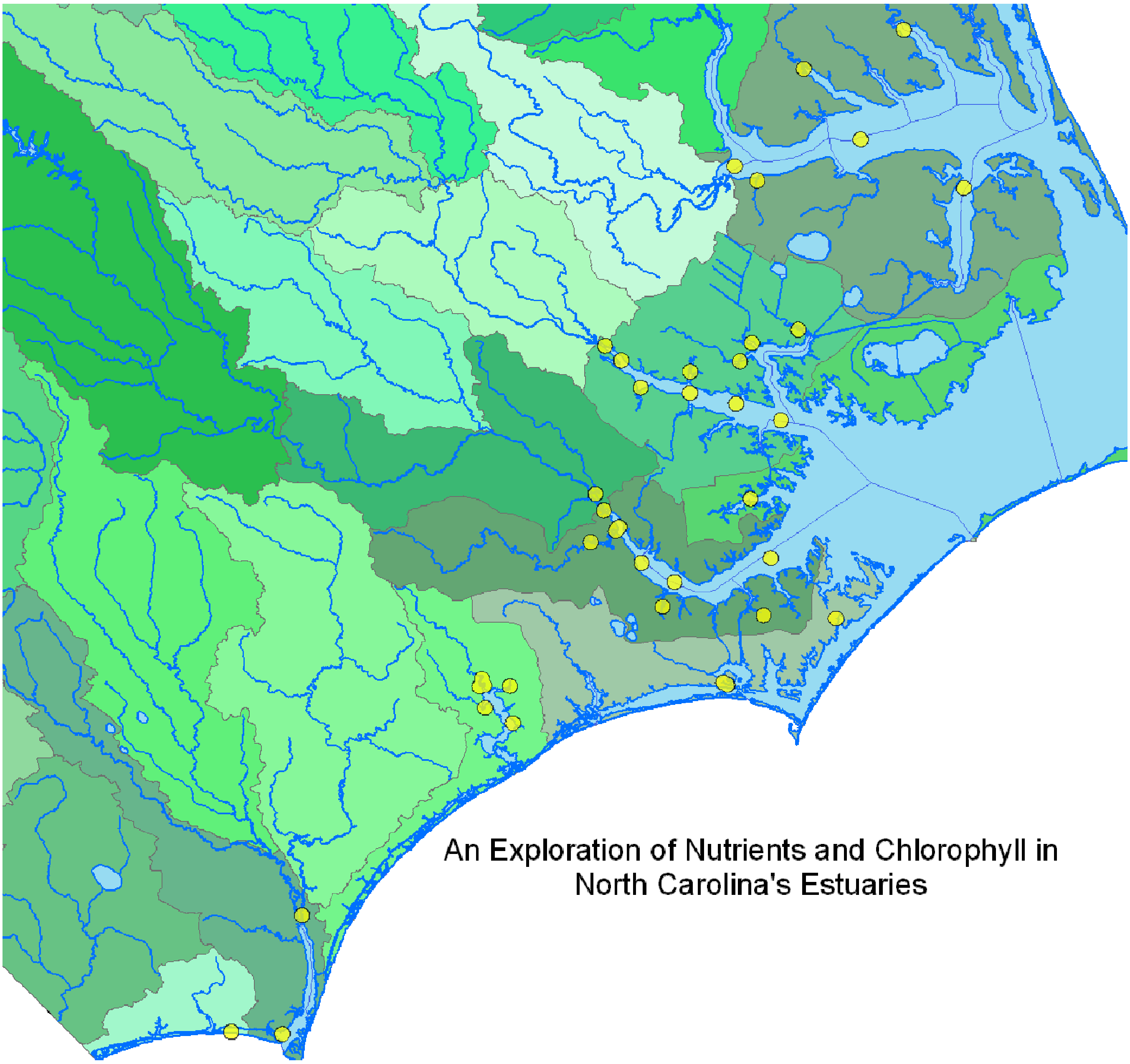


North Carolina is home to many estuarine waters, from Albemarle Sound in the North, to Lockwoods Folly in the South. In order to investigate possible linkages between nutrient concentrations and chlorophyll a concentrations in estuarine waters, we have examined data from several monitoring stations throughout North Carolina's coastal area. These stations are shown in yellow above. Finding a link between nutrient concentrations and chlorophyll concentrations would allow for the development of statewide nutrient concentration limits. North Carolina monitor's a large number of stations in the coastal areas. The ones chosen to examine here had to meet the following criteria: the waters are classified as estuarine, chlorophyll a and nutrient concentrations were analyzed for, and samples were collected in the period January 1, 2002 through December 31, 2006, which was the assessment period used.

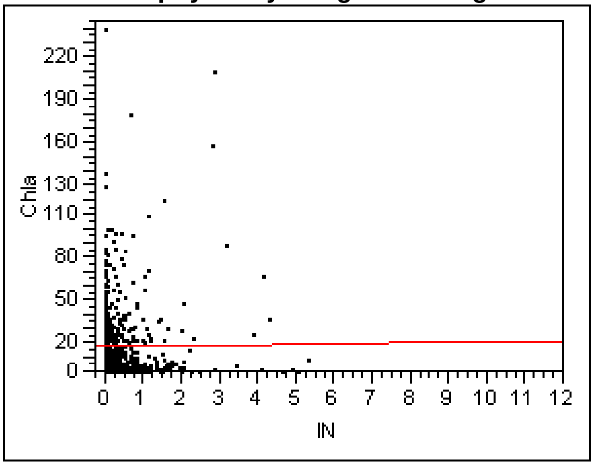
The data were divided in many different ways to help evaluate what has an effect and what does not. For example, the data were divided by basin location (north, central, and south), location within the estuary (upper, middle, and lower), and season. Location is a useful distinction because the tidal movements of each area vary significantly, from mostly wind driven in the north to strong lunar tides in the south. For similar reasons, location within an estuary is also a useful divider. Upper estuarine locations get heavier loading of sediment due to drops in stream velocity, and the lower in the estuary you are, the greater the tidal action (though this varies greatly from north to south).

Attachment II
Estuarine Data Evaluation Report

The first task is to evaluate whether there is a direct link between chlorophyll a and nutrient concentrations.

Chlorophyll a vs. Nutrients

Fit of Chlorophyll a By Inorganic Nitrogen



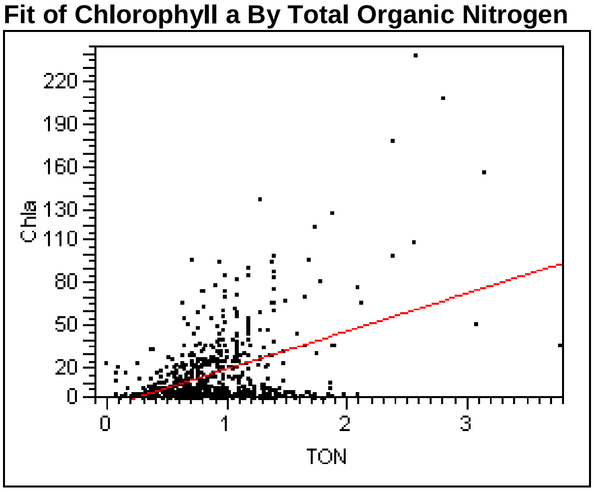
Summary of Fit

RSquare	0.00006
RSquare Adj	-0.00154
Root Mean Square Error	25.9416
Mean of Response	18.22127
Observations (or Sum Wgts)	629

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	25.15	25.154	0.0374
Error	627	421950.19	672.967	Prob > F
C. Total	628	421975.34		0.8468

Fit of Chlorophyll a By Total Organic Nitrogen



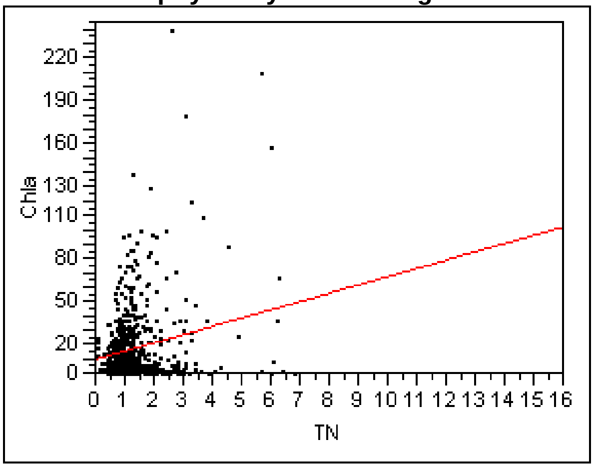
Summary of Fit

RSquare	0.189569
RSquare Adj	0.188278
Root Mean Square Error	23.34329
Mean of Response	18.19505
Observations (or Sum Wgts)	630

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	80045.01	80045.0	146.8961
Error	628	342202.85	544.9	Prob > F
C. Total	629	422247.86		<.0001

Fit of Chlorophyll a By Total Nitrogen



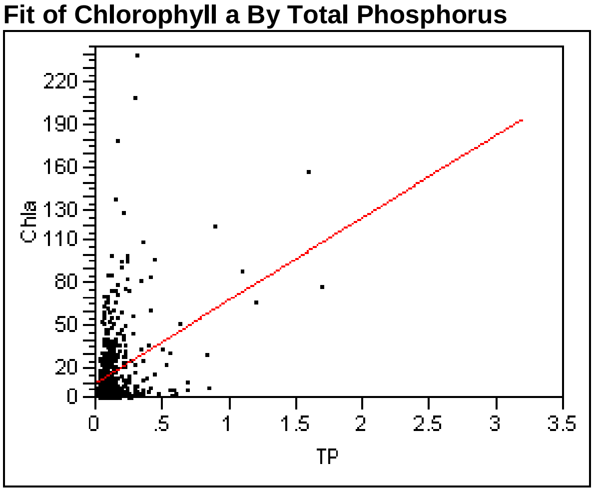
Summary of Fit

RSquare	0.042728
RSquare Adj	0.041201
Root Mean Square Error	25.3821
Mean of Response	18.22127
Observations (or Sum Wgts)	629

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	18030.08	18030.1	27.9861
Error	627	403945.26	644.3	Prob > F
C. Total	628	421975.34		<.0001

