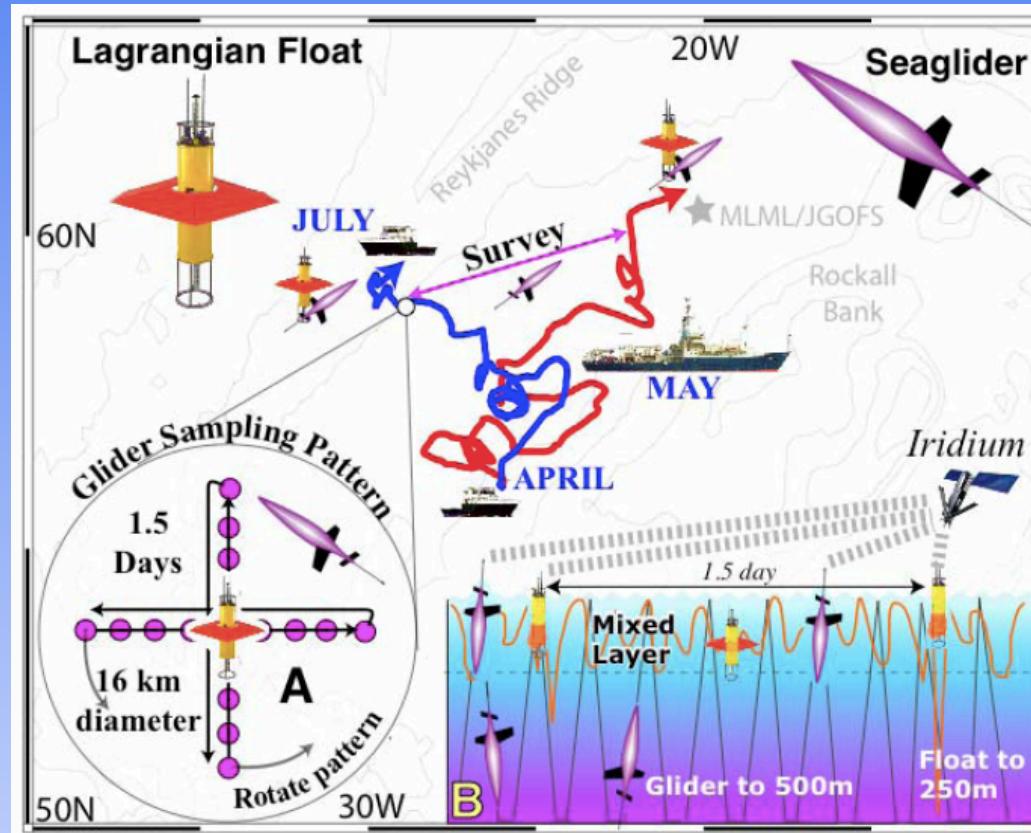


Autonomous Measurements of Carbon Fluxes in the North Atlantic Bloom

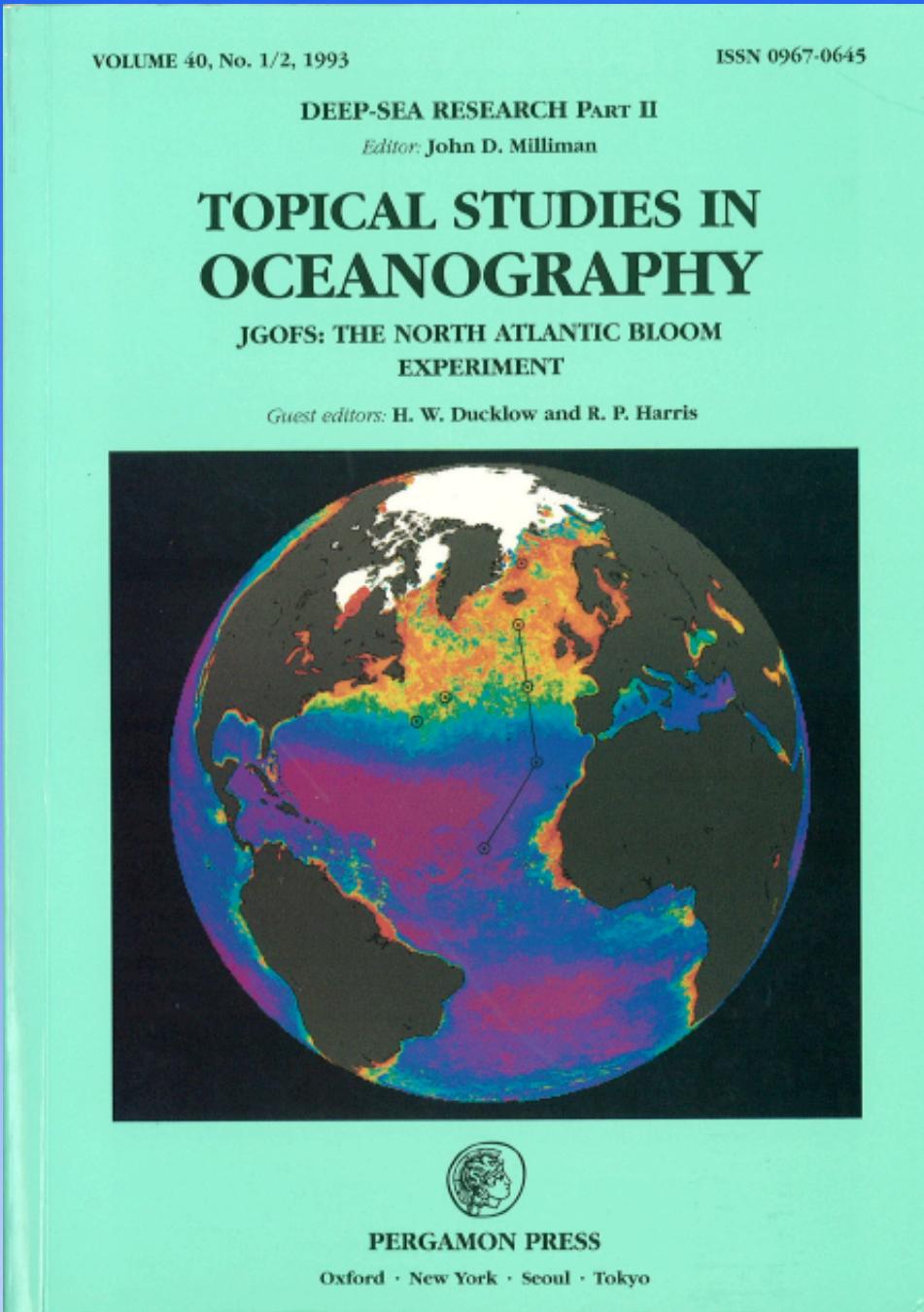
Mary Jane Perry, U. Maine

Eric D'Asaro, U. Washington

Craig Lee, U. Washington



North Atlantic Bloom 2008



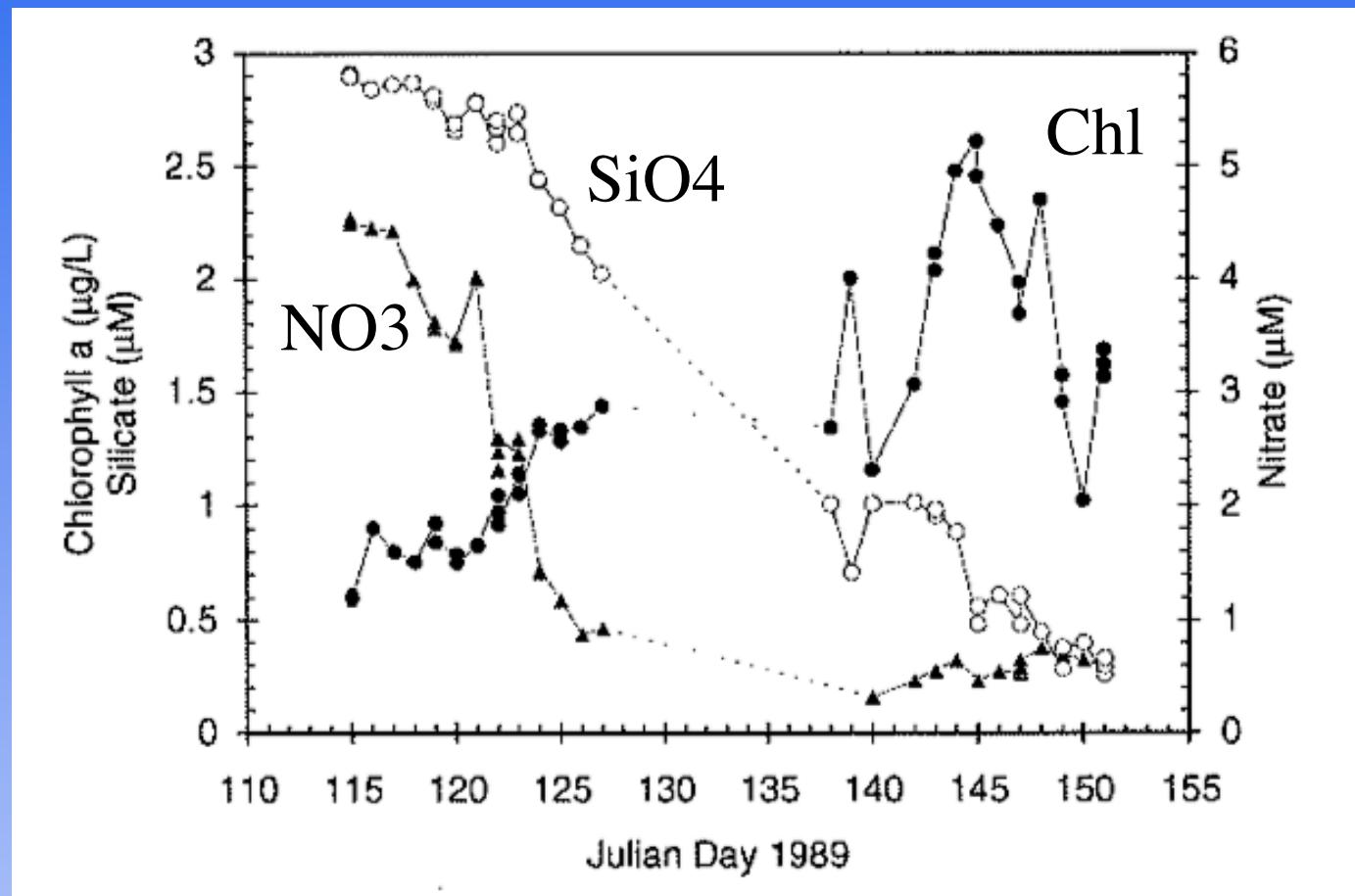
Return to JGOFS NAB 1989
study site at 60°N

Can we use autonomous
platforms to study carbon
flux?

