



DEPARTMENT *of*
PRIMARY INDUSTRY
and FISHERIES

Tasmania

**State of River Report on
Mersey River Flow Study**

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Mersey River Flow Study

Introduction

This study examines the Mersey River at Liena streamflows to compare the pre- and post-Hydro development of the Parangana Dam. This report is intended to complement the Mersey River Flow Estimation Study prepared by Crispin Smythe from the HEC. Data used was extracted from Site 60 (Mersey at Liena) using Hydrol (a software package used to manage and analyse hydrological time series data). Hellyer River at Guilford, Site 61 was also studied as a control. Table 1 defines the terms pre- and post-dam data used in this analysis.

Table 1 Site and data time periods

Site	Pre-Dam data	Post-Dam data
Mersey at Liena (60)	1/8/1950 - 1/1/1967	1/1/1971 - 30/6/1997
Hellyer at Guilford (61)	1/2/1922 - 1/1/1967	1/1/1971 - 30/6/1997

Data variables examined include monthly minimum, maximum, average and median flows (cumecs). Each month was examined individually to explore the effects of Parangana Dam. Data were analysed using simple t-tests assuming independent samples and unequal variances. Genstat 5 and Minitab 11 were used for the afore mentioned analysis.

Results

Simple plots of the mean and median data shows significantly greater river flows at Liena pre-dam compared to the post-dam flow for all months (Figure 1). This difference is approximately an order of magnitude (i.e. ten times the flow pre-dam).

The summary of all the data (Appendix 1) also indicates there is a greater flow pre- dam than post- dam for all months. There was only one statistical test (Appendix 2) that showed there was no significant difference ($p < 0.05$) between pre- and post- dam flows. This occurred in January when comparing the maximum flows for that month. Every other test for all variables showed a significantly greater flow pre- dam than post- dam.

Analysis of the Hellyer River at Guilford site indicated that there were significantly ($p < 0.05$) greater average and maximum flows for the month of November pre- dam period than post-dam period. Outside of these results no other significant differences were found to exist between the pre- and post-dam periods for monthly flows.

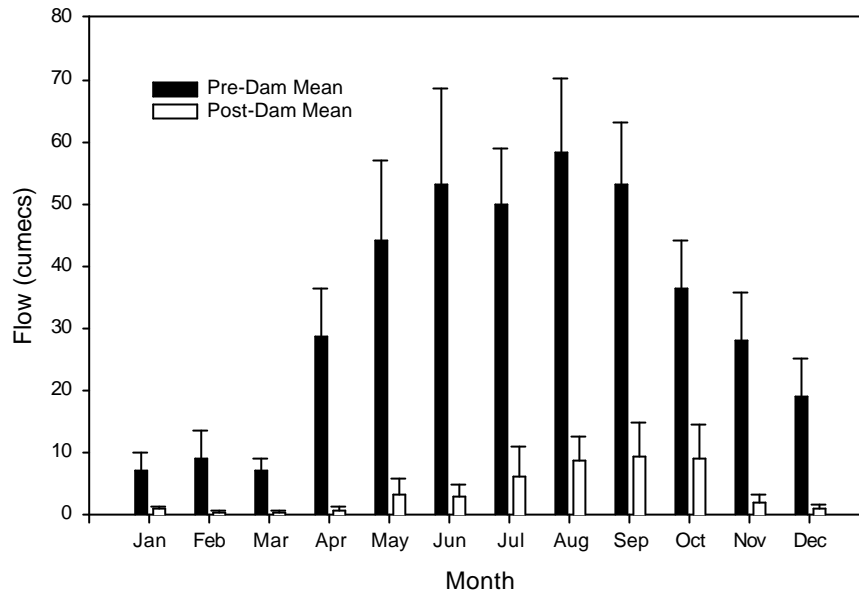
Discussion

It is clear from the graphs alone that there has been a significant reduction in the flow of the Mersey River at Liena. This reduction can be directly attributed to the Hydro development of the Parangana Dam, especially as the monthly flows of the Hellyer River at Guilford are on the whole not significantly different in the pre- and post- time periods.

While the flows are significantly different the annual trends of the pre- and post- dam monthly flows are similar although the summer (Dec - Mar) flows are somewhat reduced. Post- dam monthly flows are highly skewed in comparison with pre-dam flows (Figure 1). That is, the change in normal flow regime down stream of Parangana has changed significantly more than the mean statistics show. Figure 1 also shows the significance of April floods in terms of breaking the low flow conditions in the Mersey River.

