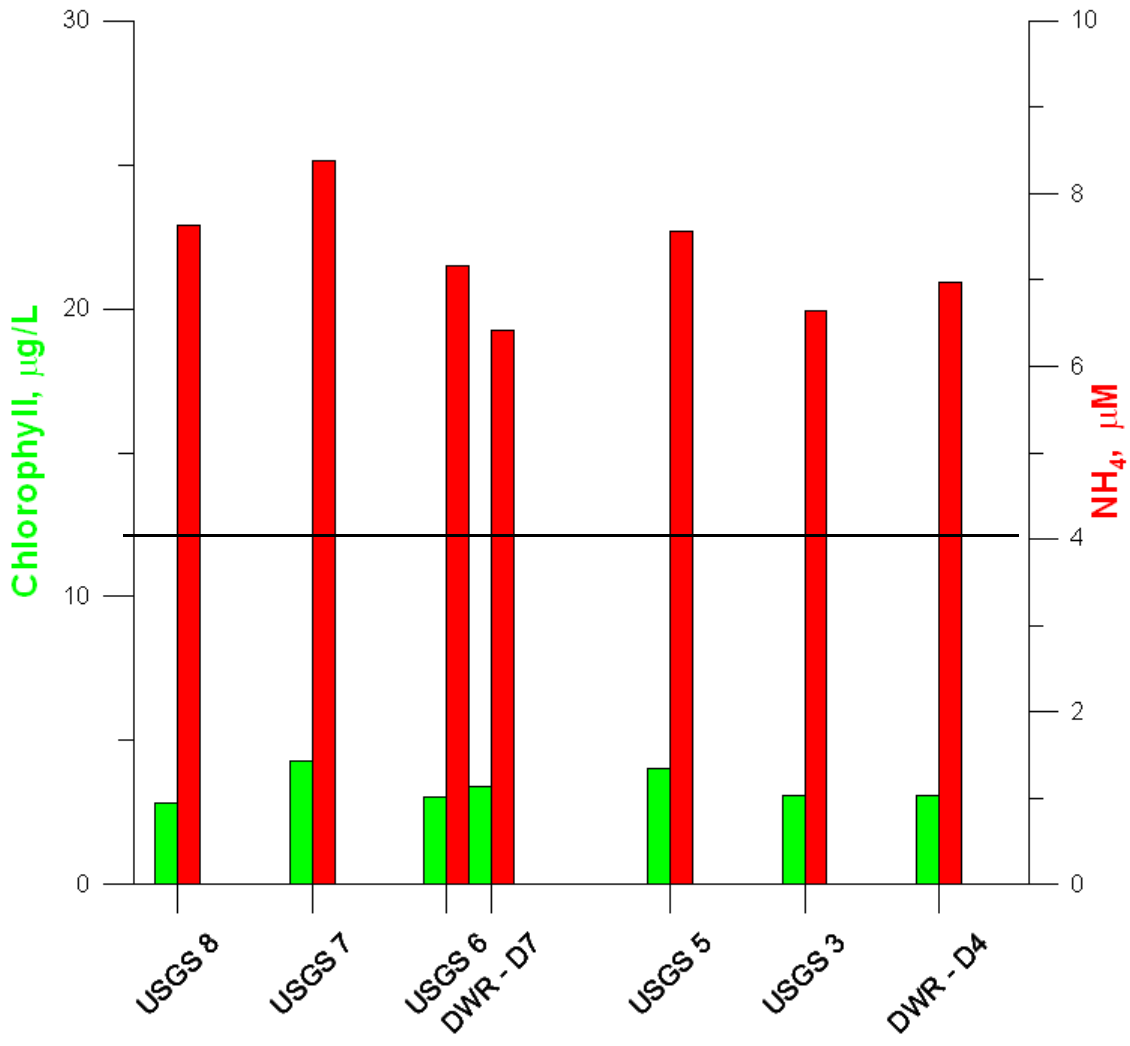

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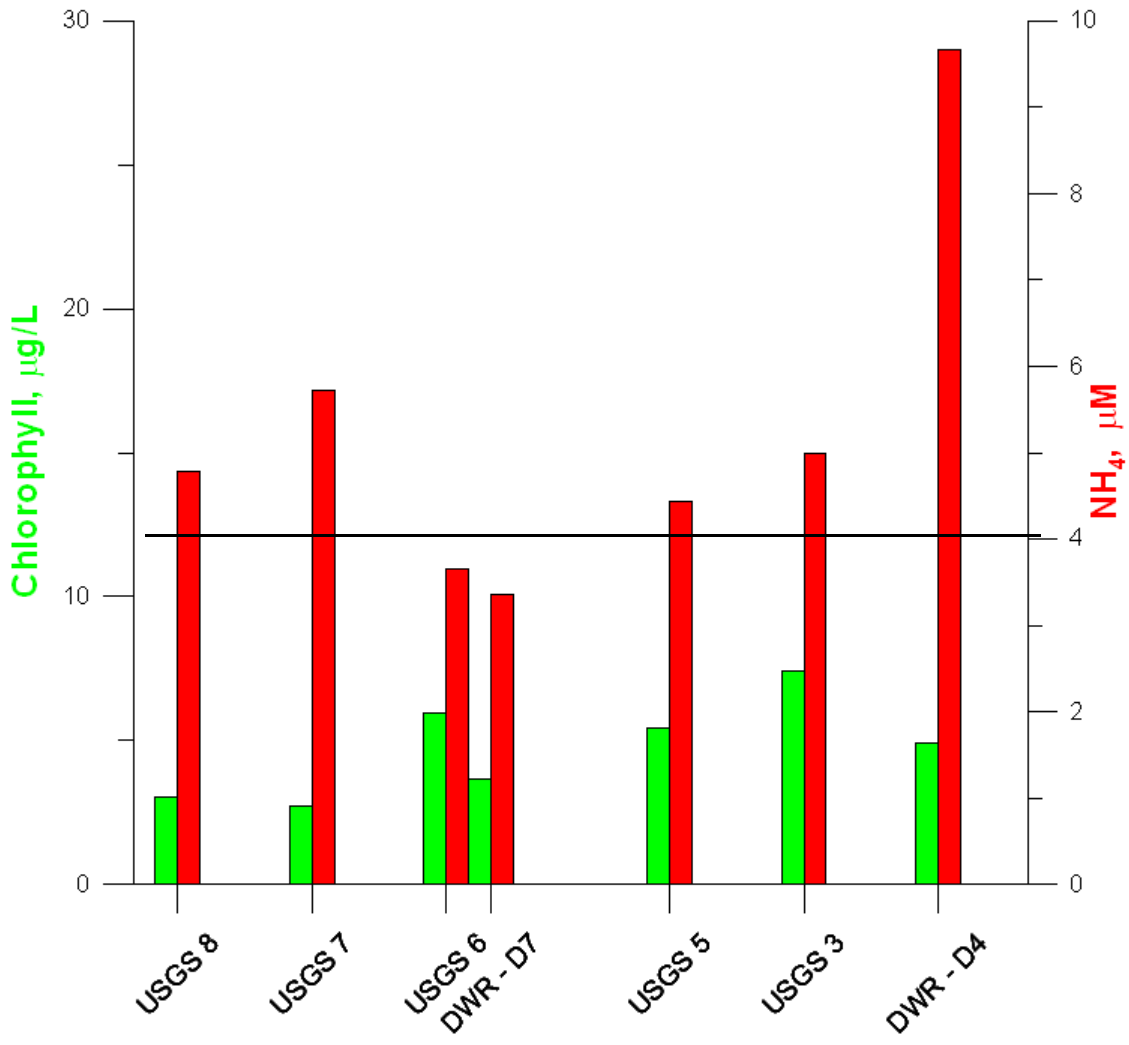

