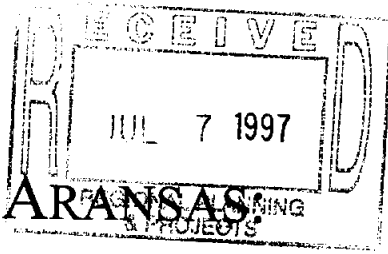


Trout Harvests in Aransas Bay:
A Regression Analysis

Harvest vs Freshwater Inflows

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TABLE OF CONTENTS

1. Summary Report	1
1.1 Description of the Problem	1
1.2 Constructing Models - General Discussion	1
1.2.1 Detecting Influential Points and Outliers	1
1.2.2 Variable Selection	2
1.2.3 Multicollinearity	2
1.2.4 Other Procedures	2
1.3 How the Final Model Was Chosen	2
1.3.1 Selecting the Data Set Used	2
1.3.2 Selecting the Points to be Omitted	3
1.3.3 Selecting the Final Candidate Models	6
1.3.4 Selecting the Final Models	6
1.4 Best Model: Logged Harvest and Square Root of Inflows	7
1.4.1 Summary Information	7
2. Exploring the Data	12
2.1 Listing of data	12
2.2 Examination of Individual Variables	13
2.2.1 The trout data	15
2.2.2 The January-February Inflows data	18
2.2.3 The March-April Inflows data	21
2.2.4 The May-June Inflows data	24
2.2.5 The July-August Inflows data	27
2.2.6 The September-October Inflows data	30
2.2.7 The November-December Inflows data	33
3. Prediction Ellipses and Confidence Regions	36
4. Box-Cox Analysis	43
5. Model Choice Diagnostics	45
5.1 Untransformed trout data and untransformed inflow data	45
5.2 Log of trout data and untransformed inflow data	46
5.3 Log of trout data and log of inflow data	47
5.4 Log of trout data and square root of inflow data	48
5.5 Square root of trout data and square root of inflow data	49

5.6 Various transformation suggested by Box-Cox	50
6. Regression for the Best Models	51
6.1 Regression - Log of trout data on inflow data	51
6.1.1 ANOVA and Parameter Estimates	51
6.1.2 Collinearity Diagnostic	52
6.1.3 Residuals Diagnostics	53
6.1.4 Prediction Intervals for Trout Harvest	58
6.1.5 Outliers and Influential Point Detection	59
6.2 Regression - Log of trout data on log of inflow data	63
6.2.1 ANOVA and Parameter Estimates	63
6.2.2 Collinearity Diagnostic	64
6.2.3 Residuals Diagnostics	65
6.2.4 Prediction Intervals for Trout Harvest	70
6.2.5 Outliers and Influential Point Detection	71
6.3 Regression - Log of trout data on square root of inflow data	75
6.3.1 ANOVA and Parameter Estimates	75
6.3.2 Collinearity Diagnostic	76
6.3.3 Residuals Diagnostics	77
6.3.4 Prediction Intervals for Trout Harvest	82
6.3.5 Outliers and Influential Point Detection	83
7. Examining Subsets of the Data	87
7.1 Log of trout data and untransformed inflow data: None Omitted	87
7.2 Log of trout data and log of inflow data: 1963 Omitted	91
7.3 Log of trout data and square root of inflow data: 1963 Omitted	95

1. SUMMARY REPORT

1.1 Description of the Problem¹

Bimonthly freshwater inflows into Aransas were recorded for the years 1961 to 1980. These variables, and various transformations of them, were used to construct a model for the annual harvest of trout.

1.2 Constructing Models - General Discussion

Stability of coefficient estimates and accuracy of predicted values are primary goals in constructing models for prediction. To this end, the data must be examined from three points of view: individual observations (to detect outliers or influential points); variables, individually and in groups (to select an optimal set of predictors); and the interaction of these two, which produces the overall structure of the data set (to determine whether multicollinearity is present or not). The first two of these were examined by both graphic and quantitative means; the third by quantitative means only.

1.2.1 Detecting Influential Points and Outliers

The structures of individual variables were examined via box plots and histograms, as well as by all the usual numerical measures. For each pair of variables, 99% prediction ellipses and 95% confidence regions were plotted in a further effort to look for unusual points. For example, suppose large values of Variable A are generally associated with large values for Variable B. If an observation consisted of a large value for Variable A but a small value for Variable B, that point would be considered unusual, even though it was well within the range of data for both variables and could not be considered an outlier.

In addition, a number of residual analysis techniques were employed. A large residual indicates a point not well-fit by the model. The deleted residual, however, is somewhat more useful in the search for influential points. The model is fitted without a given observation, and the predicted response and corresponding residual are calculated for that observation. The Studentized deleted residual is scaled to have a Student's t distribution. Histograms and normal P-P plots of the residuals were also examined.

Other quantities, such as the Mahalanobis distance, Cook's distance, the leverage value, standardized values for the $Dffits$ (to measure the influence of a given observation on the predicted response) and the $Dfbetas$ (to measure the influence of a given observation on the calculated coefficients) were also used to build a general picture of the influence of individual points. Plots were made of the standardized $Dffits$ value for each model against the standardized $Dfbeta$ values for each predictor in the model. Points which were extreme indicated observations which had strong effects on both predicted values and coefficient estimates.

¹ The following discussion, prepared by Jacqueline Kiffe, was taken from *Seatrout Harvest in Galveston Bay: A Regression Analysis*, by F. Michael Speed, Sr. and Jacqueline Kiffe.

1.2.2 Variable Selection

For each regression, residuals were plotted against each of the independent variables to look for nonlinear relationships between the response variable and individual predictors. Partial residual plots were employed to examine the overall relationship between the response and individual predictors. A partial residual is a corollary to the deleted residual. That is, the model is fitted without a given variable and the predicted response and corresponding residual are calculated for each observation. This seeks to answer the question, "What is the relationship of this predictor to the response variable, taking all other variables into account?" Thus, it examines the marginal relationship of a given predictor to the response.

Numerous measures have been developed over the years to assess the adequacy of a given model. We examined a number of these, including R^2 and mean squared error (MSE), and several others which directly incorporate penalties for having too many predictors in the model, such as adjusted R^2 , C_p , AIC , and SBC . It is well-established that too many predictors in a model can lead to bad prediction, just as too few can, and these measures are used as part of the attempt to find an optimal model.

1.2.3 Multicollinearity

Multicollinearity arises when one or more variables are nearly closely approximated by linear combinations of the remaining variables, resulting in unstable coefficient estimates. The variance inflation factor (VIF) was calculated for each coefficient estimate to measure this instability, which is not usually considered profound for VIF 's less than 10. No problems were found with this data. Additionally, the condition index (a ratio of eigenvalues of the covariance matrix, with the largest eigenvalue always on top) was calculated. A ratio greater than 30 is considered cause for concern. Again, no evidence of multicollinearity was found.

1.2.4 Other Procedures

Several other miscellaneous diagnostics, including the Durbin-Watson test for serial autocorrelation were performed, and no general problems were detected. The Box-Cox procedure, used to find a transformation to normality, was also performed.

1.3 How the Final Model Was Chosen

1.3.1 Selecting the Data Set Used

First, the variables were explored thoroughly, individually and in pairs, in a first effort to detect outliers. The SAS[®] programming language allows a number of diagnostics to be calculated for a group of models on a given data set without actually performing a formal regression, thus allowing one to examine a large number of models quite efficiently. The Box-Cox procedure was performed to find if a transformation to normality was suggested. The log transform was suggested for some variables, and the squared root for others. At this point, there were several data sets for which the diagnostic series was calculated:

1. Untransformed trout data and untransformed inflow data
2. Log of trout data and untransformed inflow data
3. Log of trout data and log of inflow data
4. Log of trout data and square root of inflow data
5. Square root of trout data and square root of inflow data
6. Various transformation suggested by Box-Cox

1.3.2 Selecting the Points to be Omitted

The full regression with all diagnostics was performed for these models, each one contained all variables in its corresponding data set. All diagnostics were generated, and influential points were determined for each model.

Table 1.1 R^2 and Adjusted R^2 for full data sets.

Data Set	R^2	Adj. R^2
1	0.5863	0.3954
2	0.7345	0.6119
3	0.7048	0.5686
4	0.7503	0.6351
5	0.6727	0.5216
6	0.6343	0.4655

Data sets 2, 3, and 4 presented the highest R^2 values. These three models were considered final candidates. The observations flagged as potentially influential are given in the summary table below, for each model.

Table 1.2 Summary of points flagged by Boxplots.

Year	Variable
1980	Ln(Trout), July-August Inflows, Sqrt(July-August)

Table 1.3 Summary of points flagged by 99% prediction ellipses.

Year	Variable
None	None

Table 1.4 Outliers of data set 2.

Year	BOX	SRE	SDR	LEV	MAH	COO	SDF	SDB	TOTAL
1961							1		1
1963							1		1
1976				1			1		2
1980	2			1	1				4

Table 1.5 Outliers of data set 3.

Year	BOX	SRE	SDR	LEV	MAH	COO	SDF	SDB	TOTAL
1961							1		1
1963			1	1		1	1	5	9
1964				1					1
1975							1		1
1976							1		1
1980	1			1			1		3

Table 1.6 *Outliers of data set 4.*

Year	BOX	SRE	SDR	LEV	MAH	COO	SDF	SDB	TOTAL
1961							1		1
1963			1				1	4	6
1976							1		1
1980	2			1					3

A Key to Abbreviations:

BOX	Box plot
SRE	Studentized residual
SDR	Studentized deleted residual
LEV	Leverage value
MAH	Mahalanobis distance
COO	Cook's distance
SDF	Standardized Dffits value
SDB	Standardized Dfbeta value

1.3.3 Selecting the Final Candidate Models

After the subset analysis led us to four models, Data Set 2 with none omitted; Data Set 3 with 1963 omitted and Data Set 4 with 1963 omitted.

Table 1.7 R^2 and Adjusted R^2 for data sets number 2, 3 and 4.

Data set	Observations omitted	R^2	Adj. R^2
2	None	0.7291	0.6324
3	1963	0.8477	0.7715
4	1963	0.8793	0.8190

1.3.4 Selecting the Final Models

It appears that Data set 4 with 1963 omitted is the best model. Regression was performed using this model, and the deleted residuals were calculated.

$$\begin{aligned} \text{Ln(Trout Harvest)} = & 6.27401 - 0.083477 * \text{Sqrt}(\text{Jan.-Feb. Inflows}) \\ & + 0.11770 * \text{Sqrt}(\text{ March-April Inflows}) \\ & - 0.09539 * \text{Sqrt}(\text{May-June Inflows}) \\ & - 0.21394 * \text{Sqrt}(\text{Jul-Aug Inflows}) \\ & + 0.053512 * \text{Sqrt}(\text{Sep-Oct Inflows}) \\ & + 0.068904 * \text{Sqrt}(\text{Nov.-Dec. Inflows}) \end{aligned}$$

1.4 Best Model: Logged Harvest and Square Root of Inflows

1.4.1 Summary Information

Table 1.8 Descriptive statistics for dependent and independent variables.

	Mean	Std. Deviation	N
Ln(Trout Harvest)	5.086102	.520164	19
Sqrt(January-February Inflows)	5.049526	2.321081	19
Sqrt(March-April Inflows)	4.750408	1.522770	19
Sqrt(May-June Inflows)	11.2119	4.162315	19
Sqrt(July-August Inflows)	6.430674	2.253051	19
Sqrt(September-October Inflows)	13.6319	7.417221	19
Sqrt(November-December Inflows)	5.663156	2.916187	19

Table 1.9 Model summary for the final model.

Variables Entered	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Sqrt(November-December), Sqrt(September-October), Sqrt(March-April), Sqrt(July-August), Sqrt(January-February), Sqrt(May-June) ^{c,d}	.938	.879	.819	.221297	2.765

a. Dependent Variable: Ln(Trout Harvest)

b. Method: Enter

c. Independent Variables: (Constant), Square Root of November-December Inflows, Square Root of September-October Inflows, Square Root of March-April Inflows, Square Root of July-August Inflows, Square Root of January-February Inflows, Square Root of May-June Inflows

d. All requested variables entered.

Table 1.10 Anova for the final model.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.283	6	.714	14.575	.000 ^b
	Residual	.588	12	4.9E-02		
	Total	4.870	18			

a. Dependent Variable: Ln(Trout Harvest)

b. Independent Variables: (Constant), Square Root of November-December Inflows, Square Root of September-October Inflows, Square Root of March-April Inflows, Square Root of July-August Inflows, Square Root of January-February Inflows, Square Root of May-June Inflows

Table 1.11 Parameter estimates for the final model.

Coefficients^a

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	6.274	.246		25.516	.000	5.738	6.810
Sqrt(January-February)	-8.3E-02	.028	-.372	-2.965	.012	-.145	-.022
Sqrt(March-April)	.118	.066	.345	1.789	.099	-.026	.261
Sqrt(May-June)	-9.5E-02	.032	-.763	-2.982	.011	-.165	-.026
Sqrt(July-August)	-.214	.027	-.927	-7.885	.000	-.273	-.155
Sqrt(September-October)	5.4E-02	.014	.763	3.834	.002	.023	.084
Sqrt(November-December)	6.9E-02	.021	.386	3.239	.007	.023	.115

a. Dependent Variable: Ln(Trout Harvest)

Table 1.12 Residuals statistics for the final model.

Residuals Statistics ^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.694492	5.877695	5.086102	.487772	19
Std. Predicted Value	-2.853	1.623	.000	1.000	19
Standard Error of Predicted Value	.106250	.193234	.132707	2.1E-02	19
Adjusted Predicted Value	3.641087	5.869698	5.071822	.505107	19
Residual	-.348173	.352254	1.2E-15	.180688	19
Std. Residual	-1.573	1.592	.000	.816	19
Stud. Residual	-1.869	1.858	.024	1.014	19
Deleted Residual	-.491294	.495014	1.4E-02	.281582	19
Stud. Deleted Residual	-2.125	2.108	.035	1.079	19
Mahal. Distance	3.202	12.777	5.684	2.270	19
Cook's Distance	.000	.371	.080	.095	19
Centered Leverage Value	.178	.710	.316	.126	19

a. Dependent Variable: Ln(Trout Harvest)

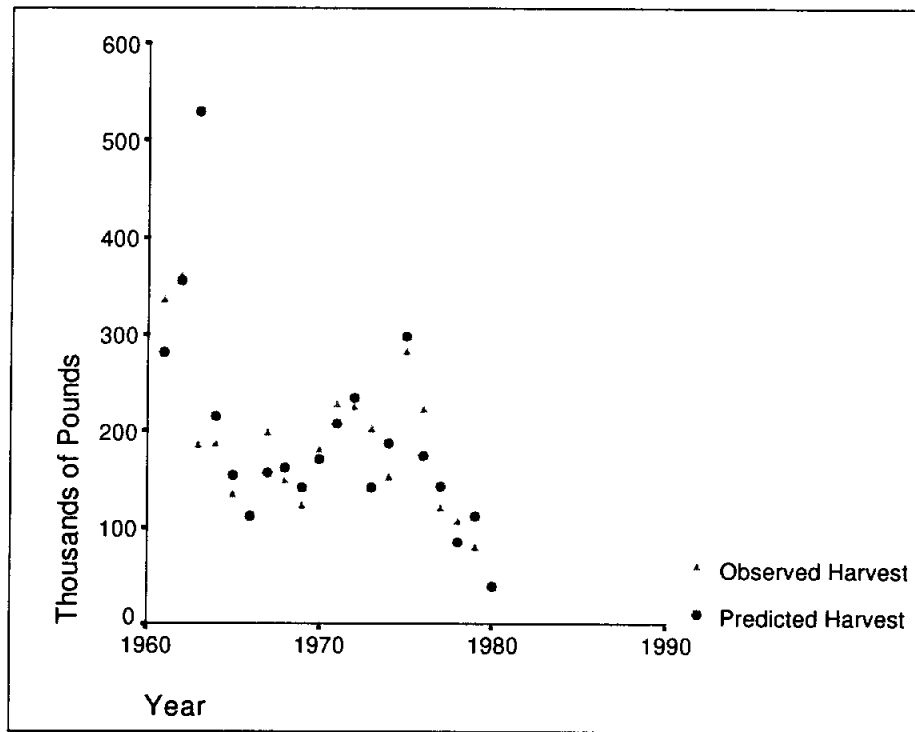


Figure 1.1 Predicted and observed values for the harvest.

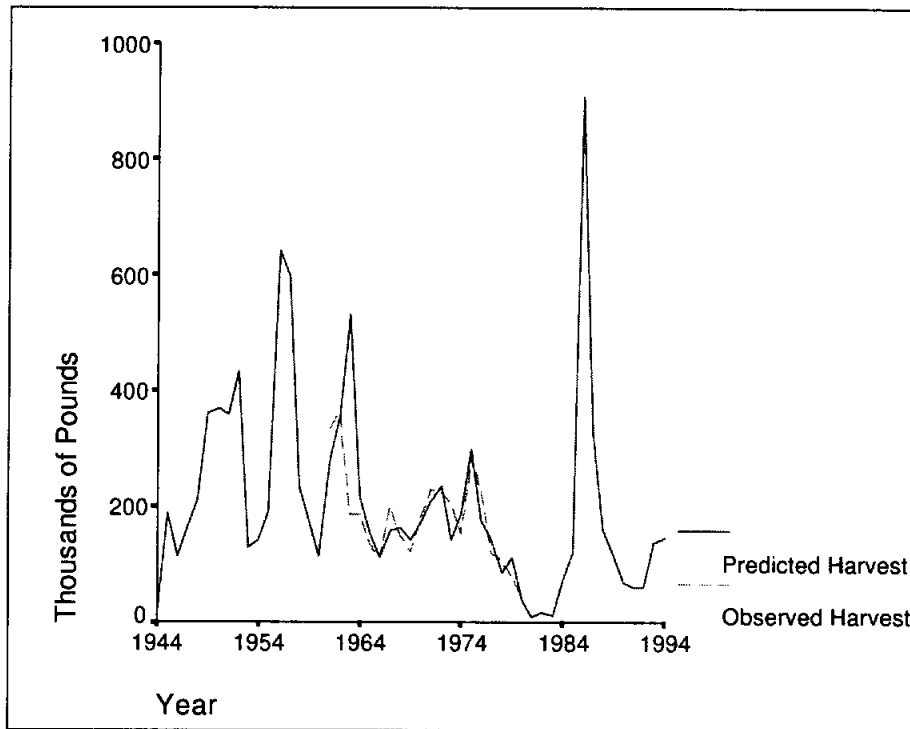


Figure 1.2 Predicted and observed values for the harvest.

Table 1.14 Prediction Intervals for Trout Harvest based on the final model.

<i>YEAR</i>	<i>TROUT</i>	<i>PRE_1</i>	<i>LICI_1</i>	<i>UICI_1</i>
1961	335.80	282.89	125.94	635.44
1962	360.70	356.99	158.81	802.45
1963	185.30	530.35	216.98	1296.28
1964	187.00	216.58	96.24	487.40
1965	134.40	155.10	70.09	343.22
1966	110.80	112.50	52.14	242.72
1967	199.00	157.79	71.88	346.37
1968	148.70	163.08	76.97	345.56
1969	123.00	141.96	65.90	305.78
1970	181.00	171.57	81.06	363.16
1971	228.10	208.29	93.18	465.57
1972	225.50	236.11	109.65	508.41
1973	202.50	142.38	66.54	304.64
1974	152.80	187.98	88.63	398.67
1975	283.20	298.80	136.57	653.77
1976	223.10	175.84	76.43	404.53
1977	120.60	143.41	64.86	317.10
1978	106.00	86.44	38.73	192.91
1979	79.60	112.75	52.30	243.06
1980	40.90	40.23	16.40	98.68

TROUT Observed trout harvest
PRE_1 Predicted trout harvest
LICI_1 Lower limit for 99% prediction interval for the trout harvest.
UICI_1 Upper limit for 99% prediction interval for the trout harvest.

2. EXPLORING THE DATA

2.1 Listing of data

Table 2.1 The trout data and the inflow data.

Year	Trout	JF_inflow	MA_inflow	MJ_inflow	JA_inflow	SO_inflow	ND_inflow
1961	335.80	85.35	12.53	76.10	22.09	261.57	102.55
1962	360.70	71.46	11.40	58.42	16.61	238.01	99.51
1963	185.30	68.35	6.21	16.04	9.88	197.47	102.87
1964	187.00	2.27	2.73	11.40	27.05	25.49	8.41
1965	134.40	10.94	3.93	21.76	27.02	9.91	8.54
1966	110.80	16.67	37.16	117.89	33.60	5.95	9.96
1967	199.00	16.39	36.63	127.86	16.07	6.96	9.10
1968	148.70	12.89	36.99	303.30	39.42	492.61	10.27
1969	123.00	37.58	20.20	224.35	34.75	502.38	5.04
1970	181.00	42.43	38.25	263.17	35.14	502.41	19.33
1971	228.10	37.99	37.01	73.54	22.08	54.97	17.70
1972	225.50	14.82	33.38	176.66	39.38	399.10	29.29
1973	202.50	11.60	20.10	275.96	39.53	415.48	16.51
1974	152.80	13.40	22.00	302.27	31.27	559.45	19.57
1975	283.20	6.87	9.71	182.54	14.08	311.23	38.09
1976	223.10	5.73	11.83	52.72	87.96	303.41	44.08
1977	120.60	21.29	33.65	103.25	90.67	153.34	114.66
1978	106.00	29.50	34.03	127.02	90.38	53.14	94.82
1979	79.60	60.44	46.07	137.12	64.26	75.87	93.72
1980	40.90	83.81	22.90	64.94	145.73	149.76	21.28

Trout	Trout harvest (thousands of pounds)
JF_inflow	Lagged January-February inflows (thousands of acre-feet)
MA_inflow	Lagged March-April inflows (thousands of acre-feet)
MJ_inflow	Lagged May-June inflows (thousands of acre-feet)
JA_inflow	Lagged July-August inflows (thousands of acre-feet)
SO_inflow	Lagged September-October inflows (thousands of acre-feet)
ND_inflow	Lagged November-December inflows (thousands of acre-feet)

2.2 Examination of Individual Variables

Table .2.2 Test of Normality for the trout data and the inflow data.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Trout Harvest	.132	20	.200*	.960	20	.527
Ln(Trout Harvest)	.132	20	.200*	.947	20	.379
Square Root of Trout Harvest	.110	20	.200*	.983	20	.948
January-February Inflows	.220	20	.013	.857	20	.010**
Ln(January-February Inflows)	.109	20	.200*	.953	20	.434
Square Root of January-February Inflows	.183	20	.079	.929	20	.197
March-April Inflows	.209	20	.022	.914	20	.080
Ln(March-April Inflows)	.210	20	.021	.865	20	.010**
Square Root of March-April Inflows	.217	20	.015	.909	20	.063
May-June Inflows	.145	20	.200*	.918	20	.092
Ln(May-June Inflows)	.129	20	.200*	.911	20	.070
Square Root of May-June Inflows	.091	20	.200*	.955	20	.455
July-August Inflows	.306	20	.000	.800	20	.010**
Ln(July-August Inflows)	.179	20	.094	.965	20	.623
Square Root of July-August Inflows	.246	20	.002	.901	20	.044
September-October Inflows	.149	20	.200*	.907	20	.056
Ln(September-October Inflows)	.201	20	.033	.852	20	.010**
Square Root of September-October Inflows	.109	20	.200*	.922	20	.123
November-December Inflows	.257	20	.001	.778	20	.010**
Ln(November-December Inflows)	.187	20	.066	.902	20	.046
Square Root of November-December Inflows	.214	20	.017	.843	20	.010**

*. This is a lower bound of the true significance.

**.. This is an upper bound of the true significance.

a. Lilliefors Significance Correction

Table .2.3 Percentiles of the trout data and the inflow data.

		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition 1)	Trout Harvest	42.8350	82.2400	121.2000	183.1500	224.9000	330.5400	359.4550
	Ln(Trout Harvest)	3.744424	4.405657	4.797406	5.210237	5.415645	5.799480	5.884470
	Square Root of Trout Harvest	6.521639	9.059258	11.0090	13.5331	14.9966	18.1752	18.9587
	January-February Inflows	2.4430	5.8440	11.9225	18.9800	55.9375	82.5750	85.2730
	Ln(January-February Inflows)	.866077	1.763860	2.477367	2.935924	4.013202	4.412611	4.445850
	Square Root of January-February Inflows	1.551006	2.416475	3.451974	4.348500	7.459195	9.084642	9.234320
	March-April Inflows	2.7900	4.1580	11.5075	22.4500	36.9000	38.1410	45.6790
	Ln(March-April Inflows)	1.022519	1.414392	2.442870	3.111090	3.608203	3.641252	3.820861
	Square Root of March-April Inflows	1.668779	2.033379	3.392161	4.737905	6.074523	6.175783	6.757347
	May-June Inflows	11.6320	16.6120	60.0500	122.4550	213.8975	299.6390	303.2485
	Ln(May-June Inflows)	2.450687	2.805584	4.094110	4.807048	5.361648	5.702214	5.714552
	Square Root of May-June Inflows	3.407819	4.070973	7.747107	11.0640	14.6114	17.3085	17.4140
	July-August Inflows	10.0900	14.2790	22.0825	34.1750	58.0775	90.6410	142.9770
	Ln(July-August Inflows)	2.308225	2.657975	3.094785	3.531353	4.041468	4.506906	4.958029
	Square Root of July-August Inflows	3.173701	3.777973	4.699202	5.845732	7.583997	9.520556	11.9444
	September-October Inflows	6.0005	7.2550	53.5975	217.7400	411.3850	502.4070	556.5980
	Ln(September-October Inflows)	1.791231	1.975516	3.981394	5.378950	6.019379	6.219411	6.321577
	Square Root of September-October Inflows	2.449208	2.689165	7.320833	14.7400	20.2819	22.4144	23.5908
	November-December Inflows	5.2085	8.4230	10.0375	20.4250	94.5450	102.8380	114.0705
	Ln(November-December Inflows)	1.643007	2.130955	2.306240	3.015883	4.549063	4.633154	4.736546
Square Root of November-December Inflows	2.277745	2.902233	3.168131	4.518412	9.723394	10.1409	10.6797	
Tukey's Hinges	Trout Harvest			121.8000	183.1500	224.3000		
	Ln(Trout Harvest)			4.802332	5.210237	5.412970		
	Square Root of Trout Harvest			11.0362	13.5331	14.9766		
	January-February Inflows			12.2450	18.9800	51.4350		
	Ln(January-February Inflows)			2.503728	2.935924	3.924753		
	Square Root of January-February Inflows			3.498071	4.348500	7.144074		
	March-April Inflows			11.6150	22.4500	36.8100		
	Ln(March-April Inflows)			2.452126	3.111090	3.605758		
	Square Root of March-April Inflows			3.407933	4.737905	6.067106		
	May-June Inflows			61.6800	122.4550	203.4450		
	Ln(May-June Inflows)			4.120561	4.807048	5.310088		
	Square Root of May-June Inflows			7.850917	11.0640	14.2445		
	July-August Inflows			22.0850	34.1750	51.8950		
	Ln(July-August Inflows)			3.094899	3.531353	3.919999		
	Square Root of July-August Inflows			4.699468	5.845732	7.151761		
	September-October Inflows			54.0550	217.7400	407.2900		
	Ln(September-October Inflows)			3.989859	5.378950	6.009323		
	Square Root of September-October Inflows			7.351947	14.7400	20.1804		
	November-December Inflows			10.1150	20.4250	94.2700		
	Ln(November-December Inflows)			2.313902	3.015883	4.546146		
Square Root of November-December Inflows			3.180315	4.518412	9.709233			

2.2.1 The trout data

Table .2.4 Descriptives for the trout data.

Descriptives			Statistic	Std. Error
Trout Harvest	Mean		181.4000	18.1365
	95% Confidence Interval for Mean	Lower Bound	143.4400	
		Upper Bound	219.3600	
	5% Trimmed Mean		179.2444	
	Median		183.1500	
	Variance		6578.623	
	Std. Deviation		81.1087	
	Minimum		40.90	
	Maximum		360.70	
	Range		319.80	
	Interquartile Range		103.7000	
	Skewness		.612	.512
	Kurtosis		.312	.992

Table .2.5 Extreme Values for the trout data.

Extreme Values					
			Case Number	Year	Value
Trout Harvest	Highest	1	2	1962	360.70
		2	1	1961	335.80
		3	15	1975	283.20
		4	11	1971	228.10
		5	12	1972	225.50
	Lowest	1	20	1980	40.90
		2	19	1979	79.60
		3	18	1978	106.00
		4	6	1966	110.80
		5	17	1977	120.60

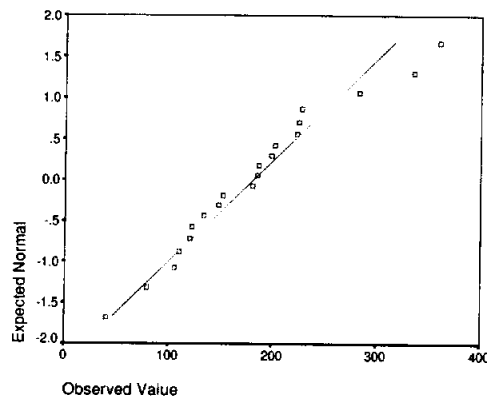


Figure 2.1 Normal Q-Q Plot of Trout Harvest.

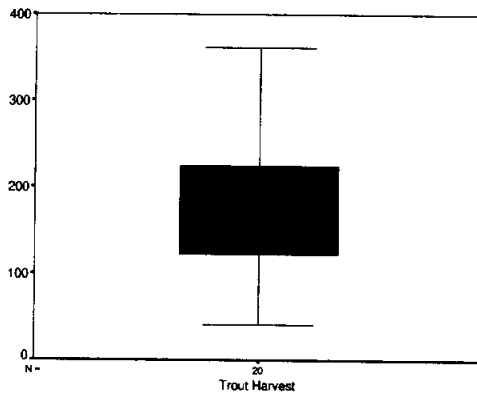


Figure 2.2 BoxPlot of Trout Harvest.

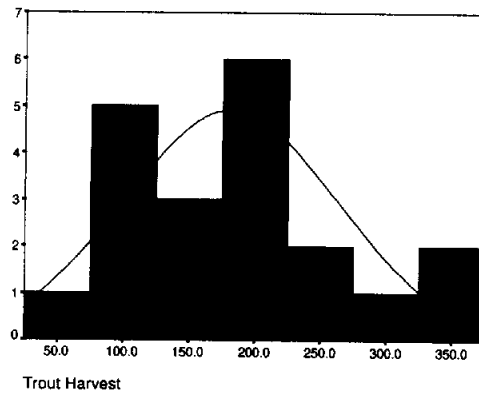


Figure 2.3 Histogram of Trout Harvest.

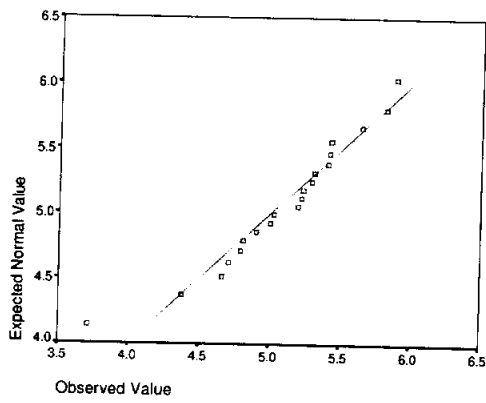


Figure 2.4 Normal Q-Q Plot of Ln(Trout Harvest).