Drifting Lagrangian floats and
seagliders

Bio-optical sensors

Nutrients and chlorophyll, 47°N 1989



N:Si ratio went to 10.
Diatom bloom came
and went rapidly
between cruises.
Community
transitioned into
mixotrophic ciliates
and small
phytoplankton.

Table 1. Biomass composition and per cent of total particulate (PC) at two time periods during the 1989 North Atlantic spring bloom at 46°N, 18°W. Values were calculated by integrating all measurements made in the top 30 m

	18–21 May			30–31 May		
	mgC m ⁻²	Per cent of PC	Per cent of biomass	mgC m ⁻²	Per cent of PC	Per cent of biomass
Heterotrophs						
Bacteria*	702	10	15	1513	28	24
Flagellates	941	13	20	885	16	14
Ciliates	30	<1	1	100	2	2
Dinoflagellates†	84	1	2	105	2	2
Mesozooplankton‡	117	2	3	375	7	6
Copepod nauplii	1264	18	26	765	14	12
Phototrophs						
Cyanobacteria	159	2	3	544	10	9
Diatoms§	150	2	3	100	2	2
Potential mixotrophs						
Plastidic flagellates	1131	16	24	1414	26	23
Dinoflagellates	163	2	3	132	2	2
Mixotrophs						
Plastidic ciliates	30	<1	1	300	6	5
Total heterotrophs	3138	44	66	3743	69	60
Total phototrophs	309	4	6	644	12	10
Total potential mixotrophs	1294	18	27	1546	28	25
Total mixotrophs	30	<1	1	300	5	5
Total biomass	4771	68	100	6233	115	100
Total PC	7065	100		5426	100	
Detritus	2294	32		-807	-15	

* DUCKLOW *et al.* (1993).

† VERITY *et al.* (1993).

‡ DAM *et al.* (1993).

§ Data courtesy of R. Harris.

|| Detritus = PC – total biomass.

Plankton biomass budget

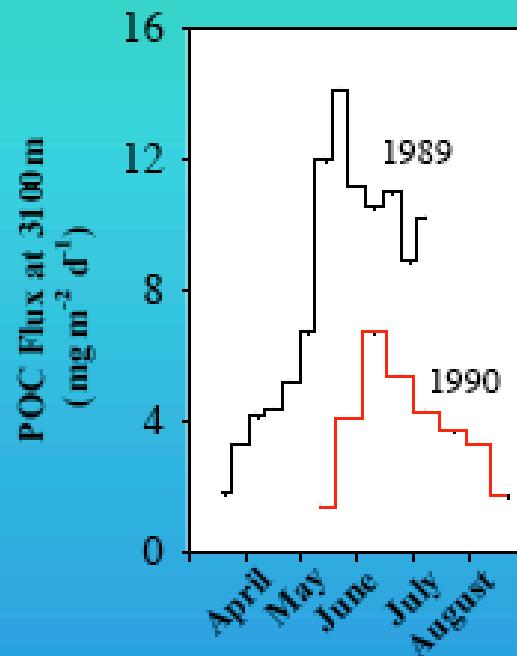
Bacteria increased from 10 to 28% of POC

Detritus decreased from 32% of POC to undetectable

Impact of community structure on particle flux

North Atlantic Bloom Study

Boyd & Newton,
1995



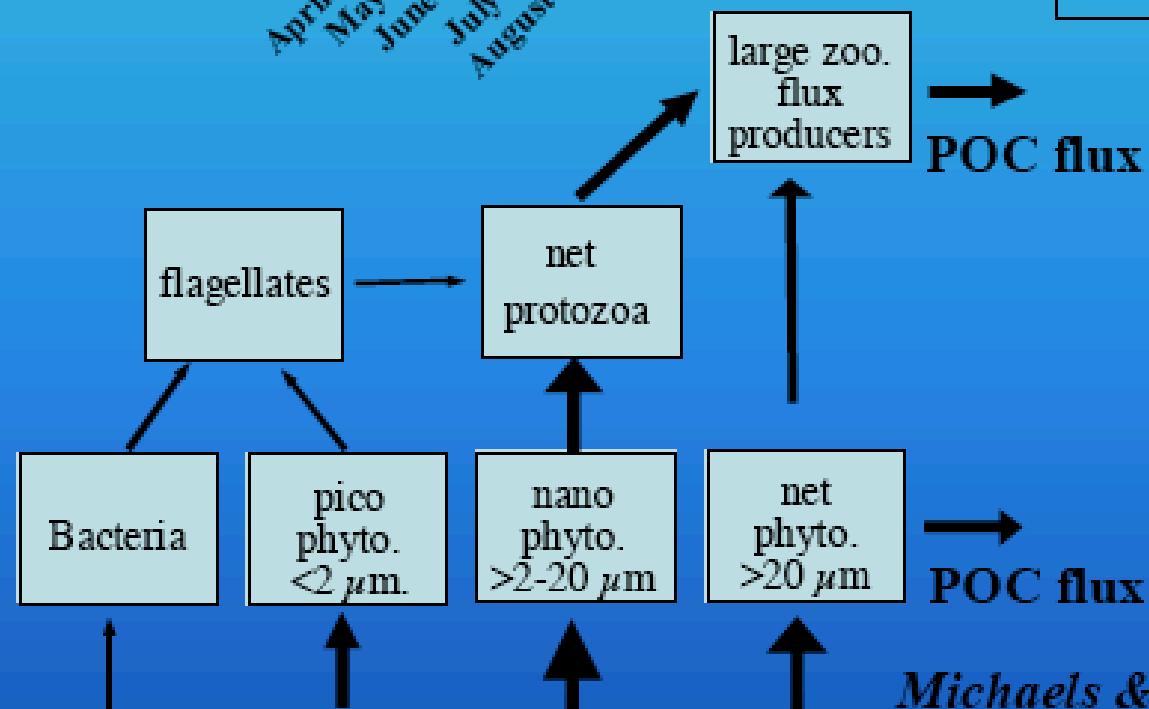
1989 vs. 1990

Chlorophyll similar
Prim. Production similar

Dominant phytoplankton

1989 Large >200 µm diatoms
(*Chaetoceros spp.*)

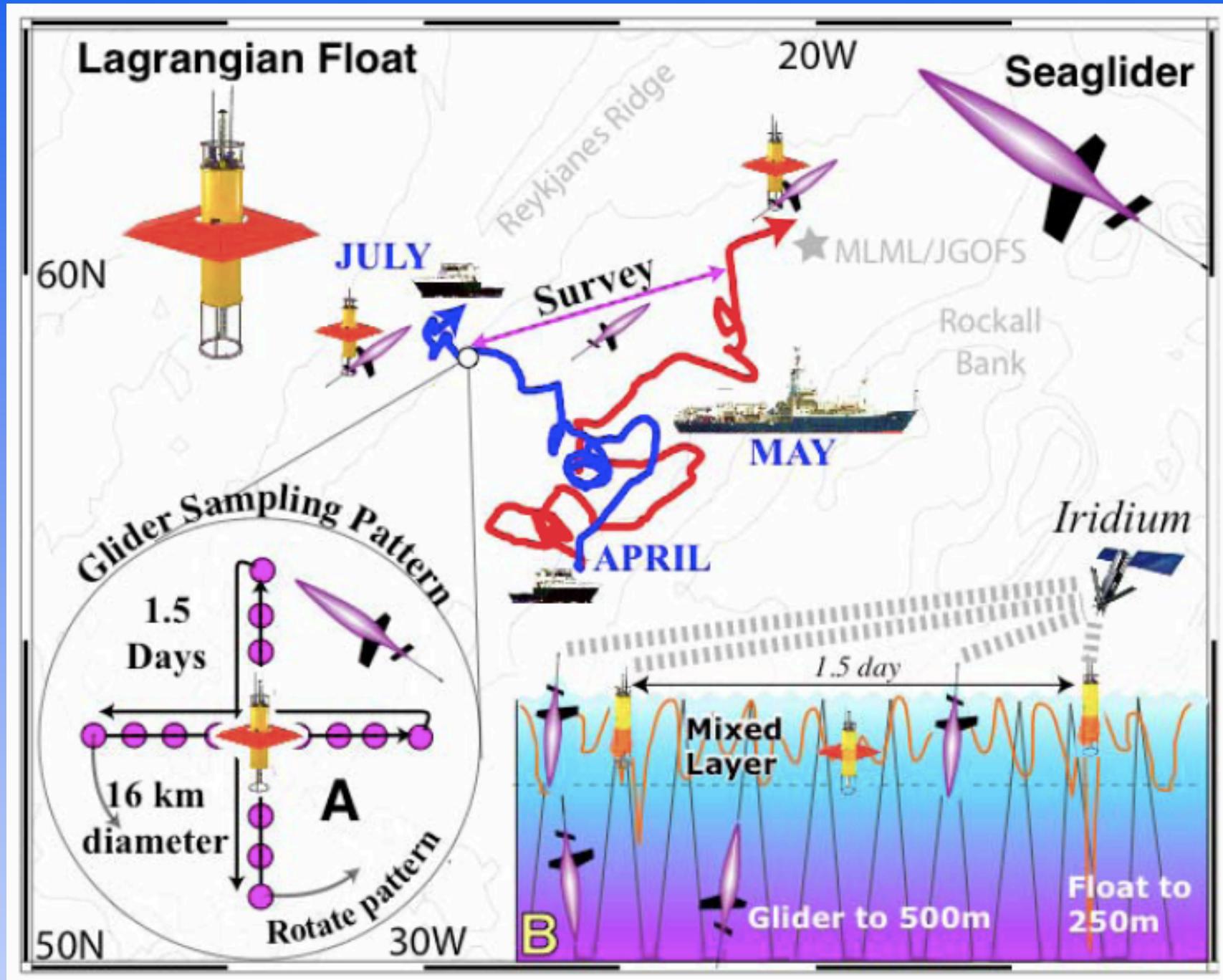
1990 Small 3-4 µm diatoms
(*Nanoneis hasleae spp.*)
and autotrophic nanoflagellates



