

# Phosphorus Loading to Lake Erie: An Update (Mostly Maumee)

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# Background

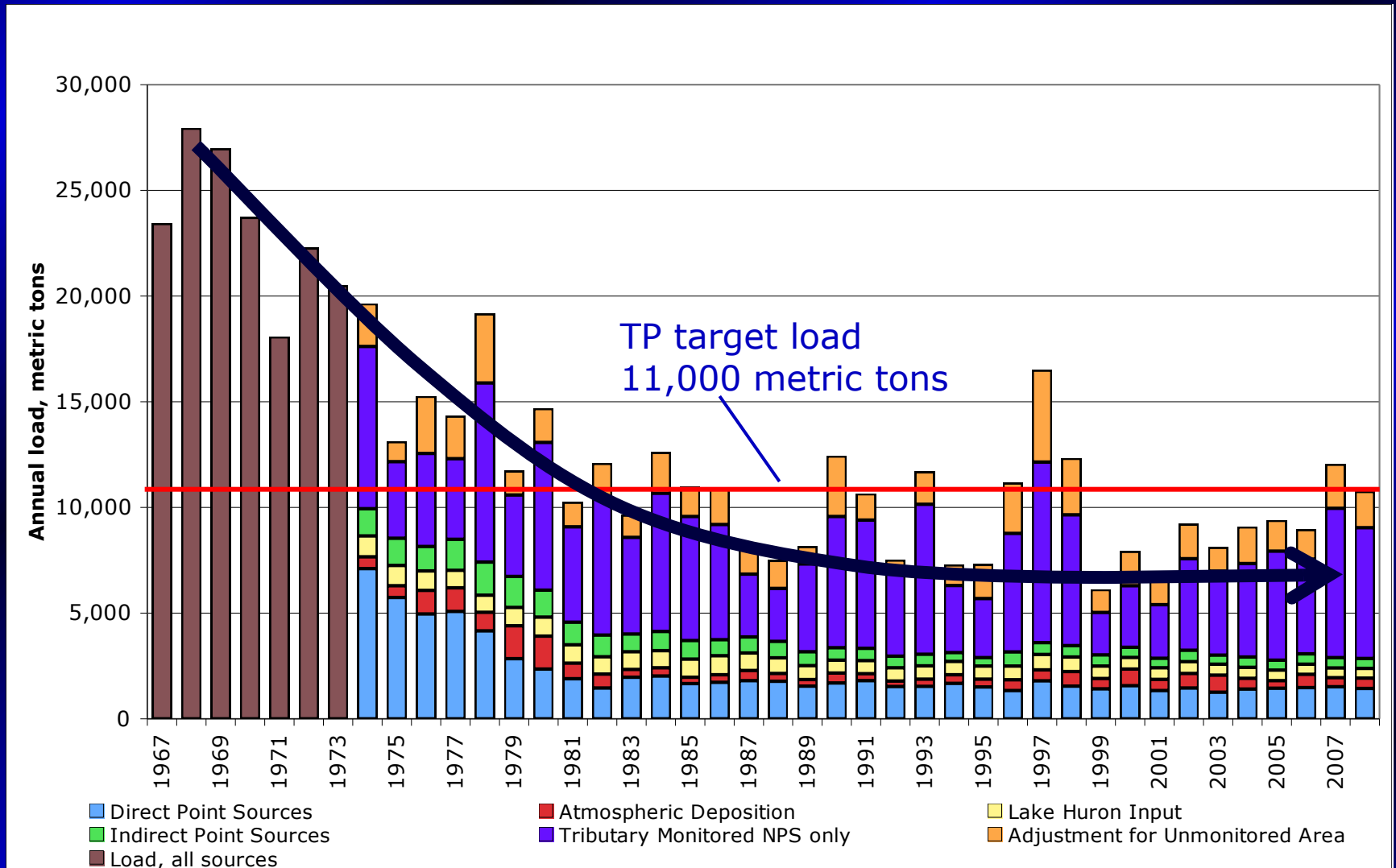
- The horrendous HAB conditions in Western Lake Erie in 2011 are driving our activities
- ...but we now have 2012 nearly complete.
- It is instructive to compare these two years with each other and with the long-term record.
- I'll try to do that from a tributary loading perspective, focusing on the Maumee River.

# Topics

- Whole lake TP loads from all sources
- Annual loads, recent and earlier, Maumee R.
  - Discharge and P forms
- Spring loads similarly, particular focus on 2011 & 2012
- Levels (post 2007) and trends (1975-2011) on a seasonal basis
  - Discharge and nutrients
- Summary

Lots of detail here - for future reference - you won't get it all....

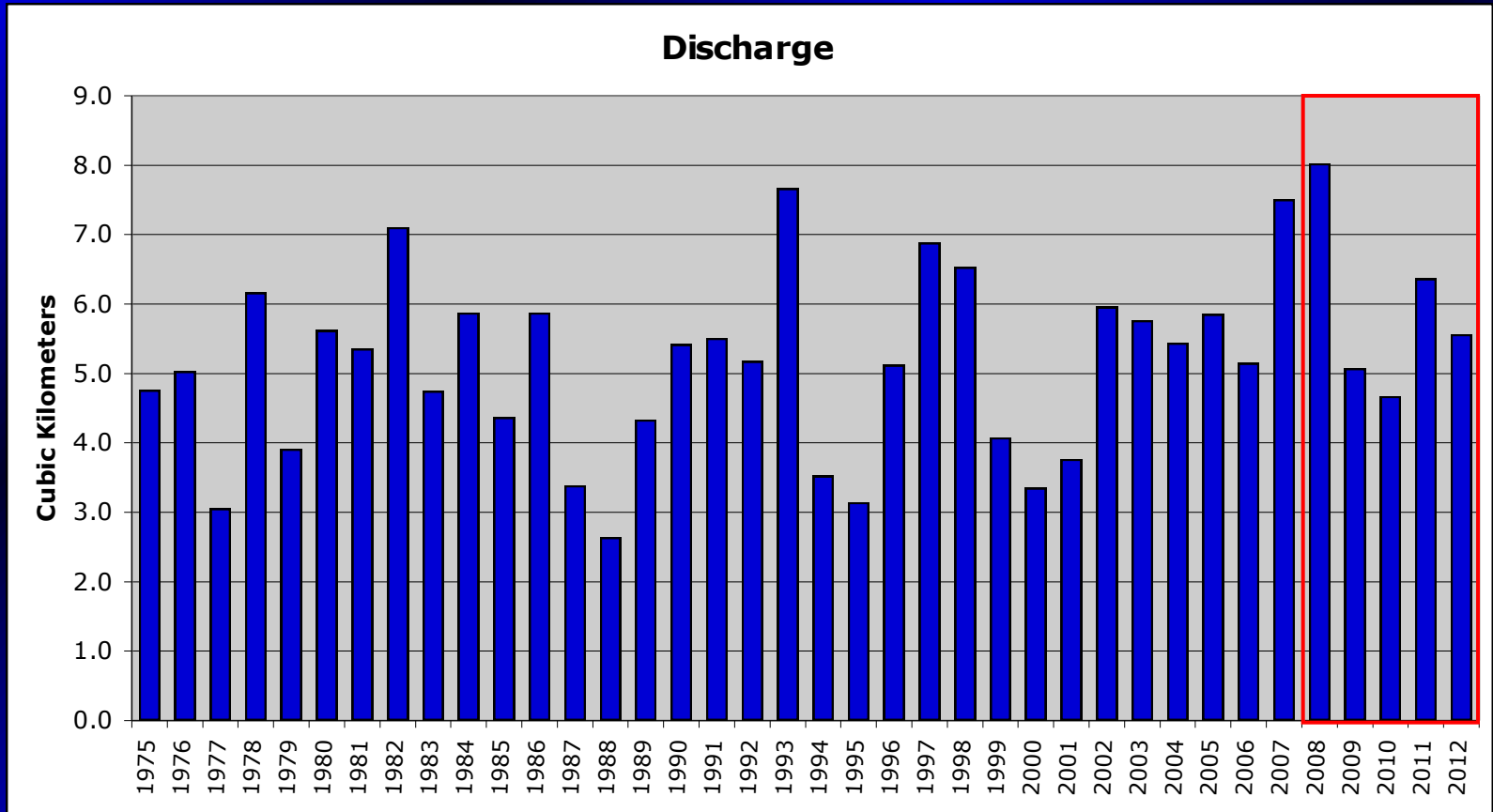
# Lake Erie Total Phosphorus Loading, 1967-2008





