Use of the Prevalence Index to Determine Plant Community Trends Related to Groundwater Withdrawal Lower Platte River, Nebraska

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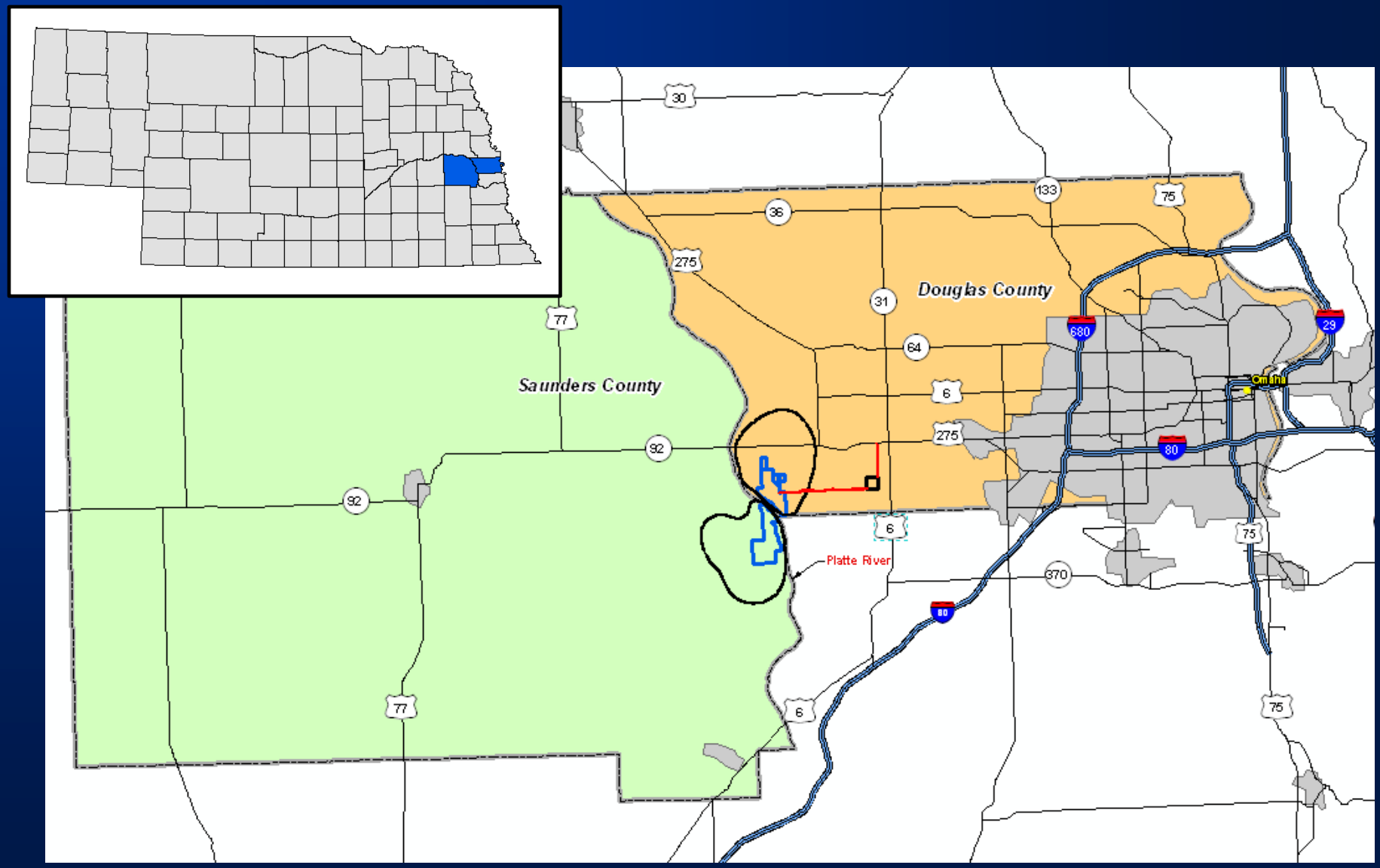
Platte West Project



The Project

- Platte West Water Production Facilities Project
- 2 types of wetland impacts:
  - Direct - construction of treatment plant and facilities
  - Indirect - drawdown of local water table during Project operation
- 14.6 acres of wetland impacts estimated in the 2002 EIS (direct and indirect)

Section 404 Permit

- Section 404 Individual Permit
  - Issued May 2003
  - Over 80 conditions included
- Permit Condition 37 states:
  - *“identify any changes (e.g., change in volume, surface area, depth of ponds and functions) in the existing or future wetlands or aquatic sites impacted as the result of project development and operation.”*

Monitoring Plan

- Multi-scale, multi-temporal monitoring plan developed
- The monitoring plan states that monitoring is to occur two times per year until:

"the Corps determines that any impacts to wetlands…are not likely to occur or that long-term wetland monitoring should be either decreased, increased, or stopped."

