

The Integrated Coastal Observation System (ICOS): High resolution detection of pollution in estuaries

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Funded By:
ONR Ocean Optics
DURIP
NSF CoOP



Rationale

- Coastal ocean and estuaries are being impacted by human activity
 - Contaminants
 - Land use
 - River flow
- Coastal oceans are dynamic
 - Need high spatial and temporal resolution
- Coastal ocean processes are interdisciplinary
 - Need a variety of instruments and expertise

Capabilities

- Non-conservative behavior in estuaries
 - Neponset Estuary
 - Mini-Shuttle
- Thin-layers
 - Mississippi River Plume
 - ECOShuttle
- Contaminant source tracking
 - Hudson River Estuary
 - ICOS

Mantoura and Woodward, 1983

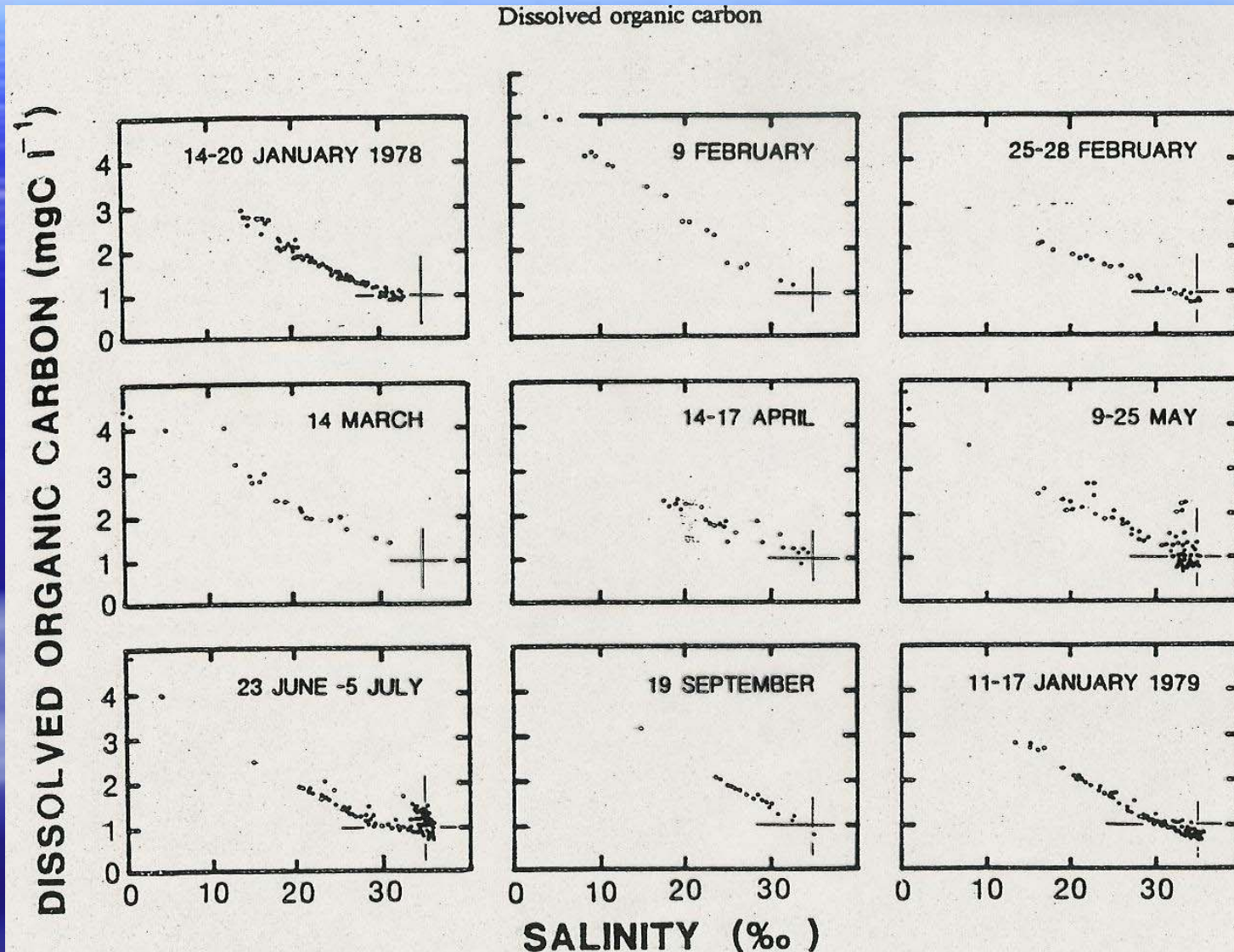


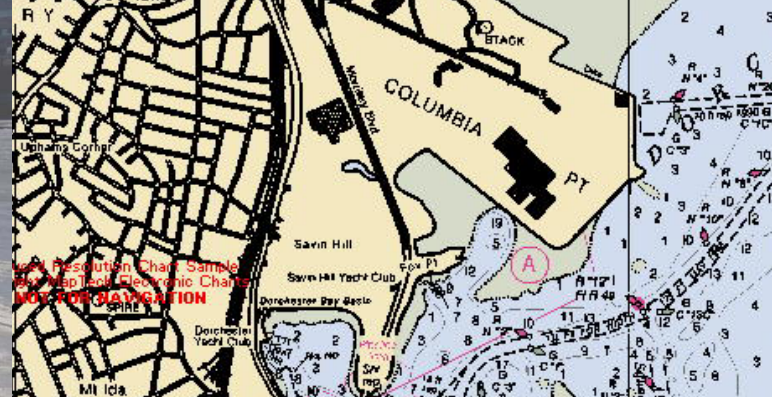
FIG. 5. DOC - salinity correlation for the Bristol Channel and Severn Estuary during 1978.

5101

FS125 1/ 380 4/5.6 FF1.0 EC 0 SP- 074.01924 65% dt028.4 45007 26.9W -61.16 ER00 CAM5136

001-1313:42 LHI-42.18.004711 CON-07.1.03.0000W 01.4046 07.103.30 01.27674 HELLOS JUS 311 10-02-94

FS125	1/380	f/5.6	FF1.0	EC 0	SP-	0%h, 01834	65%	dH028, 4	d=007	26.9V	-61mb	EP00	CAM5136
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Redundant Resolution, Copyright MapTech, Inc. NOT FOR NAVIGATION

Q 11: *What is the difference between a*

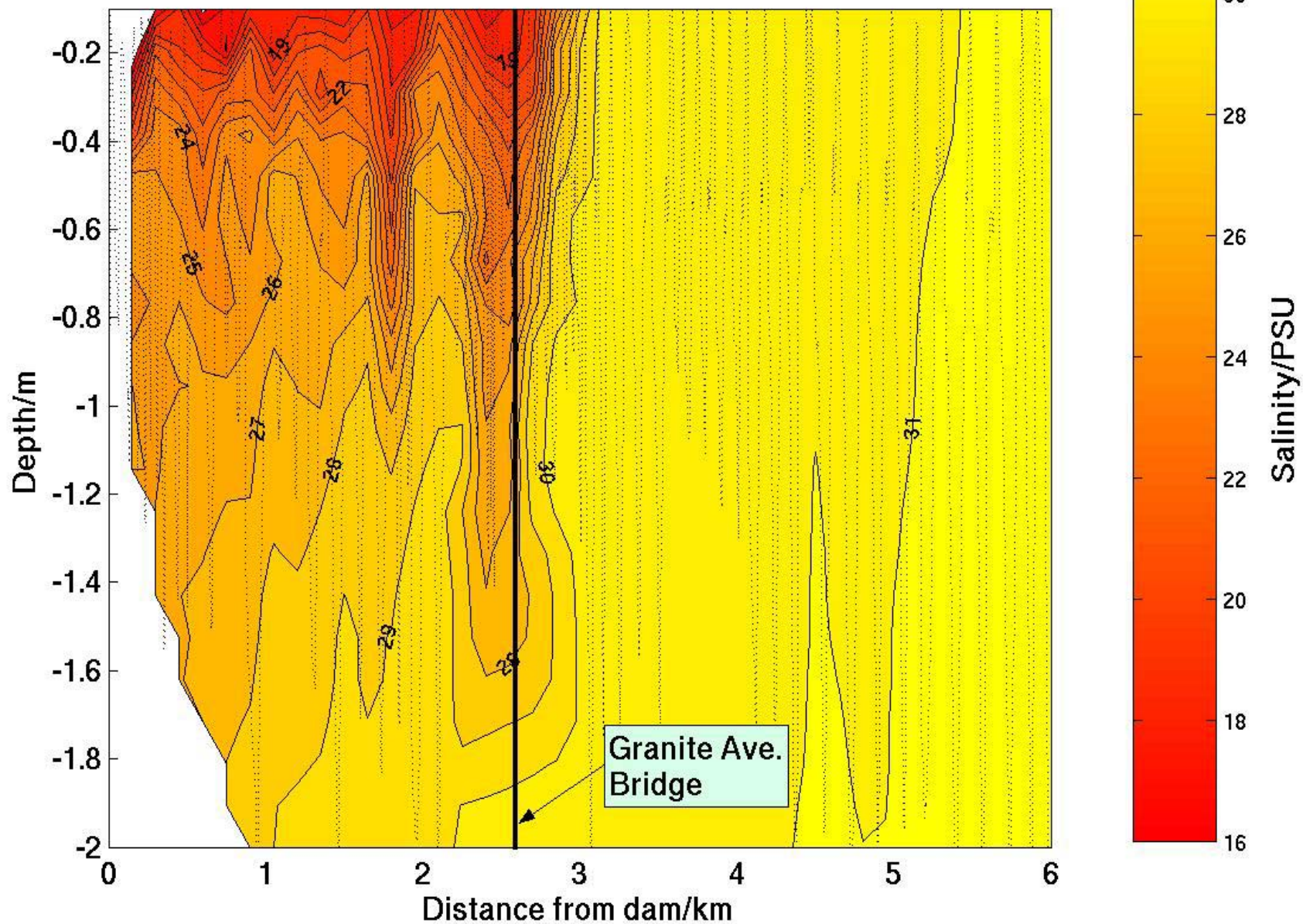


MiniShuttle

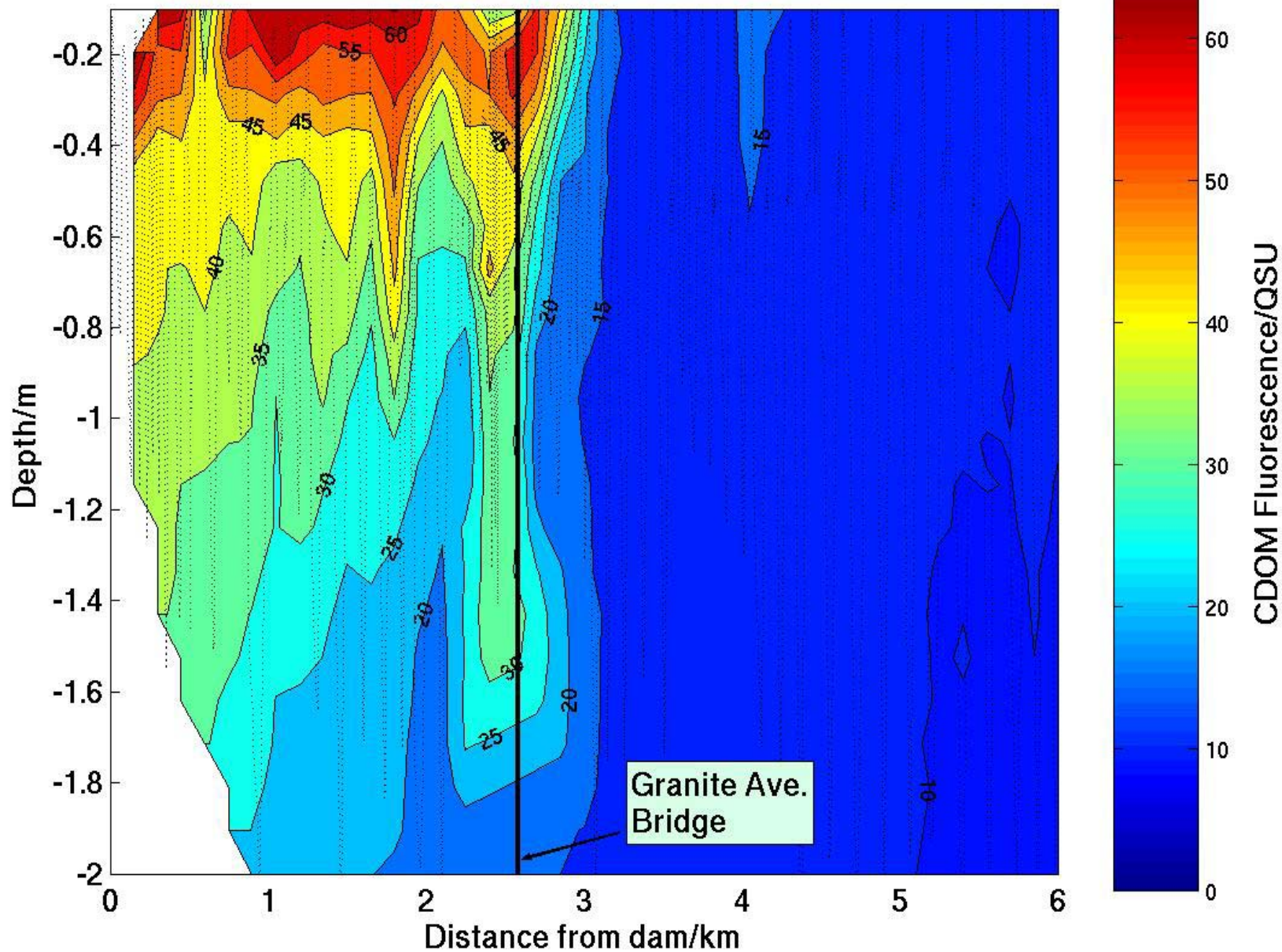
- CTD, CDOM, Chl, Dissolved O₂
- All sensors within 4 cm vertically



