EFFECTIVELY USING A HANDHELD FLUOROMETER TO PREDICT LABORATORY EXTRACTED CHLOROPHYLL-A MEASUREMENTS IN LAKE WATER SAMPLES

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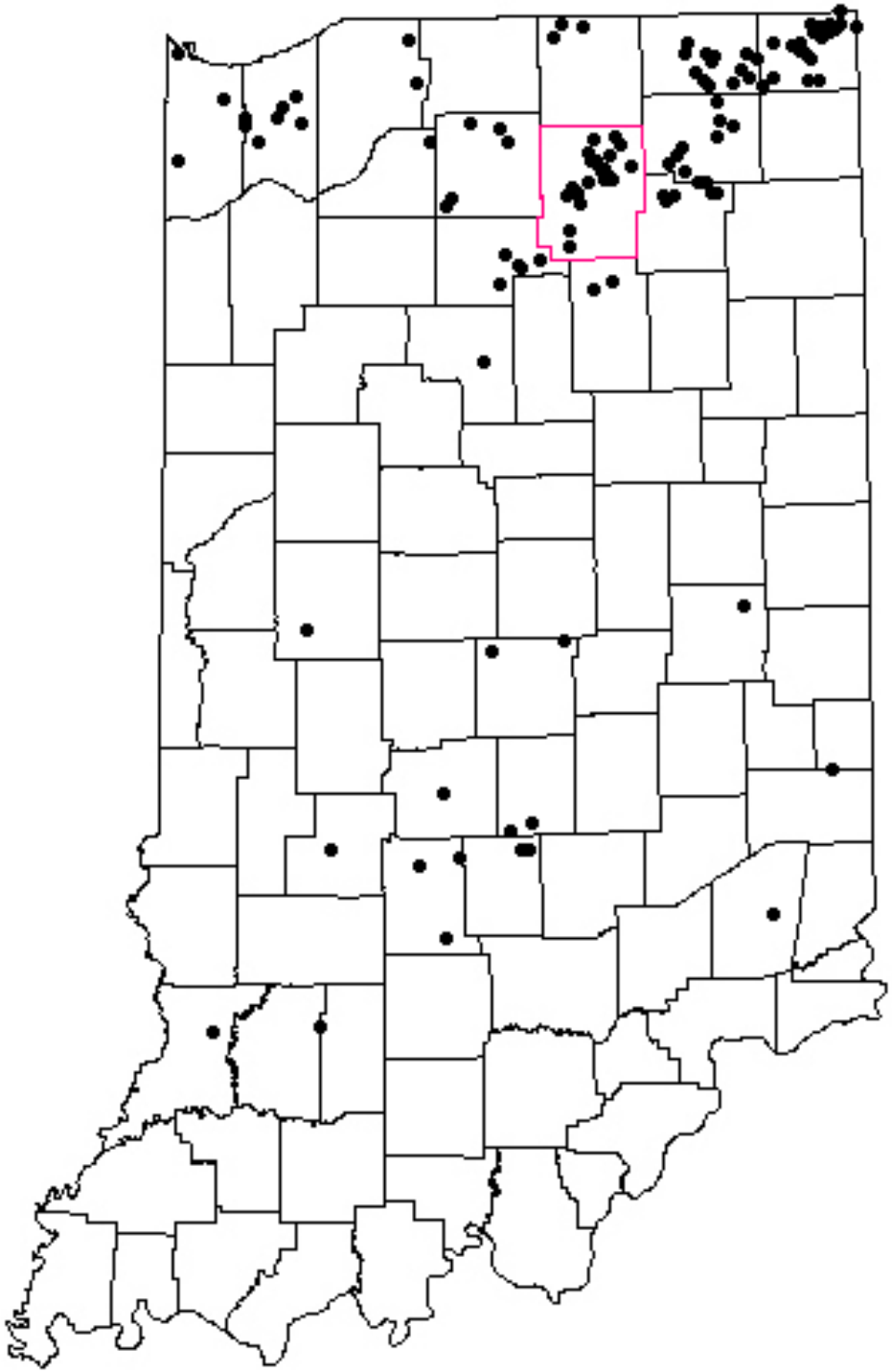
Summer 2007