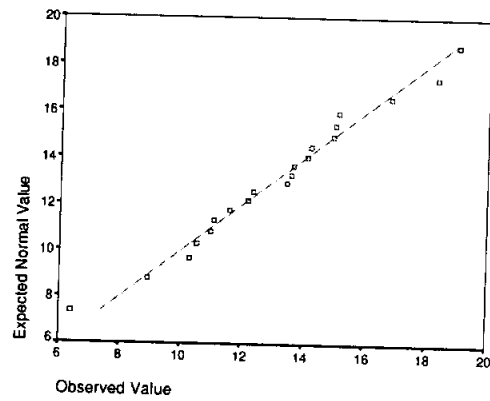


Figure 2.5 Normal Q-Q Plot of Sqrt(Trout Harvest).

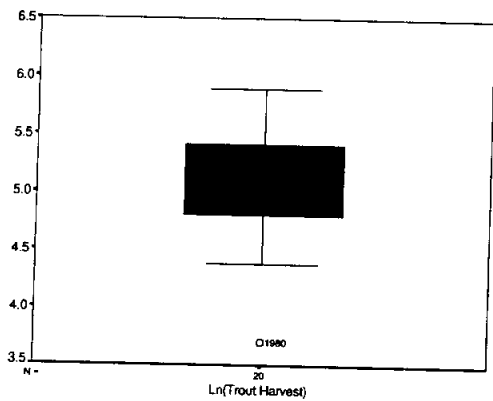


Figure 2.6 BoxPlot of Ln(Trout Harvest).

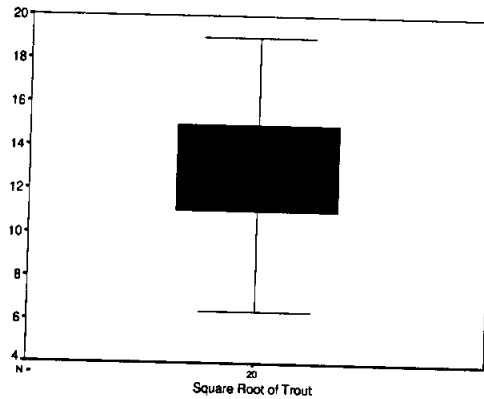


Figure 2.7 BoxPlot of Sqrt(Trout Harvest).

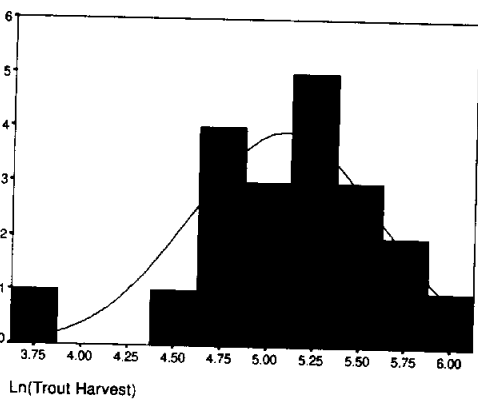


Figure 2.8 Histogram of Ln(Trout Harvest).

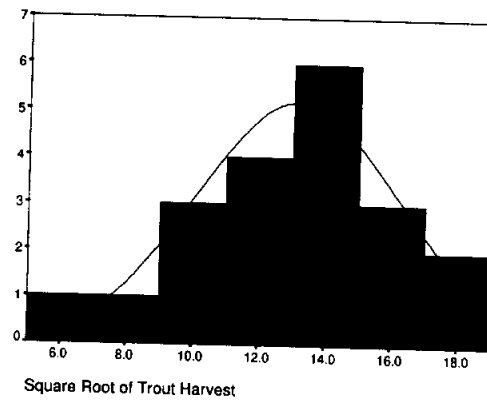


Figure 2.9 Histogram of Sqrt(Trout Harvest).

2.2.2 The January-February Inflows data

Table .2.6 Descriptives for the January-February Inflow data.

Descriptives			Statistic	Std. Error
January-February Inflows	Mean		32.4890	6.0827
	95% Confidence Interval for Mean	Lower Bound	19.7577	
		Upper Bound	45.2203	
	5% Trimmed Mean		31.2311	
	Median		18.9800	
	Variance		739.994	
	Std. Deviation		27.2028	
	Minimum		2.27	
	Maximum		85.35	
	Range		83.08	
	Interquartile Range		44.0150	
	Skewness		.869	.512
	Kurtosis		-.632	.992

Table .2.7 Extreme Values for the January-February Inflow data.

			Extreme Values		
			Case Number	Year	Value
January-February Inflows	Highest	1	1	1961	85.35
		2	20	1980	83.81
		3	2	1962	71.46
		4	3	1963	68.35
		5	19	1979	60.44
	Lowest	1	4	1964	2.27
		2	16	1976	5.73
		3	15	1975	6.87
		4	5	1965	10.94
		5	13	1973	11.60

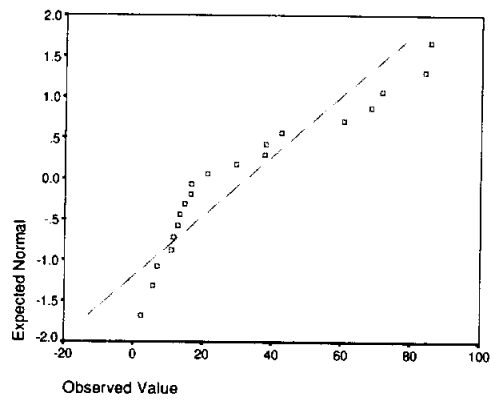


Figure 2.10 Normal Q-Q Plot of January-February Inflows.

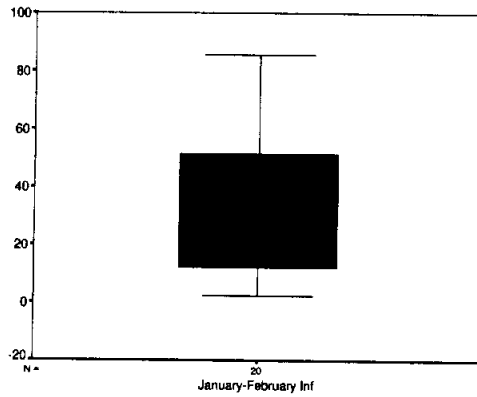


Figure 2.11 BoxPlot of January-February Inflows.

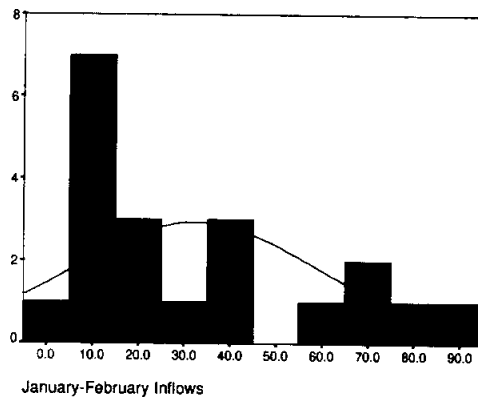


Figure 2.12 Histogram of January-February Inflows.

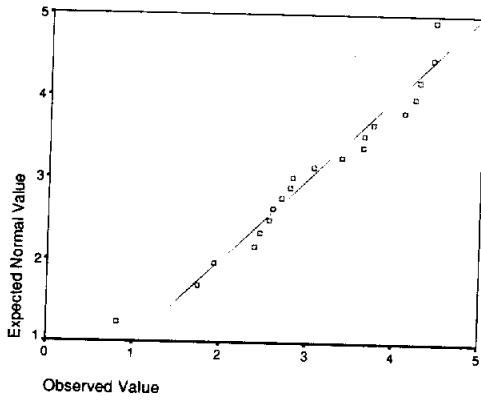


Figure 2.13 Normal Q-Q Plot of Ln January-February Inflows).

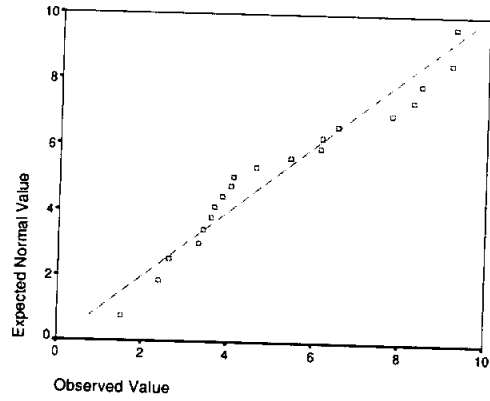


Figure 2.14 Normal Q-Q Plot of Sqrt(January-February Inflows).

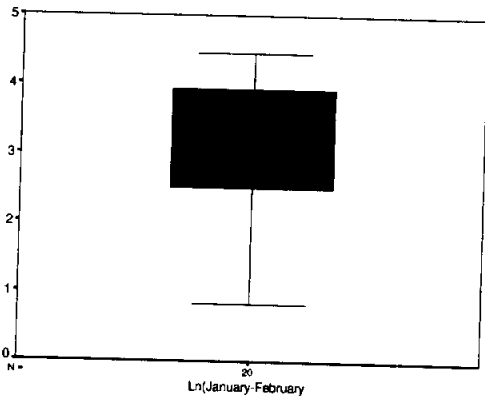


Figure 2.15 BoxPlot of Ln(January-February Inflows).

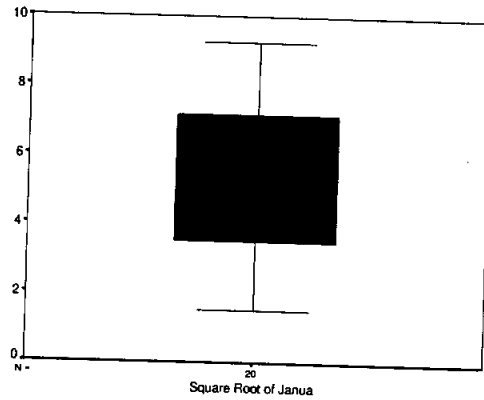


Figure 2.16 BoxPlot of Square Root of January-February Inflows.

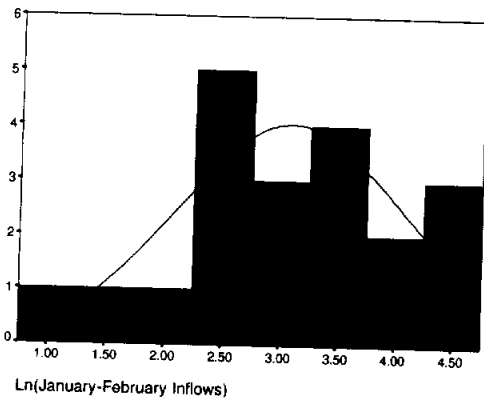


Figure 2.17 Histogram of Ln(January-February Inflows).

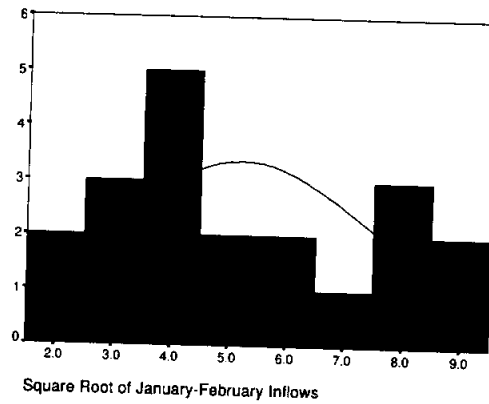


Figure 2.18 Histogram of Sqrt(January-February Inflows).

2.2.3 The March-April Inflows data

Table .2.8 Descriptives for the March-April Inflow data.

Descriptives			Statistic	Std. Error
March-April Inflows	Mean		23.8355	3.0311
	95% Confidence Interval for Mean	Lower Bound	17.4914	
		Upper Bound	30.1796	
		5% Trimmed Mean	23.7728	
	Median		22.4500	
	Variance		183.748	
	Std. Deviation		13.5554	
	Minimum		2.73	
	Maximum		46.07	
	Range		43.34	
	Interquartile Range		25.3925	
	Skewness		-.115	.512
	Kurtosis		-1.426	.992

Table .2.9 Extreme Values for the March-April Inflow data.

			Case Number	Year	Value
March-April Inflows	Highest	1	19	1979	46.07
		2	10	1970	38.25
		3	6	1966	37.16
		4	11	1971	37.01
		5	8	1968	36.99
	Lowest	1	4	1964	2.73
		2	5	1965	3.93
		3	3	1963	6.21
		4	15	1975	9.71
		5	2	1962	11.40

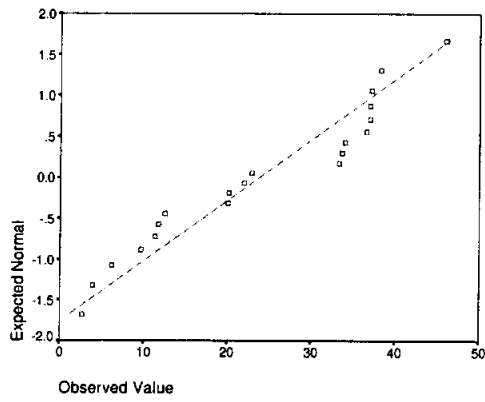


Figure 2.19 Normal Q-Q Plot of March-April Inflows.

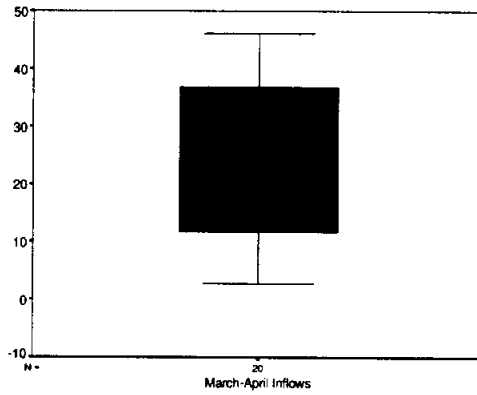


Figure 2.20 BoxPlot of March-April Inflows.

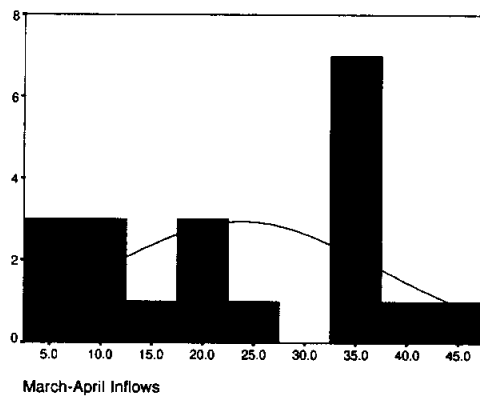


Figure 2.21 Histogram of March-April Inflows.

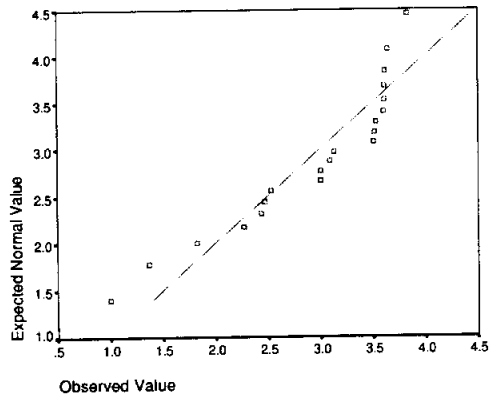


Figure 2.22 Normal Q-Q Plot of Ln(March-April Inflows).

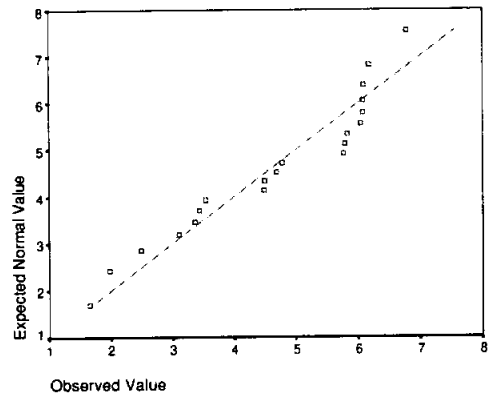


Figure 2.23 Normal Q-Q Plot of Sqrt(March-April Inflows).

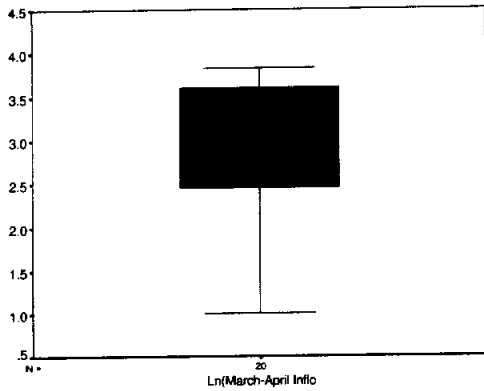


Figure 2.24 BoxPlot of Ln(March-April Inflows).

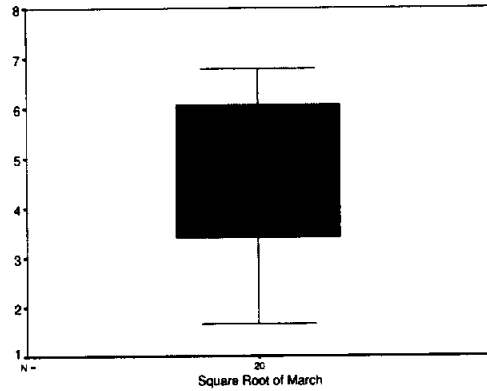


Figure 2.25 BoxPlot of Square Root of March-April Inflows.

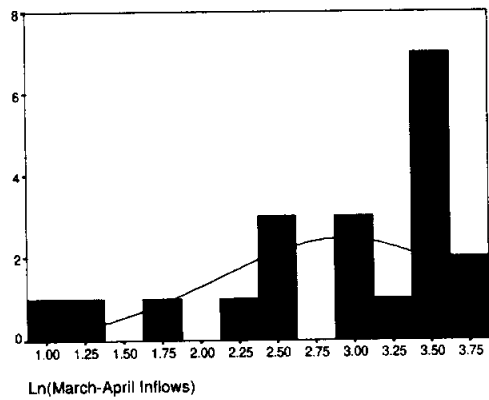


Figure 2.26 Histogram of Ln(March-April Inflows).

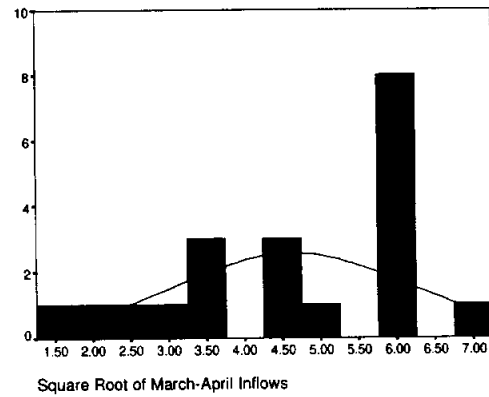


Figure 2.27 Histogram of Sqrt(March-April Inflows).

2.2.4 The May-June Inflows data

Table .2.10 Descriptives for the May-June Inflow data.

Descriptives			Statistic	Std. Error
May-June Inflows	Mean		135.8155	21.3386
	95% Confidence Interval for Mean	Lower Bound	91.1532	
		Upper Bound	180.4778	
	5% Trimmed Mean		133.4228	
	Median		122.4550	
	Variance		9106.752	
	Std. Deviation		95.4293	
	Minimum		11.40	
	Maximum		303.30	
	Range		291.90	
	Interquartile Range		153.8475	
	Skewness		.537	.512
	Kurtosis		-.904	.992

Table .2.11 Extreme Values for the May-June Inflow data.

Extreme Values					
		Case Number	Year	Value	
May-June Inflows	Highest	1	8	1968	303.30
		2	14	1974	302.27
		3	13	1973	275.96
		4	10	1970	263.17
		5	9	1969	224.35
	Lowest	1	4	1964	11.40
		2	3	1963	16.04
		3	5	1965	21.76
		4	16	1976	52.72
		5	2	1962	58.42

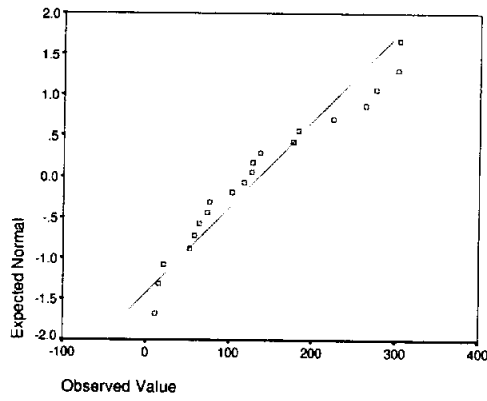


Figure 2.28 Normal Q-Q Plot of May-June Inflows.

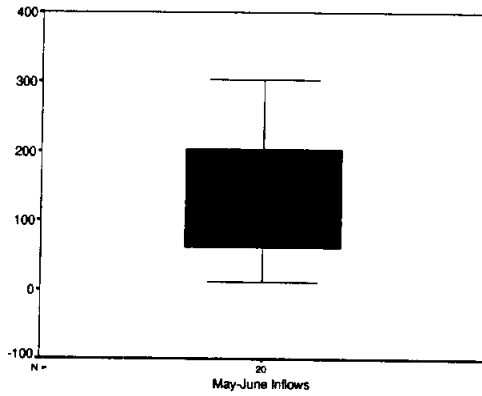


Figure 2.29 BoxPlot of May-June Inflows.

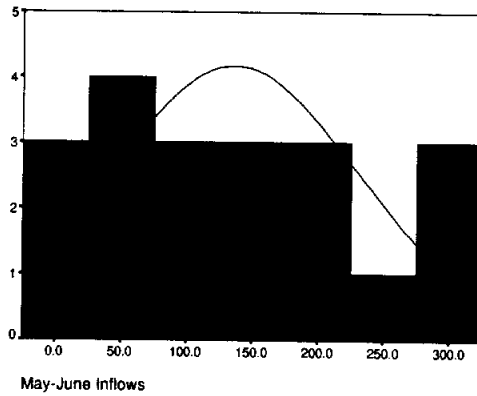


Figure 2.30 Histogram of May-June Inflows.

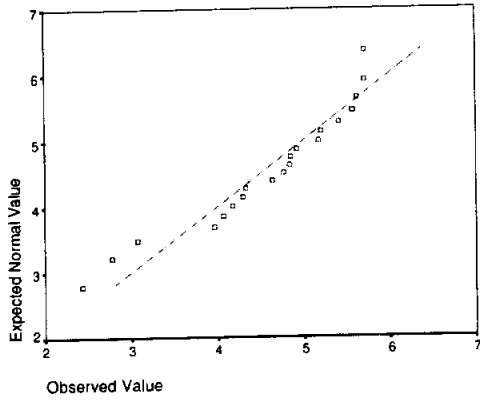


Figure 2.31 Normal Q-Q Plot of Ln(May-June Inflows).

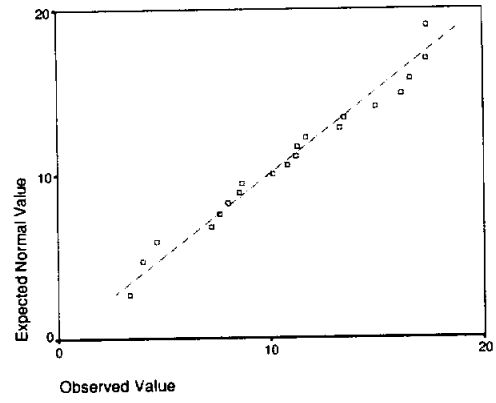


Figure 2.32 Normal Q-Q Plot of Sqrt(May-June Inflows).

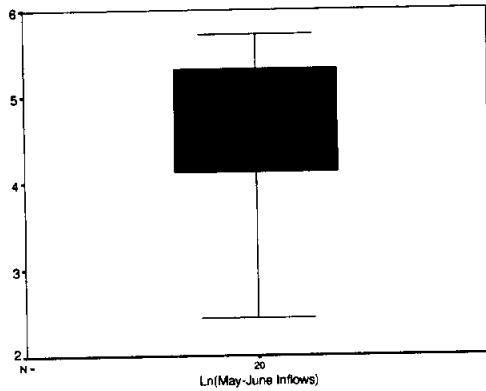


Figure 2.33 BoxPlot of Ln(May-June Inflows).

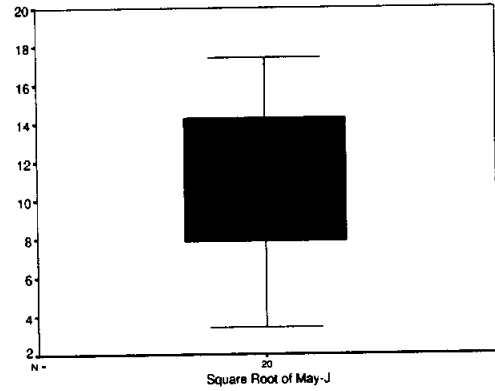


Figure 2.34 BoxPlot of Square Root of May-June Inflows.

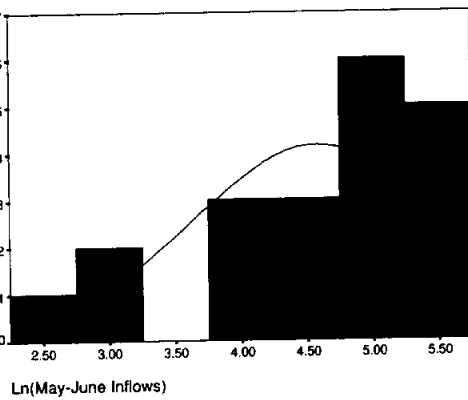


Figure 2.35 Histogram of Ln(May-June Inflows).

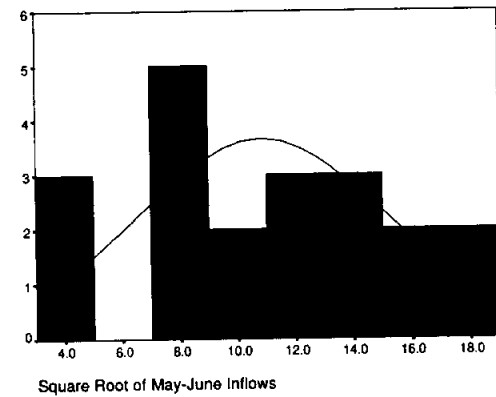


Figure 2.36 Histogram of Sqrt(May-June Inflows).

2.2.5 The July-August Inflows data

Table .2.12 Descriptives for the July-August Inflow data.

Descriptives			Statistic	Std. Error
July-August Inflows	Mean		44.3485	7.7189
	95% Confidence Interval for Mean	Lower Bound	28.1926	
		Upper Bound	60.5044	
	5% Trimmed Mean		40.6311	
	Median		34.1750	
	Variance		1191.638	
	Std. Deviation		34.5201	
	Minimum		9.88	
	Maximum		145.73	
	Range		135.85	
	Interquartile Range		35.9950	
	Skewness		1.676	.512
	Kurtosis		2.704	.992

Table .2.13 Extreme Values for the July-August Inflow data.

Extreme Values					
			Case Number	Year	Value
July-August Inflows	Highest	1	20	1980	145.73
		2	17	1977	90.67
		3	18	1978	90.38
		4	16	1976	87.96
		5	19	1979	64.26
	Lowest	1	3	1963	9.88
		2	15	1975	14.08
		3	7	1967	16.07
		4	2	1962	16.61
		5	11	1971	22.08

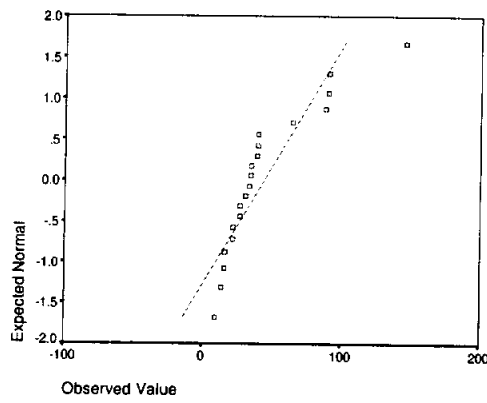


Figure 2.37 Normal Q-Q Plot of July-August Inflows.

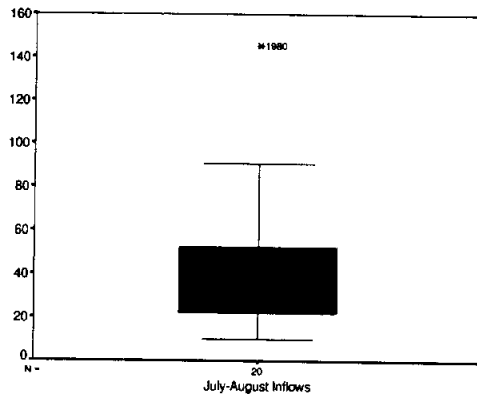


Figure 2.38 BoxPlot of July-August Inflows.

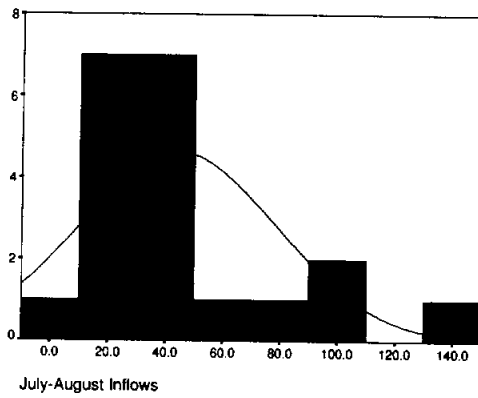


Figure 2.39 Histogram of July-August Inflows.

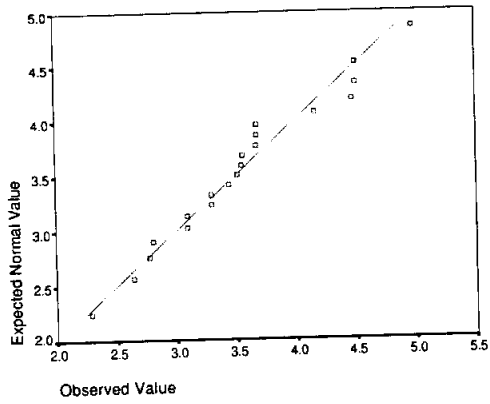


Figure 2.40 Normal Q-Q Plot of Ln(July-August Inflows).

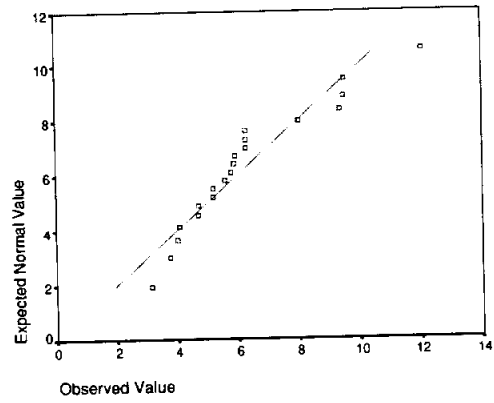


Figure 2.41 Normal Q-Q Plot of Sqrt(July-August Inflows).

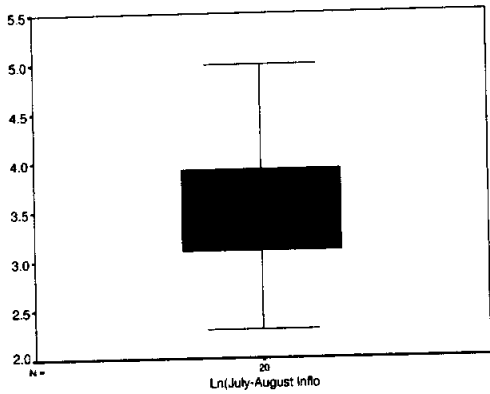


Figure 2.42 BoxPlot of Ln(July-August Inflows).

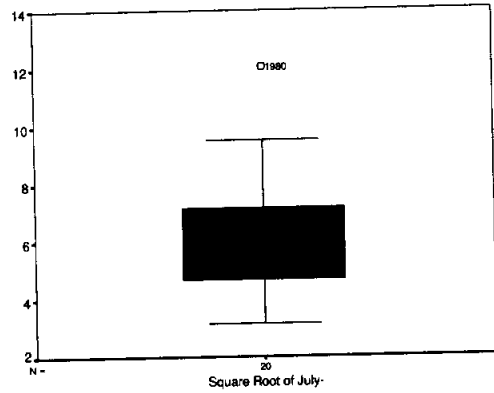


Figure 2.43 BoxPlot of Square Root of July-August Inflows.

