CHAPTER 4

STATISTICAL ANALYSIS

In this chapter regression analysis is used instead of two-way analysis of variance to analyze the hydrographic measurements. The advantage of regression analysis is that it gives a more complete summary of the results including the individual day effects and station effects, together with their standard errors. In the two-way analysis of variance results a number of outliers were seen. In the results reported in the present chapter, these outliers are removed before fitting the regression models, giving more stable results. This chapter concludes with separate analyses of the day and station effects, from which the temporal and spatial patterns are evident.

Regression analysis

Figure 25 shows the results from fitting the regression model to the temperature readings. The p-value indicates significant differences between stations at the 0.05 level ($p=0.036$). The highest temperature occurs in March and the lowest occurs in February. This contrasts with the result obtained from the two-way anova. The difference is due to the fact that outliers are omitted in the regression analysis. With the outliers omitted, the normality assumption is more reasonable.

linear regression analysis: response = temperature

predictor	coeff	St. Error	p-value
constant	30	0.3019	0
StationID			0.03578
Dato	(0)		
Yaring R	-0.5861	0.2644	0.02771
Bay centre	-0.9646	0.3023	0.001642
Parae	-0.1748	0.2951	0.5543
Cockle B	-0.5297	0.2718	0.05266
T Lulo	-0.4514	0.262	0.08635
PSU	-0.8305	0.2799	0.003359
T Sumilae	-0.5934	0.2759	0.03264
Laem Nok	-0.0865	0.3107	0.7834
Industry	-0.2241	0.2652	0.399
Barn Num	-0.7678	0.2761	0.005916
Budi	-0.499	0.262	0.05817
Pattani R	-0.4392	0.2726	0.1087
Ban Na	-0.3085	0.262	0.2402
day			0
88	(0)		
108	1.871	0.3452	1.654e-007
122	1.047	0.3545	0.003508
151	1.184	0.3545	0.0009944
165	0.3257	0.3441	0.345
178	0.4902	0.3452	0.1571
201	0.759	0.3671	0.03993
213	-0.04692	0.3267	0.8866
229	-0.7136	0.3287	0.03109
241	-1.88	0.3287	3.696e-008
263	0.7633	0.3374	0.02473
303	0.4797	0.3362	0.1551
321	-3.301	0.3373	0
333	-0.4373	0.322	0.176
348	-2.599	0.3285	1.501e-013
369	-2.322	0.3172	5.356e-012
382	-1.251	0.3172	0.0001101
402	-4.596	0.3373	0
431	-0.5363	0.3172	0.09238
445	2.321	0.3172	5.465e-012
507	-0.02139	0.323	0.9473

r-sq: 0.8442 rss: 127.2 df: 207 sd: 0.7838 p-value: 0

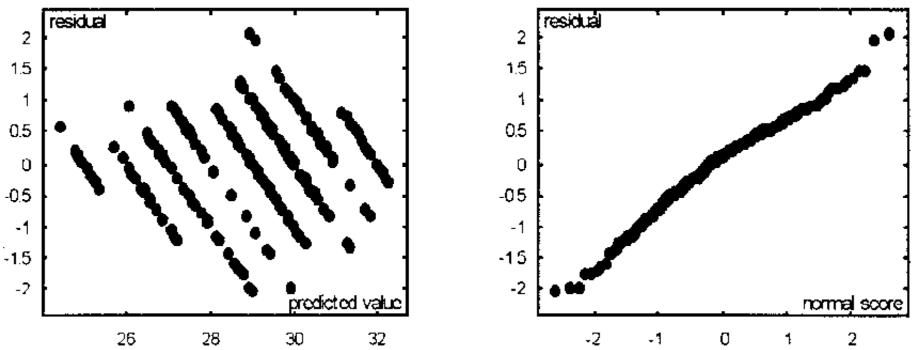


Figure 25: Linear regression analysis of temperature from Pattani Bay in 1995-96

Figure 26 shows the linear regression analyses of salinity. As in the case of the two-way anova, the p-value indicates significant differences between stations at the 0.05 level (p=0), the highest salinity occurs in June and the lowest occurs in November. The normality assumption is valid, after omitting the outliers shown in Figure 16.

linear regression analysis: response = salinity

predictor	coeff	St. Error	p-value
constant	28.33	1.829	0
StationID			1.467e-011
Dato	(0)		
Yaring R	-1.921	1.348	0.1555
Bay centre	4.43	1.515	0.003773
Parae	0.9764	1.511	0.5186
Cockle B	0.7698	1.406	0.5843
T Lulo	2.679	1.348	0.048
PSU	8.95	1.409	9.67e-010
T Sumilae	2.516	1.412	0.07598
Laem Nok	3.793	1.574	0.01666
Industry	1.396	1.375	0.3109
Barn Num	4.1	1.409	0.003925
Budi	3.519	1.348	0.009594
Pattani R	1.949	1.431	0.1745
Ban Na	4.013	1.369	0.00345
day			0
76	(0)		
88	-2.784	1.977	0.1603
108	-3.07	2.019	0.1296
122	-1.559	2.118	0.4625
151	-3.548	2.124	0.09611
165	-6.468	2.118	0.002504
178	-8.552	2.068	0.00004803
201	-9.08	2.067	0.00001644
213	-10.66	1.983	1.718e-007
229	-13.41	1.983	9.216e-011
241	-18.24	2.025	0
263	-18.58	2.08	0
303	-12.58	2.024	2.079e-009
321	-27.54	2.074	0
333	-24.27	1.947	0
348	-18.24	1.962	0
369	-18.7	1.92	0
382	-8.561	1.92	0.00001242
402	-0.7134	2.03	0.7238
431	-2.346	1.92	0.2229
445	-1.561	1.92	0.4171
472	-1.061	1.92	0.5812
485	-3.275	1.92	0.08933
493	3.368	1.92	0.08066
507	-8.878	1.952	8.359e-006

r-sq: 0.8045 rss: 5072 df: 254 sd: 4.469 p-value: 0

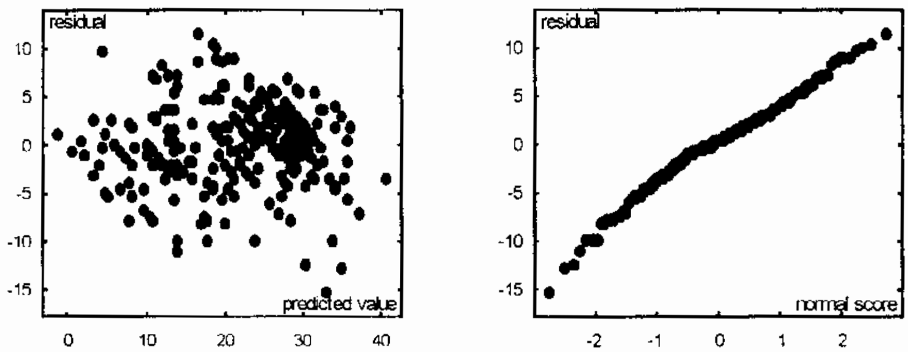


Figure 26: Linear regression analysis of salinity from Pattani Bay in 1995-96

Figure 27 shows the linear regression analyses of transparency. The p-value indicates significant differences between stations at the 0.05 level (p=0). The highest transparency occurs in June and the lowest occurs in November. The normal scores plot shows that omitting the two outliers appearing in Figure 17 has validated the normality assumption.

linear regression analysis: response = transparency

predictor	coeff	St.Error	p-value
constant	72.51	6.194	0
StationID			8.882e-016
Dato	(0)		
Yaring R	9.853	5.23	0.06072
Bay Centre	20.63	6.058	0.0007692
Parae	-5.784	5.814	0.3207
Cockle B	0.4108	5.477	0.9403
T Lubo	-4.522	5.23	0.3881
PSU	-17.84	5.48	0.00129
T Sumilae	-5.486	5.491	0.3187
Laem Nok	-15.01	6.057	0.01388
Industry	-17.23	5.23	0.00113
Barn Num	12.4	5.48	0.02454
Budi	-6.272	5.23	0.2316
Pattani R	-22.39	5.494	0.00006201
Ban Na	-9.73	5.23	0.064
day			1.11e-016
88	(0)		
108	-11.83	7.205	0.102
122	10.04	7.612	0.1885
151	-10.27	7.89	0.1944
165	-17.43	7.382	0.01898
178	-22.31	7.402	0.002841
201	-28.98	7.382	0.0001121
213	-23.63	7.04	0.0009127
229	-34.88	7.04	1.344e-006
241	-24.05	7.04	0.0007428
263	-45.1	7.226	1.874e-009
303	-25.94	7.205	0.0003842
321	-26.96	7.224	0.0002363
333	-21.73	6.893	0.001819
348	3.775	7.037	0.5921
369	-25.66	6.782	0.000194
382	-8.947	6.909	0.1966
402	-6.137	7.424	0.4092
431	-9.231	6.782	0.1747
445	-4.945	6.782	0.4666
472	-2.731	6.782	0.6875
485	-18.16	6.782	0.007909
493	-6.374	6.782	0.3482
507	4.666	6.909	0.5

r-sq: 0.5441 rss: 7.303e+004 df: 247 sd: 17.19 p-value: 0

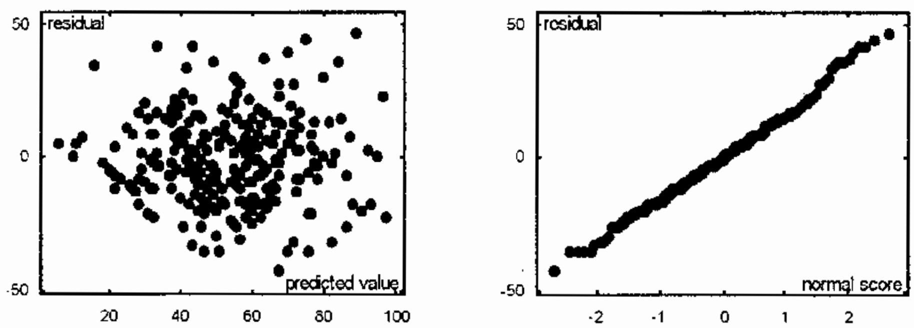


Figure 27: Linear regression analysis of transparency from Pattani Bay in 1995-96