4/07

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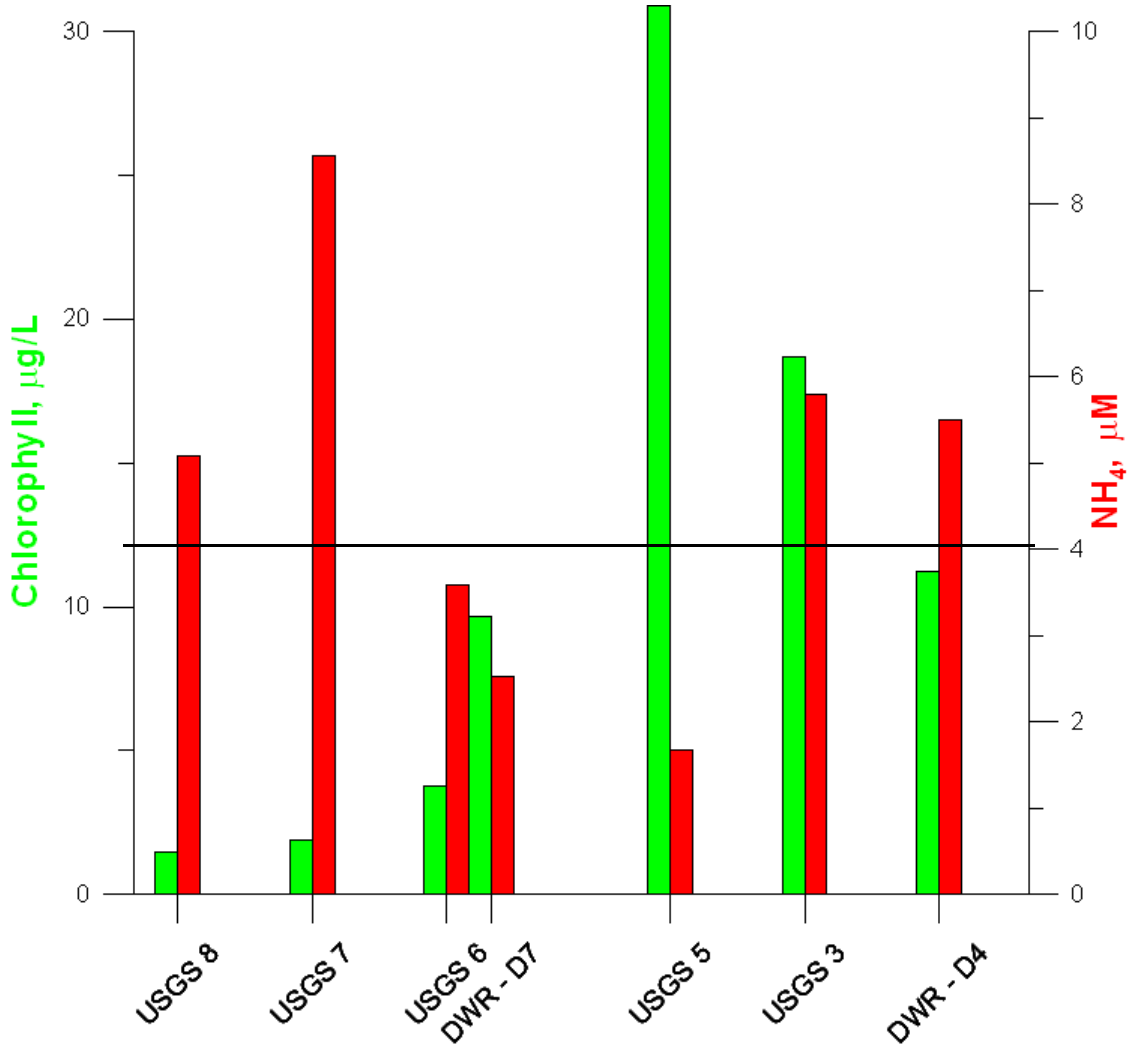