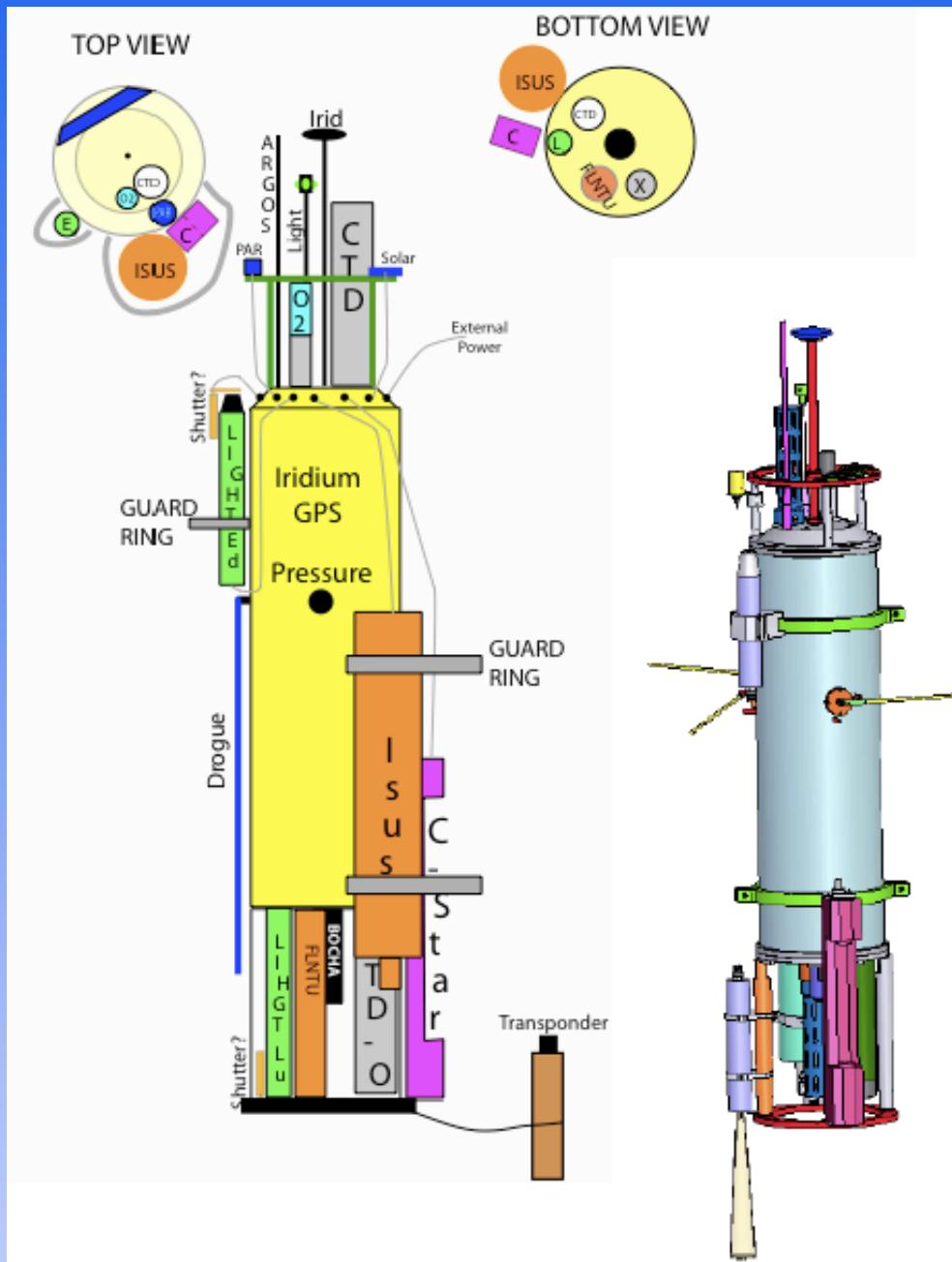
Conclusion:
Two fold change in deep POC flux due to different algal size distributions

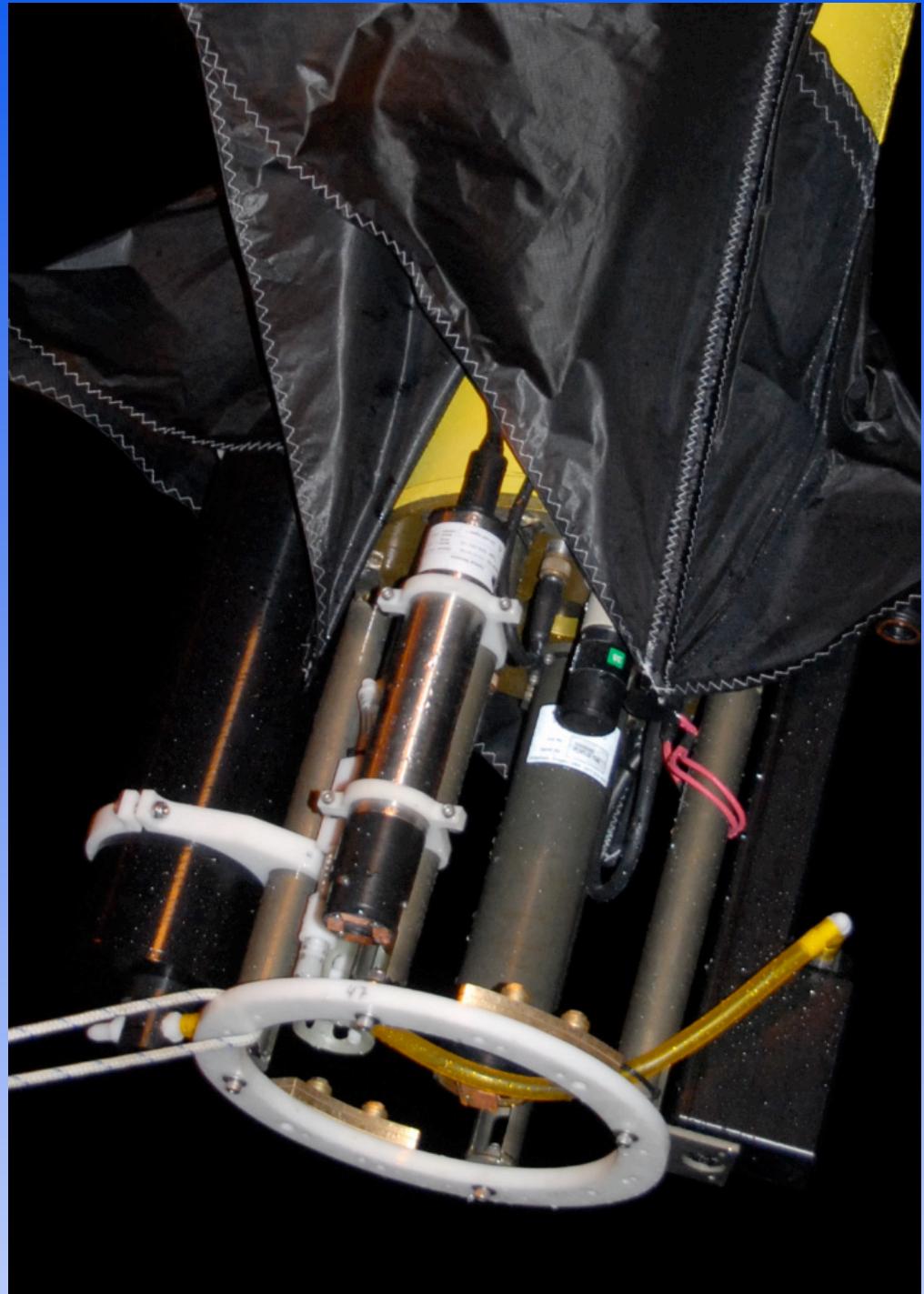


North Atlantic bloom '08 sampling plan

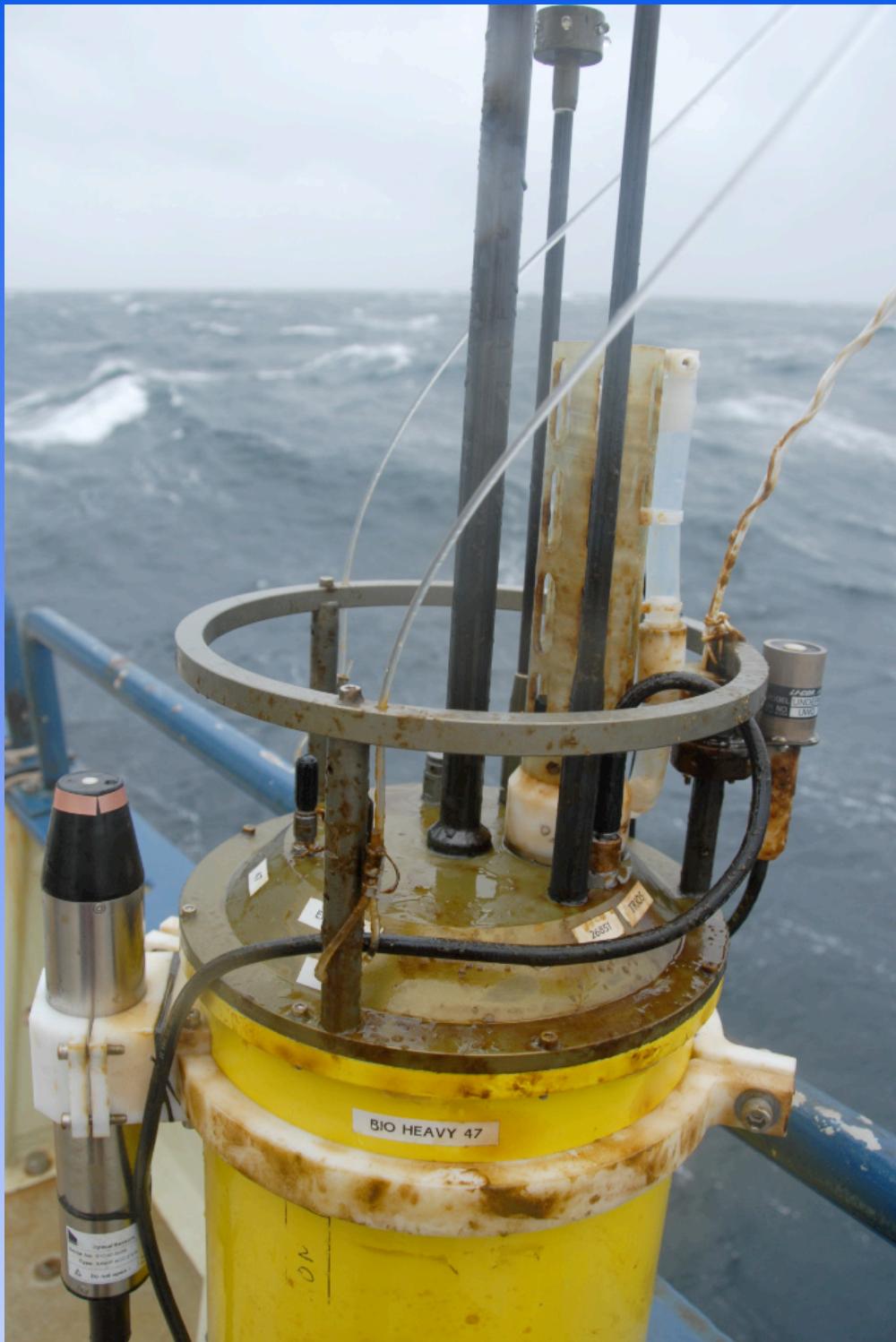


"Bio-heavy float"





