Spatio-Temporal Dynamics of SAV Abundance and Water Quality in the Mangrove Lakes Region of Florida Bay

Thomas A. Frankovich[1], James W. Fourqurean[1], Douglas Morrison[2]

[1] Florida International University
[2] Everglades National Park

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Where are the Mangrove Lakes?
USGS

Importance

Wintering area for waterfowl

Ruppia maritima

Blue-winged teal

American coot

Extensive SAV beds (historically)

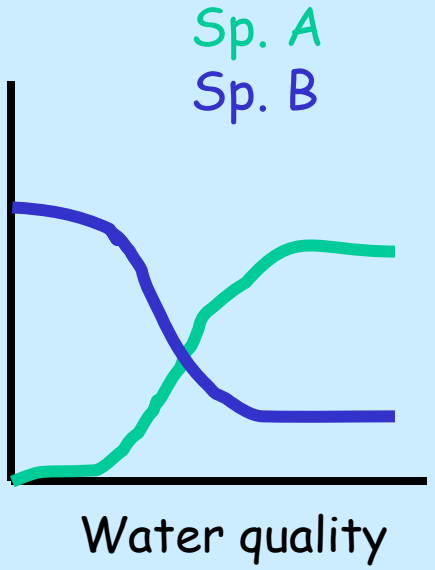
Critical habitat for American crocodile

Photos courtesy D. Chalfant, naturepicsonline, AnimalPlanet

Study Objectives

To identify relationships between water quality and benthic macrophytes

To use the identified relationships to predict changes in benthic macrophyte distribution and abundance that may result from changes in water quality produced by restoration efforts



Methods

SAV % cover, quarterly (41 sites)

- 1/4 m^2 quadrat (5% intervals)
- all benthic macrophytes
- 15 replicates per site

WQ monitoring, monthly

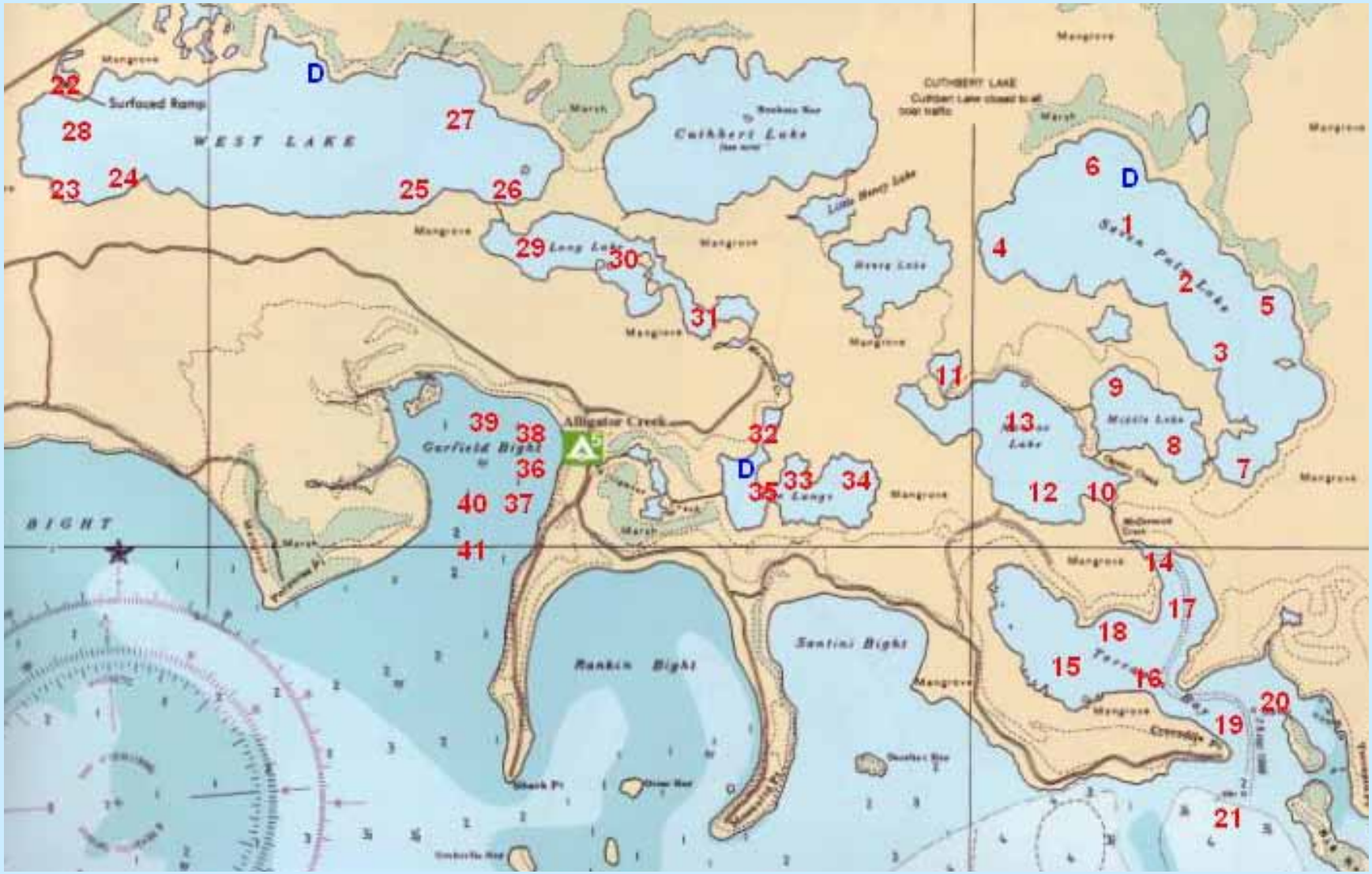
- temp, sal, water depth, secchi depth (41 sites)
- TotN, TotP, Phytoplankton chl-a (each basin –8 sites)

