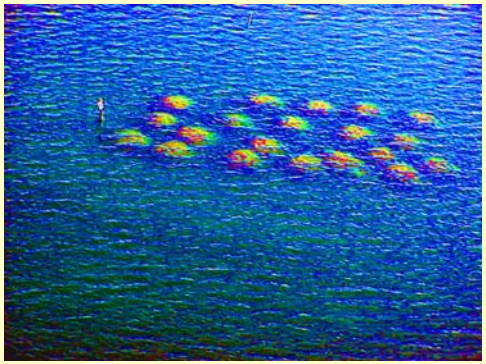
Oyster Restoration & Research in Virginia: Some Metrics & How We Monitor Them

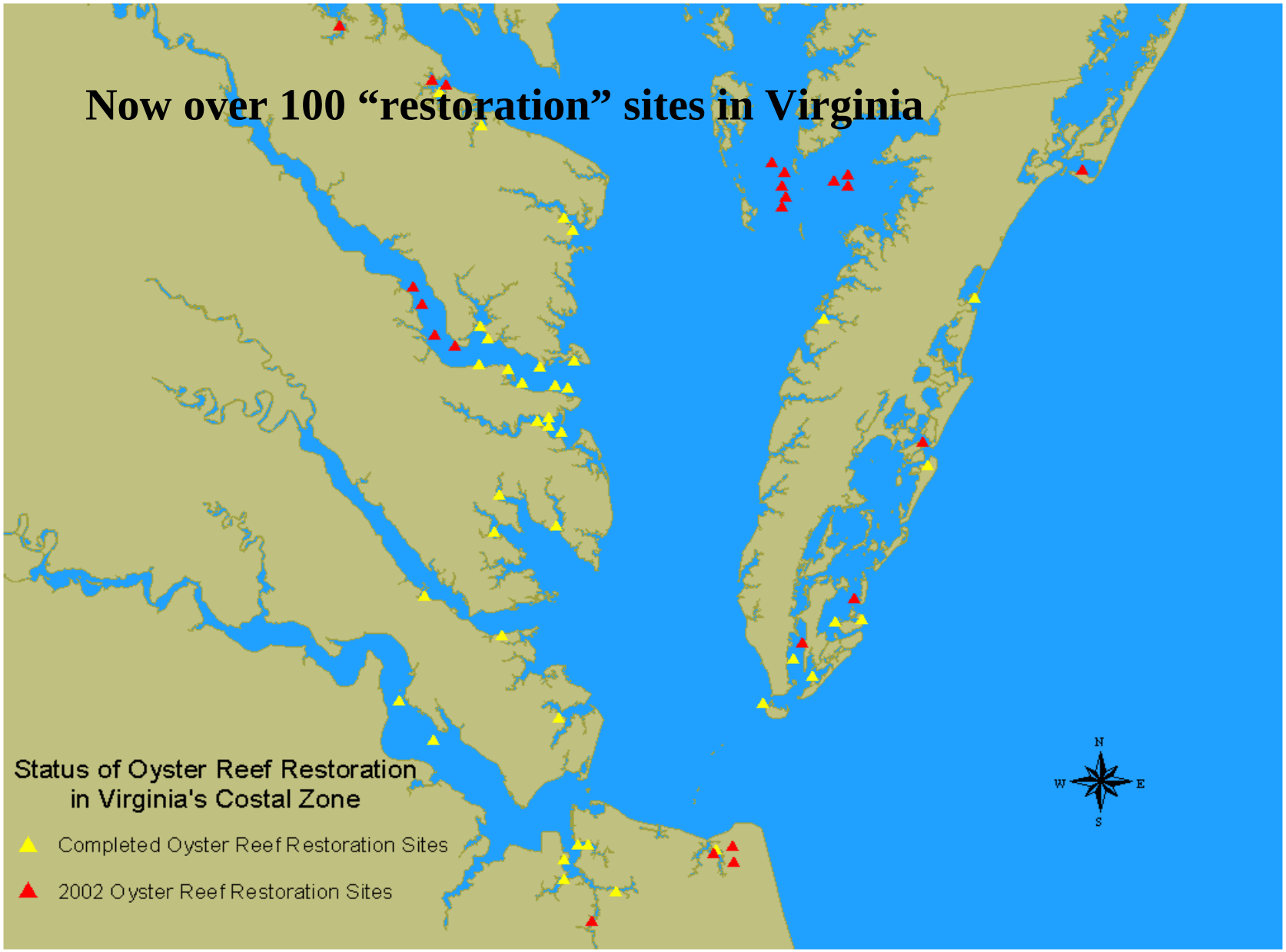


Oyster Restoration Workshop
Myrtle Beach, SC
May 20-21, 2004

P.G. Ross
College of William and Mary
VA Institute of Marine Science
Eastern Shore Laboratory

