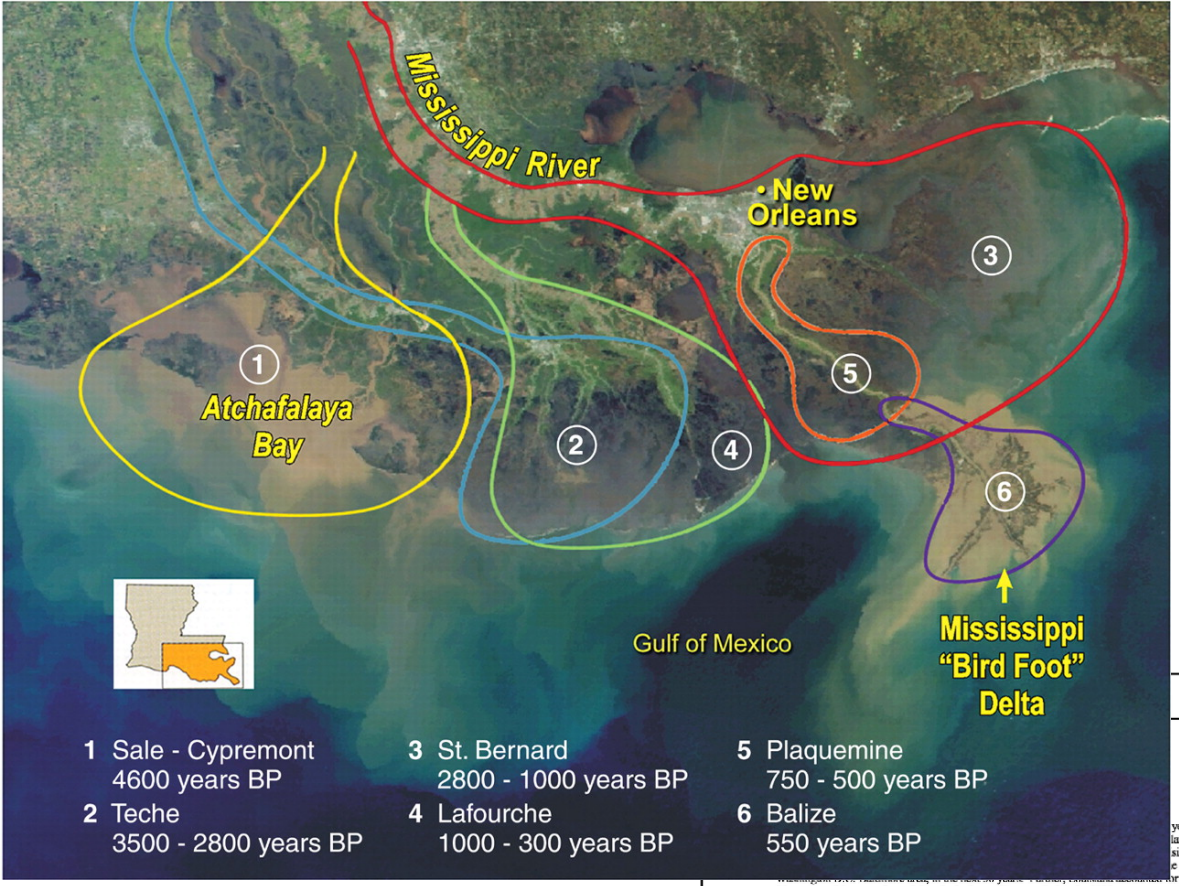
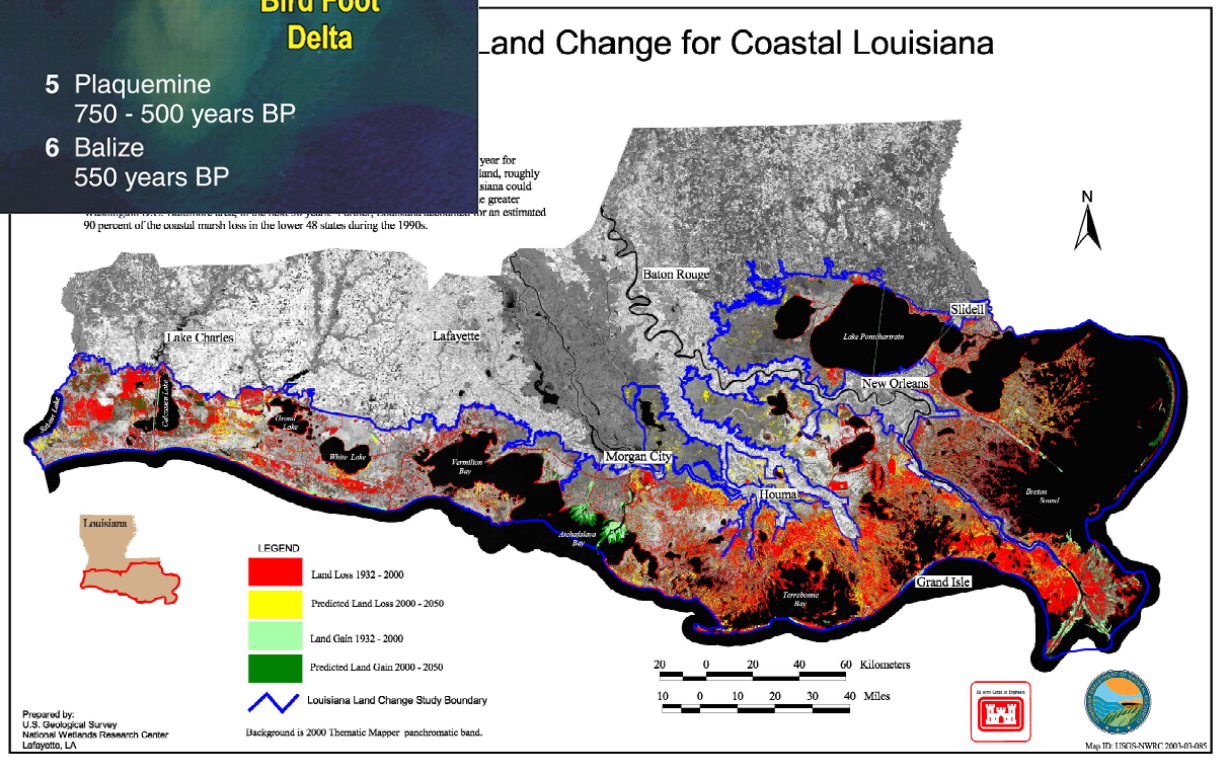
Establishing a River-Dominated Coastal Wetlands Observatory

Alexander S. Kolker[1,2], Valerie Cruz[1]
Chris Esposito[3], Ioannis Georgiou[3],
Mead Allison[4]

[1]Louisiana Universities Marine Consortium
[2]Earth and Environmental Sciences, Tulane University
[3]Earth and Environmental Sciences, University of New Orleans
[4]Jackson School of Geosciences, University of Texas



While there are numerous causes of land-loss in Louisiana, the decoupling of the river and its delta plays a dominant role.



Restoring Wetlands with River Diversions

- Goal: Mimic natural deltaic processes that build land.
- Observational evidence indicate that river diversions should work.
- But many questions remain regarding the size, shape and functioning of diversions.
- Solution: Study natural analogues.

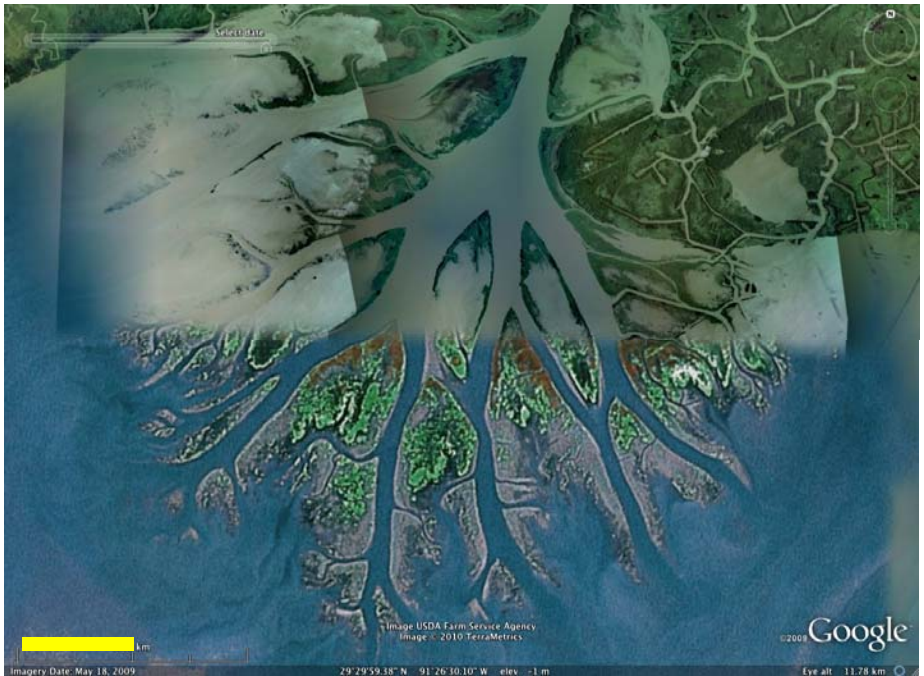
River dominated coastal wetlands

-Freshwater wetlands

-Primary sediment transport pathways are associate with river flow, rather than tides or winds.

