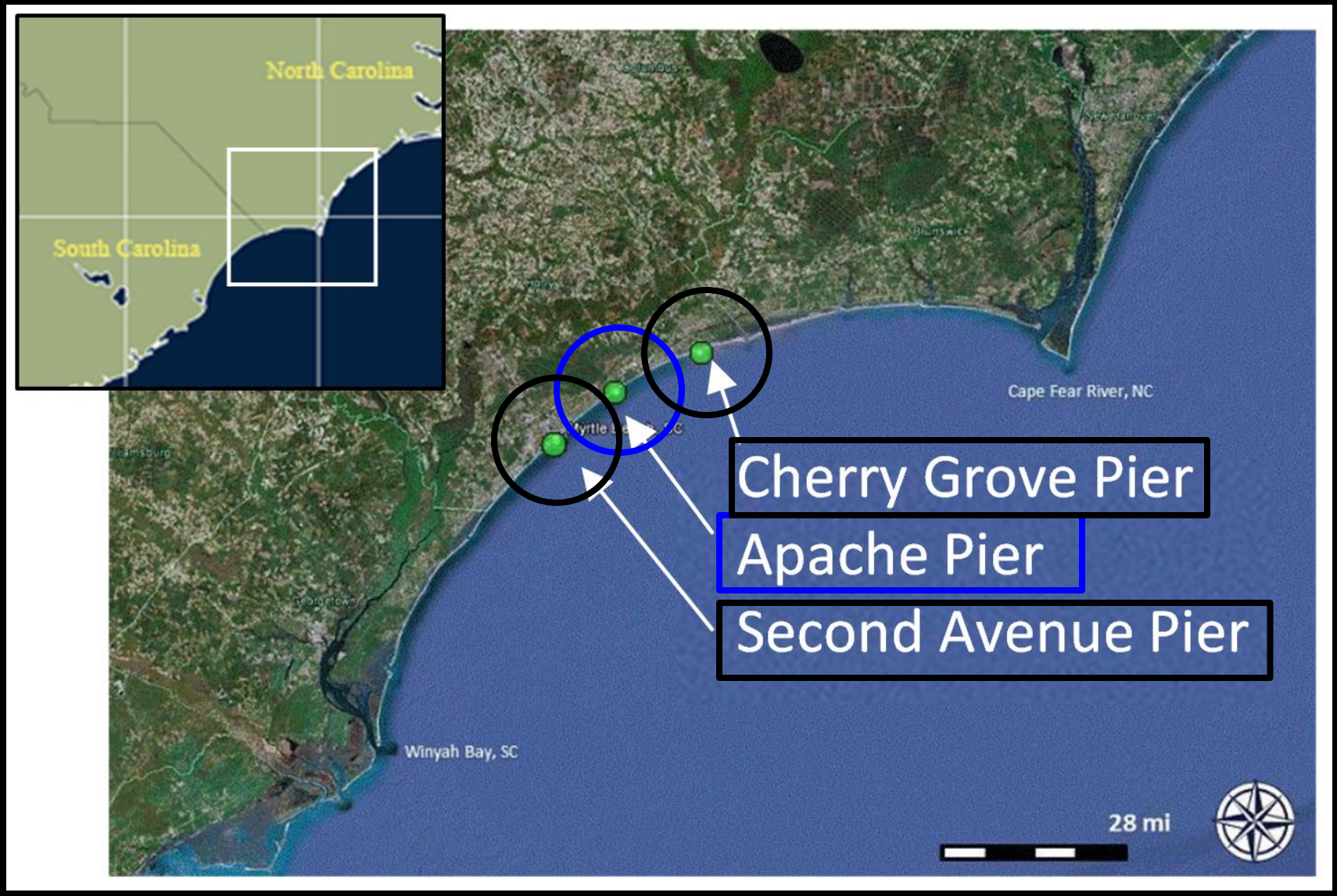
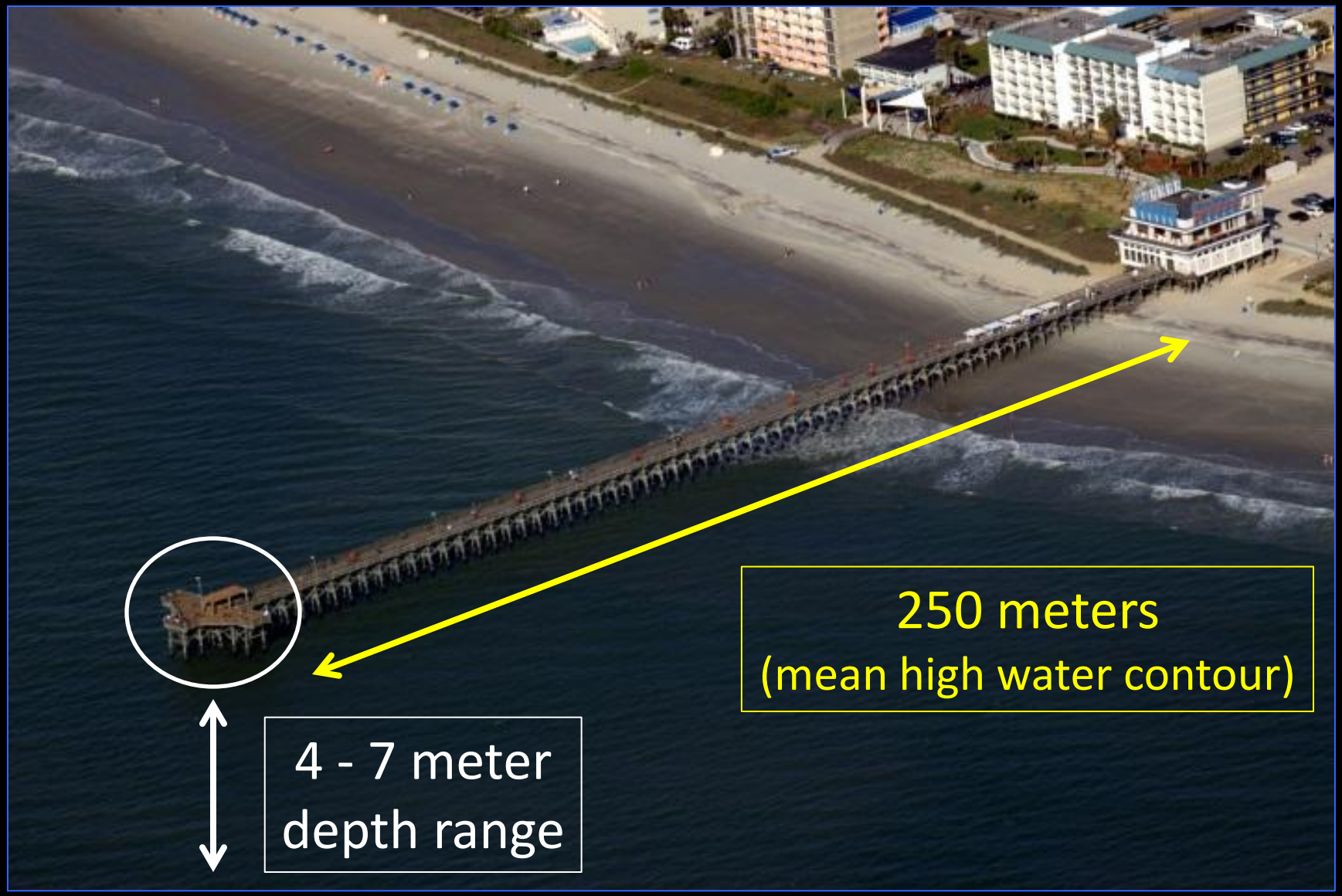
NEW APPROACHES TO PIER-BASED OCEAN MONITORING PLATFORMS

- Scott Kindelberger
- Danielle Doremus
- J. Michael Trapp
- Susan Libes

Long Bay Hypoxia Monitoring Consortium



2nd Ave North (Fishing Pier)



