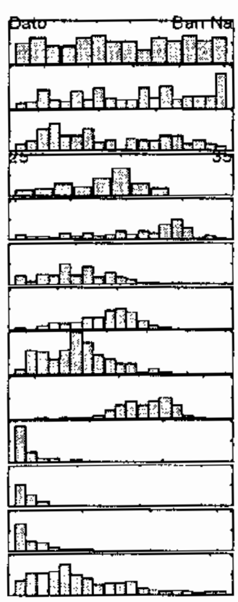
CHAPTER 3

PRELIMINARY RESULTS

In this chapter, the following results are presented

- Histograms and statistics of raw data for all variables
- Histograms and statistics for selected variables after transformation using logarithms and square roots
- Time series plots of the variables
- Two-way analysis of variance of the variables

Histograms and numerical summaries of the data are shown in Figure 3



col	variable	size	mean	st dev	SE	skew	kurt	min	max
1	StationID	305	7.685	4.076	0.233	-0.046	1.774	1	14
2	day	305	301.5	138.9	7.956	-0.153	1.79	38	507
3	timeID	235	21.55	9.913	0.647	0.358	1.883	6	42
4	temperature	247	29.13	1.935	0.123	-0.202	2.92	25	35
5	salinity	304	22.45	9.408	0.54	-0.712	2.548	0	38
6	transparency	288	53.32	24.43	1.439	0.585	3.643	10	150
7	alkalinity	297	89.91	25.98	1.508	-0.287	3.498	15	190
8	oxygen	283	6.609	1.748	0.104	0.795	4.189	3.4	14
9	pH	298	8.276	0.376	0.022	-0.956	4.676	6.77	9.28
10	nitrite	282	0.011	0.018	0.001	3.85	21.49	0	0.143
11	nitrate	232	0.034	0.049	0.003	3.69	18.52	0.001	0.34
12	phosphate	282	0.029	0.04	0.002	3.932	24.28	0	0.313
13	silicate	237	0.714	0.485	0.032	0.846	3.145	0.013	2.16

Data from Fisheries Office 1995-96

Figure 3: Histograms and numerical summaries of variables

From Figure 3 the values of means, standard deviations standard errors, skew and kurt are not particularly meaningful for the nominal variables. The distributions of nitrite, nitrate, and phosphate are heavily skewed to the right, with silicate less skewed, suggesting a transformation. After taking base 2 logarithms of the nitrite, nitrate, and phosphate data, and square roots of the silicate concentrations, the results are shown in Figure 4 As can be seen, the skewness has largely disappeared from each histogram.

col	variable	size	mean	stdev	SE	skew	kurt	min	max
1	StationID	305	7.685	4.076	0.233	-0.046	1.774	1	14
2	day	305	301.5	138.9	7.956	-0.153	1.79	38	507
3	timeID	235	21.55	9.913	0.647	0.358	1.883	6	42
4	log2(nitrite)	258	-7.652	1.887	0.117	0.255	2.256	-11.29	-2.806
5	log2(nitrate)	232	-5.691	1.55	0.102	-0.088	3.583	-10.97	-1.556
6	log2(phosp)	282	-6.224	1.996	0.119	-0.529	3.107	-12.29	-1.674
7	sqrt(silic)	237	0.792	0.295	0.019	0.068	2.513	0.114	1.47

Data from Fisheries Office 1995-96

Figure 4: Histograms and numerical summaries of transformed variables

Turning to the time series plots, Figure 5 shows the variation in temperature.