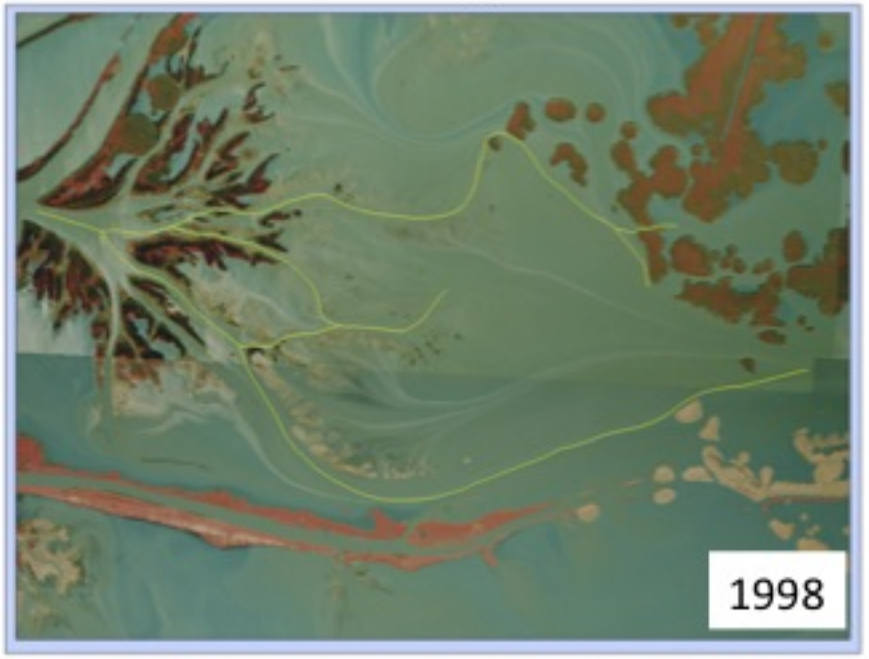
-Serve as examples for the type of wetland that will be created by a river diversion.