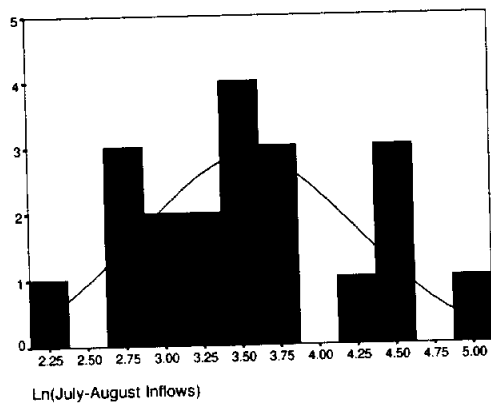


Figure 2.44 Histogram of Ln(July-August Inflows).

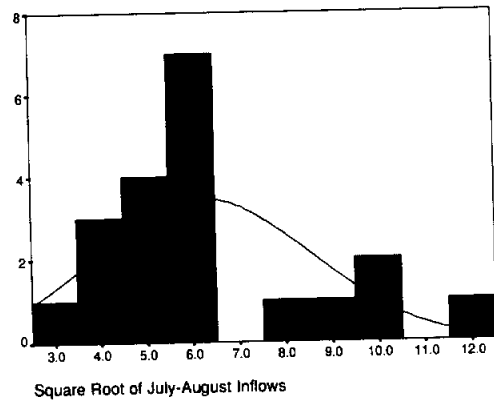


Figure 2.45 Histogram of Sqrt(July-August Inflows).

2.2.6 The September-October Inflows data

Table .2.14 Descriptives for the September-October Inflow data.

Descriptives			Statistic	Std. Error
September-October Inflows	Mean		235.9255	42.6274
	95% Confidence Interval for Mean	Lower Bound	146.7053	
		Upper Bound	325.1457	
	5% Trimmed Mean		230.7283	
	Median		217.7400	
	Variance		36341.9	
	Std. Deviation		190.6356	
	Minimum		5.95	
	Maximum		559.45	
	Range		553.50	
	Interquartile Range		357.7875	
	Skewness		.313	.512
	Kurtosis		-1.338	.992

Table .2.15 Extreme Values for the September-October Inflow data.

Extreme Values			Case Number	Year	Value
September-October Inflows	Highest	1	14	1974	559.45
		2	10	1970	502.41
		3	9	1969	502.38
		4	8	1968	492.61
		5	13	1973	415.48
	Lowest	1	6	1966	5.95
		2	7	1967	6.96
		3	5	1965	9.91
		4	4	1964	25.49
		5	18	1978	53.14

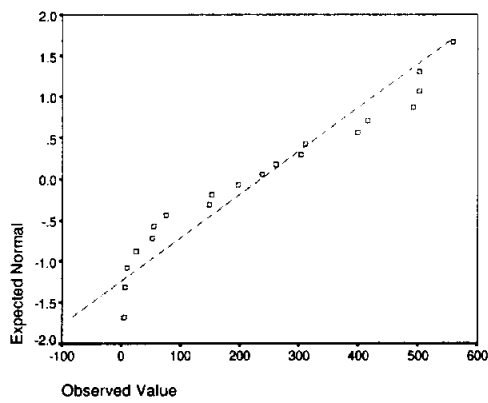


Figure 2.46 Normal Q-Q Plot of September-October Inflows.

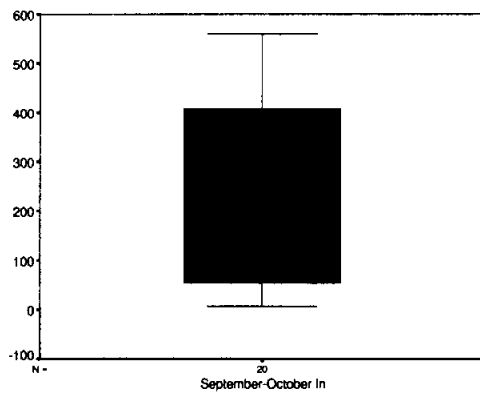


Figure 2.47 BoxPlot of September-October Inflows.

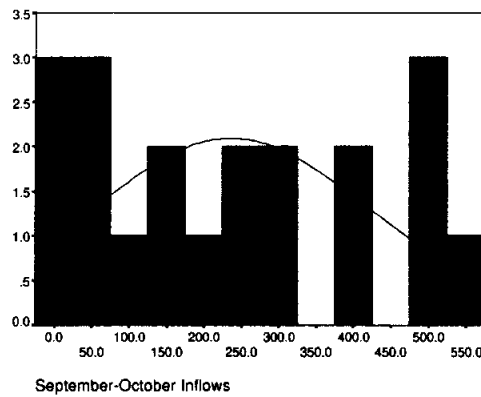


Figure 2.48 Histogram of September-October Inflows.

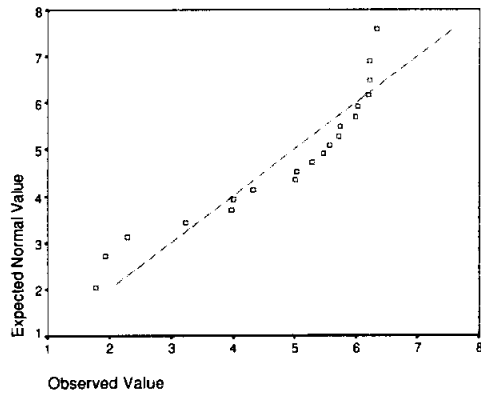


Figure 2.49 Normal Q-Q Plot of Ln(September-October Inflows).

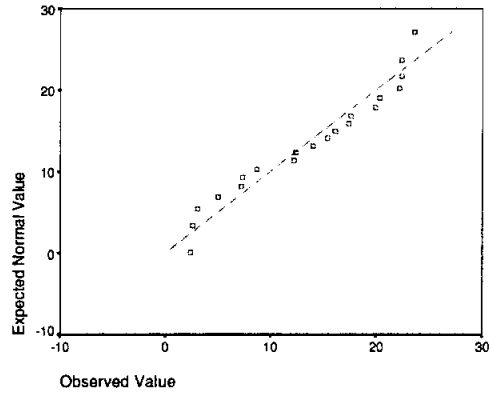


Figure 2.50 Normal Q-Q Plot of Sqrt(September-October Inflows).

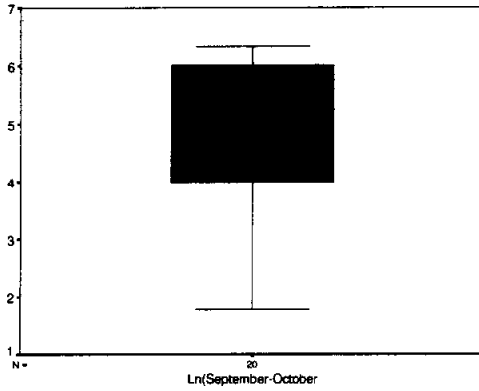


Figure 2.51 BoxPlot of Ln(September-October Inflows).

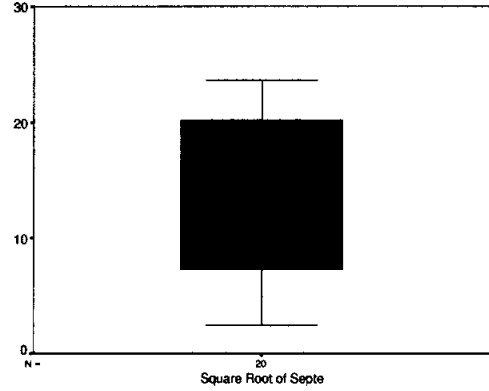


Figure 2.52 BoxPlot of Square Root of September-October Inflows.

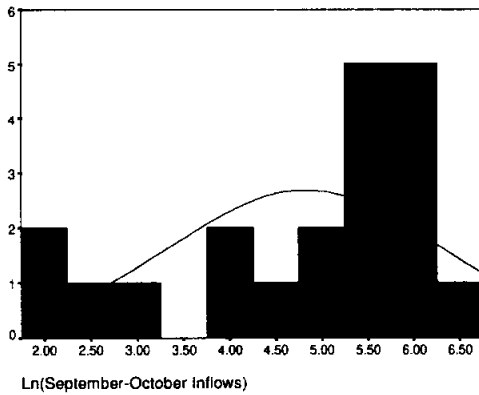


Figure 2.53 Histogram of Ln(September-October Inflows).

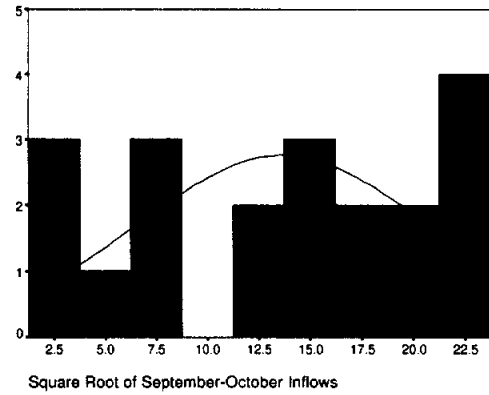


Figure 2.54 Histogram of Sqrt(September-October Inflows).

2.2.7 The November-December Inflows data

Table .2.16 Descriptives for the November-December Inflow data.

Descriptives			Statistic	Std. Error
November-December Inflows	Mean		43.2650	9.0305
	95% Confidence Interval for Mean	Lower Bound	24.3640	
		Upper Bound	62.1660	
	5% Trimmed Mean		41.4222	
	Median		20.4250	
	Variance		1630.981	
	Std. Deviation		40.3854	
	Minimum		5.04	
	Maximum		114.66	
	Range		109.62	
	Interquartile Range		84.5075	
	Skewness		.798	.512
	Kurtosis		-1.225	.992

Table .2.17 Extreme Values for the November-December Inflow data.

			Case Number	Year	Value
November-December Inflows	Highest	1	17	1977	114.66
		2	3	1963	102.87
		3	1	1961	102.55
		4	2	1962	99.51
		5	18	1978	94.82
	Lowest	1	9	1969	5.04
		2	4	1964	8.41
		3	5	1965	8.54
		4	7	1967	9.10
		5	6	1966	9.96

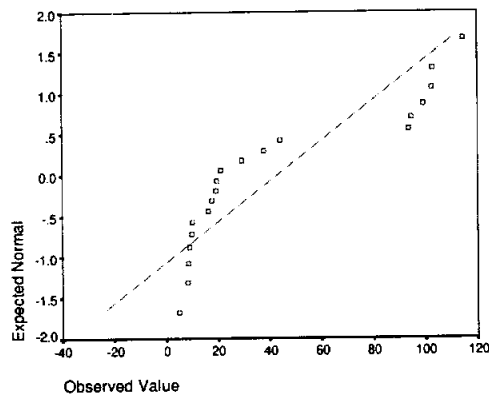


Figure 2.55 Normal Q-Q Plot of November-December Inflows.

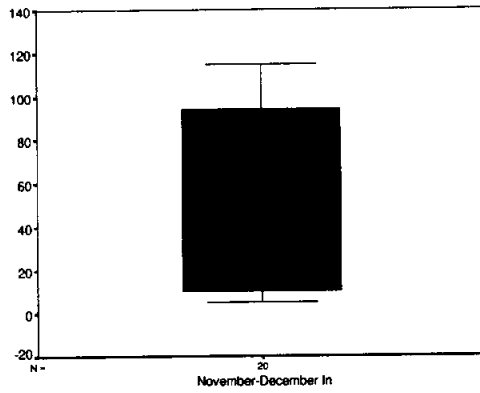


Figure 2.56 BoxPlot of November-December Inflows.

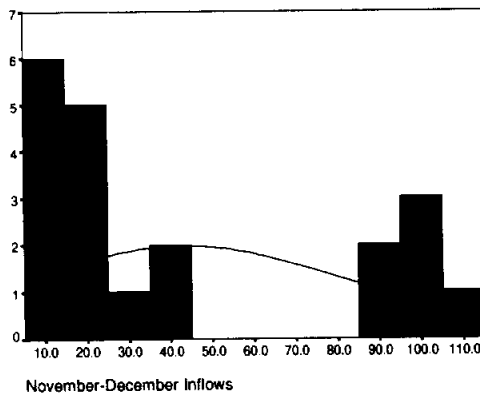


Figure 2.57 Histogram of November-December Inflows.

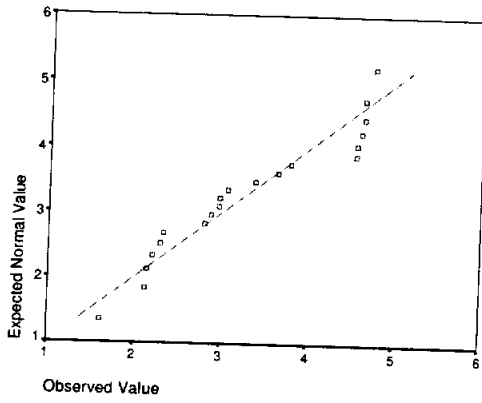


Figure 2.58 Normal Q-Q Plot of Ln(November_December Inflows).

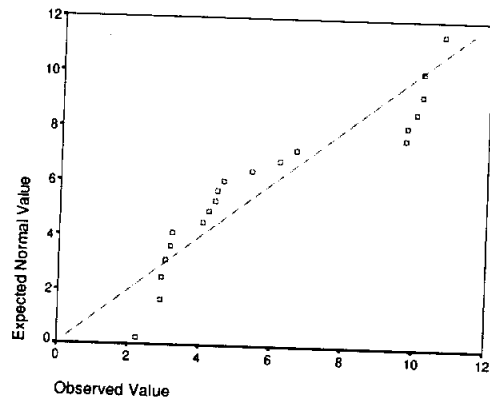


Figure 2.59 Normal Q-Q Plot of Sqrt(November_December Inflows).

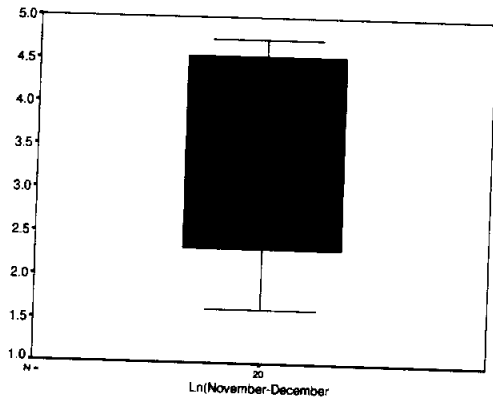


Figure 2.60 BoxPlot of Ln(November_December) Inflows.

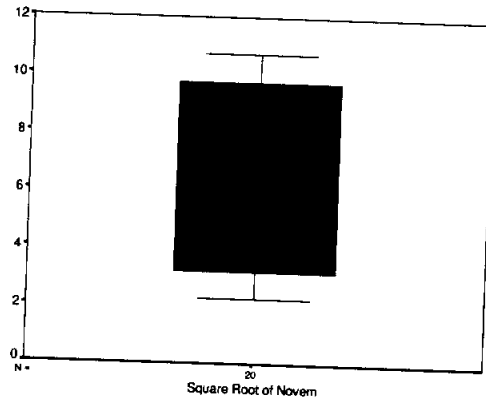


Figure 2.61 BoxPlot of Square Root of November_December Inflows.

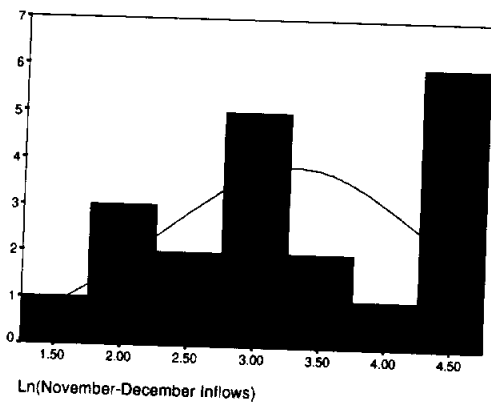


Figure 2.62 Histogram of Ln(November_December) Inflows.

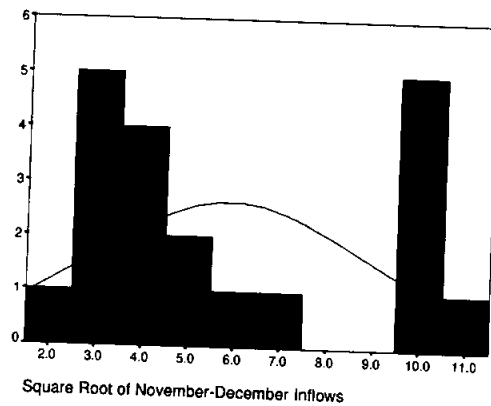


Figure 2.63 Histogram of Sqrt(November_December) Inflows.

3. PREDICTION ELLIPSES AND CONFIDENCE REGIONS

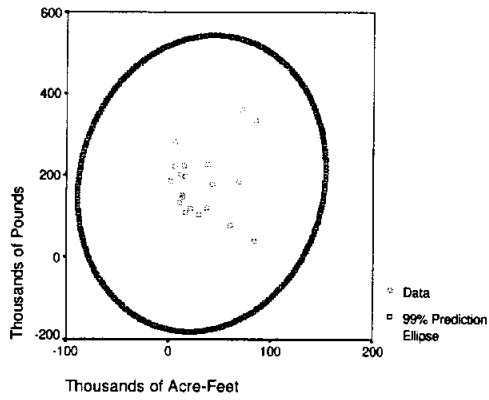


Figure 3.1 Trout Harvest vs. January-February Inflows, PE.

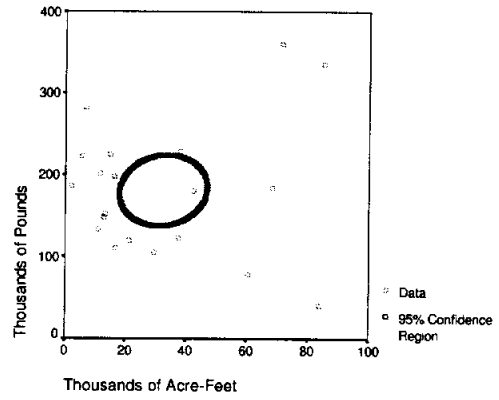


Figure 3.2 Trout Harvest vs. January-February Inflows, CR.

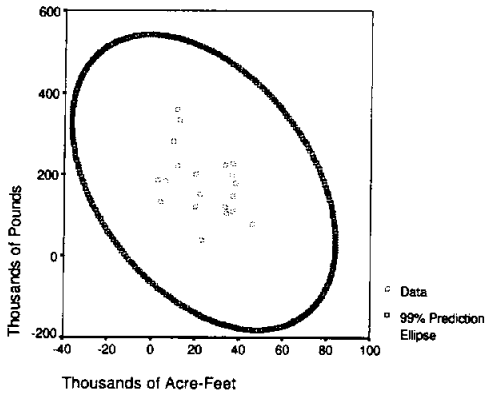


Figure 3.3 Trout Harvest vs. March-April Inflows, PE.

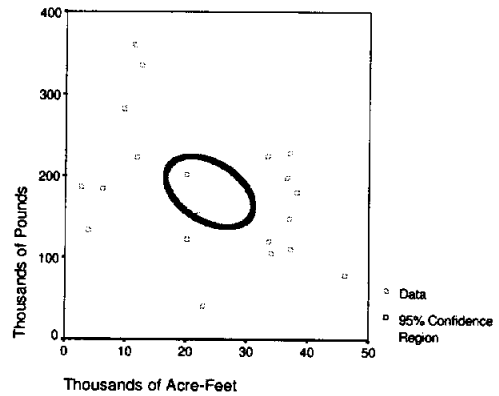


Figure 3.4 Trout Harvest vs. March-April Inflows, CR.

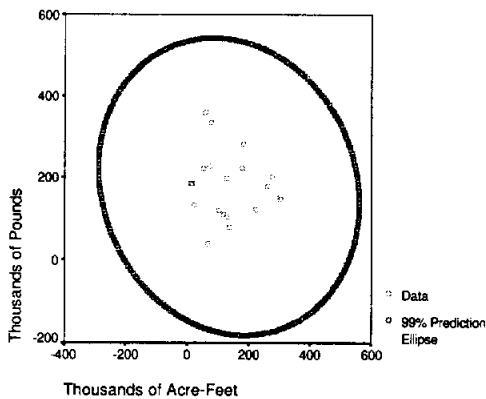


Figure 3.5 Trout Harvest vs. May-June Inflows, PE.

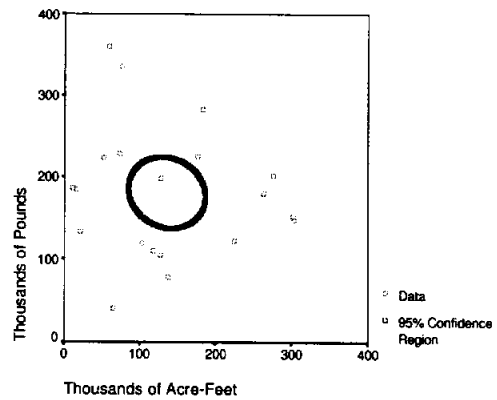


Figure 3.6 Trout Harvest vs. May-June Inflows, CR.

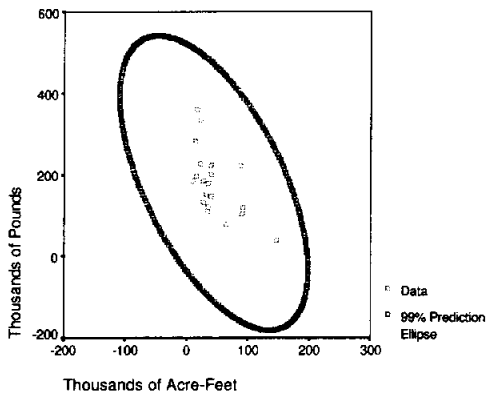


Figure 3.7 Trout Harvest vs. July-August Inflows, PE.

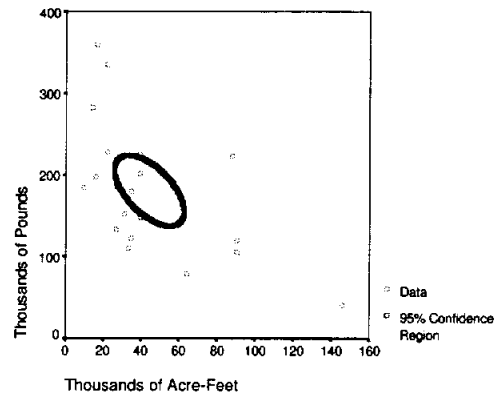


Figure 3.8 Trout Harvest vs. July-August Inflows, CR.

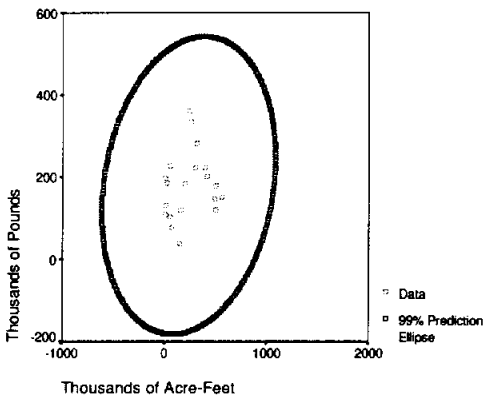


Figure 3.9 Trout Harvest vs. September-October Inflows, PE.

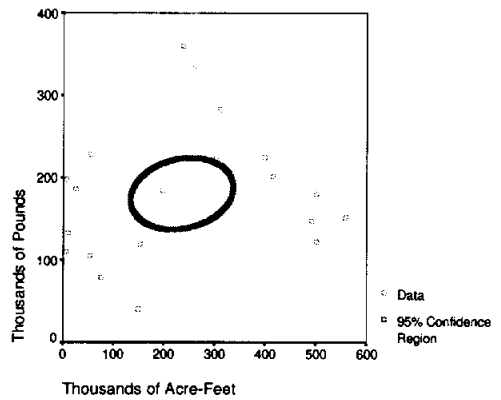


Figure 3.10 Trout Harvest vs. September-October Inflows, CR.

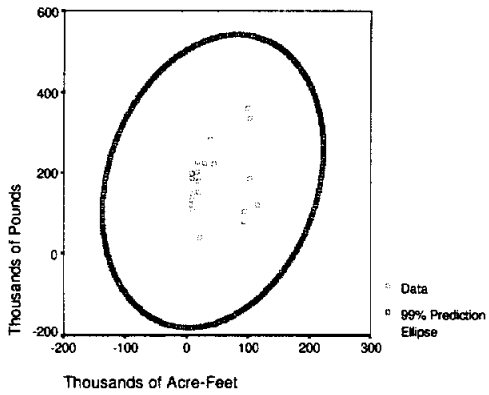


Figure 3.11 Trout Harvest vs. November-December Inflows, PE.

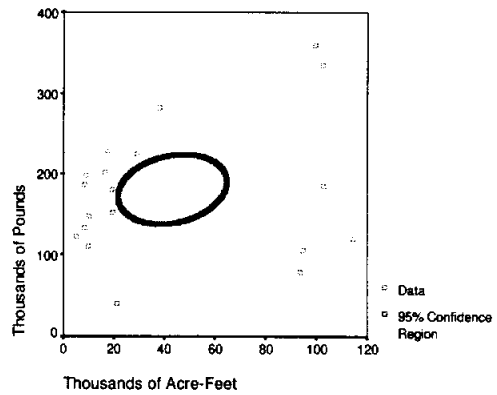


Figure 3.12 Trout Harvest vs. November-December Inflows, CR.

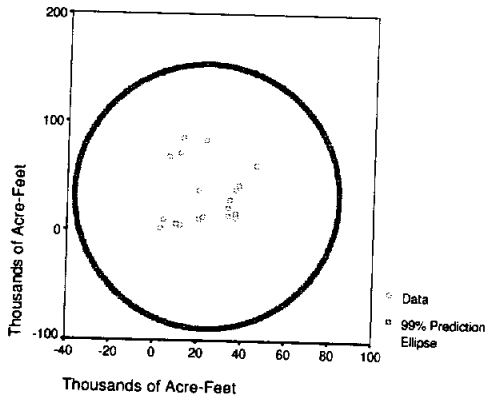


Figure 3.13 January-February Inflows vs. March-April Inflows, PE.

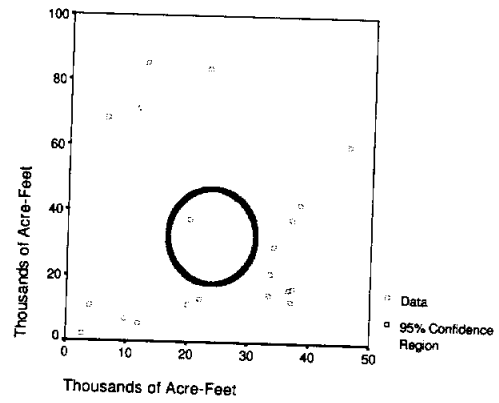


Figure 3.14 January-February Inflows vs. March-April Inflows, CR.

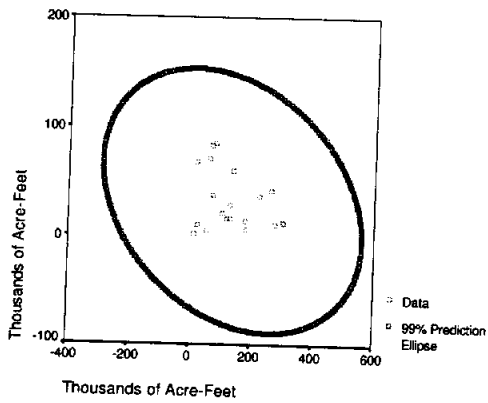


Figure 3.15 January-February Inflows vs. May-June Inflows, PE.

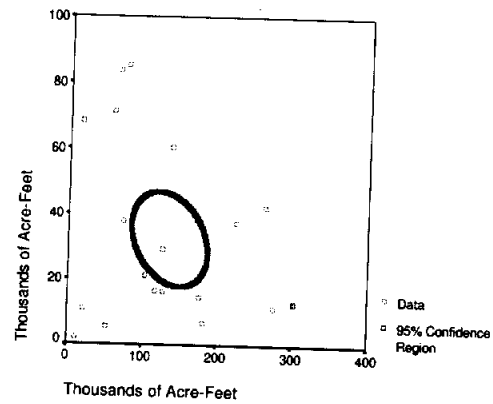


Figure 3.16 January-February Inflows vs. May-June Inflows, CR.

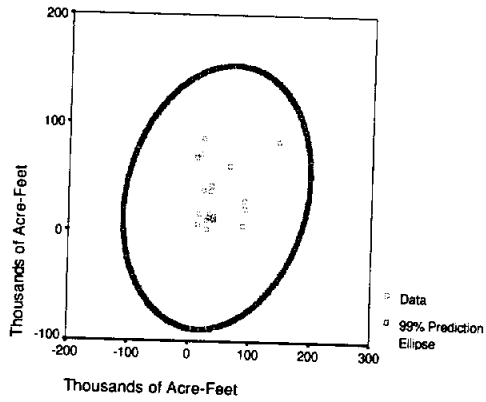


Figure 3.17 January-February Inflows vs. July-August Inflows, PE.

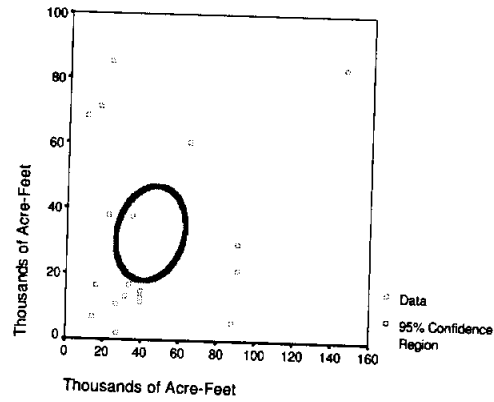


Figure 3.18 January-February Inflows vs. July-August Inflows, CR.

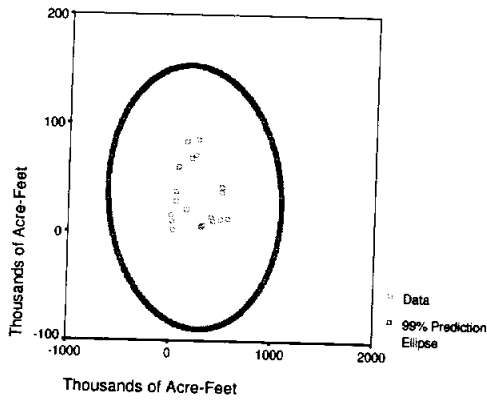


Figure 3.19 January-February Inflows vs. September-October Inflows, PE.

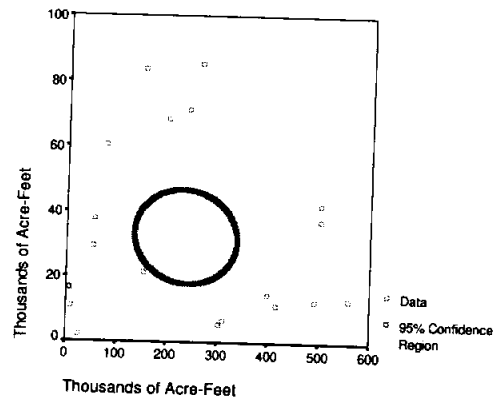


Figure 3.20 January-February Inflows vs. September-October Inflows, CR.

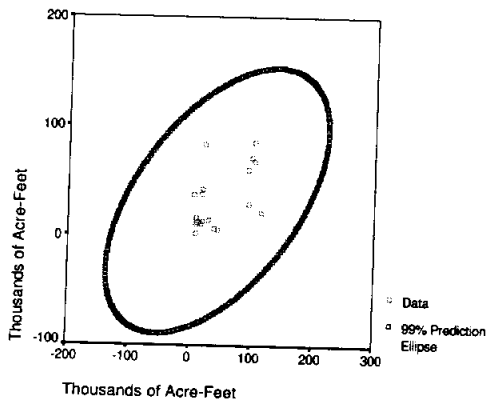


Figure 3.21 January-February Inflows vs. November-December Inflows, PE.