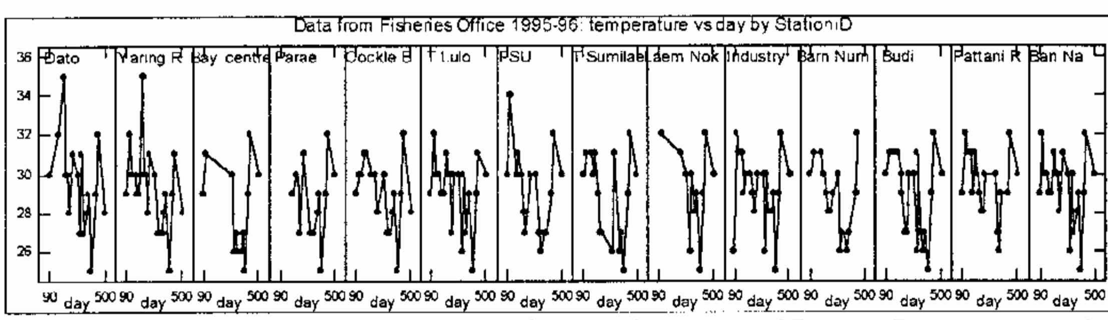


Figure 5: Time series of temperature from 14 locations of Pattani Bay in 1995-96

Time series plot of the other variables are shown in Figures 6 – 14

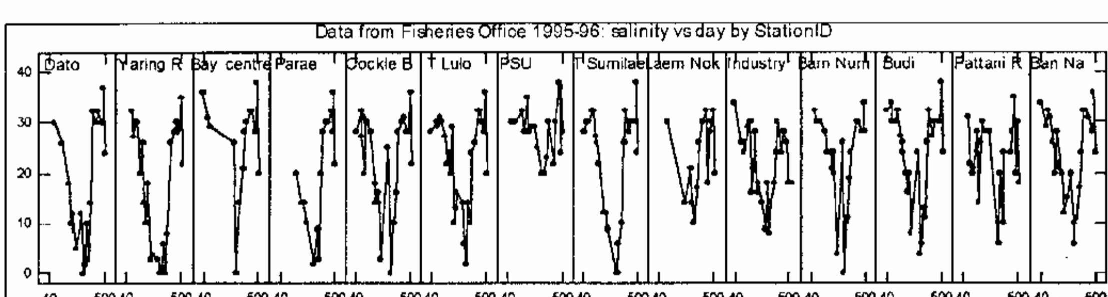


Figure 6: Time series of salinity from 14 locations of Pattani Bay in 1995-96

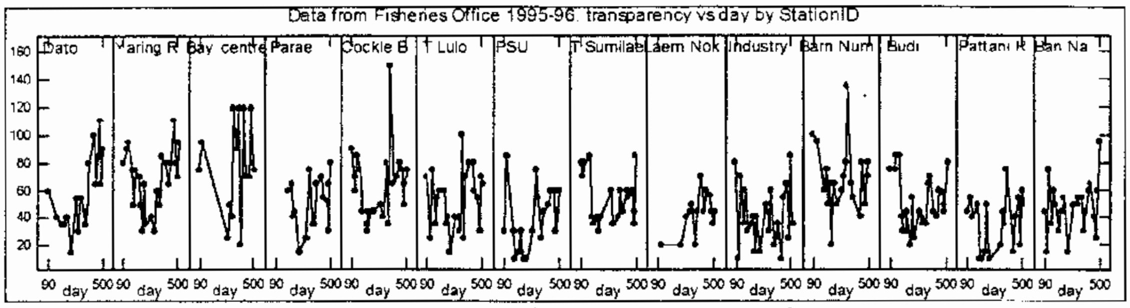


Figure 7: Time series of transparency from 14 locations of Pattani Bay in 1995-96