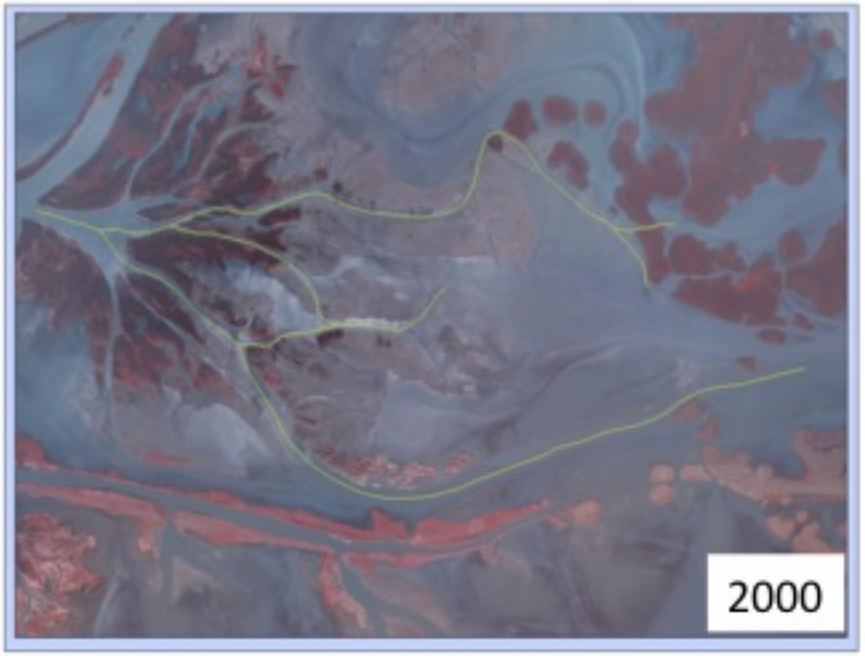
Wax Lake:
A developing swamp

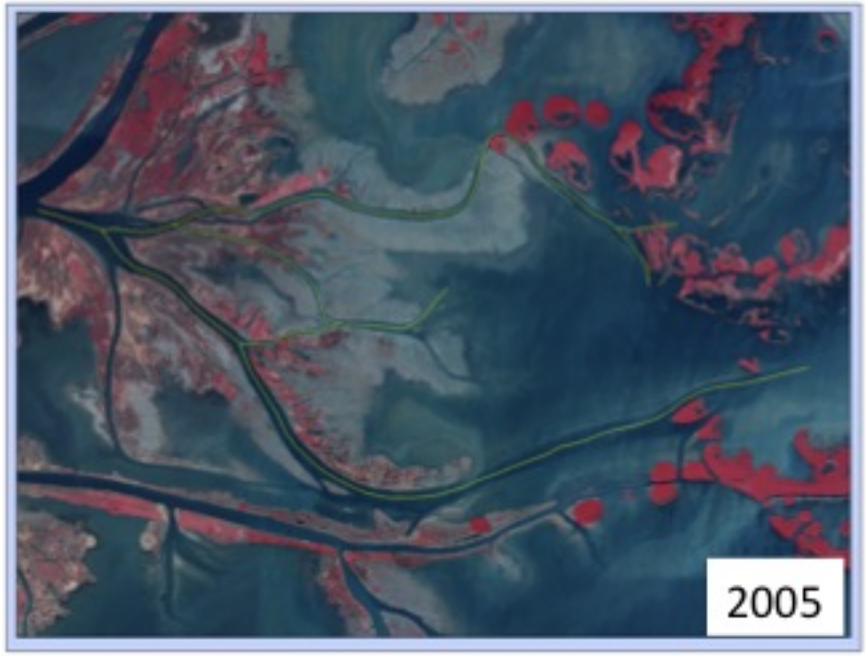


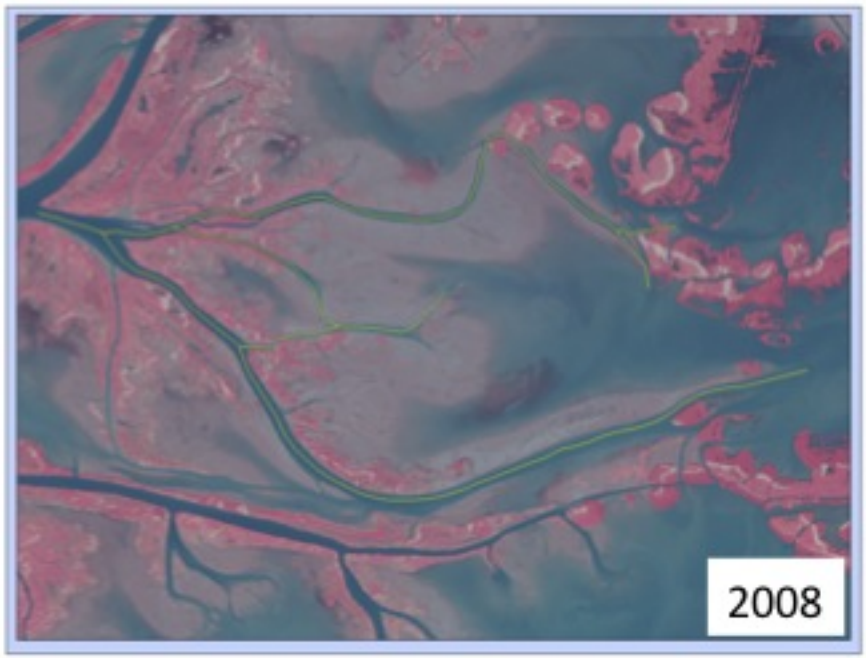
Cubits Gap:
A developing marsh

Development of Cubit's Gap Wetland Complex









Long-term Goal

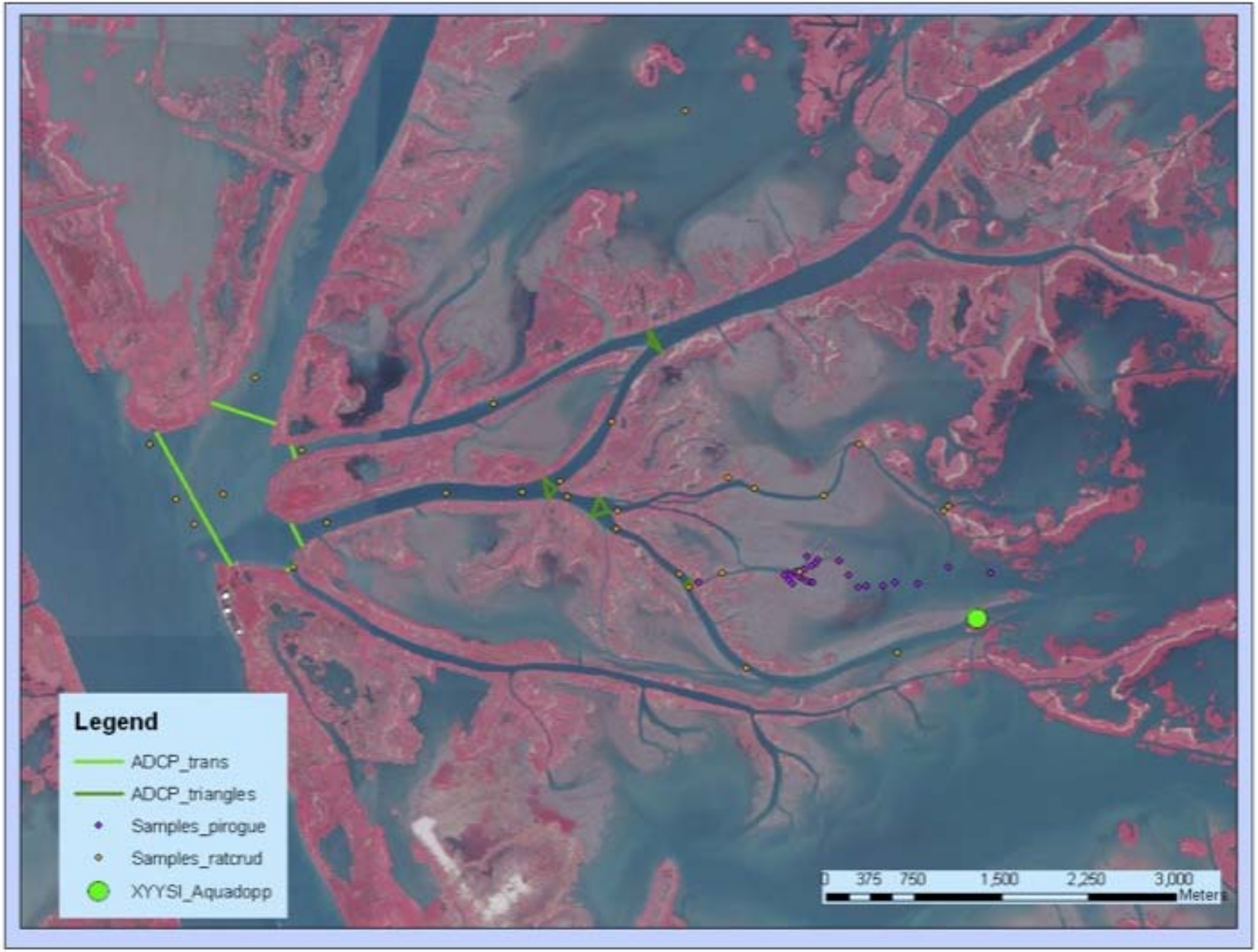
Develop the capacity for a river-dominated coastal wetlands observatory. This observatory will build on existing activities in the Mississippi River and will develop new capabilities to investigate sediment dynamics and land-building activities in the lower river.

Hypothesis

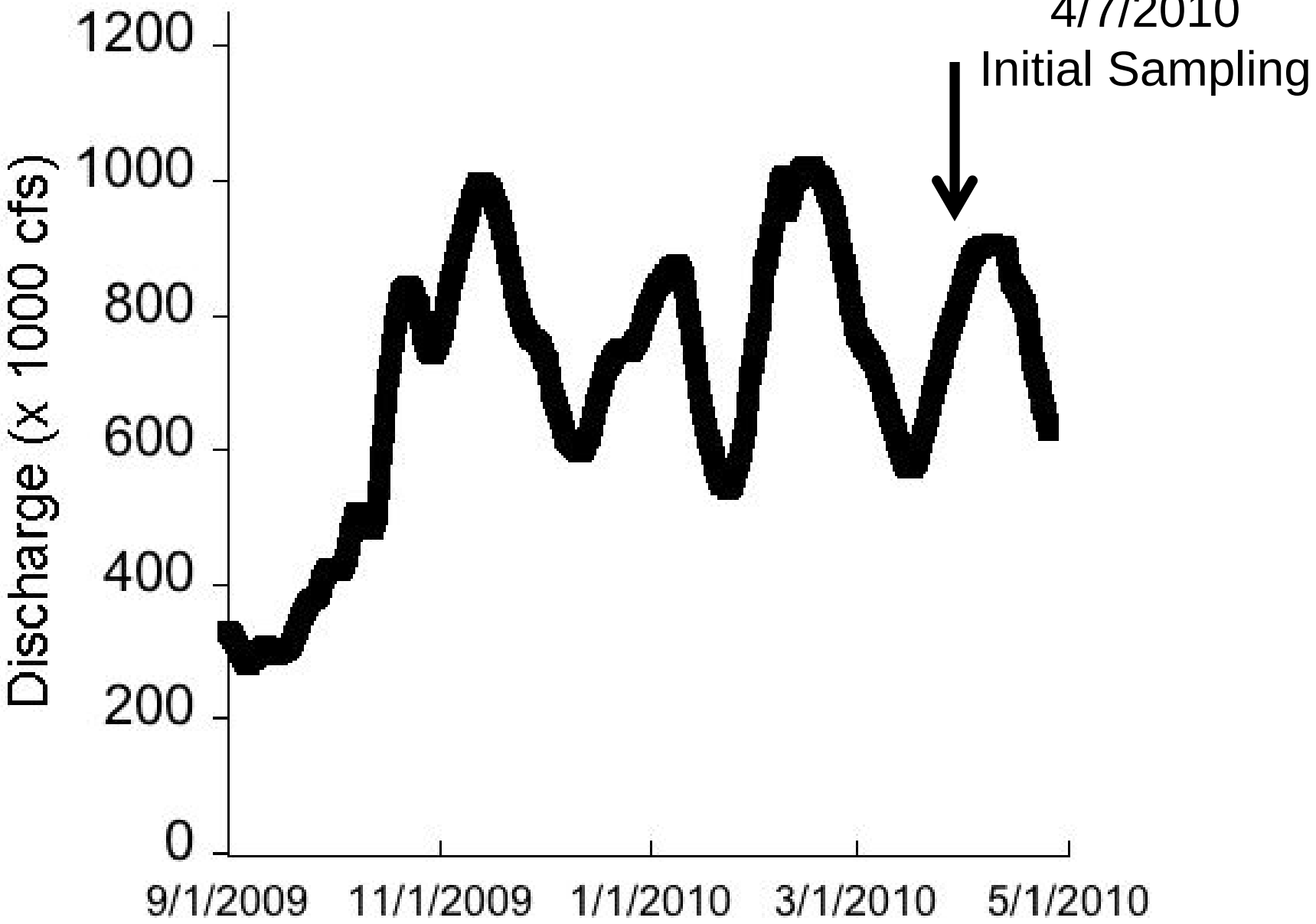
Patterns of sediment delivery to wetlands in Cubit's Gap should be related to river discharge, coastal geomorphology and the presence of plants.