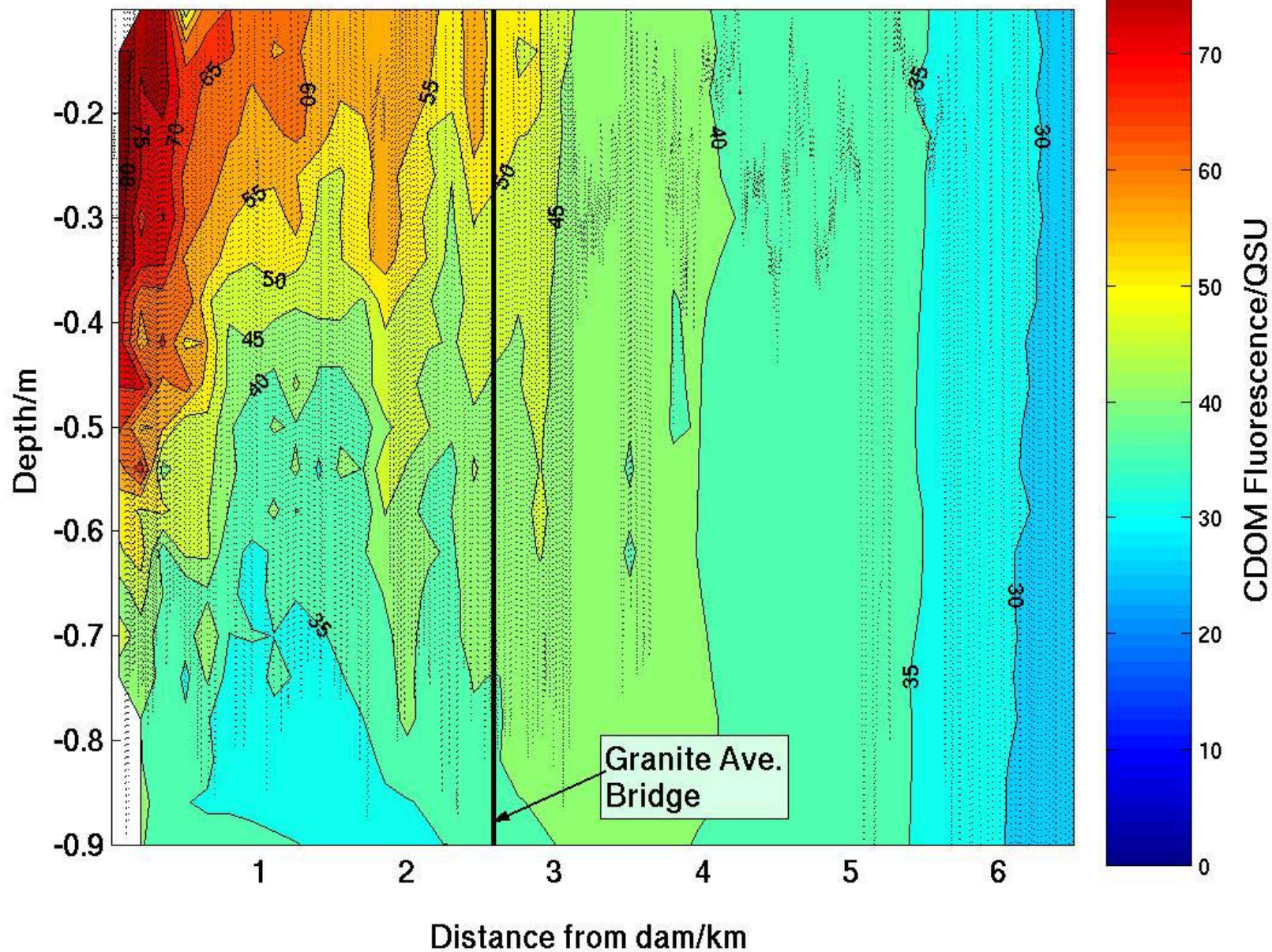
Salinity Vertical Section
August 21-22 2002 : 0000EDT : High Tide



CDOM Fluorescence Vertical Section
August 21-22 2002 : 0000EDT : High Tide



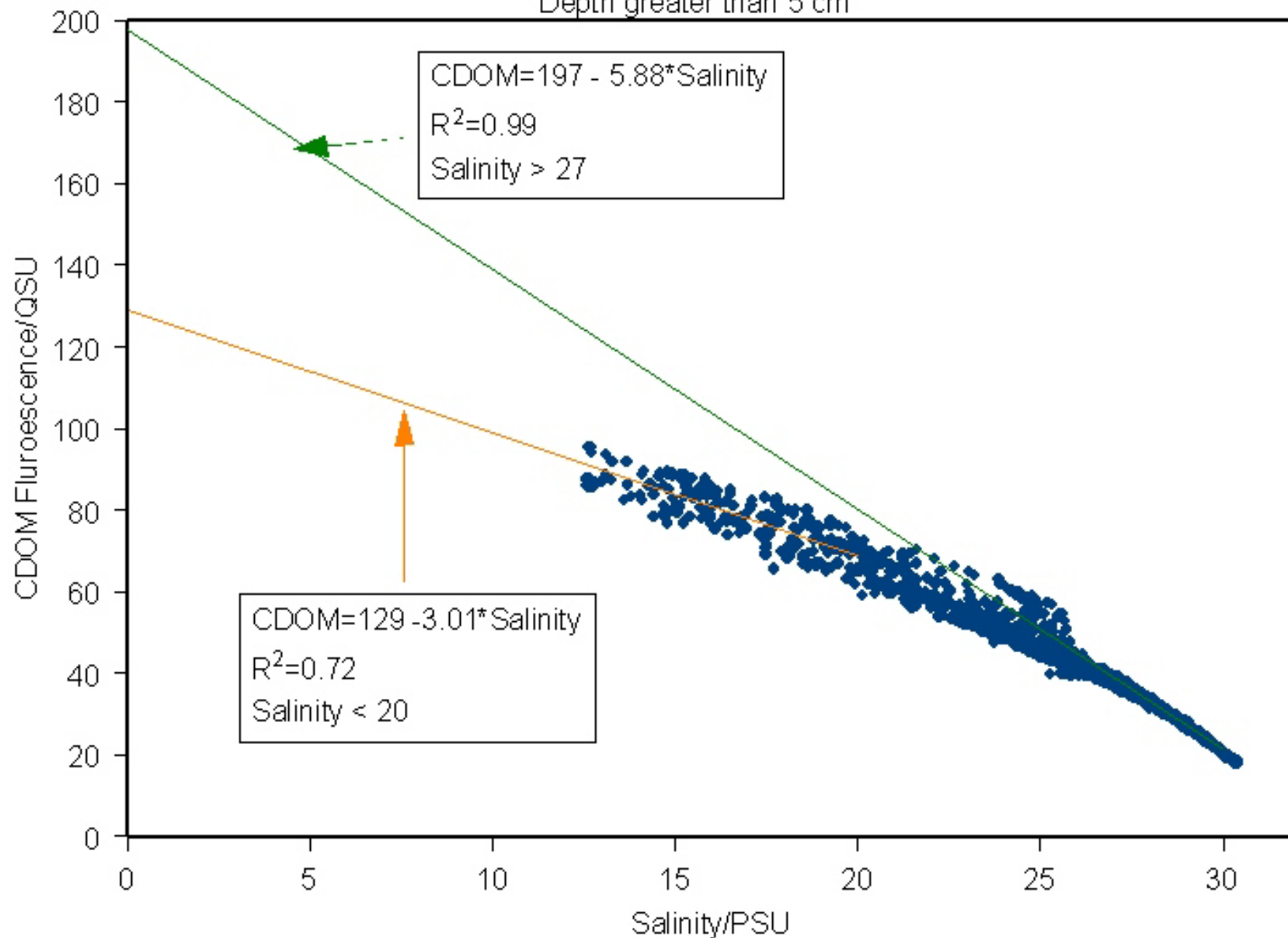
CDOM Fluorescence Vertical Section
August 22 2002 : 0600EDT : Low Tide



