Appendix 1. LOADEST Model Summaries for Rejected Models

Rejected LOADEST Models from Klamath River at Keno (site KRK)

Total Phosphorus

```
> print(TP.keno.sel, brief=F,load.only=T)
                     LOADEST
       A Program to Estimate Constituent Loads
U.S. Geological Survey, Version for R 0.1 (June, 2013)
-----------------------------------------------------

Station: Klamath River at Keno, OR
Constituent: TP

-------------------------------------------------------------------------
    Constituent Output File Part Ia: Calibration (Load Regression)
-------------------------------------------------------------------------

           Number of Observations: 75
Number of Uncensored Observations: 75
           Center of Decimal Time: 2013.73
                  Center of ln(Q): 6.74
                Period of record: 2012-04-10 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model    AIC   SPCC   AICc
1     1 104.68 111.64 105.02
2     2 102.76 112.03 103.33
3     3 106.51 115.78 107.08
4     4  48.21  59.80  49.08
5     5 103.68 115.27 104.55
6     6  48.13  62.04  49.37
7     7  49.44  63.35  50.68
8     8  49.96  66.18  51.63
9     9  48.61  67.15  50.79
Model # 6 selected

Selected Load Model:
--------------------

TP ~ model(6)

where:
   TP is the constituent load in log(kg/d)
and model 6 has these variables:
   lnQ is ln(Q) - center of ln(Q)
   lnQ2 is ln(Q) - center of ln(Q))^2
   sin.DECTIME is sine(2 * pi * decimal time)
   cos.DECTIME is cosine(2 * pi * decimal time)

Model coefficients:
            Estimate Std. Error z-score p-value
(Intercept)  5.61015    0.04465 125.651  0.0000
lnQ          0.76527    0.10181   7.517  0.0000
lnQ2        -0.15831    0.11300  -1.401  0.1499
sin.DECTIME  0.06205    0.05792   1.071  0.2695
cos.DECTIME -0.50409    0.05537  -9.103  0.0000
```

```
AMLE Regression Statistics
Residual variance: 0.1016
R-squared: 77.6 percent
G-squared: 112.2 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.995
  p-value = 0.7404
Serial Correlation of Residuals: 0.563

Correlation Between Explanatory Variables
-----------------------------------------

             lnQ     lnQ2    sin.DECTIME
lnQ2         0.0000
sin.DECTIME  0.3645  0.1643
cos.DECTIME -0.3316  0.1646 -0.0204

Correlation Between Variable Coefficients
-----------------------------------------

             lnQ     lnQ2    sin.DECTIME
lnQ2         0.0064
sin.DECTIME -0.3754 -0.1600
cos.DECTIME  0.3428 -0.1578 -0.0862

Variance Inflation Factors:
              VIF
lnQ         1.312
lnQ2        1.058
sin.DECTIME 1.199
cos.DECTIME 1.167

Comparison of Observed and Estimated Loads
------------------------------------------
  The summary statistics and bias diagnostics presented below are based
on a comparison of observed and estimated loads for all dates/times within
the calibration data set. Although this comparison does not directly
address errors in load estimation for unsampled dates/times, large
discrepancies between observed and estimated loads are indicative of a
poor model fit. Additional details and warnings are provided below.

Note: The comparison that follows uses a concentration equal to 1/2 the
detection limit when an observation is censored. The summary stats and
bias diagnostics are therefore slightly inaccurate for censored datasets.

      Summary Stats: Loads in kg/d
-------------------------------------------
     Min 25% 50% 75% 90% 95% Max
Est 53.9 157 278 381 499 638 751
Obs 48.0 147 244 445 542 704 856

Bias Diagnostics
----------------
 Bp: -0.2487 percent
PLR: 0.9975
  E: 0.6406

where:
   Bp Load Bias in Percent
      Positive (negative) values indicate over (under) estimation.
      ***The model should not be used when the + or - bias exceeds 25%***
 PLR Partial Load Ratio
    Sum of estimated loads divided by sum of observed loads.
      Values greater than 1 indicate over estimation.
```

```
      Values less than 1 indicate under estimation.
    E Nash Sutcliffe Efficiency Index
      E ranges from -infinity to 1.0
      E = 1; a perfect fit to observed data.
      E = 0; model estimates are as accurate as the mean of observed data.
      E < 0; the observed mean is a better estimate than the model estimates.