Figure 28 shows the linear regression analyses of alkalinity. The p-value indicates significant differences between stations at the 0.05 level (p=0), the highest alkalinity occurs in June and the lowest occurs in November. Again, the omission of the outliers shown in Figure 18 gives a better approximation to normality.

linear regression analysis: response = alkalinity

predictor	coeff	St. Error	p-value
constant	71.93	5.975	0
StationID			2.333e-007
Dato	(0)		
Yaring R	-9.751	4.299	0.02415
Bay centre	12.39	4.772	0.009956
Parae	4.722	4.757	0.3218
Cockle B	-1.324	4.442	0.7659
T Lujo	1.483	4.256	0.7276
PSU	14.33	4.442	0.001421
T Sumilae	11.45	4.452	0.0107
Laem Nok	2.686	4.953	0.588
Industry	-3	4.289	0.4849
Barn Num	2.038	4.442	0.6469
Budi	4.208	4.289	0.3275
Pattani R	2.981	4.398	0.4984
Ban Na	9.375	4.289	0.02975
day			0
76	(0)		
88	36.21	6.494	6.289e-008
108	38.09	6.497	1.407e-008
122	36.58	6.798	1.686e-007
151	37.69	6.819	8.016e-008
165	28.5	6.625	0.00002427
178	30.49	6.646	7.03e-006
201	19.84	6.644	0.0031
213	23.03	6.39	0.0003767
229	6.365	6.39	0.3201
241	3.032	6.39	0.6356
253	-1.659	6.536	0.7998
303	-7.147	6.514	0.2736
321	-31.62	6.533	2.258e-006
333	-29.61	6.279	3.989e-006
346	-8.38	6.387	0.1907
369	-12.28	6.28	0.05168
382	13.18	6.2	0.03454
402	24.51	6.533	0.0002178
431	33.97	6.294	1.551e-007
445	36.6	6.2	1.132e-008
472	24.82	6.2	0.00008213
485	21.39	6.2	0.0006562
493	28.46	6.2	6.956e-006
507	4.725	6.296	0.4537

r-sq: 0.732 rss: 4.901e+004 df: 254 sd: 13.89 p-value: 0

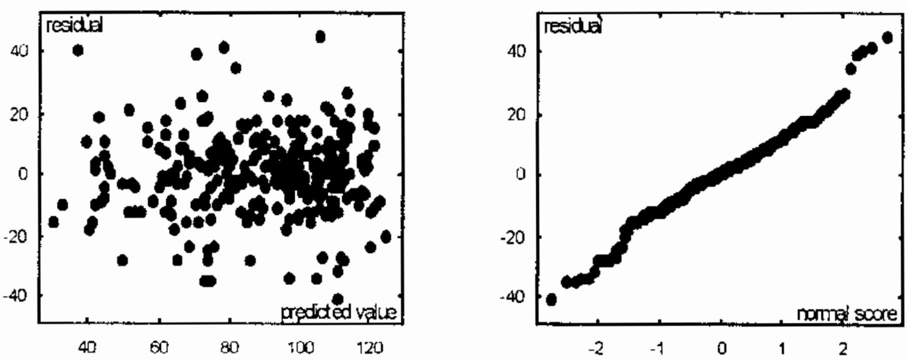


Figure 28: Linear regression analysis of alkalinity from Pattani Bay in 1995-96

Figure 29 shows the linear regression analyses of oxygen. The p-value indicates significant differences between stations at the 0.05 level (p=0.0002). The highest and lowest oxygen occurs in August. Omitting the single (low) outlier shown in Figure 19 has clearly improved the normal scores plot.

linear regression analysis: response = oxygen

predictor	coeff	St. Error	p-value
constant	6.086	0.4465	0
StationID			0.0002125
Dato	(0)		
Yaring R	0.4276	0.3404	0.2103
Bay centre	0.06614	0.382	0.8627
Parae	0.7642	0.3747	0.04251
Cockle B	0.09728	0.3596	0.787
T Lulo	0.3633	0.3442	0.2965
PSU	-0.1473	0.3555	0.6791
T Sumilae	0.5117	0.3617	0.1584
Laem Nok	-0.06416	0.3973	0.8718
Industry	-0.8088	0.343	0.0192
Barn Num	-0.1434	0.3597	0.6904
Budi	-0.4787	0.3404	0.1609
Pattani R	0.2119	0.3668	0.5632
Ban Na	0.435	0.3503	0.2156
day			0
76	(0)		
108	-0.9979	0.4812	0.03918
122	-1.367	0.5048	0.007245
151	-1.372	0.5064	0.007223
165	-1.24	0.5049	0.01474
178	-1.711	0.4928	0.0006127
201	-1.863	0.4927	0.0001973
213	2.089	0.544	0.0001813
229	0.6475	0.4914	0.1899
241	1.162	0.4727	0.01464
263	1.234	0.4842	0.01142
303	0.5232	0.4942	0.2908
321	0.5058	0.4839	0.297
333	-0.4019	0.4712	0.3945
346	1.939	0.4725	0.00005612
369	0.6604	0.4577	0.1504
382	1.725	0.4577	0.0002077
402	0.5539	0.4839	0.2288
431	-0.01821	0.4577	0.9683
445	-0.2253	0.4577	0.6229
472	0.3532	0.4577	0.441
485	1.26	0.4577	0.006346
493	1.668	0.4577	0.0003308
507	1.348	0.4726	0.004735

r-sq: 0.5971 rss: 267.5 df: 236 sd: 1.065 p-value: 0

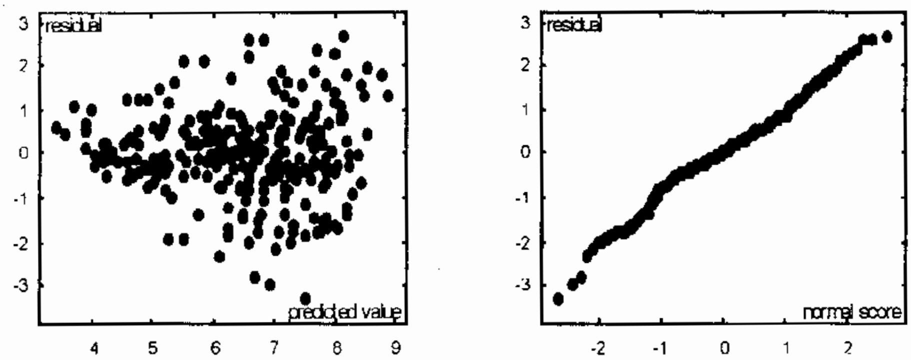


Figure 29: Linear regression analysis of oxygen from Pattani Bay in 1995-96

Figure 30 show the linear regression analyses of pH. The p-value indicates significant differences between stations at the 0.05 level (p=0). The highest pH occurs in March and the lowest occurs in November. Omitting the four low outliers shown in Figure 20 improves the normal scores plot markedly.

linear regression analysis: response = pH

predictor	coeff	St. Error	p-value
constant	8.356	0.1006	0
StationID			5.552e-007
Dato	(0)		
Yaring R	-0.1129	0.07616	0.1395
Bay centre	-0.1173	0.08376	0.1626
Parae	0.06005	0.08353	0.4729
Cockle B	-0.009095	0.07798	0.9073
T Lulo	-0.02777	0.07473	0.7105
PSU	-0.1363	0.07798	0.08054
T Sumilae	0.02415	0.07817	0.7576
Laem Nok	-0.07315	0.08696	0.401
Industry	-0.3087	0.07531	0.00005606
Bam Num	-0.05399	0.078	0.4894
Budi	-0.1486	0.07473	0.04787
Pattani R	-0.2223	0.07796	0.004707
Ban Na	0.09966	0.07531	0.1869
day			0
76	(0)		
88	0.1401	0.1079	0.1954
108	0.1633	0.1102	0.1396
122	0.02108	0.1193	0.86
151	0.2212	0.1159	0.05748
165	0.2846	0.1125	0.01203
178	-0.02535	0.1128	0.8224
201	0.253	0.1128	0.02578
213	-0.223	0.1082	0.04033
229	-0.1322	0.1082	0.223
241	-0.1455	0.1082	0.1799
263	-0.2411	0.1108	0.03047
303	-0.2144	0.1105	0.05336
321	-0.8162	0.1106	2.434e-012
333	0.1216	0.1104	0.2717
348	0.1696	0.1082	0.1182
369	-0.04575	0.1082	0.6728
382	-0.1392	0.1048	0.1854
402	-0.1594	0.1103	0.1514
431	0.293	0.1048	0.005574
445	0.3316	0.1048	0.001747
472	0.3273	0.1048	0.001996
485	-0.1634	0.1048	0.1201
493	0.1008	0.1048	0.3368
507	0.1411	0.1065	0.1865

r-sq: 0.5817 rss: 15.05 df: 253 sd: 0.2439 p-value: 0

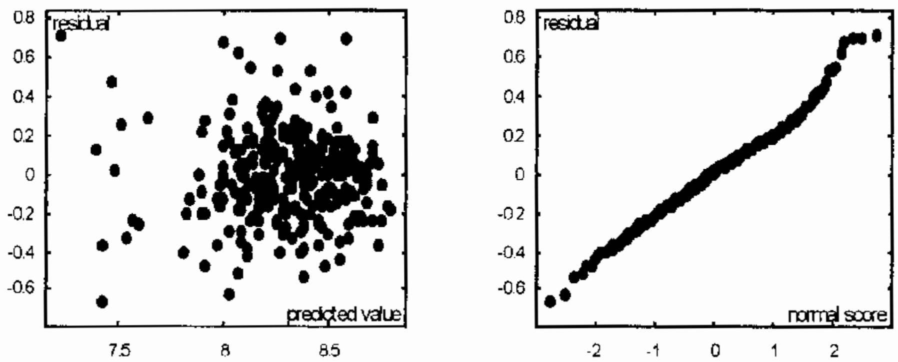


Figure 30: Linear regression analysis of pH from Pattani Bay in 1995-96

Figure 31 show the linear regression analyses of log2 (nitrite). The p-value indicates significant differences between stations at the 0.05 level (p=0.00003). The highest log2 (nitrite) occurs in August and the lowest occurs in March. Omitting the outliers shown in Figure 21 improves the normal scores plot.

