

# **The Influence of Lake Age and Watershed Condition on Lake Eutrophication in Kansas**

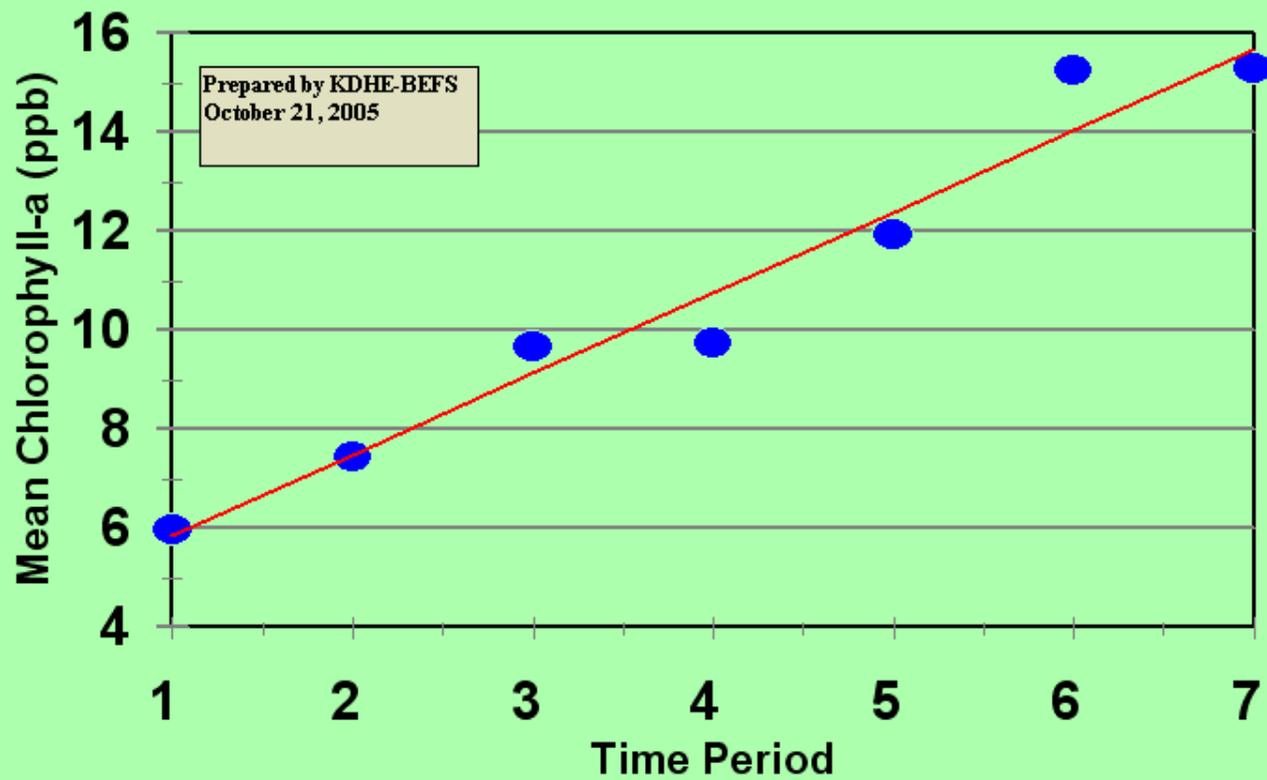
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Kansas Department of Health & Environment**

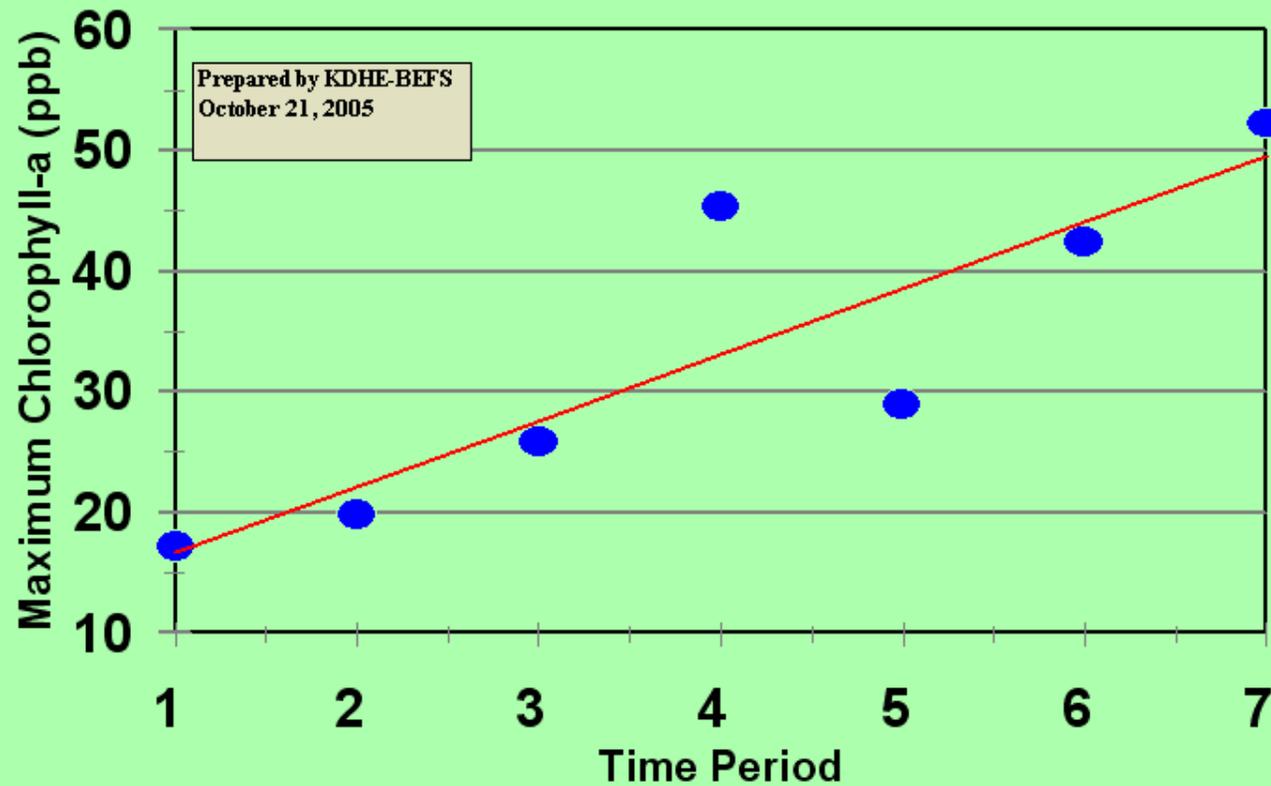
**April 8, 2006**



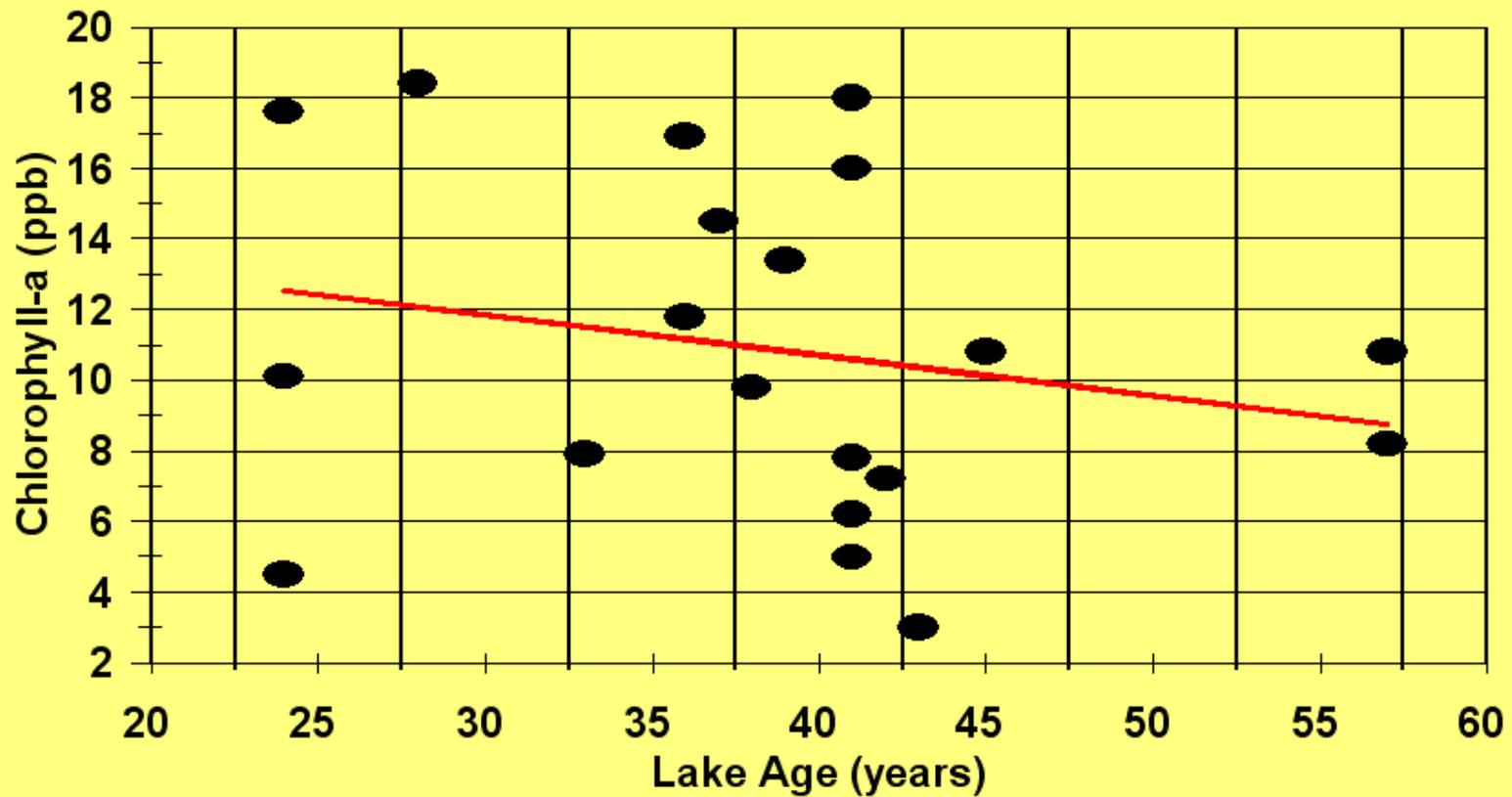
## Mean Chl-a 20 Federal Lakes 1985-2005 By 3 Year Time Periods



