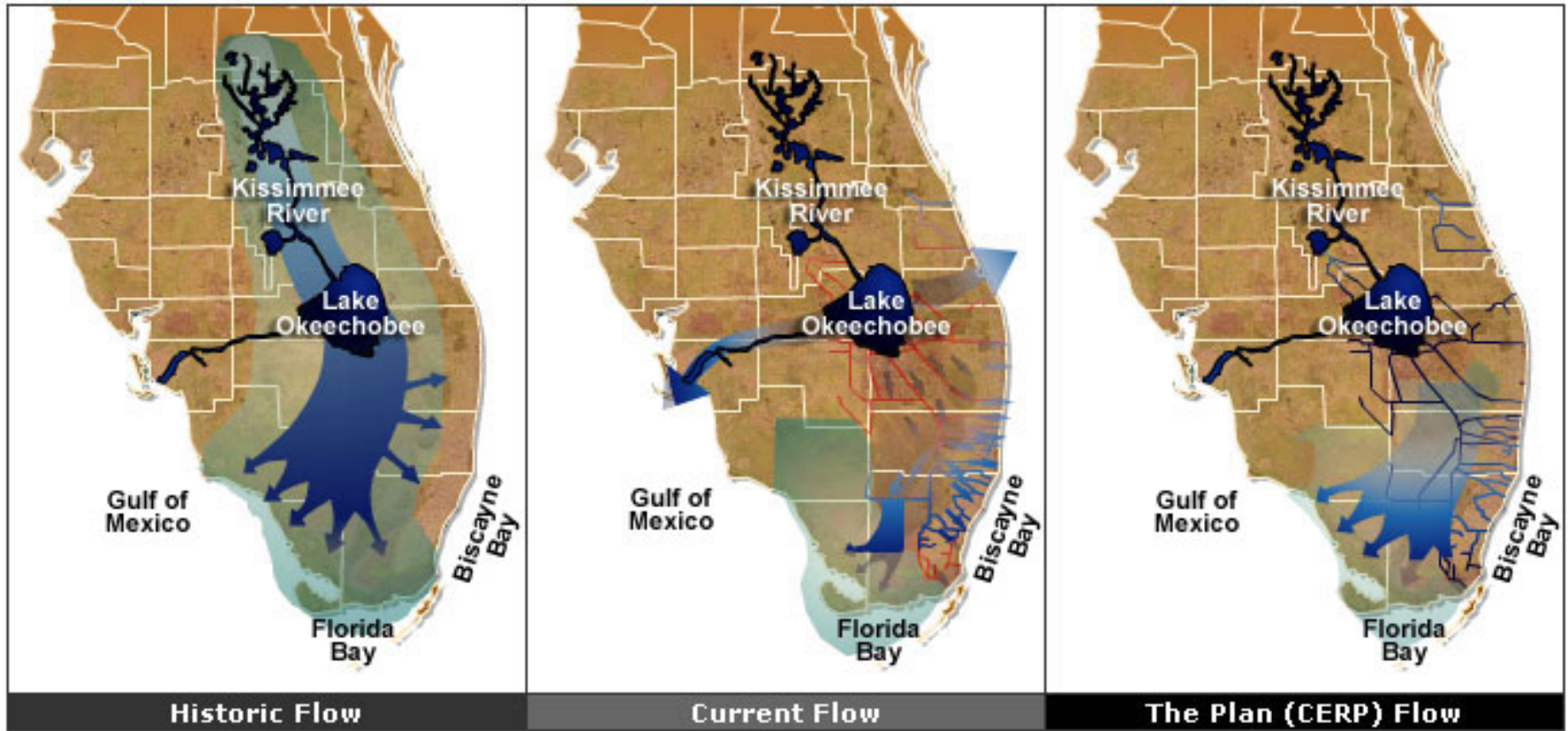


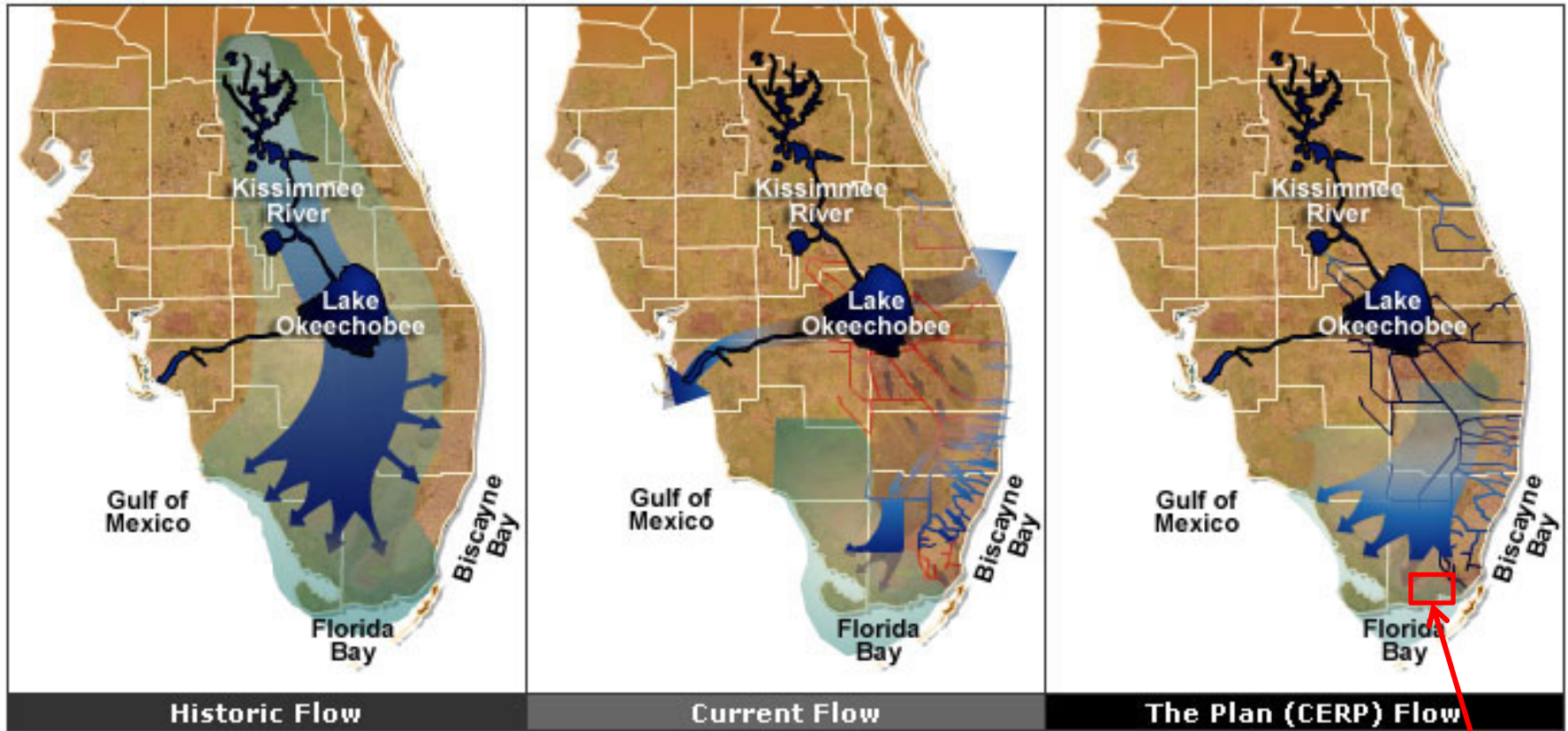


# Phytoplankton Response to Changing Nutrients from the Comprehensive Everglades Restoration Plan: Comparison of Two Coastal Lagoon Systems in Northern Florida Bay, USA

**Yini Shangguan, Patricia M. Glibert,**  
Jeff Alexander, Sue Murasko,  
University of Maryland Center for Environmental Science, Cambridge, MD, USA  
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South Florida Water Management District, West Palm Beach, FL, USA