CDOM-S relationship for Neponset River

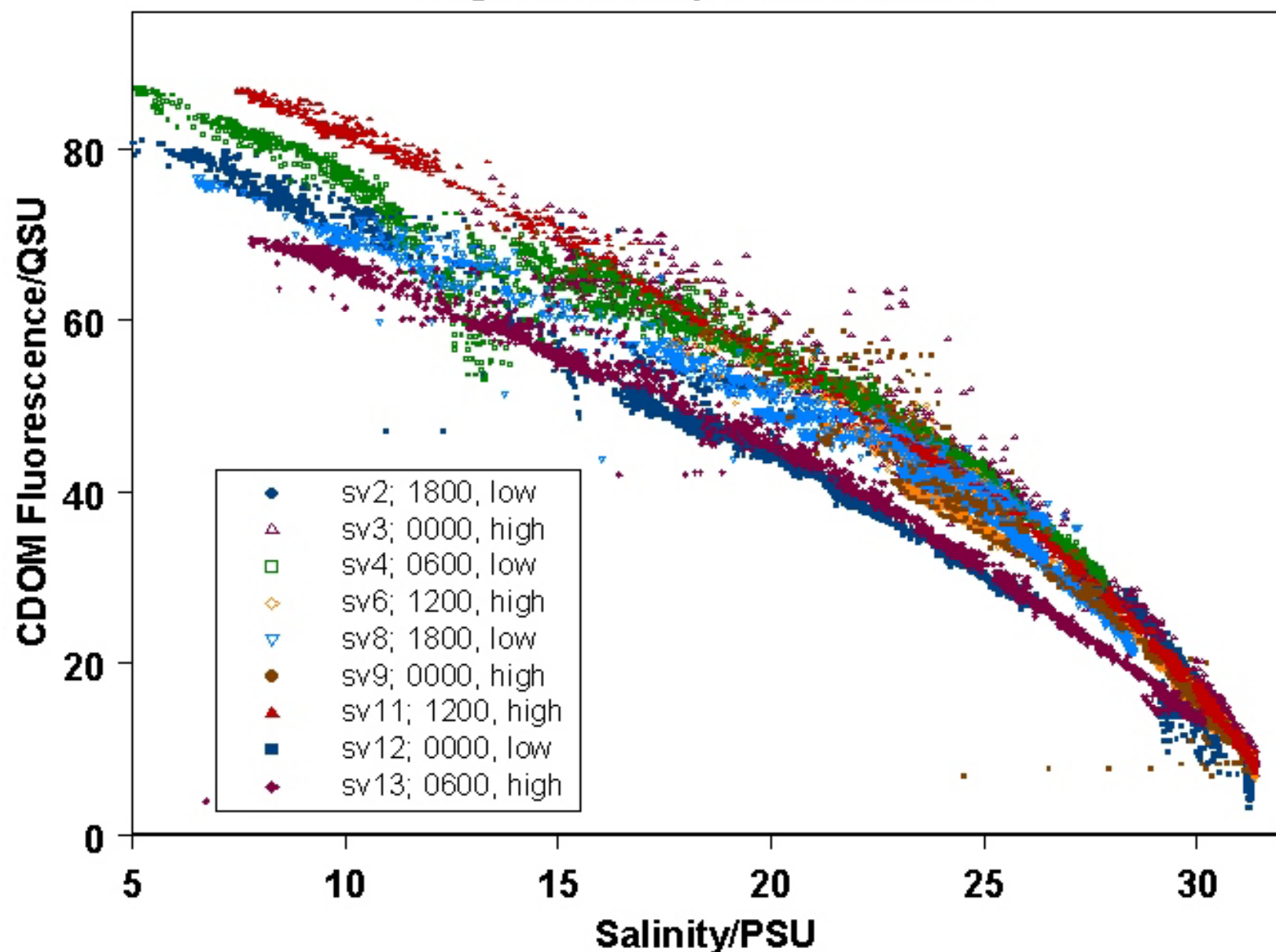
September 14 2001

Depth greater than 5 cm



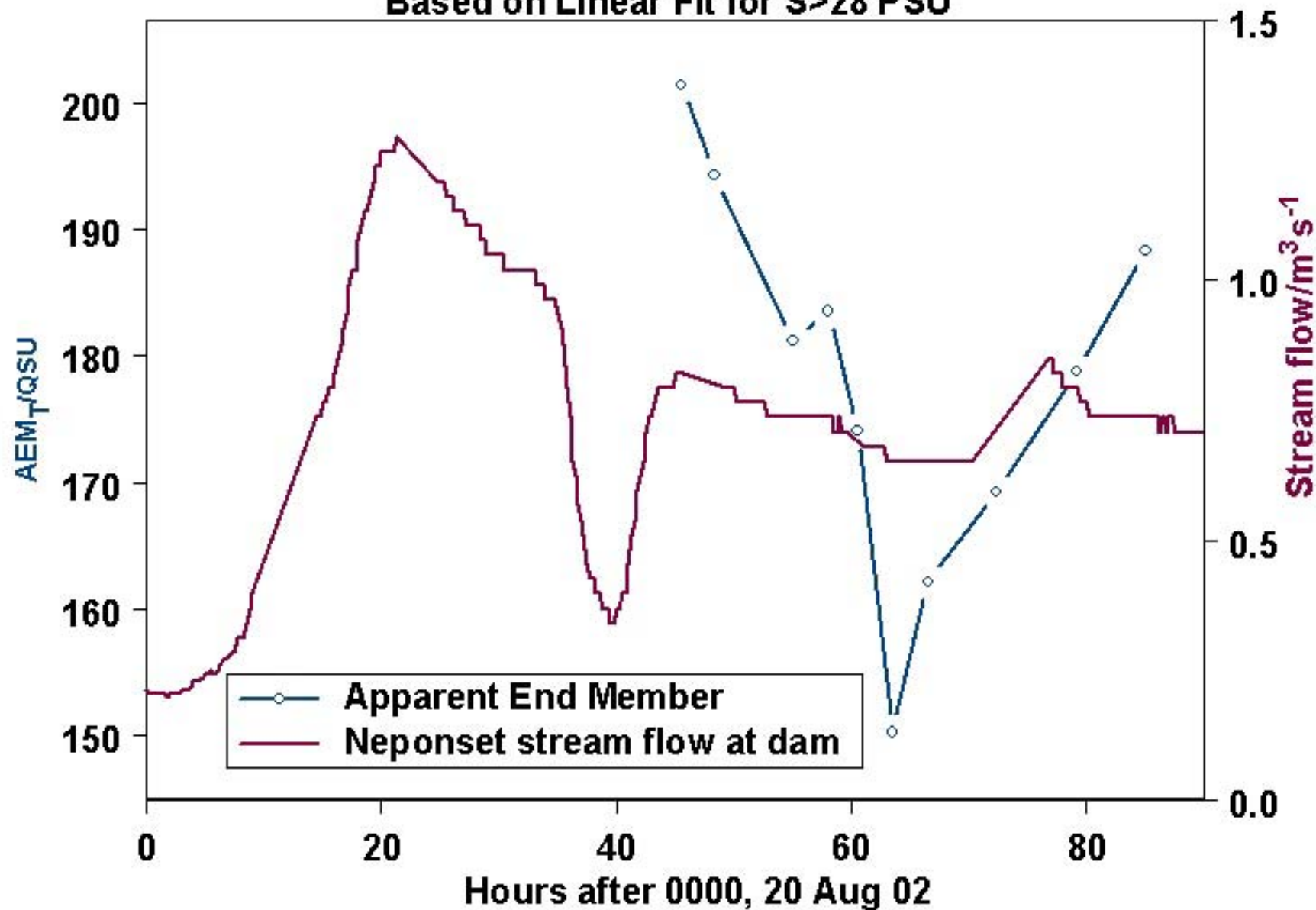
CDOM Fluorescence vs Salinity

August 2002: Upstream, surface



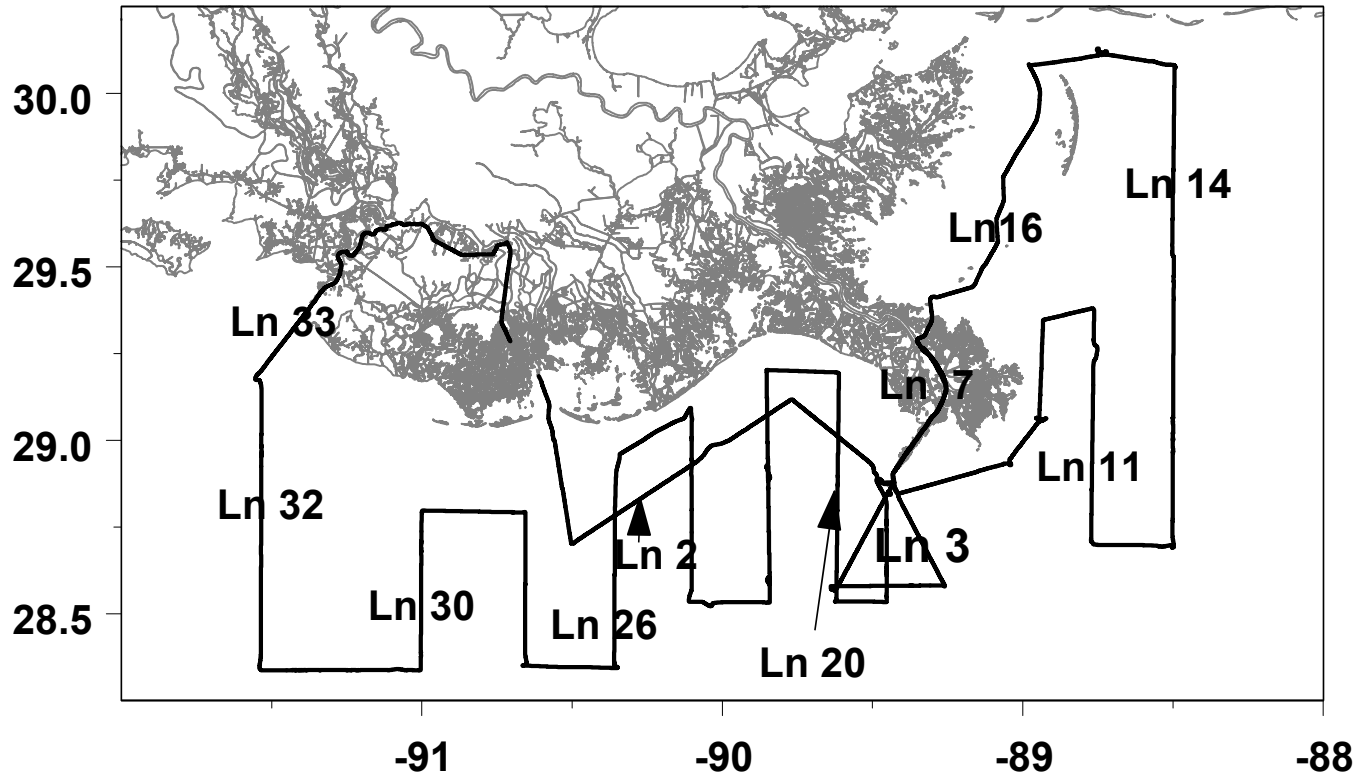
Tangent Based App. End Member vs. Time

Based on Linear Fit for $S > 28$ PSU



II) Mississippi River Plume

Cruise Track for June 2000 Cruise



ECOShuttle

- SeaBird CTD
- SeaPoint Chl, OBS
- SeaTech CDOM
- Chelsea UV
- Aquatracka
- Altimeter
- Optical Plankton Counter (Brooke)
- Video Plankton Recorder (SeaScan)
- Submersible Pump

