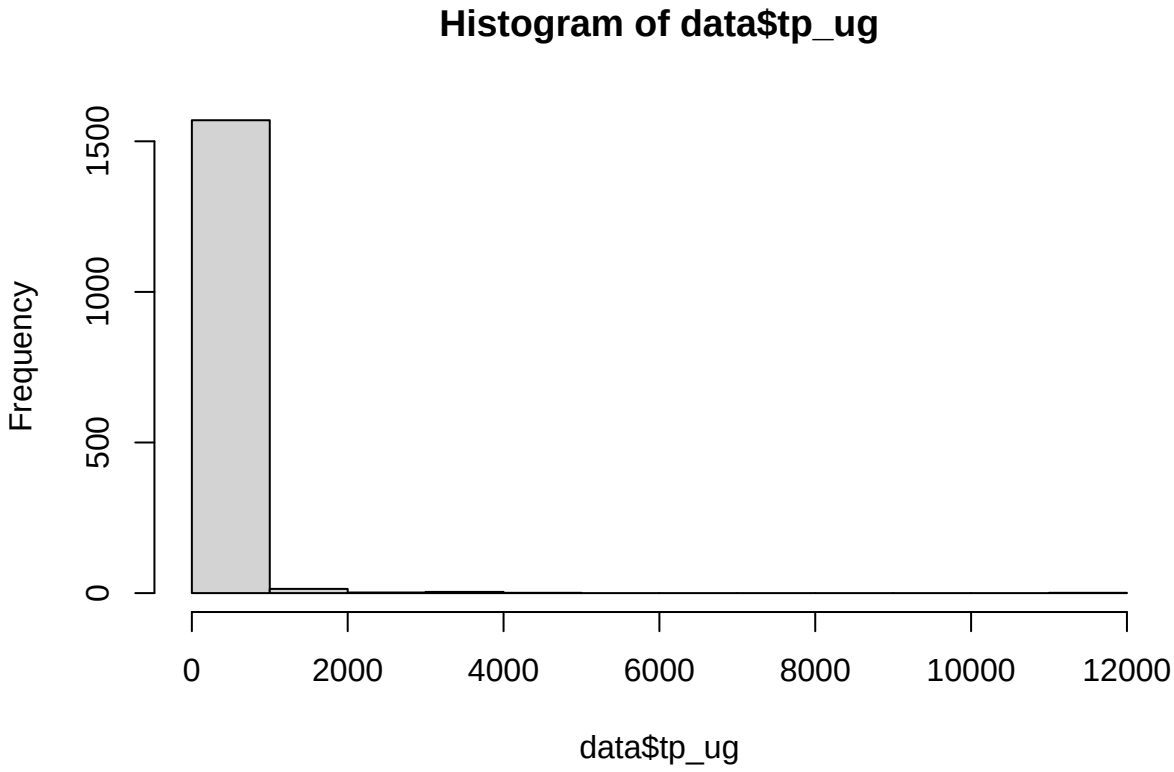
GEO Class models

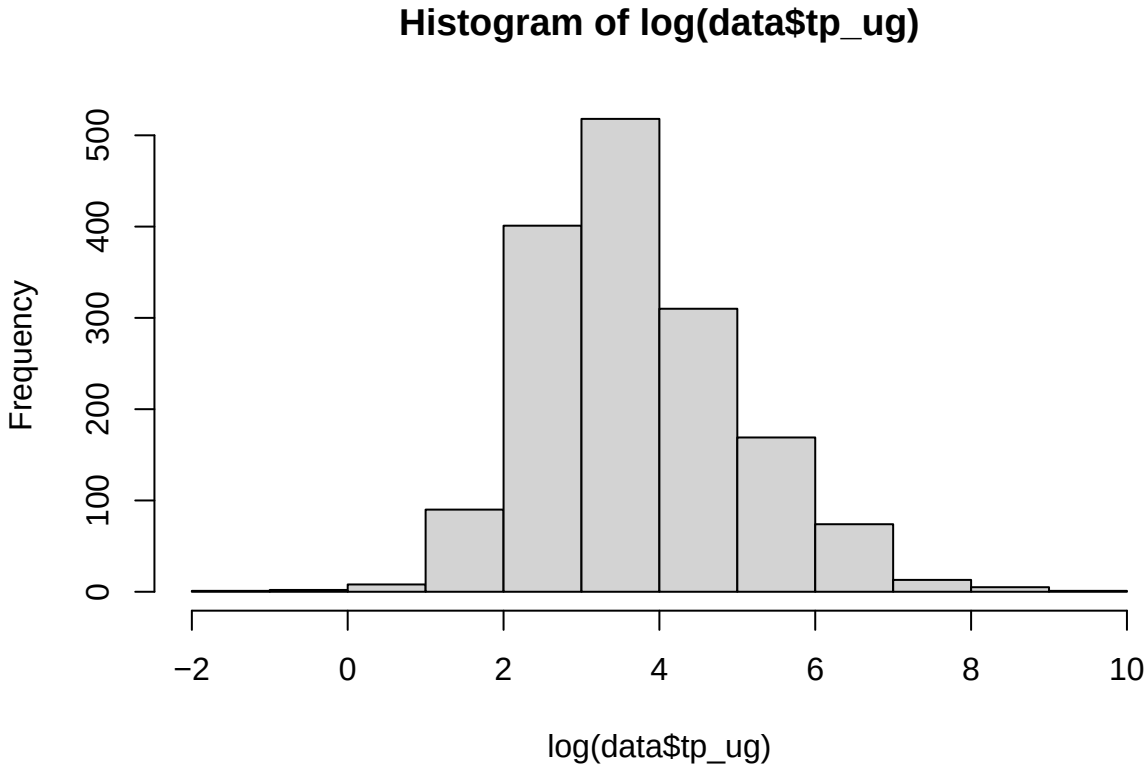
```
##      lake_climate8110norm_ppt_mmperyr lake_climate8110norm_tmean_degc
## [1,]                          1014.4612                        12.667676
## [2,]                          1352.5294                        22.050747
## [3,]                           356.7877                         5.211880
## [4,]                          1542.9588                        19.790745
## [5,]                           818.1258                         6.806020
## [6,]                          1573.0031                         4.331956
## [7,]                           259.8651                         7.757644
##      ws_soil_kffact ws_soil_depthtobedrock_cm ws_soil_sand_pct ws_soil_silt_pct
## [1,]     0.37614340                 3.355516         25.58247        52.283109
## [2,]     0.08554742                 2.583093         87.91728         8.991113
## [3,]     0.31323216                 3.775530         33.21197        38.140647
## [4,]     0.47610411                 3.279830         11.20137        65.372980
## [5,]     0.10039301                 3.485569         66.51206        22.894704
## [6,]     0.23044797                 2.843953         54.12616        39.795097
## [7,]     0.27335221                 3.189607         51.24208        28.861086
##      hu12_baseflowindex_pct hu12_runoff_inperyr ws_lake_arearatio
## [1,]               24.80337          11.8476391         3.3039491
## [2,]               40.77829          12.7027326         0.8544751
## [3,]               32.04031           0.5300966         0.7726166
## [4,]               16.16385          20.6229107        -0.5391557
## [5,]               80.71824          14.2022267         1.3130543
## [6,]               70.38442          43.5632515         0.8319672
## [7,]               54.92286           0.5108218         2.4573008
##      lake_elevation_m ws_nlcd16_totfor_pct ws_nlcd16_totwetl_pct
## [1,]         2.460466            -1.667168             -4.161225
## [2,]         2.016779            -1.785667             -3.068301
## [3,]         2.993445            -4.558116             -4.572404
## [4,]         1.956773            -4.536390             -1.854694
## [5,]         2.538599            -2.648372              2.506625
## [6,]         3.200891             4.071658             -4.525694
## [7,]         3.269668            -4.520580             -4.509537
##      ws_nlcd16_shrub_pct ws_landform_notgentle_pct ws_streams_all_mperha
## [1,]          -4.418235                -4.196914             1.6669242
## [2,]          -3.756547                -4.563691            -0.7481135
## [3,]          -4.582865                -4.582963            -0.9747965
## [4,]          -4.526579                -4.575825            -0.9778994
## [5,]          -4.568419                -4.575160            -0.1915795
## [6,]          -4.557666                 4.231427            -0.4913738
## [7,]           4.157319                -1.928576             1.0261469
```