Hourly water temperature, salinity, and water level

- datasondes in West Lake, The Lungs, 7 Palms Lake

Data collection ongoing – April 2006 – April 2009

Study Sites


WEST LAKE
Cuthbert Lake
CUTHBERT LAKE
Alligator Creek
Garfield Bight
Rankin Bight
Santini Bight
BIGHT
Surfaced Ramp
Mangrove
Marsh
D
22
28
23
24
27
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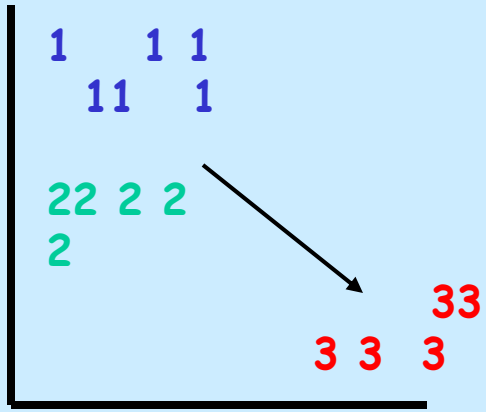
Statistics

Exploratory statistics

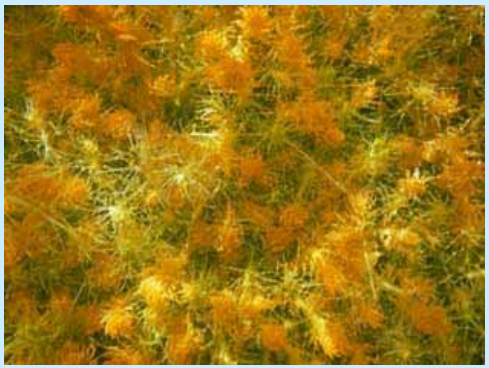
- Cluster analysis
- NMS ordination
- Regression analyses



Statistical model

- Discriminant Function Analysis
- Logistic Regression

Results – Benthic macrophytes



Chara hornemanni

Halodule wrightii

Batophora oerstedii

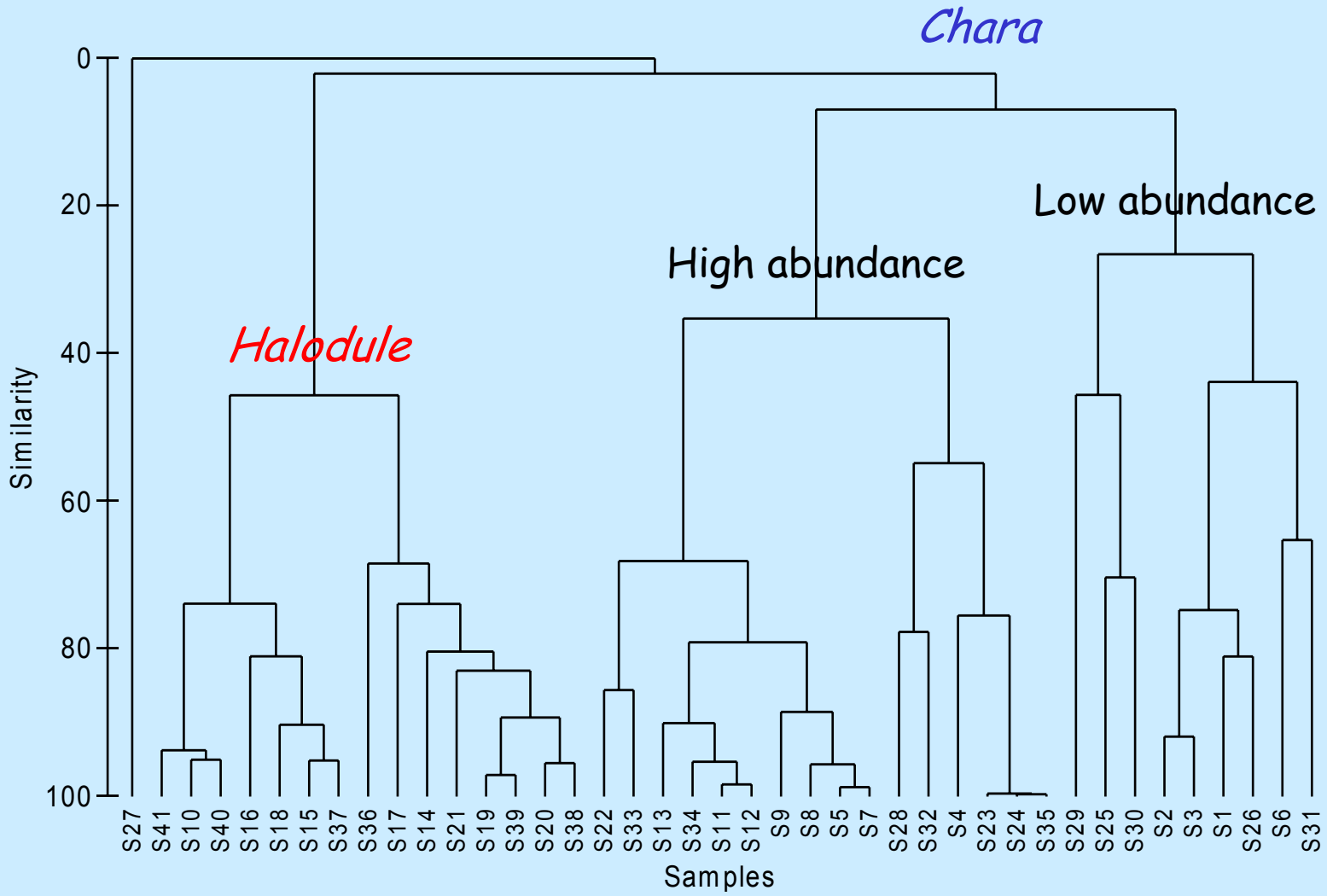
Acetabularia sp.

