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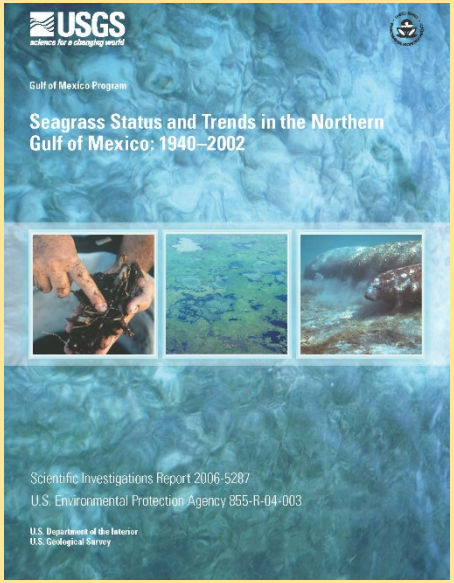
- Brief History
- Economic Evaluation
- Non-nutrient Contaminants

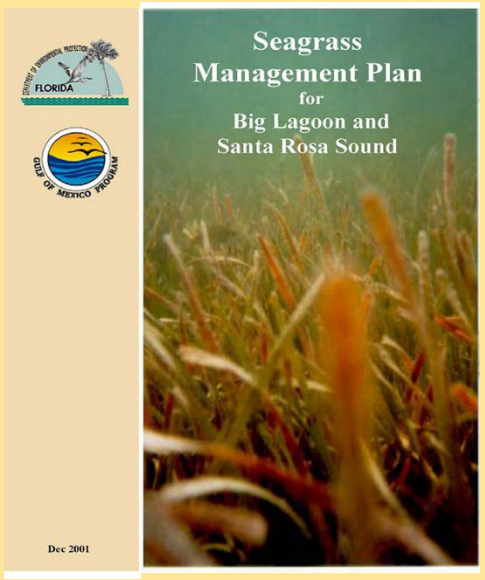
History

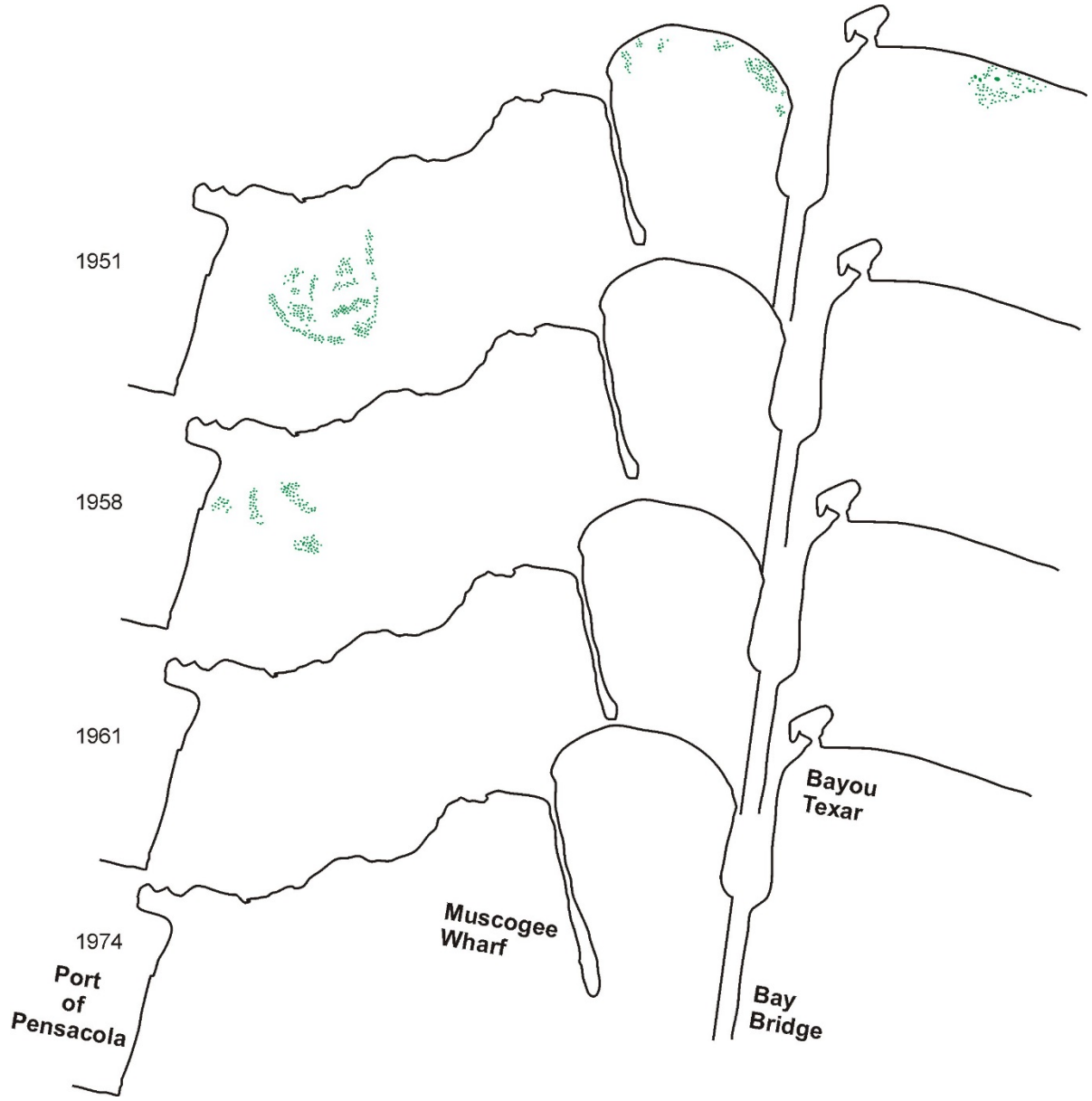
- 1931 - Present
- 60+ reports (coverage dominates)
- Structural characteristics, effects of epiphytes, nutrient enrichment, low salinity, bacterial community/biogeochemical interactions, chemical quality
- At least 12 seagrass summaries (status/trends)
- 38 Photographic descriptions
- First aerial survey 1940; latest 2010
- 1948 extensive beds
- First reported lost - 1955
- 1966/1972 most destroyed
- 20 causes
- Excellent summary: Collard 1991
- Currently about 4460 acres (statewide 2.3 - 2.7 million)

