Biscayne Bay 2013 Phytoplankton Bloom Status

by Al G. Blume

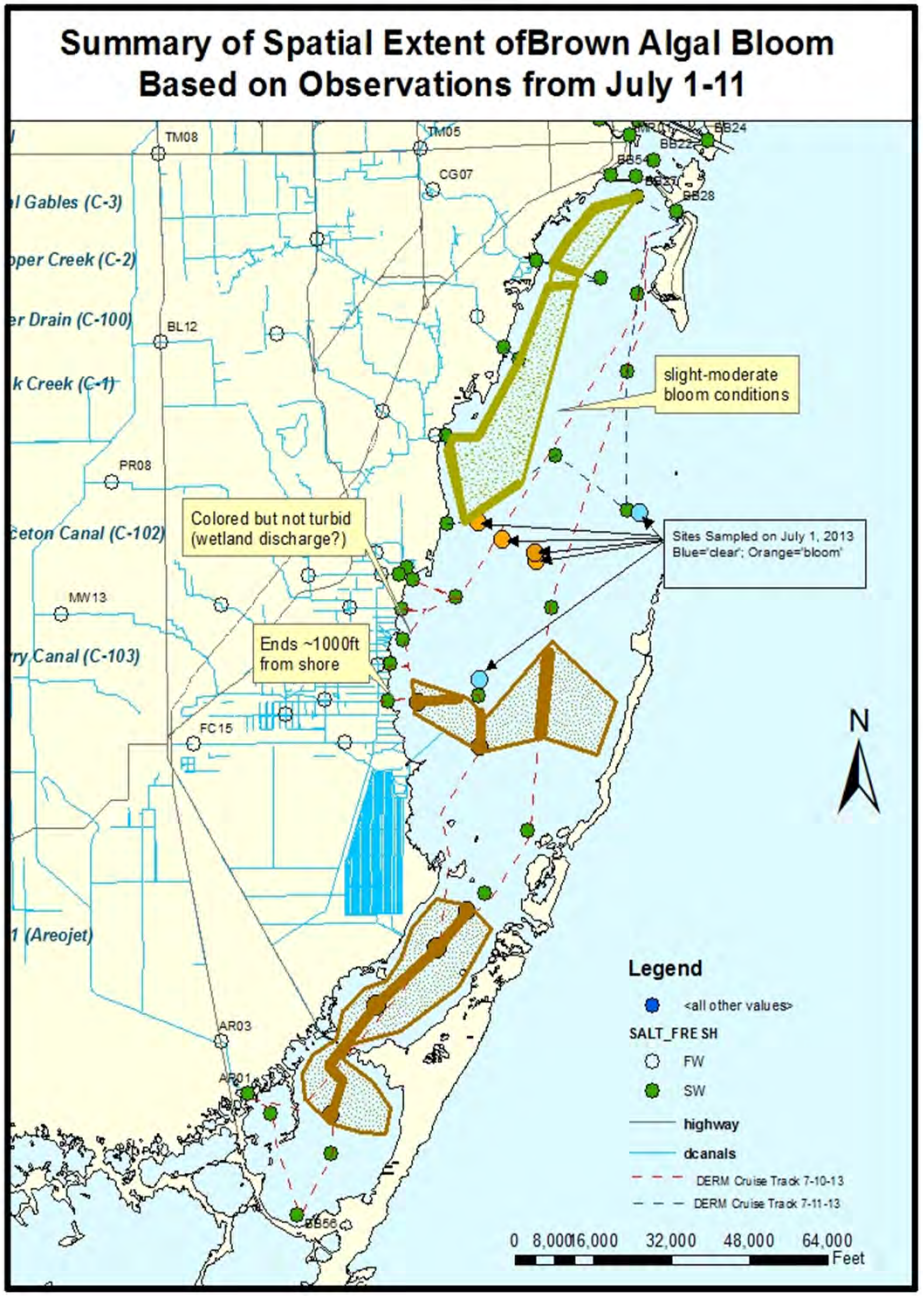
Water Quality Summary &
Observations on Spatial Extent:

Thanks to: NPS-BNP, SFWMD, NOAA AOML, NOAA-NMFS M-D DERM UM-RSMAS , USGS, FWC-FMRI, FIU

Biscayne Bay Regional Restoration Coordination Team
August 21, 2013

Initial Observations

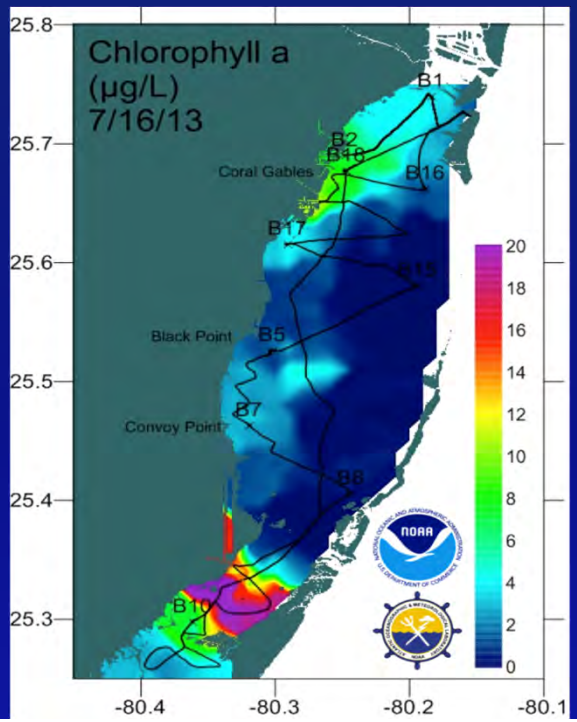
- In mid-June, field staff from BNP and other agencies reported areas of brown-colored, cloudy water and foul odors, especially in areas between Black Point and Convoy Point
- Meeting on July 12, 2013 to review available information and formulate plan (NPS, AOML, NMFS, FWC, FDEP, UM, FIU, M-D DERM, SFWMD)
- Three 'general' regions of the bloom identified, which showed of Chl-a concentrations up to 20x higher than normal.
- Samples examined by UM-RSMAS, FWC-FWRI, FIU and USGS determined the bloom organisms to be marine Diatoms (*Nitchisia* & *Chaetoceros*)
  - No toxic algal components identified
- No indicators of septic/sewage contamination within the bloom area



Bloom Response Sampling

NOAA-AOML Sampling

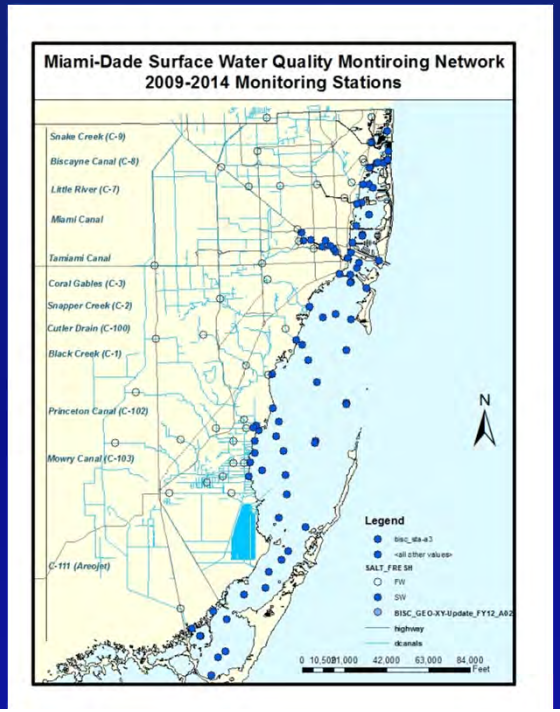
- Cruises in South Biscayne Bay, Card Sound and Barnes Sound
  - TSG flow-through system data (flurometry for CDOM, Chl-a), CTD profiles, light meter readings
  - Grab samples for Chl-a & nutrients
- Cruises: 7/16,7/23, 7/31, 8/8/13