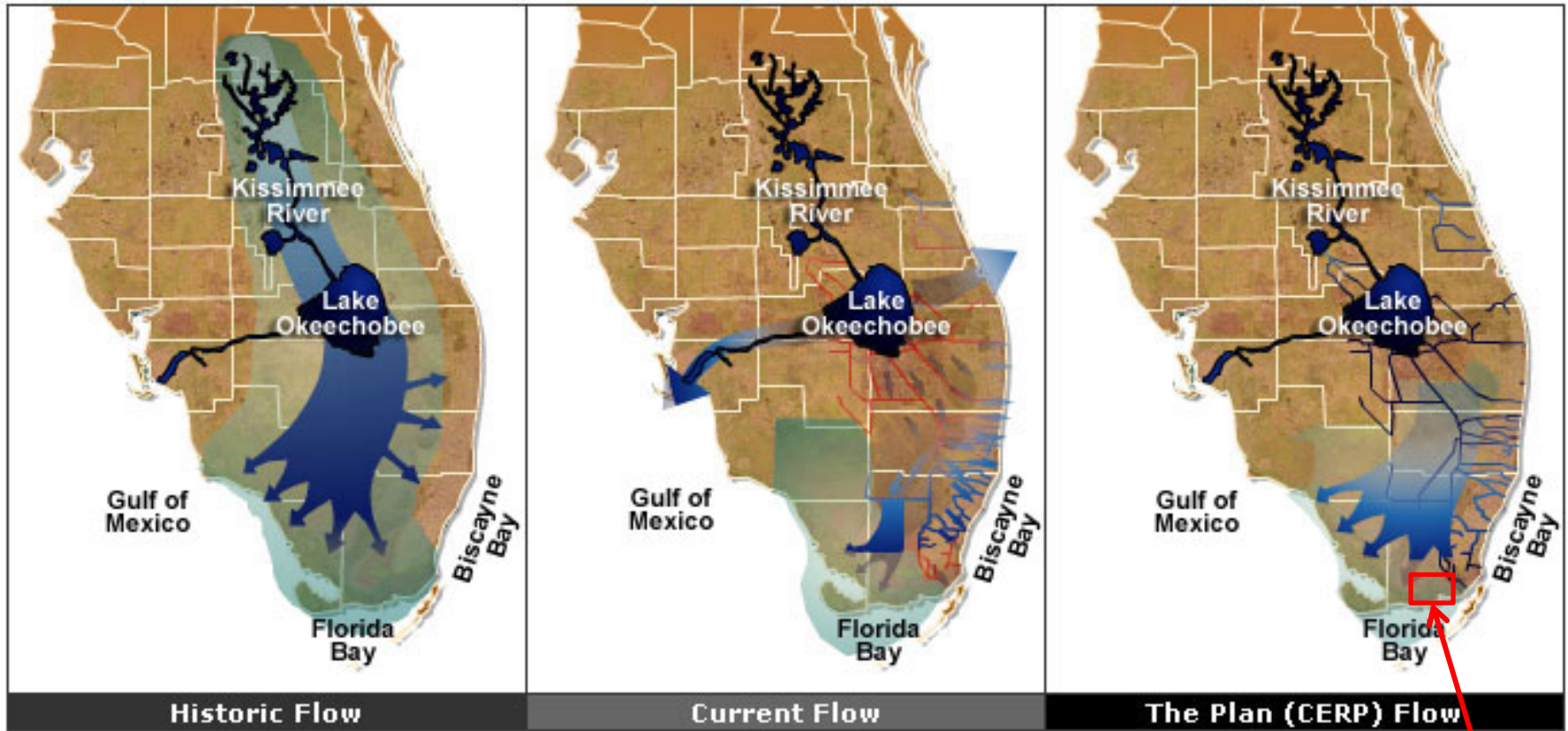


SOURCE: WWW.EVERGLADESPLAN.ORG



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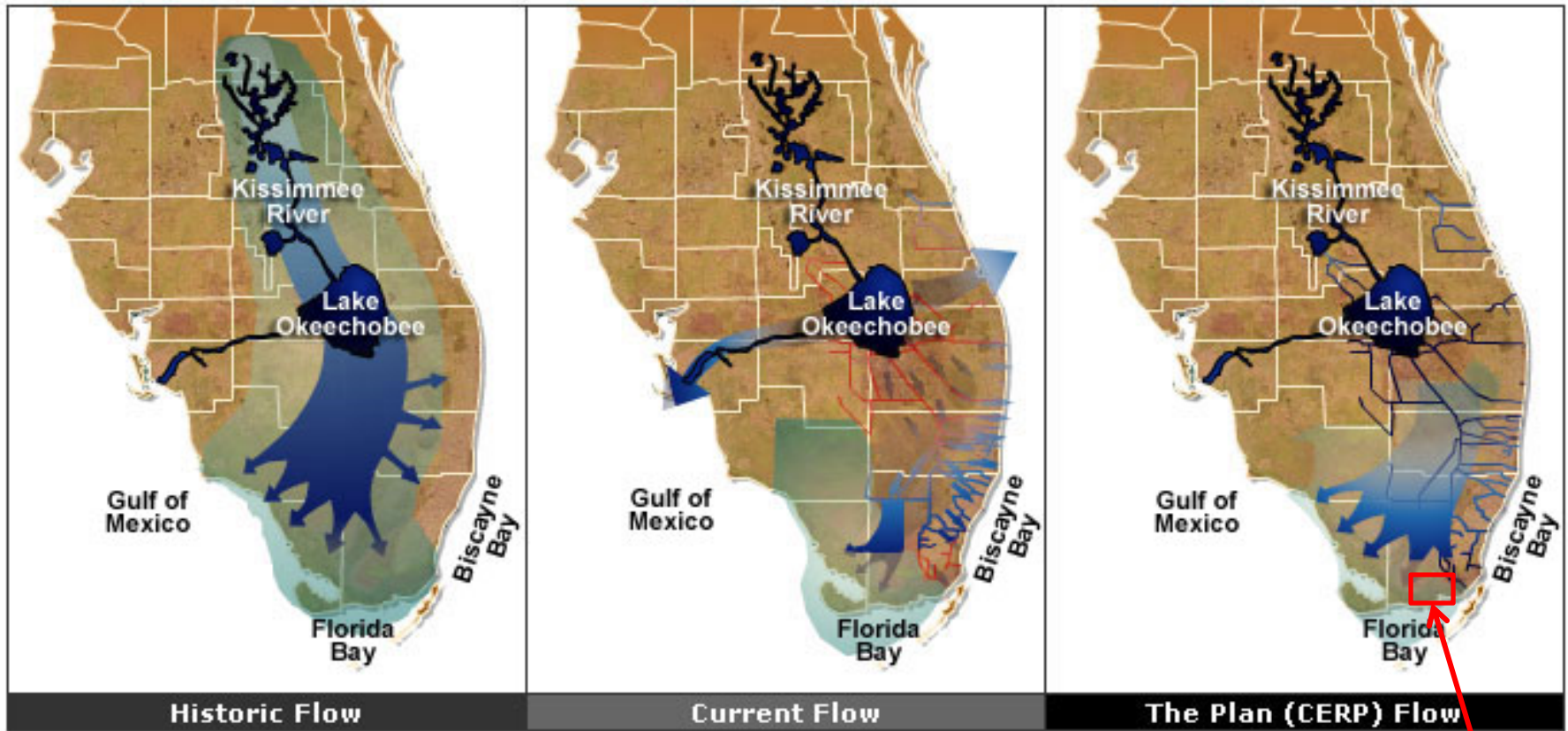
**C-111**



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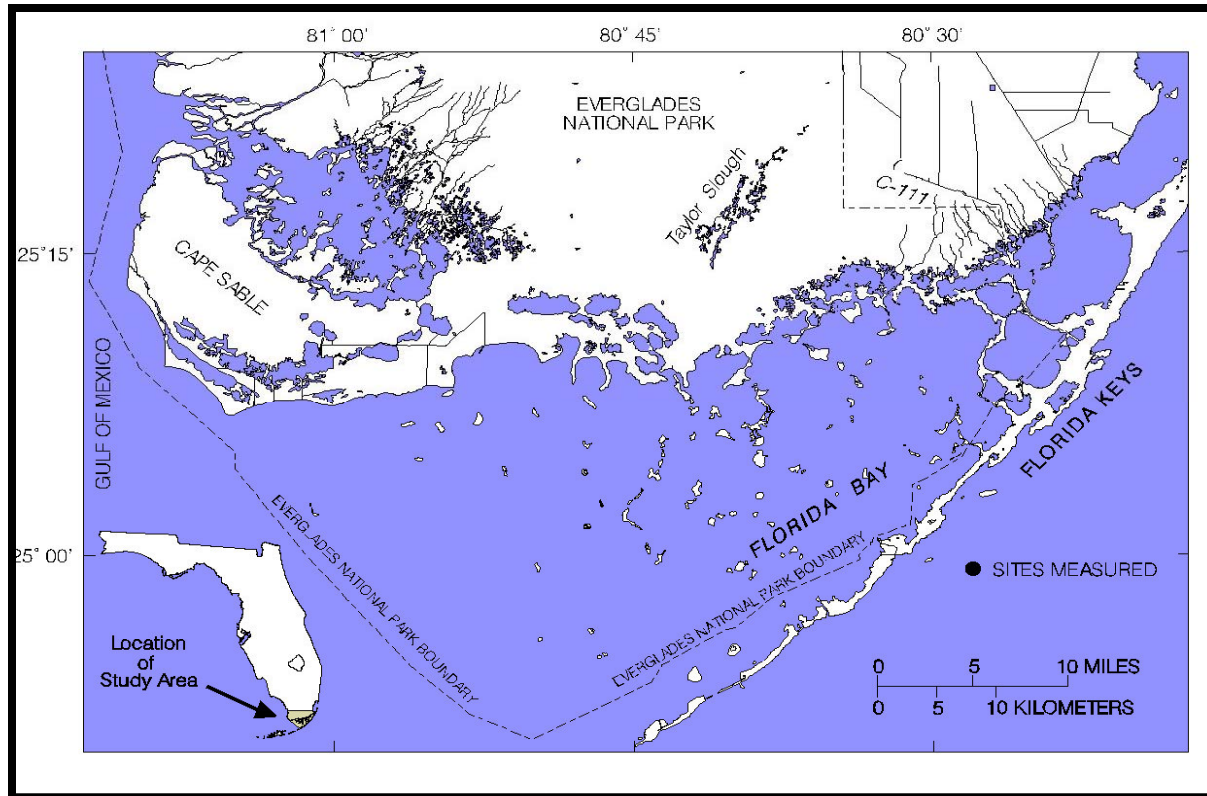
C-111