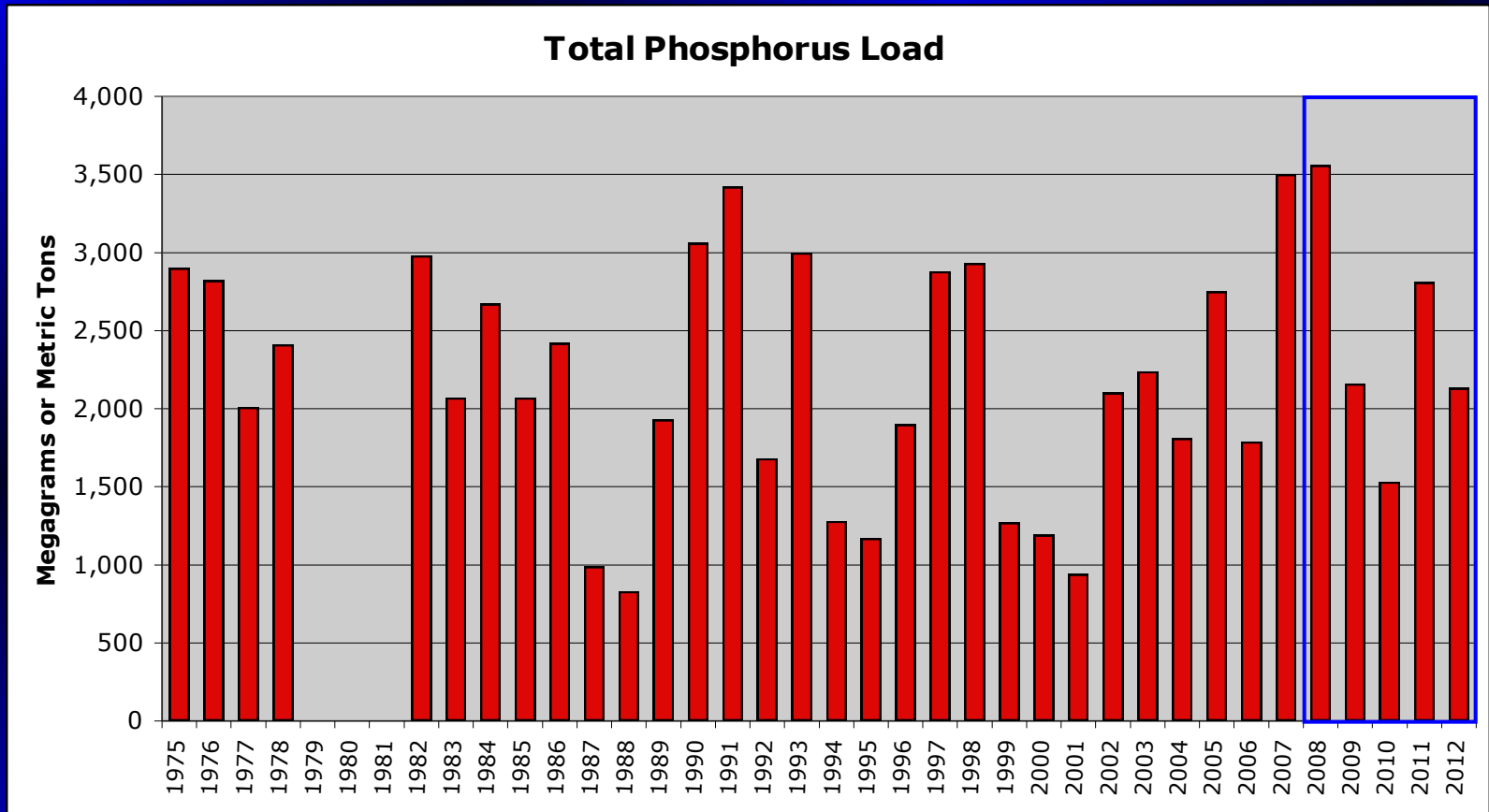
# Annual (Water Year) Graphs, Maumee River