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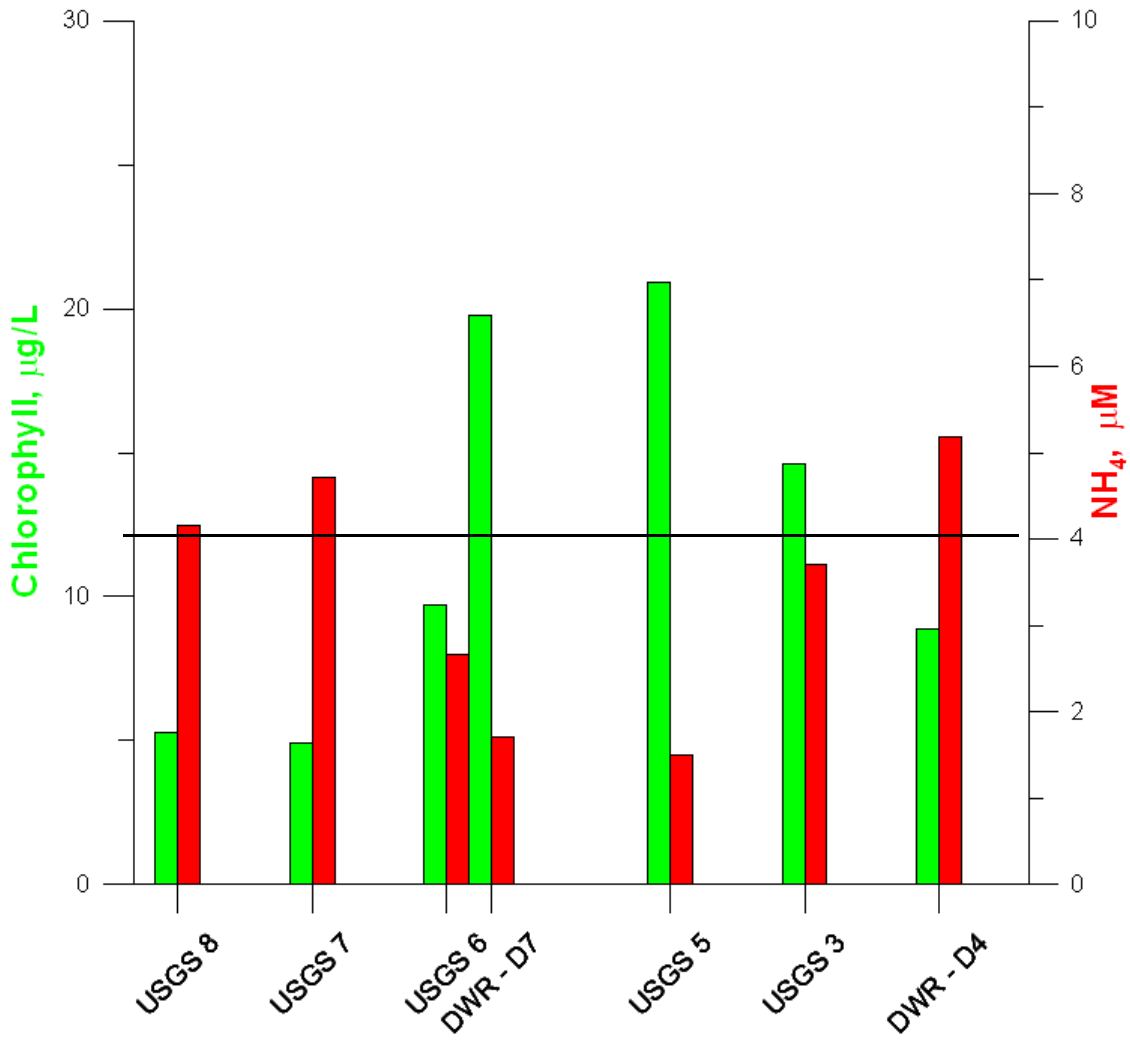