WILLIAM & MARY
VIMS
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

Restoration Projects



Research Projects

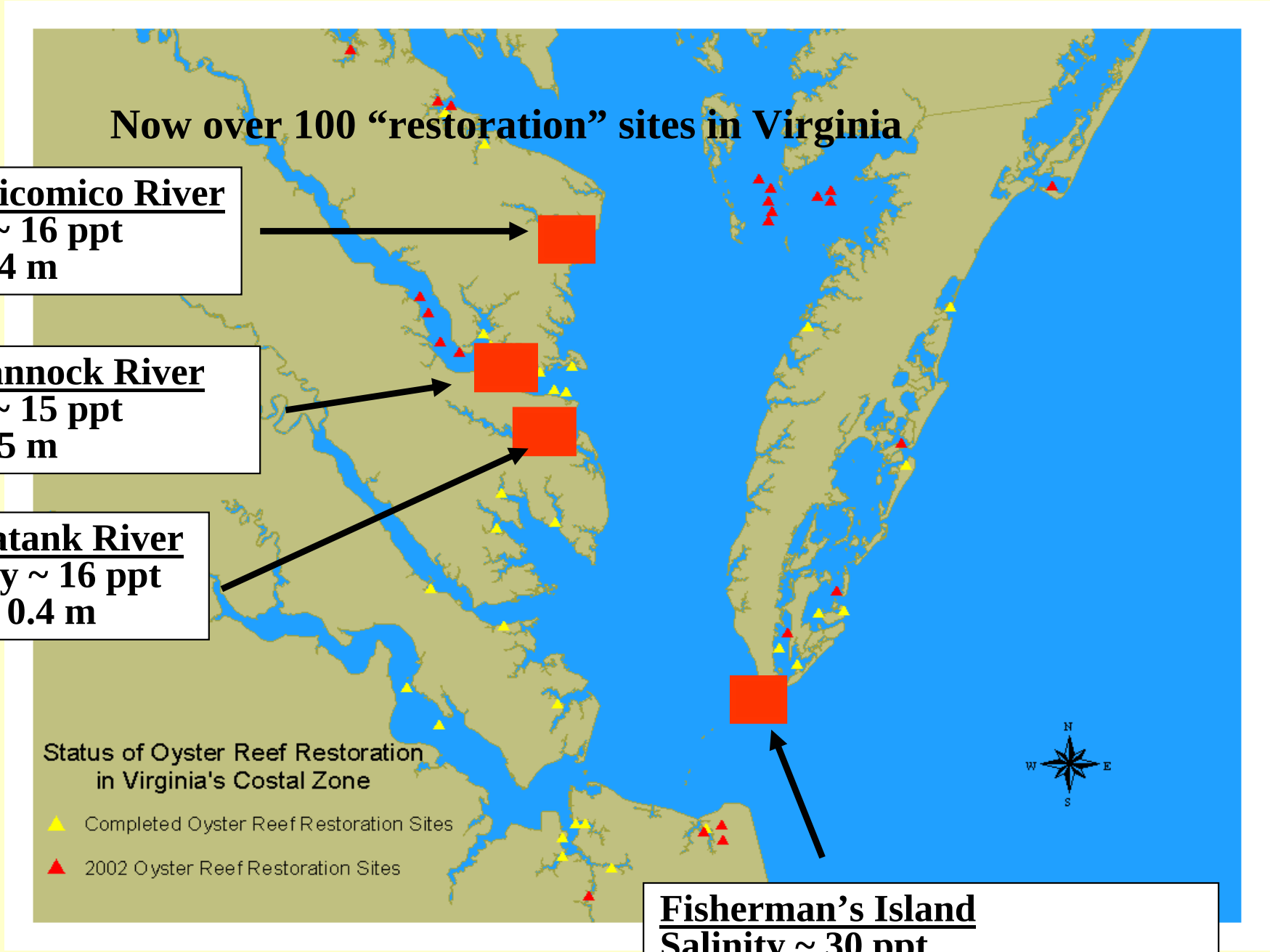
Project	Construction Funded By	Built By	Research Funded By	Adaptive Mgt.
Fisherman's Island (1996-1999)	CBBT, VA Power, VMRC	VMRC[1]	EPA-CBP	Yes, *cultch*
Rappahannock River (2000-2002)	ACOE	VMRC[1]	NOAA Sea Grant	Possibly, *brood stock*
Oyster Heritage (2003-current)	VA, ACOE Others	VMRC[1]	VEE, VORHF, NOAA	Possibly, *brood stock*
Army Corp. Project (2004-current)	VA, ACOE Others	VMRC[1]	NOAA, ACOE	Yes (proposed)

[1] Built on sites chosen by and under the supervision of VMRC by commercial sub-contractors

Research Projects

Project	# Sites	# Reefs	Ht.	Age (yrs)	Scale	Restoration Purpose	Research Priorities
FI ('96-'99)	1	13	Inter	8	100-500 m^2	Mitigation	Community structure, architecture
Rapp. ('01-'02)	4	10 **2 reefs**	Sub	4	400-8000 m^2	Habitat/Brood stock	Scale (landscape & reef size), architecture
OHP ('03-'04) ACOE ('04-)	6 4	6 4	Sub	4-11	400-8000 m^2	Habitat/Brood stock	Monitoring biological & physical parameters

Opportunistically utilize existing or planned reefs for larger scale research…



Great Wicomico River
Salinity ~ 16 ppt
Tide ~ 0.4 m

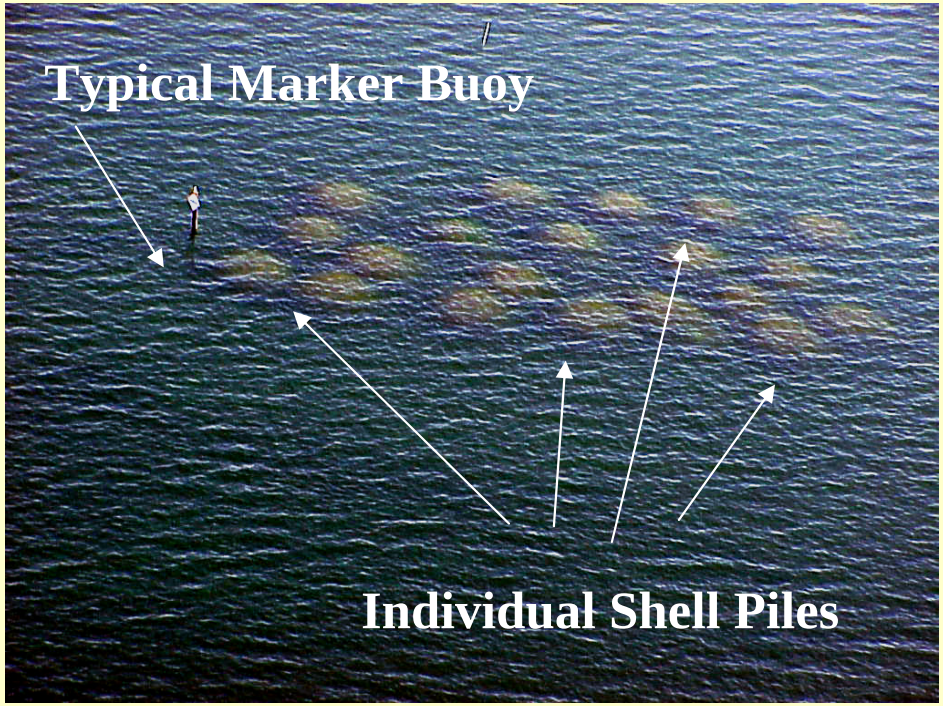
Rappahannock River
Salinity ~ 15 ppt
Tide ~ 0.5 m

