



Reservoir Nutrient Criteria

Texas Parks and Wildlife Department

February 2007



Texas Parks and Wildlife Code

- **Conserve and manage state fish and wildlife resources**
- **Provide information to entities that make decisions affecting those resources**



Freshwater Fishing in Texas

Inland Fisheries manages resources in:

- Over 800 public impoundments
- 80,000 miles of rivers and streams
- About 1.7 million acres in total

1.8 million anglers (16 years and older)

Fishing generates \$3.1 billion in economic output annually



TPWD Approach - June 2004



TPWD biologists can manage the fisheries in most Texas reservoirs as they are today
BUT, we believe that numerous reservoirs are borderline hypereutrophic

TCEQ Presentation at RTAG

1/18/2006

- Calculation of TCEQ and TPWD criteria for thirty reservoirs
- Five year running assessments compared to both criteria



Approaches

- Causal (N, P) and response (chl-*a*) variables
- 90th percentile
- Last 10 years
- Nonparametric approach
- All reservoirs



<http://watercenter.montana.edu/gallery>

TCEQ

TPWD



www.ohiodnr.com/WILDLIFE/fishing

- Response (chl-*a*) variable
- 99th percentile confidence interval of the mean
- All historical data
- Parametric approach
- Subset of reservoirs

TPWD Response

- **Recalculate TCEQ and TPWD criteria**
- **Comment on methodologies**
- **Compare compliance assessment using both criteria**