Float after
several weeks of
deployment

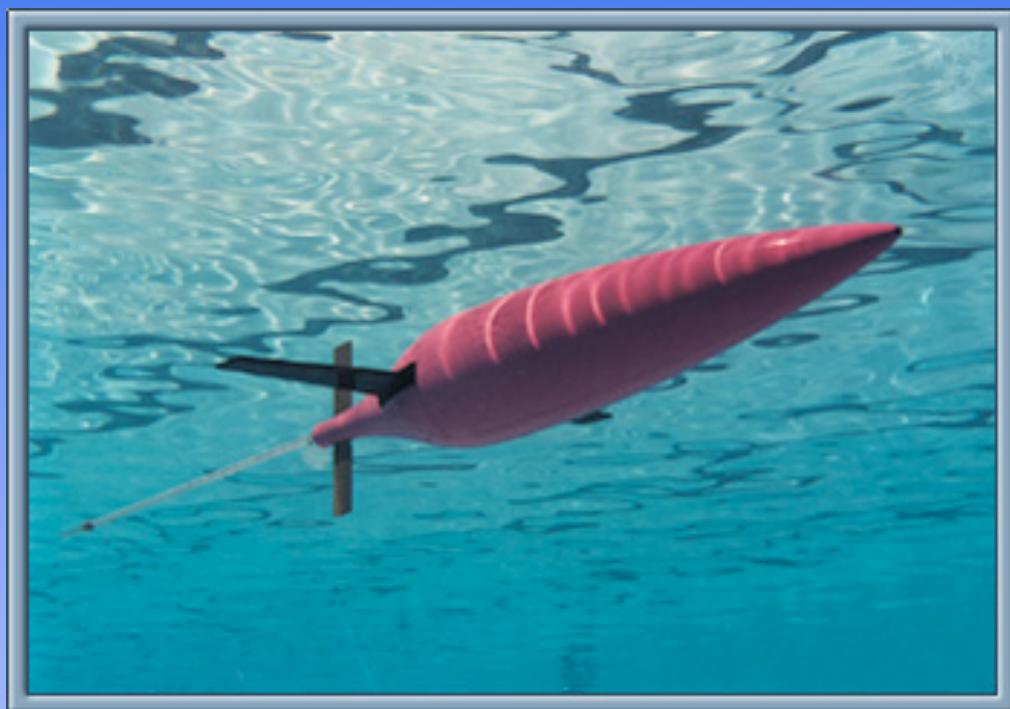


Seagliders

Applied Physics Lab - UW

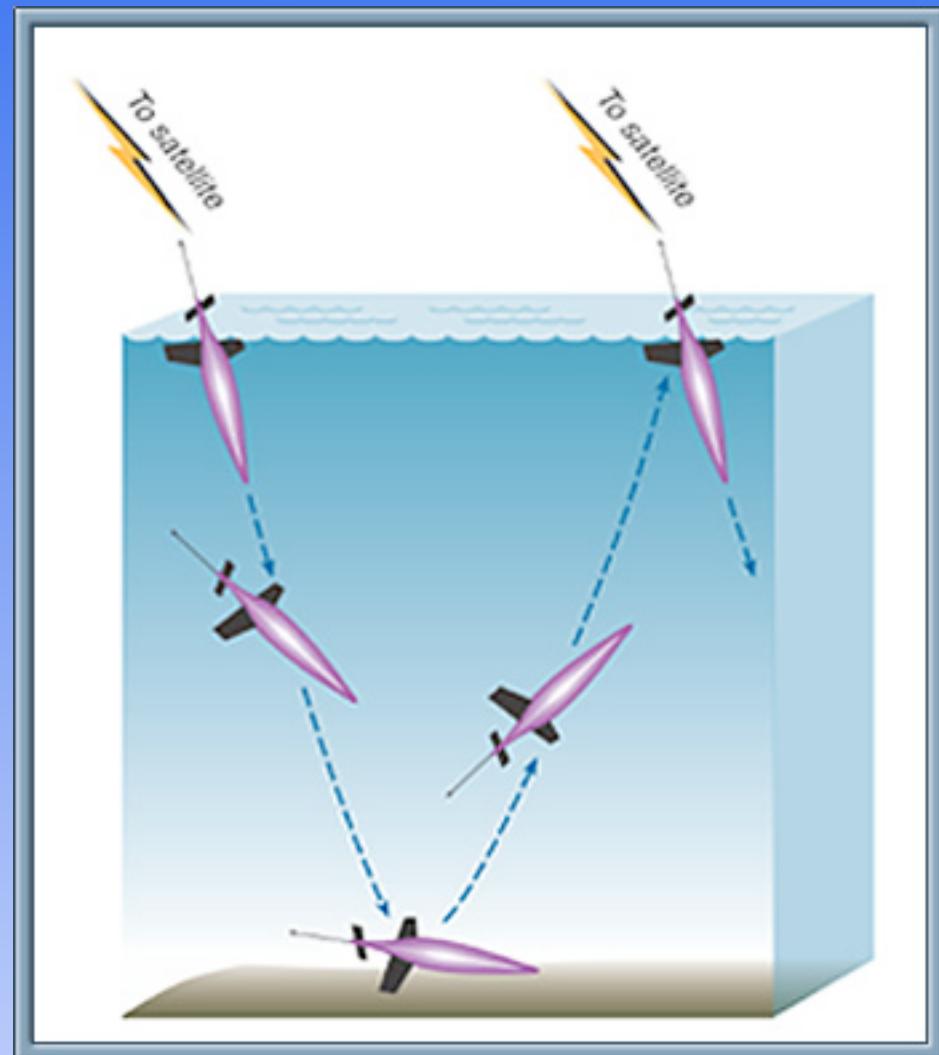
>3800km

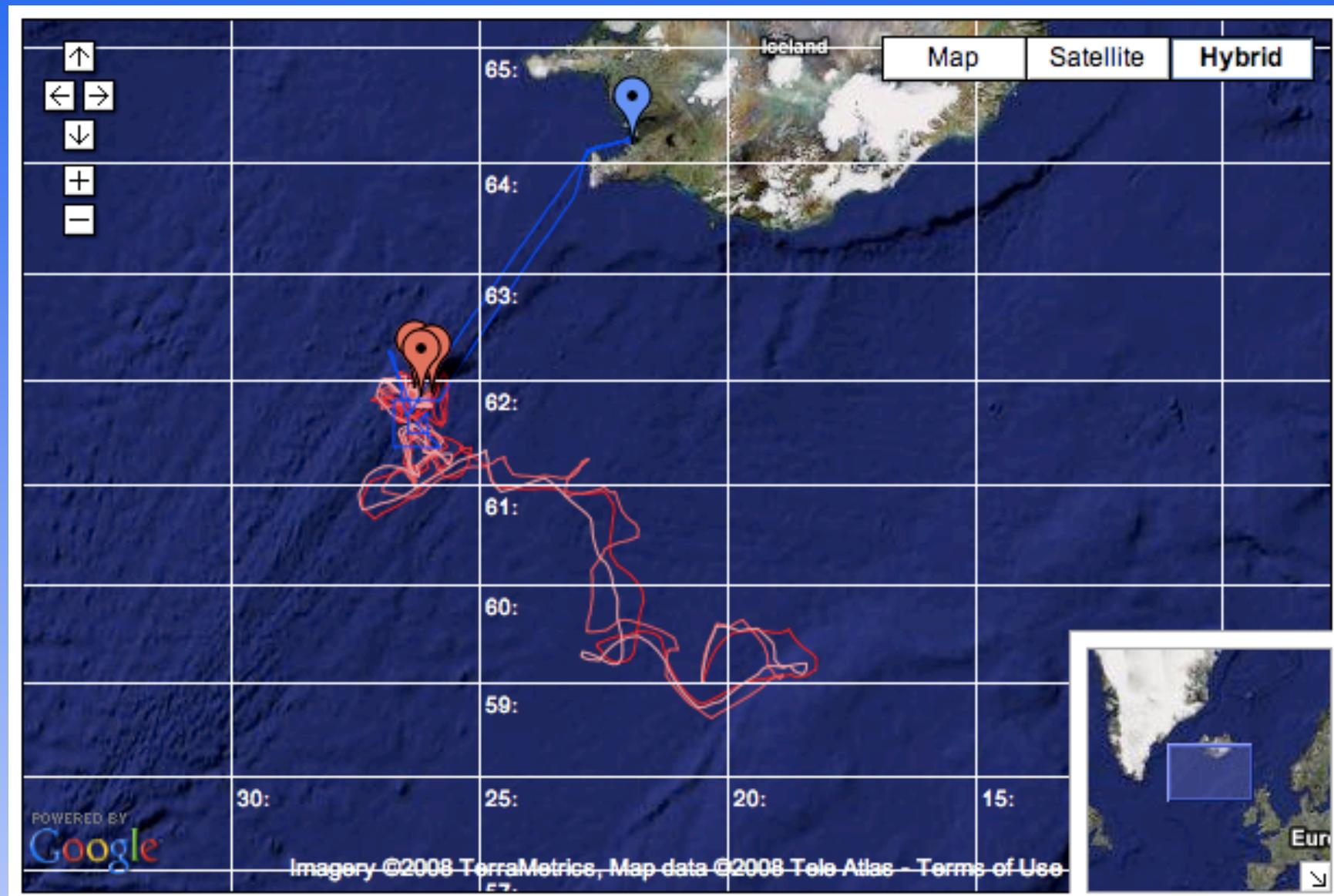
>7 months





Seaglider deployment
~1.8m long
dives to 1000m

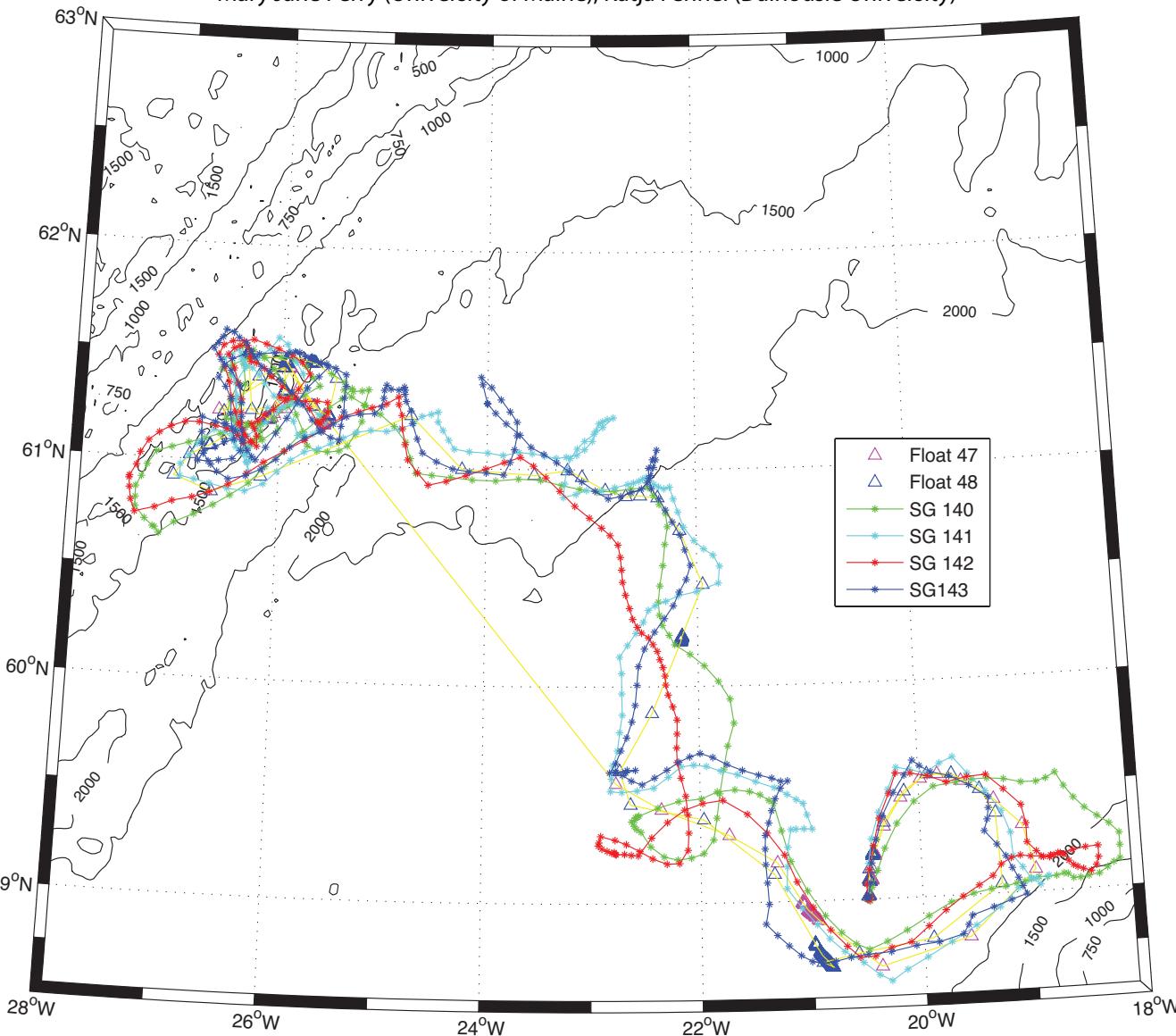




North Atlantic Bloom 2008: 4 April - 22 May 2008

Locations of Lagrangian Floats and Seagliders

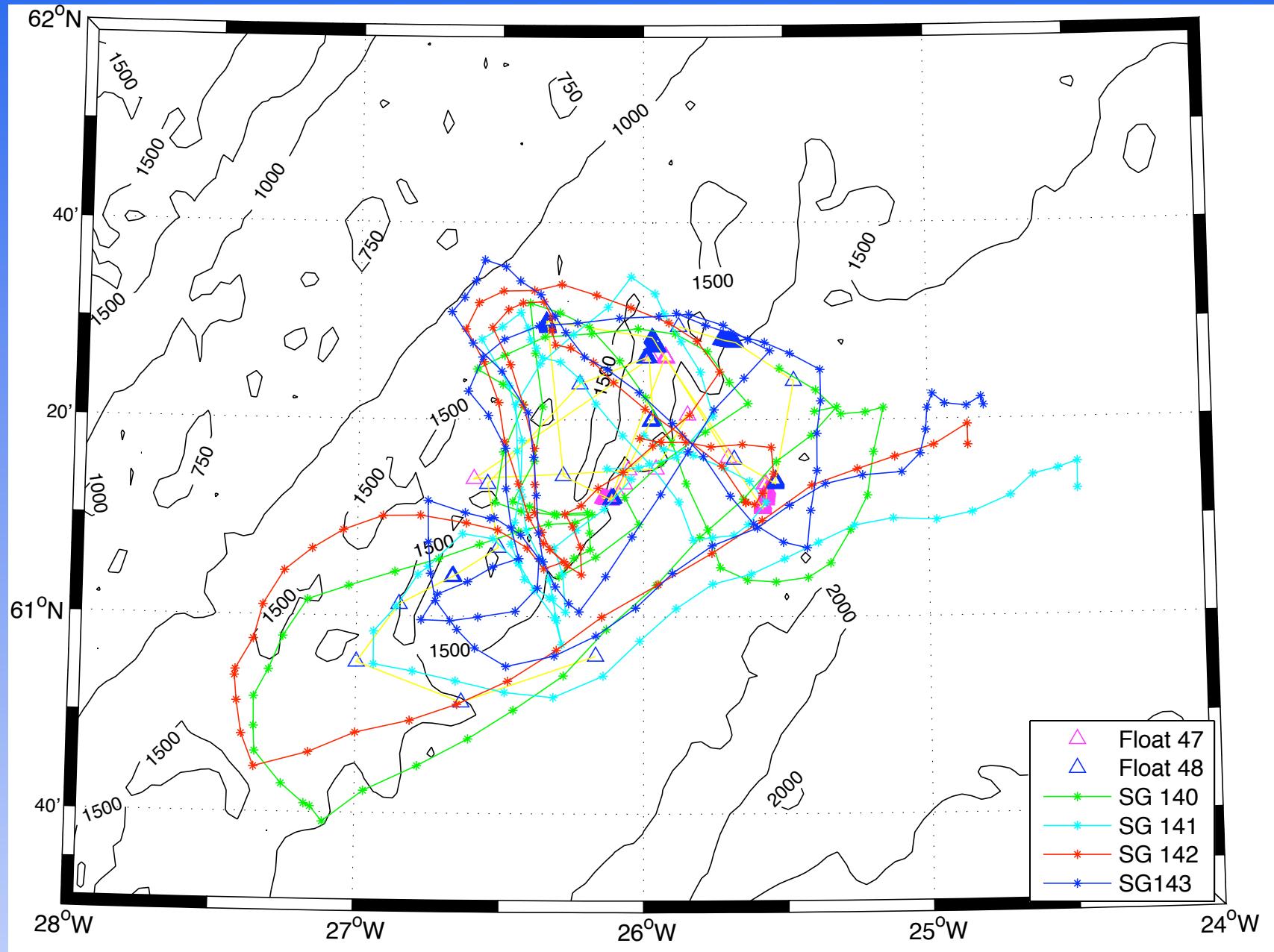
PIs: Eric D'Asaro and Craig Lee (University of Washington - Applied Physics Lab),