Biofouling Issues

6 day deployment, Jan 2013
Water Temp 54 °F

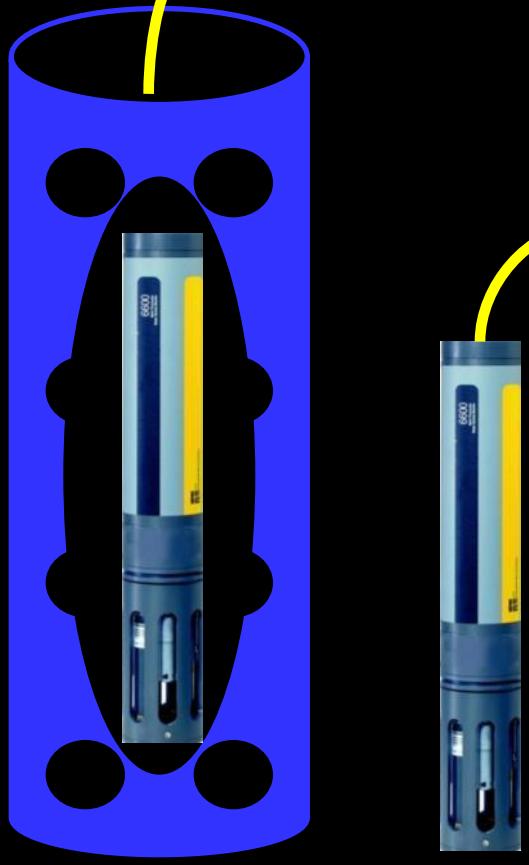
4 month deployment
Winter 2012

Traditional Standpipe Deployment

3 inch OD/ 2.75 inch ID, CPVC pipe
Drilled for water exchange
Copper-based antifouling paint

The ‘Standpipe Effect’

- → Mac[illegible]g reduces flushing rates
- → Microenvironment creat[illegible] pipe
- → Not reflective of ambier[illegible]s



5-7m depth range

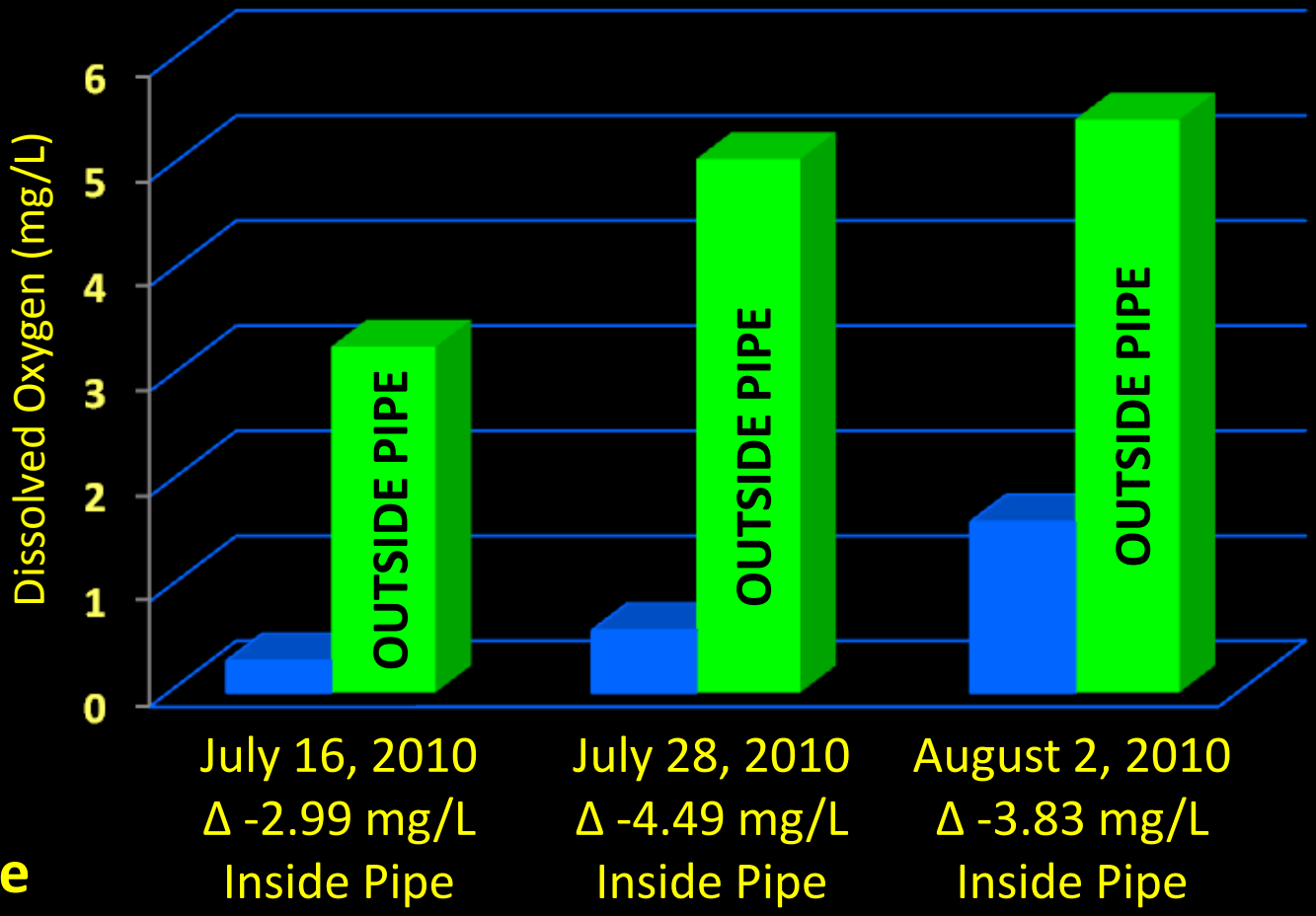
Side by Side Profile Comparison

- →Measurements taken outside pipe
- →Compare with readings inside pipe
- →Take before and after sensor cleaning

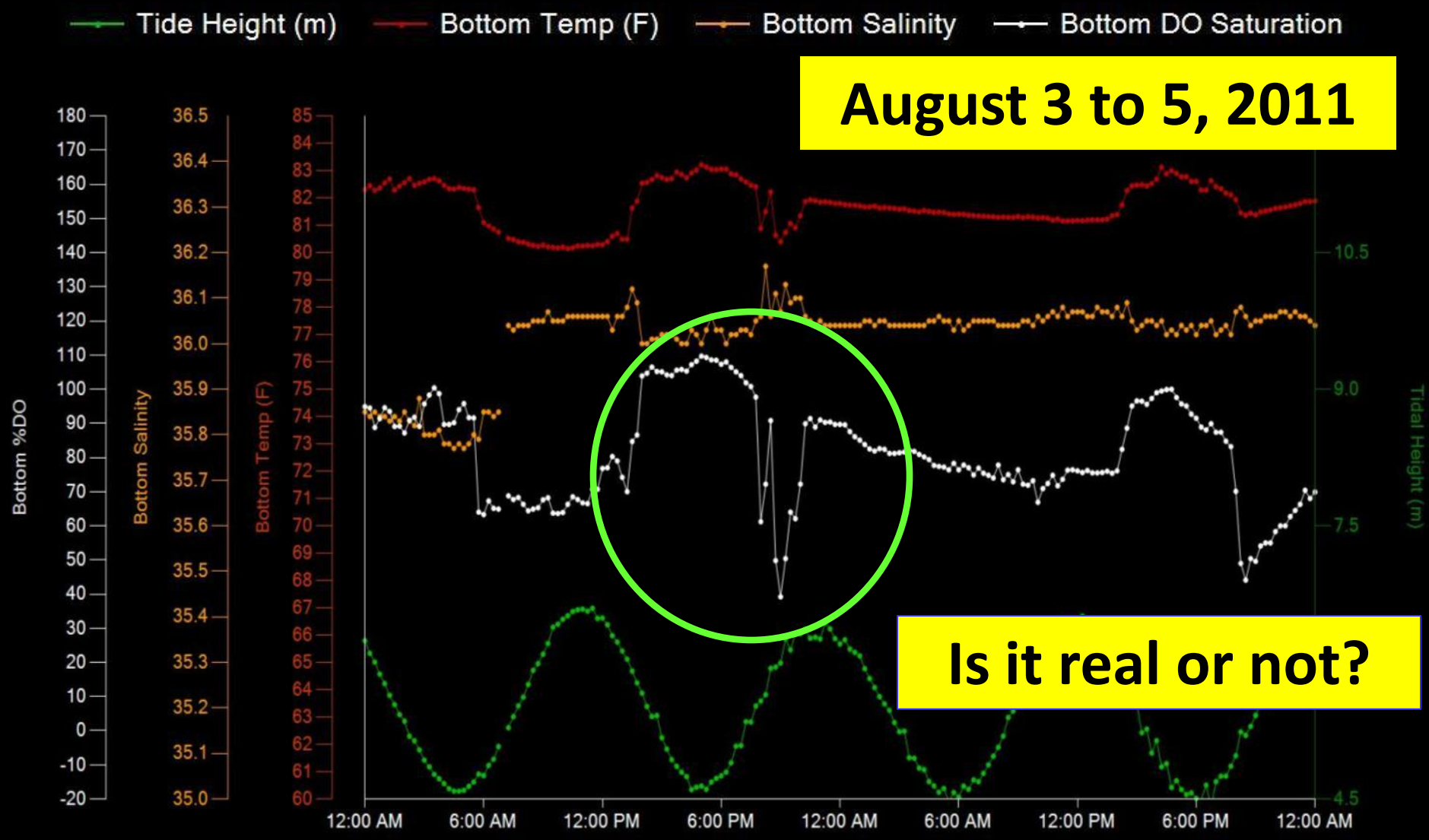
The ‘Standpipe Effect’