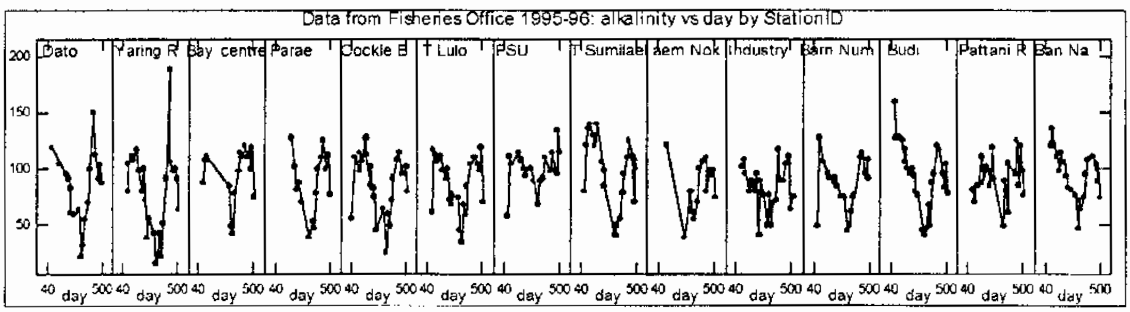


Figure 8: Time series of alkalinity from 14 locations of Pattani Bay in 1995-96

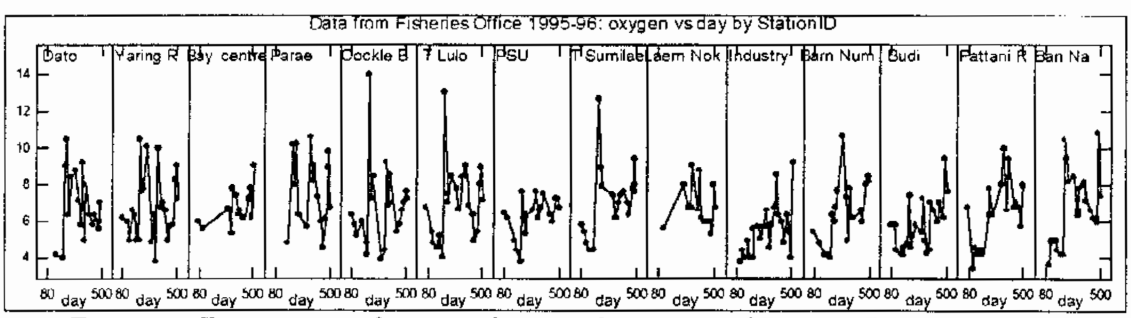


Figure 9: Time series of oxygen from 14 locations of Pattani Bay in 1995-96

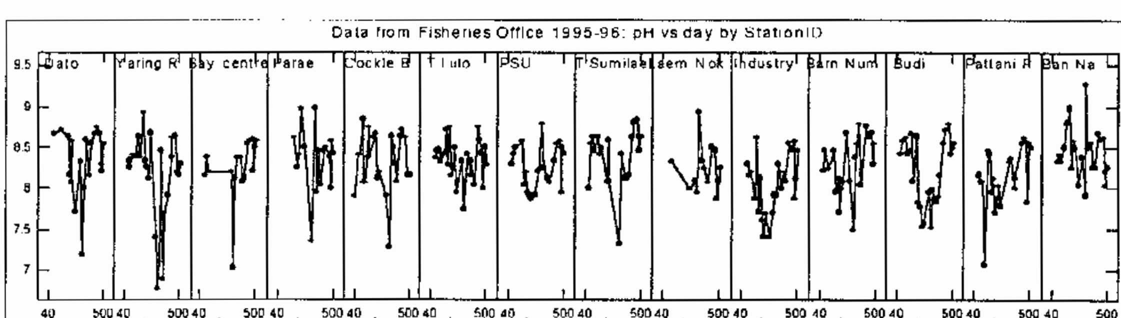


Figure 10: Time series of pH from 14 locations of Pattani Bay in 1995-96

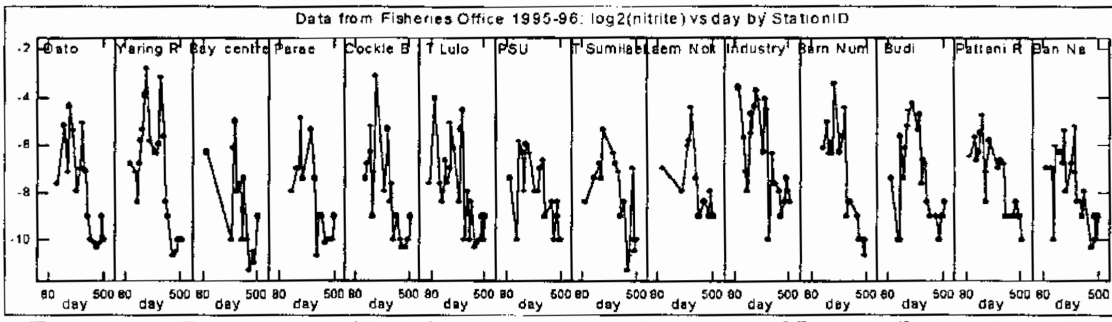


Figure 11: Time series of log2(nitrite) from 14 locations of Pattani Bay in 1995-96

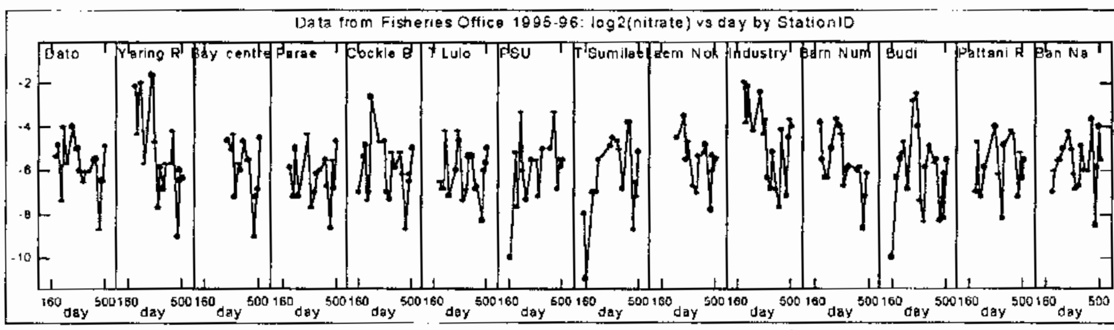


Figure 12: Time series of log2(nitrate) from 14 locations of Pattani Bay in 1995-96

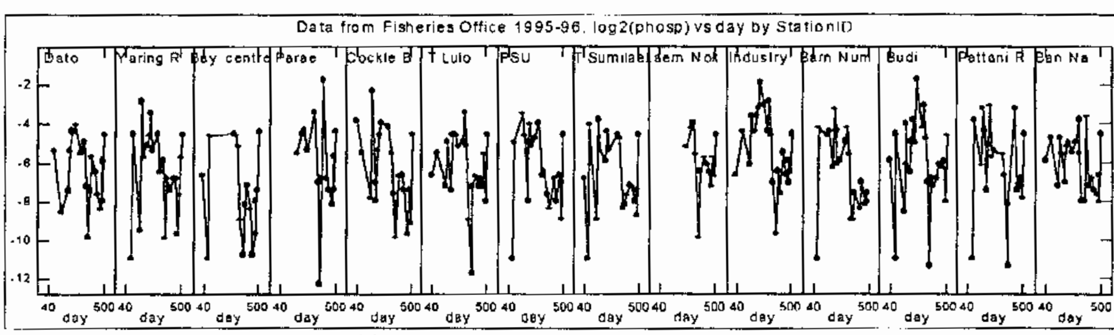


Figure 13: Time series of log2(phosphate) from 14 locations of Pattani in 1995-96

