# CHAPTER 4

## STATISTICAL ANALYSIS

In chapter 3 it was found that there was no difference in rainfall between the three stations when no account of seasonal patterns and difference between amount of rainfall at different stations. When taking account of the seasonal difference it could be seen that the salinity is thus different between stations and the salinity values are negatively associated with the rainfall.

In this chapter, the results of the analysis are presented on the relationship between salinity and rainfall and the model of the relationship between salinity and rainfall. These results may be classified as follows.

(a) The relationship between salinity and rainfall, using regression analysis. The variables which are included in each model are the salinity at each location and the rainfall at all three locations ( PSU, Yaring, Laem Tachi).

(b) The model of the relationship between salinity and rainfall, using the same method to indicate the best single predictor (the rainfall).

(c) Two-way analysis of varaince of the salinity at each location after adjusting for rainfall after finding the best model for the relationship between salinity and rainfall.

### 1. Adjustment of Salinity by Rainfall, using Regression Analysis

As described in Chapter 2, the relation between the salinity at each of the 14 locations in the Bay and the rainfall at all three meteorological stations may be developed using multiple regression. In this method, the cube root of the smoothed rainfall taken as the outcome variable and the best model using (a) one predictor and (b) two predictors is sought. The results are presented in Table 4.

*Table 4: The Relationship between Salinity at each Location and Rainfall at all Three Locations*

| Bay location (Salinity) | Best Single Predictor(Rainfall) | Best two (Rainfall) |
|---|---|---|
| 1. Dato | PSU, $r^2$ (.6525) | PSU , Tachi (ns),$r^2$ (.6540) |
| 2. Yaring | PSU, $r^2$ (.7068) | PSU , Tachi (ns),$r^2$ (.7065) |
| 3. Middle Bay | PSU, $r^2$ (.5231) | PSU(ns), Tachi (ns), $r^2$ (.5370) |
| 4. Parae | PSU, $r^2$ (.7184) | PSU , Yaring (ns),$r^2$ (.7257) |
| 5. Cockle bed | PSU, $r^2$ (.6433) | PSU , Tachi (ns),$r^2$ (.6449) |
| 6. Tanyong Lulo | PSU, $r^2$ (.6630) | PSU(ns), Yaring(ns), $r^2$ (.6697) |
| 7. PSU | Tachi, $r^2$ (.3632) | Tachi, PSU (ns),$r^2$ (.3742) |
| 8. Talo Samilae | PSU, $r^2$ (.5977) | PSU , Yaring (ns),$r^2$ (.6001) |
| 9. Laem Nok | PSU, $r^2$ (.5789) | PSU , Yaring (ns),$r^2$ (.6022) |
| 10. Industry Estate | Tachi, $r^2$ (.4932) | Tachi, Yaring (ns), $r^2$ (.5040) |
| 11. Barn Num | PSU, $r^2$ (.5536) | PSU , Tachi (ns),$r^2$ (.5579) |
| 12. Budi | PSU, $r^2$ (.6165) | PSU , Yaring (ns),$r^2$ (.6194) |
| 13. Pattani River mouth | Tachi, $r^2$ (.3951) | Tachi, Yaring(ns), $r^2$ (.4008) |
| 14. Bana | PSU, $r^2$ (.6559) | PSU , Tachi (ns),$r^2$ (.6607) |

From Table 4 we see that most of the salinity values are most strongly related to the rainfall at the PSU location, but there are three locations where salinity is most affected by the rainfall at the Tachi location (PSU, Industry Estate, Pattani River). At no salinity station is the salinity determined by the rainfall at more than one stations. Table 5 shows the best model at each salinity station.