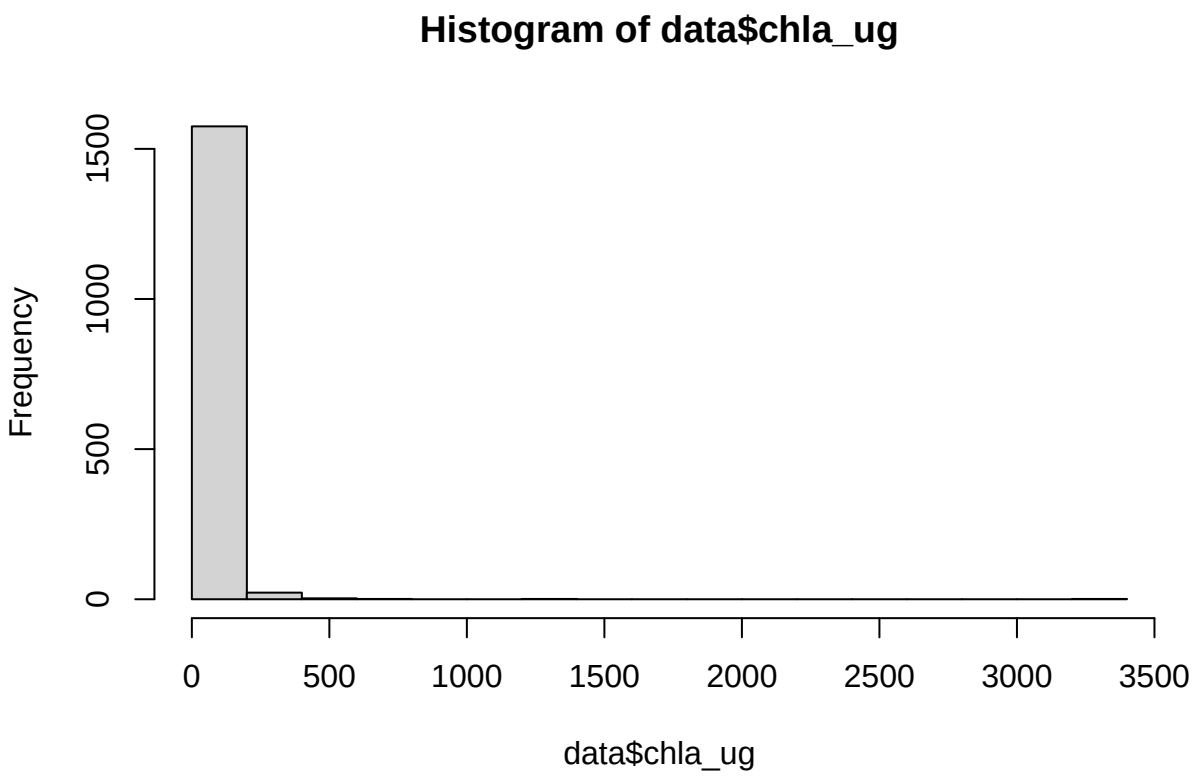
```
##  [1] "X"                         "site_id"
##  [3] "uid"                       "comid"
##  [5] "date_col"                  "ag_eco9"
##  [7] "lat_dd83"                  "lon_dd83"
##  [9] "area_ha"                   "tp_ug"
```

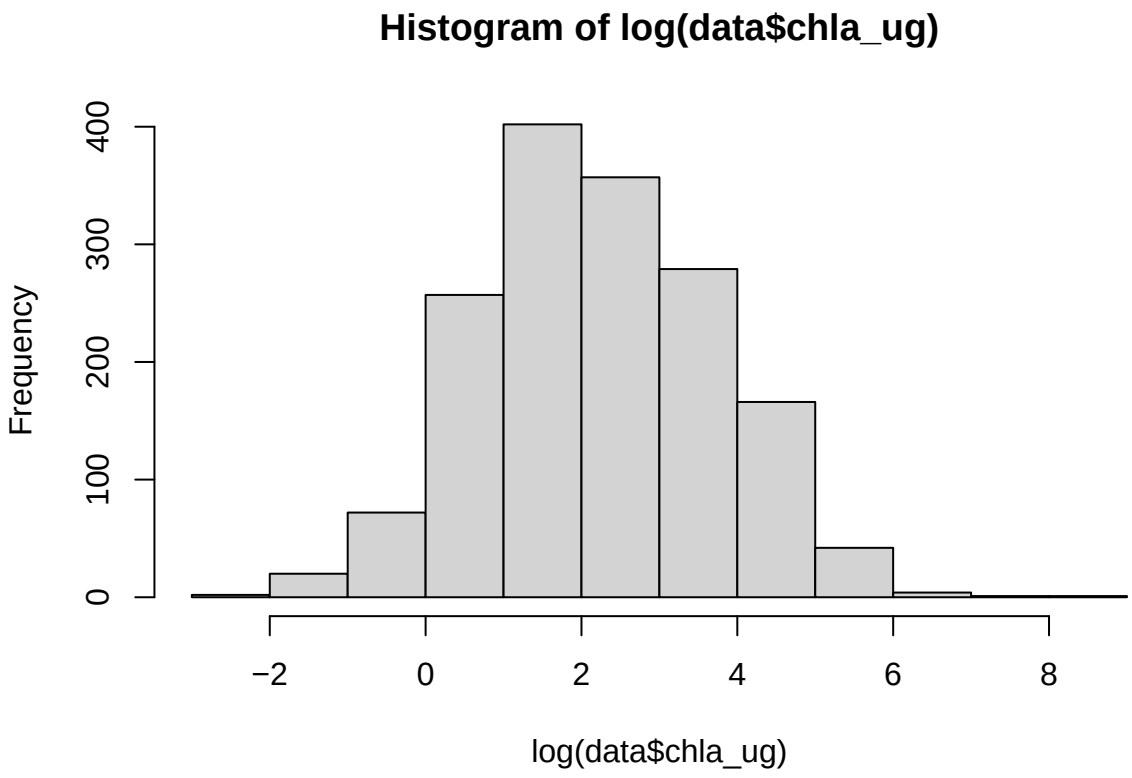
```
## [11] "nitrate_mg"                "nitrate_nitrite_mg"
## [13] "nitrite_mg"                "ammonia_mg"
## [15] "tn_ug"                     "doc_mg"
## [17] "toc_mg"                    "site_depth"
## [19] "chla_ug"                   "secchi_m"
## [21] "lake_nhdid"                "lagoslakeid"
## [23] "year"                      "lake_connectivity_permanent"
## [25] "lake_maxdepth_m"           "w.arch1"
## [27] "w.arch2"                   "w.arch3"
## [29] "w.arch4"                   "w.arch5"
## [31] "w.arch6"                   "w.arch7"
## [33] "max.arch"                  "w.max.arch"
```