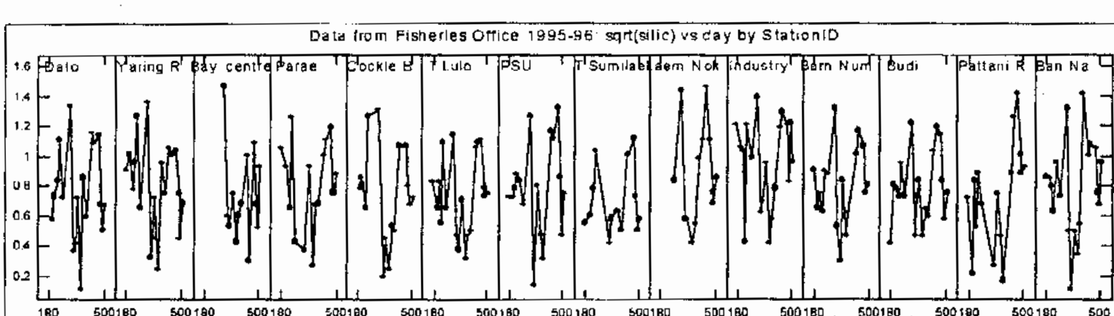


Figure 14: Time series of sqrt(silicate) from 14 locations of Pattani Bay in 1995-96

The time series plots indicate strong seasonal patterns for some variables, particularly for temperature and salinity, and to a lesser extend for alkalinity. Some unusually high and low observations are evident. For example, Cockle Bed had one extremely high transparency observation, and Yaring River each had one extremely high alkalinity observation. Cockle Bed and Tunyong Lulo each had one extremely high oxygen observation. Bay Centre had one extremely low pH observation. Talo Sumilae had one extremely low nitrate observation. Parae, Tunyong Lulo and Pattani River mouth had one, one and two extremely low phosphate observations, respectively. Bay Centre had one extremely high silicate observation.

Figure 15 shows the two-way anova analysis of temperature collected by the Fisheries Office in 1995-96. The graph shows the data after seasonal adjustment (by adjusting for day effects). The stations contributing most to this difference are Dato (high), and Bay Centre (low). Some of these residuals appear to be unusually high and low, and are omitted from further analysis. Using the complete set of data, the differences between stations are not statistically significant (p=0.103).

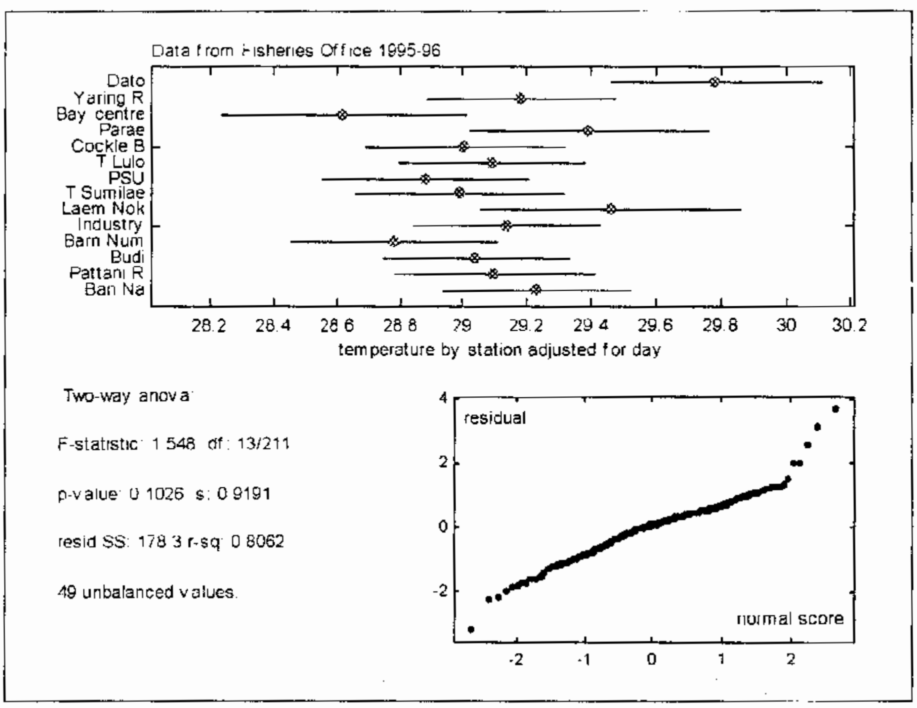


Figure 15 : Two-way anova analysis of temperature

Figure 16 shows the two-way anova analysis of salinity collected by the Fisheries Office in 1995-96. The graph again shows the data after seasonal adjustment (by adjusting for day effects). The stations contributing most to this difference are Yaring (low) and Tunyong Lulo (high). Some of these residuals appear to be unusually high, and are omitted from further analysis. The differences between stations are highly significant (p=0).

