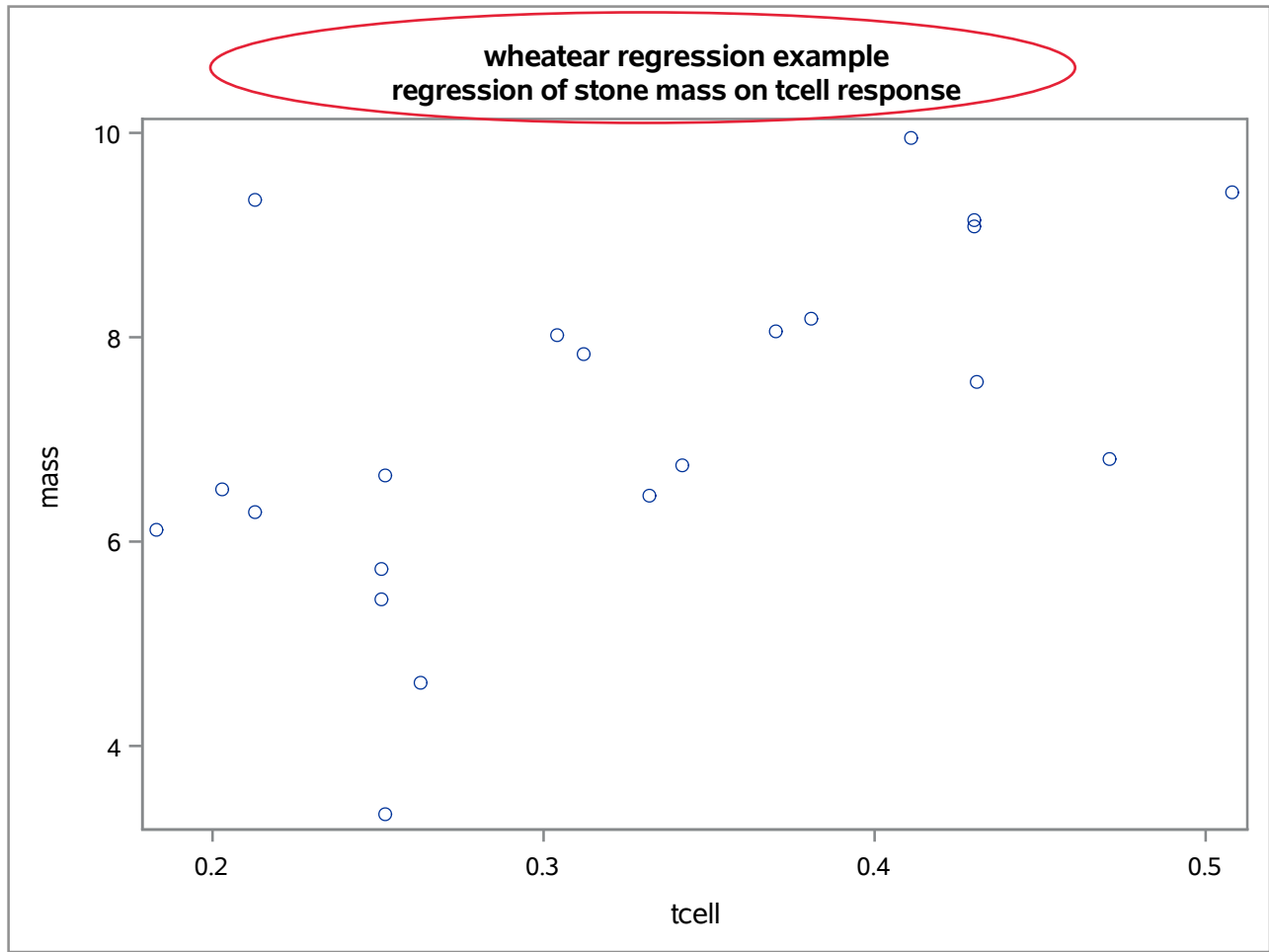


wheat ear regression example
tcell mean for input into estimate command in proc glm

Obs	tcellmean
1	0.32395

this is the mean of the x=tcell values
which we will input into the prog GLM
contrast and estimate statements