	Chara	*Hal.*	*Bat.*	*Ruppia*	*Acet.*	Other
Prevalence (%)	46	39	30	20	11	8
Rel. abundance (%)	58	30	9	2	<1	<1

Chara and Halodule dominate species assemblages

Other – *Halimeda incrassata, Penicillus capitatus, Sargassum pteropleuron,Laurencia sp., Thalassia testudinum, Polysiphonia sp., Caulerpa prolifera, Rhizophora mangle*

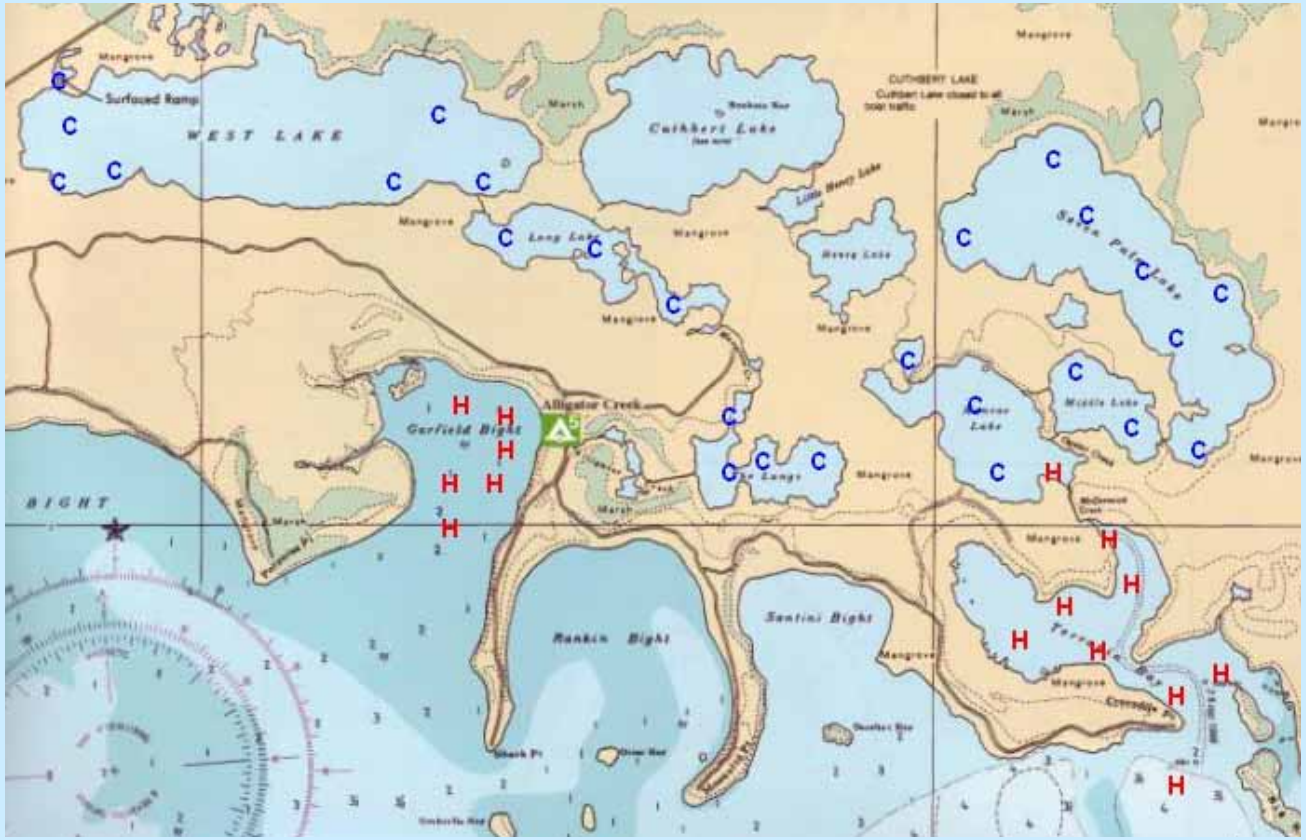