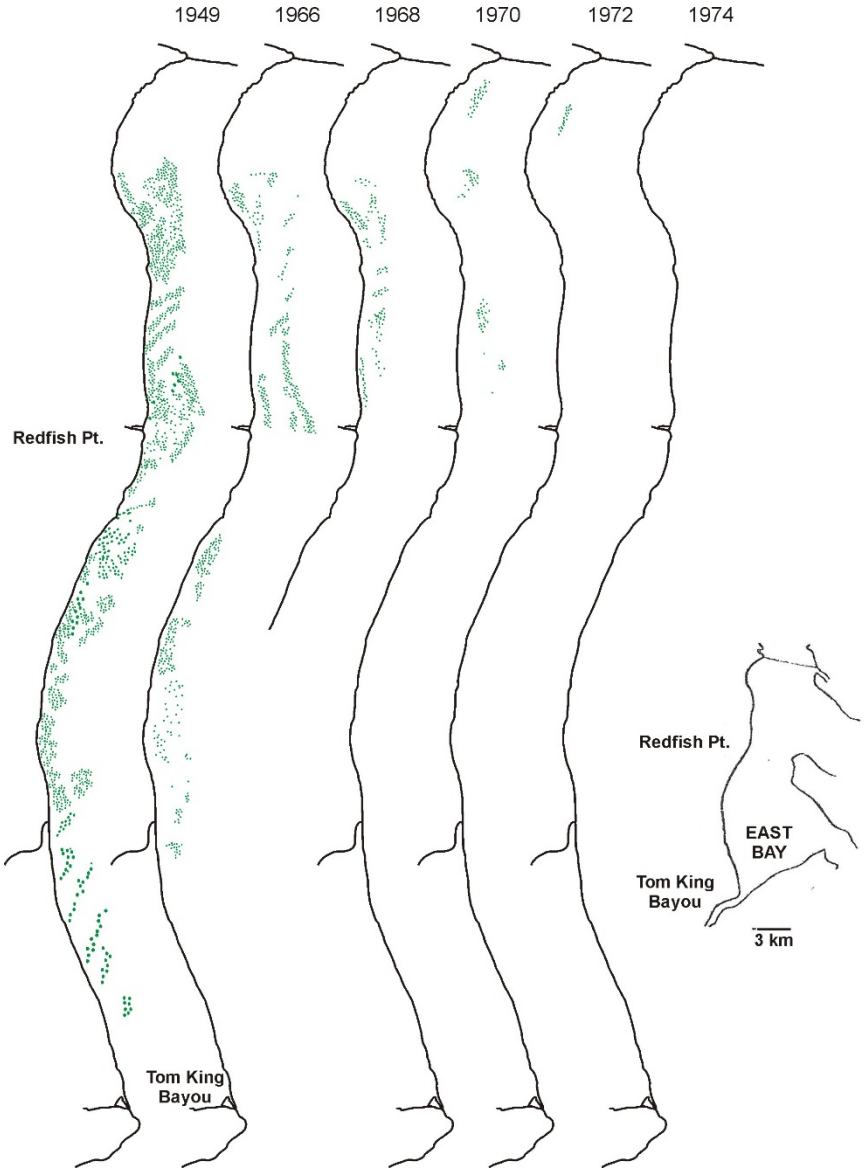
Seagrass Coverage and Trend

		Percent Cover				
Aerial Survey	Acres	SRS	BL	EB	PB	EscB
1960	9529	68	7	12	10	3
1980	4678	78	12	5	3	1
1992	4190	63	12	9	6	10
2003	4085	74	13	<1	9	3
2010	4462	65	12	6	13	4






1951
1958
1961
1974
Port of Pensacola
Muscogee Wharf
Bay Bridge
Bayou Texar


1949
1966
1968
1970
1972
1974
Redfish Pt.
Tom King
Bayou
Redfish Pt.
EAST
BAY
Tom King
Bayou
3 km