linear regression analysis: response = log2(nitrite)

predictor	coeff	St. Error	p-value
constant	-7.481	1.079	4.598e-011
StationID			0.00003121
Dato	(0)		
Yaring R	0.3273	0.3367	0.3321
Bay centre	-0.4001	0.3794	0.2928
Parae	-0.4317	0.3631	0.2357
Cockle B	-0.1633	0.3446	0.6361
T Lulo	-0.1632	0.3284	0.6198
PSU	-0.1098	0.3415	0.7482
T Sumilae	-0.3946	0.3574	0.2708
Laem Nok	0.4439	0.3708	0.2326
Industry	1.238	0.3284	0.0002112
Barn Num	0.2366	0.3501	0.4999
Budi	0.2742	0.3324	0.4103
Pattani R	0.4052	0.3414	0.2365
Ban Na	-0.1736	0.3324	0.6023
day			0
76	(0)		
108	0.9127	1.099	0.4072
151	-0.01166	1.11	0.9916
165	-1.131	1.11	0.3095
178	0.5519	1.099	0.6159
201	1.378	1.099	0.211
213	0.8294	1.091	0.448
229	1.03	1.091	0.3463
241	2.469	1.091	0.02463
263	1.399	1.095	0.2025
303	0.131	1.095	0.9049
321	1.749	1.095	0.1116
333	1.51	1.088	0.1666
348	-0.6045	1.086	0.5813
369	-0.06822	1.086	0.9499
382	-1.557	1.086	0.1528
402	-1.165	1.095	0.2884
431	-2.07	1.095	0.05993
445	-2.515	1.086	0.02144
472	-2.045	1.086	0.06093
485	-2.005	1.088	0.06678
493	-2.145	1.091	0.05054
507	-1.845	1.088	0.09134

r-sq: 0.7384 rss: 232.6 df: 220 sd: 1.028 p-value: 0

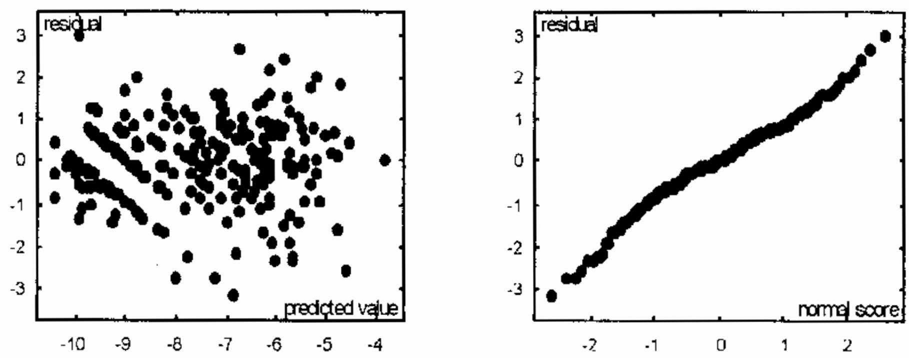


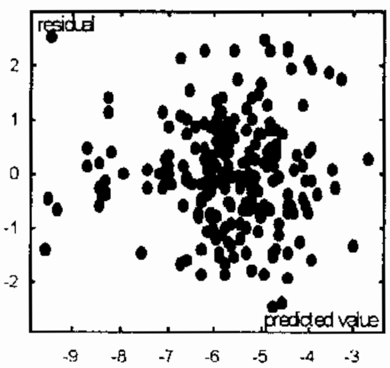
Figure 31: Linear regression analysis of log2 (nitrite) from Pattani Bay in 1995-96

Figure 32 shows the linear regression analyses of log2 (nitrate). The p-value indicates significant differences between stations at the 0.05 level (p=0.00045). The highest log2 (nitrate) occurs in August and the lowest occurs in March. A single high outlier has been omitted, based on the analyses shown in Figure 22.

linear regression analysis: response = log2(nitrate)

predictor	coeff	St. Error	p-value
constant	-7.866	1.113	2.697e-011
StationID			0.0004516
Dato	(0)		
Yaring R	0.8163	0.3499	0.02067
Bay centre	-0.06098	0.3848	0.8743
Parae	-0.3237	0.3685	0.3808
Cockle B	0.02273	0.3574	0.9494
T Lulo	-0.3495	0.3499	0.3191
PSU	0.1412	0.3574	0.6932
T Sumilae	-0.09944	0.3707	0.7888
Laem Nok	0.1856	0.3848	0.6301
Industry	1.35	0.3554	0.0001937
Barn Num	0.08398	0.3616	0.8166
Budi	-0.04607	0.3465	0.8944
Pattani R	0.08766	0.3685	0.8122
Ban Na	0.04472	0.3499	0.8984
day			0
151	(0)		
165	-1.604	1.196	0.1816
178	2.609	1.138	0.02287
213	1.963	1.124	0.08214
229	2.122	1.124	0.06045
241	3.04	1.124	0.007414
263	1.854	1.133	0.1035
303	3.791	1.133	0.0009836
321	3.522	1.127	0.002048
333	3.095	1.121	0.006293
348	0.789	1.129	0.4855
369	1.212	1.118	0.2797
382	2.119	1.118	0.05956
402	1.99	1.127	0.07899
431	2.441	1.121	0.03062
445	2.753	1.118	0.01468
472	-0.5043	1.118	0.6525
485	1.803	1.118	0.1086
493	1.621	1.118	0.1487
507	2.62	1.121	0.02041

r-sq: 0.6055 rss: 217.1 df: 197 sd: 1.05 p-value: 0



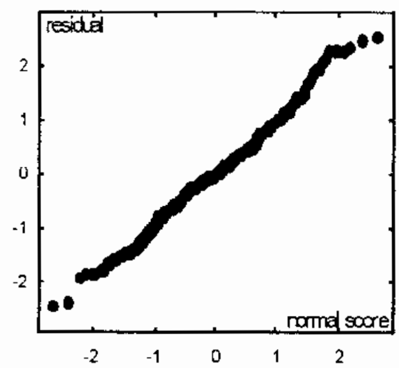


Figure 32: Linear regression analysis of log2 (nitrate) from Pattani Bay in 1995-96

Figure 33 shows the linear regression analyses of log2 (phosphate). The p-value indicates significant differences between stations at the 0.05 level (p=0.000065). The highest log2 (phosphate) occurs in July and the lowest occurs in March. Omitting the three high outliers shown in Figure 23 improves the normal scores plot.

linear regression analysis: response = log2(phosp)

predictor	coeff	St.Error	p-value
constant	-10.94	0.4054	0
StationID			0.00006563
Dato	(0)		
Yaring R	0.02371	0.2775	0.932
Bay centre	-0.6759	0.312	0.03129
Parae	0.08569	0.3118	0.7837
Cockle B	-0.1663	0.2952	0.5737
T Lulo	-0.05045	0.2835	0.8589
PSU	0.0605	0.2883	0.834
T Sumlac	-0.1581	0.2924	0.5892
Laem Nok	0.53	0.3252	0.1045
Industry	1.017	0.28	0.0003447
Barn Num	-0.1374	0.2882	0.634
Budi	0.3679	0.2775	0.1863
Pattani R	0.3199	0.2882	0.2682
Ban Na	0.1223	0.28	0.6626
day			0
76	(0)		
88	6.322	0.4475	0
151	3.017	0.4618	3.923e-010
165	7.053	0.4482	0
178	5.549	0.4493	0
201	4.061	0.4506	0
213	5.968	0.4345	0
229	6.596	0.4345	0
241	6.252	0.4345	0
263	6.075	0.4428	0
303	6.292	0.4424	0
321	6.684	0.4425	0
333	5.441	0.4273	0
348	3.401	0.4342	1.639e-013
369	0.8705	0.4224	0.04042
382	3.708	0.4224	4.441e-016
402	3.954	0.4519	4.441e-016
431	4.213	0.4224	0
445	3.493	0.4224	9.992e-015
472	2.935	0.4224	3.582e-011
485	4.2	0.4224	0
493	3.108	0.4224	3.099e-012
507	6.298	0.4285	0

r-sq: 0.8239 rss: 192.1 df: 235 sd: 0.9042 p-value: 0

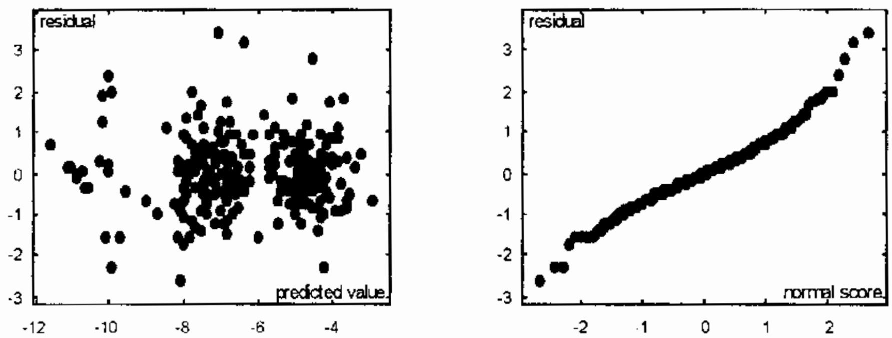


Figure 33: Linear regression analysis of log2(phosphate) from Pattani Bay in 1995-96

Figure 34 shows the linear regression analyses of sqrt(silicate). The p-value indicates significant differences between stations at the 0.05 level (p=0.00028). The highest sqrt(silicate) occurs in July and the lowest occurs in March. The normality assumption is valid, after omitting the outliers shown in Figure 24.