Models and plots





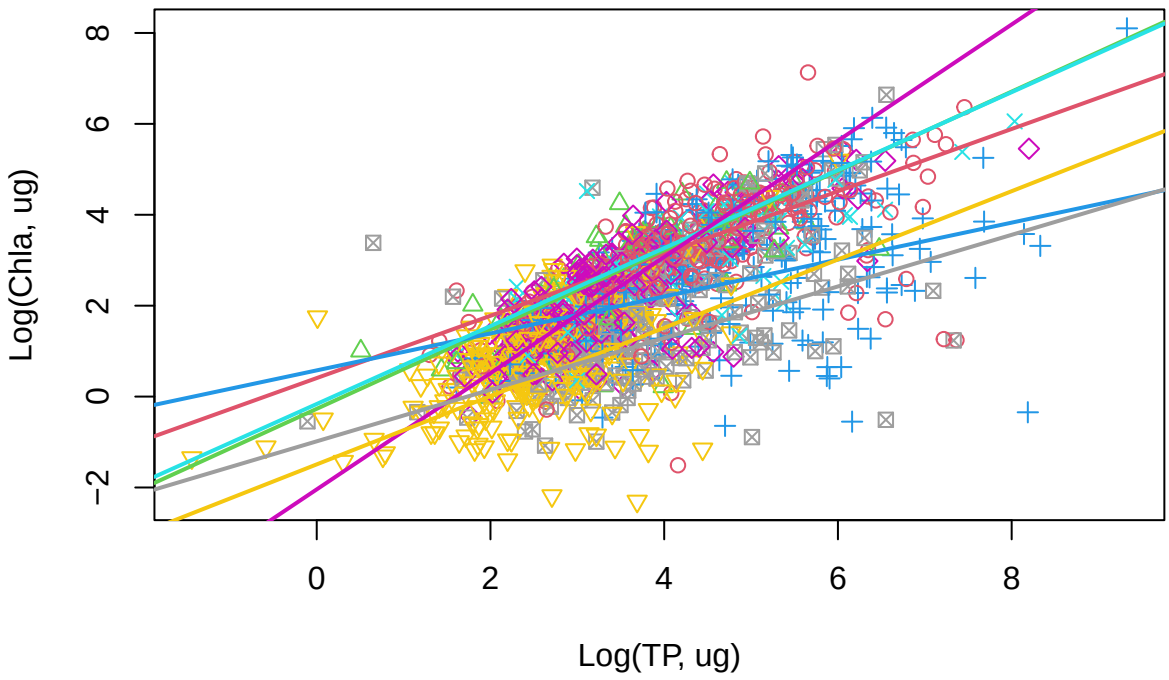

Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

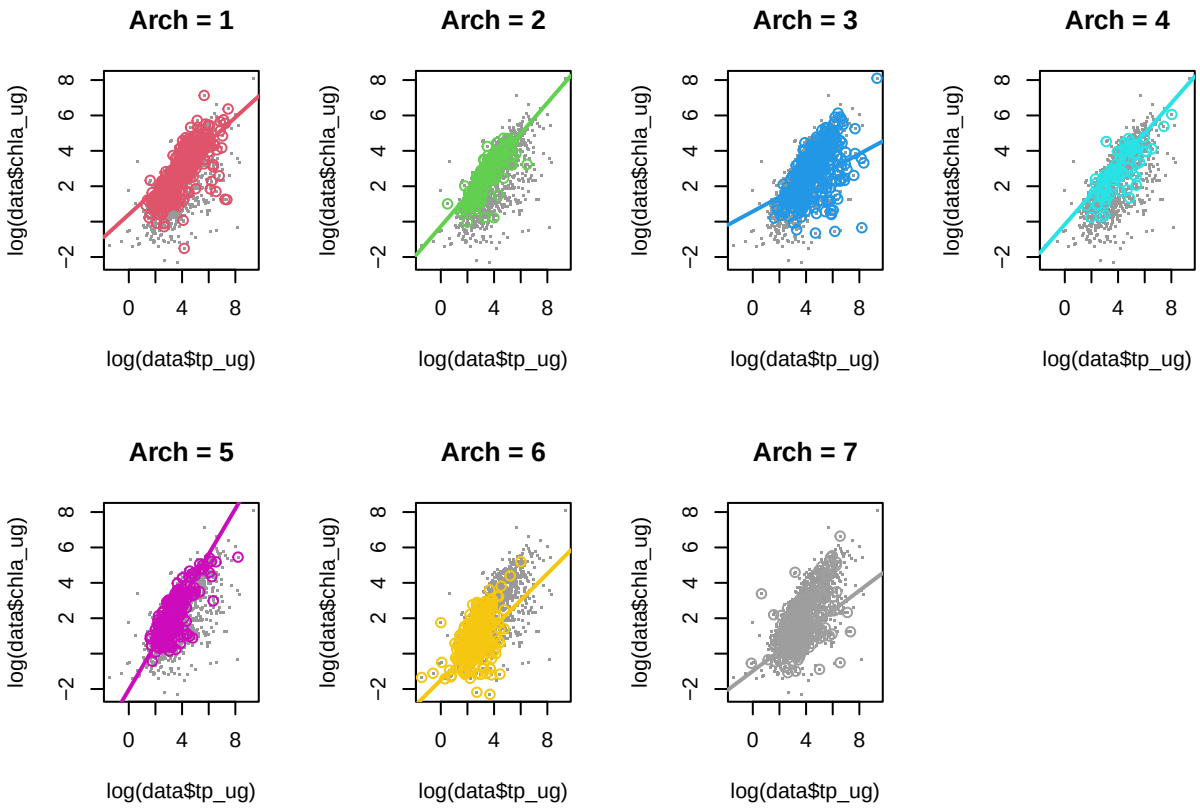



```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(tp_ug) + log(tp_ug):w.arch2 + log(tp_ug):w.arch3 +
##     log(tp_ug):w.arch4 + log(tp_ug):w.arch5 + log(tp_ug):w.arch6 +
##     log(tp_ug):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.7171 -0.5269  0.0689  0.5933  3.6866
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         0.40751    0.34193   1.192  0.23351
## w.arch2            -0.67691    0.67015  -1.010  0.31261
## w.arch3             0.16878    0.48807   0.346  0.72953
## w.arch4            -0.57103    0.76826  -0.743  0.45743
## w.arch5            -2.44977    0.55412  -4.421 1.05e-05 ***
## w.arch6            -1.89937    0.46971  -4.044 5.52e-05 ***
## w.arch7            -1.39179    0.51067  -2.725  0.00649 **
## log(tp_ug)          0.68499    0.07941   8.626  < 2e-16 ***
## w.arch2:log(tp_ug)  0.18748    0.17218   1.089  0.27639
## w.arch3:log(tp_ug) -0.27868    0.11072  -2.517  0.01193 *
## w.arch4:log(tp_ug)  0.17256    0.17691   0.975  0.32950
## w.arch5:log(tp_ug)  0.59364    0.13877   4.278 2.00e-05 ***
## w.arch6:log(tp_ug)  0.06632    0.12691   0.523  0.60133
```

```
## w.arch7:log(tp_ug) -0.11712    0.12633  -0.927  0.35405
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9483 on 1578 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5926, Adjusted R-squared:  0.5893
## F-statistic: 176.6 on 13 and 1578 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(tp_ug) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.8993 -0.5558  0.0792  0.6621  3.8313
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)          0.113845   0.178737   0.637 0.524255
## log(tp_ug)           0.735065   0.042955  17.113  < 2e-16 ***
## max.arch            -0.144920   0.038102  -3.803 0.000148 ***
## log(tp_ug):max.arch -0.005794   0.009841  -0.589 0.556112
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.007 on 1588 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5376, Adjusted R-squared:  0.5367
## F-statistic: 615.5 on 3 and 1588 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(tp_ug) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.7682 -0.4974  0.0771  0.5554  3.7220
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -0.43168    0.27542  -1.567  0.11723
## log(tp_ug)             0.84305    0.06657  12.664  < 2e-16 ***
## ag_eco9NAP            -1.02437    0.38067  -2.691  0.00720 **
## ag_eco9NPL             0.14374    0.45161   0.318  0.75031
## ag_eco9SAP            -0.30074    0.37147  -0.810  0.41829
## ag_eco9SPL             0.20176    0.40317   0.500  0.61685
## ag_eco9TPL             0.10026    0.36077   0.278  0.78113
## ag_eco9UMW            -0.94821    0.37103  -2.556  0.01069 *
## ag_eco9WMT            -0.96976    0.32441  -2.989  0.00284 **
## ag_eco9XER            -0.33176    0.37589  -0.883  0.37759
## log(tp_ug):ag_eco9NAP  0.28604    0.11209   2.552  0.01081 *
## log(tp_ug):ag_eco9NPL -0.26757    0.09587  -2.791  0.00532 **
## log(tp_ug):ag_eco9SAP  0.09008    0.09866   0.913  0.36134
```

```
## log(tp_ug):ag_eco9SPL -0.16837    0.09255  -1.819  0.06908 .
## log(tp_ug):ag_eco9TPL -0.07161    0.08367  -0.856  0.39220
## log(tp_ug):ag_eco9UMW  0.21875    0.09938   2.201  0.02787 *
## log(tp_ug):ag_eco9WMT -0.05881    0.08451  -0.696  0.48659
## log(tp_ug):ag_eco9XER -0.19138    0.09004  -2.126  0.03370 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9507 on 1574 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5916, Adjusted R-squared:  0.5872
## F-statistic: 134.1 on 17 and 1574 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(tp_ug), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0841 -0.5470  0.1509  0.7363  3.5899
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.72081    0.08064  -8.939   <2e-16 ***
## log(tp_ug)   0.78911    0.02046  38.566   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.064 on 1590 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.4833, Adjusted R-squared:  0.483
## F-statistic:  1487 on 1 and 1590 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
0
2
4
6
8
Log(TP, ug)




