

# ***Characteristics of nutrient and sediment delivery to Lake Erie from Ohio tributaries.***

**The Sixth Biennial Conference of the  
Lake Erie Millennium Network**

David Baker, Jack Kramer, Peter Richards, Aaron  
Roerdink, Remegio Confesor and Kenneth Krieger

National Center for Water Quality Research

Heidelberg University, Tiffin, OH

dbaker@heidelberg.edu

# **Outline**

## **Annual Loads**

**Six Rivers: Raisin, Maumee, Sandusky, Vermilion, Cuyahoga and Grand**

**Four Parameters: Suspended Sediments, Total Phosphorus, Dissolved Reactive Phosphorus and Nitrate Nitrogen**

**Three Characteristics: Annual loads, unit area loads, flow weighted mean concentrations**

**Two time periods: five year average annual loads (2004 – 2008 Water Years) and 2009 Water Year coincides with Lake Erie Intensive Study**







## **Pulsed Loading**

## **Seasonal Loading Patterns**

## **Trends in Dissolved Reactive Phosphorus Loading**

# The Heidelberg University Tributary Loading Program

## Station Support

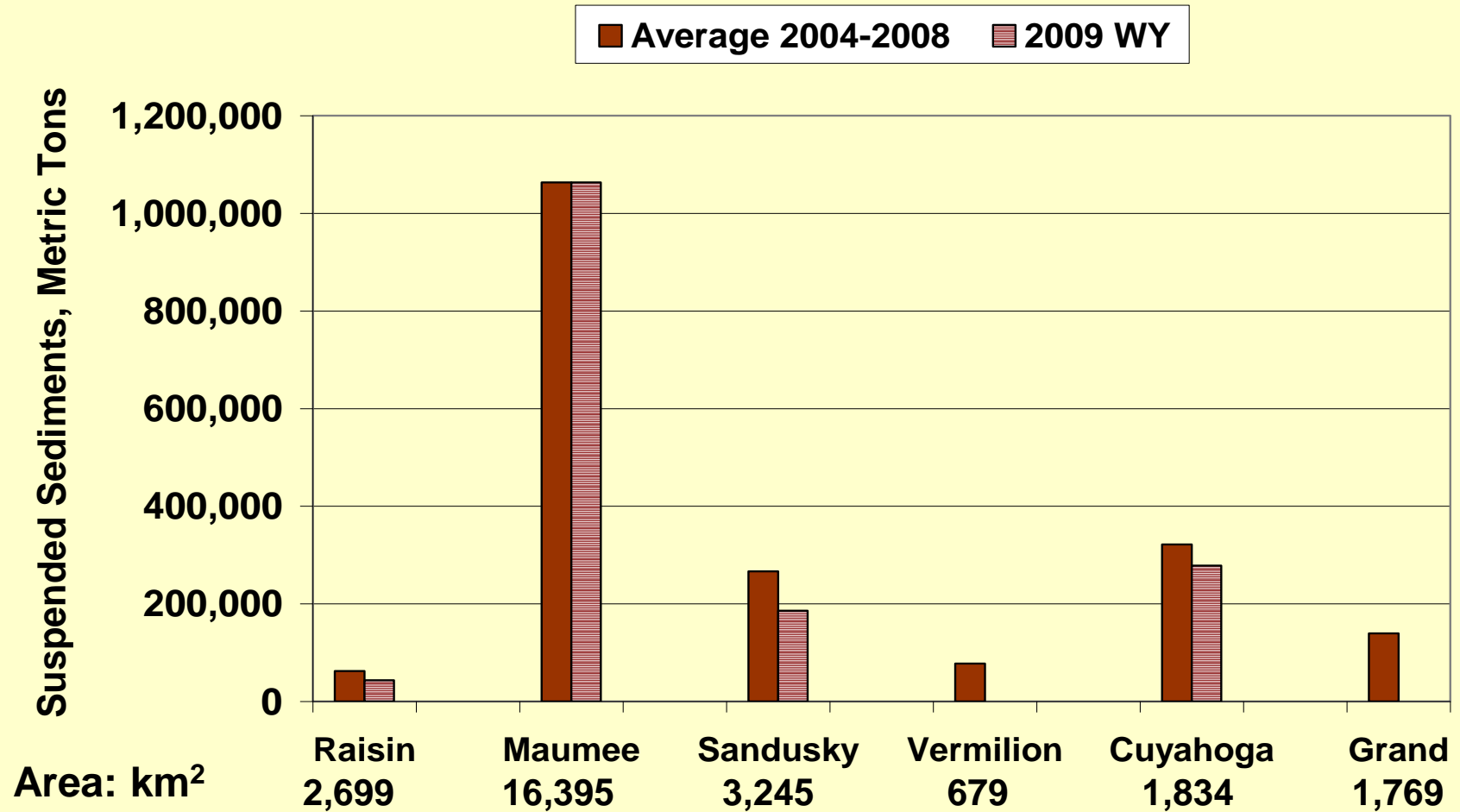
-  ODNR/NRCS
-  Michigan DEQ
-  Lake Erie CREP
-  Great Lakes Protection Fund
-  EDF/Joyce Foundation
-  USDA/NRCS