*Table 5: The Best Models for the Relationship between Salinity and Rainfall*

| Station | Model Equation | *p-value* | $r^2$ | residual sd |
|---|---|---|---|---|
| Dato | salinity = 36.00 - 3.468 rainfall(PSU) | 0.00000 | .6525 | 6.613 |
| Yaring | salinity = 36.27 - 3.925 rainfall(PSU) | 0.00000 | .7046 | 6.641 |
| Middle Bay | salinity = 35.45 - 2.425 rainfall(PSU) | 0.00004 | .5231 | 6.051 |
| Parae | salinity = 35.45 - 3.150 rainfall(PSU) | 0.00000 | .7184 | 5.154 |
| Cockle bed | salinity = 35.69 - 3.189 rainfall(PSU) | 0.00000 | .6433 | 6.205 |
| Tanyong Lulo | salinity = 36.19 - 2.940 rainfall(PSU) | 0.00000 | .6630 | 5.478 |
| PSU | salinity = 35.93 - 1.417 rainfall(Tachi) | 0.00143 | .3632 | 5.189 |
| Talo Samilae | salinity = 36.48 - 3.039 rainfall(PSU) | 0.00001 | .5977 | 6.515 |
| Laem Nok | salinity = 32.41 - 1.735 rainfall(PSU) | 0.00020 | .4596 | 5.201 |
| Industry Estate | salinity = 30.58 - 1.707 rainfall(Tachi) | 0.00001 | .4932 | 4.784 |
| Barn Num | salinity = 35.78 - 2.559 rainfall(PSU) | 0.00002 | .5536 | 6.003 |
| Budi | salinity = 36.61 - 2.853 rainfall(PSU) | 0.00000 | .6165 | 5.879 |
| Pattani River | salinity = 32.57 - 1.862 rainfall(Tachi) | 0.00077 | .3951 | 6.371 |
| Bana | salinity = 35.86 - 2.592 rainfall(PSU) | 0.00000 | .6559 | 4.905 |

From Table 5 we see that most of the models have $r^2$ greater than 0.5 indicating that more than 50% of variation in the data can be explained by each model. There are three models with $r^2$ less than 0.5 indicating that less than 50% of variation in the data can be explained by the model (PSU, Industry Estate, and Pattani River). The regression coefficients range in magnitude from 1.42 (for the effect of rainfall at Tachi on the salinity at PSU) to 3.47 (for the effect of rainfall at PSU on the salinity at Dato).

These models may be used to adjust the salinity at each location for the effect of rainfall, using the method described in Chapter 2. The effects of these adjustment are shown in Figure 17 - 20.

