

Florida Department of Environmental Protection



Standards and Assessment

Florida's Use of Supplemental NWCA Funds to Inform Water Quality Standards Development 9th INTECOL International Wetlands Conference Session 13 - Monday, June 4, 2012

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Florida's Dissolved Oxygen Standard

- Dissolved Oxygen (DO) ≥ 5.0 mg/L, all times and places for most fresh waters, including wetlands*
- DO ≥ 4.0 mg/L (instantaneous measurement) for marine waters, including wetlands*
- Revision of statewide fresh water DO criteria underway, based on regional expectations for streams

* Rule 62-302, Florida Administrative Code (F.A.C)



Alternative DO Criteria

- A Site Specific Alternative Criterion (SSAC) was established for the Everglades, and other wetland SSACs are under development.
- SSAC development is data and labor intensive.
- DEP would like to establish statewide DO criteria appropriate for wetlands.
 - Establish expectations for minimally disturbed wetlands
 - Determine driving factors

* SSAC guidelines in 62-302.800, F.A.C.

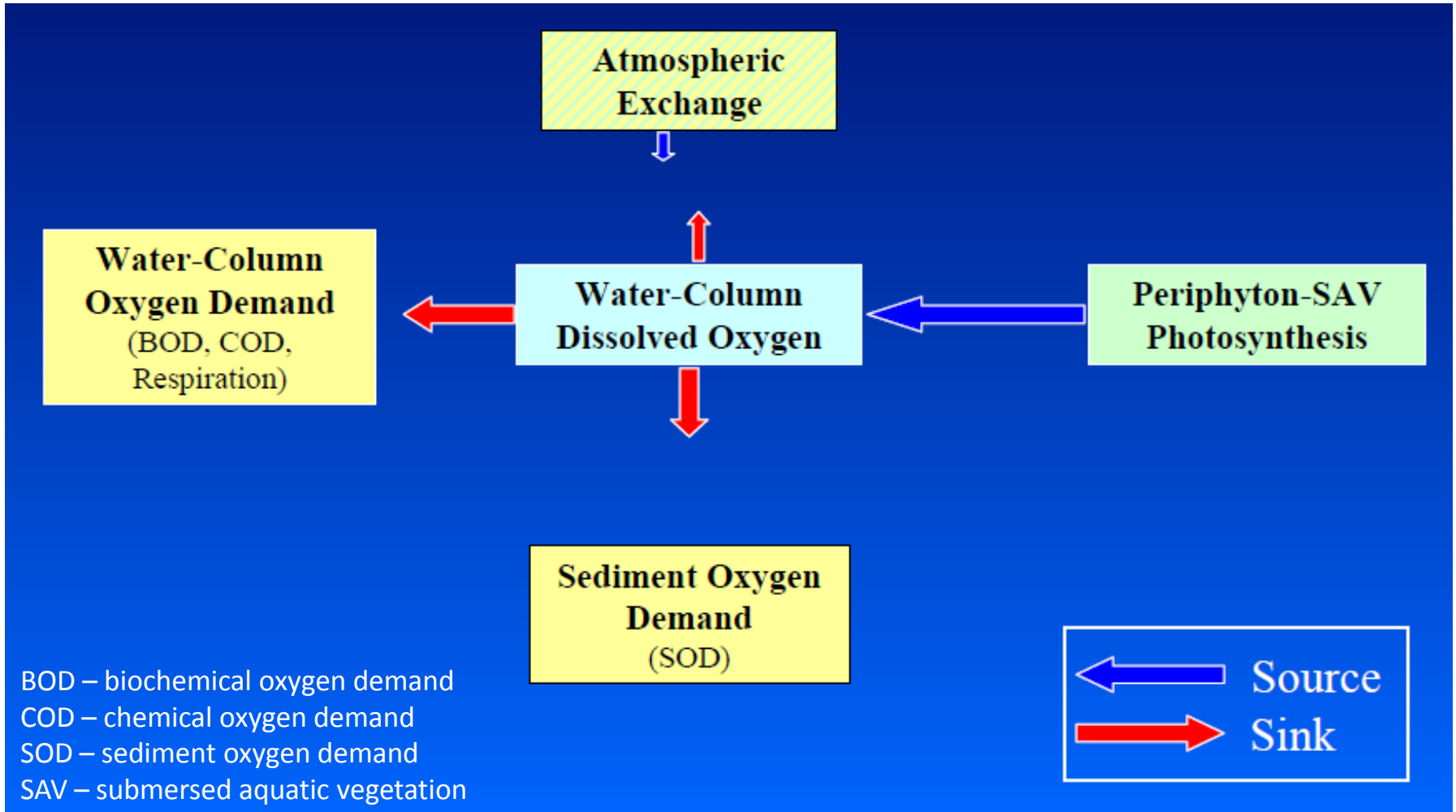


Hypotheses

- Many wetlands have naturally lower DO due to stagnant conditions and high respiration demand
- Natural drivers of DO
 - Plant photosynthesis and respiration
 - Microbial oxygen demand (especially sediment)
- Indicators
 - Color is an indicator of dissolved organic carbon (DOC), available food for microbes
 - Total Kjeldahl nitrogen (TKN) is the nitrogen fraction that is typically from natural sources



Wetland DO Drivers



From Weaver, K., 2004, An Alternative Water Quality Criterion for Everglades Dissolved Oxygen.