Fit of Chlorophyll a By Total Phosphorus



Summary of Fit

RSquare	0.115536
RSquare Adj	0.114128
Root Mean Square Error	24.38619
Mean of Response	18.19505
Observations (or Sum Wgts)	630

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	48784.89	48784.9	82.0347
Error	628	373462.97	594.7	Prob > F
C. Total	629	422247.86		<.0001

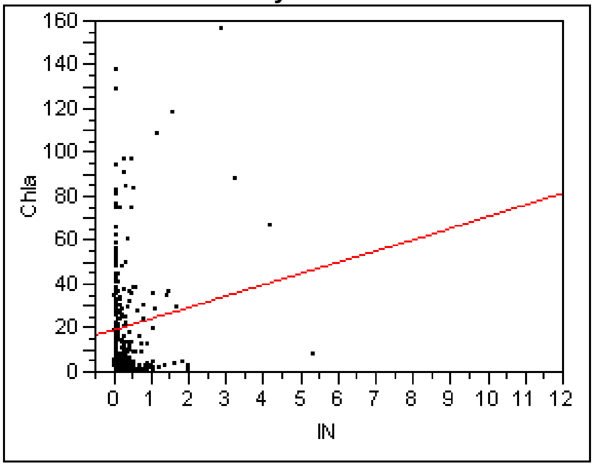
Linear regression indicates that there are weak correlations between chlorophyll a (chla) concentrations and total organic nitrogen (TON), total nitrogen (TN), and total phosphorus (TP) concentrations, and no correlation at all between chla and inorganic nitrogen concentrations (IN). The strongest of the four is TON, which has an r^2 value of 0.190. However, it is problematic to rely on TON, TP, or TN, because each of them includes in their concentration the nitrogen and phosphorus already incorporated into the biomass of algae, resulting in self-correlation. This self-correlation probably explains most of the observed correlation. IN does not have this problem and is thus a better indicator of free nutrient concentrations. Additionally, because IN is not yet incorporated into algal biomass, it is more available to algae to use for growth.

The graph of chla vs. IN appears to indicate an exclusive relationship, where most commonly, either chla is present or IN is present, but not both. This is consistent with the idea that IN is taken up readily by algae when present.

Growing Season

Because the initial comparison did not provide satisfactory results, various data restrictions were used to probe the relationship further. This included restricting data points to May through September, the “growing season,” which is the time of most concern for algal blooms.

Bivariate Fit of Chla By IN



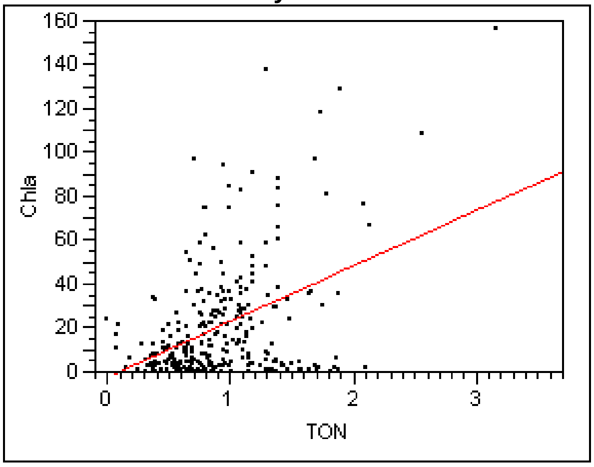
Summary of Fit

RSquare	0.012521
RSquare Adj	0.009127
Root Mean Square Error	25.69493
Mean of Response	21.30836
Observations (or Sum Wgts)	293

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2436.05	2436.05	3.6897
Error	291	192126.74	660.23	Prob > F
C. Total	292	194562.79		0.0557

Bivariate Fit of Chla By TON



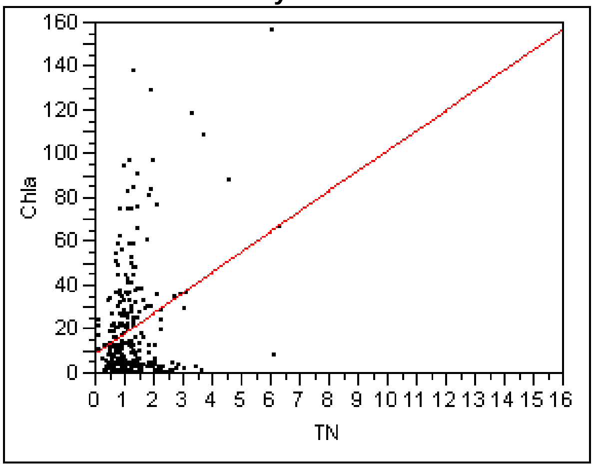
Summary of Fit

RSquare	0.175035
RSquare Adj	0.17221
Root Mean Square Error	23.4684
Mean of Response	21.24167
Observations (or Sum Wgts)	294

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	34122.32	34122.3	61.9543
Error	292	160823.65	550.8	Prob > F
C. Total	293	194945.97		<.0001

Bivariate Fit of Chla By TN



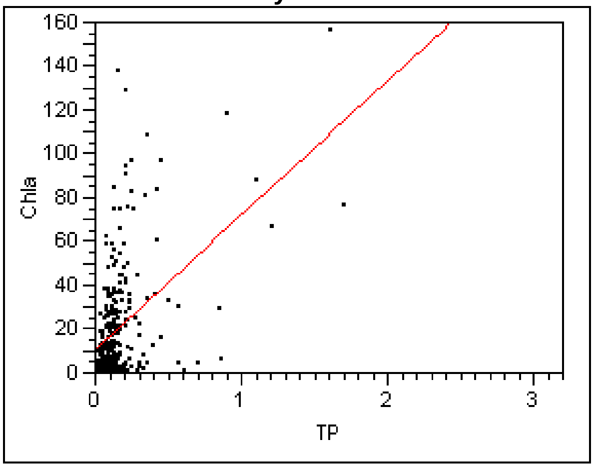
Summary of Fit

RSquare	0.086235
RSquare Adj	0.083094
Root Mean Square Error	24.71729
Mean of Response	21.30836
Observations (or Sum Wgts)	293

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	16778.03	16778.0	27.4625
Error	291	177784.76	610.9	Prob > F
C. Total	292	194562.79		<.0001

Bivariate Fit of Chla By TP



Summary of Fit

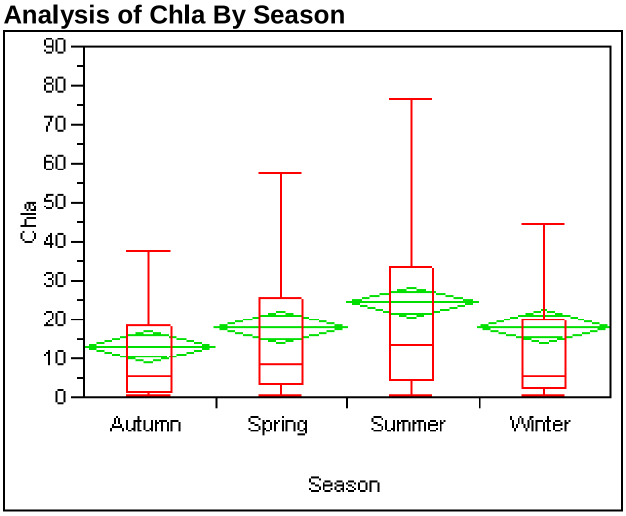
RSquare	0.214952
RSquare Adj	0.212264
Root Mean Square Error	22.89358
Mean of Response	21.24167
Observations (or Sum Wgts)	294

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	41904.08	41904.1	79.9519
Error	292	153041.89	524.1	Prob > F
C. Total	293	194945.97		<.0001

Restricting the data to the growing season did generally improve the correlations slightly; however the best correlation, chla vs TP, still only yielded an r^2 of 0.215. IN still did not significantly correlate with chla. However, there were fewer points in the graph where IN was present without chla, indicating that IN concentrations are seasonal. The next step was to examine seasonal and geographical variation in chla and IN concentrations.

Analysis of Chla By Season



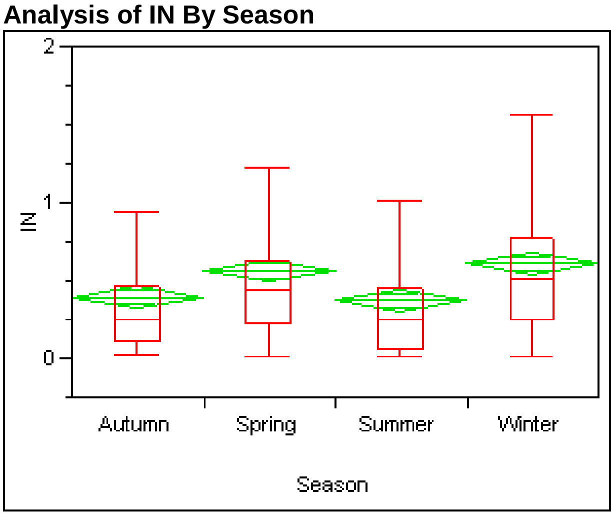
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Autumn	175	50813	290.360	-3.456
Spring	157	54220	345.350	0.883
Summer	180	70730.5	392.947	4.855
Winter	154	46347.5	300.958	-2.395

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
31.0196	3	<.0001

Analysis of IN By Season



Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

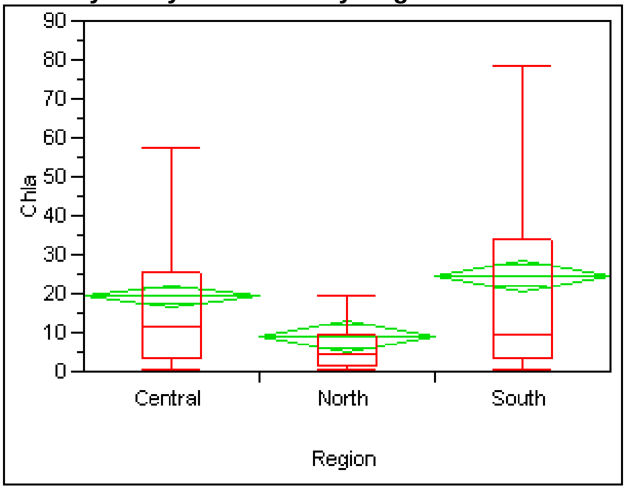
Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Autumn	380	247038	650.100	-4.784
Spring	365	299526	820.619	4.127
Summer	378	226689	599.706	-7.425
Winter	357	322687	903.885	8.295