```
aa.r.sq
```

```
## [1] 0.5892852
```

```
max.arch.r.sq
```

```
## [1] 0.5367407
```

```
ecoreg.r.sq
```

```
## [1] 0.5871549
```

```
global.r.sq
```

```
## [1] 0.4829982
```

```
aa.AIC
```

```
## [1] 4364.732
```

```
max.arch.AIC
```

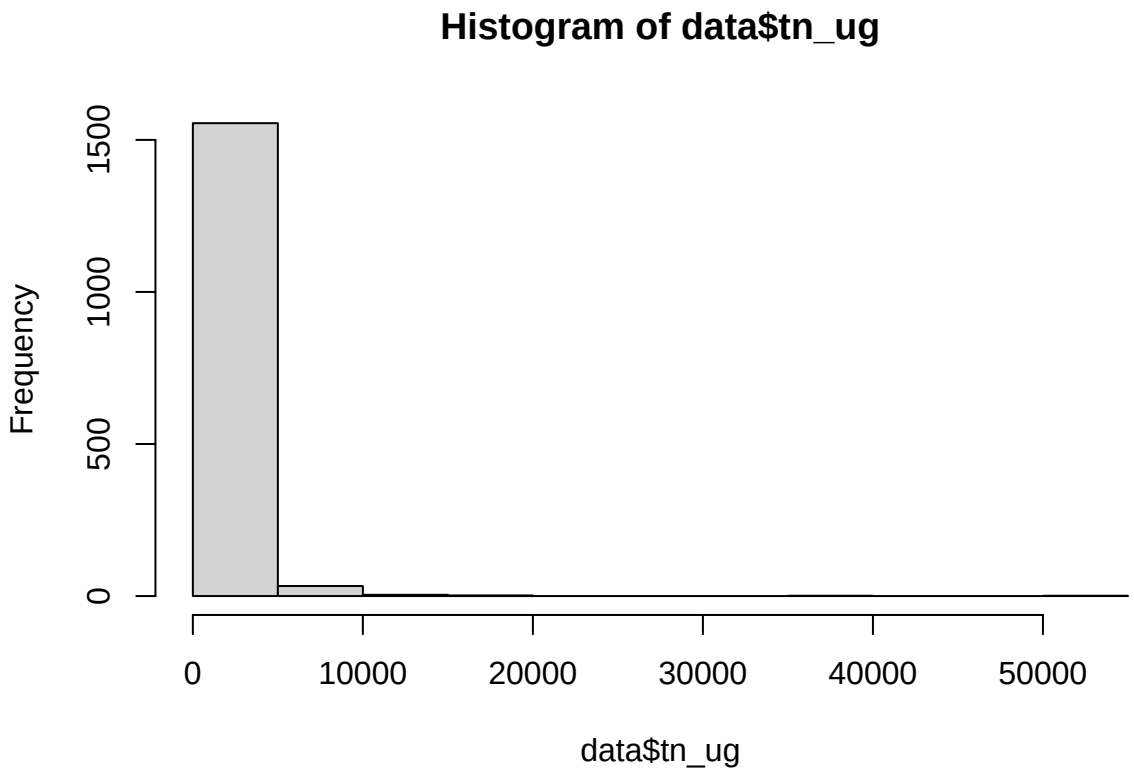
```
## [1] 4546.447
```

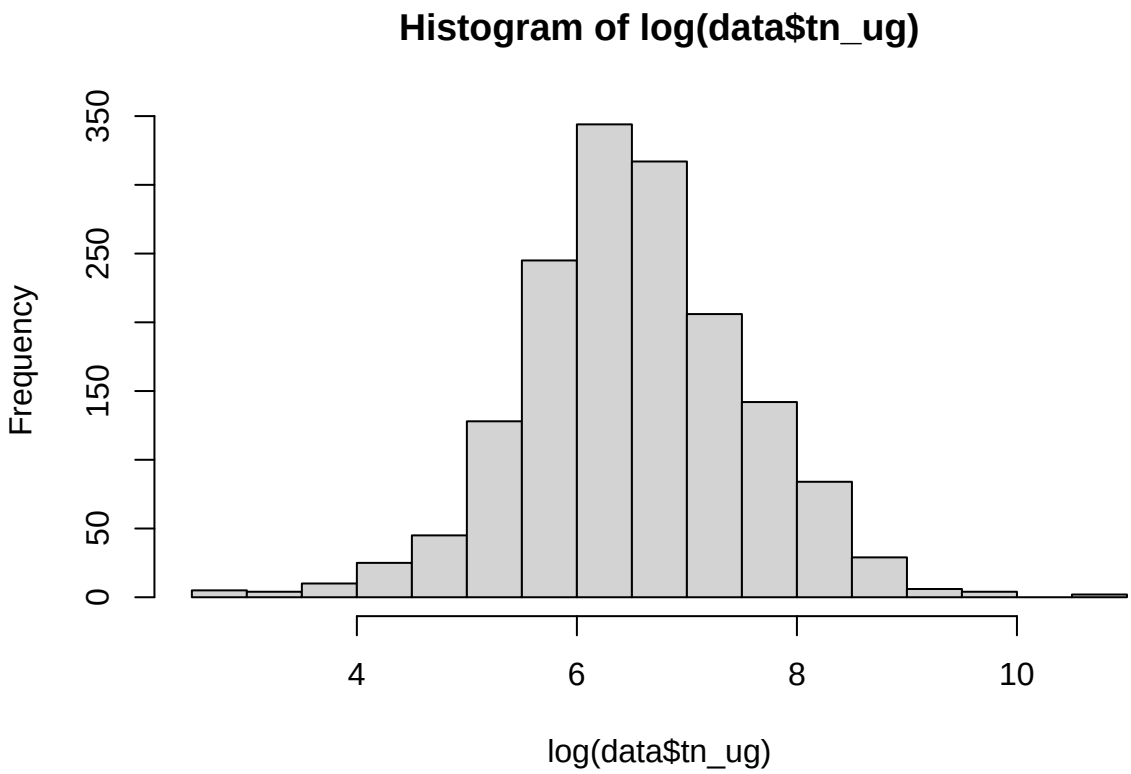
```
ecoreg.AIC
```

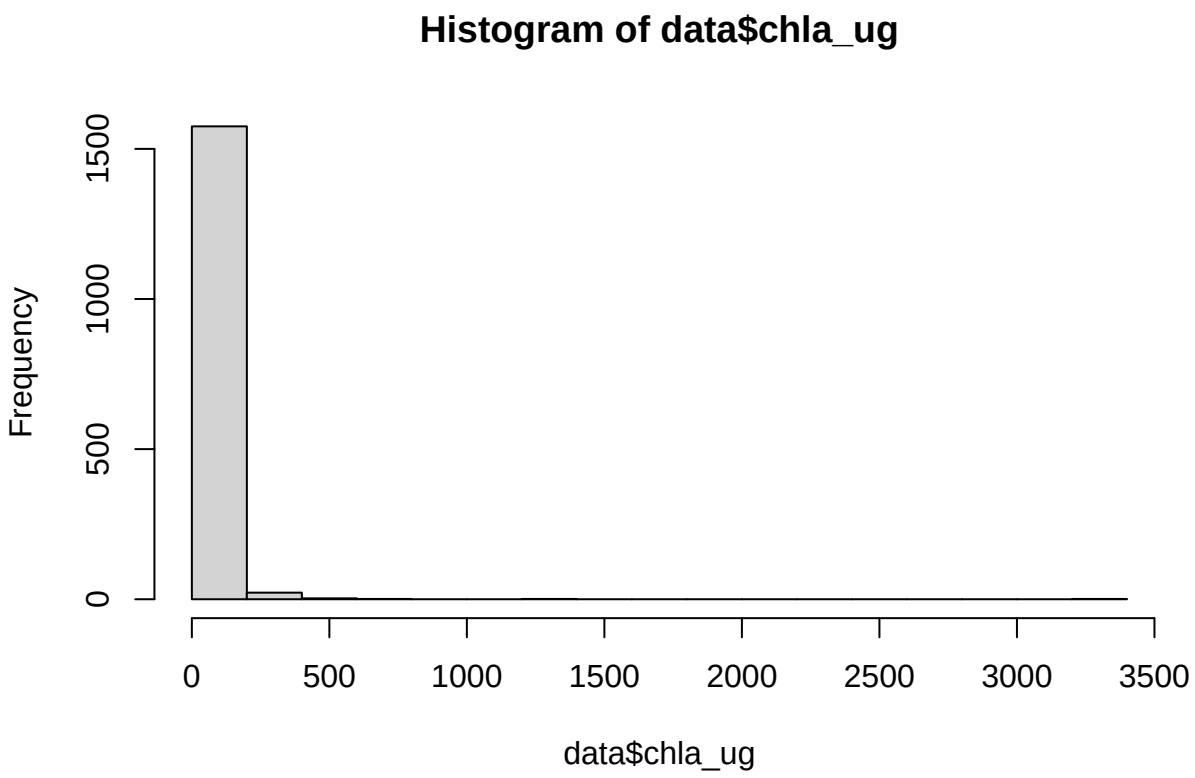
```
## [1] 4376.928
```

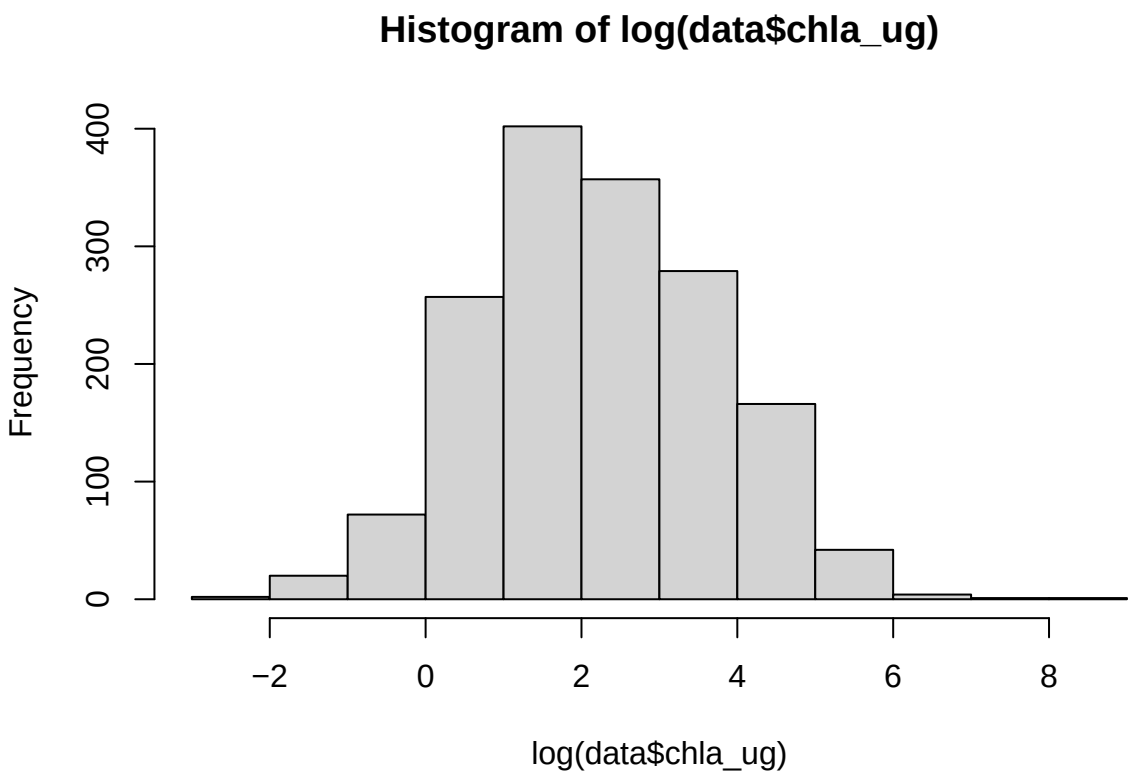
```
global.AIC
```