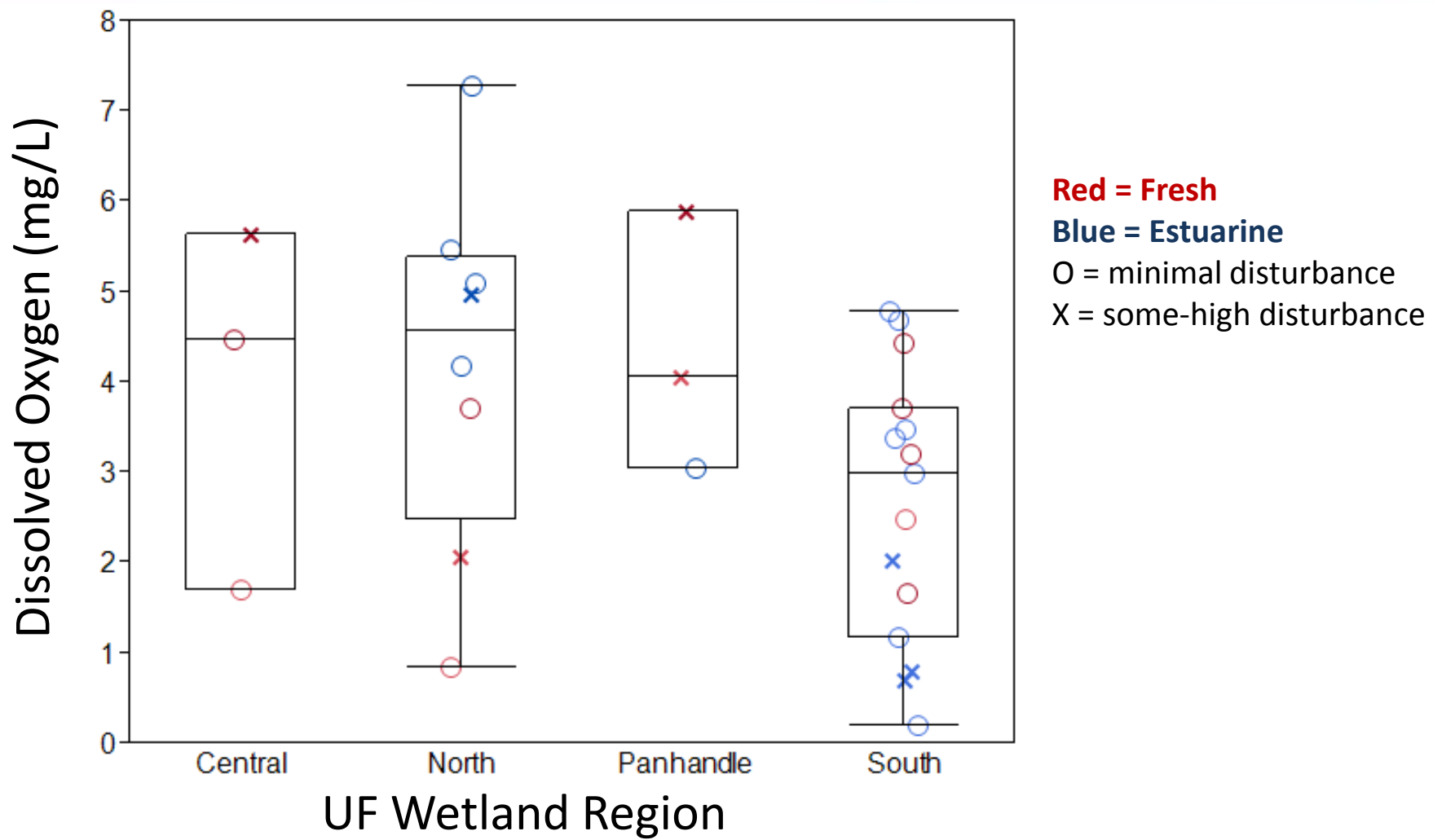
Florida NWCA Sites

- 67 randomly selected sampling sites in Florida NWCA 2011 effort
 - 34 of 67 sites had sufficient water
 - 15 freshwater
 - 9 marsh; 5 forested ; 1 shrub
 - 19 estuarine
 - 9 salt marsh; 10 mangrove
- Additional water quality collections for color, turbidity, and TKN





Dissolved Oxygen by Region



Higher DO expected in Panhandle and North, but not clear trend here.



NWCA Summer 2011 Data Summary

(Field and Supplemental Data)

	Wetland Type	N	DO (mg/L)	pH (SU)	Specific conductance (μmhos/cm)	Color (PCU)	TKN (mg/L)	Turbidity (NTU)
Fresh	Marsh (PEM)	9	4.1 (8)	6.3	435 (7)	140	1.69	3.6
	Forested (PFO)	5	2.2 (4)	6.2	540 (3)	278	1.72	3.3
	Shrub (PSS)	1	2.5 (1)	7.2	-	49	0.79	0.7
	All Fresh	15	3.4 (13)	6.3	467 (10)	180	1.64	3.3
Estuarine	Marsh (E2EM)	9	5.0 (6)	7.5	44,642 (8)	25	0.64	10.3
	Mangrove (E2SS)	10	2.4 (10)	7.5	48,140 (9)	64	1.01	5.5
	All Estuarine	19	3.4 (16)	7.5	46,494 (17)	45	0.84	7.7

Note: Sample sizes in parentheses for DO and specific conductance; data excluded due to calibration verification failures.