5-7m depth range

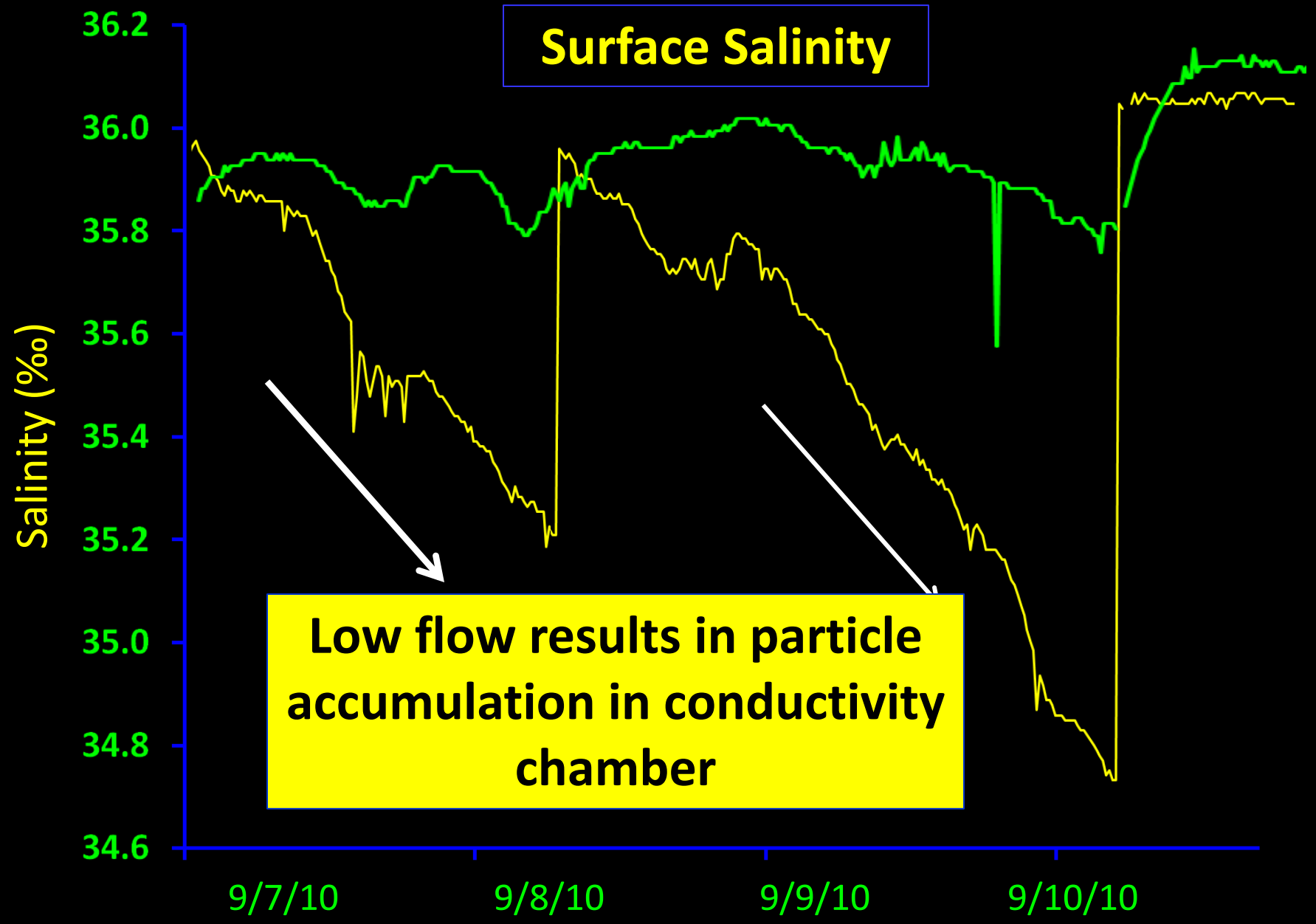
Δ Dissolved Oxygen Comparison (Inside - Outside Pipe)



Bad Timing

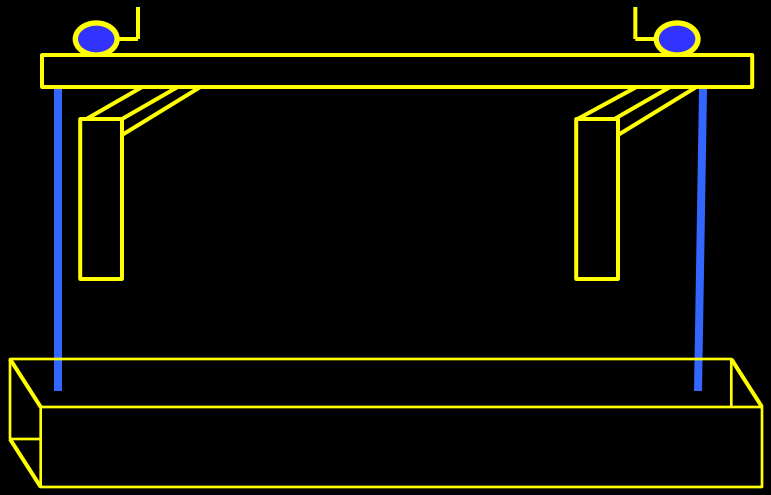

Tide Height (m)
Bottom Temp (F)
Bottom Salinity
Bottom DO Saturation
August 3 to 5, 2011
Is it real or not?
Bottom %DO
Bottom Salinity
Bottom Temp (F)
Tidal Height (m)
12:00 AM
6:00 AM
12:00 PM
6:00 PM
12:00 AM
6:00 AM
12:00 PM
6:00 PM
12:00 AM