linear regression analysis: response = sqrt(silic)

predictor	coeff	St.Error	p-value
constant	0.7878	0.05742	0
StationID			0.0002822
Dato	(0)		
Yaring R	0.04886	0.04702	0.3001
Bay centre	0.05463	0.05367	0.3099
Parae	0.0552	0.04932	0.2644
Cockle B	-0.02608	0.04919	0.5965
T Lulo	-0.01786	0.04702	0.7045
PSU	-0.005621	0.04849	0.9078
T Sumilae	-0.02227	0.05027	0.6582
Laem Nok	0.1243	0.05233	0.01847
Industry	0.1879	0.04702	0.00008043
Barn Num	0.03474	0.04848	0.4744
Budi	0.02765	0.04702	0.5572
Pattani R	-0.01097	0.04934	0.8243
Ban Na	-0.007182	0.04772	0.8805
day			0
178	(0)		
201	-0.07355	0.06425	0.2537
213	-0.001774	0.0613	0.9769
229	-0.1188	0.0613	0.054
241	0.2525	0.0613	0.00005556
263	-0.09652	0.06268	0.1252
303	0.4986	0.0631	1.741e-013
321	-0.3557	0.0629	5.272e-008
333	-0.4025	0.0605	2.649e-010
348	-0.07029	0.06151	0.2545
369	-0.4418	0.05945	2.971e-012
382	-0.2366	0.05945	0.00009686
402	-0.1715	0.0647	0.008687
431	0.2299	0.05945	0.0001483
445	0.3312	0.0603	1.189e-007
472	0.3282	0.05945	1.031e-007
485	-0.03276	0.05945	0.5822
493	-0.1417	0.05945	0.01805
507	-0.0186	0.06049	0.7588

r-sq: 0.7925 rss: 4.117 df: 202 sd: 0.1428 p-value: 0

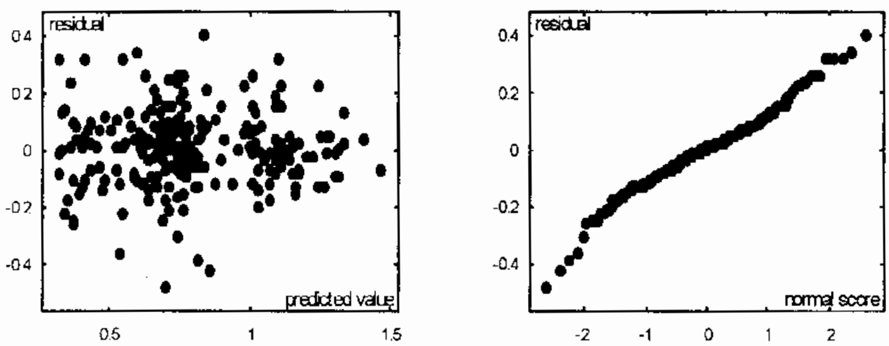


Figure 34: Linear regression analysis of sqrt(silicate) from Pattani Bay in 1995-96

Table 1 shows the day effects in the fitted models, using the Dato station as a referent value. This table shows the seasonal variation in the hydrographic variables. The cells containing the minimum and maximum values are shaded.

Table 1 also shows the day of variables that have minimum and maximum value, so that the minimum and maximum value of temperature occurred in February and March, salinity occurred in November and May, transparency occurred in September and May, alkalinity occurred in November and June, oxygen occurred in July and August, pH occurred in November and March, nitrite occurred in March and August, nitrate occurred in June and October, phosphate occurred in January and June, silicate occurred in January and October.

Table 1: The predicted value of the hydrographic variables at Dato

Day	Date	Temp.	Sali.	Trans.	Alk.	Oxygen	pH	log2 (Nitri)	log2 (nitra)	log2 (phos)	sqrt (silicate)
76	Mar.17		28.3		71.9	6.09	8.36	-7.48		-10.94	
88	Mar. 29	30.0	25.5	72.5	108.1		8.50			-4.62	
108	Apr. 18	31.9	25.3	60.7	110.0	5.09	8.52	-6.57			
122	May 2	31.0	26.8	82.6	108.5	4.72	8.38				
151	May 31	31.2	24.8	62.2	109.6	4.71	8.58	-7.49	-7.87	-7.92	
165	Jun. 14	30.3	21.9	55.1	100.5	4.85	8.64	-8.61	-9.47	-3.89	
178	Jun. 27	30.5	19.8	50.2	102.4	4.38	8.33	-6.93	-5.26	-5.39	0.79
201	Jul. 20	30.8	19.3	43.5	91.8	4.22	8.61	-6.10		-6.88	0.71
213	Aug. 1	30.0	17.7	48.9	95.0	8.16	8.13	-6.65	-5.90	-4.97	0.79
229	Aug. 17	29.3	14.9	37.6	78.3	6.73	8.22	-6.45	-5.74	-4.34	0.67
241	Aug. 29	28.1	10.1	48.5	75.0	7.25	8.21	-5.01	-4.83	-4.69	1.04
263	Sept. 20	30.8	9.8	27.4	70.2	7.32	8.11	-6.08	-6.01	-4.87	0.69
303	Oct. 30	30.5	15.8	46.6	64.8	6.61	8.14	-7.35	-4.08	-4.65	1.29
321	Nov. 17	26.7	0.8	45.6	40.3	6.59	7.54	-5.73	-4.34	-4.26	0.43
333	Nov. 29	29.6	4.1	50.8	42.3	5.68	8.48	-5.97	-4.77	-5.50	0.39
348	Dec. 14	27.4	10.1	76.3	63.6	8.03	8.53	-8.09	-7.08	-7.54	0.72
369	Jan. 4	27.7	9.6	46.9	59.7	6.75	8.31	-7.55	-6.65	-10.07	0.35
382	Jan. 17	28.7	19.8	63.6	85.1	7.81	8.22	-9.04	-5.75	-7.23	0.55
402	Feb. 6	25.4	28.1	66.4	96.4	6.67	8.20	-8.65	-5.88	-6.99	0.62
431	Mar. 7	29.5	26.0	63.3	105.9	6.07	8.65	-9.55	-5.43	-6.73	1.02
445	Mar. 21	32.3	26.8	67.6	108.5	5.86	8.69	-10.00	-5.11	-7.45	1.12
472	Apr. 27		27.3	69.8	96.8	6.44	8.68	-9.53	-8.37	-8.01	1.12
485	May 10		25.1	54.4	93.3	7.35	8.19	-9.49	-6.06	-6.74	0.76
493	May 18		31.7	66.1	100.4	7.75	8.46	-9.63	-6.25	-7.83	0.65
507	Jun. 1	30.0	19.5	77.2	119.2	7.43	8.50	-9.33	-5.25	-4.65	0.77
	Range	***6.9***	***30.9***	***55.2***	***78.9***	***3.94***	***1.15***	***4.99***	***5.39***	***7.18***	***0.94***

Table 2 shows the variations between the station at the various locations in the Bay, expressed differences from the referent values at Dato shown in Table 1.

Table 2: Spatial variation in hydrographic variables on January 4, 1996 (From Dato)

Station	Temp.	Salin.	Trans.	Alk.	O_2	pH	log2 (nitri.)	log2 (nitra.)	log2 (phos.)	sqrt (silic.)
Dato	27.7	9.6	46.9	59.7	6.75	8.31	-7.55	-6.65	-10.07	0.35
Yaring River	-0.6	-1.9	9.9	-9.8	0.43	-0.11	0.33	0.82	0.02	0.05
Bay Centre	-1.0	4.4	20.6	12.4	0.07	-0.12	-0.40	-0.06	-0.68	0.05
Parae	-0.2	1.0	-5.8	4.7	0.76	0.06	-0.43	-0.32	0.09	0.06
Cockle Bed	-0.5	0.8	0.4	-1.3	0.10	-0.01	-0.16	0.02	-0.17	-0.03
Tunyong Lulo	-0.5	2.7	-4.5	1.5	0.38	-0.03	-0.16	-0.35	-0.05	-0.02
PSU	-0.8	9.0	-17.8	14.3	-0.15	-0.14	-0.11	0.14	0.06	-0.01
Talo Samilae	-0.6	2.5	-5.5	11.5	0.51	0.02	-0.39	-0.10	-0.16	-0.02
Laem Nok	-0.1	3.8	-15.0	2.7	-0.06	-0.07	0.44	0.19	0.53	0.12
Industry	-0.2	1.4	-17.2	-3.0	-0.81	-0.31	1.24	1.35	1.02	0.19
Barn Num	-0.8	4.1	12.4	2.0	-0.14	-0.05	0.24	0.08	-0.14	0.03
Budi	-0.5	3.5	-6.3	4.2	-0.48	-0.15	0.27	-0.05	0.37	0.03
Pattani River	-0.4	1.9	-22.4	2.9	0.21	-0.22	0.41	0.09	0.32	-0.01
Ban Na	-0.3	4.0	-9.7	9.4	0.44	0.10	-0.17	0.04	0.12	-0.01
range	***1.0***	***10.9***	***43.0***	***24.1***	***1.57***	***0.41***	***1.67***	***1.70***	***1.70***	***0.21***

Table 2 shows that extreme values for six variables (minimum values for oxygen and pH, and maximum values for nitrite, nitrate, phosphate and silicate) occur at the Industry location. Transparency also reaches a low value on occasion at this site.

Figure 35 shows how the temperature predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is fairly smooth with the exception of three occasions. On days 263 (September 20, 1995), 303 (October 30, 1995) and 333 (November 29, 1995) unusually high temperatures were recorded, while on day 402 (February 6, 1996) unusually low temperatures were recorded. Not surprisingly, the peak temperatures occurred during summer on days 108 (April 18, 1995) and 445 (March 21, 1996).