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
123.0969	3	<.0001

Oneway Analysis of Chla By Region



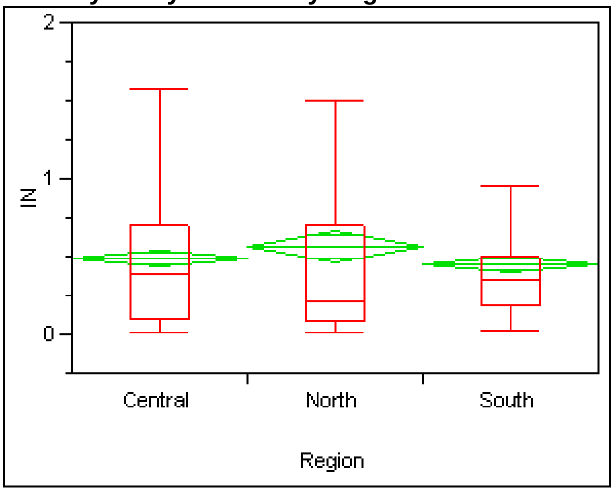
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Central	348	121635.5	349.527	2.250
North	148	38117.5	257.551	-5.448
South	170	62358	366.812	2.617

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
30.6088	2	<.0001

Oneway Analysis of IN By Region



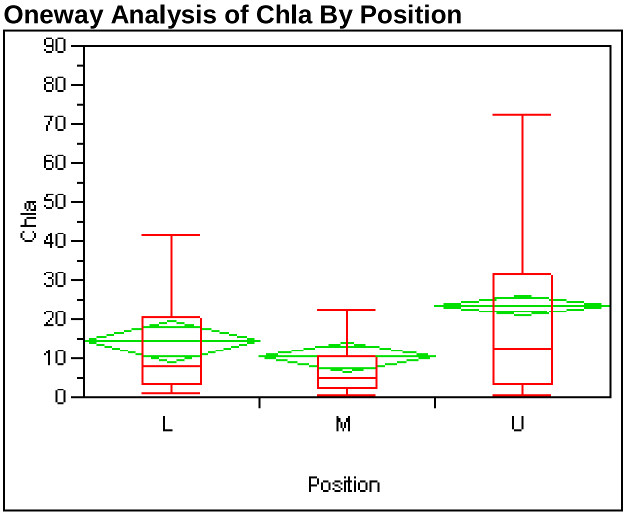
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Central	624	479268.5	768.058	2.119
North	167	112884.5	675.955	-2.073
South	689	503787	731.186	-0.783

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
6.7346	2	0.0345

Oneway Analysis of Chla By Position



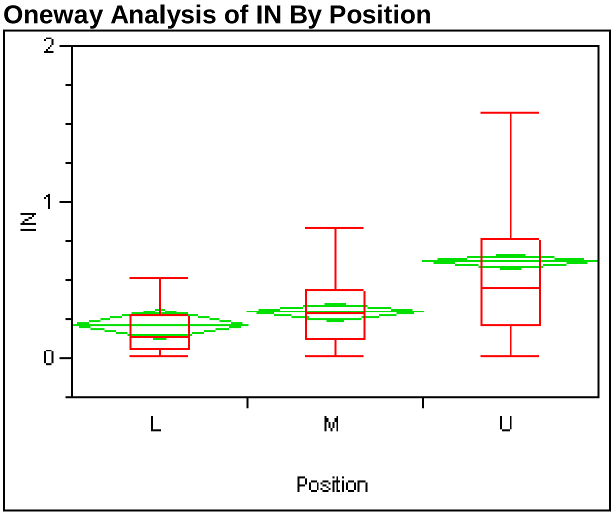
Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
L	96	32052.5	333.880	0.021
M	191	49567.5	259.516	-6.296
U	379	140491	370.689	5.735

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
42.4521	2	<.0001

Oneway Analysis of IN By Position



Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
L	176	78157.5	444.077	-9.805
M	424	262207.5	618.414	-6.965
U	880	755575	858.608	12.879

1-way Test, ChiSquare Approximation

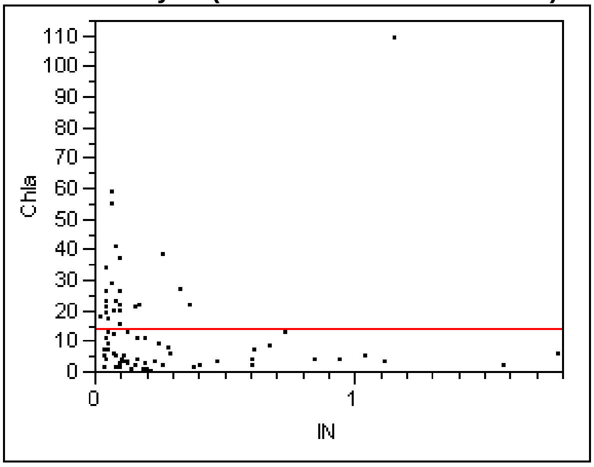
ChiSquare	DF	Prob>ChiSq
186.5773	2	<.0001

Chla is highest in the Summer and lowest in the Autumn. IN is highest in the Winter and Spring, and lowest in the Summer. This again implies the exclusive relationship where generally one is present when the other is not. When viewed from the perspective of loading, this makes sense. The accumulation of IN in the winter and spring is consumed by algae during the summer.

Differences among “Regions” show the variation between concentrations in the North (Albemarle Sound and related waters), the Central (the Neuse and Pamlico rivers), and the Southern (the White Oak, Cape Fear and other smaller rivers near to them) estuaries. This comparison again shows the exclusive relationship of IN and chla. IN is highest in the northern estuaries and chla is lowest in them, and the reverse is true in the southern estuaries.

“Positions” show the differences between The lower, middle, and upper sections of each estuary. In this comparison there is a hint of correlation, as the highest concentrations of both chla and IN occur in the upper portions of the estuaries. This again makes sense from a loading standpoint, as once waters enter the slower waters of the estuary, the drop most of their burden of sediment, including any particulate IN burden, leaving less to move into the middle and lower portions of the estuary. It also makes sense for the highest algal growth to take place where the most loading has taken place. To investigate this further, the data was separated by estuary position and then chla and IN were compared again.

Fit of Chla By IN (Lower Portion of Estuaries)



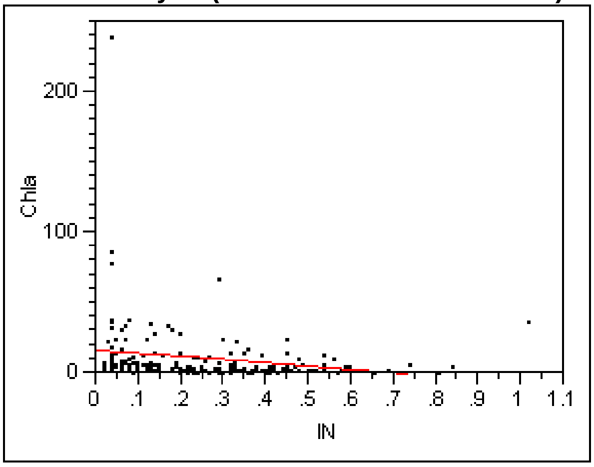
Summary of Fit

RSquare	0.000016
RSquare Adj	-0.01314
Root Mean Square Error	16.70544
Mean of Response	14.27564
Observations (or Sum Wgts)	78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.331	0.331	0.0012
Error	76	21209.453	279.072	Prob > F
C. Total	77	21209.784		0.9726

Fit of Chla By IN (Middle Portion of Estuaries)



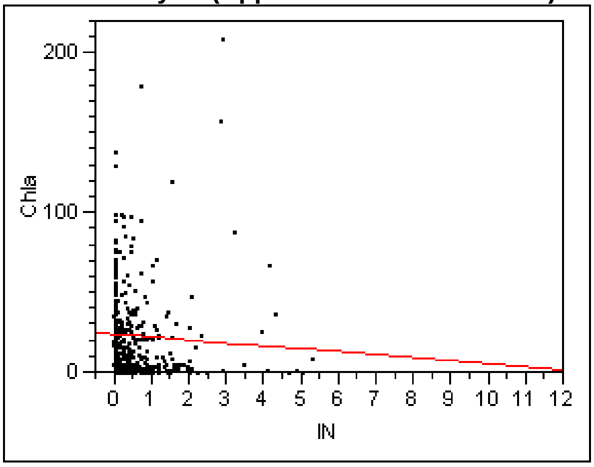
Summary of Fit

RSquare	0.037834
RSquare Adj	0.032716
Root Mean Square Error	20.52202
Mean of Response	10.572
Observations (or Sum Wgts)	190

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3113.332	3113.33	7.3924
Error	188	79176.814	421.15	Prob > F
C. Total	189	82290.146		0.0072

Fit of Chla By IN (Upper Portion of Estuaries)



Summary of Fit

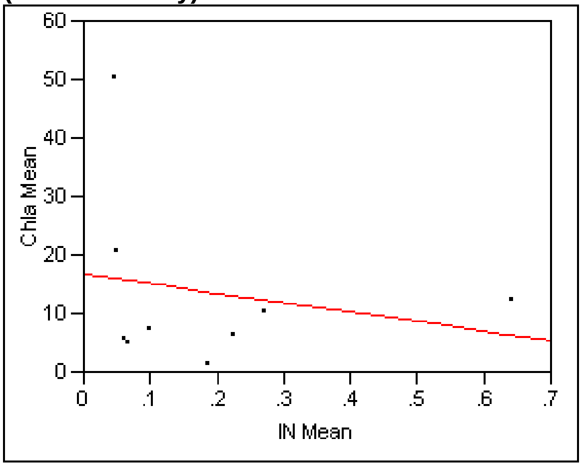
RSquare	0.00312
RSquare Adj	0.000343
Root Mean Square Error	28.74459
Mean of Response	23.09972
Observations (or Sum Wgts)	361

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	928.24	928.239	1.1234
Error	359	296624.17	826.251	Prob > F
C. Total	360	297552.41		0.2899

This graph again shows the pattern of exclusivity. However, because chla and IN are both highest in the upper portions of the estuaries, it is worth breaking this down further into the seasons. A comparison of the high seasons for IN (winter and spring) and the high season for chla (summer), may reveal a correlation.

