Detection of temporal trends in transparency across North America using volunteer-collected “snapshot” data.

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The Great North American Secchi Dip-In

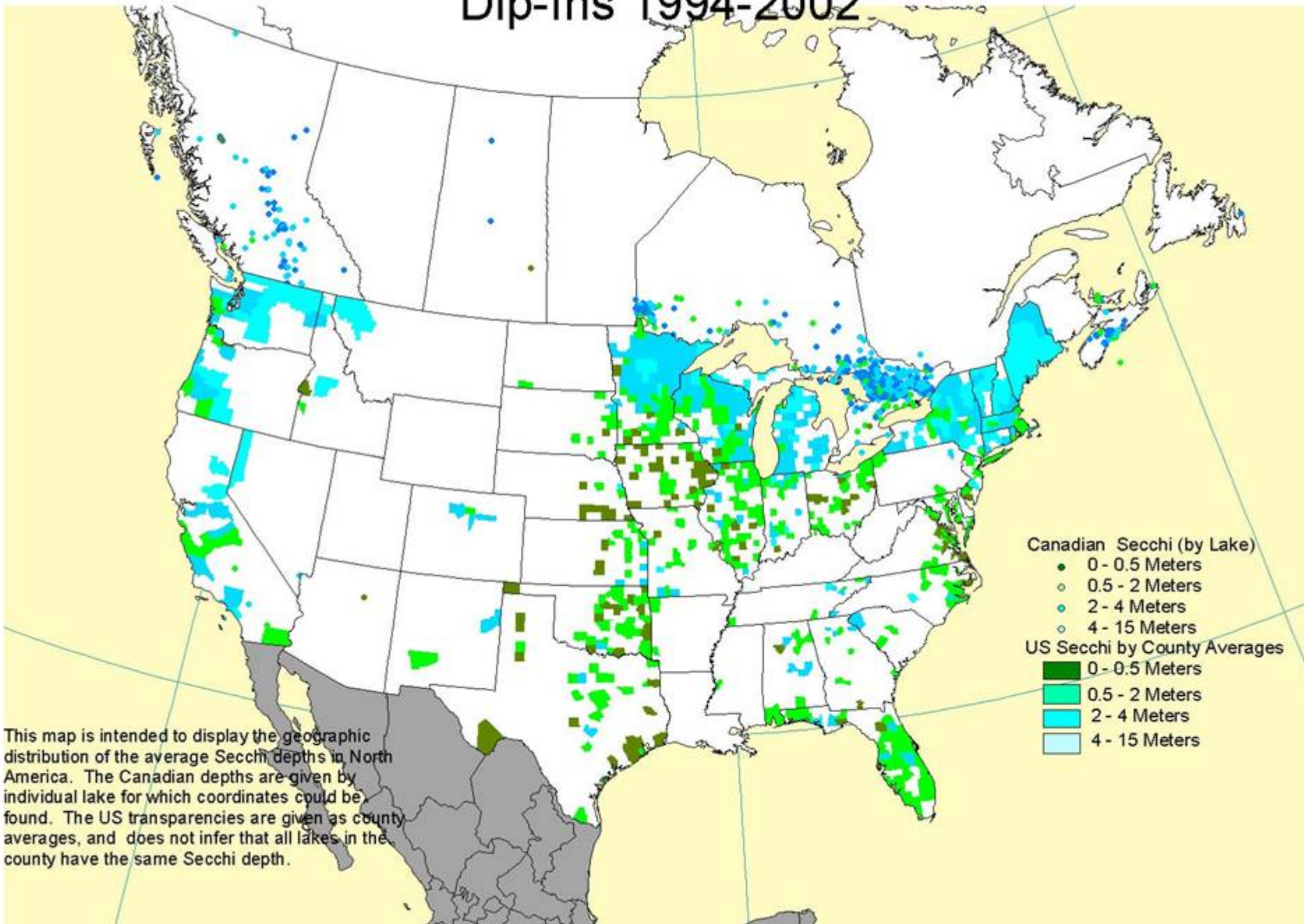
- “Snapshot” of transparency in North America
- Provides unifying event for professionals and volunteers
- Uniform time (2 Weeks in early July)
- Same basic method
- Trained volunteers
- Same person gathering the data, often year after year

The Dip-In Statistics

Begun July, 1994

- **30,758 Data Entries (1994-2003)**
- **Providing 30,268 transparency records**
- **On 6,626 waterbodies**
- **By 9,220 volunteers**
- **Belonging to 394 Programs, both volunteer and professional**
- **In 50 US states, 9 Canadian provinces, 6 other countries**

Average Secchi Depth in North America
Dip-Ins 1994-2002



Can an annual "snapshot", provide scientifically-relevant temporal trend data?