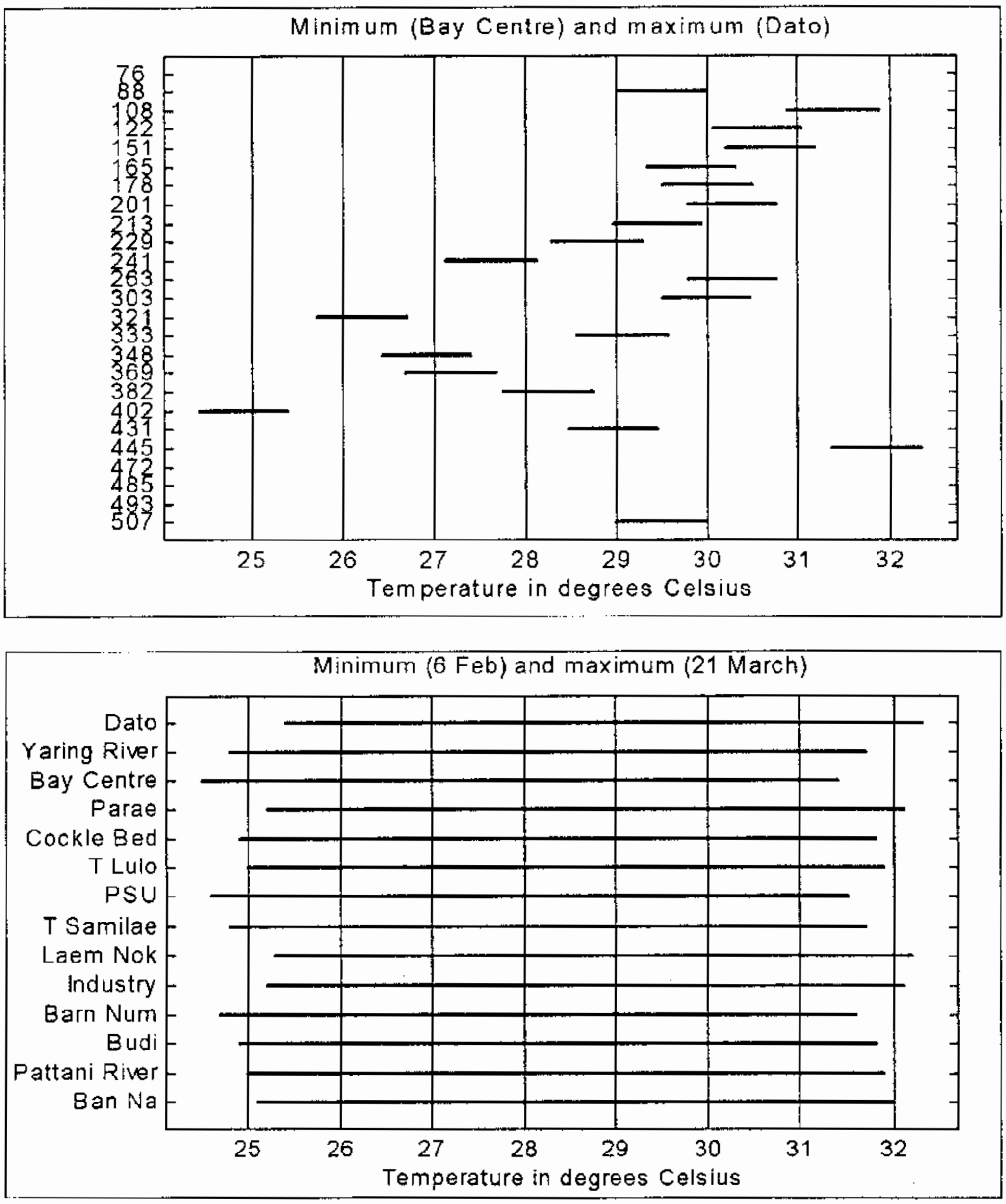


Figure 35: The variation of temperature from Pattani Bay in 1995-96

Figure 36 shows how the salinity predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is fairly smooth with one or two exceptions. On days 303 (October 30, 1995) and 493 (May 8, 1996) unusually high salinity were recorded, while on day 321 (November 17, 1995) unusually low salinity was recorded.

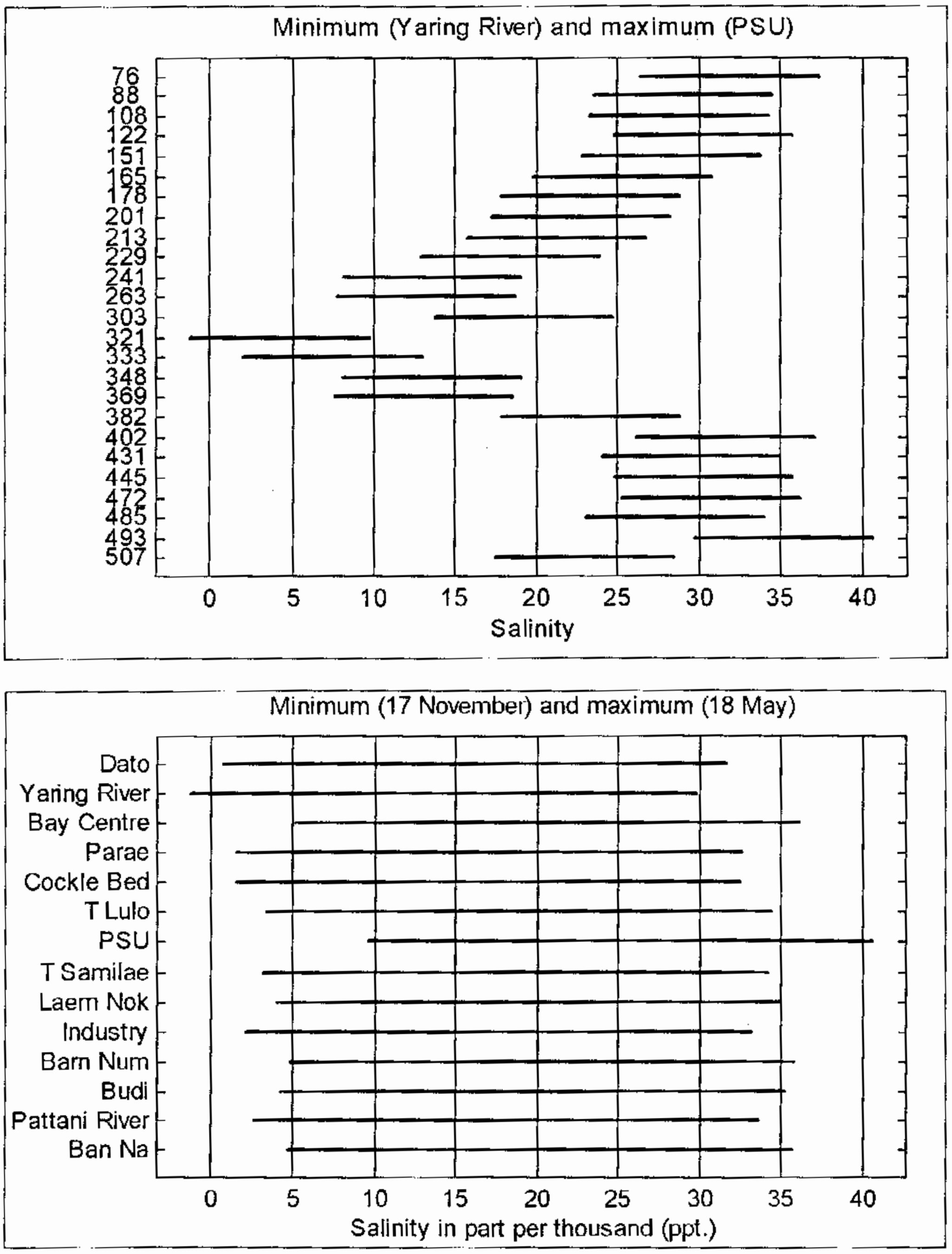


Figure 36: The variation of salinity from Pattani Bay in 1996-96

Figure 37 shows how the transparency predicted by the model varies over the course of time and from location to location. In this case, the variation over time is comparable with the variation between locations in the Bay. The pattern of variation over time is fairly smooth with one or two exception. On days 122 (May 2,1995) and 348 (December 30, 1995) unusually high transparency were recorded.