72 Hour Salinity Drift

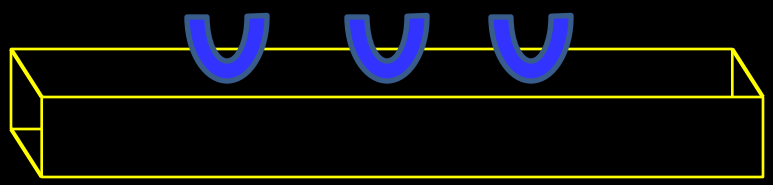


Deck Structure

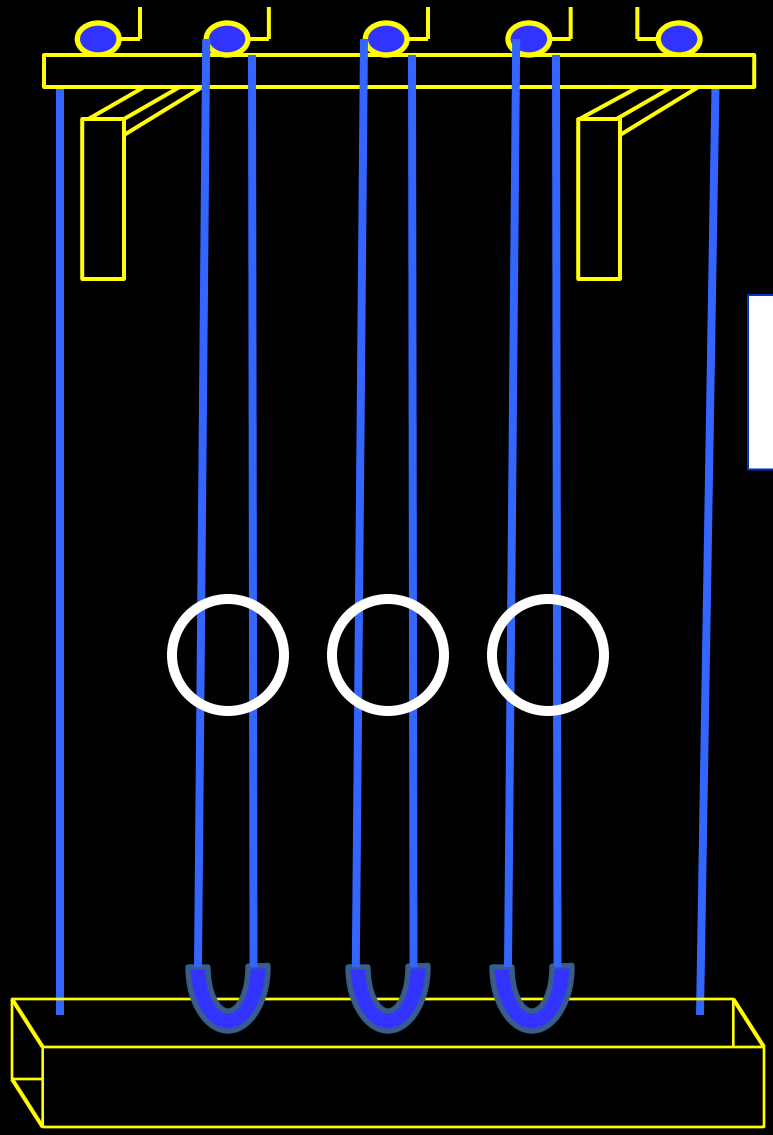
Anchor / Cable Deployment



Anchor Design

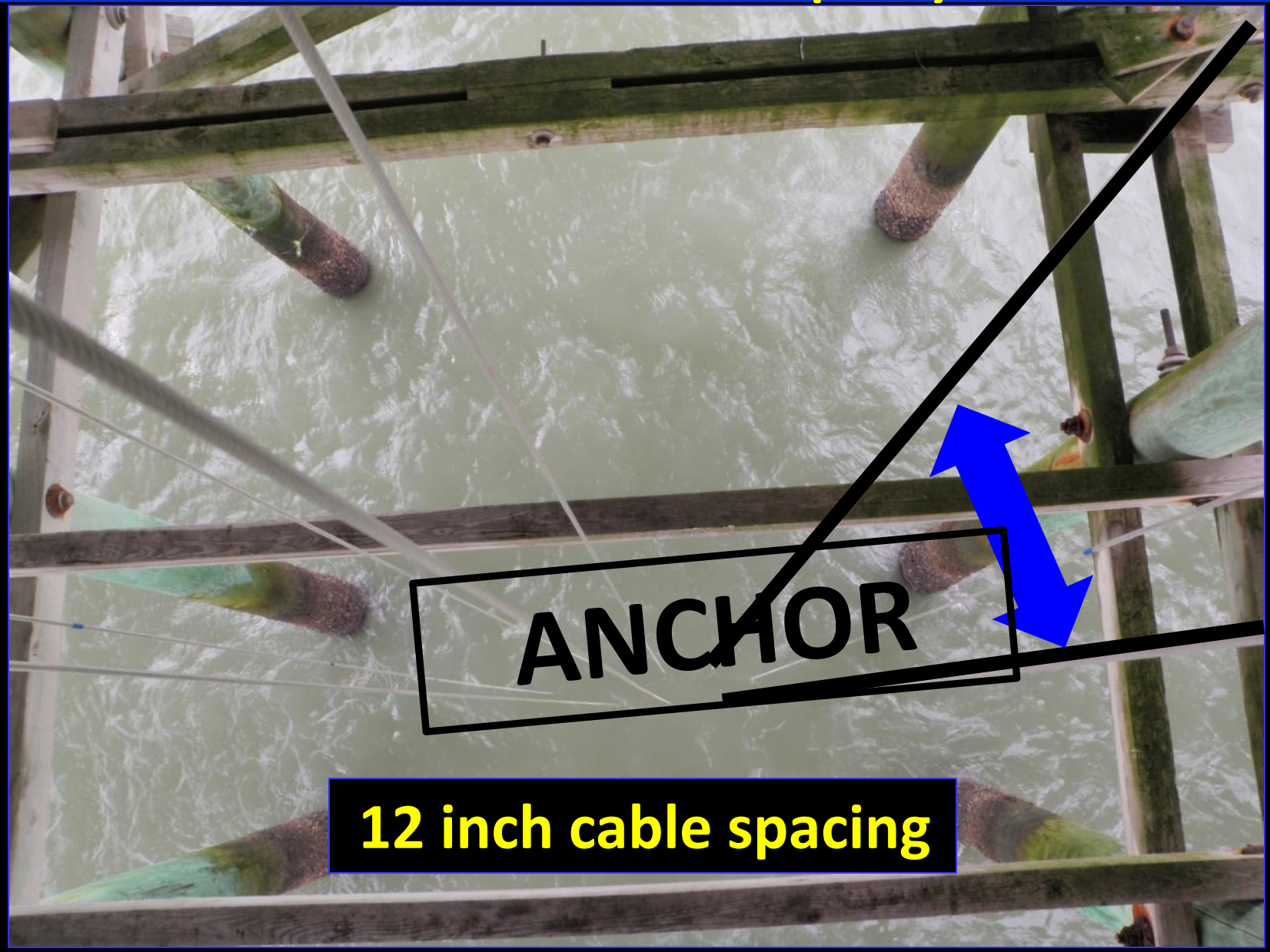


Cable Deployment



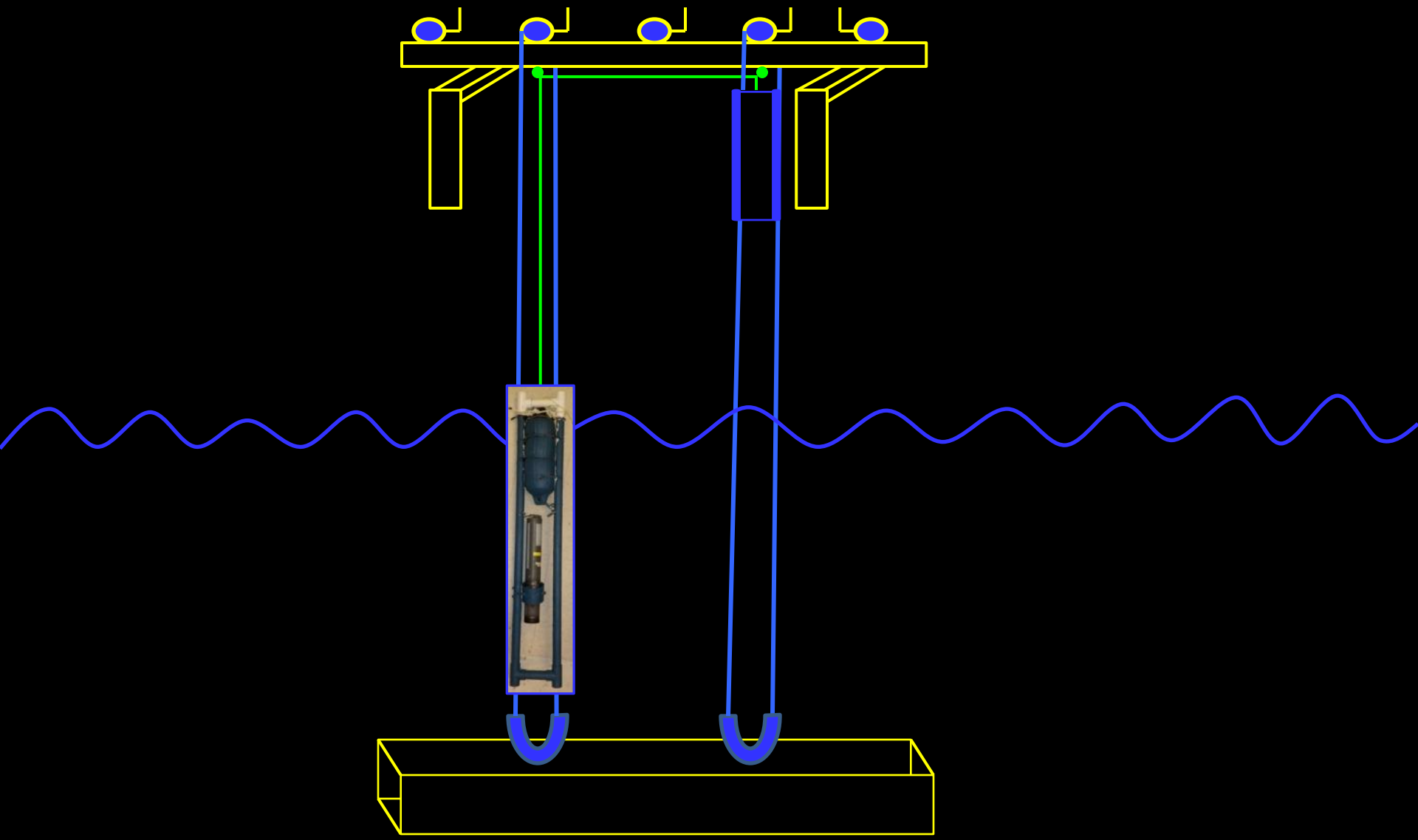
Bent pipes maintains 12inch cable spacing