Mary Jane Perry (University of Maine), Katja Fennel (Dalhousie University)



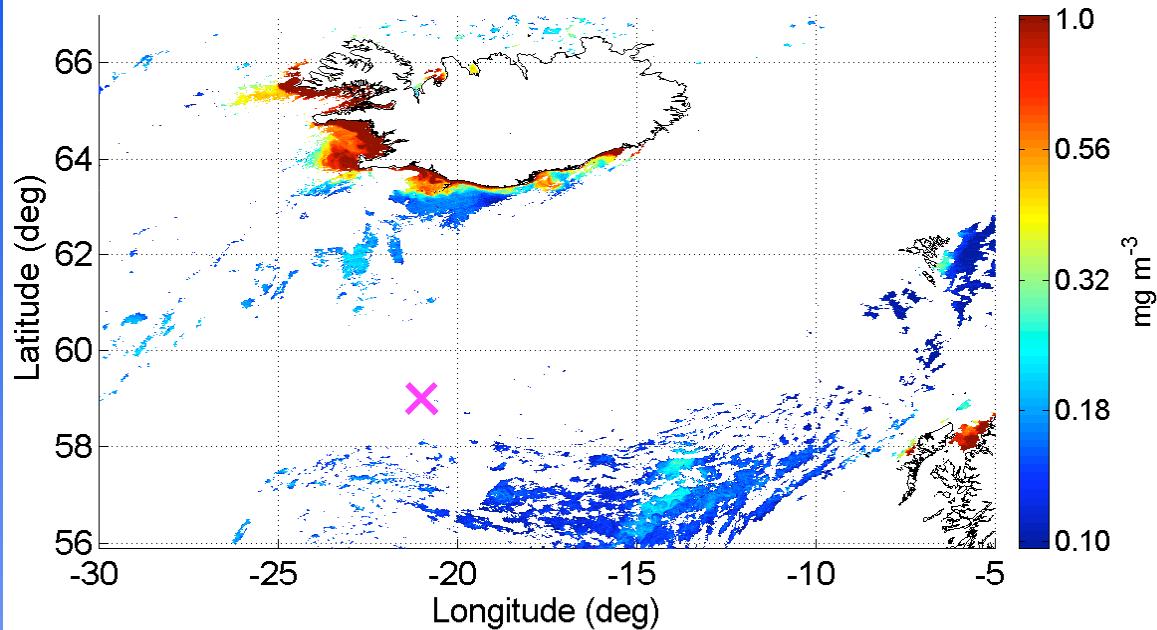
North Atlantic Bloom 2008: Process Cruise 2 - 22 May 2008

Locations of Lagrangian Floats and Seagliders

PIs: Eric D'Asaro and Craig Lee (University of Washington - Applied Physics Lab),
Mary Jane Perry (University of Maine), Katja Fennel (Dalhousie University)

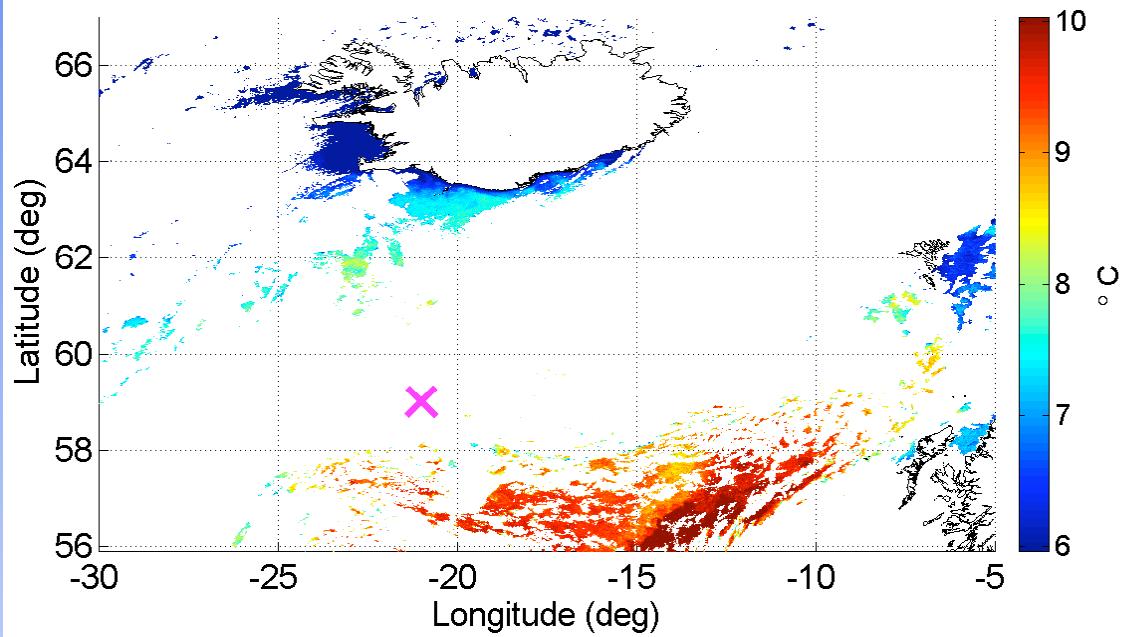


MODIS-Aqua CHL [29-Mar-2008 13:45:00 GMT]