There is a reasonably strong linear trend in $y=\text{mass}$ as a function of $x=\text{tcell}$

wheatear regression example
regression of stone mass on tcell response

The GLM Procedure

Number of Observations Read	21
Number of Observations Used	21

wheatear regression example
regression of stone mass on tcell response

The GLM Procedure

Dependent Variable: mass

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	19.33949354	19.33949354	9.51	0.0061
Error	19	38.62662075	2.03298004		
Corrected Total	20	57.96611429			

ANOVA for the regression of mass on tcell.
 Model here indicates "slope"

R-Square	Coeff Var	Root MSE	mass Mean
0.333634	19.79136	1.425826	7.204286

This F test is for $H_0: \beta = 0$ (slope = 0)
 The small P-value .0061 shows strong evidence that the slope is not zero.

$R^2 = .3336$
 The linear trend relating mass to tcell accounts for 33.36% of the variability in the distribution of mass

Source	DF	Type I SS	Mean Square	F Value	Pr > F
tcell	1	19.33949354	19.33949354	9.51	0.0061

Source	DF	Type II SS	Mean Square	F Value	Pr > F
tcell	1	19.33949354	19.33949354	9.51	0.0061

Parameter	Estimate	Standard Error	t Value	Pr > t	95% Confidence Limits	
intercept	3.9112702	1.11208441	3.52	0.0023	1.5836507	6.2388896
slope	10.1651222	3.29576786	3.08	0.0061	3.2670008	17.0632436
mean	7.2042615	0.31114076	23.15	<.0001	6.5530364	7.8554866

Parameter	Estimate	Standard Error	t Value	Pr > t	95% Confidence Limits	
Intercept	3.91127017	1.11208441	3.52	0.0023	1.58365074	6.23888959
tcell	10.16512222	3.29576786	3.08	0.0061	3.26700082	17.06324362

slope estimate: 10.1651
 95% confidence interval for the slope: $3.2670 \leq \beta_1 \leq 17.0632$
 P-value for $H_0: \beta_1 = 0$: .0061 (as above)

estimate of the mean response at $x = \bar{x} = .32395$ (from page 1)
 $\hat{y}(.32395) = \bar{y} = 7.2042$
 95% confidence interval for $\mu(.32395)$
 $6.5530 \leq \mu(.32395) \leq 7.8555$

fitted equation (simple linear regression of $y = \text{mass}$ on $x = \text{tcell}$)

intercept and slope form:
 $\hat{y} = 3.9113 + 10.1651x$

mean and slope form:
 $\hat{y} = 7.2043 + 10.1651(x - .32395)$

wheat ear regression example regression of stone mass on tcell response

values of
observed response: y
predicted mean response: \hat{y}
residual: $y - \hat{y}$