## Max Chl-a 20 Federal Lakes 1985-2005 By 3 Year Time Periods

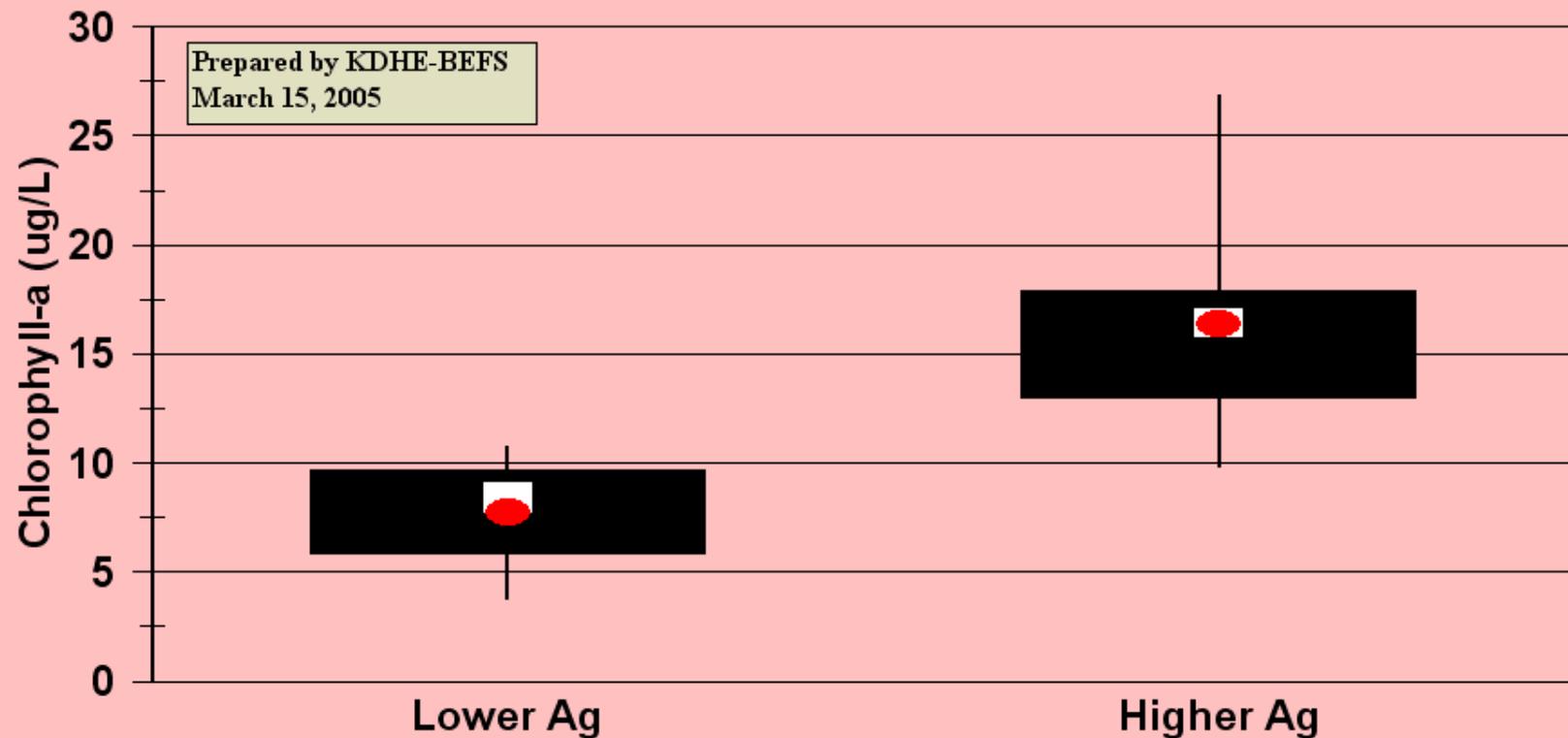


# 20 Federal Lakes 1985-2005



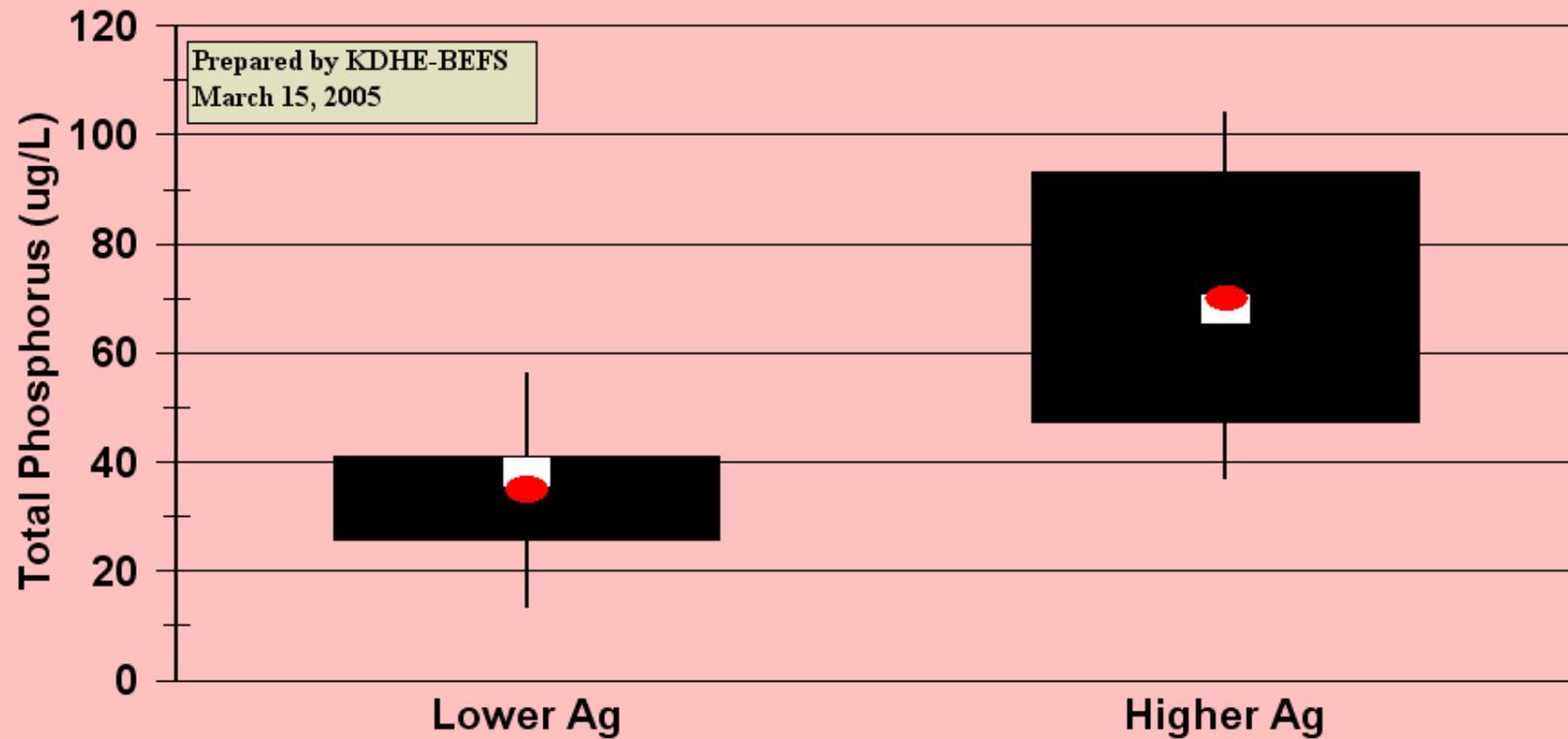
# Federal Lakes Chl-a

Versus Gross land Use



# Federal Lakes TP

## Versus Gross land Use





# Dam Age Taken From The ACOE Dam Safety Database

[Http://crunch.tec.army.mil/nid/webpages/nid.cfm](http://crunch.tec.army.mil/nid/webpages/nid.cfm)