NOTE: Additional information on model calibration is included in the
      residual diagnostic plots. users should conduct a thorough
      residuals analysis. Example residual plots are shown in figures
      7, 8, 9, and 17 of the LOADEST documentation (Runkel et al., 2004).
```

```
> print(TP.keno.4, brief=F,load.only=T)
                      LOADEST
       A Program to Estimate Constituent Loads
U.S. Geological Survey, Version for R 0.1 (June, 2013)
-----------------------------------------------------

Station: Klamath River at Keno, OR
Constituent: TP

-------------------------------------------------------------------------
    Constituent Output File Part Ia: Calibration (Load Regression)
-------------------------------------------------------------------------

           Number of Observations: 75
Number of Uncensored Observations: 75
           Center of Decimal Time: 2013.73
                 Center of ln(Q): 6.74
               Period of record: 2012-04-10 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model   AIC SPCC
1     4 48.21 59.8
Model # 4 selected

Selected Load Model:
--------------------

TP ~ model(4)

where:
   TP is the constituent load in log(kg/d)
and model 4 has these variables:
   lnQ is ln(Q) - center of ln(Q)
   sin.DECTIME is sine(2 * pi * decimal time)
   cos.DECTIME is cosine(2 * pi * decimal time)

Model coefficients:
            Estimate Std. Error  z-score p-value
(Intercept)  5.58007    0.03941 141.5916  0.0000
lnQ          0.76618    0.10250   7.4751  0.0000
sin.DECTIME  0.04906    0.05756   0.8524  0.3822
cos.DECTIME -0.51633    0.05505  -9.3793  0.0000

AMLE Regression Statistics
Residual variance: 0.1029
R-squared: 76.97 percent
G-squared: 110.1 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9958
  p-value = 0.8354
```

```
Serial Correlation of Residuals: 0.5546

Correlation Between Explanatory Variables
-----------------------------------------

             lnQ     sin.DECTIME
sin.DECTIME  0.3645
cos.DECTIME -0.3316 -0.0204

Correlation Between Variable Coefficients
-----------------------------------------

             lnQ     sin.DECTIME
sin.DECTIME -0.3793
cos.DECTIME  0.3482 -0.1144

Variance Inflation Factors:
              VIF
lnQ         1.312
sin.DECTIME 1.169
cos.DECTIME 1.138

Comparison of Observed and Estimated Loads
------------------------------------------
  The summary statistics and bias diagnostics presented below are based
on a comparison of observed and estimated loads for all dates/times within
the calibration data set. Although this comparison does not directly
address errors in load estimation for unsampled dates/times, large
discrepancies between observed and estimated loads are indicative of a
poor model fit. Additional details and warnings are provided below.

Note: The comparison that follows uses a concentration equal to 1/2 the
detection limit when an observation is censored. The summary stats and
bias diagnostics are therefore slightly inaccurate for censored datasets.

      Summary Stats: Loads in kg/d
-----------------------------------------------
     Min 25% 50% 75% 90% 95% Max
Est 65.9 152 279 377 490 689 866
Obs 48.0 147 244 445 542 704 856

Bias Diagnostics
----------------
 Bp: 0.4955 percent
PLR: 1.005
  E: 0.6402

where:
   Bp Load Bias in Percent
      Positive (negative) values indicate over (under) estimation.
      ***The model should not be used when the + or - bias exceeds 25%***
  PLR Partial Load Ratio
      Sum of estimated loads divided by sum of observed loads.
      Values greater than 1 indicate over estimation.
      Values less than 1 indicate under estimation.
    E Nash Sutcliffe Efficiency Index
      E ranges from -infinity to 1.0
      E = 1; a perfect fit to observed data.
      E = 0; model estimates are as accurate as the mean of observed data.
      E < 0; the observed mean is a better estimate than the model estimates.

NOTE: Additional information on model calibration is included in the
      residual diagnostic plots. users should conduct a thorough
      residuals analysis. Example residual plots are shown in figures
```
7, 8, 9, and 17 of the LOADEST documentation (Runkel et al., 2004).