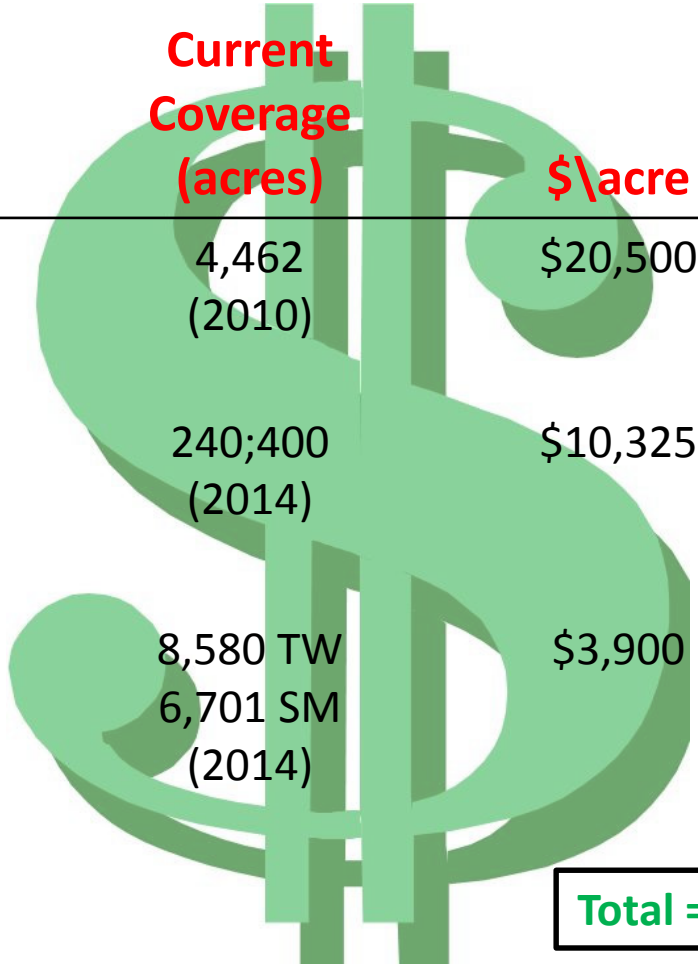
Restorations

- Restorations for 40 years
- Transplants: Sods, seedlings, plastic grass
- Most large-scale restorations/creations failures
- Pre-restoration; 2 yr. test plots (1 acre), sediment toxicity assessment
- Life sustaining requirements not fully understood
- Current: trial and error stage
- Project GreenShores - 200-fold increase seagrass; 50 m^2 - 10,000 m^2 (2.5 acres)

Ecofinance Approach

- Ecological goods and services
- Rarely reported for PBS - exceptions: tourism and seafood
- 1973 - Masters Thesis (UWF) - $14 million - $141 million lost due to wastewaters (water quality)
- Preliminary estimate for seagrass meadows
- Total value = coverage x value of one acre seagrass
- $20,500/acre (FDEP) - nutrient cycling, recreational and commercial fisheries

Ecological Services: Annual Value



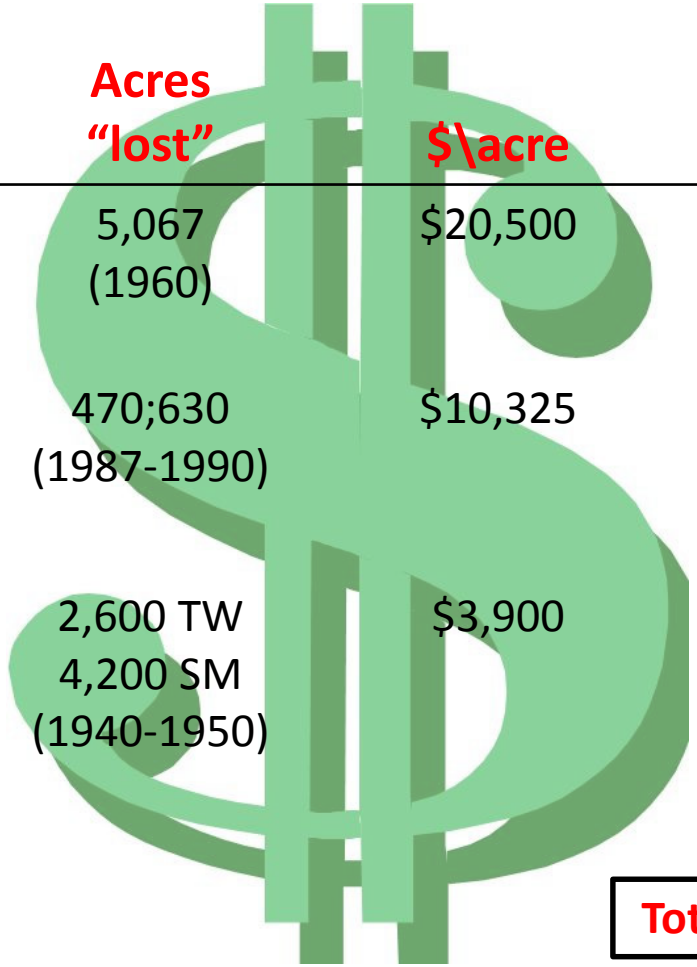
	Current Coverage (acres)	$\acre	Value
Seagrass	4,462 (2010)	$20,500	$91.5 million
Oyster Reef	240;400 (2014)	$10,325	$1.0 - $1.7 million
Coastal Wetlands	8,580 TW 6,701 SM (2014)	$3,900	$26.0 - $34.0 million

Total = $119 - $127 million

Current Annual Value Comparison

- Escambia County RE taxes - $100 million
- Santa Rosa County RE taxes - $48 million
- Trees (Escambia County) - $70 million