```
## [1] 4719.188
```




Histogram of log(data$tn_ug)
Frequency
0
50
150
250
350
4
6
8
10
log(data$tn_ug)


Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

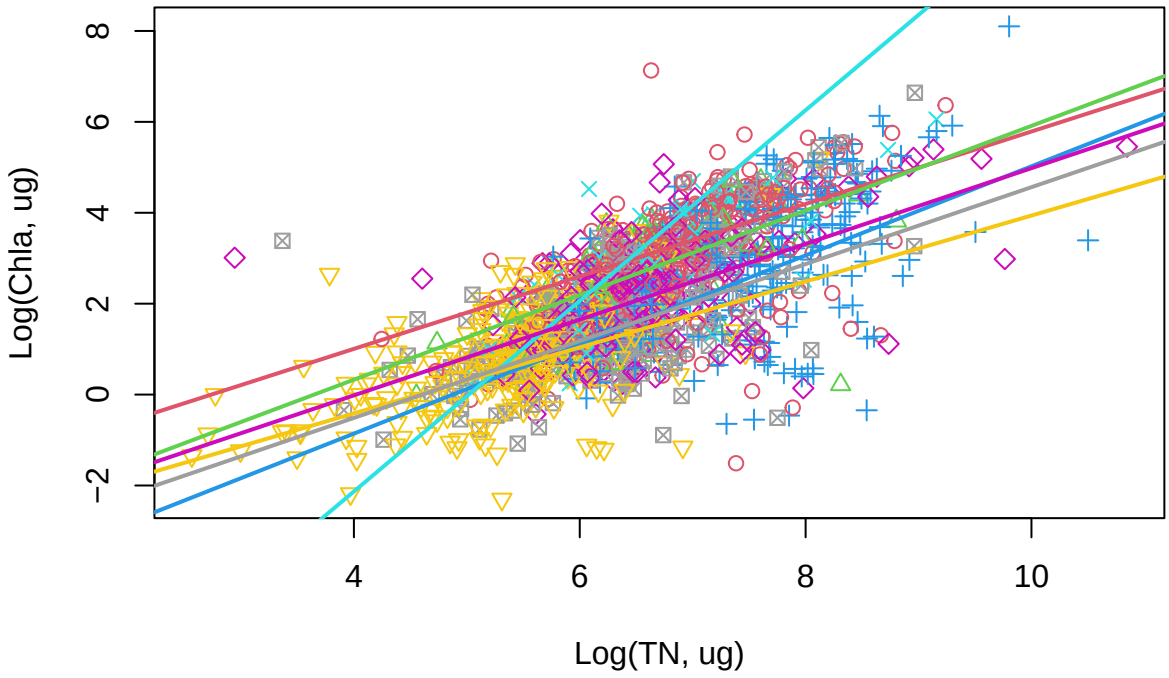


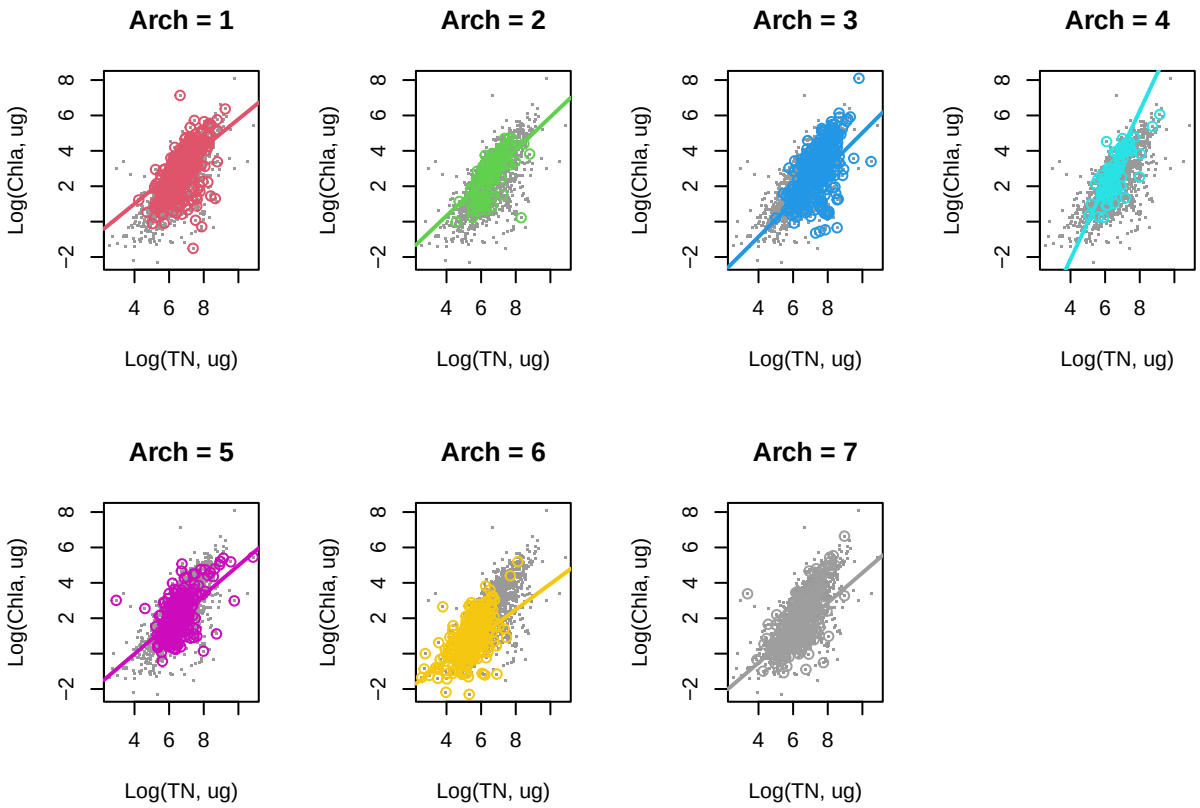

```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(tn_ug) + log(tn_ug):w.arch2 + log(tn_ug):w.arch3 +
##     log(tn_ug):w.arch4 + log(tn_ug):w.arch5 + log(tn_ug):w.arch6 +
##     log(tn_ug):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.5611 -0.5751  0.0663  0.6423  4.7257
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -2.18244    0.81454  -2.679  0.00745 **
## w.arch2            -1.21272    1.74475  -0.695  0.48711
## w.arch3            -2.59763    1.16997  -2.220  0.02654 *
## w.arch4            -8.33618    1.94054  -4.296 1.85e-05 ***
## w.arch5            -1.16674    1.30090  -0.897  0.36992
## w.arch6            -1.13247    1.03571  -1.093  0.27437
## w.arch7            -1.71502    1.16389  -1.474  0.14081
## log(tn_ug)          0.79700    0.11858   6.721 2.50e-11 ***
## w.arch2:log(tn_ug)  0.13367    0.25894   0.516  0.60579
## w.arch3:log(tn_ug)  0.18322    0.16512   1.110  0.26733
## w.arch4:log(tn_ug)  1.29980    0.28630   4.540 6.05e-06 ***
## w.arch5:log(tn_ug)  0.03605    0.19230   0.187  0.85133
## w.arch6:log(tn_ug) -0.07161    0.16232  -0.441  0.65913
```

```
## w.arch7:log(tn_ug)  0.04907    0.17679   0.278  0.78139
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9993 on 1582 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.5473, Adjusted R-squared:  0.5436
## F-statistic: 147.1 on 13 and 1582 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(tn_ug) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.9154 -0.6246  0.0604  0.7104  4.4403
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -3.57376    0.43635  -8.190  5.3e-16 ***
## log(tn_ug)           0.96522    0.06431  15.010  < 2e-16 ***
## max.arch            -0.03151    0.08960  -0.352    0.725
## log(tn_ug):max.arch -0.01590    0.01376  -1.156    0.248
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.038 on 1592 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.5085, Adjusted R-squared:  0.5076
## F-statistic: 549.1 on 3 and 1592 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(tn_ug) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.8132 -0.5837  0.0670  0.6501  4.6638
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -3.185785   0.705193  -4.518 6.72e-06 ***
## log(tn_ug)               0.909789   0.104188   8.732  < 2e-16 ***
## ag_eco9NAP              -4.083888   1.115814  -3.660 0.000261 ***
## ag_eco9NPL              -1.896096   1.081472  -1.753 0.079752 .
## ag_eco9SAP              -1.638042   0.984349  -1.664 0.096294 .
## ag_eco9SPL              -1.347213   0.993524  -1.356 0.175295
## ag_eco9TPL              -1.712215   0.937920  -1.826 0.068108 .
## ag_eco9UMW              -0.417405   0.947333  -0.441 0.659555
## ag_eco9WMT              -0.876969   0.786405  -1.115 0.264951
## ag_eco9XER              -0.908502   0.914717  -0.993 0.320762
## log(tn_ug):ag_eco9NAP    0.597203   0.178343   3.349 0.000831 ***
## log(tn_ug):ag_eco9NPL    0.094901   0.148977   0.637 0.524203
## log(tn_ug):ag_eco9SAP    0.252038   0.152331   1.655 0.098216 .
```