# Potential problems?



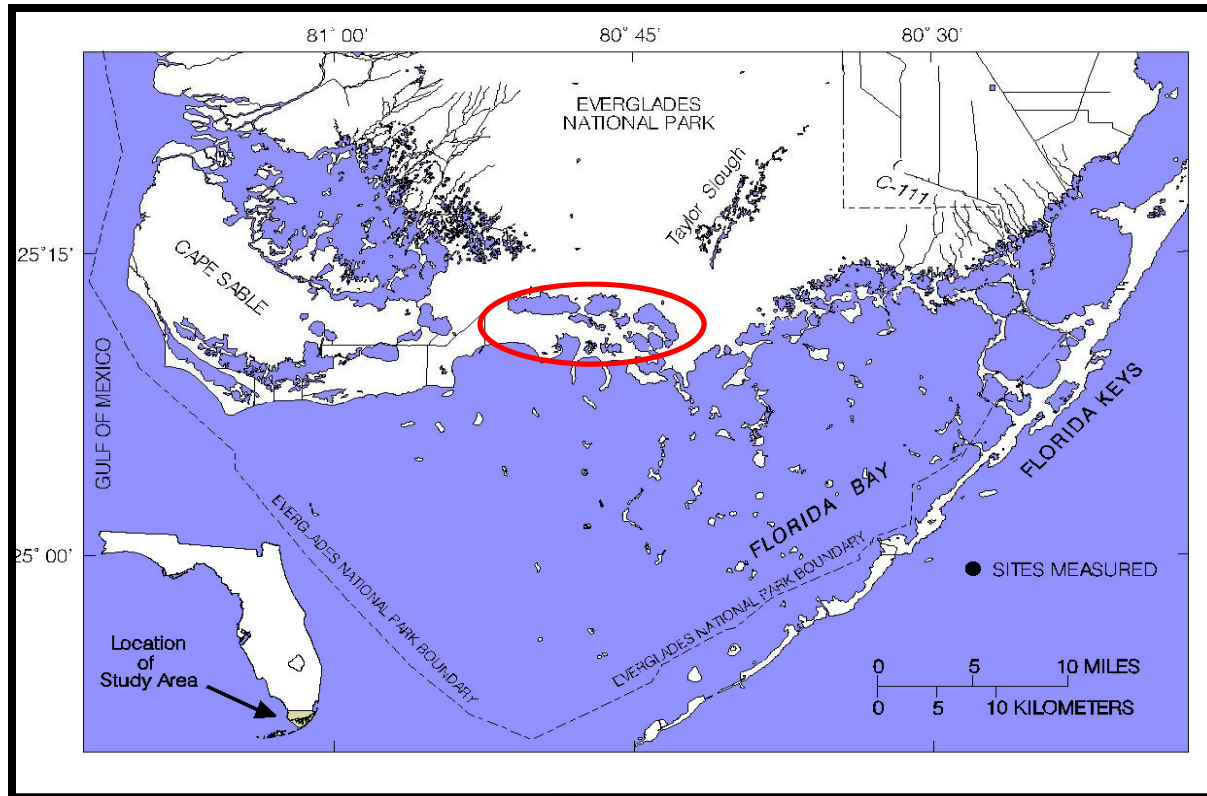
SOURCE: WWW.EVERGLADESPLAN.ORG

**Water flow => Nutrient regime change => Algal blooms**



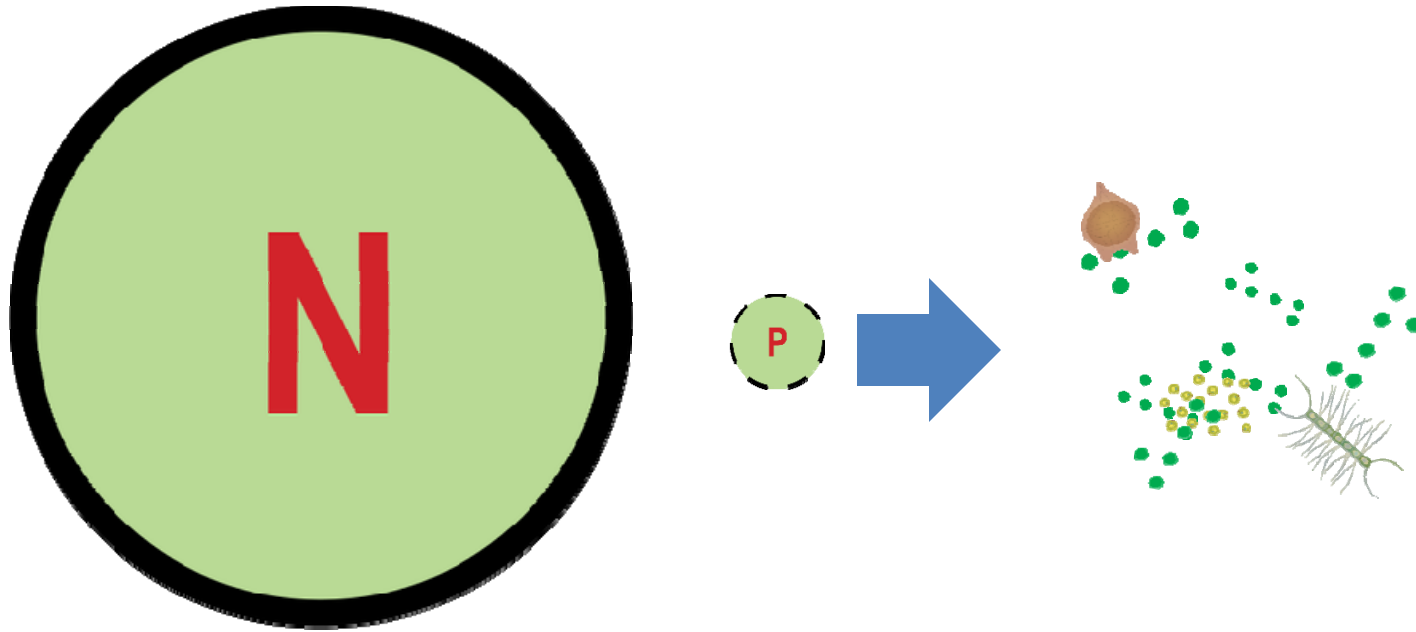
## Florida Bay is a subtropical coastal lagoon

- Shallow, highly enclosed, relatively quiescent, long residence time
- High nutrient regeneration rate
- Very sensitive to nutrients input



## Intermittent Closed Open Lakes and Lagoons (ICOLLs) in Northern Florida Bay

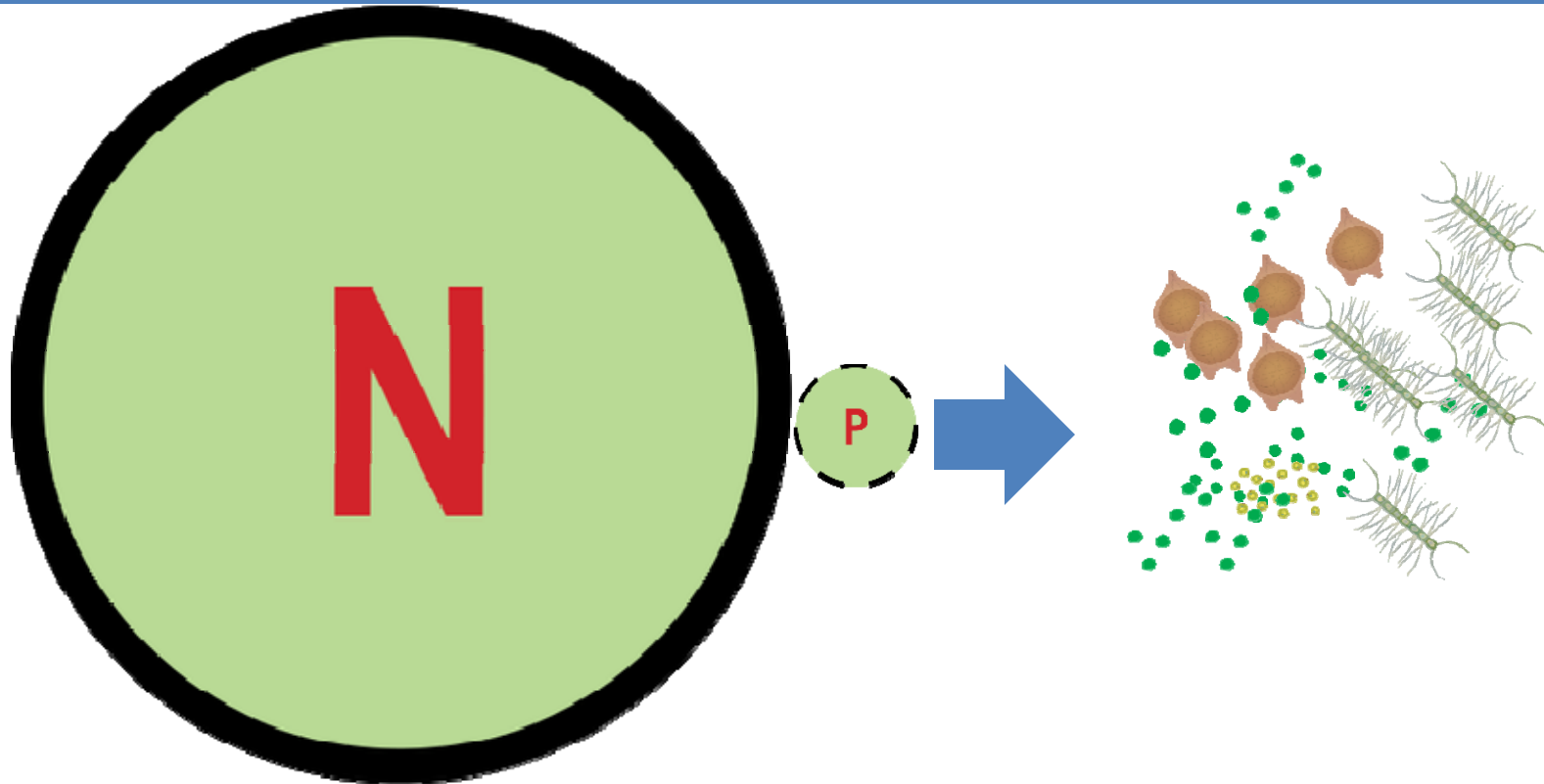
- Sinks of land-derived nutrients
- Could be very ecologically productive ecosystem (Suzuki *et al.*, 1998; Menendez & Comin, 2000)



- P-limited system
- Small-sized phytoplankton are favored



# Hypothesis

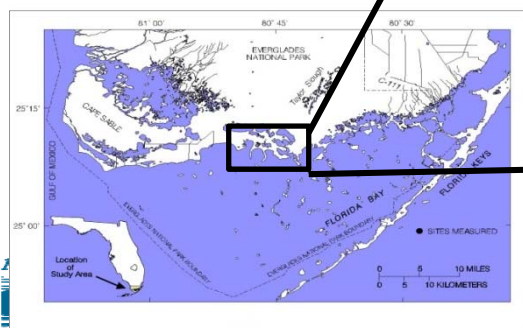
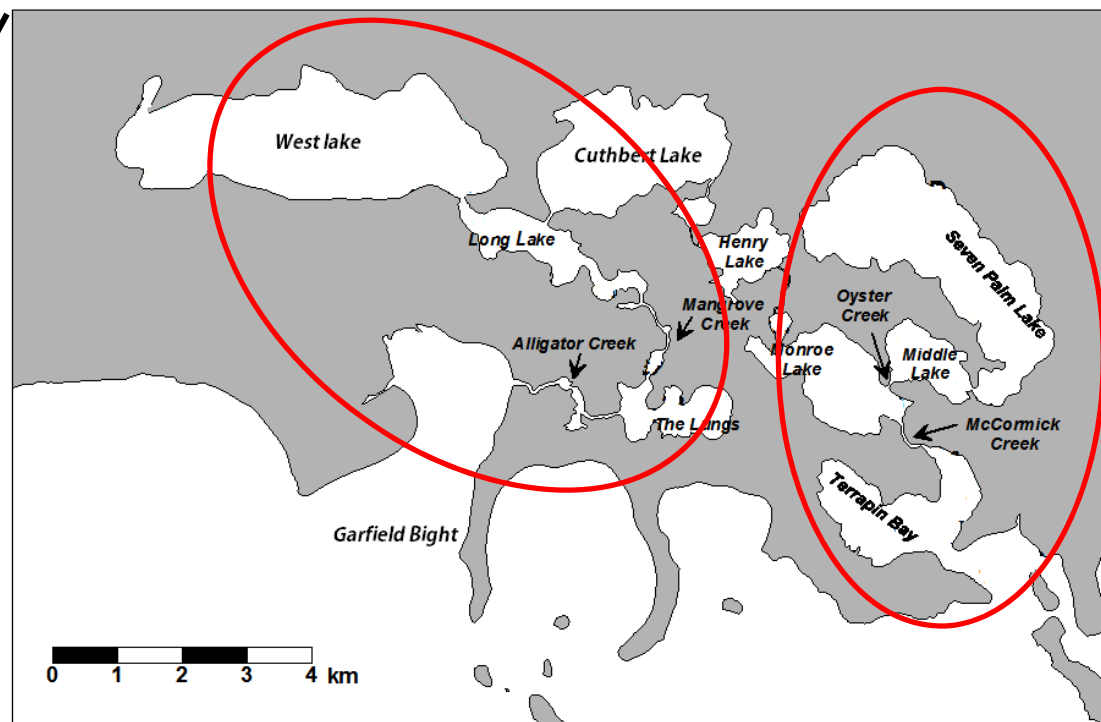


After CERP,

- The nitrogen and phosphorus concentrations in northern Florida Bay will increase
- The phytoplankton abundance will increase and community composition will change

# Methods: Site Description

		Total Dissolved Nitrogen (TDN) ( $\mu\text{M}$ )	Total Dissolved Phosphorus (TDP) ( $\mu\text{M}$ )	Chlorophyll a (Chl a) ( $\mu\text{g/L}$ )
West Lake Chain (WLC)	Eutrophic	119.19	0.66	36.94
Seven Palm Lake Chain (SPLC)	Less nutrient-rich	75.58	0.34	1.46