All stations are associated with USGS Stream Flow Stations

## Sampling Stations

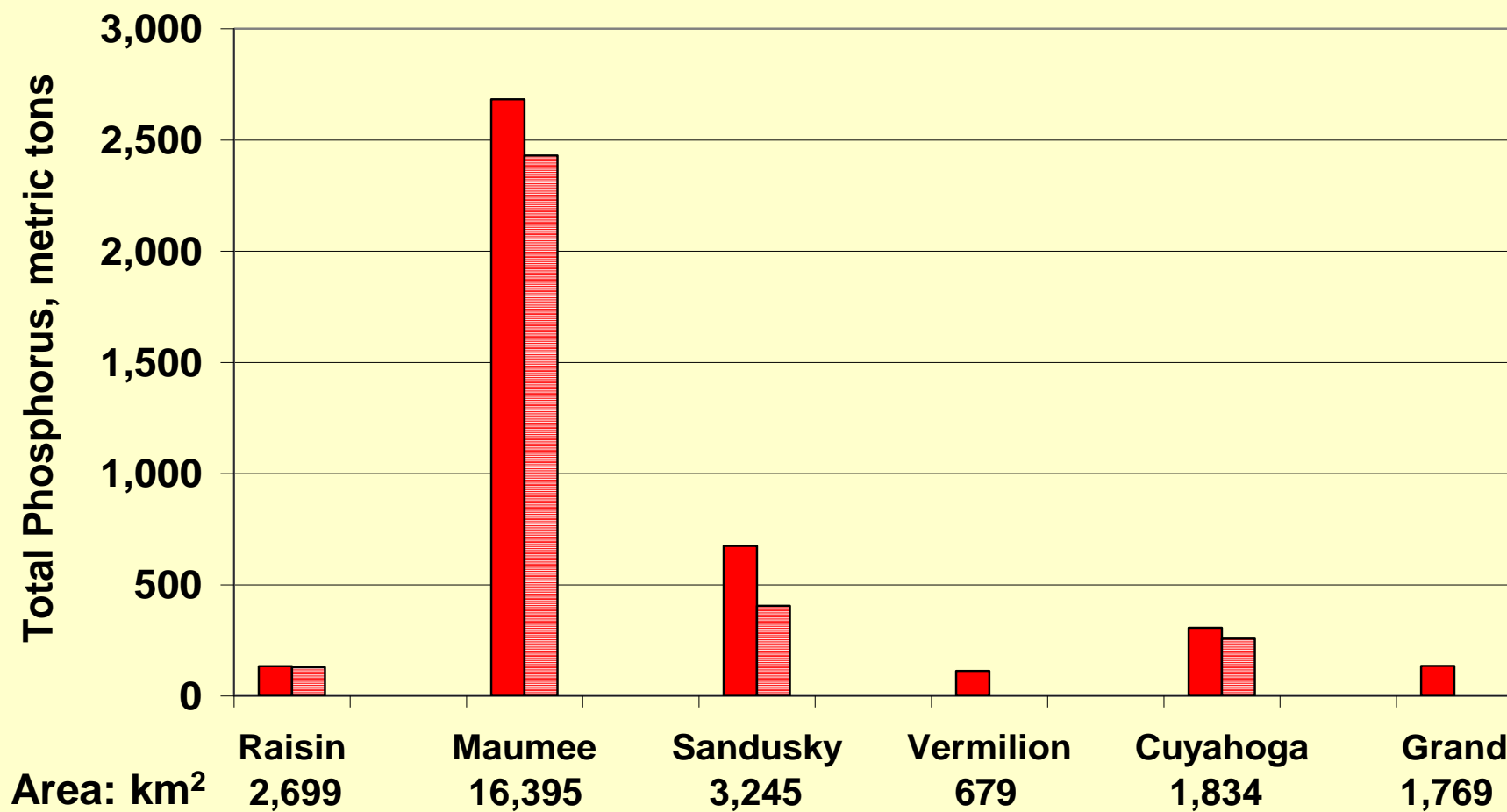


## Annual Suspended Sediment Loading

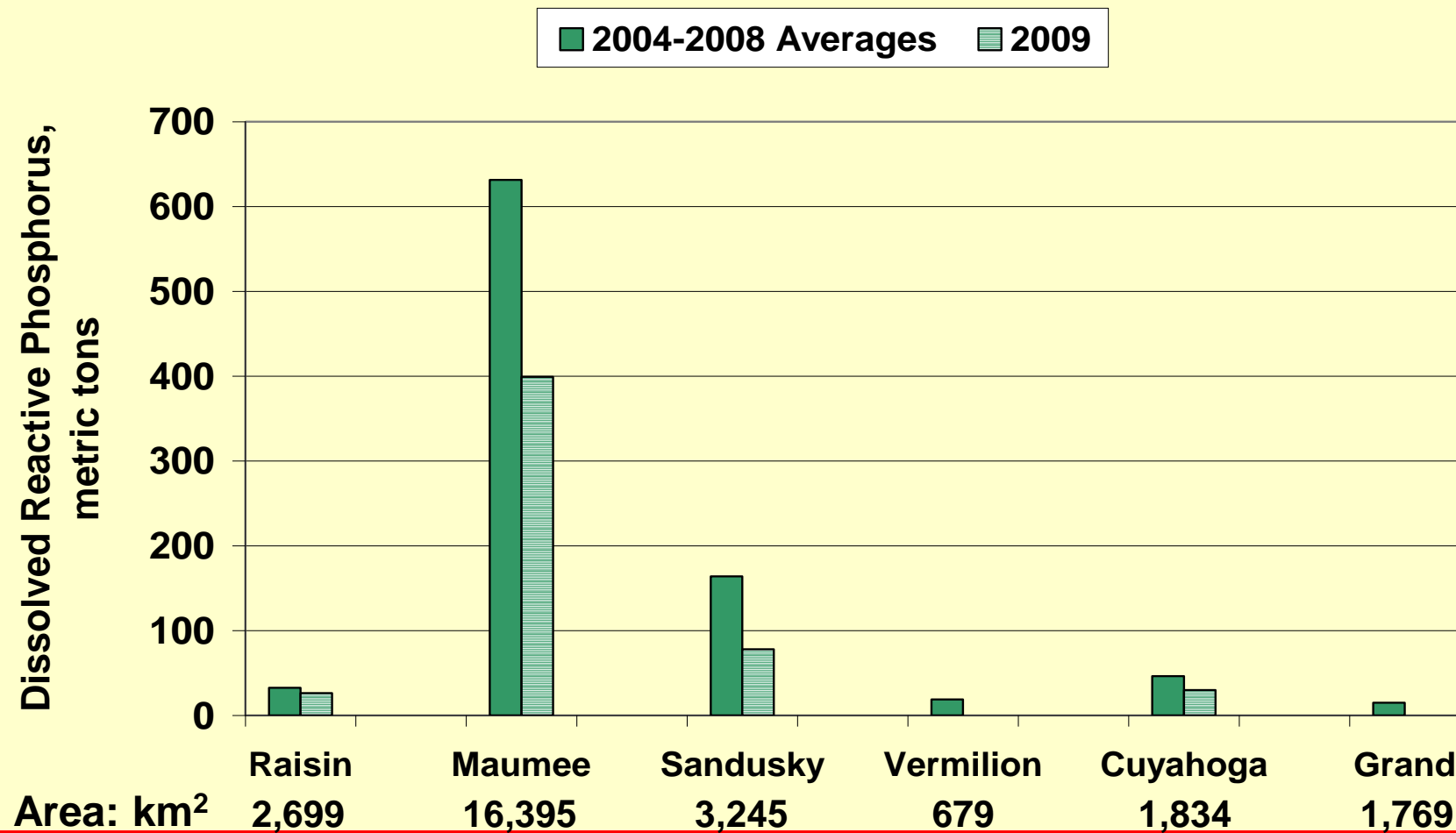


## Annual Total Phosphorus Loading

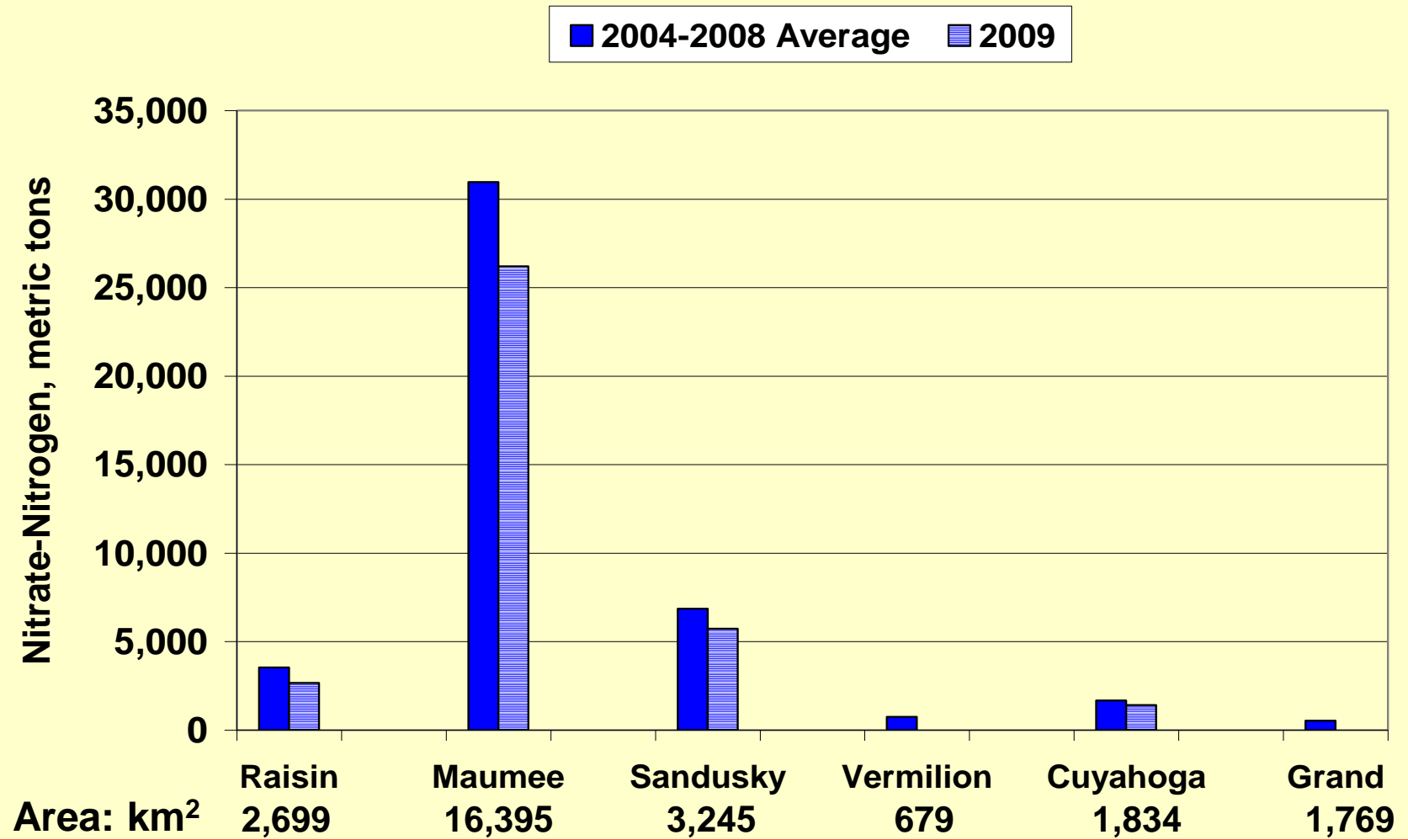
■ 2004-2008 Average    ▨ 2009



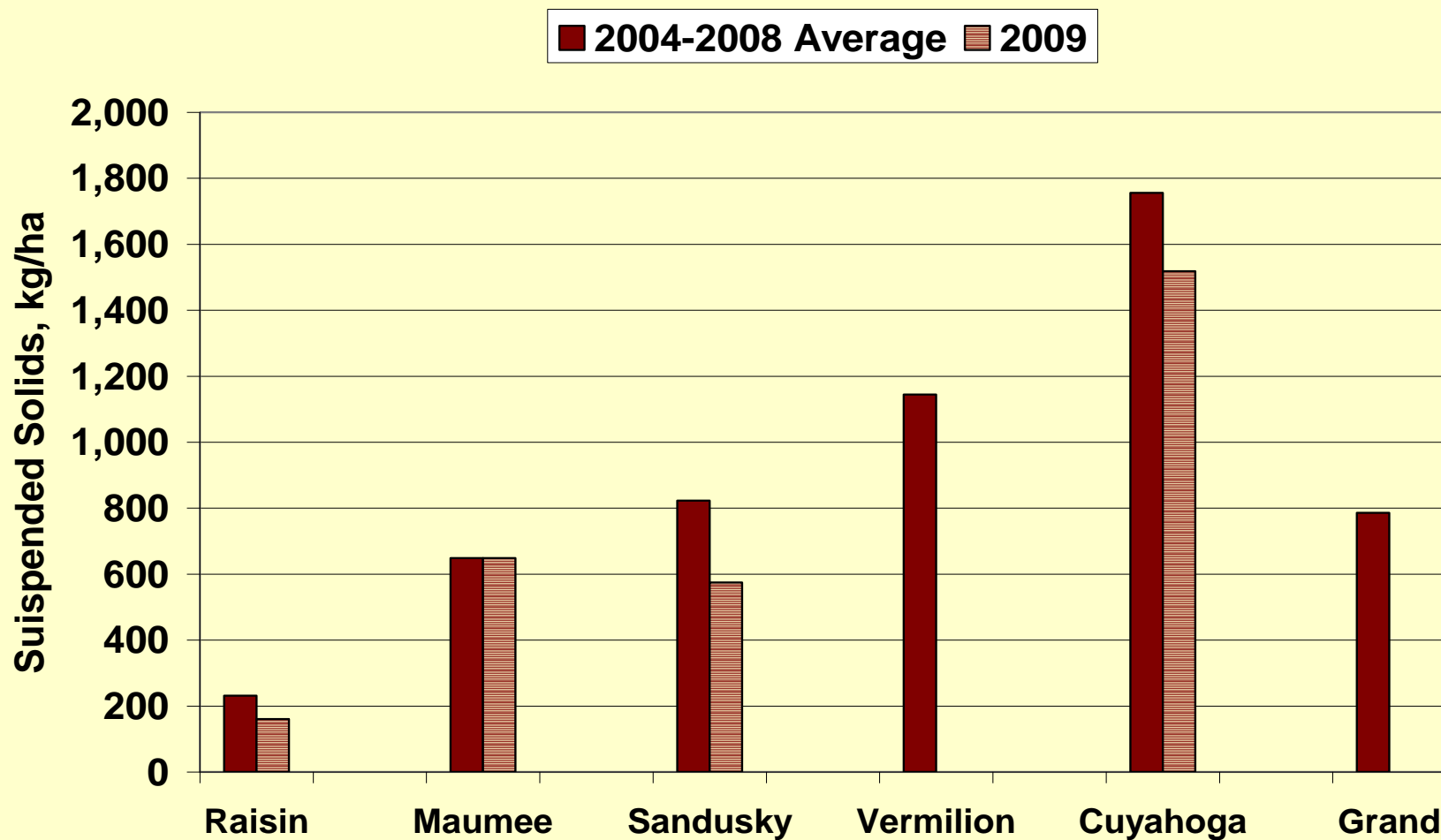
## Annual Dissolved Reactive Phosphorus Loading