Monitoring

- Baseline Monitoring – document the range of natural variation in the wetlands
- Operational Monitoring – attempt to identify indirect impacts to wetlands due to project operation

Monitoring Approach

- Systematic, multi-tiered monitoring approach
- Corollary data
- Sampling regime
- Vegetation:
  - key to monitoring approach

Data Collection

- Sample Plots

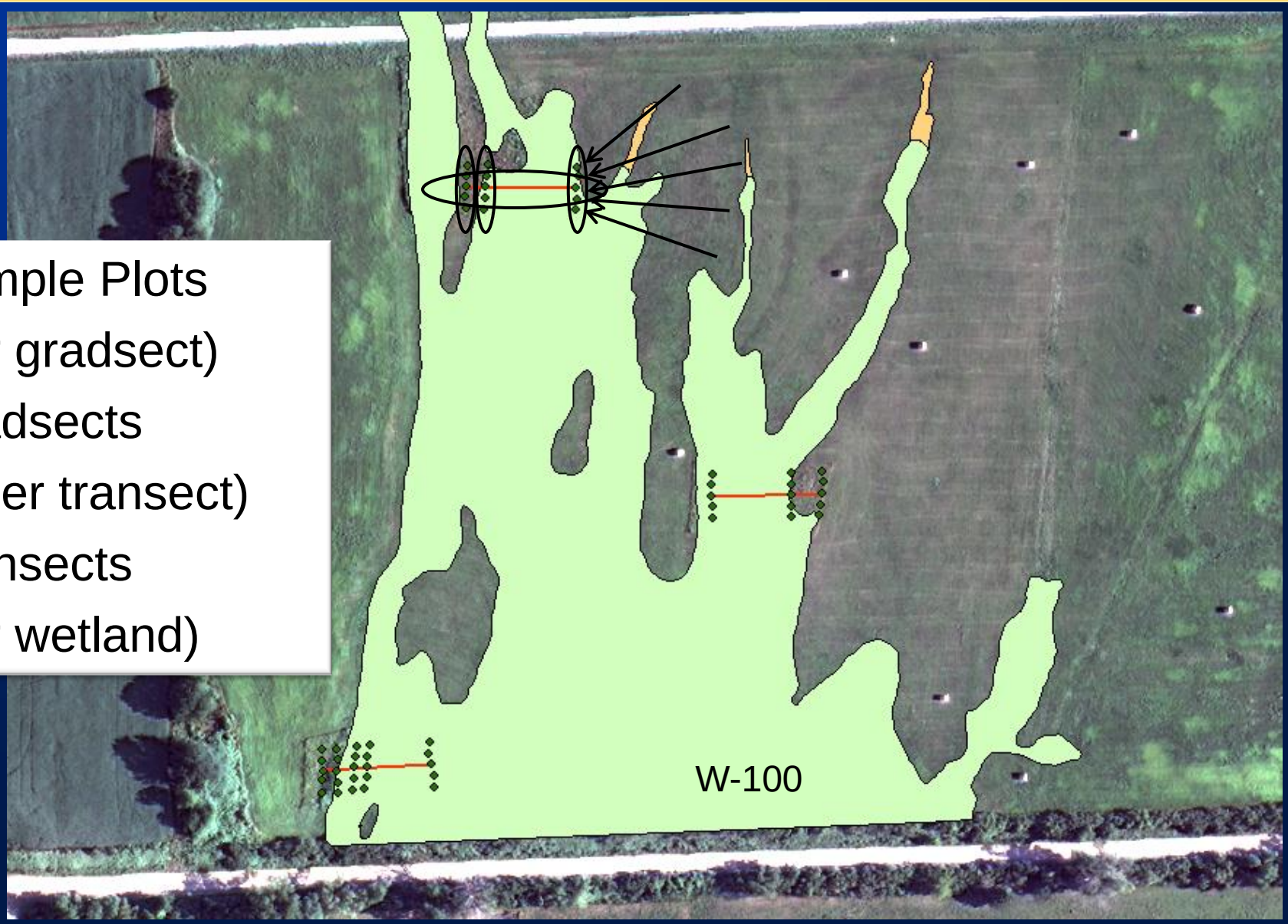
(5 per gradsect)

- Gradsects

(2-7 per transect)

- Transects

(3 per wetland)



Data Collection

- At each sample plot:
  - Identify all vegetation to species
  - Assign modified Daubenmire cover class value
- Cover classes vs. absolute percent cover
- Database

Vegetative Indices

- Species Richness – count of different spp.
- Species Diversity – Simpson's Reciprocal Index
- Mean C-Value – measure of botanical quality
- FQI – combines mean C-value with total number of spp. identified
- Prevalence Index – indicates if the vegetation is hydrophytic

Prevalence Index

$$PI = \frac{\sum I\ E}{\sum I}$$

- E = ecological index *(wetland indicator status)*
- I = importance value *(percent cover)*