## Sampling collection

- Apr 2010, Nov 2010, Apr 2011
- May 2013, Apr 2014



## Chemical analysis

- TND, TDP
- Chl a, HPLC pigments

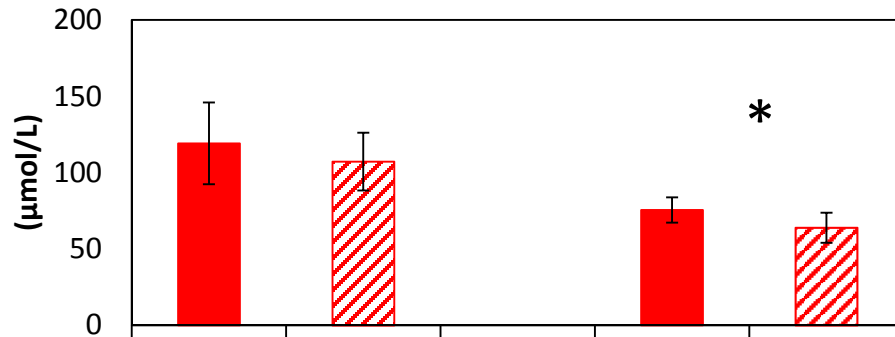


## Data analysis

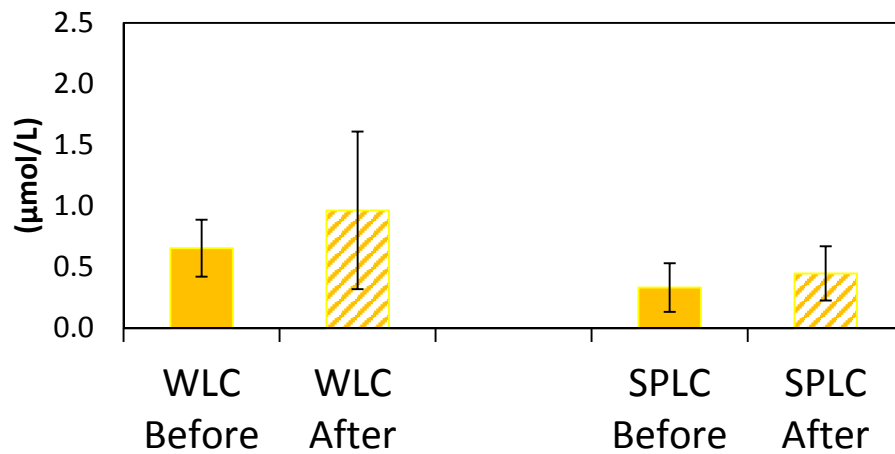
- One-way ANOVA at  $p=0.1$



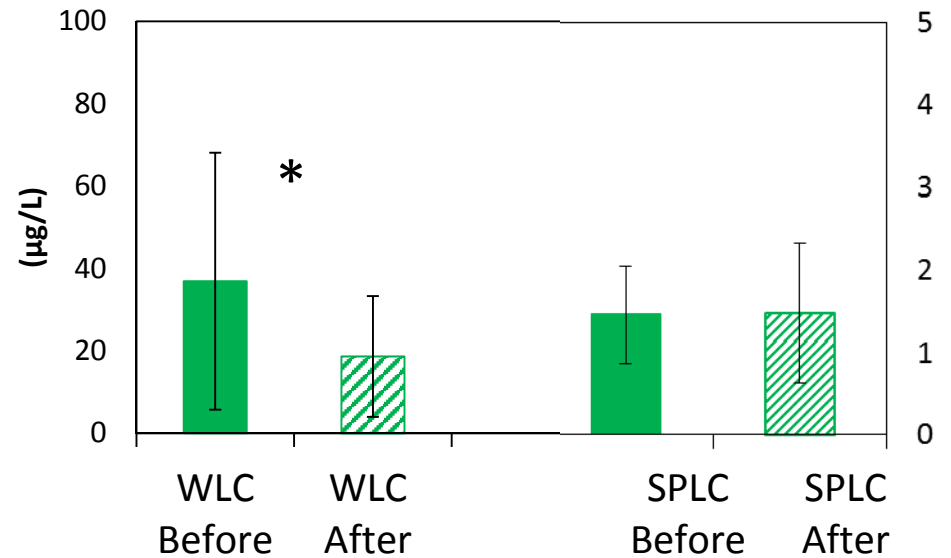
### TDN



### TDP

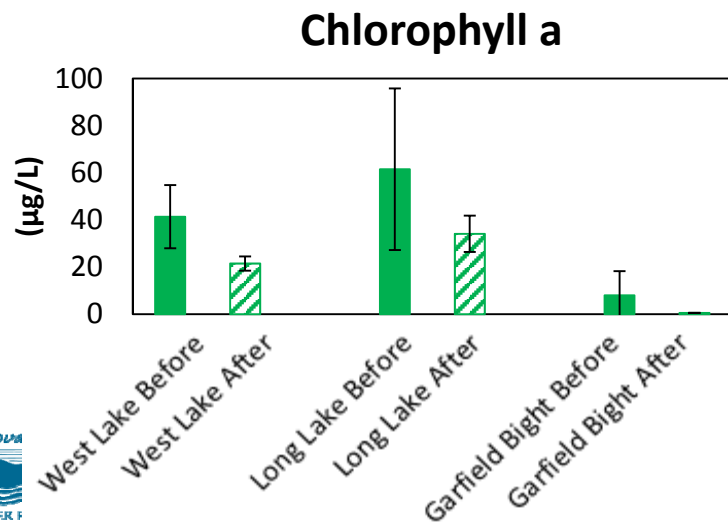
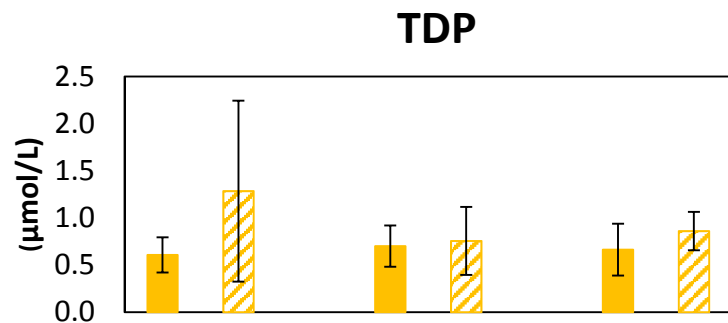
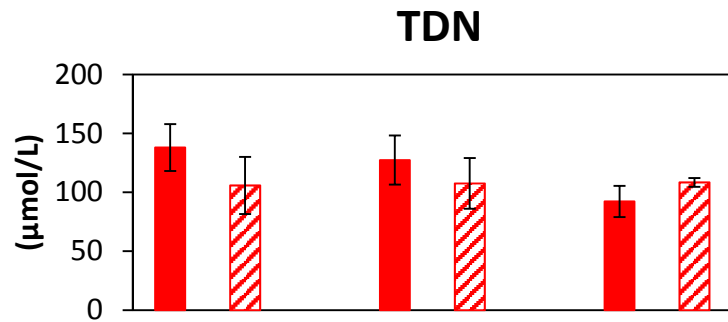


### Chlorophyll a

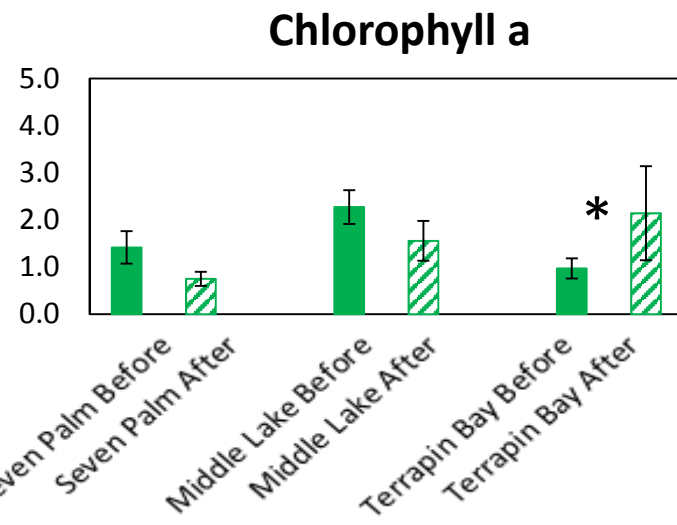
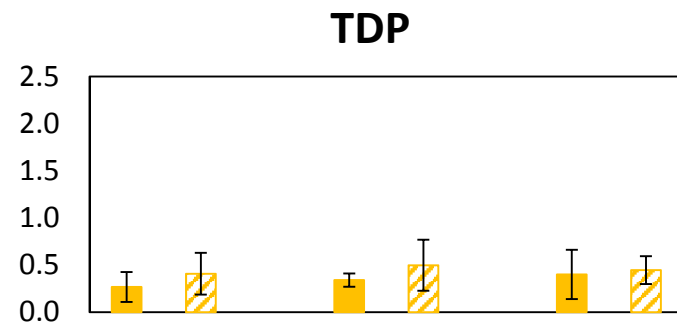
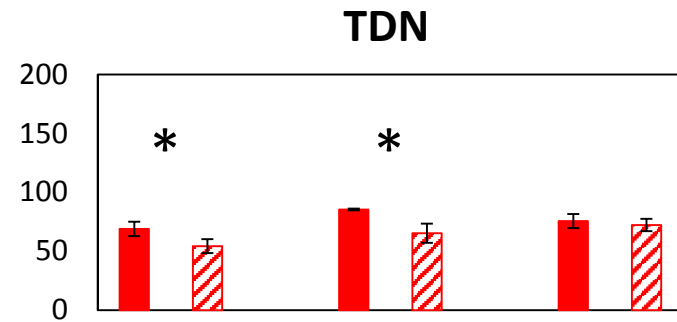


N decreased ,P increased,  
chlorophyll a declined in WLC while elevated slightly in SPLC

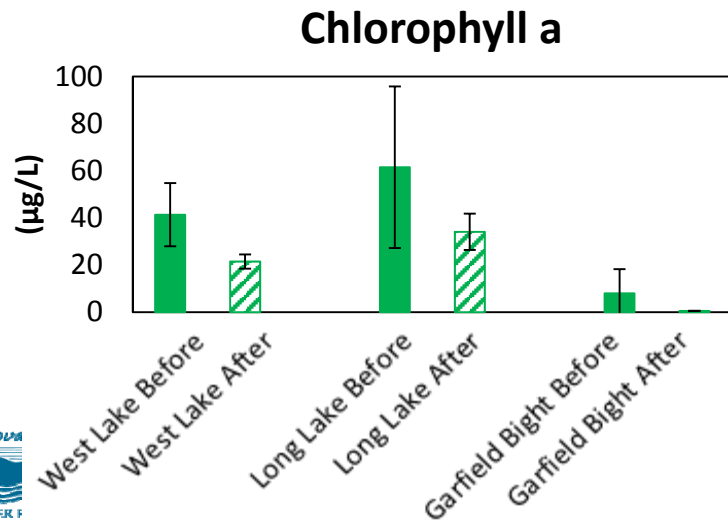
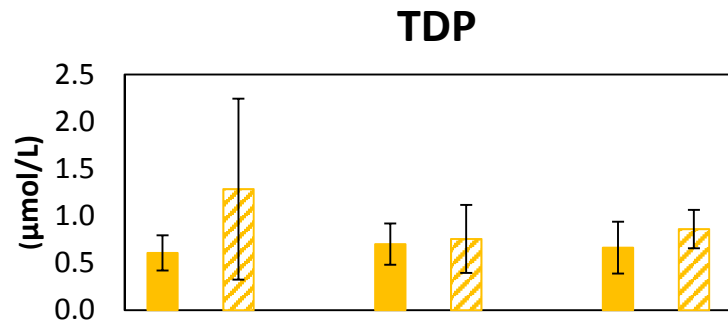
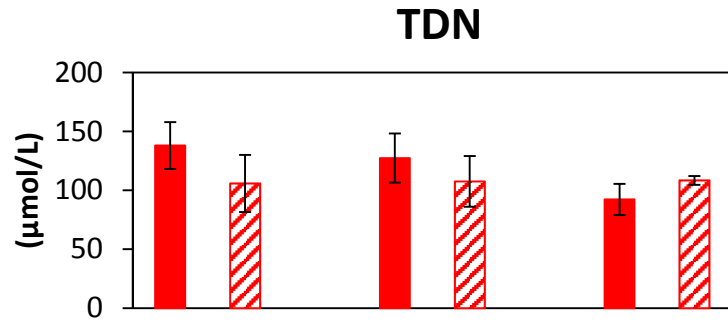
### West Lake Chain