## Annual Nitrate Nitrogen Loading

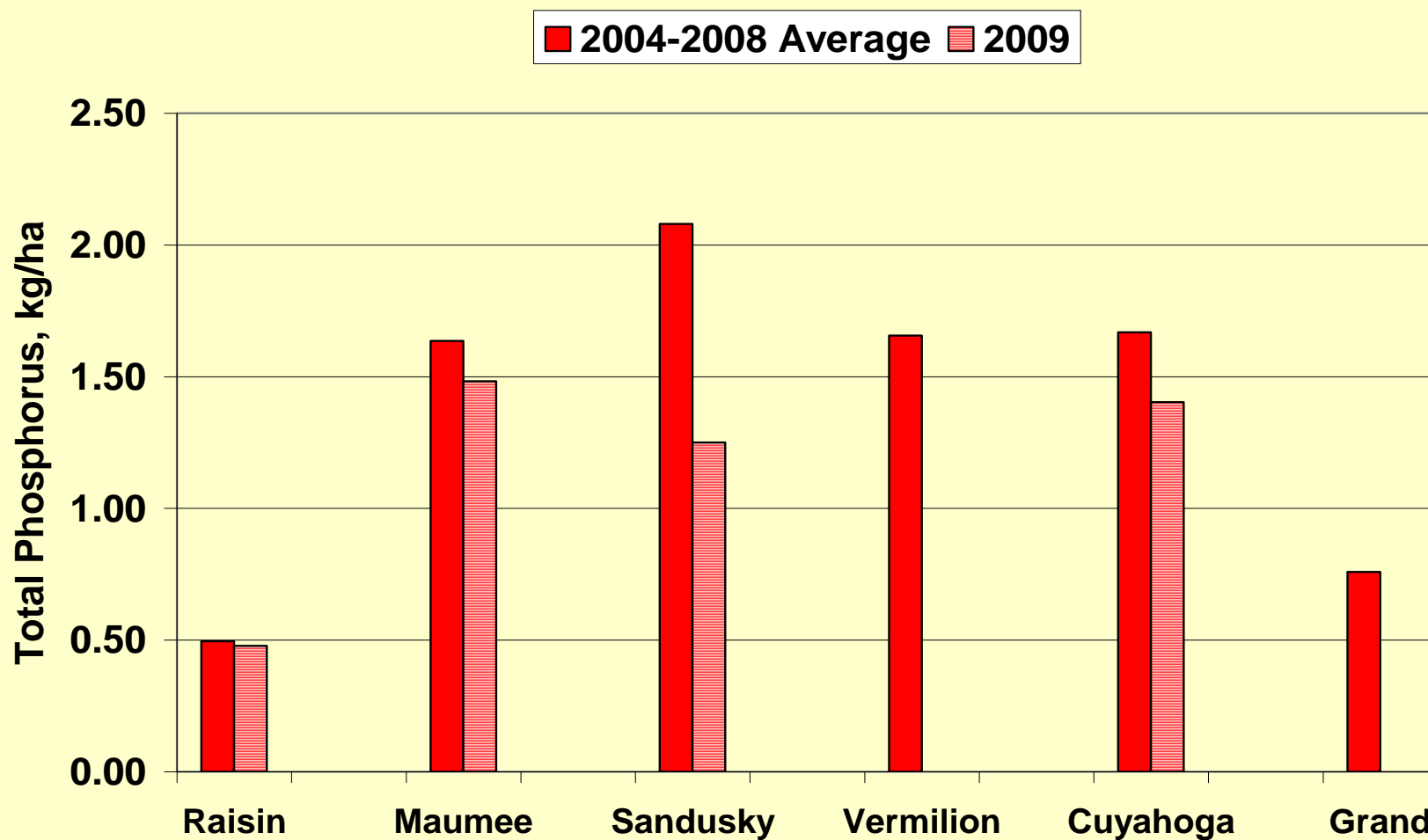


## Annual Suspended Solids Unit Area Export, kg/ha

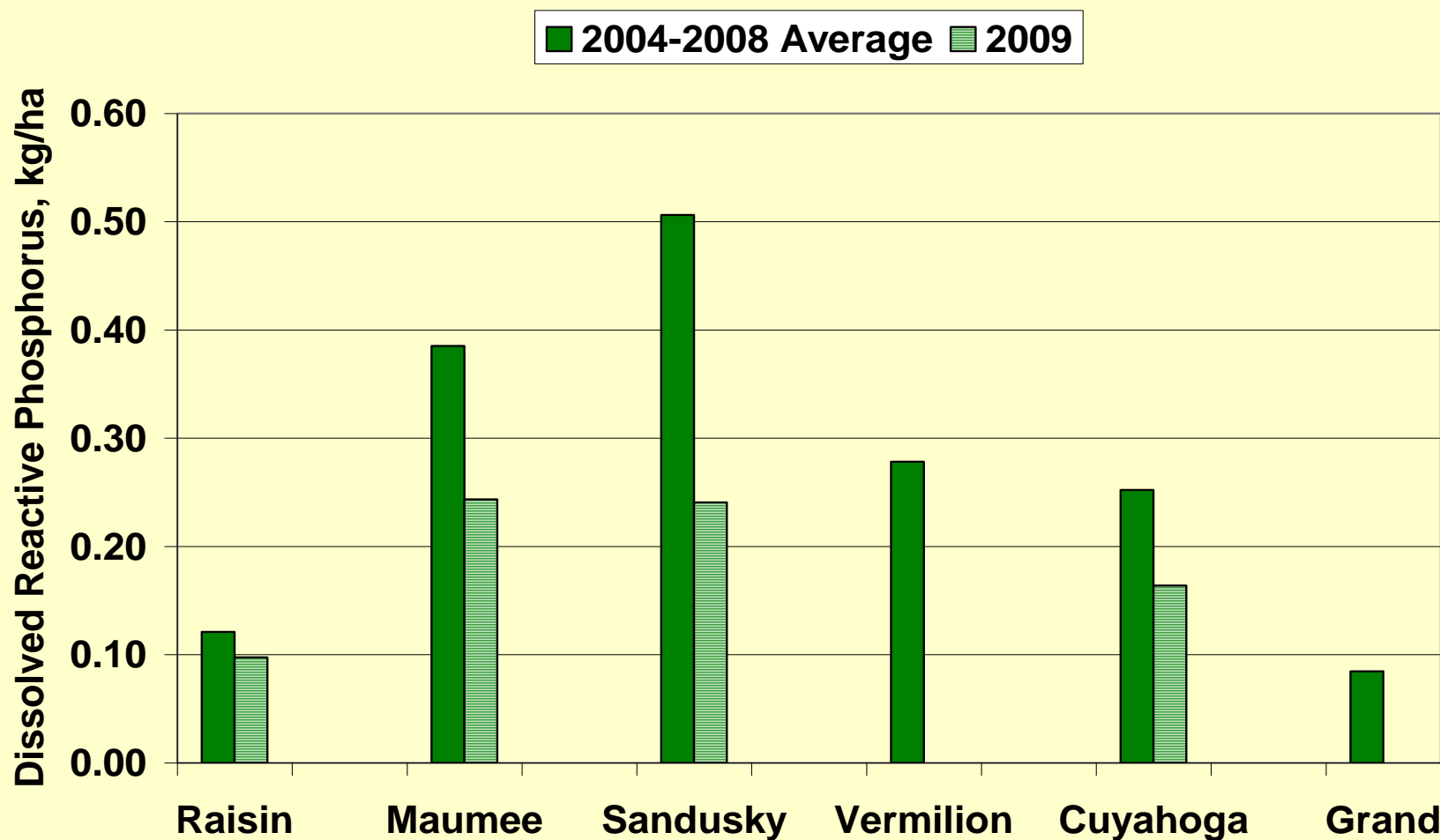




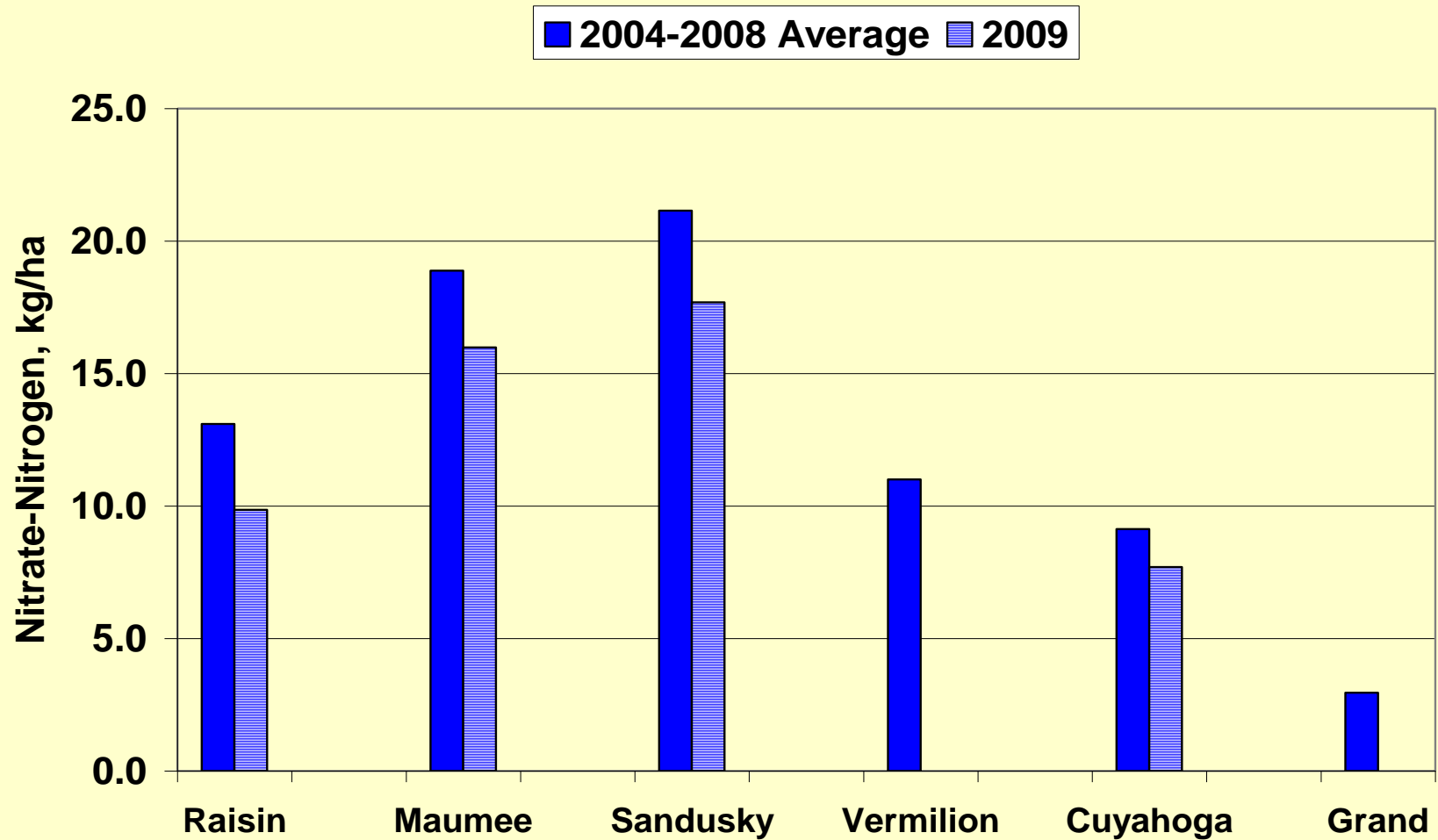
## Total Phosphorus, Unit Area Export



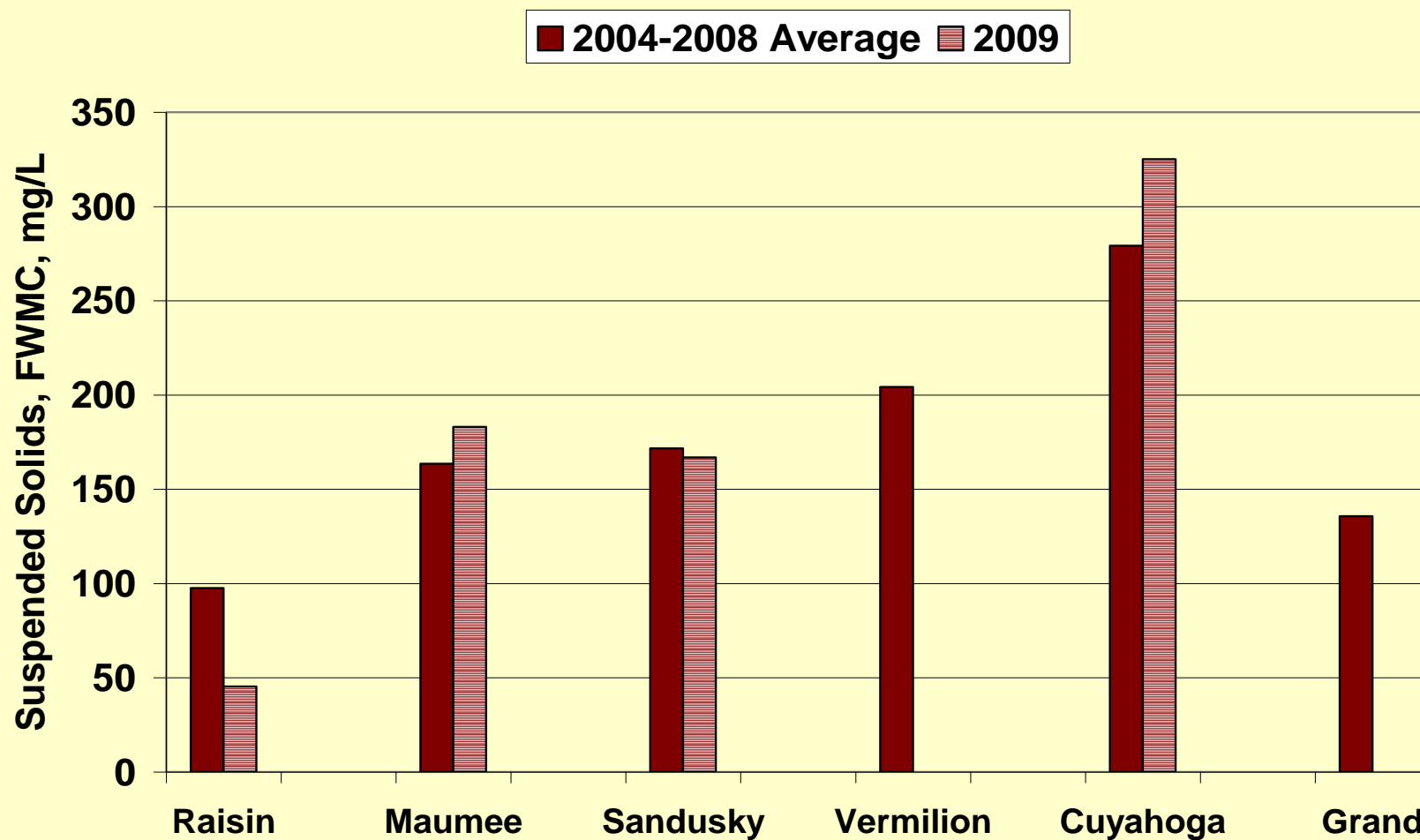
## Dissolved Reactive Phosphorus, unit area export