Total Nitrogen

```
TN model output from R-LOADEST:

*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.7396
                Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model   AIC  SPCC  AICc
1     1 59.39 66.42 59.72
2     2 57.18 66.55 57.73
3     3 60.89 70.26 61.44
4     4 53.44 65.15 54.28
5     5 57.35 69.07 58.20
6     6 53.33 67.39 54.53
7     7 55.41 69.48 56.61
8     8 54.87 71.28 56.50
9     9 56.62 75.37 58.74
Model # 6 selected

Selected Load Model:
--------------------

TN ~ model(6)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)  7.97120    0.04534 175.826  0.0000
lnQ          0.87020    0.10219   8.515  0.0000
lnQ2        -0.16391    0.11604  -1.413  0.1468
sin.DECTIME -0.13299    0.05799  -2.293  0.0198
cos.DECTIME -0.07613    0.05675  -1.342  0.1680

AMLE Regression Statistics
Residual variance: 0.1071
R-squared: 57.88 percent
G-squared: 66.57 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9959
  p-value = 0.8432
Serial Correlation of Residuals: 0.7137

Variance Inflation Factors:
              VIF
lnQ         1.307
lnQ2        1.060
sin.DECTIME 1.198
cos.DECTIME 1.168

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
    Min  25%  50%  75%  90%  95%  Max
Est 794 2320 2720 3280 3730 4790 6020
Obs 625 1860 2410 3560 4840 5770 7010

Bias Diagnostics
----------------
 Bp: -0.2307 percent
PLR: 0.9977
  E: 0.5075
```

```
TN model - User defined Model 4

*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.7396
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TN ~ model(4)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)  7.94016    0.03993 198.867  0.0000
lnQ          0.87119    0.10288   8.468  0.0000
sin.DECTIME -0.14628    0.05762  -2.539  0.0107
cos.DECTIME -0.08874    0.05642  -1.573  0.1092

AMLE Regression Statistics
Residual variance: 0.1086
R-squared: 56.71 percent
G-squared: 64.47 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9962
  p-value = 0.8705
Serial Correlation of Residuals: 0.6864

Variance Inflation Factors:
              VIF
lnQ         1.307
sin.DECTIME 1.166
cos.DECTIME 1.139

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-----------------------------------------------
    Min  25%  50%  75%  90%  95%  Max
Est 977 2330 2690 3200 3670 4970 7290
Obs 625 1860 2410 3560 4840 5770 7010

Bias Diagnostics
----------------
 Bp: 0.3348 percent
PLR: 1.003
  E: 0.4941
```

Five-Day Biochemical Oxygen Demand (BOD_5)

```
*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.7396
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TN ~ model(8)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  7.97306    0.04561 174.8141  0.0000
lnQ          0.84322    0.11067   7.6196  0.0000
lnQ2        -0.19061    0.12352  -1.5432  0.1110
DECTIME     -0.03247    0.04990  -0.6507  0.4987
sin.DECTIME -0.12603    0.05920  -2.1288  0.0291
cos.DECTIME -0.06861    0.05813  -1.1802  0.2213

AMLE Regression Statistics
Residual variance: 0.108
R-squared: 58.13 percent
G-squared: 67.03 on 5 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9962
  p-value = 0.8734
Serial Correlation of Residuals: 0.7118

Variance Inflation Factors:
              VIF
lnQ         1.521
lnQ2        1.191
DECTIME     1.382
sin.DECTIME 1.238
cos.DECTIME 1.216

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
------------------------------------------
    Min  25%  50%  75%  90%  95%  Max
Est 815 2340 2730 3340 3750 4870 5930
Obs 625 1860 2410 3560 4840 5770 7010

Bias Diagnostics
----------------
 Bp: -0.2199 percent
PLR: 0.9978
  E: 0.5086
```

Five-Day Biochemical Oxygen Demand (BOD_5)

```
> print(BOD.keno.7)
*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: P00310

           Number of Observations: 74
Number of Uncensored Observations: 63
           Center of Decimal Time: 2013.714
                 Center of ln(Q): 6.7427
               Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P00310 ~ model(7)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  8.60561    0.05864 146.7408  0.0000
lnQ          0.61569    0.15944   3.8616  0.0002
DECTIME      0.03384    0.06529   0.5182  0.5859