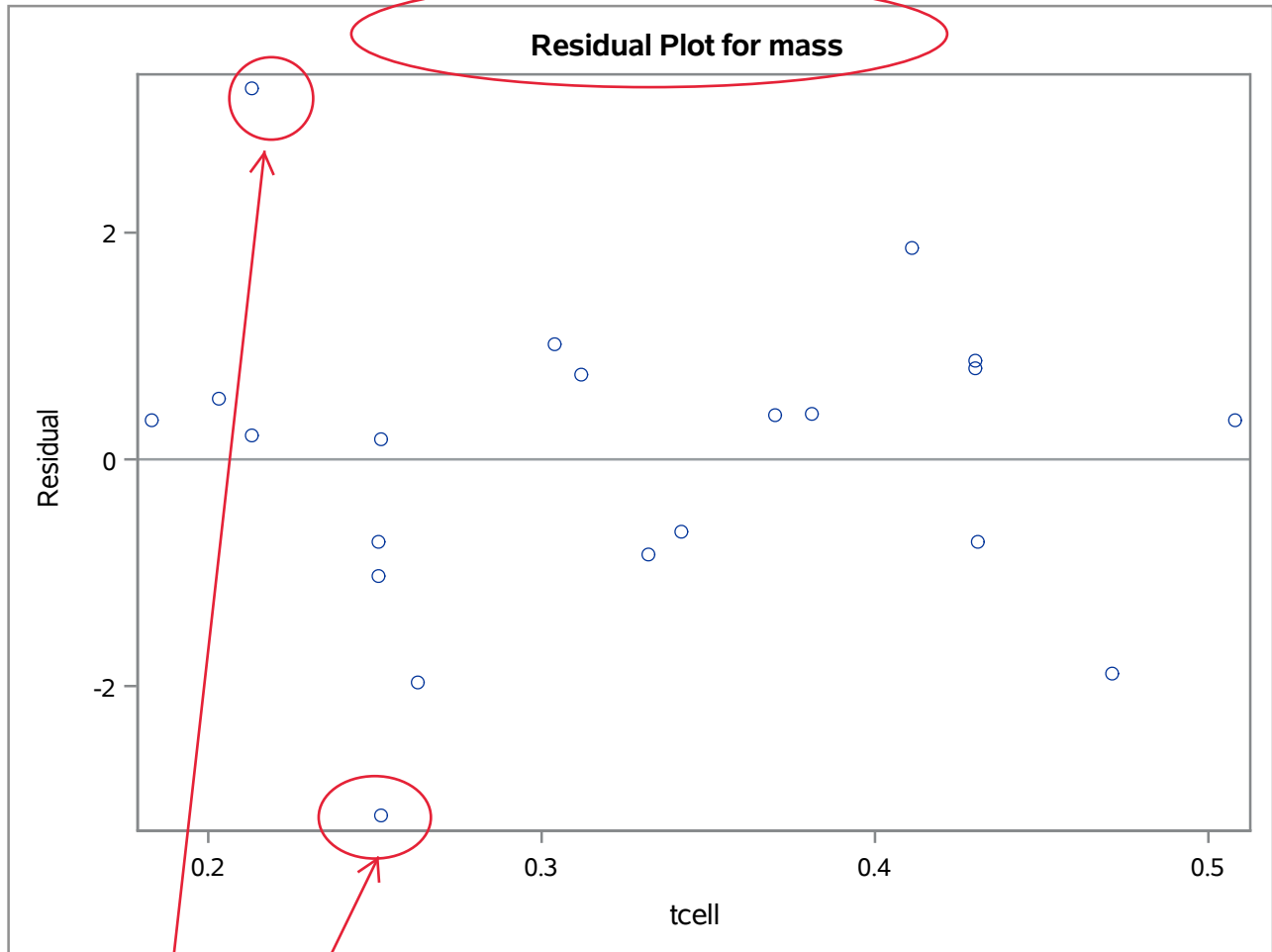
The GLM Procedure

Observation	Observed	Predicted	Residual	95% Confidence Limits for Mean Predicted Value	
				Lower	Upper
1	3.33000000	6.47288097	-3.14288097	5.65407464	7.29168730
2	4.62000000	6.58469731	-1.96469731	5.80953401	7.35986062
3	5.43000000	6.46271585	-1.03271585	5.63970979	7.28572190
4	5.73000000	6.46271585	-0.73271585	5.63970979	7.28572190
5	6.12000000	5.77148753	0.34851247	4.60124212	6.94173295
6	6.29000000	6.07644120	0.21355880	5.07151601	7.08136639
7	6.45000000	7.28609075	-0.83609075	6.63250382	7.93967767
8	6.51000000	5.97478998	0.53521002	4.91638345	7.03319651
9	6.65000000	6.47288097	0.17711903	5.65407464	7.29168730
10	6.75000000	7.38774197	-0.63774197	6.72472383	8.05076010
11	6.81000000	8.69904273	-1.88904273	7.49363626	9.90444921
12	7.56000000	8.29243785	-0.73243785	7.30787233	9.27700336
13	7.83000000	7.08278830	0.74721170	6.42636469	7.73921192
14	8.02000000	7.00146732	1.01853268	6.33585690	7.66707774
15	8.06000000	7.67236539	0.38763461	6.94780303	8.39692775
16	8.18000000	7.78418173	0.39581827	7.02329198	8.54507149
17	9.08000000	8.28227272	0.79772728	7.30287019	9.26167525
18	9.15000000	8.28227272	0.86772728	7.30287019	9.26167525
19	9.35000000	6.07644120	3.27355880	5.07151601	7.08136639
20	9.42000000	9.07515226	0.34484774	7.64829043	10.50201408
21	9.95000000	8.08913540	1.86086460	7.20332933	8.97494147