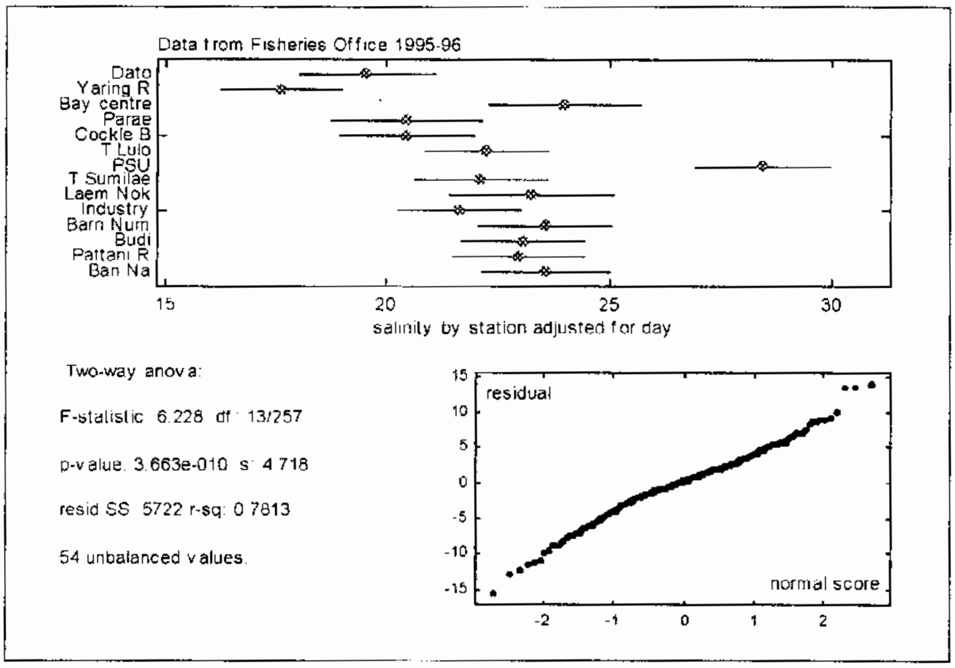


Figure 16: Two-way anova analysis of salinity

Figure 17 shows the two-way anova analysis of transparency collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0), and no stations are very extreme. Two of these residuals appear to be unusually high and low, and are omitted from further analysis.

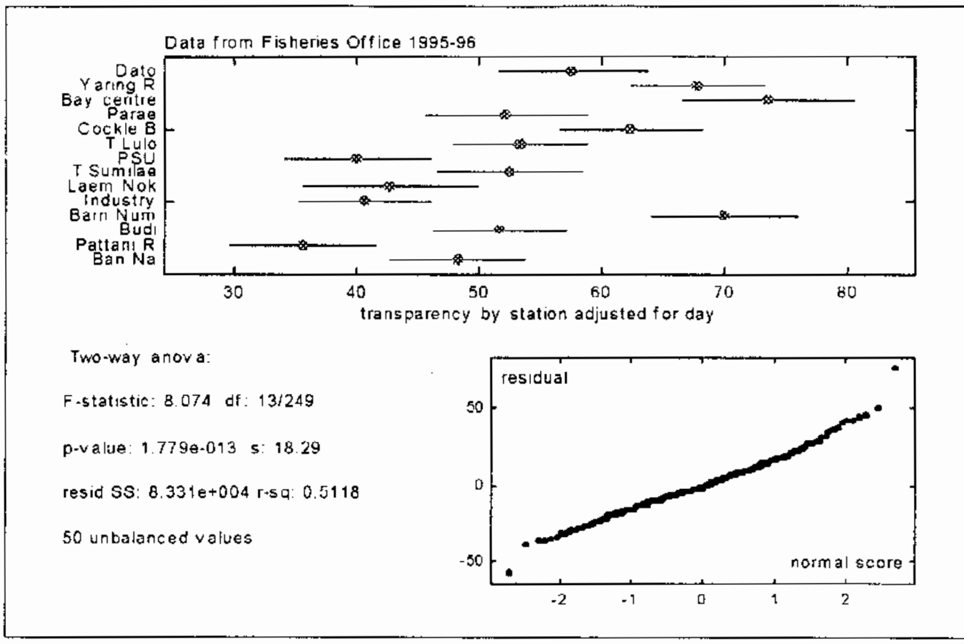


Figure 17: Two-way anova analysis of transparency

Figure 18 shows the two-way anova analysis of alkalinity collected by the Fisheries Office in 1995-96. The differences are statistically significant (p=0.0002). Two of these residuals appear to be unusually high, and are omitted from further analysis.