sin.DECTIME  0.08087    0.08097   0.9987  0.3066
cos.DECTIME -0.46026    0.08162  -5.6388  0.0000

AMLE Regression Statistics
Residual variance: 0.1971
Generalized R-squared: 53.2 percent
G-squared: 56.18 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.988
  p-value = 0.1956
Serial Correlation of Residuals: 0.4561

Variance Inflation Factors:
              VIF
lnQ         1.437
DECTIME     1.189
sin.DECTIME 1.165
cos.DECTIME 1.160

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------
     Min  25%  50%  75%   90%   95%   Max
Est 1710 3790 5970 8030  9820 12400 15000
Obs  617 3360 4830 7710 12500 14100 20000

Bias Diagnostics
----------------
 Bp: 3.19 percent
PLR: 1.032
  E: 0.3928
```

```
> print(BOD.keno.6)
*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: P00310

           Number of Observations: 74
Number of Uncensored Observations: 63
           Center of Decimal Time: 2013.714
                  Center of ln(Q): 6.7427
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P00310 ~ model(6)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  8.63091    0.06509 132.6084  0.0000
lnQ          0.60741    0.15465   3.9277  0.0002
lnQ2        -0.12080    0.16902  -0.7147  0.3887
sin.DECTIME  0.09199    0.08035   1.1450  0.2367
cos.DECTIME -0.43893    0.08049  -5.4532  0.0000

AMLE Regression Statistics
Residual variance: 0.1944
Generalized R-squared: 53.48 percent
G-squared: 56.63 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9882
  p-value = 0.204
Serial Correlation of Residuals: 0.4601

Variance Inflation Factors:
              VIF
lnQ         1.290
lnQ2        1.053
sin.DECTIME 1.169
cos.DECTIME 1.170

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------
     Min  25%  50%  75%   90%   95%   Max
Est 1530 3750 5990 8010  9650 12000 13800
Obs  617 3360 4830 7710 12500 14100 20000

Bias Diagnostics
----------------
 Bp: 3.091 percent
PLR: 1.031
  E: 0.3732
```

Five-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)

```
#Note, this model run excludes CBOD value from 2013-07-29

> print(CBOD.keno.sel)
*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: P80082

           Number of Observations: 73
Number of Uncensored Observations: 56
           Center of Decimal Time: 2013.713
                 Center of ln(Q): 6.7422
               Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model    AIC  SPCC   AICc
1     1 119.51 126.4 119.86
2     2 119.62 128.8 120.21
3     3 120.51 129.7 121.10
4     4  97.17 108.6  98.07
5     5 121.17 132.6 122.07
6     6  98.98 112.7 100.25
7     7  95.68 109.4  96.95
8     8  97.62 113.7  99.34
9     9  99.16 117.5 101.41
Model # 7 selected

Selected Load Model:
--------------------

P80082 ~ model(7)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  8.34614    0.06583 126.7806  0.0000
lnQ          0.56806    0.18150   3.1298  0.0014
DECTIME      0.12509    0.07033   1.7786  0.0615
sin.DECTIME  0.06612    0.08472   0.7804  0.4290
cos.DECTIME -0.48764    0.08972  -5.4349  0.0000

AMLE Regression Statistics
Residual variance: 0.2033
Generalized R-squared: 48.84 percent
G-squared: 48.93 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9799
  p-value = 0.0526
Serial Correlation of Residuals: 0.2777

Variance Inflation Factors:
              VIF
lnQ         1.445
DECTIME     1.189
sin.DECTIME 1.160
cos.DECTIME 1.168

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------
     Min  25%  50%  75%  90%   95%   Max
Est 1280 2970 4480 6260 7850  8470  9760
Obs  617 2390 3510 6070 9620 12500 15700

Bias Diagnostics
----------------
 Bp: 3.656 percent
PLR: 1.037
  E: 0.36
```

```
> print(CBOD.keno.8.2)
*** Load Estimation ***

Station: Klamath River at Keno, OR
Constituent: P80082

           Number of Observations: 73
Number of Uncensored Observations: 56
           Center of Decimal Time: 2013.713
                  Center of ln(Q): 6.7422
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P80082 ~ model(8)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  8.33477    0.07303 114.1280  0.0000
lnQ          0.58827    0.18584   3.1655  0.0013
lnQ2         0.08616    0.20530   0.4197  0.8088