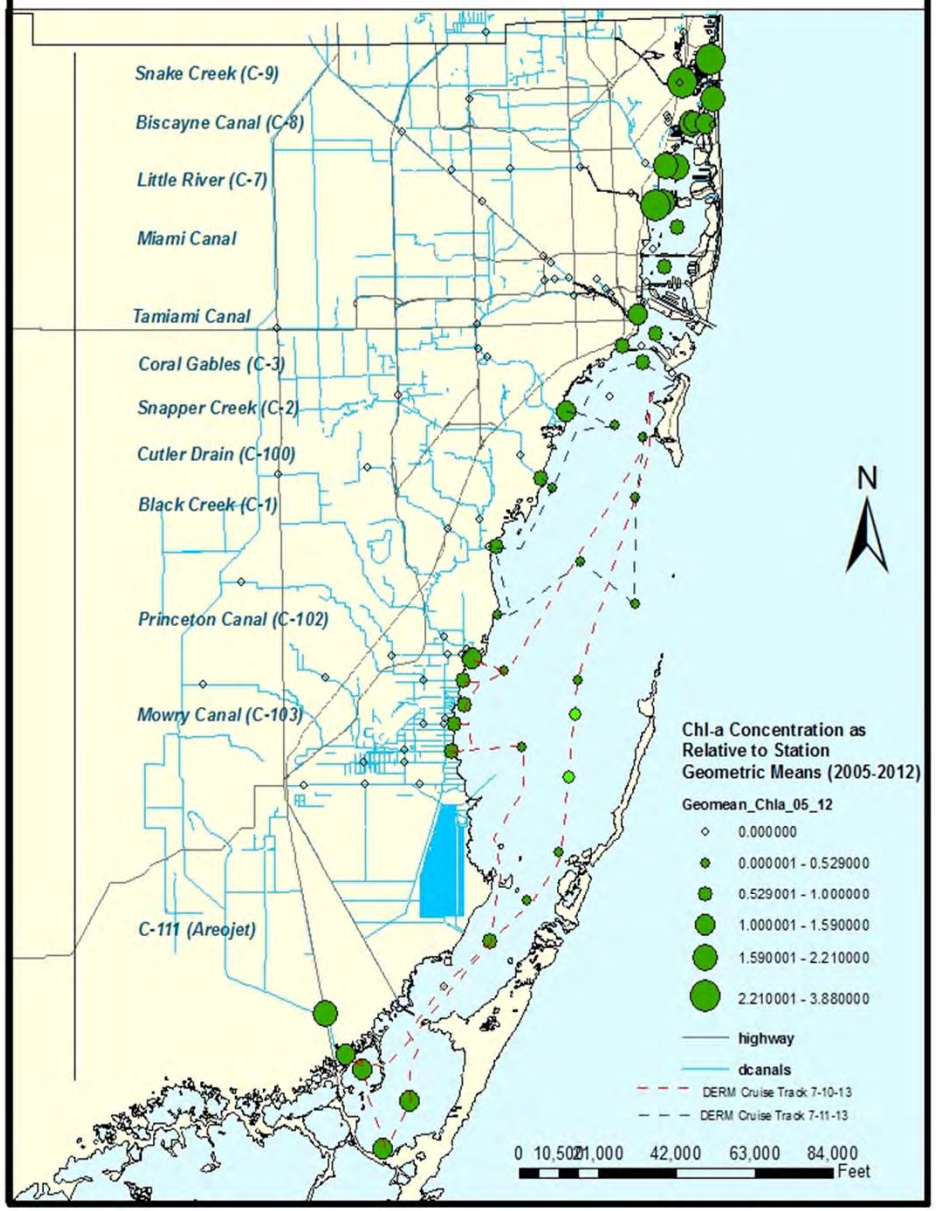
- M-D DERM monthly sampling
- Physical, Physio-chemical:
  - Light penetration (Bay only),Temp, pH, DO, Sal. conductivity, TSS, BOD, COD
- Nutrients
  - Ammonia, NOx, TP, OPO4, TKN
  - Chl-a (most Bay stations)
- Bacteria, Fecal Coliform
- Added Silicate to July & August sampling

Algal bloom Composition Sampling

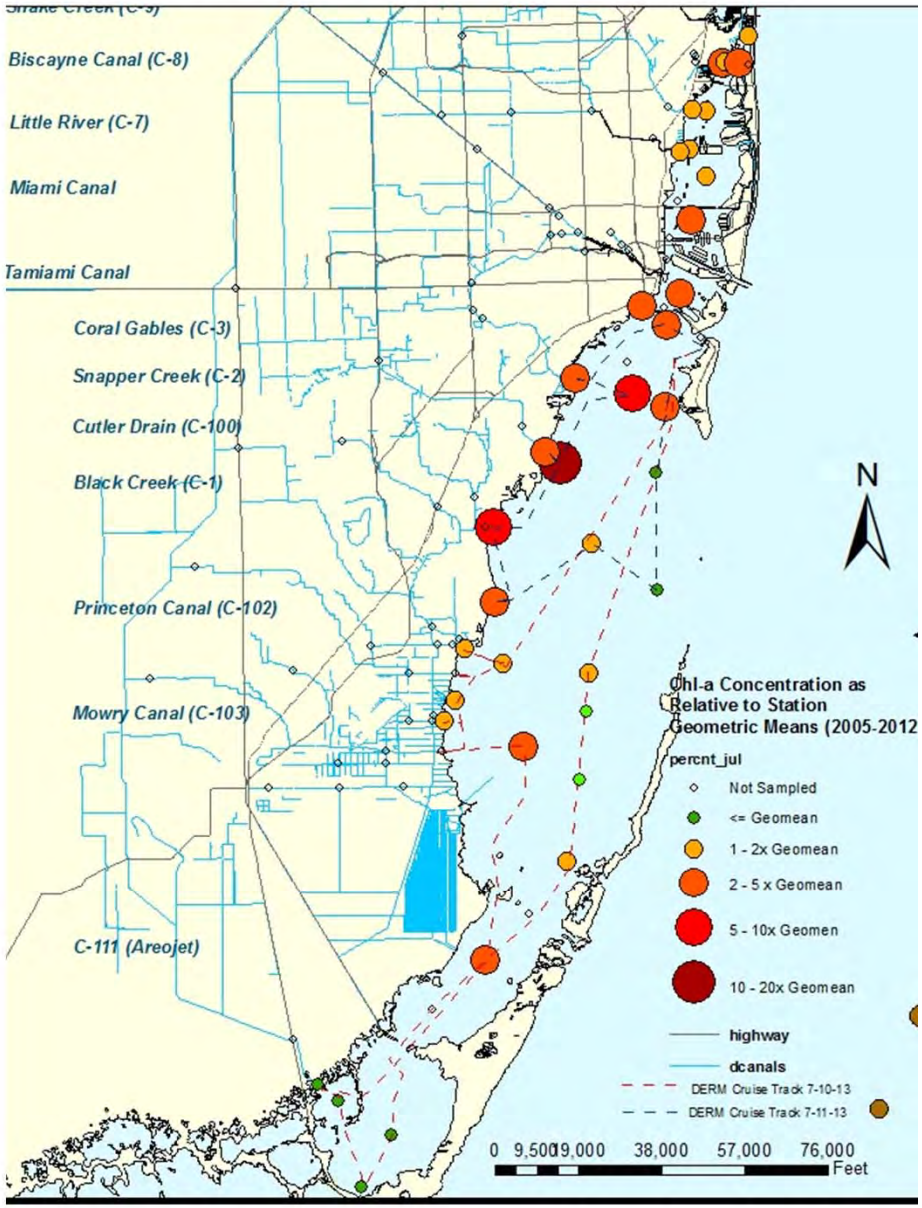
- Grab samples collected by DERM & NOAA
- Samples forwarded to FWC-FWRI, UM, FIU, and/or USGS for species composition analysis



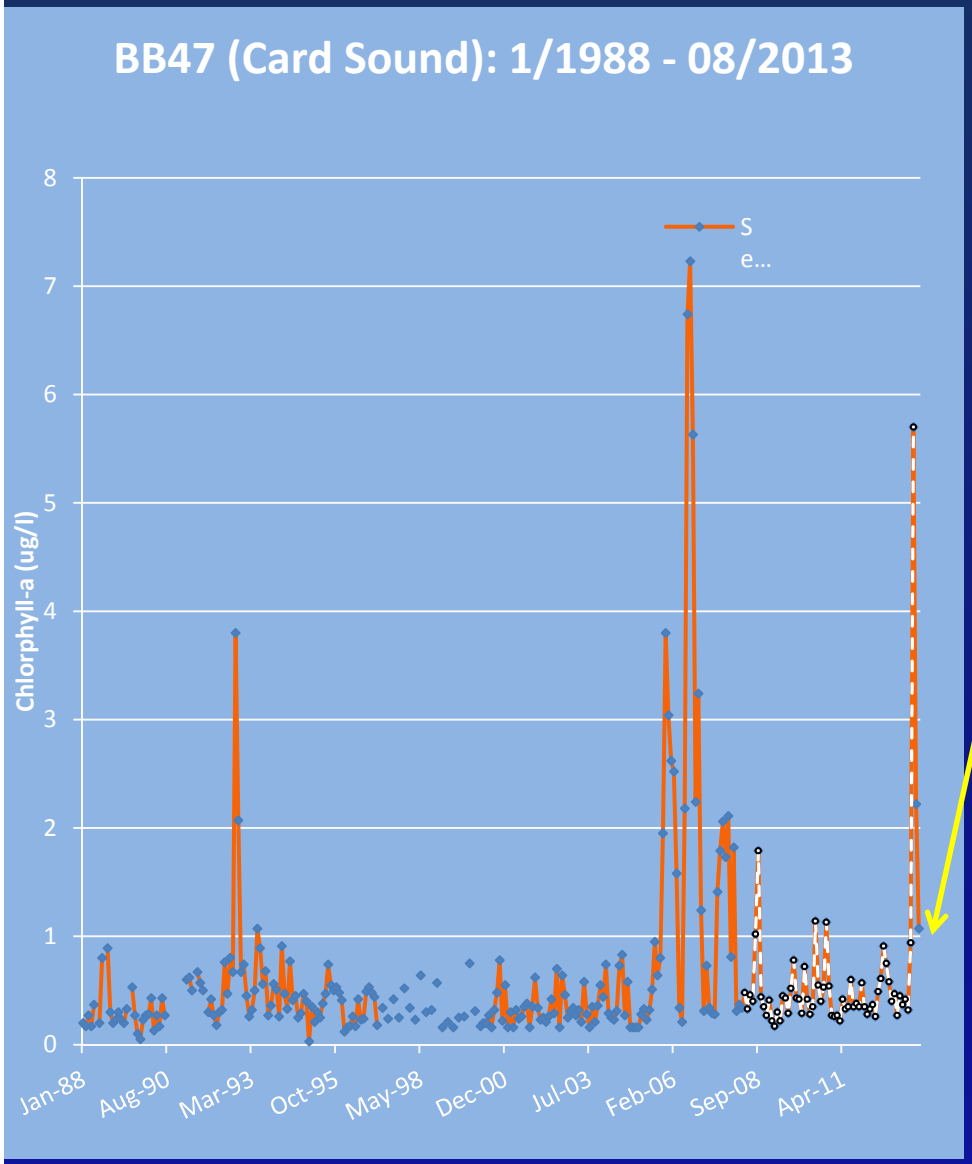
Geometric Mean of Chlorophyll-a by Station (2005 - 2012)