# Maumee Water Year Discharge



2011 and 2012 sort of medium, not too different

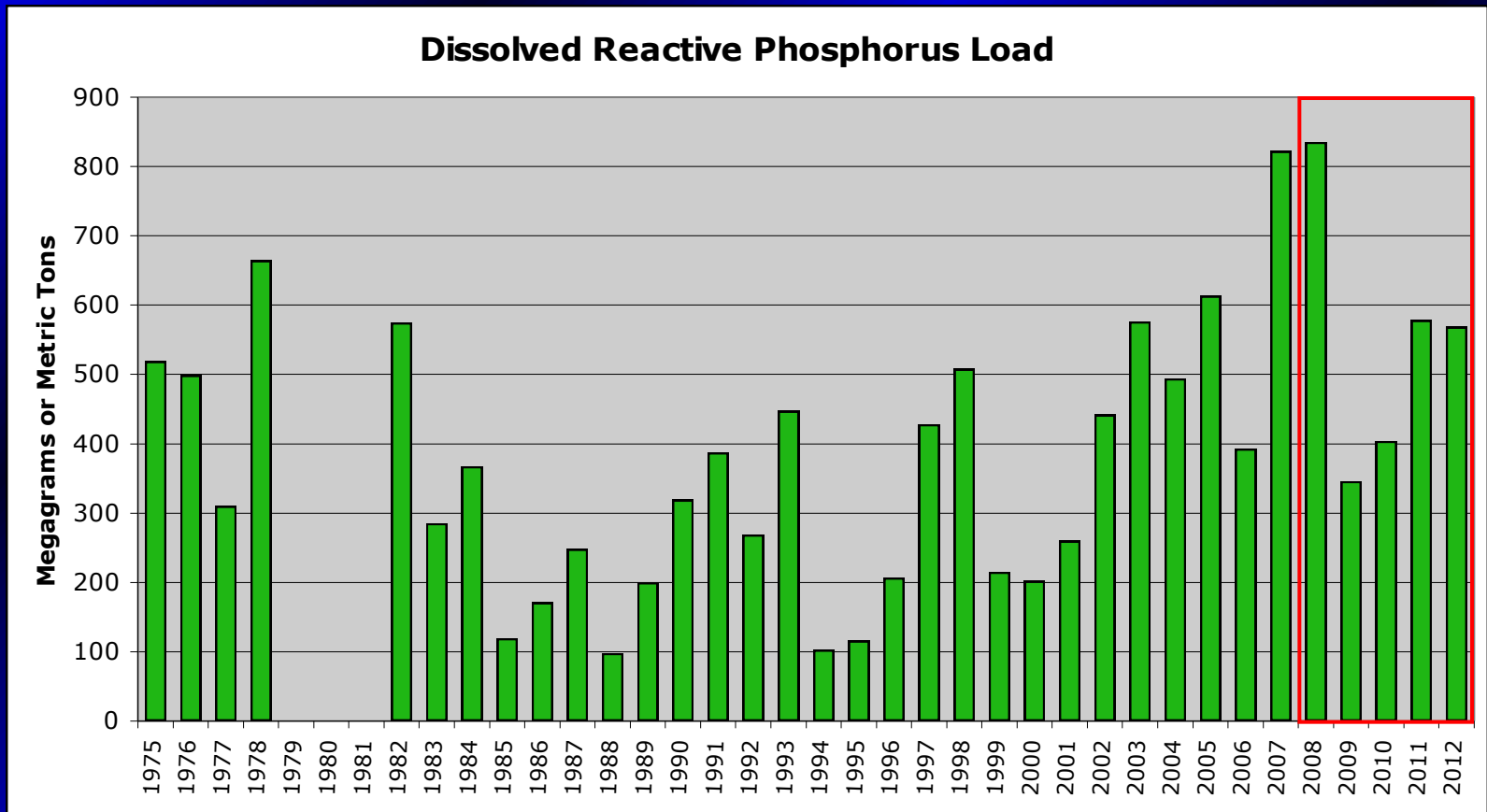
# Water Year TP Load



2011 high medium, 2012 low medium

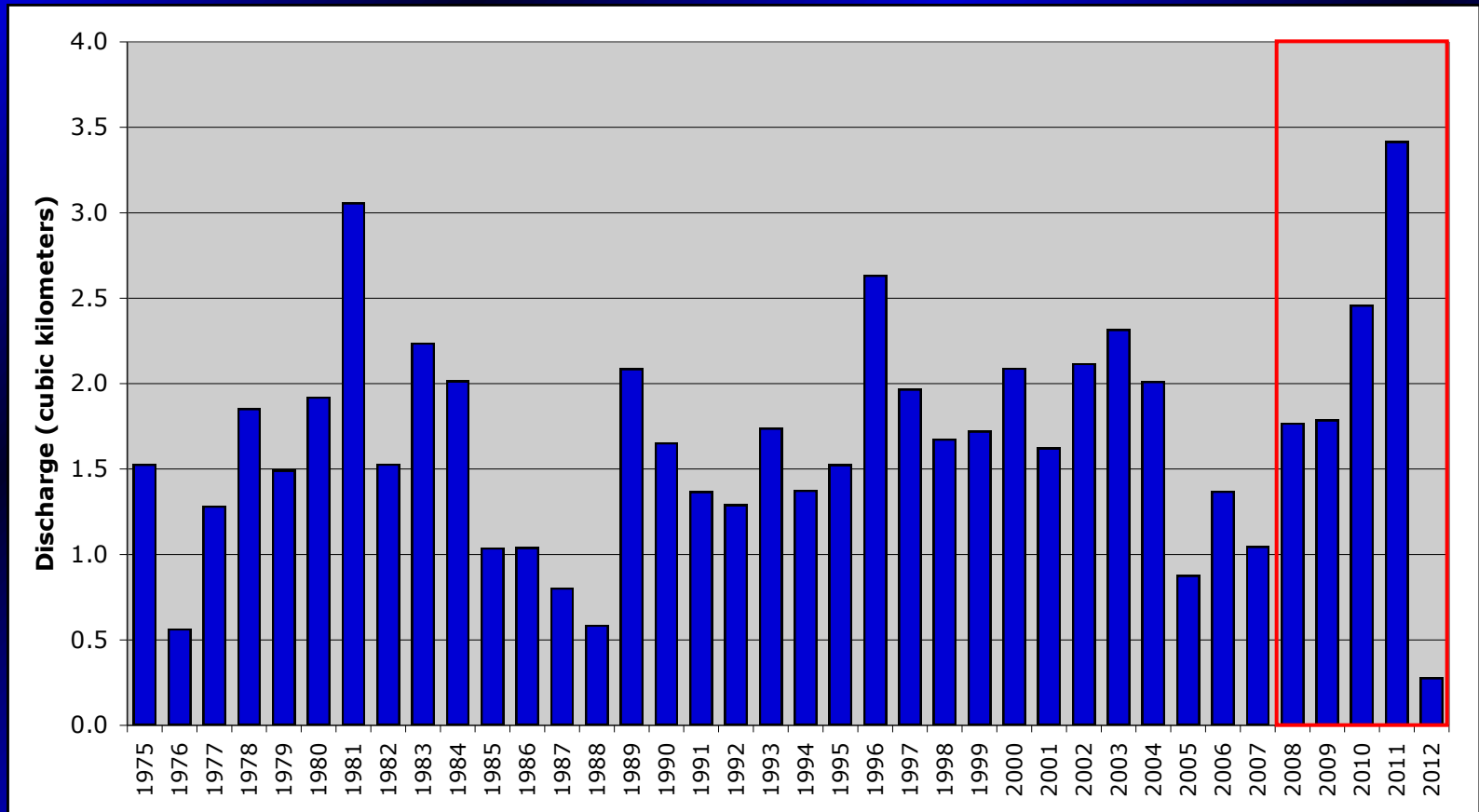


# Water Year DRP Load



2011 and 2012 very comparable, sort of medium

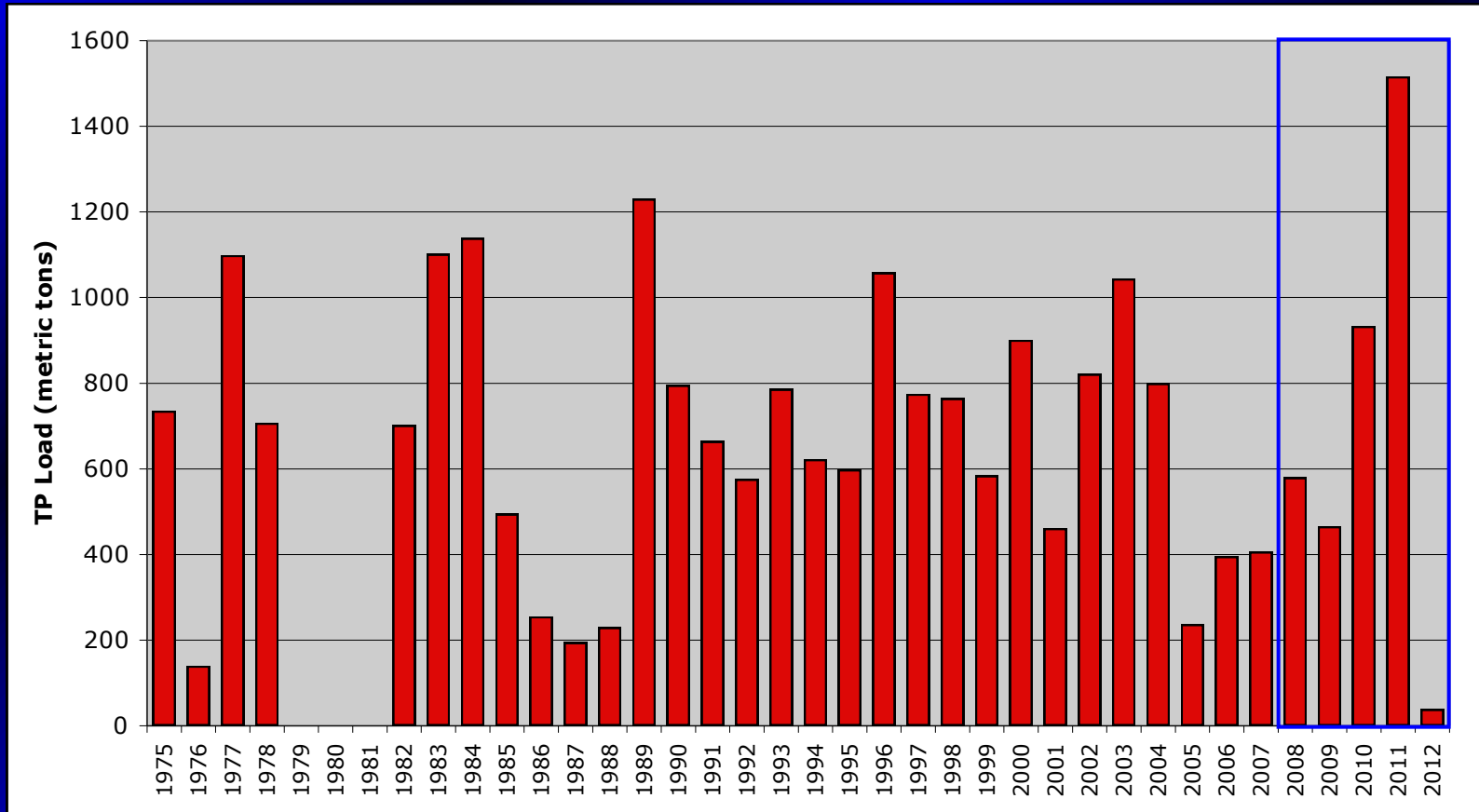
# Spring Discharge (April-June)



2011 and 2012 are the extremes - 2012 is 8.2% of 2011!

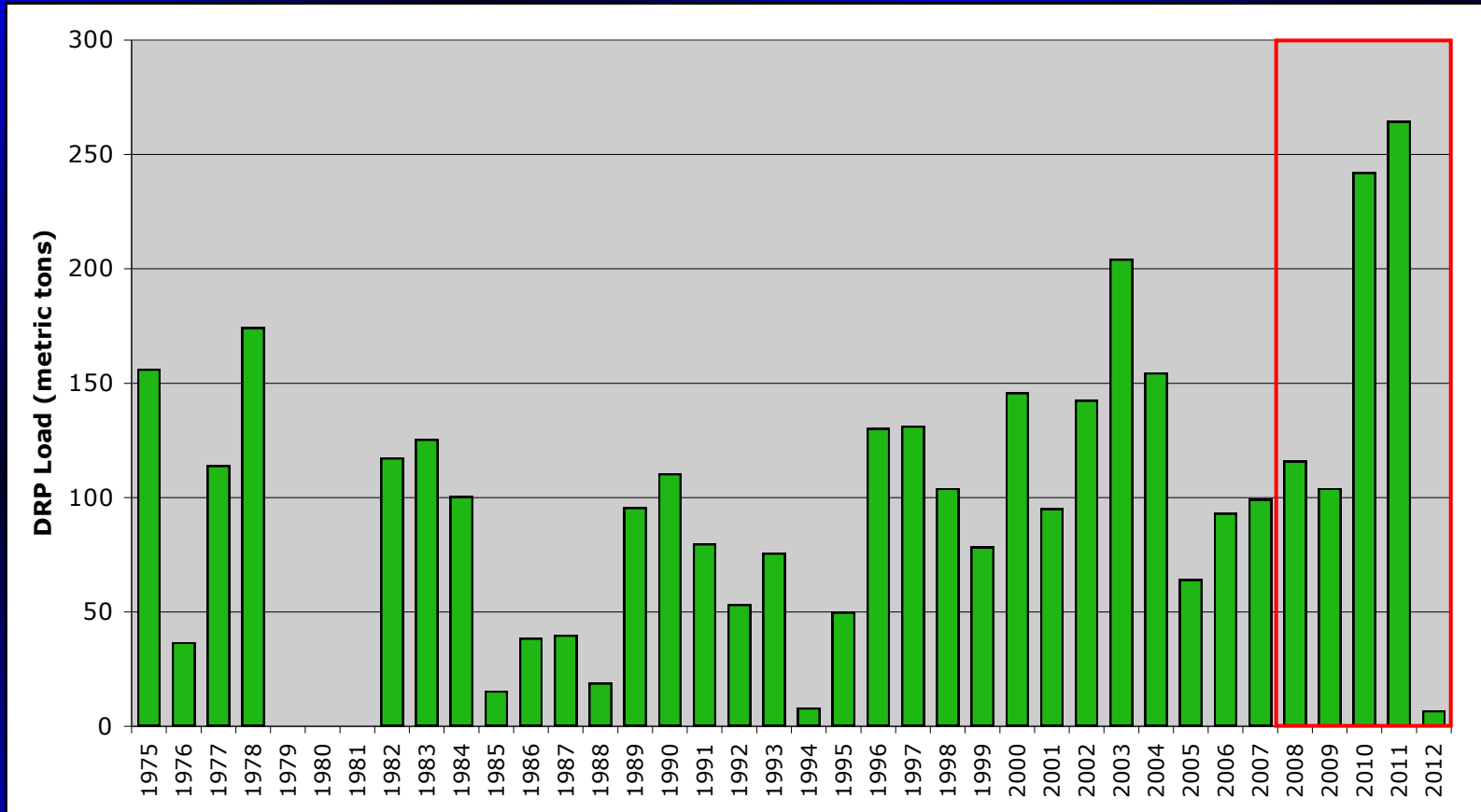
This is the time that seems to drive HAB production

# Spring TP Load



2011 and 2012 are the extremes - 2012 is 2.5% of 2011!

# Spring DRP Load



2011 and 2012 are the extremes - 2012 is 2.6% of 2011!

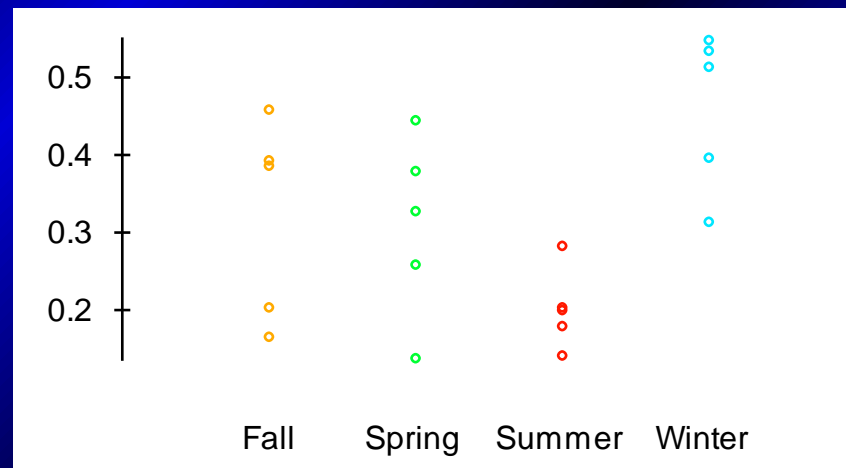
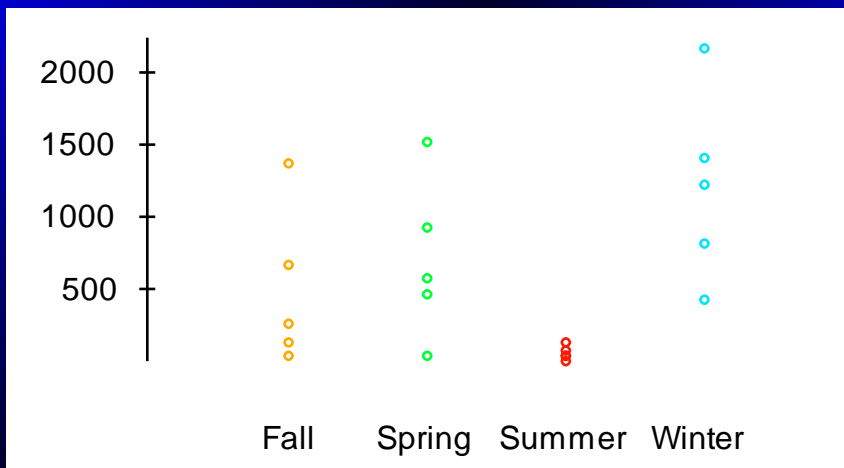
# Seasonal Level and Trend Graphs, Maumee River