DECTIME      0.13396    0.07533   1.7783  0.0668
sin.DECTIME  0.06094    0.08629   0.7062  0.4549
cos.DECTIME -0.49561    0.09298  -5.3303  0.0000

AMLE Regression Statistics
Residual variance: 0.205
Generalized R-squared: 48.88 percent
G-squared: 48.99 on 5 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9819
  p-value = 0.0774
Serial Correlation of Residuals: 0.2773

Variance Inflation Factors:
              VIF
lnQ         1.460
lnQ2        1.183
DECTIME     1.335
sin.DECTIME 1.201
cos.DECTIME 1.227

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min  25%  50%  75%  90%   95%   Max
Est 1360 2940 4420 6230 7860  9210 10500
Obs  617 2390 3510 6070 9620 12500 15700

Bias Diagnostics
----------------
 Bp: 4.117 percent
PLR: 1.041
  E: 0.367
```

Rejected LOADEST Models from Upper Klamath Lake at Fremont Bridge (site FMT)

Total Phosphorus

```
> TP.FMT.sel
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TP

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.8212
                Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model    AIC   SPCC   AICc
1     1 126.33 133.36 126.66
2     2 128.22 137.59 128.77
3     3 125.82 135.19 126.37
4     4  83.83  95.54  84.67
5     5 127.76 139.48 128.61
6     6  85.63  99.69  86.83
7     7  83.50  97.57  84.70
8     8  84.22 100.63  85.85
9     9  85.46 104.21  87.58
Model # 7 selected

Selected Load Model:
--------------------

TP ~ model(7)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)  5.31239    0.04744 111.986  0.0000
lnQ          0.86841    0.13026   6.667  0.0000
DECTIME      0.08385    0.05647   1.485  0.1275
sin.DECTIME -0.30275    0.06463  -4.684  0.0000
cos.DECTIME -0.61714    0.10569  -5.839  0.0000

AMLE Regression Statistics
Residual variance: 0.1585
R-squared: 84.8 percent
G-squared: 145.1 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.99
  p-value = 0.2306
Serial Correlation of Residuals: 0.6313

Variance Inflation Factors:
              VIF
lnQ         3.045
DECTIME     1.206
sin.DECTIME 1.006
cos.DECTIME 2.736

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min 25% 50% 75%  90%  95%  Max
Est 38.5 118 231 573  707  759  805
Obs 33.4 118 194 421 1050 1320 1710

Bias Diagnostics
----------------
 Bp: -6.327 percent
PLR: 0.9367
  E: 0.6437
```

```
> TP.FMT.4
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TP

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.8212
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TP ~ model(4)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)    5.3200    0.04755 111.880       0
lnQ            0.8048    0.12402   6.489       0
sin.DECTIME   -0.3023    0.06516  -4.640       0
cos.DECTIME   -0.6329    0.10603  -5.969       0

AMLE Regression Statistics
Residual variance: 0.1611
R-squared: 84.34 percent
G-squared: 142.8 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9845
  p-value = 0.0564
Serial Correlation of Residuals: 0.6371

Variance Inflation Factors:
              VIF
lnQ         2.716
sin.DECTIME 1.006
cos.DECTIME 2.708

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min 25% 50% 75%  90%  95%  Max
Est 41.0 106 231 561  696  776  840
Obs 33.4 118 194 421 1050 1320 1710

Bias Diagnostics
----------------
 Bp: -5.996 percent
PLR: 0.94
  E: 0.6293
```

```
> TP.FMT.6
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TP

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.8212
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TP ~ model(6)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)  5.30088    0.06544 81.0097  0.0000
lnQ          0.80982    0.12527  6.4643  0.0000
lnQ2         0.04892    0.11451  0.4272  0.6589
sin.DECTIME -0.31107    0.06865 -4.5315  0.0000
cos.DECTIME -0.62806    0.10722 -5.8579  0.0000

AMLE Regression Statistics
Residual variance: 0.1629
R-squared: 84.38 percent
G-squared: 142.9 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9838
  p-value = 0.0475
Serial Correlation of Residuals: 0.6439

Variance Inflation Factors:
              VIF
lnQ         2.740
lnQ2        1.105
sin.DECTIME 1.104
cos.DECTIME 2.738