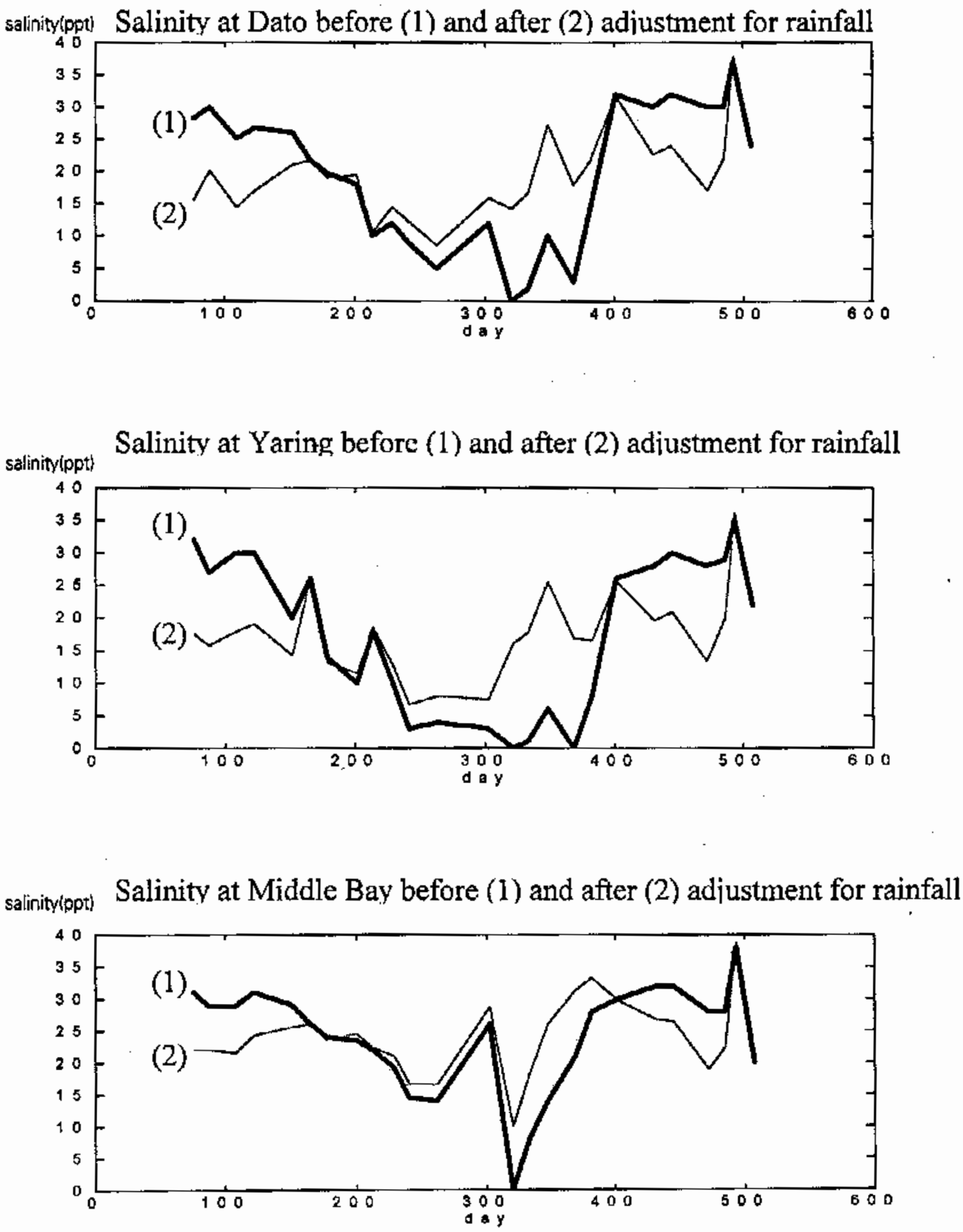


*Figure 17: Effects of Adjustment for Rainfall at Dato, Yaring, and Middle Bay*

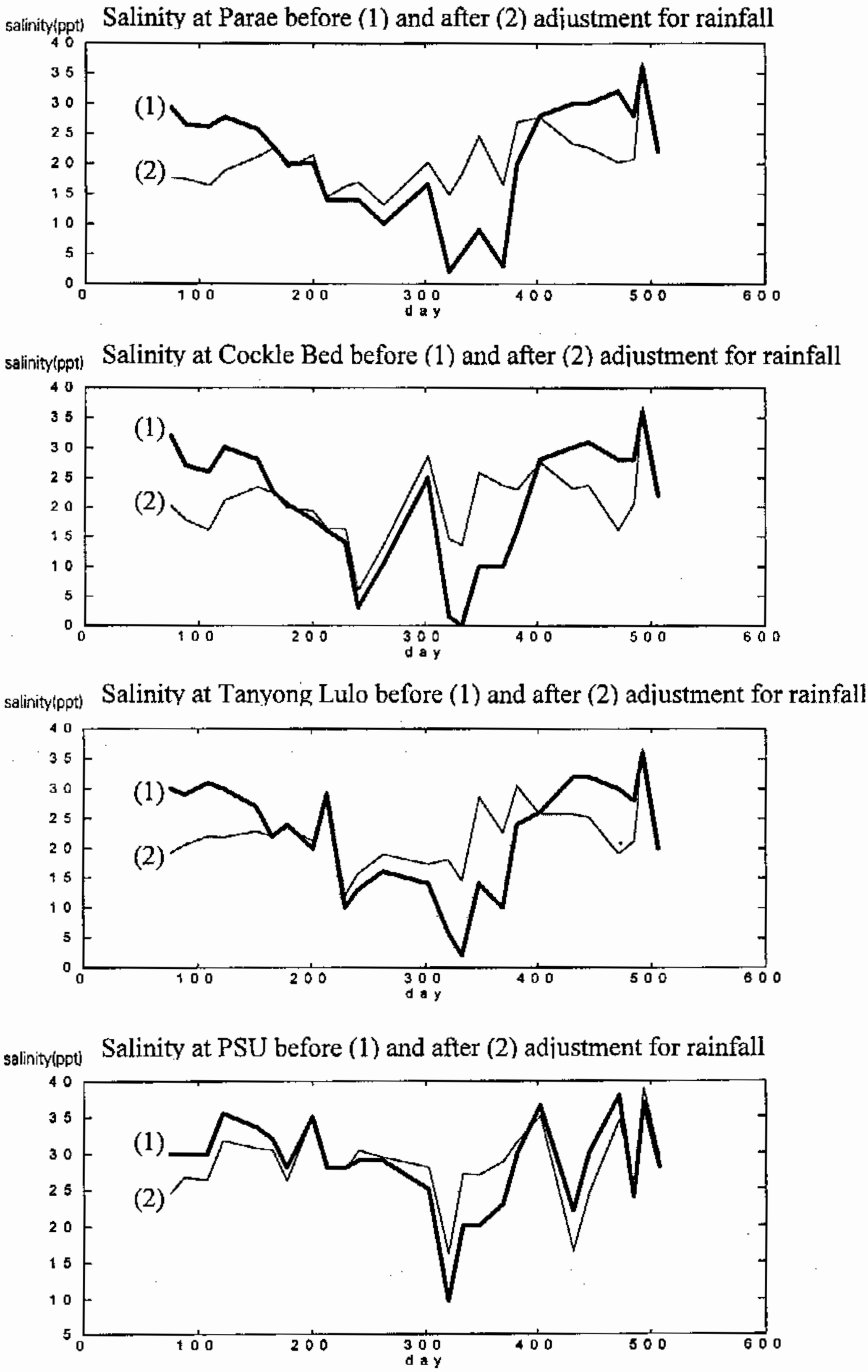


*Figure 18: Effects of Adjustment for Rainfall at Parae, Cockle Bed, Tanyong Lulo, and PSU*