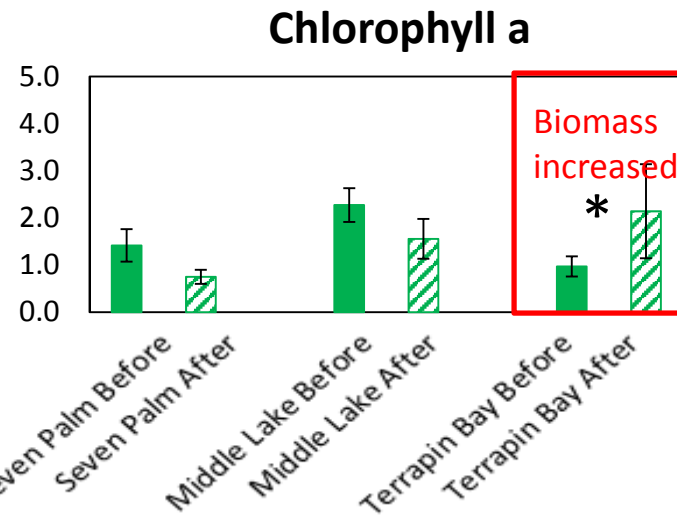
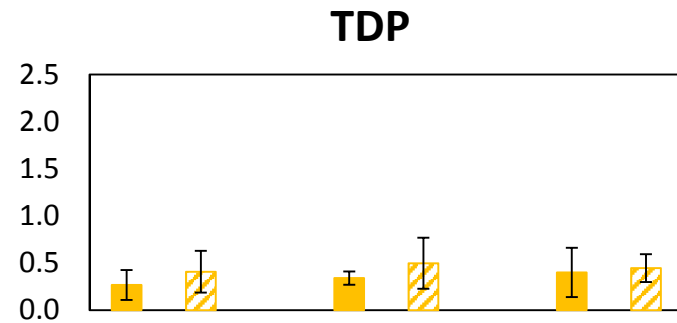
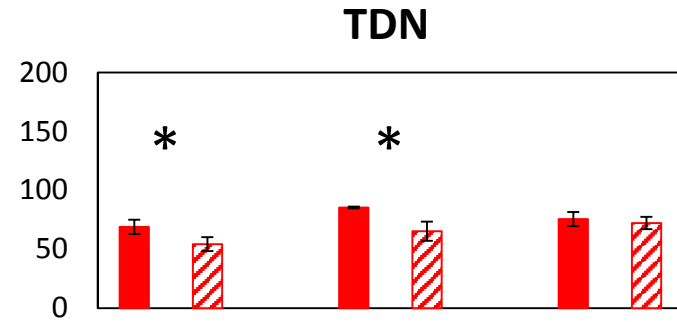
### Seven Palm Lake Chain



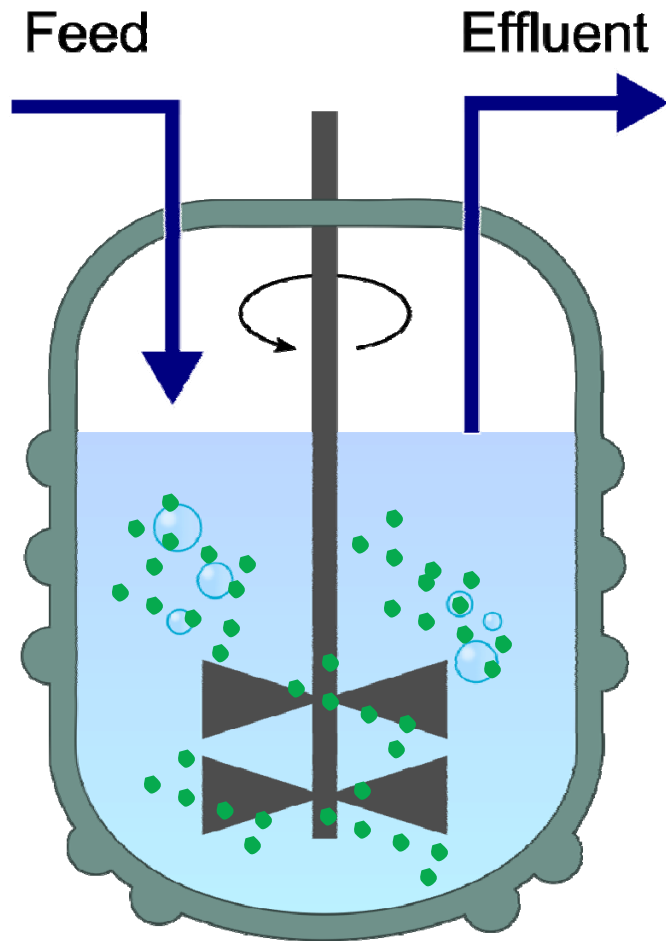
## West Lake Chain



## Seven Palm Lake Chain



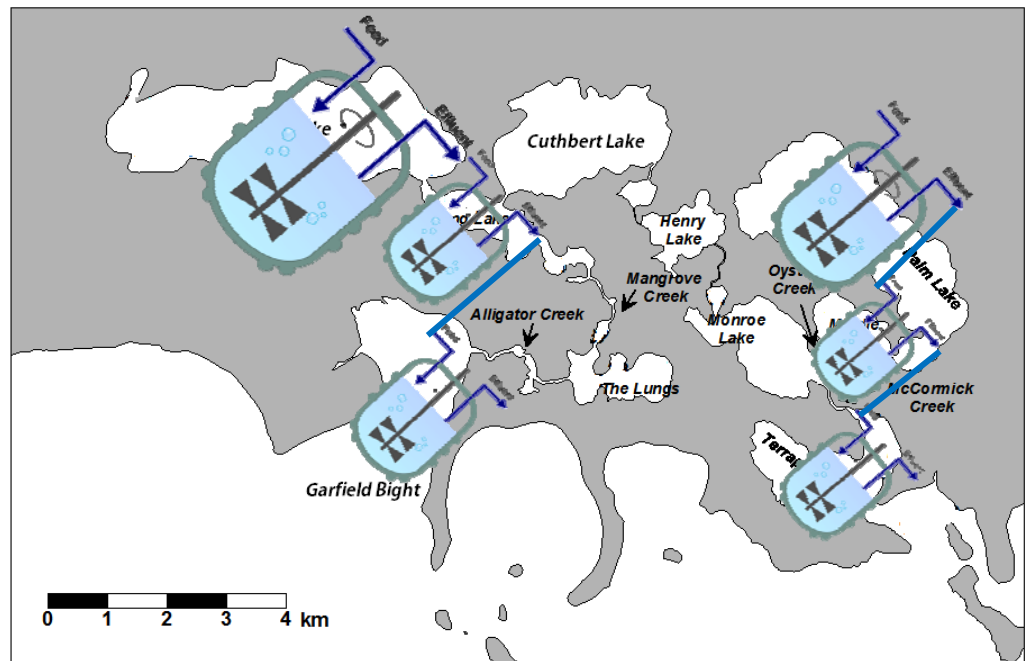
# Chemostat model



In steady state

- Biomass  $\leq$  limiting nutrient
- Growth rate  $\leq$  flow

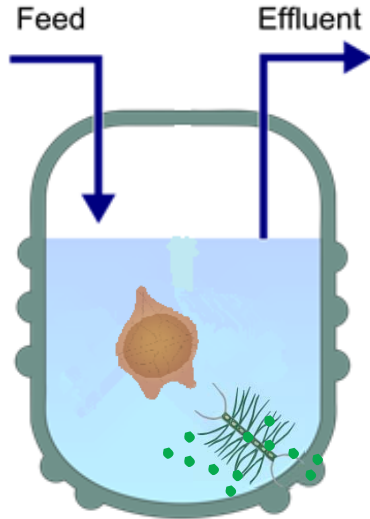
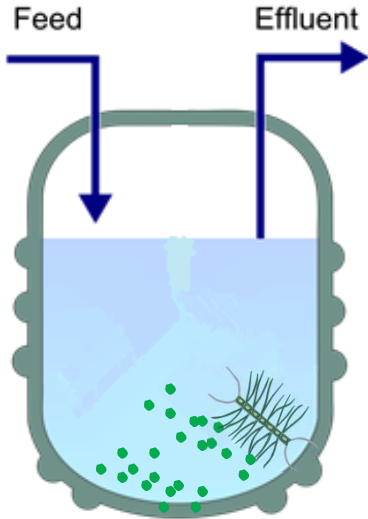
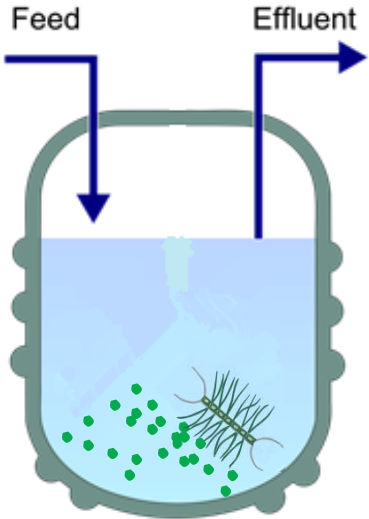
Flow will flush cells out when dilution is higher than the *maximum growth*



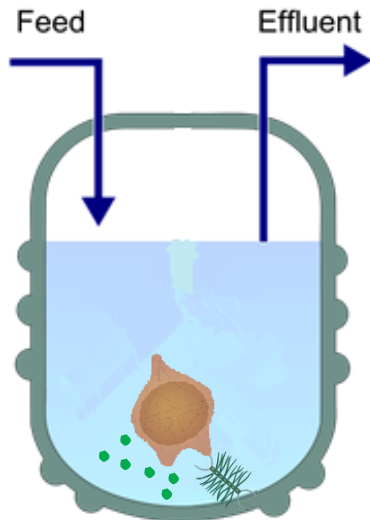
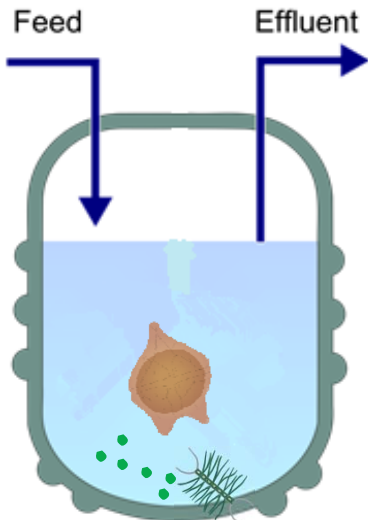
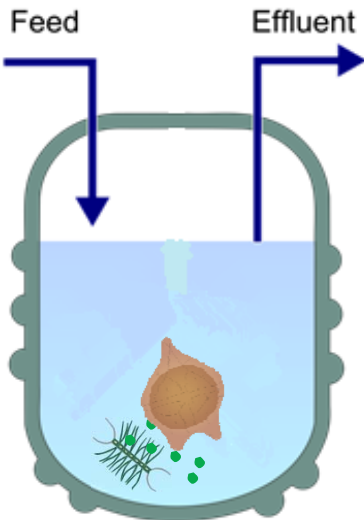
Nutrient, flow