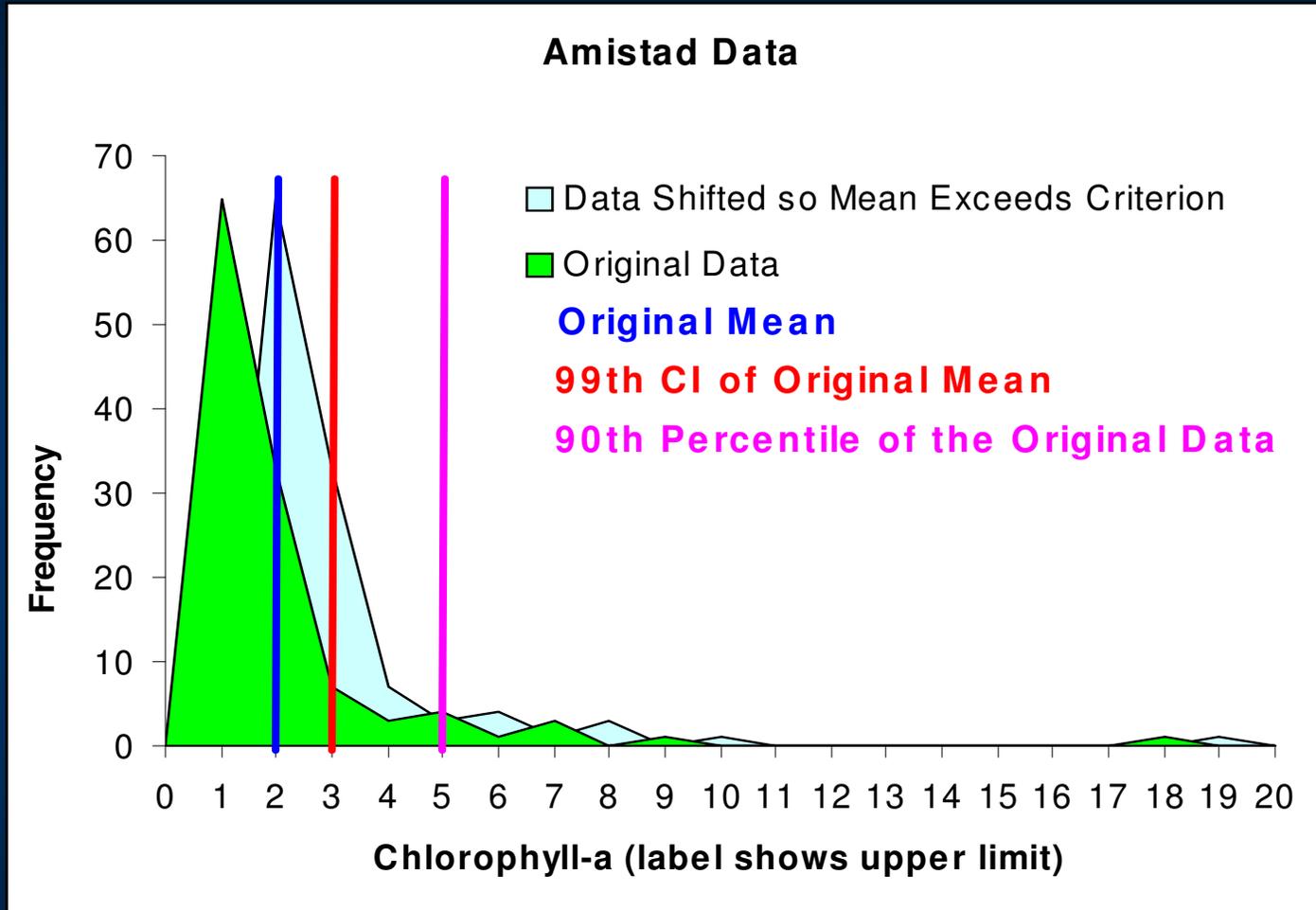
Comment on the Methodologies

Chronic vs. acute tendencies

TCEQ confidence interval approach – based on the mean - identifies “chronic” problems

TPWD percentile approach – accentuates individual points – identifies “acute” problems

Amistad Reservoir Example



At time impairment is identified:

TCEQ approach – 44% of data points exceed TCEQ criterion

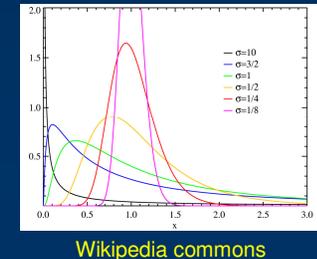
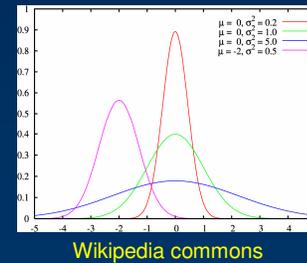
TPWD approach – 10% of data points exceed TPWD criterion

Comment on the Methodologies

Parametric vs. nonparametric approach

TCEQ parametric approach assumes a normal (bell curve) distribution. Typically, environmental data exhibit skewness (long tails, non-uniform shape).

TPWD nonparametric approach uses actual data and makes no assumptions about a distribution.



Outliers (extreme values of data) often affect the mean more than nonparametric approaches, so treatment of outliers becomes important in parametric approaches.