# Maumee Levels 2008-2012

## LOAD

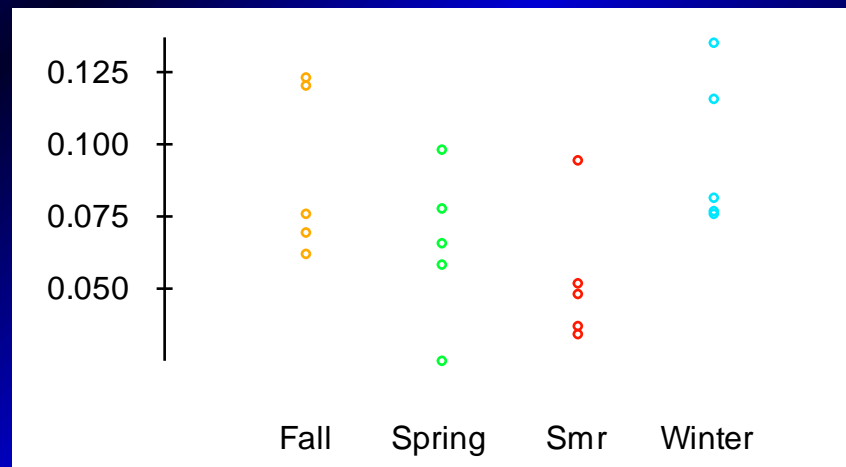
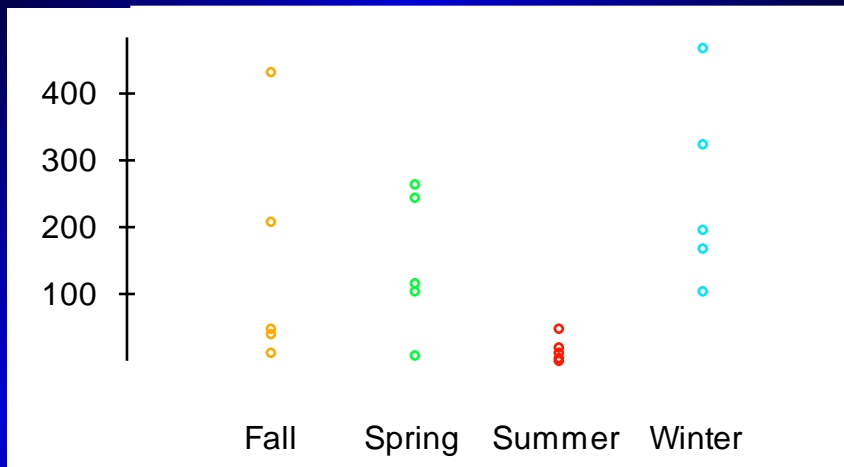
## FWMC