Fresh – higher color, TKN

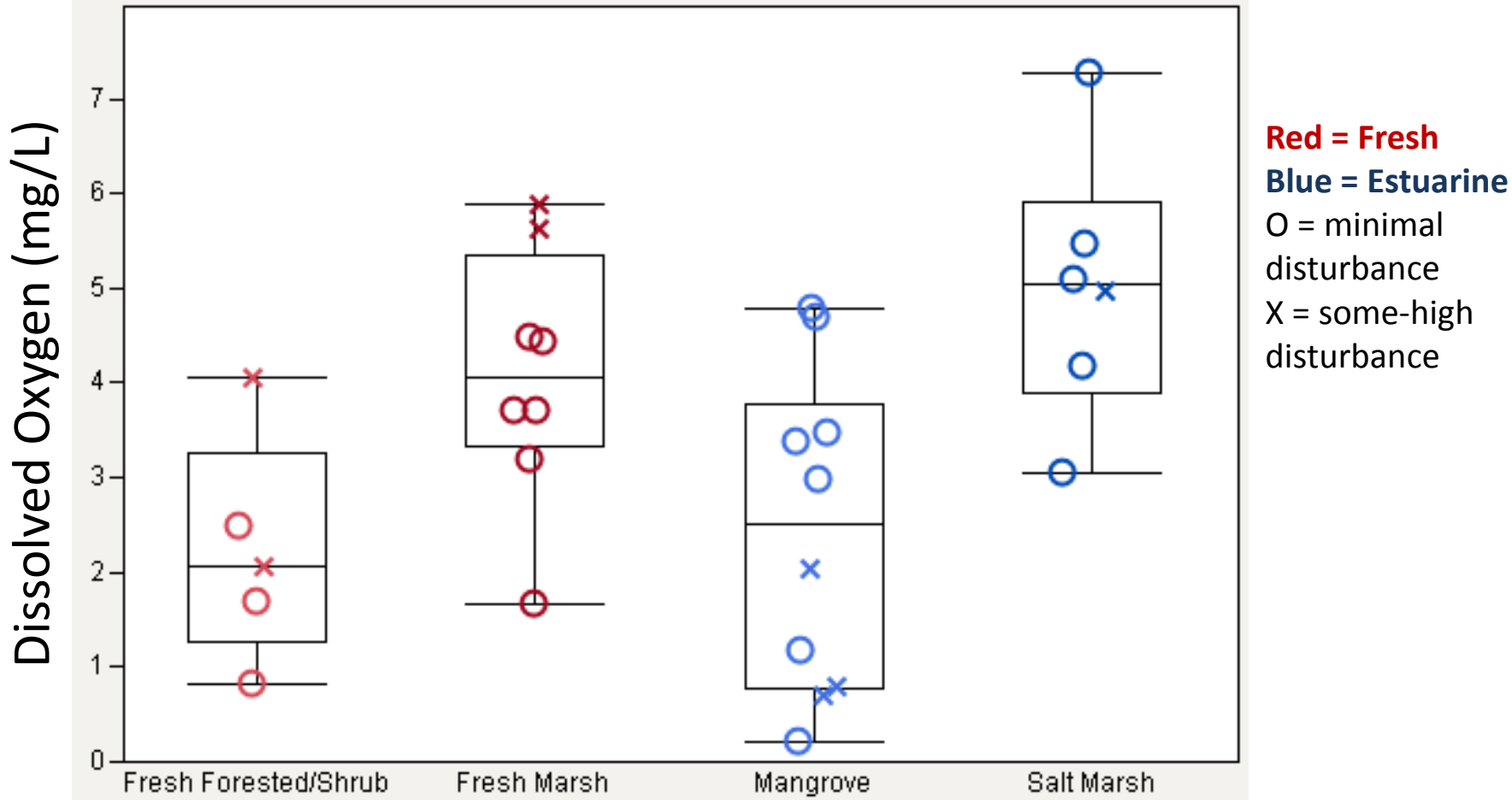
Estuarine – higher pH, specific conductance, turbidity

No difference in average DO between fresh and estuarine.

DO higher in marshes than in forested wetlands.