Piankatank River
Salinity ~ 16 ppt
Tide ~ 0.4 m

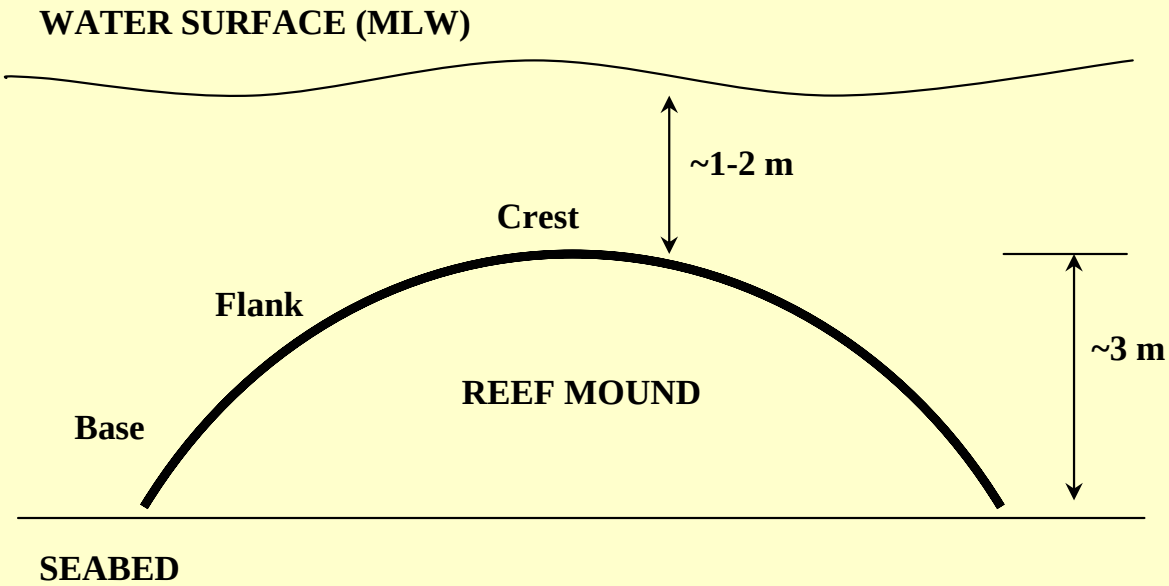
Fisherman's Island
Salinity ~ 30 ppt
Tide ~1 m

Reef Design


Fisherman's Island


Typical Marker Buoy
Individual Shell Piles

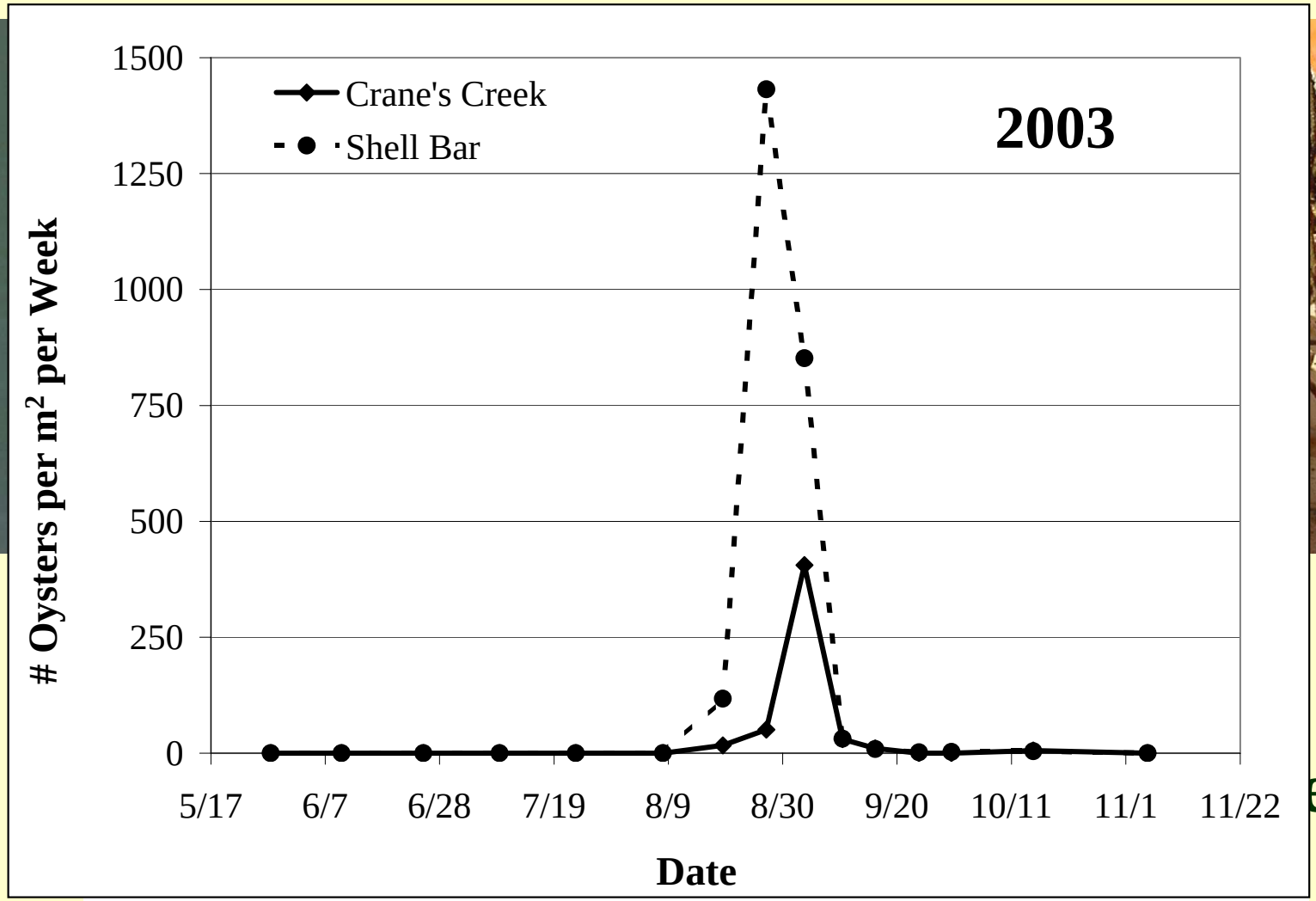

Rapp.