5	• UPL
4	• FACU
3	• FAC
2	• FACW
1	• OBL

Prevalence Index

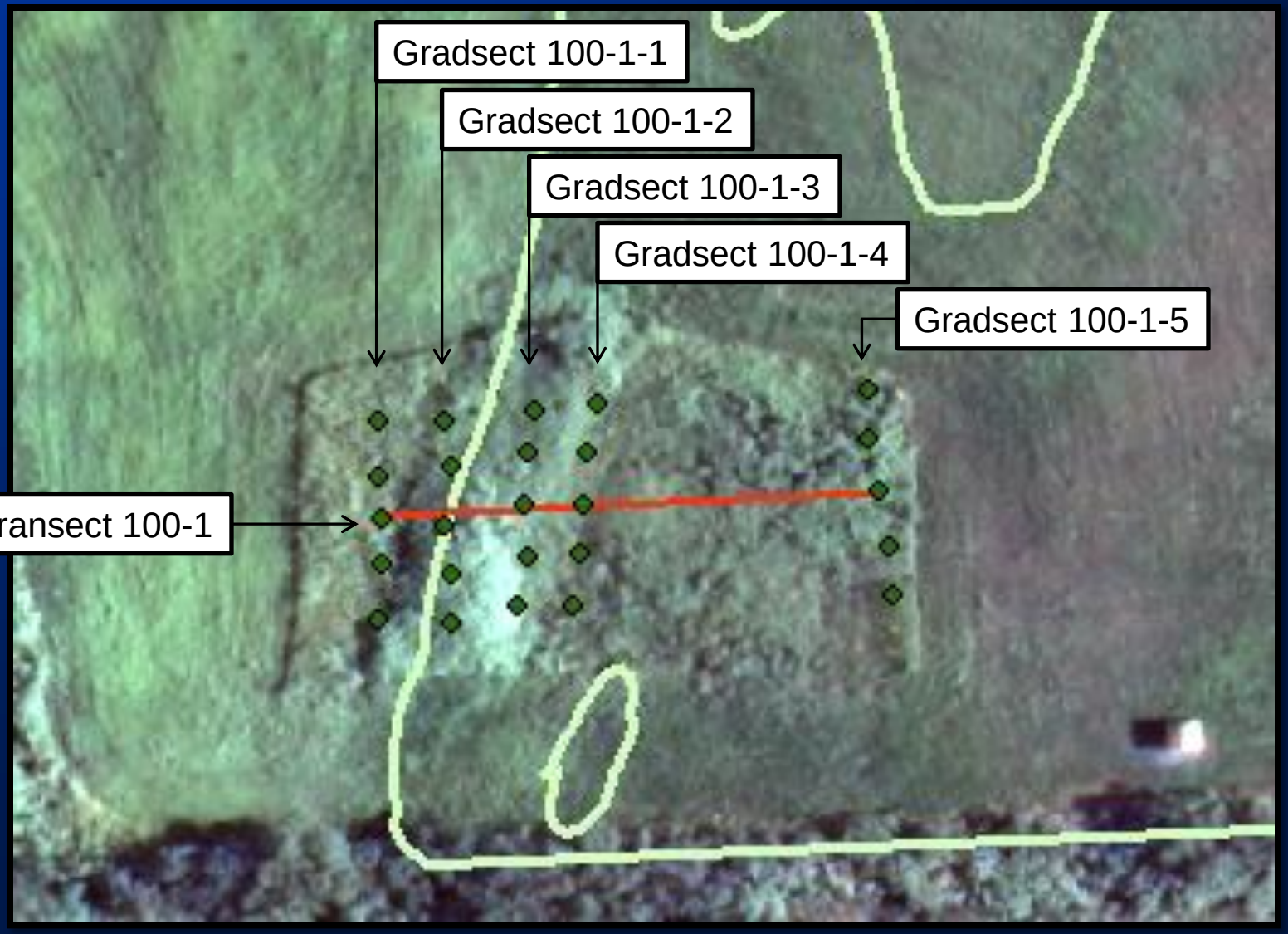
- Provides a measure of the "wetness" of the community
- ≤ 3.0 = wetland
- Comparing PI over time can indicate trends in the wetland