Quartile Box Plots of DO by Wetland Type



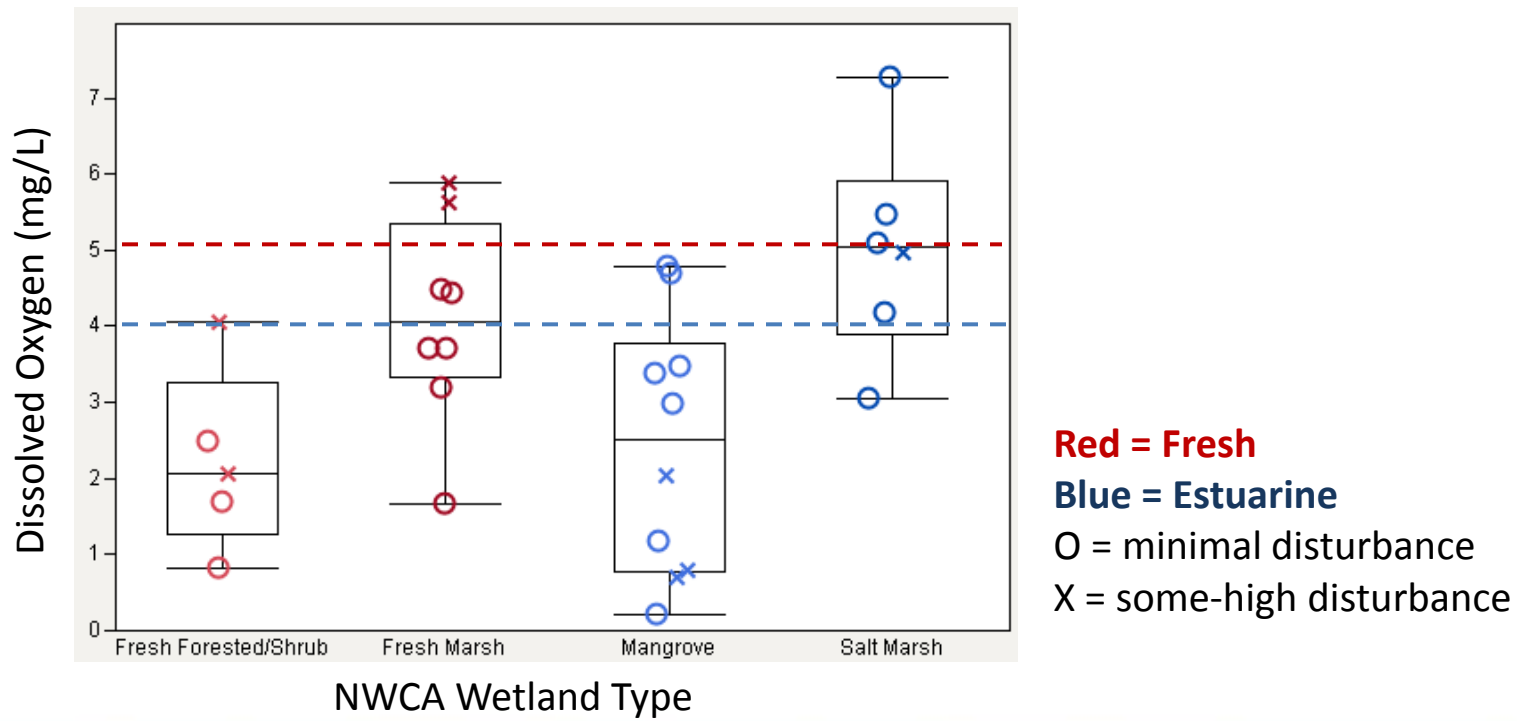
DO lower in forested. For fresh, higher DO at higher disturbance sites (low N)