Grace College carried out a comparative study of lake water quality in Kosciusko County lakes



Dots Show Indiana Clean Lakes Program Volunteer Monitoring Locations

www.spea.indiana.edu/clp/

Purpose of the Study

- Identify a current average of various water quality measurements
- Identify lakes that stand out from the average

30 Lakes in the Study

Beaver Dam Lake
Big Barbee Lake
Big Chapman Lake
Carr Lake
Center Lake
Crystal Lake
Dewart Lake
Diamond Lake
Goose Lake
Hill Lake
Hoffman Lake
Irish Lake
Loon Lake
McClures Lake
Palestine Lake
Papakeechie Lake
Pike Lake
Ridinger Lake
Rock Lake
Sellers Lake
Shoe Lake
Silver Lake
Spear Lake
Syracuse Lake
Tippecanoe Lake
Waubee Lake
Wawasee Lake
Webster Lake
Winona Lake
Yellow Creek Lake

451 sampling sites total on the 30 lakes

3 Monthly Samplings: June, July, August

<u>During Each Monthly Sampling</u>

2 Deep water sites

2 Shallow Water Sites

1 Selected Inlet Site

Measurements Taken

E. Coli

Total phosphorus

Nitrogen (Nitrates plus Nitrites)

Dissolved oxygen

pH

Chlorophyll-a (in vivo)

Turbidity

Secchi disk depth

Measurements Taken

Chlorophyll-a (in vivo)

Chlorophyll-a Concentration

- One of the most important indicators of lake water quality (Trophic Status)
- Volunteers frequently take more convenient measurements: ex. Secchi disk
- Secchi disk transparency depth can be significantly confounded with other factors
- Handheld fluorometers are available which conveniently measure chlorophyll-a in vivo
- There is a trade-off for the convenience of in vivo chlorophyll-a measurements: UNITS!! Total Fluorescence

Chlorophyll-a In Vivo is an Indirect Measurement of Chlorophyll-a Concentration

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- Chlorophyll-a in vivo measurements were planned
- We determined in advance to build a regression model in order to convert measurements into µg/L
- Fourteen different lakes were selected upon which to build a regression model
- Lakes were selected based upon their wide range of trophic status estimates
  - In vivo measurements on grab samples
  - In vivo measurements on water from a column sample
  - Laboratory Chlorophyll a measurements on water from a column sample

