

Vital Sign: Periphyton (Freshwater)

[shortened name: Periphyton]

Parks Where Vital Sign will be Implemented:

BICY – SFCN implements monitoring in NW BICY,
EVER – SFCN summarizes reports from existing monitoring program,
BISC - deferred

Justification/Issues being addressed: Periphyton ranked 17th among the 44 SFCN vital signs. Periphyton is a critical primary producer base of the food web in South Florida non-forested wetlands and estuarine areas. Periphyton production can exceed phytoplankton; it stabilizes the sediments, controls nutrient upwelling, and changes compositionally in direct response to salinity and water management (quality, quantity, duration). Periphyton composition reflects changes over a period of time and thus may provide a better indicator of changes in hydroperiod or nutrients than monthly water quality measurements or depth measurements.

General Monitoring Questions to be Addressed by the Vital Sign:

- What are the status and trends in periphyton community composition, structure, and nutrient content, especially in response to alterations in water quality and water management (quantity, timing, duration)?

Measures:

Community composition & structure, biomass, organic/inorganic (calcite) content, nutrient content

Basic Approach:

Periphyton is easily collected as part of monitoring for other indicators but travel costs would prohibit monitoring it in isolation. Thus periphyton monitoring would be conducted in concert with monitoring for “Freshwater fish and large macro-invertebrates” vital sign and could also be collected together with coastal wetland monitoring (e.g., Vital Signs “Mangrove-Marsh Ecotone,” “Coastal Geomorphology”)

Use of periphyton to monitor changes in hydroperiod and nutrient status is still in its early stages. Current work appears very promising but the relationships with hydroperiod, nutrient status are still being developed and refined. Diatoms tolerant of freshwater versus saltwater are well documented. Andy Gottlieb has shown a relationship between hydroperiod and changes in the diatom community. The Department of Environmental Protection has commissioned development of relationships between algal community and nutrient levels that is expected in 2008. Pilot studies will be needed to estimate variability and sample sizes needed. SOPs for collection procedures already exist with SFWMD.

Although estimates at sample size are loose at best, for planning purposes we are assuming about 75 samples per year will be needed per area mentioned below.

Shark River Slough and Taylor Slough

SFCN is assuming that CERP MAP funded monitoring of these areas through Evelyn Gaiser of FIU and Scott Hagerthey of SFWMD is sufficient. SFCN hopes to get copies of the reports for this monitoring or provide links to CERP's web pages regarding this indicator. Approximately 125 samples are being conducted annually from Shark River Slough through the Water Conservation Areas to Lake Okeechobee with about 24 inside Everglades National Park. We are aware of no effort to date to conduct a power analysis to determine if this level of sampling is adequate.

Big Cypress

Periphyton in northwestern Big Cypress will be monitored by SFCN in concert with monitoring freshwater fish and macro-invertebrates in freshwater prairies and marshes, i.e. periphyton samples would be taken at the same time as fish sampling occurs to save on the considerable travel costs (helicopter). A single monitoring protocol "Freshwater Fish, invertebrates, and periphyton" will be developed. The sampling design should at a minimum be designed to detect changes due to alterations in hydrology and nutrients to the north and northwest of the park.

A pilot study is needed to determine the range of variability in periphyton in the area and estimate appropriate sample sizes. If monitoring can be cost-effectively expanded into other areas of Big Cypress, SFCN will explore doing so.

Other areas:

Currently there is not sufficient funding, but additional areas for expansion in the future in order of priority would include: Biscayne Coastal Wetlands, EVER's marl prairies, and Florida Bay coastal wetlands.

Principal Investigators/Key Contacts and NPS Lead:

- Kevin Whelan, National Park Service, South Florida/Caribbean Inventory and Monitoring Network. Kevin_R_Whelan@nps.gov, 305-252-0347 [NPS Lead]
- Julie Espy, Department of Environmental Protection, 850-245-8185
- Evelyn Gaiser, Florida International University, SE Environmental Research Center, University Park, OE 167, Miami, FL 33199, 305-348-6145, gaisere@fiu.edu
- Scott Hagerthey, SFWMD, 3301 Gun Club Road, West Palm Beach, FL 33406, (561) 681-2563, shagerth@sfwmd.gov,
- Jennifer B. Zimmerman, South Florida Water Management District, Everglades Research Division, Westhorp & Associates, Inc., 561.686.8800 x4550, 561.681.6310 fax, jzimmerm@sfwmd.gov

Development Schedule, Budget, and Expected Interim Products:

This vital sign will be developed and implemented in concert with the freshwater fish and large macro-invertebrates vital sign. SOPs already exist with the South Florida Water Management District for collection procedures. SFCN will develop a "Freshwater fish, invertebrates, and periphyton" protocol in 2008-2011 with implementation in 2012 in Big Cypress National Preserve only. Current estimates from possible contractors to

analyze the periphyton samples for algal composition & dominance is \$400/sample + \$65.34/sample for FIU to analyze the sample for total phosphorous, total nitrogen and total carbon (total calcium costs were not listed). Although pilot studies have not been done to estimate sample sizes, for planning purposes, assuming 75 samples/year each in BICY, costs to analyze samples will be \$34,900.50. Samples will need to be divided and mailed (.5 week/year) plus data will need to be analyzed and reported (.5 week/year). Additional time estimates involving separating and counting aquatic invertebrates is covered under a separate vital sign. Links to the CERP monitoring and reports will begin as soon as feasible but no latter than 2011.