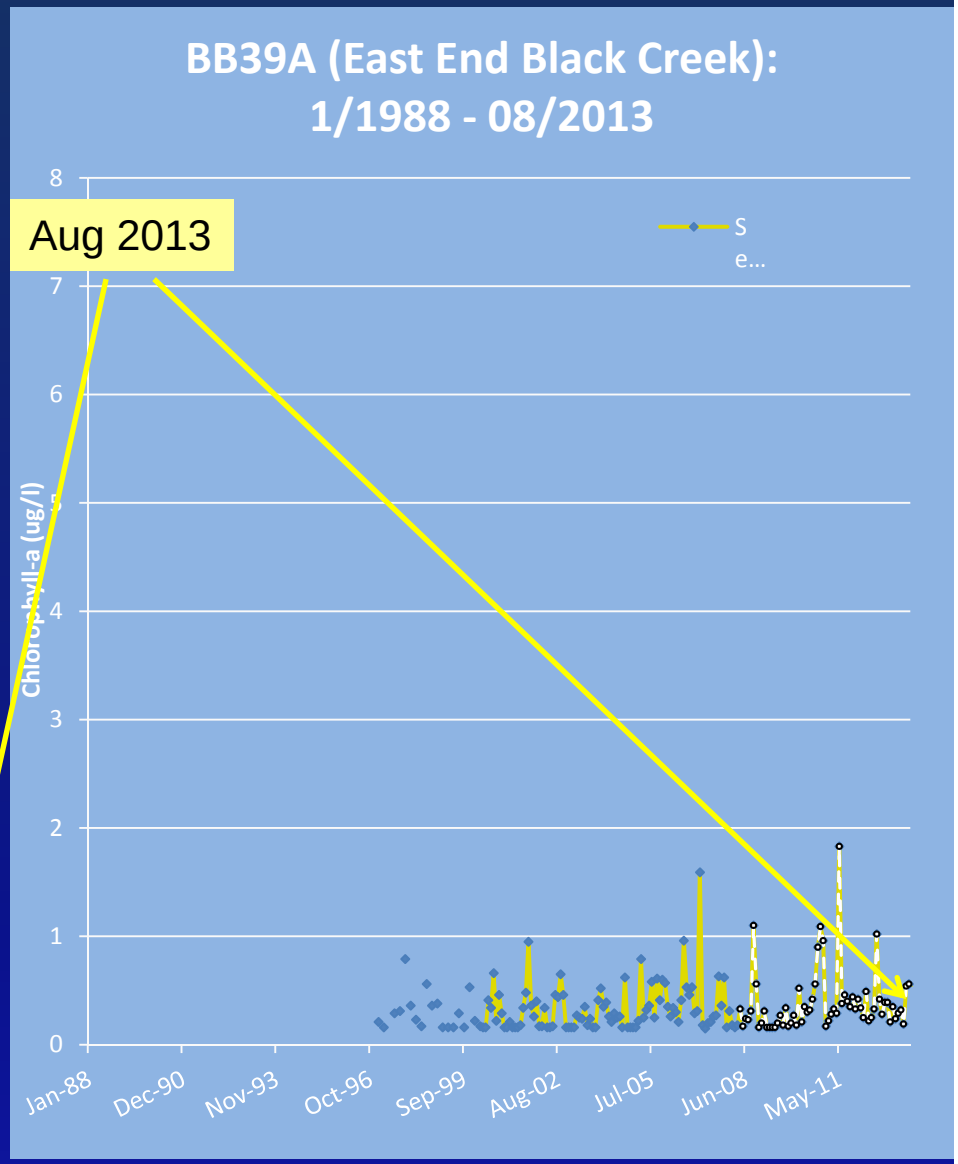


Normalized Chlorophyll-a Concentrations Based on Observations from July 10-11, 2013