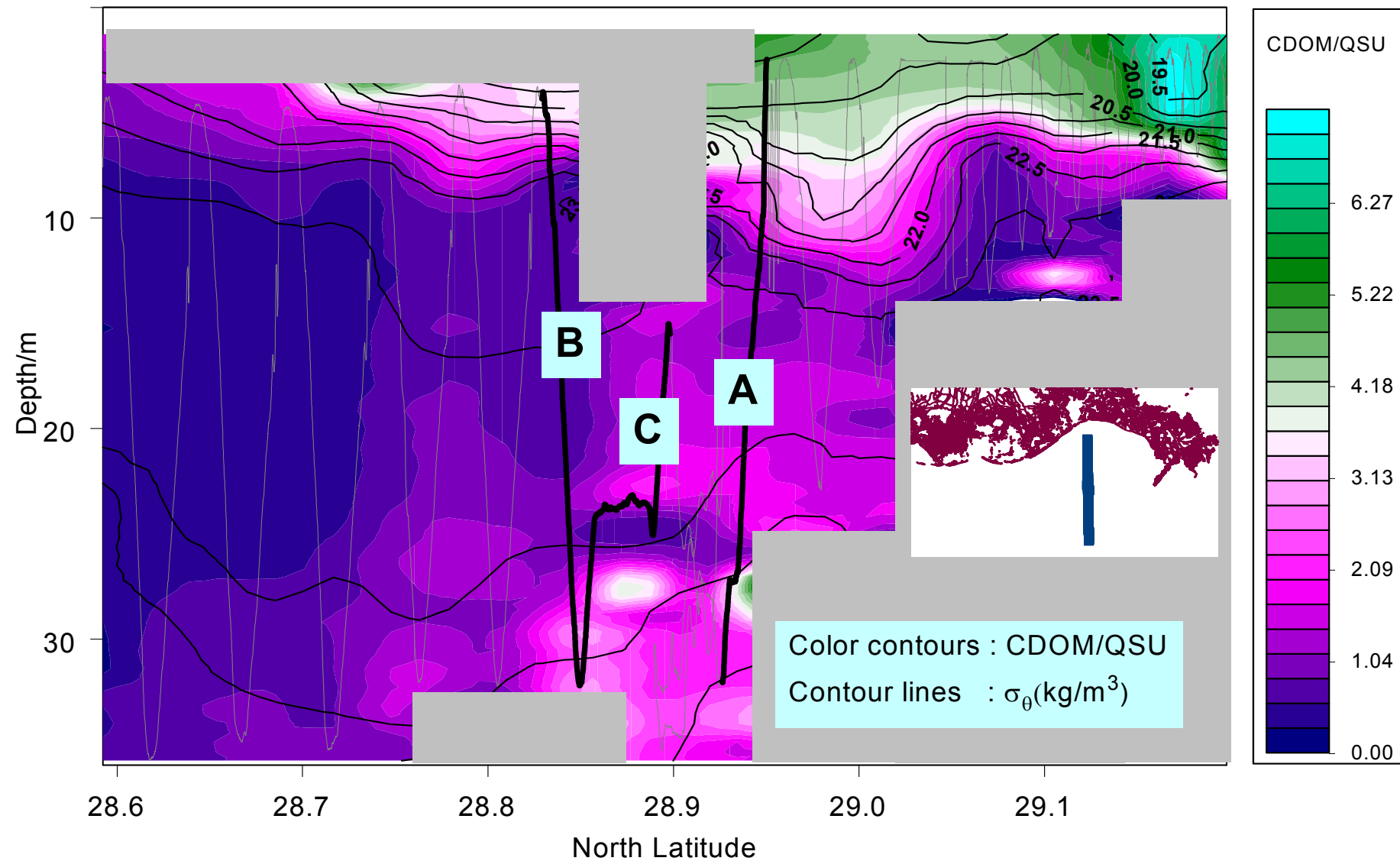


Specialized Terminations and Slip Ring

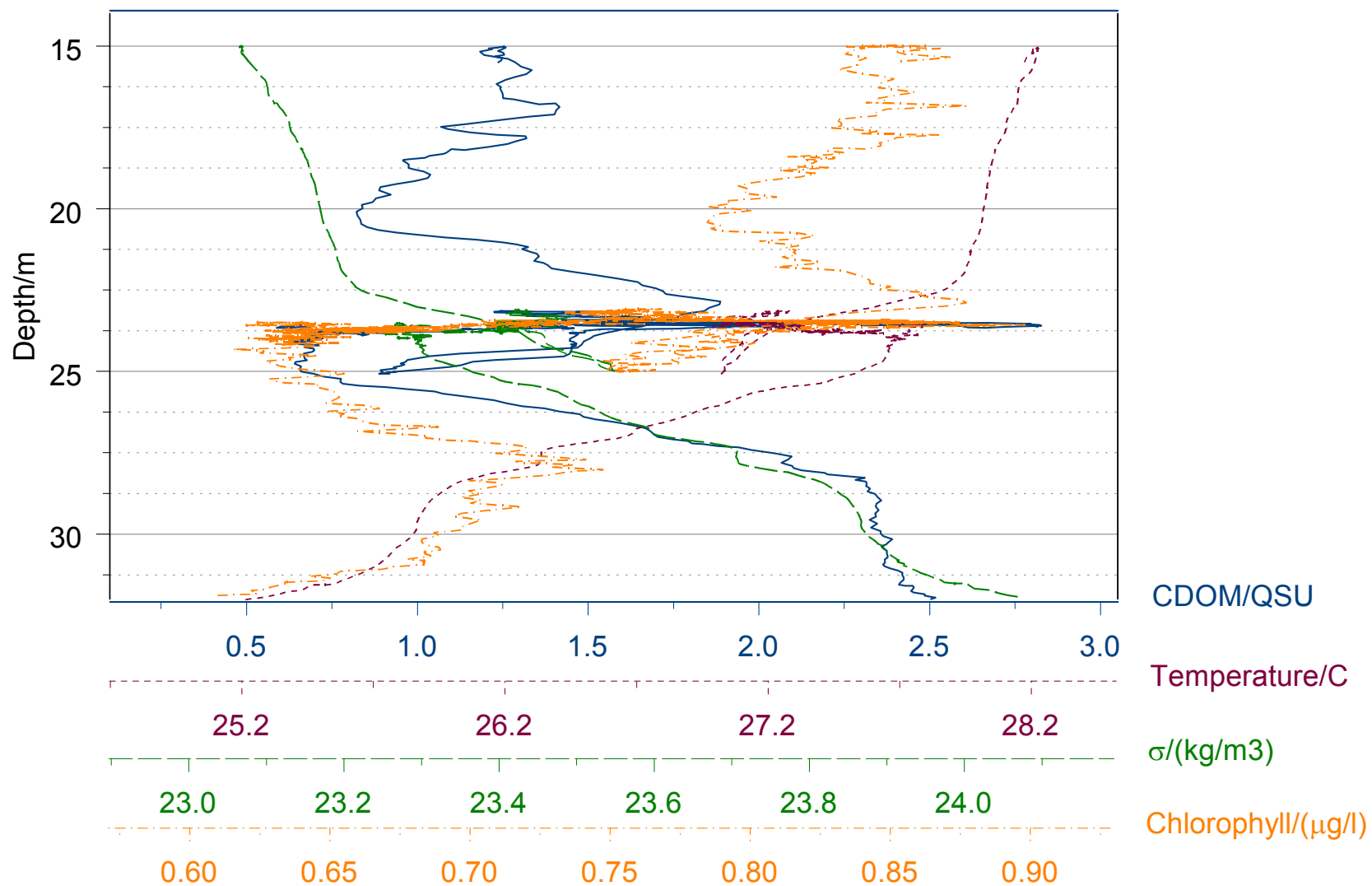


CDOM Fluorometer and Density

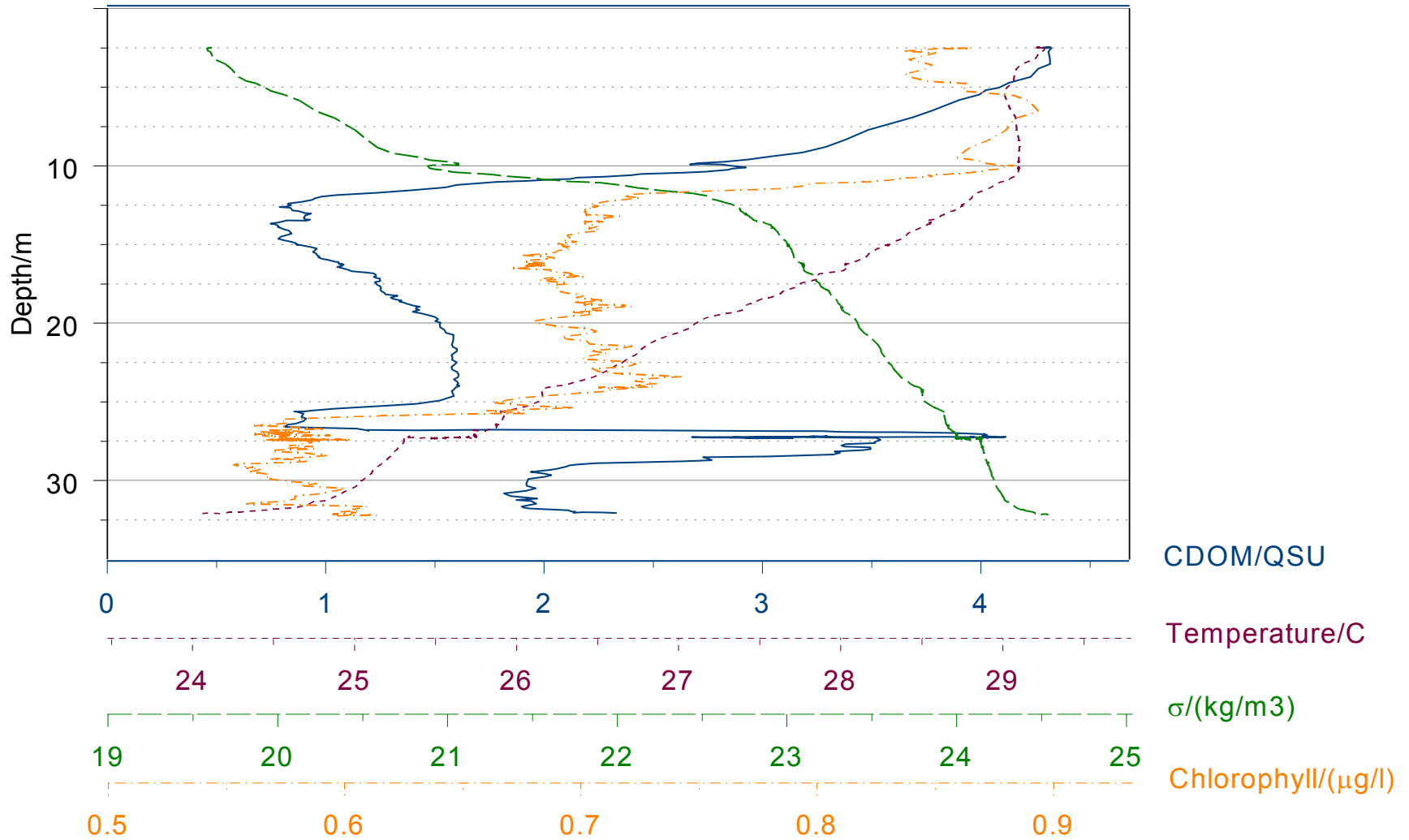
On north-south line at 89.85° W : June 25 2000(Ln22)



Mississippi 2000: LN 22: Profile C

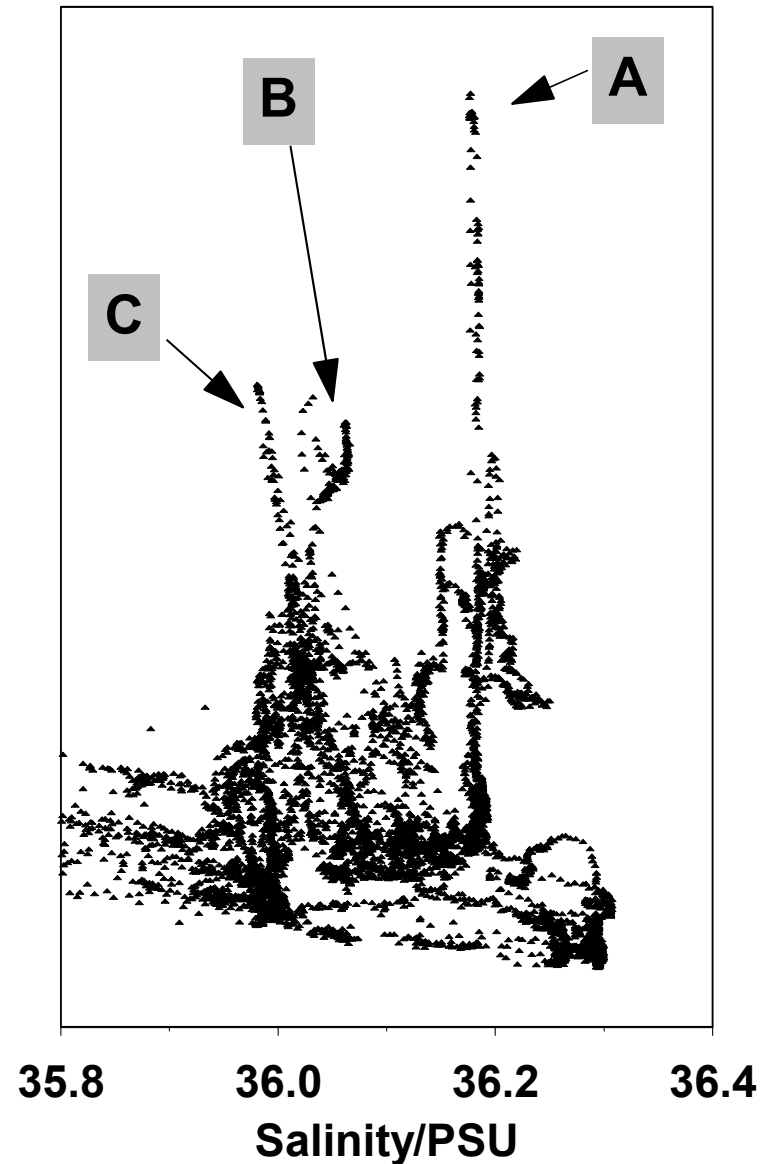
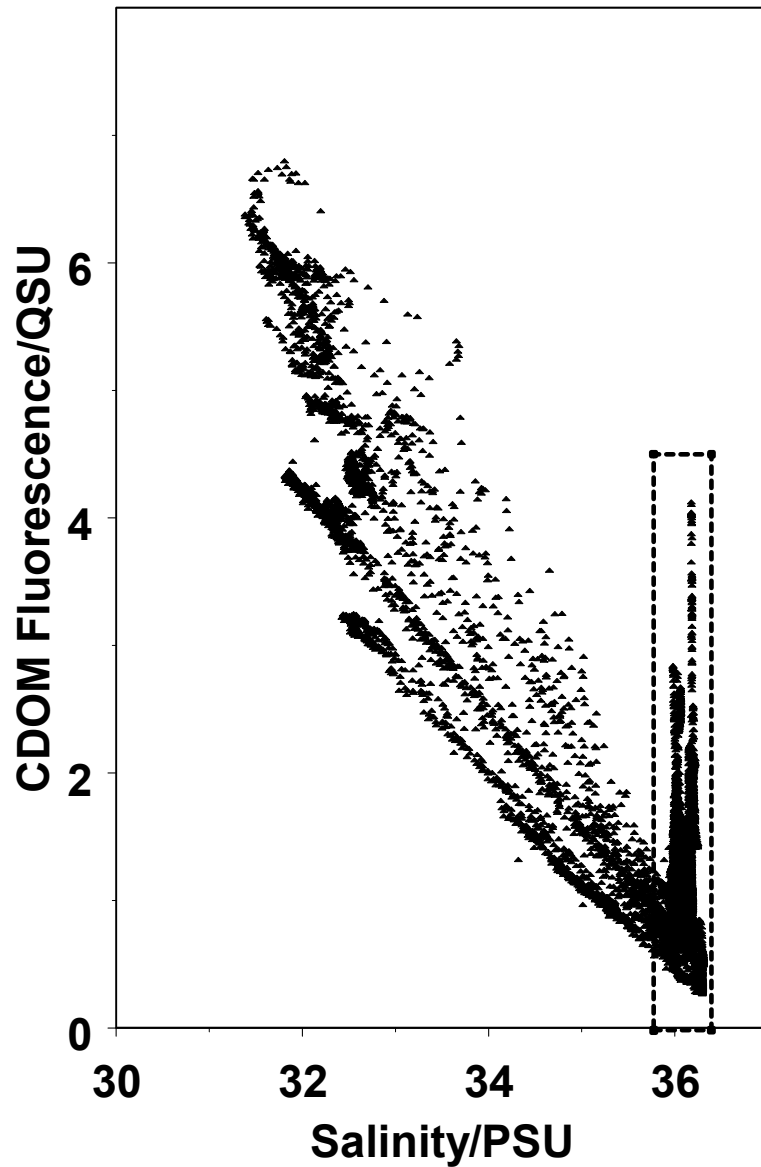


Mississippi 2000: LN 22: Profile A



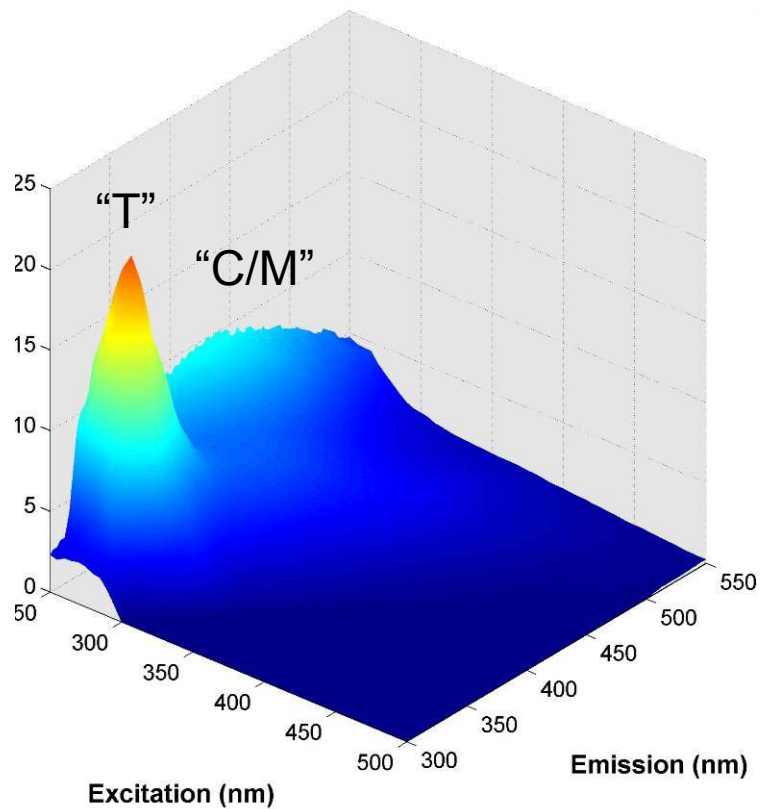
CDOM-Salinity Curve for North-South Line at 89.85°W

June 25 2000(Ln22)