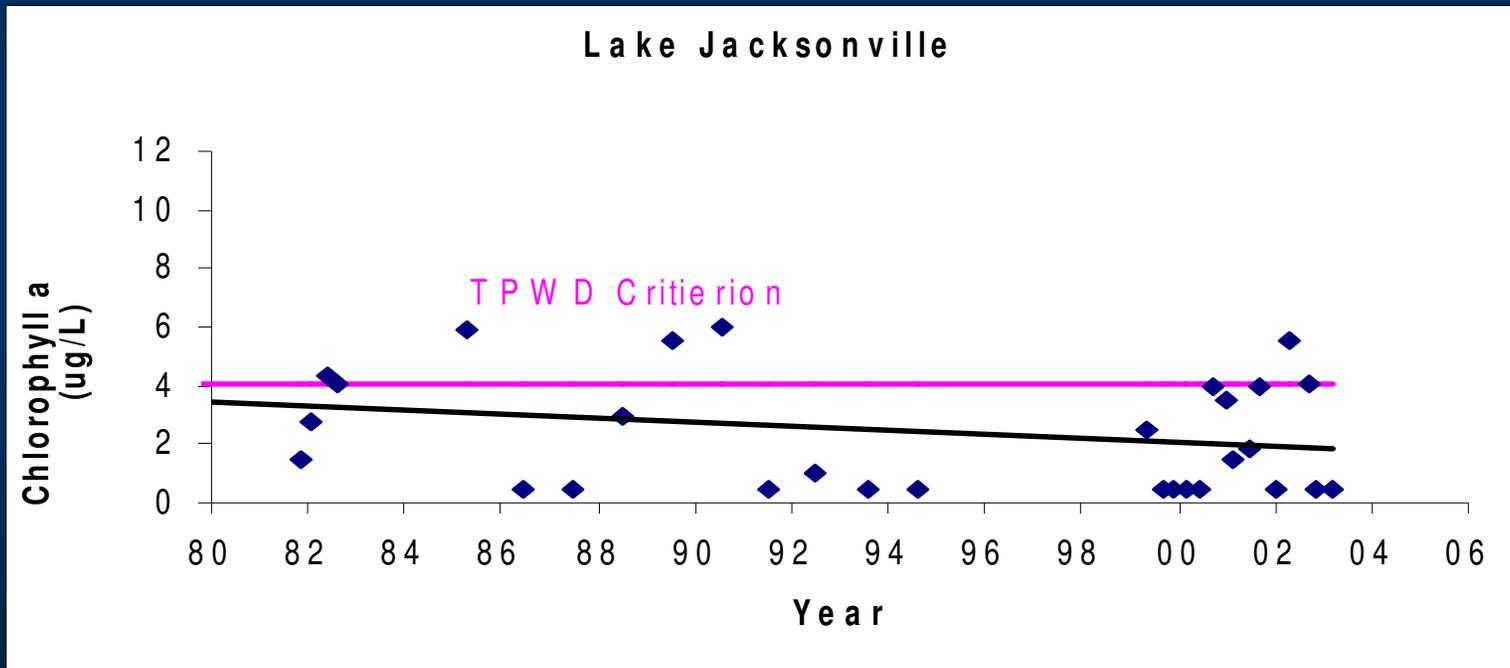
Compliance Assessment

- TPWD approach more sensitive to deviations in the data
- Approaches can be made similar by adjusting percentiles, time frame

TCEQ	TPWD	TCEQ sets flagged	TPWD sets flagged	Correlation
99 th , all data	90 th , 10 years	28	102	33 %
99 th , 10 years	90 th , 10 years	75	102	50 %
90 th , 10 years	90 th , 10 years	87	102	55 %

Compliance Assessment

For Lake Amon G. Carter, Diversion Lake and Lake Jacksonville, TCEQ method did not identify a problem, even though 50% of data exceeded 90th percentile

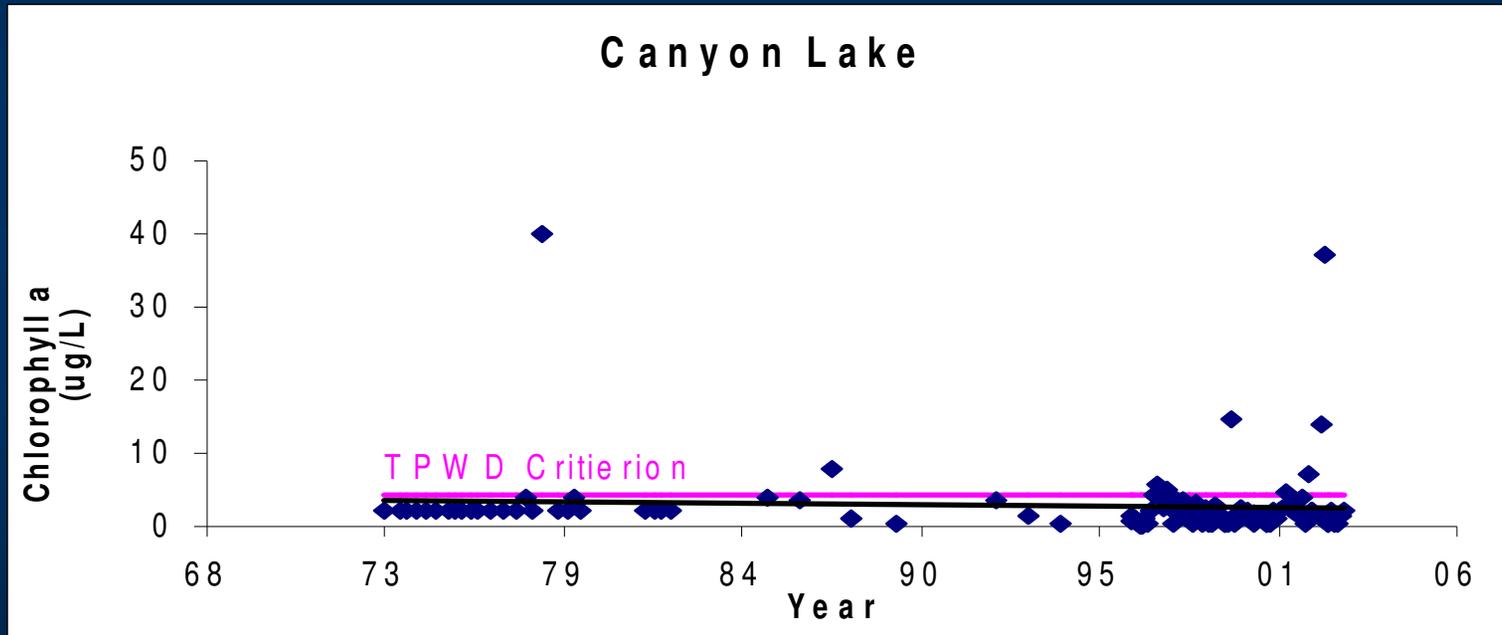


TPWD assessment: 17 – 50% exceed 90th percentile (4.09 ug/l)