Achievement of Water Quality Standards

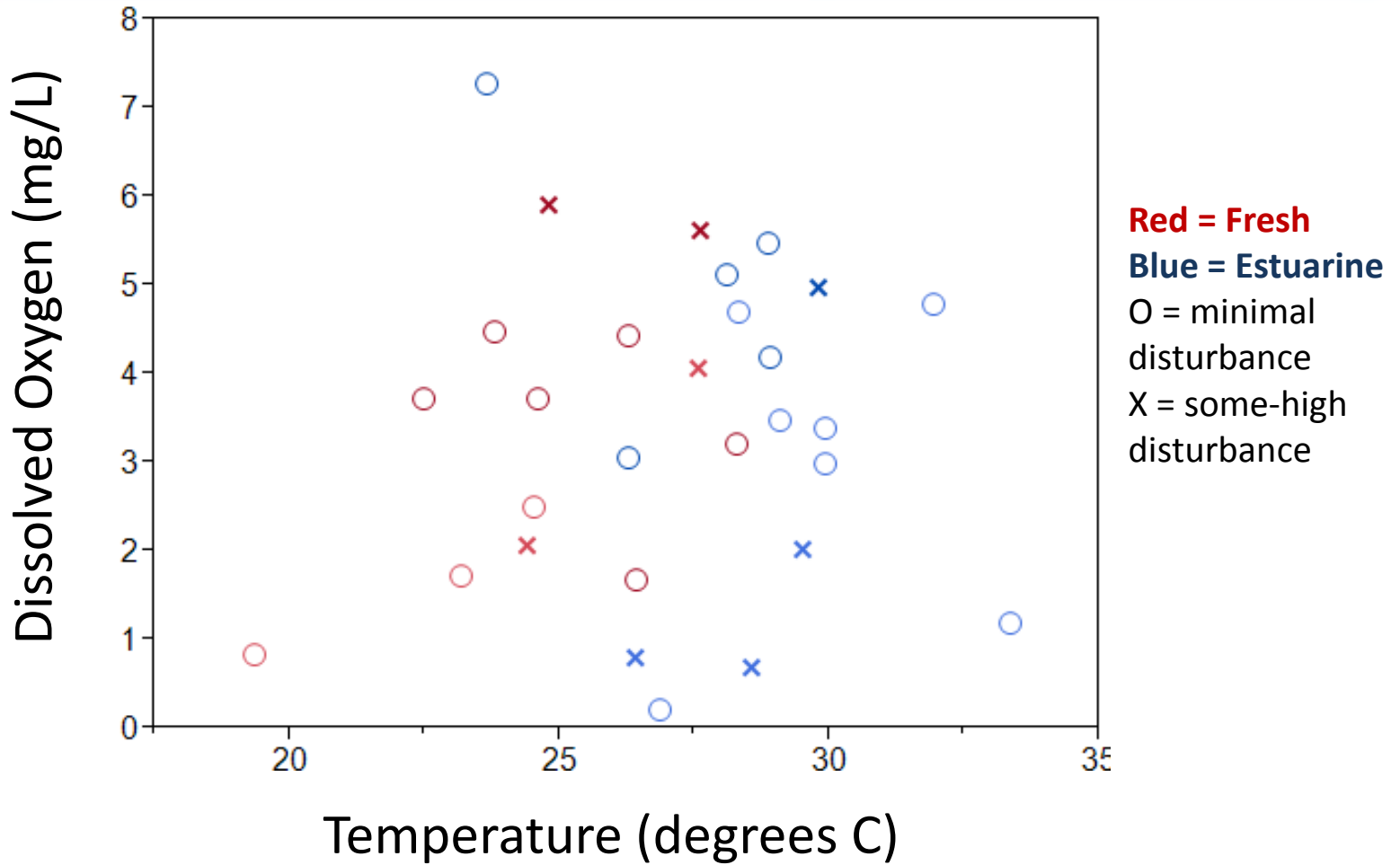
Fresh: Only 2 sites met criterion of ≥ 5 mg/L (and those were non minimally disturbed sites).

Estuarine: Most marshes met single sample minimum of 4 mg/L, but most mangroves did not meet it.