Fluorometer

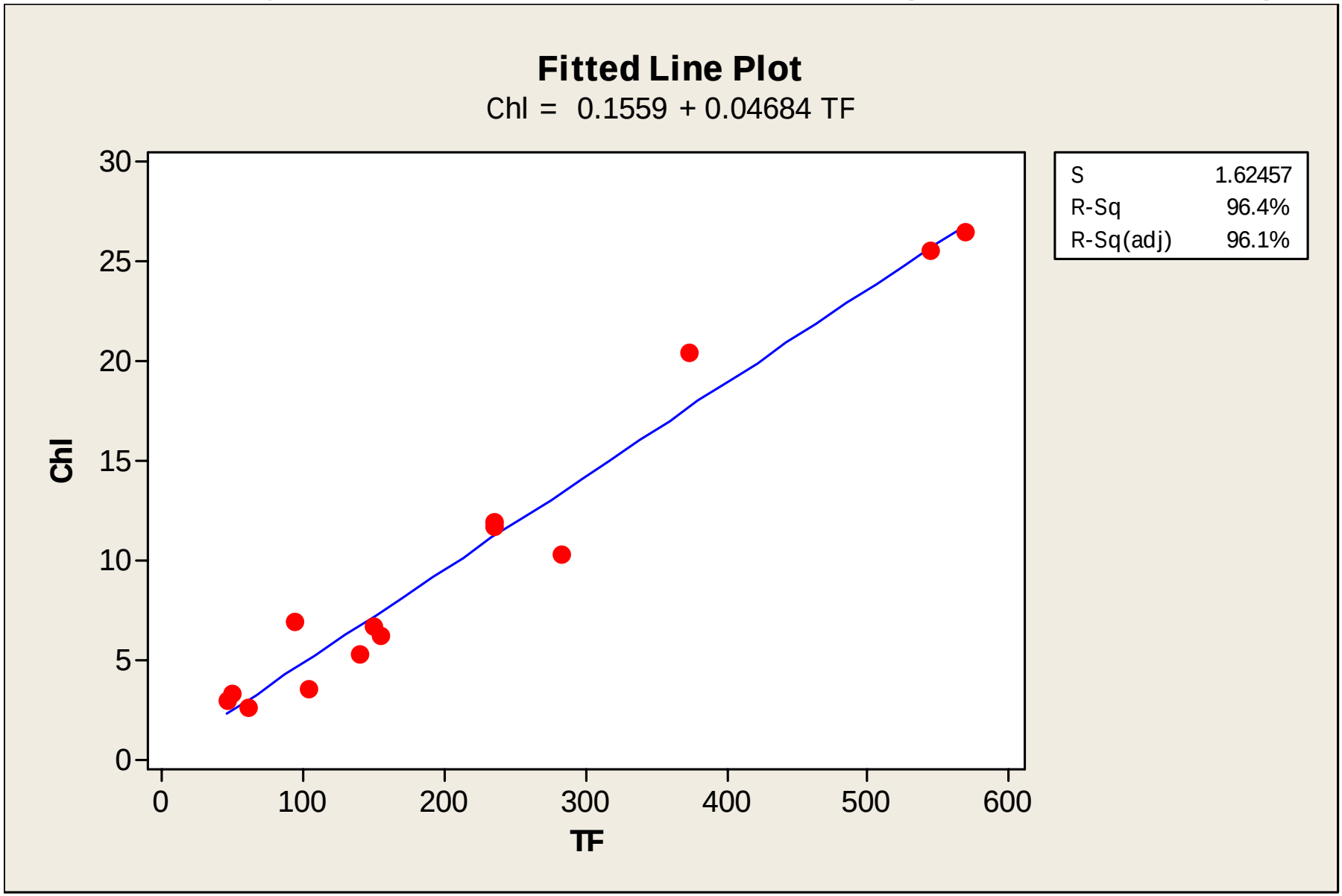
Fluorometer Utilized: Turner Designs Aquafluor handheld fluorometer (Turner Designs; Sunnyvale, California)

The total fluorescence measurements recorded were the average of five readings taken with the same water in the test chamber of the fluorometer.