Ecological Services: Annual Value Lost



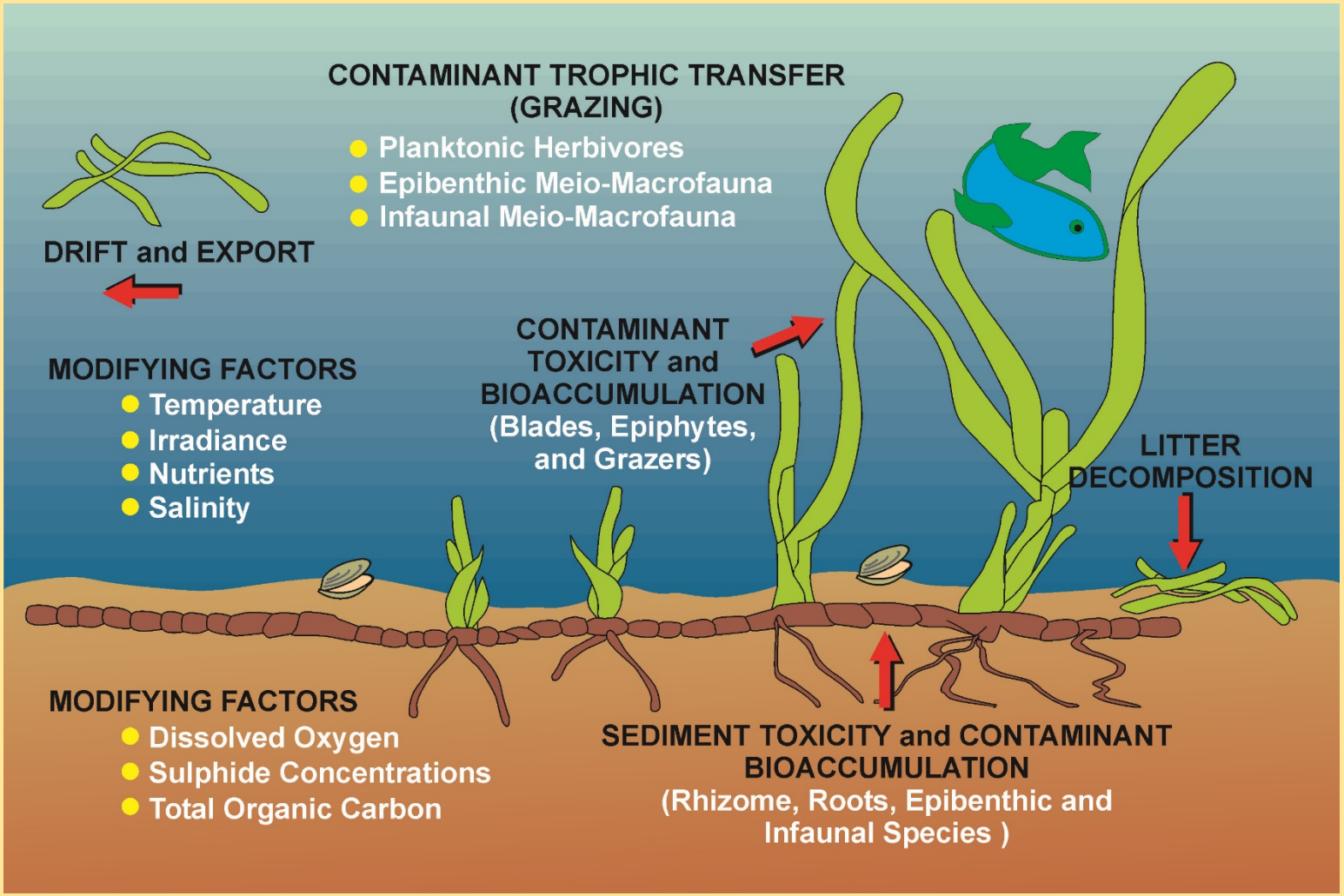
	Acres "lost"	$\acre	Value lost
Seagrass	5,067 (1960)	$20,500	$104.0 million
Oyster Reef	470;630 (1987-1990)	$10,325	$2.0 - $2.6 million
Coastal Wetlands	2,600 TW 4,200 SM (1940-1950)	$3,900	$10.0 - $16.3 million

Total = $116 - $123 million

Role of Non-nutrient Contaminants

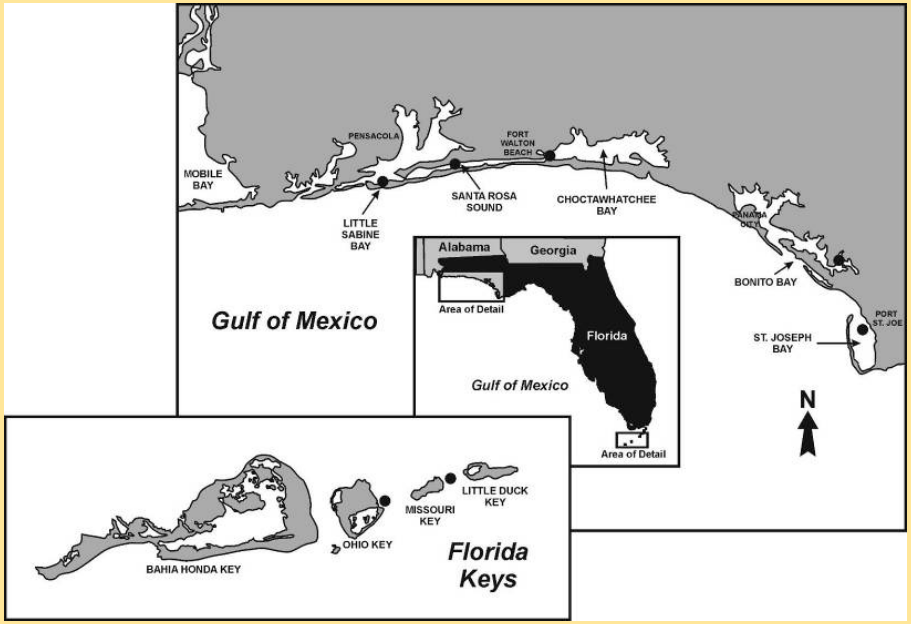
- 2003 mapping - provided $ for completion (USGS National Wetlands Center)
- Updated coverage and summary of Collard 1991
- Compared absence and presence to sediment contaminants (15 yrs. chemical data)
- Esc B > Pens B > East B > SRS (bad to good)
- Led to chemical survey