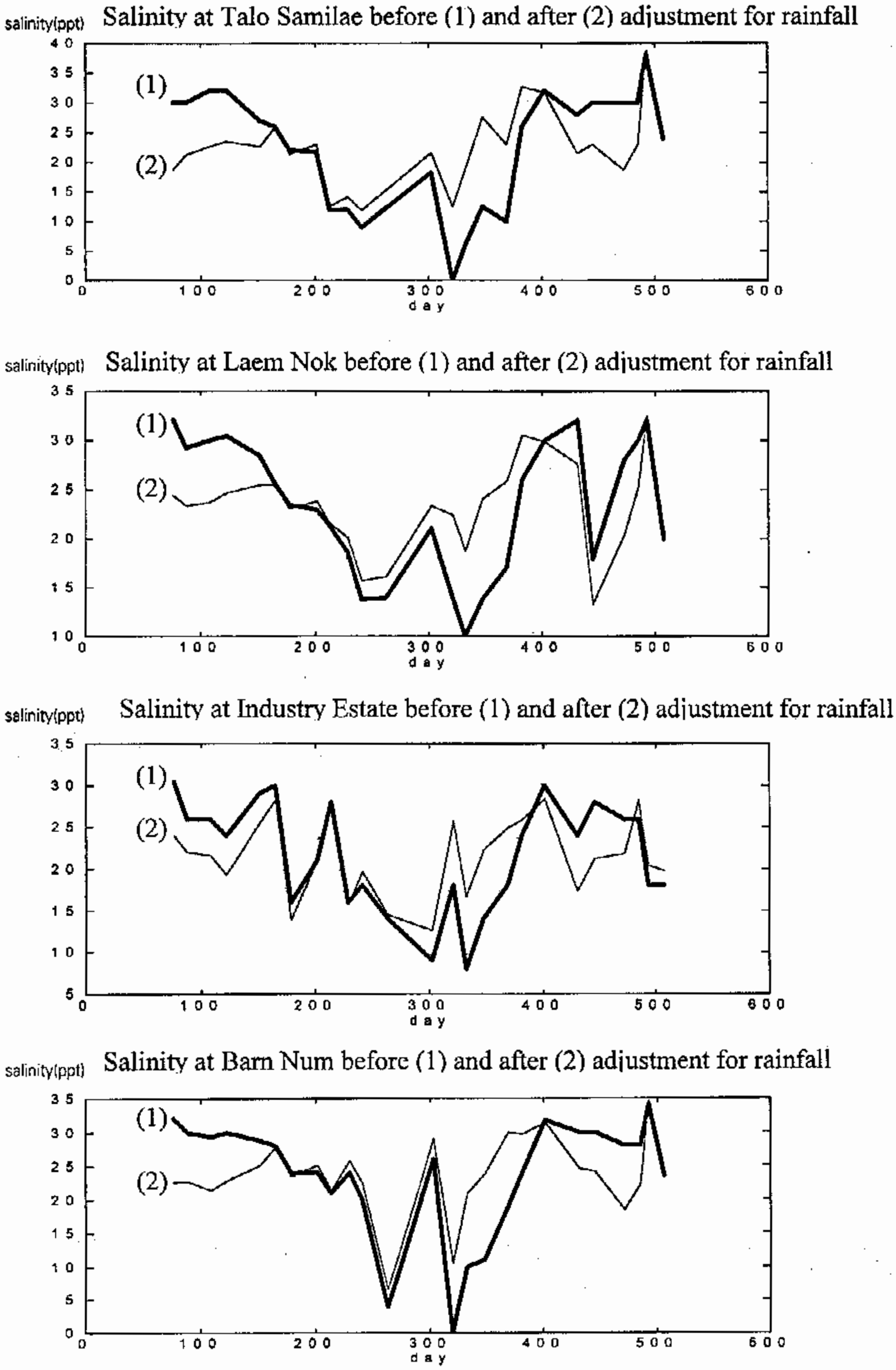


*Figure 19: Effects of Adjustment for Rainfall at Talo Samilae, Laem Nok, Industry Zone, and Barn Num*

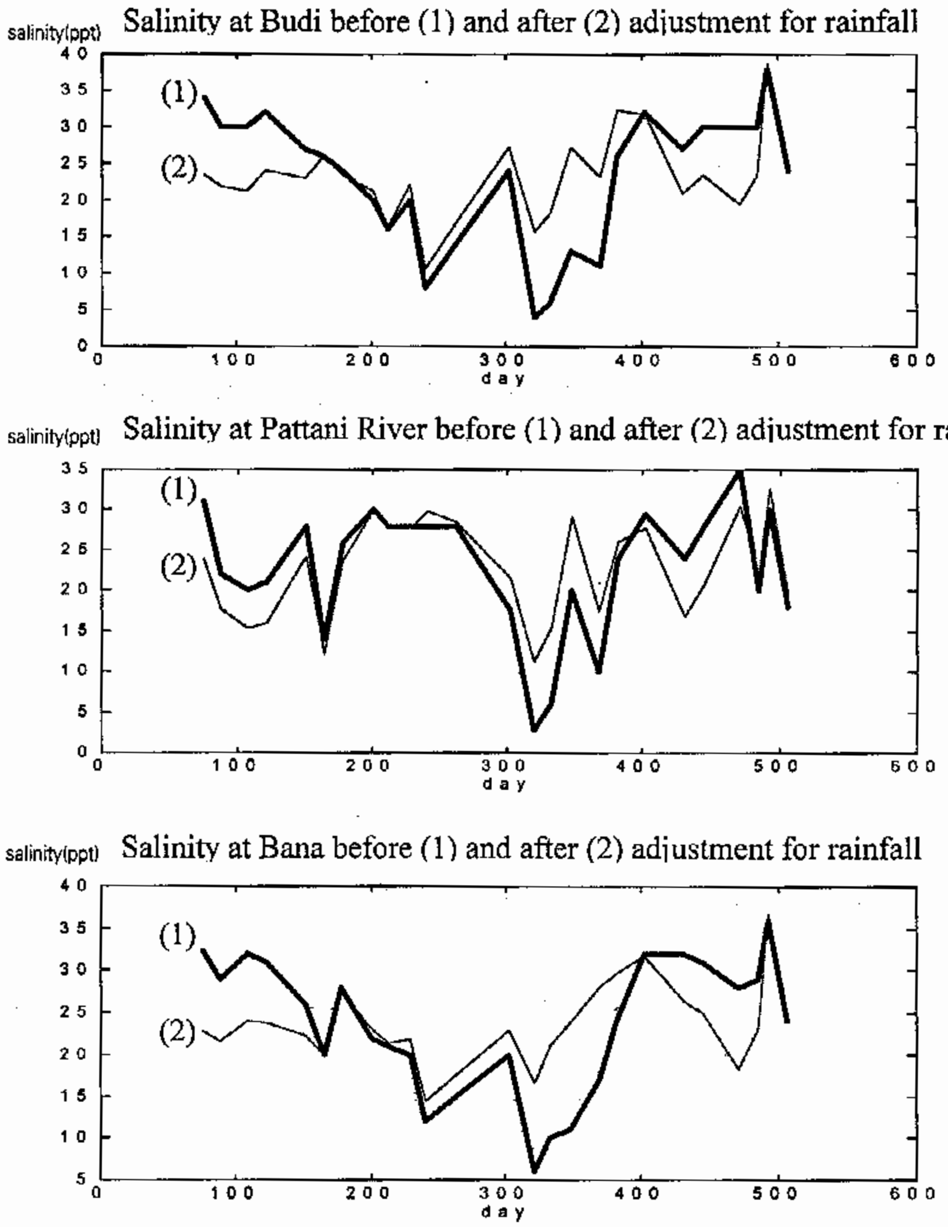


*Figure 20: Effects of Adjustment for Rainfall at Budi, Pattani River, and Bana*

From these graphs we can see that the salinity before and after adjustment at each location has a similar pattern but the seasonal variations are substantially reduced.