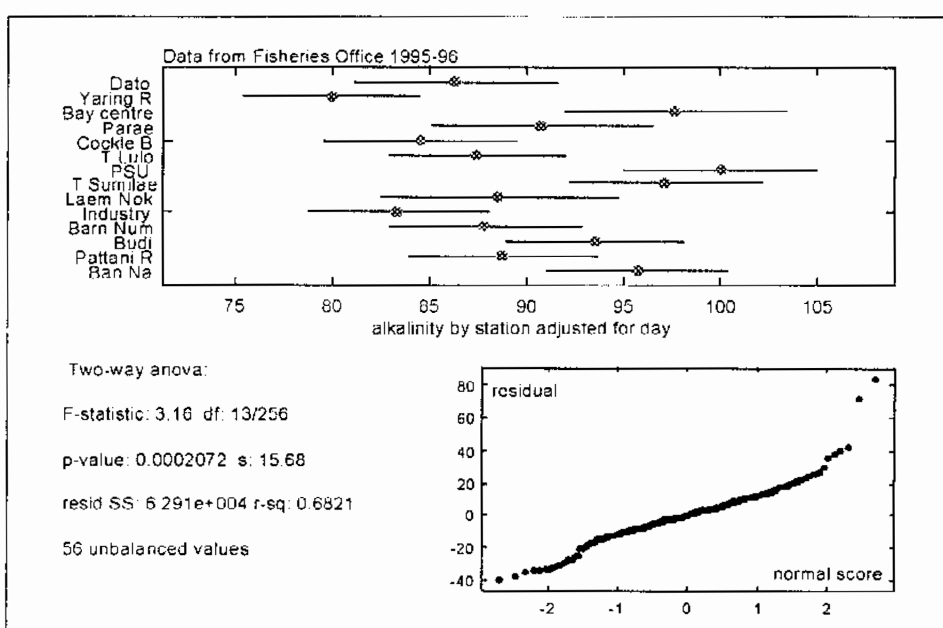


Figure 18: Two-way anova analysis of alkalinity

Figure 19 shows the two-way anova analysis of oxygen collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0.002). One of these residuals appears to be unusually low, and is omitted from further analysis.

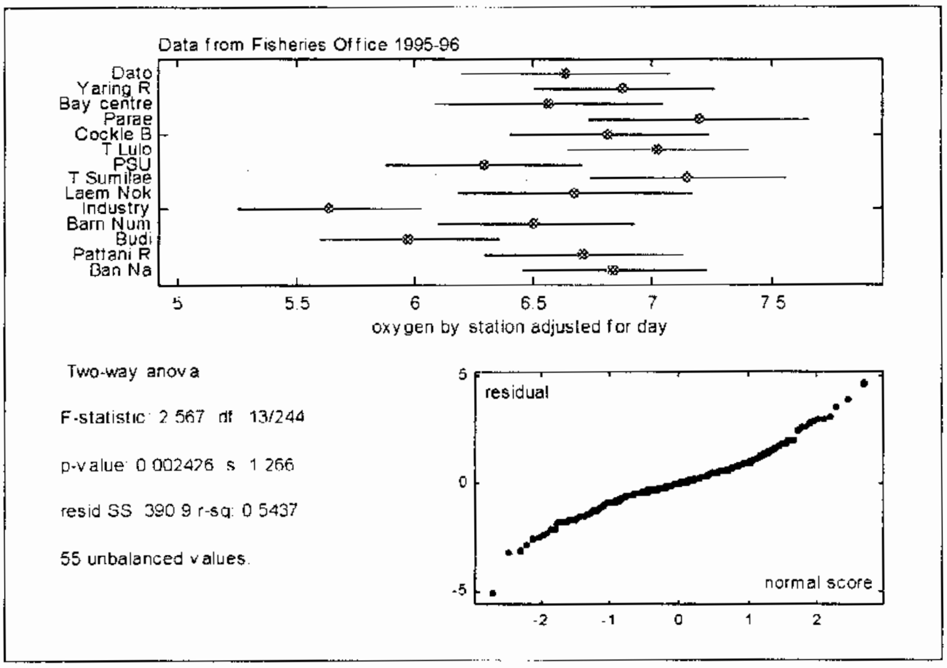


Figure 19: Two-way anova analysis of oxygen

Figure 20 shows the two-way anova analysis of pH collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0). Four of these residuals appear to be unusually low, and are omitted from further analysis.