Anchor / Cable Deployment

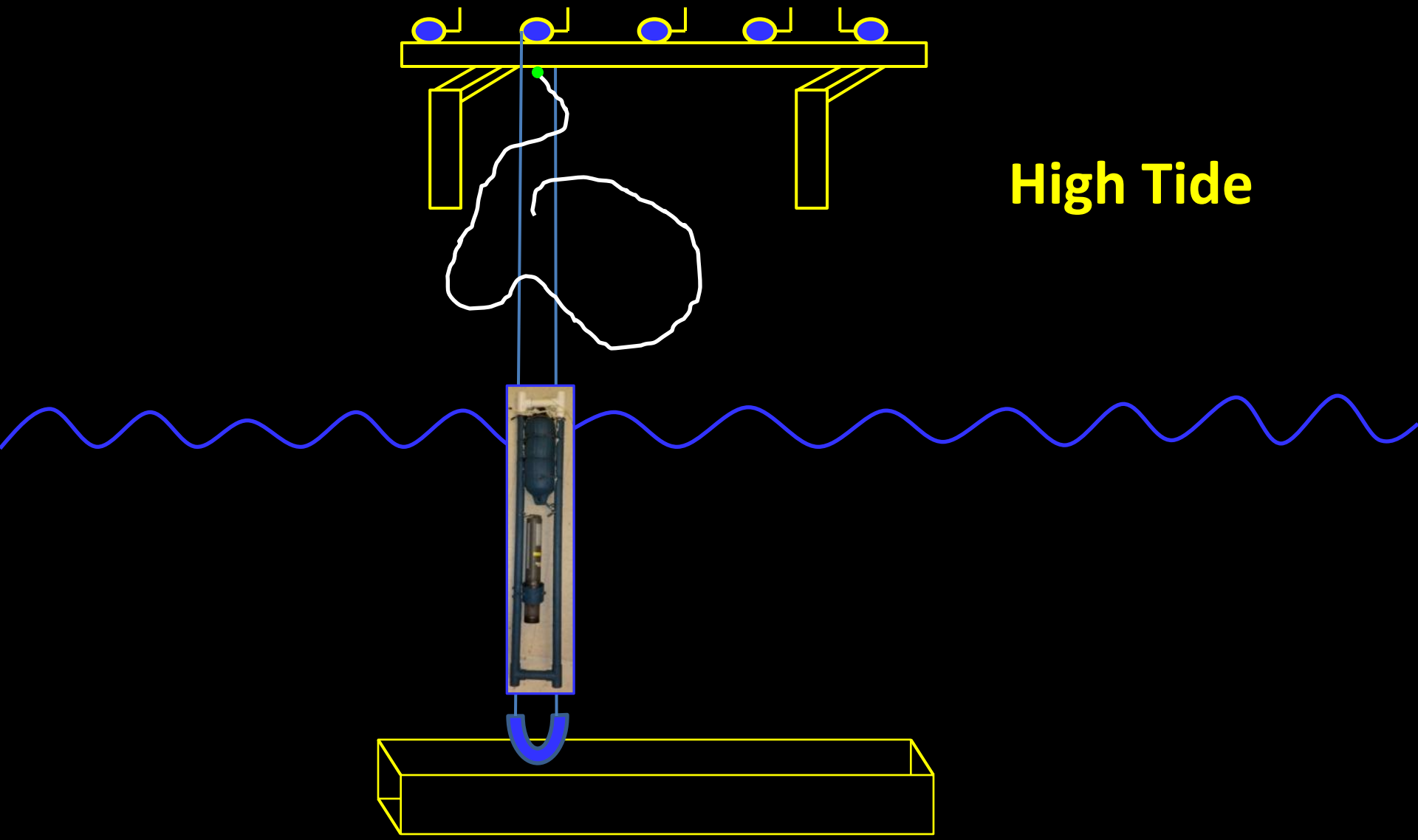


Surface Sled / Counterweight

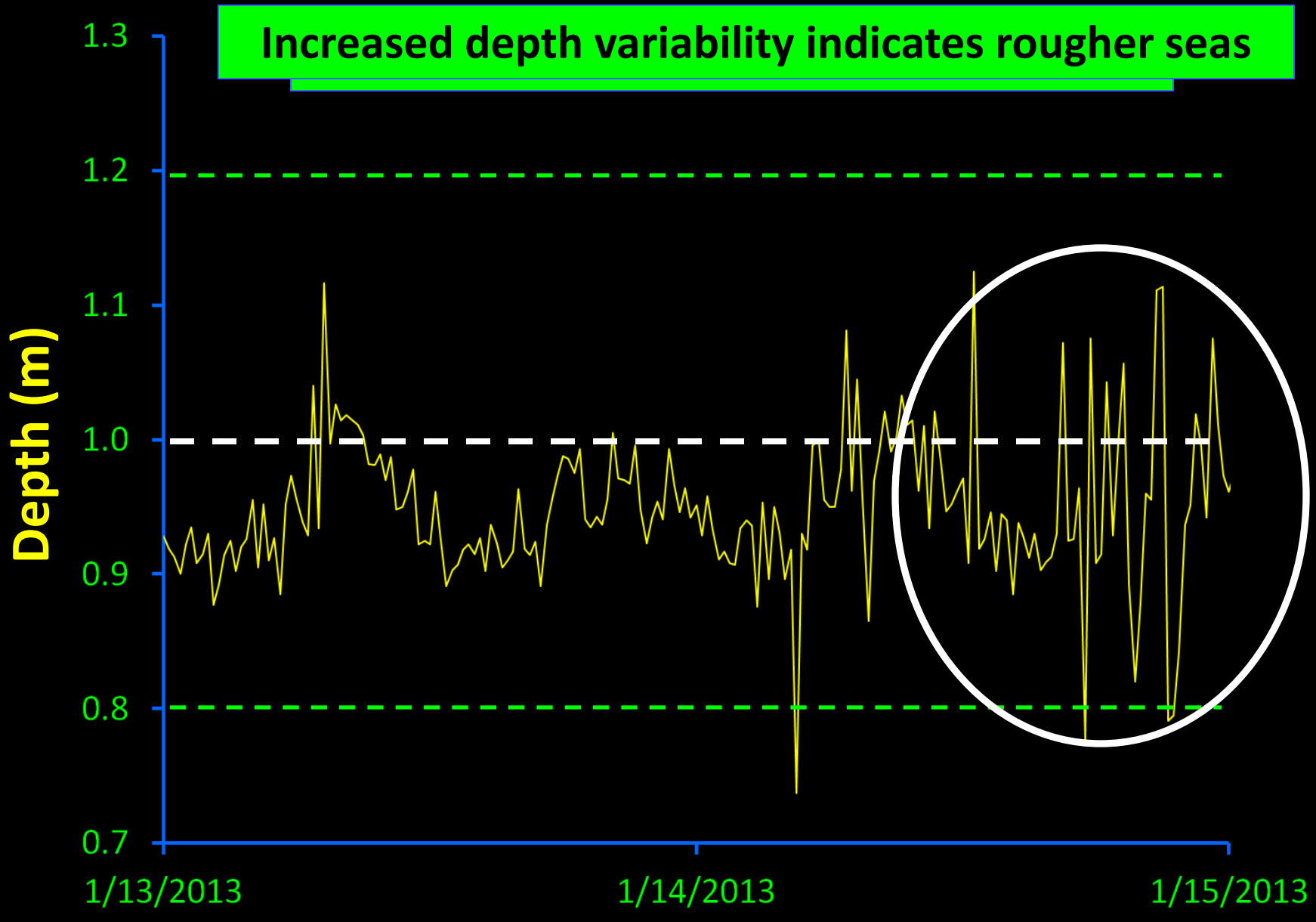
Surface Sled / Counterweight



Surface Sled / Counterweight

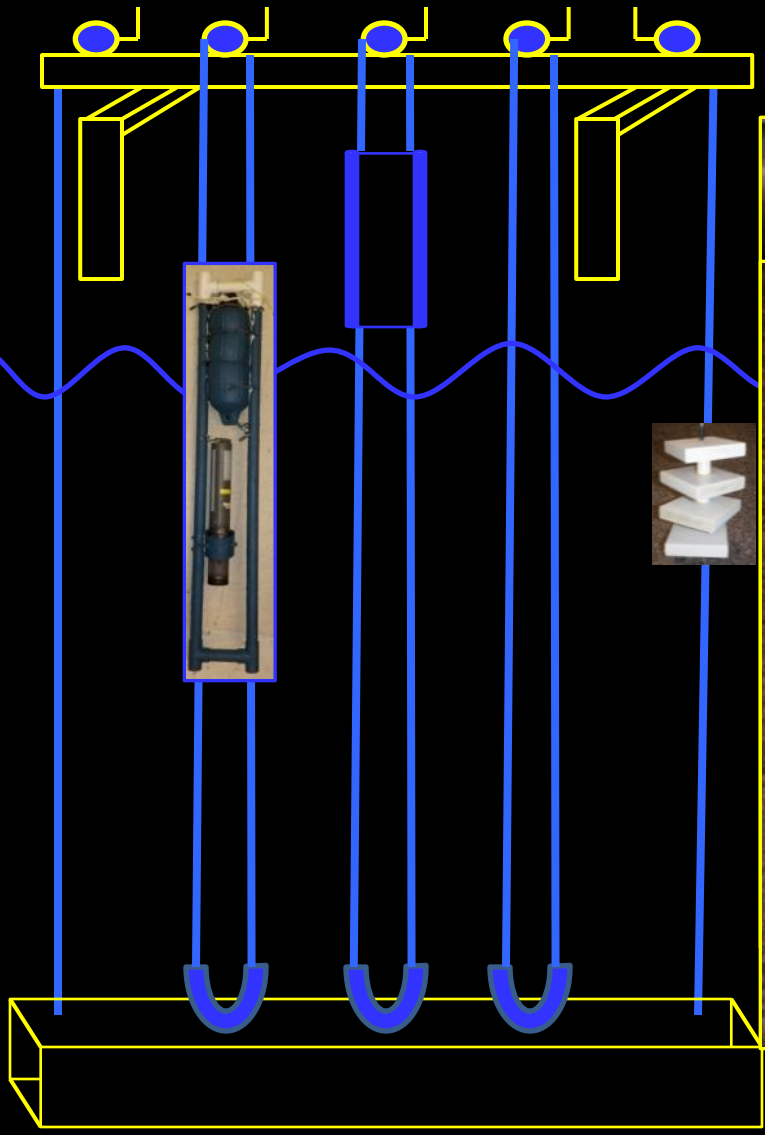


48 Hour Surface Depths

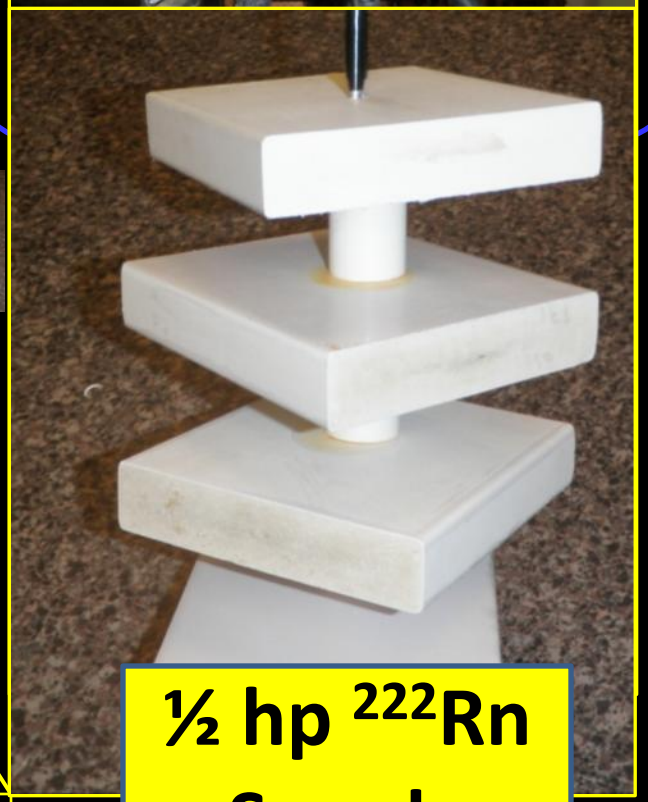


Additional Equipment

YSI 6600

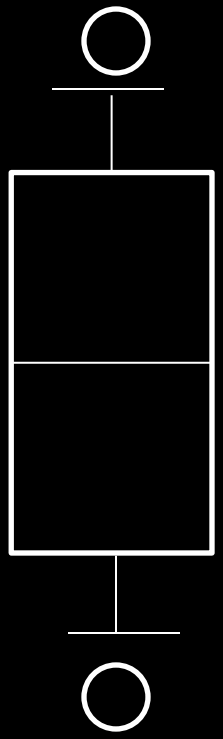


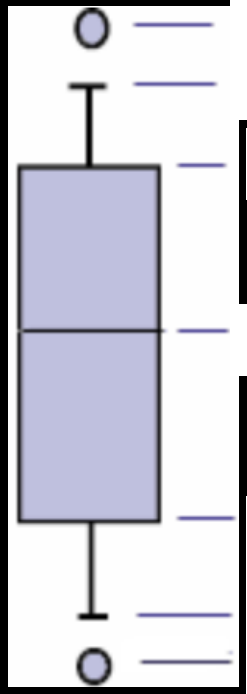
Larval Recruitment Tiles