**2. One-way and Two-way Anova Analysis of Salinity after Adjusting for Rainfall**

Figure 21 shows the results from the one-way anova analysis of adjusted salinity showing variation between stations.

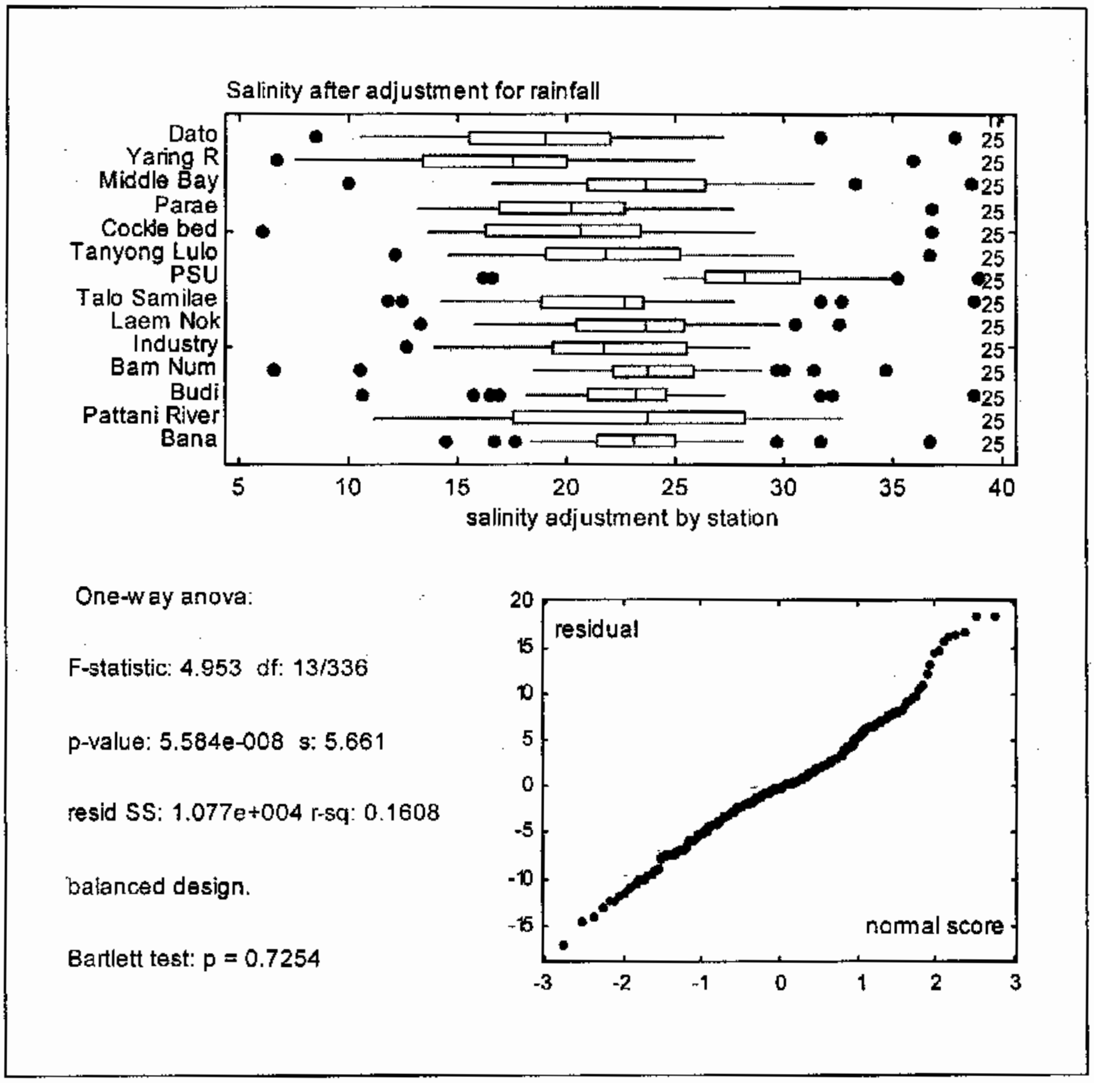


*Figure 21: One-way Anova Analysis of Adjusted Salinity (Showing Station Difference)*

Figure 21 should be compared with Figure 14. The residual sum of squares has been reduced substantially from 27460 to 10770. Apart from this, the result are very similar.