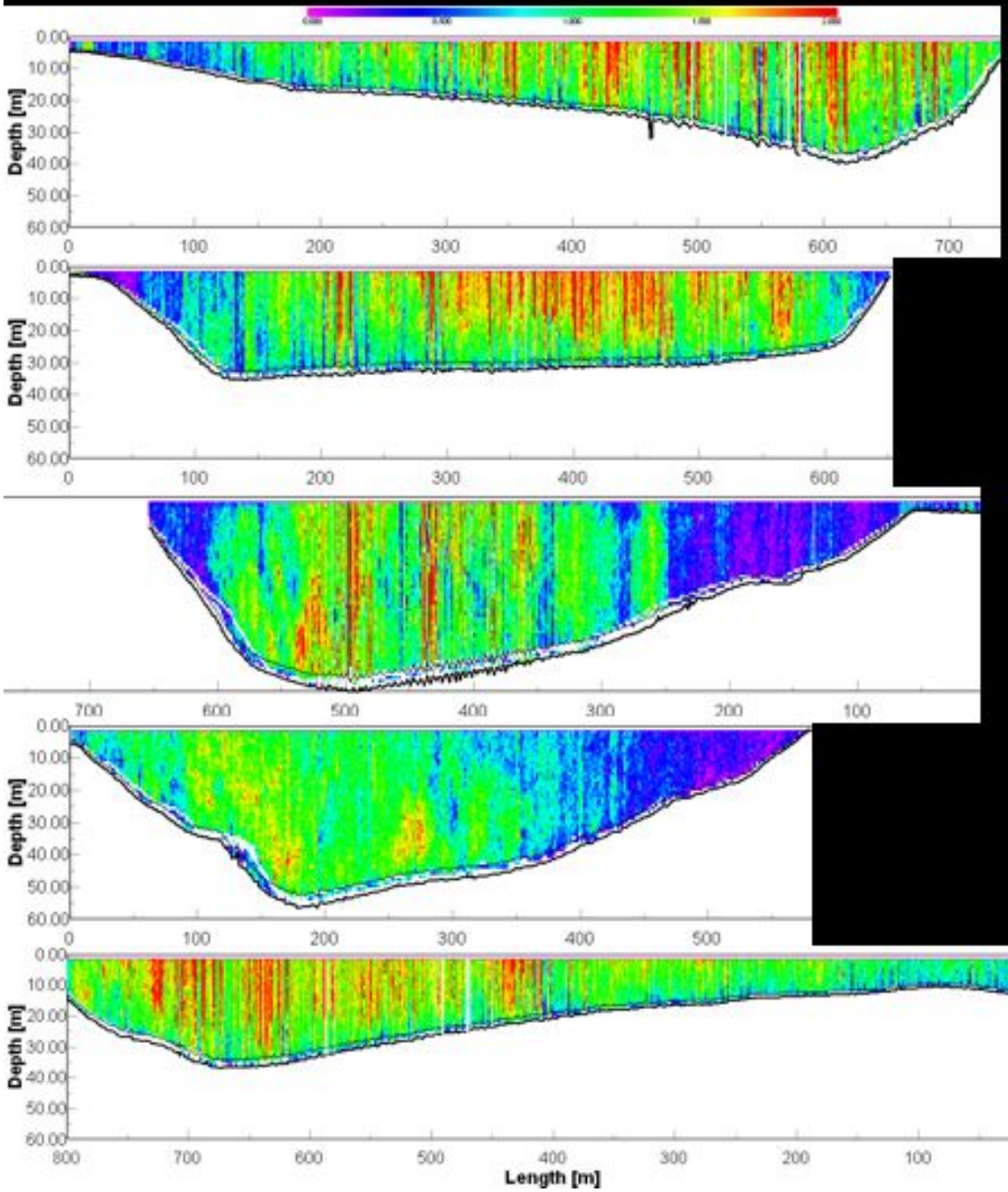
Methods of this study

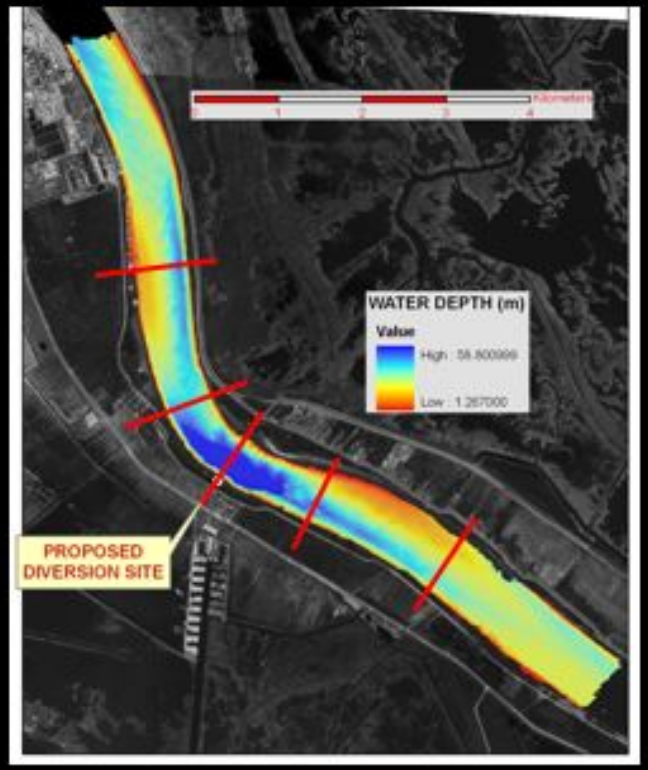
- Develop 2 dimensional velocity profiles along wetland creeks using Acoustic Current Doppler Profilers.
- Determine particle size distributions of in-situ using laser in situ scattering and transmissometry, which will be cross calibrated against a laser-diffraction particle size analyzer at LUMCON.
- Determine grain size of the creekbeds and wetland using the laser diffraction particle size analyzer at LUMCON.
- Determine total suspended sediment concentrations in the wetland and its associated creeks.
- Determine sediment deposition rates using ^{7}Be.
- Integrate data with ongoing river-observatory efforts in the lower Mississippi River.


Legend
ADCP_trans
ADCP_triangles
Samples_pirogue
Samples_ratcrud
XYYSI_Aquadopp
0 375 750 1,500 2,250 3,000
Meters