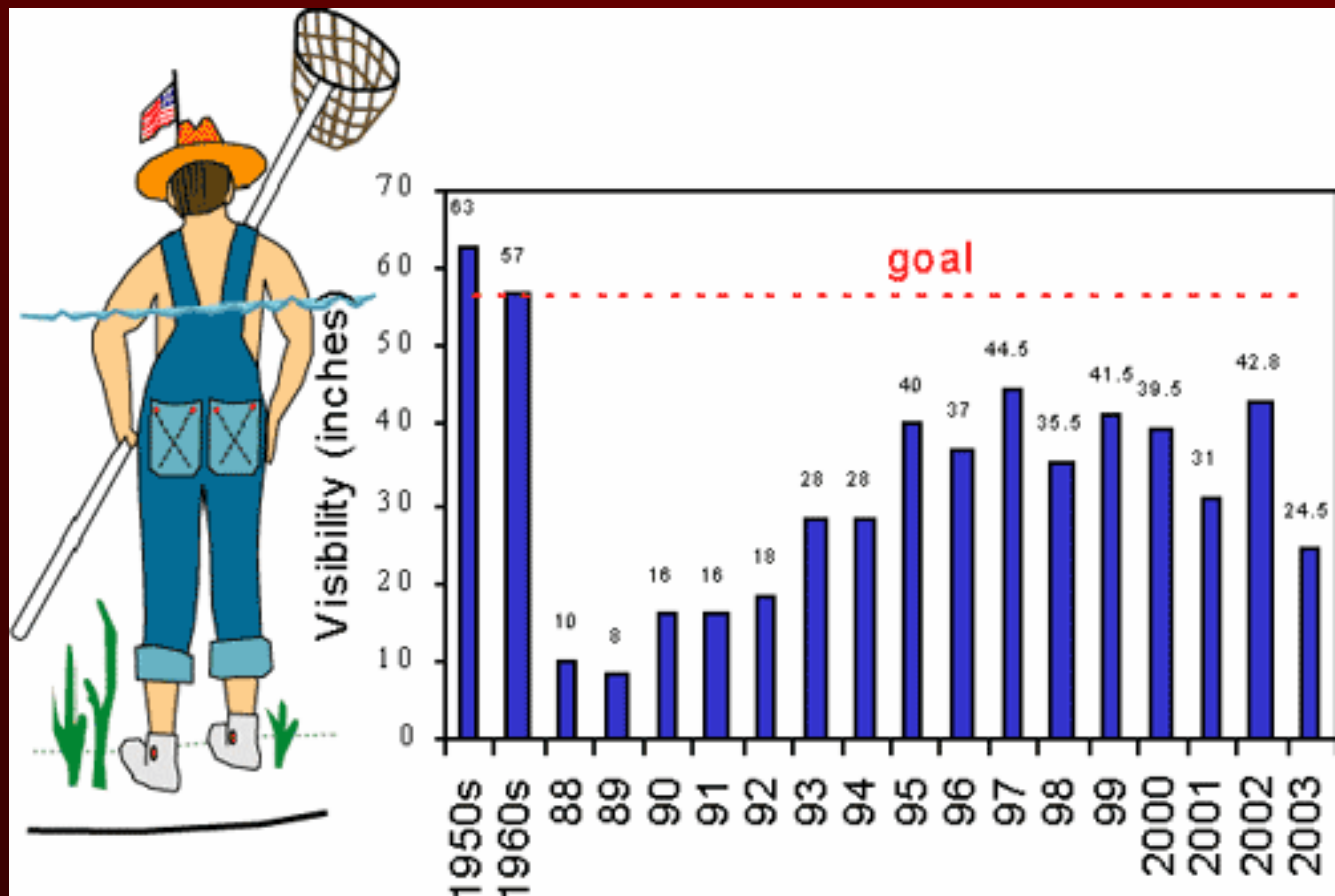
- Is transparency a useful variable?
- Is a single early-summer value meaningful?
- Are single samples too variable to detect trends?

Techniques don't have to be sophisticated to obtain meaningful temporal trend data

Should be

- **Simple**
- **Consistent in method**
- **Consistent in time**

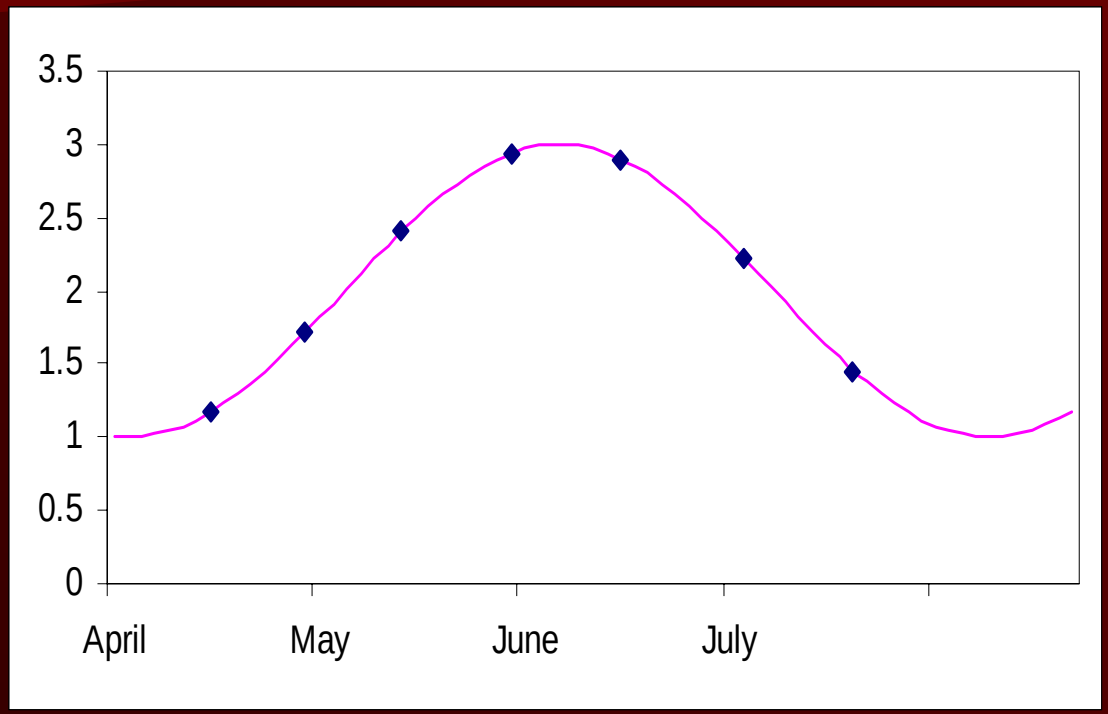
BERNIE FOWLER SNEAKER INDEX
Patuxent River Wade-In



Is a single early-summer event meaningful?