Figure 1. Pre- and Post-Dam Monthly Flows

**River Flow at Liena
Pre- and Post-Dam Mean Statistics**



**River Flow at Liena
Pre- and Post-Dam Median Statistics**

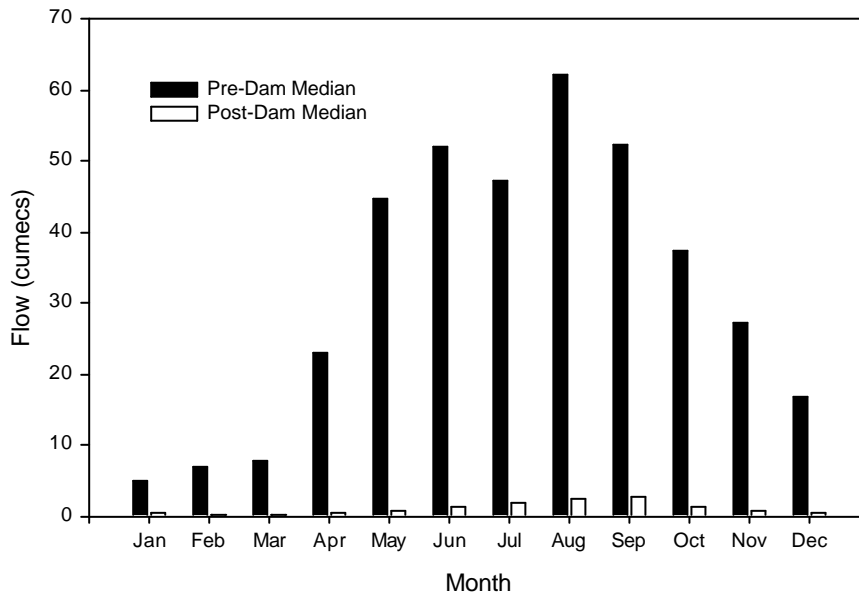


Figure 2. Pre- and Post-Dam Mean Monthly Flows

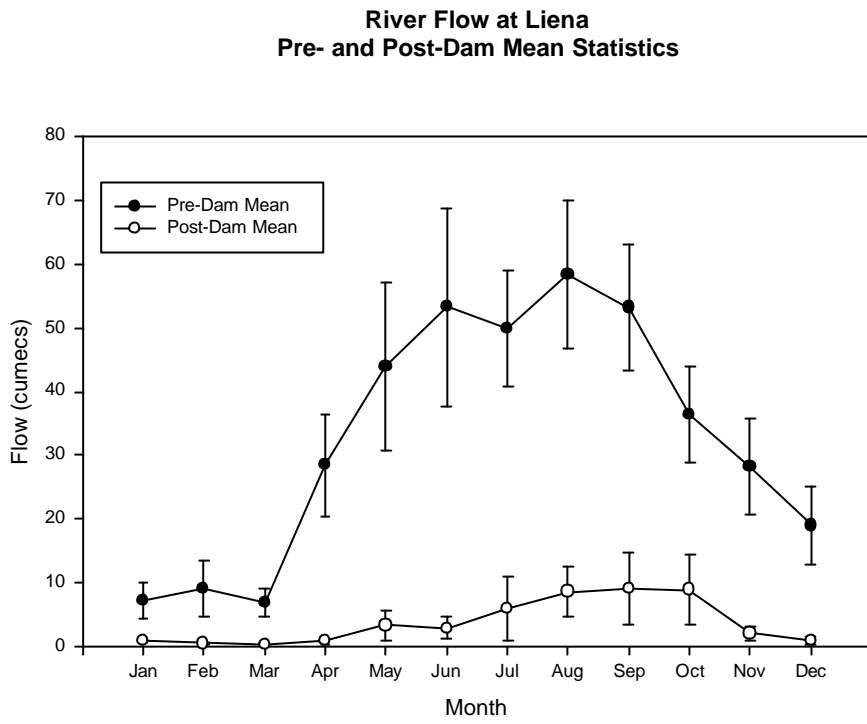


Figure 3. Pre- and Post-Dam Median, Minimum and Maximum Statistics

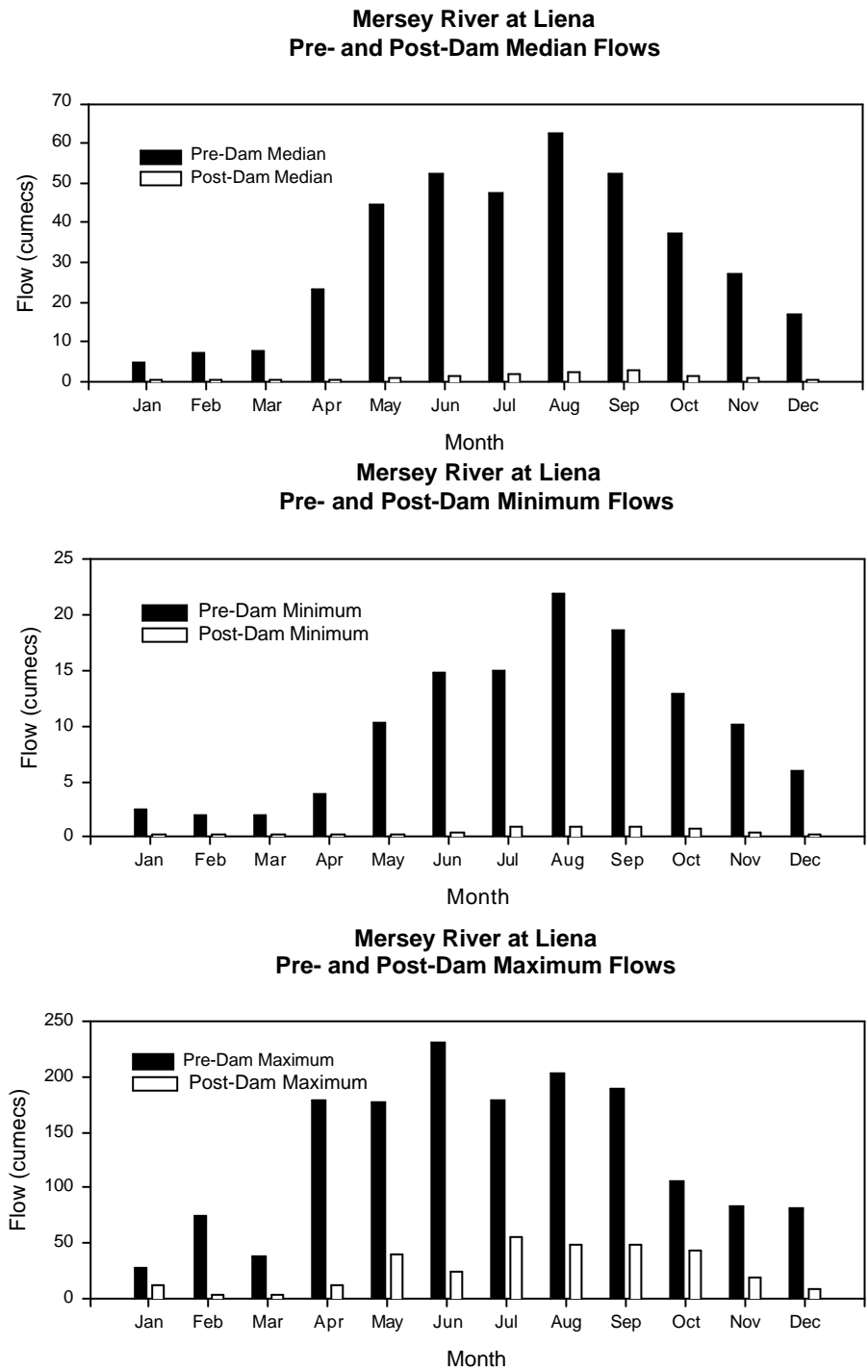
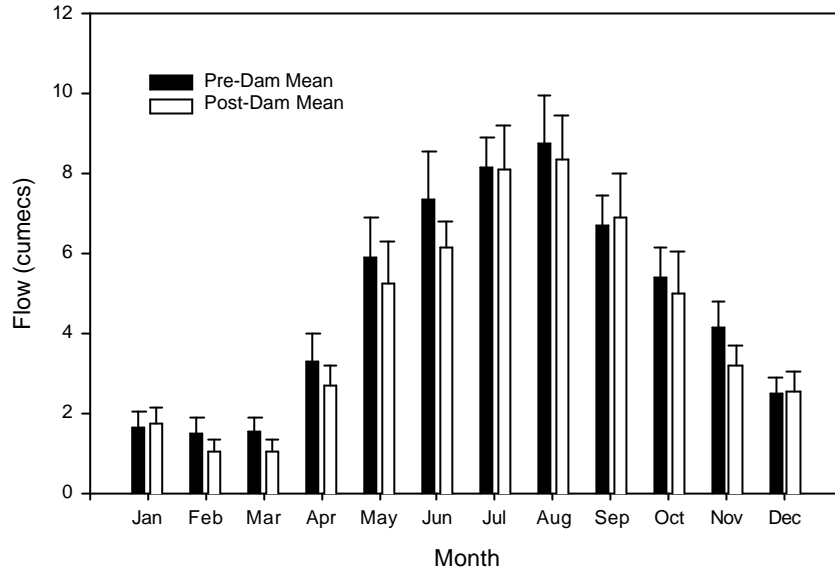
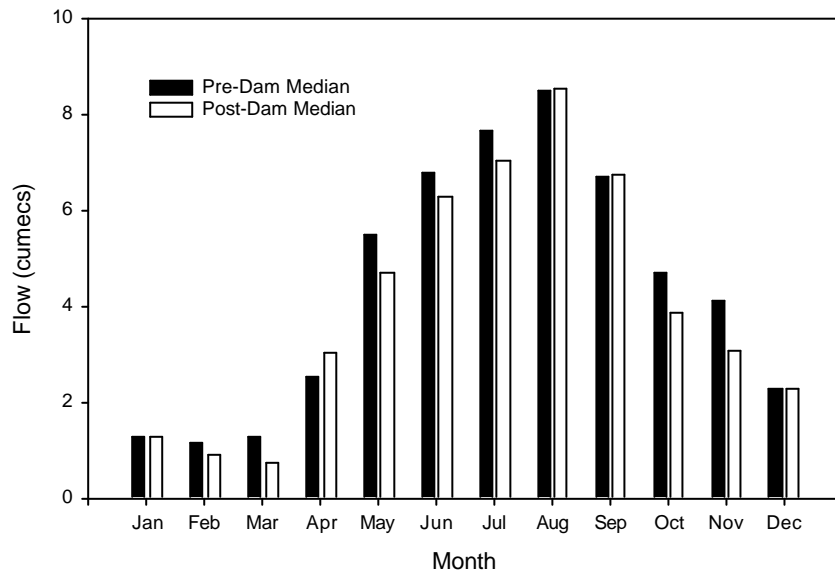