Data Analysis

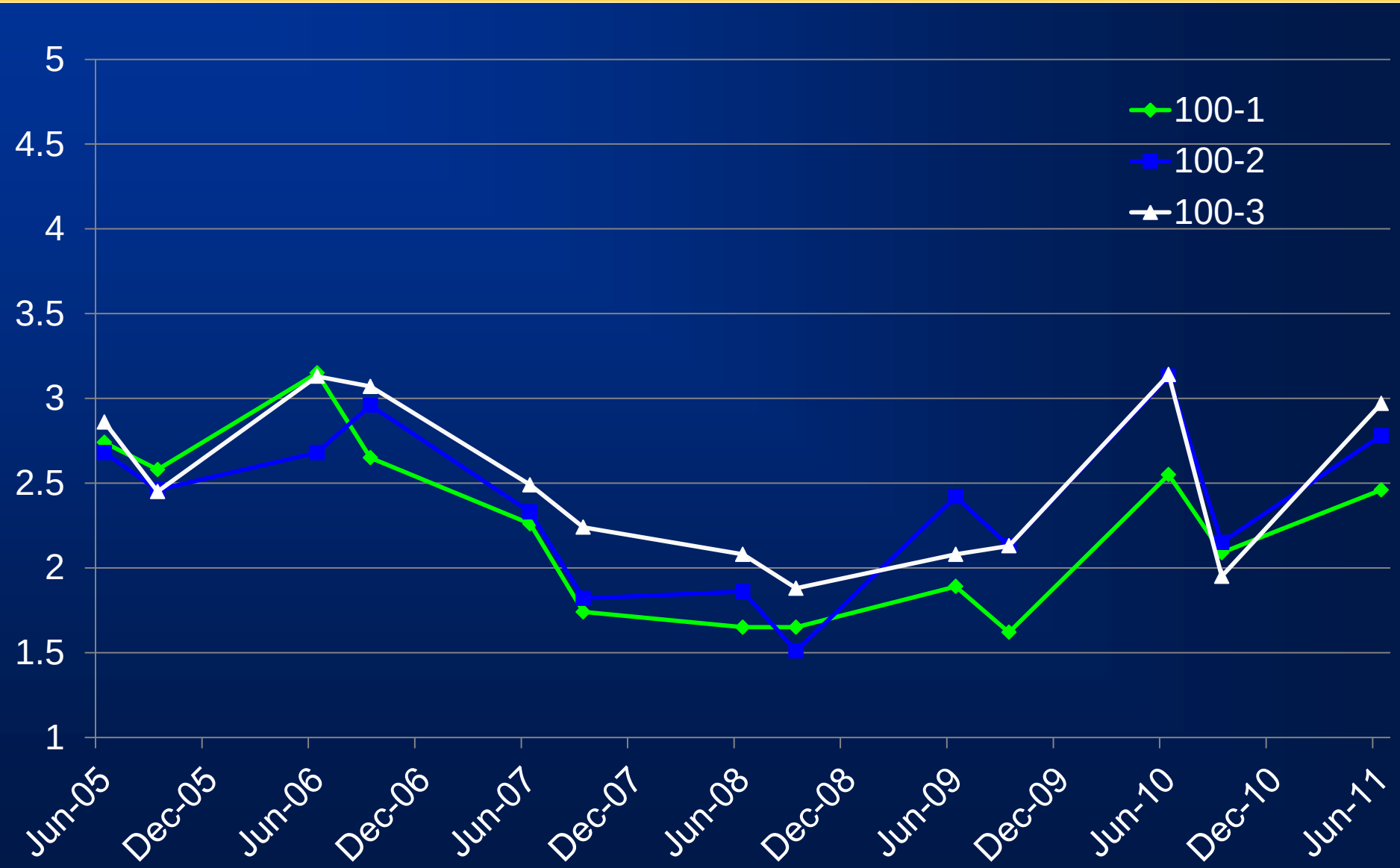
- An abundance of data available
- Comparisons:
  - Location-Based
    - Wetland
    - Transect
    - Gradsect
  - Temporal-Based
    - Sampling Effort
    - Year
    - Baseline/Operational
- Focus on Monitoring Goals: identify indirect impacts