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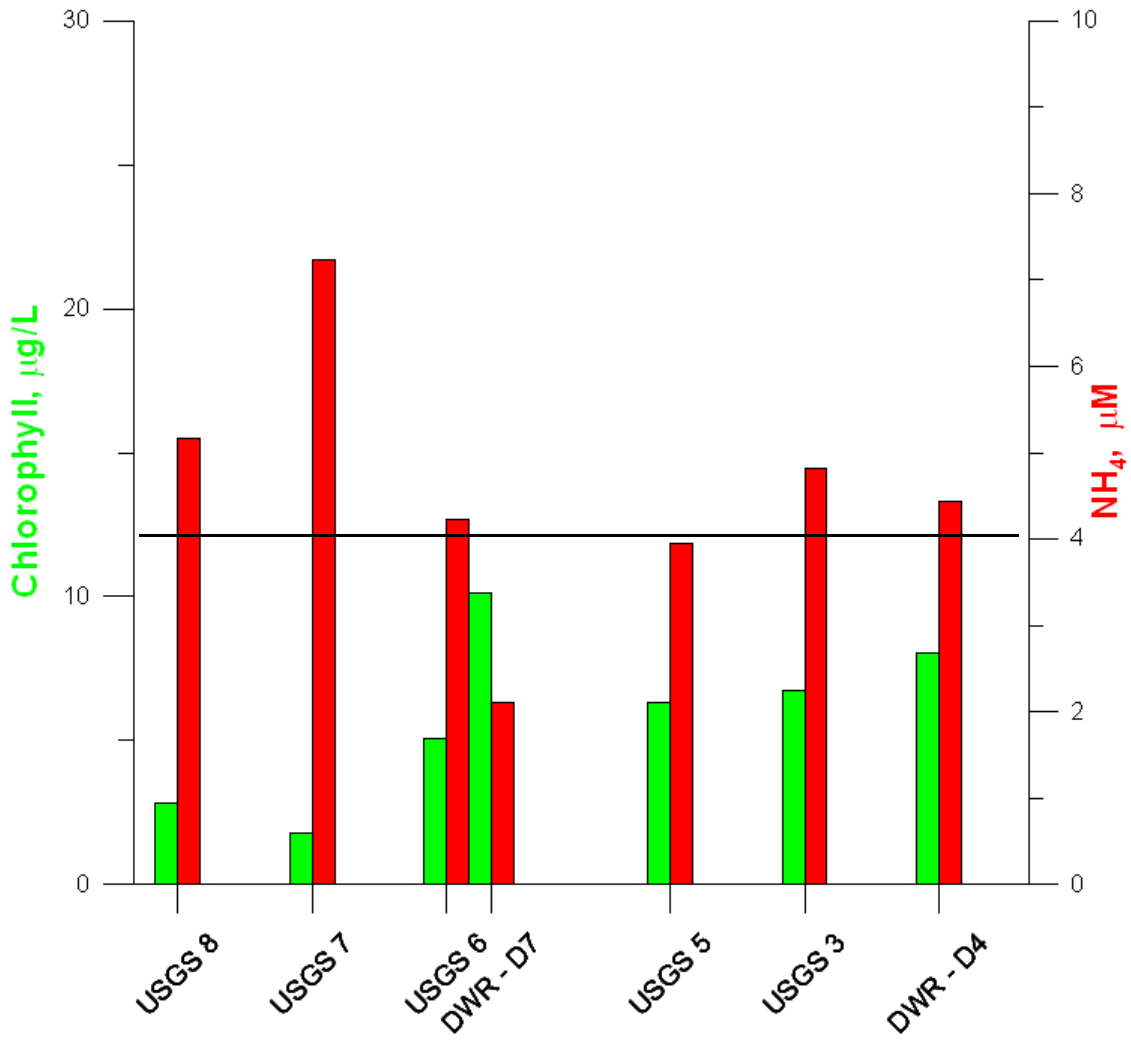

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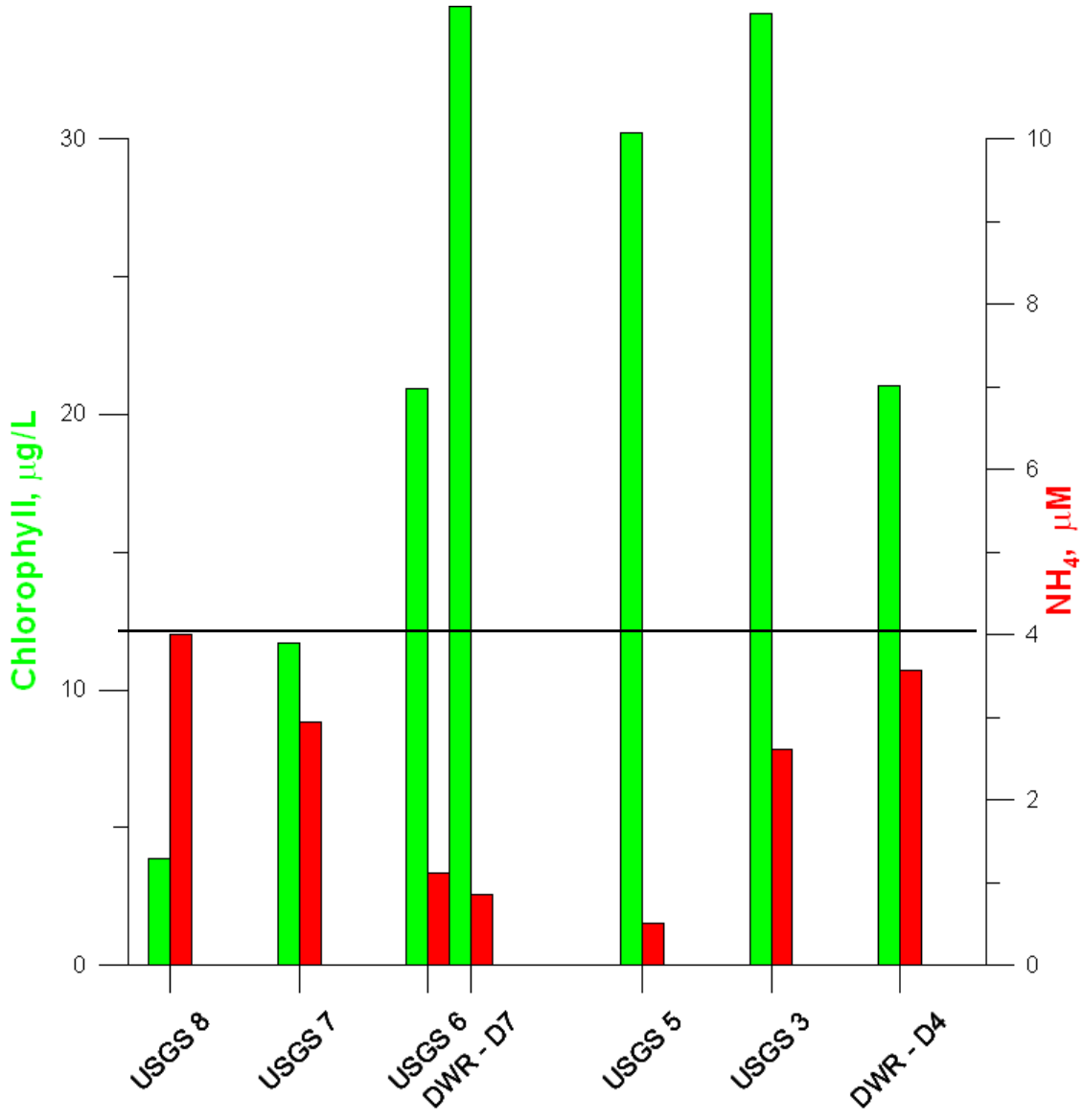