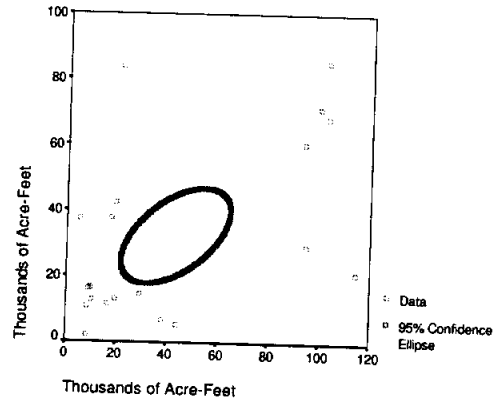


Figure 3.22 January-February Inflows vs. November-December Inflows, CR.

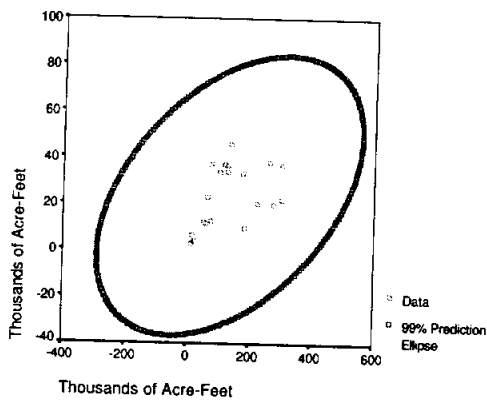


Figure 3.23 March-April Inflows vs. May-June Inflows, PE.

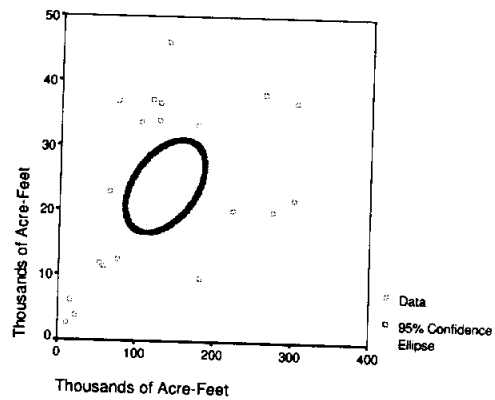


Figure 3.24 March-April Inflows vs. May-June Inflows, CR.

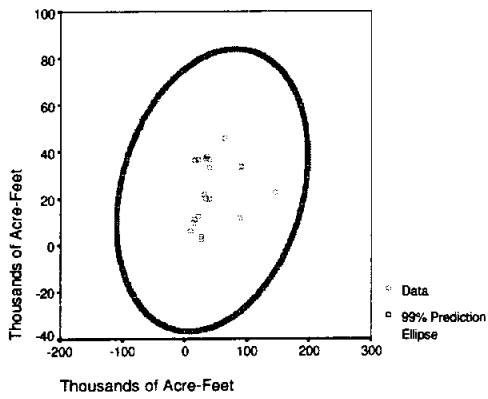


Figure 3.25 *March-April Inflows vs. July-August Inflows, PE.*

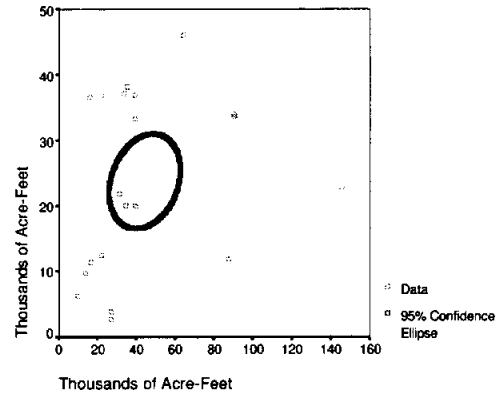


Figure 3.26 *March-April Inflows vs. July-August Inflows, CR.*

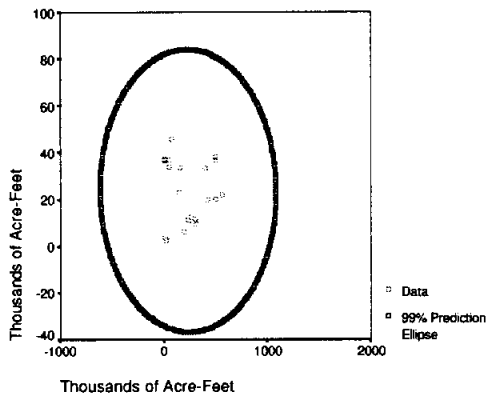


Figure 3.27 *March-April Inflows vs. September-October Inflows, PE.*

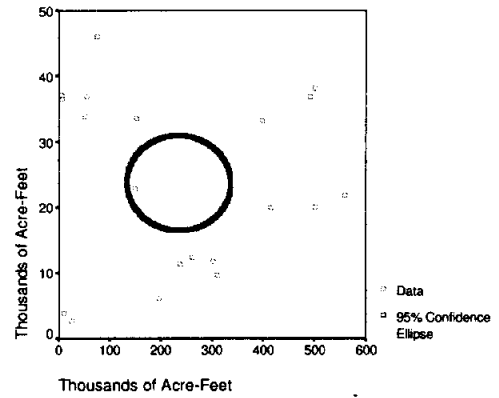


Figure 3.28 *March-April Inflows vs. September-October Inflows, CR.*

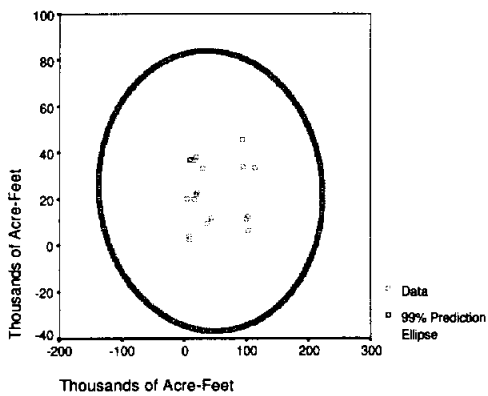


Figure 3.29 *March-April Inflows vs. November-December Inflows, PE.*

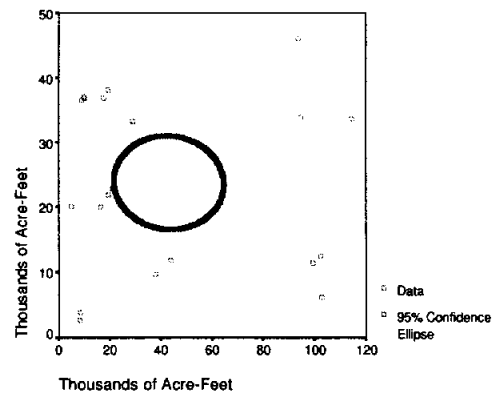


Figure 3.30 *March-April Inflows vs. November-December Inflows, CR.*

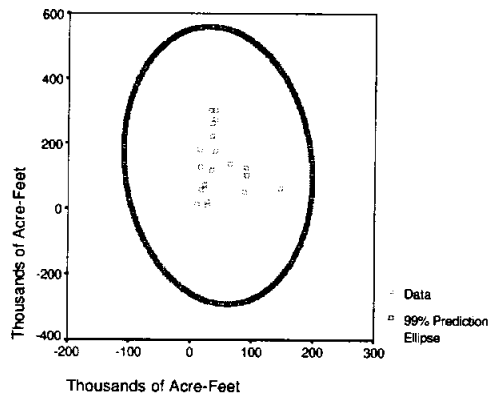


Figure 3.31 May-June Inflows vs. July-August Inflows, PE.

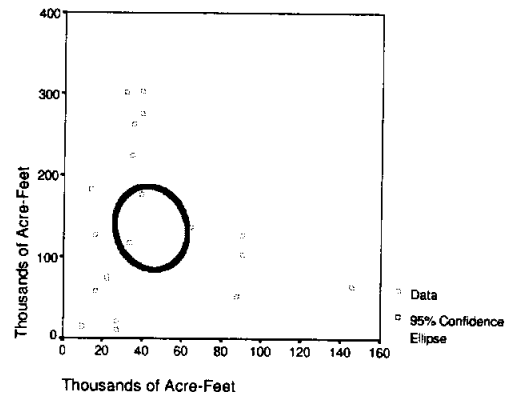


Figure 3.32 May-June Inflows vs. July-August Inflows, CR.

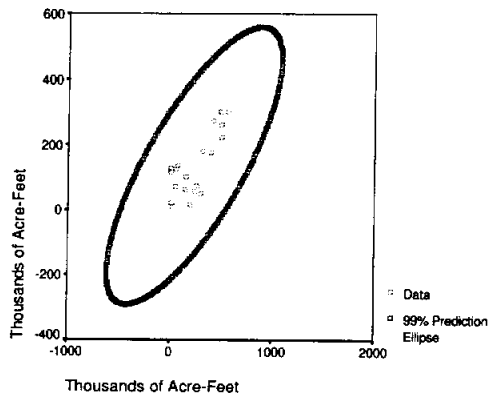


Figure 3.33 May-June Inflows vs. September-October Inflows, PE.

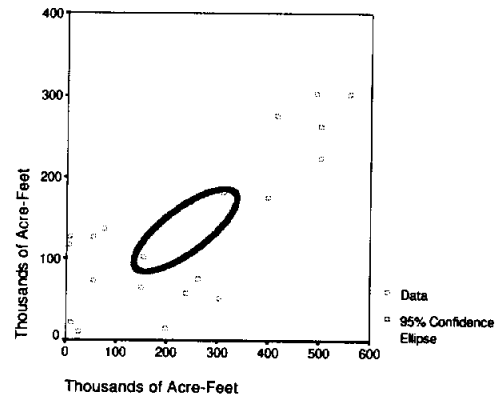


Figure 3.34 May-June Inflows vs. September-October Inflows, CR.

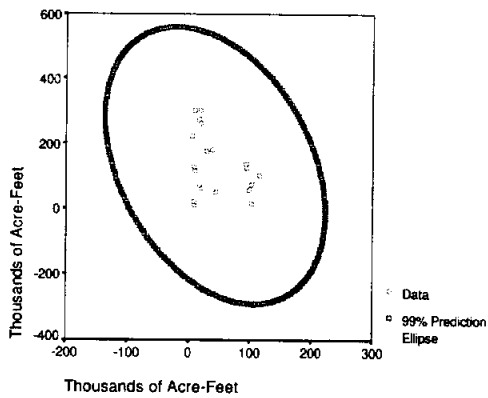


Figure 3.35 May-June Inflows vs. November-December Inflows, PE.

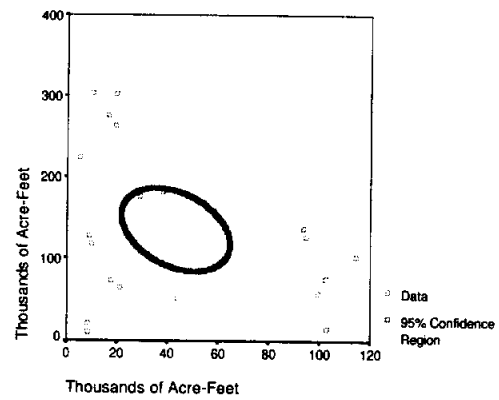


Figure 3.36 May-June Inflows vs. November-December Inflows, CR.

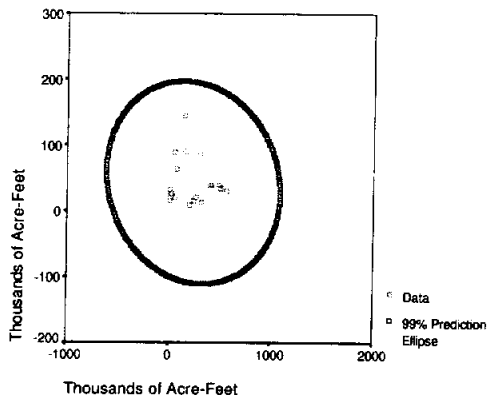


Figure 3.37 July-August Inflows. vs. September-October Inflows, PE.

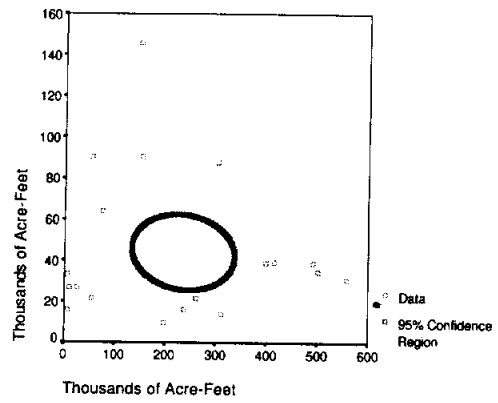


Figure 3.38 July-August Inflows. vs. September-October Inflows, CR.

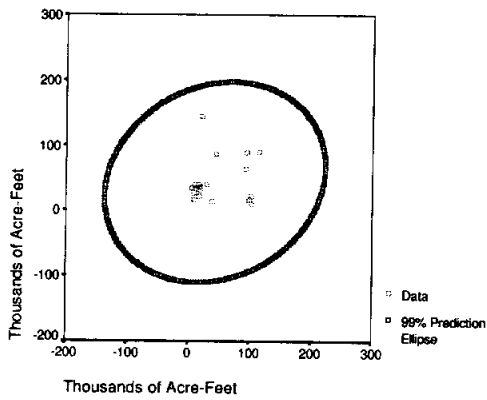


Figure 3.39 July-August Inflows. vs. November-December Inflows, PE.

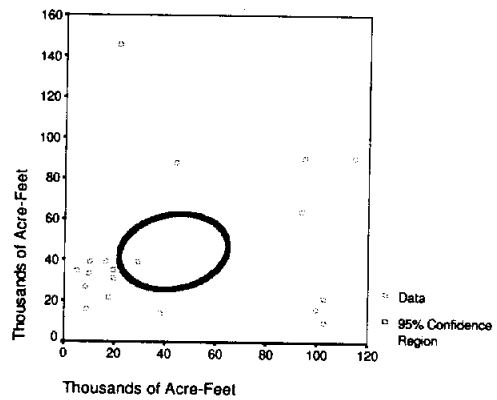


Figure 3.40 July-August Inflows. vs. November-December Inflows, CR.

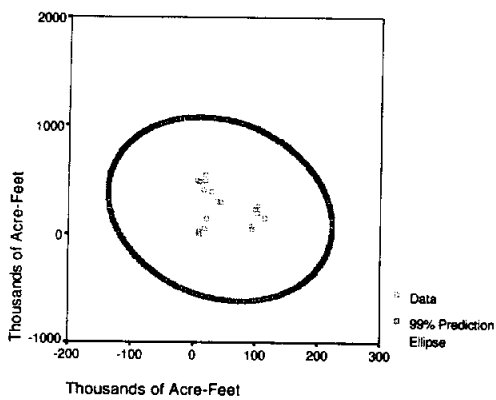


Figure 3.41 September-October Inflows vs. November-December Inflows, PE.

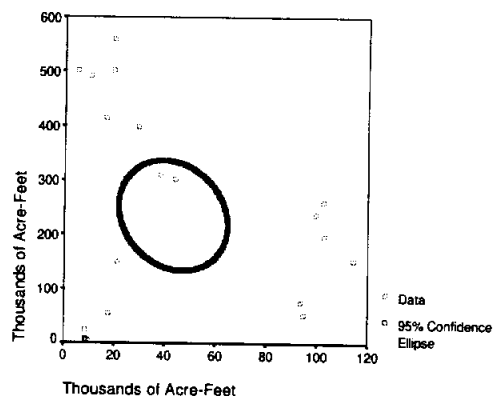


Figure 3.42 September-October Inflows vs. November-December Inflows, CR.

4. BOX-COX ANALYSIS

Table 4.1 Mean Square Error from Box-Cox transformation of the trout data and the inflow data for different lambda.

Lam.	Trout	JF_inflow	MA_inflo	MJ_inflow	JA_inflow	SO_inflow	ND_inflow
-2.0	77552.6	50708.9	11029.2	752149	2628.4	53961199	8343.5
-1.9	64668.9	35668.4	8383.1	549366	2277.7	33067621	6719.1
-1.8	54156.2	25230.2	6406.9	403544	1983.7	20385066	5447.7
-1.7	45561.0	17958.9	4925.6	298249	1736.8	12649071	4449.2
-1.6	38519.4	12873.4	3811.1	221888	1529.3	7905462	3662.3
-1.5	32738.8	9301.4	2969.2	166258	1354.6	4980172	3040.0
-1.4	27983.8	6780.9	2330.5	125539	1207.6	3165084	2546.5
-1.3	24064.6	4993.8	1843.8	95586	1083.9	2031339	2153.8
-1.2	20828.0	3720.1	1471.4	73441	980.0	1318060	1840.6
-1.1	18150.2	2807.5	1185.1	56982	892.8	865806	1590.4
-1.0	15931.3	2150.0	963.9	44685	819.9	576637	1390.4
-0.9	14089.9	1673.8	792.3	35448	759.4	390069	1230.6
-0.8	12560.3	1327.0	658.5	28475	709.7	268535	1103.5
-0.7	11289.1	1073.3	553.6	23185	669.5	188557	1002.9
-0.6	10232.8	887.2	471.1	19155	637.7	135368	924.5
-0.5	9355.9	750.4	406.0	16074	613.6	99615	864.5
-0.4	8629.7	650.1	354.4	13713	596.5	75334	820.5
-0.3	8030.8	577.1	313.4	11904	586.0	58690	790.4
<u>-0.2</u>	7539.9	525.1	280.7	10522	<u>581.9</u>	47200	772.9
<u>-0.1</u>	7141.6	489.2	254.8	9474	584.1	39246	<u>767.0</u>
0.0	6823.3	466.4	234.2	8693	592.6	33763	772.3
0.1	6574.7	454.3	218.0	8126	607.8	30053	788.7
<u>0.2</u>	6387.8	<u>451.6</u>	205.4	7736	630.0	27653	816.6
0.3	6255.9	457.2	195.7	7497	659.8	26261	856.6
<u>0.4</u>	6174.0	470.7	188.6	<u>7390</u>	698.1	<u>25685</u>	909.7
<u>0.5</u>	<u>6138.1</u>	492.2	183.6	7401	746.0	25810	977.6
0.6	6145.5	521.8	180.5	7522	804.8	26577	1062.3
<u>0.7</u>	6194.1	560.3	<u>179.1</u>	7752	876.4	27973	1166.3
0.8	6282.6	608.5	179.3	8089	962.8	30020	1292.8
0.9	6410.8	667.9	180.8	8538	1066.7	32779	1446.1
1.0	6578.6	740.0	183.7	9107	1191.6	36342	1631.0
1.1	6787.0	827.1	188.0	9805	1341.6	40841	1853.8
1.2	7037.4	931.9	193.6	10648	1521.7	46450	2122.3
1.3	7331.8	1057.8	200.6	11654	1738.3	53395	2445.9
1.4	7672.8	1209.0	208.9	12844	1999.2	61965	2836.2
1.5	8063.6	1390.4	218.8	14247	2314.2	72525	3307.8
1.6	8508.2	1608.5	230.2	15896	2695.3	85533	3878.3
1.7	9011.1	1871.0	243.3	17831	3157.7	101571	4569.9
1.8	9577.7	2187.3	258.2	20099	3720.0	121369	5409.8
1.9	10214.0	2569.3	275.2	22757	4405.7	145847	6431.8
2.0	10927.3	3031.3	294.4	25875	5244.0	176165	7677.8

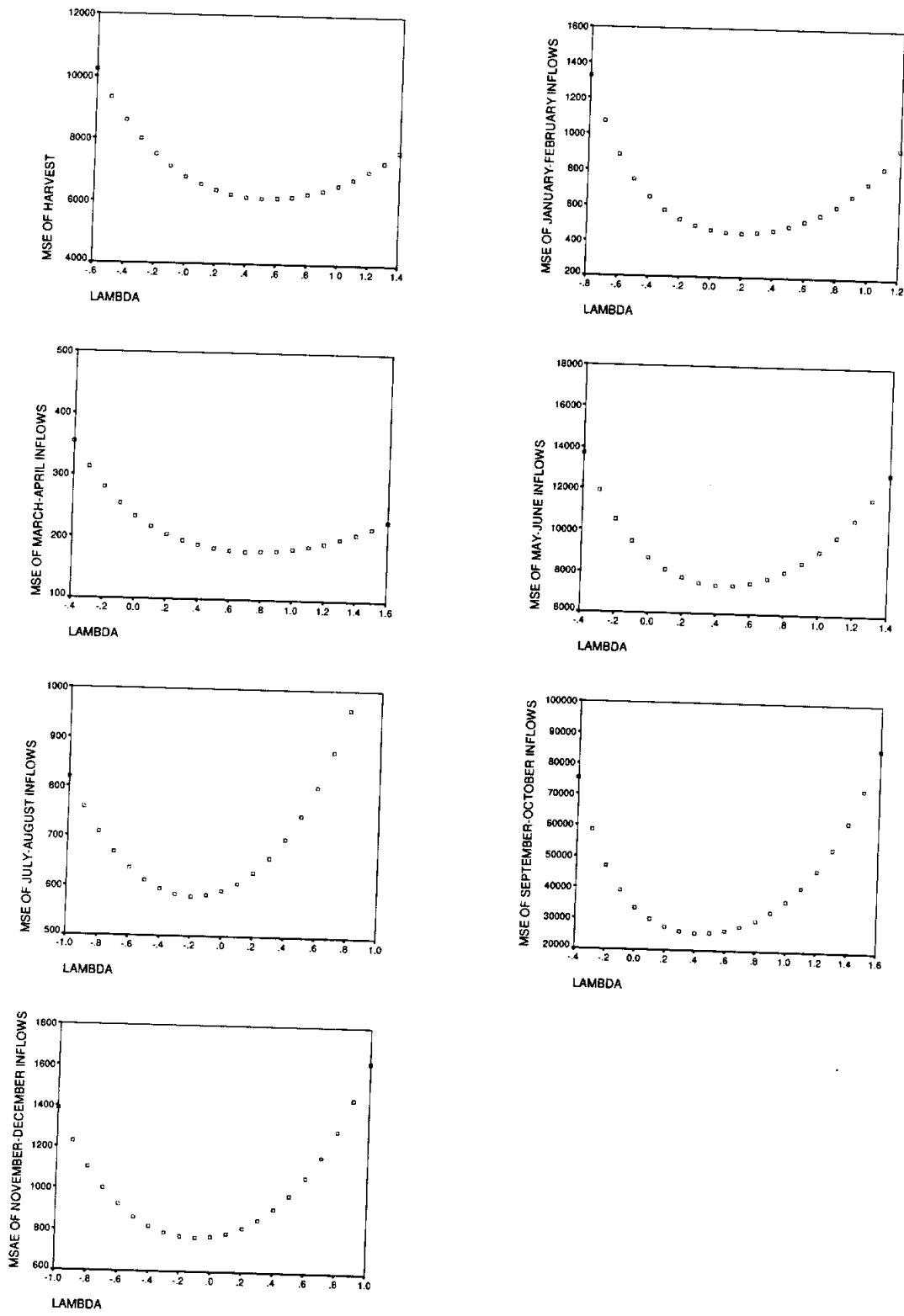


Figure 4.1 Box-Cox Transformation - MSE of Trout vs. Lambda and MSE of Inflow data vs. Lambda.

5. MODEL CHOICE DIAGNOSTICS

5.1 Untransformed trout data and untransformed inflow data

Table 5.1 Regression Models for Dependent Variable: TROUT on INFLOWS

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.3539	0.3180	4.303	170.1	4486	172.1	QJA_LAG
1	0.1692	0.1230	10.11	175.1	5769	177.1	QMA_LAG
1	0.0471	-.0058	13.94	177.8	6617	179.8	QND_LAG
1	0.0322	-.0215	14.41	178.2	6720	180.1	QSO_LAG

2	0.4514	0.3869	3.239	168.8	4033	171.8	QJA_LAG QND_LAG
2	0.4308	0.3638	3.887	169.5	4185	172.5	QMA_LAG QJA_LAG
2	0.3935	0.3222	5.058	170.8	4459	173.8	QJF_LAG QJA_LAG
2	0.3872	0.3151	5.257	171.0	4506	174.0	QMJ_LAG QJA_LAG

3	0.5414	0.4555	2.410	167.2	3582	171.2	QMJ_LAG QJA_LAG QSO_LAG
3	0.5156	0.4248	3.223	168.3	3784	172.3	QMA_LAG QJA_LAG QND_LAG
3	0.4793	0.3817	4.363	169.8	4068	173.7	QJA_LAG QSO_LAG QND_LAG
3	0.4650	0.3647	4.812	170.3	4180	174.3	QJF_LAG QMA_LAG QJA_LAG

4	0.5840	0.4731	3.072	167.3	3466	172.2	QMJ_LAG QJA_LAG QSO_LAG QND_LAG
4	0.5439	0.4223	4.332	169.1	3800	174.1	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG
4	0.5437	0.4221	4.338	169.1	3802	174.1	QMA_LAG QJA_LAG QSO_LAG QND_LAG
4	0.5429	0.4210	4.364	169.1	3809	174.1	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG

5	0.5863	0.4385	5.000	169.2	3694	175.1	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG
5	0.5843	0.4359	5.063	169.2	3711	175.2	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG
5	0.5449	0.3823	6.302	171.1	4063	177.0	QJF_LAG QMA_LAG QJA_LAG QSO_LAG QND_LAG
5	0.5444	0.3817	6.317	171.1	4068	177.1	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG

6	0.5863	0.3954	7.000	171.2	3978	178.1	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG

N = 20

5.2 Log of trout data and untransformed inflow data

Table 5.2 Regression Models for Dependent Variable: Ln(TROUT) on INFLOWS

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.5266	0.5003	7.175	-39.14	0.1285	-37.15	QJA_LAG
1	0.1314	0.0832	26.52	-27.00	0.2359	-25.01	QMA_LAG
1	0.0505	-.0023	30.49	-25.22	0.2578	-23.22	QSO_LAG
1	0.0210	-.0334	31.93	-24.60	0.2658	-22.61	QJF_LAG

2	0.5794	0.5299	6.592	-39.50	0.1209	-36.51	QJA_LAG QND_LAG
2	0.5646	0.5134	7.317	-38.81	0.1252	-35.82	QMA_LAG QJA_LAG
2	0.5467	0.4934	8.192	-38.00	0.1303	-35.02	QJA_LAG QSO_LAG
2	0.5349	0.4802	8.768	-37.49	0.1337	-34.50	QMJ_LAG QJA_LAG

3	0.6443	0.5776	5.416	-40.85	0.1087	-36.87	QMJ_LAG QJA_LAG QSO_LAG
3	0.6130	0.5405	6.945	-39.17	0.1182	-35.19	QJA_LAG QSO_LAG QND_LAG
3	0.6108	0.5378	7.055	-39.05	0.1189	-35.07	QMA_LAG QJA_LAG QND_LAG
3	0.6071	0.5335	7.234	-38.87	0.1200	-34.88	QJF_LAG QJA_LAG QND_LAG

4	0.6702	0.5823	6.145	-40.37	0.1075	-35.39	QMJ_LAG QJA_LAG QSO_LAG QND_LAG
4	0.6653	0.5760	6.388	-40.07	0.1091	-35.09	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG
4	0.6462	0.5519	7.319	-38.96	0.1153	-33.98	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG
4	0.6447	0.5499	7.397	-38.87	0.1158	-33.89	QMA_LAG QJA_LAG QSO_LAG QND_LAG

5	0.7291	0.6324	5.261	-42.30	0.0946	-36.33	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG
5	0.6760	0.5603	7.863	-38.72	0.1131	-32.75	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG
5	0.6756	0.5597	7.884	-38.69	0.1133	-32.72	QJF_LAG QMA_LAG QJA_LAG QSO_LAG QND_LAG
5	0.6702	0.5524	8.145	-38.37	0.1151	-32.39	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG

6	0.7345	0.6119	7.000	-40.70	0.0998	-33.73	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG

N = 20

5.3 Log of trout data and log of inflow data

Table 5.3 Regression Models for Dependent Variable: Ln(TROUT) on Ln(INFLOWS)

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.4713	0.4420	7.284	-36.93	0.1436	-34.94	LN_QJA
1	0.0907	0.0401	24.05	-26.08	0.2469	-24.09	LN_QMA
1	0.0458	-.0072	26.02	-25.12	0.2591	-23.13	LN_QSO
1	0.0402	-.0131	26.27	-25.00	0.2606	-23.01	LN_QJF

2	0.5530	0.5004	5.687	-38.28	0.1285	-35.30	LN_QJA LN_QSO
2	0.5225	0.4663	7.031	-36.96	0.1373	-33.98	LN_QJA LN_QND
2	0.5060	0.4479	7.756	-36.29	0.1420	-33.30	LN_QJF LN_QJA
2	0.4797	0.4184	8.918	-35.25	0.1496	-32.26	LN_QMJ LN_QJA

3	0.6271	0.5572	4.424	-39.91	0.1139	-35.93	LN_QJF LN_QJA LN_QND
3	0.6117	0.5389	5.103	-39.10	0.1186	-35.12	LN_QJF LN_QJA LN_QSO
3	0.5773	0.4981	6.616	-37.40	0.1291	-33.42	LN_QJA LN_QSO LN_QND
3	0.5561	0.4729	7.549	-36.42	0.1356	-32.44	LN_QMA LN_QJA LN_QSO

4	0.6937	0.6120	3.491	-41.84	0.0998	-36.86	LN_QJF LN_QJA LN_QSO LN_QND
4	0.6624	0.5723	4.870	-39.90	0.1100	-34.92	LN_QJF LN_QMJ LN_QJA LN_QND
4	0.6396	0.5436	5.871	-38.59	0.1174	-33.61	LN_QJF LN_QMA LN_QJA LN_QND
4	0.6132	0.5101	7.035	-37.18	0.1260	-32.20	LN_QJF LN_QMA LN_QJA LN_QSO

5	0.7035	0.5977	5.057	-40.50	0.1035	-34.52	LN_QJF LN_QMA LN_QJA LN_QSO LN_QND
5	0.6984	0.5907	5.283	-40.15	0.1053	-34.18	LN_QJF LN_QMJ LN_QJA LN_QSO LN_QND
5	0.6654	0.5459	6.737	-38.08	0.1168	-32.10	LN_QJF LN_QMA LN_QMJ LN_QJA LN_QND
5	0.6325	0.5013	8.185	-36.20	0.1283	-30.23	LN_QJF LN_QMA LN_QMJ LN_QJA LN_QSO

6	0.7048	0.5686	7.000	-38.58	0.1110	-31.61	LN_QJF LN_QMA LN_QMJ LN_QJA LN_QSO LN_QND

N = 20

5.4 Log of trout data and square root of inflow data

Table 5.4 Regression Models for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS)

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.5126	0.4855	9.380	-38.55	0.1324	-36.56	SQR_QJA
1	0.1182	0.0692	29.92	-26.69	0.2395	-24.70	SQR_QMA
1	0.0576	0.0053	33.07	-25.37	0.2559	-23.38	SQR_QSO
1	0.0301	-.0237	34.50	-24.79	0.2634	-22.80	SQR_QJF

2	0.5723	0.5220	8.270	-39.17	0.1230	-36.18	SQR_QJA SQR_QND
2	0.5687	0.5180	8.457	-39.00	0.1240	-36.01	SQR_QJA SQR_QSO
2	0.5255	0.4697	10.71	-37.09	0.1364	-34.10	SQR_QJF SQR_QJA
2	0.5250	0.4691	10.74	-37.07	0.1366	-34.08	SQR_QMA SQR_QJA

3	0.6493	0.5836	6.260	-41.14	0.1071	-37.16	SQR_QJF SQR_QJA SQR_QND
3	0.6262	0.5561	7.463	-39.86	0.1142	-35.88	SQR_QJA SQR_QSO SQR_QND
3	0.6089	0.5355	8.367	-38.95	0.1195	-34.97	SQR_QMJ SQR_QJA SQR_QSO
3	0.5849	0.5071	9.614	-37.77	0.1268	-33.78	SQR_QJF SQR_QJA SQR_QSO

4	0.7105	0.6333	5.075	-42.97	0.0943	-37.99	SQR_QJF SQR_QJA SQR_QSO SQR_QND
4	0.6526	0.5600	8.090	-39.33	0.1132	-34.35	SQR_QJF SQR_QMJ SQR_QJA SQR_QND
4	0.6510	0.5580	8.171	-39.24	0.1137	-34.26	SQR_QJF SQR_QMA SQR_QJA SQR_QND
4	0.6435	0.5485	8.563	-38.81	0.1162	-33.83	SQR_QJF SQR_QMJ SQR_QJA SQR_QSO

5	0.7316	0.6358	5.974	-42.49	0.0937	-36.51	SQR_QJF SQR_QMJ SQR_QJA SQR_QSO SQR_QND
5	0.7129	0.6104	6.950	-41.14	0.1002	-35.16	SQR_QJF SQR_QMA SQR_QJA SQR_QSO SQR_QND
5	0.6769	0.5615	8.825	-38.78	0.1128	-32.80	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO
5	0.6631	0.5428	9.543	-37.94	0.1176	-31.97	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QND

6	0.7503	0.6351	7.000	-41.93	0.0939	-34.96	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO SQR_QND

N = 20

5.5 Square root of trout data and square root of inflow data

Table 5.5 Regression Models for Dependent Variable: Sqrt(TROUT) on Ln(INFLOWS)

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.4513	0.4208	5.792	35.83	5.457	37.82	SQR_QJA
1	0.1352	0.0872	18.35	44.93	8.601	46.92	SQR_QMA
1	0.0593	0.0071	21.36	46.61	9.356	48.60	SQR_QSO
1	0.0362	-0.0173	22.28	47.10	9.586	49.09	SQR_QND

2	0.5374	0.4830	4.372	34.42	4.871	37.40	SQR_QJA SQR_QND
2	0.5092	0.4515	5.492	35.60	5.168	38.59	SQR_QJA SQR_QSO
2	0.4745	0.4127	6.870	36.97	5.534	39.95	SQR_QMA SQR_QJA
2	0.4539	0.3896	7.690	37.74	5.751	40.72	SQR_QMJ SQR_QJA

3	0.5926	0.5162	4.181	33.88	4.559	37.86	SQR_QJA SQR_QSO SQR_QND
3	0.5781	0.4989	4.758	34.58	4.721	38.56	SQR_QMJ SQR_QJA SQR_QSO
3	0.5703	0.4898	5.065	34.94	4.808	38.92	SQR_QJF SQR_QJA SQR_QND
3	0.5545	0.4710	5.692	35.66	4.984	39.65	SQR_QMA SQR_QJA SQR_QND

4	0.6303	0.5317	4.682	33.93	4.412	38.91	SQR_QJF SQR_QJA SQR_QSO SQR_QND
4	0.6202	0.5190	5.083	34.47	4.533	39.45	SQR_QMJ SQR_QJA SQR_QSO SQR_QND
4	0.6123	0.5090	5.397	34.88	4.627	39.86	SQR_QMA SQR_QJA SQR_QSO SQR_QND
4	0.5864	0.4761	6.426	36.18	4.936	41.16	SQR_QJF SQR_QMJ SQR_QJA SQR_QSO

5	0.6642	0.5443	5.336	34.01	4.294	39.98	SQR_QJF SQR_QMJ SQR_QJA SQR_QSO SQR_QND
5	0.6415	0.5135	6.238	35.32	4.584	41.29	SQR_QJF SQR_QMA SQR_QJA SQR_QSO SQR_QND
5	0.6203	0.4848	7.079	36.47	4.855	42.44	SQR_QMA SQR_QMJ SQR_QJA SQR_QSO SQR_QND
5	0.6048	0.4637	7.696	37.27	5.054	43.24	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO

6	0.6727	0.5216	7.000	35.50	4.508	42.47	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO SQR_QND

N = 20

5.6 Various transformation suggested by Box-Cox

Table 5.6 Regression Models for Dependent Variable: $\text{Sqrt}(\text{TROUT})$ on variously transformed INFLOWS.