Fit of Summer Chla Mean By Spring IN Mean (Lower Estuary)



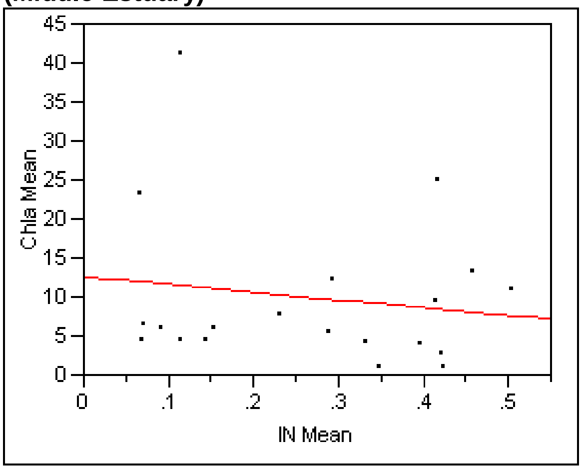
Summary of Fit

RSquare	0.041723
RSquare Adj	-0.09517
Root Mean Square Error	15.68284
Mean of Response	13.87963
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	74.9601	74.960	0.3048
Error	7	1721.6598	245.951	Prob > F
C. Total	8	1796.6199		0.5981

Fit of Summer Chla Mean By Spring IN Mean (Middle Estuary)



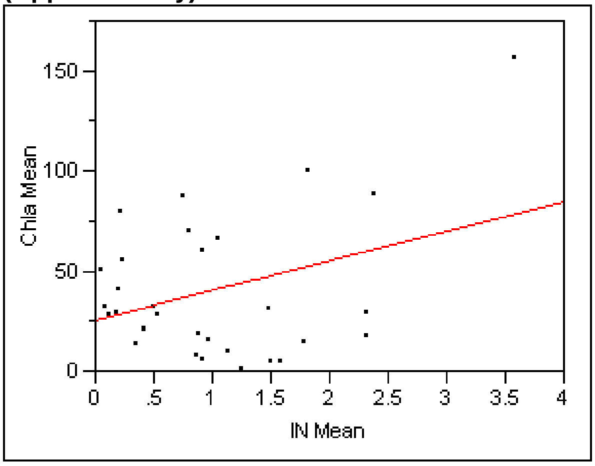
Summary of Fit

RSquare	0.0238
RSquare Adj	-0.03043
Root Mean Square Error	9.955826
Mean of Response	10.07325
Observations (or Sum Wgts)	20

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	43.4982	43.4982	0.4389
Error	18	1784.1325	99.1185	Prob > F
C. Total	19	1827.6306		0.5161

Fit of Summer Chla Mean By Spring IN Mean (Upper Estuary)



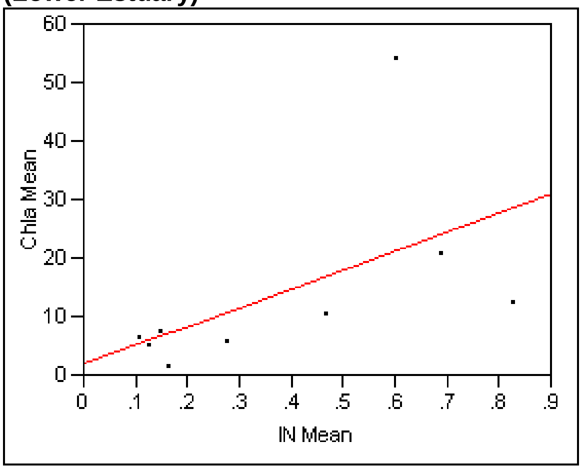
Summary of Fit

RSquare	0.127286
RSquare Adj	0.098196
Root Mean Square Error	32.9874
Mean of Response	40.56771
Observations (or Sum Wgts)	32

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4761.323	4761.32	4.3755
Error	30	32645.058	1088.17	Prob > F
C. Total	31	37406.381		0.0450

Fit of Summer Chla Mean By Winter IN Mean (Lower Estuary)



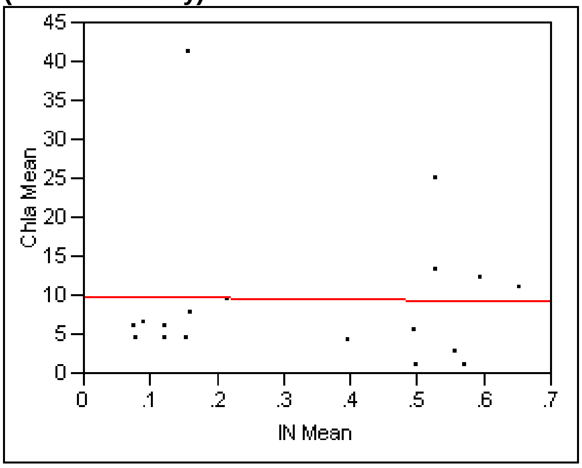
Summary of Fit

RSquare	0.303137
RSquare Adj	0.203585
Root Mean Square Error	14.29951
Mean of Response	14.25
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	622.6330	622.633	3.0450
Error	7	1431.3325	204.476	Prob > F
C. Total	8	2053.9656		0.1245

Fit of Summer Chla Mean By Winter IN Mean (Middle Estuary)



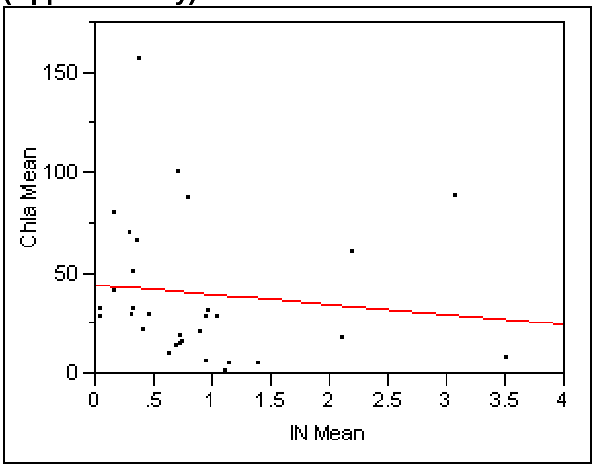
Summary of Fit

RSquare	0.000425
RSquare Adj	-0.06205
Root Mean Square Error	10.01116
Mean of Response	9.631667
Observations (or Sum Wgts)	18

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.6825	0.682	0.0068
Error	16	1603.5719	100.223	Prob > F
C. Total	17	1604.2544		0.9353

Fit of Summary Chla Mean By Winter IN Mean (Upper Estuary)



Summary of Fit

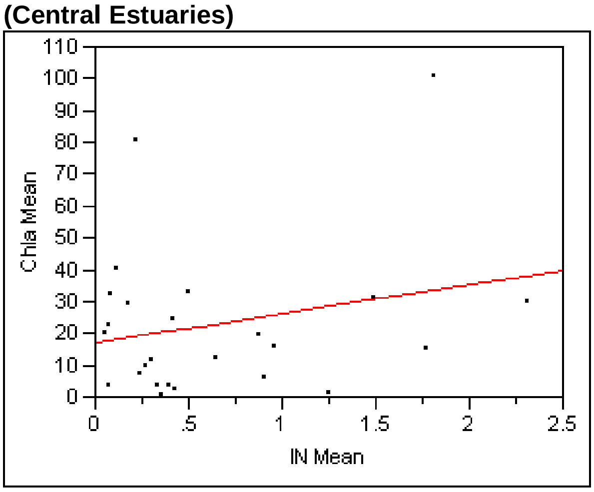
RSquare	0.012827
RSquare Adj	-0.02121
Root Mean Square Error	35.55056
Mean of Response	40.03763
Observations (or Sum Wgts)	31

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	476.228	476.23	0.3768
Error	29	36651.422	1263.84	Prob > F
C. Total	30	37127.651		0.5441

The fit of summer chla by spring IN in the upper portions of estuaries shows a significant correlation, and an r^2 of 0.127. However, a visual examination of this graph indicates that the correlation does not begin until above 50 ug/L chla. Below 50, the correlation is very noisy. The other correlations were not significant. A cross-season comparison was also done by estuary location.

Fit of Summer Chla Mean By Spring IN Mean (Central Estuaries)



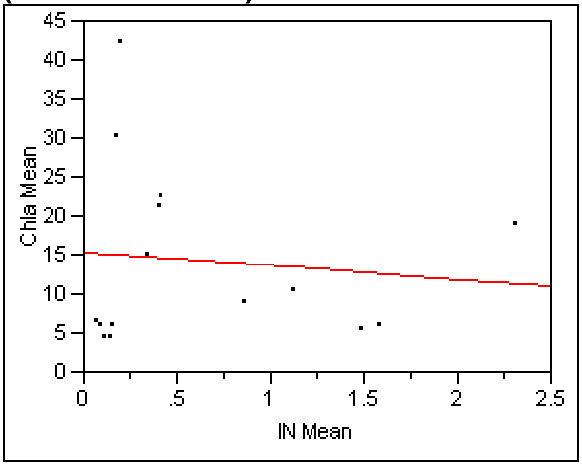
Summary of Fit

RSquare	0.057084
RSquare Adj	0.016088
Root Mean Square Error	23.67267
Mean of Response	23.2386
Observations (or Sum Wgts)	25

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	780.305	780.305	1.3924
Error	23	12889.094	560.395	Prob > F
C. Total	24	13669.399		0.2501

Fit of Summer Chla Mean By Spring IN Mean (Northern Estuaries)