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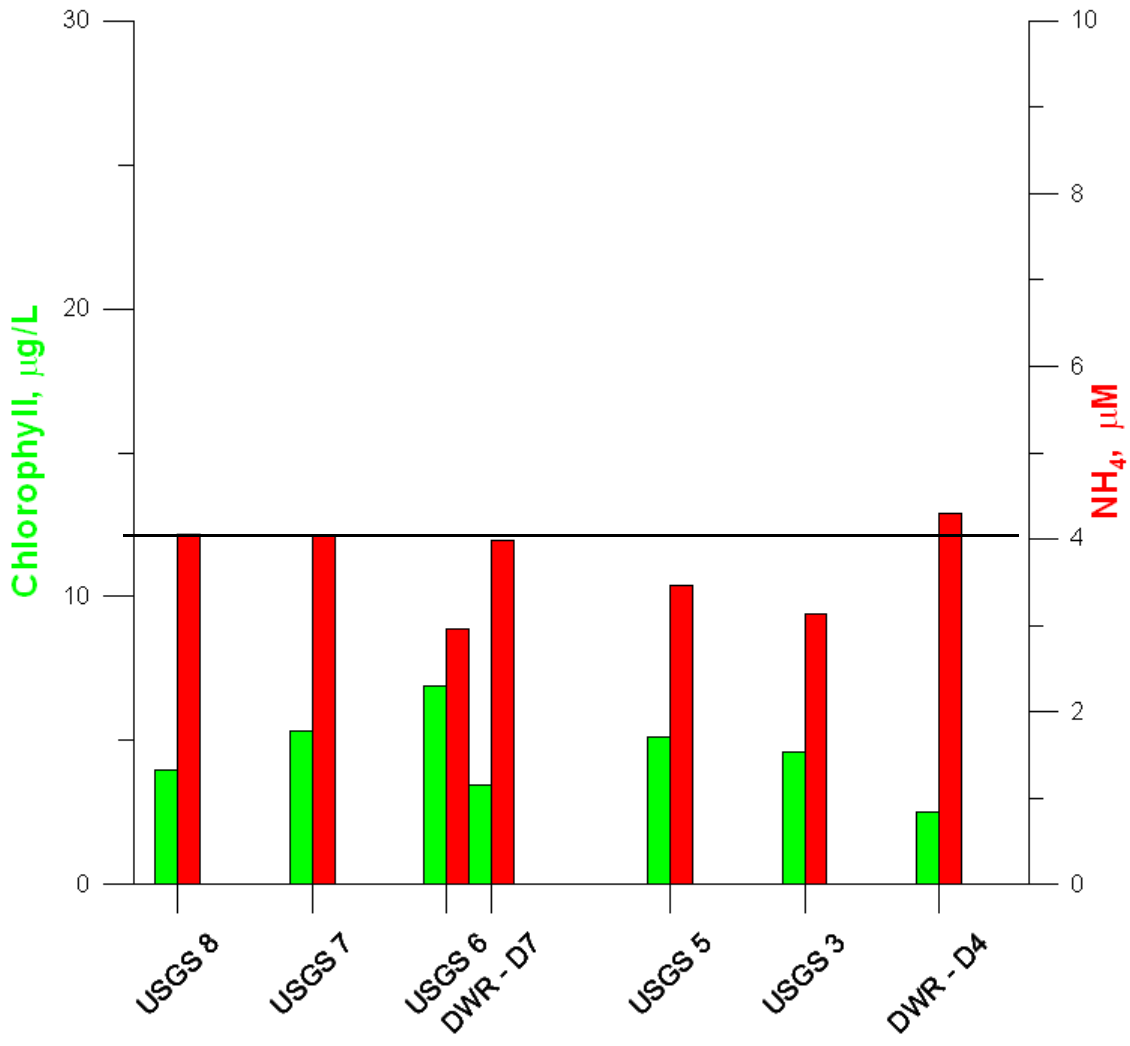