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.4214	0.3893	4.566	36.89	5.755	38.88	QR_QJA
1	0.1461	0.0987	14.35	44.68	8.493	46.67	QR_QMA
1	0.0609	0.0088	17.38	46.58	9.340	48.57	QR_QSO
1	0.0487	-.0041	17.81	46.84	9.461	48.83	QR_QND

2	0.5003	0.4415	3.763	35.96	5.263	38.95	QR_QJA QR_QSO
2	0.4923	0.4325	4.048	36.28	5.347	39.27	QR_QJA QR_QND
2	0.4388	0.3728	5.948	38.28	5.910	41.27	QR_QMA QR_QJA
2	0.4323	0.3655	6.181	38.51	5.979	41.50	QR_QJF QR_QJA

3	0.5576	0.4747	3.725	35.52	4.950	39.51	QR_QJF QR_QJA QR_QND
3	0.5556	0.4722	3.798	35.62	4.973	39.60	QR_QJA QR_QSO QR_QND
3	0.5249	0.4358	4.887	36.95	5.316	40.93	QR_QMJ QR_QJA QR_QSO
3	0.5175	0.4270	5.151	37.26	5.399	41.24	QR_QJF QR_QJA QR_QSO

4	0.6272	0.5277	3.253	34.10	4.450	39.08	QR_QJF QR_QJA QR_QSO QR_QND
4	0.5706	0.4561	5.262	36.93	5.124	41.91	QR_QJF QR_QMJ QR_QJA QR_QND
4	0.5690	0.4540	5.321	37.00	5.144	41.98	QR_QMA QR_QJA QR_QSO QR_QND
4	0.5616	0.4447	5.582	37.34	5.232	42.32	QR_QMJ QR_QJA QR_QSO QR_QND

5	0.6324	0.5011	5.066	35.82	4.700	41.79	QR_QJF QR_QMJ QR_QJA QR_QSO QR_QND
5	0.6285	0.4958	5.206	36.03	4.751	42.01	QR_QJF QR_QMA QR_QJA QR_QSO QR_QND
5	0.5924	0.4469	6.487	37.89	5.212	43.86	QR_QJF QR_QMA QR_QMJ QR_QJA QR_QND
5	0.5695	0.4158	7.301	38.98	5.504	44.95	QR_QMA QR_QMJ QR_QJA QR_QSO QR_QND

6	0.6343	0.4655	7.000	37.72	5.037	44.69	QR_QJF QR_QMA QR_QMJ QR_QJA QR_QSO QR_QND

N = 20

Dependent Variable: $\text{Sqrt}(\text{TROUT})$
 Independent Variables: $\text{QR_QJF} = (\text{January-February Inflows})^{0.2}$
 $\text{QR_QMA} = (\text{March-April Inflows})^{0.7}$
 $\text{QR_QMJ} = (\text{May-June Inflows})^{0.4}$
 $\text{QR_QMJ} = (\text{July-August Inflows})^{0.2}$
 $\text{QR_QND} = (\text{September-October Inflows})^{0.4}$
 $\text{QR_QND} = (\text{November-December Inflows})^{0.1}$

6. REGRESSION FOR THE BEST MODELS

6.1 Regression - Log of trout data on inflow data

6.1.1 ANOVA and Parameter Estimates

Table 6.1 Model Summary for log of trout data on inflow data.

Model Summary^{a,b}

	Variables	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	Entered					
	November-December Inflows, March-April Inflows, September-October Inflows, July-August Inflows, January-February Inflows, May-June Inflows ^{c,d}	.857	.734	.612	.315969	2.095

a. Dependent Variable: Ln(Trout Harvest)

b. Method: Enter

c. Independent Variables: (Constant), November-December Inflows, March-April Inflows, September-October Inflows, July-August Inflows, January-February Inflows, May-June Inflows

d. All requested variables entered.

Table 6.2 ANOVA table of log of trout data on inflow data

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.590	6	.598	5.993	.003 ^b
	Residual	1.298	13	1.0E-01		
	Total	4.888	19			

a. Dependent Variable: Ln(Trout Harvest)

b. Independent Variables: (Constant), November-December Inflows, March-April Inflows, September-October Inflows, July-August Inflows, January-February Inflows, May-June Inflows

Table 6.3 Table of coefficients for log of trout data on inflow data.

Coefficients ^a							
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	5.550	.214		25.904	.000	5.087	6.013
January-February Infl.	-6.1E-03	.003	-.325	-1.773	.100	-.013	.001
March-April Inflows	4.4E-03	.009	.119	.511	.618	-.014	.023
May-June Inflows	-3.5E-03	.002	-.659	-1.698	.113	-.008	.001
July-August Inflows	-1.1E-02	.002	-.735	-4.761	.000	-.016	-.006
September-October Infl.	1.8E-03	.001	.680	2.119	.054	.000	.004
November-December Infl.	3.7E-03	.002	.297	1.692	.114	-.001	.009

a. Dependent Variable: Ln(Trout Harvest)

6.1.2 Collinearity Diagnostic

Table 6.4 Variance Inflation for log of trout data on inflow data.

Coefficients ^a			
	t	Collinearity Statistics	
		Tolerance	VIF
(Constant)	25.904		
January-February Infl.	-1.773	.610	1.640
March-April Inflows	.511	.378	2.642
May-June Inflows	-1.698	.136	7.375
July-August Inflows	-4.761	.858	1.165
September-October Infl.	2.119	.199	5.036
November-December Infl.	1.692	.661	1.514

a. Dependent Variable: Ln(Trout Harvest)

Table 6.5 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: LN(TROUT) on INFLOWS.

Number	Eigenvalue	Condition Index	Var Prop QJF_LAG	Var Prop QMA_LAG	Var Prop QMJ_LAG	Var Prop QJA_LAG	Var Prop QSO_LAG	Var Prop QND_LAG
1	2.23431	1.00000	0.0411	0.0064	0.0220	0.0105	0.0204	0.0569
2	1.39421	1.26592	0.0656	0.0967	0.0083	0.1685	0.0045	0.0487
3	1.11529	1.41540	0.1145	0.0574	0.0029	0.1100	0.0555	0.0846
4	0.72226	1.75884	0.0068	0.1594	0.0008	0.6516	0.0272	0.0329
5	0.46125	2.20092	0.6120	0.0019	0.0020	0.0055	0.0009	0.7490
6	0.07268	5.54451	0.1601	0.6781	0.9640	0.0540	0.8915	0.0279

6.1.3 Residuals Diagnostics

Table 6.6 Residuals Diagnostics for log of trout data on inflow data.

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.694241	5.742424	5.092896	.434676	20
Std. Predicted Value	-3.218	1.494	.000	1.000	20
Standard Error of Predicted Value	.147076	.296638	.183999	3.4E-02	20
Adjusted Predicted Value	3.568744	6.014528	5.075135	.477937	20
Residual	-.520448	.376390	-1.6E-16	.261360	20
Std. Residual	-1.647	1.191	.000	.827	20
Stud. Residual	-2.033	1.468	.019	1.014	20
Deleted Residual	-.792552	.598149	1.8E-02	.396956	20
Stud. Deleted Residual	-2.364	1.544	.006	1.064	20
Mahal. Distance	3.167	15.796	5.700	2.819	20
Cook's Distance	.001	.309	.075	.087	20
Centered Leverage Value	.167	.831	.300	.148	20

a. Dependent Variable: Ln(Trout Harvest)

Table 6.7 Case Values for Residuals Diagnostics for log of trout data on inflow data.

YEAR	PRE_1	RES_1	DRE_1	ADJ_1	ZPR_1	ZRE_1	SRE_1 ¹	SDR_1 ²
1961	5.4401	.3764	.5717	5.2448	.7988	1.1912	1.4682	1.5444
1962	5.5863	.3018	.4173	5.4707	1.1351	.9550	1.1231	1.1355
1963	5.7424	-.5204	-.7926	6.0145	1.4943	-1.6471	-2.0326	-2.3644
1964	5.2939	-.0628	-.0956	5.3268	.4624	-.1987	-.2453	-.2362
1965	5.1831	-.2823	-.4152	5.3161	.2075	-.8934	-1.0836	-1.0915
1966	4.8863	-.1786	-.2377	4.9454	-.4753	-.5651	-.6520	-.6369
1967	5.0385	.2548	.3615	4.9318	-.1251	.8063	.9605	.9574
1968	5.0772	-.0753	-.0971	5.0990	-.0360	-.2384	-.2706	-.2607
1969	5.1784	-.3662	-.4675	5.2797	.1967	-1.1590	-1.3096	-1.3504
1970	5.1424	.0561	.0772	5.1213	.1139	.1775	.2082	.2004
1971	5.1539	.2759	.4196	5.0102	.1402	.8733	1.0769	1.0842
1972	5.3956	.0227	.0334	5.3850	.6963	.0720	.0872	.0838
1973	4.9885	.3222	.4712	4.8396	-.2401	1.0198	1.2332	1.2608
1974	5.2548	-.2257	-.3079	5.3371	.3725	-.7143	-.8343	-.8240
1975	5.4651	.1811	.2431	5.4031	.8563	.5730	.6640	.6490
1976	5.1470	.2606	.5981	4.8095	.1245	.8248	1.2496	1.2799
1977	4.9358	-.1433	-.2629	5.0554	-.3615	-.4534	-.6142	-.5989
1978	4.5523	.1111	.1812	4.4822	-1.2437	.3517	.4492	.4349
1979	4.7020	-.3250	-.4850	4.8620	-.8992	-1.0287	-1.2565	-1.2880
1980	3.6942	.0169	.1424	3.5687	-3.2177	.0535	.1552	.1493

PRE_1	Predicted value of harvest
RES_1	Ordinary residuals: observed harvest minus predicted harvest
DRE_1	Deleted residuals: residuals obtained when the model is fitted without that observation
ADJ_1	Adjusted predicted value: predicted value of harvest when the model is fitted without that observation
ZPR_1	Z-score of the predicted value of harvest
ZRE_1	Z-score of the residual
SRE_1	Studentized residual
SDR_1	Studentized deleted residuals

¹Values greater than 3 are flagged.

²This is flagged if it exceeds $t_{n-p-2, \alpha} = t_{12, 0.01} = 2.681$.

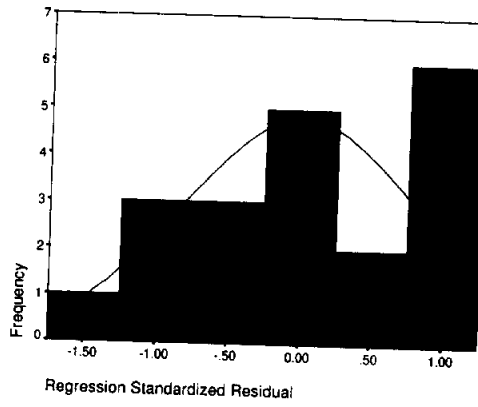


Figure 6.1 Histogram of Standardized Residuals.

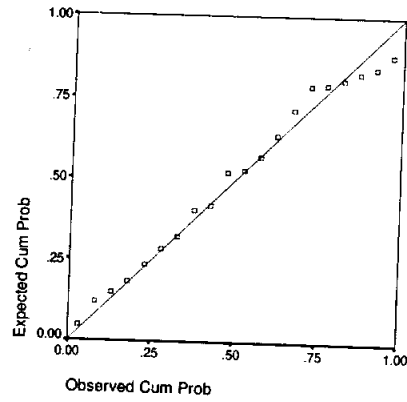


Figure 6.2 Normal P-P Plot of Residuals.

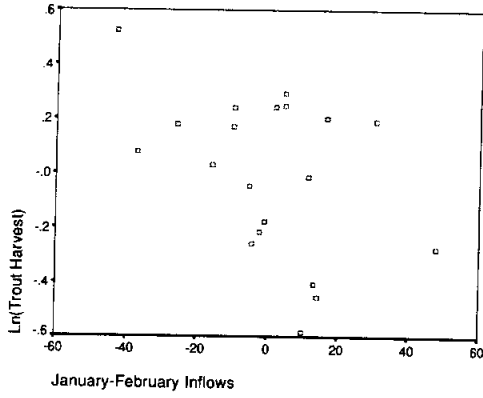


Figure 6.3 Partial Residual Plot for January-February Inflows.

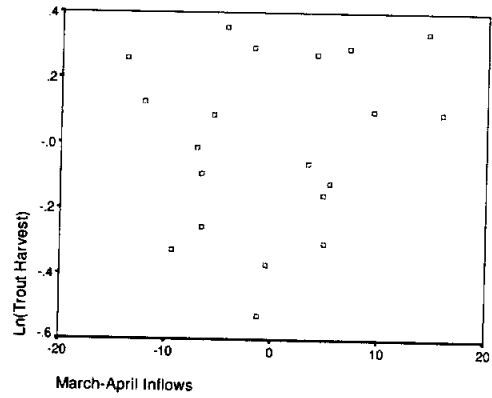


Figure 6.4 Partial Residual Plot for March-April Inflows.

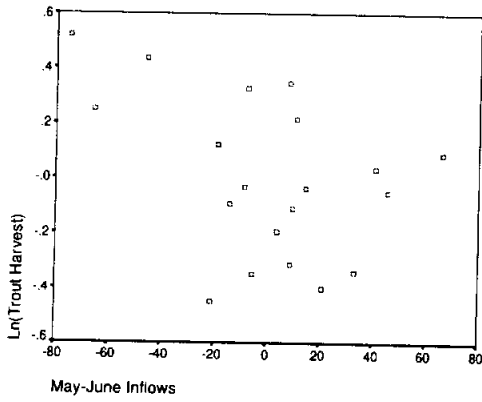


Figure 6.5 Partial Residual Plot for May-June Inflows.

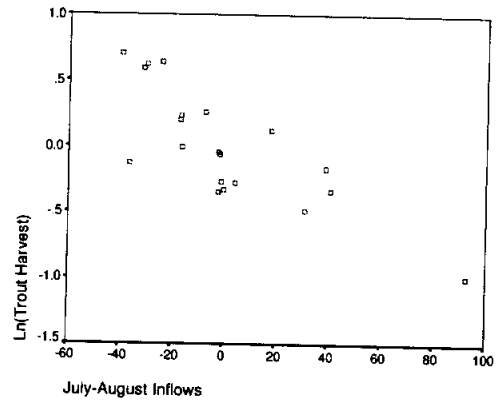


Figure 6.6 Partial Residual Plot for July-August Inflows.

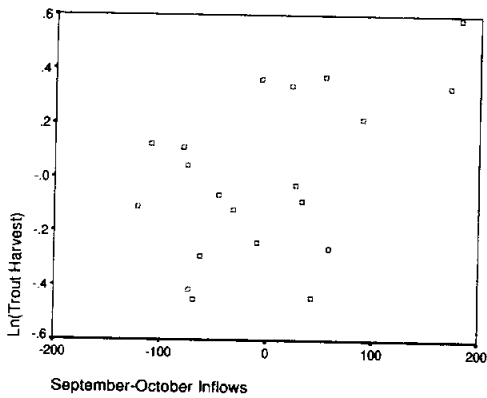


Figure 6.7 Partial Residual Plot for September-October Inflows.

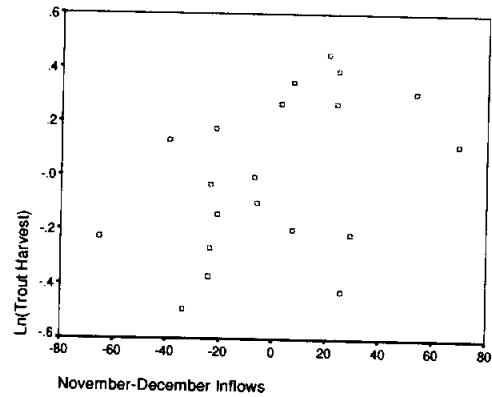


Figure 6.8 Partial Residual Plot for November-December Inflows.

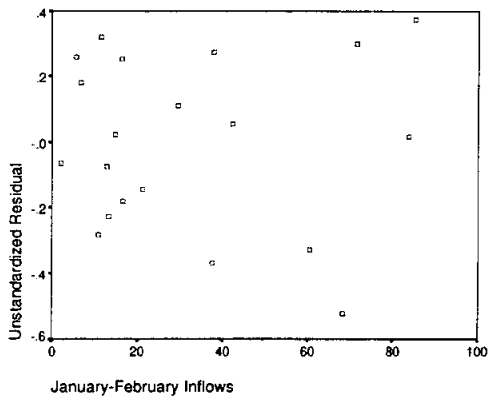


Figure 6.9 Residuals Plot for January-February Inflows.

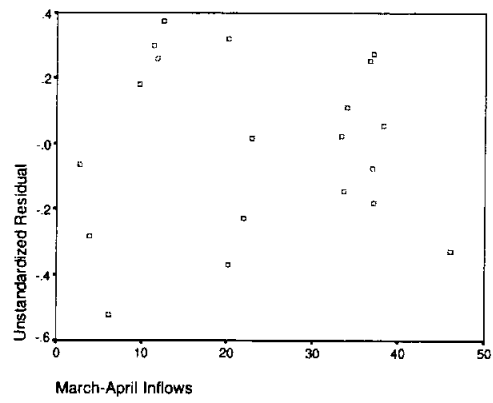


Figure 6.10 Residuals Plot for March-April Inflows.

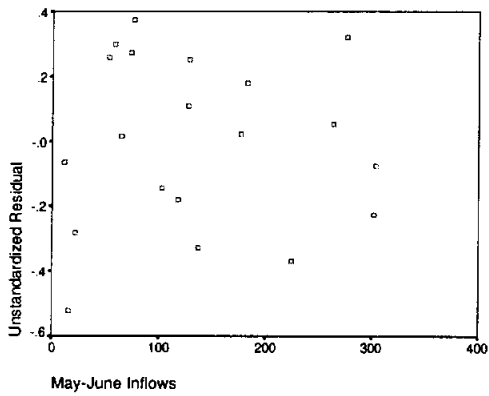


Figure 6.11 Residuals Plot for May-June Inflows.

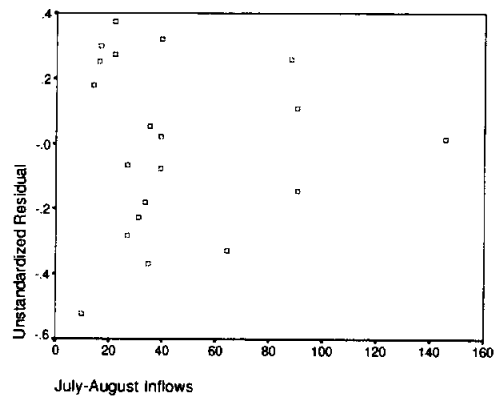


Figure 6.12 Residuals Plot for July-August Inflows.

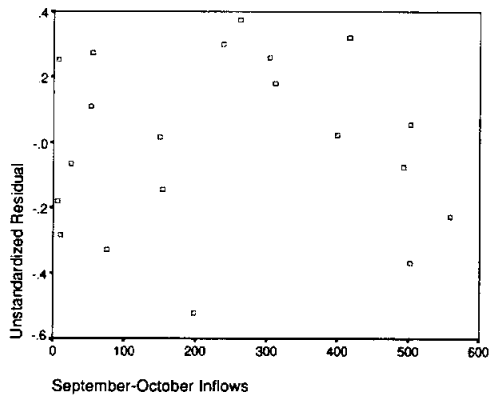


Figure 6.13 Residuals Plot for September-October Inflows.

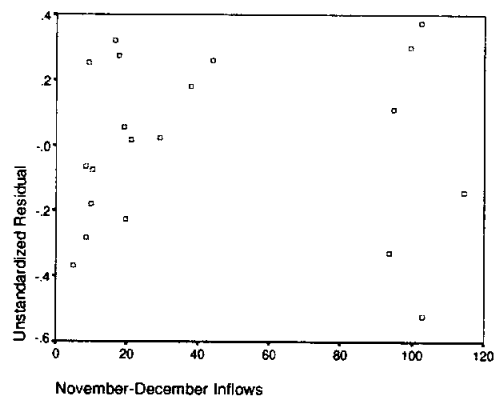


Figure 6.14 Residuals Plot for November-December Inflows.

6.1.4 Prediction Intervals for Trout Harvest

Table 6.8 Prediction Intervals for Trout Harvest.

YEAR	LICI_1	LN_TROUT	UICI_1
1961	4.3377	5.8165	6.5426
1962	4.5108	5.8880	6.6618
1963	4.6393	5.2220	6.8456
1964	4.1907	5.2311	6.3971
1965	4.0895	4.9008	6.2767
1966	3.8227	4.7077	5.9499
1967	3.9553	5.2933	6.1217
1968	4.0242	5.0019	6.1303
1969	4.1286	4.8122	6.2283
1970	4.0685	5.1985	6.2164
1971	4.0511	5.4298	6.2566
1972	4.3028	5.4183	6.4884
1973	3.8966	5.3107	6.0804
1974	4.1834	5.0291	6.3262
1975	4.3988	5.6462	6.5314
1976	3.9566	5.4076	6.3374
1977	3.7877	4.7925	6.0838
1978	3.4314	4.6634	5.6732
1979	3.6045	4.3770	5.7996
1980	2.3887	3.7111	4.9997

LICI_1 Lower limit for 99% prediction interval for the natural log of trout harvest.

LN_TROUT Natural log of trout harvest.

UICI_1 Upper limit for 99% prediction interval for the natural log of trout harvest.

6.1.5 Outliers and Influential Point Detection

Table 6.9 Mahalanobis distance, Cook's distance, Leverage value and associated p-values

YEAR	MAH_1	COOK_1	LEV_1 ¹	MAH_PV ²	COOK_PV ³
1961	5.5419	.1598	.2917	.5941	.0107
1962	4.3119	.0690	.2269	.7432	.0008
1963	5.5732	.3086	.2933	.5904	.0627
1964	5.5766	.0045	.2935	.5900	.0000
1965	5.1337	.0790	.2702	.6436	.0012
1966	3.7768	.0201	.1988	.8051	.0000
1967	4.6581	.0552	.2452	.7016	.0004
1968	3.3091	.0030	.1742	.8550	.0000
1969	3.1667	.0678	.1667	.8692	.0008
1970	4.2406	.0023	.2232	.7517	.0000
1971	5.5563	.0863	.2924	.5924	.0016
1972	5.0959	.0005	.2682	.6483	.0000
1973	5.0570	.1004	.2662	.6530	.0027
1974	4.1248	.0362	.2171	.7653	.0001
1975	3.8984	.0216	.2052	.7914	.0000
1976	9.7713	.2889	*.5143	.2019	.0533
1977	7.6950	.0450	.4050	.3603	.0002
1978	6.4000	.0182	.3368	.4939	.0000
1979	5.3165	.1110	.2798	.6214	.0036
1980	15.7963	.0256	*.8314	*.0270	.0000

MAH_1 Mahalanobis distance

COOK_1 Cook's distance

LEV_1 Leverage value

MAHA_PV P-value associated with the Mahalanobis distance

COOK_P P-value associated with Cook's distance

¹This is flagged if it exceeds $(2p+1)/n$ or 0.5, whichever is smaller.

²MAHA_PV = $1-F(\text{MAH}_1)$, where F is the CDF of a Chi-squared random variable with $p+1$ degrees of freedom. Small values indicate a problem.

³COOK_PV = $F(\text{COOK}_1)$, where F is the CDF of an F-ratio random variable with $p+1$ numerator degrees of freedom and $n-p-1$ denominator degrees of freedom. A value greater than 0.5 indicates a problem. A value less than 0.2 indicates no problem. Values in between are inconclusive.

Table 6.10 Standardized *dfits* value and Standardized *dfbeta* values

YEAR	<i>SDFFITs</i>	<i>SDFBET_0</i>	<i>SDFBET_1</i>	<i>SDFBET_2</i>
1961	*1.1126	-.0249	.6267	-.2333
1962	.7028	.0893	.2352	-.0683
1963	*-1.7096	-.4762	-.3186	.0979
1964	-.1709	-.1647	.0499	.0532
1965	-.7491	-.7069	.0626	.3402
1966	-.3665	-.1508	.0064	-.0969
1967	.6195	.2725	.0229	.1259
1968	-.1401	.0335	.0165	-.0273
1969	-.7102	-.0253	-.2352	.0198
1970	.1228	-.0417	.0288	.0611
1971	.7824	.2354	.0658	.5311
1972	.0572	-.0004	-.0283	.0442
1973	.8573	.0670	.0748	-.5782
1974	-.4974	.0348	.0236	.1752
1975	.3799	.1828	-.0805	-.2509
1976	*1.4565	.3239	-.9100	.3766
1977	-.5472	.1178	.3242	-.1198
1978	.3455	-.0598	-.0599	-.0858
1979	-.9035	.3582	-.2252	-.2125
1980	.4068	-.0527	.2243	-.0848

SDFFITs Standardized *dfits* value
SDFBET_0 Standardized *dfbeta* for the intercept term
SDFBET_1 Standardized *dfbeta* for January-February inflows
SDFBET_2 Standardized *dfbeta* for March-April inflows

*Items are flagged if $|sdfits|$ or $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

Table 6.11 Standardized *dfbeta* values

YEAR	<i>SDFBET_3</i>	<i>SDFBET_4</i>	<i>SDFBET_5</i>	<i>SDFBET_6</i>
1961	.1011	-.3322	-.0340	.2741
1962	-.0671	-.2884	.0804	.2264
1963	.4001	.7628	-.3364	-.5243
1964	.0165	.0047	.0246	.0426
1965	-.0768	.0102	.2605	.2214
1966	-.0180	.0862	.1238	.1204
1967	.0789	-.2562	-.2432	-.1716
1968	-.0186	.0033	-.0215	.0123
1969	.0537	.0235	-.2404	.3586
1970	-.0292	-.0282	.0571	-.0386
1971	-.4018	-.3816	.1941	-.3644
1972	-.0434	-.0124	.0473	-.0049
1973	.6593	.1974	-.4508	.0778
1974	-.2086	-.0302	.0233	-.0500
1975	.2010	-.0399	-.1522	.1251
1976	-.9489	.5430	.9532	.0360
1977	.0753	-.1817	-.0714	-.3939
1978	.1660	.1633	-.1825	.2075
1979	-.2158	-.0007	.2922	-.3232
1980	.0405	.2885	-.0529	-.1977

SDFBET_3 Standardized *dfbeta* for May-June inflows
SDFBET_4 Standardized *dfbeta* for July-August inflows
SDFBET_5 Standardized *dfbeta* for September-October inflows
SDFBET_6 Standardized *dfbeta* for November-December inflows

*Items are flagged if $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

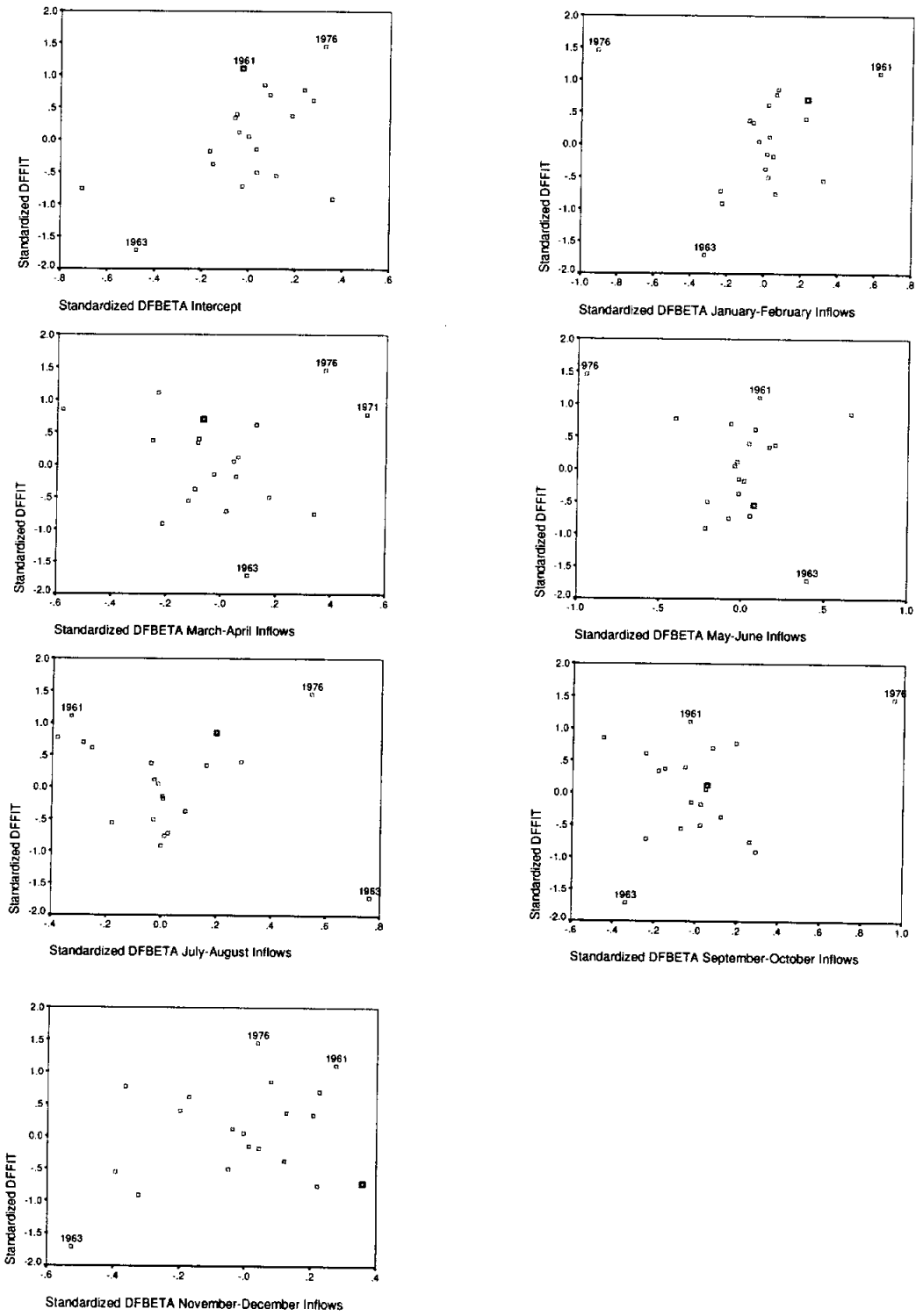


Figure 6.15. Standardized DFFITS vs. Standardized DFBETA Intercept and vs. Standardized DFBETA of inflow variables.