Figure 22 shows the results from the two-way anova analysis of adjusted salinity showing the variation between stations.

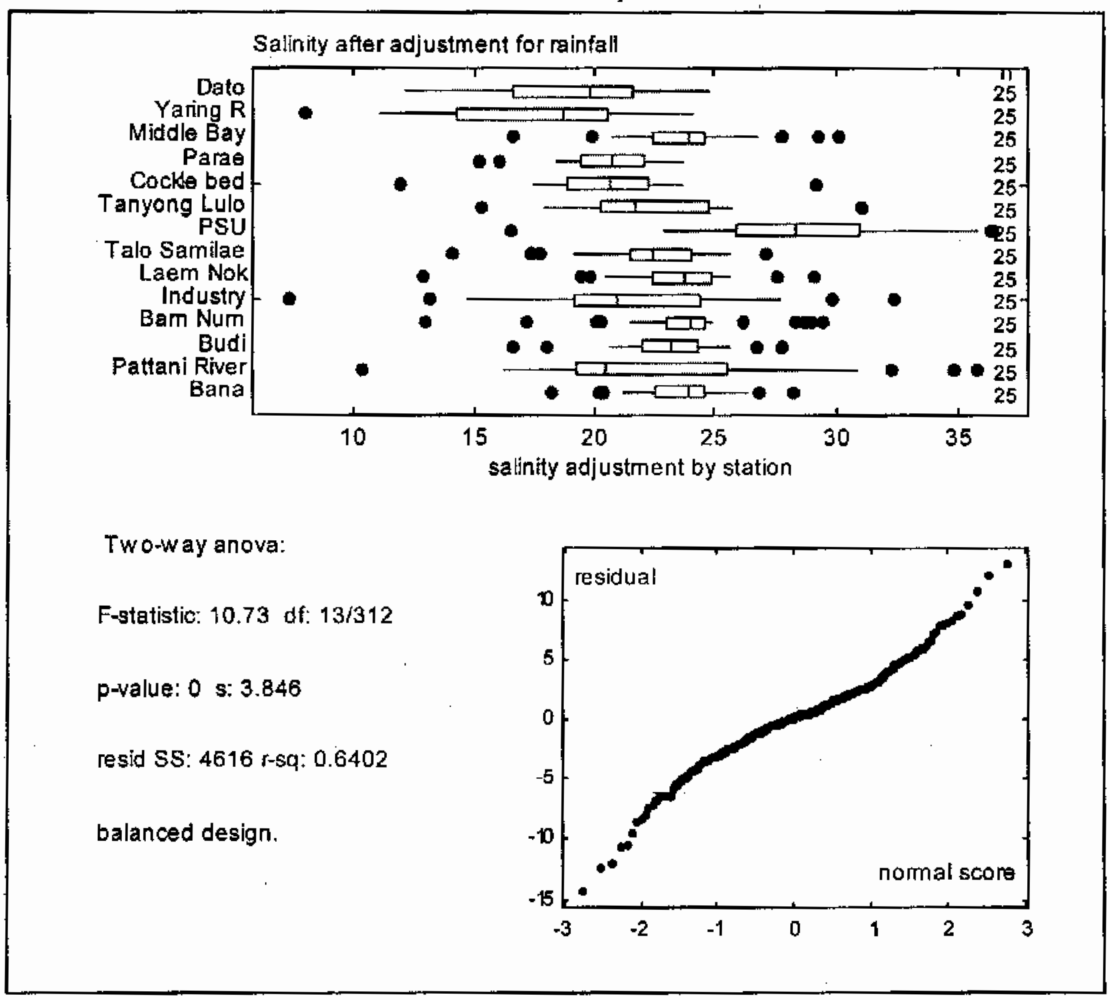


*Figure 22: Two-way Anova Analysis of Adjusted Salinity (Showing Station Difference)*

Figure 22 should be compared with Figure 15. The residual sum of squares has been reduced from 5704 to 4616. Apart from this, the results are very similar.