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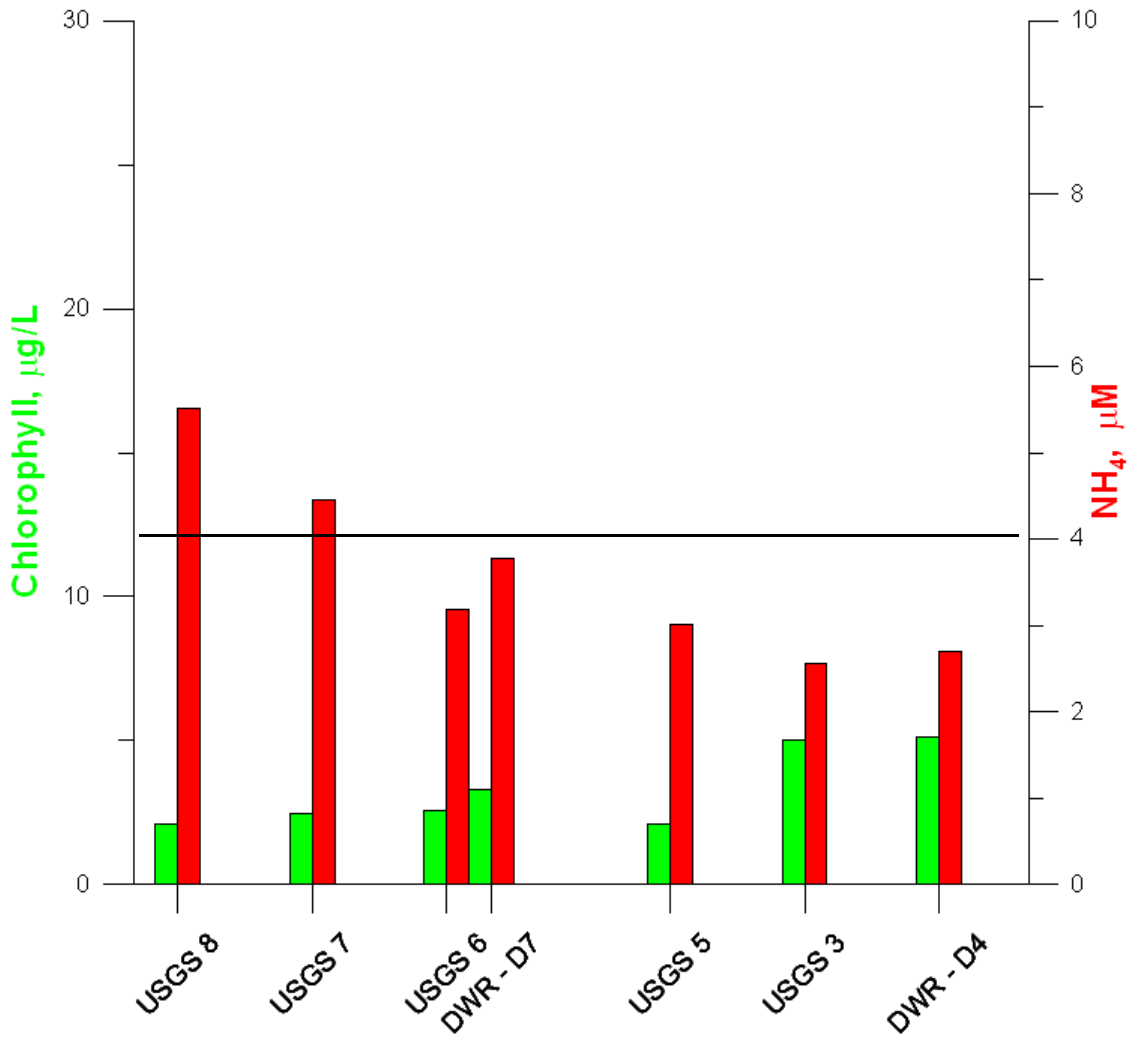