TP

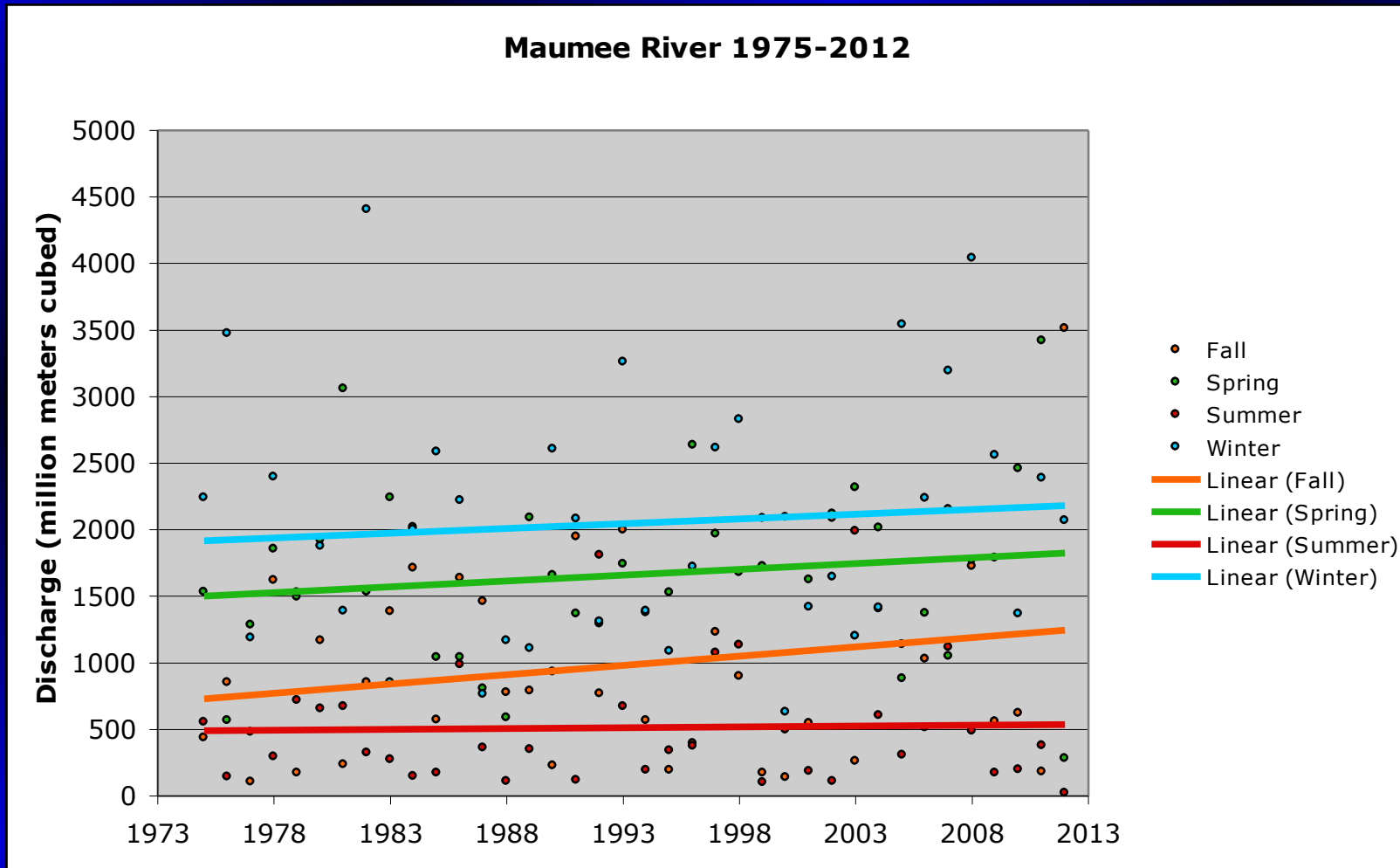


O-N-D    A-M-J    J-A-S    J-F-M

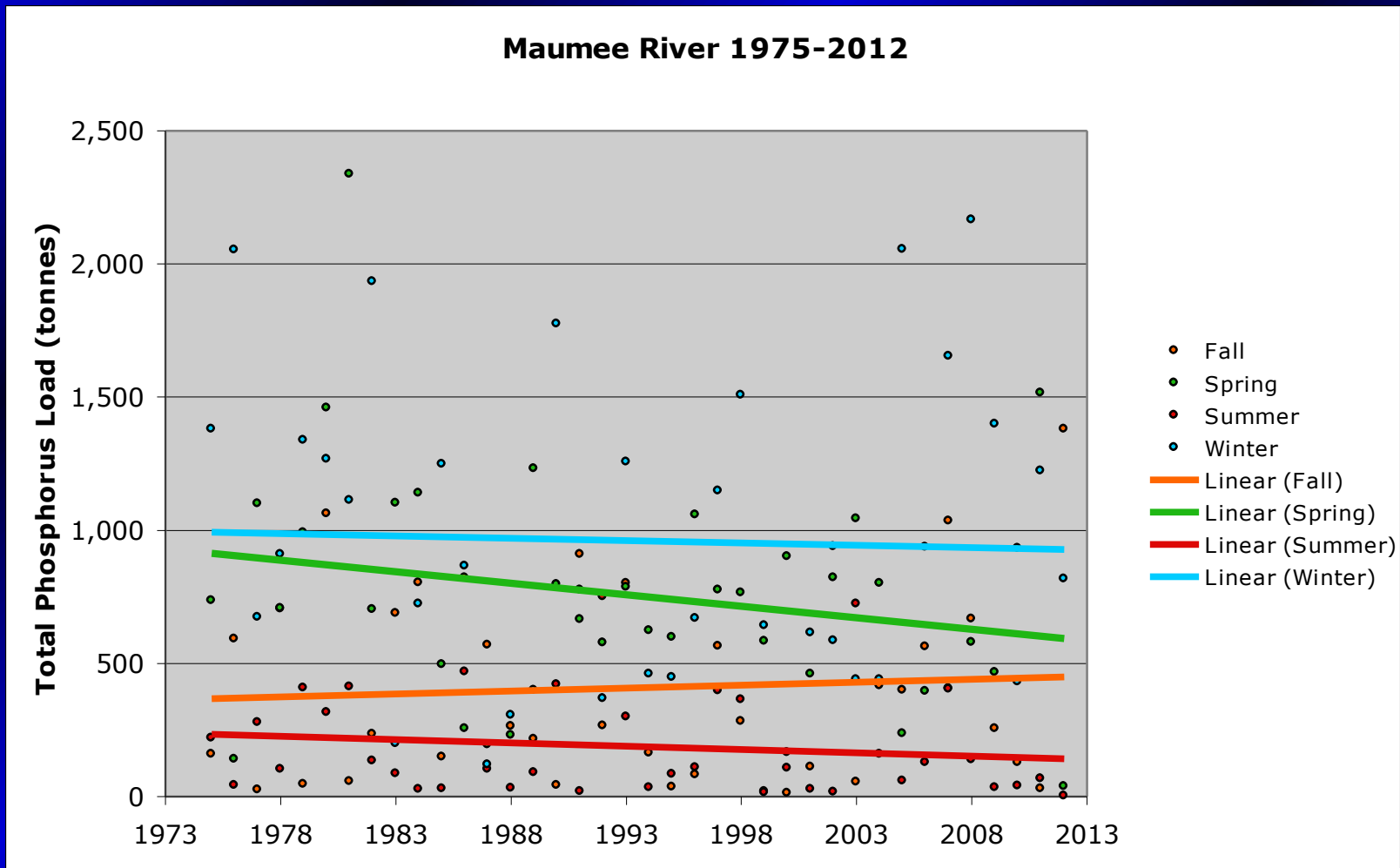
DRP



# Maumee Trends 1975-2012: Discharge

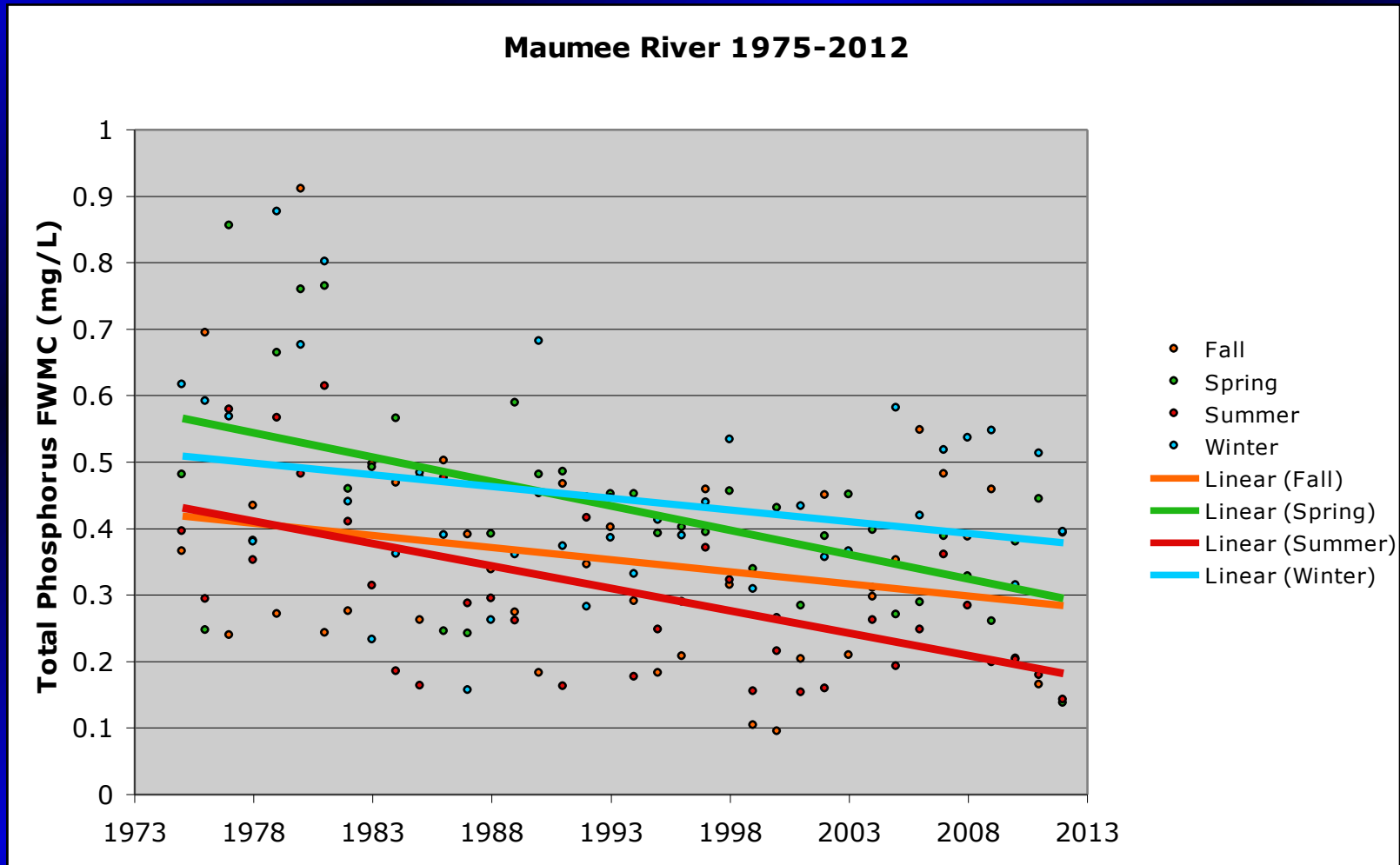


# Maumee Trends 1975-2012: TP Loads

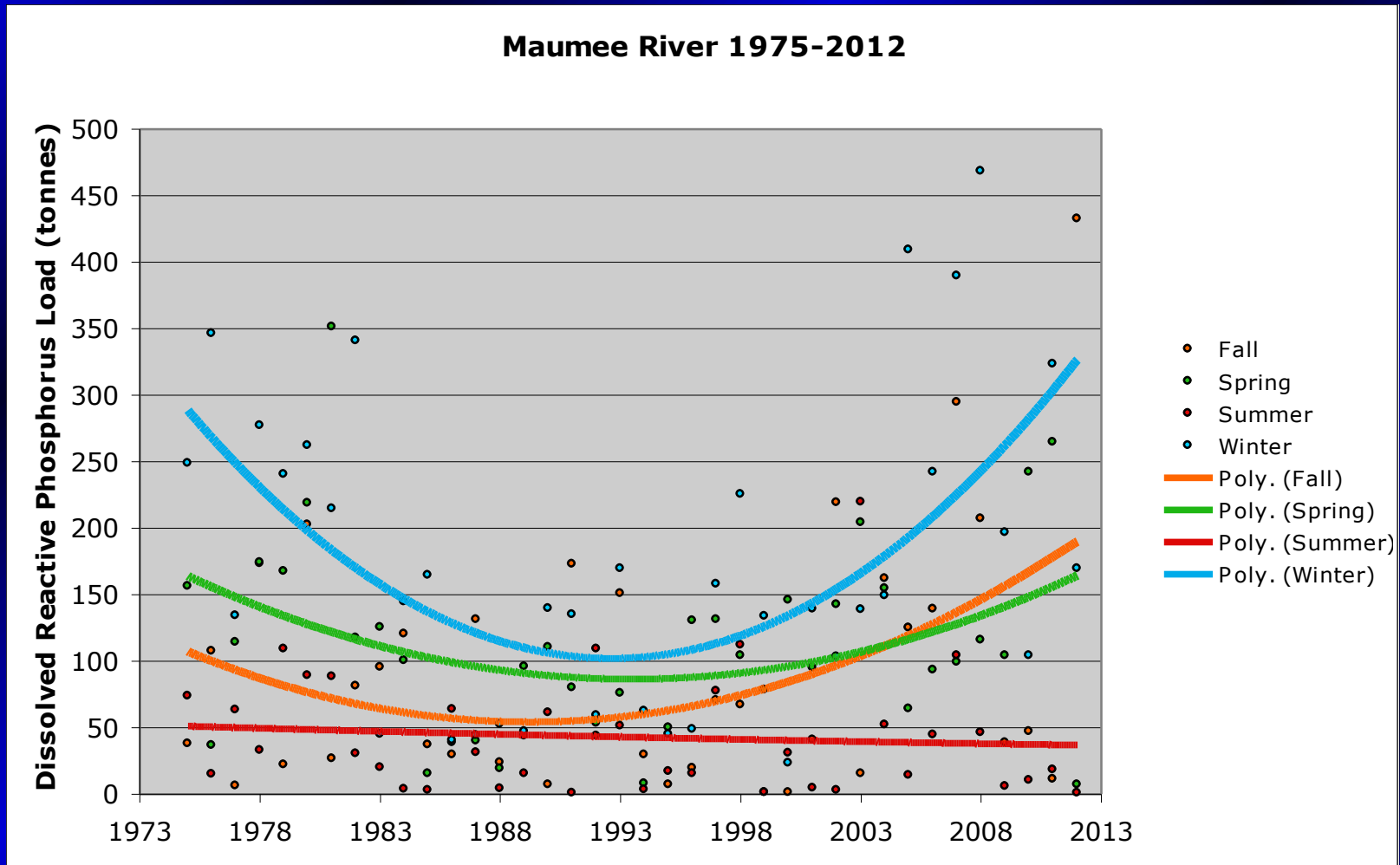




