EPIPHYTE ACCUMULATION RATES AND EPIPHYTIC LIGHT ATTENUATION ALONG A PRODUCTIVITY GRADIENT IN FLORIDA BAY

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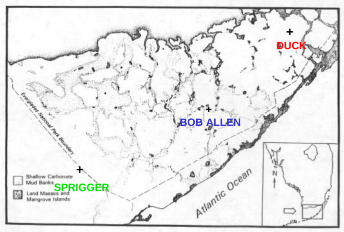

Figure 1. Location Map of Florida Bay sites.

INTRODUCTION

The recent decline of seagrasses worldwide is most often attributed to cultural eutrophication of coastal areas resulting in decreased water clarity and higher epiphyte loading on the seagrass leaves (Orth and Moore, 1983; Silberstein et al., 1986; Giesen et al., 1990, Larkum and West, 1990). Seagrass growth models indicate that ambient light and those factors affecting light levels at the leaf surface are the principal factors determining the distribution of seagrasses (Wetzel and Neckles, 1986; Madden and Kemp, 1996; Buzzelli et al., 1998).

Previous investigations in Florida Bay revealed large gradients in benthic vegetation (Zieman et al., 1989), water column nutrient concentrations (Fourqurean et al., 1993; Boyer et al., 1997), and seagrass epiphyte levels (Frankovich and Zieman, 1994; Frankovich and Fourqurean, 1997). Phosphorus availability accounts for most of the baywide variation in phytoplankton levels (Fourqurean et al., 1993; Phlips and Badylak, 1996) and in the biomass of *Thalassia testudinum* (Fourqurean et al., 1992a, b) and for some of the regional variation in epiphyte loads (Frankovich and Fourqurean, 1997). This investigation aims to quantify epiphyte accumulation rates in Florida Bay along a nutrient availability gradient and quantify the effect of epiphyte loading on light transmission to the leaf surface.

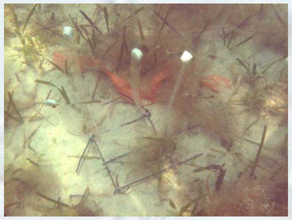

Figure 2. Mylar seagrass mimic array.

METHODS - Epiphyte Loads

* Mylar seagrass leaf arrays placed along nutrient availability gradient (Fig. 1).
* "Leaves" sampled at varying periods up to approximate seagrass leaf turnover period.
* Epiphyte material removed with razor blade.
* Epiphytes were freeze-dried then weighed.
* Epiphyte chl-a concentrations were determined fluorometrically.

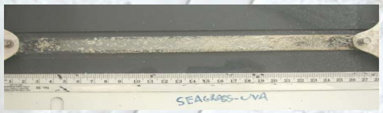

Figure 3. Light attenuation measurement apparatus, "LAMA", with Mylar leaf fouled by diatoms and adhered sediment, Bob Allen, 71 days

Epiphyte Light Transmission

* Light (PAR) transmission measured at seven locations along Mylar "leaves" (i.e., 3, 6, 9, 12, 15, 18, and 21 cm) through epiphytized and clean reference strips (same leaf locations) using the underwater light attenuation measurement apparatus (Figs. 3, 4) (Stankelis et al., 1999).
* Light transmission to the leaf surface for one-sided samples (filamentous algae)was calculated as: PAR transmission (one-sided sample) divided by PAR reference, I/I_0.
* For two-sided samples (diatoms, coralline algae)the epiphyte material on each side acts as a separate filter; therefore epiphyte light transmission was calculated as: the square root of PAR transmission (two-sided sample)/PAR reference, square root (I/I_0).
* The total epiphyte loads associated with the measured epiphyte light transmissions were measured from 3 cm long sections of the Mylar leaves surrounding the point of light measurement.

Figure 4. "LAMA" with Mylar leaf fouled by *Polysiphonia binneyi*, Duck, 73 days

Figure 5. Epiphytic diatom community developing on Mylar leaf mimic.

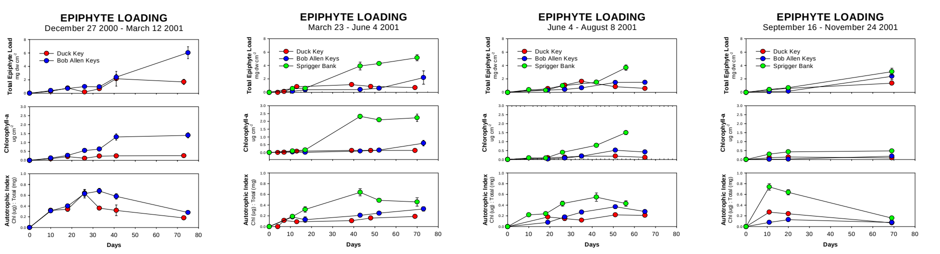

Figure 6. Epiphyte Loading Characteristics.

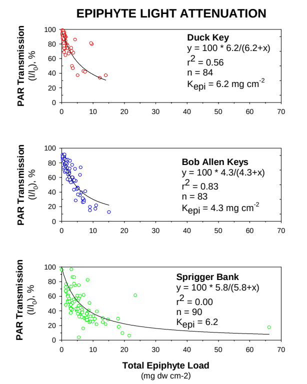

Figure 7. Epiphytic Light Attenuation.

Epiphyte Accumulation - Observations

* Epiphyte accumulation rates increase towards GOM, consistent with nutrient and productivity gradient.
* Highest epiphyte loading observed during winter-spring consistent with epiphyte loads on natural *Thalassia testudinum*.
* Depressed epiphyte accumulation rates at start of incubation suggest substrate-conditioning period.
* Epiphyte primary producers reach greatest relative abundance on middle-aged "leaves"

Theoretical Epiphyte Light Transmission Relationship

T = Tm * E / (Kepi + E)

T = Epiphyte light transmission

T_m = Maximum epiphyte light transmission (100%)

E = Total epiphyte load

K_{epi} = epiphyte half-transmission coefficient

Epiphyte Light Attenuation – Preliminary Results

* Full range of epiphyte loading only captured during winter-spring.
* Rectangular hyperbolic decay equations capture the majority of variation of epiphyte light transmissions observed during winter-spring (Duck and Bob Allen).
* Adaptation of half-saturation coefficients (e.g., bacterial growth, enzyme-catalyzed reactions) show promise for use in comparing epiphyte community light transmission characteristics.

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