½ hp ^{222}Rn Supply Pump

Boxplot Analysis





Value > 90th percentile

90th percentile

75th percentile

Median

25th percentile

10th percentile

Value < 10th percentile

Standpipe Deployment

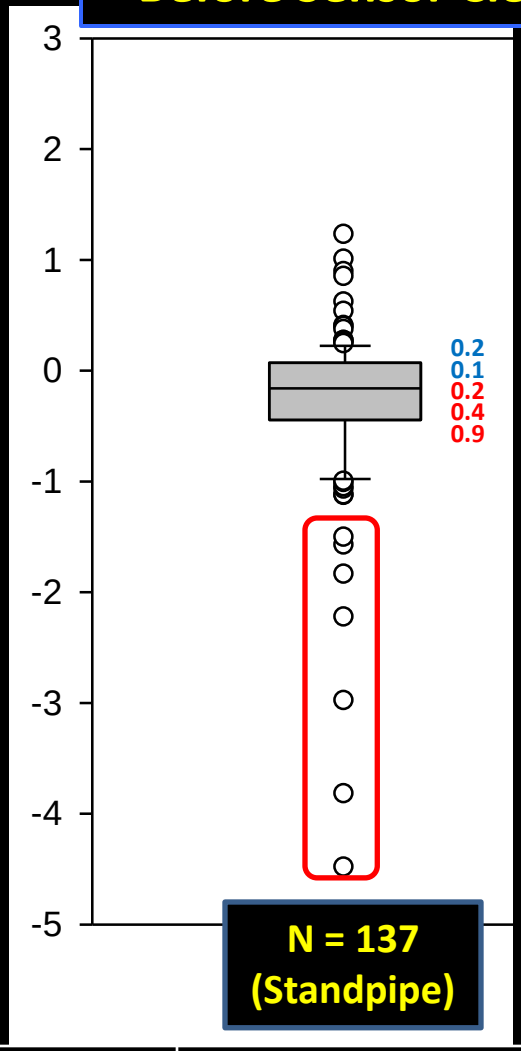
Zipline Deployment

August 2009

March 2011

May 2012

DISSOLVED OXYGEN



In-situ Uncertainty Estimates

	Before Sensor Cleaning		After Sensor Cleaning	
Interval	Standpipe	Zipline	Standpipe	Zipline
10th to 90th	± 0.9	± 0.2	± 0.6	± 0.3