Figure 4. Pre- and Post-Dam Period, Monthly Flows for the Hellyer River at Guilford

**River Flow, Hellyer at Guilford
Pre- and Post-Dam Mean Statistics**



**River Flow, Hellyer at Guilford
Pre- and Post-Dam Median Statistics**



APPENDIX 1 Data Summary

Appendix 1 Data Summary

Summary statistics for average flow at Liena								
	January		February		March		April	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	27	16	27	16	27
Mean	7.12	0.94	9.08	0.50	6.95	0.43	28.54	0.81
Standard error of mean	1.41	0.23	2.26	0.13	1.11	0.06	4.00	0.25
Median	4.88	0.49	6.99	0.32	7.75	0.29	23.05	0.39
Range	19.90	4.55	34.92	3.39	14.32	1.07	46.88	6.37
Lower quartile	3.85	0.27	2.10	0.21	2.71	0.21	17.42	0.31
Upper quartile	8.17	1.01	12.61	0.47	9.91	0.64	42.34	0.64
Variance	31.89	1.42	81.40	0.44	19.81	0.10	255.49	1.66
Standard deviation	5.65	1.19	9.02	0.66	4.45	0.31	15.98	1.29
Skewness	1.36	2.25	1.69	3.81	0.15	1.34	0.77	3.65
Kurtosis	0.72	3.94	2.72	14.54	-1.10	0.63	-0.89	13.07

	May		June		July		August	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	26	16	26	17	26
Mean	43.98	3.30	53.21	2.91	49.80	6.03	58.42	8.64
Standard error of mean	6.57	1.18	7.72	0.90	4.51	2.48	5.83	1.99
Median	44.71	0.74	52.09	1.23	47.30	2.00	62.25	2.46
Range	112.23	29.42	118.68	16.83	64.42	64.34	90.40	33.14
Lower quartile	31.23	0.49	30.13	0.88	33.91	1.24	40.55	1.47
Upper quartile	50.92	2.61	61.24	2.74	63.41	6.43	75.42	14.01
Variance	690.65	37.70	953.50	20.89	324.92	159.63	578.30	103.22
Standard deviation	26.28	6.14	30.88	4.57	18.03	12.63	24.05	10.16
Skewness	1.07	3.23	1.11	2.35	0.35	4.16	0.30	1.21
Kurtosis	2.03	10.82	1.09	3.89	-0.74	16.85	-0.51	0.19

	September		October		November		December	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	17	26	17	26	17	26	17	26
Mean	53.15	9.20	36.40	8.90	28.16	2.05	18.99	1.02
Standard error of mean	4.98	2.80	3.82	2.80	3.74	0.57	3.07	0.28
Median	52.33	2.62	37.23	1.42	27.28	0.71	16.68	0.52
Range	67.34	62.64	53.25	68.24	53.72	11.38	45.45	6.85
Lower quartile	36.02	1.32	20.57	0.75	15.42	0.45	9.94	0.36
Upper quartile	70.26	11.60	48.40	14.47	39.68	3.19	24.69	1.14
Variance	421.99	204.24	248.54	204.46	237.21	8.52	160.13	2.05
Standard deviation	20.54	14.29	15.77	14.30	15.40	2.92	12.65	1.43
Skewness	0.33	2.54	-0.03	2.95	0.57	2.23	0.91	3.31
Kurtosis	-0.97	6.38	-0.93	9.78	-0.46	4.20	0.05	10.78

Summary statistics for minimum flow at Liena								
	January		February		March		April	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	27	16	27	16	27
Mean	2.59	0.27	2.00	0.24	2.03	0.22	3.91	0.24
Standard error of mean	0.37	0.03	0.25	0.02	0.26	0.02	0.49	0.02
Median	2.25	0.22	1.89	0.21	2.00	0.19	3.62	0.21
Range	6.12	0.71	3.38	0.56	3.79	0.47	6.79	0.55
Lower quartile	1.50	0.14	1.38	0.16	1.32	0.15	3.01	0.15
Upper quartile	3.34	0.37	2.69	0.29	2.65	0.27	4.89	0.28
Variance	2.17	0.02	0.97	0.02	1.11	0.01	3.78	0.02
Standard deviation	1.47	0.16	0.98	0.12	1.05	0.10	1.95	0.13
Skewness	1.53	1.59	0.54	1.62	0.28	1.70	0.18	1.96
Kurtosis	2.50	2.92	-0.63	3.24	-0.36	3.73	-0.49	3.61