# Maumee Trends 1975-2012: TP FWMC

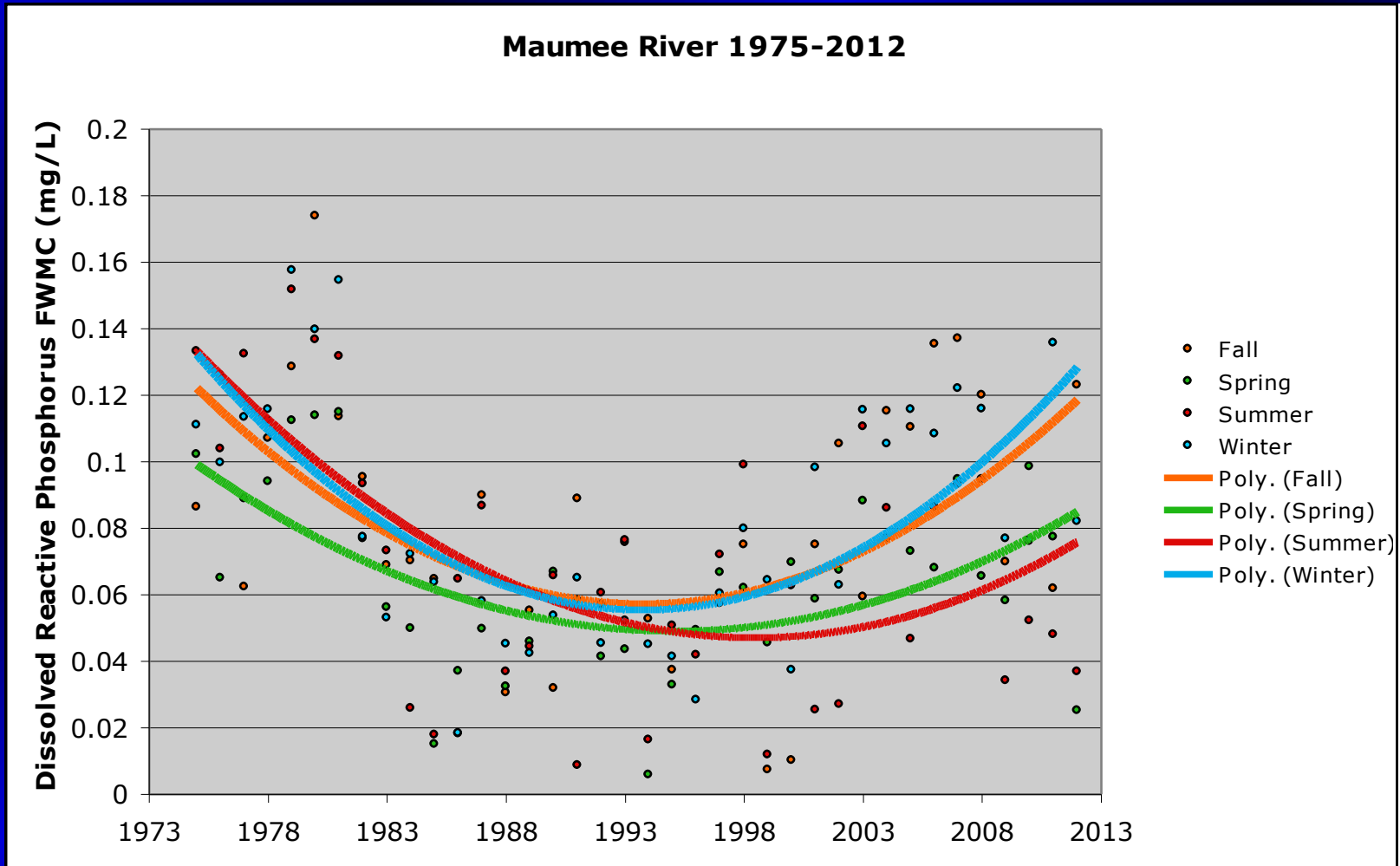


# Maumee Trends 1975-2012: DRP Loads



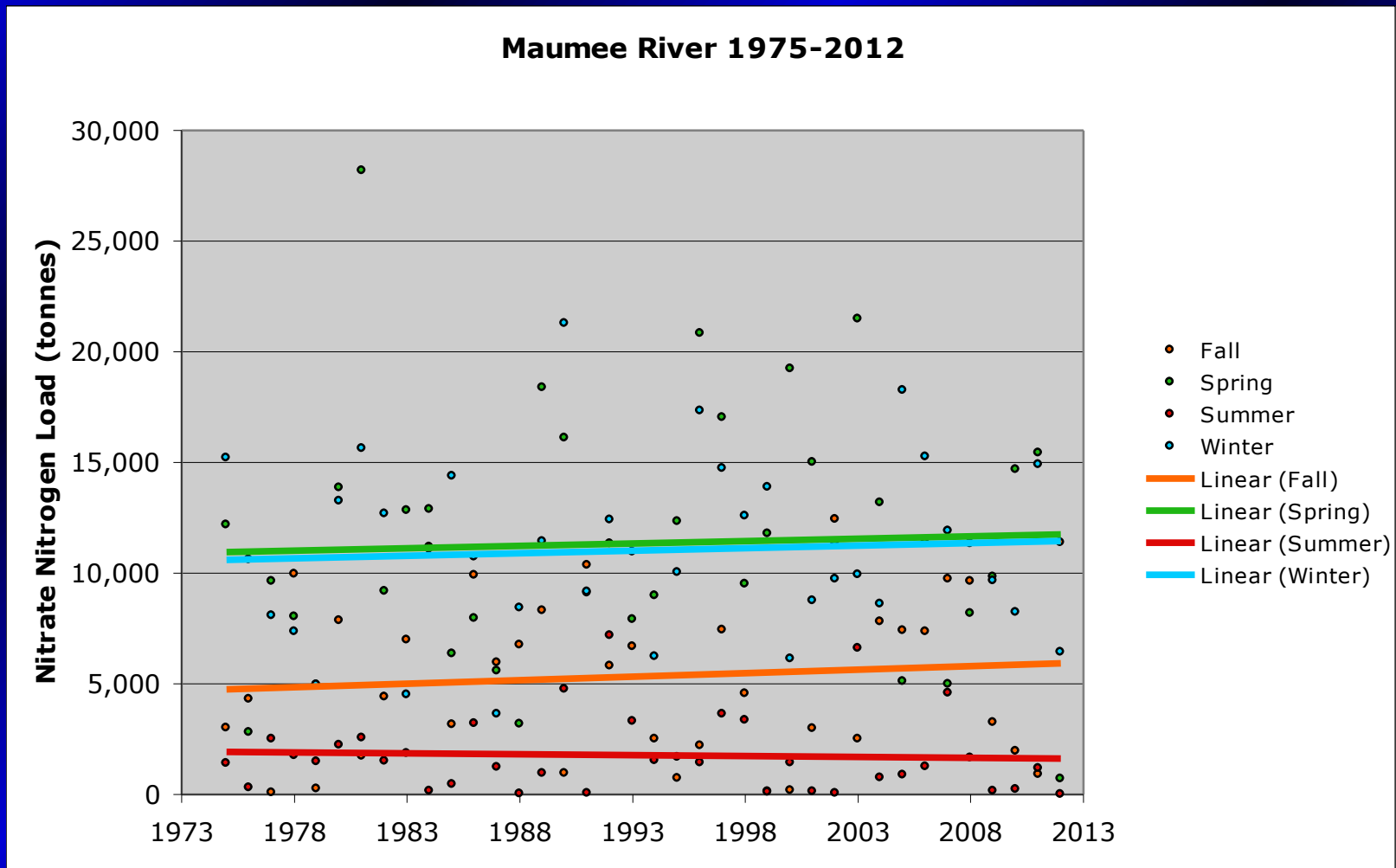
**Big seasonal differences!**

# Maumee Trends 1975-2012: DRP FWMC

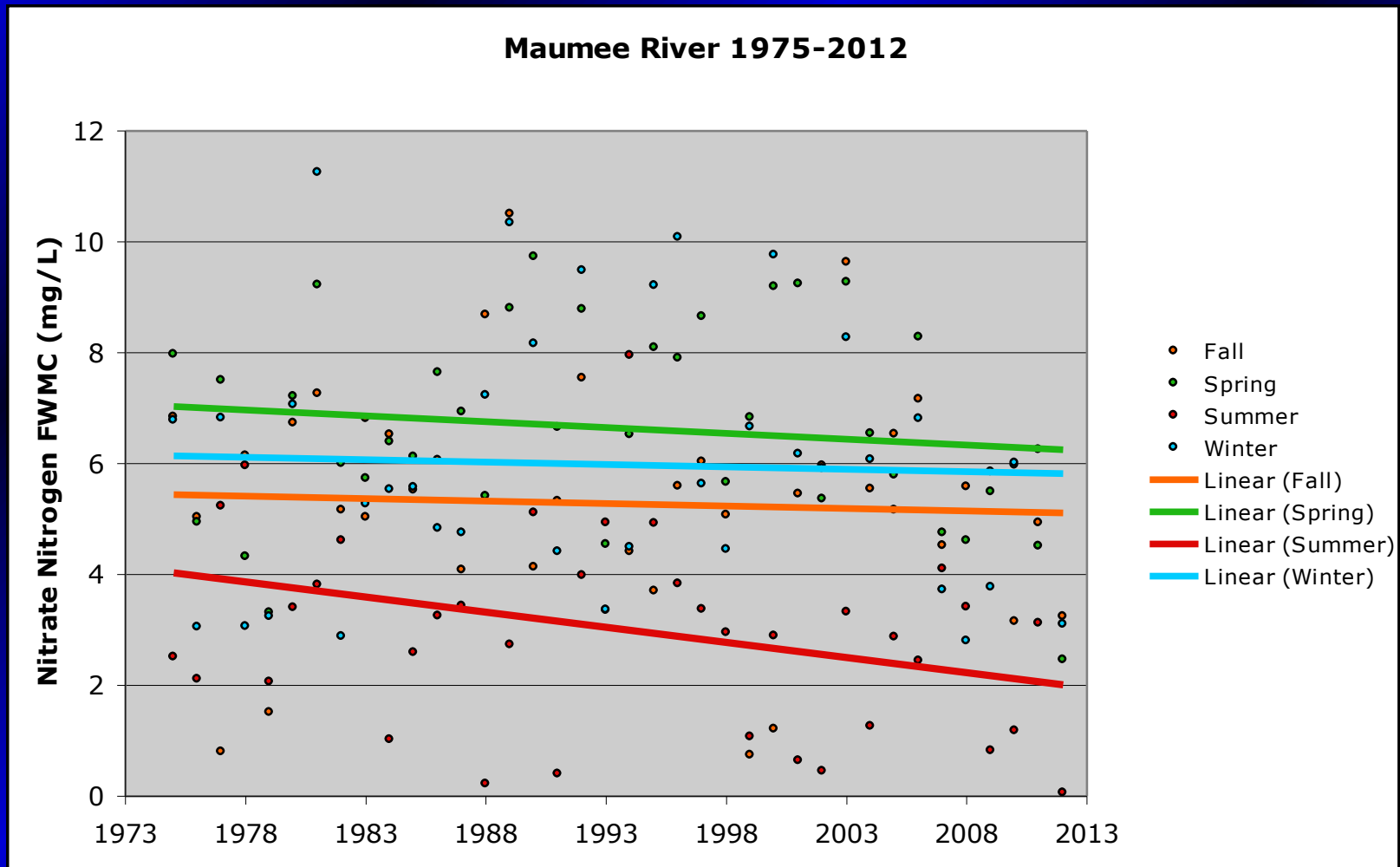


Not so much! Implies an important discharge effect.