WATER SURFACE (MLW)
~1-2 m
Crest
Flank
~3 m
REEF MOUND
Base
SEABED

Monitoring Methods

Oyster Settlement

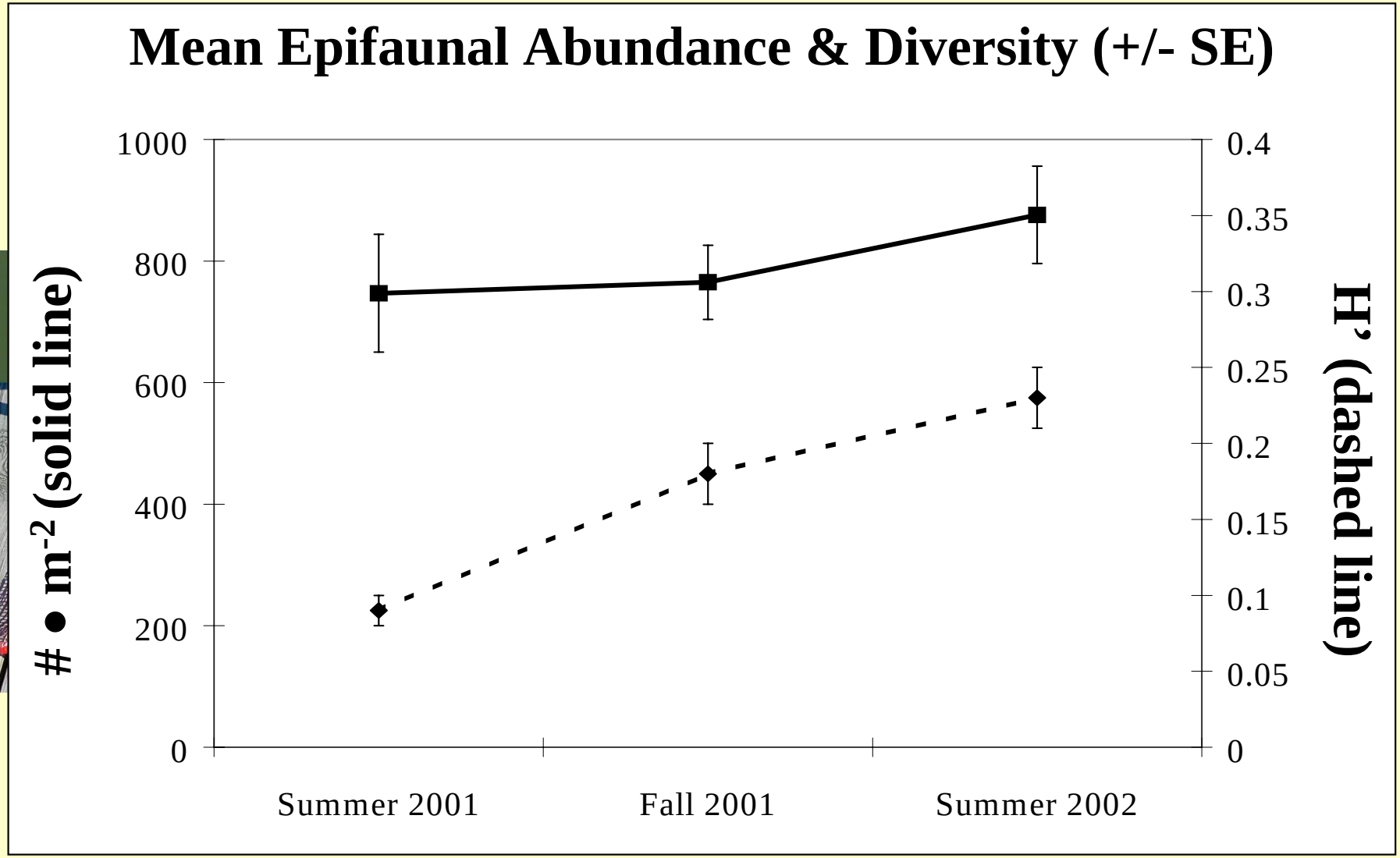
•*Measure timing & intensity of recruitment*