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min 25% 50% 75%  90%  95%  Max
Est 42.8 104 230 576  697  825  861
Obs 33.4 118 194 421 1050 1320 1710

Bias Diagnostics
----------------
 Bp: -5.745 percent
PLR: 0.9425
  E: 0.6281
```

Total Nitrogen

File Edit Format View Help

```
> TN.FMT.sel
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                 Center of ln(Q): 6.8212
               Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model   AIC  SPCC  AICc
1     1 118.2 125.3 118.6
2     2 119.3 128.6 119.8
3     3 120.2 129.6 120.7
4     4 100.1 111.8 100.9
5     5 121.3 133.0 122.1
6     6 102.1 116.1 103.3
7     7 102.1 116.1 103.3
8     8 104.1 120.5 105.7
9     9 105.7 124.5 107.9
Model # 4 selected

Selected Load Model:
--------------------

TN ~ model(4)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)    7.9385    0.05285 150.222  0.0000
lnQ            0.8508    0.13783   6.172  0.0000
sin.DECTIME   -0.3219    0.07242  -4.444  0.0000
cos.DECTIME   -0.2220    0.11783  -1.884  0.0559

AMLE Regression Statistics
Residual variance: 0.199
R-squared: 70.9 percent
G-squared: 95.06 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9932
  p-value = 0.504
Serial Correlation of Residuals: 0.6599

Variance Inflation Factors:
              VIF
lnQ         2.716
sin.DECTIME 1.006
cos.DECTIME 2.708

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-----------------------------------------------
    Min  25%  50%  75%   90%   95%   Max
Est 735 2100 3580 6190  7150  8180  8910
Obs 672 1820 2950 4630 11700 15800 16400

Bias Diagnostics
----------------
 Bp: -4.551 percent
PLR: 0.9545
  E: 0.4922
```

```
> TN.FMT.6
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.8212
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TN ~ model(6)

Model coefficients:
             Estimate Std. Error   z-score p-value
(Intercept)  7.936724    0.07281 109.00267  0.0000
lnQ          0.851242    0.13940   6.10656  0.0000
lnQ2         0.004605    0.12742   0.03614  0.9702
sin.DECTIME -0.322684    0.07639  -4.22440  0.0000
cos.DECTIME -0.221526    0.11930  -1.85680  0.0577

AMLE Regression Statistics
Residual variance: 0.2017
R-squared: 70.9 percent
G-squared: 95.06 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9932
  p-value = 0.4993
Serial Correlation of Residuals: 0.6601

Variance Inflation Factors:
              VIF
lnQ         2.740
lnQ2        1.105
sin.DECTIME 1.104
cos.DECTIME 2.738

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-----------------------------------------------
    Min  25%  50%  75%   90%   95%   Max
Est 733 2100 3580 6200  7160  8190  8820
Obs 672 1820 2950 4630 11700 15800 16400

Bias Diagnostics
----------------
 Bp: -4.536 percent
PLR: 0.9546
  E: 0.4933
```

```
> TN.FMT.7
*** Load Estimation ***

Station: Fremont Bridge
Constituent: TN

           Number of Observations: 77
Number of Uncensored Observations: 77
           Center of Decimal Time: 2013.728
                  Center of ln(Q): 6.8212
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

TN ~ model(7)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  7.937941    0.05352 148.3258  0.0000
lnQ          0.855636    0.14695   5.8226  0.0000
DECTIME      0.006415    0.06371   0.1007  0.9171
sin.DECTIME -0.321893    0.07292  -4.4145  0.0000
cos.DECTIME -0.220775    0.11924  -1.8515  0.0584

AMLE Regression Statistics
Residual variance: 0.2017
R-squared: 70.91 percent
G-squared: 95.07 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9932
  p-value = 0.5054
Serial Correlation of Residuals: 0.6602

Variance Inflation Factors:
              VIF
lnQ         3.045
DECTIME     1.206
sin.DECTIME 1.006
cos.DECTIME 2.736

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
    Min  25%  50%  75%   90%   95%   Max
Est 737 2090 3590 6230  7120  8140  8890
Obs 672 1820 2950 4630 11700 15800 16400

Bias Diagnostics
----------------
 Bp: -4.56 percent
PLR: 0.9544
  E: 0.4933
```

Five-Day Biochemical Oxygen Demand BOD_5

```
> BOD.fmt.sel
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P00310

           Number of Observations: 66
Number of Uncensored Observations: 61