```
## log(tn_ug):ag_eco9SPL  0.124669   0.143595   0.868 0.385415
## log(tn_ug):ag_eco9TPL  0.200756   0.134768   1.490 0.136518
## log(tn_ug):ag_eco9UMW -0.040052   0.141770  -0.283 0.777584
## log(tn_ug):ag_eco9WMT -0.003408   0.120760  -0.028 0.977489
## log(tn_ug):ag_eco9XER  0.018101   0.137646   0.132 0.895394
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.015 on 1578 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.534,  Adjusted R-squared:  0.529
## F-statistic: 106.4 on 17 and 1578 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = log(chla_ug) ~ log(tn_ug), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.5870 -0.6361  0.0803  0.7601  4.8058
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -4.29788    0.17362  -24.75   <2e-16 ***
## log(tn_ug)   0.99863    0.02631   37.95   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.072 on 1594 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.4747, Adjusted R-squared:  0.4744
## F-statistic:  1440 on 1 and 1594 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
4
6
8
10
Log(TN, ug)




```
aa.r.sq
```

```
## [1] 0.5435783
```

```
max.arch.r.sq
```

```
## [1] 0.5076073
```

```
ecoreg.r.sq
```

```
## [1] 0.529019
```

```
global.r.sq
```

```
## [1] 0.4743763
```

```
aa.AIC
```

```
## [1] 4542.833
```

```
max.arch.AIC
```