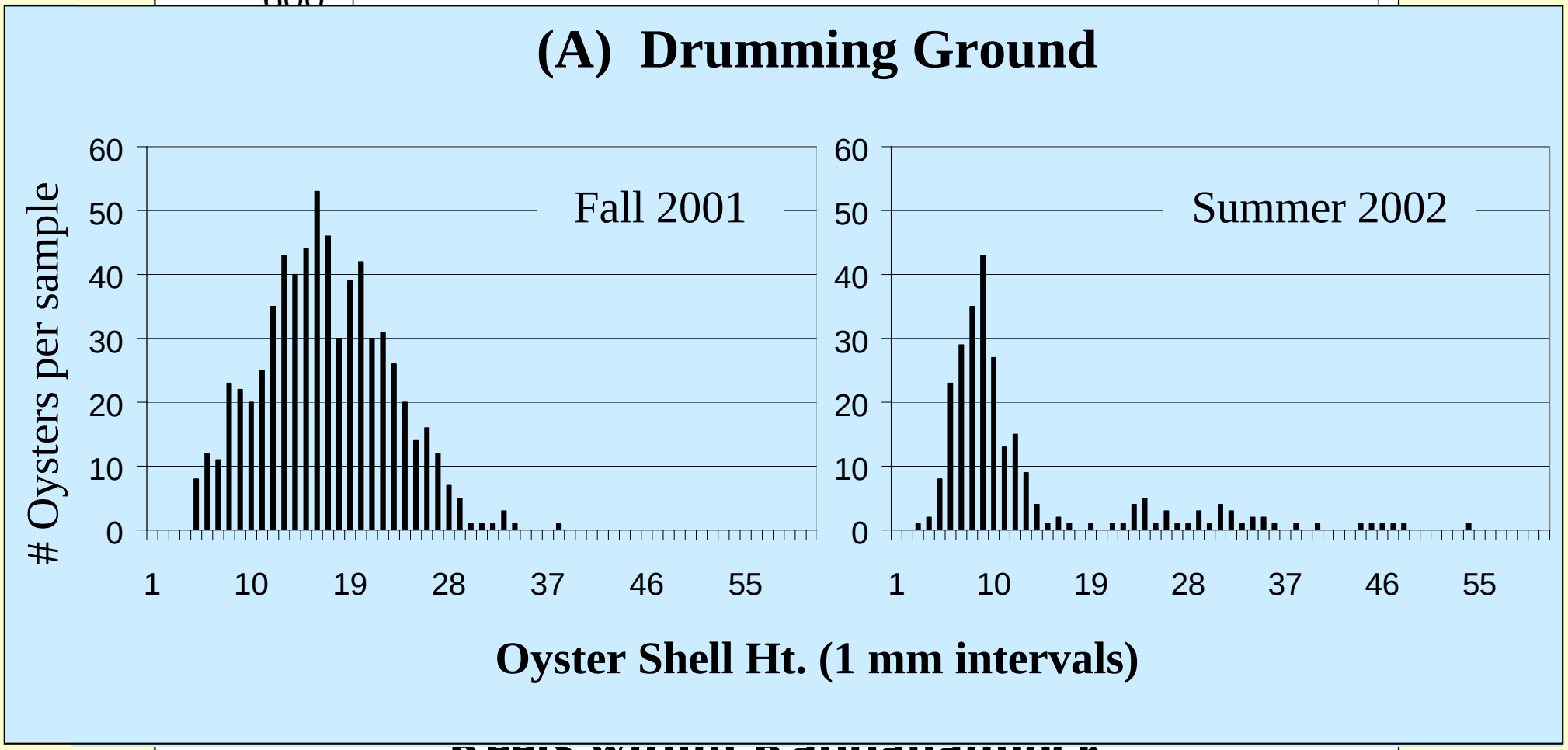
ekly

Monitoring Methods

Epifaunal Population



Monitoring Methods

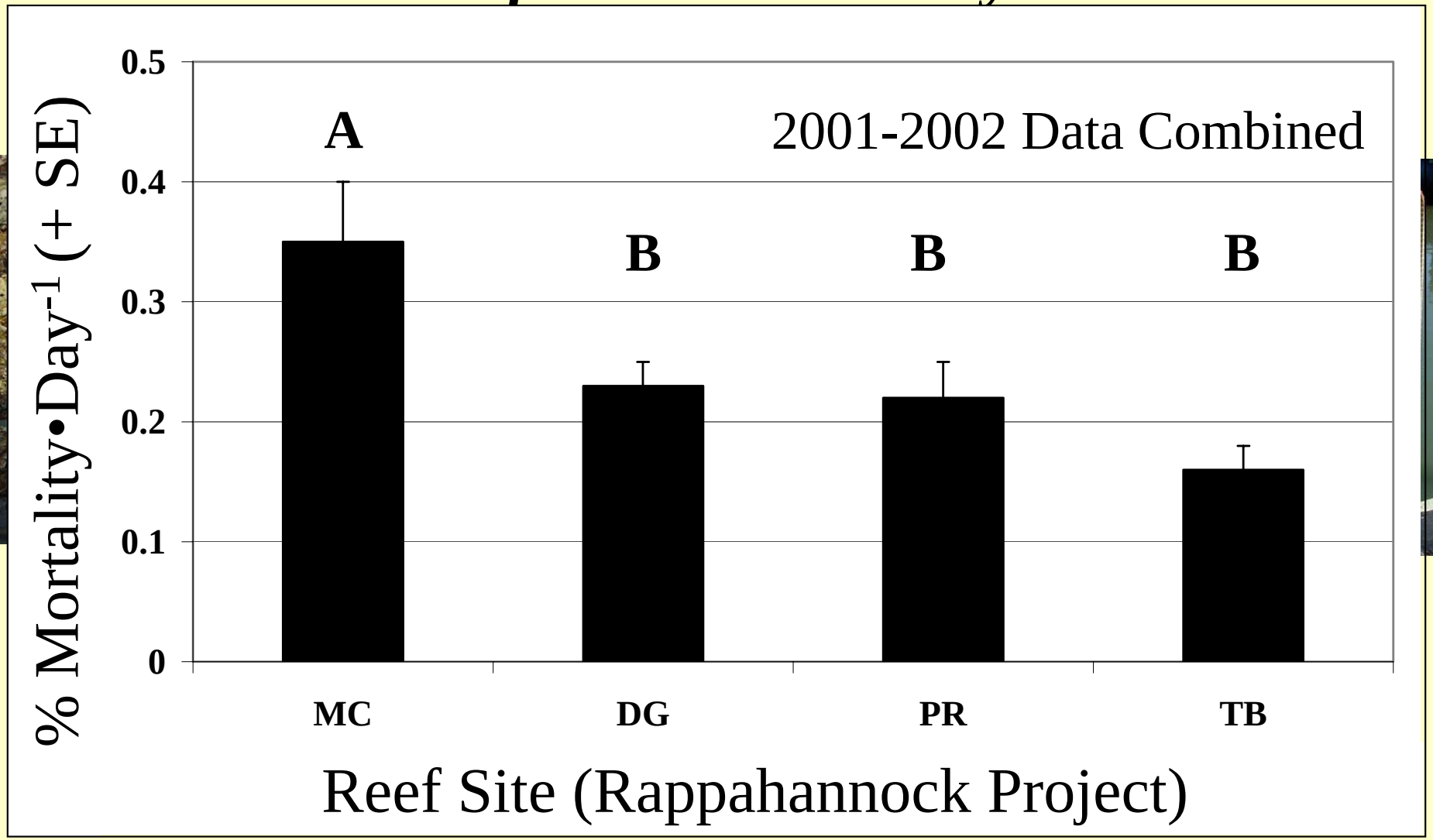


Reefs within Rappahannock

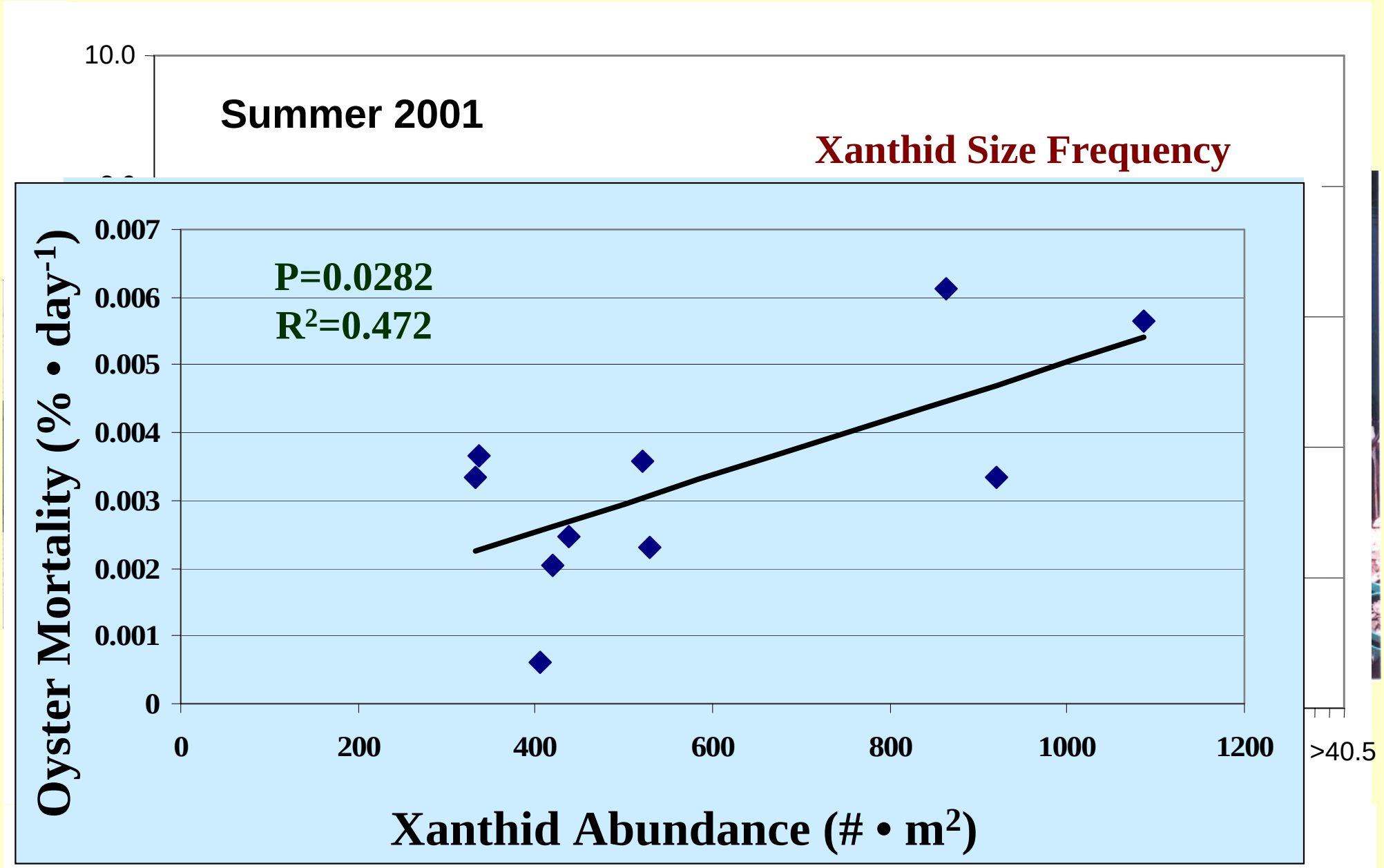
Monitoring Methods

Oyster Mortality & Growth

•*Estimate predation mortality*



Monitoring Methods



Monitoring Methods

Relative abundance of dominant species (Rapp 2001-2002)