Sum of Residuals	-0.00000000
Sum of Squared Residuals	38.62662075
Sum of Squared Residuals - Error SS	0.00000000
PRESS Statistic	47.35583810
First Order Autocorrelation	0.44282434
Durbin-Watson D	0.76898024

confidence intervals for the mean response at the observed values of x : i.e., confidence intervals for $\mu(x)$

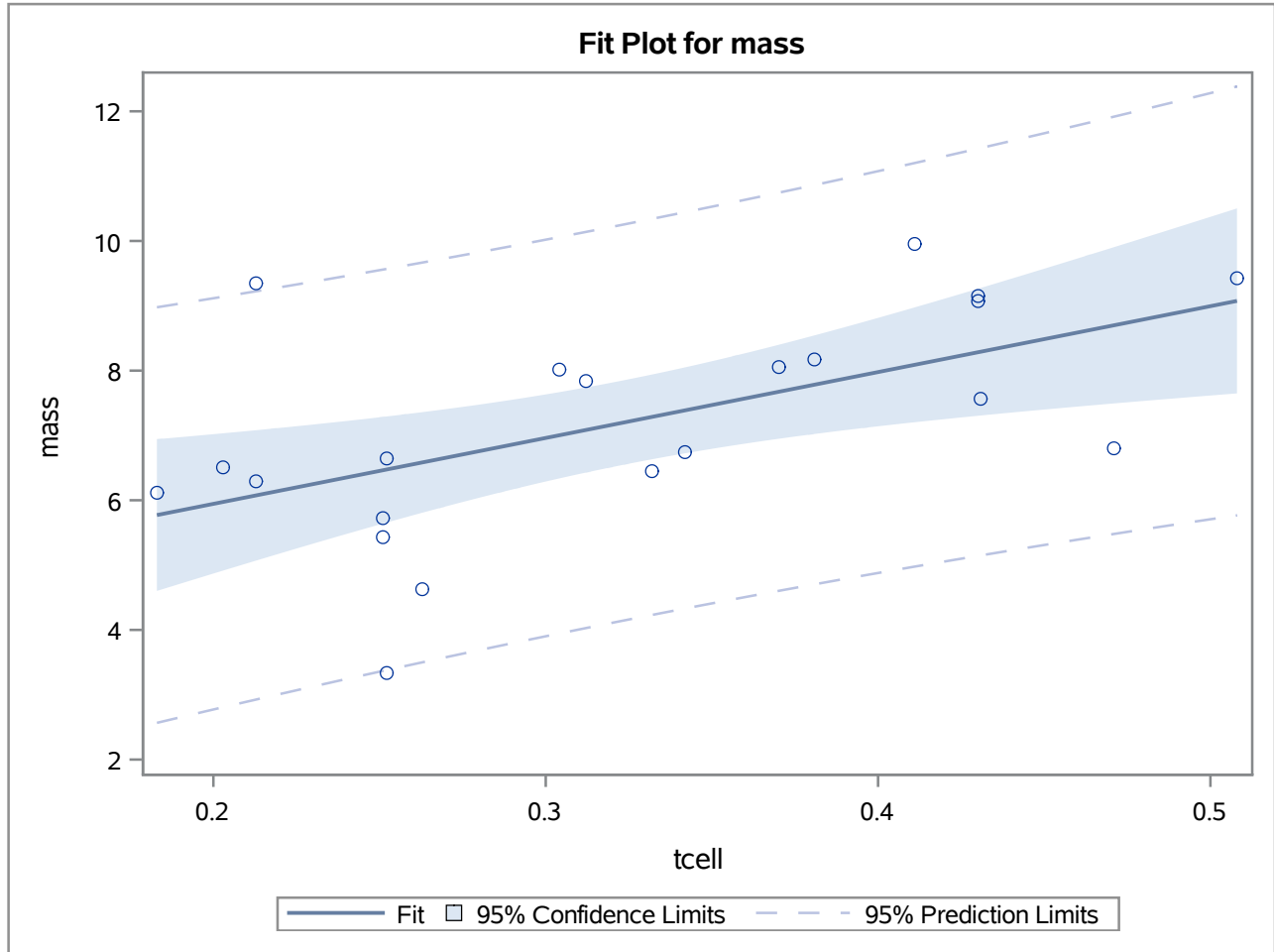
The GLM Procedure



plot of \hat{y} versus x

somewhat large residuals
see the tables on pages 5 and 8

The GLM Procedure



Plot of data with fitted line.