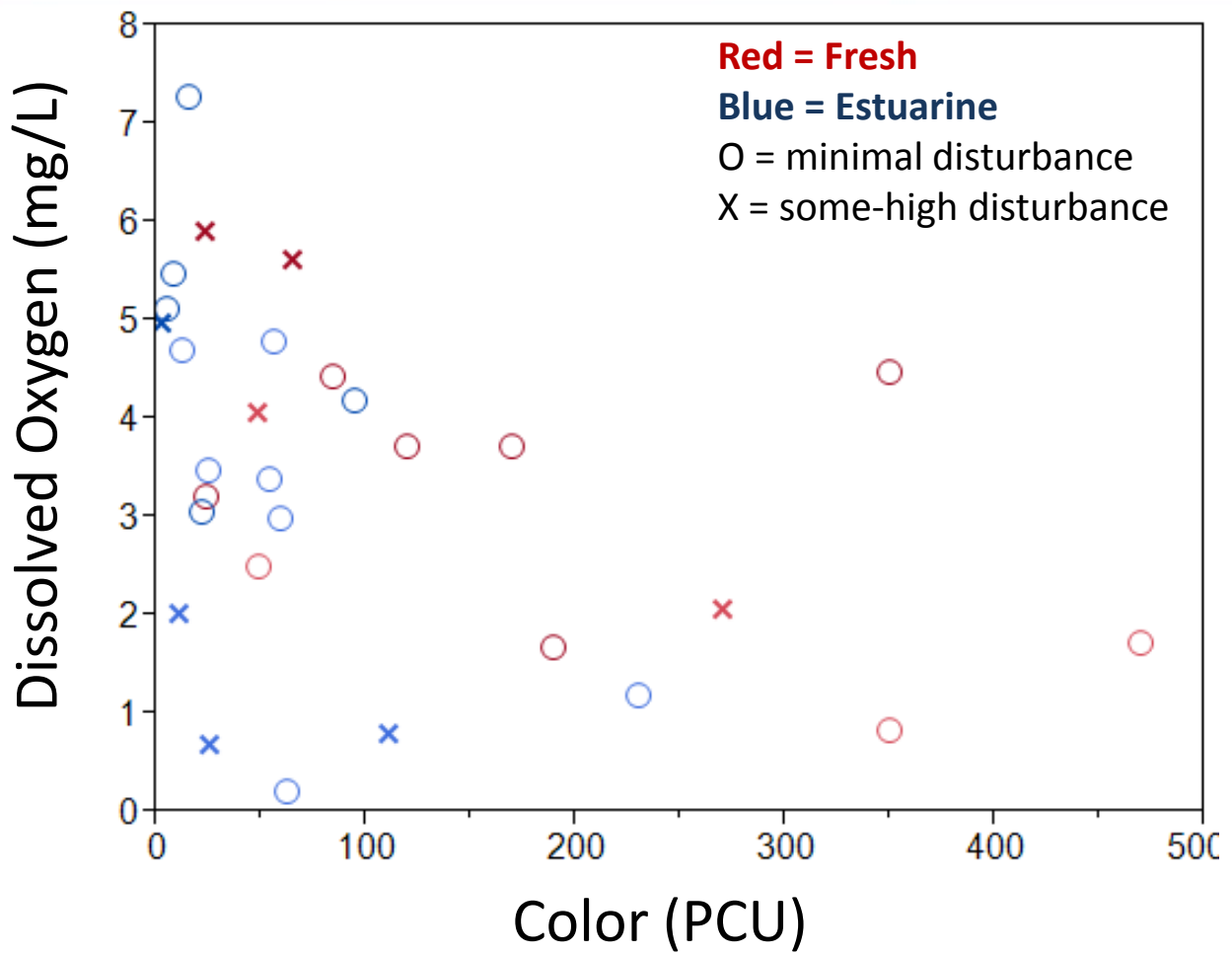
Water Temperature vs. DO



Temperature is not driving the DO trends. No effect of land use intensity.