Species (Resident and Transient Groups)	(%)
Skilletfish (*Gobiesox strumosus*)	**55**
Naked Goby (*Gobiosoma bosci*)	**38**
Feather Blenny (*Hypsoblennius hentzi*)	**4**
Menhaden (*Brevoortia tyrranus*)	**36**
Croaker (*Micropogonias undulatus*)	**29**
White Perch (*Morone americanus*)	**18**
Striped Bass (*Morone saxatilis*)	**8**
Spot (*Leiostomus xanthurus*)	**5**

Monitoring Methods

Physical Characteristics of Reef

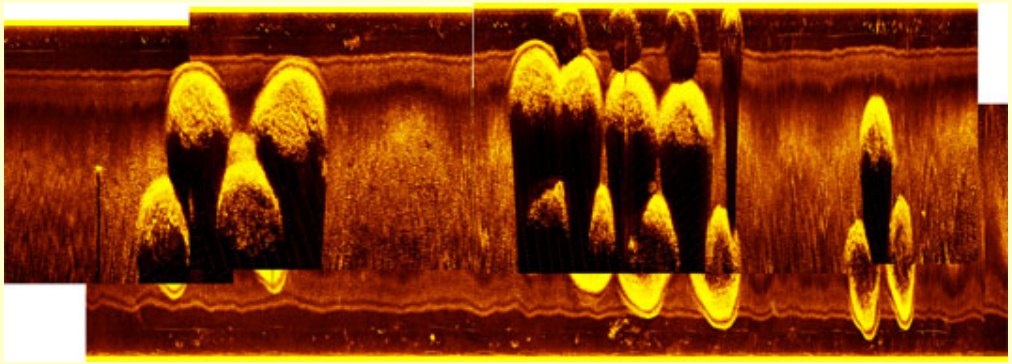
- *Determine static vs. dynamic nature of veneer*
- *Physical parameters to correlate with biological parameters*

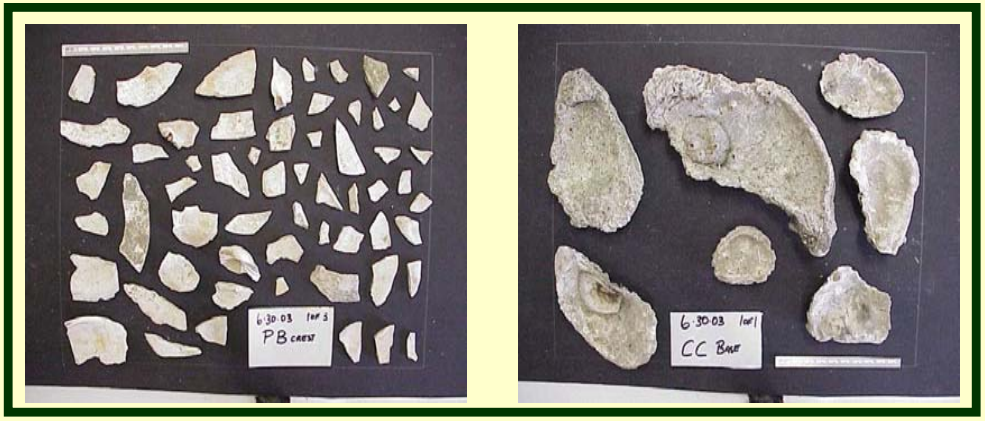
- ✓3-D shape & bathymetry
- ✓Interstitial space
- ✓Surface rugosity
- ✓Particle geometry
- ✓Large scale flow patterns
- ✓Temporal changes…..?