6.2 Regression - Log of trout data on log of inflow data

6.2.1 ANOVA and Parameter Estimates

Table 6.12 Model Summary for log of trout data on log of inflow data.

Model Summary^{a,b}

	Variables	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	Entered					
1	Ln(November-December), Ln(March-April), Ln(September-October), Ln(July-August), Ln(January-February), Ln(May-June)	.840	.705	.569	.333133	1.693

a. Dependent Variable: Ln(Trout Harvest)

b. Method: Enter

c. Independent Variables: (Constant), Ln(November-December Inflows), Ln(March-April Inflows), Ln(September-October Inflows), Ln(July-August Inflows), Ln(January-February Inflows), Ln(May-June Inflows)

d. All requested variables entered.

Table 6.13 ANOVA table of log of trout data on log of inflow data

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.445	6	.574	5.174	.006 ^b
	Residual	1.443	13	.111		
	Total	4.888	19			

a. Dependent Variable: Ln(Trout Harvest)

b. Independent Variables: (Constant), Ln(November-December Inflows), Ln(March-April Inflows), Ln(September-October Inflows), Ln(July-August Inflows), Ln(January-February Inflows), Ln(May-June Inflows)

Table 6.14 Table of coefficients for log of trout data on log of inflow data.

Coefficients^a

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
	(Constant)	6.691	.656				10.201	.000	5.274	8.108
Ln(January-February)	-.234	.105	-.455	-2.227	.044	-.461	-.007
Ln(March-April)	.122	.229	.196	.532	.604	-.373	.617
Ln(May-June)	-4.7E-02	.197	-.089	-.239	.815	-.471	.378
Ln(July-August)	-.582	.130	-.802	-4.497	.001	-.862	-.303
Ln(September-October)	.104	.079	.305	1.318	.210	-.067	.275
Ln(November-December)	.166	.093	.338	1.785	.098	-.035	.368

a. Dependent Variable: Ln(Trout Harvest)

6.2.2 Collinearity Diagnostic

Table 6.15 Variance Inflation for log of trout data on log of inflow data.

Coefficients^a

	t	Collinearity Statistics	
		Tolerance	VIF
(Constant)	10.201		
Ln(January-February)	-2.227	.543	1.842
Ln(March-April)	.532	.167	6.006
Ln(May-June)	-.239	.165	6.067
Ln(July-August)	-4.497	.714	1.400
Ln(September-October)	1.318	.424	2.358
Ln(November-December)	1.785	.633	1.579

a. Dependent Variable: Ln(Trout Harvest)

Table 6.16 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: Ln(TROUT) on Ln(INFLOWS):

Number	Eigenvalue	Condition Index	Var Prop LN_QJF	Var Prop LN_QMA	Var Prop LN_QMJ	Var Prop LN_QJA	Var Prop LN_QSO	Var Prop LN_QND
1	2.53959	1.00000	0.0057	0.0068	0.0426	0.0403	0.0415	0.0549
1	2.24535	1.00000	0.0274	0.0241	0.0212	0.0327	0.0247	0.0110
2	1.43658	1.25019	0.1023	0.0059	0.0160	0.0111	0.0095	0.2134
3	0.97499	1.51755	0.0190	0.0119	0.0139	0.2247	0.2166	0.0058
4	0.86292	1.61308	0.1375	0.0169	0.0042	0.3880	0.0761	0.0354
5	0.40587	2.35205	0.4349	0.0235	0.0207	0.1365	0.0844	0.6372
6	0.07428	5.49791	0.2789	0.9177	0.9240	0.2070	0.5886	0.0972

6.2.3 Residuals Diagnostics

Table 6.17 Residuals Diagnostics for log of trout data on log of inflow data.

Residuals Statistics ^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.969346	5.936247	5.092896	.425818	20
Std. Predicted Value	-2.639	1.981	.000	1.000	20
Standard Error of Predicted Value	.137965	.252480	.193745	3.7E-02	20
Adjusted Predicted Value	4.286778	6.473432	5.123577	.496174	20
Residual	-.560108	.513780	4.7E-16	.275558	20
Std. Residual	-1.681	1.542	.000	.827	20
Stud. Residual	-2.513	1.823	-.034	1.063	20
Deleted Residual	-1.251456	.718034	-3.1E-02	.466684	20
Stud. Deleted Residual	-3.367	2.030	-.064	1.209	20
Mahal. Distance	2.309	9.964	5.700	2.483	20
Cook's Distance	.000	1.114	.114	.248	20
Centered Leverage Value	.122	.524	.300	.131	20

a. Dependent Variable: Ln(Trout Harvest)

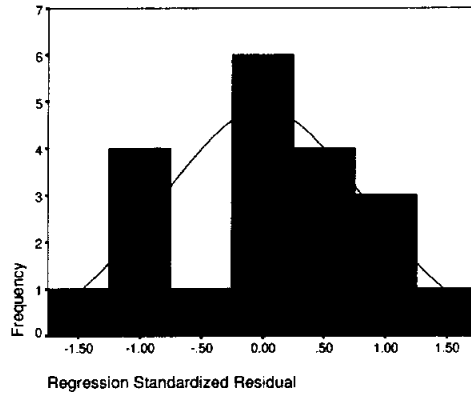


Figure 6.16 Histogram of Standardized Residuals.

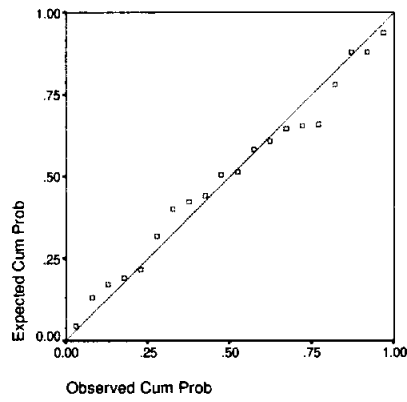


Figure 6.17 Normal P-P Plot of Residuals.

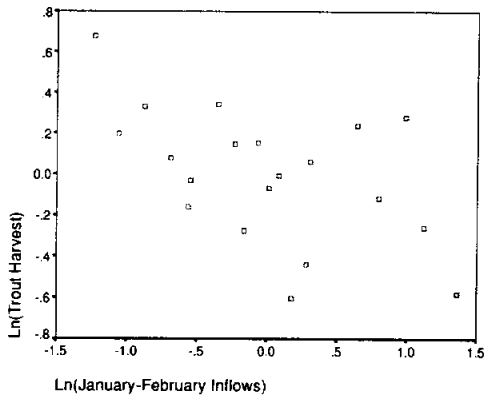


Figure 6.18 Partial Residual Plot for $\text{Ln}(\text{January-February Inflows})$.

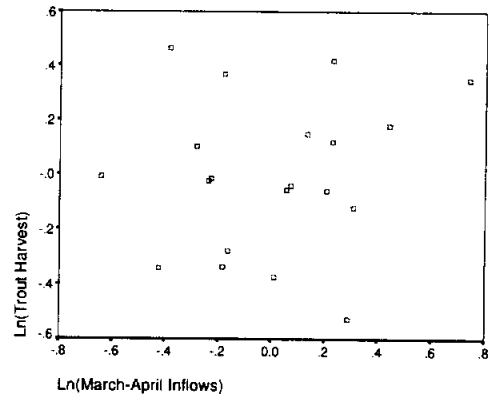


Figure 6.19 Partial Residual Plot for $\text{Ln}(\text{March-April Inflows})$.

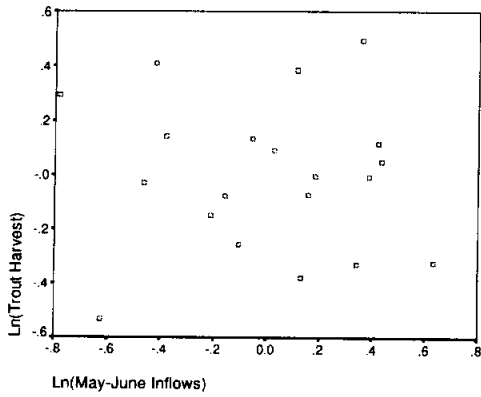


Figure 6.20 Partial Residual Plot for $\text{Ln}(\text{May-June Inflows})$.

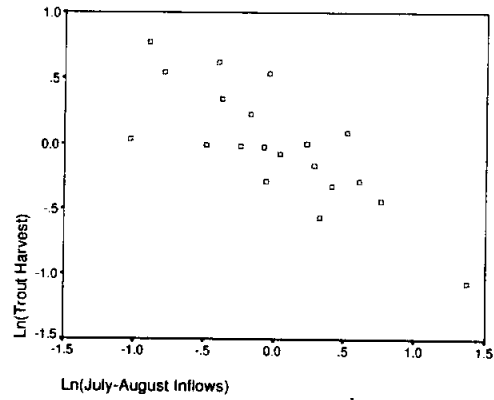


Figure 6.21 Partial Residual Plot for $\text{Ln}(\text{July-August Inflows})$.

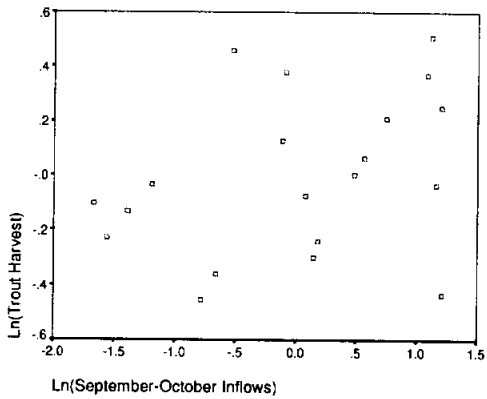


Figure 6.22 Partial Residual Plot for $\text{Ln}(\text{September-October Inflows})$.

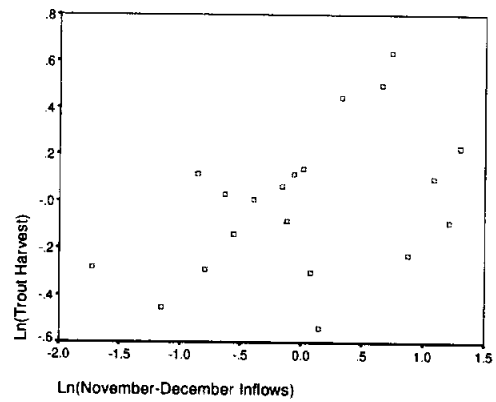


Figure 6.23 Partial Residual Plot for $\text{Ln}(\text{November-December Inflows})$.

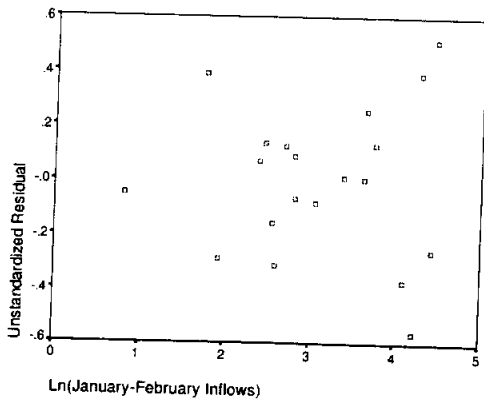


Figure 6.24 Residuals Plot for Ln(January-February Inflows).

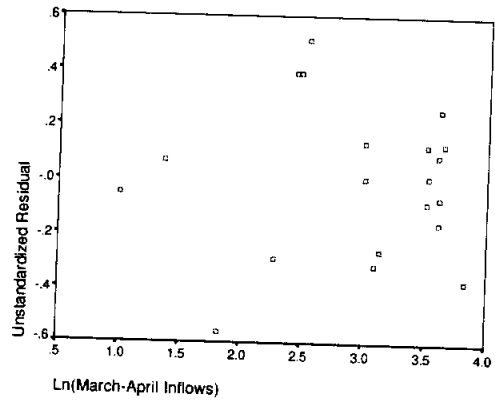


Figure 6.25 Residuals Plot for Ln(March-April Inflows).

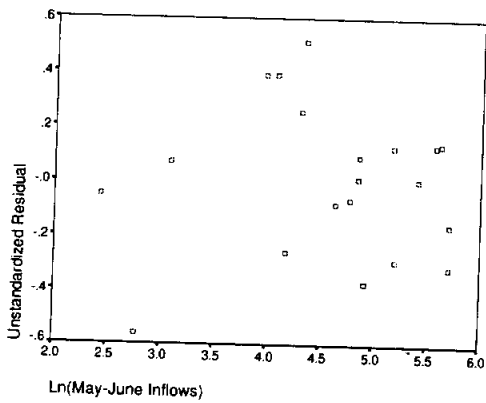


Figure 6.26 Residuals Plot for Ln(May-June Inflows).

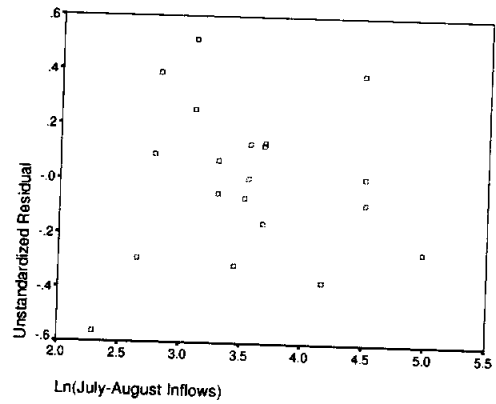


Figure 6.27 Residuals Plot for Ln(July-August Inflows).

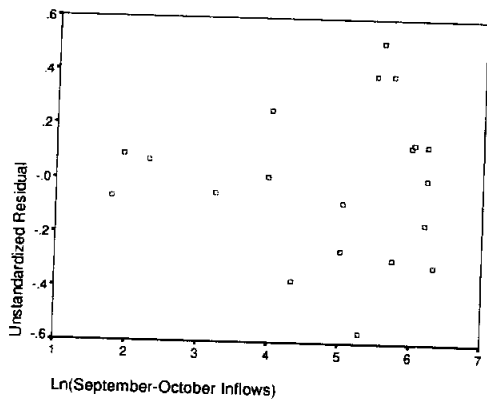


Figure 6.28 Residuals Plot for Ln(September-October Inflows).

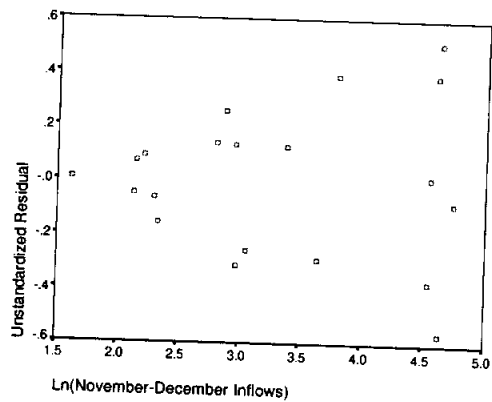


Figure 6.29 Residuals Plot for Ln(November-December Inflows).

6.2.4 Prediction Intervals for Trout Harvest

Table 6.19 Prediction Intervals for Trout Harvest.

YEAR	<i>LICI_1</i>	<i>LN_TROUT</i>	<i>UICI_1</i>
1961	4.1654	5.8165	6.4400
1962	4.3716	5.8880	6.6212
1963	4.5318	5.2220	7.0324
1964	4.0195	5.2311	6.5378
1965	3.6041	4.9008	6.0545
1966	3.6030	4.7077	5.9383
1967	3.9993	5.2933	6.4006
1968	4.0403	5.0019	6.2761
1969	3.6069	4.8122	6.0034
1970	3.9781	5.1985	6.1503
1971	3.9897	5.4298	6.3529
1972	4.1932	5.4183	6.3896
1973	4.0762	5.3107	6.2690
1974	4.2466	5.0291	6.4362
1975	4.7280	5.6462	7.1445
1976	3.8304	5.4076	6.2009
1977	3.7351	4.7925	6.0137
1978	3.4930	4.6634	5.8060
1979	3.6331	4.3770	5.8643
1980	2.7194	3.7111	5.2193

LICI_1 Lower limit for 99% prediction interval for the natural log of trout harvest.
LN_TROUT Natural log of trout harvest
UICI_1 Upper limit for 99% prediction interval for the natural log of trout harvest.

6.2.5 Outliers and Influential Point Detection

Table 6.20 Mahalanobis distance, Cook's distance, Leverage value and associated p-values

YEAR	MAH_1	COOK_1	LEV_1 ¹	MAH_PV ²	COOK_PV ³
1961	4.4548	.1888	.2345	.7262	.0172
1962	3.9221	.0916	.2064	.7887	.0020
1963	9.5463	1.1137	*.5024	.2158	*.5895
1964	9.9637	.0092	*.5244	.1906	.0000
1965	8.3728	.0125	.4407	.3009	.0000
1966	5.7757	.0043	.3040	.5662	.0000
1967	7.2474	.0150	.3814	.4036	.0000
1968	3.6293	.0132	.1910	.8214	.0000
1969	7.1420	.0001	.3759	.4143	.0000
1970	2.3088	.0058	.1215	.9408	.0000
1971	6.3920	.0883	.3364	.4948	.0018
1972	2.8055	.0064	.1477	.9024	.0000
1973	2.7314	.0073	.1438	.9087	.0000
1974	2.6666	.0365	.1403	.9140	.0001
1975	7.5971	.1610	.3998	.3695	.0110
1976	6.5561	.2135	.3451	.4765	.0242
1977	4.5407	.0049	.2390	.7158	.0000
1978	5.2875	.0002	.2783	.6249	.0000
1979	3.5331	.0719	.1860	.8317	.0009
1980	9.5273	.2352	*.5014	.2170	.0314

MAH_1 Mahalanobis distance

COOK_1 Cook's distance

LEV_1 Leverage value

MAHA_PV P-value associated with the Mahalanobis distance

COOK_P P-value associated with Cook's distance

¹This is flagged if it exceeds $(2p+1)/n$ or 0.5, whichever is smaller.

²MAHA_PV = $1-F(MAH_1)$, where F is the CDF of a Chi-squared random variable with $p+1$ degrees of freedom. Small values indicate a problem.

³COOK_PV = $F(COOK_1)$, where F is the CDF of an F-ratio random variable with $p+1$ numerator degrees of freedom and $n-p-1$ denominator degrees of freedom. A value greater than 0.5 indicates a problem. A value less than 0.2 indicates no problem. Values in between are inconclusive.

Table 6.21 Standardized *dffits* value and Standardized *dfbeta* values

YEAR	<i>SDFFITs</i>	<i>SDFBET_0</i>	<i>SDFBET_1</i>	<i>SDFBET_2</i>
1961	*1.2802	-.3869	.7489	-.6379
1962	.8309	-.0074	.3326	-.2016
1963	*-3.7412	*-1.9653	-.2805	*-1.0040
1964	-.2447	-.1642	.1079	-.0159
1965	.2848	.0471	.1022	-.1794
1966	-.1675	-.0303	-.0009	-.0109
1967	.3127	.1321	-.0348	.0750
1968	-.2949	-.0437	.1033	-.1277
1969	.0230	-.0022	.0125	-.0057
1970	.1951	-.0222	.0456	.0432
1971	.7855	.5029	-.1397	.6443
1972	.2042	.0480	-.1275	.1391
1973	.2193	-.0778	-.0103	-.0967
1974	-.5069	.1318	.0591	.1458
1975	*-1.0788	.0641	.2846	.4663
1976	*1.2941	.1204	-.7996	.3230
1977	-.1792	.0499	.0722	-.0477
1978	.0343	-.0196	.0016	-.0093
1979	-.7287	.3426	-.1341	-.0120
1980	*-1.3017	.4147	-.7527	.1952

SDFFITs Standardized *dffits* value
SDFBET_0 Standardized *dfbeta* for the intercept term
SDFBET_1 Standardized *dfbeta* for log of January-February inflows
SDFBET_2 Standardized *dfbeta* for log of March-April inflows

*Items are flagged if $|sdfits|$ or $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

Table 6.22 Standardized *dfbeta* values

YEAR	<i>SDFBET_3</i>	<i>SDFBET_4</i>	<i>SDFBET_5</i>	<i>SDFBET_6</i>
1961	.5086	-.0362	-.3002	.4967
1962	.1100	-.2572	-.0363	.3020
1963	*1.8507	*2.0050	*-1.4498	-.2099
1964	.0880	-.0053	-.0370	.0502
1965	.1043	.0961	-.1606	-.0445
1966	-.0260	.0081	.1039	.0094
1967	.0080	-.1458	-.1349	-.0213
1968	.0744	.0563	-.1652	.1334
1969	.0038	.0039	.0047	-.0170
1970	-.0149	-.0307	.0831	-.0829
1971	-.5834	-.4405	.3257	-.3016
1972	-.1030	-.0668	.1310	-.0079
1973	.1240	.0445	-.0133	.0022
1974	-.2347	.0240	-.0401	-.0243
1975	-.6028	.3042	.2523	-.5468
1976	-.5088	.4110	.5476	.1885
1977	.0311	-.0530	-.0060	-.1010
1978	.0137	.0177	-.0197	.0217
1979	-.1160	-.1885	.2776	-.3674
1980	.1091	-.9354	-.0766	.5641

SDFBET_3 Standardized *dfbeta* for log of May-June inflows
SDFBET_4 Standardized *dfbeta* for log of July-August inflows
SDFBET_5 Standardized *dfbeta* for log of September-October inflows
SDFBET_6 Standardized *dfbeta* for log of November-December inflows

*Items are flagged if $|sdfbeta|$ or $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

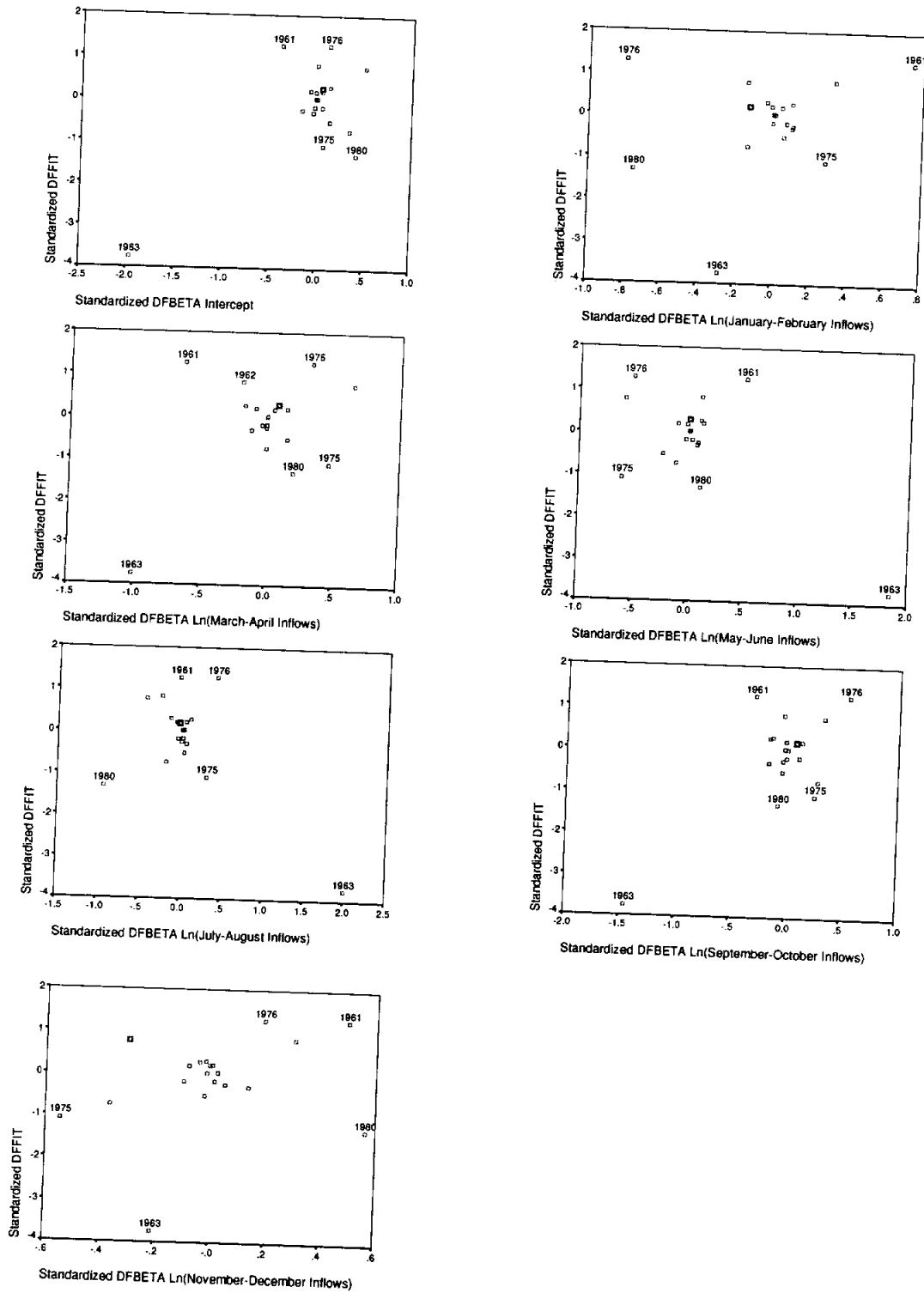


Figure 6.30 Standardized DFFITS vs. Standardized DFBETA Intercept and vs. Standardized DFBETA of log of inflow variables.

6.3 Regression - Log of trout data on square root of inflow data

6.3.1 ANOVA and Parameter Estimates

Table 6.23 Model Summary for log of trout data on square root of inflow data.

Model Summary^{a,b}

Variables Entered	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Sqrt(November-December), Sqrt(September-October), Sqrt(March-April), Sqrt(July-August), Sqrt(January-February), Sqrt(May-June) ^{c,d}	.866	.750	.635	.306374	2.094

a. Dependent Variable: Ln(Trout Harvest)

b. Method: Enter

c. Independent Variables: (Constant), Square Root of November-December Inflows, Square Root of September-October Inflows, Square Root of March-April Inflows, Square Root of July-August Inflows, Square Root of January-February Inflows, Square Root of May-June Inflows

d. All requested variables entered.

Table 6.24 ANOVA table of log of trout data on square root of inflow data

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.668	6	.611	6.512	.002 ^b
	Residual	1.220	13	9.4E-02		
	Total	4.888	19			

a. Dependent Variable: Ln(Trout Harvest)

b. Independent Variables: (Constant), Square Root of November-December Inflows, Square Root of September-October Inflows, Square Root of March-April Inflows, Square Root of July-August Inflows, Square Root of January-February Inflows, Square Root of May-June Inflows

Table 6.25 Table of coefficients for log of trout data on square root of inflow data.

Coefficients ^a							
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	6.020	.326		18.462	.000	5.316	6.725
Sqrt(January-February)	-9.3E-02	.039	-.434	-2.391	.033	-.177	-.009
Sqrt(March-April)	8.9E-02	.090	.276	.987	.342	-.106	.285
Sqrt(May-June)	-5.9E-02	.042	-.504	-1.397	.186	-.149	.032
Sqrt(July-August)	-.175	.034	-.798	-5.082	.000	-.250	-.101
Sqrt(September-October)	4.0E-02	.019	.563	2.131	.053	-.001	.080
Sqrt(November-December)	5.7E-02	.029	.338	1.956	.072	-.006	.120

a. Dependent Variable: Ln(Trout Harvest)

6.3.2 Collinearity Diagnostic

Table 6.26 Collinearity Diagnostic for log of trout data on square root of inflow data.

Coefficients ^a			
	t	Collinearity Statistics	
		Tolerance	VIF
(Constant)	18.462		
Sqrt(January-February)	-2.391	.583	1.714
Sqrt(March-April)	.987	.246	4.057
Sqrt(May-June)	-1.397	.148	6.772
Sqrt(July-August)	-5.082	.778	1.285
Sqrt(September-October)	2.131	.275	3.635
Sqrt(November-December)	1.956	.645	1.551

a. Dependent Variable: Ln(Trout Harvest)

Table 6.27 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: Sqrt(TROUT) on Sqrt(INFLOWS).

Condition Number	Var Prop Eigenvalue	Var Prop Index	Var Prop SQR_QJF	Var Prop SQR_QMA	Var Prop SQR_QMJ	Var Prop SQR_QJA	Var Prop SQR_QSO	Var Prop SQR_QND
1	1.96860	1.00000	0.0052	0.0285	0.0354	0.0081	0.0287	0.0188
2	1.63314	1.09791	0.1383	0.0151	0.0000	0.0717	0.0008	0.1410
3	1.13754	1.31551	0.0325	0.0363	0.0020	0.2104	0.0932	0.0343
4	0.74148	1.62941	0.0937	0.0744	0.0024	0.4848	0.0628	0.0119
5	0.44471	2.10396	0.5038	0.0170	0.0063	0.0790	0.0108	0.7302
6	0.07452	5.13961	0.2265	0.8288	0.9539	0.1459	0.8037	0.0638

6.3.3 Residuals Diagnostics

Table 6.28 Residuals Diagnostics for log of trout data on square root of inflow data.