Mean Baseline PI by Gradsect

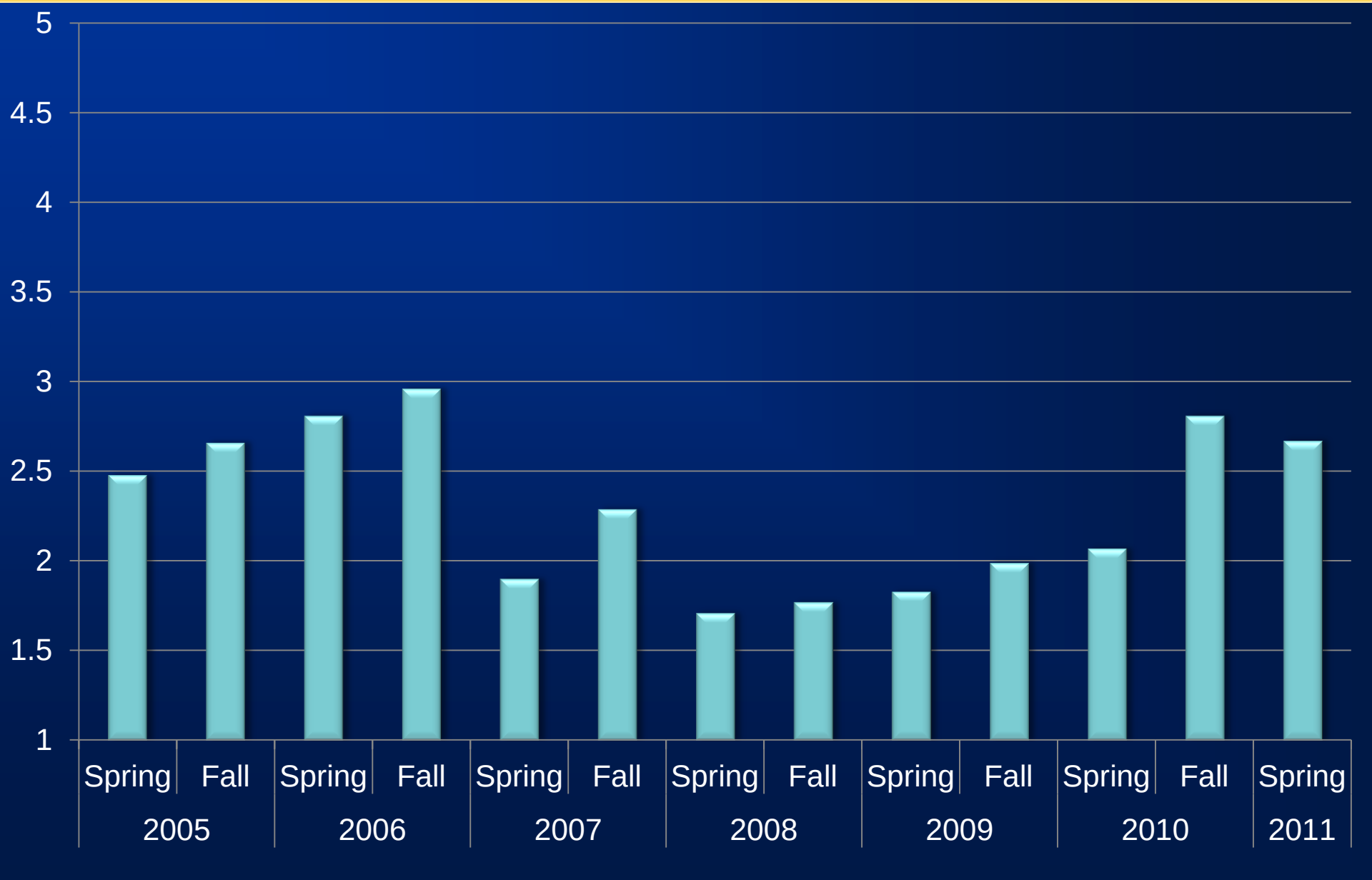
Wetland 100, Transect 1



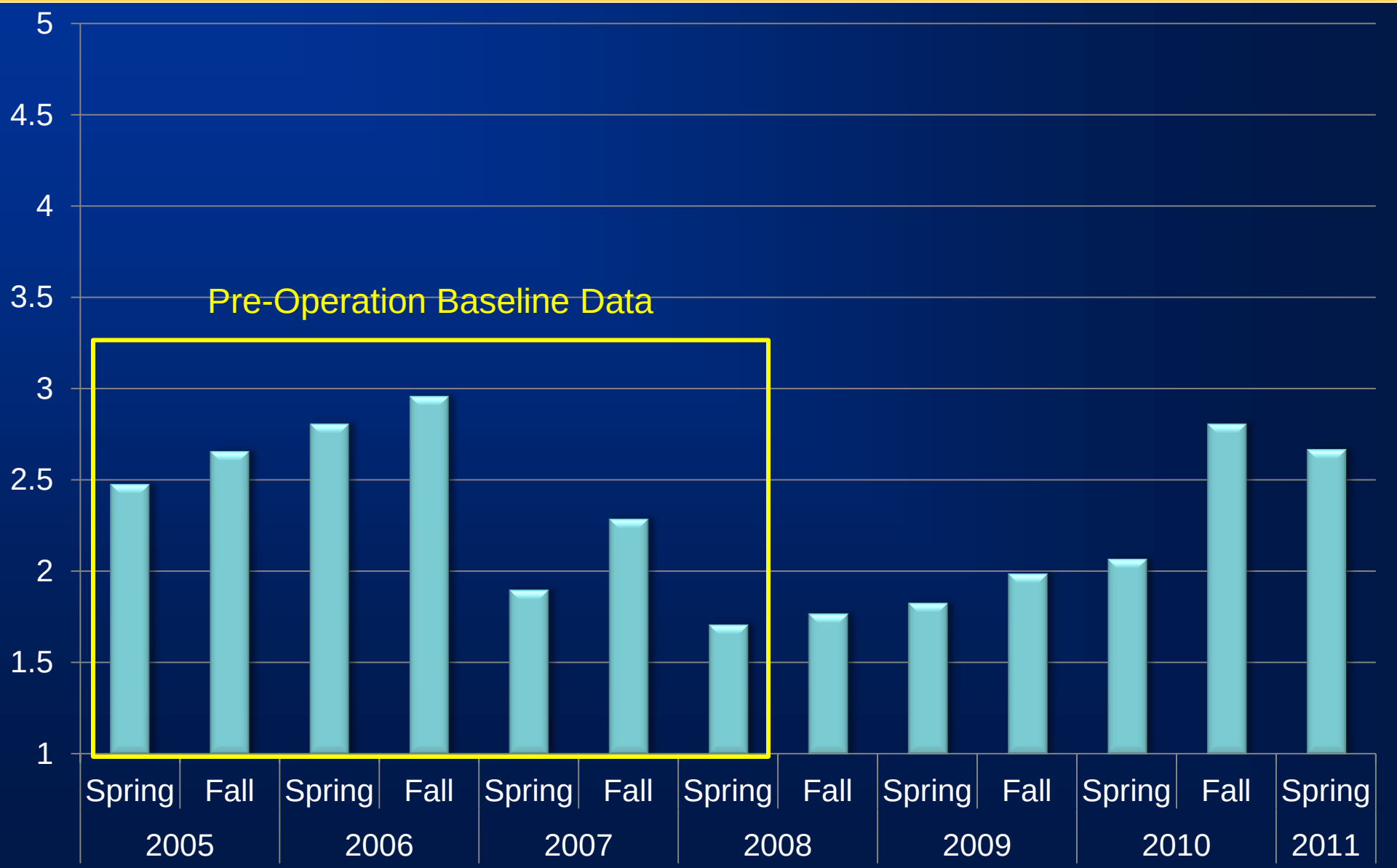