# Watershed Land Use Taken From Physical Surveys



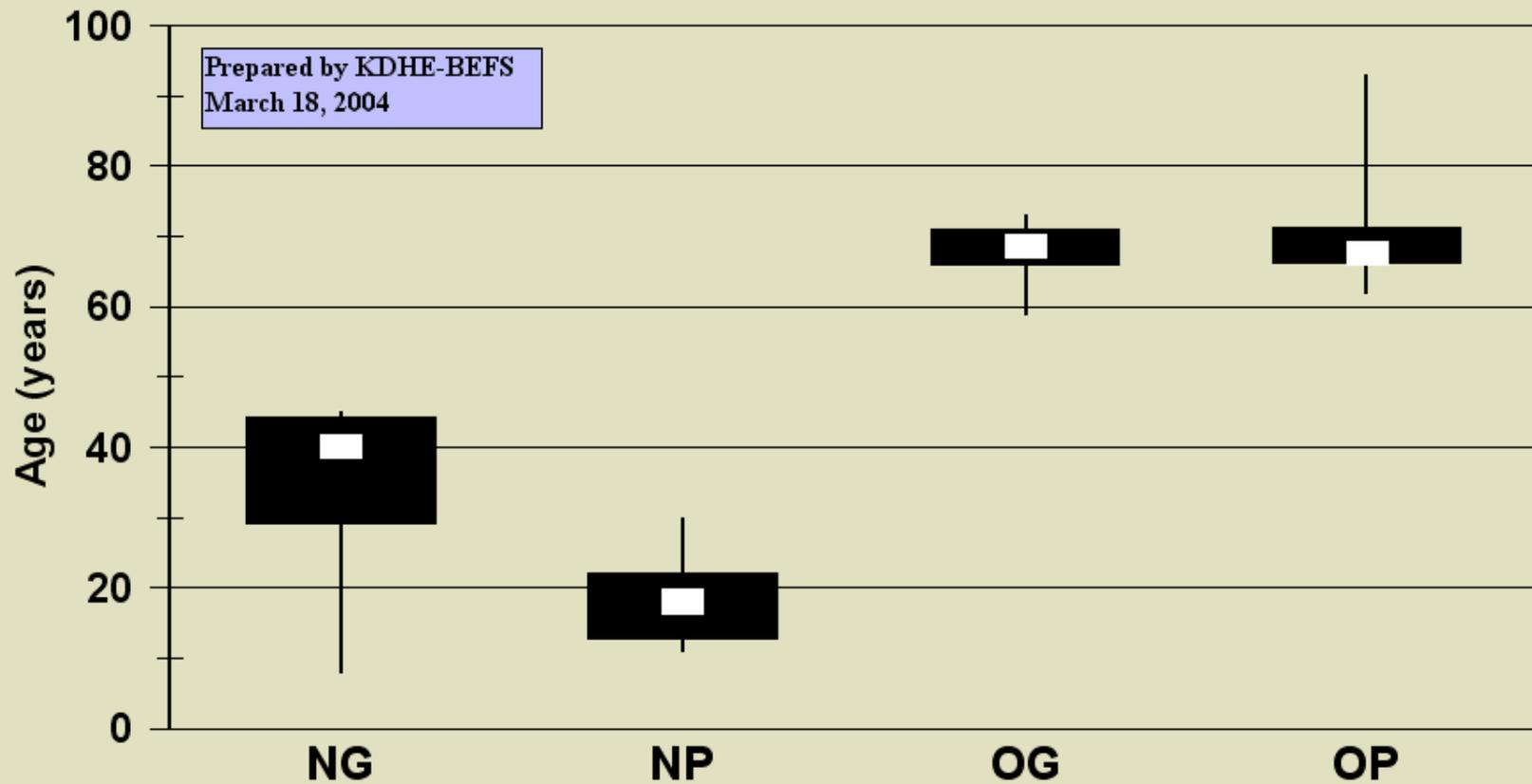
# The Four Groups of Smaller Lakes

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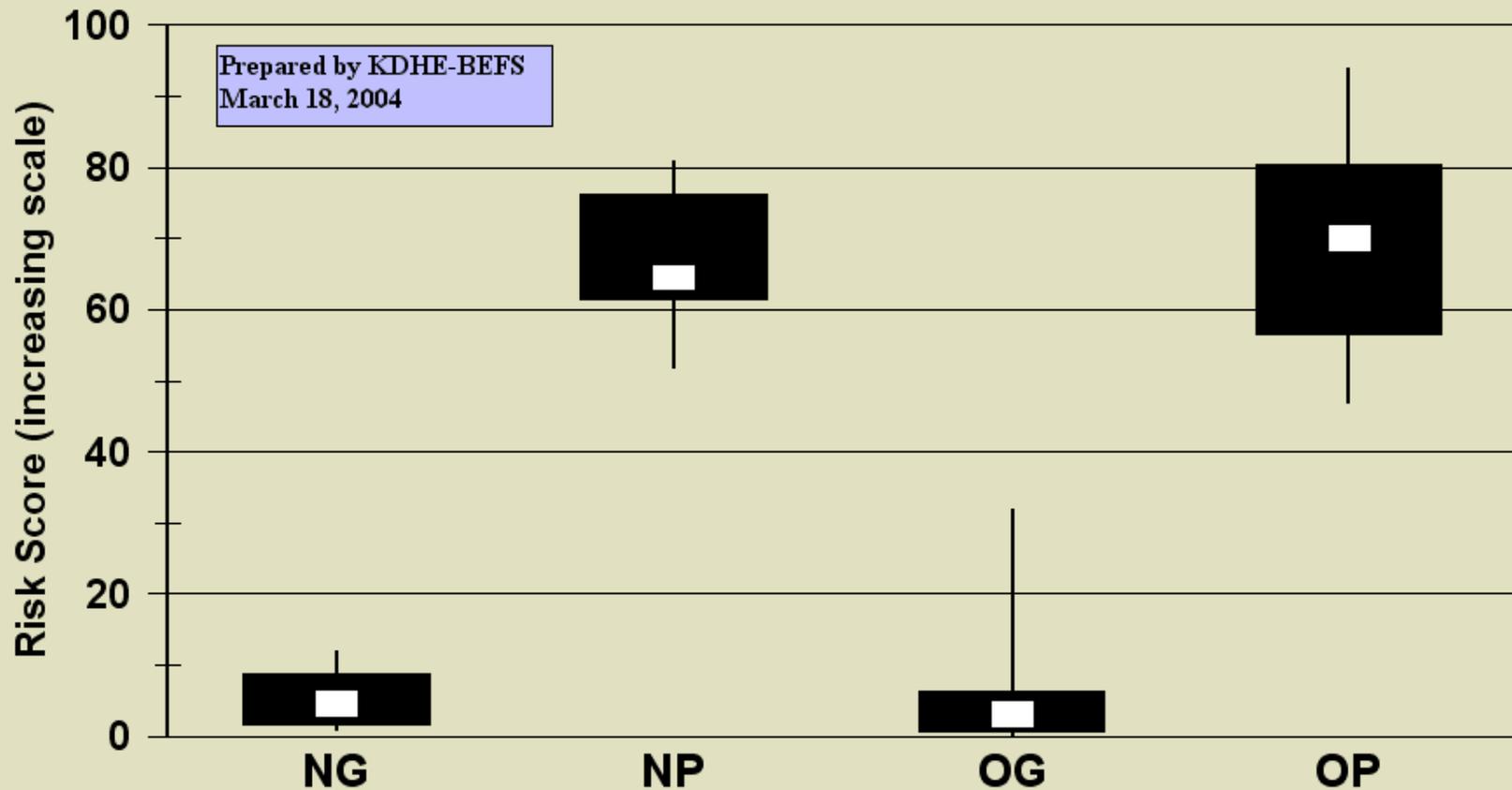
("Good" and "Poor" Refer to the Potential for Lower Nutrient Loadings)

- U NG: Newer Lake/Good Quality Watershed
- U NP: Newer Lake/Poorer Quality Watershed
- U OG: Older Lake/Good Quality Watershed
- U OP: Older Lake/Poorer Quality Watershed