           Center of Decimal Time: 2013.7
                 Center of ln(Q): 6.8833
               Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model   AIC  SPCC  AICc
1     1 166.6 173.2 167.0
2     2 167.5 176.2 168.1
3     3 167.3 176.0 167.9
4     4 151.6 162.5 152.6
5     5 168.6 179.6 169.6
6     6 153.5 166.6 154.9
7     7 152.5 165.6 153.9
8     8 154.4 169.8 156.4
9     9 155.6 173.1 158.1
Model # 4 selected

Selected Load Model:
--------------------

P00310 ~ model(4)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)    8.8694    0.09347  94.896  0.0000
lnQ            0.4841    0.28204   1.716  0.0941
sin.DECTIME   -0.2575    0.12812  -2.010  0.0400
cos.DECTIME   -0.9728    0.24007  -4.052  0.0001

AMLE Regression Statistics
Residual variance: 0.5454
Generalized R-squared: 60.29 percent
G-squared: 60.95 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9929
  p-value = 0.5814
Serial Correlation of Residuals: 0.6426

Variance Inflation Factors:
              VIF
lnQ         3.090
sin.DECTIME 1.004
cos.DECTIME 3.084

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min  25%   50%   75%   90%   95%    Max
Est 1910 4700 14300 24900 31400 32600  35600
Obs  776 3540  6290 15000 69700 87200 105000

Bias Diagnostics
----------------
 Bp: -15.28 percent
PLR: 0.8472
  E: 0.4159
```

```
> BOD.fmt.6
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P00310

           Number of Observations: 66
Number of Uncensored Observations: 61
           Center of Decimal Time: 2013.7
                  Center of ln(Q): 6.8833
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P00310 ~ model(6)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)  8.88407     0.1311 67.7821  0.0000
lnQ          0.48830     0.2855  1.7102  0.0975
lnQ2        -0.03998     0.2558 -0.1563  0.8366
sin.DECTIME -0.24882     0.1380 -1.8030  0.0658
cos.DECTIME -0.96897     0.2425 -3.9950  0.0001

AMLE Regression Statistics
Residual variance: 0.5544
Generalized R-squared: 60.31 percent
G-squared: 60.99 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9928
  p-value = 0.5651
Serial Correlation of Residuals: 0.6434

Variance Inflation Factors:
              VIF
lnQ         3.094
lnQ2        1.156
sin.DECTIME 1.155
cos.DECTIME 3.094

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
------------------------------------------------
     Min  25%   50%   75%   90%   95%    Max
Est 1750 4750 14400 25100 31500 32700  35400
Obs  776 3540  6290 15000 69700 87200 105000

Bias Diagnostics
----------------
 Bp: -15.29 percent
PLR: 0.8471
  E: 0.4179
```

```
> BOD.fmt.7
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P00310

           Number of Observations: 66
Number of Uncensored Observations: 61
           Center of Decimal Time: 2013.7
                  Center of ln(Q): 6.8833
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P00310 ~ model(7)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)    8.8409    0.09868 89.5884  0.0000
lnQ            0.5943    0.30421  1.9537  0.0532
DECTIME        0.1242    0.12558  0.9892  0.2952
sin.DECTIME   -0.2587    0.12917 -2.0026  0.0385
cos.DECTIME   -0.9649    0.24224 -3.9833  0.0001

AMLE Regression Statistics
Residual variance: 0.55
Generalized R-squared: 60.94 percent
G-squared: 62.05 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9922
  p-value = 0.5125
Serial Correlation of Residuals: 0.6505

Variance Inflation Factors:
              VIF
lnQ         3.604
DECTIME     1.443
sin.DECTIME 1.004
cos.DECTIME 3.088

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-----------------------------------------------
     Min  25%   50%   75%   90%   95%    Max
Est 1930 5140 14400 26100 31800 33000  37100
Obs  776 3540  6290 15000 69700 87200 105000

Bias Diagnostics
----------------
 Bp: -15.38 percent
PLR: 0.8462
  E: 0.4287
```

Five-Day Carbonaceous Biochemical Oxygen Demand (**$CBOD_5$**)

```
> CBOD.fmt.sel
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P80082

           Number of Observations: 65
Number of Uncensored Observations: 55
           Center of Decimal Time: 2013.698
                 Center of ln(Q): 6.8843