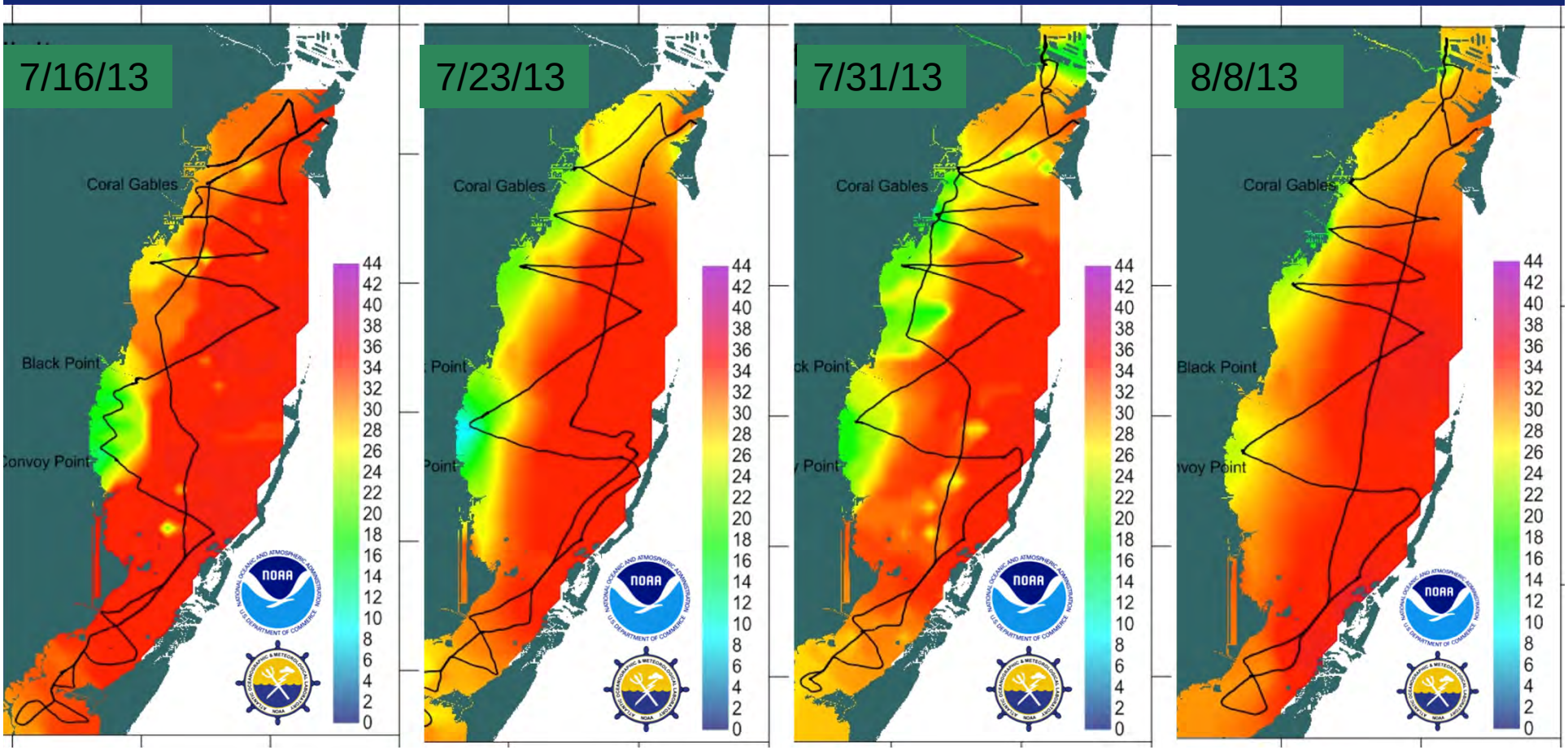


Chlorophyll-a Concentrations in Card Sound and SCI Biscayne Bay



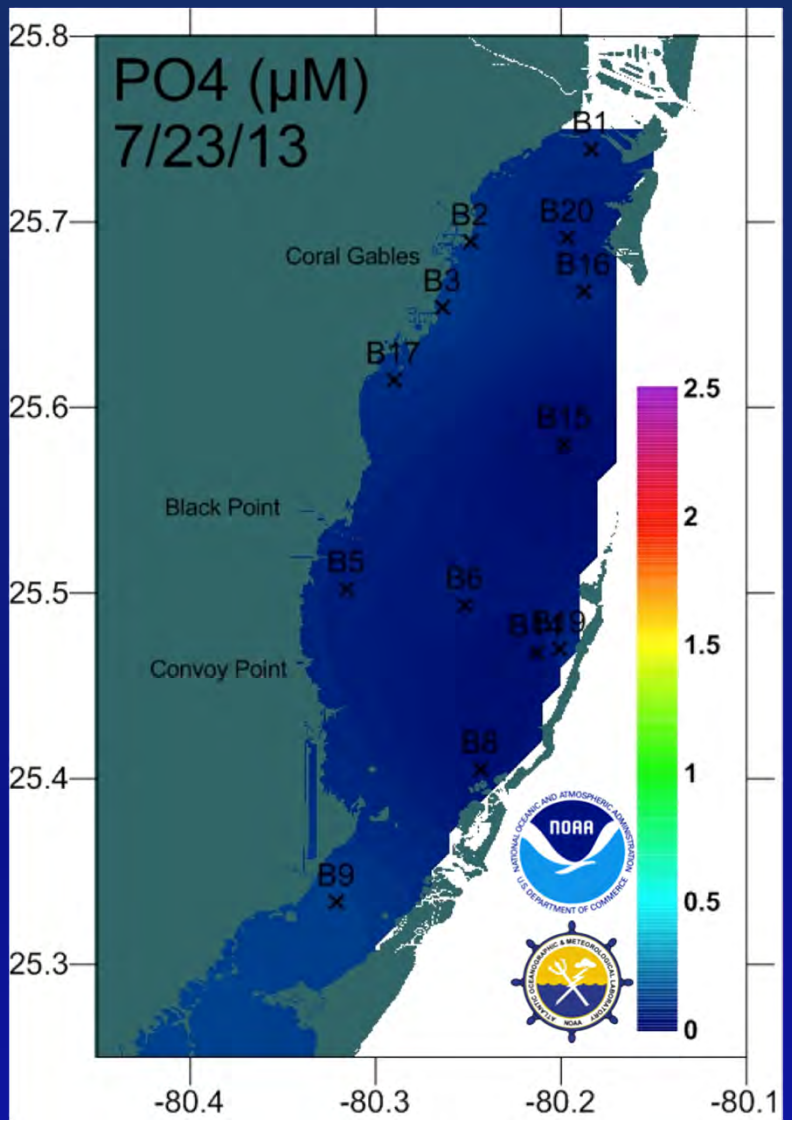


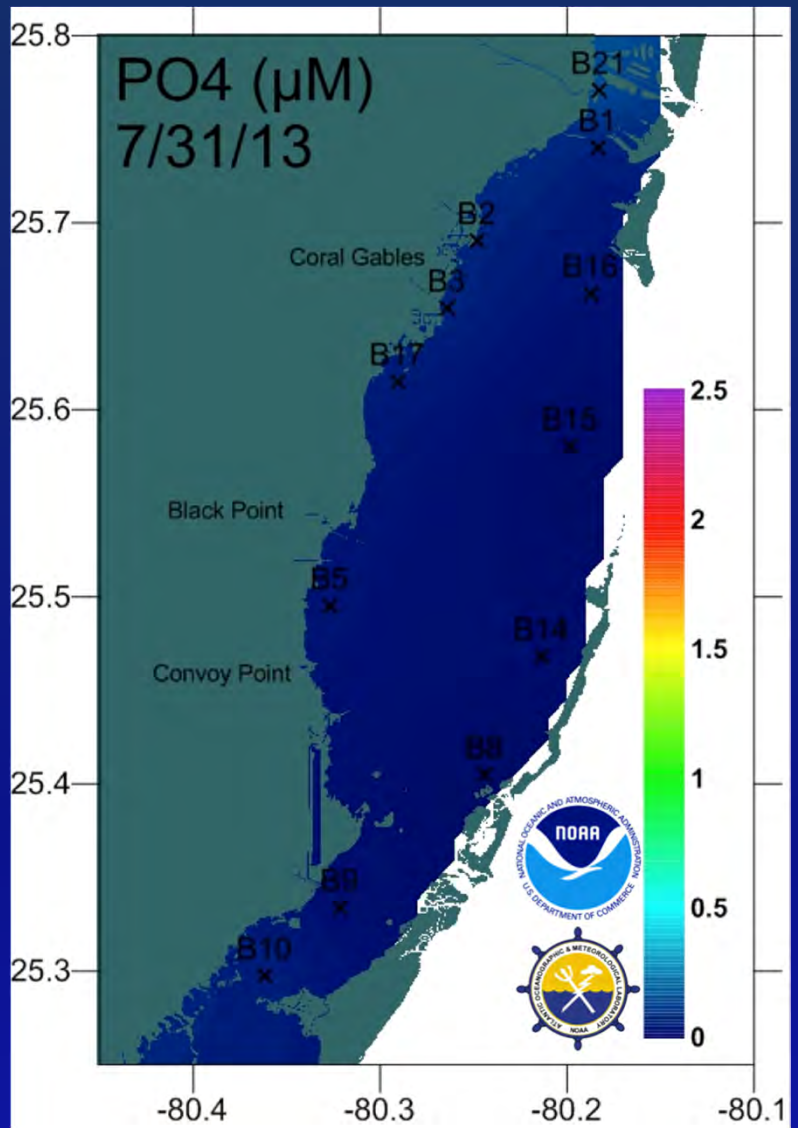
Salinity (PSU)
NOAA-AOML Cruise Sampling