Mean PI by Transect



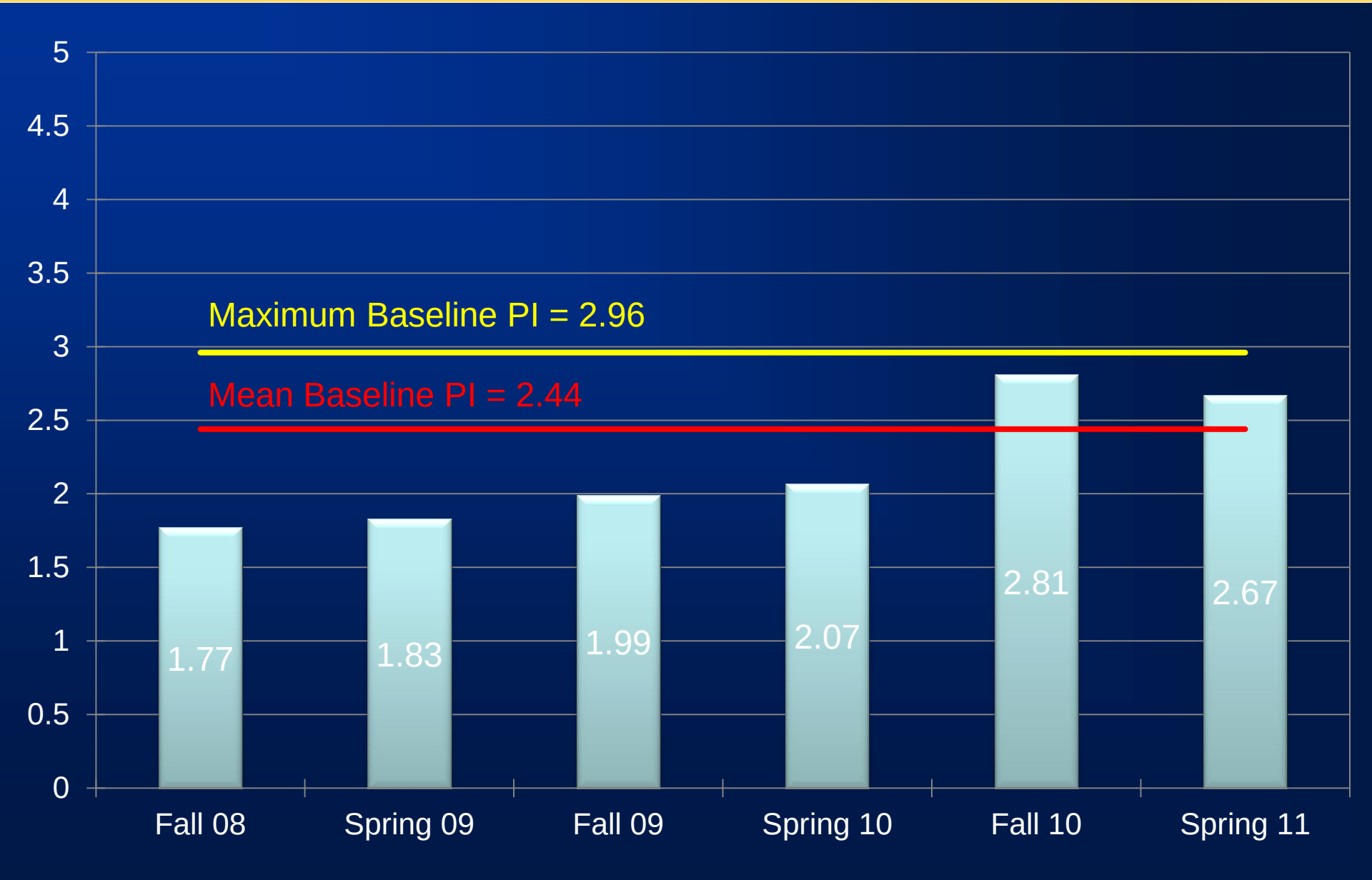
Mean PI Over Time (W-100)



Mean PI Over Time (W-100)