Mississippi River Discharge Since September, 2009

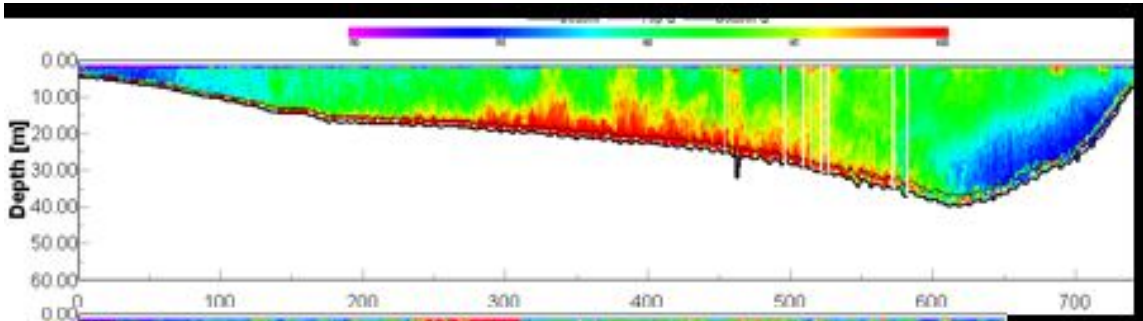


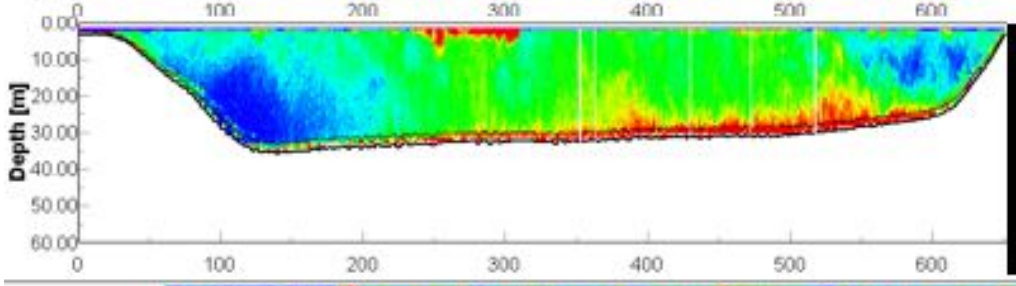


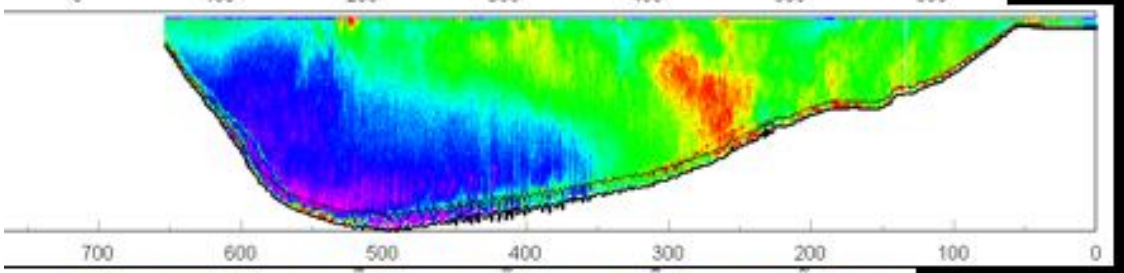


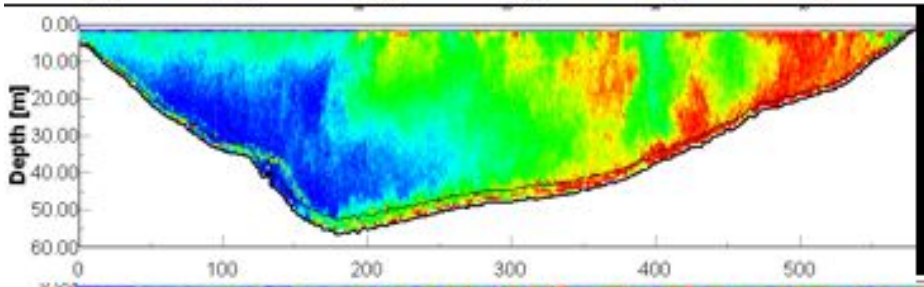
VELOCITY MAGNITUDE (m/s)