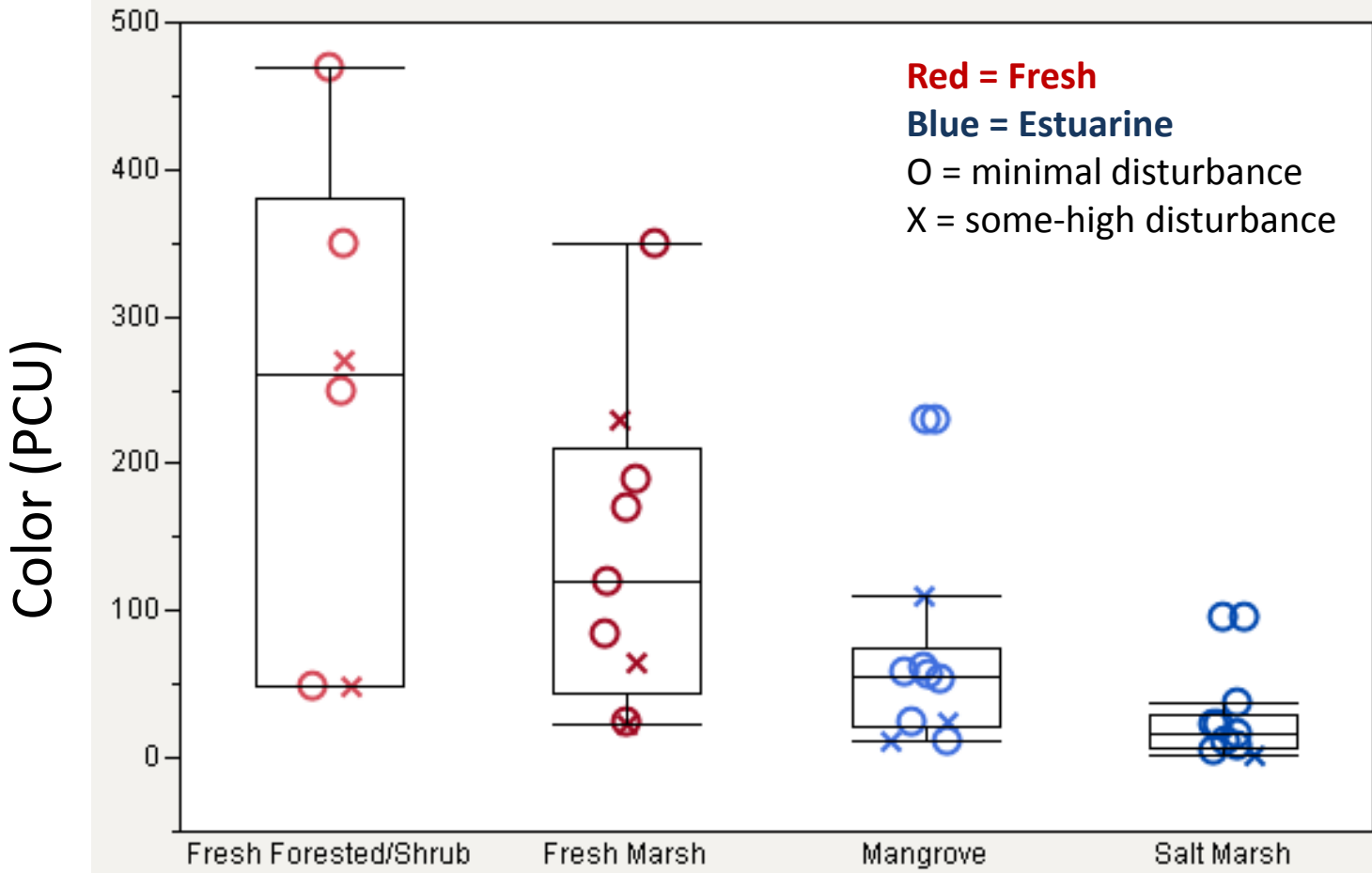
Color vs. Dissolved Oxygen



DO decreases with increasing color, for fresh and estuarine.
No effect of land use intensity.



Quartile Box Plots of Color by Wetland Type



NWCA Wetland Type

Color higher in fresh, forested. No effect of land use intensity.



Conclusions

- Current water quality standard for DO may not be appropriate for some wetlands
 - Not achieved in nearly all freshwater and half of estuarine wetlands samples in 2011 NWCA samples
- Overall, DO decreases as color increases
- Wetland type may be driving factor for DO levels
 - Higher DO in marsh habitats than forested, due to increased potential for photosynthesis
 - Higher DO in estuarine than in fresh, due to greater flushing of water and organic materials



Next Steps

- Collect additional data focusing on minimally disturbed sites
 - See if relationships hold for larger dataset
 - Determine potential diurnal DO swings
 - Investigate regional differences further
- Establish protective but appropriate DO criteria, potentially by wetland type
 - Estuarine vs. Fresh
 - Forested vs. Herbaceous



Acknowledgements

- HT Odum Center for Wetlands Field Crews, University of Florida
- DEP Contract Manager, Stephanie Sunderman
- US Environmental Protection Agency Monitoring Initiative Funds

- Learn more on the web

DEP Surface Water Quality Standards

<http://www.dep.state.fl.us/water/wqssp/index.htm>



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