

Advisory Panel for March 30–31, 1999, Workshop

Name	Main area(s) of expertise
Dr. Steve Bortone	SAV
David Camp	Benthic macroinvertebrates
Dr. Paul Carlson	SAV
Dr. Richard E. Dodge	Corals
Steve Grabe	Benthic macroinvertebrates
Dr. Penny Hall	SAV
Dr Pam Hallock-Muller	Corals
Dr. Walt Jaap	Corals
Dr. Nancy Marcus	Phyto/zooplankton
Ed Matheson	Fish
Bob McMichael	Fish
Michael Milligan	Benthic macroinvertebrates
Matt Patterson	Corals
Dr. Karen Steidinger	Phyto/zooplankton
Alex Stone	Corals
Dr. Carm Tomas	Phyto/zooplankton
Dr. Gabe Vargo	Phyto/zooplankton
Dr. Bob Virnstein	SAV
Vicki Whiting	Benthic macroinvertebrates

Administrative Committee, Coastal & Estuarine Bioassessment Program

Ellen McCarron	FDEP, Division of Water Facilities; Tallahassee, FL
Gil McRae	FDEP, Florida Marine Research Institute; St. Petersburg, FL
Jan Landsberg	FDEP, Florida Marine Research Institute; St. Petersburg, FL
Kent Smith	FDEP, Bureau of Marine Resources; Tallahassee, FL
Steve Wolfe	FDEP, Bureau of Laboratories; Tallahassee, FL

The following breakout sessions were held to generate lists of measures and methods for assessing each habitat, which were subsequently discussed and amended by the entire workshop. The final results are presented in the following tables.

Day 1 Breakout Sessions

Water Column

<i>Name</i>	<i>Area</i>	<i>Affiliation</i>
Jan Landsberg *	Steering/Phyto	FDEP; FMRI
Carm Tomas	PhyZoo	FDEP; FMRI
Ed Matheson	Fish	FDEP; FMRI
Gary Hitchcock	Phyto	RSMAS; University of Miami
Gabriel Vargo	PhyZoo	University of South Florida; Dept. of Marine Science

Mud bottom (>40% silt/clay)

<i>Name</i>	<i>Area</i>	<i>Affiliation</i>
Stephen Grabe	Invert	Hillsborough County Environmental Protection Commission
Walt Jaap	Corals	FDEP; FMRI
Gil McRae *	Steering	FDEP; FMRI
Karen Steidinger	Phyto	FDEP; FMRI
Lori Wolfe	Biostatistics	FDEP; Division of Technical Services

Submerged Aquatic Vegetation (SAV)

<i>Name</i>	<i>Area</i>	<i>Affiliation</i>
Penny Hall-Ruark	SAV	FDEP; FMRI
Joan Bernstein	Fish	FDEP; FMRI
Jim Culter	Invert	Mote Marine Laboratory
Kent Smith	Steering/SAV	FDEP; Division of Marine Resources
Vicki Whiting *	Invert	FDEP; Division of Technical Services

Coral Reef

Dave Camp	Invert	Consultant
Matt Patterson	Corals	FDEP; FMRI
Steve Wolfe *	Steering	FDEP; Division of Technical Services
Alexander Stone	Corals	Reefkeeper International, Inc.

* group leader

Day 2 Breakout Sessions

Intertidal Grasses

Jan Landsberg	Steering/Phyto	FDEP; FMRI
Steve Grabe	Invert	Hillsborough County Environmental Protection Commission
Penny Hall-Ruark	SAV	FDEP; FMRI
Kent Smith	Steering/SAV	FDEP; Division of Marine Resources
Karen Steidinger *	Phyto	FDEP; FMRI

Mangroves

Dave Camp	Invert	Consultant
Gil McRae	Steering	FDEP; FMRI
Pam Hallock Muller	Corals	Department of Marine Science; University of South Florida
Matt Patterson	Corals	FDEP; FMRI
Gabriel Vargo *	PhyZoo	University of South Florida; Dept. of Marine Science

Sand bottom (<40% silt/clay)

Michael Milligan	Invert	Center for Systematics and Taxonomy
Vicki Whiting	Invert	FDEP; Division of Technical Services
Carm Tomas *	Phyto	FDEP; FMRI
Lori Wolfe	Biostatistics	FDEP; Division of Technical Services
Ed Matheson	Fish	FDEP; FMRI