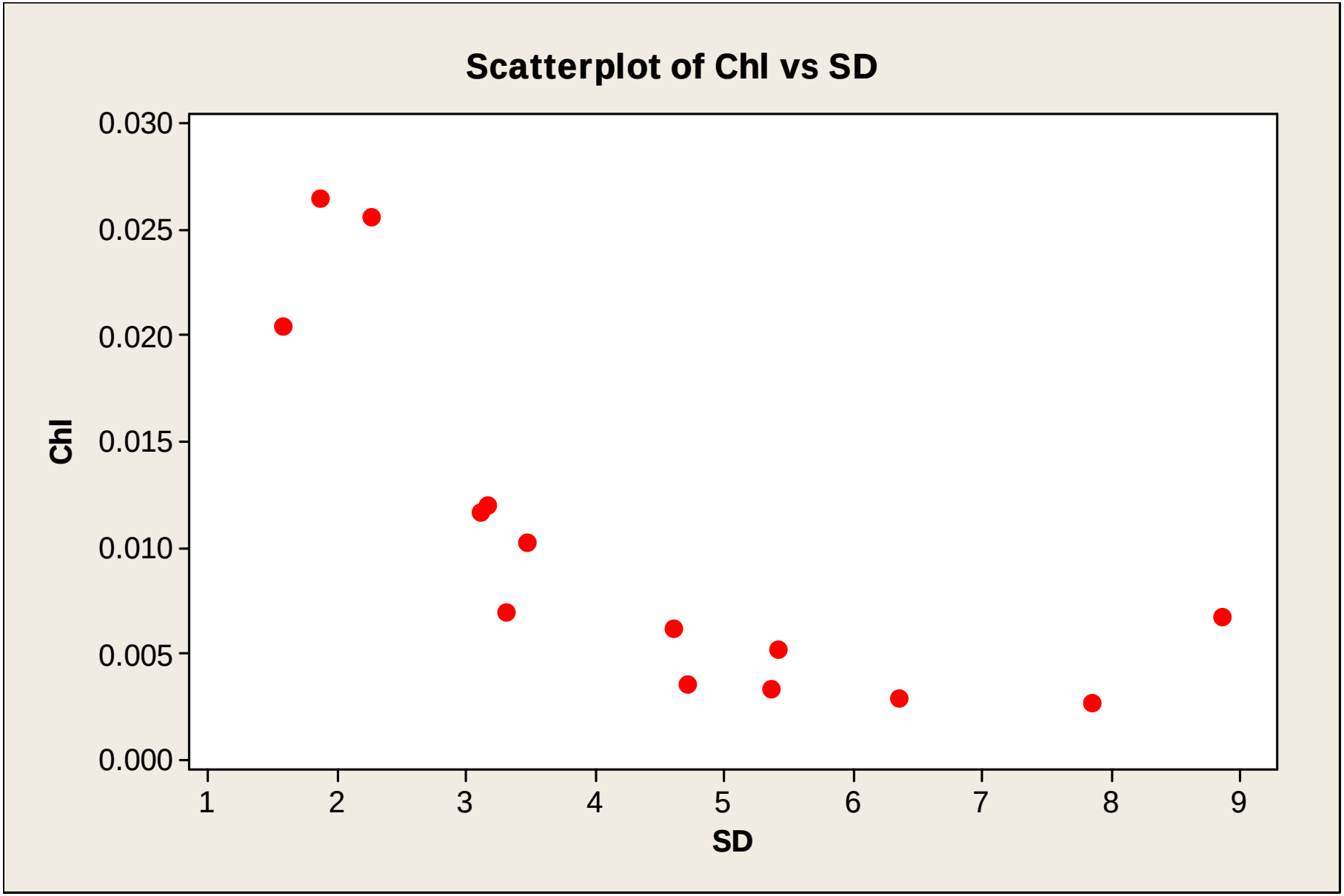
Fluorometer

Lake	Mean	Standard Deviation
Beaver Dam	155	6.79
Big Barbee	139.2	8.68
Diamond	235.74	9.47
McClures	373.92	3.9
Palestine	568.84	14.71
Pike	283.24	10.63
Ridinger	93.7	4.14
Sellers	545.2	47.3
Silver	234.4	7.05
Spear	149.98	19.14
Syracuse	45.582	1.601
Tippecanoe	103.66	2.16
Waubee	60.73	3.6
Wawasee	49.38	2.95