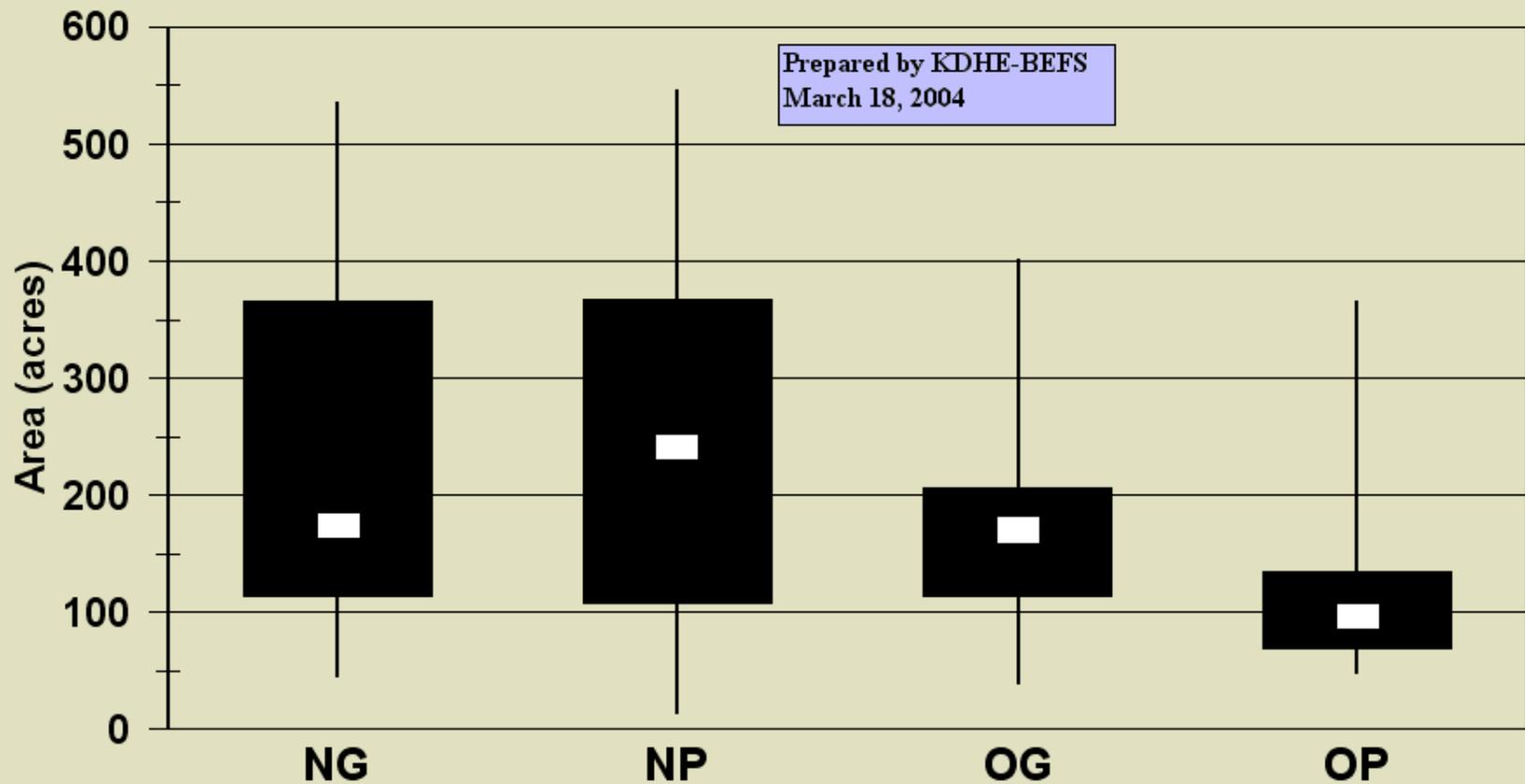
# Lake Age by Group



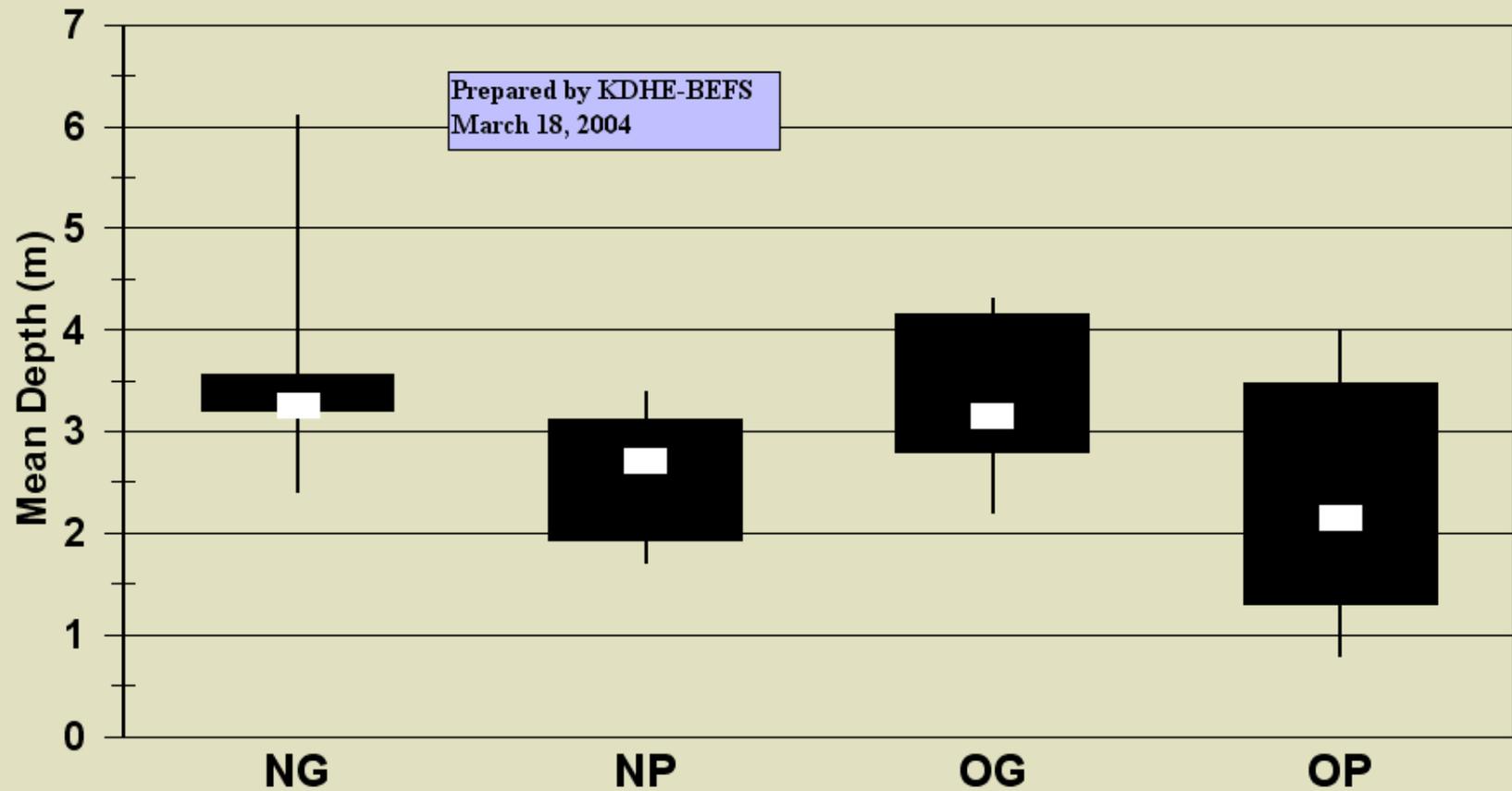
# Watershed Pollution Risk by Group



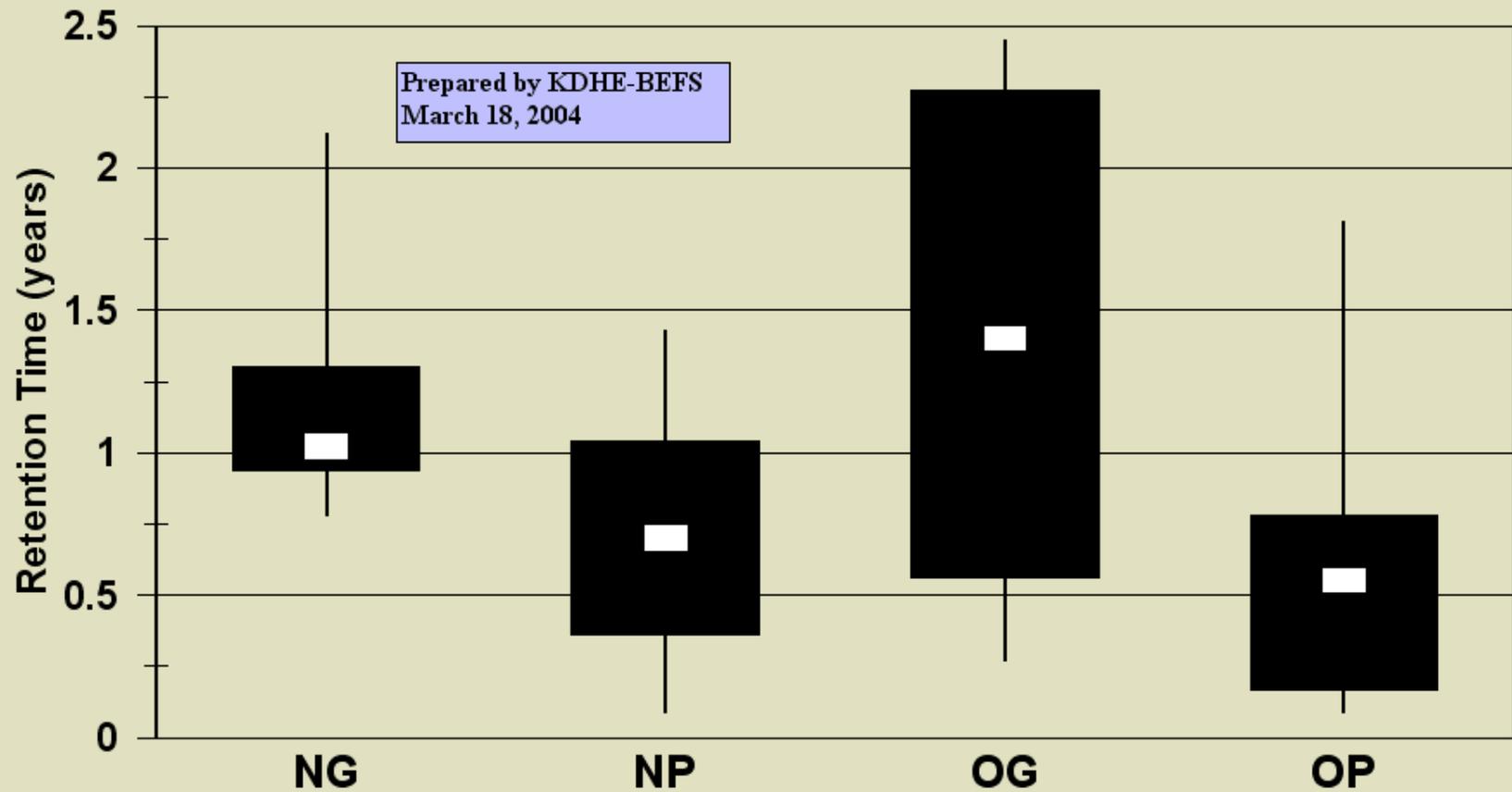
# Lake Surface Area by Group



# Mean Depth by Group



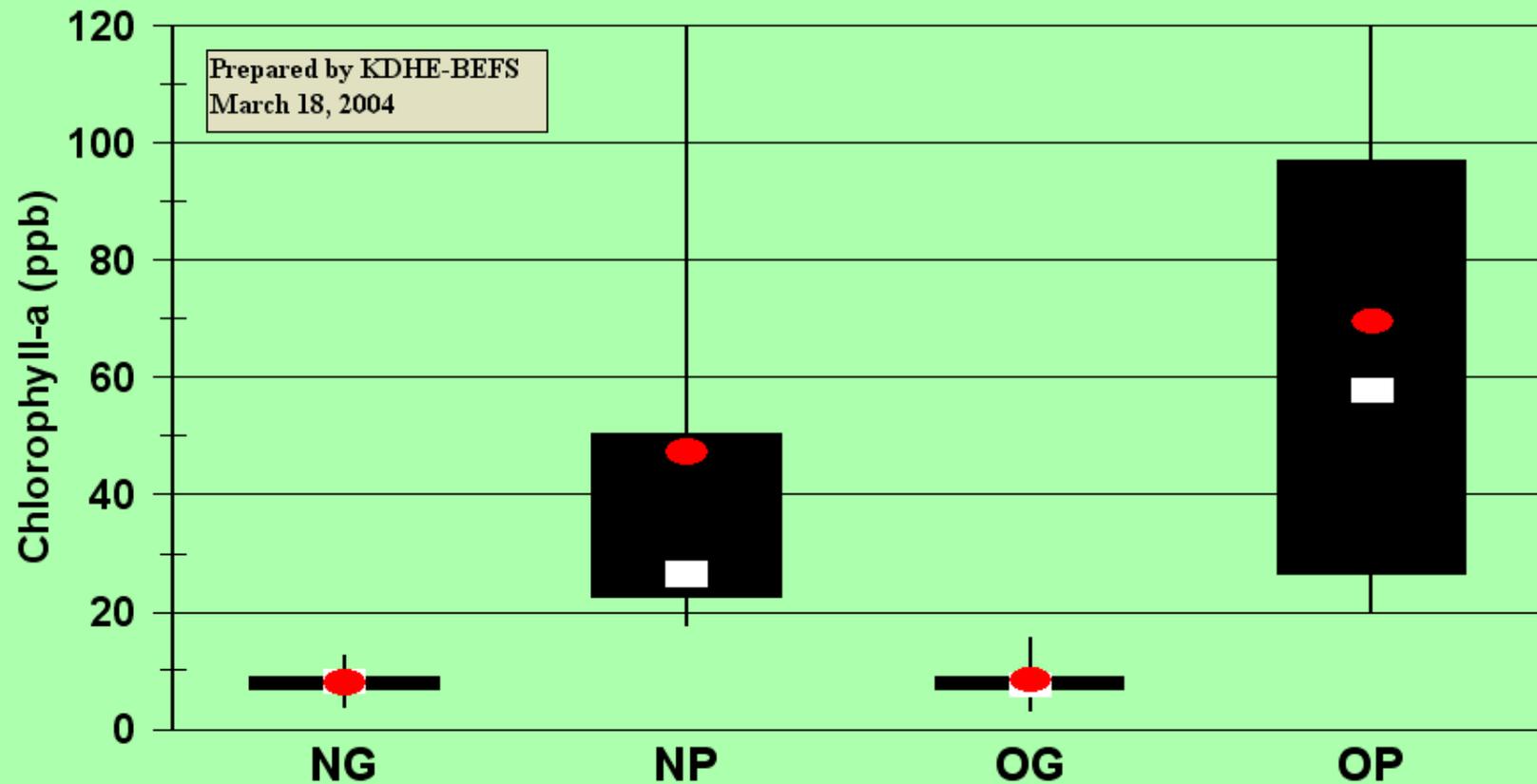