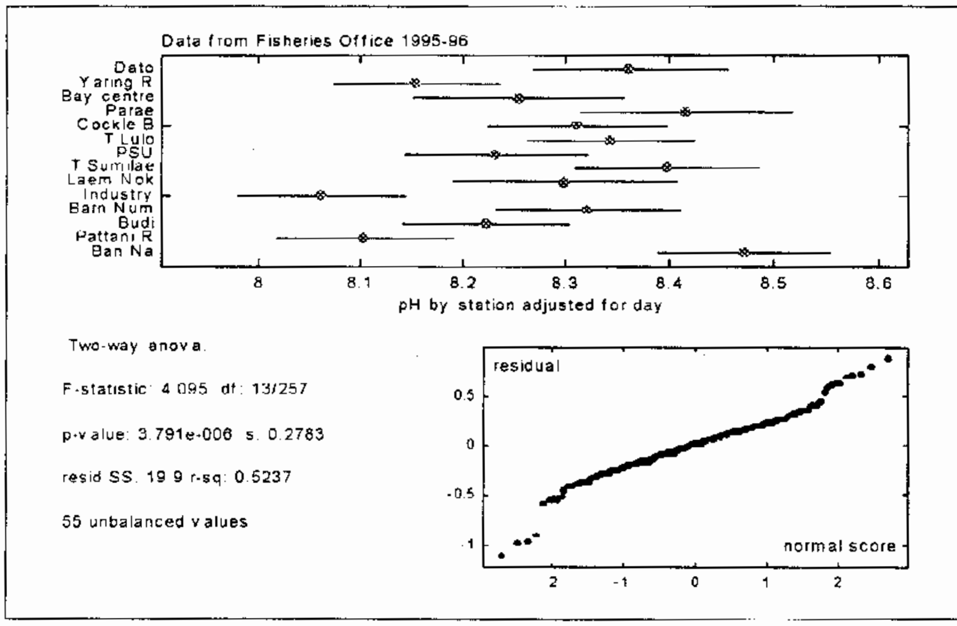


Figure 20: Two-way anova analysis of pH

Figure 21 shows the two-way anova analysis of log2(nitrite) collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0). The station contributing most to this difference is Industry (high). Two of these residuals appear to be unusually high and low, and are omitted from further analysis.

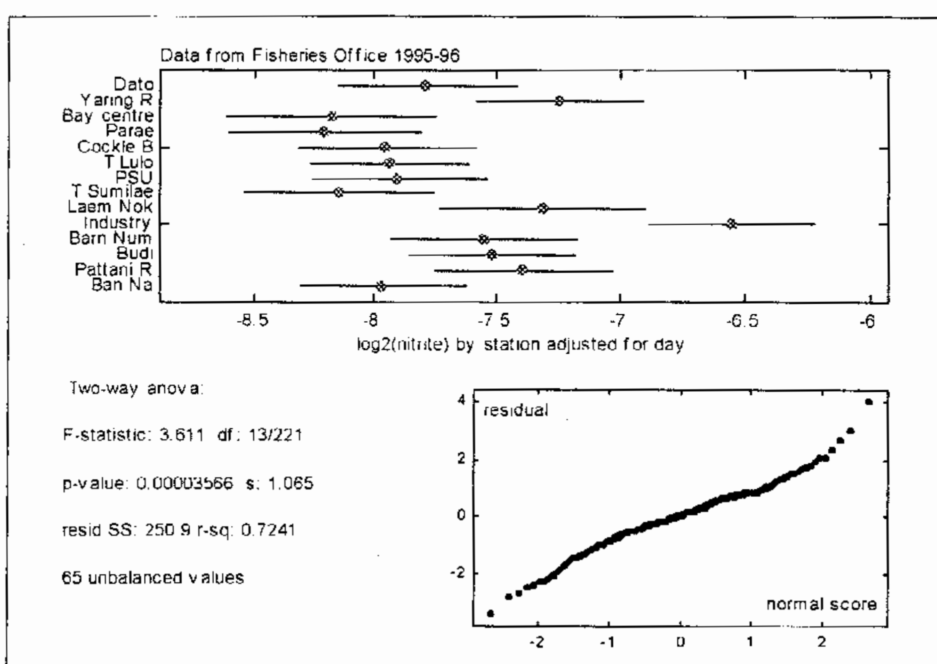


Figure 21: Two-way anova analysis of log2(nitrite)

Figure 22 shows the two-way anova analysis of log2(nitrate) collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0.004). The stations contributing most to this difference are Industry and Yaring R.(high). One of the residuals appears to be unusually low, and is omitted from further analysis.

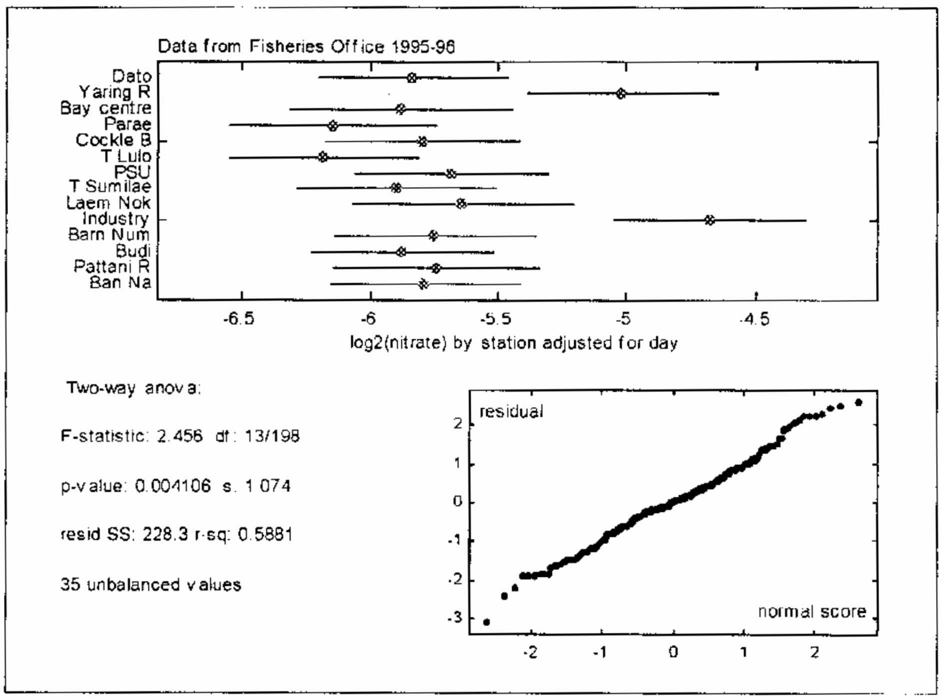


Figure 22: Two-way anova analysis of log2(nitrate)

Figure 23: shows two-way anova analysis of log2(phosphate) collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0.001). The station contributing most to this difference is Bay Centre (low). Three of these residuals appear to be unusually high, and are omitted from further analysis.