- Is July the best time to sample?
- Can a single sample taken annually characterize a waterbody?

Typical Summer Sampling Scheme



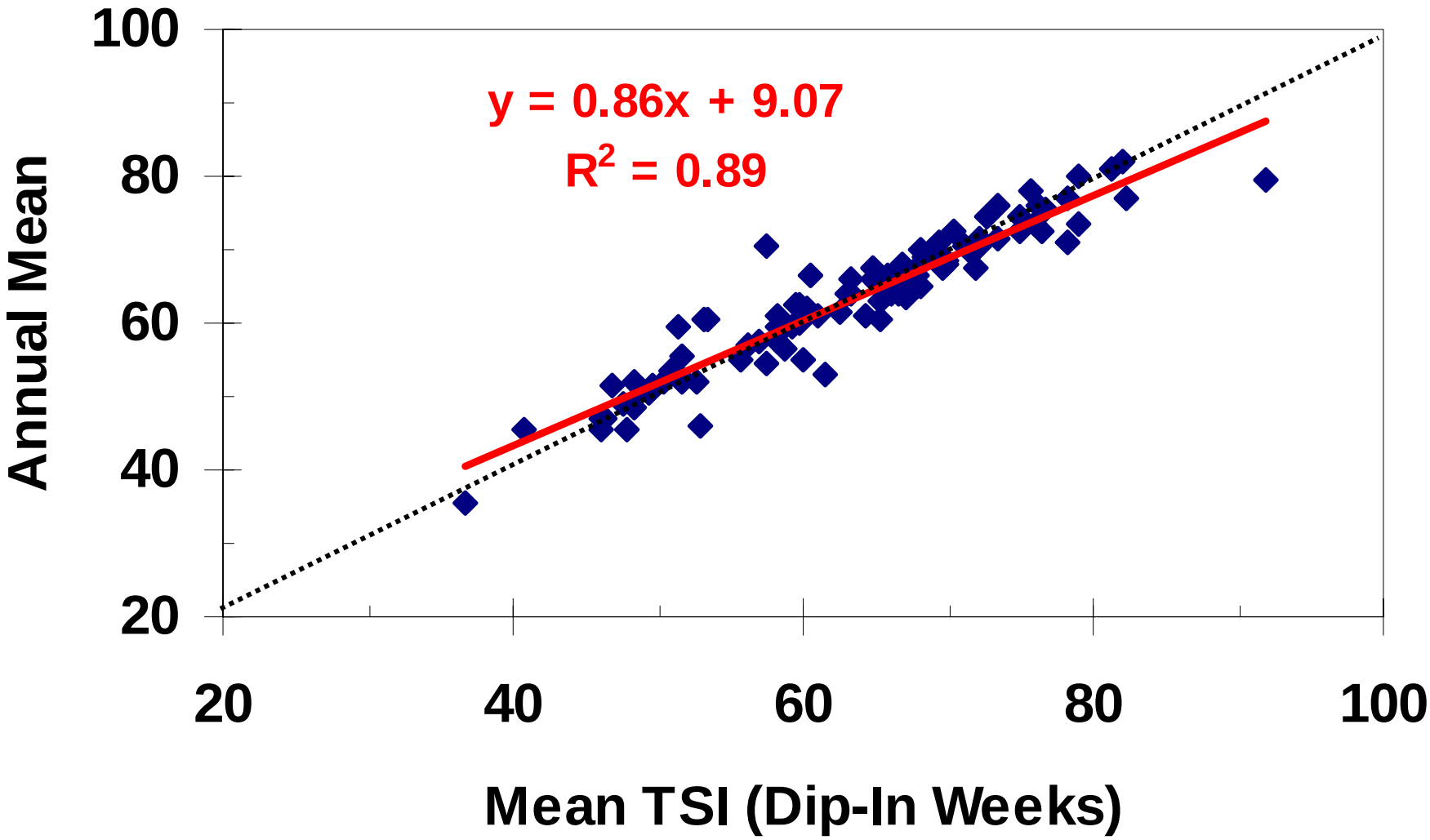
Assumptions:

Each point is independent

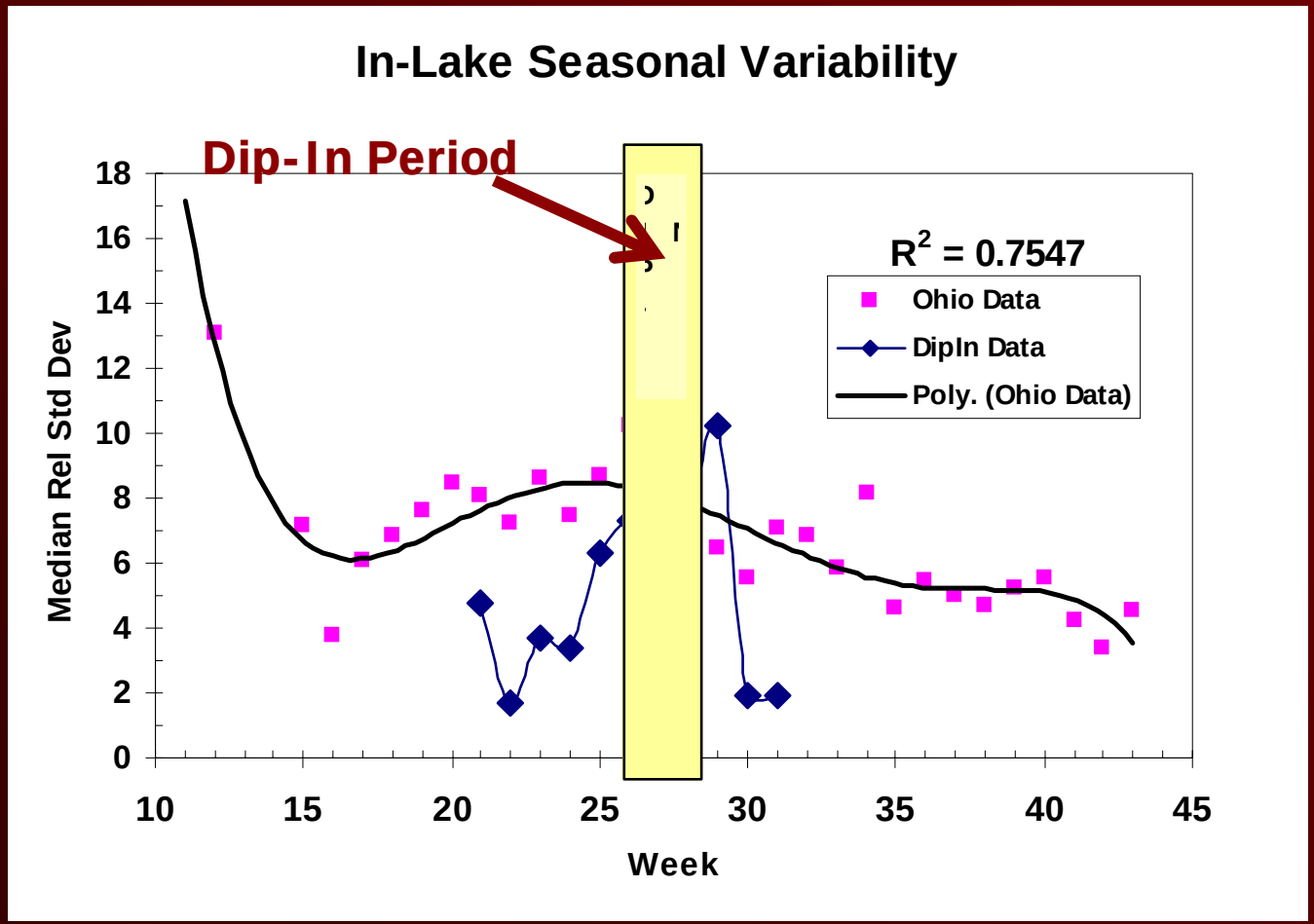
A seasonal average is the best indicator of status

Temporal trends will be consistent throughout the season

Estimation of Annual Mean from Dip-In Weeks Only: Ohio Volunteer Data



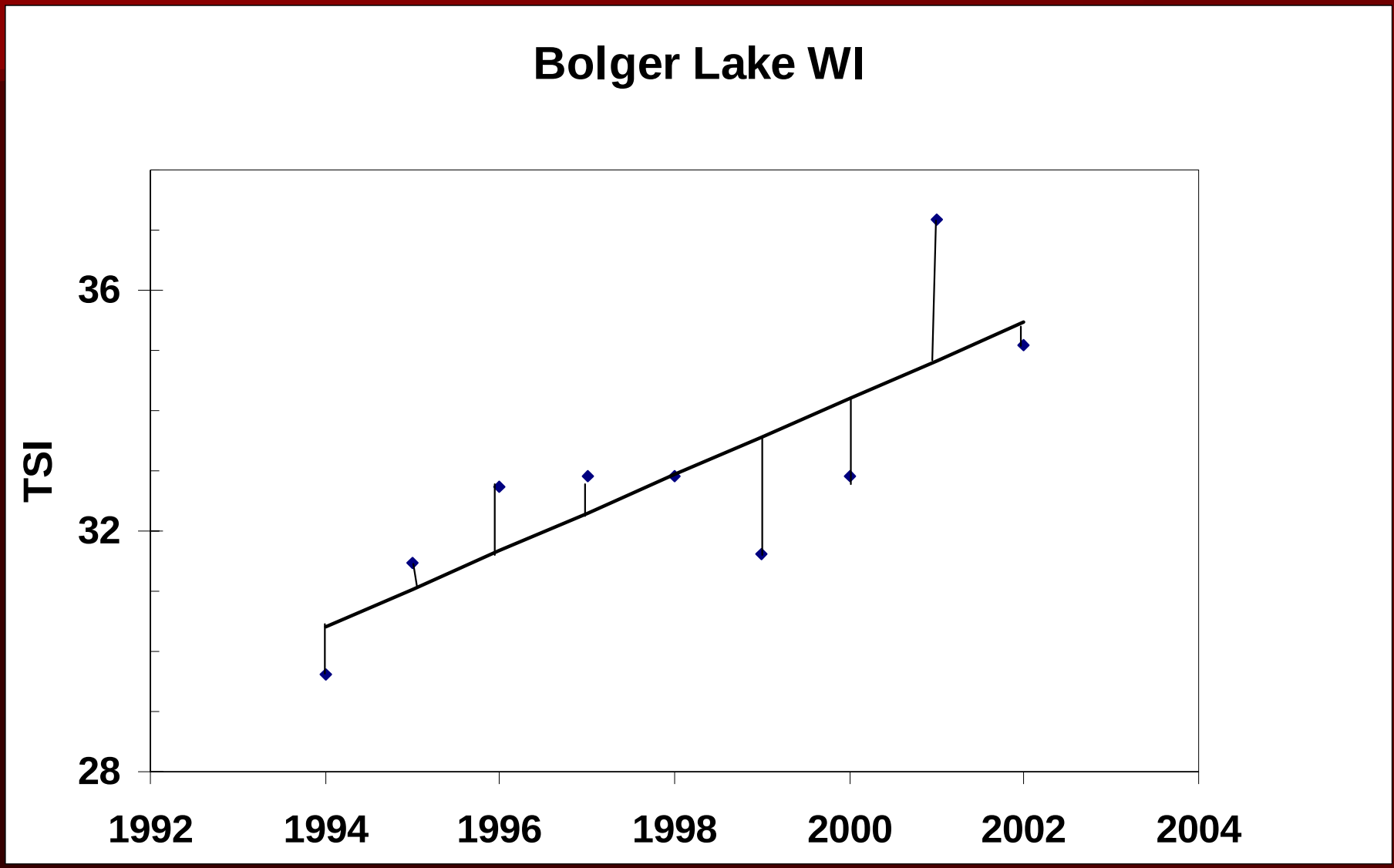
Variability during the Dip-In is similar to that found in the Ohio data
Variability During Dip-In only 3-4% Higher than in Late August