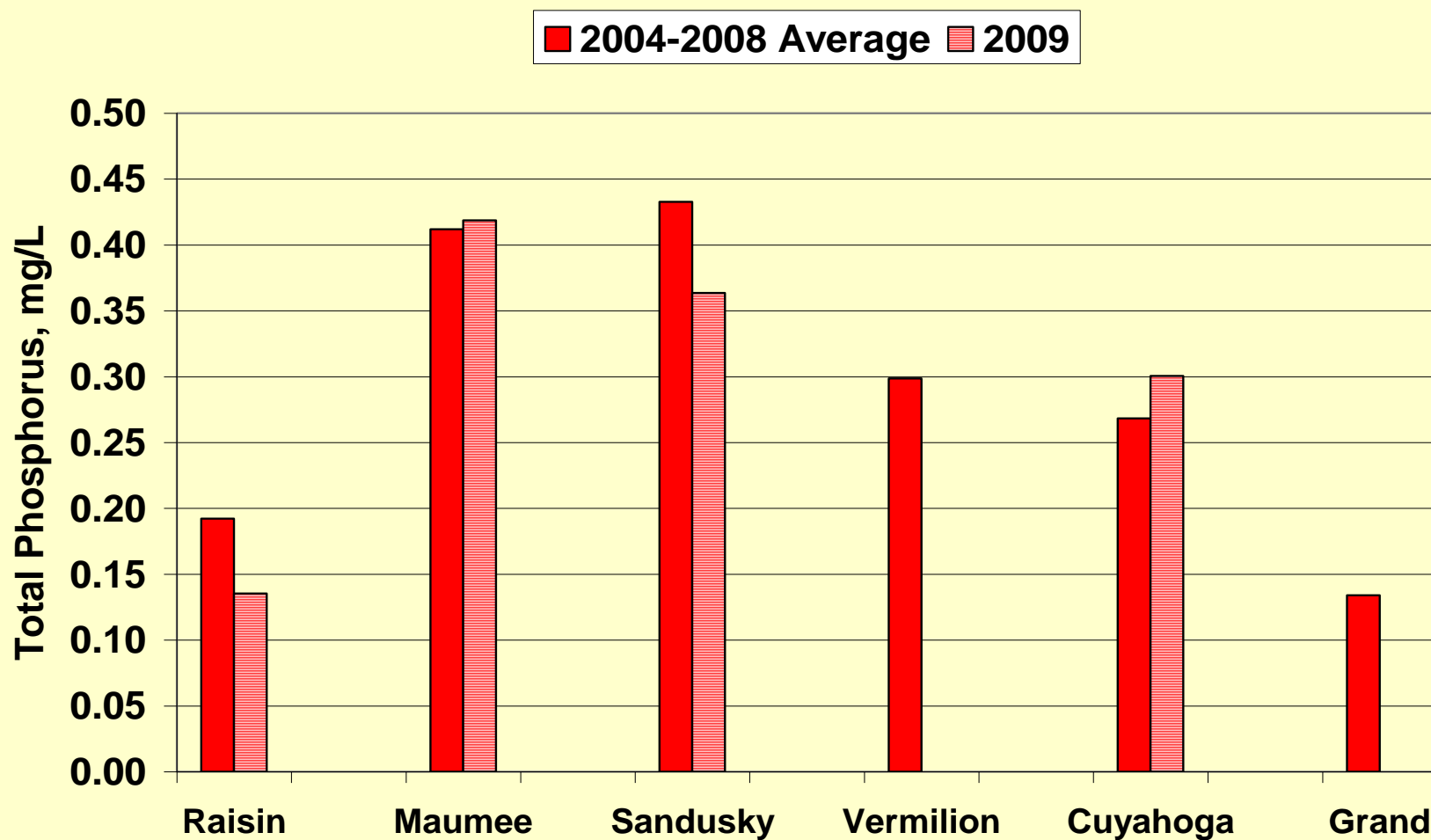
## Nitrate Nitrogen, Unit Area Export



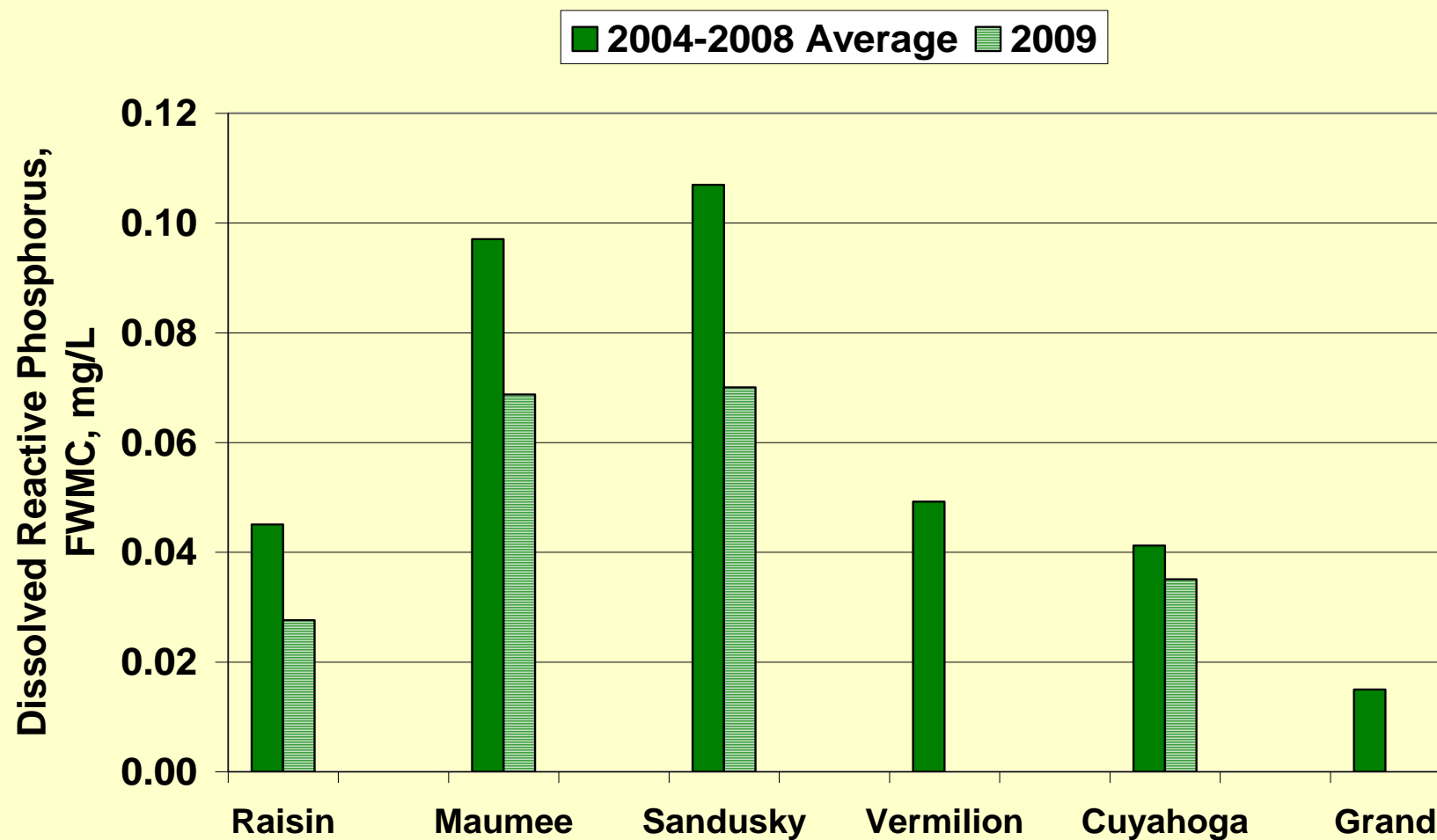
## Suspended Solids, Flow Weighted Mean Concentrations