Results – Benthic macrophytes



Sites grouped according to differences in community structure

Results – Benthic macrophytes

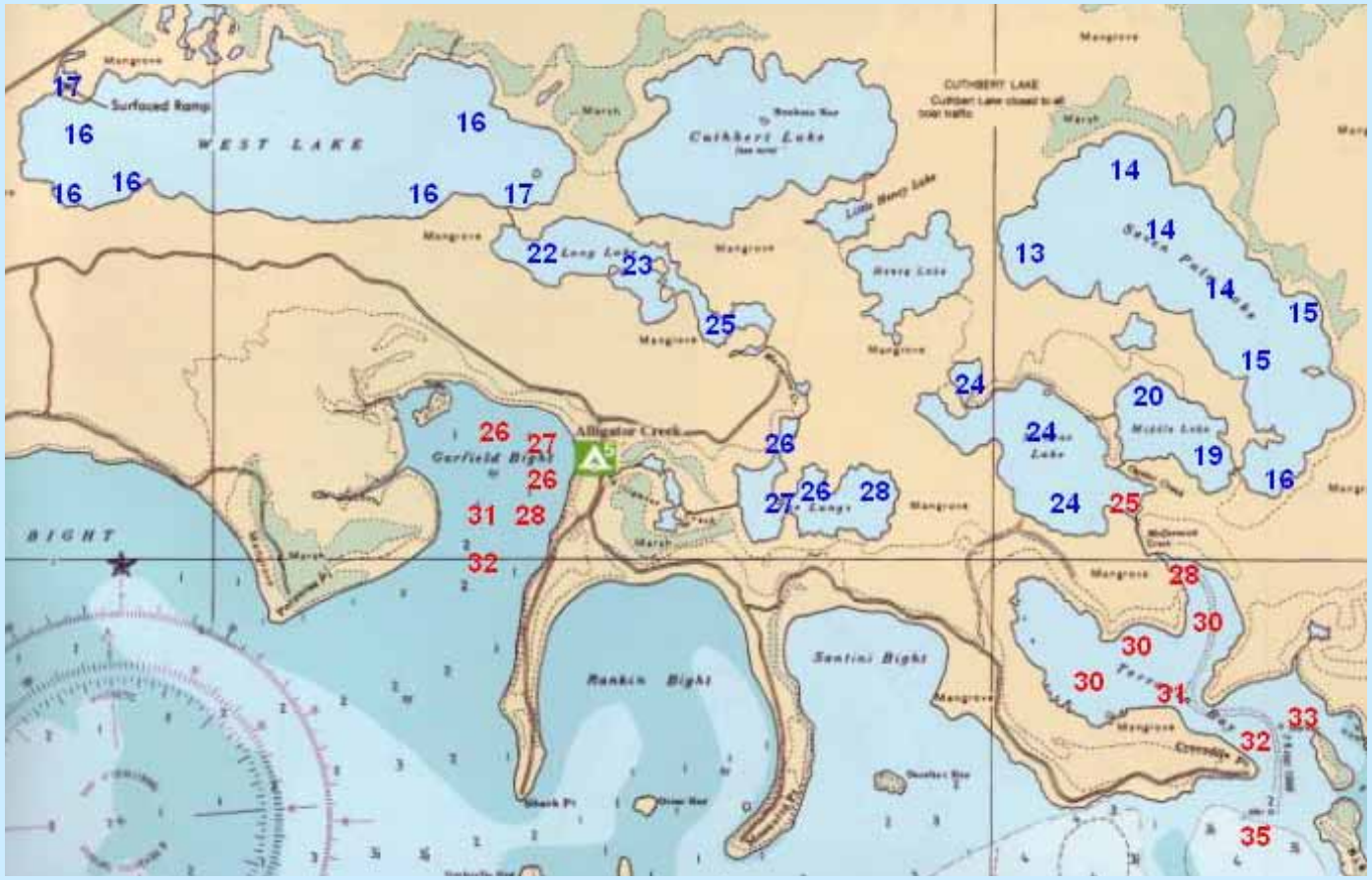
Species distribution



Chara characterizes upstream lakes
Halodule characterizes coastal embayments

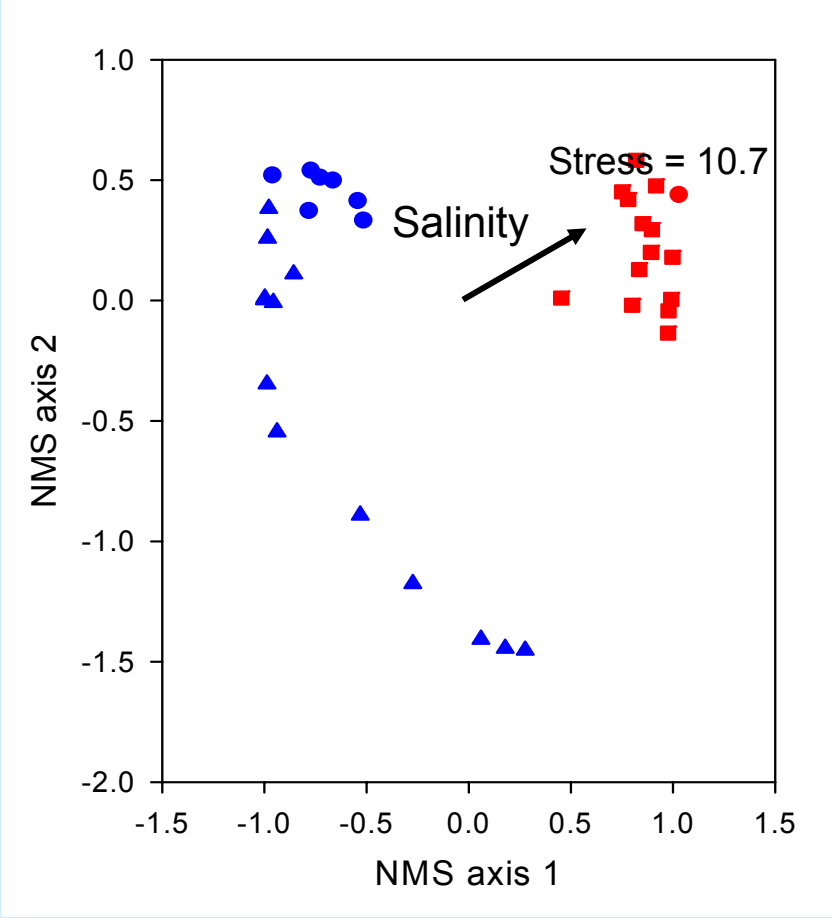
Results – Benthic macrophytes, salinity

Salinity distribution (mean 2006 – 2008)