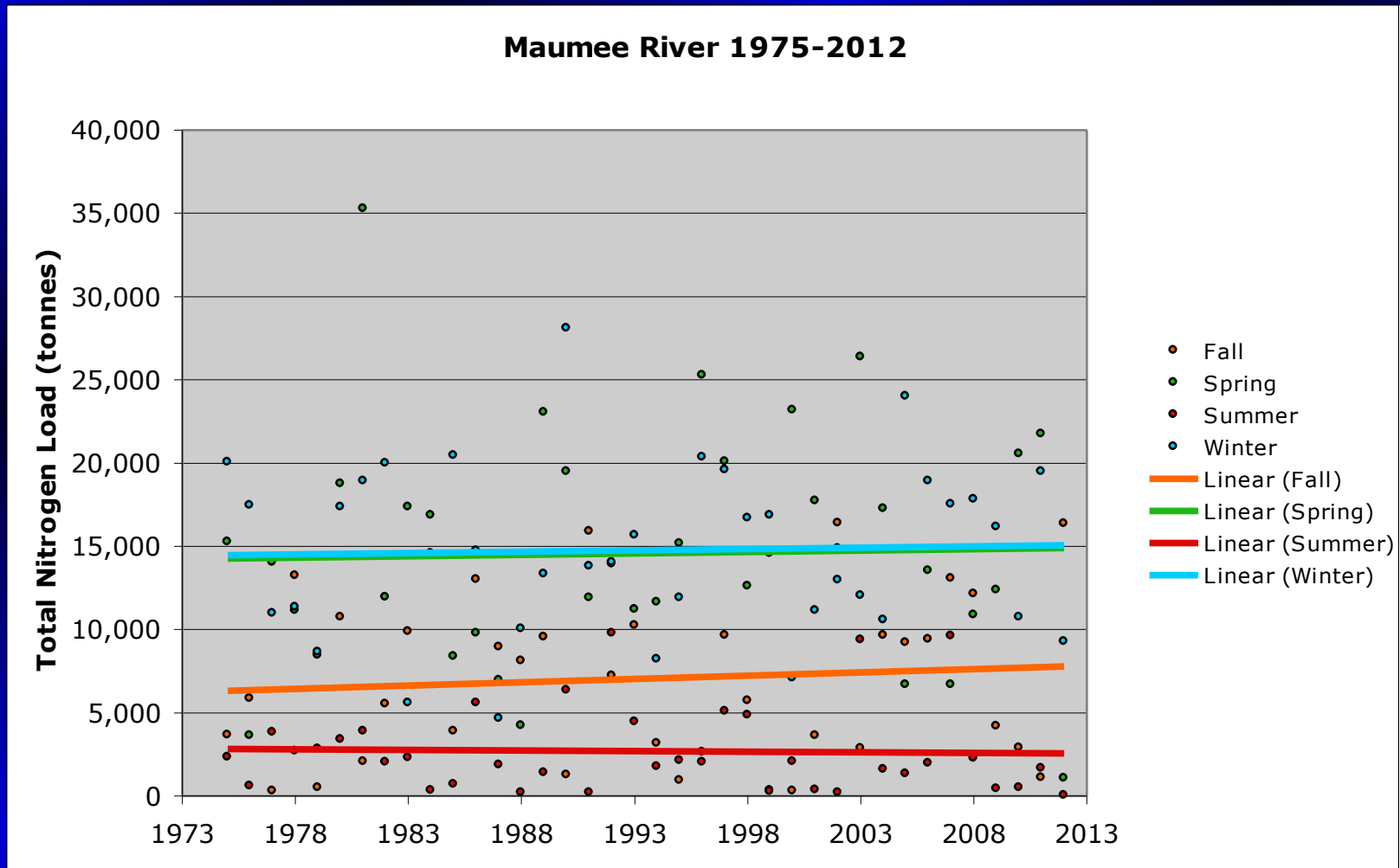
# Maumee Trends 1975-2012: Nitrate N Loads



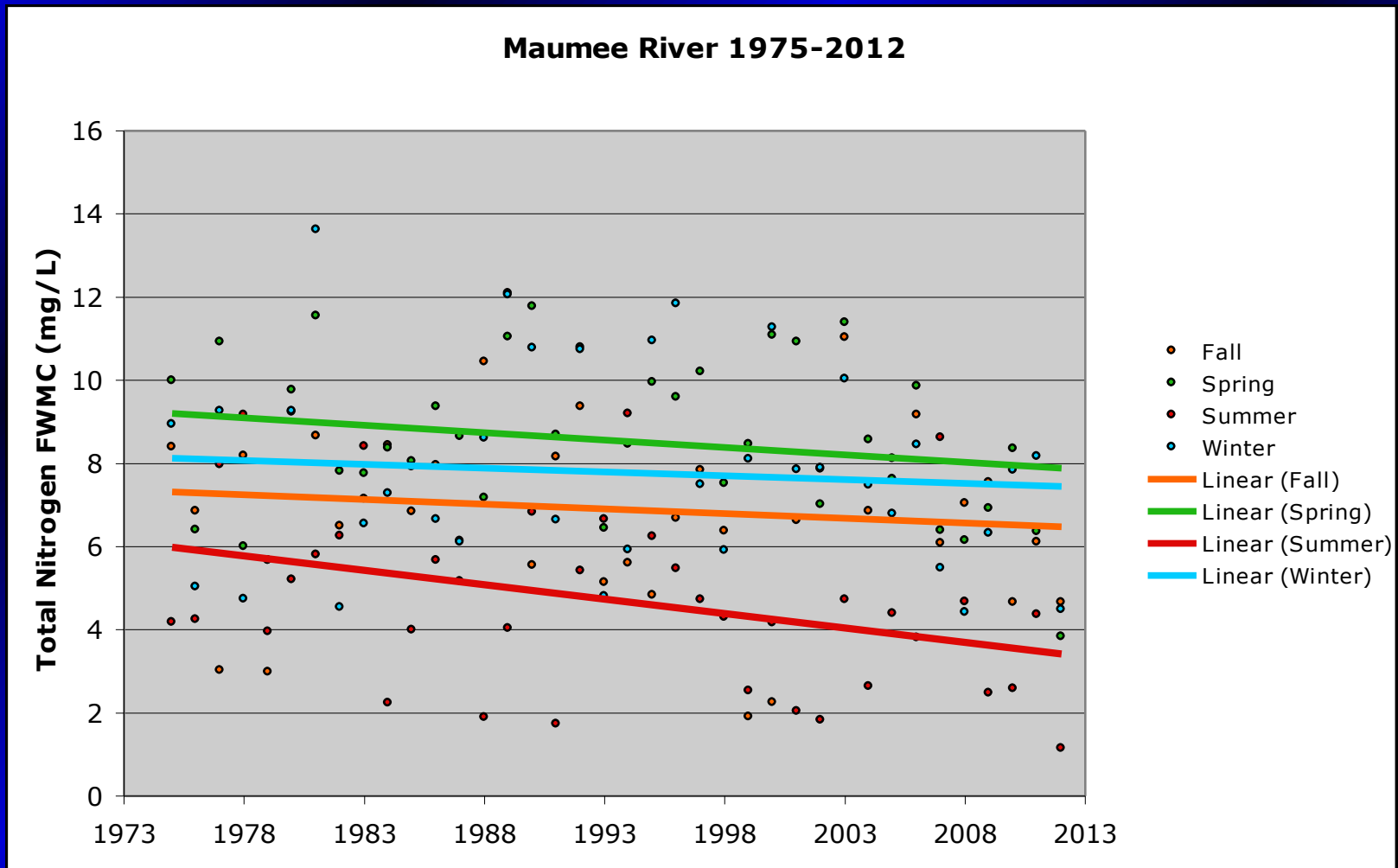
# Maumee Trends 1975-2012: Nitrate FWMC



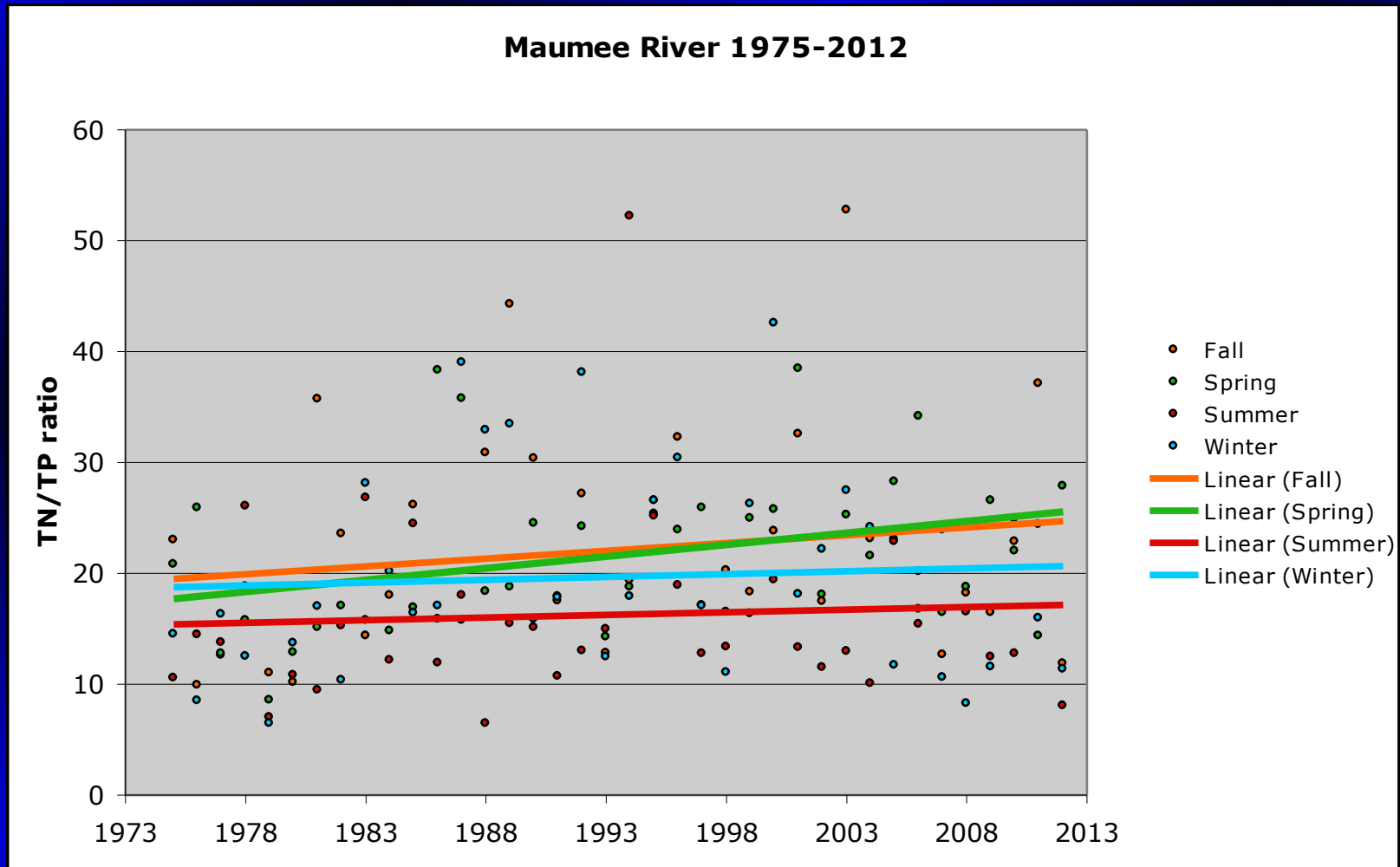
# Maumee Trends 1975-2012: Total N Loads



