DETERIORATION OF FLORIDA’S SPRING-FED COASTAL RIVERS: CAUSES AND CONSEQUENCES

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WEEKI WACHEE SPRINGS

Data provided by the Southwest Florida Water Management District and UF
Is increased nutrient delivery compromising the ecological integrity of Florida’s spring-fed coastal rivers?
Increased nitrate concentrations

Homosassa

Chassahowitzka
Concomitant declines in plant biomass

Homosassa

Chassahowitzka
Periphyton loads on remnant plant populations have increased 4-fold.
EUTROPHICATION PROGRESSION SCHEME

INCREASED NUTRIENT DELIVERY

GRAZING

ENHANCED MICROALGAL AND MACROALGAL GROWTH

INCREASED SHADING AND BENTHIC RESPIRATION

MACROPHYTIE LOSS

Adapted from C.M. Duarte (1995)
The Nitrogen-Limitation Hypothesis

Increasing NO$_3^-$ concentrations in Florida springs have alleviated nutrient limitation, promoting higher growth rates of algae that have led to the proliferation of macroalgal blooms in Florida springs.
Challenges to the Nitrogen-Limitation Hypothesis

Adapted from Heffernan et al. 2010. Ecological Applications
Poor relationship between nitrate concentration and algal cover

From Heffernan et al. 2010
nutrient enrichment appears to have preceded establishment of algal mats by a considerable period

From Heffernan et al. 2010
Nutrient addition experiments conducted in mesocosms or in spring systems provide little evidence for N-limitation of algae

- Kings Bay (Cowell and Botts 1995)
- Weeki Wachee (Frazer et al. 2001)
- Homosassa (Frazer et al. 2001)
- Crystal River (Frazer et al. 2001)
- Chassahowitzka River (Notestein et al. 2003)
- 27 Springs (Stevenson et al. 2004)
- Silver Glenn (PBS&J 2007)
- Alexander Springs (PBS&J 2007)

From Heffernan et al. 2010
And finally....

mass balance calculations for N in spring systems suggests that N fluxes exceed autotrophic demand even under historic conditions.

From Heffernan et al. 2010
Other factors influencing the ecology of coastal spring-fed systems
Discharge by Time Period

Homosassa

Chassahowitzka
Salinity by Time Period

Homosassa

Chassahowitzka
Salinity influences the abundance and distribution of SAV

Figure 4. Relations between macroalgae biomass, macrophyte biomass and salinity in three Florida Gulf coast rivers.

Distribution of *Vallisneria americana*
Conclusions

- nitrate concentrations are increasing
- submersed aquatic vegetation is declining
- increased periphyton loads on remnant plant populations
- reductions in spring discharge are apparent
- increased salinities will further impact the abundance and distribution of SAV in Florida’s coastal, spring-fed rivers
Acknowledgments