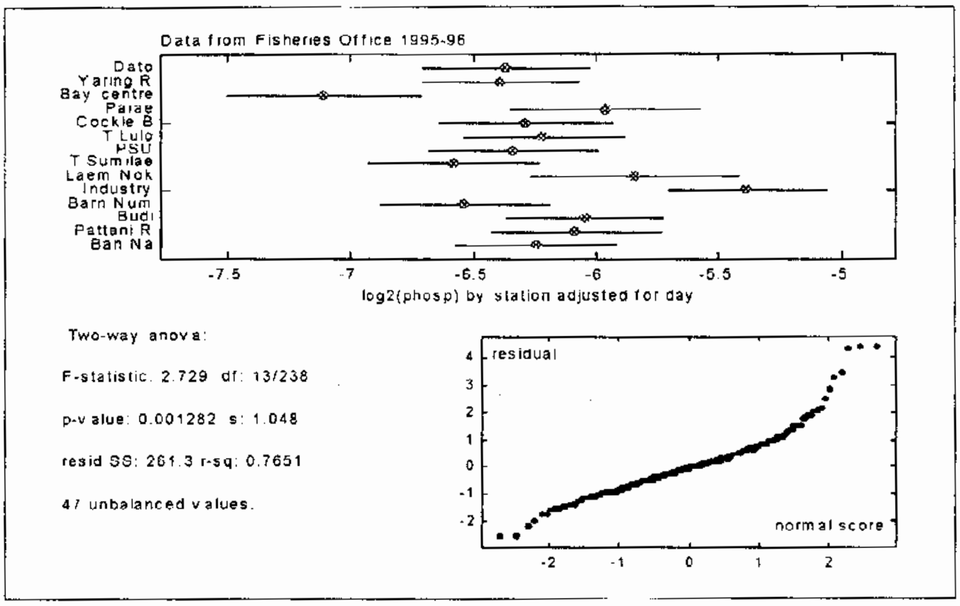


Figure 23: Two-way anova analysis of log2(phosphate)

Figure 24 shows the two-way anova analysis of sqrt(silicate) collected by the Fisheries Office in 1995-96. The differences between stations are highly significant (p=0.005). The stations contributing most to this difference are Industry and Laem Nok (high). Two of these residuals appear to be unusually high and low, and are omitted from further analysis.

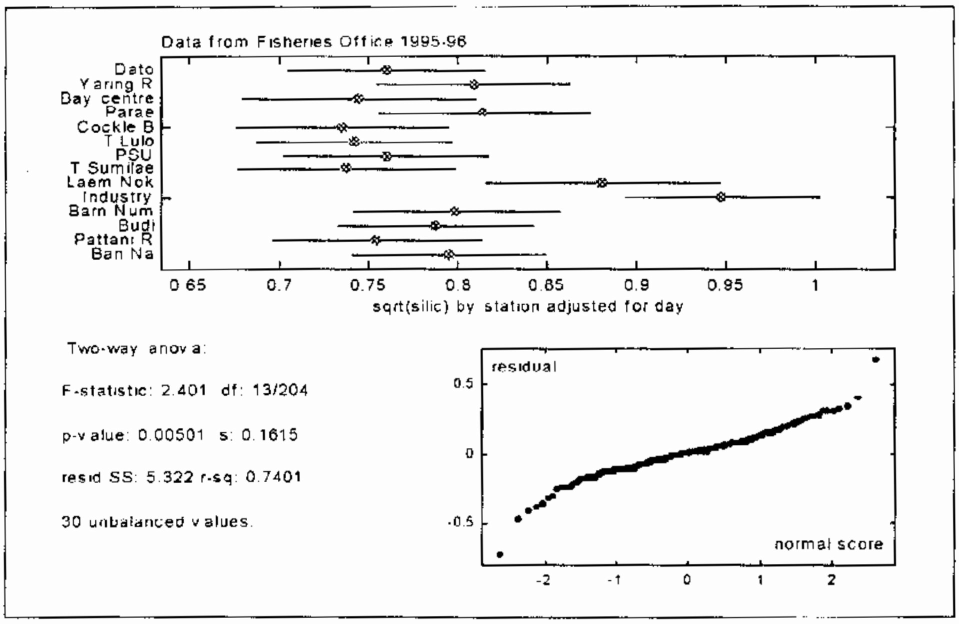


Figure 24: Two-way anova analysis of sqrt(silicate)