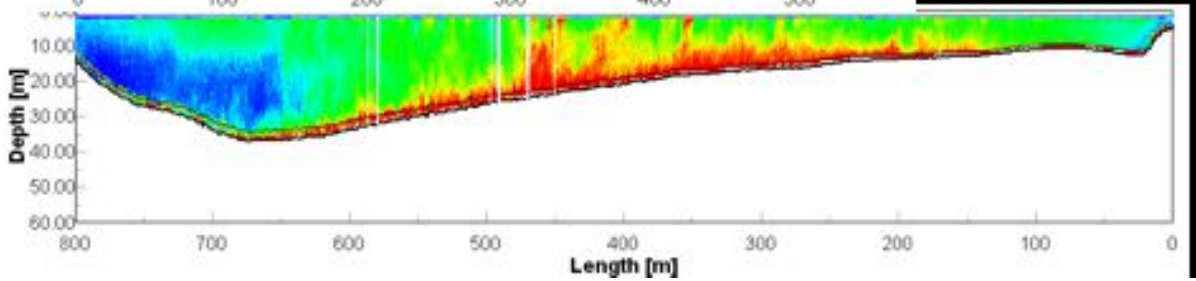
4/09

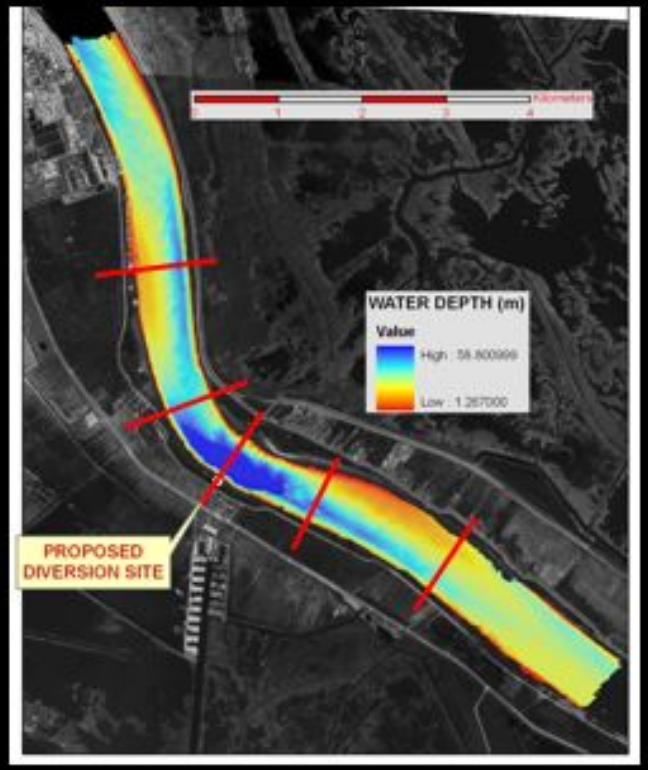








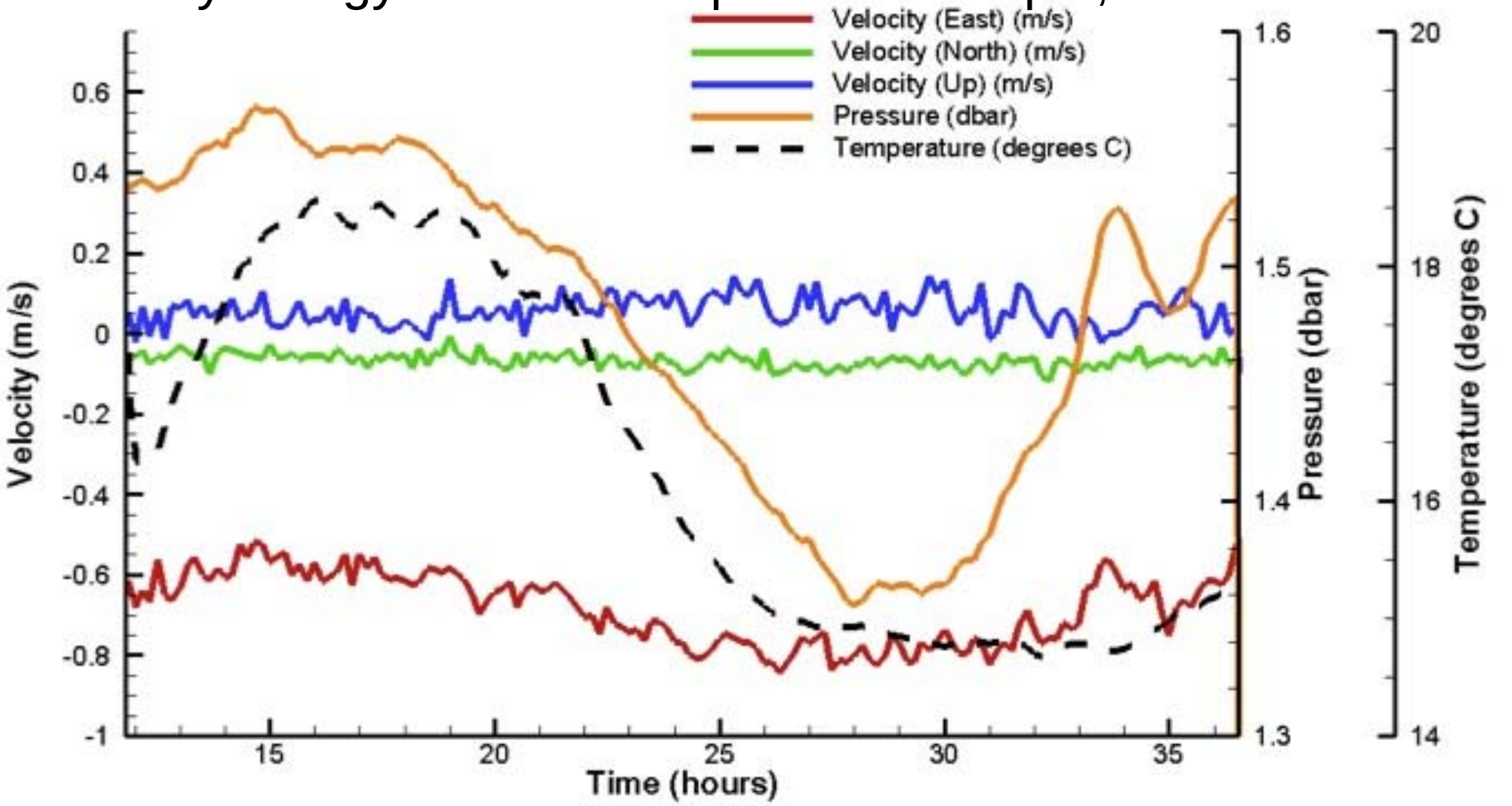


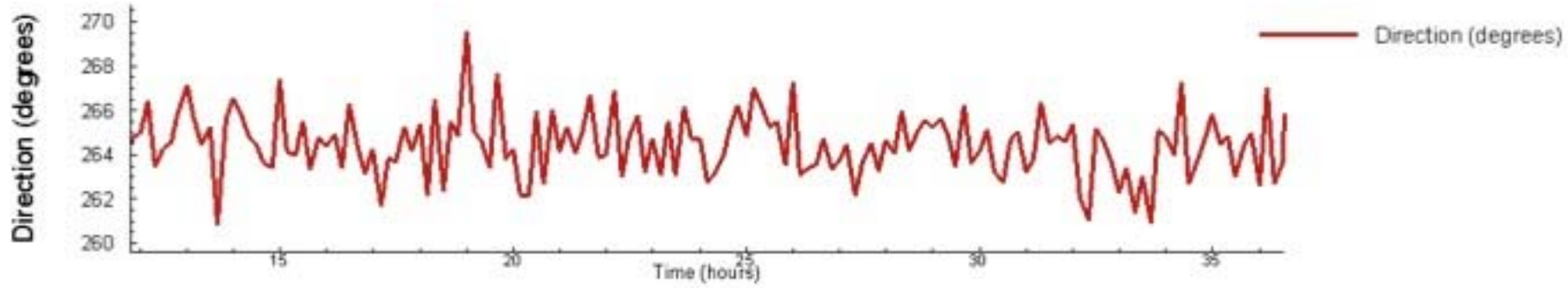


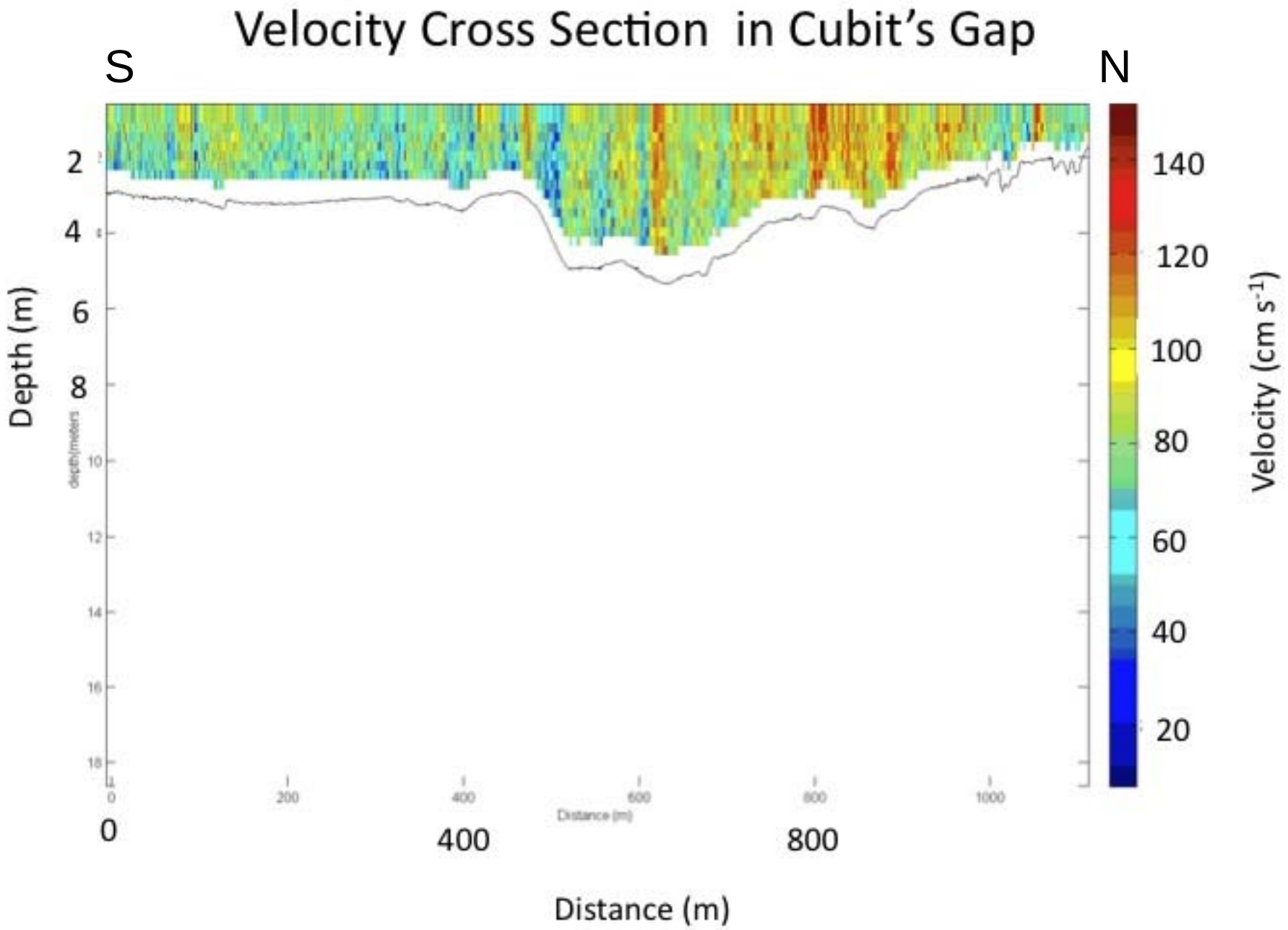
ADCP
BACKSCATTER
INTENSITY
(sed load)