Pathways

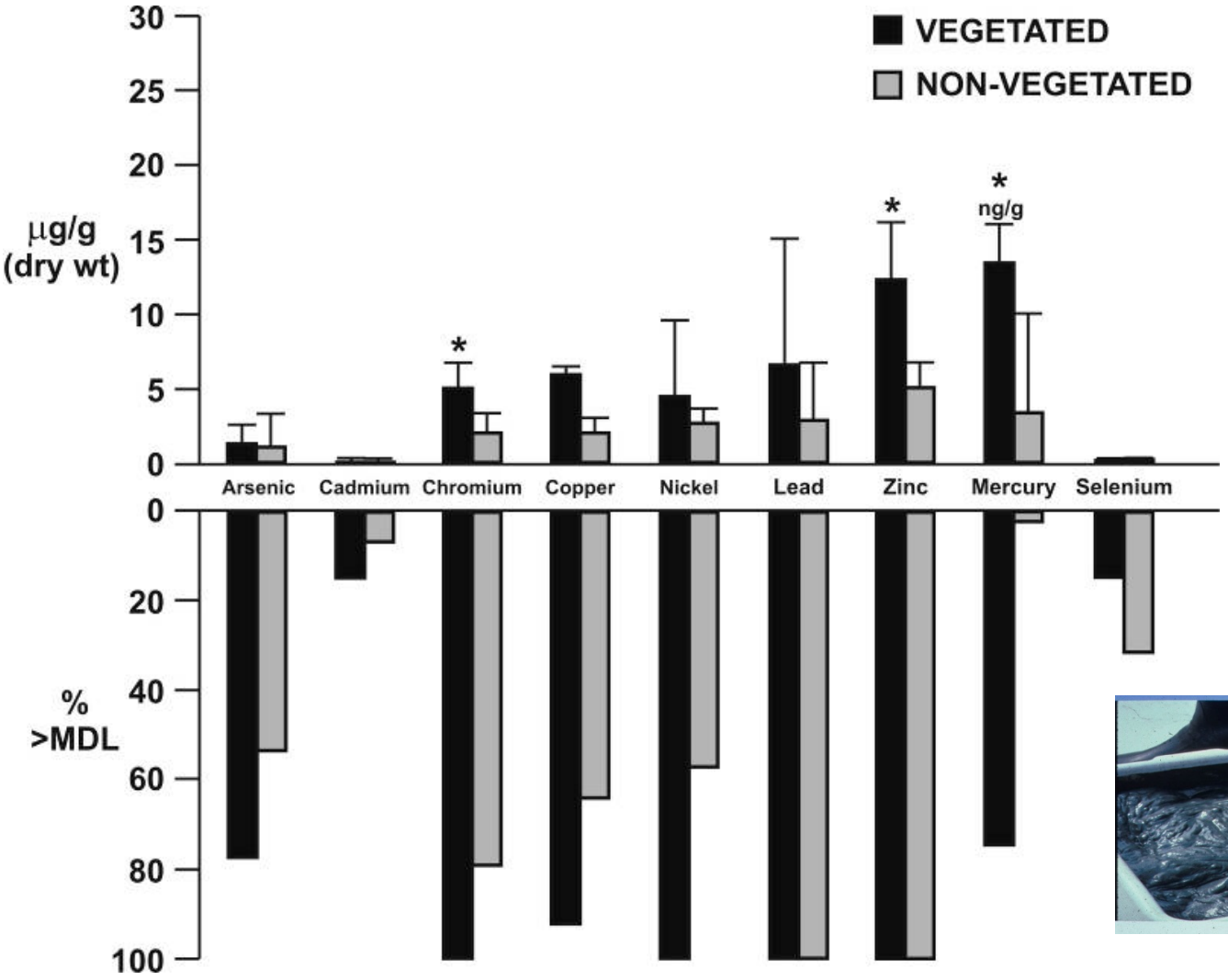

CONTAMINANT TROPHIC TRANSFER
(GRAZING)
Planktonic Herbivores
Epibenthic Meio-Macrofauna
Infaunal Meio-Macrofauna
DRIFT and EXPORT
MODIFYING FACTORS
Temperature
Irradiance
Nutrients
Salinity
CONTAMINANT
TOXICITY and
BIOACCUMULATION
(Blades, Epiphytes,
and Grazers)
LITTER
DECOMPOSITION
MODIFYING FACTORS
Dissolved Oxygen
Sulphide Concentrations
Total Organic Carbon
SEDIMENT TOXICITY and CONTAMINANT
BIOACCUMULATION
(Rhizome, Roots, Epibenthic and
Infaunal Species)