	May		June		July		August	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	26	16	26	17	26
Mean	10.26	0.33	14.85	0.51	14.90	0.90	21.96	1.02
Standard error of mean	1.19	0.04	2.20	0.05	1.59	0.14	2.10	0.08
Median	12.17	0.25	12.24	0.46	14.62	0.68	18.98	1.01
Range	14.98	0.94	28.15	1.25	26.40	3.74	33.47	1.83
Lower quartile	5.49	0.19	7.65	0.33	10.28	0.56	16.19	0.74
Upper quartile	13.97	0.37	23.05	0.70	18.76	0.92	26.36	1.20
Variance	22.75	0.05	77.43	0.08	40.65	0.50	75.18	0.16
Standard deviation	4.77	0.21	8.80	0.27	6.38	0.71	8.67	0.41
Skewness	-0.22	2.06	0.58	1.17	1.25	3.48	0.89	0.91
Kurtosis	-1.38	4.22	-1.01	2.23	1.72	12.76	0.12	1.26

	September		October		November		December	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	17	26	17	26	17	26	17	26
Mean	18.52	0.97	12.87	0.68	10.10	0.42	5.94	0.31
Standard error of mean	1.68	0.10	1.66	0.07	1.44	0.04	0.90	0.03
Median	18.32	0.92	12.14	0.60	8.37	0.41	4.99	0.29
Range	21.77	2.77	23.65	1.22	20.06	0.80	13.37	0.56
Lower quartile	12.37	0.69	7.81	0.41	4.99	0.26	3.03	0.22
Upper quartile	25.06	1.10	17.86	0.83	14.25	0.49	8.57	0.34
Variance	48.03	0.28	46.92	0.12	35.04	0.04	13.91	0.02
Standard deviation	6.93	0.53	6.85	0.34	5.92	0.19	3.73	0.13
Skewness	0.40	2.53	0.56	0.68	0.75	1.18	0.86	1.28
Kurtosis	-1.09	8.01	-0.59	-0.37	-0.39	1.75	-0.05	1.67

Summary statistics for maximum flow at Liena								
	January		February		March		April	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	27	16	27	16	27
Mean	28.44	12.52	74.68	3.27	38.04	3.75	179.53	13.11
Standard error of mean	10.25	5.63	25.01	1.06	7.67	1.70	41.13	6.59
Median	16.87	1.54	22.41	0.60	32.36	0.71	99.86	2.42
Range	170.15	121.97	318.08	20.24	99.88	41.56	596.41	161.37
Lower quartile	11.39	0.58	6.18	0.39	7.71	0.35	69.72	0.91
Upper quartile	22.91	7.85	99.74	3.31	64.76	1.84	261.07	3.78
Variance	1681.25	855.45	10009.84	30.43	942.13	78.44	27069.51	1173.05
Standard deviation	41.00	29.25	100.05	5.52	30.69	8.86	164.53	34.25
Skewness	2.94	2.94	1.38	2.10	0.36	3.43	1.44	3.55
Kurtosis	7.75	7.51	0.54	3.38	-0.97	11.35	1.38	11.98

	May		June		July		August	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	16	27	16	26	16	26	17	26
Mean	177.76	40.29	230.61	24.60	179.09	55.96	202.83	47.99
Standard error of mean	29.82	10.52	45.72	7.28	24.11	13.24	21.05	10.46
Median	151.98	5.45	177.19	4.58	147.36	25.75	200.16	13.95
Range	385.53	170.41	760.65	137.55	320.62	206.09	304.38	155.40
Lower quartile	102.80	1.78	139.56	3.05	101.86	4.30	141.47	4.73
Upper quartile	254.86	77.86	252.35	39.22	275.66	78.11	273.29	95.26
Variance	14225.82	2985.04	33442.04	1376.43	9298.24	4559.76	7535.64	2843.06
Standard deviation	119.27	54.64	182.87	37.10	96.43	67.53	86.81	53.32
Skewness	0.55	1.11	1.96	1.77	0.34	1.16	0.18	0.73
Kurtosis	-0.57	-0.28	3.69	2.19	-1.14	-0.11	-0.73	-1.05

	September		October		November		December	
	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam	Pre-Dam	Post-Dam
Number of observations	17	26	17	26	17	26	17	26
Mean	189.92	49.75	105.63	43.20	82.76	19.82	81.60	9.73
Standard error of mean	28.76	13.07	12.47	10.55	11.81	5.84	15.49	4.31
Median	147.83	19.93	94.74	9.38	71.57	1.82	73.43	1.69
Range	493.36	241.77	172.05	168.84	164.50	114.42	218.75	103.02
Lower quartile	117.24	4.27	63.42	1.73	50.57	0.99	32.45	0.97
Upper quartile	262.00	72.15	143.74	83.01	127.08	30.45	126.63	6.21
Variance	14056.52	4439.34	2641.36	2893.14	2371.83	886.70	4076.74	482.59
Standard deviation	118.56	66.63	51.39	53.79	48.70	29.78	63.85	21.97
Skewness	1.21	1.71	0.18	1.03	0.73	1.68	0.97	3.42
Kurtosis	1.77	2.16	-0.94	-0.16	-0.63	2.24	0.02	11.32

APPENDIX 2 Data Analysis

Appendix 2 Data Analysis

Analysis of Mean, Minimum and Maximum data from Liena

```
Twosample T for JanAve
Jan  N      Mean      StDev    SE Mean
1   16      7.12      5.65     1.4
2   27      0.93      1.19     0.23

95% C.I. for mu 1 - mu 2: ( 3.1,  9.23)
T-Test mu 1 = mu 2 (vs not =): T= 4.32  P=0.0006  DF= 15

TwoT 95.0 'JanMin' 'Jan';
Alternative 0.
```