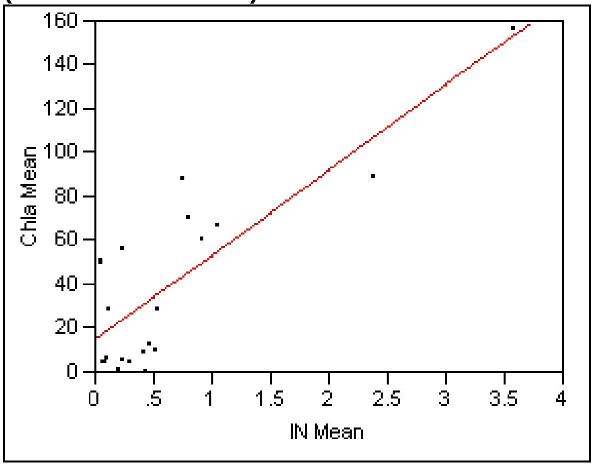
Summary of Fit

RSquare	0.011078
RSquare Adj	-0.06499
Root Mean Square Error	11.52923
Mean of Response	14.34444
Observations (or Sum Wgts)	15

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	19.3581	19.358	0.1456
Error	13	1728.0012	132.923	Prob > F
C. Total	14	1747.3593		0.7089

Fit of Summer Chla Mean By Spring IN Mean (Southern Estuaries)



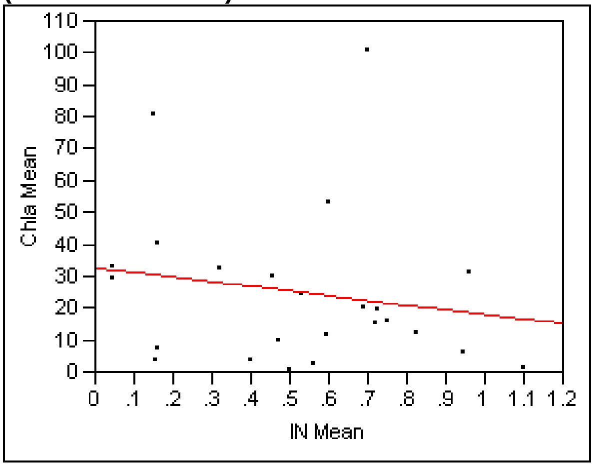
Summary of Fit

RSquare	0.673362
RSquare Adj	0.65617
Root Mean Square Error	23.73667
Mean of Response	39.44841
Observations (or Sum Wgts)	21

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	22068.579	22068.6	39.1683
Error	19	10705.163	563.4	Prob > F
C. Total	20	32773.742		<.0001

Fit of Summer Chla Mean By Winter IN Mean (Central Estuaries)



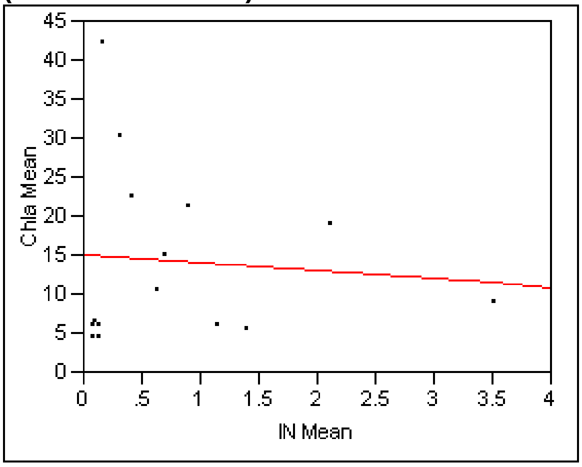
Summary of Fit

RSquare	0.031108
RSquare Adj	-0.01293
Root Mean Square Error	24.9873
Mean of Response	25.30014
Observations (or Sum Wgts)	24

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	441.017	441.017	0.7063
Error	22	13736.036	624.365	Prob > F
C. Total	23	14177.053		0.4097

Fit of Summer Chla Mean By Winter IN Mean (Northern Estuaries)



Summary of Fit

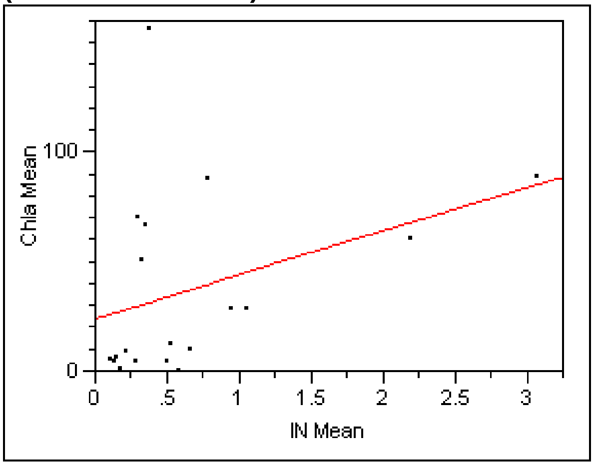
RSquare	0.007992
RSquare Adj	-0.06832
Root Mean Square Error	11.54721
Mean of Response	14.34444
Observations (or Sum Wgts)	15

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	13.9656	13.966	0.1047
Error	13	1733.3937	133.338	Prob > F
C. Total	14	1747.3593		0.7514

Fit of Summer Chla Mean By Winter IN Mean (Southern Estuaries)



Summary of Fit

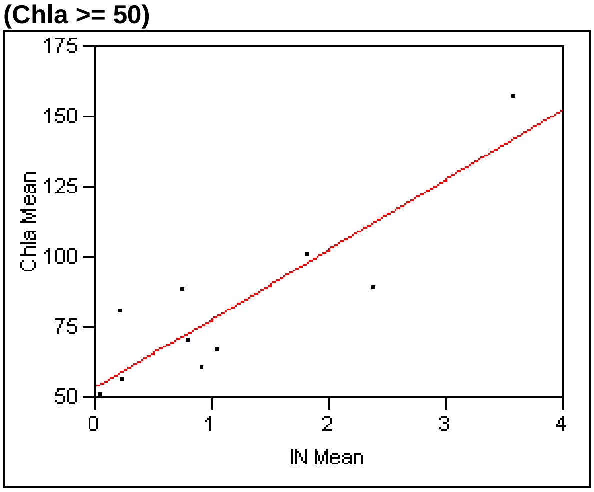
RSquare	0.12753
RSquare Adj	0.076209
Root Mean Square Error	40.707
Mean of Response	37.91667
Observations (or Sum Wgts)	19

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4117.655	4117.66	2.4849
Error	17	28170.011	1657.06	Prob > F
C. Total	18	32287.666		0.1334

The fit of summer chla to spring IN in the southern estuaries shows significant correlation and an r2 of 0.673, by far the best fit seen. The rest of the location fits did not produce significant results. However, similar to what was seen in the fit of summer chla to spring IN in the upper estuary set, the correlation does not appear until approximately 50 ug/L chla and above. So next, chla concentrations were separated into those greater then 50 ug/L and those less than 50 ug/L.

Fit of Summer Chla Mean By Spring IN Mean (Chla >= 50)



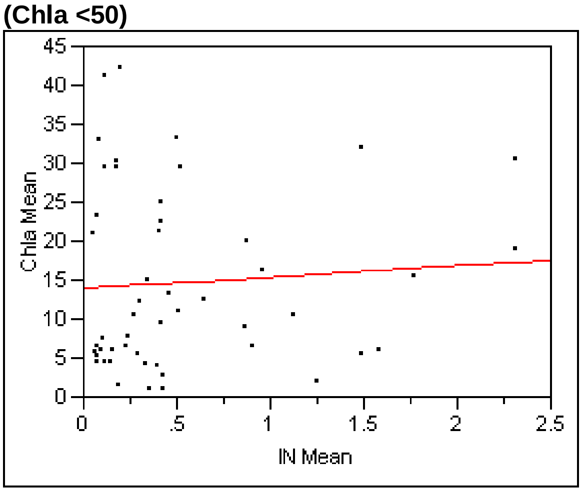
Summary of Fit

RSquare	0.79505
RSquare Adj	0.772278
Root Mean Square Error	14.6922
Mean of Response	80.10606
Observations (or Sum Wgts)	11

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	7536.3795	7536.38	34.9132
Error	9	1942.7468	215.86	Prob > F
C. Total	10	9479.1263		0.0002

Fit of Summer Chla Mean By Spring IN Mean (Chla <50)



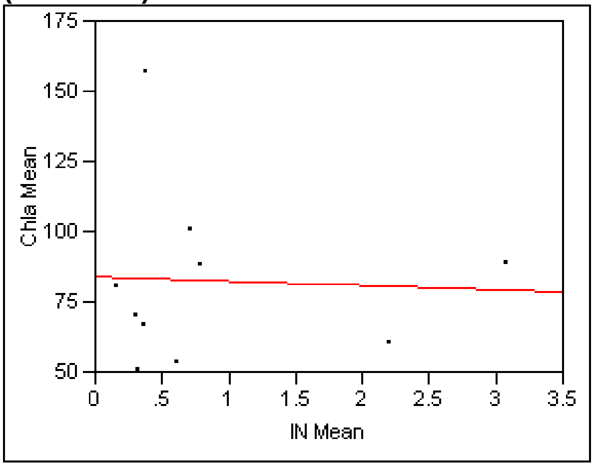
Summary of Fit

RSquare	0.005033
RSquare Adj	-0.0157
Root Mean Square Error	11.4631
Mean of Response	14.86763
Observations (or Sum Wgts)	50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	31.9070	31.907	0.2428
Error	48	6307.3329	131.403	Prob > F
C. Total	49	6339.2400		0.6244

Fit of Summer Chla Mean By Winter IN Mean (Chla >= 50)



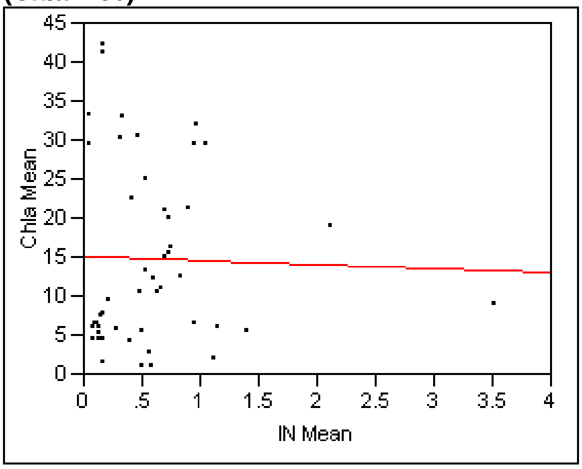
Summary of Fit

RSquare	0.002461
RSquare Adj	-0.12223
Root Mean Square Error	32.92227
Mean of Response	82.75
Observations (or Sum Wgts)	10

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	21.3939	21.39	0.0197
Error	8	8671.0088	1083.88	Prob > F
C. Total	9	8692.4028		0.8917

Fit of Summer Chla Mean By Winter IN Mean (Chla < 50)



Summary of Fit

RSquare	0.000663
RSquare Adj	-0.02106
Root Mean Square Error	11.55844
Mean of Response	14.90181
Observations (or Sum Wgts)	48

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4.0761	4.076	0.0305
Error	46	6145.4856	133.598	Prob > F
C. Total	47	6149.5617		0.8621

A strong correlation appears to exist between summer chla concentrations and spring IN concentrations (r^2 is 0.795), but only at high concentrations of chla (>= 50). The other fits were not significant.