West Lake Chain

Biomass, growth



Seven Palm Lake Chain

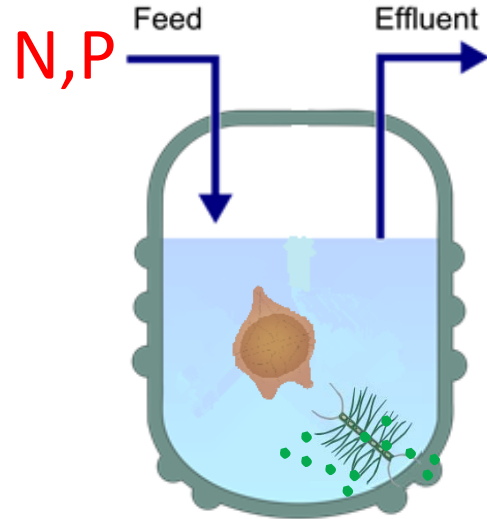
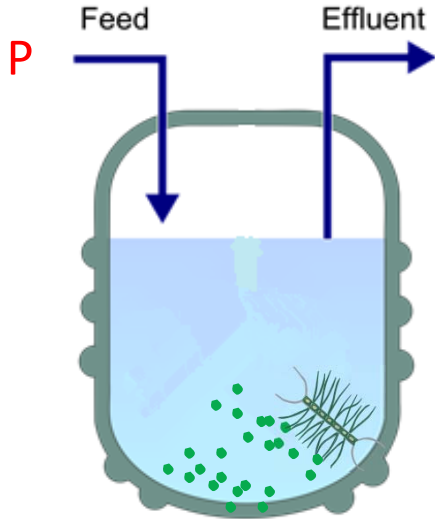
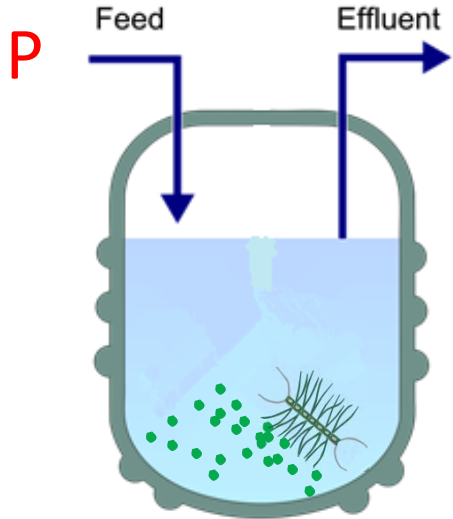




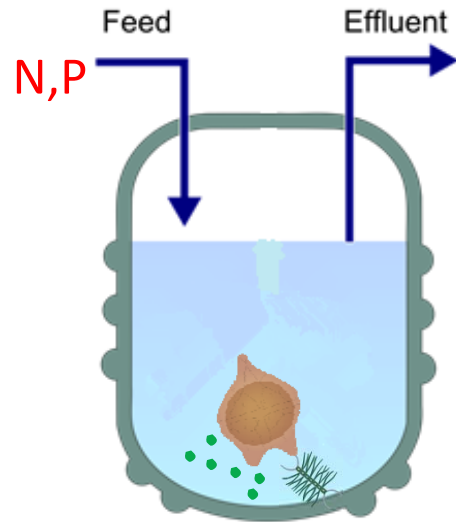
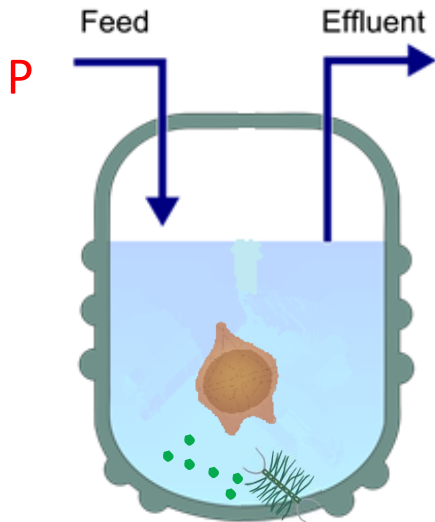
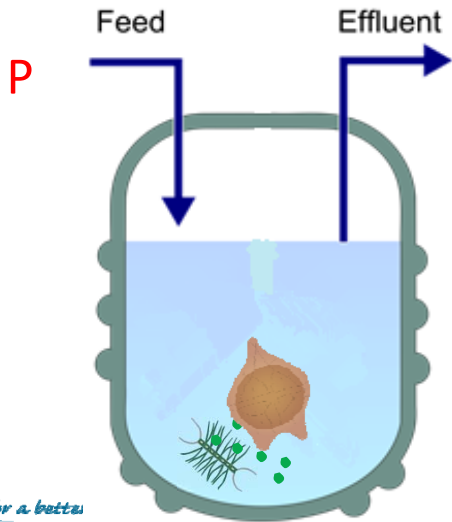
Nutrient, flow

West Lake Chain

Biomass, growth



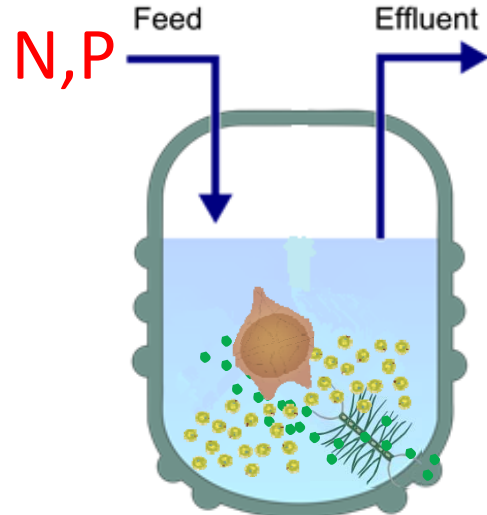
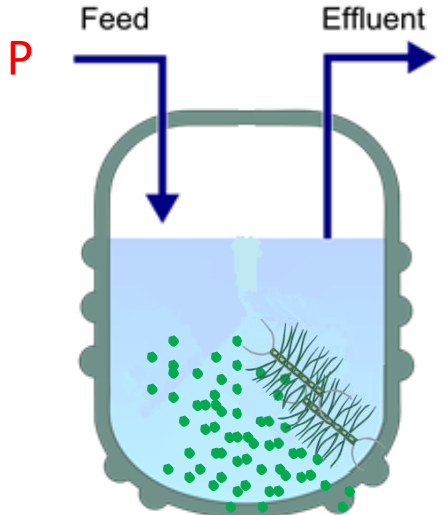
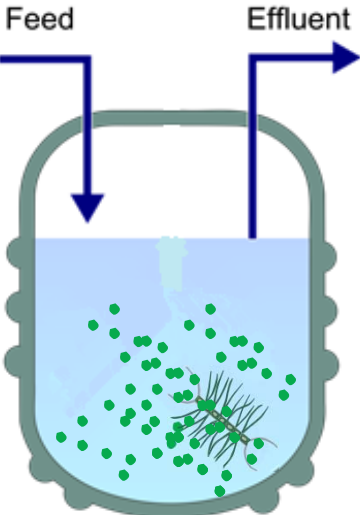
Seven Palm Lake Chain



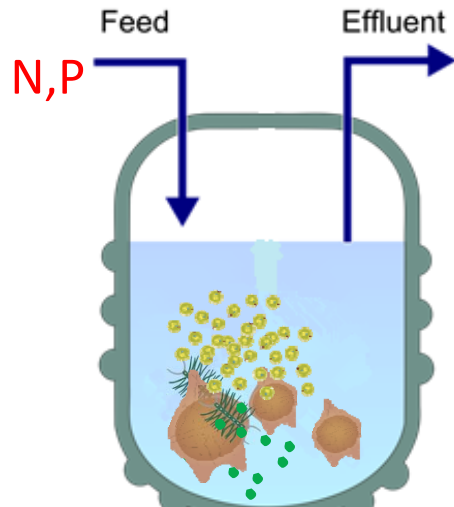
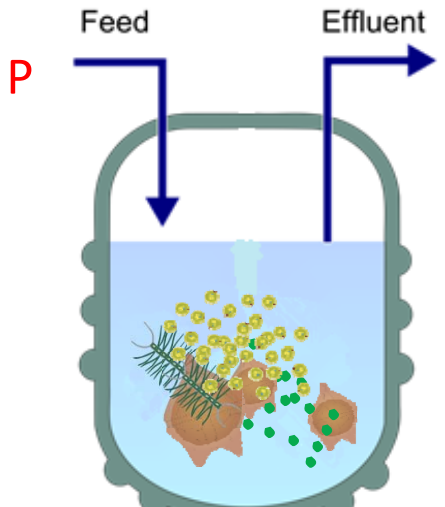
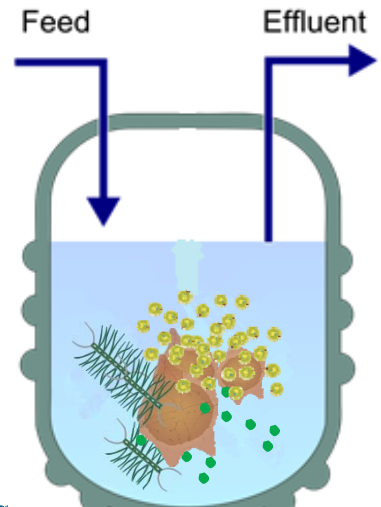
Flow, flow

West Lake Chain

Biomass, growth



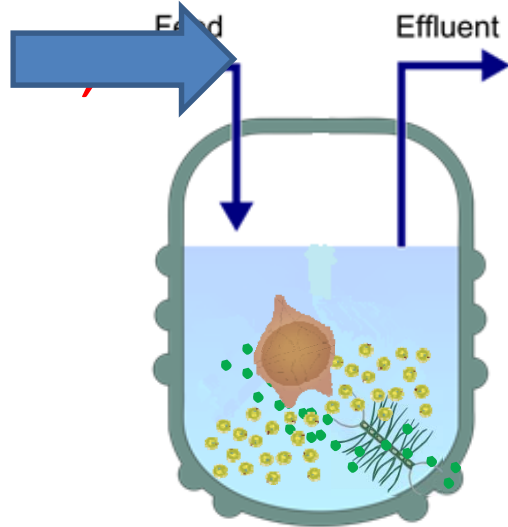
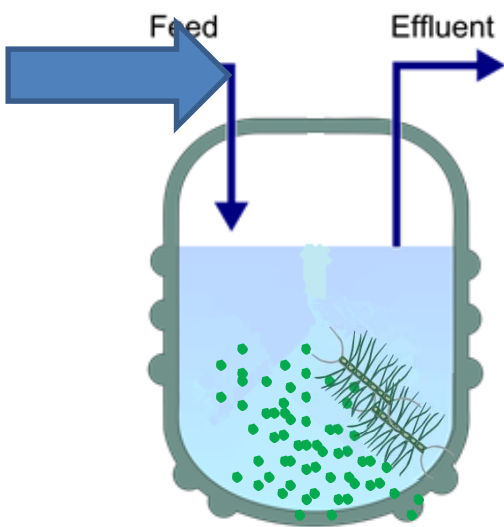
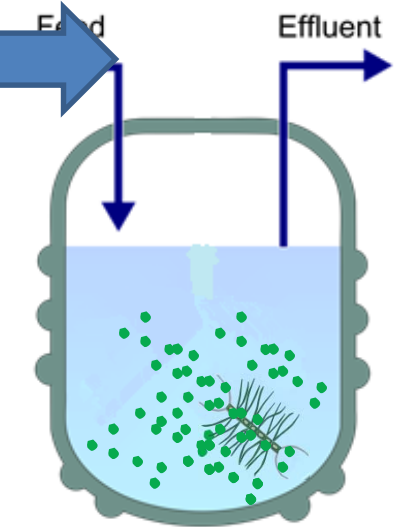
Seven Palm Lake Chain