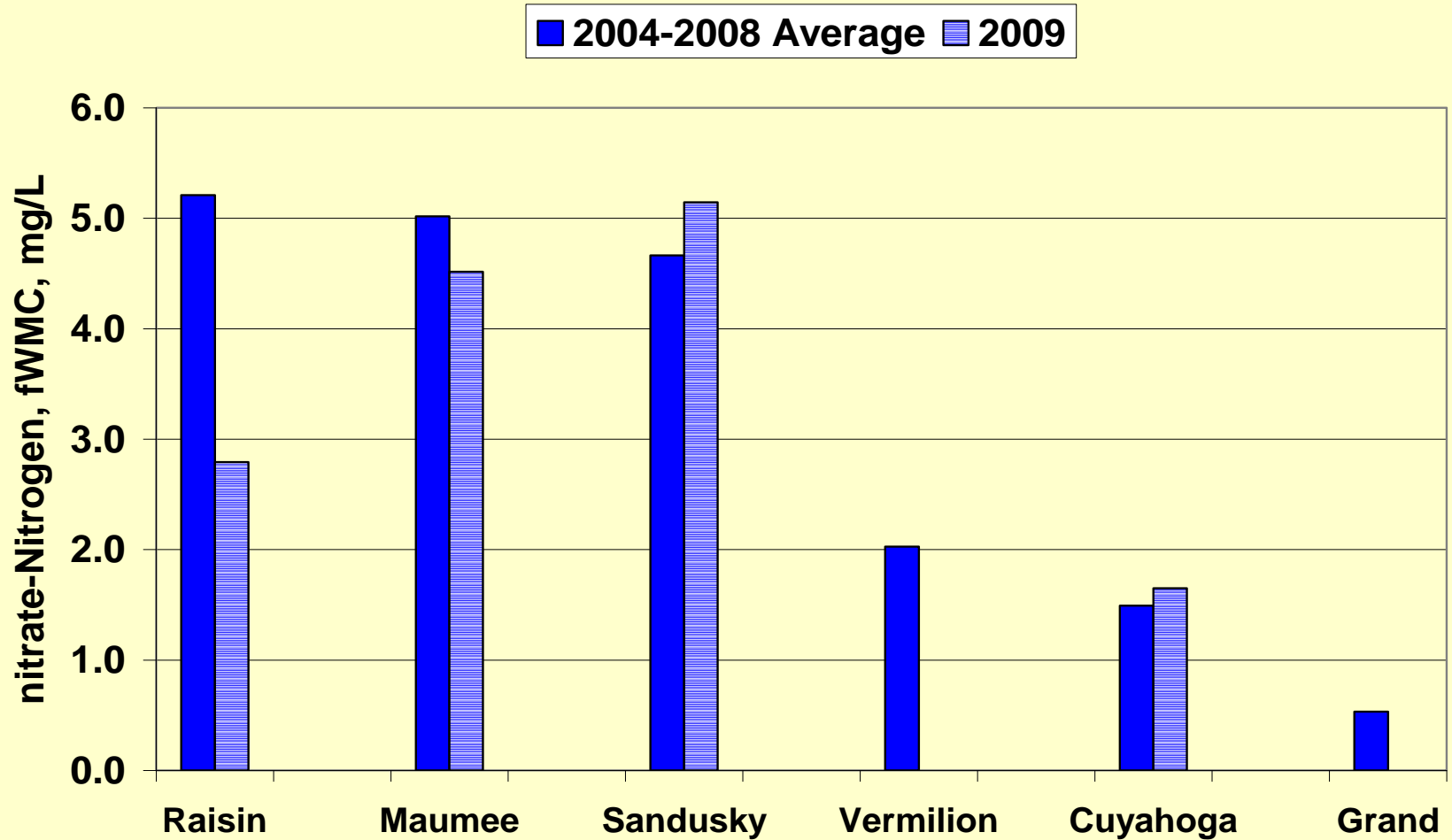
## Total Phosphorus, Flow Weighted Mean Conc.



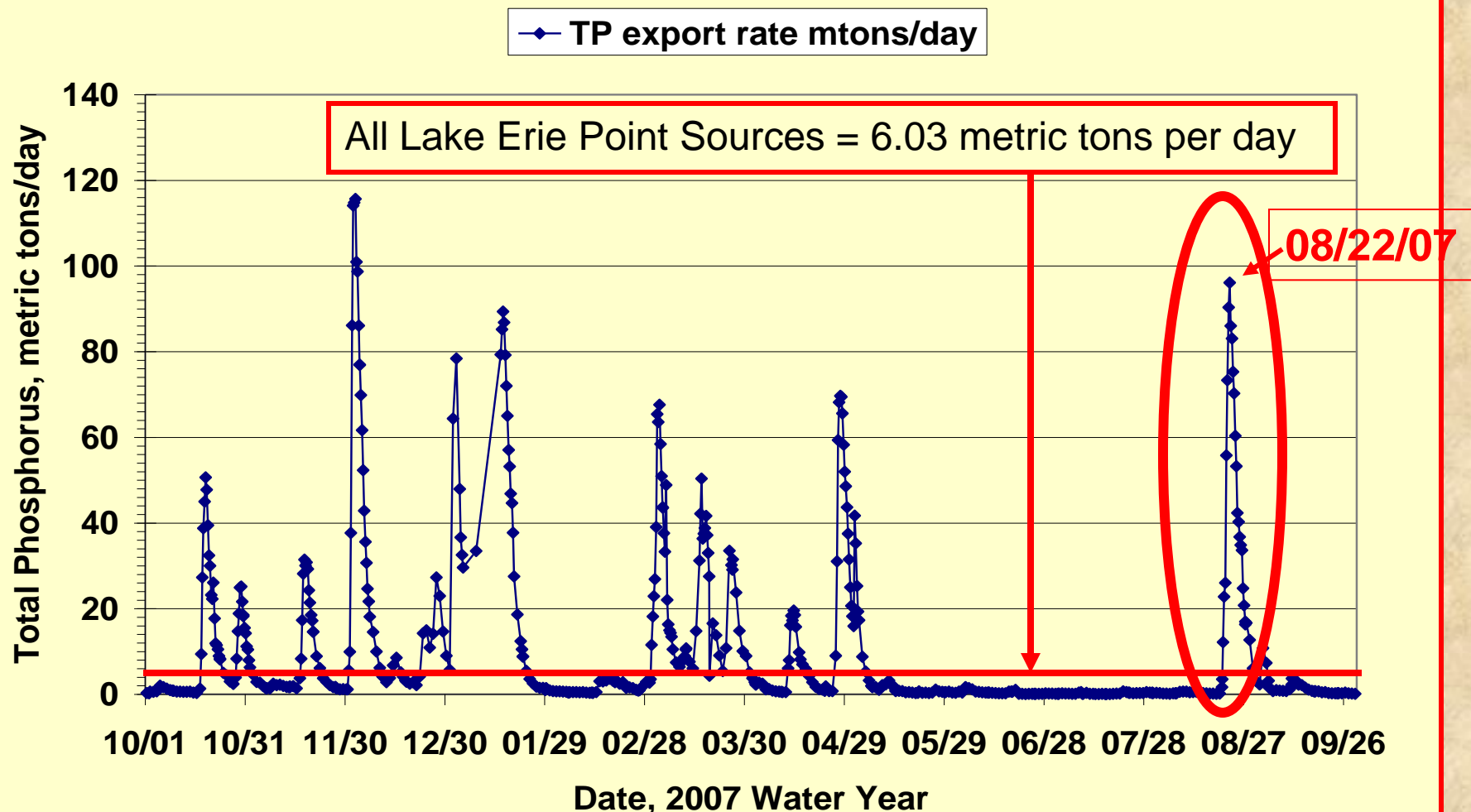
## Dissolved Reactive Phos., Flow Weighted Mean Conc.