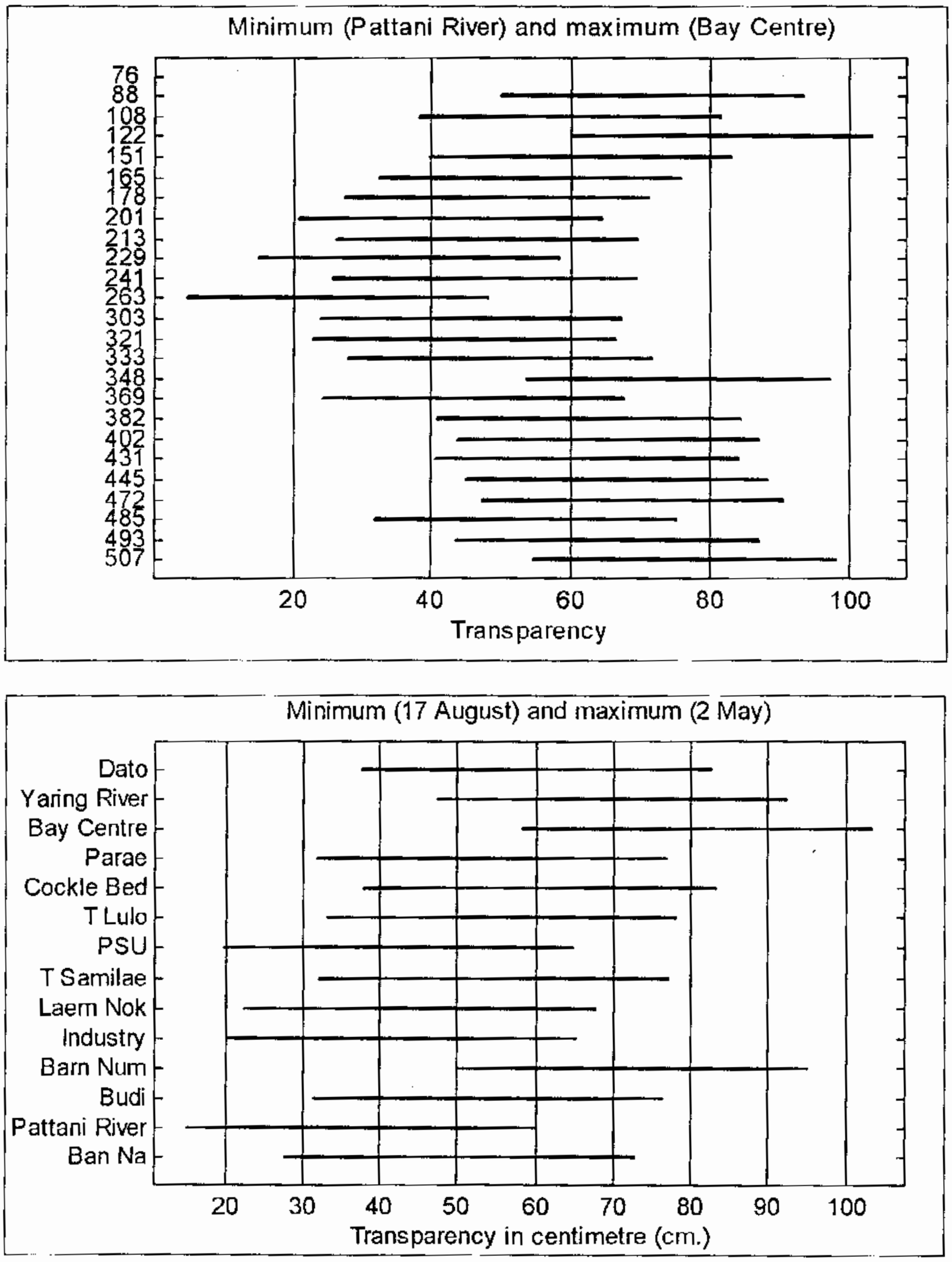


Figure 37: The variation of transparency from Pattani Bay in 1995-96

Figure 38 shows how the alkalinity predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is fairly smooth with a few exceptions.

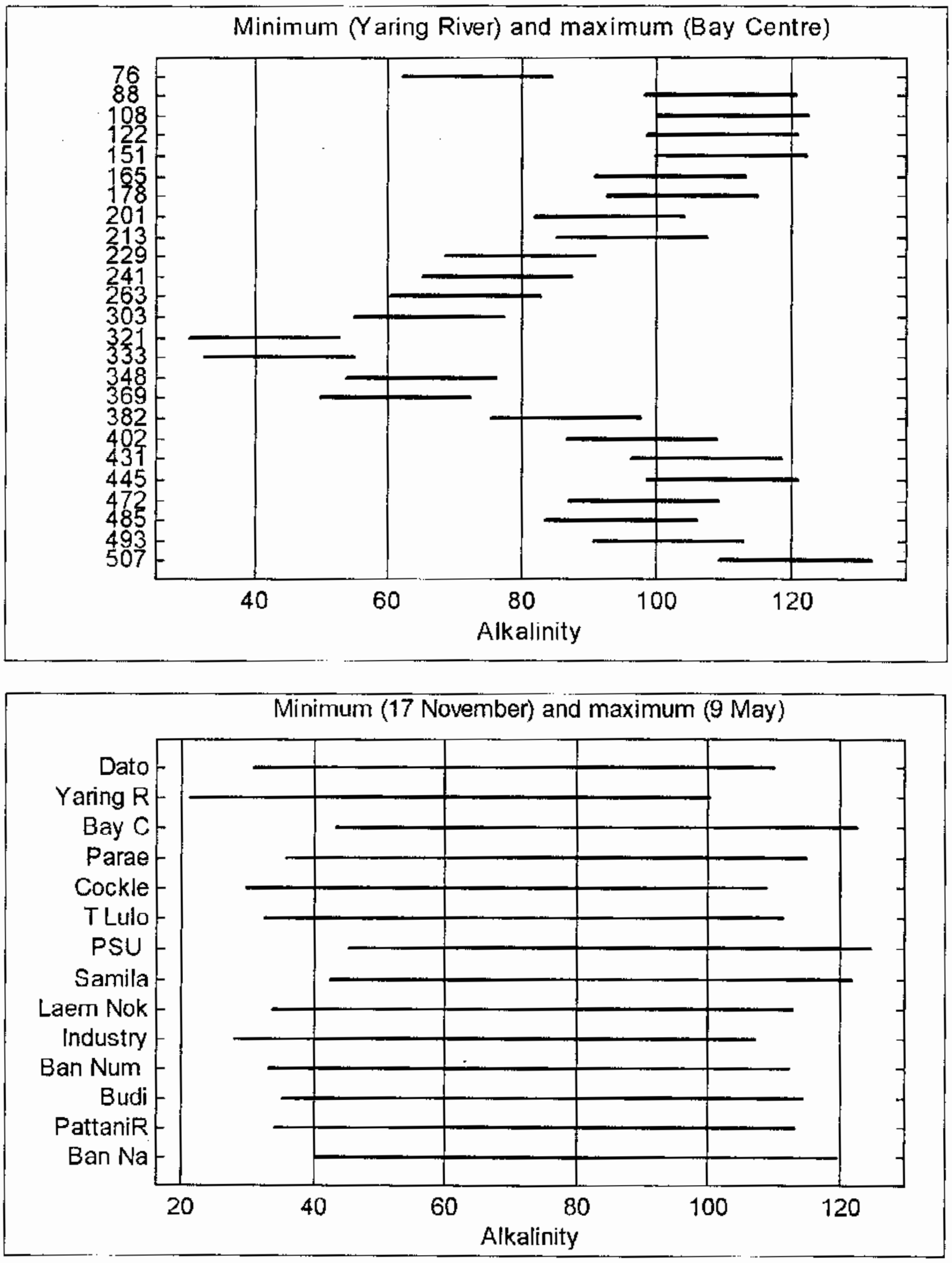


Figure 38: The variation of alkalinity from Pattani Bay in 1995-96

Figure 39 shows how the oxygen predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The variation over time is irregular, and not easily accounted for by a seasonal pattern.

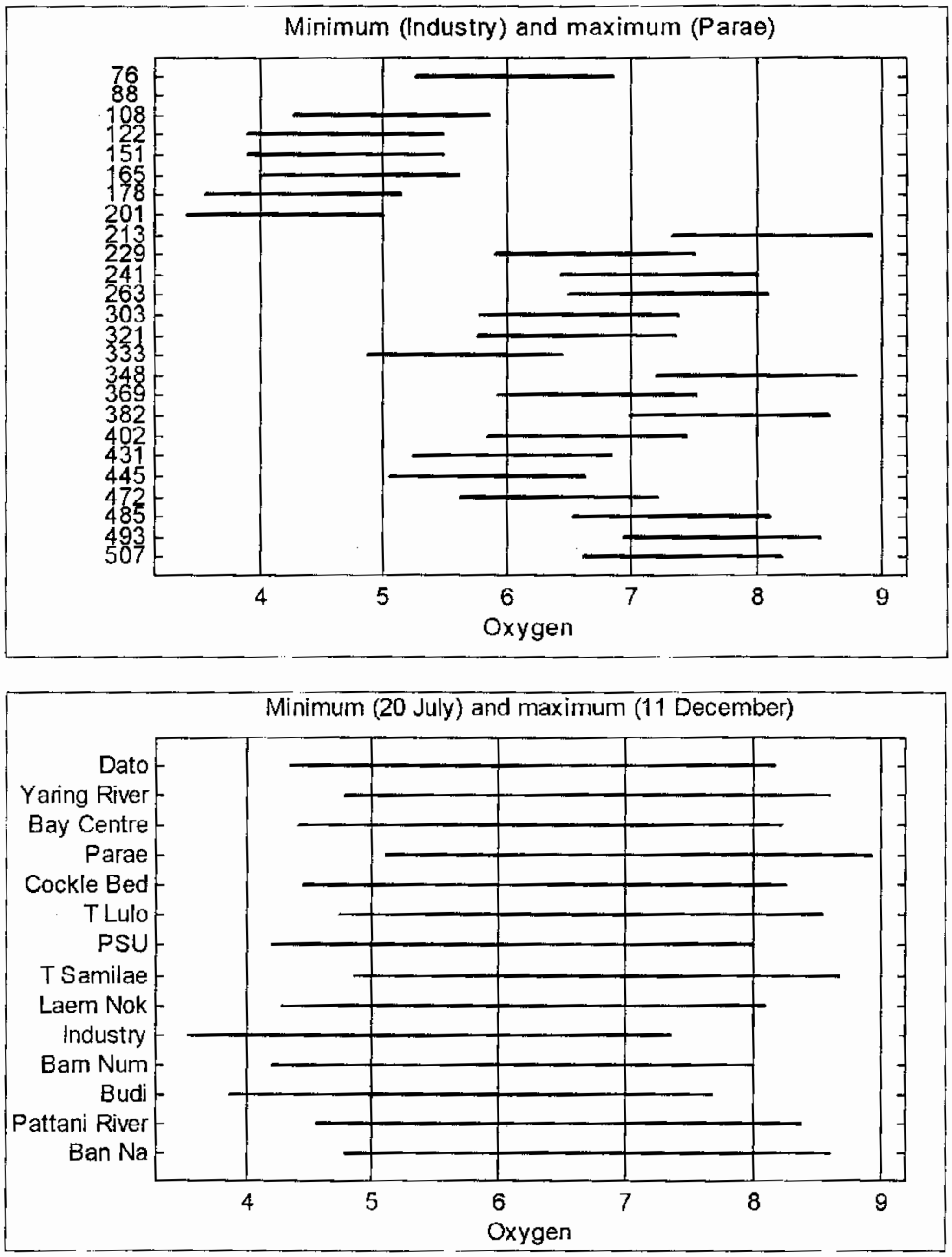


Figure 39: The variation of oxygen from Pattani Bay in 1995-96

Figure 40 shows how the pH predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is fairly irregular, with unusually low readings on day 321(November 17, 1995).