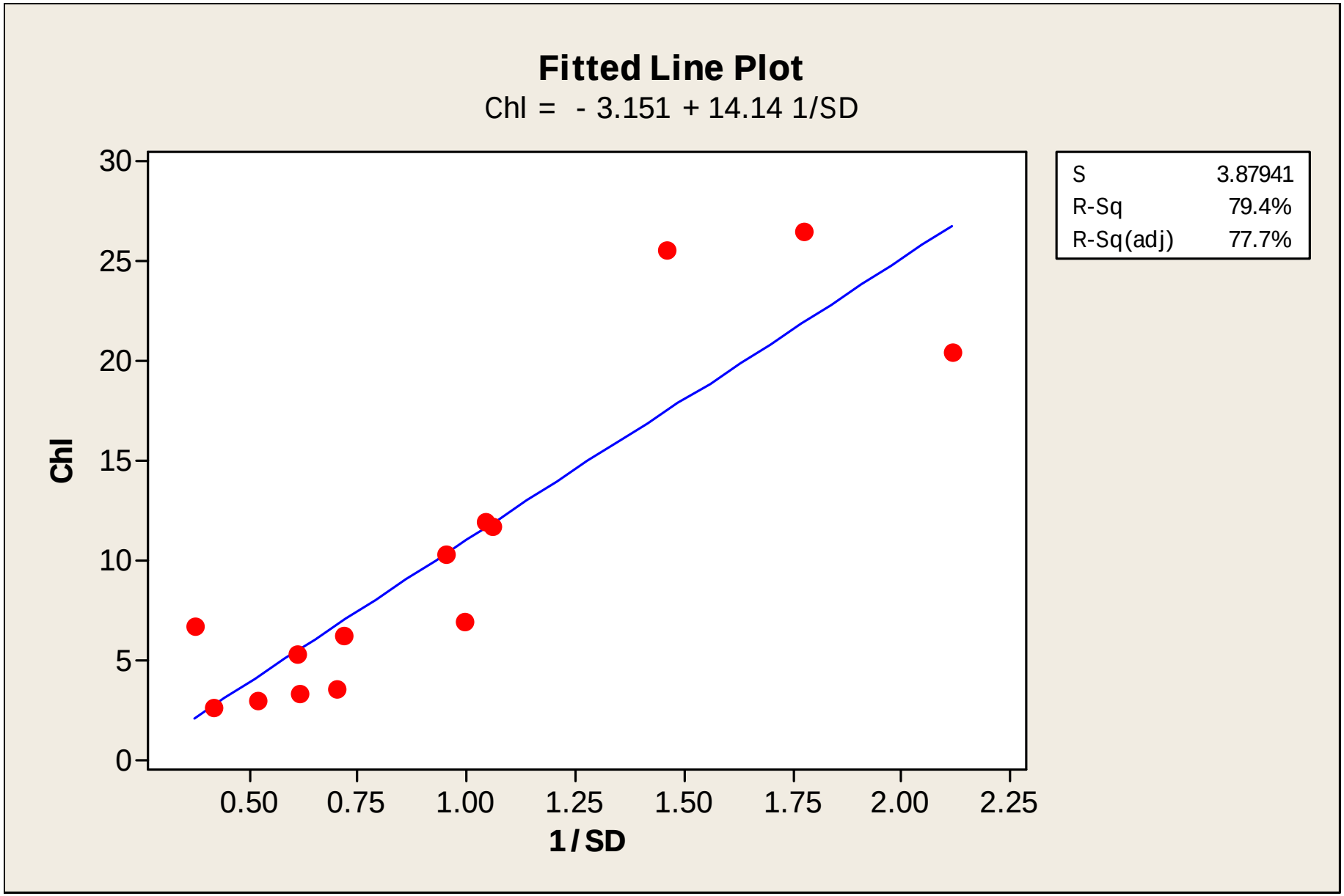
Chlorophyll-a vs. Total Fluorescence (column sample)