Monitoring Methods

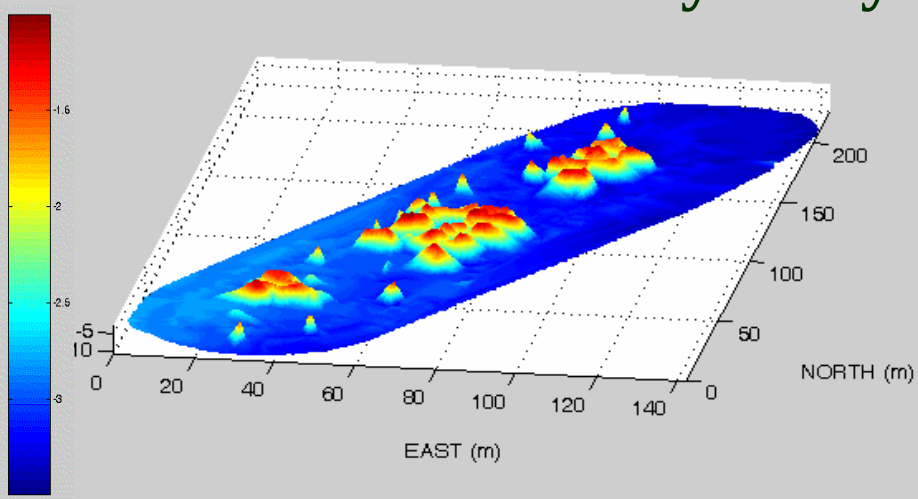
Physical Characteristics of Reef

Side Scan Sonar

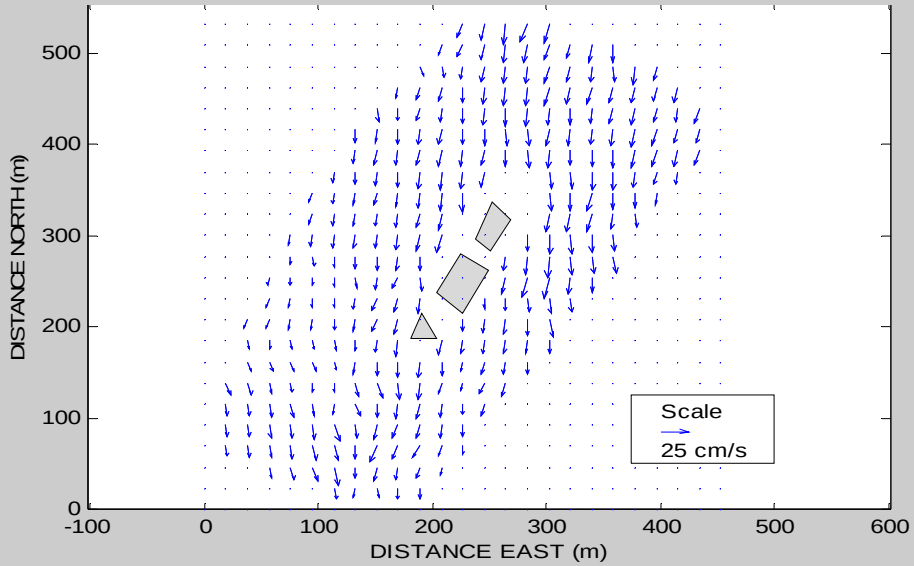




Parrot's Rock Bathymetry

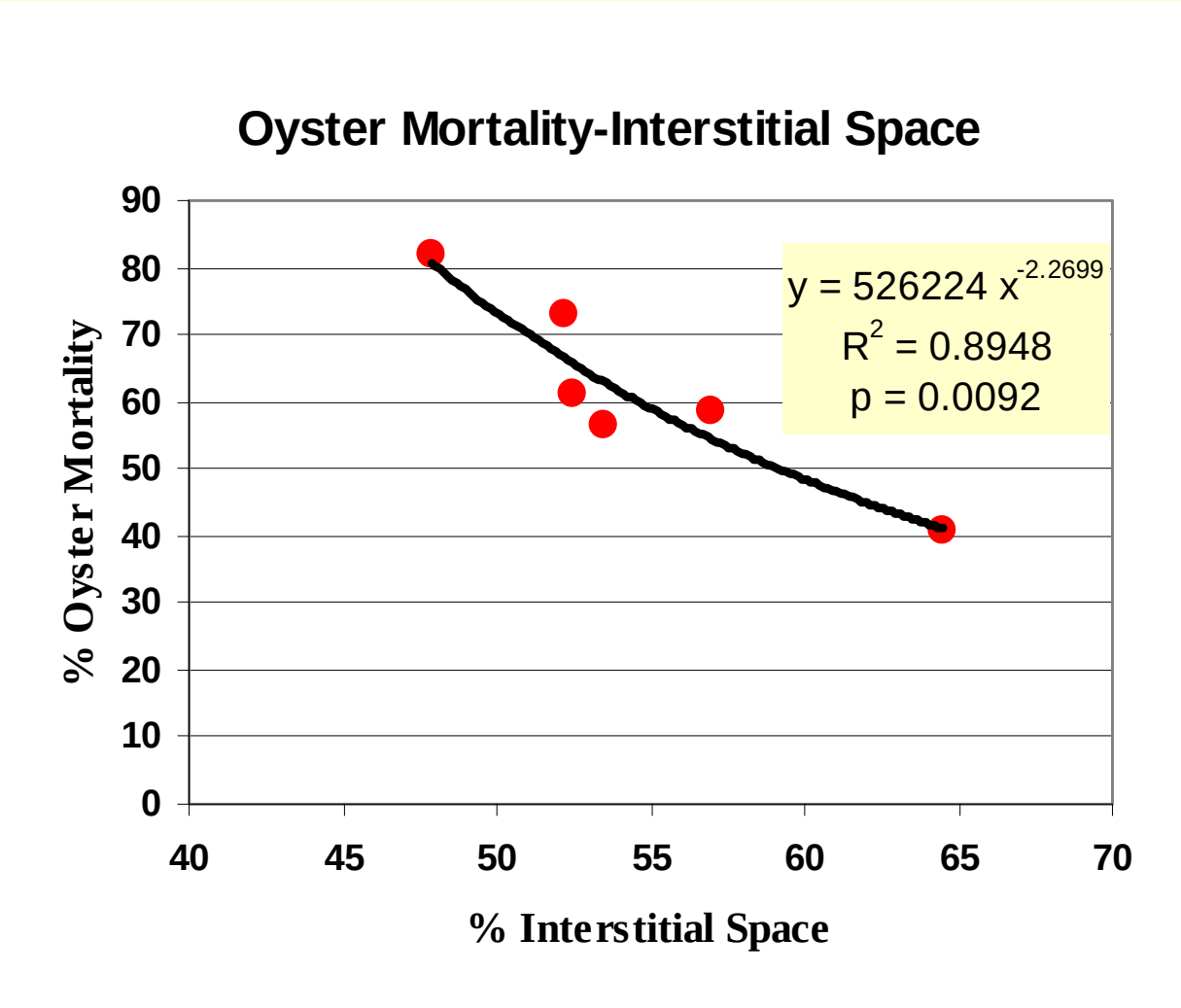


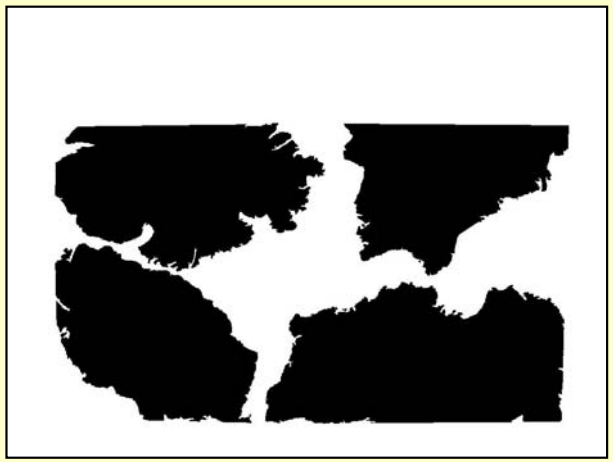
ADV Stacked Flow Profile



Monitoring Methods

Physical Characteristics of Reef





140 mm

245 mm

Monitoring Methods

Techniques Planned for 2004

Technique	*Frequency*
Oyster settlement (tiles)	Bi-weekly/weekly (June-Oct.)
Quadrates (epifauna & physical)	Quarterly (spring, summer & fall)
Plankton tows (larvae)	Bi-weekly (June-Sept.)
Oyster fecundity	Bi-weekly (May-Sept.)
Oyster disease & genotyping	Semi-annually (July & Oct.)