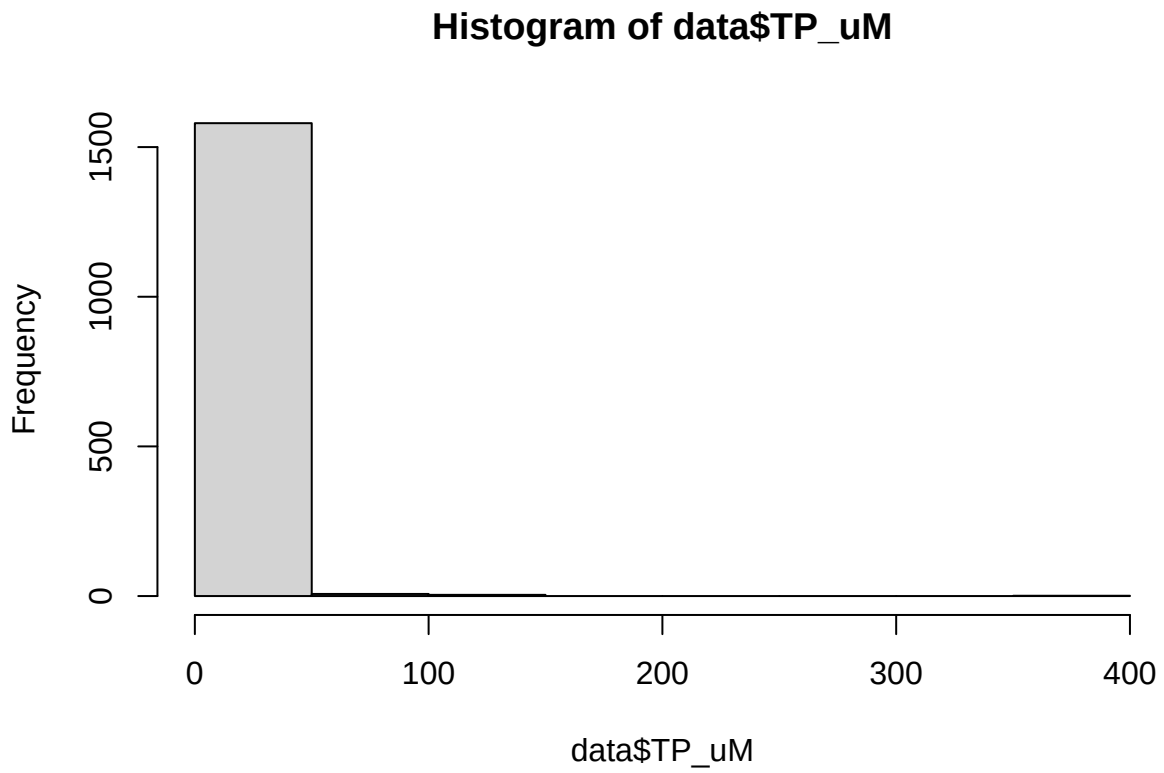
```
## [1] 4653.962
```

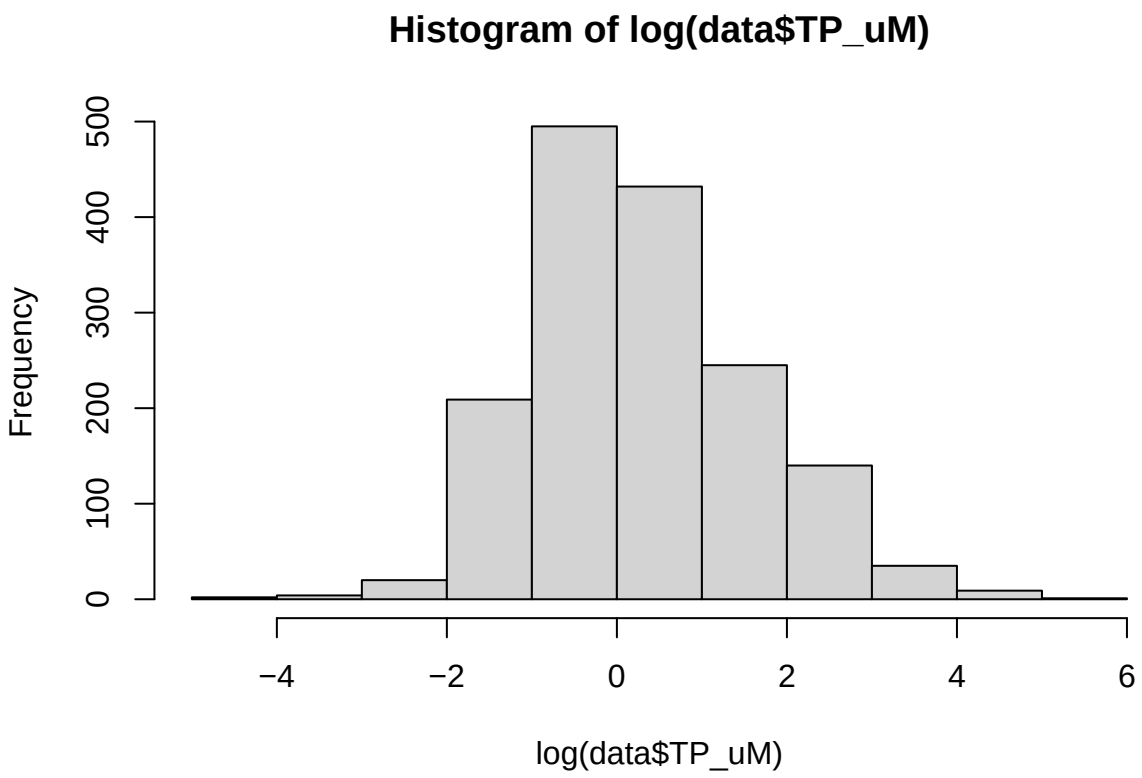
```
ecoreg.AIC
```

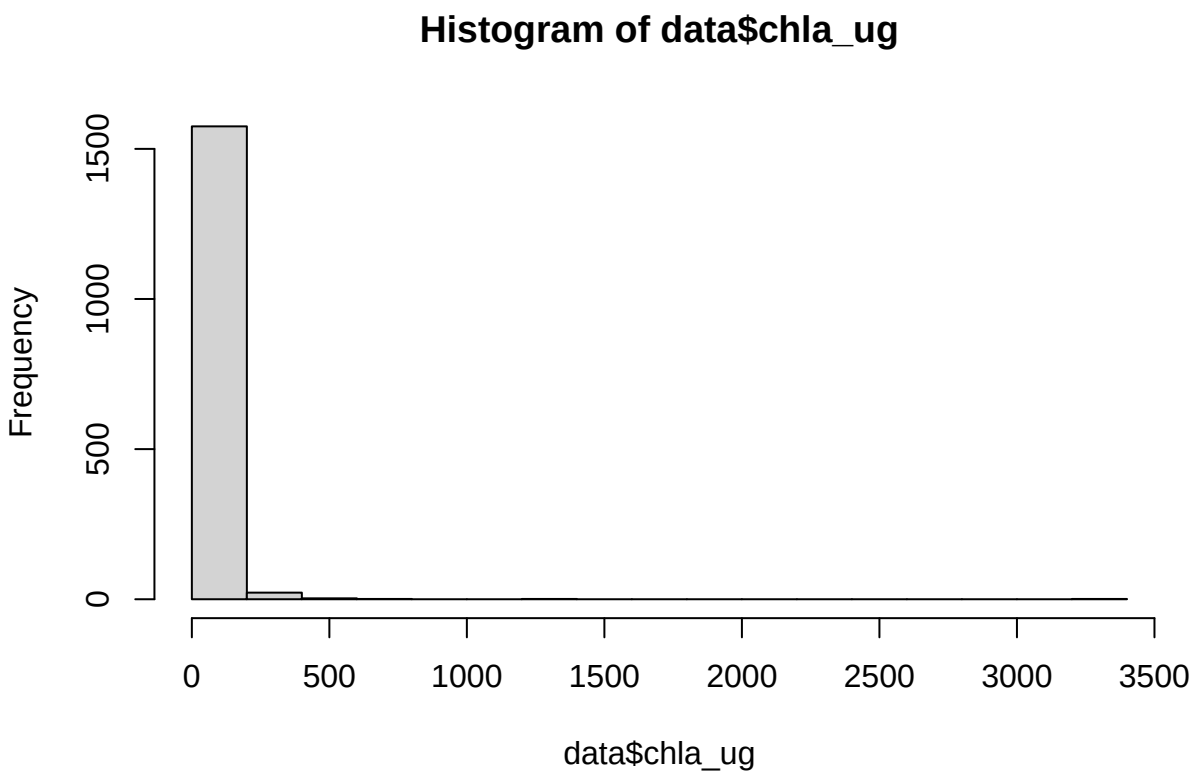
```
## [1] 4596.908
```

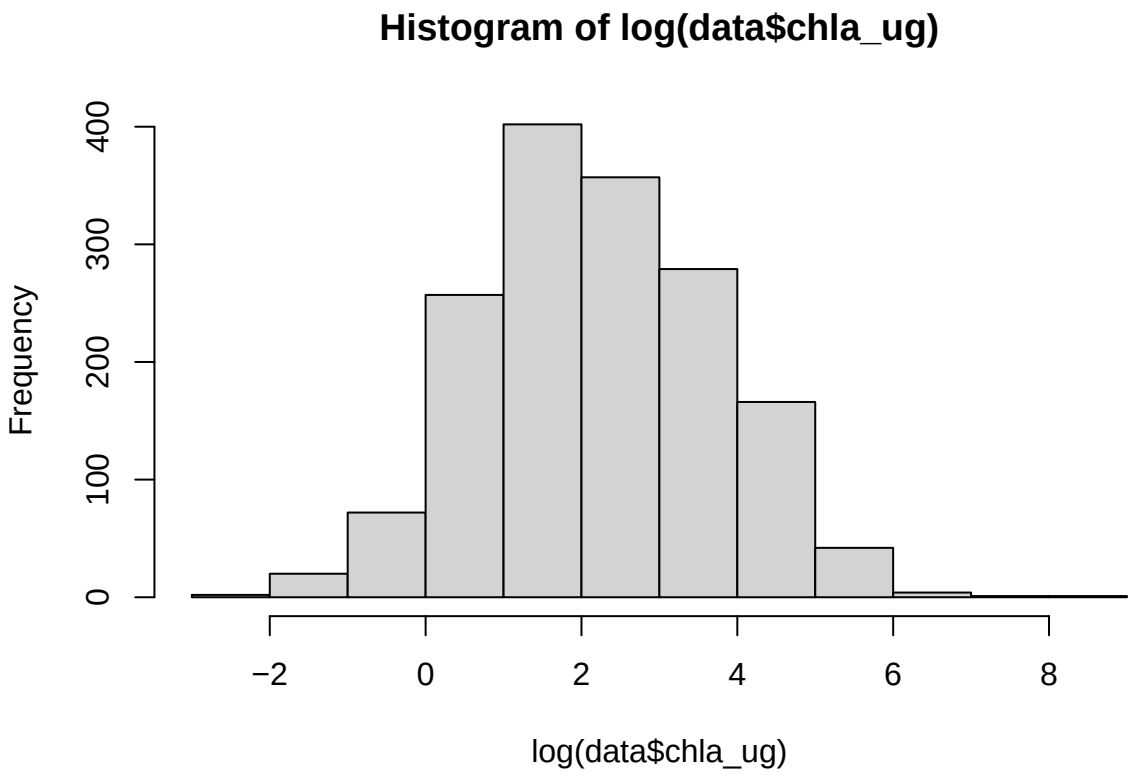
```
global.AIC
```

```
## [1] 4756.199
```




Histogram of log(data$TP_uM)
Frequency
0
100
200
300
400
500
−4
−2
0
2
4
6
log(data$TP_uM)


Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug



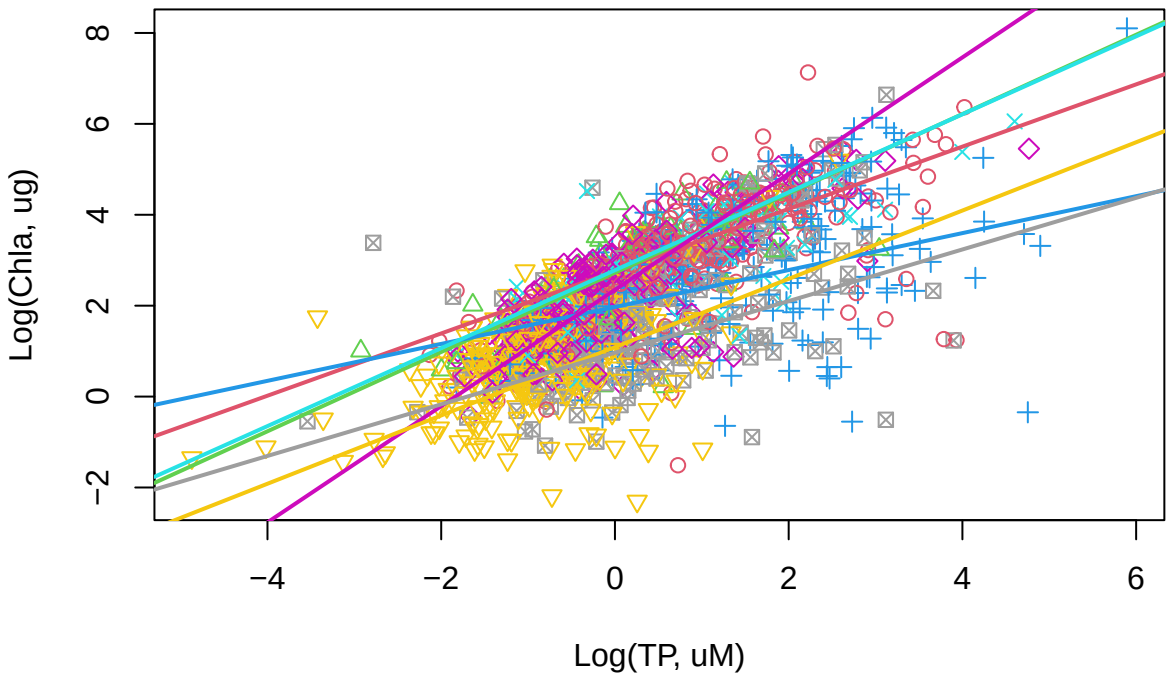

```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(TP_uM) + log(TP_uM):w.arch2 + log(TP_uM):w.arch3 +
##     log(TP_uM):w.arch4 + log(TP_uM):w.arch5 + log(TP_uM):w.arch6 +
##     log(TP_uM):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.7171 -0.5269  0.0689  0.5933  3.6866
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         2.75908    0.11620  23.743  < 2e-16 ***
## w.arch2            -0.03330    0.21411  -0.156   0.8764
## w.arch3            -0.78795    0.17150  -4.594 4.69e-06 ***
## w.arch4             0.02139    0.27277   0.078   0.9375
## w.arch5            -0.41180    0.18310  -2.249   0.0246 *
## w.arch6            -1.67168    0.19490  -8.577  < 2e-16 ***
## w.arch7            -1.79385    0.16825 -10.662  < 2e-16 ***
## log(TP_uM)          0.68499    0.07941   8.626  < 2e-16 ***
## w.arch2:log(TP_uM)  0.18748    0.17218   1.089   0.2764
## w.arch3:log(TP_uM) -0.27868    0.11072  -2.517   0.0119 *
## w.arch4:log(TP_uM)  0.17256    0.17691   0.975   0.3295
## w.arch5:log(TP_uM)  0.59364    0.13877   4.278 2.00e-05 ***
## w.arch6:log(TP_uM)  0.06632    0.12691   0.523   0.6013
```