Two Sample T-Test and Confidence Interval

```
Twosample T for JanMin
Jan  N      Mean      StDev    SE Mean
1   16      2.59      1.47     0.37
2   27      0.265     0.155    0.030

95% C.I. for mu 1 - mu 2: ( 1.54,  3.113)
T-Test mu 1 = mu 2 (vs not =): T= 6.29  P=0.0000  DF= 15

TwoT 95.0 'JanMax' 'Jan';
Alternative 0.
```

Two Sample T-Test and Confidence Interval

```
Twosample T for JanMax
Jan  N      Mean      StDev    SE Mean
1   16      28.4      41.0     10
2   27      12.5      29.2     5.6

95% C.I. for mu 1 - mu 2: ( -8,  40.1)
T-Test mu 1 = mu 2 (vs not =): T= 1.36  P=0.19  DF= 24

TwoT 95.0 'FebAve' 'Feb';
Alternative 0.
```

Two Sample T-Test and Confidence Interval

```
Twosample T for FebAve
Feb  N      Mean      StDev    SE Mean
1   16      9.08      9.02     2.3
2   27      0.503     0.663    0.13

95% C.I. for mu 1 - mu 2: ( 3.8,  13.40)
T-Test mu 1 = mu 2 (vs not =): T= 3.80  P=0.0018  DF= 15

TwoT 95.0 'FebMin' 'Feb';
Alternative 0.
```

Two Sample T-Test and Confidence Interval

Twosample T for FebMin

Feb	N	Mean	StDev	SE Mean
1	16	2.002	0.983	0.25
2	27	0.240	0.123	0.024

95% C.I. for mu 1 - mu 2: (1.24, 2.289)

T-Test mu 1 = mu 2 (vs not =): T= 7.14 P=0.0000 DF= 15

TwoT 95.0 'FebMax' 'Feb';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for FebMax

Feb	N	Mean	StDev	SE Mean
1	16	75	100	25
2	27	3.27	5.52	1.1

95% C.I. for mu 1 - mu 2: (18, 124.8)

T-Test mu 1 = mu 2 (vs not =): T= 2.85 P=0.012 DF= 15

TwoT 95.0 'MarAve' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarAve

Mar	N	Mean	StDev	SE Mean
1	16	6.95	4.45	1.1
2	27	0.429	0.309	0.060

95% C.I. for mu 1 - mu 2: (4.1, 8.899)

T-Test mu 1 = mu 2 (vs not =): T= 5.85 P=0.0000 DF= 15

TwoT 95.0 'MarMin' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarMin

Mar	N	Mean	StDev	SE Mean
1	16	2.03	1.05	0.26
2	27	0.221	0.100	0.019

95% C.I. for mu 1 - mu 2: (1.25, 2.371)

T-Test mu 1 = mu 2 (vs not =): T= 6.87 P=0.0000 DF= 15

TwoT 95.0 'MarMax' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarMax

Mar	N	Mean	StDev	SE Mean
1	16	38.0	30.7	7.7
2	27	3.75	8.86	1.7

95% C.I. for mu 1 - mu 2: (17.6, 51.0)

T-Test mu 1 = mu 2 (vs not =): T= 4.36 P=0.0005 DF= 16

TwoT 95.0 'AprAve' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprAve

Apr	N	Mean	StDev	SE Mean
1	16	28.5	16.0	4.0
2	27	0.80	1.29	0.25

95% C.I. for mu 1 - mu 2: (19.2, 36.27)

T-Test mu 1 = mu 2 (vs not =): T= 6.93 P=0.0000 DF= 15

TwoT 95.0 'AprMin' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprMin

Apr	N	Mean	StDev	SE Mean
1	16	3.91	1.95	0.49
2	27	0.239	0.126	0.024

95% C.I. for mu 1 - mu 2: (2.63, 4.704)

T-Test mu 1 = mu 2 (vs not =): T= 7.53 P=0.0000 DF= 15

TwoT 95.0 'AprMax' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprMax

Apr	N	Mean	StDev	SE Mean
1	16	180	165	41
2	27	13.1	34.2	6.6

95% C.I. for mu 1 - mu 2: (78, 255.2)

T-Test mu 1 = mu 2 (vs not =): T= 4.00 P=0.0012 DF= 15

TwoT 95.0 'MayAve' 'May';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayAve

May	N	Mean	StDev	SE Mean
1	16	44.0	26.3	6.6
2	27	3.30	6.14	1.2

95% C.I. for mu 1 - mu 2: (26.4, 54.9)

T-Test mu 1 = mu 2 (vs not =): T= 6.09 P=0.0000 DF= 15

TwoT 95.0 'MayMin' 'May';

Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayMin

May	N	Mean	StDev	SE Mean
1	16	10.26	4.77	1.2
2	27	0.327	0.214	0.041

95% C.I. for mu 1 - mu 2: (7.4, 12.472)

T-Test mu 1 = mu 2 (vs not =): T= 8.32 P=0.0000 DF= 15

TwoT 95.0 'MayMax' 'May';

Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayMax

May	N	Mean	StDev	SE Mean
1	16	178	119	30
2	27	40.3	54.6	11

95% C.I. for mu 1 - mu 2: (71, 204)

T-Test mu 1 = mu 2 (vs not =): T= 4.35 P=0.0004 DF= 18

TwoT 95.0 'JunAve' 'Jun';

Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunAve

Jun	N	Mean	StDev	SE Mean
1	16	53.2	30.9	7.7
2	26	2.91	4.57	0.90

95% C.I. for mu 1 - mu 2: (33.7, 66.86)

T-Test mu 1 = mu 2 (vs not =): T= 6.47 P=0.0000 DF= 15

TwoT 95.0 'JunMin' 'Jun';

Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunMin

Jun	N	Mean	StDev	SE Mean
1	16	14.85	8.80	2.2
2	26	0.510	0.273	0.054

95% C.I. for mu 1 - mu 2: (9.6, 19.032)

T-Test mu 1 = mu 2 (vs not =): T= 6.52 P=0.0000 DF= 15

TwoT 95.0 'JunMax' 'Jun';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunMax

Jun	N	Mean	StDev	SE Mean
1	16	231	183	46
2	26	24.6	37.1	7.3

95% C.I. for mu 1 - mu 2: (107, 304.7)

T-Test mu 1 = mu 2 (vs not =): T= 4.45 P=0.0005 DF= 15

TwoT 95.0 'JulAve' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulAve

Jul	N	Mean	StDev	SE Mean
1	16	49.8	18.0	4.5
2	26	6.0	12.6	2.5

95% C.I. for mu 1 - mu 2: (33.2, 54.4)