4/09

Hydrology of Cubits Gap Wetlands April, 2010





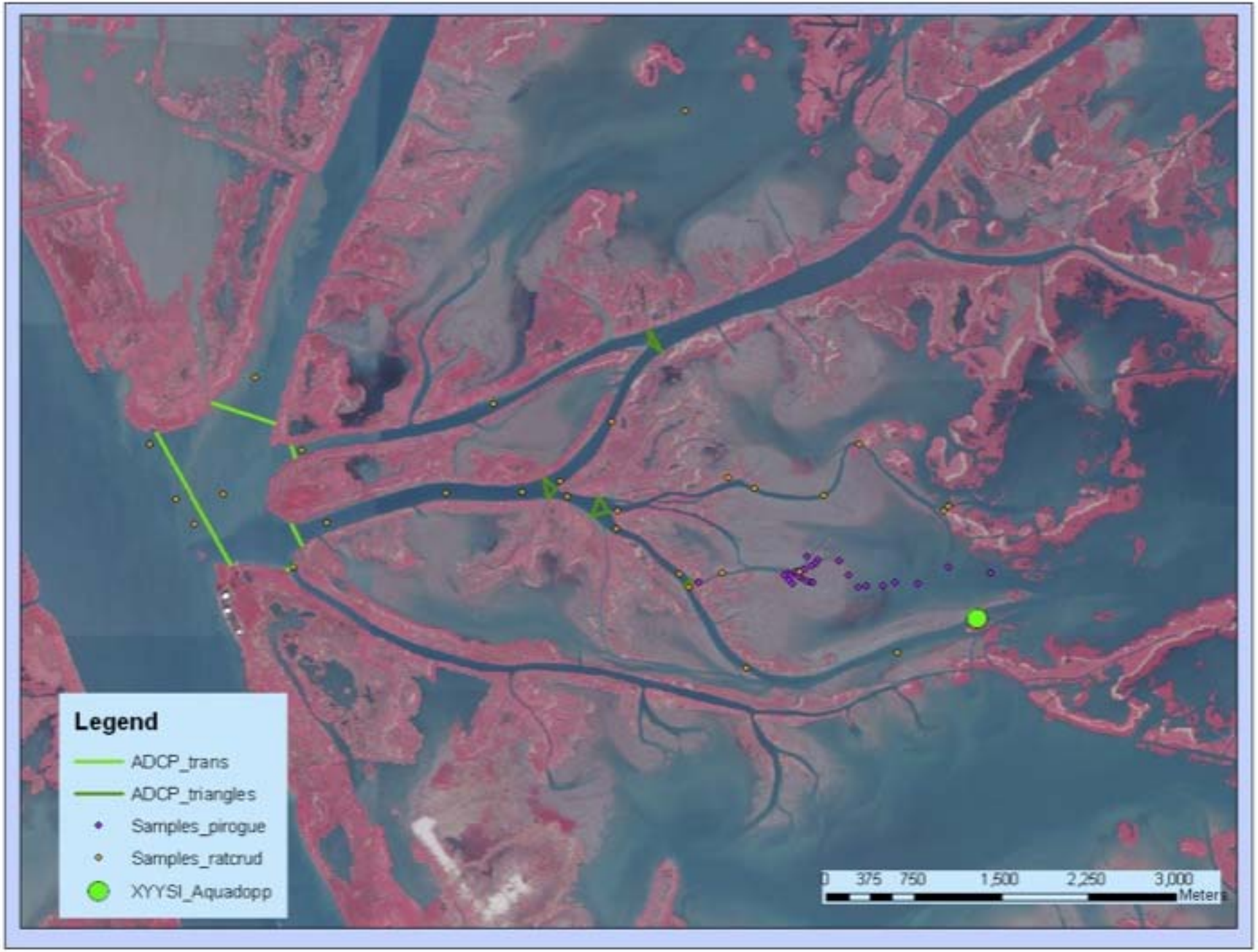

Velocity Cross Section in Cubit's Gap
S
N
Depth (m)
2
4
6
8
10
12
14
16
18
0
200
400
600
800
1000
Distance (m)
0
400
800
Distance (m)
140
120
100
80
60
40
20
Velocity (cm s-1)

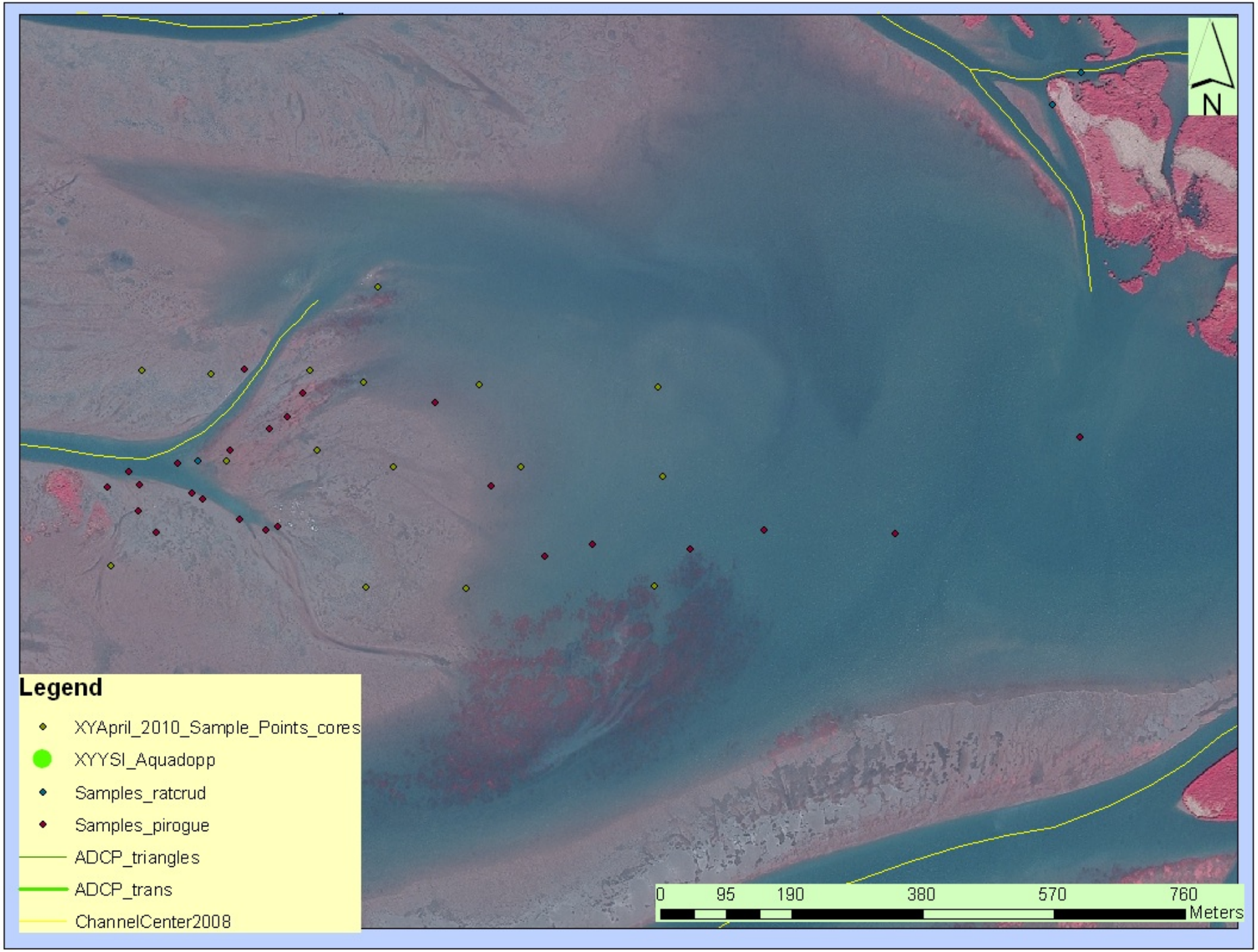
Determining Seasonal-Scale Sedimentation Using ^{7}Be

- ^{7}Be is a short-lived ($t_{½}$ = 53days) naturally occurring, particle reactive radionuclide. It is produced when cosmic rays from the sun interact with C and N atoms in Earth's upper atmosphere and delivered to Earth's surface via wet and dry deposition.

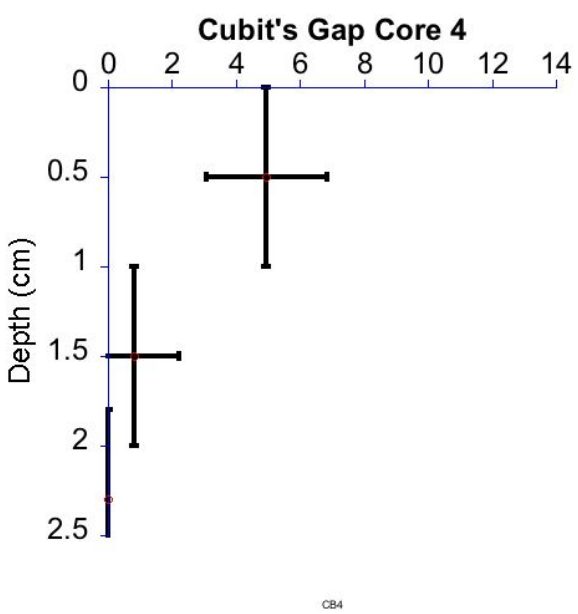
- ^{7}Be's physical and chemical properties, along with its transport pathways, makes it an ideal tracer of seasonal scale sediment dynamics.