               Period of record: 2012-03-27 to 2015-03-23

Model Evaluation Criteria Based on AMLE Results
-----------------------------------------------

  model   AIC  SPCC  AICc
1     1 168.7 175.2 169.1
2     2 169.3 178.0 170.0
3     3 167.9 176.6 168.6
4     4 149.0 159.8 150.0
5     5 169.4 180.2 170.4
6     6 150.6 163.7 152.1
7     7 148.2 161.2 149.6
8     8 150.2 165.4 152.2
9     9 151.4 168.8 154.0
Model # 7 selected

Selected Load Model:
--------------------

P80082 ~ model(7)

Model coefficients:
            Estimate Std. Error z-score p-value
(Intercept)   8.5968     0.1067 80.5603  0.0000
lnQ           0.3032     0.3348  0.9054  0.3818
DECTIME       0.2170     0.1352  1.6046  0.0955
sin.DECTIME  -0.2821     0.1389 -2.0310  0.0376
cos.DECTIME  -1.2521     0.2666 -4.6966  0.0000

AMLE Regression Statistics
Residual variance: 0.604
Generalized R-squared: 58.72 percent
G-squared: 57.51 on 4 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9885
  p-value = 0.282
Serial Correlation of Residuals: 0.6421

Variance Inflation Factors:
              VIF
lnQ         3.589
DECTIME     1.441
sin.DECTIME 1.004
cos.DECTIME 3.076

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------
     Min  25%  50%   75%   90%   95%    Max
Est 1640 3550 9990 20800 27600 31300  35800
Obs  776 2990 4650  9970 73900 78100 101000

Bias Diagnostics
----------------
 Bp: -19.26 percent
PLR: 0.8074
  E: 0.417
```

```
> CBOD.fmt.4
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P80082

           Number of Observations: 65
Number of Uncensored Observations: 55
           Center of Decimal Time: 2013.698
                  Center of ln(Q): 6.8843
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P80082 ~ model(4)

Model coefficients:
             Estimate Std. Error z-score p-value
(Intercept)    8.6558    0.09921 87.2469  0.0000
lnQ            0.1444    0.31103  0.4643  0.6718
sin.DECTIME   -0.2723    0.13647 -1.9955  0.0437
cos.DECTIME   -1.2428    0.26097 -4.7623  0.0000

AMLE Regression Statistics
Residual variance: 0.5979
Generalized R-squared: 56.92 percent
G-squared: 54.73 on 3 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9918
  p-value = 0.5208
Serial Correlation of Residuals: 0.6366

Variance Inflation Factors:
              VIF
lnQ         3.079
sin.DECTIME 1.004
cos.DECTIME 3.072

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min  25%   50%   75%   90%   95%    Max
Est 1880 3630 10900 21400 28100 28700  30100
Obs  776 2990  4650  9970 73900 78100 101000

Bias Diagnostics
----------------
 Bp: -19.26 percent
PLR: 0.8074
  E: 0.3865
```

```
> CBOD.fmt.8
*** Load Estimation ***

Station: Fremont Bridge
Constituent: P80082

           Number of Observations: 65
Number of Uncensored Observations: 55
           Center of Decimal Time: 2013.698
                  Center of ln(Q): 6.8843
                Period of record: 2012-03-27 to 2015-03-23

Selected Load Model:
--------------------

P80082 ~ model(8)

Model coefficients:
             Estimate Std. Error  z-score p-value
(Intercept)  8.59306     0.1595 53.87499  0.0000
lnQ          0.31934     0.3491  0.91487  0.4117
lnQ2         0.01629     0.3083  0.05285  0.9734
DECTIME      0.21664     0.1445  1.49877  0.1181
sin.DECTIME -0.28154     0.1500 -1.87745  0.0546
cos.DECTIME -1.24227     0.2696 -4.60725  0.0000

AMLE Regression Statistics
Residual variance: 0.6133
Generalized R-squared: 58.72 percent
G-squared: 57.51 on 5 degrees of freedom
P-value: <0.0001
Prob. Plot Corr. Coeff. (PPCC):
  r = 0.9884
  p-value = 0.2776
Serial Correlation of Residuals: 0.642

Variance Inflation Factors:
              VIF
lnQ         3.624
lnQ2        1.300
DECTIME     1.623
sin.DECTIME 1.174
cos.DECTIME 3.083

Comparison of Observed and Estimated Loads
------------------------------------------
      Summary Stats: Loads in kg/d
-------------------------------------------------
     Min  25%   50%   75%   90%   95%    Max
Est 1650 3570 10100 20900 27700 31400  35900
Obs  776 2990  4650  9970 73900 78100 101000

Bias Diagnostics
----------------
 Bp: -19.06 percent
PLR: 0.8094
  E: 0.4196
```