T-Test mu 1 = mu 2 (vs not =): T= 8.51 P=0.0000 DF= 24

TwoT 95.0 'JulMin' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulMin

Jul	N	Mean	StDev	SE Mean
1	16	14.90	6.38	1.6
2	26	0.896	0.709	0.14

95% C.I. for mu 1 - mu 2: (10.6, 17.41)

T-Test mu 1 = mu 2 (vs not =): T= 8.75 P=0.0000 DF= 15

TwoT 95.0 'JulMax' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulMax

Jul	N	Mean	StDev	SE Mean
1	16	179.1	96.4	24
2	26	56.0	67.5	13

95% C.I. for mu 1 - mu 2: (66, 180)

T-Test mu 1 = mu 2 (vs not =): T= 4.48 P=0.0002 DF= 24

TwoT 95.0 'AugAve' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugAve

Aug	N	Mean	StDev	SE Mean
1	17	58.4	24.0	5.8
2	26	8.6	10.2	2.0

95% C.I. for mu 1 - mu 2: (36.9, 62.7)

T-Test mu 1 = mu 2 (vs not =): T= 8.08 P=0.0000 DF= 19

TwoT 95.0 'AugMin' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugMin

Aug	N	Mean	StDev	SE Mean
1	17	21.96	8.67	2.1
2	26	1.022	0.405	0.079

95% C.I. for mu 1 - mu 2: (16.5, 25.403)

T-Test mu 1 = mu 2 (vs not =): T= 9.95 P=0.0000 DF= 16

TwoT 95.0 'AugMax' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugMax

Aug	N	Mean	StDev	SE Mean
1	17	202.8	86.8	21
2	26	48.0	53.3	10

95% C.I. for mu 1 - mu 2: (106, 203)

T-Test mu 1 = mu 2 (vs not =): T= 6.59 P=0.0000 DF= 23

TwoT 95.0 'SepAve' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepAve

Sep	N	Mean	StDev	SE Mean
1	17	53.2	20.5	5.0
2	26	9.2	14.3	2.8

95% C.I. for mu 1 - mu 2: (32.2, 55.7)

T-Test mu 1 = mu 2 (vs not =): T= 7.69 P=0.0000 DF= 26

TwoT 95.0 'SepMin' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepMin

Sep	N	Mean	StDev	SE Mean
1	17	18.51	6.93	1.7
2	26	0.973	0.529	0.10

95% C.I. for mu 1 - mu 2: (14.0, 21.11)

T-Test mu 1 = mu 2 (vs not =): T= 10.42 P=0.0000 DF= 16

TwoT 95.0 'SepMax' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepMax

Sep	N	Mean	StDev	SE Mean
1	17	190	119	29
2	26	49.7	66.6	13

95% C.I. for mu 1 - mu 2: (75, 206)

T-Test mu 1 = mu 2 (vs not =): T= 4.44 P=0.0002 DF= 22

TwoT 95.0 'OctAve' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctAve

Oct	N	Mean	StDev	SE Mean
1	17	36.4	15.8	3.8
2	26	8.9	14.3	2.8

95% C.I. for mu 1 - mu 2: (17.8, 37.2)

T-Test mu 1 = mu 2 (vs not =): T= 5.80 P=0.0000 DF= 31

TwoT 95.0 'OctMin' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctMin

Oct	N	Mean	StDev	SE Mean
1	17	12.87	6.85	1.7
2	26	0.680	0.343	0.067

95% C.I. for mu 1 - mu 2: (8.7, 15.711)

T-Test mu 1 = mu 2 (vs not =): T= 7.33 P=0.0000 DF= 16

TwoT 95.0 'OctMax' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctMax

Oct	N	Mean	StDev	SE Mean
1	17	105.6	51.4	12
2	26	43.2	53.8	11

95% C.I. for mu 1 - mu 2: (29, 96)

T-Test mu 1 = mu 2 (vs not =): T= 3.82 P=0.0005 DF= 35

TwoT 95.0 'NovAve' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovAve

Nov	N	Mean	StDev	SE Mean
1	17	28.2	15.4	3.7
2	26	2.05	2.92	0.57

95% C.I. for mu 1 - mu 2: (18.1, 34.13)

T-Test mu 1 = mu 2 (vs not =): T= 6.91 P=0.0000 DF= 16

TwoT 95.0 'NovMin' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovMin

Nov	N	Mean	StDev	SE Mean
1	17	10.10	5.92	1.4
2	26	0.420	0.189	0.037

95% C.I. for mu 1 - mu 2: (6.6, 12.723)

T-Test mu 1 = mu 2 (vs not =): T= 6.74 P=0.0000 DF= 16

TwoT 95.0 'NovMax' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovMax

Nov	N	Mean	StDev	SE Mean
1	17	82.8	48.7	12
2	26	19.8	29.8	5.8

95% C.I. for mu 1 - mu 2: (36, 90.2)

T-Test mu 1 = mu 2 (vs not =): T= 4.78 P=0.0001 DF= 23

TwoT 95.0 'DecAve' 'Dec';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for DecAve

Dec	N	Mean	StDev	SE Mean
1	17	19.0	12.7	3.1
2	26	1.02	1.43	0.28

95% C.I. for mu 1 - mu 2: (11.4, 24.51)

T-Test mu 1 = mu 2 (vs not =): T= 5.83 P=0.0000 DF= 16

TwoT 95.0 'DecMin' 'Dec';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for DecMin

Dec	N	Mean	StDev	SE Mean
1	17	5.94	3.73	0.90
2	26	0.306	0.134	0.026

95% C.I. for mu 1 - mu 2: (3.71, 7.548)

T-Test mu 1 = mu 2 (vs not =): T= 6.22 P=0.0000 DF= 16

TwoT 95.0 'DecMax' 'Dec';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for DecMax

Dec	N	Mean	StDev	SE Mean
1	17	81.6	63.8	15
2	26	9.7	22.0	4.3

95% C.I. for mu 1 - mu 2: (38, 105.7)

T-Test mu 1 = mu 2 (vs not =): T= 4.47 P=0.0003 DF= 18

Analysis of Mean, Minimum and Maximum data from Hellyer

TwoT 95.0 'JanAve' 'Jan';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JanAve

Jan	N	Mean	StDev	SE Mean
1	44	1.65	1.25	0.19
2	27	1.76	1.04	0.20

95% C.I. for mu 1 - mu 2: (-0.66, 0.43)

T-Test mu 1 = mu 2 (vs not =): T= -0.42 P=0.68 DF= 62

TwoT 95.0 'JanMin' 'Jan';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JanMin