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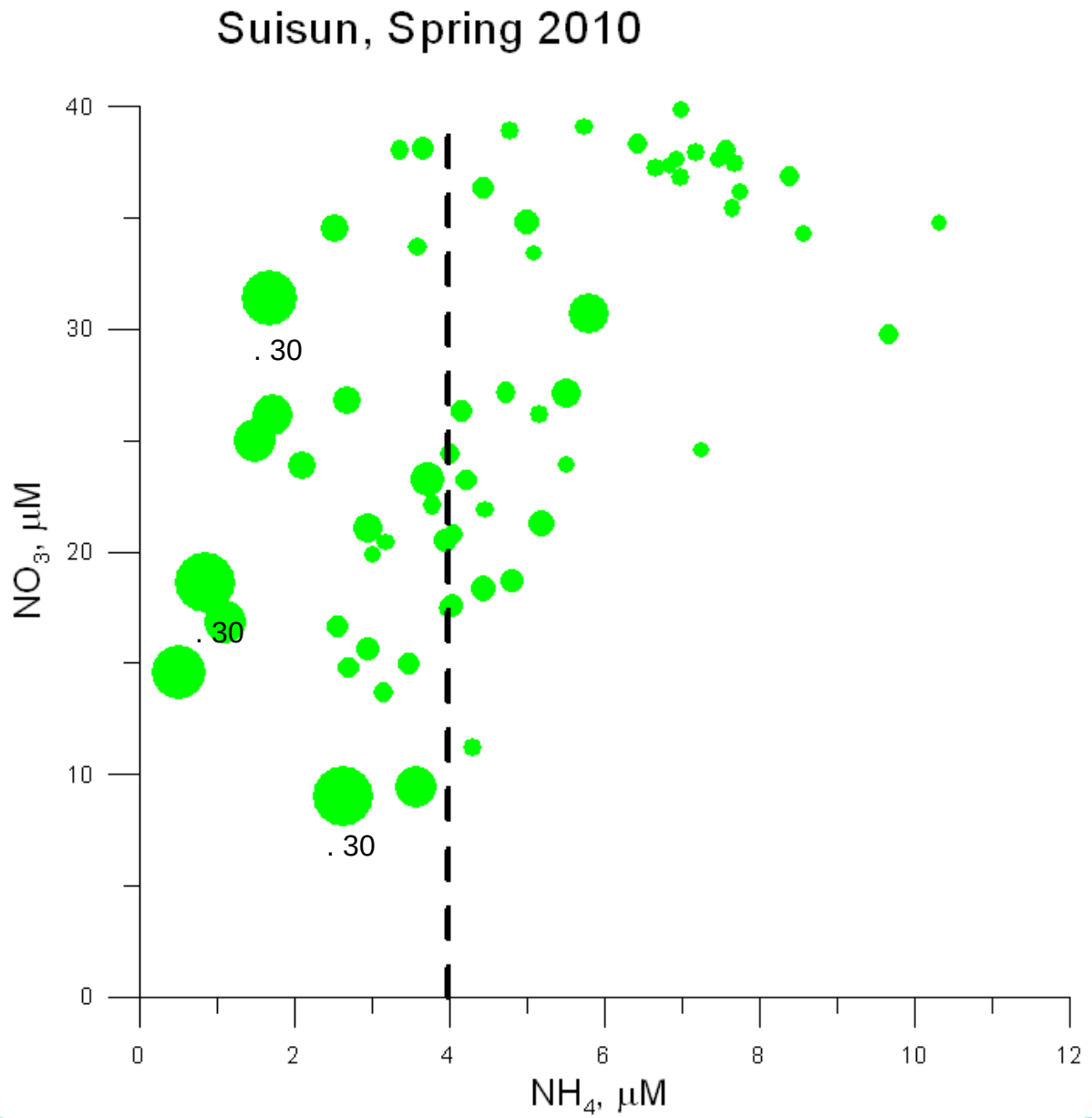

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Suisun Bay Study
Results

- Largest diatom bloom in Suisun in 10 years
- Two blooms occurred when NH4 was below 4 uM
- NH4 concentrations and load lower than previous years due to SRWTP manipulations and higher river flow, although not high enough for washout.
- NH4 signal from Sacto River and western Suisun near Central San.
- Bloom occurred despite presence of Corbula at historical spring concentrations

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Suisun Bay 2011/12 studies
Objectives

1. Determine if NH4, copper and/or pesticides cause inhibition of primary production in Suisun Bay in the spring (laboratory study – TIE)
2. Determine if NH4 conc, specific nutrient ratios, or nitrogen uptake rates are related to a lower rate of primary production in spring in Suisun Bay (field study)
3. Determine if stations w/ high primary production can accumulate high phytoplankton biomass despite the presence of *Corbula*
4. Identify sources of NH4 to Suisun Bay in the spring
5. Compare spatial patterns in inorganic nutrient conc., chl a, primary production or phytoplankton nitrogen uptake rates between channel and shoals
6. Compare phytoplankton community composition during phytoplankton blooms and non-blooms in Suisun Bay, and with different nutrient concentrations and ratios
7. Evaluate the role that water column stratification and an improved light field play in promoting phytoplankton blooms in Suisun