# Lake Retention Time by Group



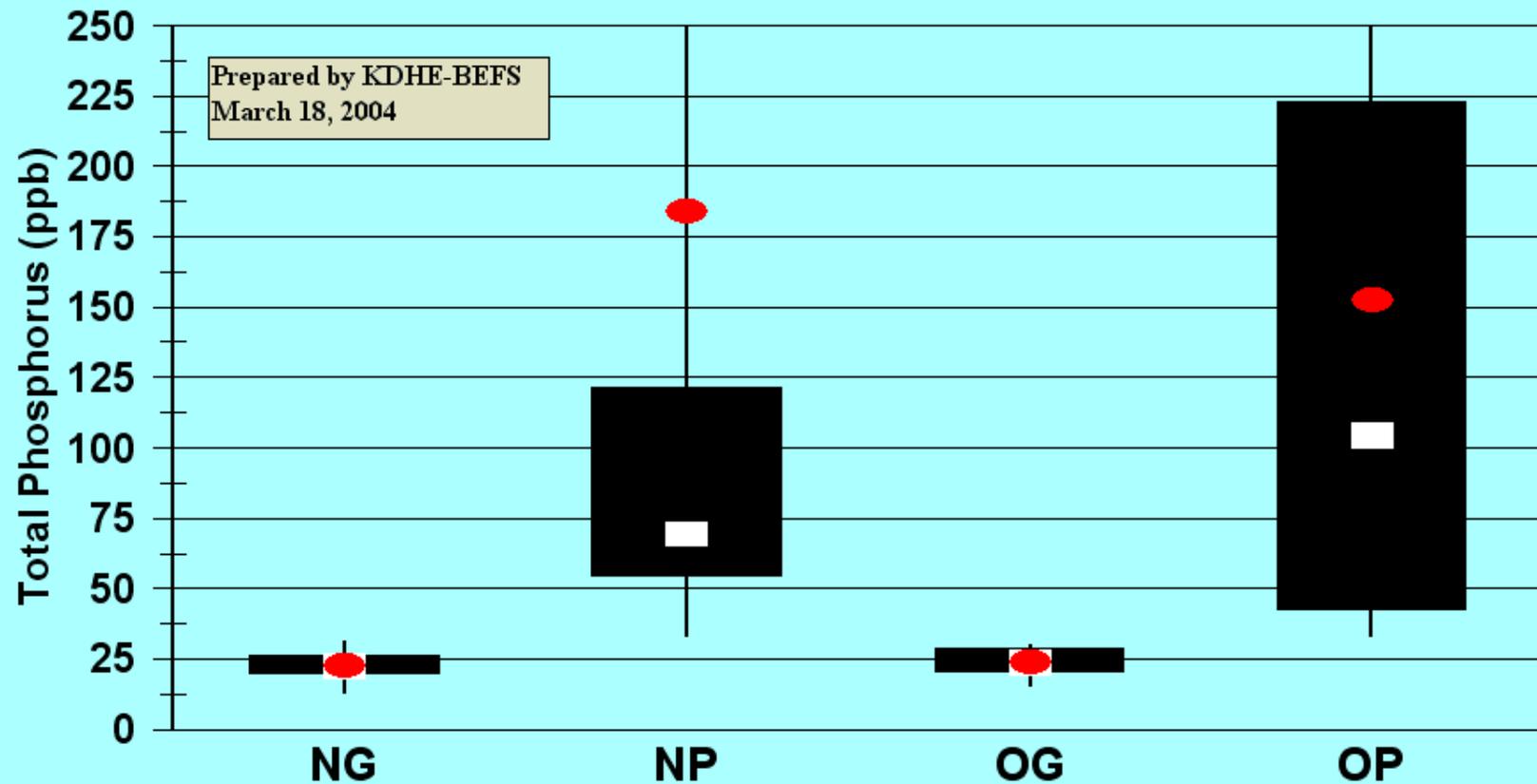
**With Four Lake/Watershed Groups Selected, Period of Record Water Quality Data (1985-2003) Were Analyzed for Each Group.**

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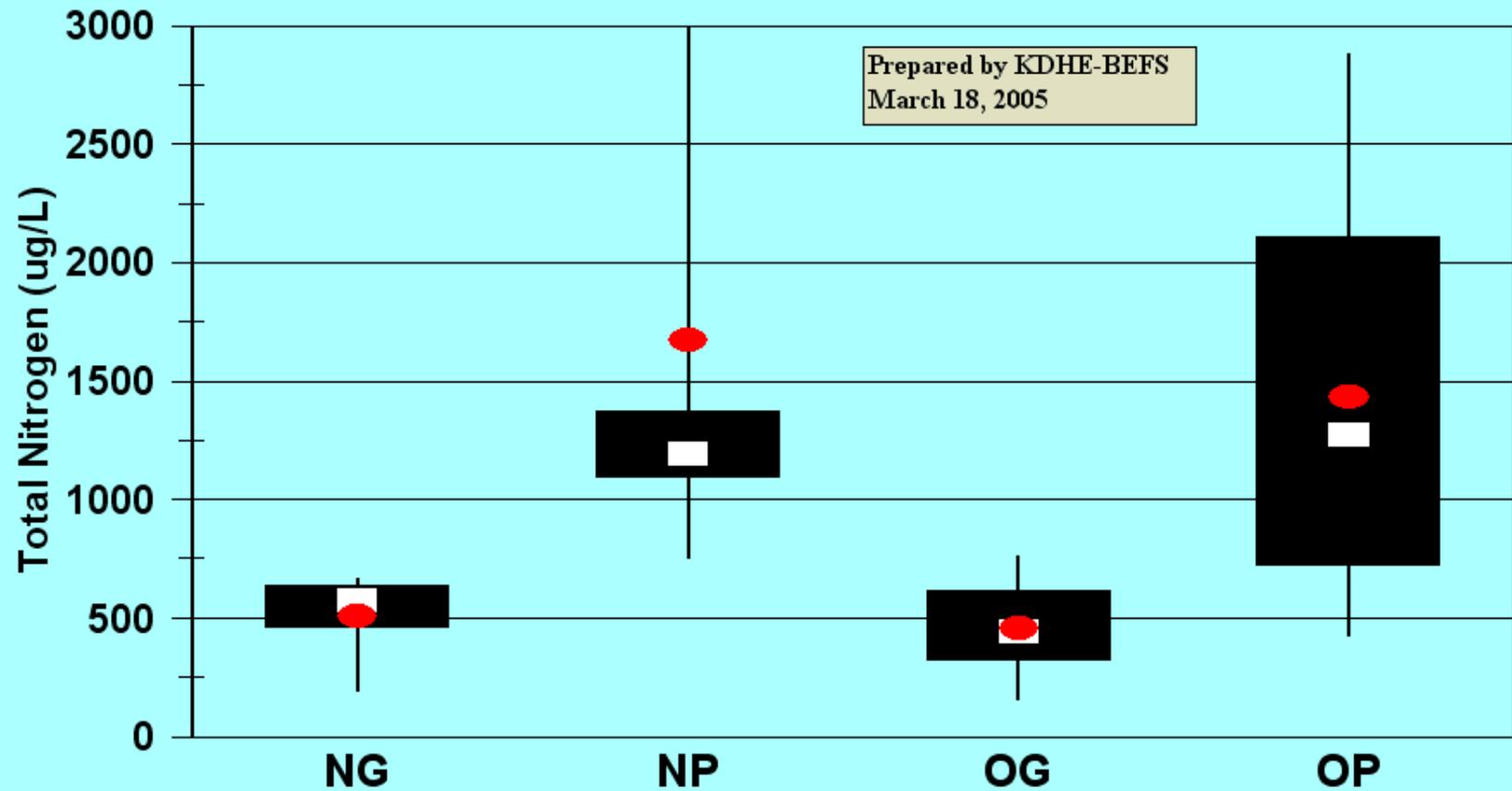
# Mean Chlorophyll-a by Group