TCEQ assessment: Mean never exceeds 4.1 ug/l; criterion is 4.58 ug/l

Compliance Assessment

For Canyon Lake and Inks Lake, TCEQ method identified a problem when TPWD method did not



TPWD assessment: 7 – 9 % exceed 90th percentile (4.2 ug/l)

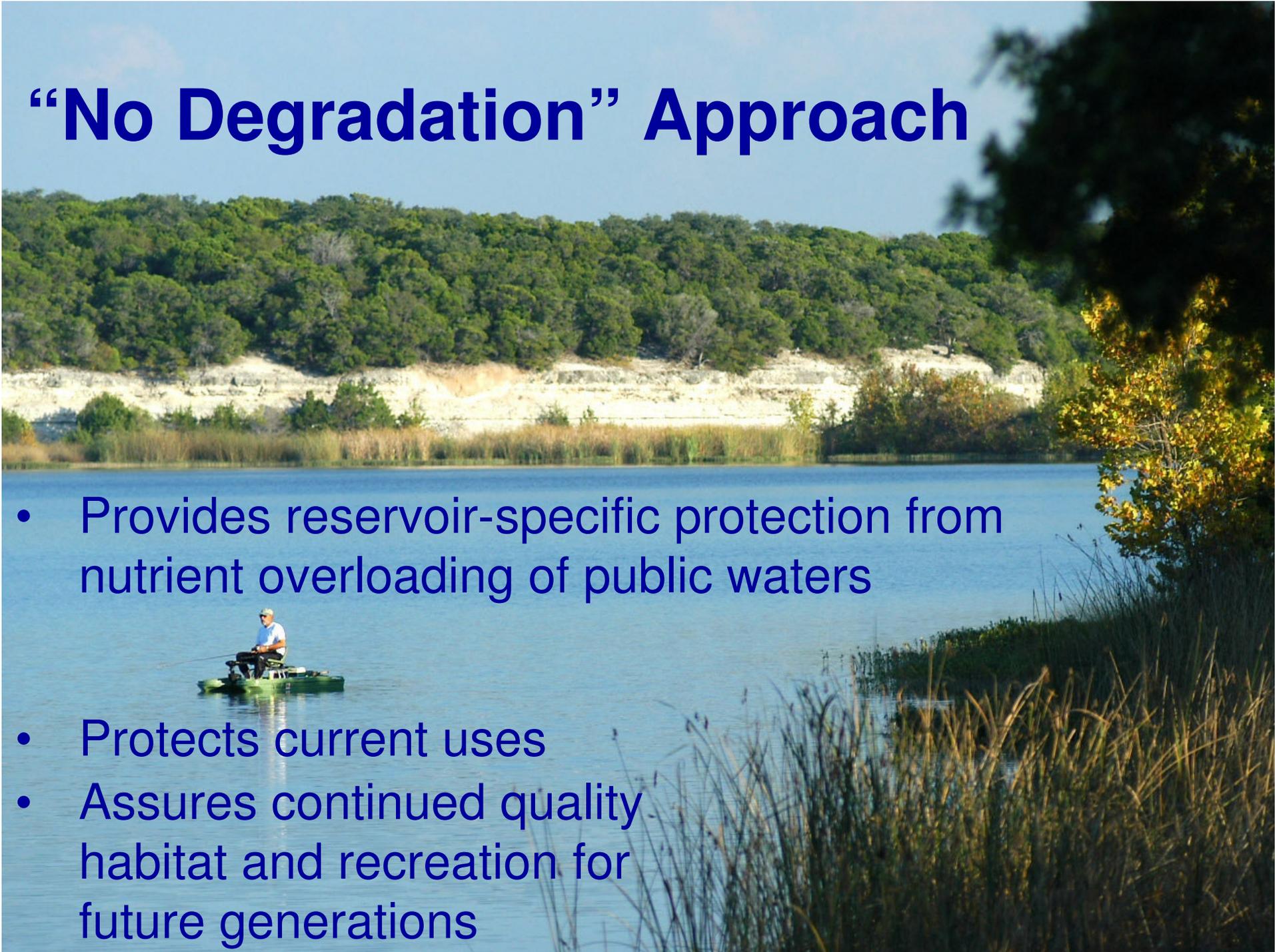
TCEQ assessment: Single large value causes mean to exceed TCEQ criterion (3.05 ug/l)

Pending Issues

- **Link between causal (N, P) and response variables (chlorophyll-a)**
- **How to account for nutrient cycling by macrophytes and benthic algae**

“No Degradation” Approach

- Provides reservoir-specific protection from nutrient overloading of public waters
- Protects current uses
- Assures continued quality habitat and recreation for future generations



Questions?

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