Species (Chara, Halodule) differentiate along salinity gradient

Results – Benthic macrophytes



Chara
Halodule

■ Florida Bay

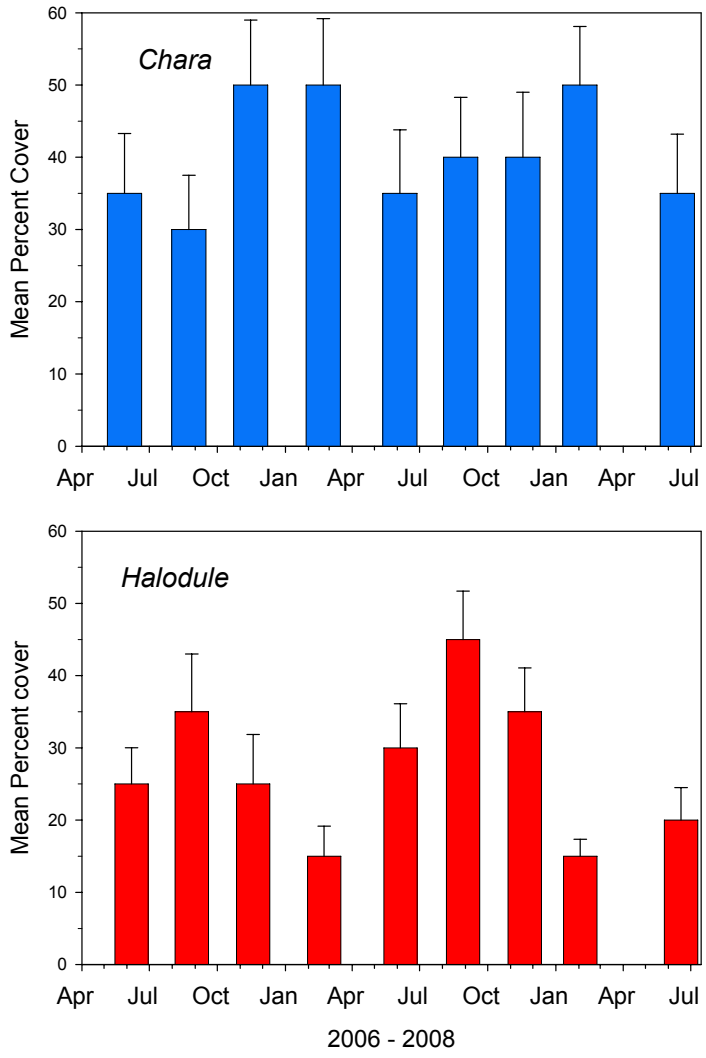
▲ West system

● 7 Palms system

Salinity $r^2 = 0.65$

Differences in community structure are evident between Florida Bay sites, West system sites, and 7 Palms sites.