Figure 23 shows the two-way anova analysis of adjusted salinity showing the variation between days.

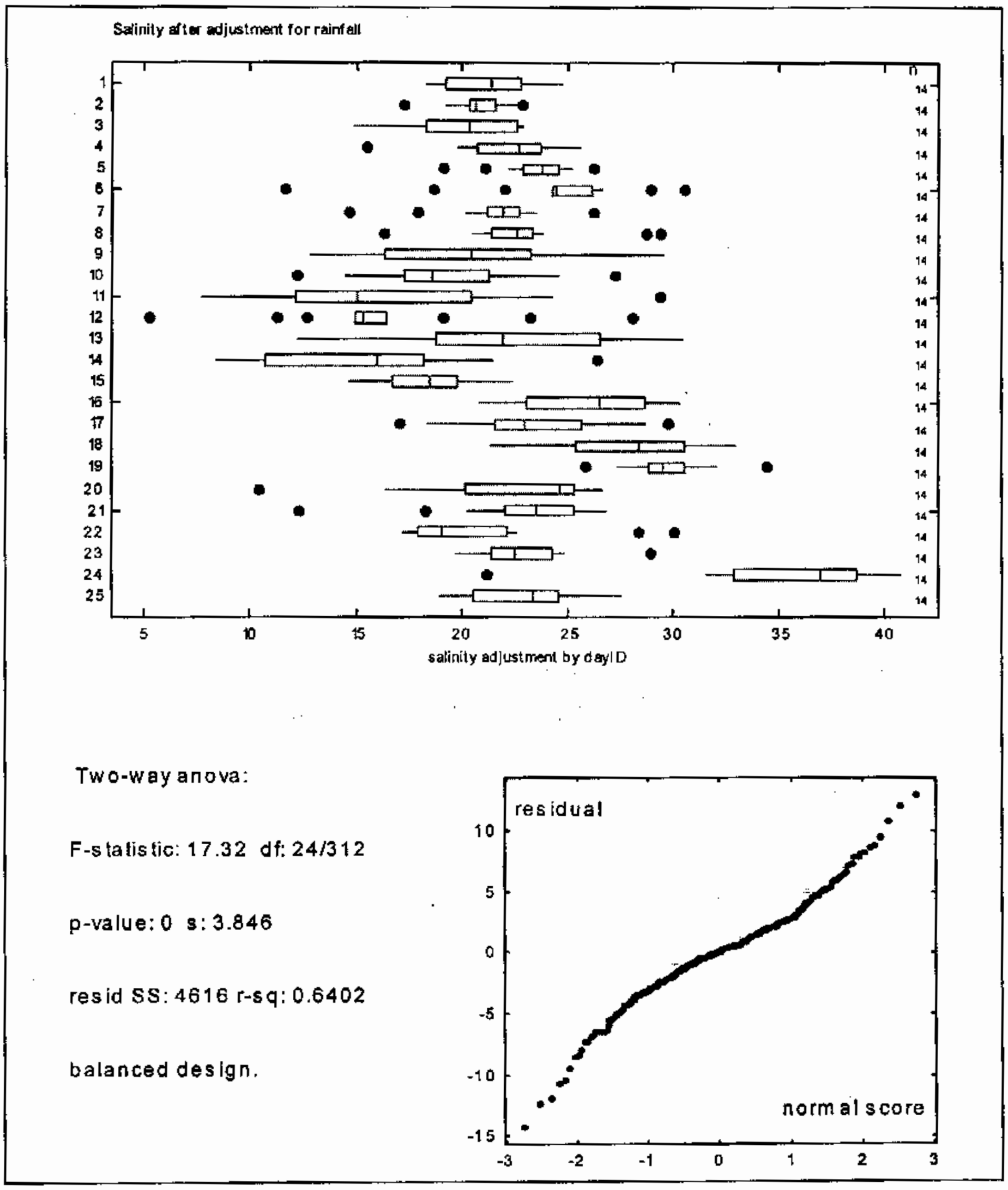


*Figure 23: Two-way Anova Analysis of Adjusted Salinity (Showing Seasonal Difference)*

Figure 23 should be compared with Figure 16. The results are very similar.