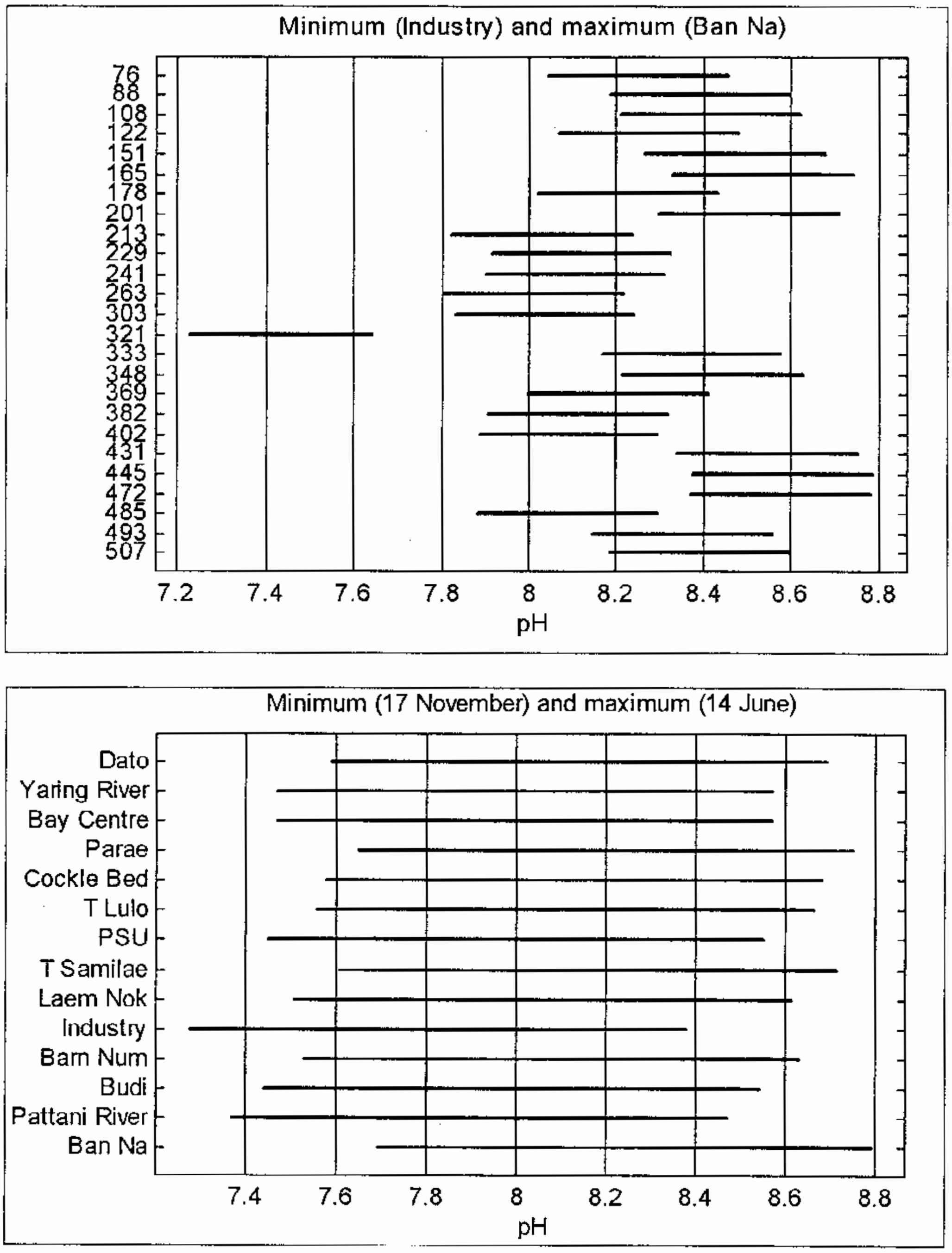


Figure 40: The variation of pH from Pattani Bay in 1995-96

Figure 41 shows how the log2 (nitrite) the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is relatively smooth.

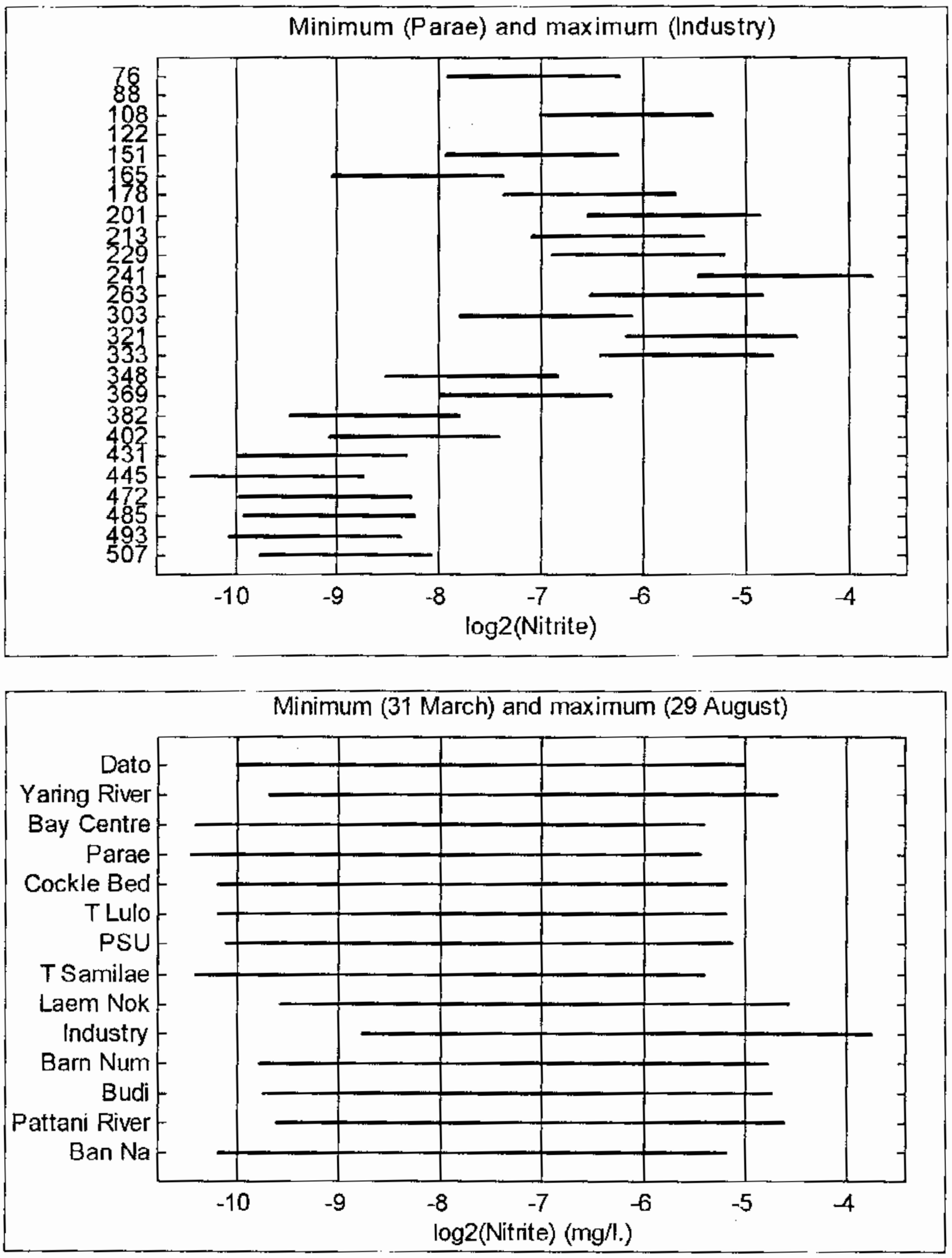
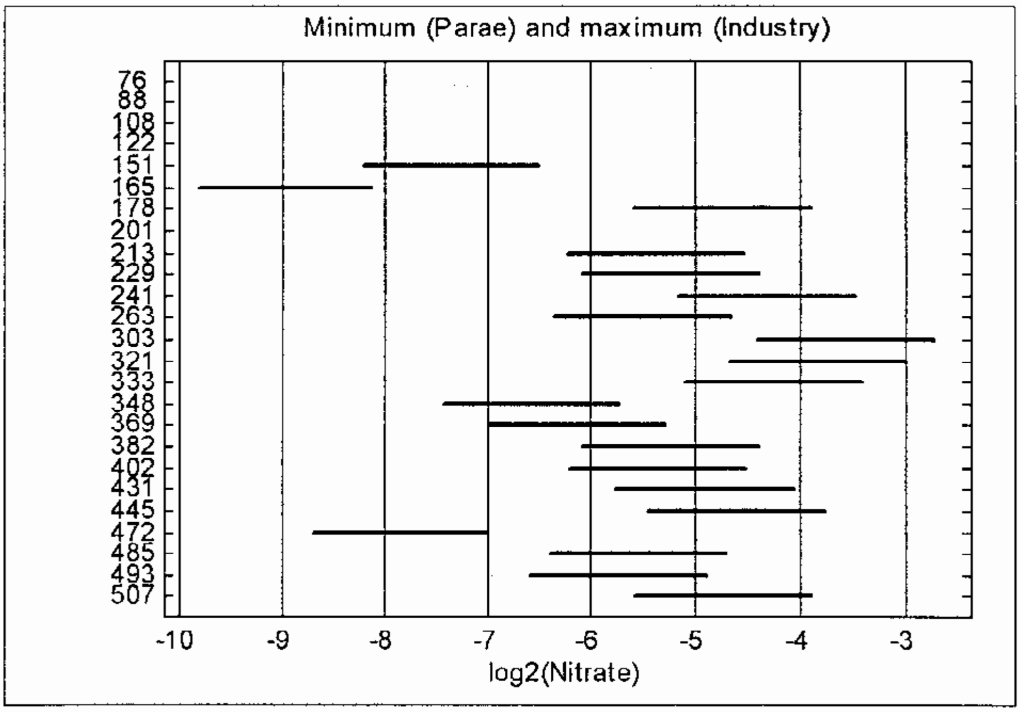


Figure 41: The variation of log2(nitrite) from Pattani Bay in 1995-96

Figure 42 shows how the log2 (nitrate) predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is irregular, with low readings in days 165 (June 14, 1995) and 472 (April 27, 1996).