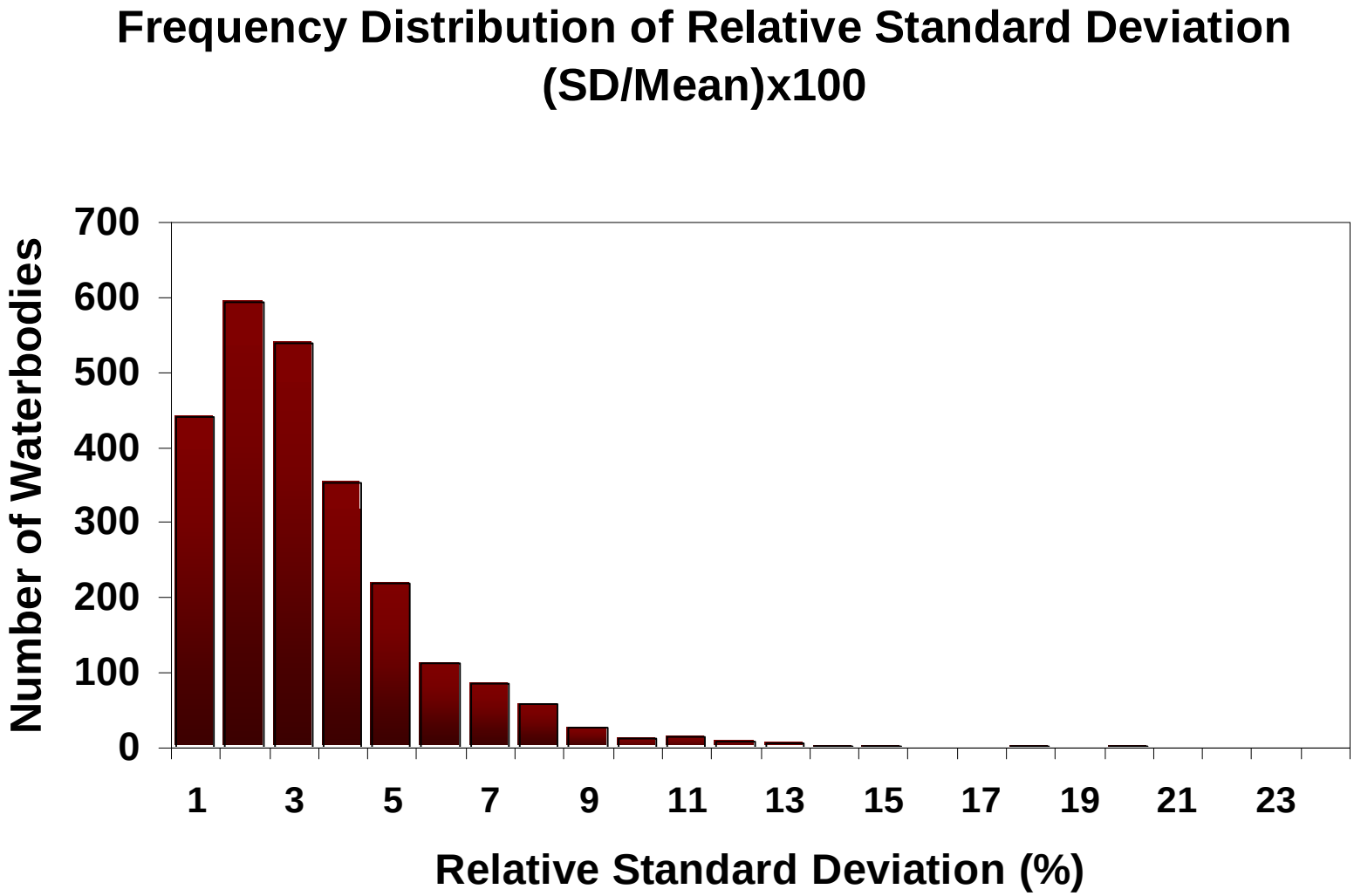
How Variable is Dip-In Data?