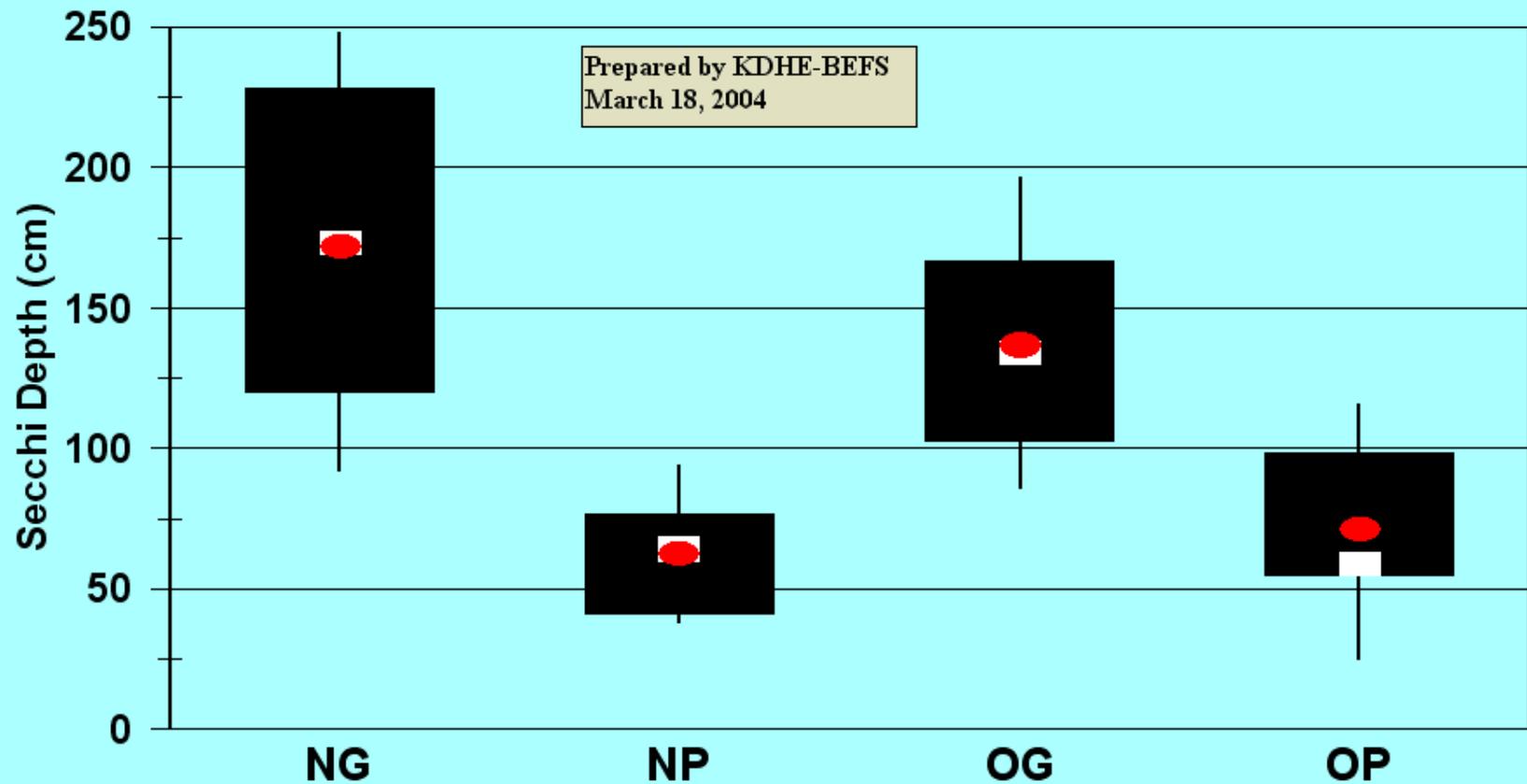
# Mean Phosphorus by Group



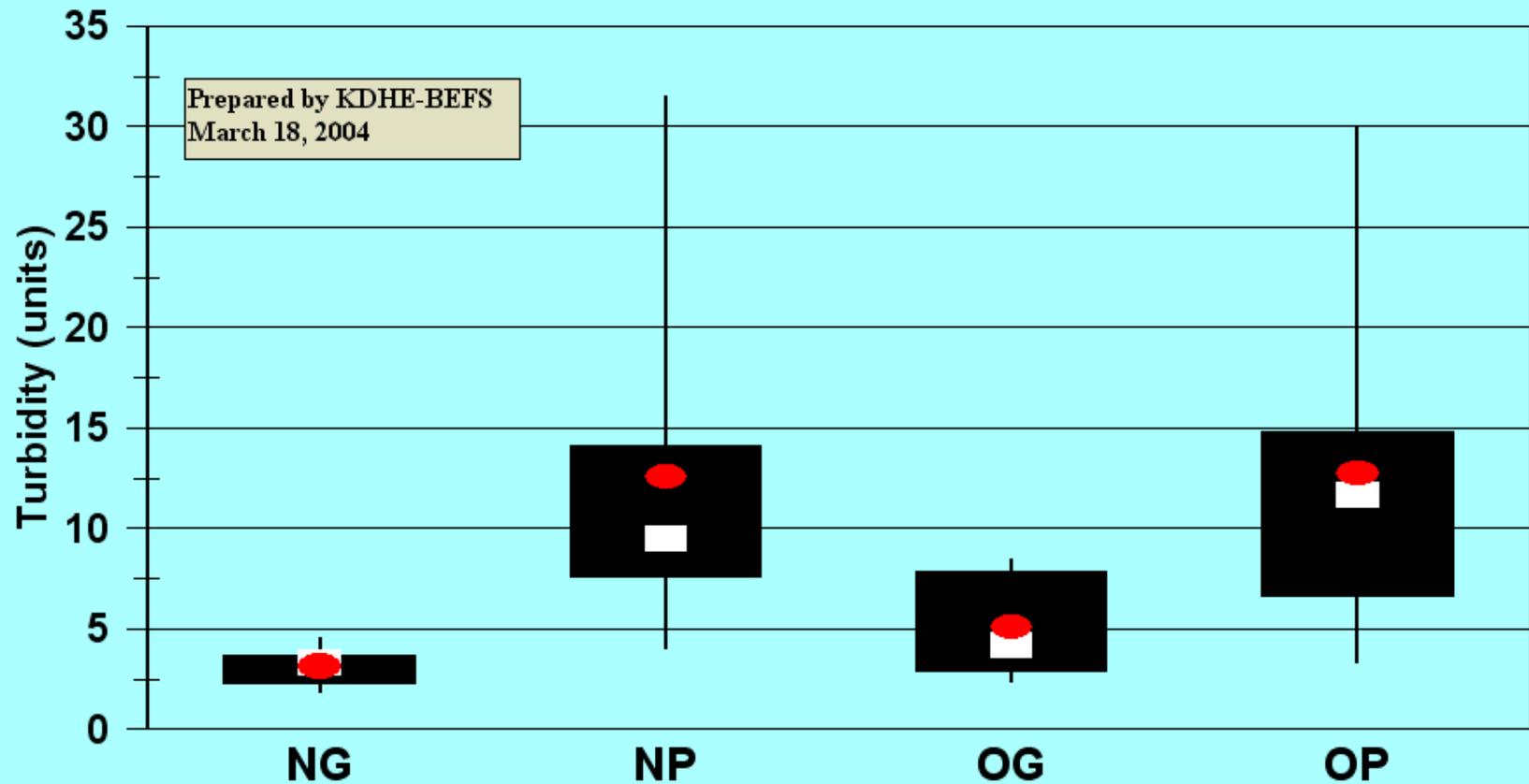
# Mean Total Nitrogen by Group



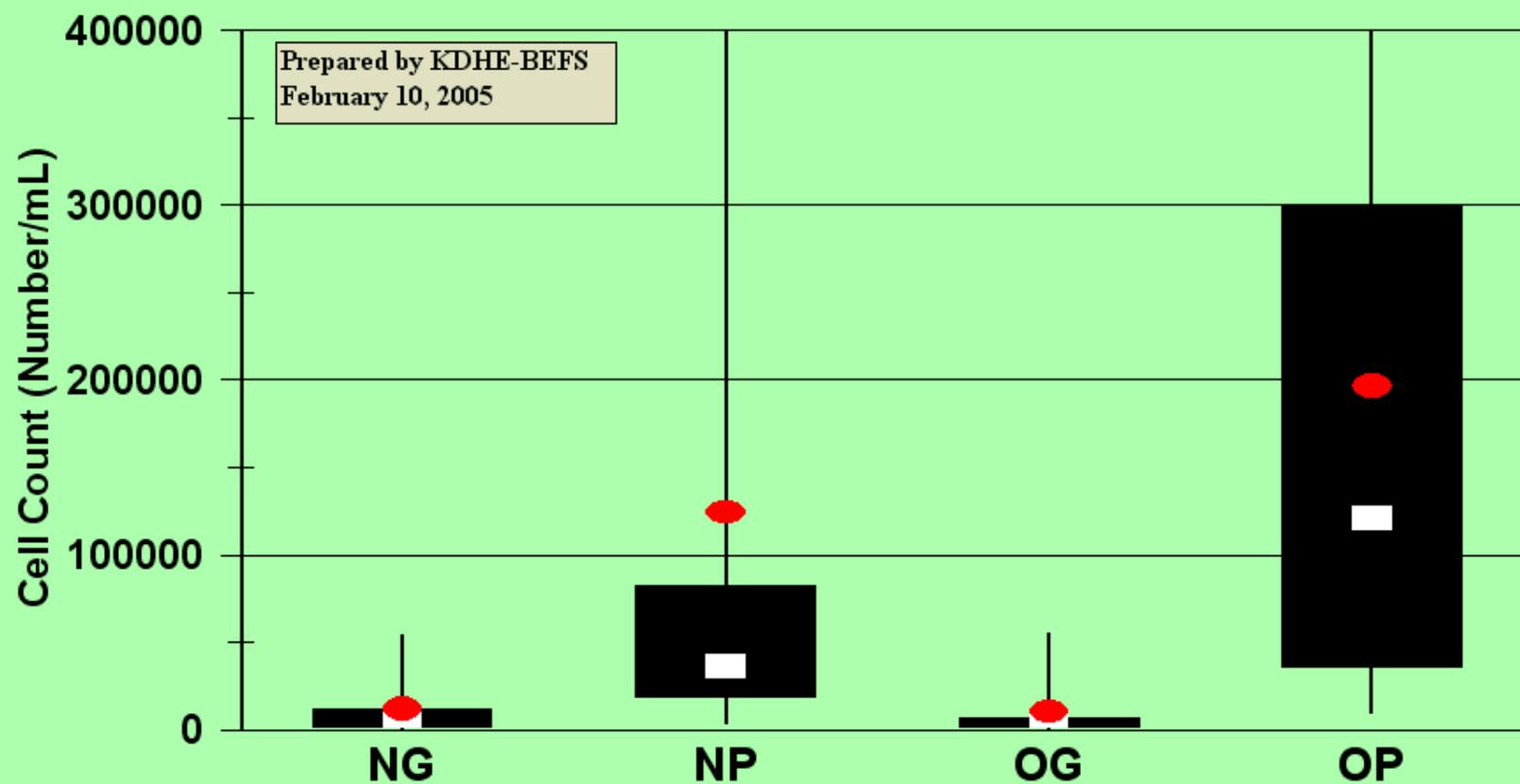
# Mean Secchi Depth by Group



# Mean Turbidity by Group



# Mean Blue-Greens by Group



# Selected Correlation Analyses

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## Trophic State

### U Lake Age versus

- T Chlorophyll-a = 0.11
- T Total Phosphorus = -0.13
- T Total Nitrogen = -0.16
- T Secchi Depth = 0.02