Hard Bottom/Oyster Reef/Worm Reef

Alex Stone	Corals	Reefkeeper International, Inc.
Jim Culter	Invert	Mote Marine Laboratory
Walt Jaap	Corals	FDEP; FMRI
Gary Hitchcock *	Phyto	RSMAS; University of Miami
Steve Bortone	SAV/Fish	Fla. Atlantic University; Fla. Center for Environmental Studies
Steve Wolfe	Steering	FDEP; Division of Technical Services

* group leader

Water Column

Water Column		Sampling Methods			
Indicators	Measure	Bottle grab	Plankton net	Bongo net	Meter
A. Phytoplankton	Community structure *	x	x		
	Chlor <i>a</i> /phaeo per size fraction	x	x		
	Proximate particulate biomass/CNP silicate ratio	x	x		
B. Zooplankton (includes larval fish and eggs)	Community structure *	x	x		
	Biomass (displacement volume, wet wt/dry wt)	x			
	Bioassays (microheterotrophs)	x			
	Enzyme indicators	x			
	Health, abnormalities and parasitism	x	x		
C. Microbes	Community structure *	x			
	indicator species	x			
	Productivity	x			
	Biomass	x			
D. Fish	Community structure *	x	x	x	
	Indicator species	x	x	x	
	Health	x	x	x	
E. Abiotic	Salinity				x
	Depth	x			
	Temperature	x			x
	Transparency	x			x
	Photosynthetically active radiation (PAR)	x			x
	Dissolved oxygen	x			x
	Nutrients	x			
	DOC	x			
	DON	x			
	DOP	x			
	TN:TP	x			
	Inorganics	x			
	SMP	x			
	Current speed & direction	x			x
	Meteorological readings				x
	Contaminants	x			
	Coliphage	x			
	Coprostanol	x			
	BOD	x			
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.					

Coral Reef

Coral Reef		Sampling Methods										
Indicators	Measure	Suction device	Photos-transect/ grid	Diver Count	Artificial substrates	Baited transect	Hard bottom sample	Visual-transect/ grid	Historical-area photo	Hook and line	Diver collection	
A. Macroinvert	Community structure *	x		x	x							
	Presence/absence indicators	x	x	x	x	x						
	Indexes of community health	x		x	x							
	Urchin density		x					x				
	Density bioeroding sponges		x	x				x				
	Sponge health (qualitative)		x					x			x	
	<i>G. ventalina</i> health		x					x			x	
B. Corals	% live coral		x					x				
	% algal abundance		x					x				
	Disease identification									x		
	% coral heads disease							x				
	Diseases presence/absence							x				
	Qualitative coral assessment		x					x				
	Physical damage		x					x	x			
	Presence/absence indicators		x					x				
	% coral cover		x					x				
	Community structure *		x					x				
	Size frequency distribution		x					x				
C. Fish	Trophic state index		x					x				
	Community structure *		x							x	x	
	Relative species abundance keystone predators		x					x			x	
	Relative species abundance herbivores		x					x			x	
	Presence/absence indicators keystone predators		x					x		x	x	
	Presence/absence indicators herbivores		x					x		x	x	
	Individual health					x		x		x	x	
D. Macroalgae	% cover		x					x				
	Species		x					x			x	
E. Forams	Community structure *	x		x	x		x					
	Presence/absence indicators	x		x	x		x					
	Indexes of community health	x		x	x		x					

Coral Reef

Indicators	Measure											
		Suction device	Photos-transect/ grid	Diver Count	Artificial substrates	Baited transect	Hard bottom sample	Visual- transect/ grid	Historical-area photo	Hook and line	Diver collection	
F. Abiotic	Salinity											
	Dissolved oxygen											
	Depth											
	Turbidity											
	pH											
	Nutrients											
	Secchi											
	Temperature											
	Location (lat long)											
	Date											
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.												