- Can single samples per year detect meaningful trends?
- High year to year variability could make it impossible to detect trends

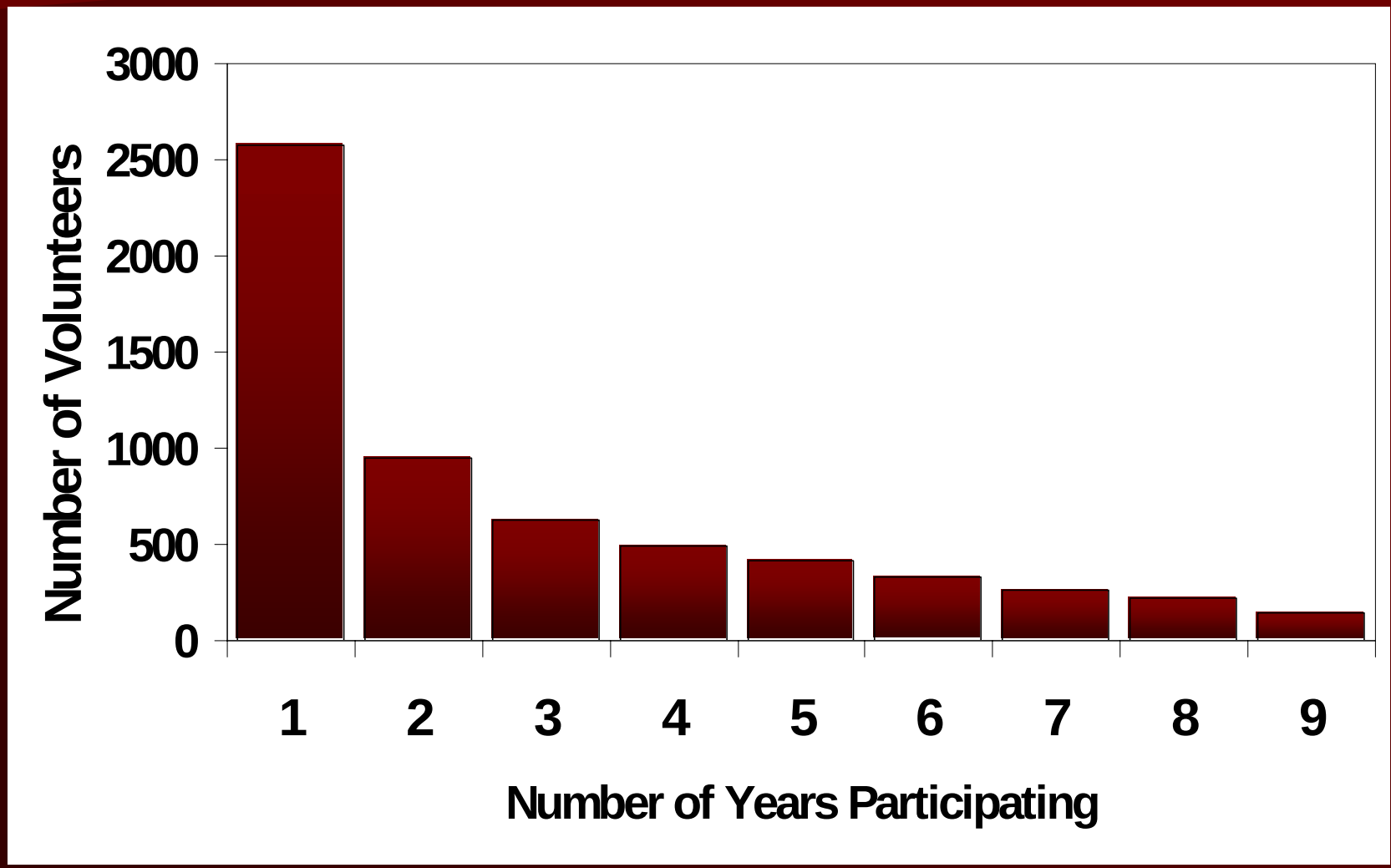
What Is The Deviation Around A Linear Fit?