### U Watershed Condition versus

- T Chlorophyll-a = 0.68
- T Total Phosphorus = 0.50
- T Total Nitrogen = 0.61
- T Secchi Depth = -0.73

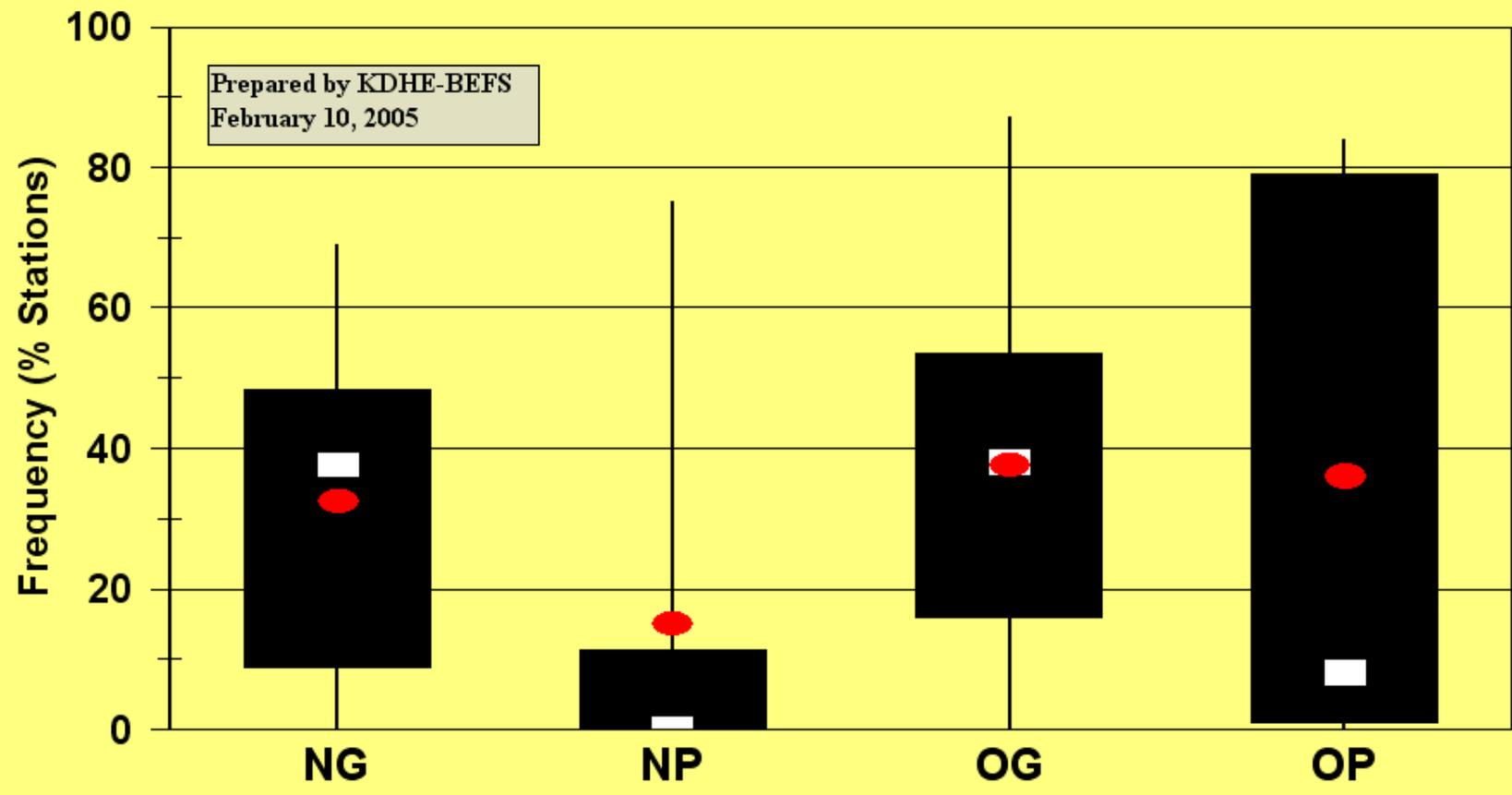
**Macrophyte Community Surveys Had  
Been Conducted for 6-8 Lakes In  
Each Grouping.**

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**Therefore, Aquatic Plant Community  
Metrics Could Also Be Examined.**