Utilizing correlation analysis and regression to determine relationships

Current projects mainly focused on monitoring oyster population

Alternative Substrates

Particle size, interstitial volume & surface rugosity

Demolished Cinder Block

Surf Clam Shell

“Lessons Learned”

- ✓ **Location, location, location**

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- ✓Measuring success at one point in time may be misleading-temporal trends may be more relevant
- ✓When and how we sample really matters

Some Criteria for Success

✓Oyster population growth +, or at higher densities, at least stable over several years

✓Multiple oyster size/age cohorts present over time

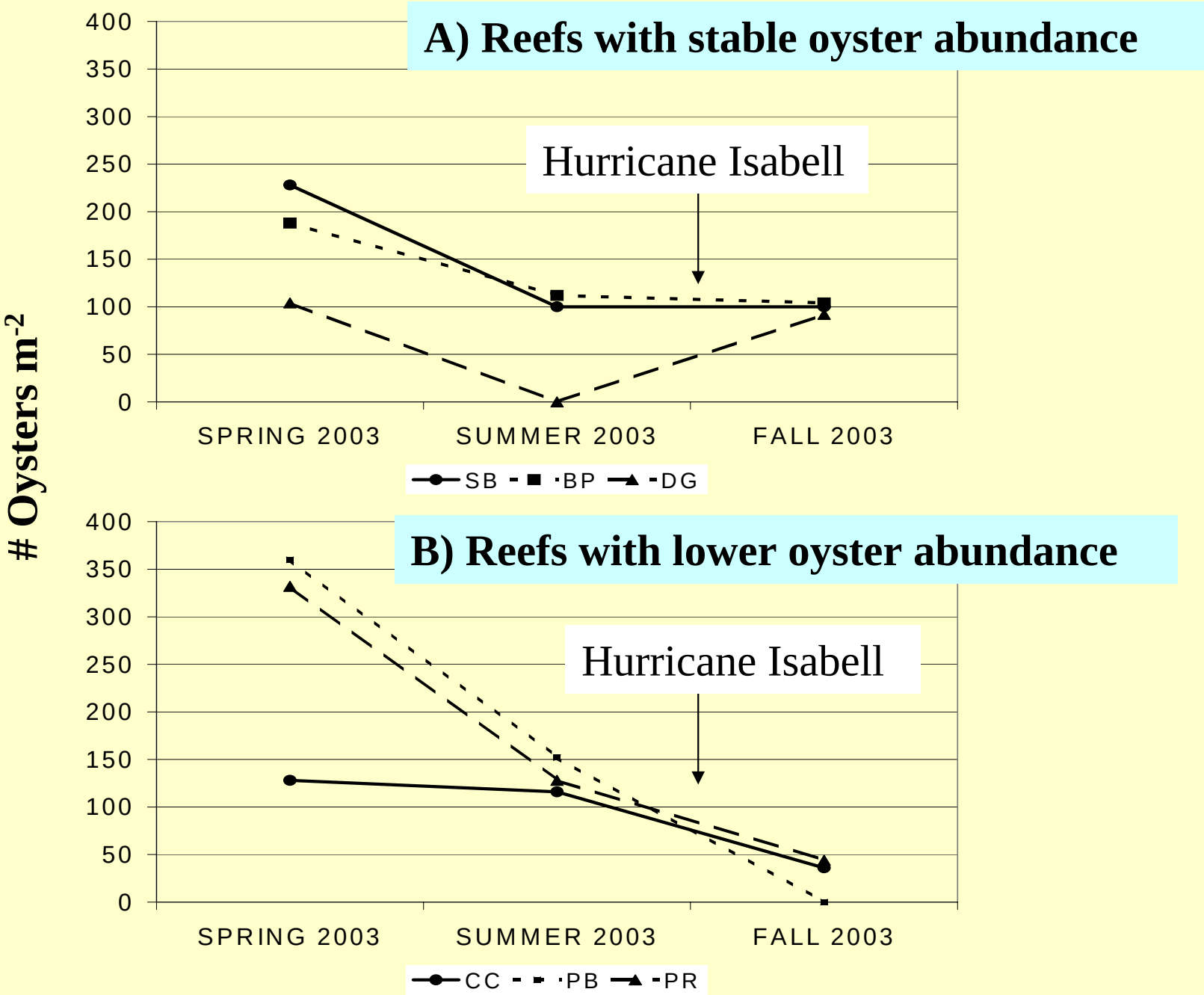
✓Overall community diversity increasing over time to stabilize after 3-5 years

✓Key community species (i.e. trophically) present in multiple age classes. Identify species/genera in multiple taxa that are indicative of healthy community

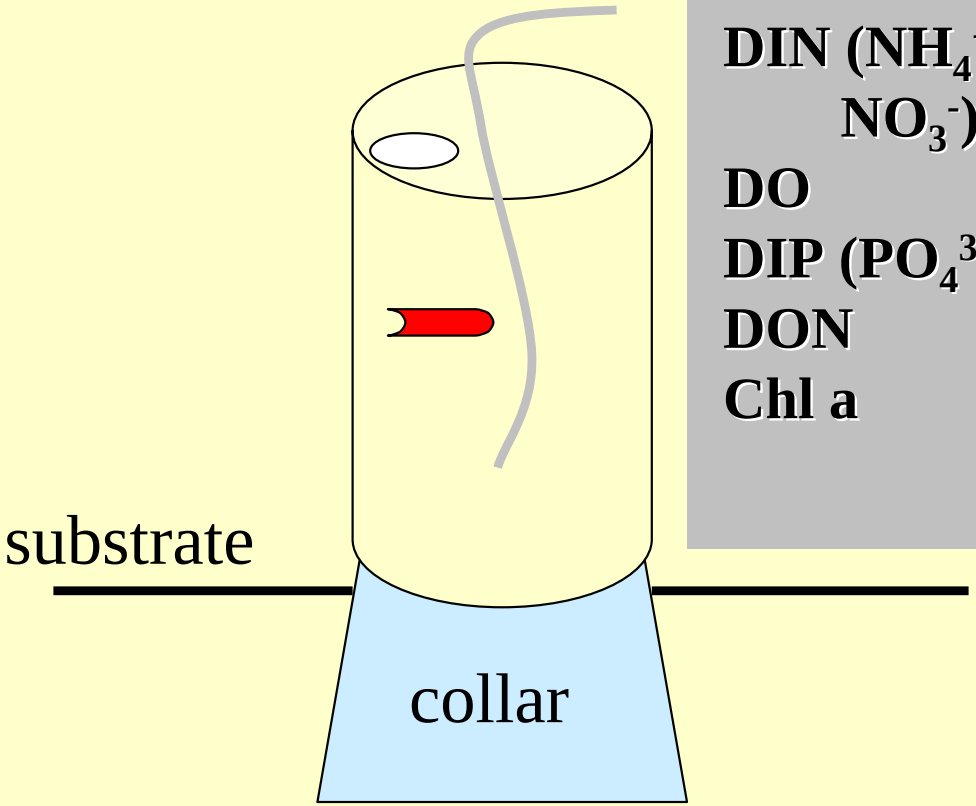
✓Does community equilibrate quickly (e.g. 2-3 years) after significant environmental perturbations

Measurement of these variables requires multiple years of monitoring (possibly 5+ years continuously). The challenge is to get financial commitments to longer-term monitoring than is currently standard

Potential Hurricane Impacts??



Flux Measurements



Bi-monthly
Apr – Oct:

DIN (NH_4^+, NO_2^- NO_3^-),
DO
DIP (PO_4^{3-})
DON
Chl a

160 Cages Deployed
June 2003