## Nitrate-Nitrogen, Flow Weighted Mean Concentrations

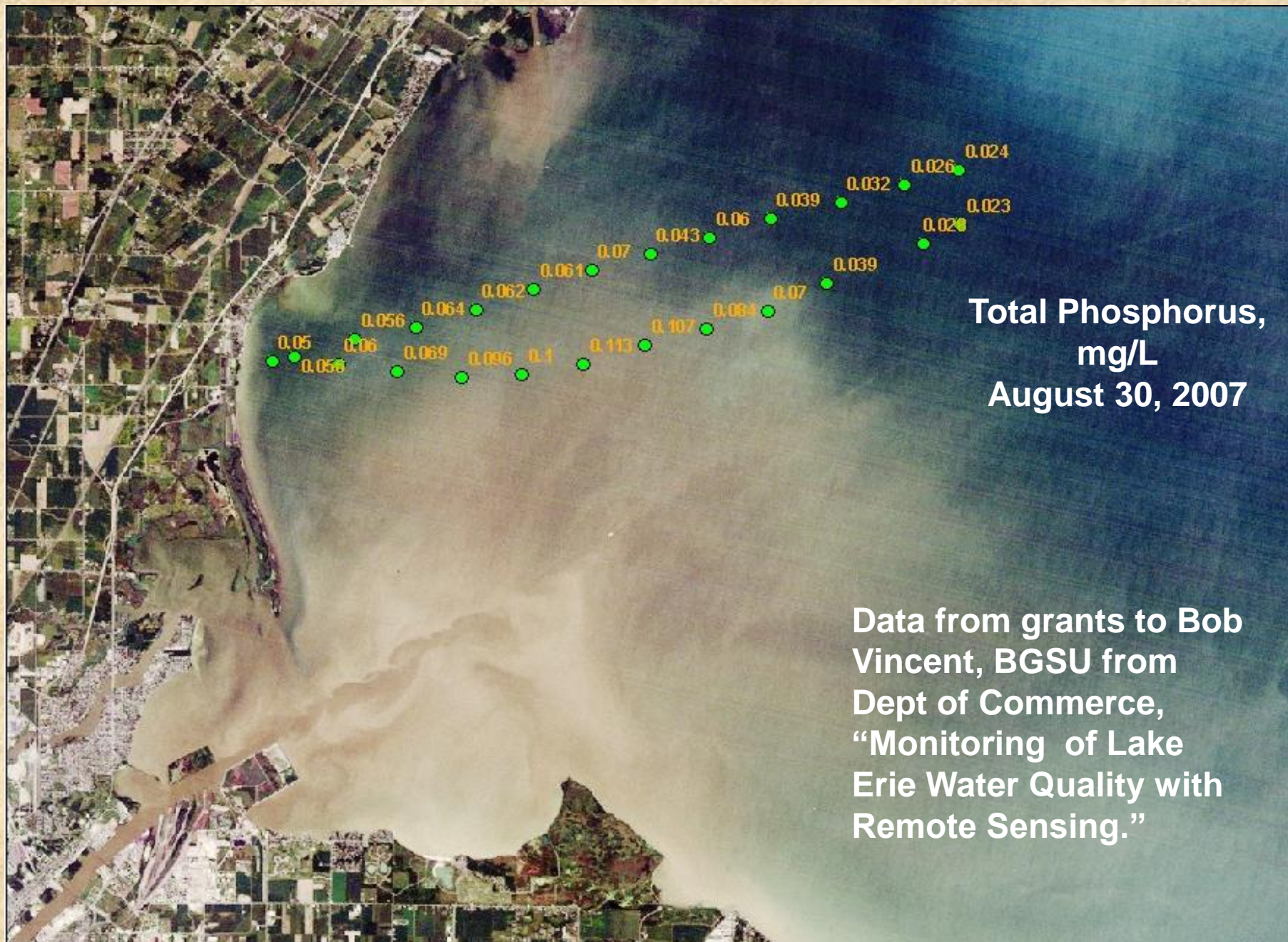


## Maumee River, Total Phosphorus Export Rate



For the total point sources entering Lake Erie from 1981 – 2007, the average daily load has been 6.03 metric tons per day