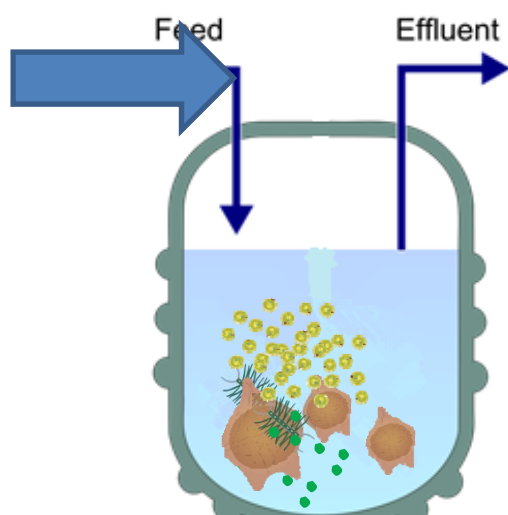
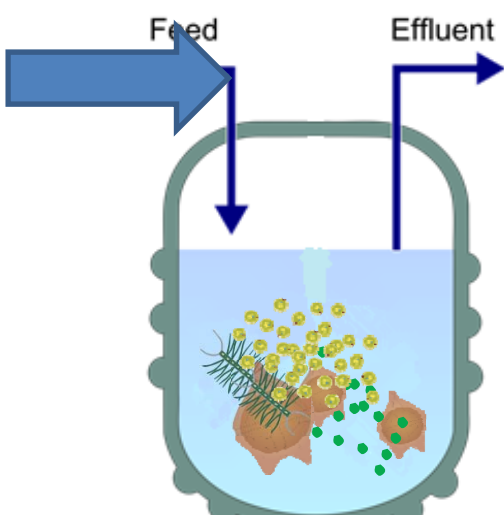
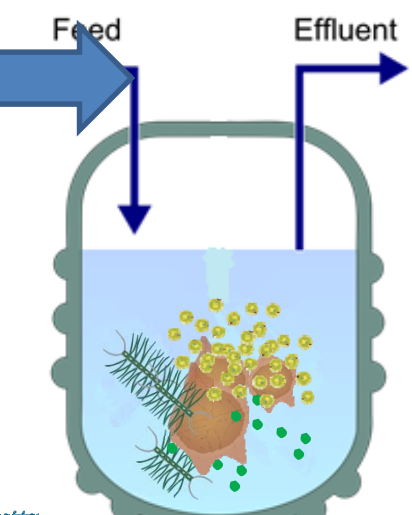
Flow, feed

West Lake Chain

Biomass, growth



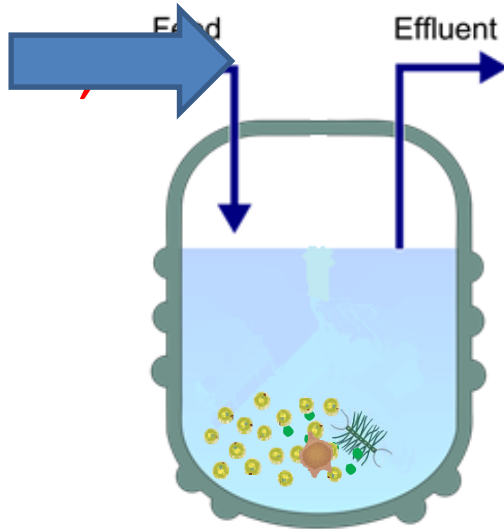
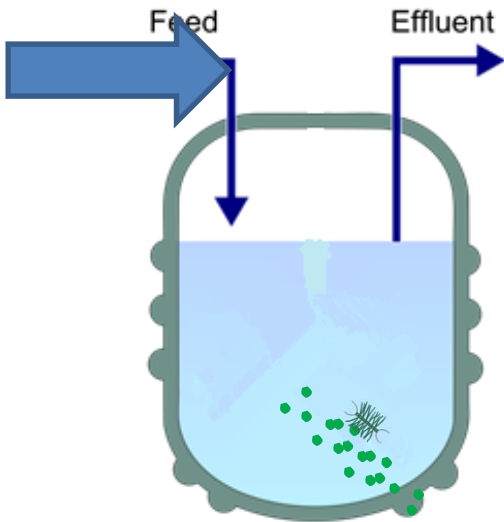
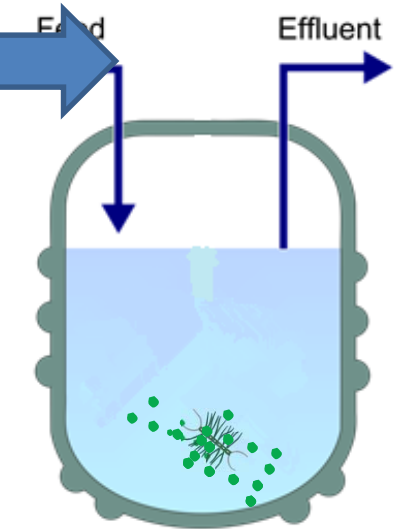
Seven Palm Lake Chain



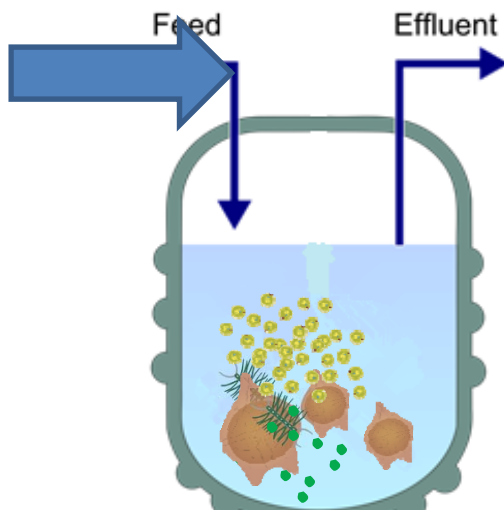
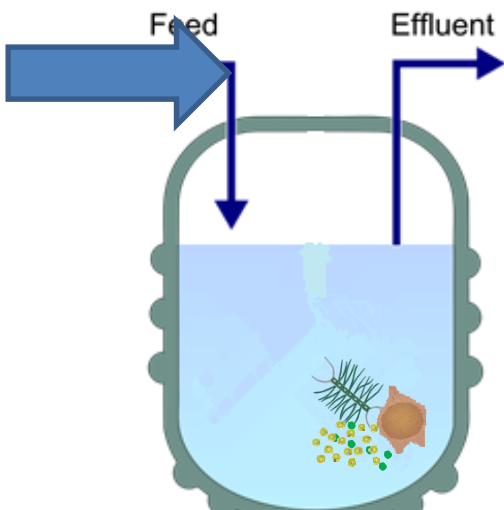
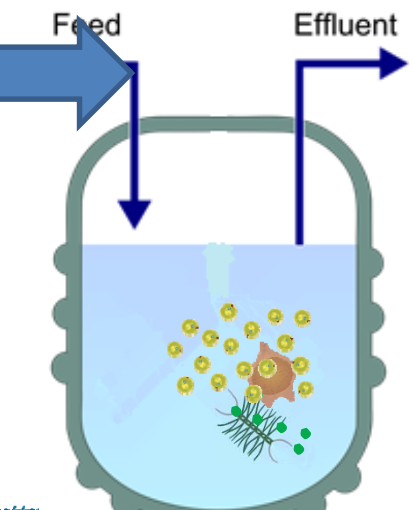
Flow, feed

West Lake Chain

Biomass, growth



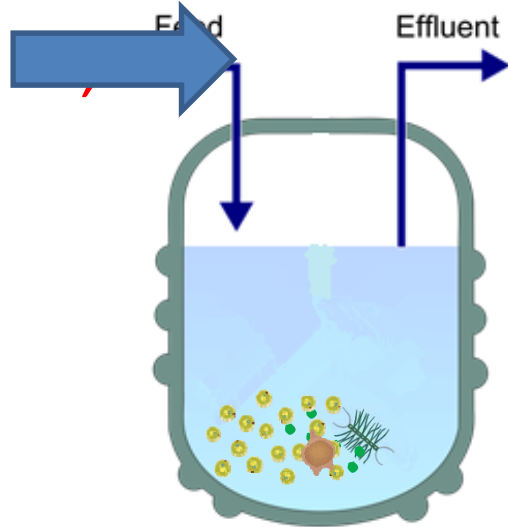
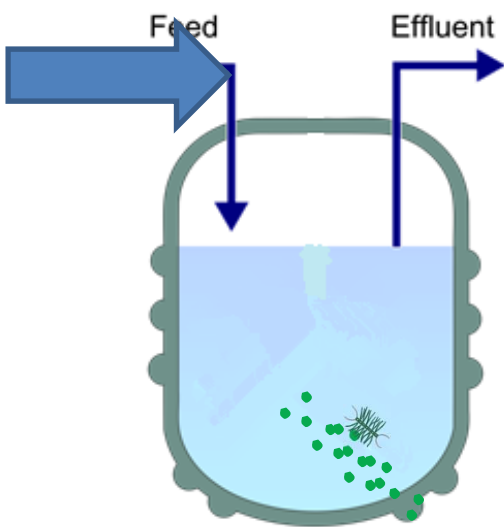
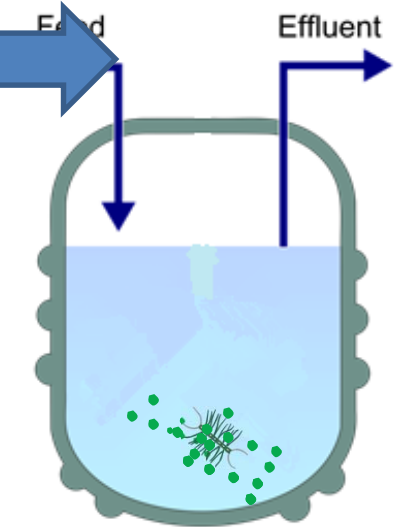
Seven Palm Lake Chain



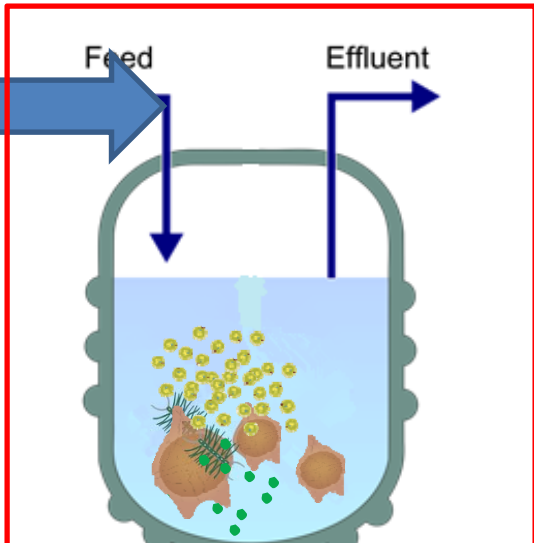
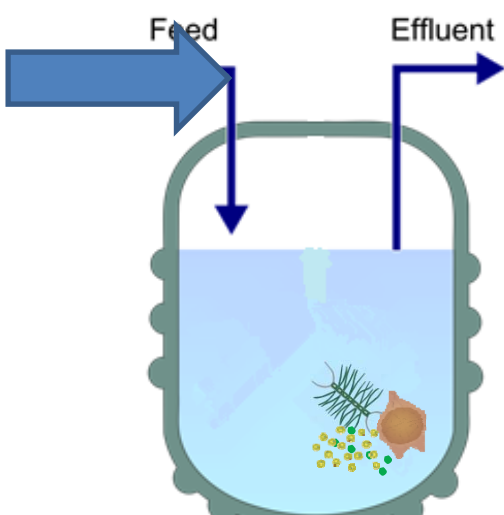
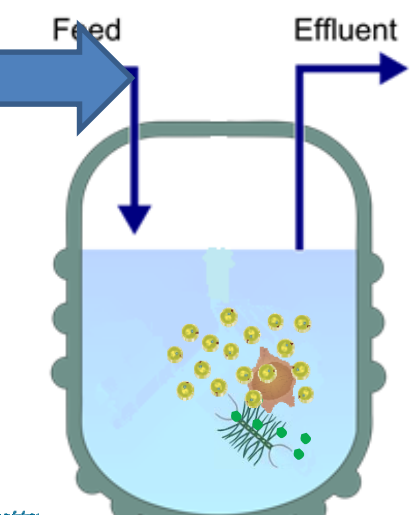
Flow, flow