Conclusions

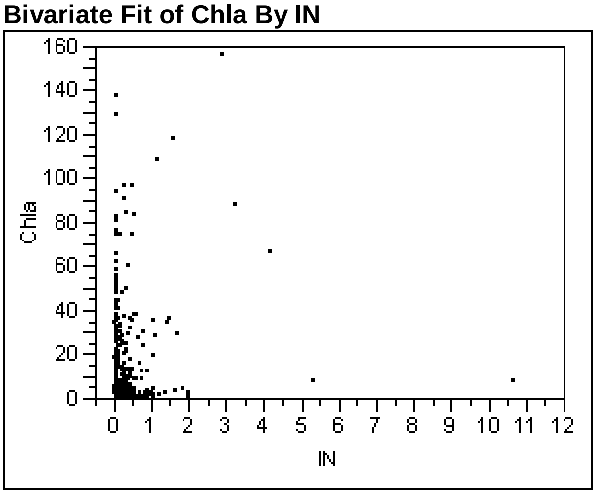
TN, TON, and TP all suffer from self-correlation when compared to chla. IN does not have that problem, but must be viewed seasonally because it is used up by algae when chla is highest. Nutrient loading occurs each day of the year, but monitoring of concentrations only happens once or twice a month at these stations. Occasional monitoring of concentration is not sufficient to accurately reflect total loading. In areas where the highest chla is found, it is reasonable to suppose that there is high loading of IN, which is reflected in the continually high observed concentrations in the spring. But in areas where chla concentrations are lower, it is also reasonable to assume that the daily loading is quite variable, leaving little correlation between concentration on six or seven days, and the total loading for the season. Because the standard for chla in North Carolina is 40 ug/L, and no correlation exists until 50+ ug/L, IN concentrations are also not useful as a statewide standard.

Appendix

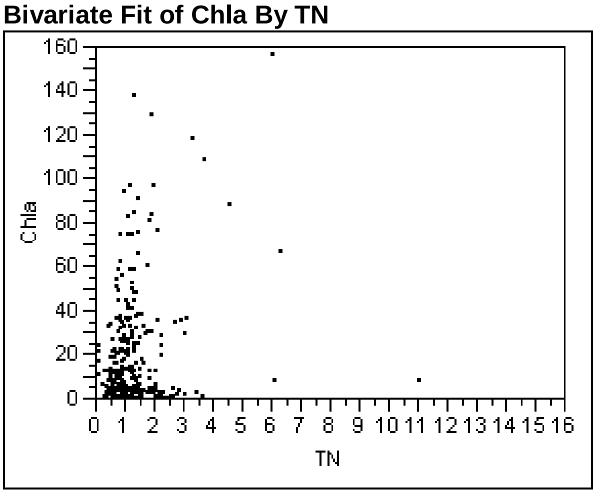
Additional comparisons of chla or IN to other parameters were made, which did not result in useful correlations. They are included here.

Growing Season:

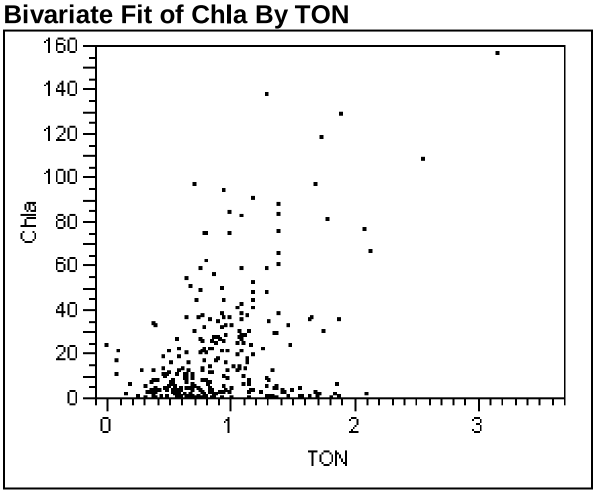
Bivariate Fit of Chla By IN



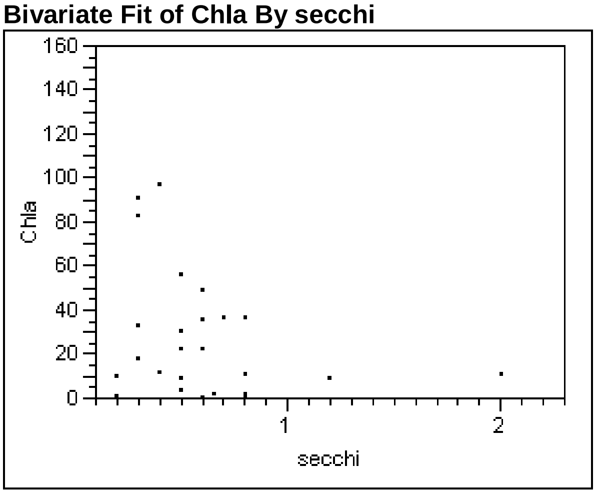
Bivariate Fit of Chla By TN



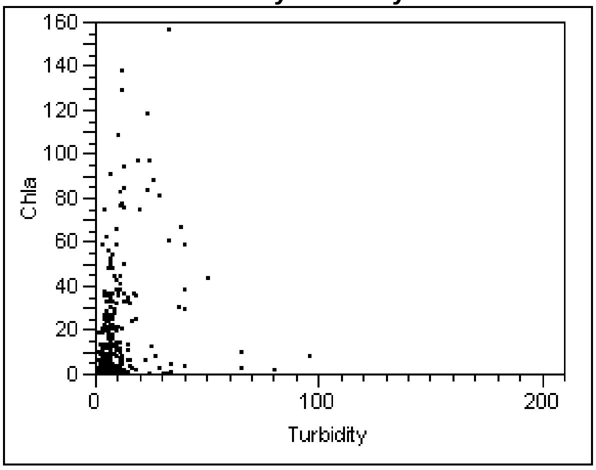
Bivariate Fit of Chla By TON



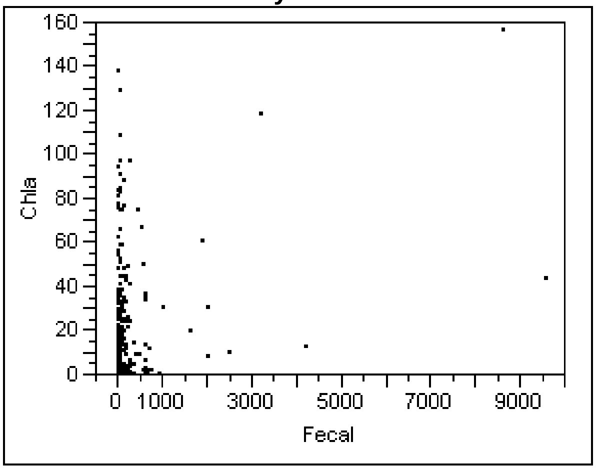
Bivariate Fit of Chla By secchi



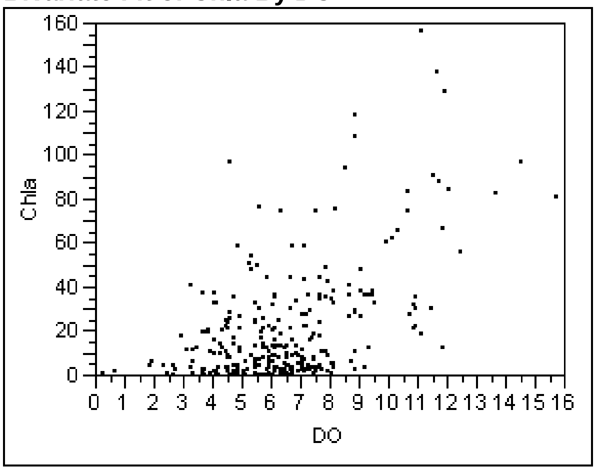
Bivariate Fit of Chla By Turbidity



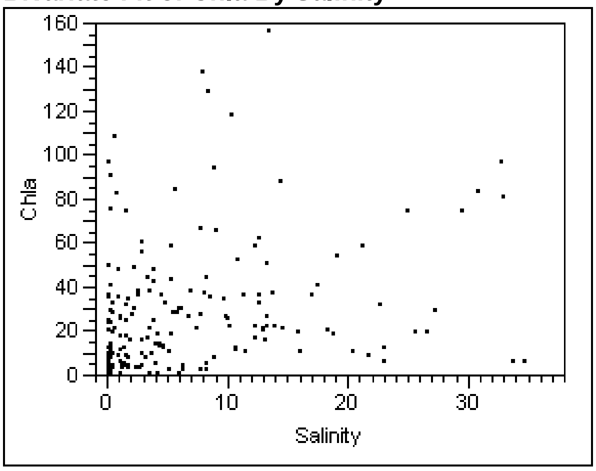
Bivariate Fit of Chla By Fecal



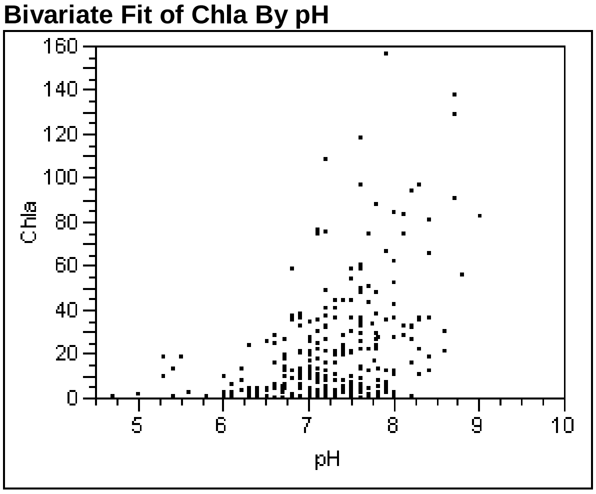
Bivariate Fit of Chla By DO



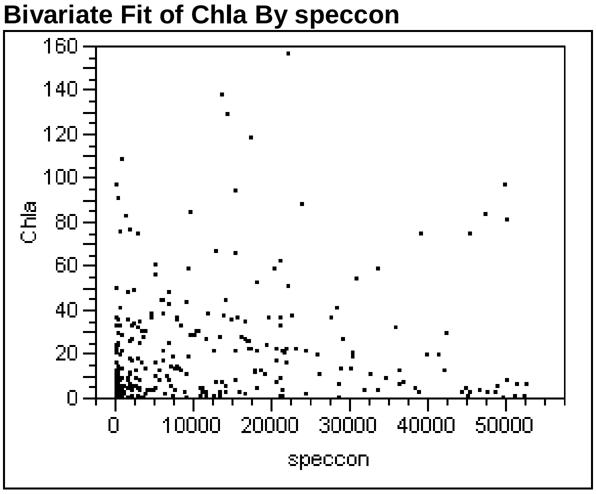
Bivariate Fit of Chla By Salinity



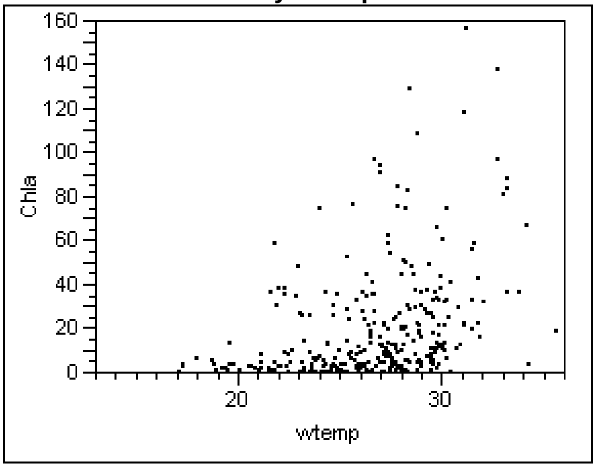
Bivariate Fit of Chla By pH



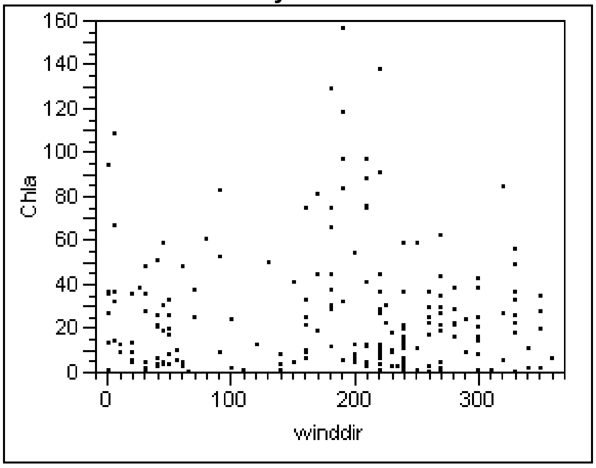
Bivariate Fit of Chla By speccon



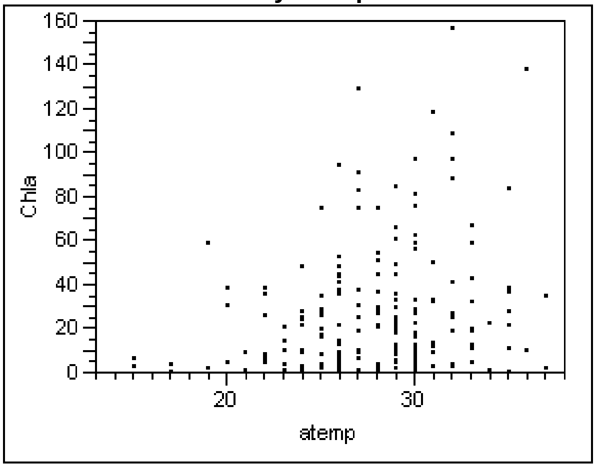
Bivariate Fit of Chla By wtemp



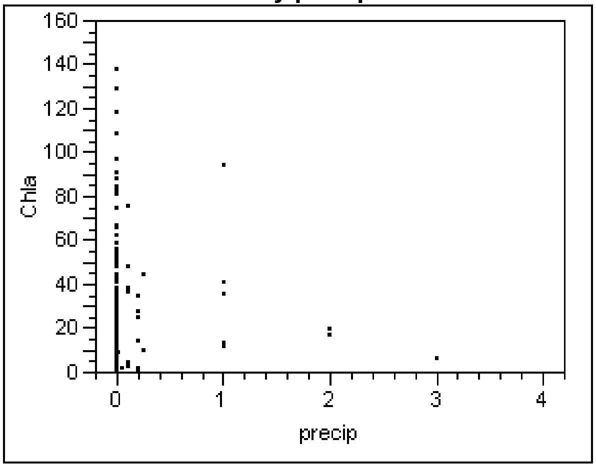
Bivariate Fit of Chla By winddir



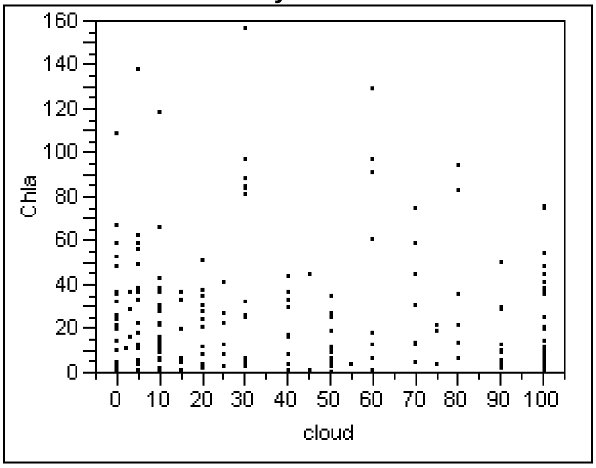
Bivariate Fit of Chla By atemp



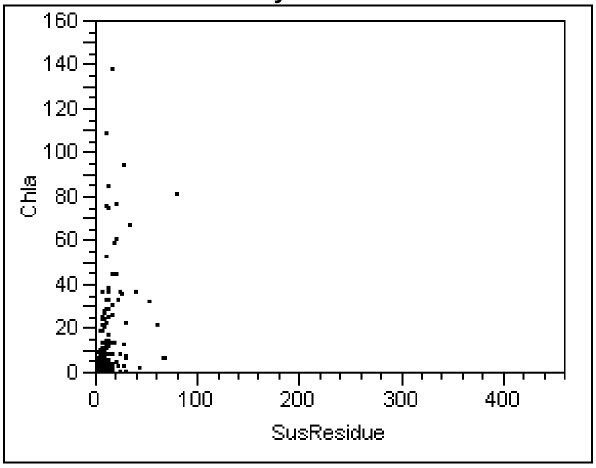
Bivariate Fit of Chla By precip