# **Relationships between Stream Flow and Pollutant Export**

**For the Maumee River at Waterville, 2007 Water Year**

**Flows exceeded 10% of time (>21,310 cfs) accounted for:**

**70 % of the suspended sediment**

**61 % of the total phosphorus export**

**51 % of the dissolved reactive phosphorus export**

**Flows exceeded 50% of time (>3,338 cfs) accounted for:**

**98 % of the suspended sediment**

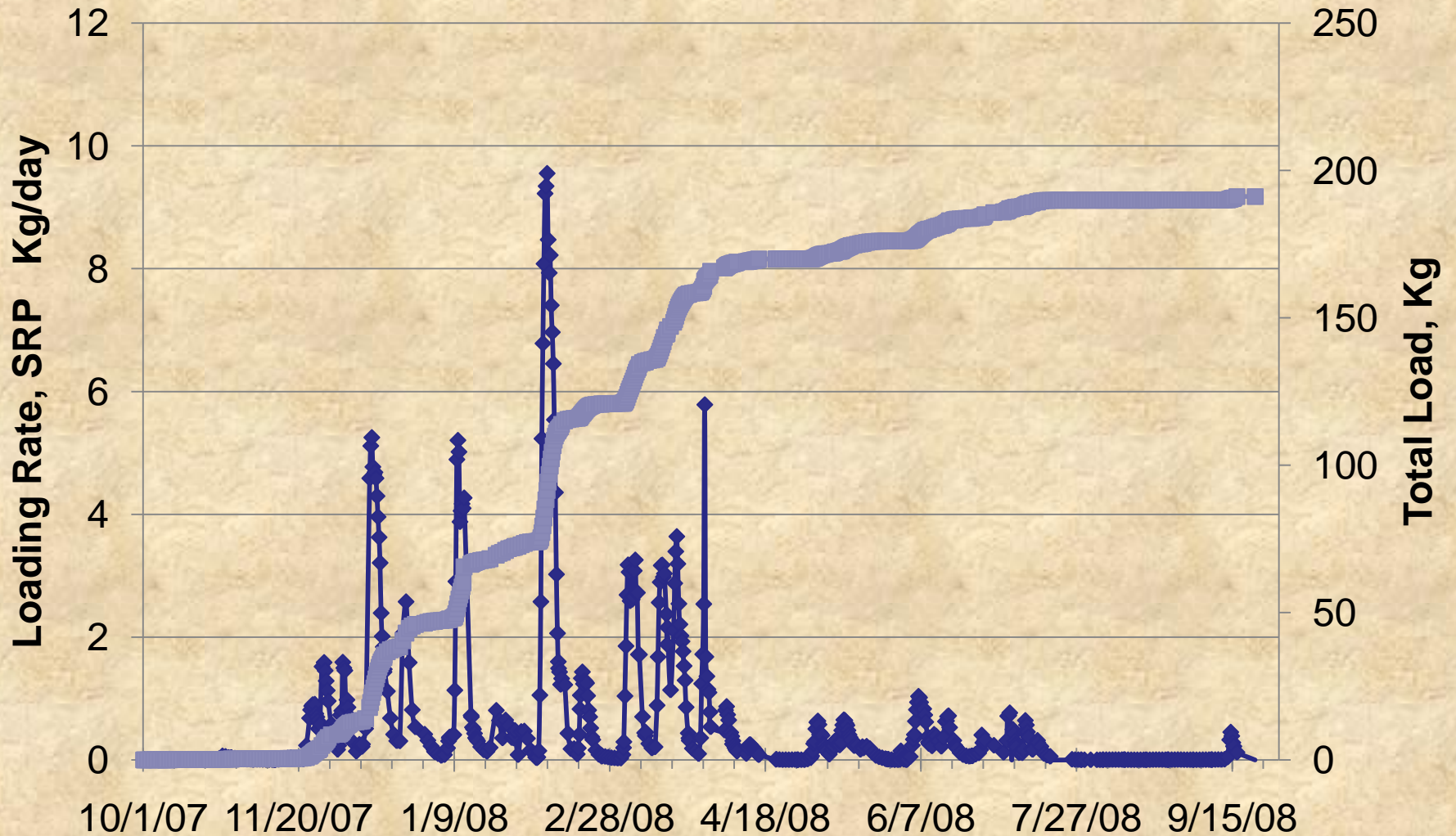
**97 % of the total phosphorus export**

**97 % of the dissolved reactive phosphorus export**



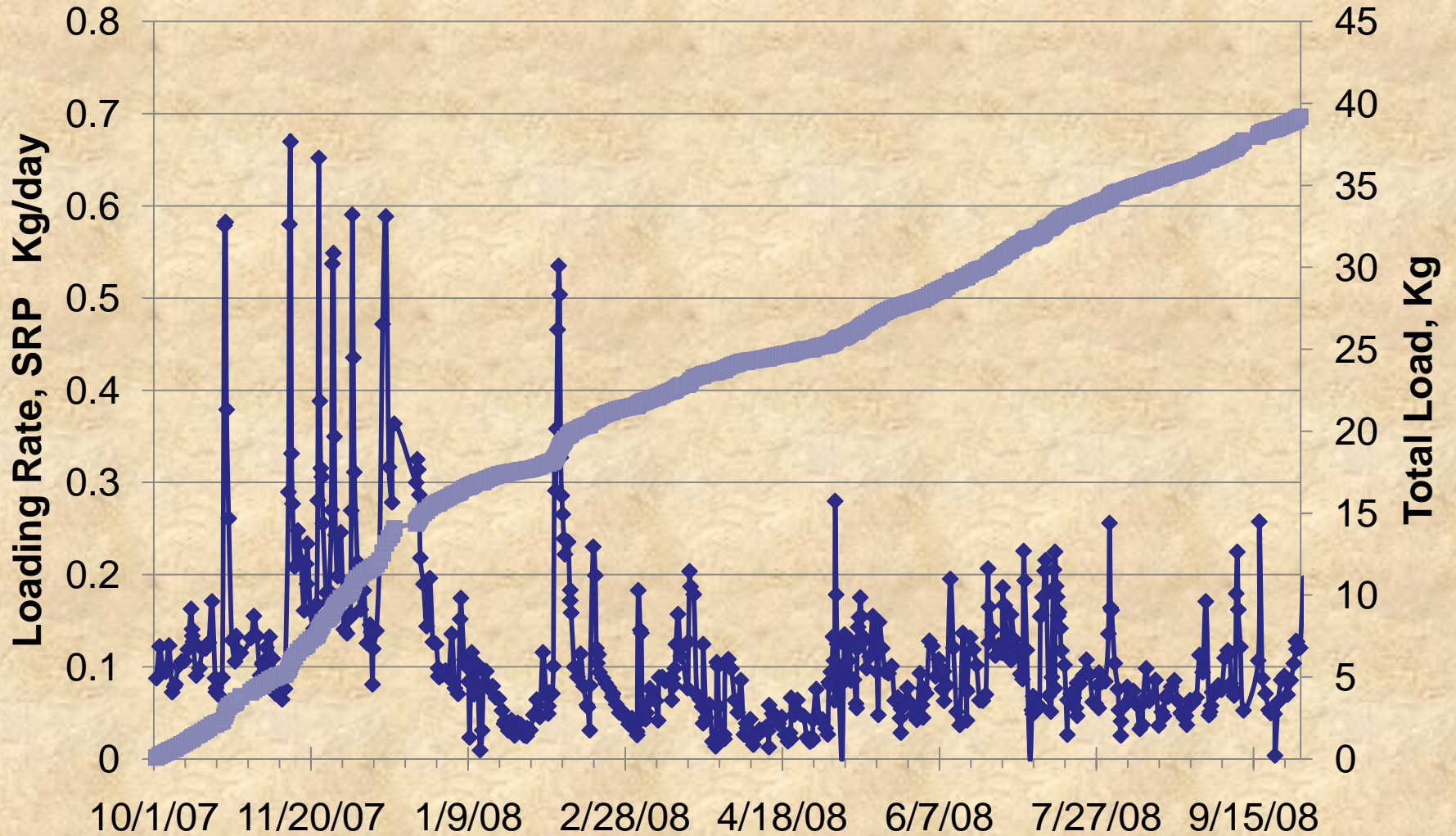