25th to 75th	± 0.4	± 0.1	± 0.3	± 0.1

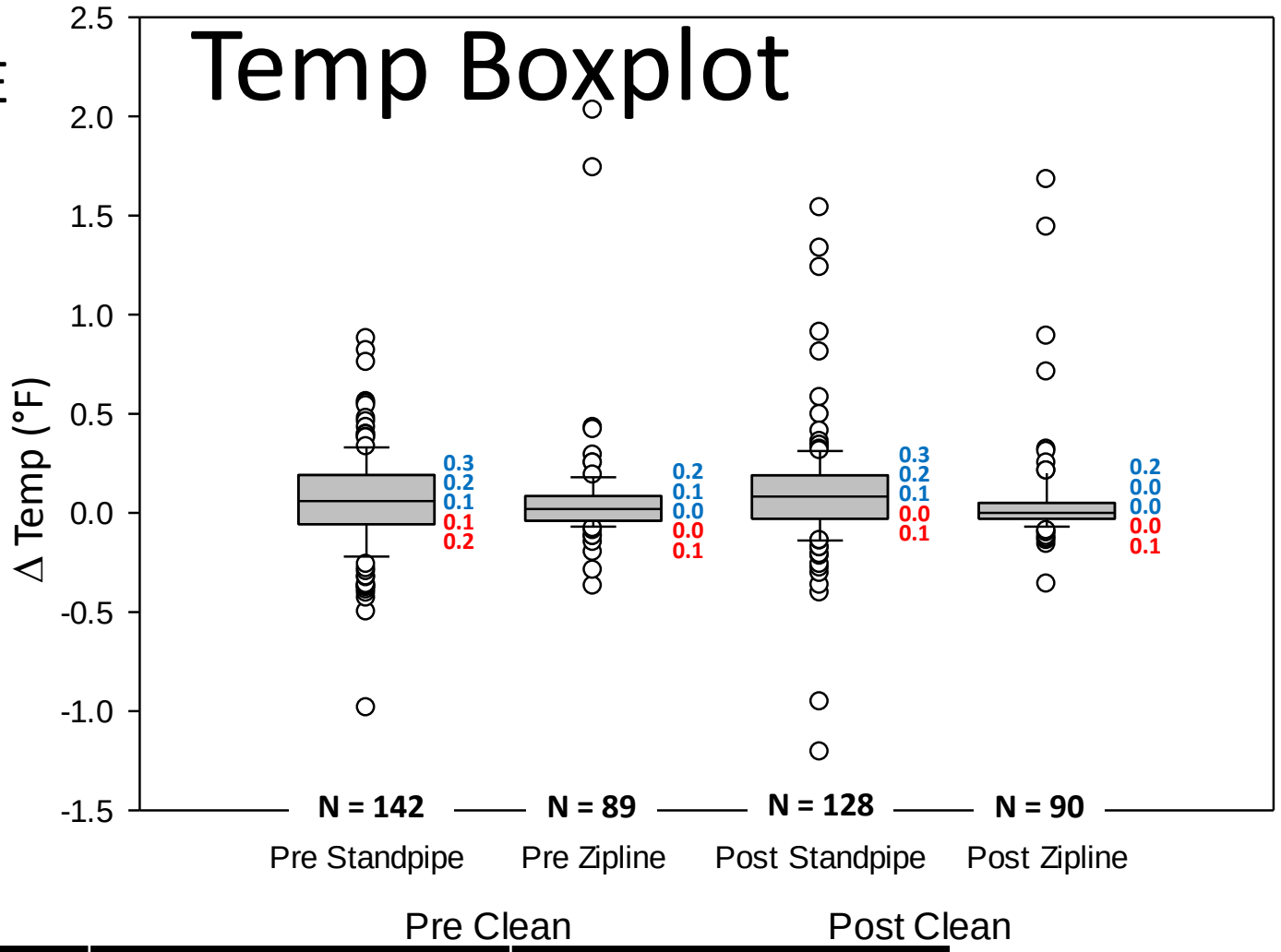
OEM Specifications

	Before Sensor Cleaning		After Sensor Cleaning	
Interval	Standpipe	Zipline	Standpipe	Zipline
10^{th} to 90^{th}	± 0.9	± 0.2	± 0.6	± 0.3
25^{th} to 75^{th}	± 0.4	± 0.1	± 0.3	± 0.1

→**Manufacturer Specifications: ± 1%, or 0.1mg/L (whichever is larger)**

TEMPERATURE

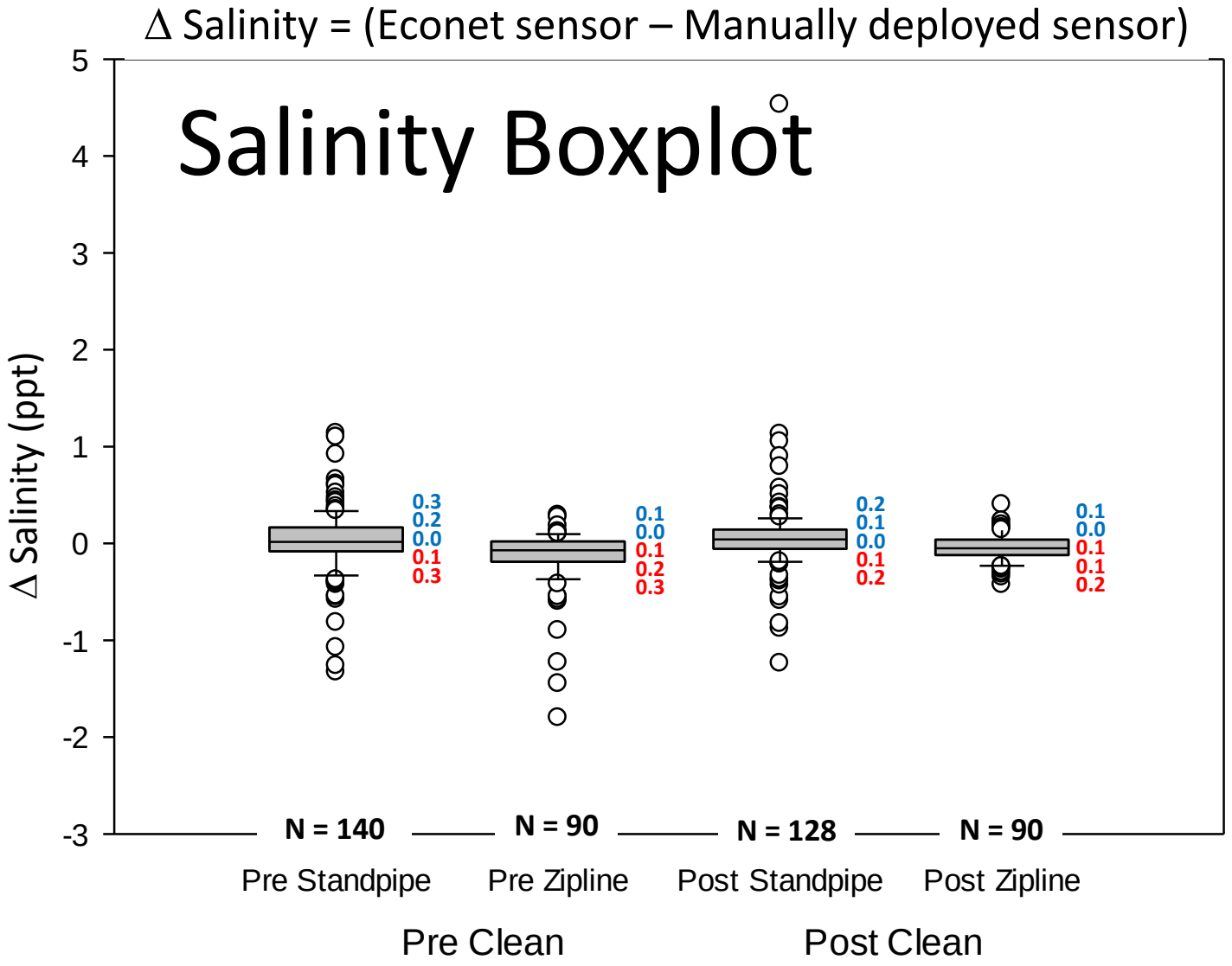
Δ Temp = (Econet sensor – Manually deployed sensor)