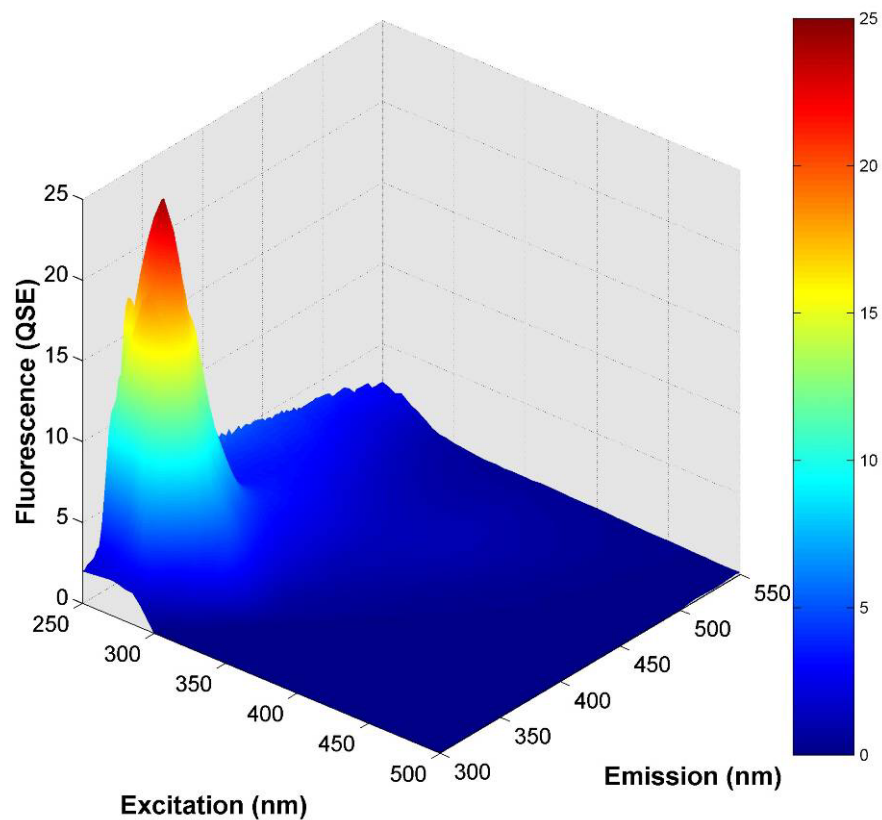
Surface (River Plume)

A



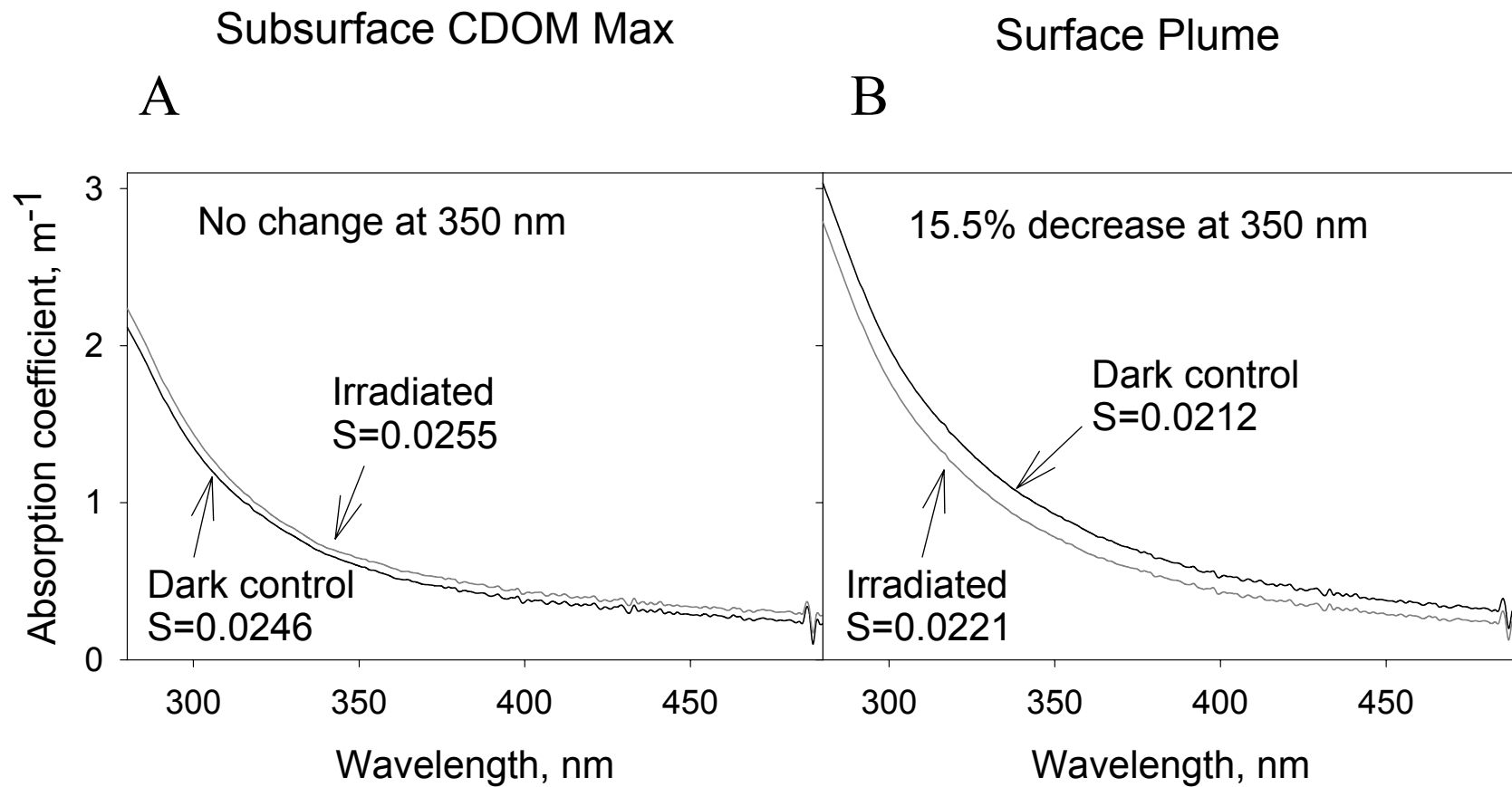
Subsurface CDOM max

B



Line 20--June, 2000

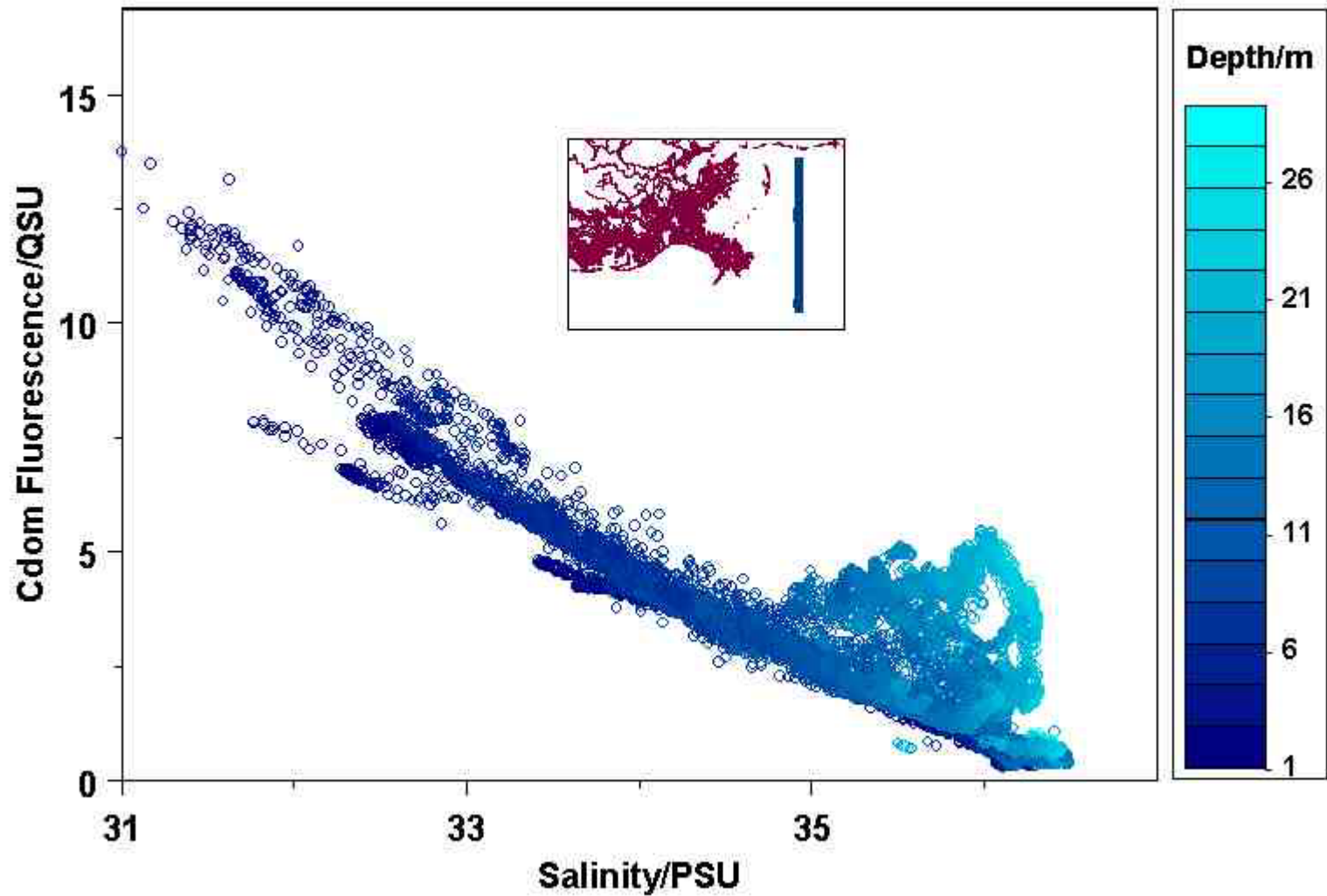
Data from Moran and Zepp
Chen et al., Marine Chemistry, 2004



Data from Zepp and Moran
Chen et al., Marine Chemistry, 2004

Mississippi 2000: Line 14

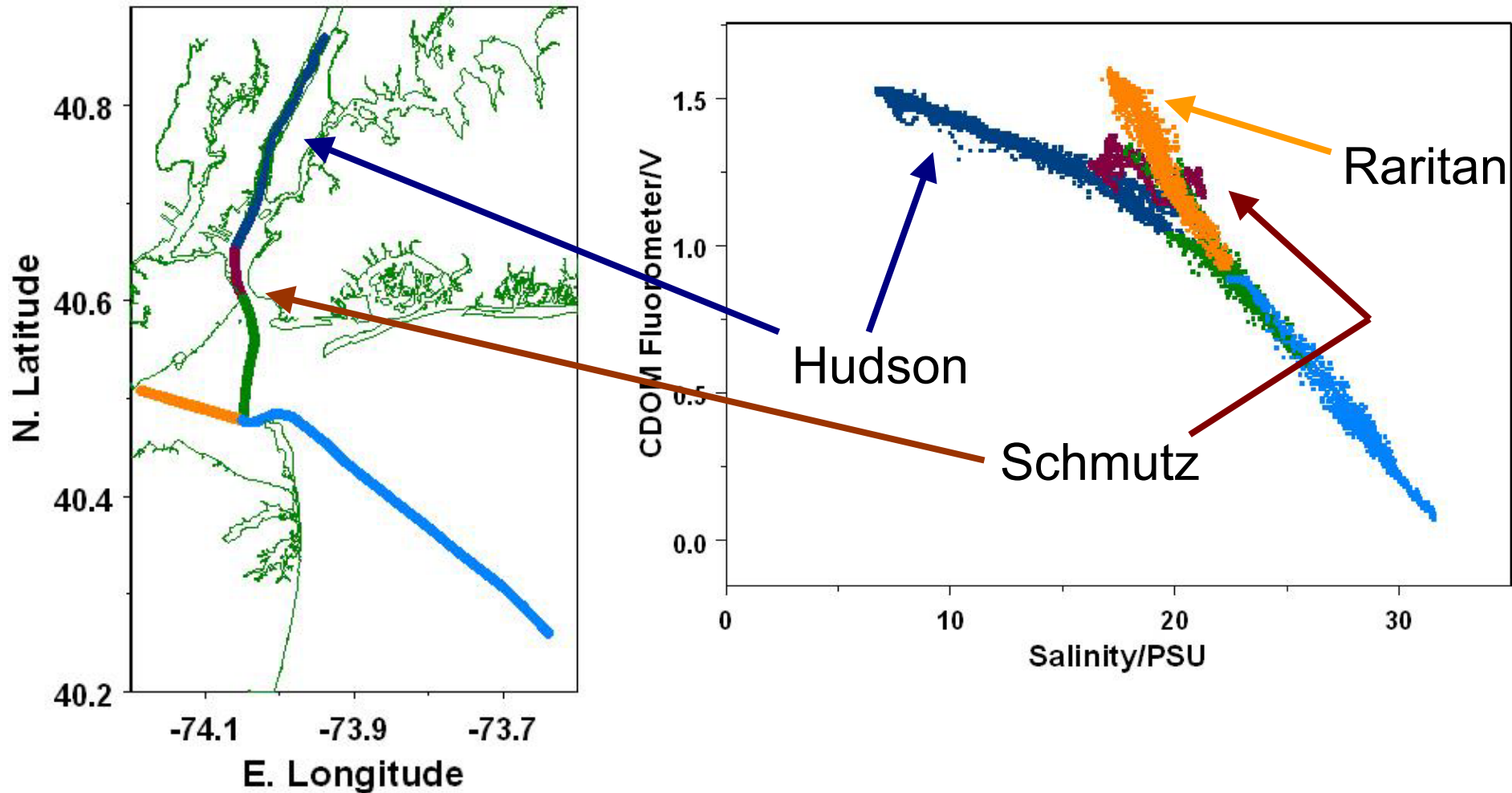
CDOM Fluorescence/V vs. salinity



III.) Hudson River Estuary

Colored Dissolved Organic Matter (CDOM)