Results – Benthic macrophytes

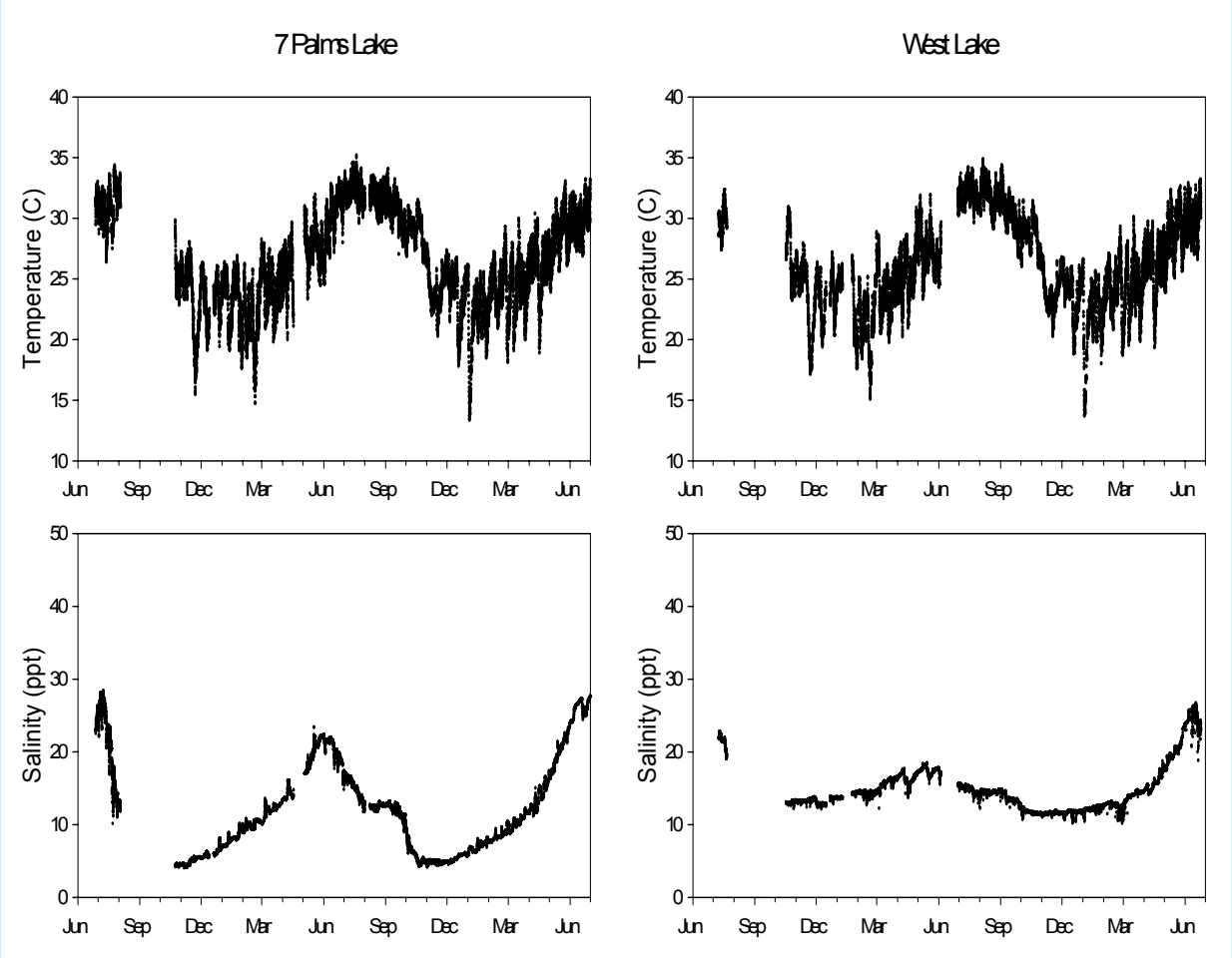


Chara percent cover is minimum in summer and fall and peaks in winter and spring.

Halodule percent cover is minimum in winter and spring and maximum in summer and fall.

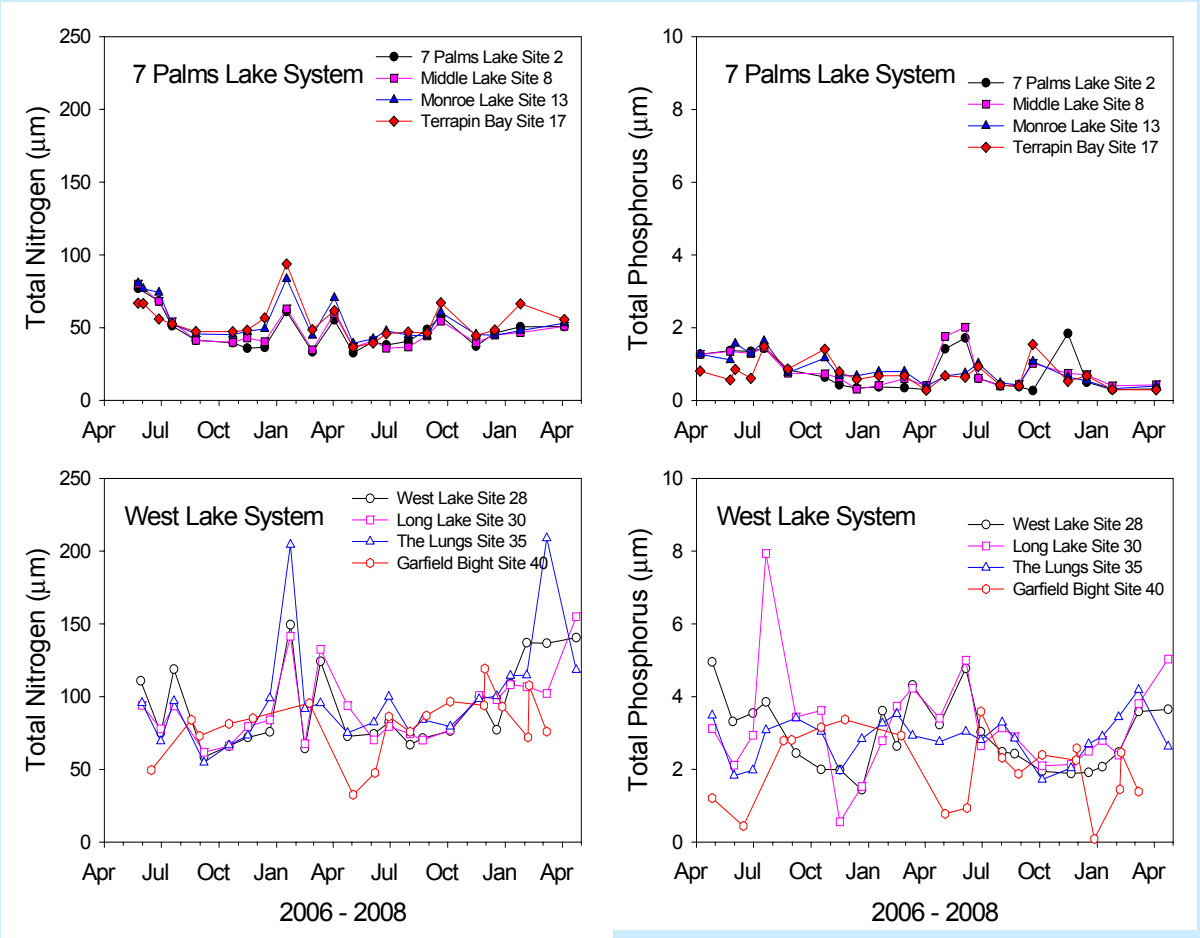
Seasonality is evident in *Chara* and *Halodule*, but timing is asynchronous.