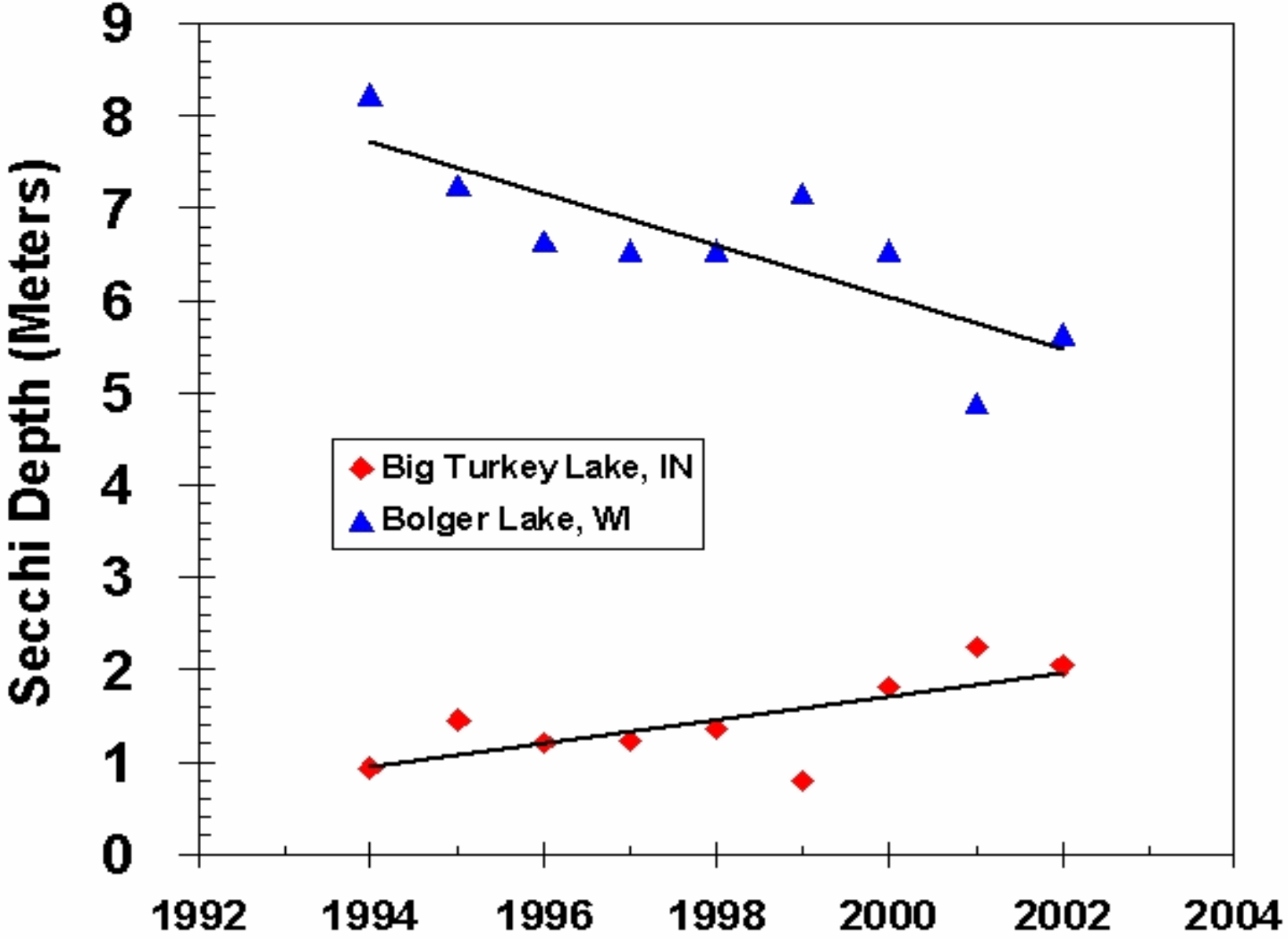


Median Variability Of Deviations From Mean Is Very Small



Analysis of Trends
1,374 Of These Have 5 Or More Years Of Data

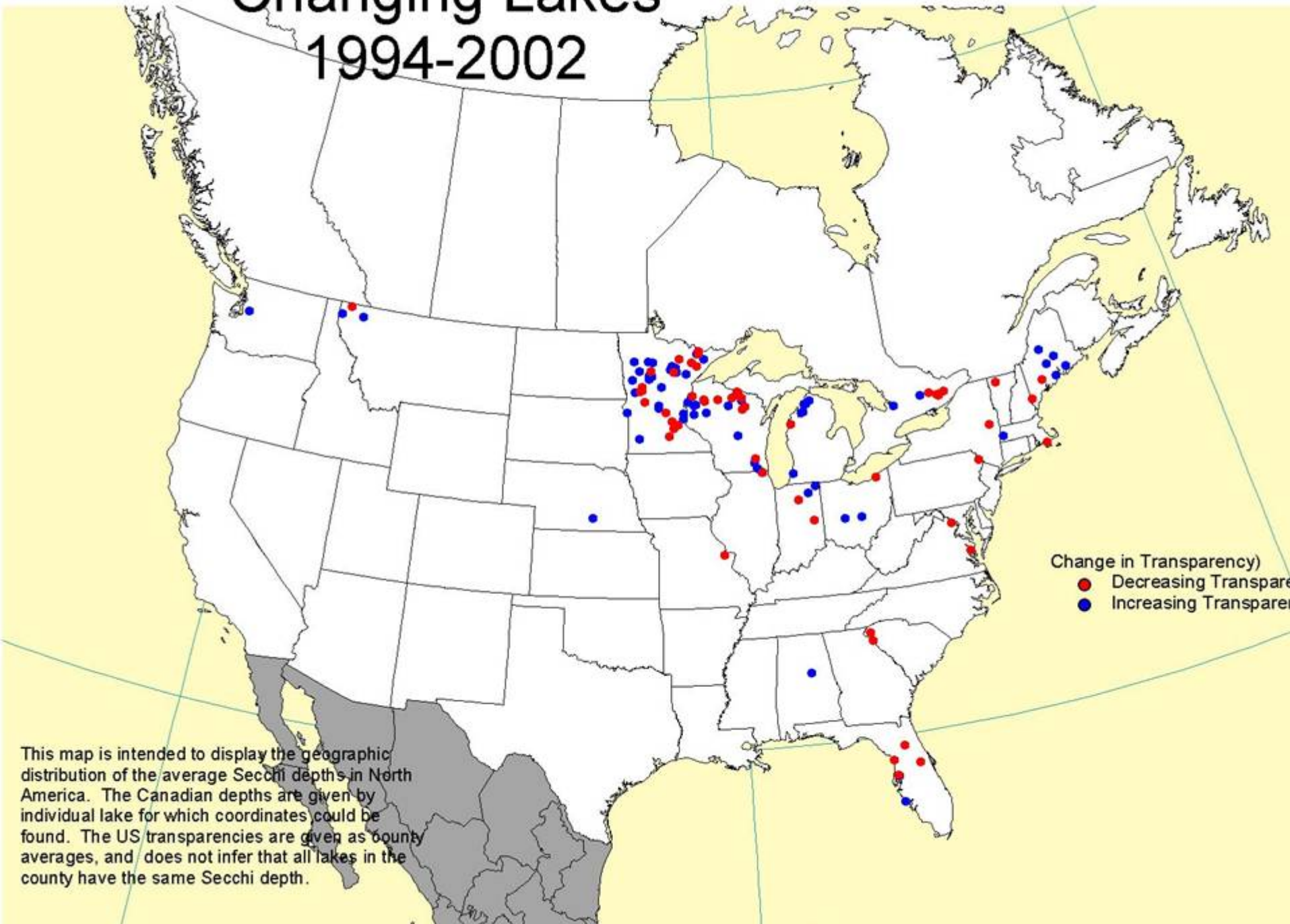



Secchi Depth (Meters)
0
1
2
3
4
5
6
7
8
9
1992
1994
1996
1998
2000
2002
2004
Big Turkey Lake, IN
Bolger Lake, WI