T-PO4 Concentrations

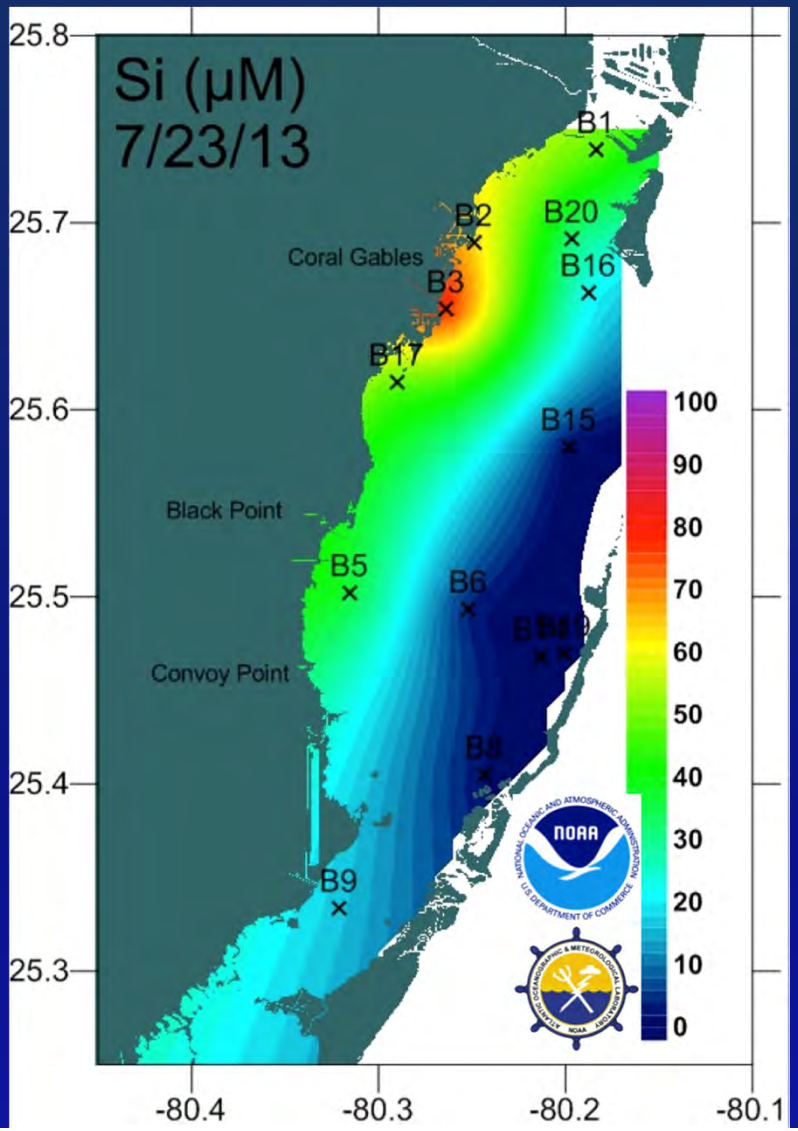
NOAA-AOML Cruise Sampling

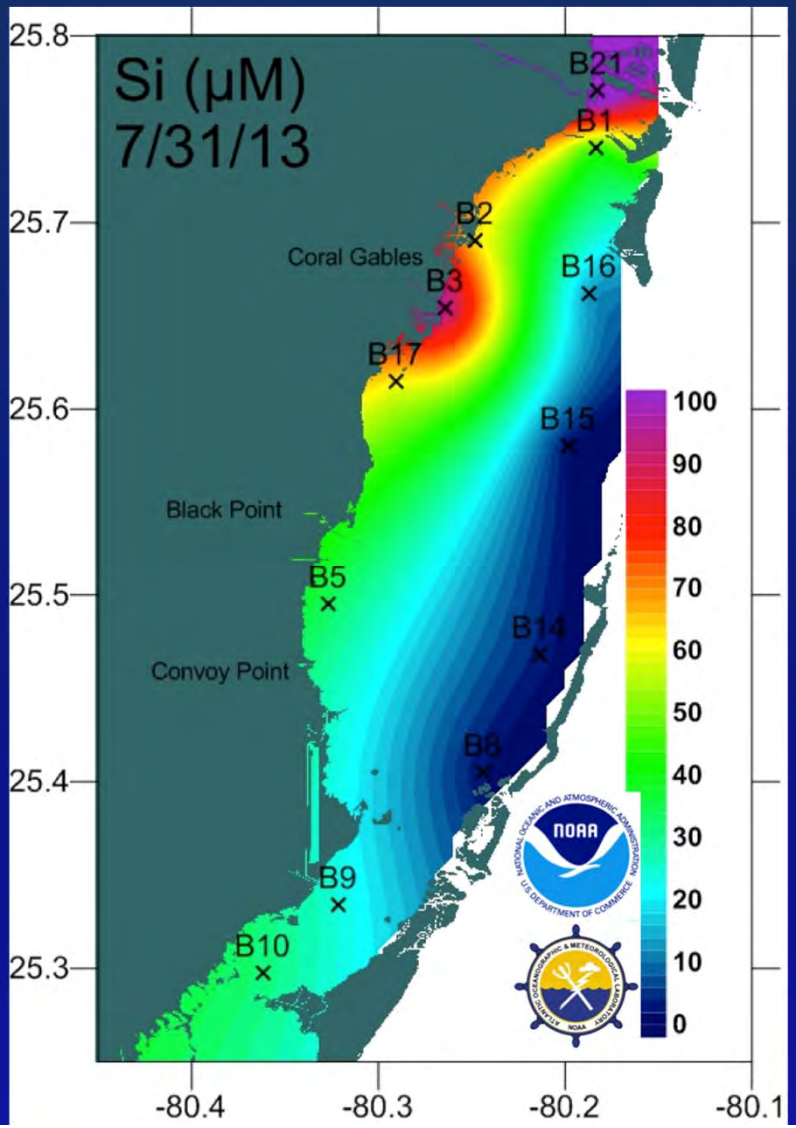




Silicate Concentrations

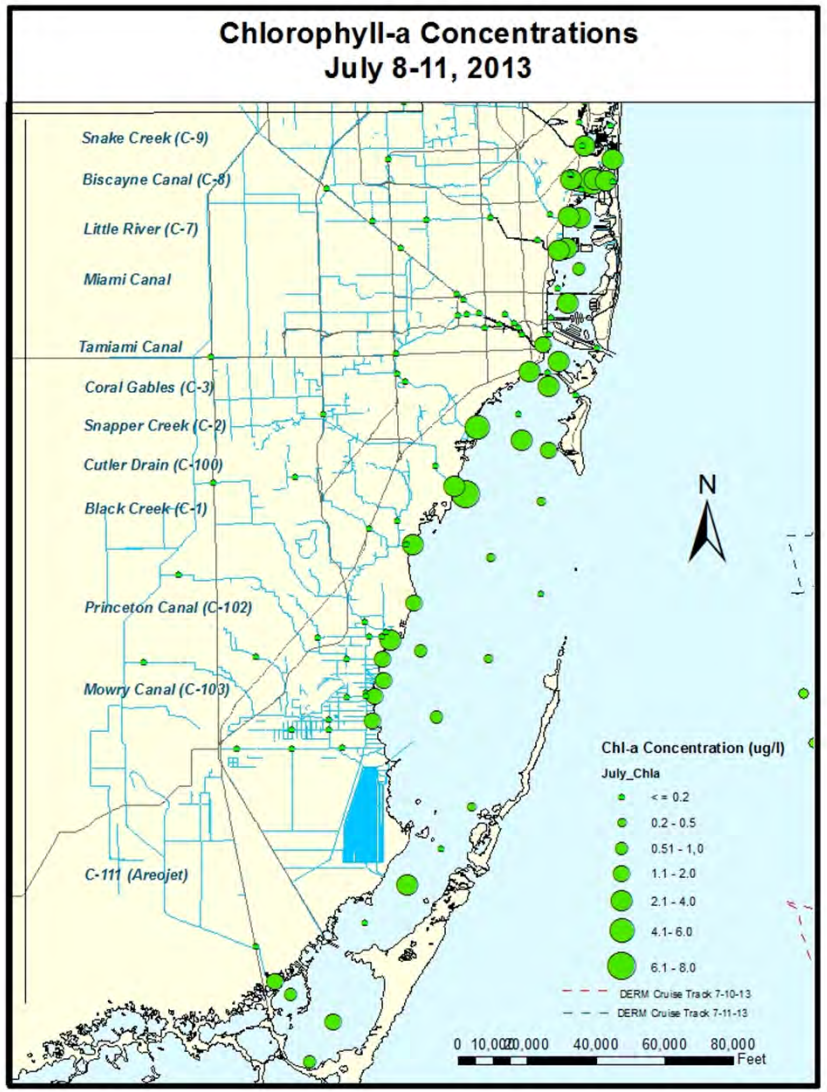
NOAA-AOML Cruise Sampling

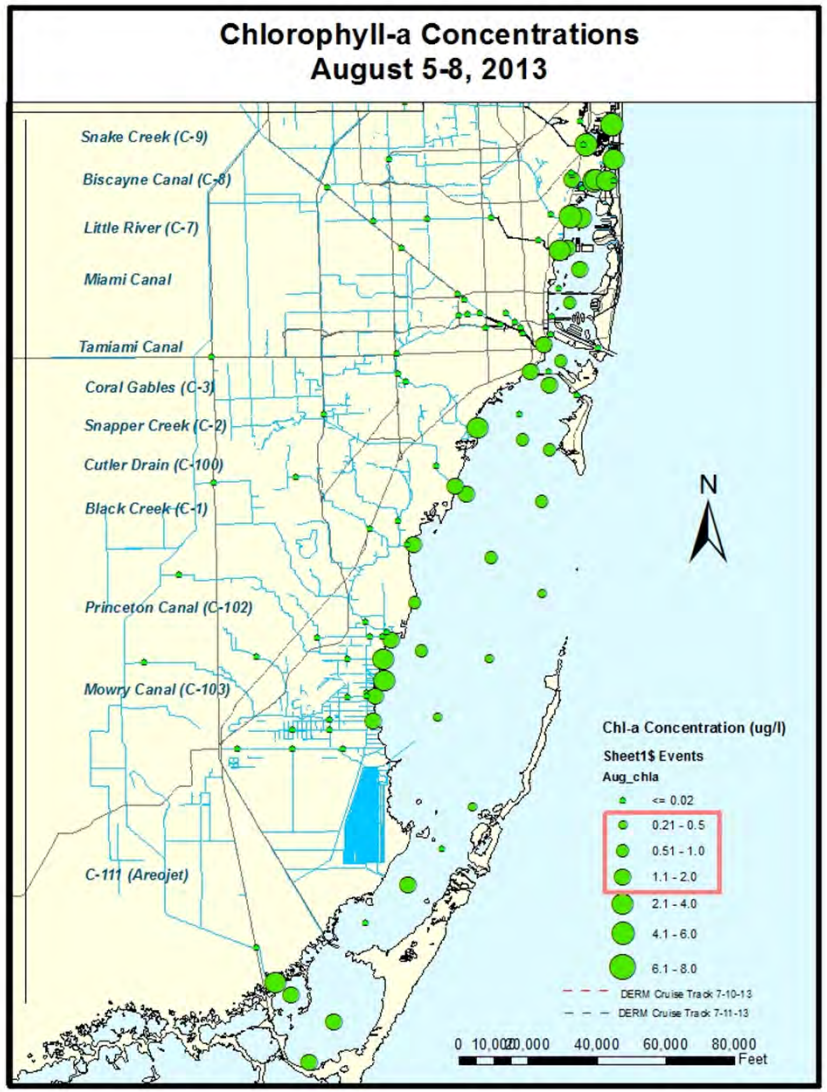




Chlorophyll-a Concentrations

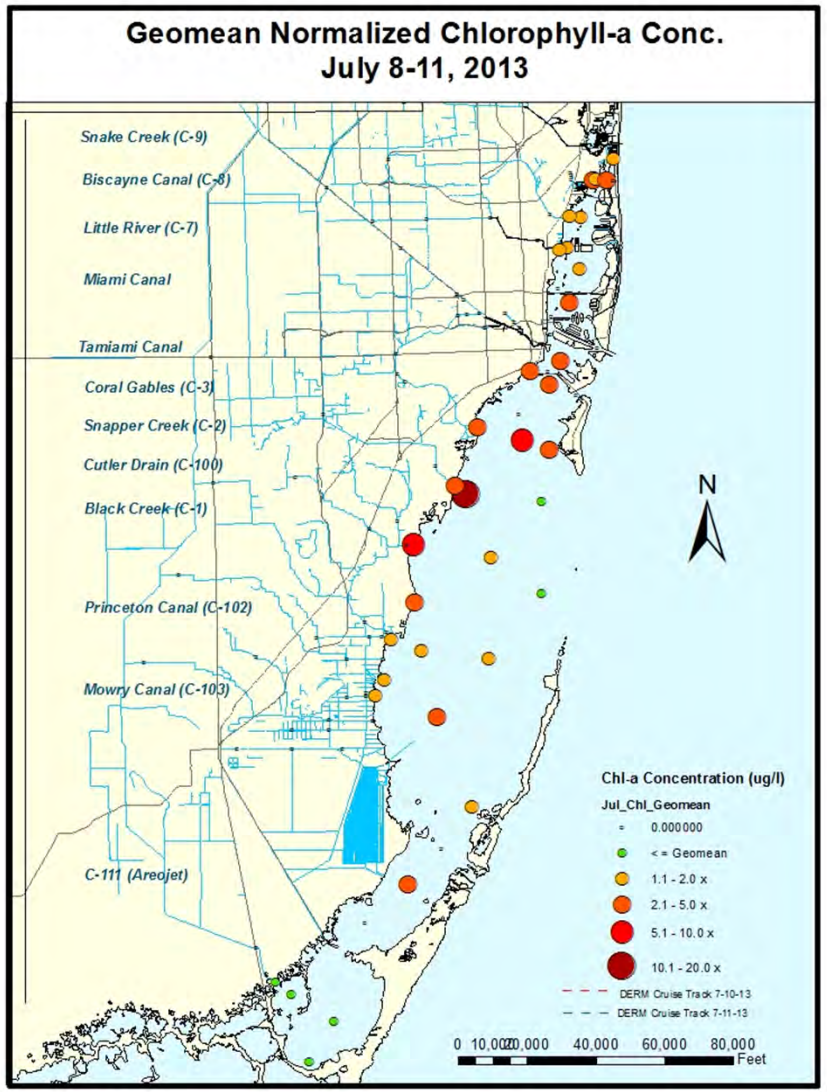
DERM Monthly Sampling

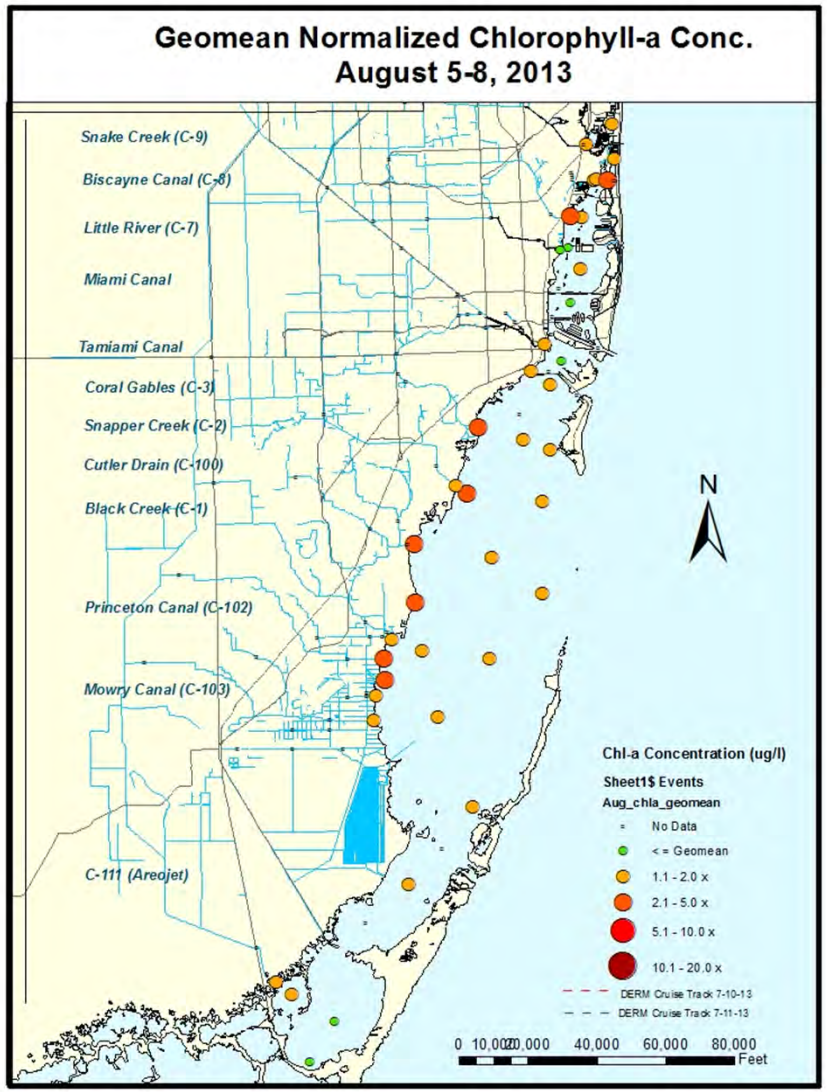




Normalized Chl-a Concentrations

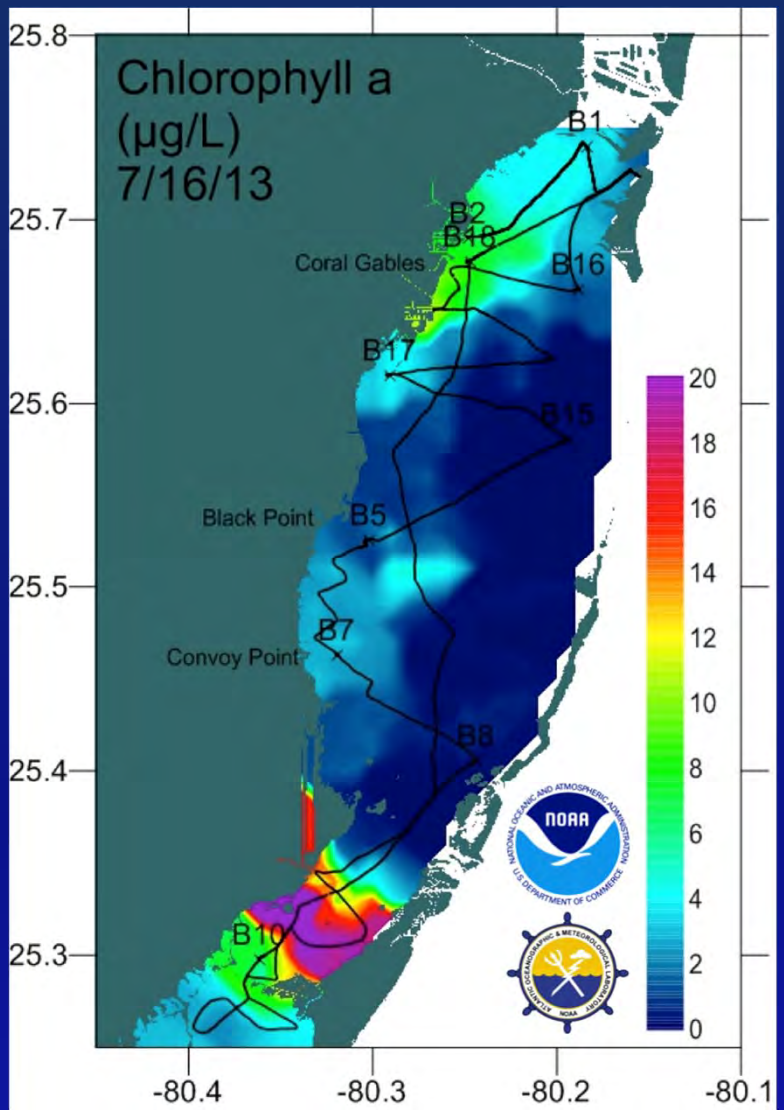
DERM Monthly Sampling

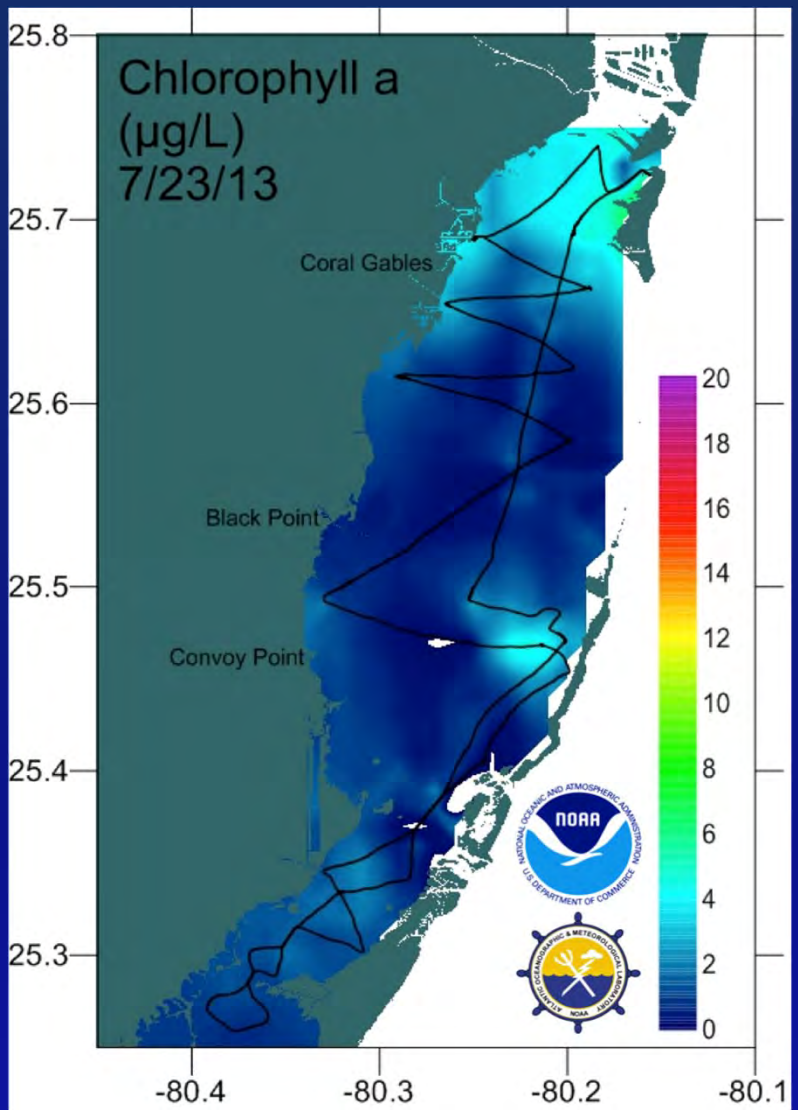




Chl-a Concentrations

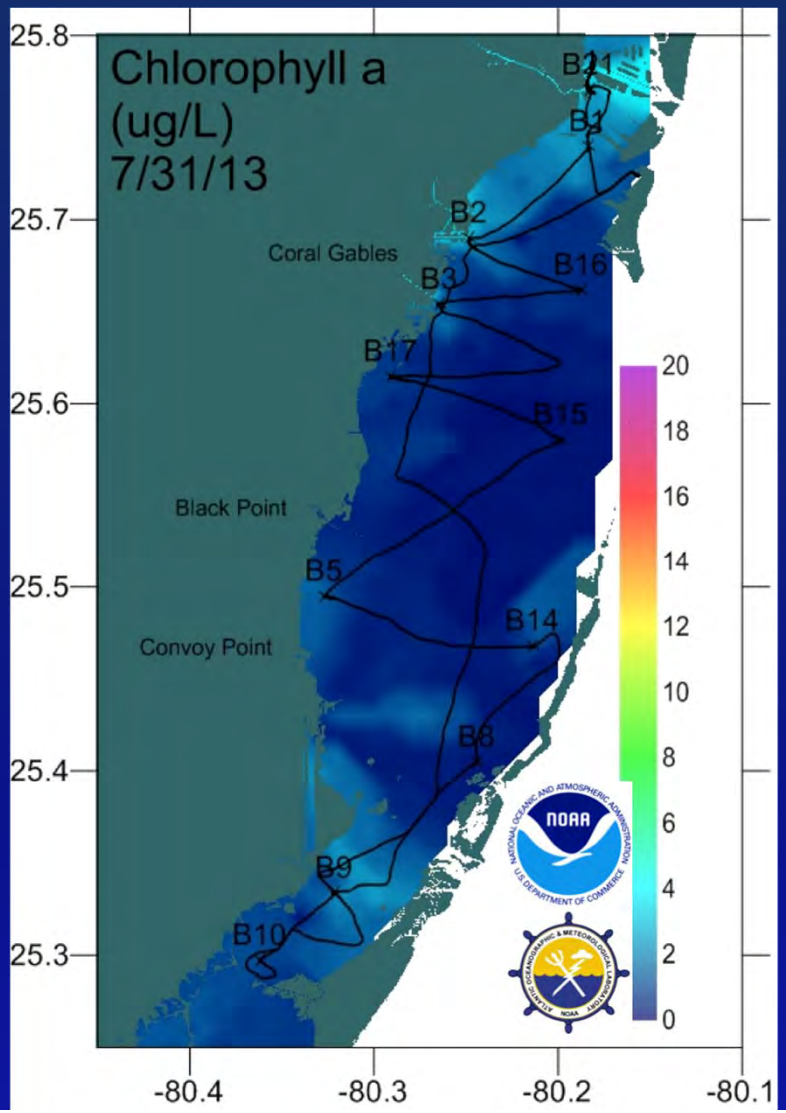
NOAA-AOML Cruise Sampling

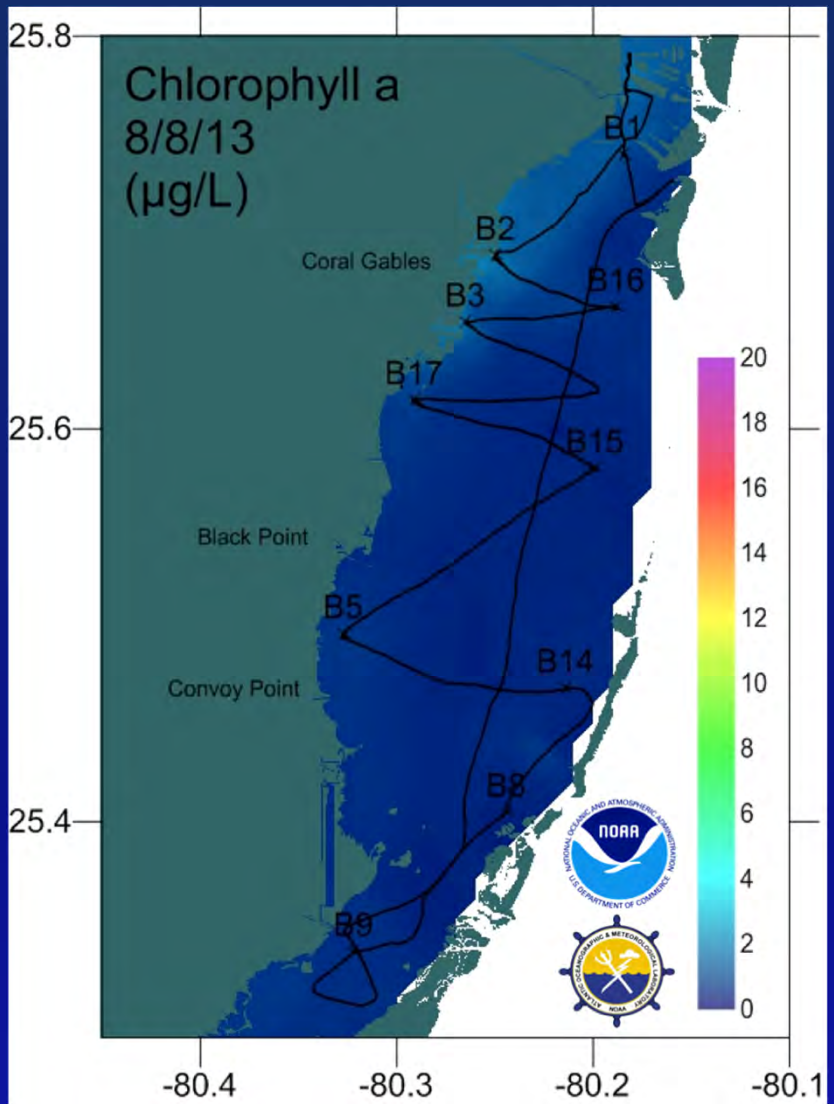




Chl-a Concentrations

NOAA-AOML Cruise Sampling





Present Status