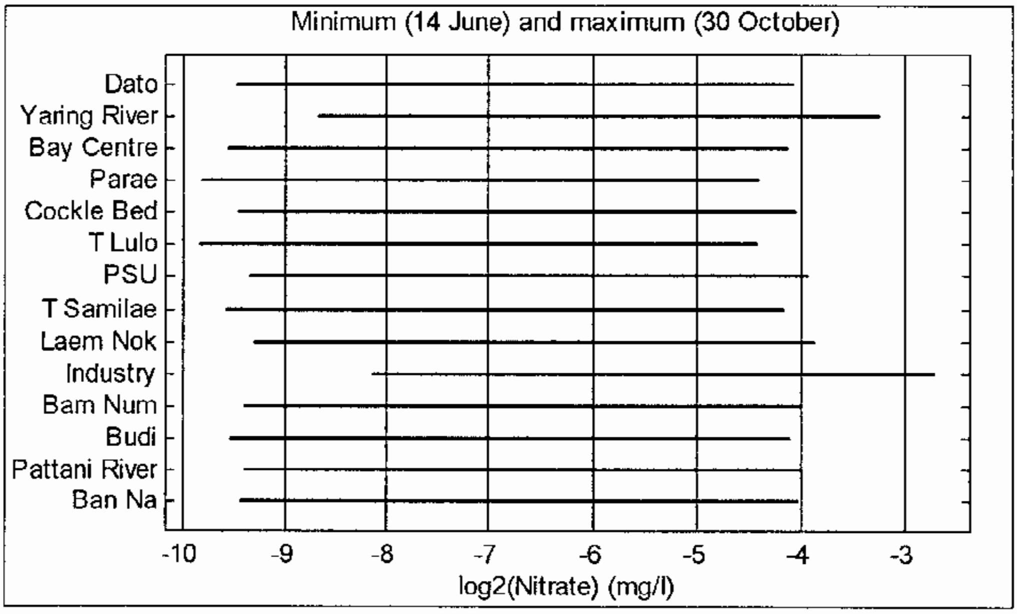


Figure 42: The variation of log2(nitrate) from Pattani Bay in 1995-96

Figure 43 shows how the log2(phosphate) predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is fairly smooth with some exceptions.

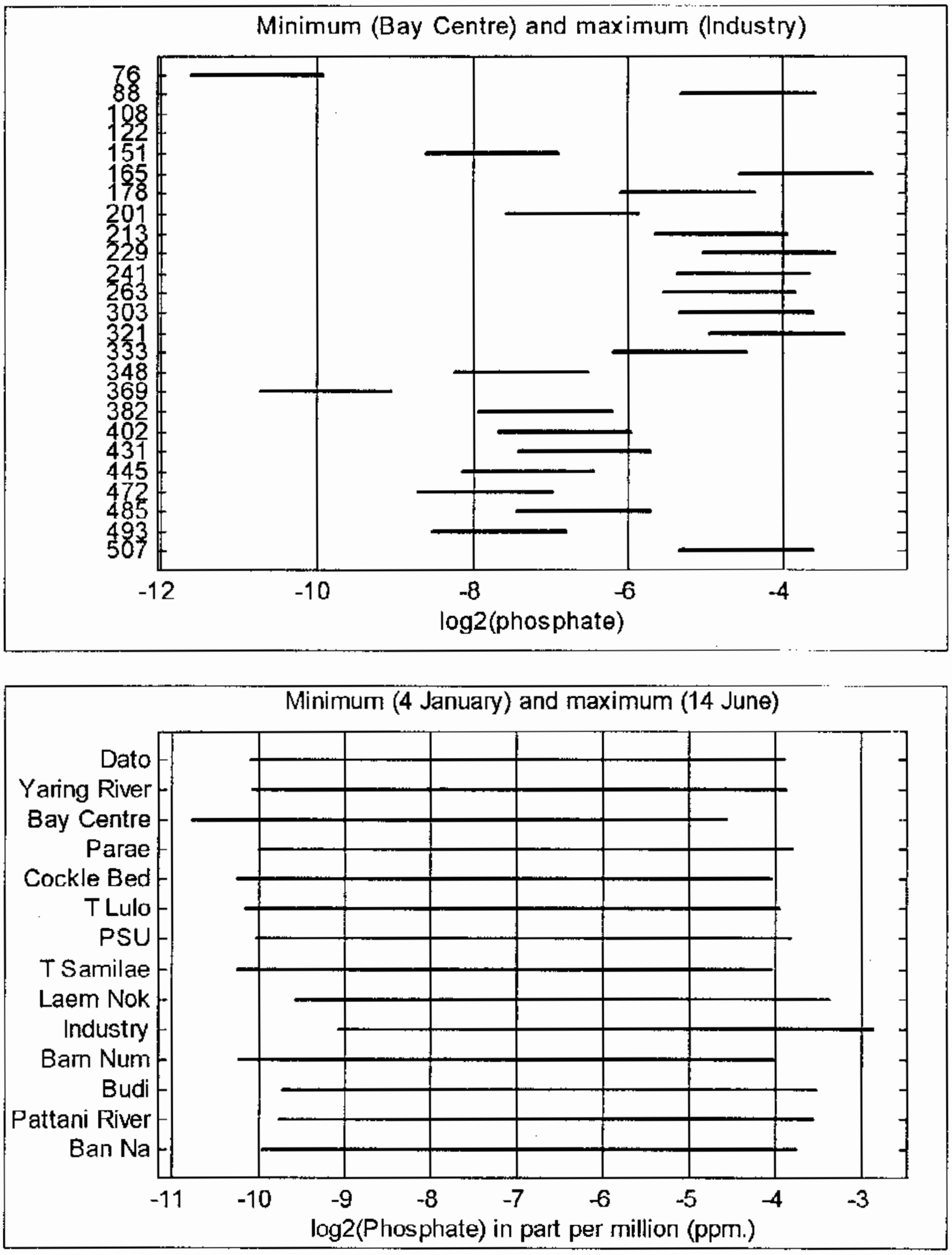


Figure 43: The variation of log2(phosphate) from Pattani Bay in 1995-96

Figure 44 shows how the sqrt(silicate) predicted by the model varies over the course of time and from location to location. Clearly, the variation over time is much greater than the variation between locations in the Bay. The pattern of variation over time is quite irregular, and these are no clear evidence of any seasonal pattern.

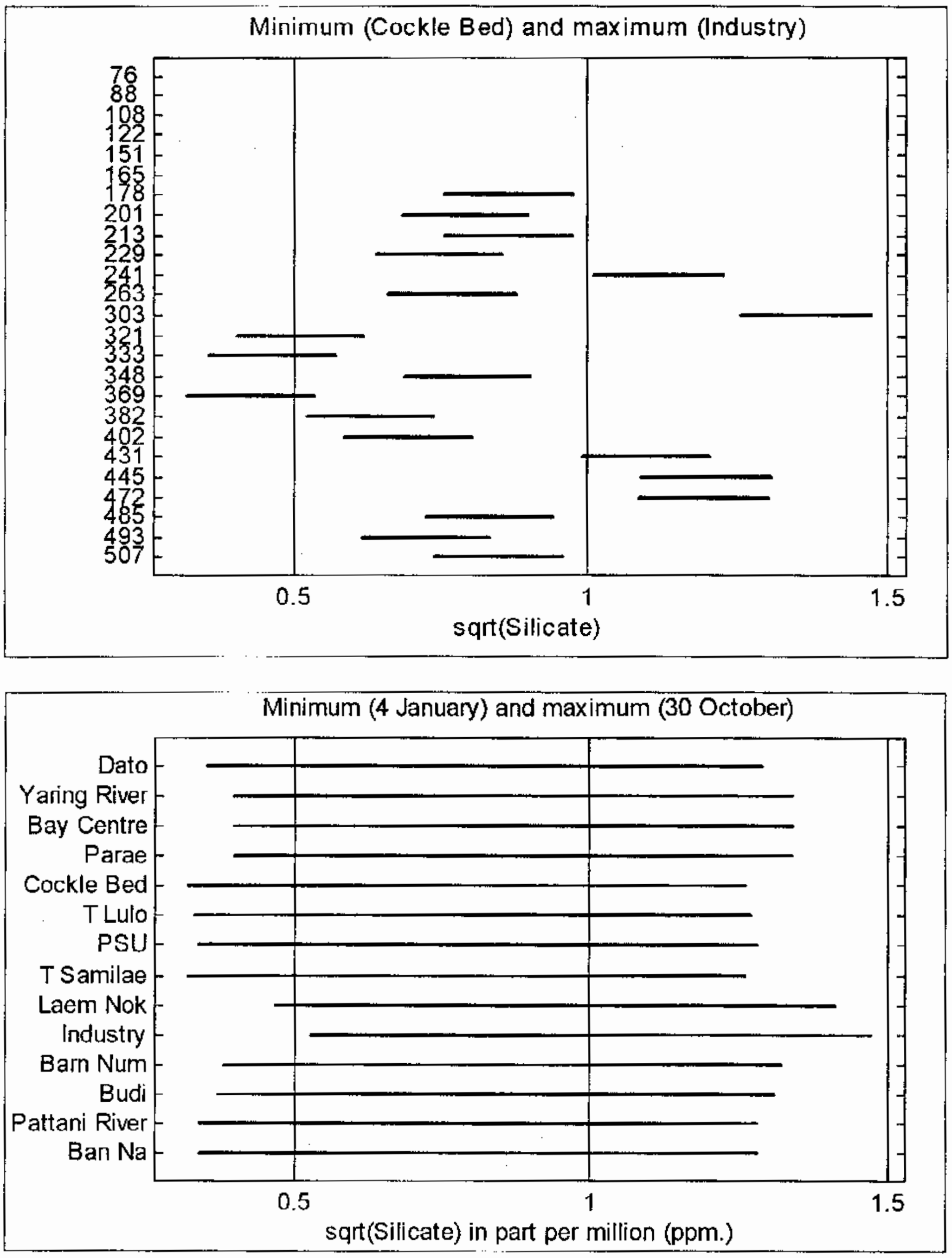


Figure 44: the variation of sqrt(silicate) from Pattani Bay in 1995-96