# Maumee Trends 1975-2012: Total N FWMC

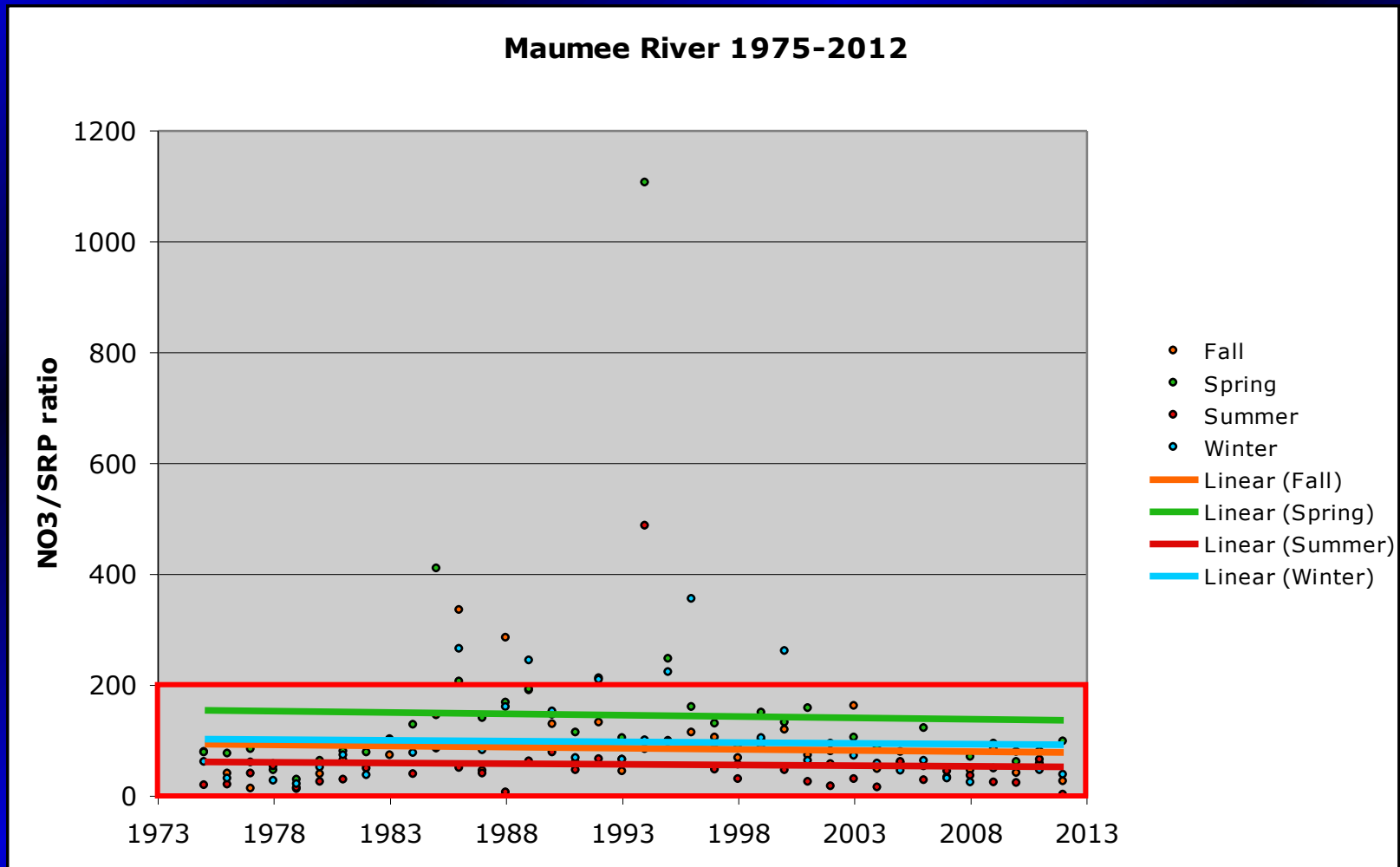


# Maumee Trends 1975-2012: TN/TP Ratio

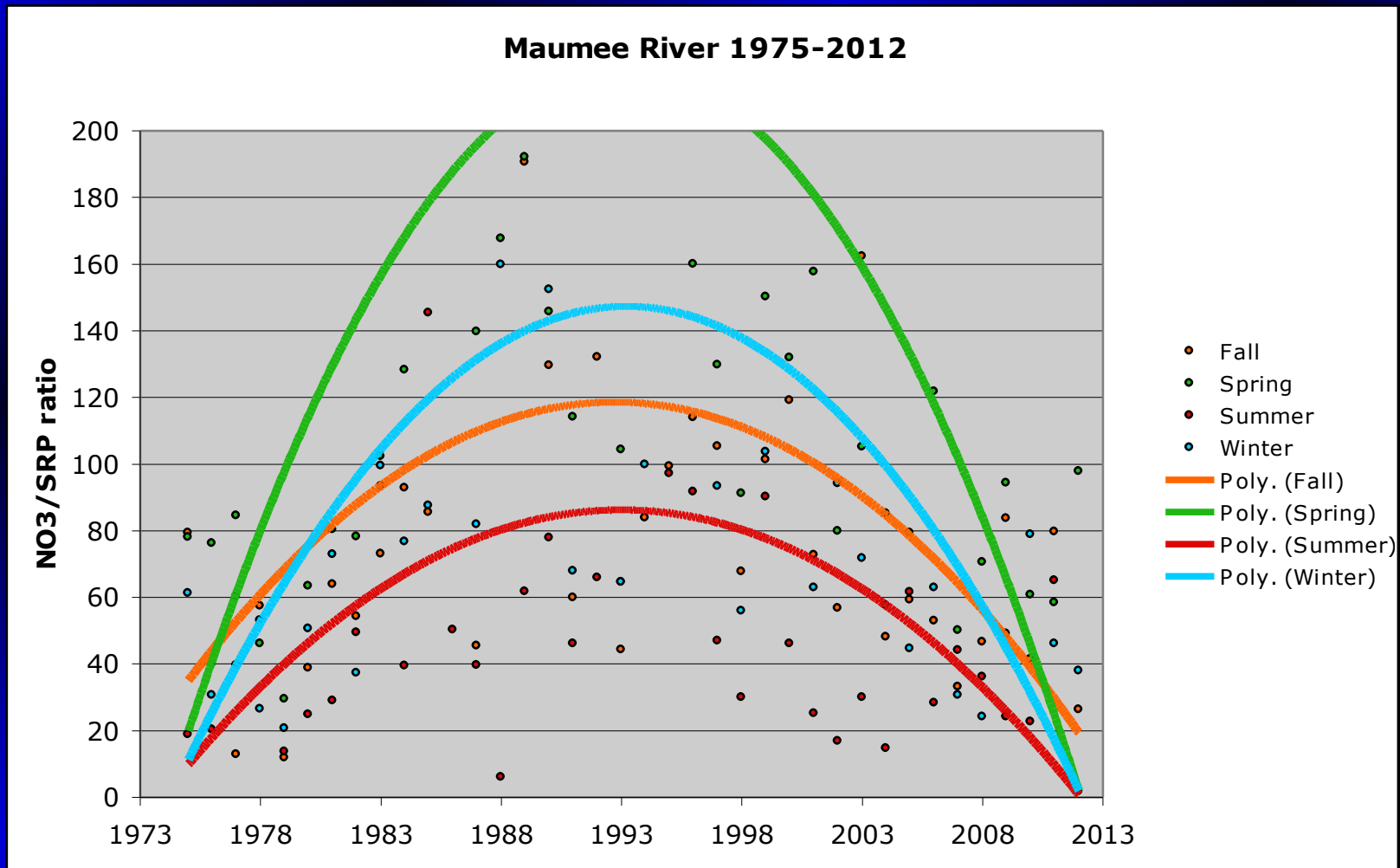




# Maumee Trends 1975-2012: NO<sub>3</sub>/SRP Ratio




# Maumee Trends 1975-2012: NO<sub>3</sub>/SRP Ratio



# Major Points

- Loads and discharge generally greater 2008-2012 vs 2000-2007
- 2008 a record setter on a water year basis
- Loads: winter > spring > fall > summer
- Concentrations: same but less consistent
- Loads: discharge ↑ TP ↓ DRP ▲ NO<sub>3</sub>, TN ↑
- Conc's: discharge TP ▼ DRP ▲ NO<sub>3</sub>, TN ↓
- 2011: extremely high spring loading
- 2012: extremely low spring loading
- Western Basin algal response...



09/03/2011 (DOY=246)

# Big Contrast!



08/30/2012 (DOY=243)