In-situ Uncertainty Estimates

	Preclean		Postclean	
Interval	Standpipe	Zipline	Standpipe	Zipline
10th to 90th	± 0.3	± 0.2	± 0.3	± 0.2
25th to 75th	± 0.2	± 0.1	± 0.2	± 0.1

SALINITY



In-situ Uncertainty Estimates

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10th to 90th	± 0.3	± 0.3	± 0.2	± 0.2
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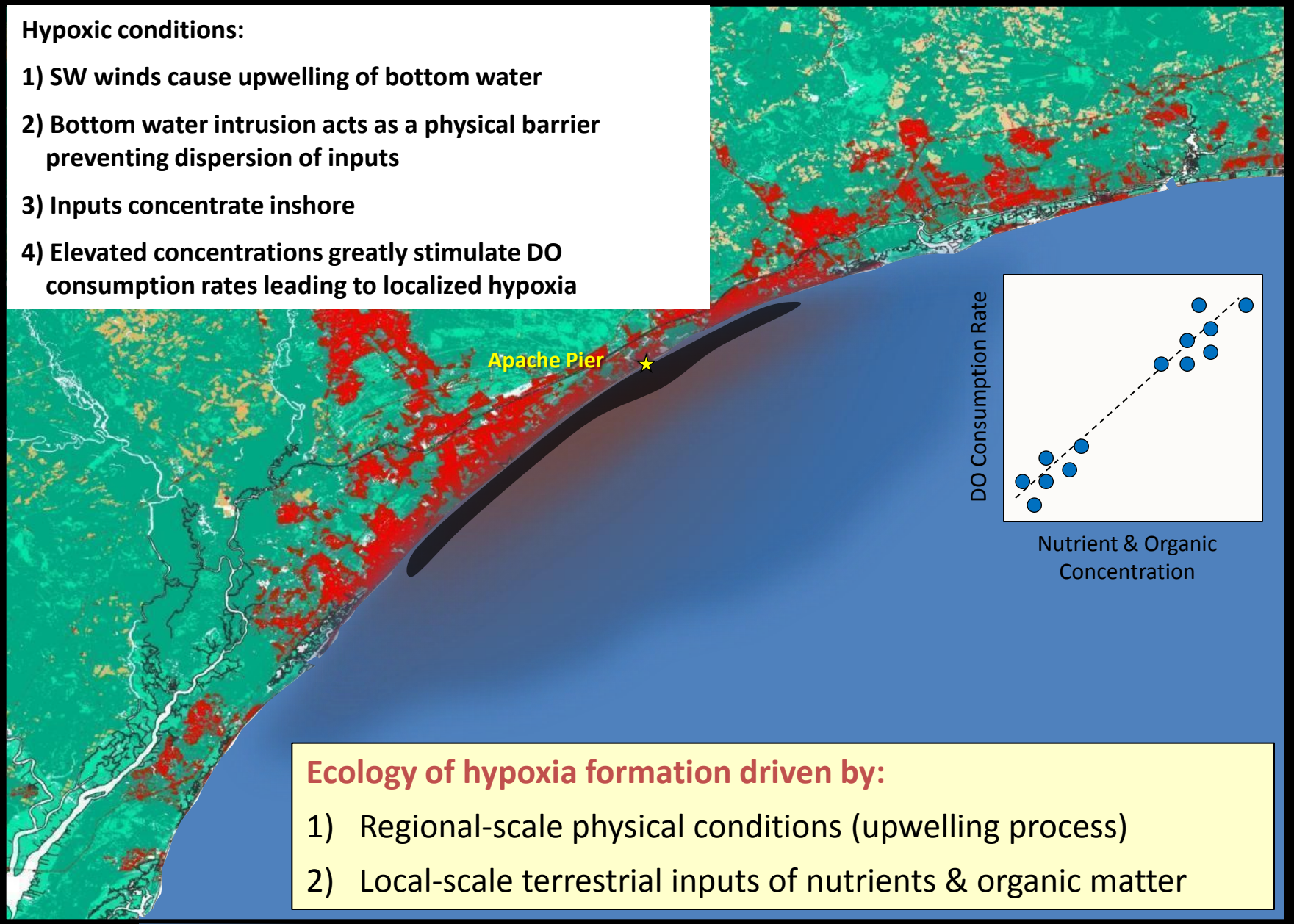
www.ysieconet.com
(select 'Long Bay Hypoxia Monitoring')

Deck Hardware

“Constrained Enrichment” Hypothesis for Hypoxia Formation along the Grand Strand

Hypoxic conditions:

1) SW winds cause upwelling of bottom water
2) Bottom water intrusion acts as a physical barrier preventing dispersion of inputs
3) Inputs concentrate inshore
4) Elevated concentrations greatly stimulate DO consumption rates leading to localized hypoxia



Ecology of hypoxia formation driven by:

1) Regional-scale physical conditions (upwelling process)
2) Local-scale terrestrial inputs of nutrients & organic matter

Slide courtesy of Eric Smith

Anchor Installation

Bottom Sonde Spin Stop

Center Cable Deployment Layout

Stats

	Shapiro-Wilkes Normality	Kruskal-Wallis	Fligner-Kileen
	p-value (0.05)	p-value (0.05)	Homogeneity of Variances
Pre-Clean DO Standpipe	6.066 x 10^-14	0.2347	0.224
Pre-Clean DO Zipline	4.28 x 10^-9		
Post-clean DO Standpipe	5.351 x 10^-9	0.2332	0.397
Post-clean DO Zipline	1.515 x 10^-12		

	Shapiro-Wilkes Normality	Kruskal-Wallis	Fligner-Kileen
	p-value (0.05)	p-value (0.05)	Homogeneity of Variances
Pre-Clean Temp Standpipe	1.234 x 10^-4	0.6727	0.1537
Pre-Clean Temp Zipline	2.54 x 10^-16		
Post-clean Temp Standpipe	3.639 x 10^-12	0.3338	0.1927
Post-clean Temp Zipline	7.904 x 10^-16		

	Shapiro-Wilkes Normality	Kruskal-Wallis	Fligner-Kileen
	p-value (0.05)	p-value (0.05)	Homogeneity of Variances
Pre-Clean Salinity Standpipe	1.084 x 10^-8	0.5466	0.5895
Pre-Clean Salinity Zipline	5.09 x 10^12		
Post-clean Salinity Standpipe	2.2 x 10^-16	0.2881	?
Post-clean Salinity Zipline	0.5467		