The boundaries of the shaded region are the 95% confidence limits for the mean response.

The dashed lines are the boundaries for the 95% confidence prediction limits for the response.

wheat ear regression example
regression of stone mass on tcell response

Obs	mass	tcell	clml	clmu	clpl	clpu	yhat	resid
1	3.33	0.252	5.65407	7.2917	3.37830	9.5675	6.47288	-3.14288
2	4.62	0.263	5.80953	7.3599	3.50138	9.6680	6.58470	-1.96470
3	5.43	0.251	5.63971	7.2857	3.36702	9.5584	6.46272	-1.03272
4	5.73	0.251	5.63971	7.2857	3.36702	9.5584	6.46272	-0.73272
5	6.12	0.183	4.60124	6.9417	2.56595	8.9770	5.77149	0.34851
6	6.29	0.213	5.07152	7.0814	2.92750	9.2254	6.07644	0.21356
7	6.45	0.332	6.63250	7.9397	4.23107	10.3411	7.28609	-0.83609
8	6.51	0.203	4.91638	7.0332	2.80837	9.1412	5.97479	0.53521
9	6.65	0.252	5.65407	7.2917	3.37830	9.5675	6.47288	0.17712
10	6.75	0.342	6.72472	8.0508	4.33069	10.4448	7.38774	-0.63774
11	6.81	0.471	7.49364	9.9044	5.48051	11.9176	8.69904	-1.88904
12	7.56	0.431	7.30787	9.2770	5.14993	11.4349	8.29244	-0.73244
13	7.83	0.312	6.42636	7.7392	4.02716	10.1384	7.08279	0.74721
14	8.02	0.304	6.33586	7.6671	3.94385	10.0591	7.00147	1.01853
15	8.06	0.370	6.94780	8.3969	4.60138	10.7434	7.67237	0.38763
16	8.18	0.381	7.02329	8.5451	4.70442	10.8639	7.78418	0.39582
17	9.08	0.430	7.30287	9.2617	5.14138	11.4232	8.28227	0.79773
18	9.15	0.430	7.30287	9.2617	5.14138	11.4232	8.28227	0.86773
19	9.35	0.213	5.07152	7.0814	2.92750	9.2254	6.07644	3.27356
20	9.42	0.508	7.64829	10.5020	5.76730	12.3830	9.07515	0.34485
21	9.95	0.411	7.20333	8.9749	4.97616	11.2021	8.08914	1.86086

95% confidence intervals for the mean response $\mu(x)$

95% confidence prediction intervals for the response $\mu(x) + \text{error}$

The large residual noted earlier are at $x=.252$ and $x=.213$

wheatar regression example descriptive statistics for residuals

The UNIVARIATE Procedure Variable: resid

Basic Statistical Measures			
Location		Variability	
Mean	0.000000	Std Deviation	1.38972
Median	0.344848	Variance	1.93133
Mode	.	Range	6.41644
		Interquartile Range	1.47993

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.957292	Pr < W	0.4633
Kolmogorov-Smirnov	D	0.169755	Pr > D	0.1128
Cramer-von Mises	W-Sq	0.092397	Pr > W-Sq	0.1362
Anderson-Darling	A-Sq	0.503659	Pr > A-Sq	0.1904