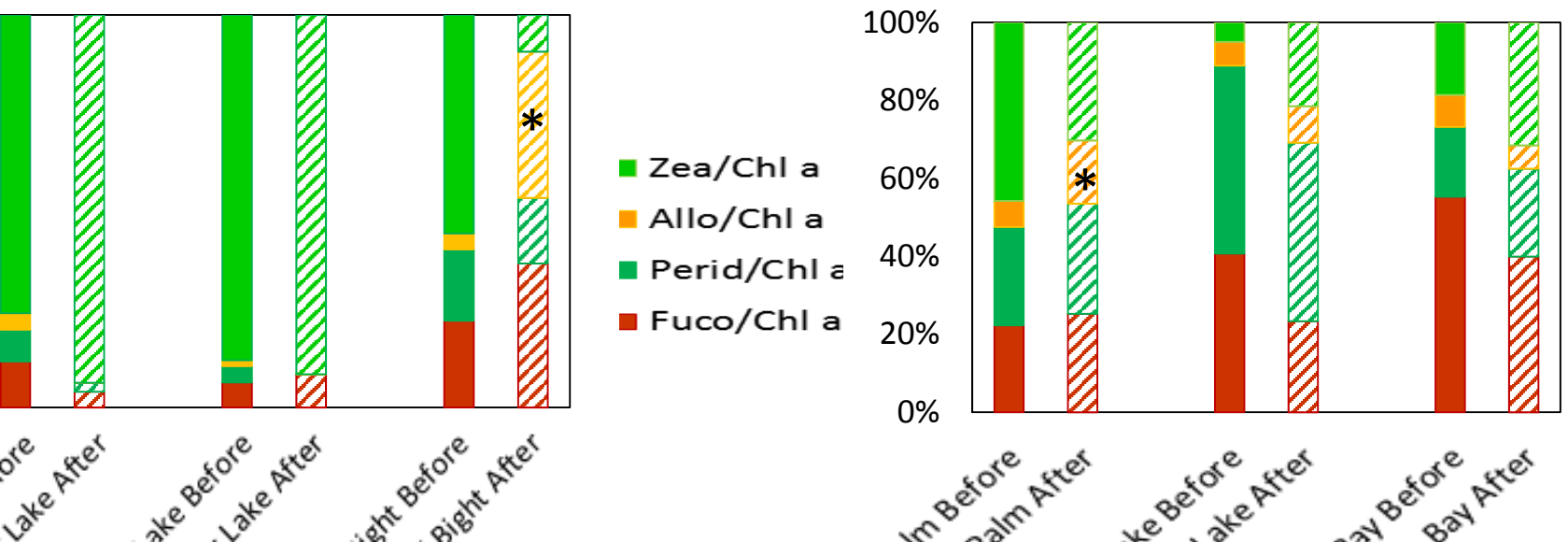
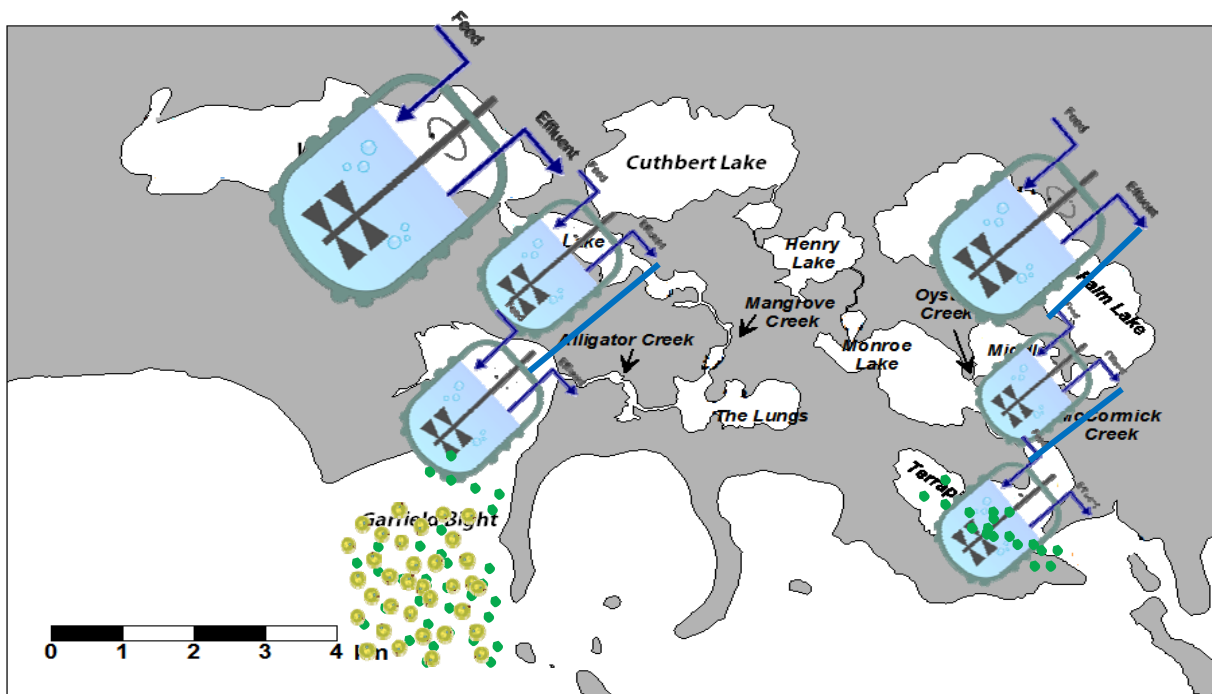
West Lake Chain

Biomass, growth



Seven Palm Lake Chain



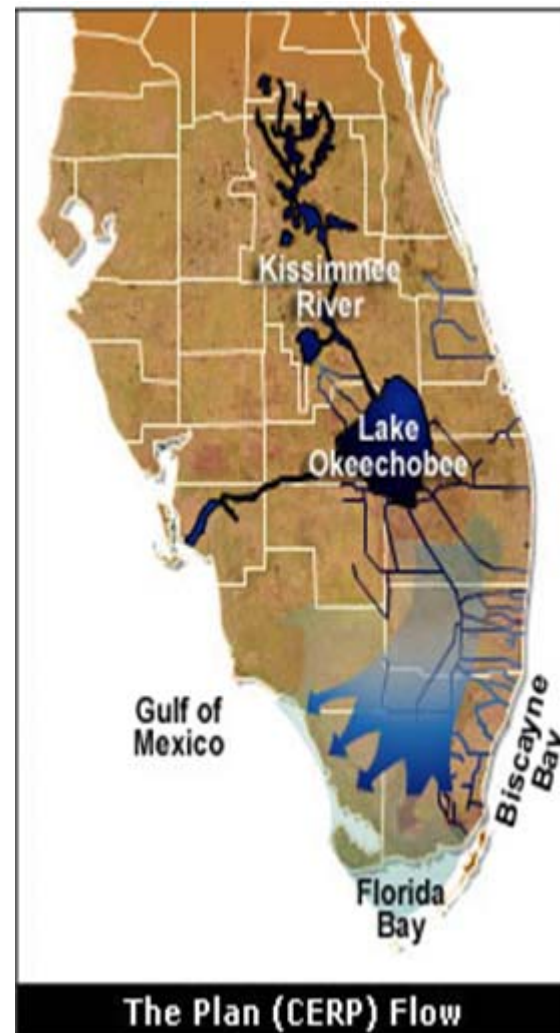


## Summary

N showed decreasing trend and P showed increasing trend

In the eutrophic WLC downstream, phytoplankton biomass was reduced while the phytoplankton community composition shifted. Phytoplankton cells might be flushed into Central Florida Bay.

In the less-eutrophic SPLC downstream, phytoplankton biomass was enhanced while the community composition was unchanged.



## Take Home Message

If the flow after CERP is higher than maximum growth, cells in Northern Florida Bay will wash out into central Florida Bay.

If the flow is lower than maximum growth, the phytoplankton biomass in Northern Florida Bay will be determined by the limiting nutrient, P in the system.



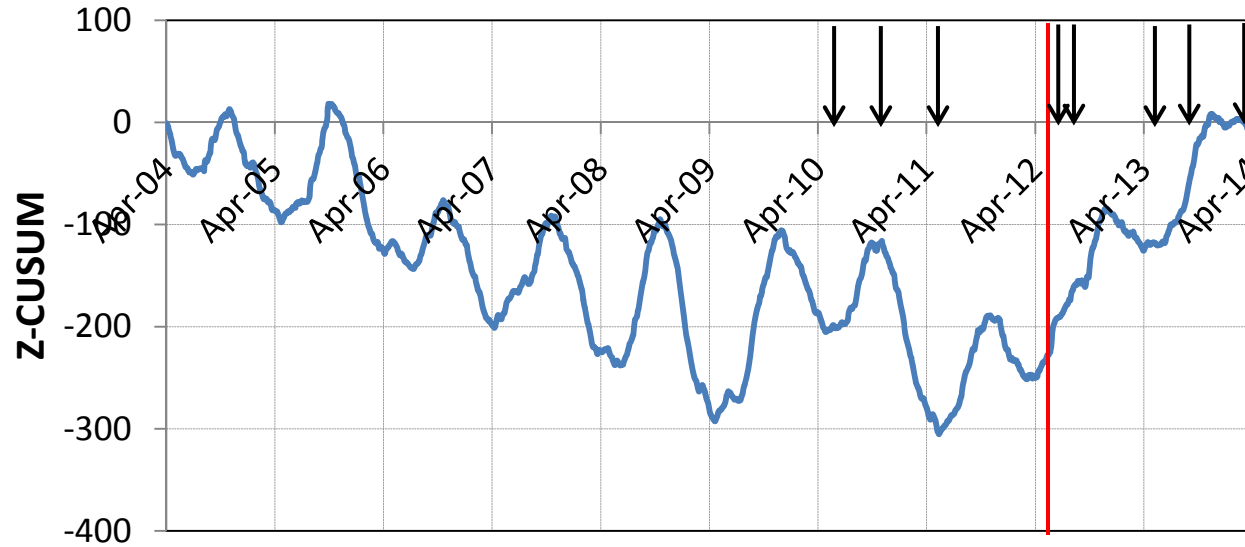
# Acknowledgement

- Field work
  - Stefano Accoroni
  - Michelle Blaha
  - Stephen Kelly
  - Joseph Stachelek
- Analytical Service
  - Erica Kiss
  - Meg Maddox
  - Jennifer O’Keefe





### Taylor Slough at mouth Water Level



### Seven Palm Lake Salinity