Seagrass Survey

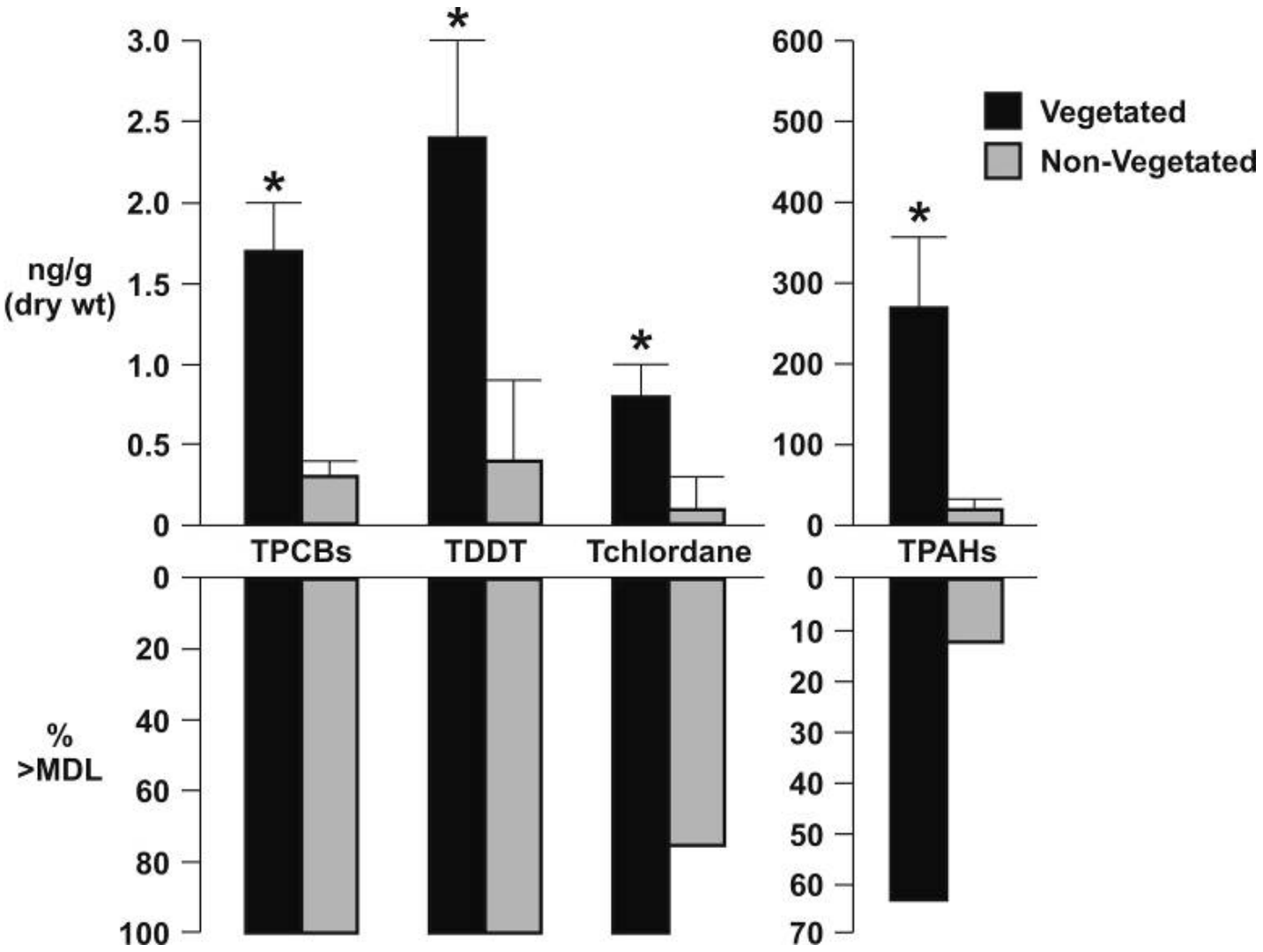
- 13 Florida seagrass beds
- *Thalassia testudinum, Halodule wrightii*
- 10 trace metals, 25 chlorinated pesticides, 18 PCB congeners, 23 PAH compounds
- Surface water, rooted and non-rooted sediments, blades, roots-rhizomes