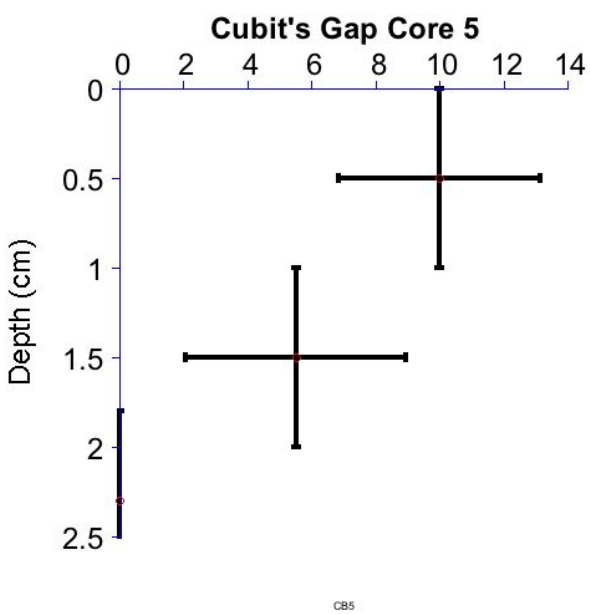
Deployment of a monitoring station to determine the flux of ^{7}Be at Cocodrie, LA

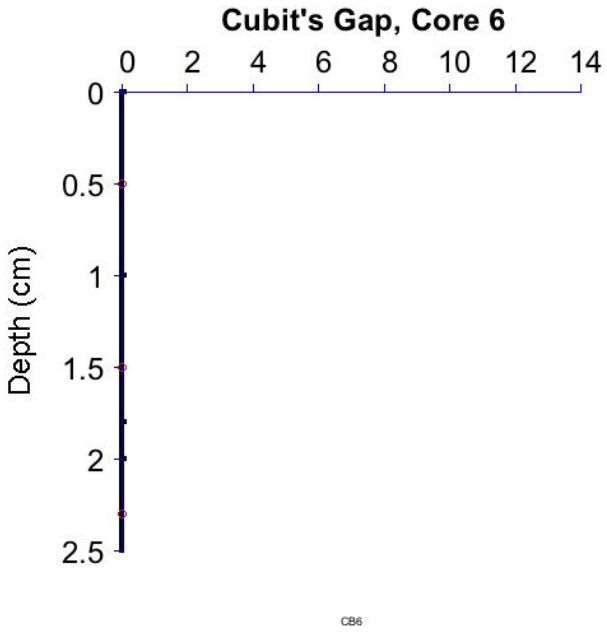

Legend
ADCP_trans
ADCP_triangles
Samples_pirogue
Samples_ratcrud
XYYSI_Aquadopp
0 375 750 1,500 2,250 3,000
Meters


N
Legend
XYApril_2010_Sample_Points_cores
XYYSI_Aquadopp
Samples_ratcrud
Samples_pirogue
ADCP_triangles
ADCP_trans
ChannelCenter2008
0
95
190
380
570
760
Meters

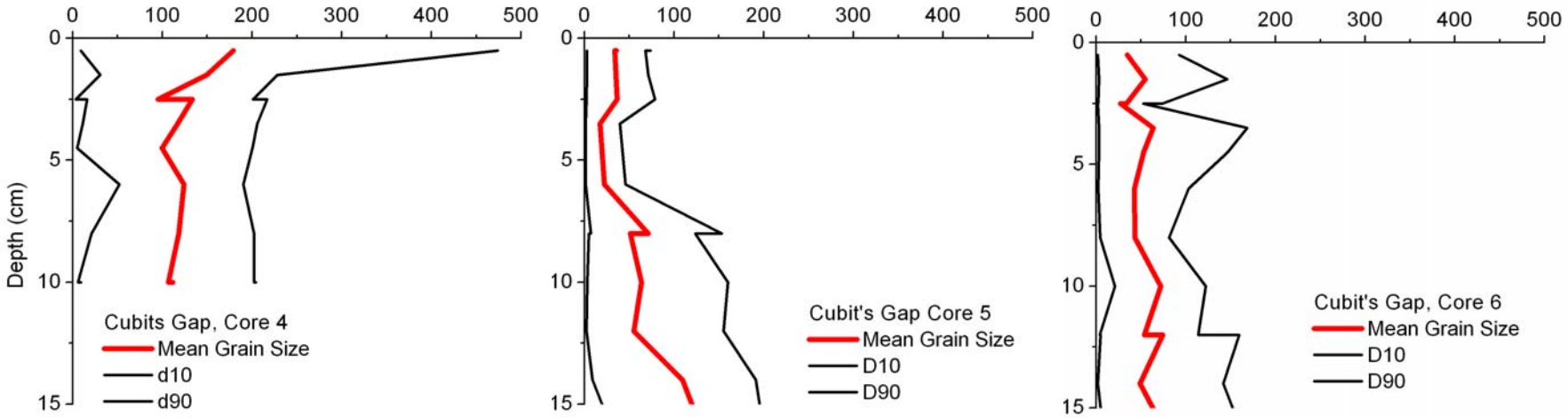
^{7}Be Activities (dpm/g) in cores from Cubit's Gap



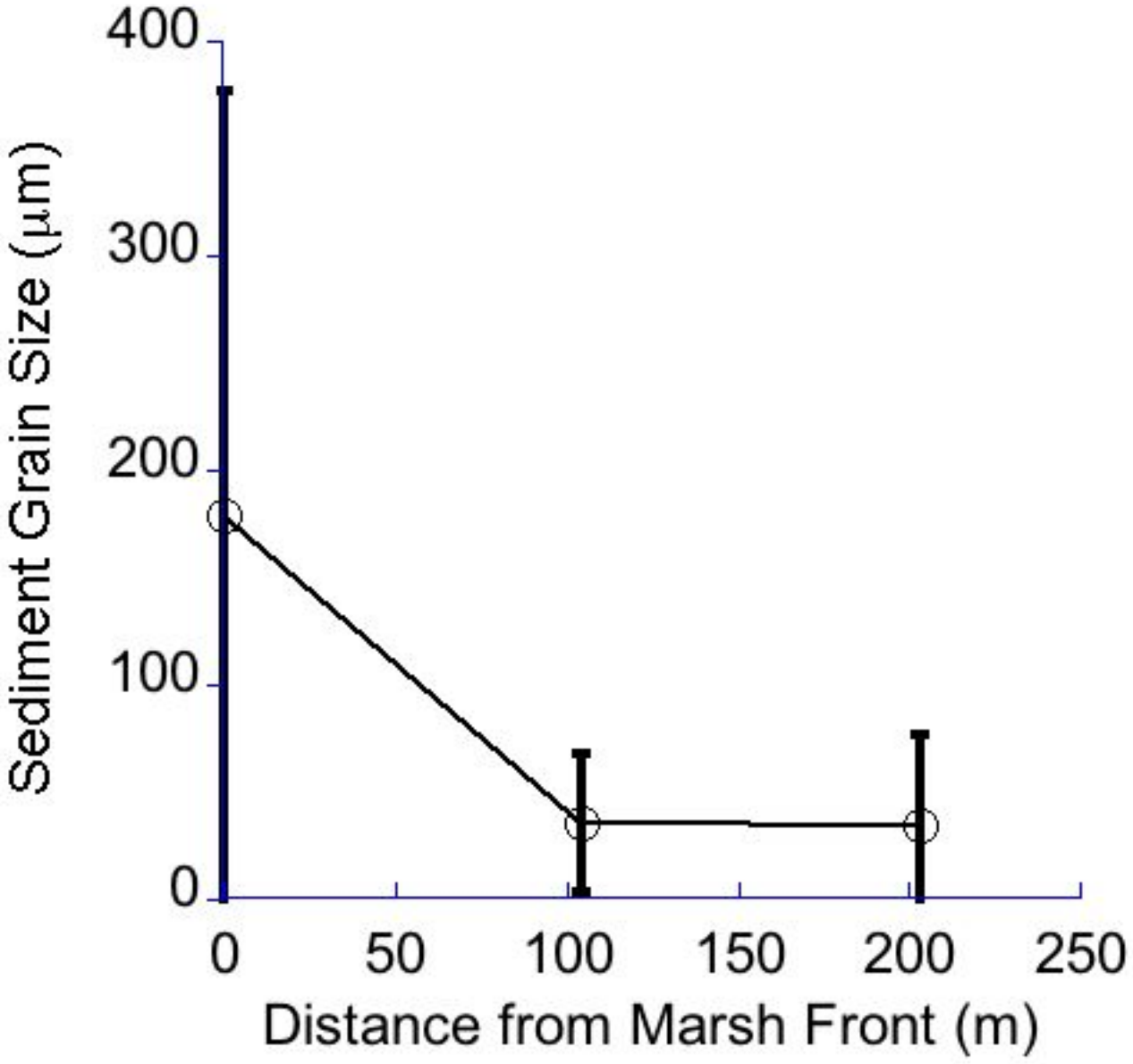




Particle Size (mm) from Cubit’s Gap Cores



Change in sediment grain size with distance from marsh front



Initial Findings

- Sediment dynamics in Cubit's Gap wetlands are connected to flow wetland creeks and Mississippi River.
- Wetland creeks transport sand, some of it coarse, in wetlands 5 km from the main channel. Once this sand reaches the wetlands most, but not all, of it is trapped within 100 m of the marsh front.
- These efforts should be continued during low discharge events and other high discharge periods.

Acknowledgements

- LEAG
- Denise Reed
- Dan Duncan
- Valerie Cruz
- Dallon Weathers
- Mike Brown