Jan	N	Mean	StDev	SE Mean
1	44	3.95	3.74	0.56
2	27	5.11	4.14	0.80

95% C.I. for mu 1 - mu 2: (-3.12, 0.80)

T-Test mu 1 = mu 2 (vs not =): T= -1.19 P=0.24 DF= 50

TwoT 95.0 'JanMax' 'Jan';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JanMax

Jan	N	Mean	StDev	SE Mean
1	44	0.783	0.520	0.078
2	27	0.812	0.393	0.076

95% C.I. for mu 1 - mu 2: (-0.247, 0.188)

T-Test mu 1 = mu 2 (vs not =): T= -0.27 P=0.79 DF= 65

TwoT 95.0 'FebAve' 'Feb';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for FebAve

Feb	N	Mean	StDev	SE Mean
1	45	1.52	1.20	0.18
2	27	1.072	0.779	0.15

95% C.I. for mu 1 - mu 2: (-0.02, 0.91)

T-Test mu 1 = mu 2 (vs not =): T= 1.91 P=0.060 DF= 69

TwoT 95.0 'FebMin' 'Feb';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for FebMin

Feb	N	Mean	StDev	SE Mean
1	45	4.35	4.94	0.74
2	27	3.03	3.11	0.60

95% C.I. for mu 1 - mu 2: (-0.58, 3.21)

T-Test mu 1 = mu 2 (vs not =): T= 1.39 P=0.17 DF= 69

TwoT 95.0 'FebMax' 'Feb';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for FebMax

Feb	N	Mean	StDev	SE Mean
1	45	0.657	0.477	0.071
2	27	0.559	0.268	0.052

95% C.I. for mu 1 - mu 2: (-0.078, 0.273)

T-Test mu 1 = mu 2 (vs not =): T= 1.11 P=0.27 DF= 69

TwoT 95.0 'MarAve' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarAve

Mar	N	Mean	StDev	SE Mean
1	45	1.53	1.23	0.18
2	27	1.073	0.787	0.15

95% C.I. for mu 1 - mu 2: (-0.02, 0.93)

T-Test mu 1 = mu 2 (vs not =): T= 1.93 P=0.058 DF= 69

TwoT 95.0 'MarMin' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarMin

Mar	N	Mean	StDev	SE Mean
1	45	4.30	4.27	0.64
2	27	3.59	3.22	0.62

95% C.I. for mu 1 - mu 2: (-1.07, 2.48)

T-Test mu 1 = mu 2 (vs not =): T= 0.79 P=0.43 DF= 66

TwoT 95.0 'MarMax' 'Mar';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MarMax

Mar	N	Mean	StDev	SE Mean
1	45	0.646	0.509	0.076
2	27	0.486	0.244	0.047

95% C.I. for mu 1 - mu 2: (-0.018, 0.338)

T-Test mu 1 = mu 2 (vs not =): T= 1.79 P=0.078 DF= 67

TwoT 95.0 'AprAve' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprAve

Apr	N	Mean	StDev	SE Mean
1	45	3.29	2.44	0.36
2	27	2.70	1.26	0.24

95% C.I. for mu 1 - mu 2: (-0.28, 1.46)

T-Test mu 1 = mu 2 (vs not =): T= 1.35 P=0.18 DF= 68

TwoT 95.0 'AprMin' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprMin

Apr	N	Mean	StDev	SE Mean
1	45	9.35	7.61	1.1
2	27	9.51	6.58	1.3

95% C.I. for mu 1 - mu 2: (-3.6, 3.2)

T-Test mu 1 = mu 2 (vs not =): T= -0.09 P=0.93 DF= 61

TwoT 95.0 'AprMax' 'Apr';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AprMax

Apr	N	Mean	StDev	SE Mean
1	45	1.101	0.963	0.14
2	27	0.845	0.584	0.11

95% C.I. for mu 1 - mu 2: (-0.11, 0.62)

T-Test mu 1 = mu 2 (vs not =): T= 1.40 P=0.16 DF= 69

TwoT 95.0 'MayAve' 'May';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayAve

May	N	Mean	StDev	SE Mean
1	45	5.91	3.39	0.51
2	27	5.25	2.80	0.54

95% C.I. for mu 1 - mu 2: (-0.82, 2.14)

T-Test mu 1 = mu 2 (vs not =): T= 0.89 P=0.38 DF= 63

TwoT 95.0 'MayMin' 'May';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayMin

May	N	Mean	StDev	SE Mean
1	45	14.3	10.0	1.5
2	27	15.1	12.0	2.3

95% C.I. for mu 1 - mu 2: (-6.2, 4.8)

T-Test mu 1 = mu 2 (vs not =): T= -0.26 P=0.80 DF= 47

TwoT 95.0 'MayMax' 'May';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for MayMax

May	N	Mean	StDev	SE Mean
1	45	1.93	1.20	0.18
2	27	1.85	1.04	0.20

95% C.I. for mu 1 - mu 2: (-0.46, 0.61)

T-Test mu 1 = mu 2 (vs not =): T= 0.29 P=0.78 DF= 61

TwoT 95.0 'JunAve' 'Jun';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunAve

Jun	N	Mean	StDev	SE Mean
1	45	7.38	3.97	0.59
2	26	6.16	1.61	0.32

95% C.I. for mu 1 - mu 2: (-0.12, 2.56)

T-Test mu 1 = mu 2 (vs not =): T= 1.82 P=0.074 DF= 63

TwoT 95.0 'JunMax' 'Jun';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunMax

Jun	N	Mean	StDev	SE Mean
1	45	2.83	1.62	0.24
2	26	2.474	0.802	0.16

95% C.I. for mu 1 - mu 2: (-0.22, 0.93)

T-Test mu 1 = mu 2 (vs not =): T= 1.22 P=0.23 DF= 67

TwoT 95.0 'JunMin' 'Jun';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JunMin

Jun	N	Mean	StDev	SE Mean
1	45	19.6	14.5	2.2
2	26	16.86	5.14	1.0

95% C.I. for mu 1 - mu 2: (-2.0, 7.5)

T-Test mu 1 = mu 2 (vs not =): T= 1.15 P=0.26 DF= 60

TwoT 95.0 'JulAve' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulAve

Jul	N	Mean	StDev	SE Mean
1	45	8.15	2.58	0.38
2	26	8.10	2.83	0.55

95% C.I. for mu 1 - mu 2: (-1.31, 1.40)