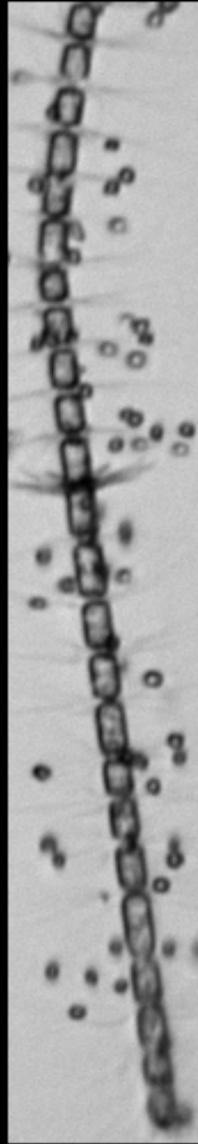
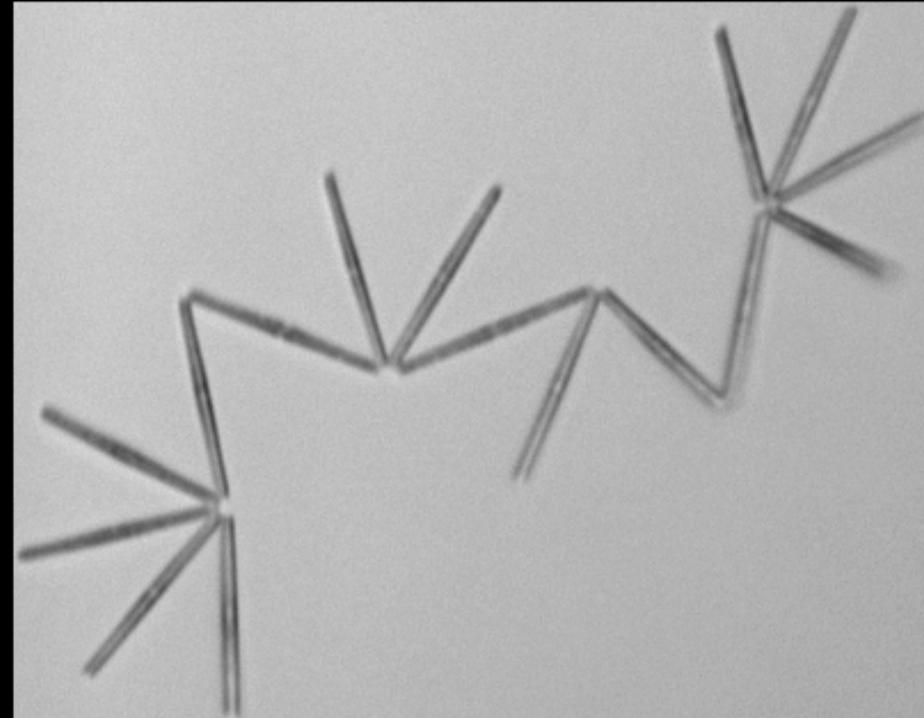
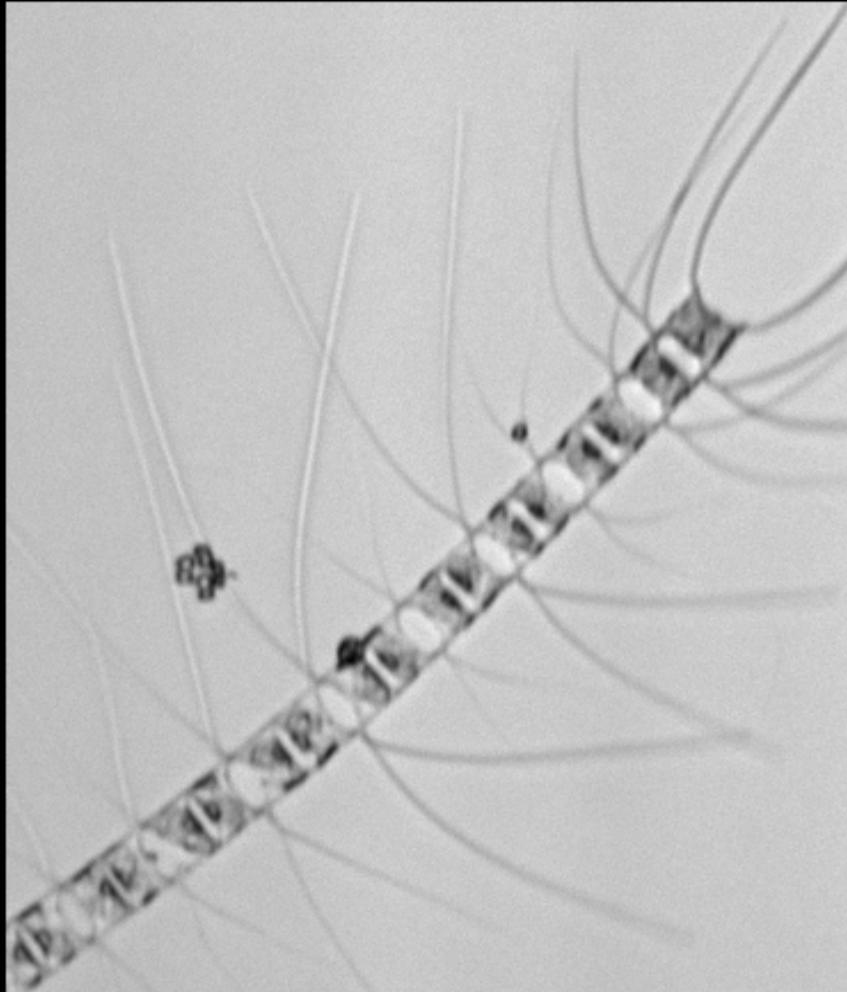


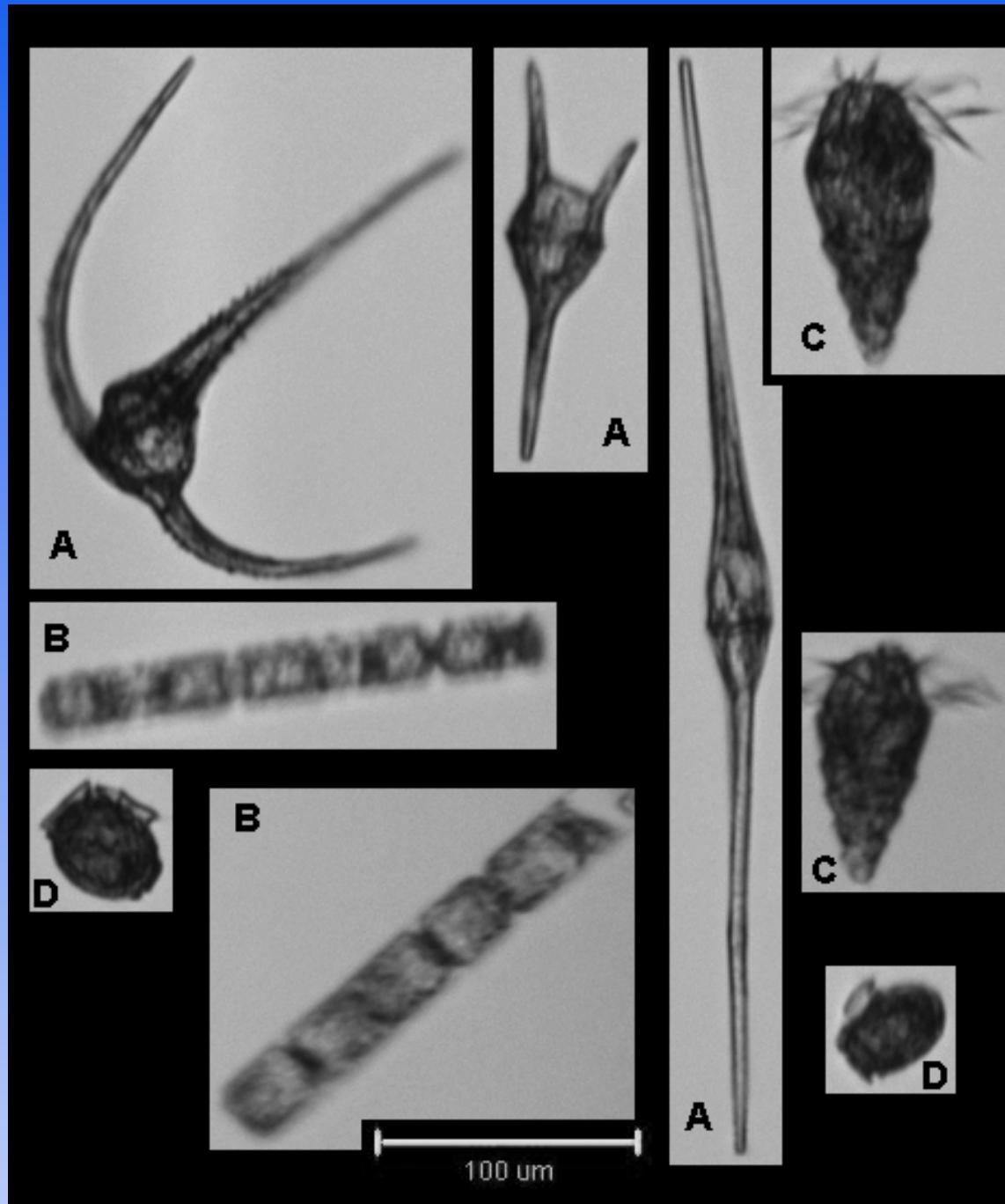
One of the
better ocean
color images

MODIS-Aqua SST [29-Mar-2008 13:45:00 GMT]