Mud bottom; >40% silt clay

Mud bottom; >40% silt clay			Sampling Methods								
Indicator	Tag	measure	Cores	Grabs	Trawl	Seine	Epibenthic sled	Dropnet	Stains	Respiration chamber	
A. Macroinvertebrate infauna	*	Community structure *	x	x							
	*	Indicator species	x	x							
		Contaminant body burden	x	x							
		Reproductive stage/fecundity	x	x							
B. Macroinvertebrate epifauna (not necessary)	*	Community structure *	x	x	x		x				
	*	Indicator species	x	x	x		x				
		Contaminant body burden	x	x	x		x				
		Reproductive stage/fecundity	x	x	x		x				
C. Microalgae		Chlorophyll/phaeophytin	x	x (8 cm)							
		C14 primary production	x	x (8 cm)							
		Productivity ratio								x	
		Presence/absence	x	x (8 cm)							
		Density/volume	x	x (8 cm)							
		Community structure *	x	x (8 cm)							
		Algal cysts	x	x (8 cm)							
D. Foraminiferans		# /unit wt	x	x							
		Indicator species	x	x							
		Gross taxonomy							x		
		Morphological anomalies	x	x							
		Stratigraphy	x	x							
E. Demersal fish		Catch/unit effort			x	x	x	x			
		#/area			x	x	x	x			
		Community structure *			x	x	x	x			
		Sex & fecundity			x	x	x	x			
		Disease presence/absence			x	x	x	x			
F. Bacteria/protozoa/viruses		Indicator species		x							
G. Abiotic	*	Sediment grain size	x	x							
	*	Organic content (TOC, AFDW)	x	x							
	*	Eh, RedoxPotential Depth	x								
		Pore water chemistry	x								
	R	Sediment Oxygen Demand	x								
		Productivity ratio/community metabolism									
		Sediment contaminants	x	x							
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.											

Submerged aquatic vegetation (SAV)				Sampling Methods											
Indicator	Tag	Measure	Visual	Photo	Quadrat	Core	Clip	Transect	Line intercept	Tissue	Throw net/trap	Roller frame	Seine	Scrape	
A. SAV		Presence/absence	x	x	x										
		Community structure *	x	x		x									
		Biomass				x	x								
		Shoot/plant count			x			x							
		Shoot/plant density			x			x							
		% cover			x				x						
		Health:													
	R	Disease, lesions	x												
		Epiphyte load	x							x				x	
		Depth of deepbed edge	x												
		Morphometrics:													
		Blade length,width				x									
		Canopy height				x									
		Isotope analysis								x					
		C:P:N ratios								x					
	R	Carbohydrate/sugars								x					
B. Macroinvert		Community structure *				x					x	x			
	R	Presence/absence indicators				x					x	x			
	R	Biomass				x									
	R	Group ratios				x					x	x			
C. Fish		Presence/absence indicators	x								x	x	x		
		Community structure *	x								x	x	x		
	R	Trophic state	x								x	x	x		
		Parasites, lesions	x												
D. Macroalgae		Presence/absence indicators	x			x							x		
		Community structure *				x							x		
		Pigment analysis: Chlorophyll <i>a</i> , epiphyte				x							x		
E. Microbial:		Community structure *				x									
(includes		Presence/absence indicators				x									
foraminiferans)		Indexes of community health				x									
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.															

Intertidal grasses

Intertidal grasses (salt marsh)			Sampling Methods										
Indicator	Tag	measure	Chart/survey	Cores	Grabs	Visual	Water bottle grab	Seines/pushnets	Traps	Transects	Sweepnets	Quadrat	Photo
A. Microalgae		Presence/abs indicator		x			x						
		Community structure *		x			x						
		Pigment analysis: Chlorophyll <i>a</i> , epiphyte		x			x						
B. Macroinverts		Community structure *											
	R	Presence/absence indicators		x				x	x	x			
	R	Biomass		x				x	x	x			
	R	Group ratios		x				x	x	x			
	R	Faunal zonation on blades				x							
C. Terrestrial organisms (birds, reptiles,mammals)		Community structure *				x					x		
D. Fish		Catch/unit effort						x	x				
		Community structure *				x		x	x				
		Sex & fecundity						x	x				
		Disease presence/absence				x		x	x				
E. Phytoplankton		Community structure *					x						
		Chlor a/phaeo per size fraction					x						
		Proximate particulate biomass/CNP silicate ratio					x						
F. Macroalgae		Presence/absence indicators											
		Community structure *											
		Pigment analysis: Chlorophyll <i>a</i> , epiphyte											
G. Microbial (bacteria/protozoa / viruses)	R	Indicator species			x								
H. Emergant Vegetation (intertidal)		Presence/absence		x		x						x	
		Community structure *		x		x						x	
		Biomass		x								x	
		Shoot/plant count		x		x						x	
		Shoot/plant density		x		x						x	
		% cover		x								x	
	R	Biochemical/metals		x									