Mean PI Compared to Baseline



Biological Significance

- An increase above maximum baseline PI of 0.5 would be considered biologically significant
- Best Professional Opinion (at the time)
- Statistical Analysis applied in recent years

Statistical Significance

- Compare mean operational PI to mean baseline PI
- Repeated Measures ANOVA used to identify significance
- Post Hoc Analysis used to identify if a sampling effort is different from baseline average

Statistical Significance

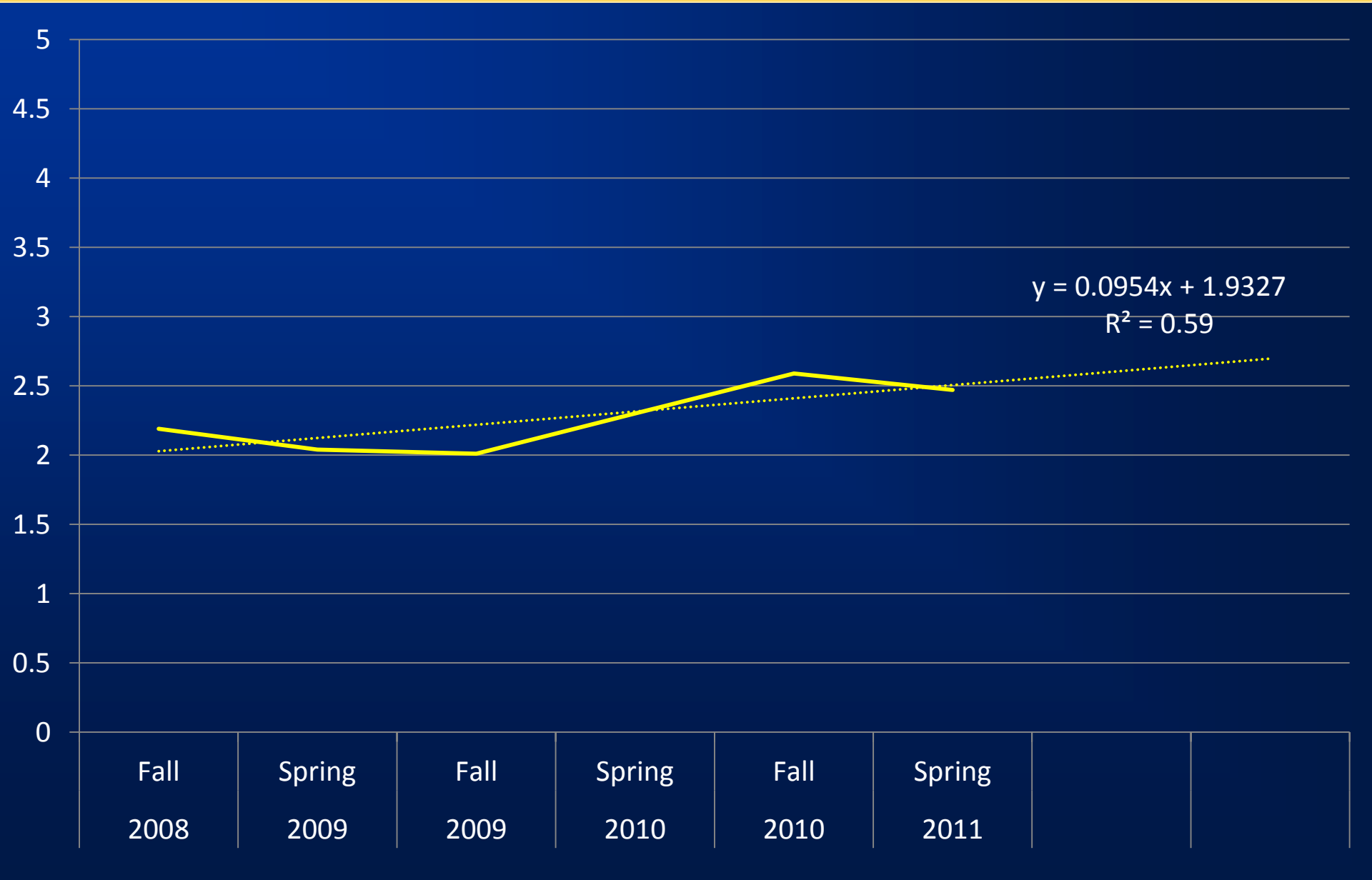
Post Hoc Tests	Mean Difference	T-Value	P - Unadjusted	P - Bonferroni	Eta Squared
Baseline Average and 9/2008	.649	7.940	.000	.002	.887
Baseline Average and 6/2009	.560	4.543	.003	.056	.721
Baseline Average and 9/2009	.369	2.628	.034	.715	.463
Baseline Average and 6/2010	.370	3.638	.008	.174	.623
Baseline Average and 9/2010	.400	2.732	.029	.614	.483
Baseline Average and 6/2011	.226	2.292	.056	1.000	.396