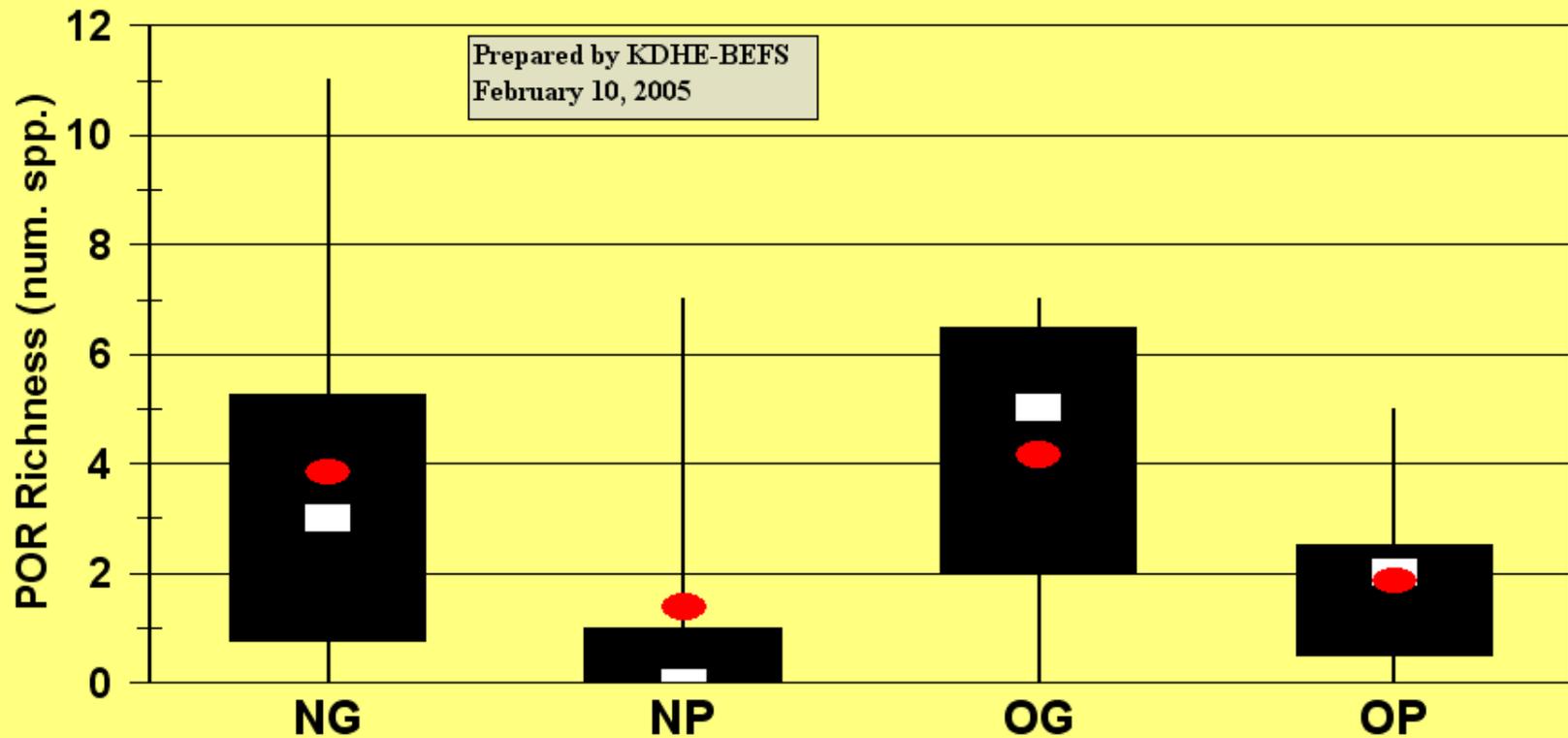


# Macrophyte Community by Group

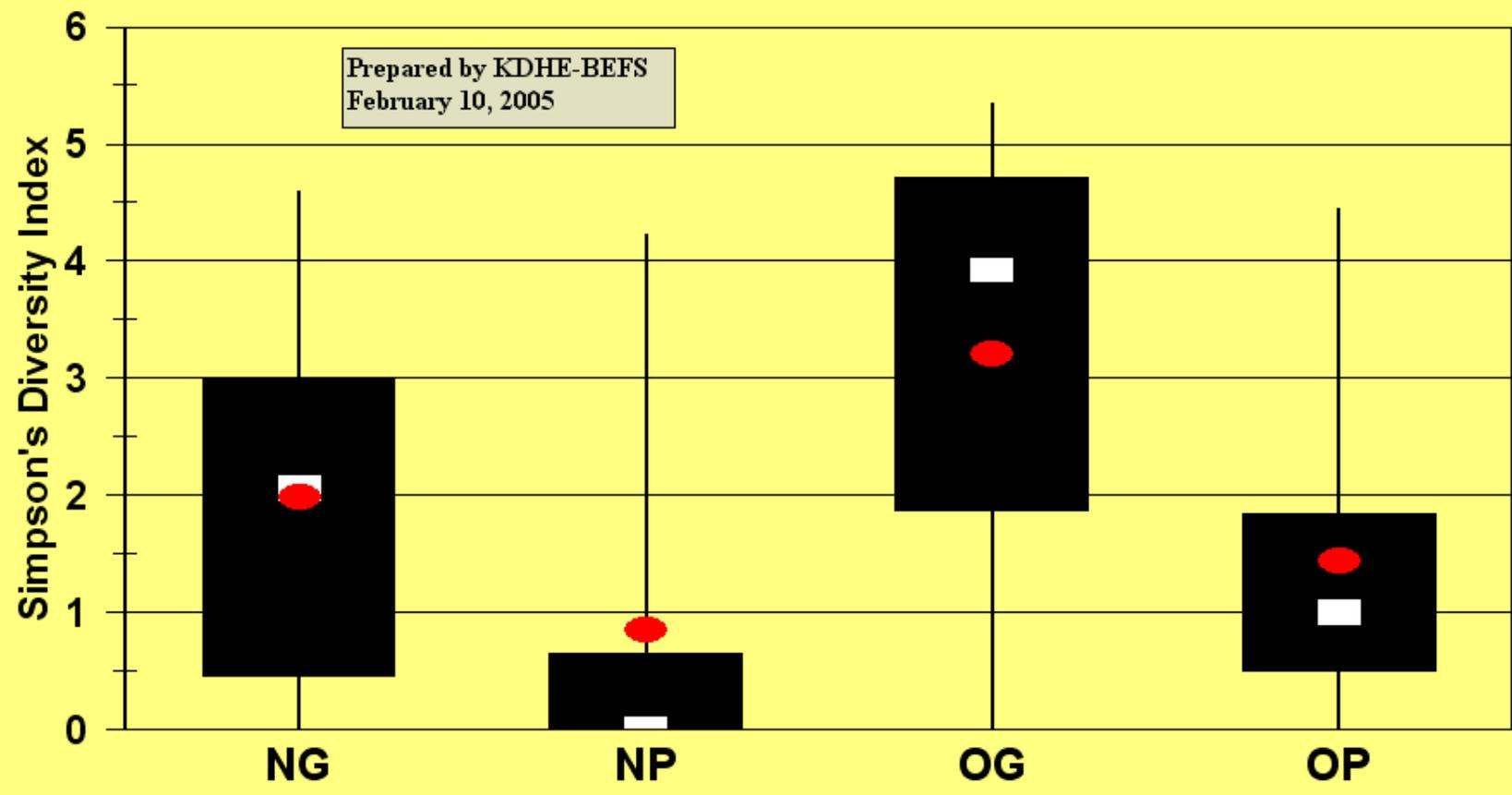


# Macrophyte Community by Group

## Species Richness



# Macrophyte Community by Group

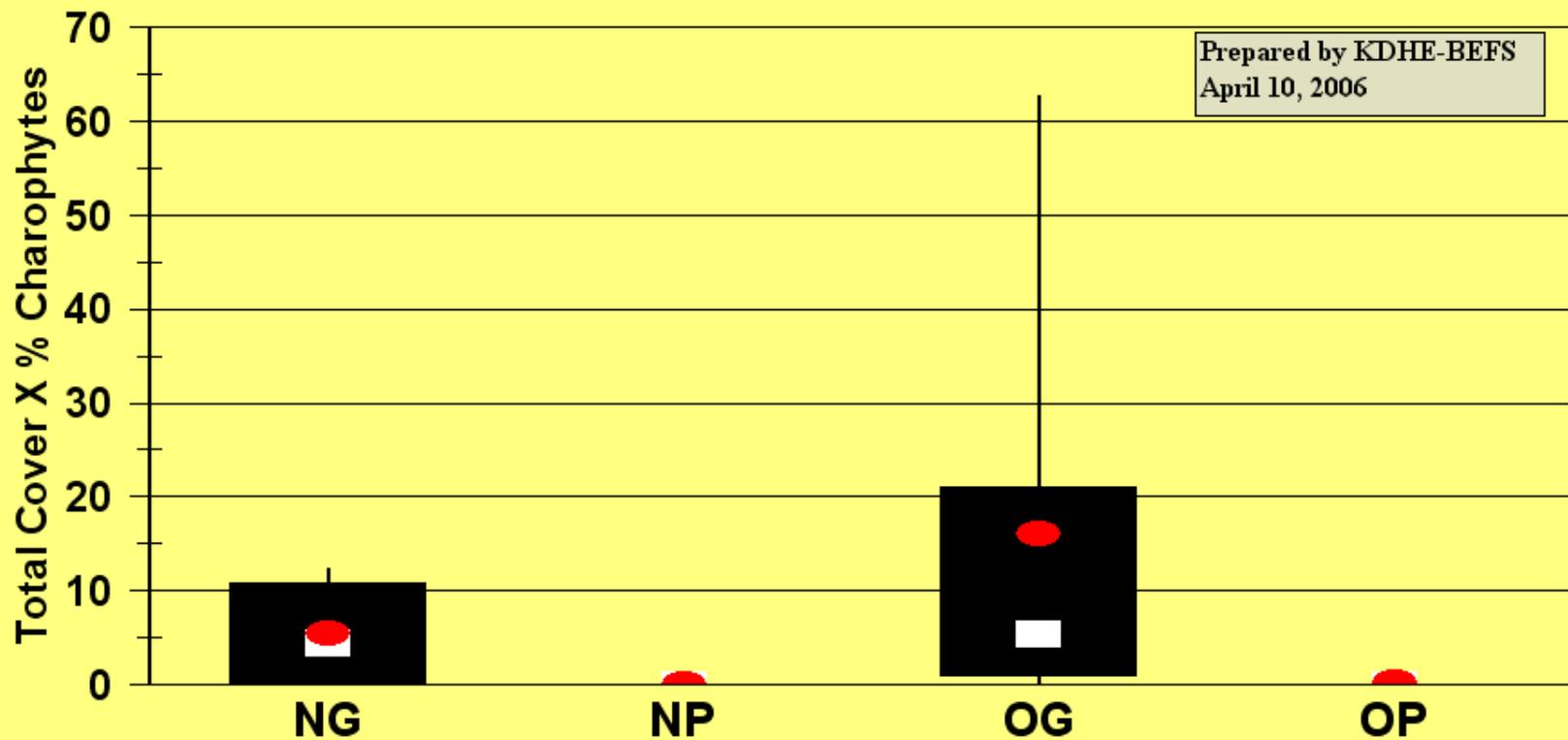


# Charophytes or Stoneworts



# Macrophyte Community by Group

## Charophyte Abundance

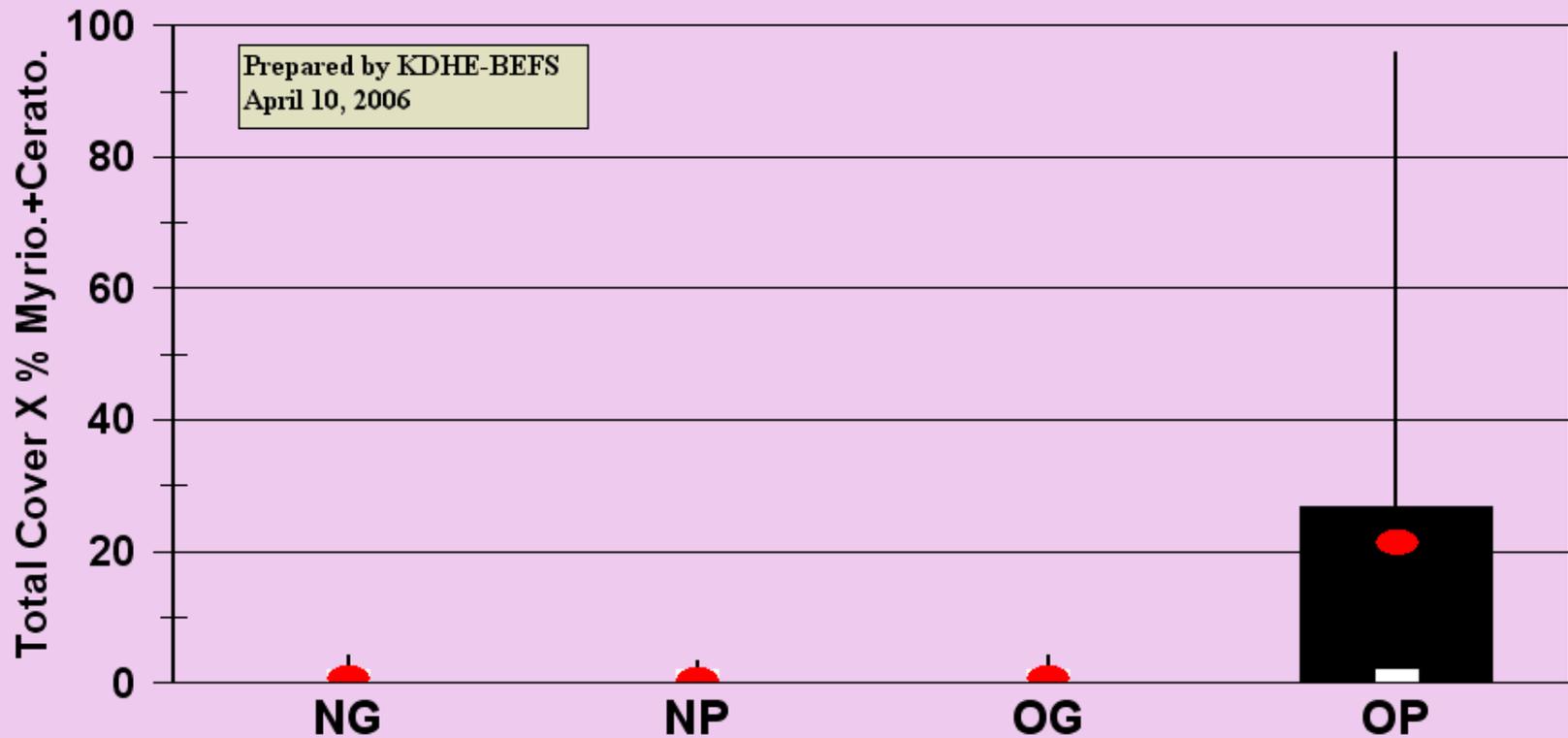


# Myriophyllum and Ceratophyllum



# Macrophyte Community by Group

## Myriophyllum+Ceratophyllum Abundance



# Selected Correlation Analyses

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## Macrophyte Community

### U Lake Age versus

T Frequency = 0.25

T Richness = 0.08

T Diversity = 0.13

T Charophytes = 0.22

### U Watershed Condition versus

T Frequency = -0.05

T Richness = -0.42

T Diversity = -0.45

T Charophytes = -0.43

# Conclusions

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- U Overall, time has no observable impact on trophic state development in Kansas lakes (over about a century). There may be evidence of a time driven trend for some aspects of the macrophyte community.
- U Over several centuries?
- U However, watershed condition exerts tremendous impact on trophic state, apparently over short time frames.
- U Collectively, the larger lakes in Kansas will achieve hypereutrophic status sometime around 2030 if the observed trend holds.
- U Lakes in high quality watersheds, regardless of age, tend to approach the conditions describing “reference” waterbodies.
- U The good news.....Of the two variables, time versus land uses, watershed condition is something we CAN influence directly. The big question.....Will society find the will to exert that influence?