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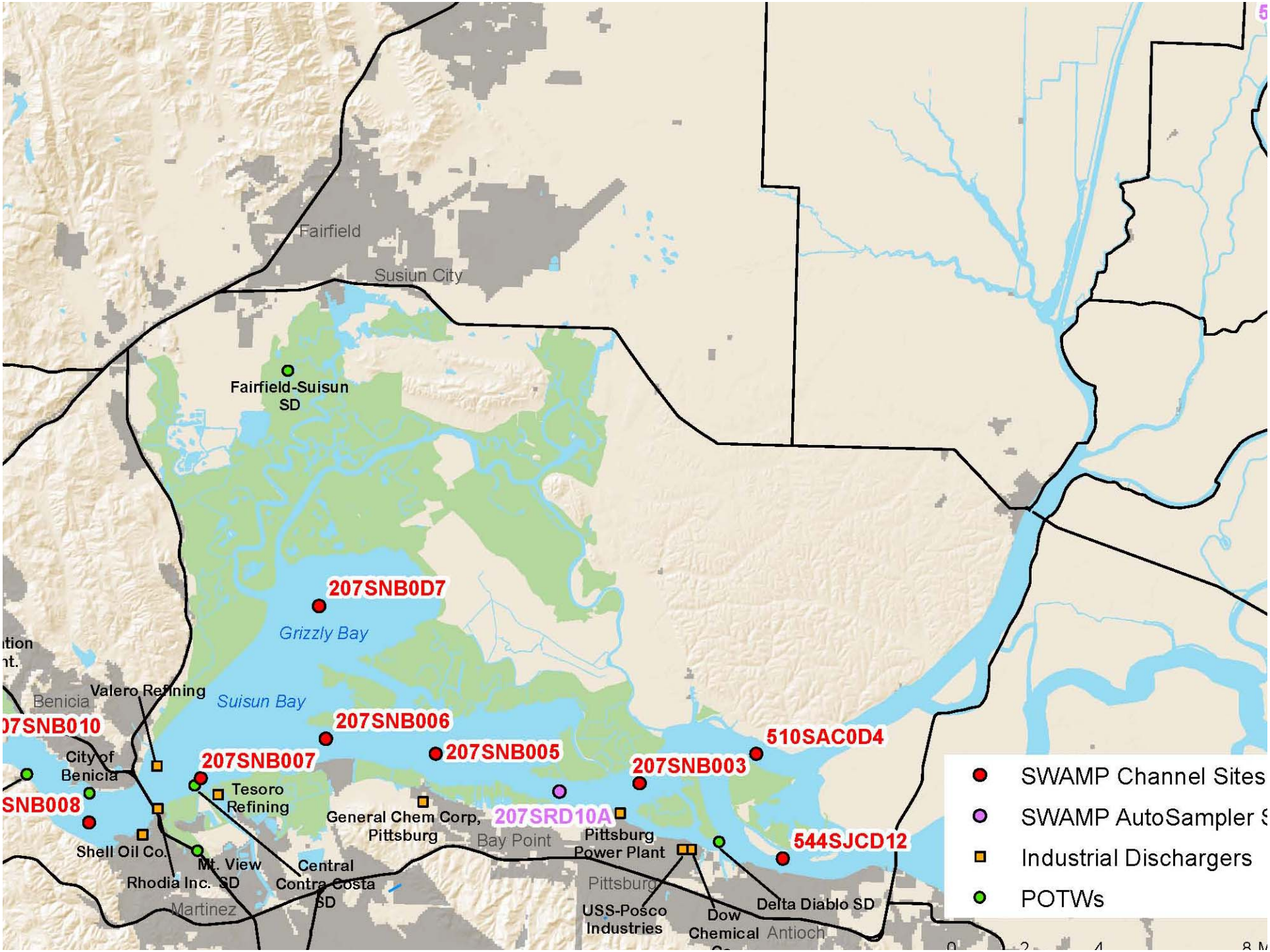
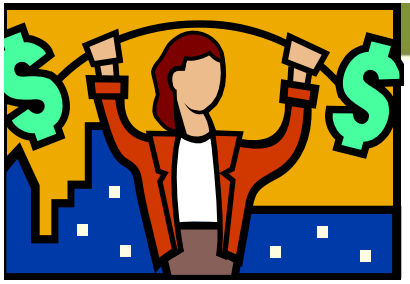
Study Design

- Sample at 9 stations for 10 weeks March - June (90 samples + 5 QA)
- Add a westerly station (USGS- 9) & station at the mouth of the SJR (D-12)
- Add DON & urea
- Add analysis of TP, pesticides/herbicides and metals
- Analyze phytoplankton community composition
- Add measurements of 4 types of biomass (in vivo chl a, size fractionated chl a, flow cytometry, direct microscopic counts)
- Take measurements (temp, salinity, OBS, PAR, in vivo chl a) at 4 depths at each station, except shoal

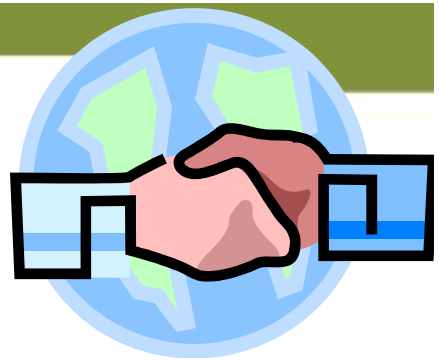
Study Design cont.

- Incubate all samples at 4 irradiances to measure primary productivity and nutrient uptake w/ stable isotopes $^{13}C/^{15}N$ (depth integrated primary production)
- Autosamplers used to take time integrated samples at Hood and at Chipps Island for ammonium analysis
- TIEs with samples from Suisun that target ammonium, copper and pesticides
- SWAMP peer reviewed workplan


Fairfield
Susiun City
Fairfield-Suisun SD
207SNB0D7
Grizzly Bay
Suisun Bay
Benicia
Valero Refining
207SNB010
City of Benicia
207SNB007
Tesoro Refining
207SNB008
Shell Oil Co.
Rhodia Inc.
Mt. View SD
Central Contra Costa SD
Martinez
207SNB006
207SNB005
General Chem Corp, Pittsburg
207SRD10A
Bay Point
207SNB003
510SAC0D4
Pittsburg Power Plant
544SJCD12
Pittsburg
USS-Posco Industries
Dow Chemical
Delta Diablo SD
Antioch
SWAMP Channel Sites
SWAMP AutoSampler S
Industrial Dischargers
POTWs



Funding/Coordination



- Continue coordination with USGS and DWR
- R2 SWAMP fund all sampling/incubations/analysis except: 9th station, taxonomy, TP, pesticides/herbicides, metals
- RTC conduct all boat sampling, incubations and nutrient analysis
- R5 supply autosamplers, R2 collect samples
- Central San./BACWA analyze metals, fund 9th station, TP & pesticides/herbicides
- Water Contractors fund taxonomy, pesticides/herbicides & TIEs
- Aquascience develop & conduct TIEs