Other Analyses

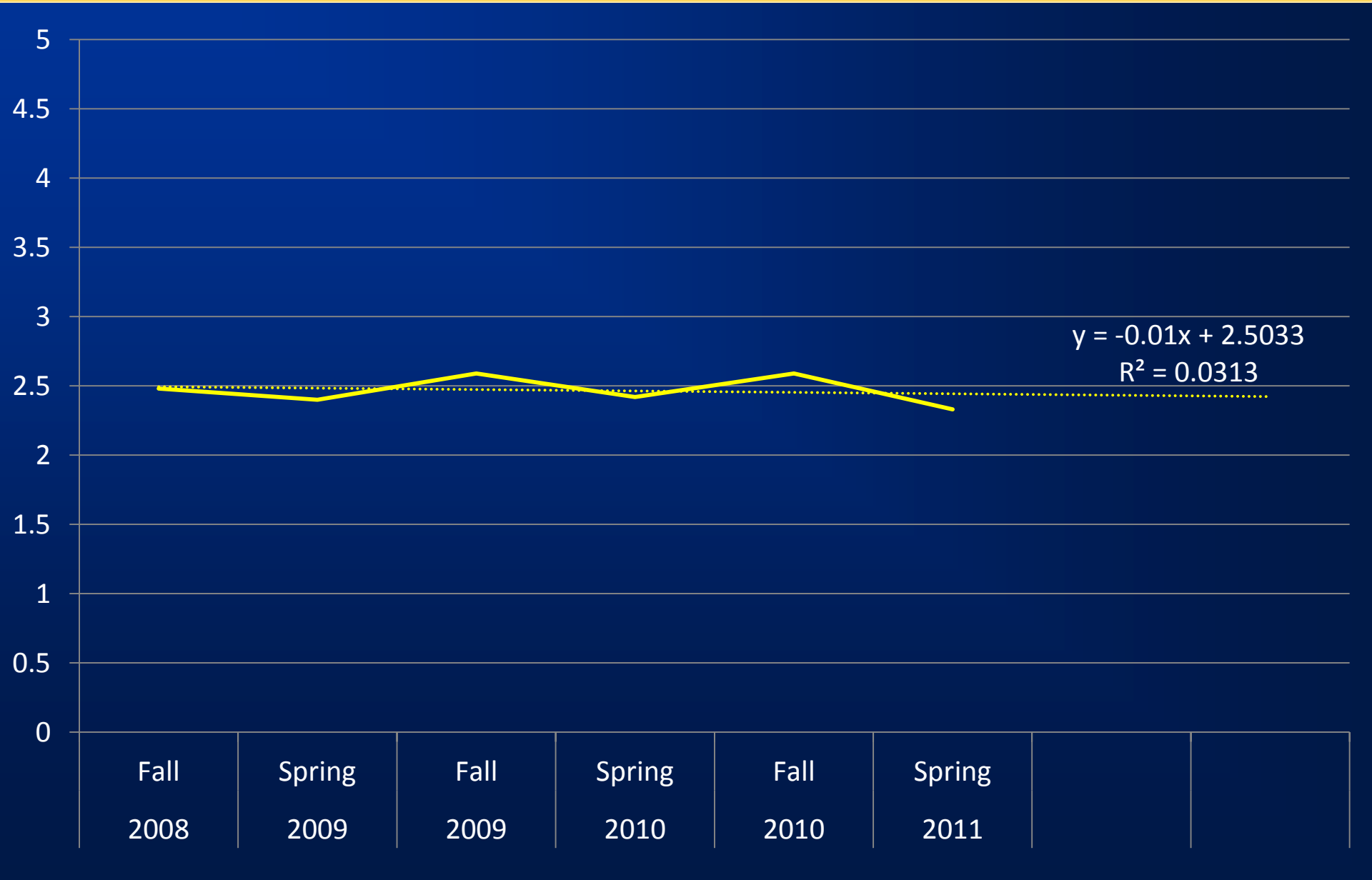
- No statistically significant increases from baseline mean detected to date
- Trend analysis conducted to identify any apparent trend in PI
- Simple, linear trendline applied to PI over time

PI Trend Over Time (W-100)

PI Trend Over Time (W-25)



PI Trend Over Time (W-68)



Prevalence Index

- Excellent early indicator of change over time in wetlands (trendlines)
- Corollary diagnostics needed:
  - Other veg indices/metrics of change
  - Aerial Photography
  - Hydrological Data
  - Production Well Data
- Indirect Impact or Natural Variation?

Thresholds Evaluation

Sampling Season	Increase in PI by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness		
Sept. 2008	No*	No	No	No	No	No	No
June 2009	No	No	No	No	No	No	No
Sept. 2009	No	No	No	No	No	No	Yes - Decrease to Level 1
June 2010	No	No	No	No	No	No	No
Sept. 2010	No	No	Yes	No	No	No	No
June 2011	No	No	Yes	No	No	No	Yes – Decrease to Level 2

* = A significant decrease in WAM occurred, indicating that the wetland was wetter than baseline average.

Prevalence Index

- Use in Wetland Delineations:
  - Provides a discrete measure of the wetness of the vegetation community
- Sensitive to subtle changes
- In long-term monitoring applications, can indicate trends over time

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