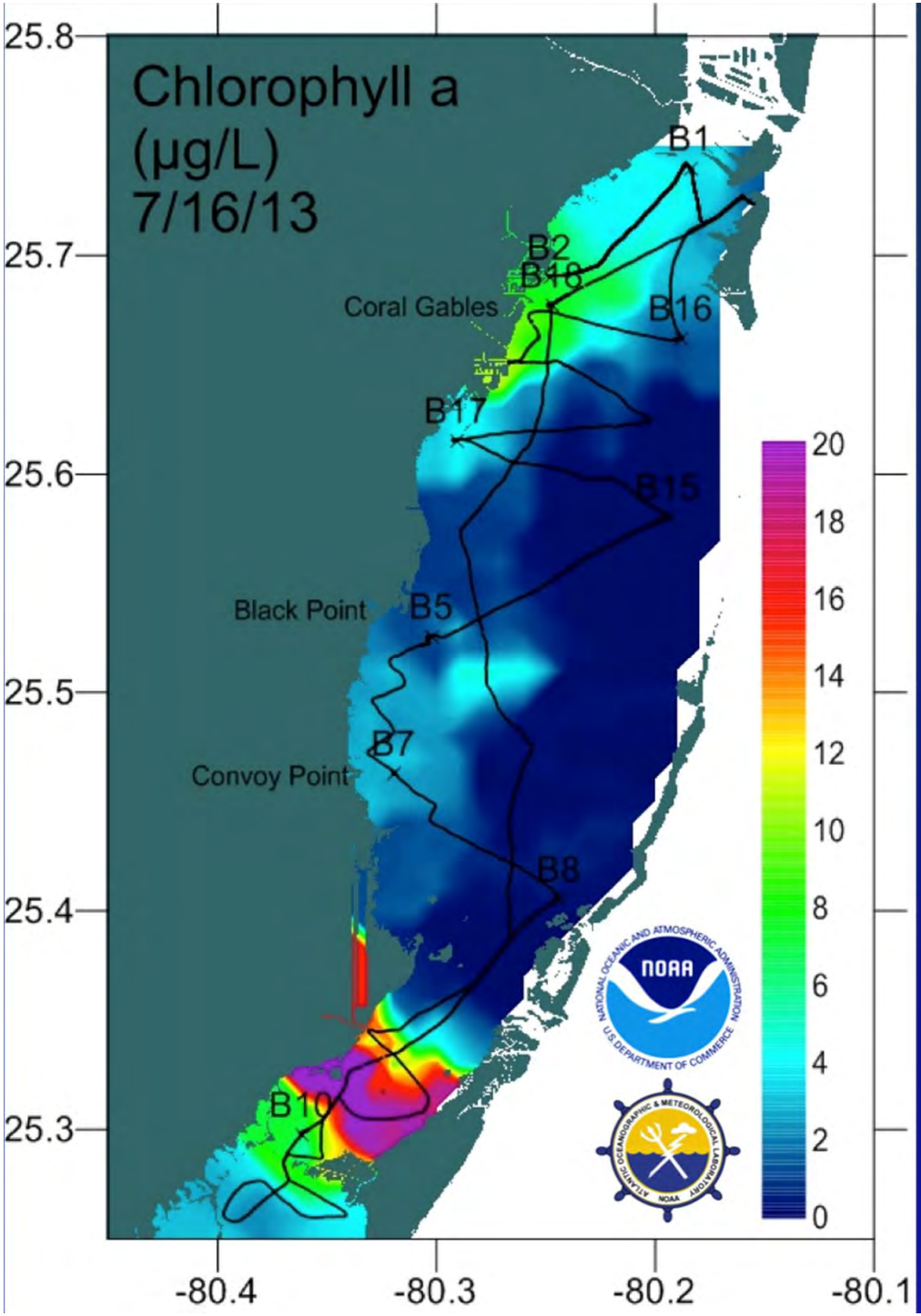
- In samples examined to date, blooming species are non-toxic, common marine diatoms (Nitzschia & Chaetoceros).
- Sampling showed Chl-a concentrations up to 20x normal values
- Phosphorus levels in freshwater canals were within range of normal variation
- Silica concentrations in freshwater canals commonly 10x higher than in bay (however, levels of silica in the bay may not have been limiting)
- SFWMD analysis shows early onset of rainy season, and periods of heavy rains have resulted in high flow from coastal control structures.
- Causes of bloom remain unknown, however, higher flows from coastal structures would increase load of nutrients.
  - Physical factors (temperature/salinity) may have favored bloom of marine diatoms over other species??
- Chl-a concentrations have reduced significantly during late July and early August, but remain 1-3 x above 'normal' levels.
- Aerial surveys during last week in July showed water color and clarity greatly improved in the regions previously showing bloom conditions.

What next?

- Important to remain vigilant. Conditions have not returned to "normal".
  - Entering 'heart' of tropical storm season – anticipating additional rains and discharges to the Bay.
- Federal, state and local agencies and university scientists need to continue collaborating sampling response to optimize cost-savings (no budget surpluses).
- M-D DERM will continue Monthly sampling .
- Algal samples should continue be collected for analysis by FWRI and universities.

Questions -Comments?