Intertidal grasses

Indicator	Tag	measure	Chart/survey	Cores	Grabs	Visual	Water bottle grab	Seines/pushnets	Traps	Transects	Sweepnets	Quadrat	Photo
A. Abiotic	*	Grain size		x	x								
(same as mud)	*	Organic content (TOC, AFDW)		x	x								
	*	Eh, Redox Potential Depth		x									
		Pore water chemistry		x									
	R	Sediment Oxygen Demand (SOD)		x									
		Productivity ratio/community metabolism											
		Sediment contaminants		x	x								
		Elevation information	x										
		Tidal height/range	x										
		Meteorological info											
		Photosynthetically active radiation (PAR)					x						
		TSS					x						
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.													

Mangroves

Mangroves				Sampling Methods												
Indicator	Tag	Measure	Chart/Survey	Cores	Grabs	Visual	Water bottle grab	Seines/push nets	Traps	Transects	Sweepnets	Quadrat	Photo	Scrapes	Artificial substrates	
A. Birds		Community structure *				x										
B. Semi-terrestrial insects		Community structure *														
C. Epiphytic algae		Biomass														
		Community structure *											x			
		??Conspt sampling rts??				x							x			
D. Macroinverts (epifaunal)		Community structure *						x	x		x					
		Presence/absence indicators						x	x		x					
		Colonization rates													x	
	R	Group ratios						x	x		x					
E. Macroinverts (infaunal)		Community structure *		x												
		Biomass		x												
		Presence/absence indicators		x												
		Group ratios		x												
F. Fish:		Presence/absence indicators				x		x	x							
		Community structure *				x		x	x							
		Trophic state						x	x							
		Disease presence/absence														
G. Microbial: (includes foraminiferans)		Community structure *		x										x		
		Presence/Absence indicators		x										x		
		Indices of community health		x										x		
H Abiotic (between roots)		Physical parameters(DO, pH, etc.)					x									
		Tidal stages/range	x													
		Eh/RDP					x									
		Turbidity					x									
		Physical analysis of trees:														
		Pruned?				x										
		Tree height				x										
		Disease/abnormalities				x										
		Light penetration	x			x										
		Nutrient measurements					x									
		Water chemistry					x									
		Litter fall/decomposition				x		x			x					
*Community structure=species composition & structure;e.g., relative species abundance,diversity,taxa richness																

*Community structure=species composition & structure;e.g., relative species abundance,diversity,taxa richness

Sand bottom; <40% silt clay			Sampling Methods														
Indicator	Measure	Chart/Survey	Cores	Grabs	Visual	Water bottle grab	Seines/push nets	Traps	Trawls	Transects	Sweepnets	Quadrat	Photo	Scrapes	Artificial substrates	Chambers	
A. Microalgae	Presence/absence indicators	x				x											
	Community structure *		x			x											
	Chlorophyll a, epiphyte		x			x											
	C:N:P:Si (phytoplankton)					x											
	Growth estimates														x		
	Bioassays															x	
B. Macroalgae	Community structure *																
	Presence/absence indicators		x														
	% coverage		x														
	Disease/lesions		x		x												
	Epiphytic load		x		x												
	Chl a, epiphyte		x														
C. Fish	Presence/absence indicators				x		x	x	x								
	Community structure *				x		x	x	x								
	Trophic state						x	x	x								
	Parasites, lesions				x		x	x	x								
D. Macroinverts	Community structure *		x	x													
	Presence/absence indicators		x	x													
	Biomass		x	x													
	Group ratios		x	x													
	Trophic analysis		x	x													
E. Microbial (includes foraminiferans)	Community structure *		x														
	Presence/absence indicators		x														
	Indexes of community health		x														
F. Abiotic	Physical parameters (DO, pH...)		x	x													
	Grain size		x	x													
	Organic content (TOC, AFDW)		x														
	Eh, Redox-potential depth		x														
	Pore water chemistry		x														
	Sediment Oxygen Demand (SOD)		x														
	Sediment contaminants		x														
	Tidal height/range	x															
	Habitat analysis	x															
	Turbidity																
* Community structure=species composition & structure; e.g., relative species abundance,diversity,taxa richness																	

* Community structure=species composition & structure; e.g., relative species abundance,diversity,taxa richness.