Results – Temperature, salinity



Water temperature – maximum in summer, minimum in winter
salinity increases during dry season (winter-spring), decreases during summer and fall.

Results – Nutrients

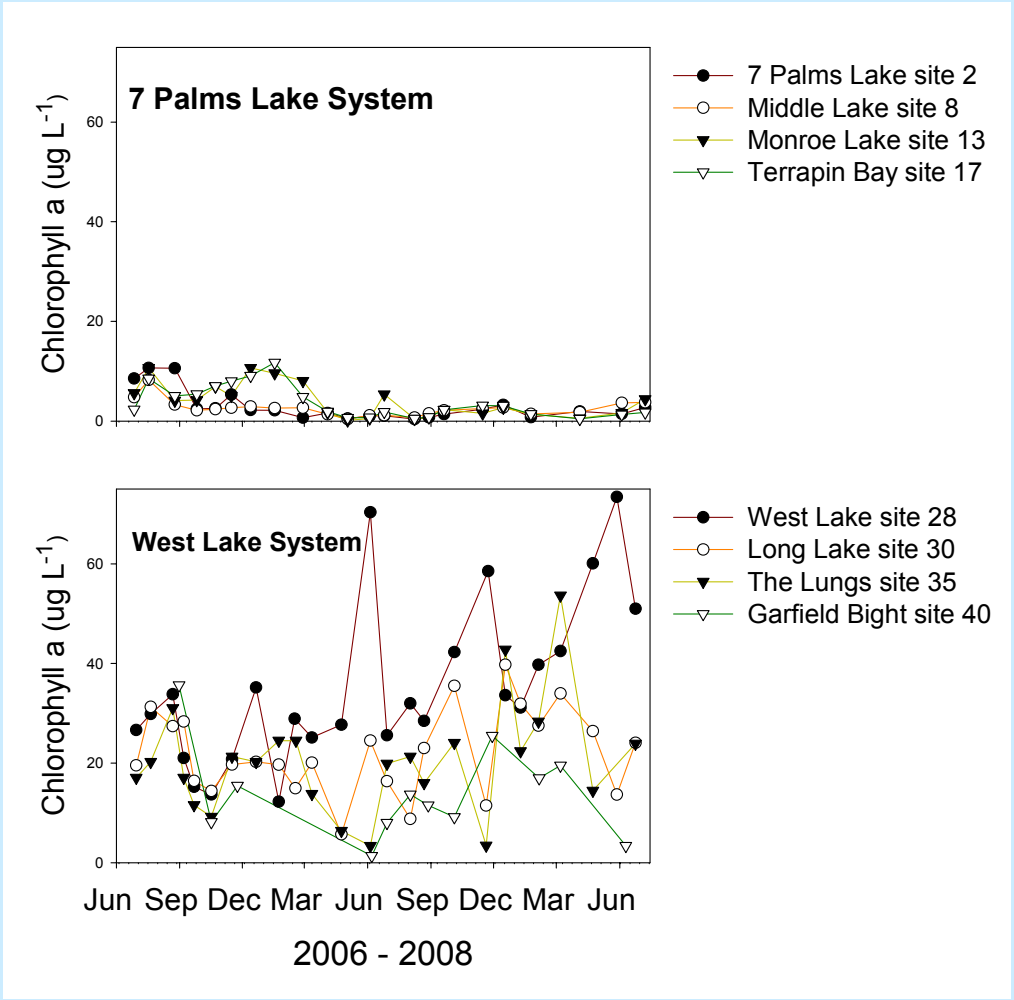


N:P ≈ 90:1

N:P ≈ 30:1

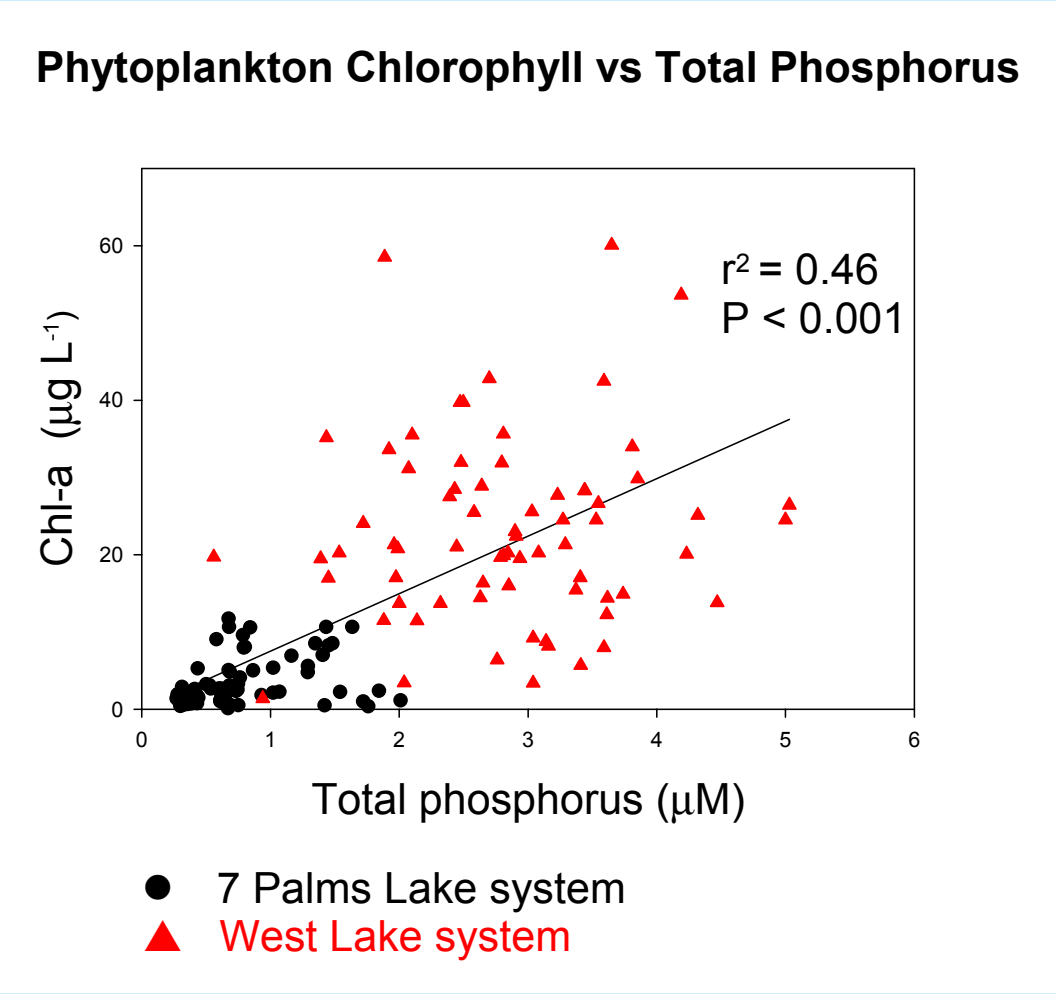
Spatial variation in nutrient concentrations more evident than seasonal variation. More nutrients in West Lake system. Phosphorus limitation less severe in West Lake system.

Results – phytoplankton



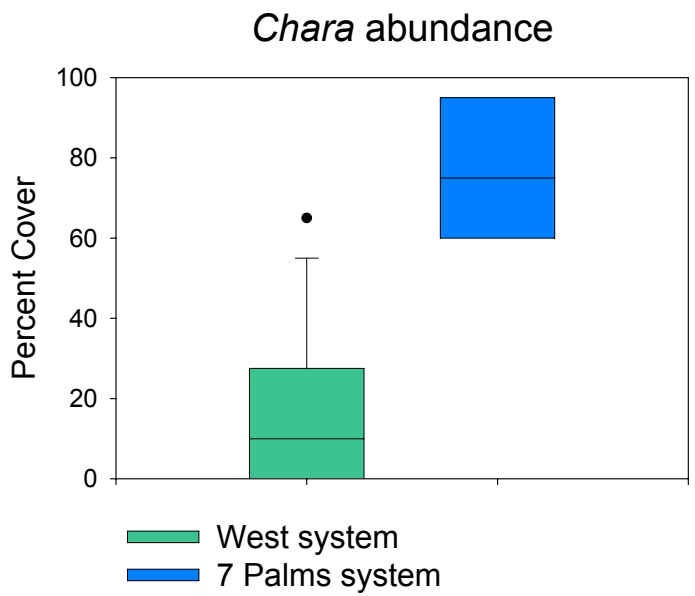
Phytoplankton abundances 6X greater in West Lake system

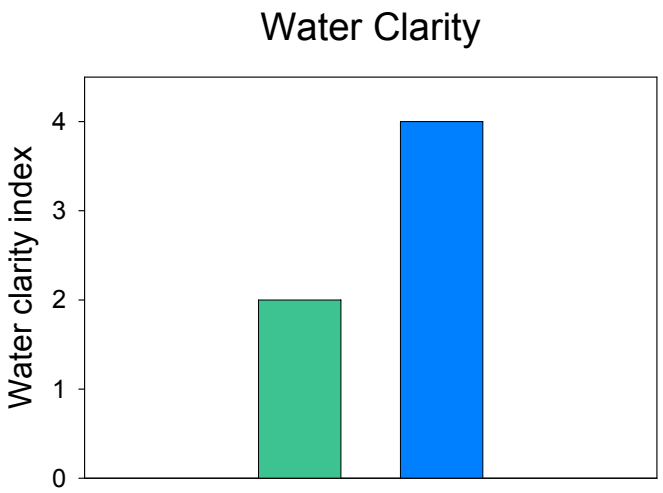
Results – phytoplankton



Phytoplankton abundance correlated with P-availability

Results – Benthic macrophytes





Water Clarity Index

	Secchi depth
1	0 – 20 cm
2	20 – 40 cm
3	40 – 60 cm
4	> 60 cm

Greater *Chara* abundance associated with increased water clarity

Key findings – preliminary conclusions

Spatial species distribution consistent with mean salinity.

Seasonality of *Chara* and *Halodule* abundances asynchronous.

P concentrations are ≈3X greater in West Lake system than in 7 Palms system, fueling ≈6X greater phytoplankton densities.

Greater water clarities in 7 Palms system coincide with ≈5X greater *Chara* abundances relative to West Lake system.

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