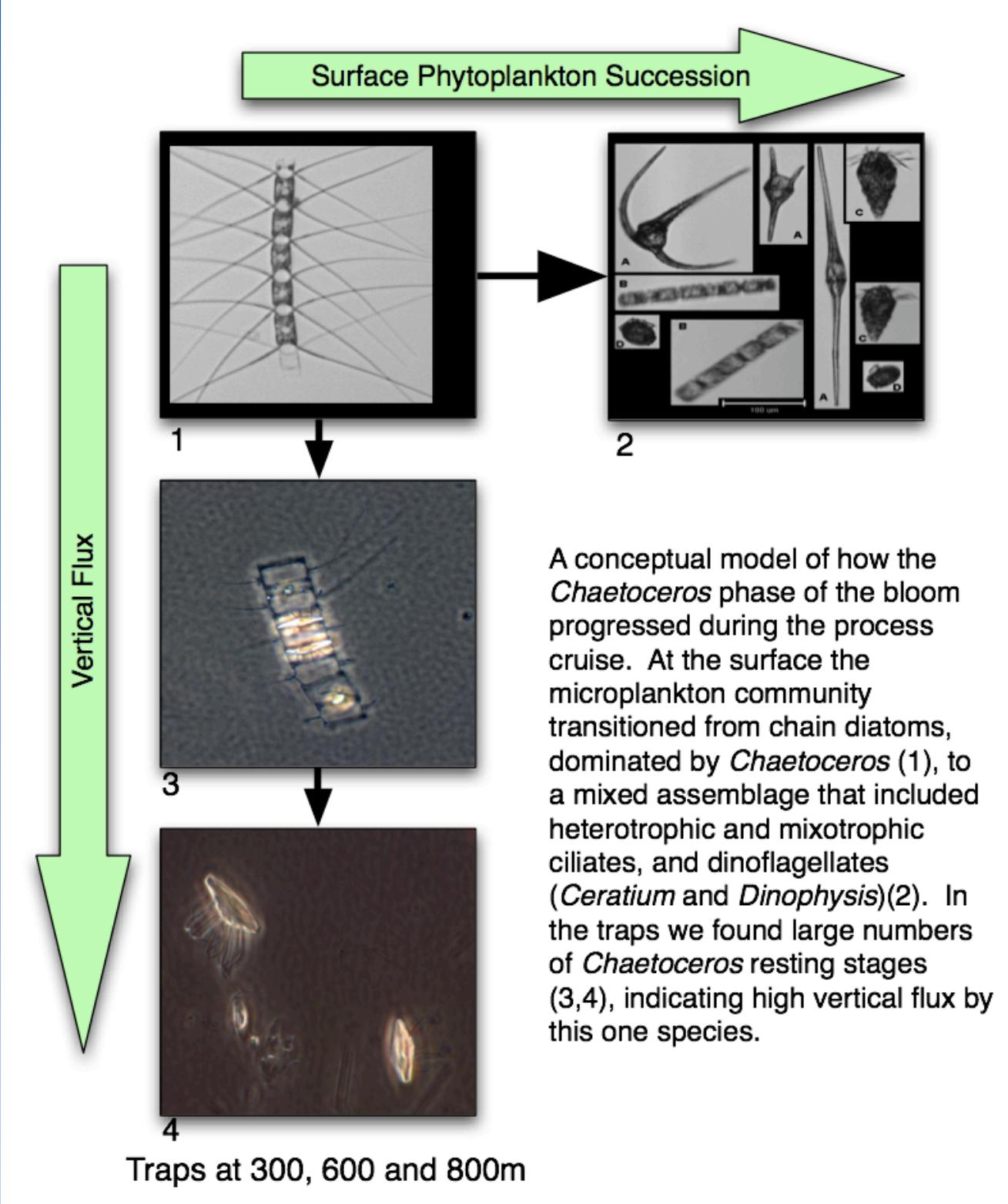
Diatoms at beginning of process cruise, 2 May