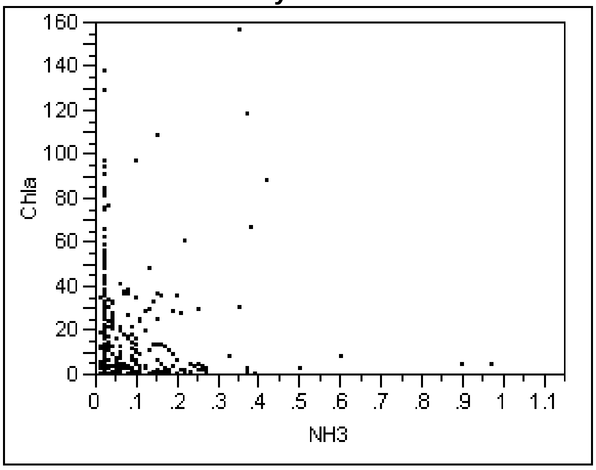
Bivariate Fit of Chla By cloud



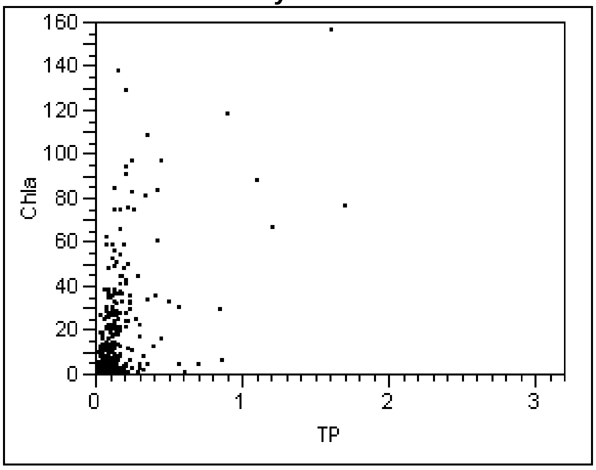
Bivariate Fit of Chla By SusResidue



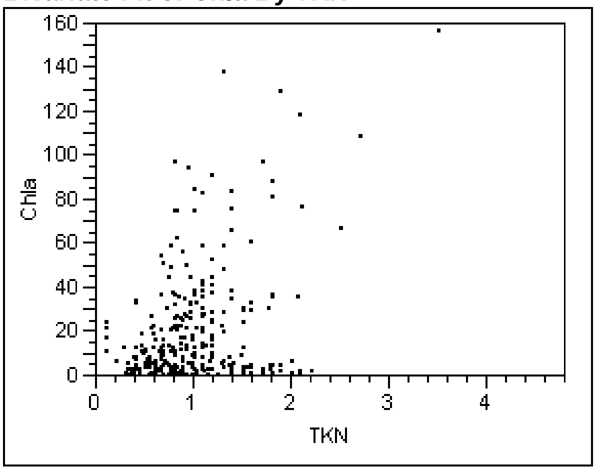
Bivariate Fit of Chla By NH3



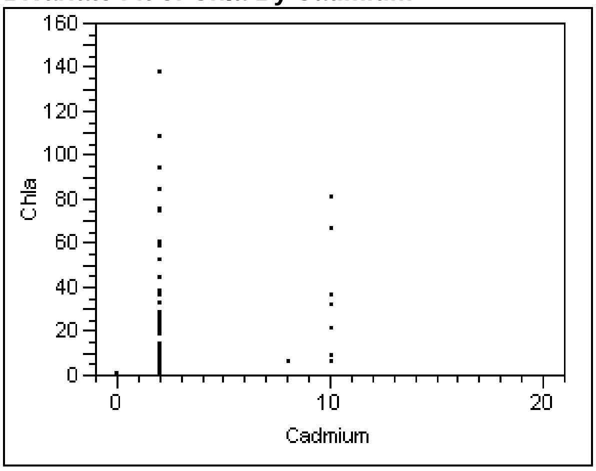
Bivariate Fit of Chla By TP



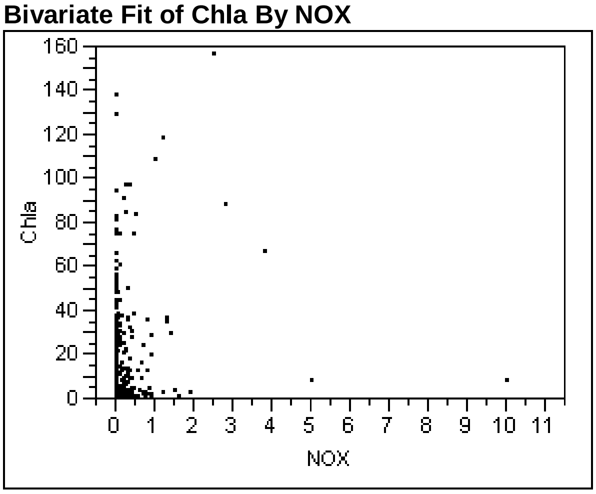
Bivariate Fit of Chla By TKN



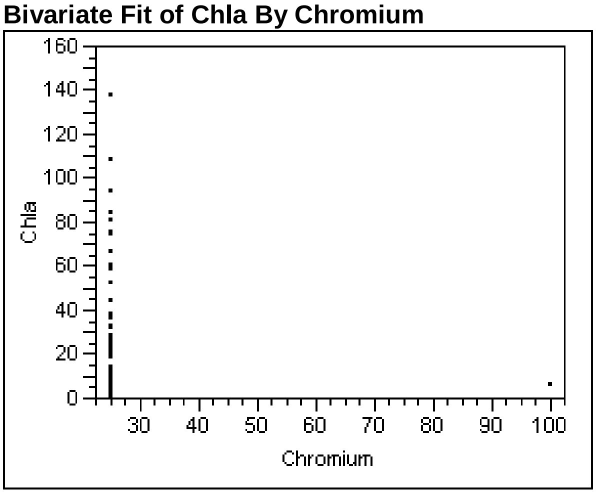
Bivariate Fit of Chla By Cadmium



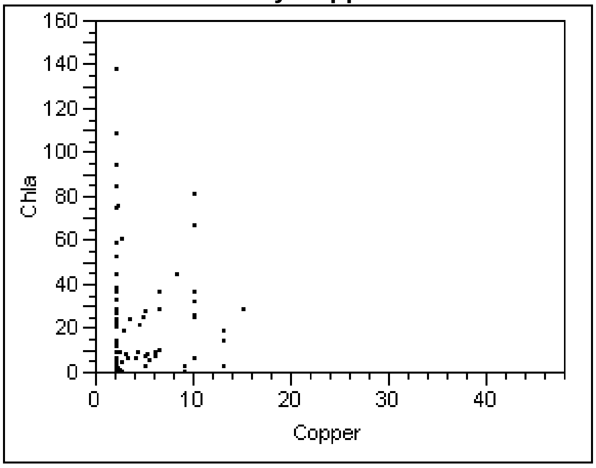
Bivariate Fit of Chla By NOX



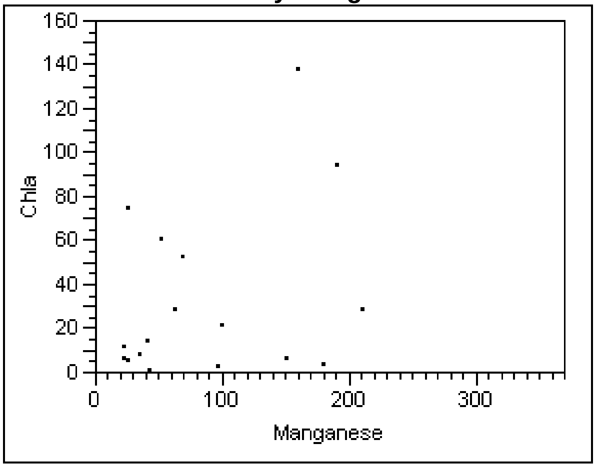
Bivariate Fit of Chla By Chromium



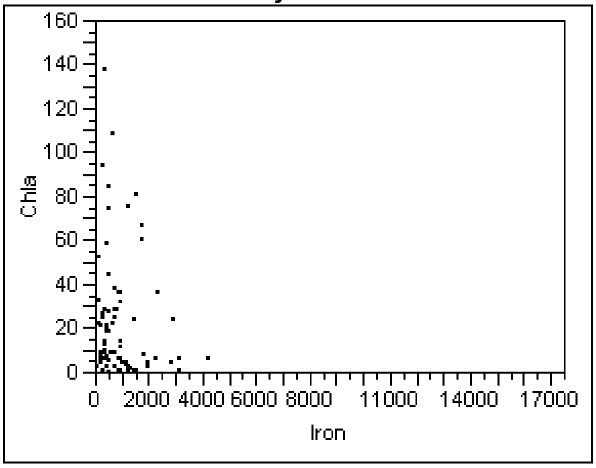
Bivariate Fit of Chla By Copper



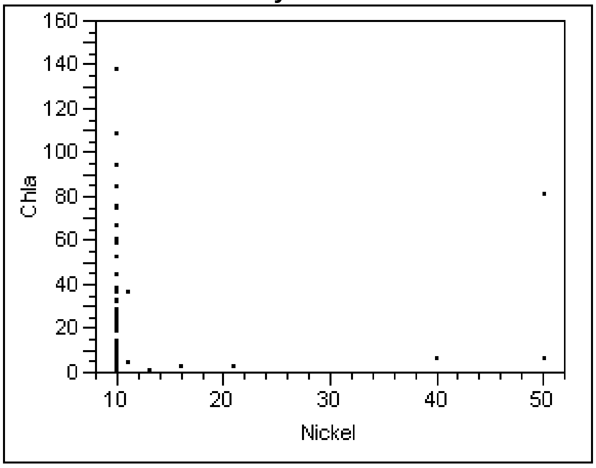
Bivariate Fit of Chla By Manganese



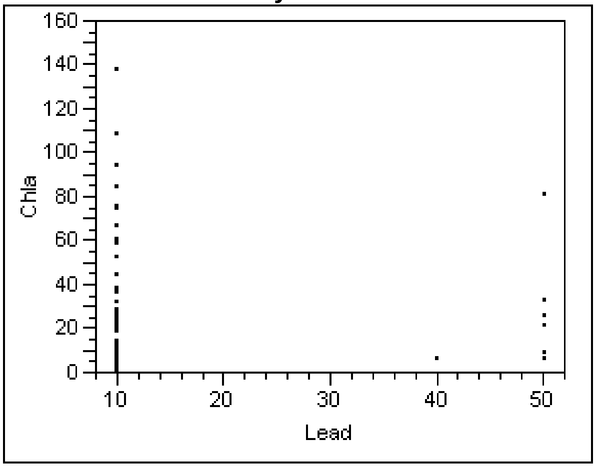
Bivariate Fit of Chla By Iron



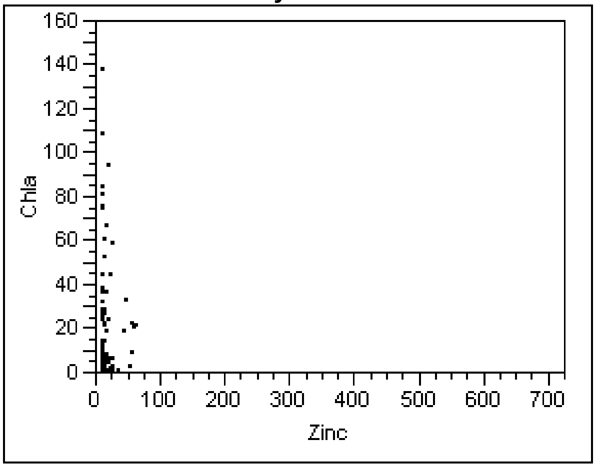
Bivariate Fit of Chla By Nickel



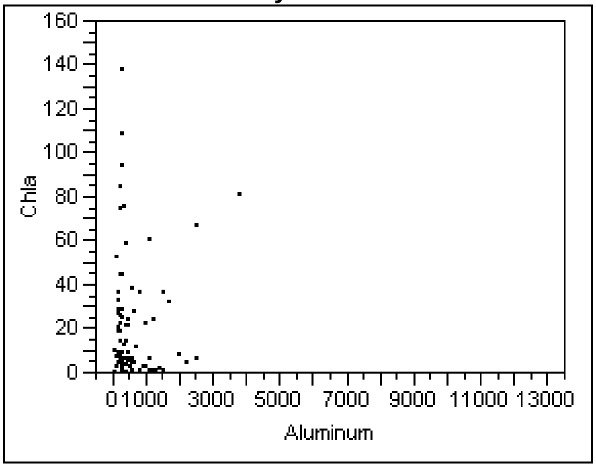
Bivariate Fit of Chla By Lead



Bivariate Fit of Chla By Zinc



Bivariate Fit of Chla By Aluminum



Bivariate Fit of Chla By Mercury