Hard bottom

Hard bottom			Method also for:			Sampling Methods	
Indicators	Tag	Measure	hard bottom	oyster reef	worm reef	Sampling method 1	method 2
A. Macroinverts		Community structure *	x	x	x	visual/photo transect/quad	traps
		Presence/absence indicators	x	x	x	visual/photo transect/quad	traps
		Indexes of community health	x	x	x	visual/photo transect/quad	traps
	R	<i>G. ventalina</i> health	x			visual/photo transect/quad	
	R	Identify indicator diseases	x	x	x		
		Ratio live:dead oysters/worm tubes		x	x	visual/photo transect/quad	worm tube ratio by "patch"
		Sponge & octocoral density	x			visual/photo transect/quad	
		Oyster condition index		x		grab sample	
		<i>Palythoa</i> % cover	x			visual/photo transect/quad	
		Natural substrate recruitment	x sp&oct		x worms	quads	
		Artificial substrate recruitment		x oysters		substrate	
	R	Acoustic snapping shrimp	x	x	x	microphone	
B. Corals		Presence/absence indicators	x			visual/photo transect/quad	
		% Coral cover	x			visual/photo transect/quad	
		Natural substrate recruitment corals	x			quads	
C. Attached macroalgae		Cover- % or Braun-Blanquet	x	x	x	visual/photo transect/quad	above threshold
		Community structure *	x	x	x	visual/photo transect/quad	excess greens
D. Drift algae		Cover- % or Braun-Blanquet	x	x	x	visual/photo transect/quad	
		Indicator species	x	x	x		

Hard bottom

Indicators	Tag	Measure	Hard bottom			Sampling method 1	method 2
			hard bottom	oyster reef	worm reef		
E. Fish		Indicator species	x		x	transect/quads/traps; audio measure for toadfish, seatrout, croakers & drums	
		Community structure *	x		x	visual/photo transect/quads/traps	
		Trophic state index	x		x	visual/photo transect/quads/traps	
		Presence/absence indicators	x		x	visual/photo transect/quads/traps	
		Growth rate (otolith) of territorial species	x	x	x	diver/hook&line	
		Individual health	x		x	diver/hook&line; visual/photot transect	
		Parasite fauna	x		x	diver/hook&line	
		Fecundity	x	x **	x	trap, net, etc	diver
F. Benthic foraminiferans		Live assemblages - stained	x			diver or suction	
		Dead assemblages	x			diver or suction	
		Total assemblages	x			diver or suction	
		Indicator spp/taxa	x			diver or suction	
		Morphological anomalies	x			diver or suction	
G. Abiotic		Salinity	x	x	x		
		Temperature	x	x	x		
		pH	x	x	x		
		Dissolved oxygen	x	x	x		
		Turbidity	x	x	x		
		Sediment particle size	x	x	x	traps or crevices	
		Nutrients	x	x	x		
	R	Acoustics from outside sources (shipping, etc.)	x	x	x		
		Body burden contaminants					
		Historical coverage of reef		x	x		
* Community structure = species composition and structure; e.g., relative species abundance, diversity, taxa richness.							
** (eggs in shells)							

Field Priorities-Sampling metho

	Method 1	Method 2	Method 3
Water column	Water sampler	Paired phyto/zooplankton net-333 &	Neuston - 333
Open mud	Young vs ponar vs diver core across sediment gradient	Beam trawl	Epibenthic sled
Sand bottom	Young vs ponar vs diver core across sediment gradient	Beam trawl	Epibenthic sled
SAV	Quad/diver core transect	Trawl	Throw trap
Coral reef	Visual quadrat	Video	Suction
Intertidal grasses	Quad/diver core transect	Block net	Throw cylinder
Mangroves	Consumptive root sampling	Non-consumptive root sampling	Semiterrestrial visual
Hard bottom, oyster/worm reef	Visual quadrat	Video h&w	Traps
Need to consider system process in the different habitats; e.g, detrital decomposition, nutrient cycling, ATP			