June, 2004



ICOS Van



Interior



Uncontaminated Seawater Pumping System

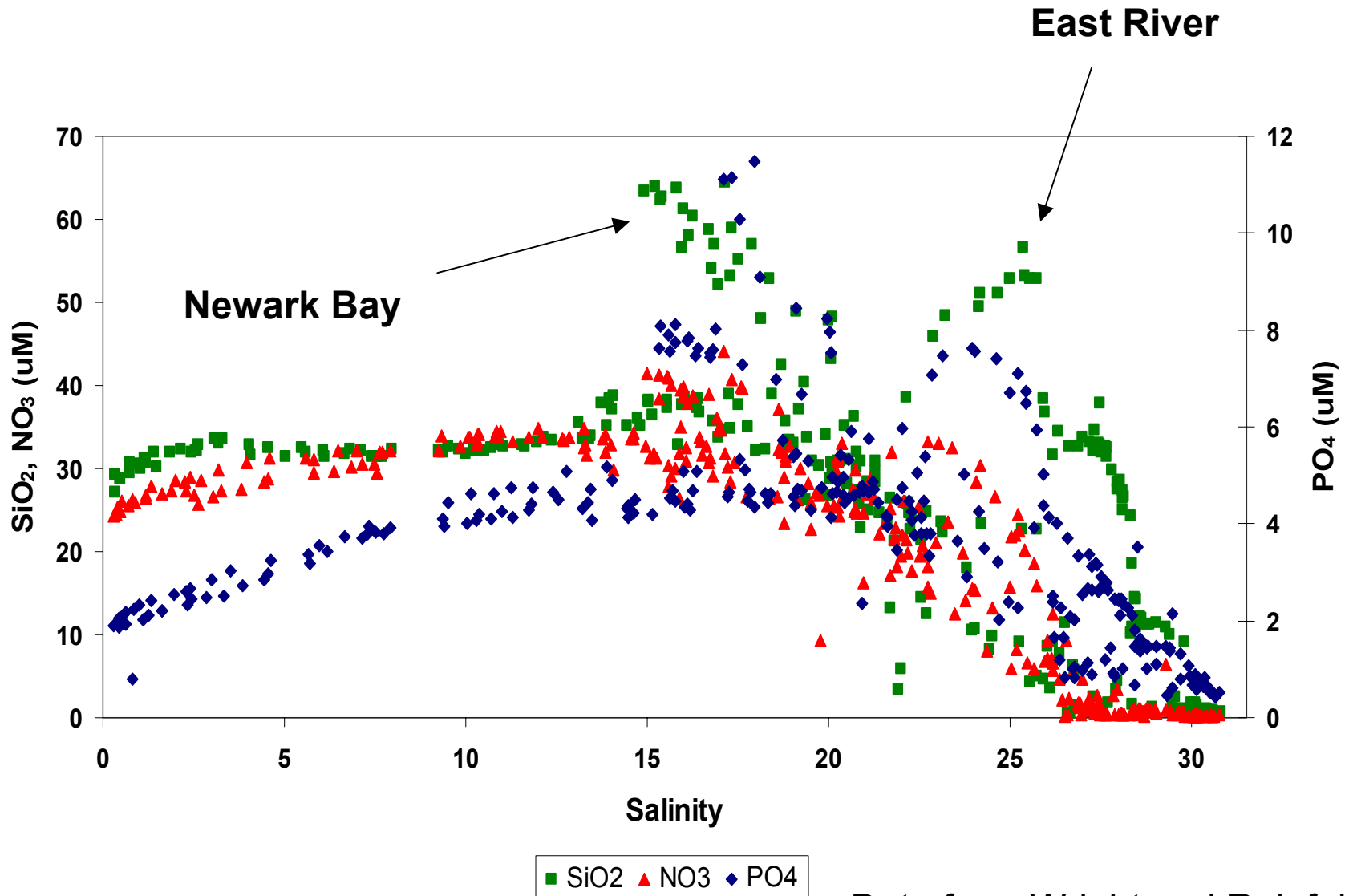
- All teflon and stainless steel
- 8 l/min flow rate, samples after ~3 min delay



Deployment in Hudson River



Nutrients



Data from Wright and Reinfelder

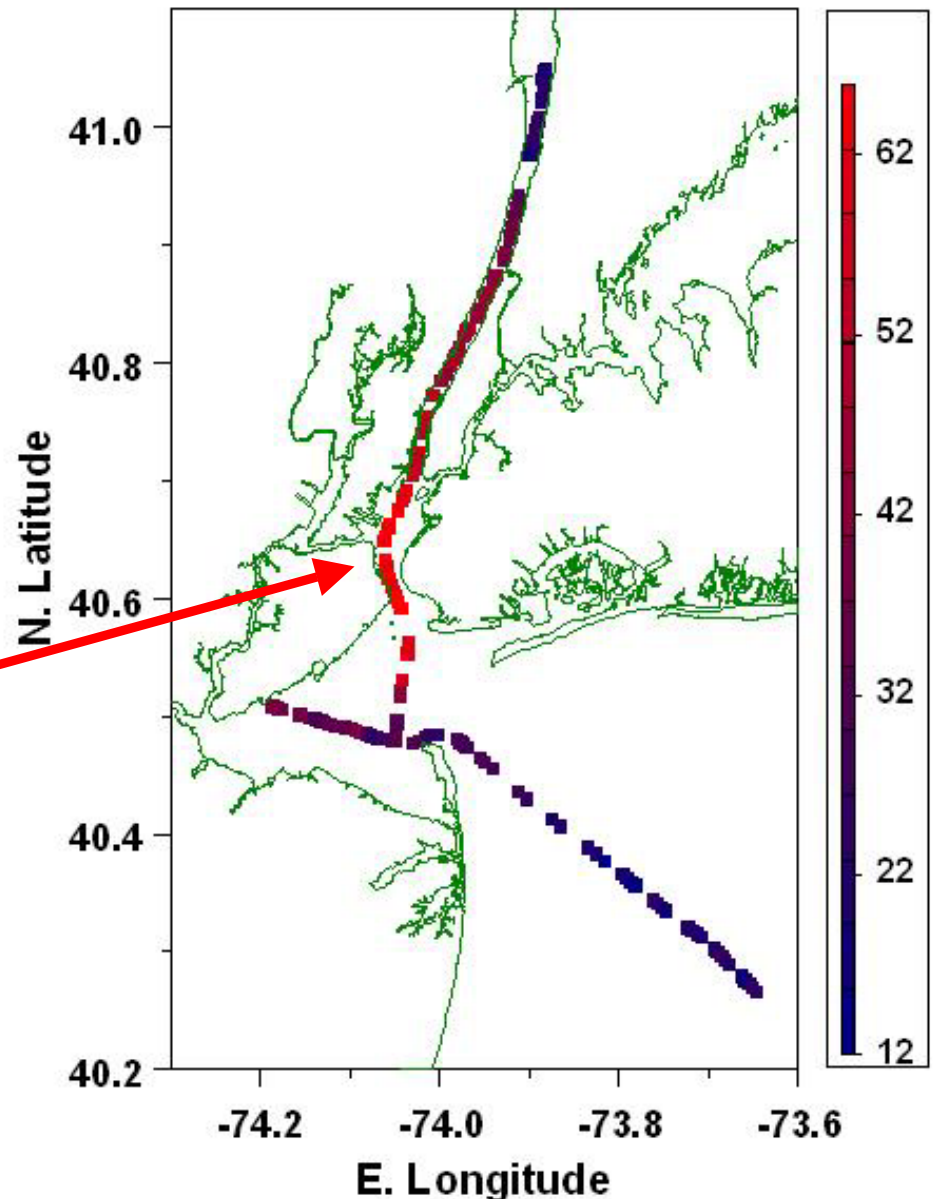
Laser-Induced Fluorescence System (Pyrene)



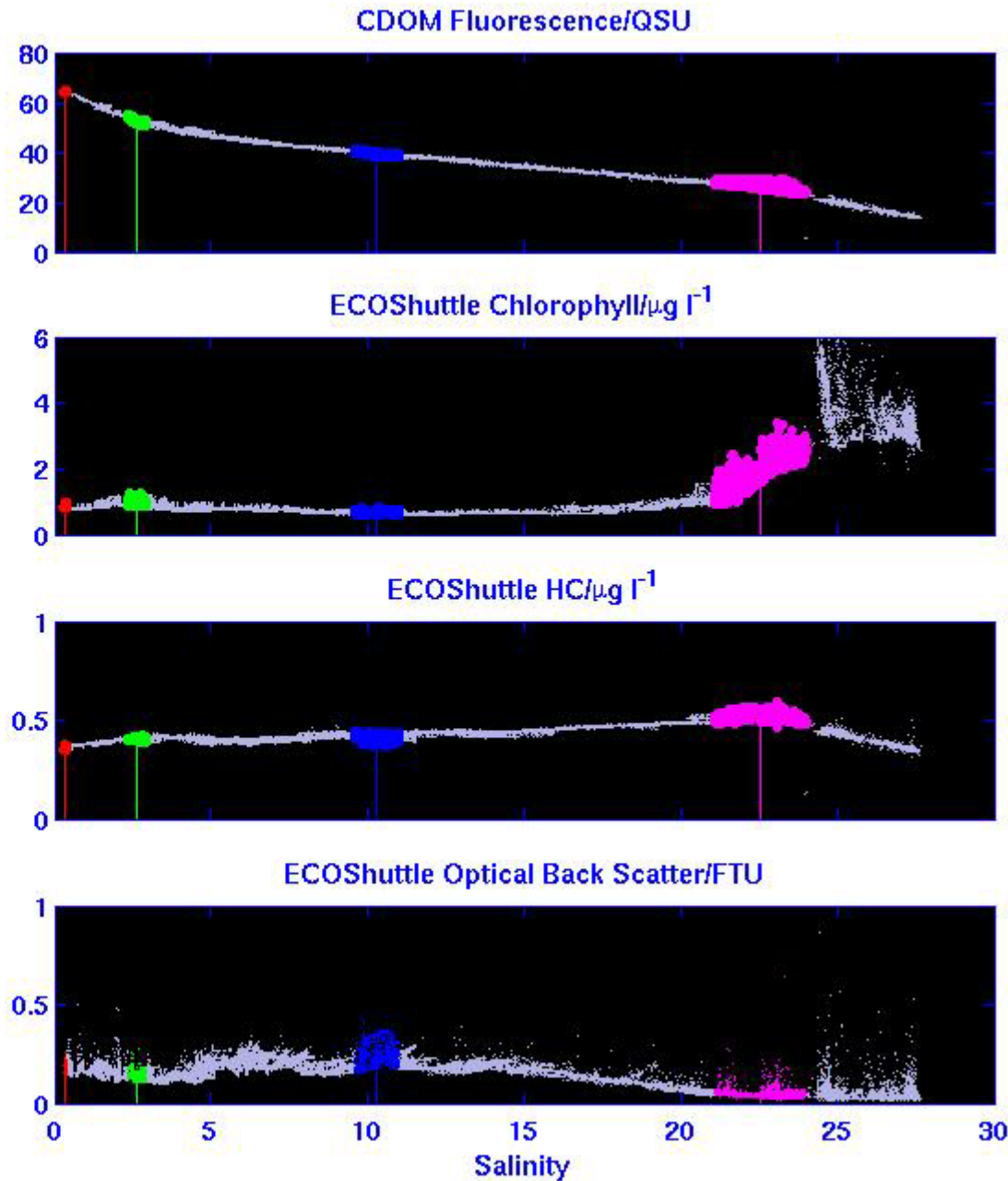
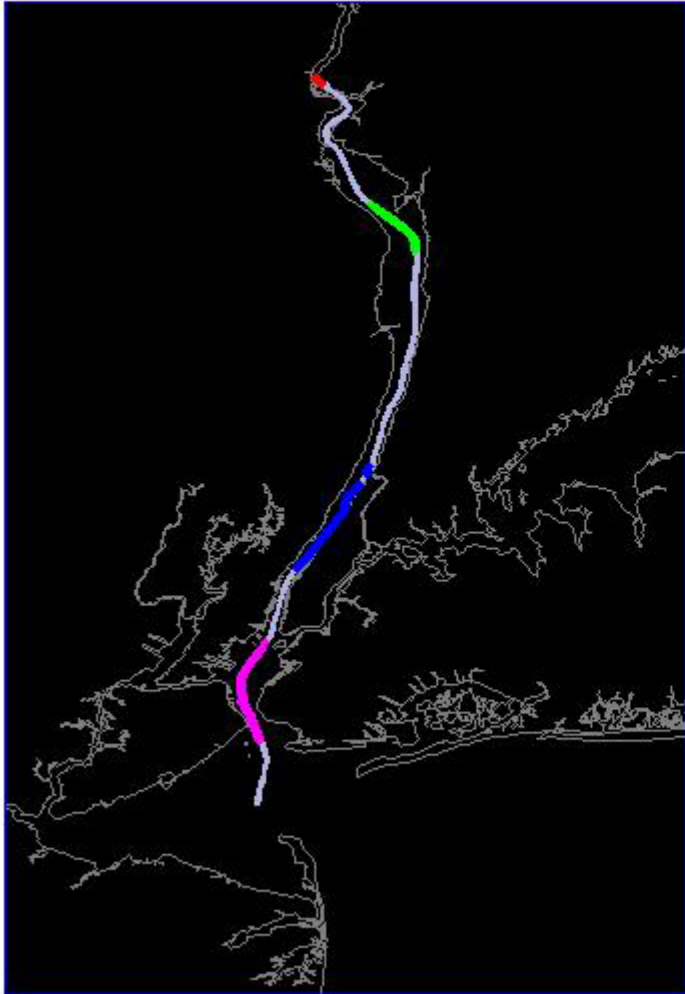
June, 2004