T-Test mu 1 = mu 2 (vs not =): T= 0.07 P=0.95 DF= 48

TwoT 95.0 'JulMin' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulMin

Jul	N	Mean	StDev	SE Mean
1	45	20.08	8.49	1.3
2	26	19.78	8.68	1.7

95% C.I. for mu 1 - mu 2: (-4.0, 4.6)

T-Test mu 1 = mu 2 (vs not =): T= 0.14 P=0.89 DF= 51

TwoT 95.0 'JulMax' 'Jul';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for JulMax

Jul	N	Mean	StDev	SE Mean
1	45	3.13	1.68	0.25
2	26	3.40	1.17	0.23

95% C.I. for mu 1 - mu 2: (-0.95, 0.40)

T-Test mu 1 = mu 2 (vs not =): T= -0.81 P=0.42 DF= 66

TwoT 95.0 'AugAve' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugAve

Aug	N	Mean	StDev	SE Mean
1	45	8.79	3.94	0.59
2	26	8.36	2.84	0.56

95% C.I. for mu 1 - mu 2: (-1.19, 2.05)

T-Test mu 1 = mu 2 (vs not =): T= 0.53 P=0.60 DF= 65

TwoT 95.0 'AugMin' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugMin

Aug	N	Mean	StDev	SE Mean
1	45	19.1	10.5	1.6
2	26	20.2	11.6	2.3

95% C.I. for mu 1 - mu 2: (-6.7, 4.4)

T-Test mu 1 = mu 2 (vs not =): T= -0.40 P=0.69 DF= 47

TwoT 95.0 'AugMax' 'Aug';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for AugMax

Aug	N	Mean	StDev	SE Mean
1	45	3.72	1.60	0.24
2	26	3.71	1.28	0.25

95% C.I. for mu 1 - mu 2: (-0.68, 0.70)

T-Test mu 1 = mu 2 (vs not =): T= 0.03 P=0.98 DF= 61

TwoT 95.0 'SepAve' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepAve

Sep	N	Mean	StDev	SE Mean
1	45	6.69	2.65	0.40
2	26	6.92	2.78	0.55

95% C.I. for mu 1 - mu 2: (-1.58, 1.12)

T-Test mu 1 = mu 2 (vs not =): T= -0.34 P=0.74 DF= 50

TwoT 95.0 'SepMin' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepMin

Sep	N	Mean	StDev	SE Mean
1	45	14.42	6.82	1.0
2	26	16.69	7.70	1.5

95% C.I. for mu 1 - mu 2: (-5.9, 1.4)

T-Test mu 1 = mu 2 (vs not =): T= -1.25 P=0.22 DF= 47

TwoT 95.0 'SepMax' 'Sep';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for SepMax

Sep	N	Mean	StDev	SE Mean
1	45	2.95	1.36	0.20
2	26	2.97	1.22	0.24

95% C.I. for mu 1 - mu 2: (-0.65, 0.60)

T-Test mu 1 = mu 2 (vs not =): T= -0.08 P=0.94 DF= 57

TwoT 95.0 'OctAve' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctAve

Oct	N	Mean	StDev	SE Mean
1	45	5.39	2.60	0.39
2	26	4.99	2.69	0.53

95% C.I. for mu 1 - mu 2: (-0.92, 1.71)

T-Test mu 1 = mu 2 (vs not =): T= 0.61 P=0.55 DF= 50

TwoT 95.0 'OctMin' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctMin

Oct	N	Mean	StDev	SE Mean
1	45	11.73	6.12	0.91
2	26	11.60	7.02	1.4

95% C.I. for mu 1 - mu 2: (-3.20, 3.5)

T-Test mu 1 = mu 2 (vs not =): T= 0.08 P=0.94 DF= 46

TwoT 95.0 'OctMax' 'Oct';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for OctMax

Oct	N	Mean	StDev	SE Mean
1	45	2.21	1.19	0.18
2	26	2.22	1.18	0.23

95% C.I. for mu 1 - mu 2: (-0.60, 0.57)

T-Test mu 1 = mu 2 (vs not =): T= -0.03 P=0.97 DF= 52

TwoT 95.0 'NovAve' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovAve

Nov	N	Mean	StDev	SE Mean
1	45	4.16	2.10	0.31
2	26	3.20	1.24	0.24

95% C.I. for mu 1 - mu 2: (0.17, 1.76)

T-Test mu 1 = mu 2 (vs not =): T= 2.43 P=0.018 DF= 68

TwoT 95.0 'NovMin' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovMin

Nov	N	Mean	StDev	SE Mean
1	45	9.19	4.30	0.64
2	26	8.39	4.48	0.88

95% C.I. for mu 1 - mu 2: (-1.38, 2.98)

T-Test mu 1 = mu 2 (vs not =): T= 0.74 P=0.46 DF= 50

TwoT 95.0 'NovMax' 'Nov';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for NovMax

Nov	N	Mean	StDev	SE Mean
1	45	1.79	1.07	0.16
2	26	1.422	0.417	0.082

95% C.I. for mu 1 - mu 2: (0.01, 0.729)

T-Test mu 1 = mu 2 (vs not =): T= 2.05 P=0.044 DF= 62

TwoT 95.0 'DecAve' 'Dec';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for DecAve

Dec	N	Mean	StDev	SE Mean
1	45	2.47	1.44	0.21
2	26	2.53	1.38	0.27

95% C.I. for mu 1 - mu 2: (-0.74, 0.64)

T-Test mu 1 = mu 2 (vs not =): T= -0.15 P=0.88 DF= 54

TwoT 95.0 'DecMin' 'Dec';
Alternative 0.

Two Sample T-Test and Confidence Interval

Twosample T for DecMin

Dec	N	Mean	StDev	SE Mean
1	45	6.02	4.08	0.61
2	26	6.67	4.52	0.89

95% C.I. for mu 1 - mu 2: (-2.82, 1.51)

T-Test mu 1 = mu 2 (vs not =): T= -0.61 P=0.55 DF= 48

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TwoT 95.0 'DecMax' 'Dec';  
Alternative 0.
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Two Sample T-Test and Confidence Interval

Twosample T for DecMax

Dec	N	Mean	StDev	SE Mean
1	45	1.141	0.774	0.12
2	26	1.061	0.378	0.074

95% C.I. for mu 1 - mu 2: (-0.19, 0.354)

T-Test mu 1 = mu 2 (vs not =): T= 0.58 P=0.56 DF= 67