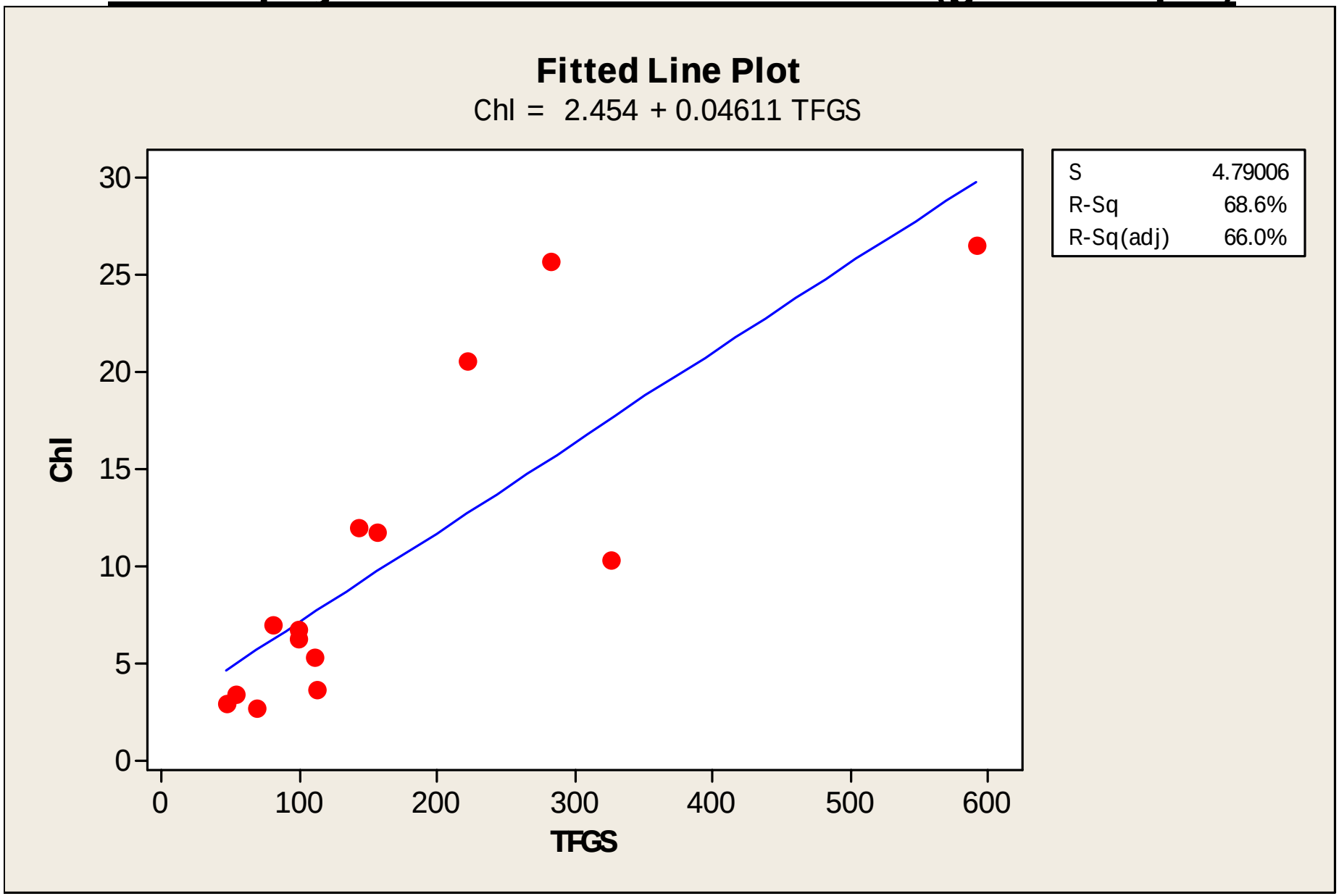
Chlorophyll-a vs. Secchi Depth



Chlorophyll-a vs. 1/Secchi Depth



Chlorophyll-a vs. Total Fluorescence (grab sample)



Chlorophyll-a vs.

1/SD and Total Fluorescence (grab sample)