Pyrene (ng/l)

- >1300 pyrene measurements in 5 days
- Maximum downstream of Manhattan



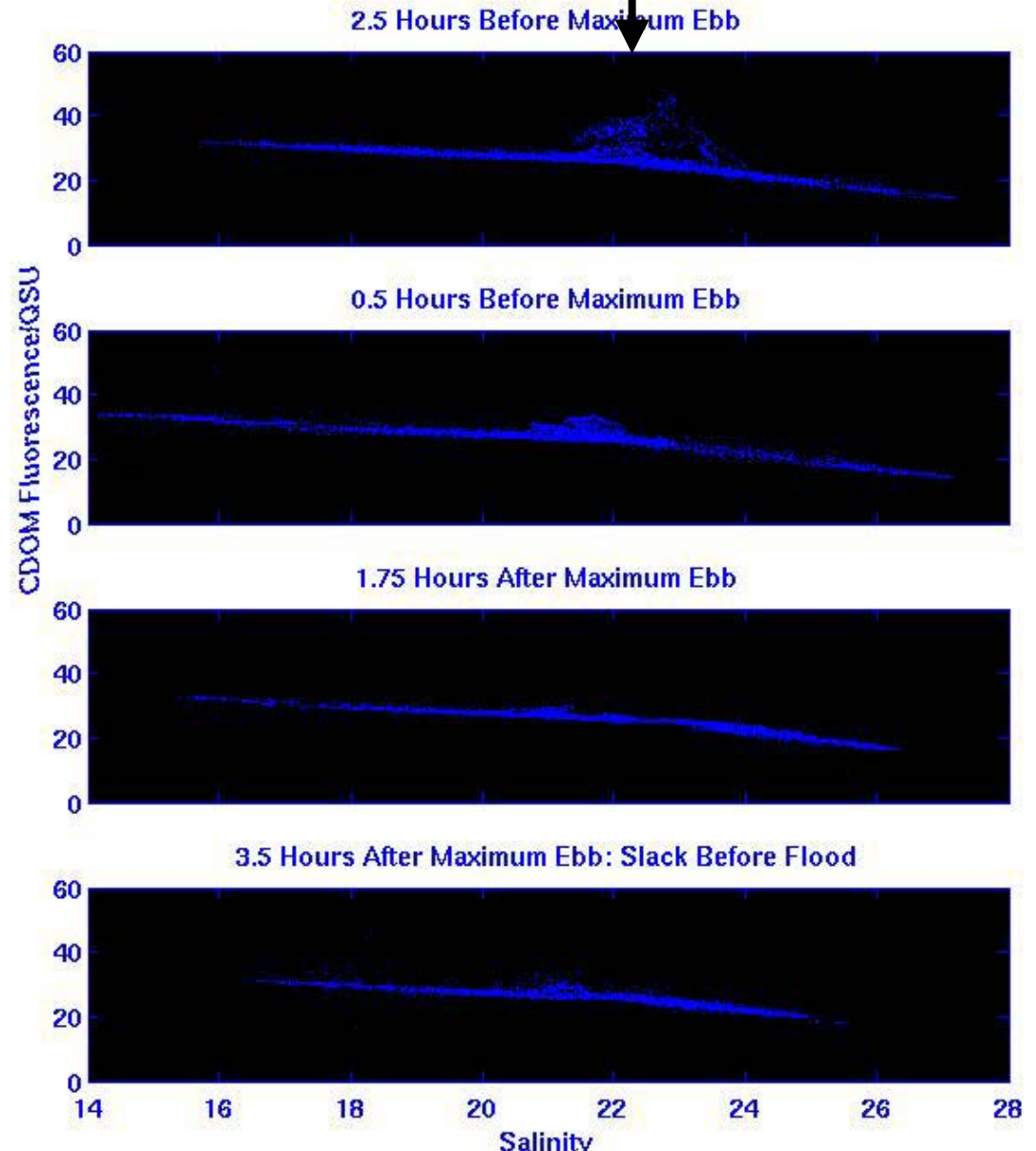
Hudson River



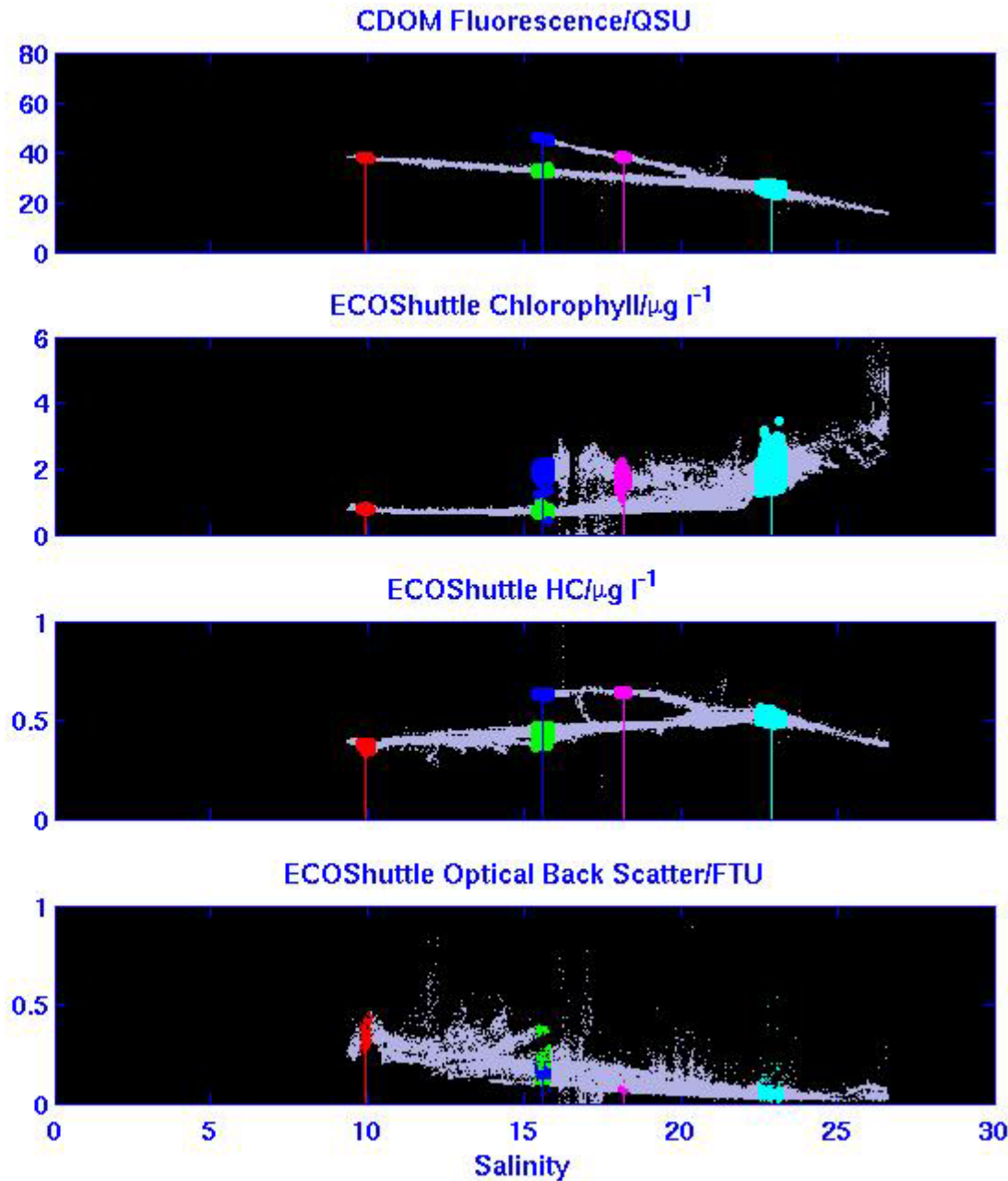
CDOM Over A Tidal Cycle



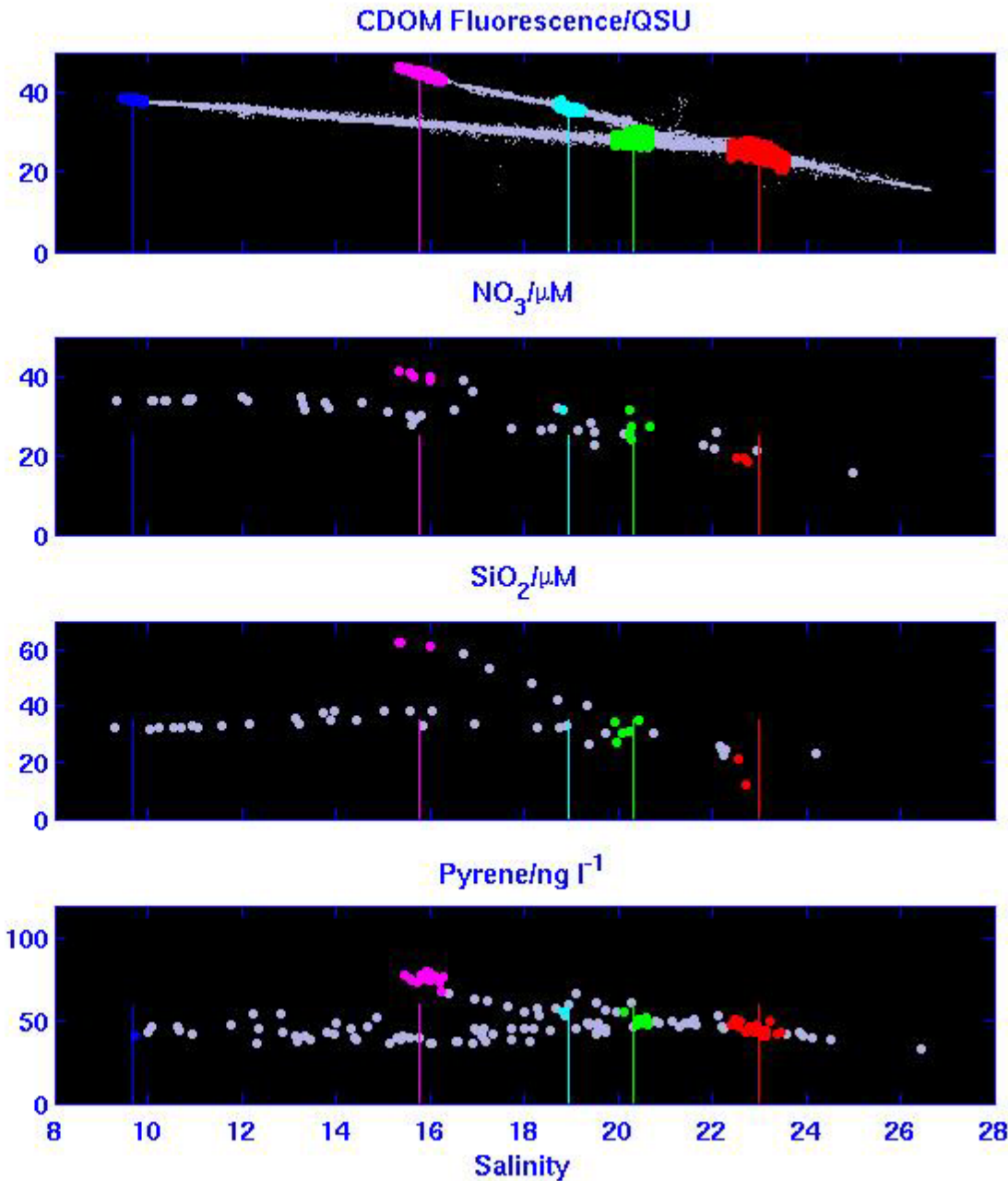
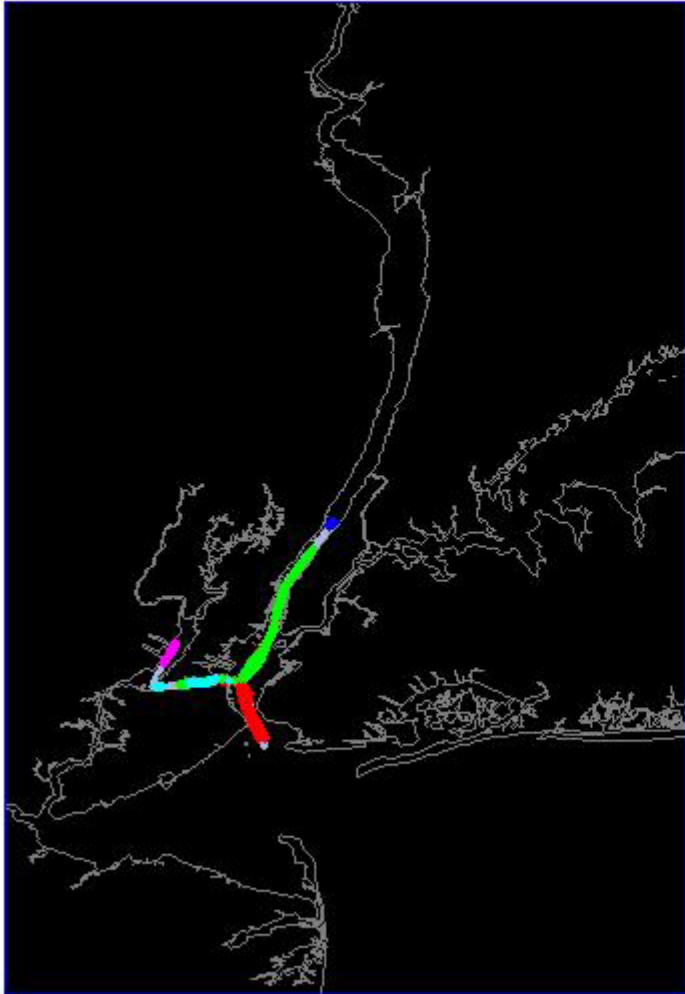
Schmutz