Expected SFCN staff time requirements once program is fully implemented in 5 years:

SFCN Staff	Full Time Equivalent (FTE)
Coordinator	
Marine Ecologist	
Fisheries Biologist	
Marine Biologist Technician (So FL)	
Marine Biologist Technician (VI)	
Community Ecologist	
Wildlife Technician (Wildlife)	0.02
Wildlife Technician (Vegetation)	
Quantitative Ecologist	
Data Manager	0.02
GIS/Data Tech	
Interns	
SFCN Total	0.04

References

- Davis, S. M., W. F. Loftus, E. E. Gaiser and A. E. Huffman. 2006. Southern marl prairies conceptual ecological model. *Wetlands* 25: 821-831
- Gaiser, E. E., J. H. Richards, J. C. Trexler, R. D. Jones and D. L. Childers. 2006. Periphyton responses to eutrophication in the Florida Everglades: Cross-system patterns of structural and compositional change. *Limnology and Oceanography* 51: 617-630.
- Gottlieb, A., J. H. Richards and E. E. Gaiser. 2005. The effects of desiccation resistance and rewetting on the community structure of Everglades periphyton. *Aquatic Botany*. 82: 99-112.
- Gaiser, E. E., J. C. Trexler, J. H. Richards, D. L. Childers, D. Lee, A. L. Edwards, L. J. Scinto, K. Jayachandran, G. B. Noe and R. D. Jones. 2005. Cascading ecological effects of low-level phosphorus enrichment in the Florida Everglades. *Journal of Environmental Quality* 34: 717-723.
- Gaiser, E. E., M. J. Brooks, W. Kenney, C. L. Schelske and B. E. Taylor. 2004. Interpreting the hydrologic history of a temporary pond using siliceous microfossils. *Journal of Paleolimnology* 31: 63-76.
- Donar, C. M., K. W. Condon, M. Gantar and E. E. Gaiser. 2004. A new technique for examining the physical structure of Everglades floating periphyton mat. *Nova Hedwigia* 78: 107-119.

- Gaiser, E. E., L. J. Scinto, J. H. Richards, K. Jayachandran, D. L. Childers, J. D. Trexler and R. D. Jones. 2004. Phosphorus in periphyton mats provides best metric for detecting low-level P enrichment in an oligotrophic wetland. *Water Research* 38: 507-516.
- Thomas, S. E., E. E. Gaiser, M. Gantar, A. Pinowska, L. J. Scinto and R. D. Jones. 2002. Growth of calcareous epilithic mats in the margin of natural and polluted hydrosystems: phosphorus removal implications in the C-111 basin, Florida Everglades, USA. *Lake and Reservoir Management* 18: 323-329.
- Noe, G. B., D. L. Childers, A. L. Edwards, E. E. Gaiser, K. Jayachandran, D. Lee, J. Meeder, J. Richards, L. J. Scinto, J. C. Trexler and R. D. Jones. 2001. Short-term changes in phosphorus storage in an oligotrophic Everglades wetland ecosystem receiving experimental nutrient enrichment. *Biogeochemistry* 59: 239-267.
- Hall, R. O., S. E. Thomas and E. E. Gaiser. In Press. Measuring freshwater primary production and respiration. In T. Fahey and A. Knapp (Eds.) *Principles and Standards for measuring Net Primary Production in Long-Term Ecological Studies*. Oxford Press, UK.
- Gaiser, E. E., A. Wachnicka, P. Ruiz, F. A. Tobias and M. S. Ross. 2004. Diatom indicators of ecosystem change in coastal wetlands. In S. Bortone (Ed.) *Estuarine Indicators*. CRC Press, Boca Raton, FL. pp. 127-144.
- Ross, M. S., E. E. Gaiser, J. F. Meeder and M. T. Lewin. 2001. Multi-taxon analysis of the "white zone", a common ecotonal feature of South Florida coastal wetlands. In Porter, J. and K. Porter (Eds). *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys*. CRC Press, Boca Raton, FL, USA. pp. 205-238.
- Childers, D. L., R. D. Jones, J. C. Trexler, C. Buzzelli, J. Boyer, A. L. Edwards, E. E. Gaiser, K. Jayachandran, D. Lee, J. F. Meeder, J. Pechmann, J. H. Richards and L. J. Scinto. 2001. Quantifying the effects of low level phosphorus enrichment on unimpacted Everglades wetlands with in situ flumes and phosphorus dosing. In Porter, J. and K. Porter (Eds). *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys*. CRC Press, Boca Raton, FL, USA. pp. 127-152.