# Sandusky River 10/1/2007 - 9/30/2008

◆ Loading Rate, Kg/day      ■ Cumulative Load, Kg

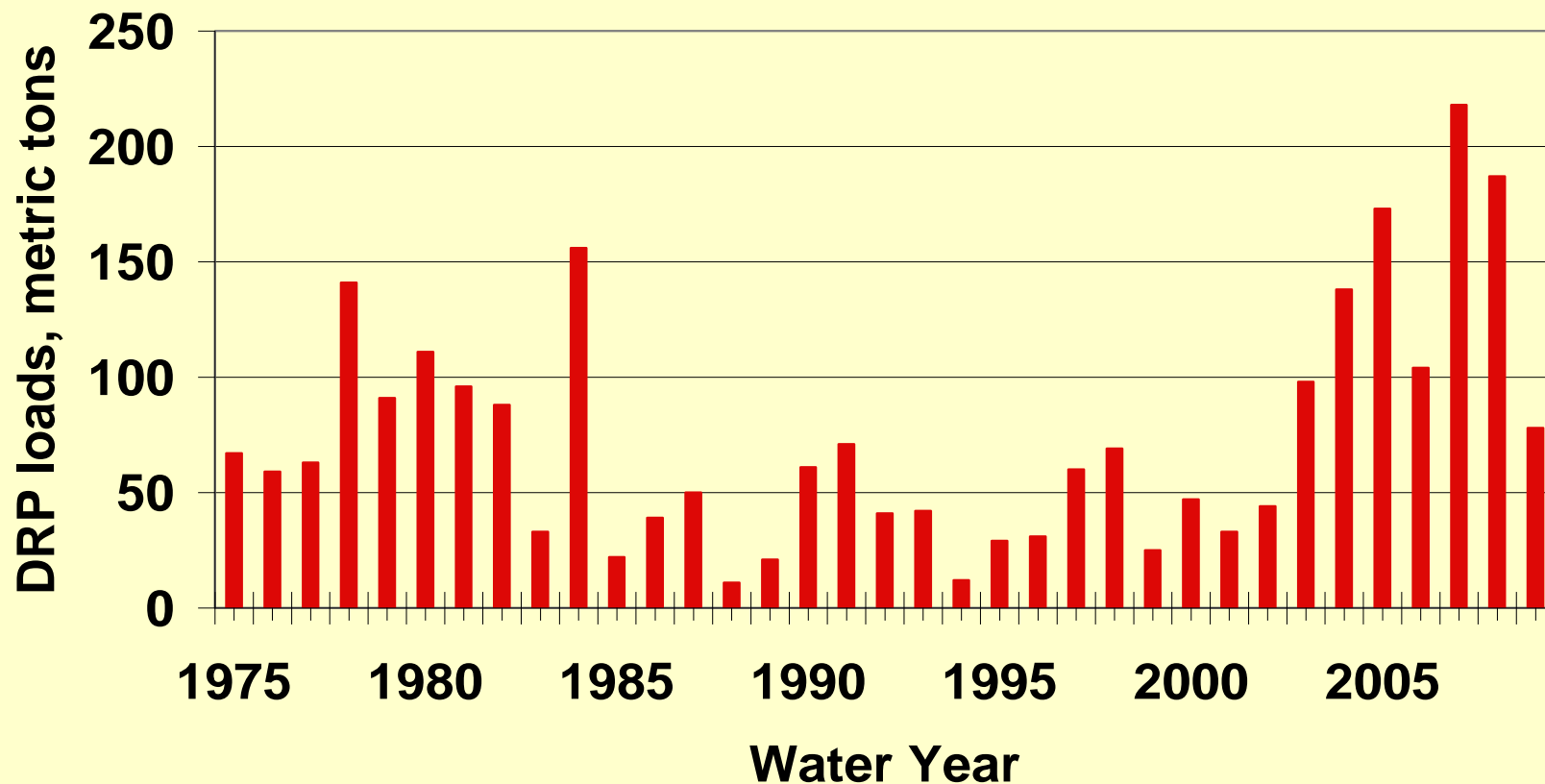


# Cuyahoga River 10/1/2007 - 9/30/2008

◆ Loading Rate, Kg/day      ■ Cumulative Load, Kg



## Sandusky River, Annual Export of Dissolved Reactive Phosphorus, 1975 to 2009

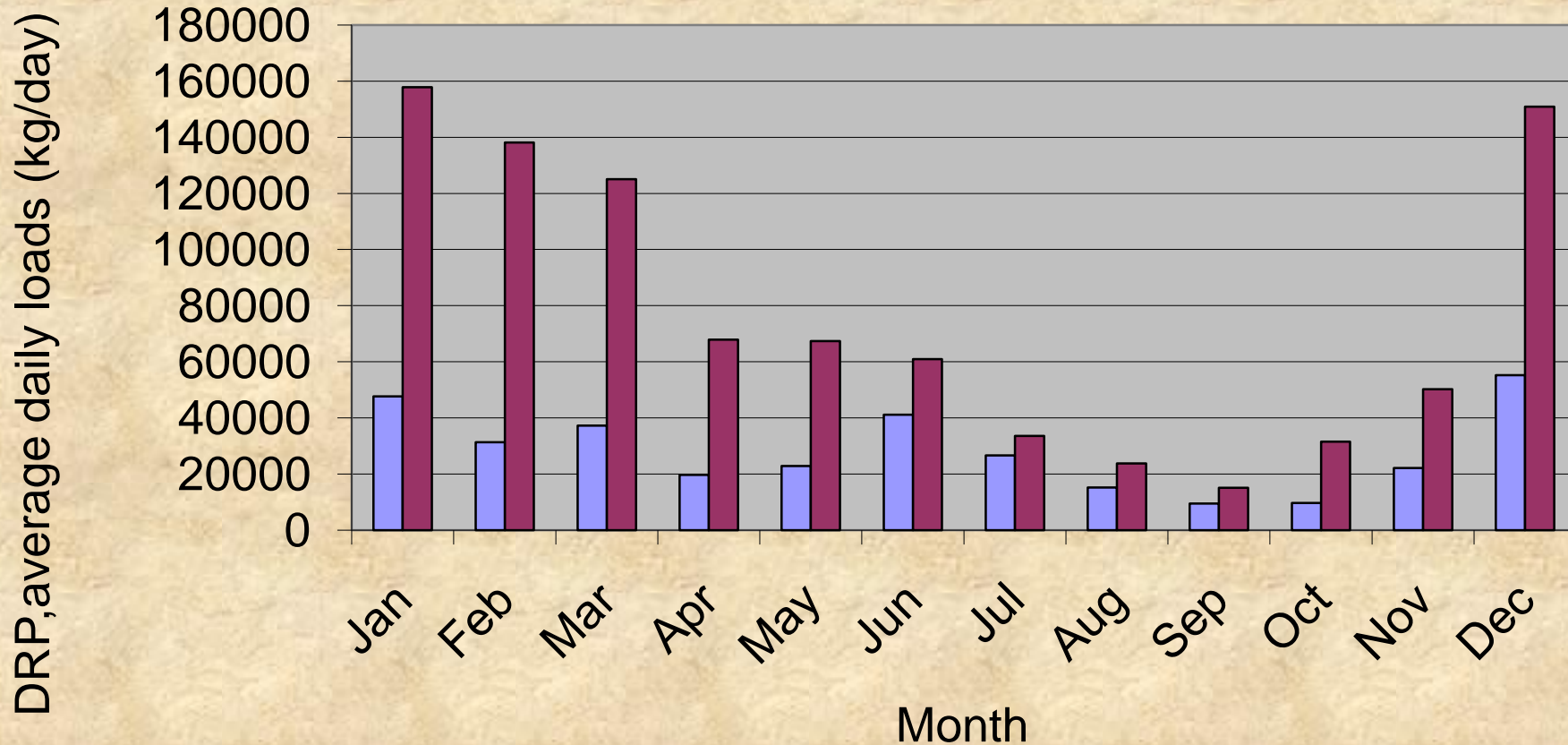


**Dissolved reactive phosphorus is 100% bioavailable to algae.**

**Particulate phosphorus is about 30% bioavailable to algae.**

## Sandusky River, Average Daily Loads of Dissolved Reactive Phosphorus

1991-1998 2002-2009



# Northwestern Ohio Agricultural Ecosystems