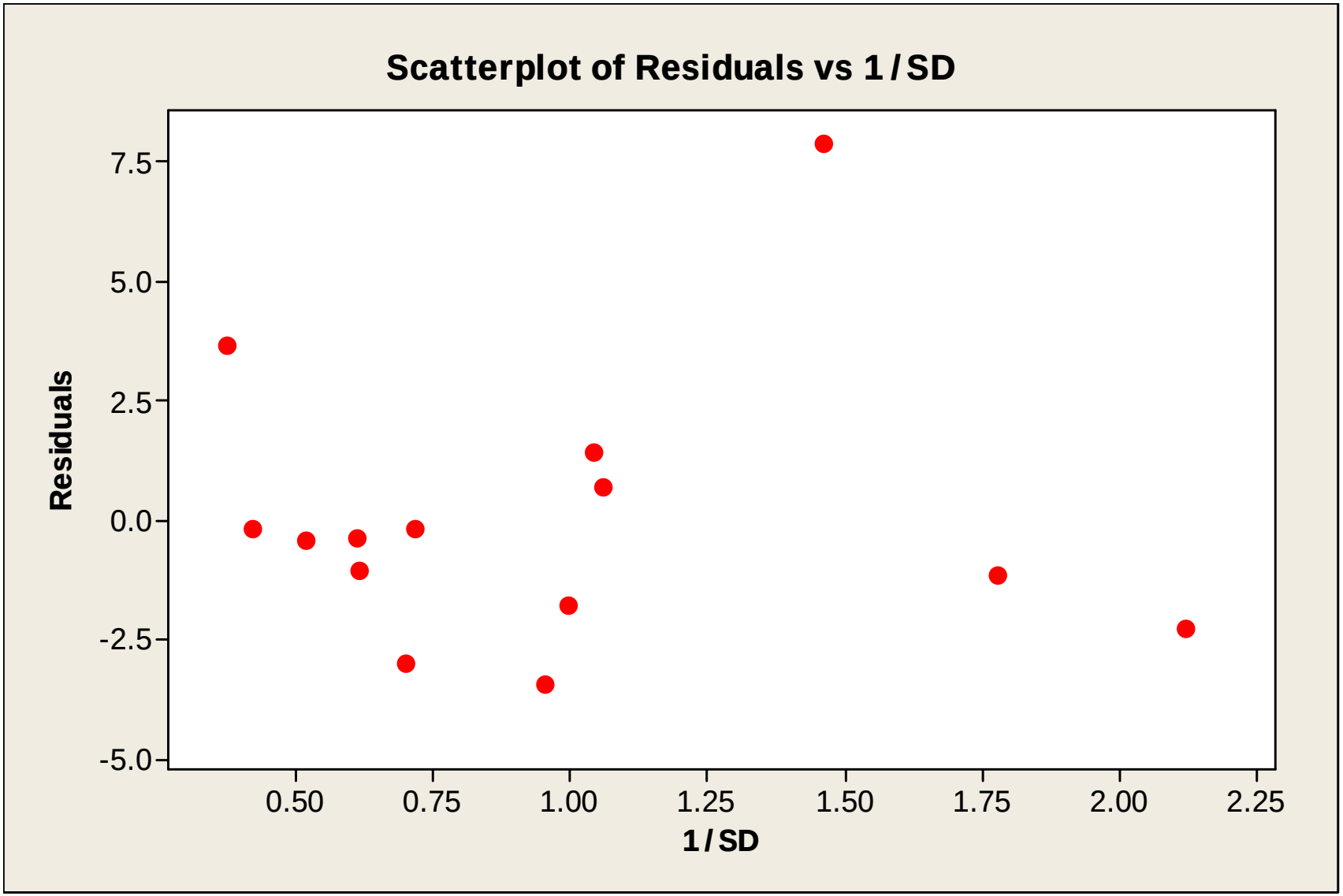
Chl = - 2.695 + 9.687 * 1/SD + 0.0222 * TFGS

Predictor	Coef	SE Coef	T	P
Constant	-2.695	1.832	-1.47	0.169
1/SD	9.687	2.387	4.06	0.002
TFGS	0.0222	0.0084	2.65	0.023

S = 3.16588 R-Sq = 87.4% R-Sq(adj) = 85.2%

Chlorophyll-a vs.

1/SD and Total Fluorescence (grab sample)



Discussion

Cost

Initial Cost of Fluorometer: $2500

Developing Regression Model: $700 (lab costs)

$ -- (statistician)

Method

Total fluorescence measurements should be on column samples

Total fluorescence measurements on grab samples are not advisable. HOWEVER, if this is done, measure Secchi Disk transparency depth as well.

Recommended Sampling Method

BEST

1. Use an integrated pipe sampler to obtain a column sample of water at the sampling location.

2. Empty the contents of the integrated pipe sampler into a container and select a sample from this container for total fluorescence measurement.

3. Take multiple total fluorescence measurements (at least five) on the exact same water sample in the instrument chamber. Average these.

These measurements can then be converted into predicted µg/L measurements via a locally established regression equation