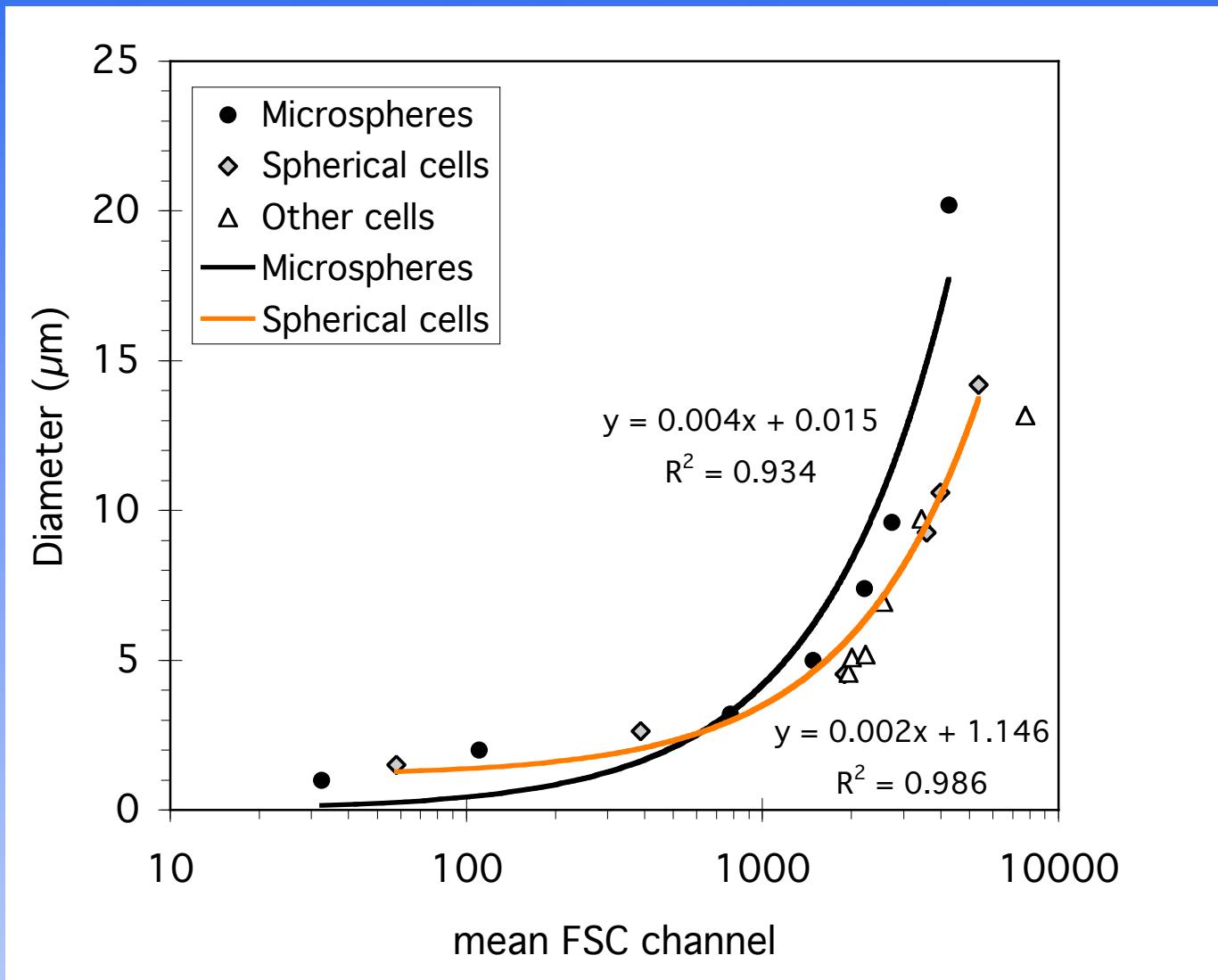


Mixed assemblage,
ciliates,
dinoflagellates, at
end of process
cruise, 20 May

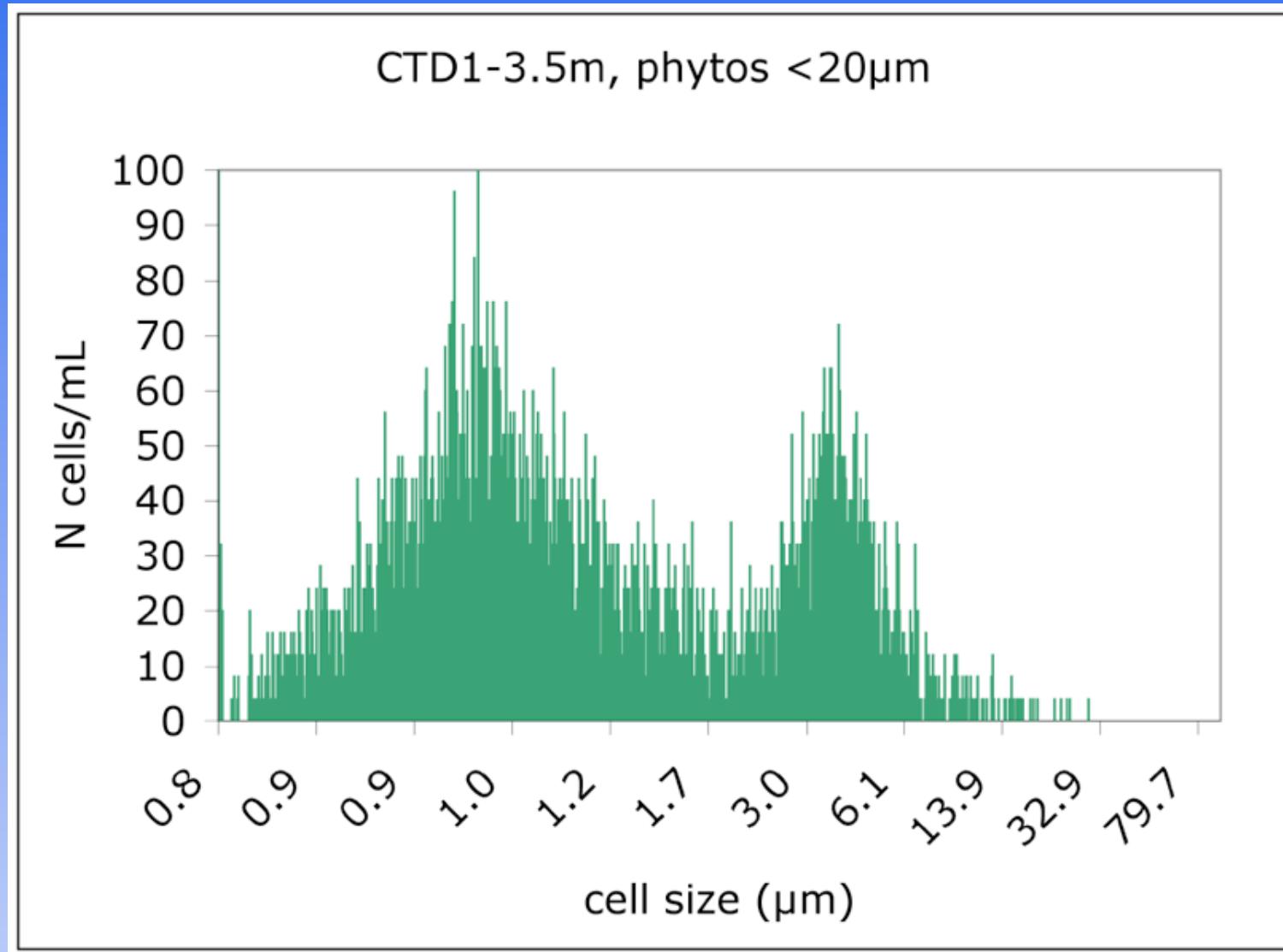
FlowCAM images

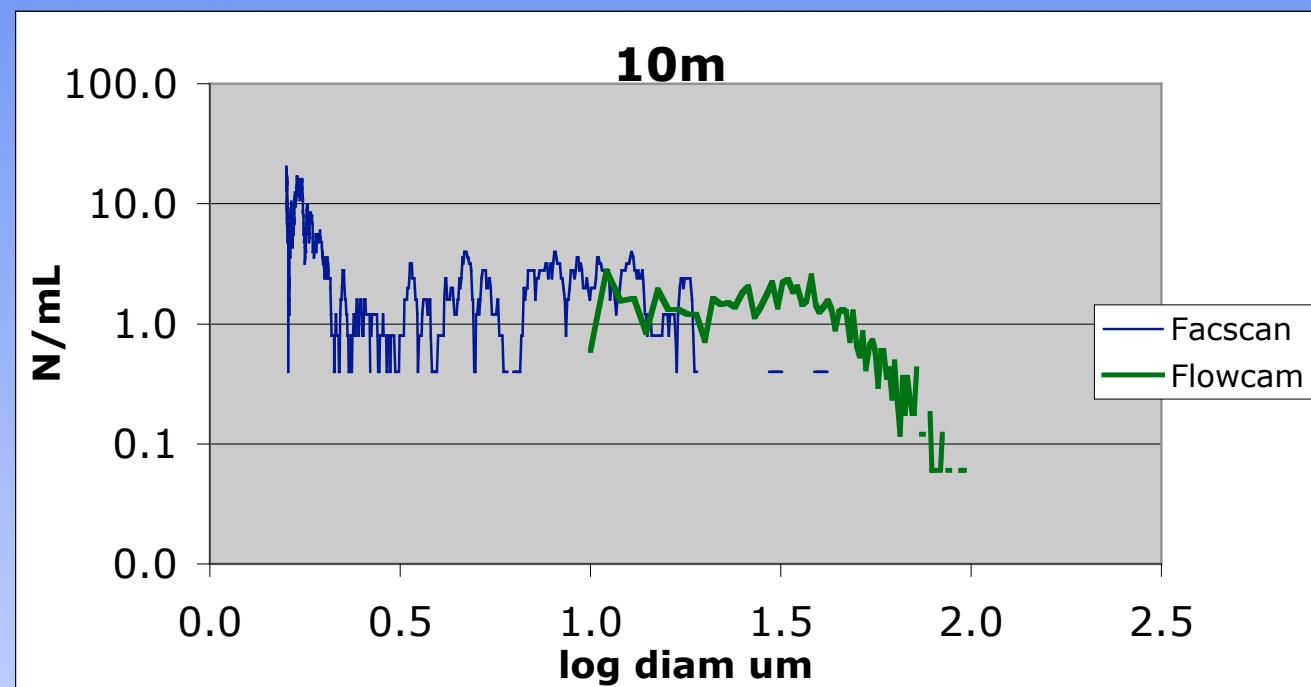
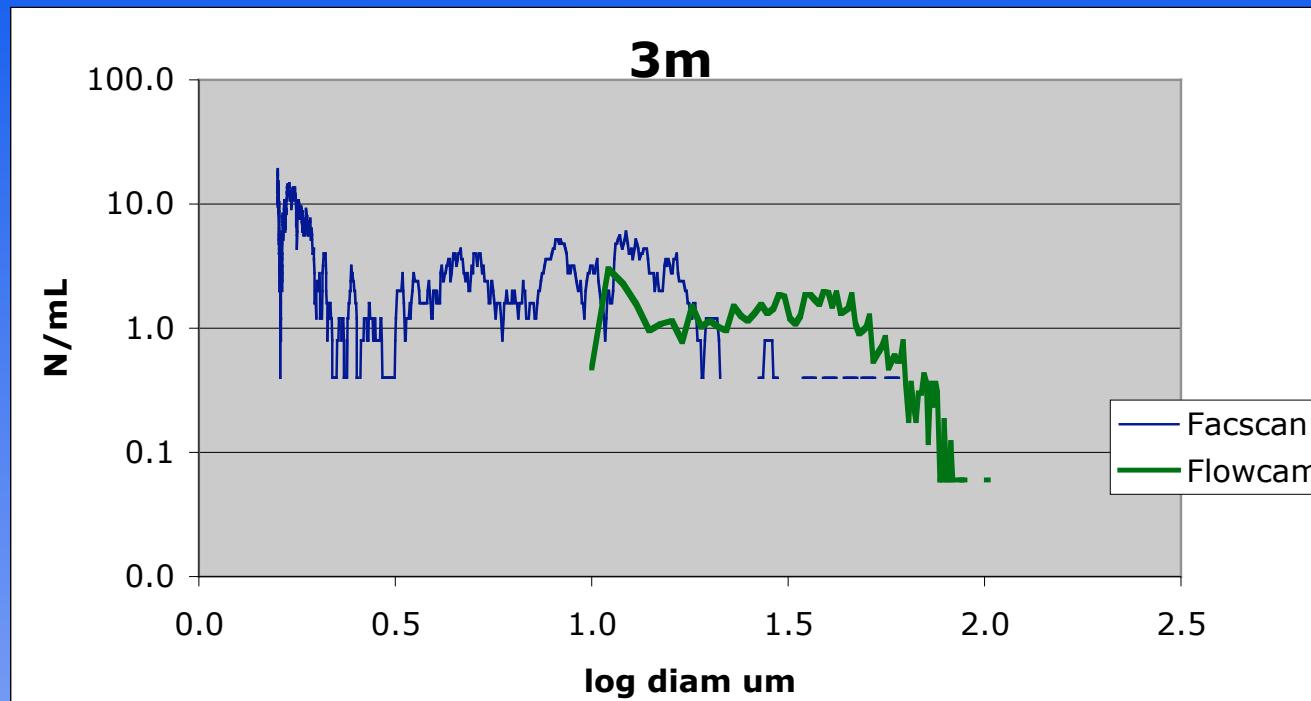


Calibration curve: forward scatter to diameter



Size spectra of pico-, nanophytoplankton from FACScan flow cytometer

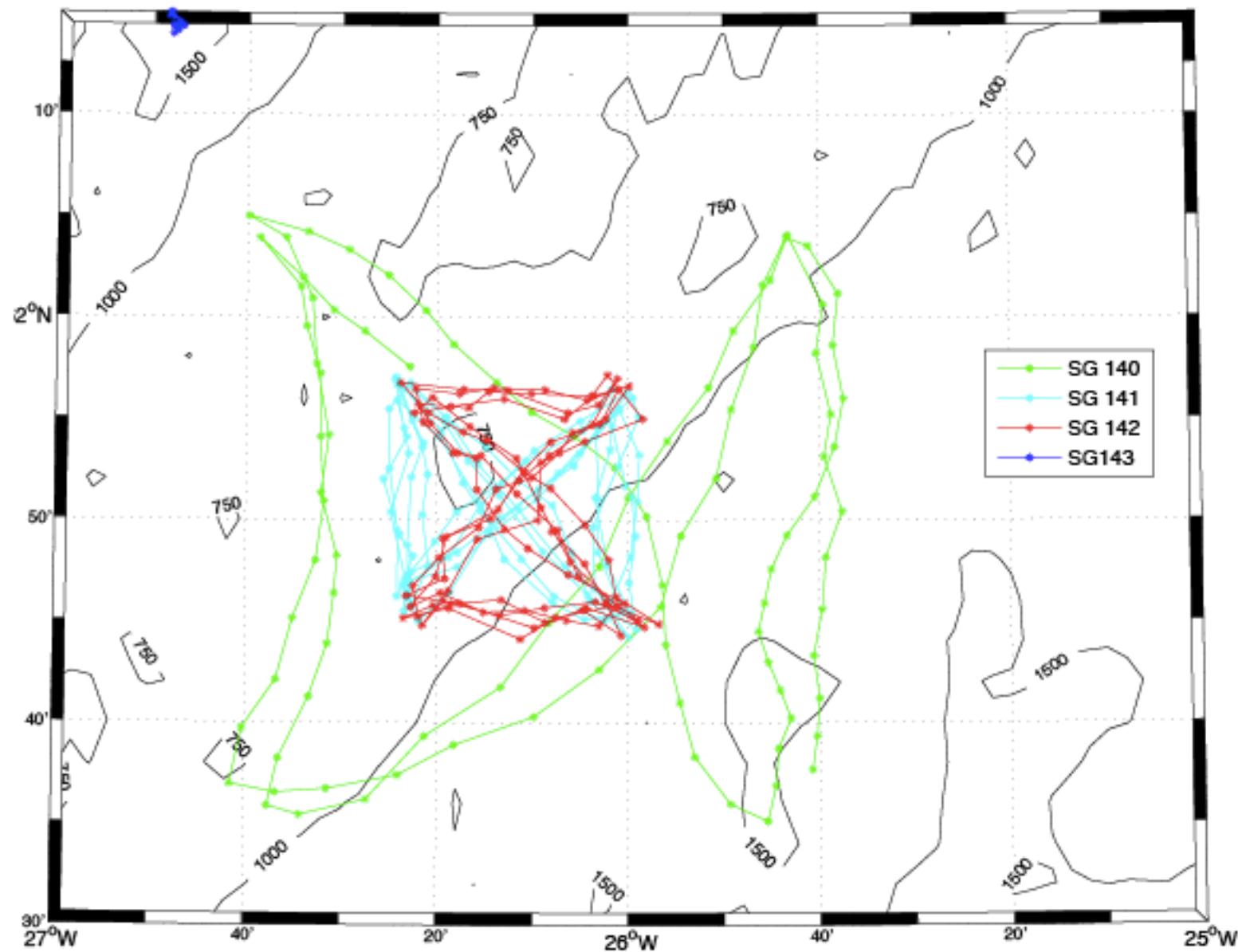




North Atlantic Bloom 2008: 1 - 23 June 2008

Locations of Seagliders 140, 141, and 142

PIs: Eric D'Asaro and Craig Lee (University of Washington - Applied Physics Lab),
Mary Jane Perry (University of Maine), Katja Fennel (Dalhousie University)



Preliminary Conclusions

- North Atlantic bloom succession followed expected pattern, as seen in 1989.
- Bio-optical proxies can reflect progression of spring bloom
- Community composition shifts not easily seen in basic bio-optical measures
- Backscatter spikes might correlate with larger sinking particles
- Correlations of bio-optics to carbon are being currently analyzed

Latest info: Acoustic search grid for seaglider #142