Residuals Statistics ^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.758675	5.823534	5.092896	.439351	20
Std. Predicted Value	-3.037	1.663	.000	1.000	20
Standard Error of Predicted Value	.145231	.266378	.179041	2.9E-02	20
Adjusted Predicted Value	3.905949	6.273537	5.096954	.464298	20
Residual	-.601558	.455594	-1.2E-15	.253423	20
Std. Residual	-1.963	1.487	.000	.827	20
Stud. Residual	-2.596	1.785	-.004	1.038	20
Deleted Residual	-1.051561	.656085	-4.1E-03	.403358	20
Stud. Deleted Residual	-3.594	1.973	-.039	1.204	20
Mahal. Distance	3.319	13.413	5.700	2.338	20
Cook's Distance	.000	.720	.089	.166	20
Centered Leverage Value	.175	.706	.300	.123	20

a. Dependent Variable: Ln(Trout Harvest)

Table 6.29 Case Values for Residuals Diagnostics for log of trout data on square root of inflow data.

YEAR	PRE_1	RES_1	DRE_1	ADJ_1	ZPR_1	ZRE_1	SRE_1 ¹	SDR_1 ²
1961	5.3609	.4556	.6561	5.1604	.6101	1.4871	1.7845	1.9731
1962	5.5537	.3343	.4579	5.4301	1.0489	1.0912	1.2771	1.3121
1963	5.8235	-.6016	-1.0516	6.2735	1.6630	-1.9635	-2.5960	*-3.5940
1964	5.2843	-.0532	-.0927	5.3238	.4357	-.1736	-.2292	-.2206
1965	4.9978	-.0969	-.1557	5.0565	-.2166	-.3164	-.4010	-.3877
1966	4.8106	-.1029	-.1433	4.8510	-.6425	-.3358	-.3963	-.3831
1967	5.0965	.1968	.3032	4.9901	.0083	.6422	.7972	.7854
1968	5.1708	-.1689	-.2178	5.2198	.1774	-.5513	-.6261	-.6108
1969	4.9575	-.1453	-.2042	5.0164	-.3083	-.4742	-.5622	-.5469
1970	5.1165	.0820	.1064	5.0921	.0537	.2677	.3050	.2940
1971	5.1989	.2309	.3754	5.0544	.2413	.7535	.9609	.9578
1972	5.3996	.0187	.0261	5.3923	.6981	.0611	.0721	.0693
1973	5.0680	.2428	.3226	4.9882	-.0568	.7924	.9134	.9072
1974	5.2891	-.2599	-.3387	5.3679	.4465	-.8484	-.9685	-.9661
1975	5.6558	-.0096	-.0146	5.6607	1.2812	-.0314	-.0387	-.0372
1976	5.1045	.3031	.6217	4.7859	.0264	.9894	1.4170	1.4805
1977	4.9464	-.1539	-.2472	5.0397	-.3334	-.5024	-.6367	-.6215
1978	4.5545	.1090	.1805	4.4830	-1.2255	.3557	.4577	.4433
1979	4.7104	-.3334	-.4703	4.8473	-.8705	-1.0883	-1.2925	-1.3302
1980	3.7587	-.0475	-.1948	3.9059	-3.0368	-.1552	-.3141	-.3030

PRE_1	Predicted value of harvest
RES_1	Ordinary residuals: observed harvest minus predicted harvest
DRE_1	Deleted residuals: residuals obtained when the model is fitted without that observation
ADJ_1	Adjusted predicted value: predicted value of harvest when the model is fitted without that observation
ZPR_1	Z-score of the predicted value of harvest
ZRE_1	Z-score of the residual
SRE_1	Studentized residual
SDR_1	Studentized deleted residuals

¹Values greater than 3 are flagged.

²This is flagged if it exceeds $t_{n-p-2, \alpha} = t_{12, 0.01} = 2.681$.

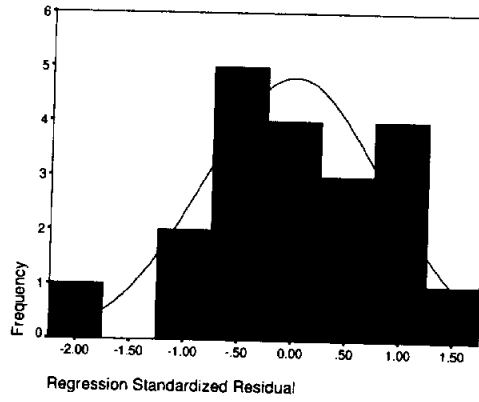


Figure 6.31 Histogram of Standardized Residuals.

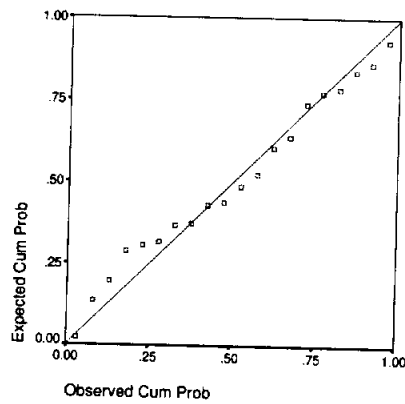


Figure 6.32 Normal P-P Plot of Residuals.

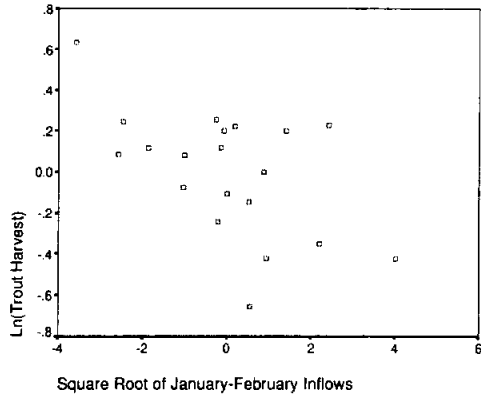


Figure 6.33 Partial Residual Plot for *Sqrt(January-February Inflows)*.

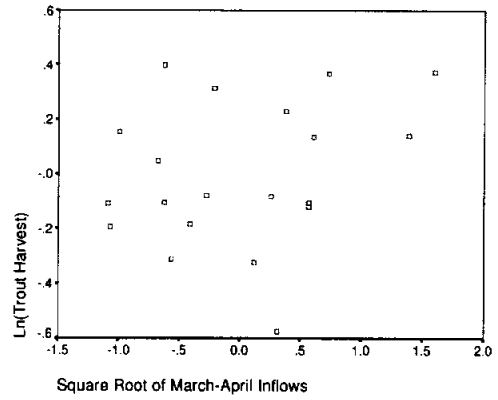


Figure 6.34 Partial Residual Plot for *Sqrt(March-April Inflows)*.

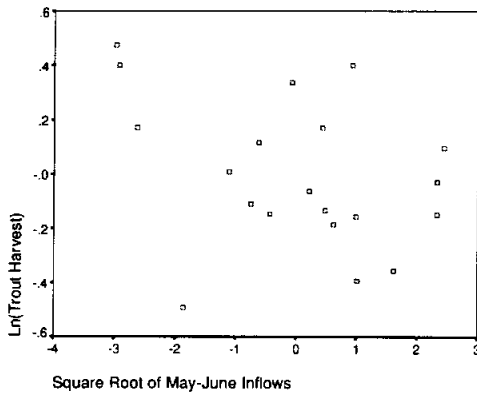


Figure 6.35 Partial Residual Plot for *Sqrt(May-June Inflows)*.

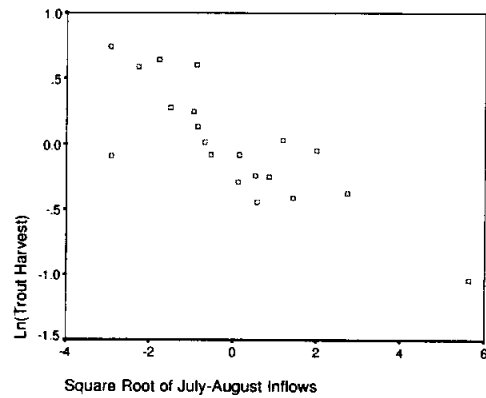


Figure 6.36 Partial Residual Plot for *Sqrt(July-August Inflows)*.

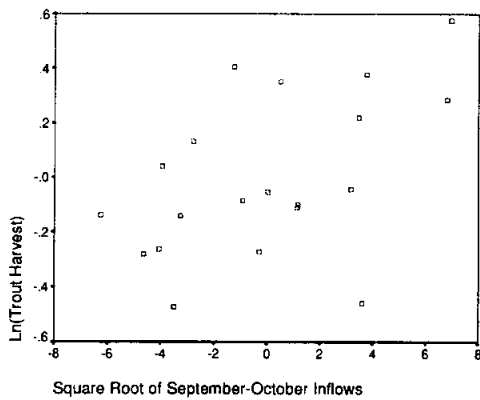


Figure 6.37 Partial Residual Plot for *Sqrt(September-October Inflows)*.

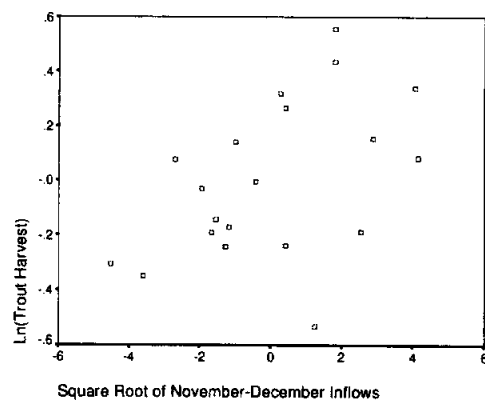


Figure 6.38 Partial Residual Plot for *Sqrt(November-December Inflows)*.

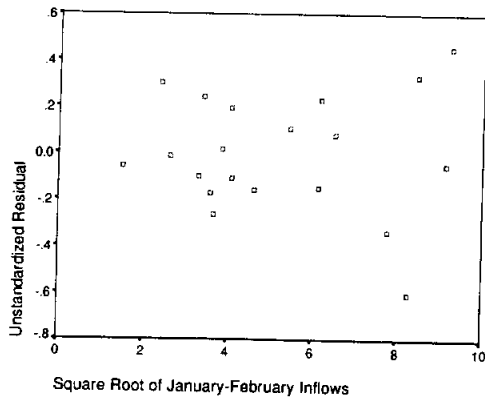


Figure 6.39 Residuals Plot for $\text{Sqrt}(\text{January-February Inflows})$.

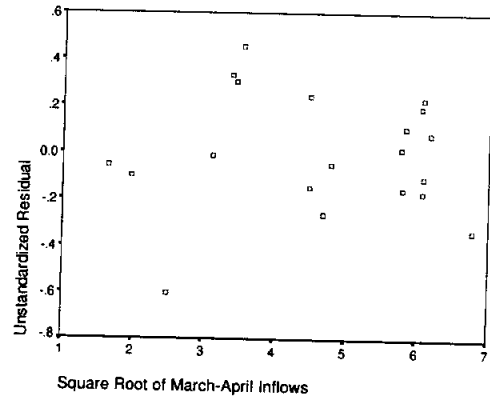


Figure 6.40 Residuals Plot for $\text{Sqrt}(\text{March-April Inflows})$.

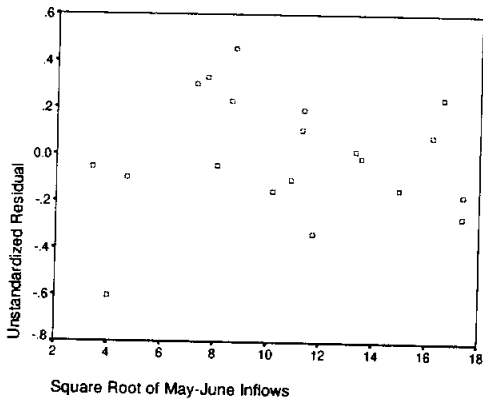


Figure 6.41 Residuals Plot for $\text{Sqrt}(\text{May-June Inflows})$.

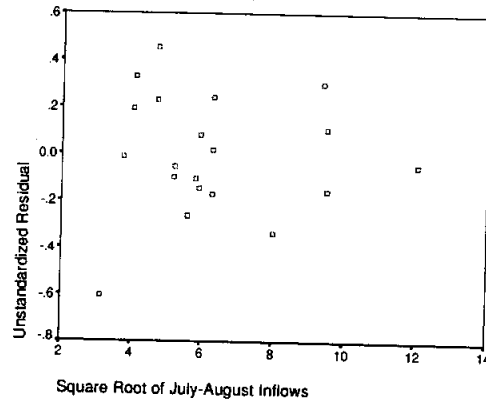


Figure 6.42 Residuals Plot for $\text{Sqrt}(\text{July-August Inflows})$.

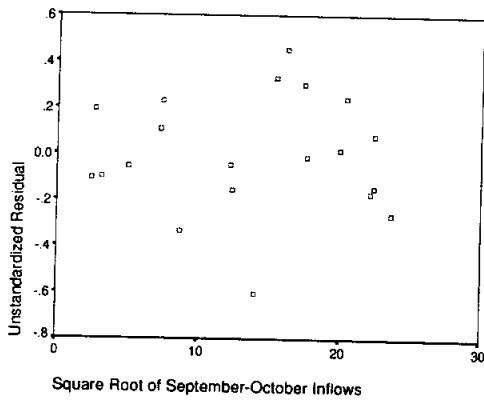


Figure 6.43 Residuals Plot for $\text{Sqrt}(\text{September-October Inflows})$.

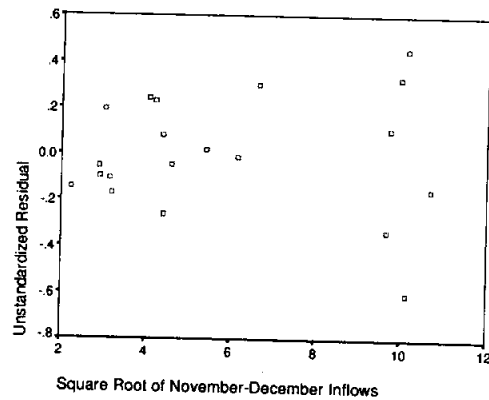


Figure 6.44 Residuals Plot for $\text{Sqrt}(\text{November-December Inflows})$.

6.3.4 Prediction Intervals for Trout Harvest

Table 6.30 Prediction Intervals for Trout Harvest.

YEAR	<i>LICI_1</i>	<i>LN_TROUT</i>	<i>UICI_1</i>
1961	4.3064	5.8165	6.4154
1962	4.5137	5.8880	6.5937
1963	4.7207	5.2220	6.9263
1964	4.1822	5.2311	6.3864
1965	3.9146	4.9008	6.0809
1966	3.7656	4.7077	5.8556
1967	4.0239	5.2933	6.1692
1968	4.1495	5.0019	6.1921
1969	3.9098	4.8122	6.0051
1970	4.0933	5.1985	6.1397
1971	4.1128	5.4298	6.2850
1972	4.3551	5.4183	6.4441
1973	4.0373	5.3107	6.0987
1974	4.2645	5.0291	6.3137
1975	4.5880	5.6462	6.7236
1976	3.9695	5.4076	6.2394
1977	3.8633	4.7925	6.0295
1978	3.4640	4.6634	5.6450
1979	3.6619	4.3770	5.7590
1980	2.5357	3.7111	4.9816

LICI_1 Lower limit for 99% prediction interval for the natural log of trout harvest.

LN_TROUT Natural log of trout harvest

UICI_1 Upper limit for 99% prediction interval for the natural log of trout harvest.

6.3.5 Outliers and Influential Point Detection

Table 6.31 Mahalanobis distance, Cook's distance, Leverage value and associated p-values

YEAR	MAH_1	COOK_1	LEV_1 ¹	MAH_PV ²	COOK_PV ³
1961	4.8562	.2002	.2556	.6775	.0203
1962	4.1783	.0861	.2199	.7590	.0016
1963	7.1808	.7202	.3779	.4103	.3421
1964	7.1443	.0056	.3760	.4140	.0000
1965	6.2220	.0139	.3275	.5141	.0000
1966	4.4101	.0088	.2321	.7315	.0000
1967	5.7183	.0491	.3010	.5730	.0003
1968	3.3194	.0162	.1747	.8540	.0000
1969	4.5354	.0183	.2387	.7164	.0000
1970	3.4054	.0040	.1792	.8451	.0000
1971	6.3644	.0826	.3350	.4979	.0014
1972	4.3870	.0003	.2309	.7343	.0000
1973	3.7488	.0392	.1973	.8082	.0001
1974	3.4696	.0406	.1826	.8384	.0001
1975	5.4839	.0001	.2886	.6011	.0000
1976	8.7860	.3015	.4624	.2684	.0592
1977	6.2203	.0351	.3274	.5143	.0001
1978	6.5784	.0196	.3462	.4741	.0000
1979	4.5784	.0979	.2410	.7113	.0025
1980	13.4131	.0437	*.7060	.0627	.0002

MAH_1 Mahalanobis distance

COOK_1 Cook's distance

LEV_1 Leverage value

MAHA_PV P-value associated with the Mahalanobis distance

COOK_PV P-value associated with Cook's distance

¹This is flagged if it exceeds $(2p+1)/n$ or 0.5, whichever is smaller.

²MAHA_PV = $1-F(MAH_1)$, where F is the CDF of a Chi-squared random variable with $p+1$ degrees of freedom. Small values indicate a problem.

³COOK_PV = $F(COOK_1)$, where F is the CDF of an F-ratio random variable with $p+1$ numerator degrees of freedom and $n-p-1$ denominator degrees of freedom. A value greater than 0.5 indicates a problem. A value less than 0.2 indicates no problem. Values in between are inconclusive.

Table 6.32 Standardized *dffits* value and Standardized *dfbeta* values

YEAR	<i>SDFFITs</i>	<i>SDFBET_0</i>	<i>SDFBET_1</i>	<i>SDFBET_2</i>
1961	*1.3089	-.1215	.7297	-.4351
1962	.7978	.0738	.2731	-.0953
1963	*-3.1085	*-1.0765	-.3324	-.4356
1964	-.1901	-.1672	.0683	.0237
1965	-.3019	-.2250	-.0327	.1551
1966	-.2401	-.0707	-.0001	-.0347
1967	.5775	.2222	-.0086	.1099
1968	-.3288	.0368	.0894	-.1155
1969	-.3484	.0035	-.1813	.0780
1970	.1604	-.0431	.0368	.0599
1971	.7578	.2418	-.0411	.5755
1972	.0433	.0022	-.0254	.0335
1973	.5200	-.0409	.0262	-.3068
1974	-.5319	.0536	.0283	.1839
1975	-.0266	-.0074	.0058	.0146
1976	*1.5178	.2654	-.9585	.4568
1977	-.4839	.1510	.2574	-.1322
1978	.3592	-.1393	-.0100	-.1138
1979	-.8521	.4317	-.1880	-.0556
1980	-.5332	.1396	-.3132	.1124

*SDFFITs*Standardized *dffits* value*SDFBET_0*Standardized *dfbeta* for the intercept term*SDFBET_1*Standardized *dfbeta* for square root of January-February inflows*SDFBET_2*Standardized *dfbeta* for square root of March-April inflows

*Items are flagged if $|sdfits|$ or $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

Table 6.33 Standardized *dfbeta* values

YEAR	<i>SDFBET_3</i>	<i>SDFBET_4</i>	<i>SDFBET_5</i>	<i>SDFBET_6</i>
1961	.2980	-.2335	-.1751	.4082
1962	-.0160	-.3056	.0483	.2641
1963	*1.2145	*1.5604	*-1.0405	-.5722
1964	.0443	-.0047	-.0006	.0425
1965	-.0665	-.0481	.1379	.0771
1966	-.0294	.0345	.1107	.0502
1967	.0575	-.2491	-.2319	-.0904
1968	.0413	.0406	-.1344	.0832
1969	-.0547	-.0389	-.0463	.2213
1970	-.0285	-.0357	.0706	-.0618
1971	-.4893	-.4055	.2785	-.3120
1972	-.0294	-.0138	.0337	-.0031
1973	.3510	.1400	-.1755	.0419
1974	-.2433	-.0163	.0189	-.0452
1975	-.0146	.0043	.0090	-.0125
1976	-.8620	.4778	.8974	.0586
1977	.0813	-.1282	-.0549	-.3117
1978	.1819	.1755	-.2153	.2206
1979	-.2185	-.1048	.3325	-.3843
1980	-.0183	-.3886	.0338	.2626

SDFBET_3 Standardized *dfbeta* for square root of May-June inflows

SDFBET_4 Standardized *dfbeta* for square root of July-August inflows

SDFBET_5 Standardized *dfbeta* for square root of September-October inflows

SDFBET_6 Standardized *dfbeta* for square root of November-December inflows

*Items are flagged if $|sdfbeta|$ exceed 1.0 for a small data set or $2\sqrt{(p + 1) / n}$ for a large data set. The cutoff used here is 1.

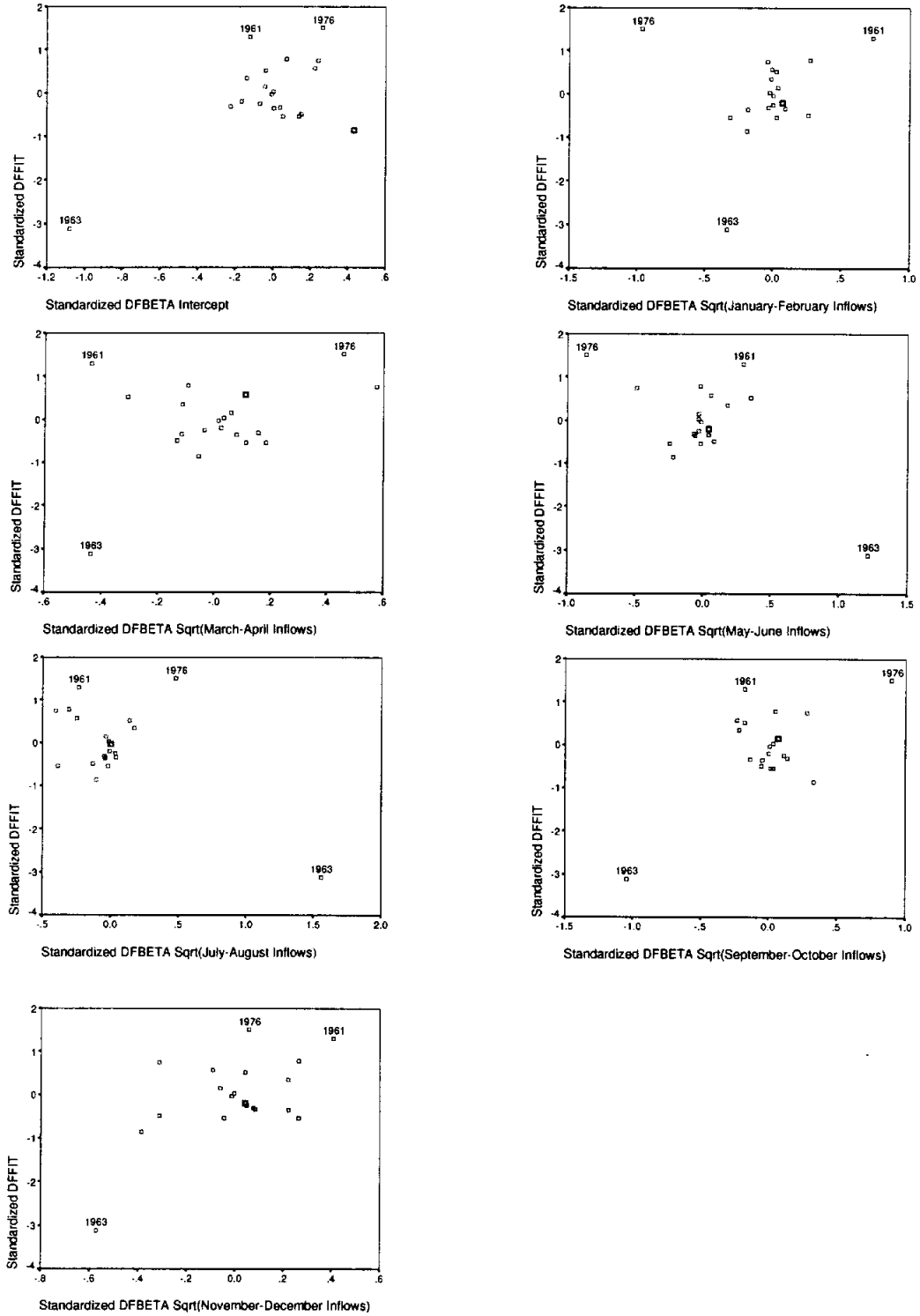


Figure 6.45 Standardized DFFITS vs. Standardized DFBETA Intercept and vs. Standardized DFBETA of square root of inflow variables.

7. EXAMINING SUBSETS OF THE DATA

7.1 Log of trout data and untransformed inflow data: None Omitted

Table 7.1 Regression Models for Dependent Variable: TROUT on INFLOWS: None Omitted

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.5266	0.5003	7.175	-39.14	0.1285	-37.15	QJA_LAG
1	0.1314	0.0832	26.52	-27.00	0.2359	-25.01	QMA_LAG
1	0.0505	-.0023	30.49	-25.22	0.2578	-23.22	QSO_LAG
1	0.0210	-.0334	31.93	-24.60	0.2658	-22.61	QJF_LAG

2	0.5794	0.5299	6.592	-39.50	0.1209	-36.51	QJA_LAG QND_LAG
2	0.5646	0.5134	7.317	-38.81	0.1252	-35.82	QMA_LAG QJA_LAG
2	0.5467	0.4934	8.192	-38.00	0.1303	-35.02	QJA_LAG QSO_LAG
2	0.5349	0.4802	8.768	-37.49	0.1337	-34.50	QMJ_LAG QJA_LAG

3	0.6443	0.5776	5.416	-40.85	0.1087	-36.87	QMJ_LAG QJA_LAG QSO_LAG
3	0.6130	0.5405	6.945	-39.17	0.1182	-35.19	QJA_LAG QSO_LAG QND_LAG
3	0.6108	0.5378	7.055	-39.05	0.1189	-35.07	QMA_LAG QJA_LAG QND_LAG
3	0.6071	0.5335	7.234	-38.87	0.1200	-34.88	QJF_LAG QJA_LAG QND_LAG

4	0.6702	0.5823	6.145	-40.37	0.1075	-35.39	QMJ_LAG QJA_LAG QSO_LAG QND_LAG
4	0.6653	0.5760	6.388	-40.07	0.1091	-35.09	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG
4	0.6462	0.5519	7.319	-38.96	0.1153	-33.98	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG
4	0.6447	0.5499	7.397	-38.87	0.1158	-33.89	QMA_LAG QJA_LAG QSO_LAG QND_LAG

5	0.7291	0.6324	5.261	-42.30	0.0946	-36.33	QJF_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG
5	0.6760	0.5603	7.863	-38.72	0.1131	-32.75	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG
5	0.6756	0.5597	7.884	-38.69	0.1133	-32.72	QJF_LAG QMA_LAG QJA_LAG QSO_LAG QND_LAG
5	0.6702	0.5524	8.145	-38.37	0.1151	-32.39	QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG

6	0.7345	0.6119	7.000	-40.70	0.0998	-33.73	QJF_LAG QMA_LAG QMJ_LAG QJA_LAG QSO_LAG QND_LAG

N = 20

Table 7.2 Analysis of Variance for Dependent Variable: Ln(TROUT) on INFLOWS: None Omitted

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	3.58993	0.59832	5.993	0.0034
Error	13	1.29787	0.09984		
C Total	19	4.88780			
Root MSE	0.31597	R-square	0.7345		
Dep Mean	5.09290	Adj R-sq	0.6119		
C.V.	6.20411				

Table 7.3 Parameter Estimates for Dependent Variable: Ln(TROUT) on INFLOWS: None Omitted

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|	Variance Inflation
INTERCEP	1	5.549905	0.21425085	25.904	0.0001	0.00000000
QJF_LAG	1	-0.006052	0.00341235	-1.773	0.0996	1.63983261
QMA_LAG	1	0.004438	0.00869270	0.511	0.6182	2.64239063
QMJ_LAG	1	-0.003503	0.00206288	-1.698	0.1133	7.37521502
QJA_LAG	1	-0.010793	0.00226692	-4.761	0.0004	1.16542162
QSO_LAG	1	0.001808	0.00085334	2.119	0.0539	5.03638070
QND_LAG	1	0.003736	0.00220827	1.692	0.1145	1.51362492

Table 7.4 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: Ln(TROUT) on INFLOWS: None Omitted

Number	Eigenvalue	Condition Index	Var Prop QJF_LAG	Var Prop QMA_LAG	Var Prop QMJ_LAG	Var Prop QJA_LAG	Var Prop QSO_LAG	Var Prop QND_LAG
1	2.23431	1.00000	0.0411	0.0064	0.0220	0.0105	0.0204	0.0569
2	1.39421	1.26592	0.0656	0.0967	0.0083	0.1685	0.0045	0.0487
3	1.11529	1.41540	0.1145	0.0574	0.0029	0.1100	0.0555	0.0846
4	0.72226	1.75884	0.0068	0.1594	0.0008	0.6516	0.0272	0.0329
5	0.46125	2.20092	0.6120	0.0019	0.0020	0.0055	0.0009	0.7490
6	0.07268	5.54451	0.1601	0.6781	0.9640	0.0540	0.8915	0.0279

Table 7.5 Parameter Estimates of Models for Dependent Variable: Ln(TROUT) on INFLOWS: None Omitted

OBS	_RMSE_	INTERCEP	QJF_LAG	QMA_LAG	QMJ_LAG	QJA_LAG	QSO_LAG	QND_LAG
1	0.35853	5.56576	.	.	.	-0.010663	.	.
2	0.48565	5.41621	.	-0.013565	.	.	.	.
3	0.50778	4.95187	.	.	.	.	.0005977	.
4	0.51560	5.18071	-.0027027	.	.	.	.	.
5	0.34775	5.46272	.	.	.	-0.011187	.	.0029196
6	0.35382	5.71349	.	-0.007508	.	-0.009958	.	.
7	0.36101	5.46544	.	.	.	-0.010420	.0003797	.
8	0.36567	5.63812	.	.	-.0004872	-0.010802	.	.
9	0.32966	5.58735	.	.	-.0026057	-0.010525	.0013827	.
10	0.34382	5.31681	.	.	.	-0.010941	.0004985	.0033214
11	0.34482	5.60381	.	-0.006849	.	-0.010513	.	.0027406
12	0.34644	5.51532	-.0036882	.	.	-0.010928	.	.0042082
13	0.32781	5.46582	.	.	-.0021209	-0.010852	.0012752	.0022091
14	0.33027	5.69596	-.0029703	.	-.0031047	-0.010166	.0015510	.
15	0.33952	5.55726	.	0.002511	-.0030022	-0.010779	.0015324	.
16	0.34028	5.45792	.	-0.006874	.	-0.010264	.0005002	.0031430
17	0.30751	5.57760	-.0055643	.	-.0026899	-0.010425	.0015093	.0038754
18	0.33633	5.65095	-.0037885	0.006254	-.0042295	-0.010697	.0019702	.
19	0.33655	5.50995	-.0038966	-0.006958	.	-0.009973	.0005182	.0045168
20	0.33931	5.46476	.	0.000125	-.0021424	-0.010864	.0012830	.0022010
21	0.31597	5.54990	-.0060517	0.004438	-.0035030	-0.010793	.0018082	.0037363

Table 7.6 Criteria Statistics of Models for Dependent Variable: Ln(TROUT) on INFLOWS: None Omitted

OBS	_MSE_	_RSQ_	_ADJRSQ_	_CP_	_AIC_	_SBC_
1	0.12854	0.52663	0.50033	7.1755	-39.1372	-37.1457
2	0.23586	0.13142	0.08317	26.5239	-26.9978	-25.0063
3	0.25784	0.05048	-0.00228	30.4869	-25.2157	-23.2242
4	0.26584	0.02101	-0.03338	31.9294	-24.6045	-22.6131
5	0.12093	0.57939	0.52991	6.5921	-39.5009	-36.5137
6	0.12519	0.56459	0.51337	7.3168	-38.8092	-35.8220
7	0.13033	0.54672	0.49339	8.1919	-38.0045	-35.0174
8	0.13371	0.53494	0.48023	8.7684	-37.4916	-34.5044
9	0.10867	0.64426	0.57756	5.4164	-40.8508	-36.8679
10	0.11821	0.61304	0.54048	6.9451	-39.1682	-35.1853
11	0.11890	0.61079	0.53782	7.0549	-39.0527	-35.0697
12	0.12002	0.60713	0.53347	7.2342	-38.8653	-34.8823
13	0.10746	0.67022	0.58228	6.1455	-40.3663	-35.3877
14	0.10908	0.66526	0.57600	6.3883	-40.0678	-35.0891
15	0.11527	0.64625	0.55191	7.3191	-38.9629	-33.9843
16	0.11579	0.64466	0.54990	7.3969	-38.8732	-33.8946
17	0.09456	0.72914	0.63241	5.2607	-42.3030	-36.3286
18	0.11312	0.67600	0.56028	7.8627	-38.7197	-32.7454
19	0.11327	0.67557	0.55970	7.8837	-38.6933	-32.7189
20	0.11513	0.67022	0.55245	8.1452	-38.3666	-32.3922
21	0.09984	0.73447	0.61191	7.0000	-40.7001	-33.7300

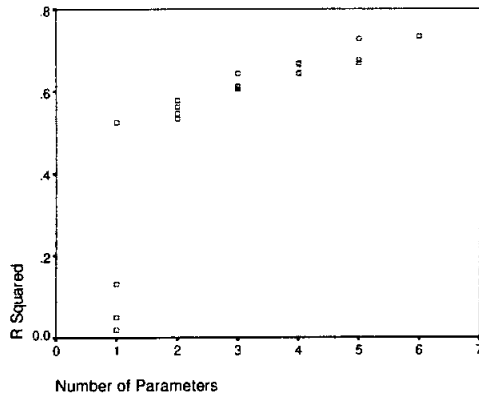


Figure 7.1 The R^2 criteria vs. Number of parameters.