Trend Results
Mann-Kendall Tau

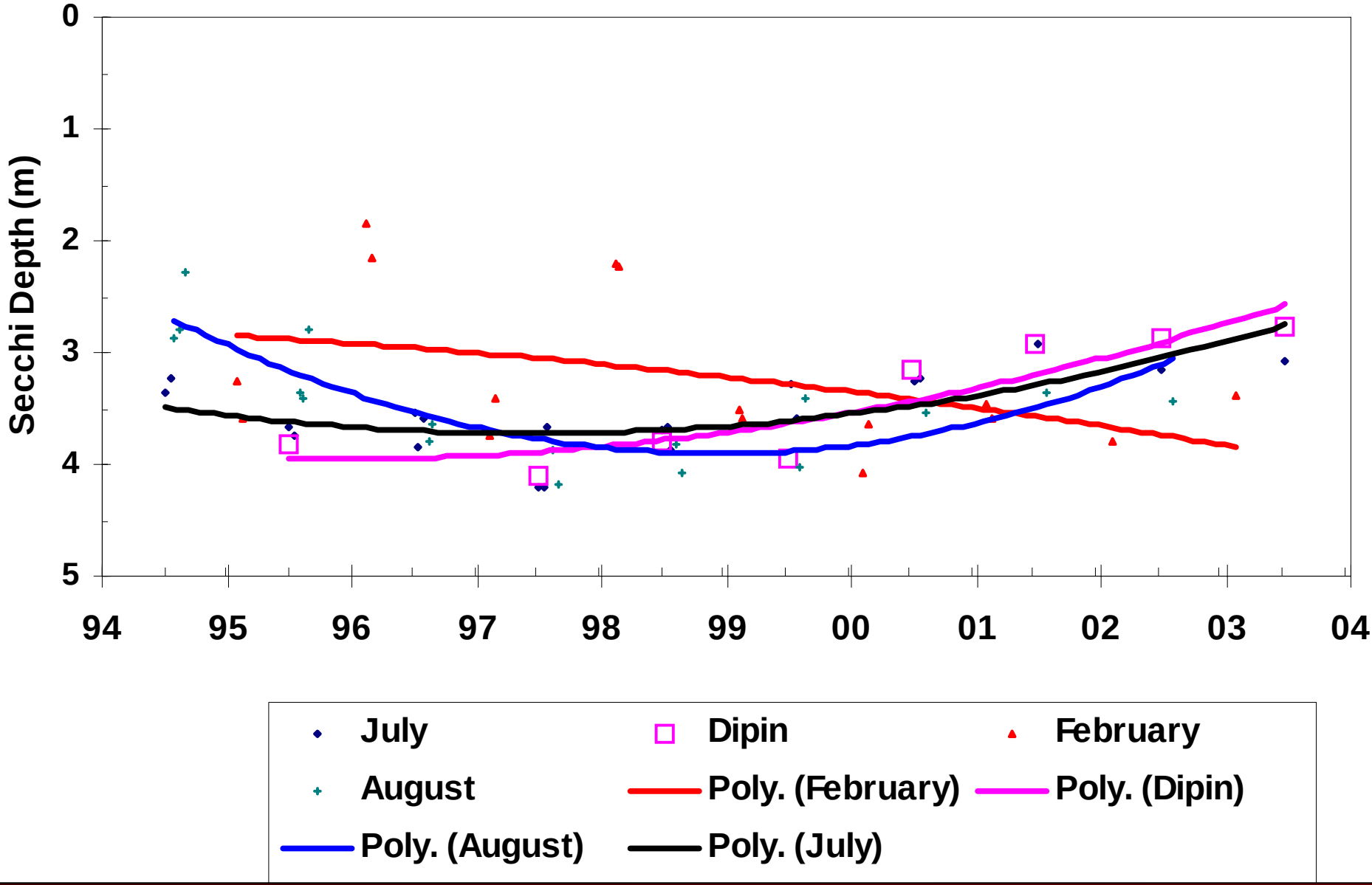
- 115 of 1,374 waterbodies had significant changes in transparency
- 54 had significant decreases
- 61 had significant increases
- Could detect changes of <0.5% per year
- No discernable pattern to explain which lakes exhibit change

Changing Lakes 1994-2002



This map is intended to display the geographic distribution of the average Secchi depths in North America. The Canadian depths are given by individual lake for which coordinates could be found. The US transparencies are given as county averages, and does not infer that all lakes in the county have the same Secchi depth.

Lake Keowee, SC



Our Investigation Indicates That Snapshot monitoring

- Is a valid technique for gathering environmental data over large spatial and temporal scales
- Acceptable levels of intra-seasonal variability
- A valid reflection of trends of a limited time frame
- Does not substitute for larger sampling schemes, but could change the nature of the question from

  "Is snapshot monitoring useful" to

  "What questions are you trying to answer with seasonal sampling?"