**Note: photos not taken at same location. Provided only for illustration.*



NOAA Survey Results

- "typical" concentrations ~ 1 ug/L
- survey track was not able to reach eastern part of south Biscayne Bay

Summary of June 'South Bay' Water Quality & Preliminary Bloom Sampling

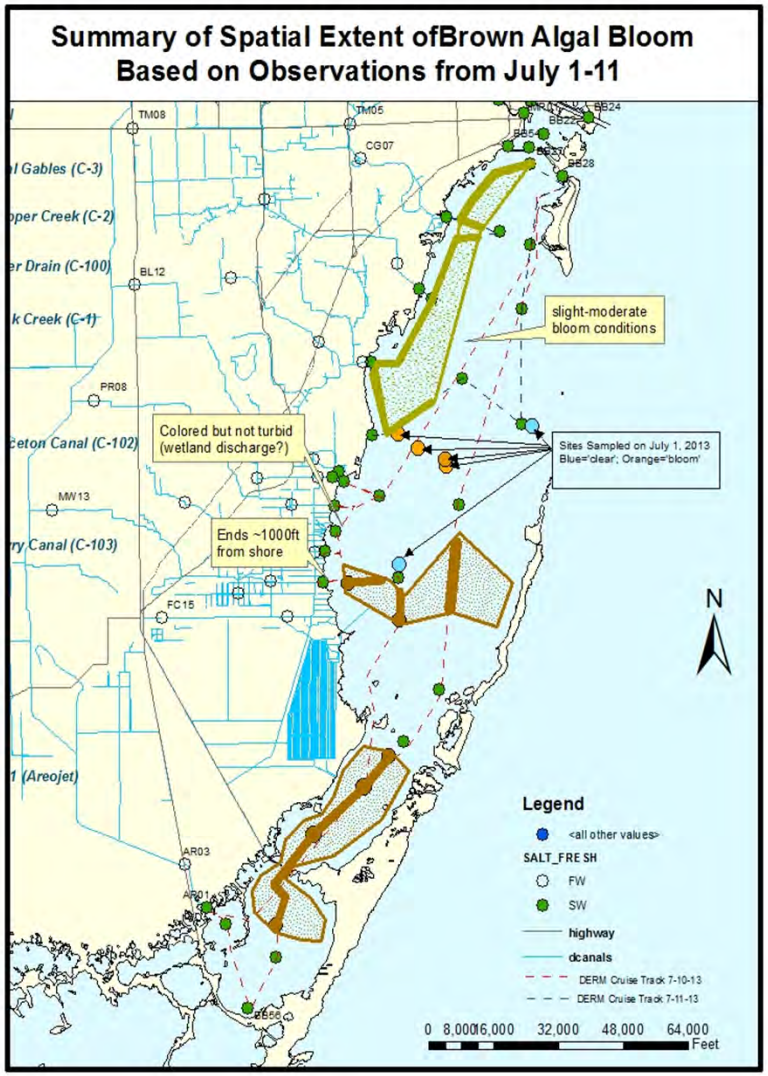
June WQ values 'normal', except Card Sound (BB47) Chl-a

June Bay Run Sampling (June 5-6, 2013)

		Chl-a	TP	OPO4	TKN	Ammonia	Nox
MDL		0.16	0.002		0.08		0.01
Units		ug/l	mg/l		mg/l		mg/l
Stations	Nut-Seg						
BB27	NCO	0.23	0.004	U	U	0.09	U
BB31	NCI	U	U	U	U	0.09	U
BB35	SCO	U	U	U	U	0.10	U
BB36		U	U			0.09	U
BB37	SCo	U	U	U	U	0.09	U
BB38	NCI	0.38	0.003	U	U	0.09	U
BB39A	SCI	0.54	0.003	U	0.49	0.10	0.20
BB41	SCM	0.55	0.002	U	0.18	0.10	0.02
BB44	SCO	0.47	0.002	0.002	0.13	0.09	U
BB47	CS	5.70	0.004	0.003	0.26	0.09	U
BB50	BSMB	1.24	0.006	0.002	0.16	0.11	U
BB51	BSMB	0.82	0.003	U	0.40	0.11	U
BB52	SCI	0.17	0.003	0.003	0.13	0.02	0.17
BB53	SCI	0.98	0.004	0.004	0.63	0.12	1.00
BB54	SNB	2.47	0.004	U	0.10	0.09	U
BB56	BSMB	1.37	0.006	U	0.52	0.13	U

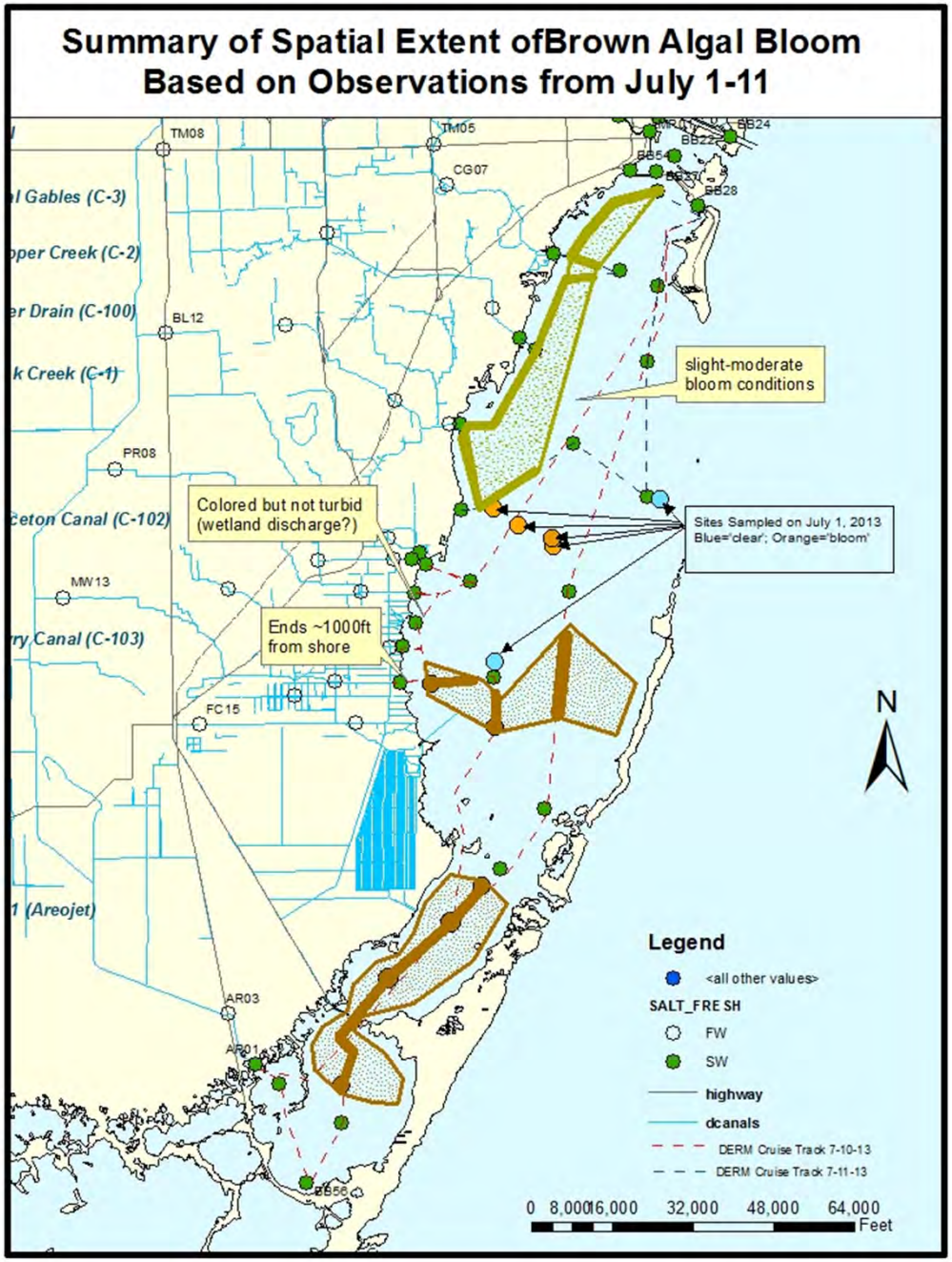
July 1, 2013 - opprotunistic sampling outside (BE1, BE2) & inside (BE3, BE4, BE5, BE6) the bloom

		Chl-a	TP	OPO4	TKN	Ammonia	Nox	Sulfate	Color	Fecal Coliform	Enterococcus
MDL		0.16	0.002	0.002	0.08	0.01	0.01	0	5	10	10
Units		ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	PCU	cfu/100ml	cfu/100ml
Stations	Nut-Seg										
BE1	SCM	0.4	0.002	0.003	<0.08	0.1	<0.01	2760	8	<10	<10
BE2	SCO	0.42	0.002	0.003	<0.08	0.08	<0.02	2700	15	<10	<10
BE3	SCO	9.63	0.028	<0.002	0.85	0.07	<0.03	2470	25	<10	<10
BE4	SCM	5.27	0.008	0.003	0.31	0.08	<0.04	2650	20	<10	<10
BE5	SCO	11.11	0.016	<0.002	0.67	0.08	<0.05	2640	30	<10	<10
BE6	SCI-SCM	11.94	0.022	<0.002	1.07	0.07	<0.06	2460	35	<10	<10



- Three large visible “patches” noted by DERM field crews while traveling from one sample station to another
  - Rickenbacker to south of Deering along western side
  - South central offshore of Convoy point to shoreline of Elliott
  - Arsenickers through Card and into northern Barnes Sound

- water samples collected outside patches (clear water) and in dense areas of patches



Biscayne Bay Numeric Nutrient Criteria

Ref: *F.A.C. 62-302.532(1)*

			CRITERION		
Rule item	**Region ID**	**Region Name**	**TP (mg/l)**	**TN (mg/l)**	**Chl-a (ug/l)**
(h)5	NNB	Northern North Bay	0.012	0.30	1.7
(h)9	SNB	Southern North Bay	0.010	0.29	1.1
(h)3	NCI	North Central Inshore	0.007	0.31	0.5
(h)4	NCO	North Central Outer-Bay	0.008	0.28	0.7
(h)6	SCI	South Central Inshore	0.007	0.48	0.4
(h)7	SCM	South Central Mid-Bay	0.007	0.35	0.2
(h)8	SCO	South Central Outer-Bay	0.006	0.24	0.2
(h)1	CS	Card Sound	0.008	0.33	0.5
(h)2	MBS	Manatee Bay – Barnes Sound	0.007	0.58	0.4