Newark Bay Transect (1)

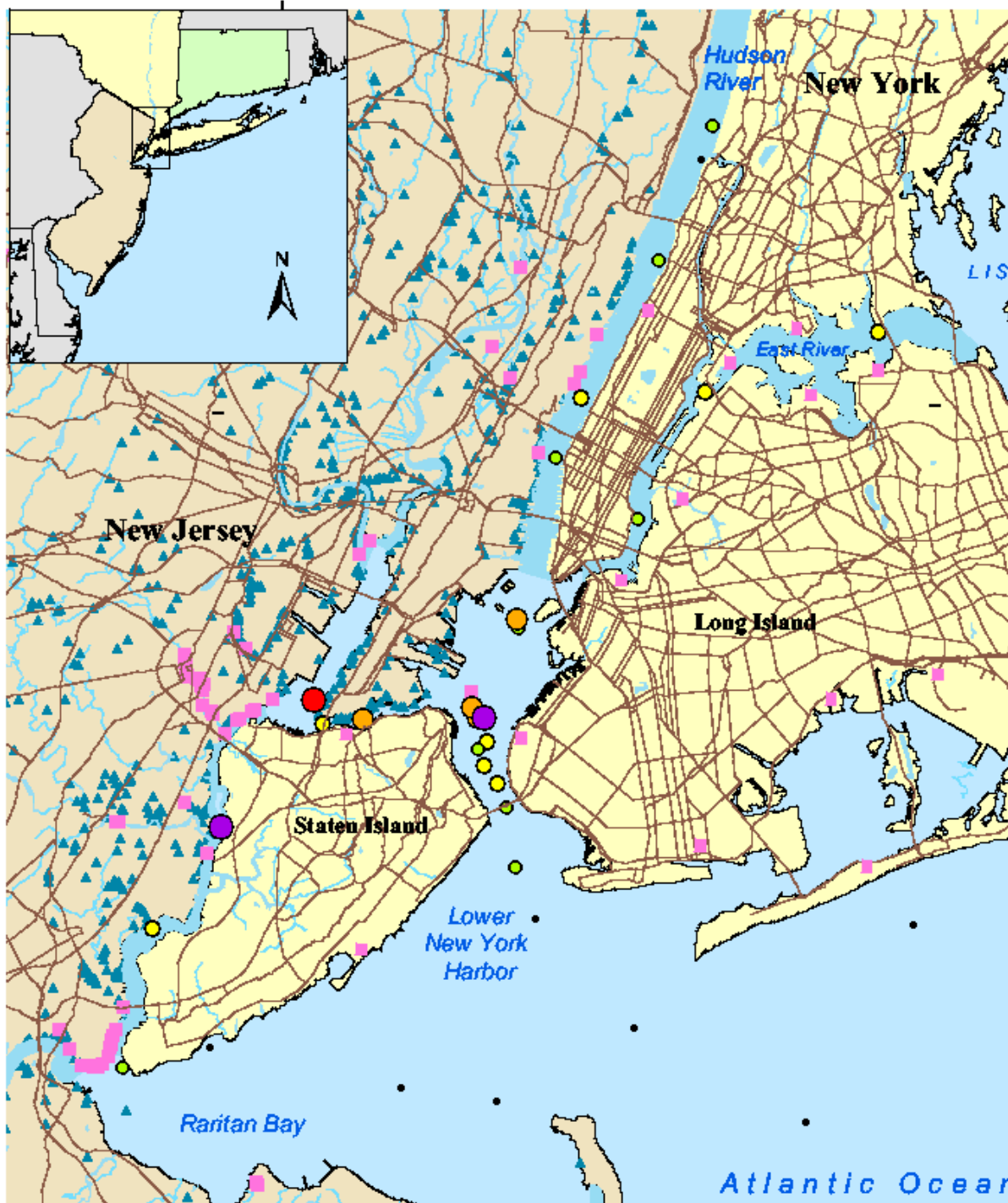


Newark Bay Transect (2)



Bacterial Indicators

(Data from Saffert)



Legend

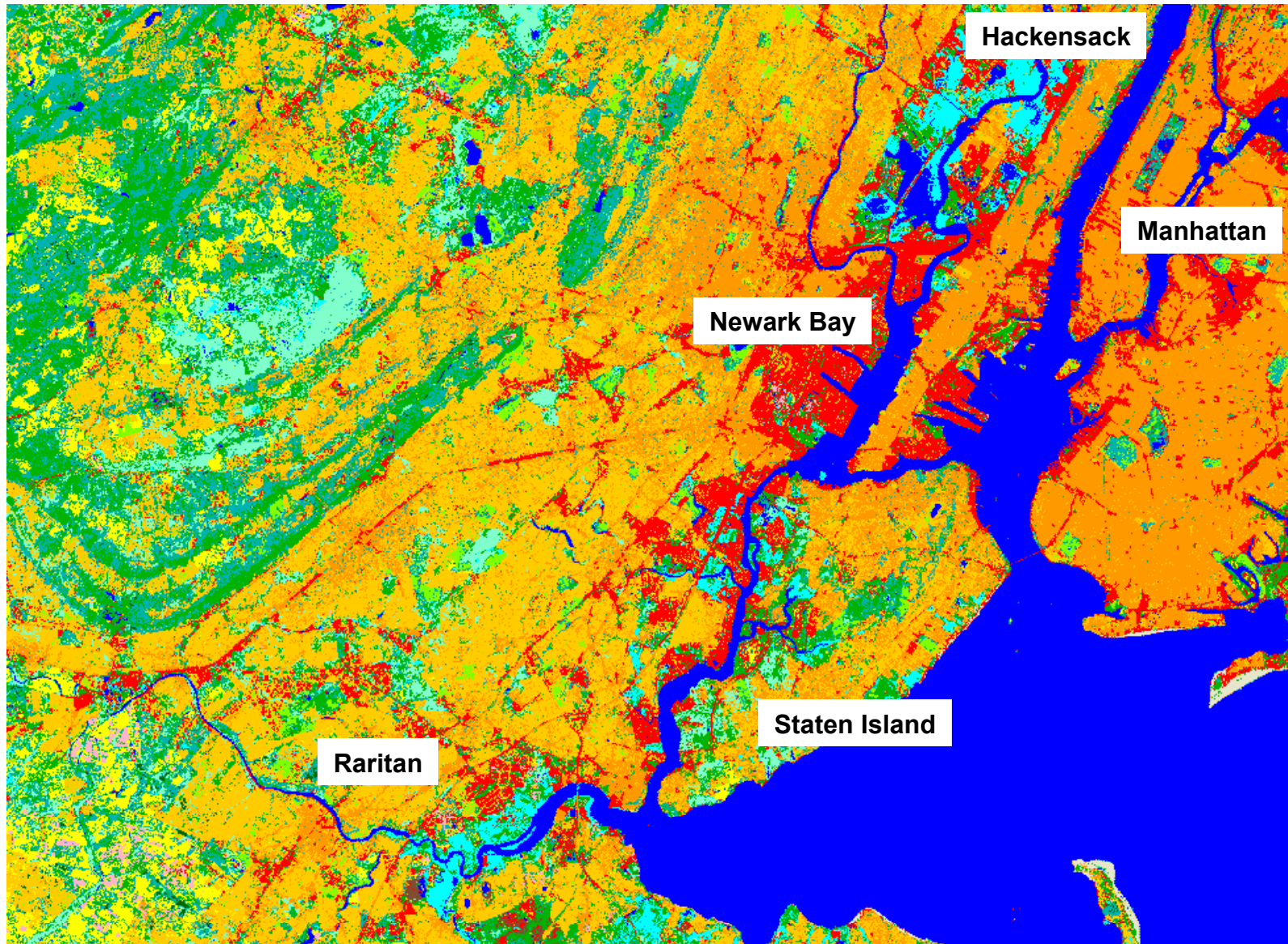
E.coli (cells/100 ml)

- 0 - 10
- 11 - 50
- 51 - 125
- 126 - 200
- 201 - 400
- 401 - 799

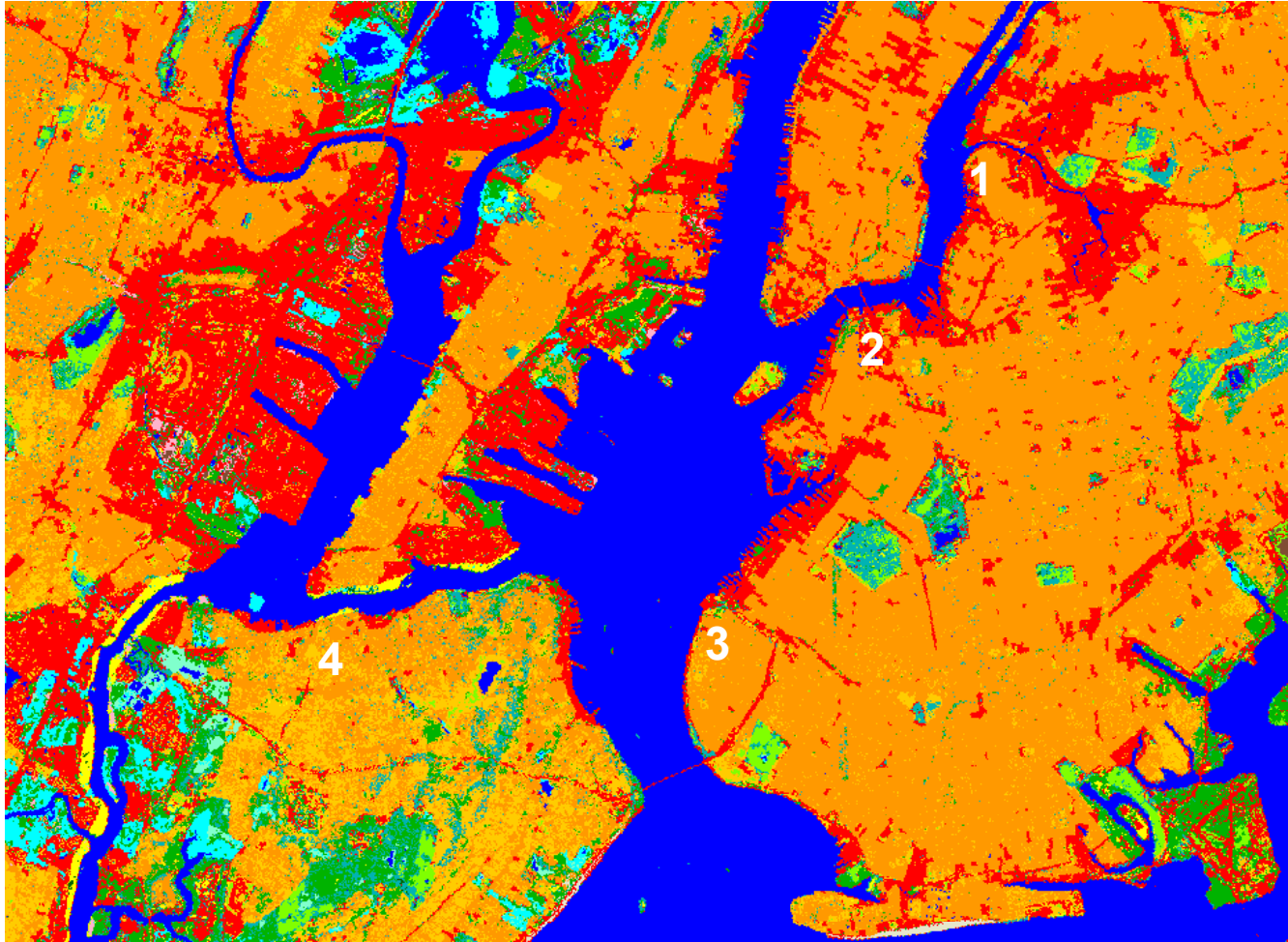
- WWTF
- ▲ NJ CSOs

- Rivers/streams
- Interstates
- Highways

Hudson River Estuary



New York Harbor Area



Land Use (%)

	Total Area	Lower Hudson	Newark Bay	Hackensack	Raritan
Low residential	10	9	11	16	28
High residential	49	<u>58</u>	33	32	14
Industrial	25	23	<u>41</u>	23	15
Wetlands	2	1	2	<u>13</u>	<u>14</u>

Summary

- High resolution allows studies of estuarine reactors (Neponset)
 - Wetlands
- Real-time data allows guided sampling strategies
 - Thin-layers
- Integrated system allows interdisciplinary source tracking
 - Schmutz