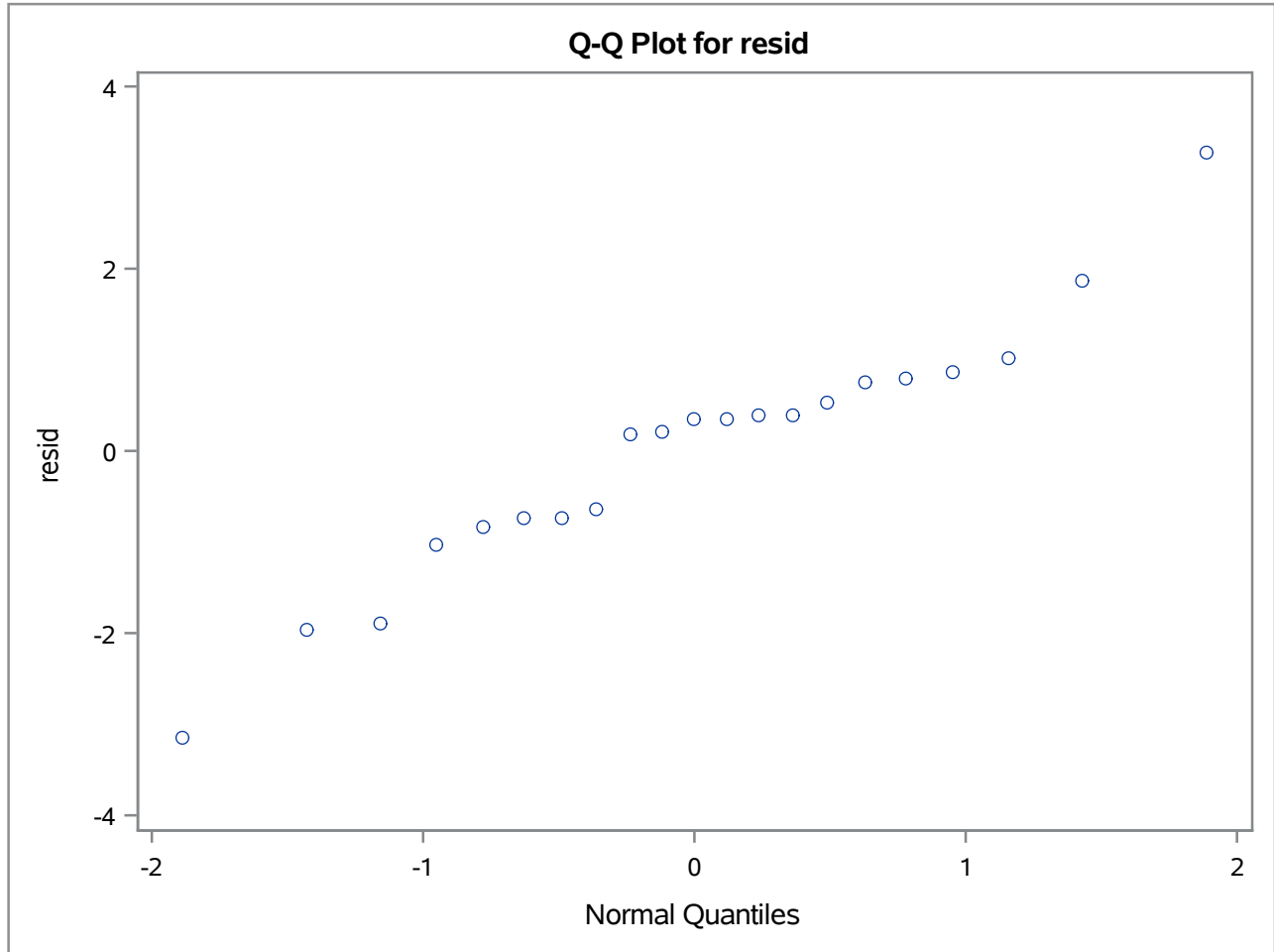
Quantiles (Definition 5)	
Level	Quantile
100% Max	3.273559
99%	3.273559
95%	1.860865
90%	1.018533
75% Q3	0.747212
50% Median	0.344848
25% Q1	-0.732716
10%	-1.889043
5%	-1.964697
1%	-3.142881
0% Min	-3.142881

Test of normality of residual
P-value .4633
The normality assumption is OK

Extreme Values			
Lowest		Highest	
Order	Value	Order	Value
1	-3.142881	17	0.797727
2	-1.964697	18	0.867727
3	-1.889043	19	1.018533
4	-1.032716	20	1.860865
5	-0.836091	21	3.273559

large residual noted above

The UNIVARIATE Procedure



The strong linear trend in this plot indicates that the normality assumption is reasonable.