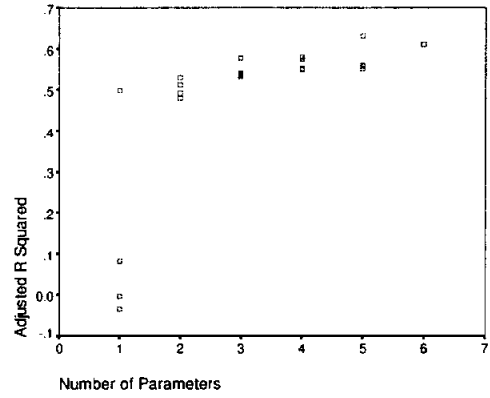


Figure 7.2 The Adjusted R^2 criteria vs. Number of parameters.

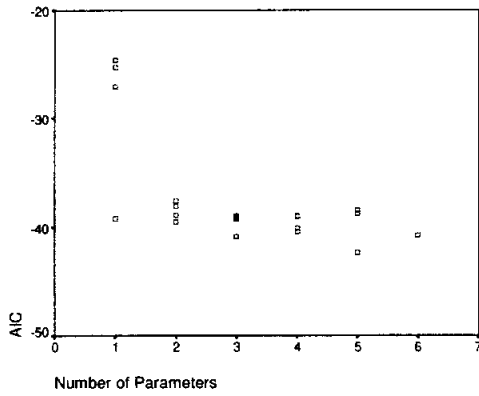


Figure 7.3 The AIC criteria vs. Number of parameters..

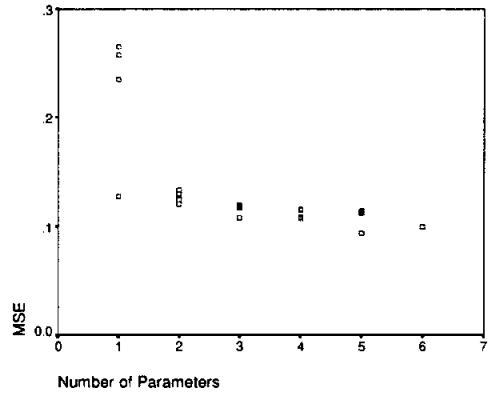


Figure 7.4 MSE vs. Number of parameters.

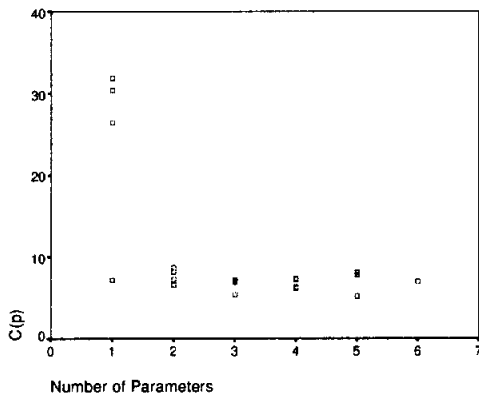


Figure 7.5 The $C(p)$ criteria vs. Number of parameters.

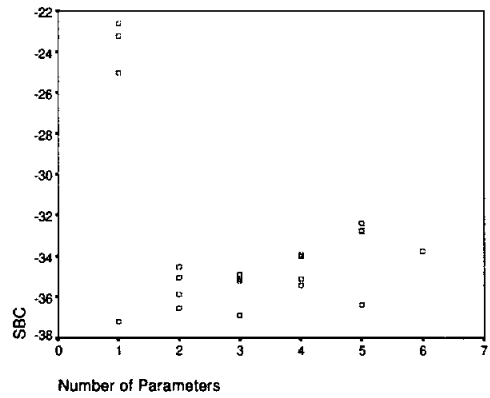


Figure 7.6 The SBC criteria vs. Number of parameters.

7.2 Log of trout data and log of inflow data: 1963 Omitted

Table 7.7 Regression Models for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.5353	0.5080	21.61	-36.43	0.1331	-34.54	LN_QJA
1	0.0888	0.0352	56.79	-23.63	0.2610	-21.74	LN_QMA
1	0.0510	-.0049	59.77	-22.86	0.2719	-20.97	LN_QJF
1	0.0444	-.0119	60.29	-22.73	0.2738	-20.84	LN_QSO

2	0.6606	0.6182	13.74	-40.40	0.1033	-37.56	LN_QJA LN_QND
2	0.6394	0.5943	15.41	-39.24	0.1098	-36.41	LN_QJA LN_QSO
2	0.5480	0.4915	22.62	-34.95	0.1376	-32.12	LN_QJF LN_QJA
2	0.5420	0.4848	23.09	-34.70	0.1394	-31.87	LN_QMA LN_QJA

3	0.7316	0.6779	10.15	-42.85	0.0871	-39.08	LN_QJF LN_QJA LN_QND
3	0.7213	0.6655	10.96	-42.14	0.0905	-38.36	LN_QJA LN_QSO LN_QND
3	0.6881	0.6257	13.57	-40.00	0.1013	-36.22	LN_QMJ LN_QJA LN_QSO
3	0.6738	0.6086	14.70	-39.15	0.1059	-35.37	LN_QMA LN_QJA LN_QND

4	0.8018	0.7451	6.618	-46.61	0.0690	-41.89	LN_QJF LN_QJA LN_QSO LN_QND
4	0.7539	0.6836	10.39	-42.50	0.0856	-37.78	LN_QMJ LN_QJA LN_QSO LN_QND
4	0.7398	0.6654	11.50	-41.44	0.0905	-36.72	LN_QMA LN_QJA LN_QSO LN_QND
4	0.7349	0.6592	11.89	-41.09	0.0922	-36.37	LN_QJF LN_QMJ LN_QJA LN_QND

5	0.8134	0.7416	7.706	-45.76	0.0699	-40.09	LN_QJF LN_QMJ LN_QJA LN_QSO LN_QND
5	0.8018	0.7255	8.618	-44.61	0.0743	-38.95	LN_QJF LN_QMA LN_QJA LN_QSO LN_QND
5	0.7622	0.6707	11.74	-41.15	0.0891	-35.49	LN_QJF LN_QMA LN_QMJ LN_QJA LN_QSO
5	0.7555	0.6615	12.26	-40.63	0.0916	-34.96	LN_QMA LN_QMJ LN_QJA LN_QSO LN_QND

6	0.8477	0.7715	7.000	-47.62	0.0618	-41.01	LN_QJF LN_QMA LN_QMJ LN_QJA LN_QSO LN_QND

N = 19

Table 7.8 Analysis of Variance for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	4.12850	0.68808	11.132	0.0003
Error	12	0.74176	0.06181		
C Total	18	4.87026			
Root MSE	0.24862	R-square	0.8477		
Dep Mean	5.08610	Adj R-sq	0.7715		
C.V.	4.88828				

Table 7.9 Parameter Estimates for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|	Variance Inflation
INTERCEP	1	7.653418	0.56681333	13.503	0.0001	0.00000000
LN_QJF	1	-0.212139	0.07872797	-2.695	0.0195	1.71780914
LN_QMA	1	0.293556	0.17845732	1.645	0.1259	5.87922395
LN_QMJ	1	-0.318307	0.16734013	-1.902	0.0814	6.34868734
LN_QJA	1	-0.776237	0.11249792	-6.900	0.0001	1.55405540
LN_QSO	1	0.189748	0.06424118	2.954	0.0121	2.78004756
LN_QND	1	0.180971	0.06971210	2.596	0.0234	1.43683478

Table 7.10 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

Number	Eigenvalue	Condition Index	Var Prop LN_QJF	Var Prop LN_QMA	Var Prop LN_QMJ	Var Prop LN_QJA	Var Prop LN_QSO	Var Prop LN_QND
1	2.42549	1.00000	0.0436	0.0195	0.0157	0.0182	0.0204	0.0265
2	1.25186	1.39194	0.0332	0.0045	0.0364	0.1084	0.0072	0.2059
3	0.96025	1.58930	0.0555	0.0392	0.0003	0.0026	0.2263	0.0560
4	0.84979	1.68944	0.1703	0.0023	0.0004	0.4875	0.0007	0.0754
5	0.44129	2.34444	0.5055	0.0292	0.0157	0.0526	0.0815	0.5695
6	0.07132	5.83168	0.1918	0.9053	0.9316	0.3307	0.6639	0.0667

Table 7.11 Parameter Estimates of Models for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

OBS	_RMSE_	INTERCEP	LN_QJF	LN_QMA	LN_QMJ	LN_QJA	LN_QSO	LN_QND
1	0.36487	7.20635	.	.	.	-0.58606	.	.
2	0.51092	5.66782	.	-0.19469	.	.	.	.
3	0.52143	5.45035	-0.12037	.	.	.	.	.
4	0.52324	4.74080	.	.	.	.	0.07203	.
5	0.32141	6.88228	.	.	.	-0.66566	.	0.18981
6	0.33133	6.81162	.	.	.	-0.62478	0.11156	.
7	0.37094	7.33855	-0.06078	.	.	-0.57176	.	.
8	0.37338	7.29915	.	-0.05609	.	-0.56539	.	.
9	0.29520	7.12051	-0.15540	.	.	-0.65361	.	0.24824
10	0.30083	6.62673	.	.	.	-0.68269	0.08763	0.15788
11	0.31822	7.34369	.	.	-0.15448	-0.63691	0.16031	.
12	0.32543	7.00338	.	-0.07907	.	-0.63891	.	0.19550
13	0.26260	6.86107	-0.16586	.	.	-0.67115	0.09446	0.21776
14	0.29260	7.08414	.	.	-0.12776	-0.68728	0.13019	0.14304
15	0.30088	6.75868	.	-0.09386	.	-0.65172	0.09168	0.16316
16	0.30367	6.97436	-0.16456	.	0.03519	-0.65391	.	0.25150
17	0.26443	7.11916	-0.14811	.	-0.07909	-0.67523	0.12008	0.20216
18	0.27251	6.86228	-0.16528	-0.00144	.	-0.67072	0.09450	0.21763
19	0.29850	8.05950	-0.16121	0.37916	-0.43840	-0.75959	0.24576	.
20	0.30263	7.18280	.	0.05579	-0.17722	-0.70747	0.14427	0.13416
21	0.24862	7.65342	-0.21214	0.29356	-0.31831	-0.77624	0.18975	0.18097

Table 7.12 Criteria Statistics of Models for Dependent Variable: Ln(TROUT) on Ln(INFLOWS): 1963 Omitted

OBS	_MSE_	_RSQ_	_ADJRSQ_	_CP_	_AIC_	_SBC_
1	0.13313	0.53529	0.50796	21.6141	-36.4252	-34.5363
2	0.26104	0.08881	0.03521	56.7925	-23.6316	-21.7428
3	0.27188	0.05097	-0.00486	59.7741	-22.8585	-20.9696
4	0.27378	0.04436	-0.01186	60.2949	-22.7266	-20.8377
5	0.10331	0.66061	0.61819	13.7404	-40.3961	-37.5628
6	0.10978	0.63936	0.59428	15.4150	-39.2421	-36.4087
7	0.13759	0.54797	0.49147	22.6153	-34.9507	-32.1174
8	0.13941	0.54200	0.48475	23.0858	-34.7014	-31.8681
9	0.08714	0.73160	0.67792	10.1471	-42.8549	-39.0771
10	0.09050	0.72127	0.66553	10.9608	-42.1376	-38.3598
11	0.10126	0.68812	0.62574	13.5733	-40.0019	-36.2242
12	0.10590	0.67382	0.60859	14.6994	-39.1505	-35.3728
13	0.06896	0.80177	0.74513	6.6185	-46.6128	-41.8906
14	0.08561	0.75390	0.68359	10.3902	-42.5029	-37.7807
15	0.09053	0.73976	0.66541	11.5041	-41.4416	-36.7194
16	0.09222	0.73492	0.65918	11.8859	-41.0910	-36.3688
17	0.06992	0.81335	0.74157	7.7059	-45.7567	-40.0901
18	0.07426	0.80177	0.72553	8.6182	-44.6132	-38.9465
19	0.08910	0.76216	0.67069	11.7391	-41.1518	-35.4852
20	0.09158	0.75554	0.66152	12.2608	-40.6301	-34.9635
21	0.06181	0.84770	0.77154	7.0000	-47.6202	-41.0092

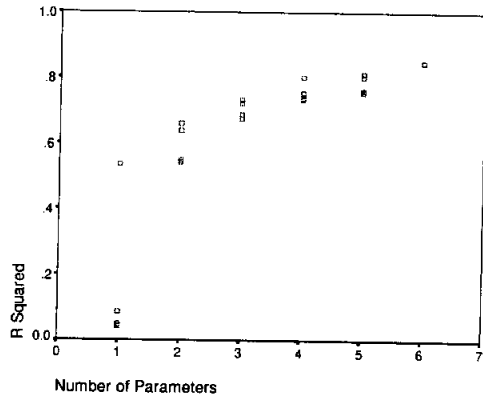


Figure 7.7 The R^2 criteria vs. Number of parameters.

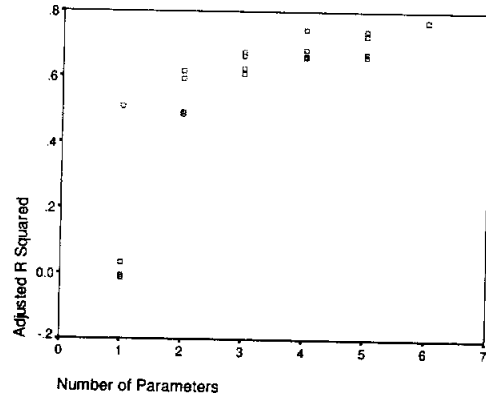


Figure 7.8 The Adjusted R^2 criteria vs. Number of parameters.

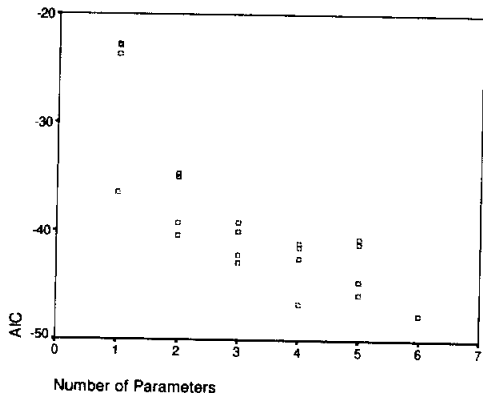


Figure 7.9 The AIC criteria vs. Number of parameters..

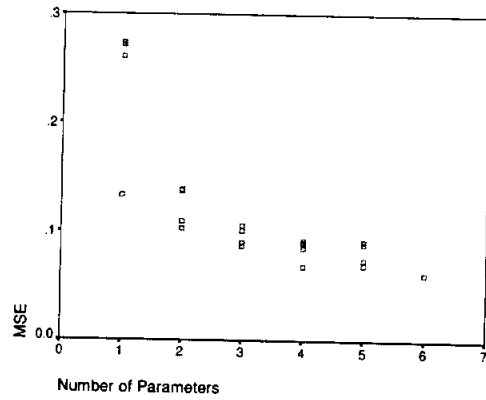


Figure 7.10 MSE vs. Number of parameters.

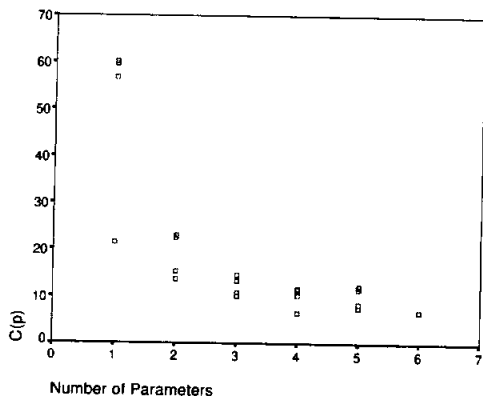


Figure 7.11 The $C(p)$ criteria vs. Number of parameters.

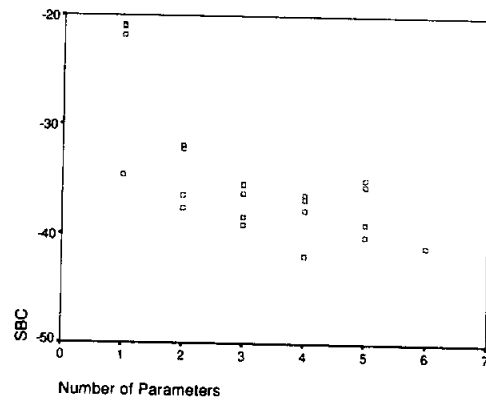


Figure 7.12 The SBC criteria vs. Number of parameters.

7.3 Log of trout data and square root of inflow data: 1963 Omitted

Table 7.13 Regression Models for Dependent Variable: $\ln(\text{TROUT})$ on $\text{Sqrt}(\text{INFLOWS})$: 1963 Omitted

In	Rsq	Adj Rsq	C(p)	AIC	MSE	SBC	Variables in Model
1	0.5422	0.5153	30.53	-36.71	0.1311	-34.82	SQR_QJA
1	0.1179	0.0660	72.73	-24.25	0.2527	-22.36	SQR_QMA
1	0.0575	0.0020	78.74	-22.99	0.2700	-21.10	SQR_QSO
1	0.0407	-0.0158	80.41	-22.65	0.2748	-20.76	SQR_QJF

2	0.6622	0.6200	20.59	-40.49	0.1028	-37.65	SQR_QJA SQR_QND
2	0.5996	0.5496	26.82	-37.26	0.1219	-34.42	SQR_QJA SQR_QSO
2	0.5675	0.5135	30.01	-35.79	0.1316	-32.96	SQR_QMA SQR_QJA
2	0.5482	0.4917	31.93	-34.96	0.1375	-32.13	SQR_QMJ SQR_QJA

3	0.7169	0.6603	17.15	-41.84	0.0919	-38.07	SQR_QJA SQR_QSO SQR_QND
3	0.7137	0.6564	17.47	-41.63	0.0930	-37.85	SQR_QJF SQR_QJA SQR_QND
3	0.7113	0.6536	17.71	-41.47	0.0937	-37.69	SQR_QMJ SQR_QJA SQR_QSO
3	0.6906	0.6287	19.77	-40.15	0.1005	-36.37	SQR_QMA SQR_QJA SQR_QND

4	0.7876	0.7269	12.13	-45.30	0.0739	-40.58	SQR_QMJ SQR_QJA SQR_QSO SQR_QND
4	0.7744	0.7100	13.43	-44.16	0.0785	-39.44	SQR_QJF SQR_QJA SQR_QSO SQR_QND
4	0.7489	0.6771	15.98	-42.12	0.0874	-37.40	SQR_QMA SQR_QJA SQR_QSO SQR_QND
4	0.7318	0.6552	17.67	-40.87	0.0933	-36.15	SQR_QMA SQR_QMJ SQR_QJA SQR_QSO

5	0.8471	0.7884	8.201	-49.55	0.0573	-43.89	SQR_QJF SQR_QMJ SQR_QJA SQR_QSO SQR_QND
5	0.7909	0.7105	13.79	-43.60	0.0783	-37.93	SQR_QMA SQR_QMJ SQR_QJA SQR_QSO SQR_QND
5	0.7899	0.7091	13.89	-43.51	0.0787	-37.84	SQR_QJF SQR_QMA SQR_QJA SQR_QSO SQR_QND
5	0.7738	0.6869	15.49	-42.11	0.0847	-36.44	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO

6	0.8793	0.8190	7.000	-52.04	0.0490	-45.43	SQR_QJF SQR_QMA SQR_QMJ SQR_QJA SQR_QSO SQR_QND

N = 19

Table 7.14 Analysis of Variance for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS): 1963 Omitted

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	4.28260	0.71377	14.575	0.0001
Error	12	0.58767	0.04897		
C Total	18	4.87026			
Root MSE	0.22130	R-square	0.8793		
Dep Mean	5.08610	Adj R-sq	0.8190		
C.V.	4.35101				

Table 7.15 Parameter Estimates for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS): 1963 Omitted

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|	Variance Inflation
INTERCEP	1	6.274007	0.24588638	25.516	0.0001	0.00000000
SQR_QJF	1	-0.083477	0.02815241	-2.965	0.0118	1.56940335
SQR_QMA	1	0.117702	0.06578664	1.789	0.0988	3.68864144
SQR_QMJ	1	-0.095386	0.03198437	-2.982	0.0114	6.51430402
SQR_QJA	1	-0.213935	0.02713175	-7.885	0.0001	1.37347374
SQR_QSO	1	0.053512	0.01395765	3.834	0.0024	3.93939616
SQR_QND	1	0.068904	0.02127328	3.239	0.0071	1.41456316

Table 7.16 Collinearity Diagnostics(intercept adjusted) for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS): 1963 Omitted

Number	Eigenvalue	Condition Index	Var Prop SQR_QJF	Var Prop SQR_QMA	Var Prop SQR_QMJ	Var Prop SQR_QJA	Var Prop SQR_QSO	Var Prop SQR_QND
1	1.93013	1.00000	0.0197	0.0378	0.0301	0.0120	0.0321	0.0061
2	1.75815	1.04777	0.0975	0.0029	0.0110	0.0793	0.0101	0.1306
3	0.95214	1.42378	0.0466	0.1001	0.0002	0.0883	0.0809	0.1179
4	0.78828	1.56478	0.1564	0.0349	0.0005	0.5469	0.0356	0.0001
5	0.49481	1.97502	0.4972	0.0173	0.0053	0.0704	0.0112	0.7081
6	0.07649	5.02322	0.1826	0.8071	0.9529	0.2032	0.8301	0.0372

Table 7.17 Parameter Estimates of Models for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS): 1963 Omitted

OBS	_RMSE_	INTERCEP	SQR_QJF	SQR_QMA	SQR_QMJ	SQR_QJA	SQR_QSO	SQR_QND
1	0.36214	6.17934	.	.	.	-0.17000	.	.
2	0.50270	5.64326	.	-0.11729	.	.	.	.
3	0.51964	4.85695	.	.	.	.	0.016810	.
4	0.52425	5.31427	-0.045187	.	.	.	.	.
5	0.32066	5.96702	.	.	.	-0.19374	.	0.064447
6	0.34911	5.95025	.	.	.	-0.16999	0.016800	.
7	0.36281	6.38363	.	-0.05626	.	-0.16021	.	.
8	0.37084	6.29805	.	.	-0.00970	-0.17156	.	.
9	0.30316	5.74557	.	.	.	-0.19347	0.016411	0.063742
10	0.30489	6.11485	-0.057521	.	.	-0.18932	.	0.084613
11	0.30615	6.35465	.	.	-0.05783	-0.17925	0.039071	.
12	0.31696	6.18060	.	-0.05957	.	-0.18369	.	0.065286
13	0.27185	6.11068	.	.	-0.04712	-0.19694	0.034625	0.052657
14	0.28012	5.88984	-0.060864	.	.	-0.18878	0.017311	0.085041
15	0.29558	5.96502	.	-0.06324	.	-0.18279	0.016949	0.064609
16	0.30545	6.28571	.	0.08044	-0.08840	-0.19815	0.050151	.
17	0.23930	6.26297	-0.061968	.	-0.04782	-0.19221	0.035811	0.074178
18	0.27987	6.09845	.	0.03440	-0.06096	-0.20377	0.039678	0.048933
19	0.28055	6.02862	-0.052997	-0.04537	.	-0.18172	0.017581	0.082909
20	0.29108	6.45054	-0.054607	0.14723	-0.11826	-0.20330	0.061997	.
21	0.22130	6.27401	-0.083477	0.11770	-0.09539	-0.21394	0.053512	0.068904

Table 7.18 Criteria Statistics of Models for Dependent Variable: Ln(TROUT) on Sqrt(INFLOWS): 1963 Omitted

OBS	_MSE_	_RSQ_	_ADJRSQ_	_CP_	_AIC_	_SBC_
1	0.13115	0.54222	0.51530	30.5256	-36.7106	-34.8218
2	0.25271	0.11789	0.06600	72.7251	-24.2479	-22.3590
3	0.27003	0.05745	0.00201	78.7356	-22.9888	-21.0999
4	0.27484	0.04066	-0.01578	80.4063	-22.6531	-20.7643
5	0.10282	0.66220	0.61997	20.5945	-40.4850	-37.6517
6	0.12187	0.59961	0.54956	26.8183	-37.2557	-34.4224
7	0.13163	0.56755	0.51349	30.0071	-35.7919	-32.9586
8	0.13752	0.54820	0.49172	31.9315	-34.9602	-32.1269
9	0.09190	0.71694	0.66033	17.1499	-41.8445	-38.0668
10	0.09296	0.71370	0.65644	17.4727	-41.6279	-37.8501
11	0.09373	0.71132	0.65359	17.7088	-41.4710	-37.6933
12	0.10047	0.69057	0.62869	19.7723	-40.1522	-36.3745
13	0.07390	0.78756	0.72687	12.1267	-45.2977	-40.5755
14	0.07847	0.77444	0.70999	13.4319	-44.1587	-39.4365
15	0.08737	0.74886	0.67711	15.9756	-42.1178	-37.3956
16	0.09330	0.73180	0.65517	17.6726	-40.8688	-36.1466
17	0.05726	0.84715	0.78836	8.2010	-49.5520	-43.8853
18	0.07833	0.79093	0.71051	13.7922	-43.6009	-37.9342
19	0.07871	0.78990	0.70910	13.8938	-43.5082	-37.8416
20	0.08473	0.77384	0.68686	15.4911	-42.1086	-36.4420
21	0.04897	0.87934	0.81900	7.0000	-52.0446	-45.4336

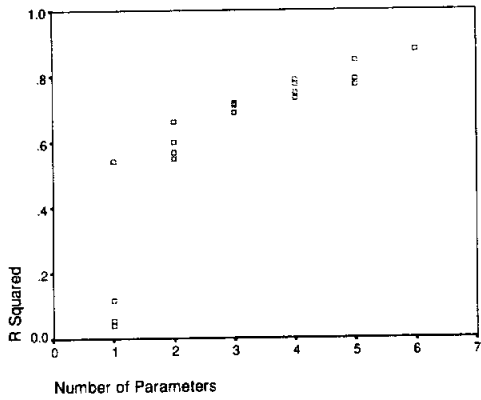


Figure 7.13 The R^2 criteria vs. Number of parameters.

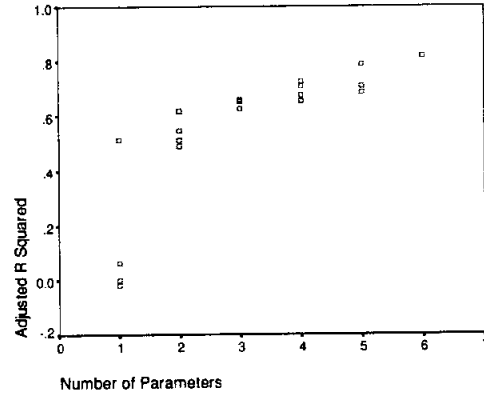


Figure 7.14 The Adjusted R^2 criteria vs. Number of parameters.

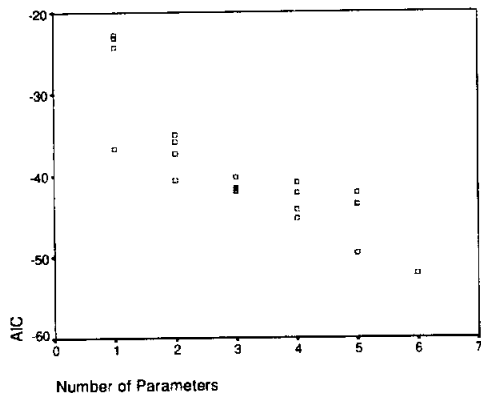


Figure 7.15 The AIC criteria vs. Number of parameters..

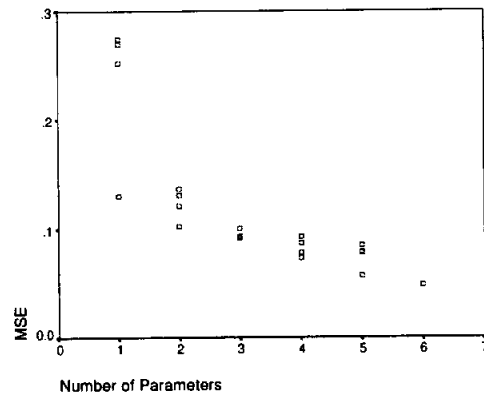


Figure 7.16 MSE vs. Number of parameters.

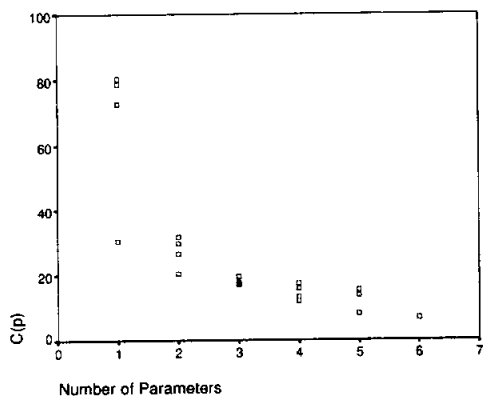


Figure 7.17 The $C(p)$ criteria vs. Number of parameters.

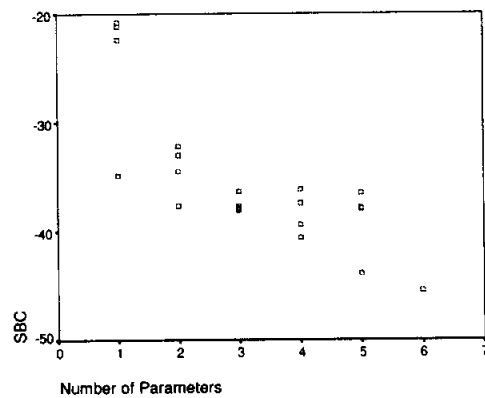


Figure 7.18 The SBC criteria vs. Number of parameters.