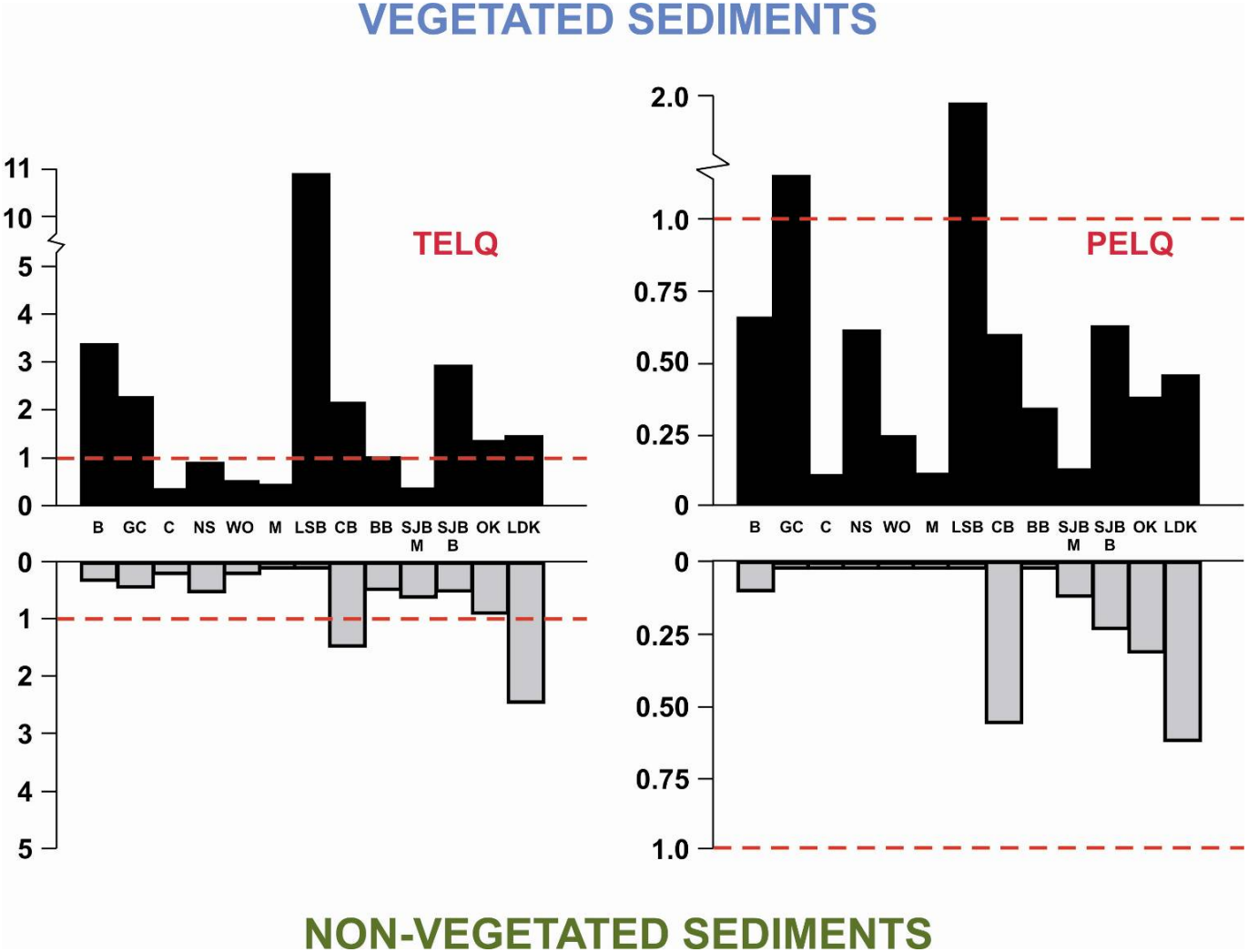
Contaminant Concentrations



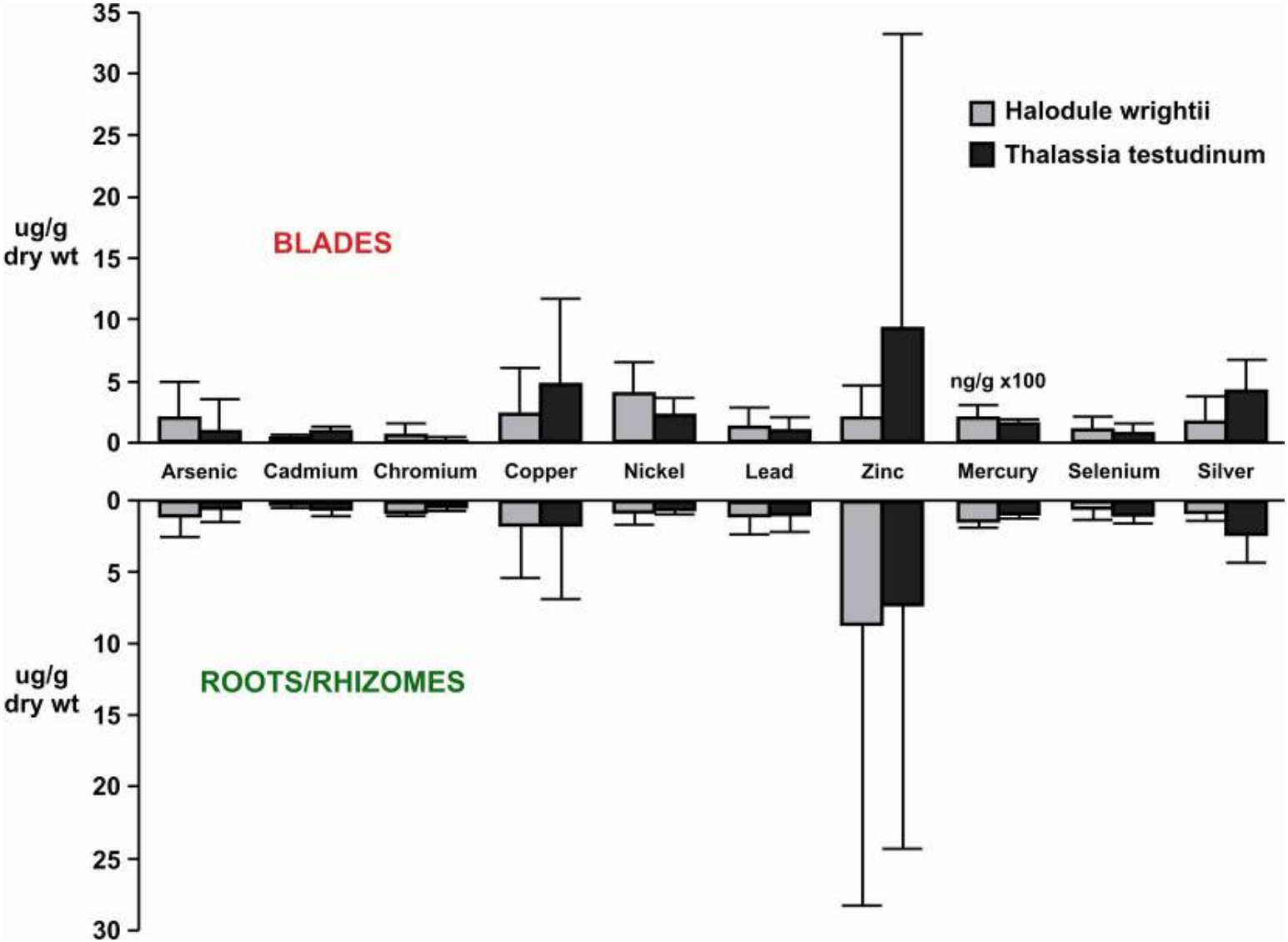
Contaminant Concentrations



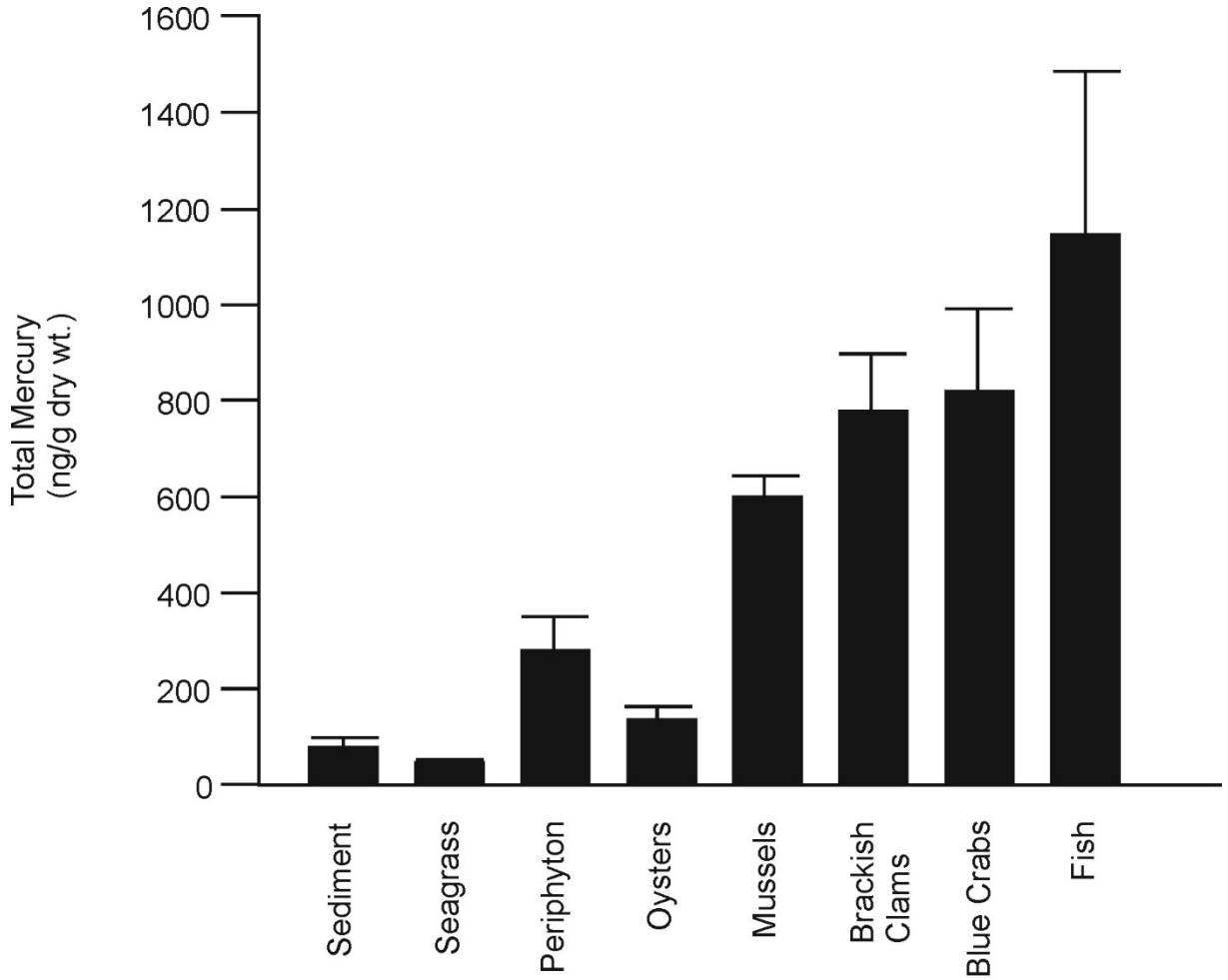
Sediment Quality Guidelines Exceedance



Tissue Residues



Mercury Comparison (PBS biota)



Bottom Line

- Grass bed sediments more contaminated than non-vegetated sediments
- Some concentrations exceed regulatory chemical guidelines
- Effects not known/but unlikely for SRS
- Non-essential trace elements are bioaccumulated (low BCFs)
- Biological significance? Alone? Mixtures?
- Concentrations (sediment, tissues) within range of others (Florida, worldwide)

Next Steps

- Target: previous vegetated areas (Esc. Bay, East Bay)
- Conduct phytotoxicity test/seagrass
- Only PBS seagrass tox study 1982-3/herbicides
- In-Situ tests
- Laboratory tests
- Sediment alone (diluted?)
- Combo with nutrients and under extremes of salinity and temperature
- Toxicity identification evaluations

Phytotoxicity Tests