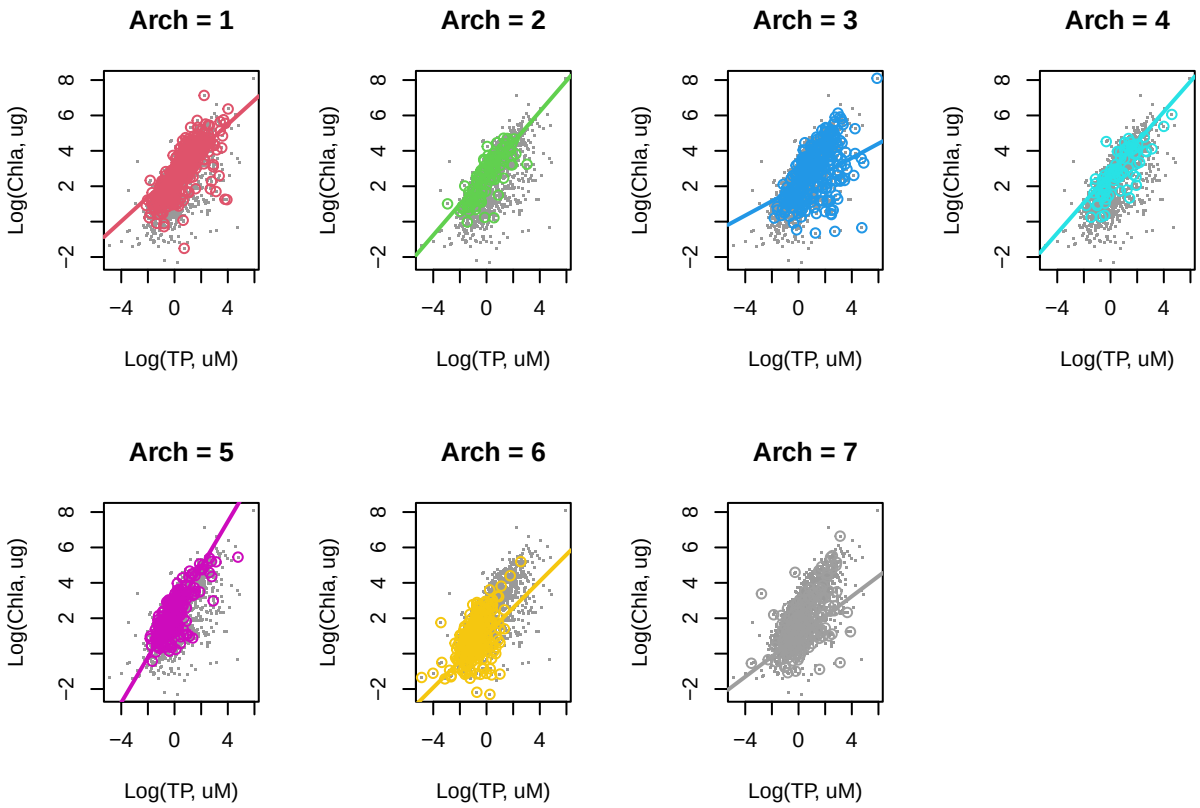
```
## w.arch7:log(TP_uM) -0.11712    0.12633  -0.927   0.3540
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9483 on 1578 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5926, Adjusted R-squared:  0.5893
## F-statistic: 176.6 on 13 and 1578 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = log(chla_ug) ~ log(TP_uM) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.8993 -0.5558  0.0792  0.6621  3.8313
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)          2.637337   0.057246  46.070   <2e-16 ***
## log(TP_uM)           0.735065   0.042955  17.113   <2e-16 ***
## max.arch            -0.164810   0.012400 -13.291   <2e-16 ***
## log(TP_uM):max.arch -0.005794   0.009841  -0.589    0.556
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.007 on 1588 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5376, Adjusted R-squared:  0.5367
## F-statistic: 615.5 on 3 and 1588 DF,  p-value: < 2.2e-16
```

```
##
## Call:
## lm(formula = log(chla_ug) ~ log(TP_uM) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.7682 -0.4974  0.0771  0.5554  3.7220
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             2.462540   0.080993  30.404  < 2e-16 ***
## log(TP_uM)              0.843055   0.066569  12.664  < 2e-16 ***
## ag_eco9NAP             -0.042385   0.125237  -0.338  0.73508
## ag_eco9NPL             -0.774830   0.163532  -4.738 2.35e-06 ***
## ag_eco9SAP              0.008519   0.112764   0.076  0.93979
## ag_eco9SPL             -0.376252   0.131260  -2.866  0.00421 **
## ag_eco9TPL             -0.145579   0.113495  -1.283  0.19979
## ag_eco9UMW             -0.197227   0.101977  -1.934  0.05329 .
## ag_eco9WMT             -1.171675   0.102273 -11.456  < 2e-16 ***
## ag_eco9XER             -0.988757   0.121617  -8.130 8.60e-16 ***
## log(TP_uM):ag_eco9NAP   0.286042   0.112094   2.552  0.01081 *
## log(TP_uM):ag_eco9NPL  -0.267570   0.095870  -2.791  0.00532 **
## log(TP_uM):ag_eco9SAP   0.090085   0.098660   0.913  0.36134
```

```
## log(TP_uM):ag_eco9SPL -0.168367   0.092553  -1.819  0.06908 .
## log(TP_uM):ag_eco9TPL -0.071610   0.083669  -0.856  0.39220
## log(TP_uM):ag_eco9UMW  0.218752   0.099382   2.201  0.02787 *
## log(TP_uM):ag_eco9WMT -0.058815   0.084515  -0.696  0.48659
## log(TP_uM):ag_eco9XER -0.191376   0.090038  -2.126  0.03370 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9507 on 1574 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.5916, Adjusted R-squared:  0.5872
## F-statistic: 134.1 on 17 and 1574 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(TP_uM), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0841 -0.5470  0.1509  0.7363  3.5899
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.98823    0.02730   72.83   <2e-16 ***
## log(TP_uM)   0.78911    0.02046   38.57   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.064 on 1590 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.4833, Adjusted R-squared:  0.483
## F-statistic:  1487 on 1 and 1590 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
−4
−2
0
2
4
6
Log(TP, uM)




```
aa.r.sq
```

```
## [1] 0.5892852
```

```
max.arch.r.sq
```

```
## [1] 0.5367407
```

```
ecoreg.r.sq
```

```
## [1] 0.5871549
```

```
global.r.sq
```

```
## [1] 0.4829982
```

```
aa.AIC
```

```
## [1] 4364.732
```

```
max.arch.AIC
```

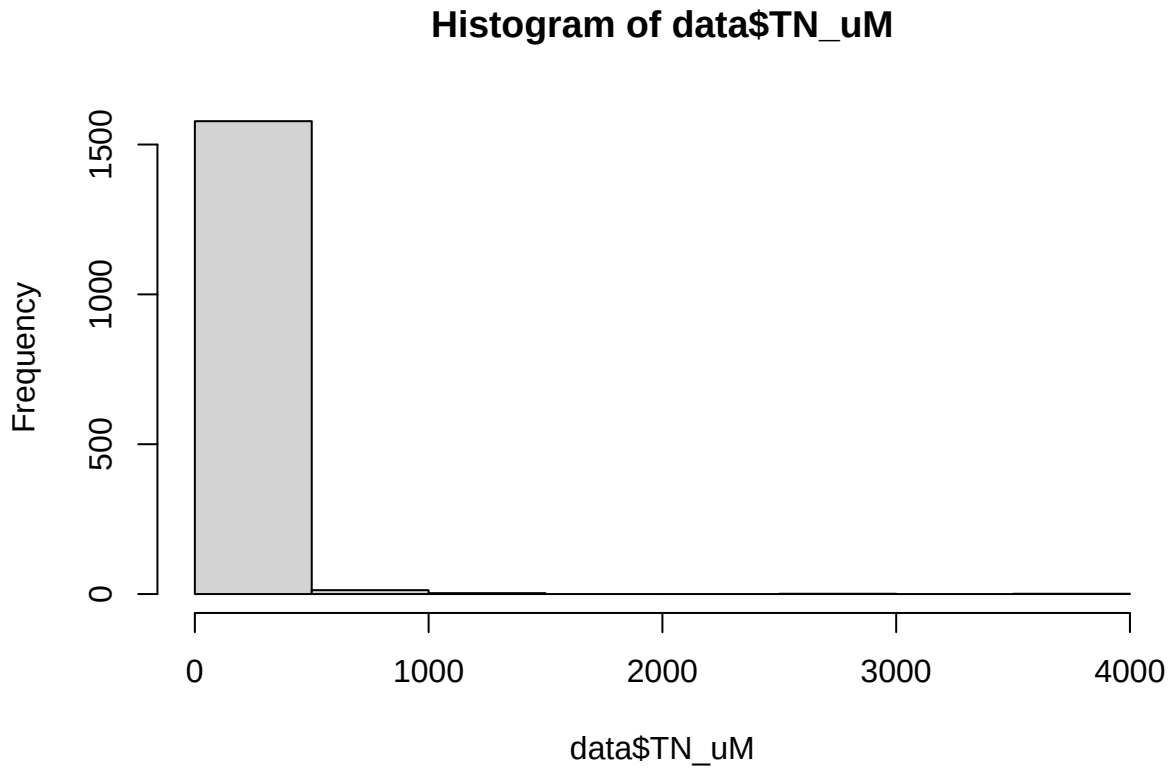
```
## [1] 4546.447
```

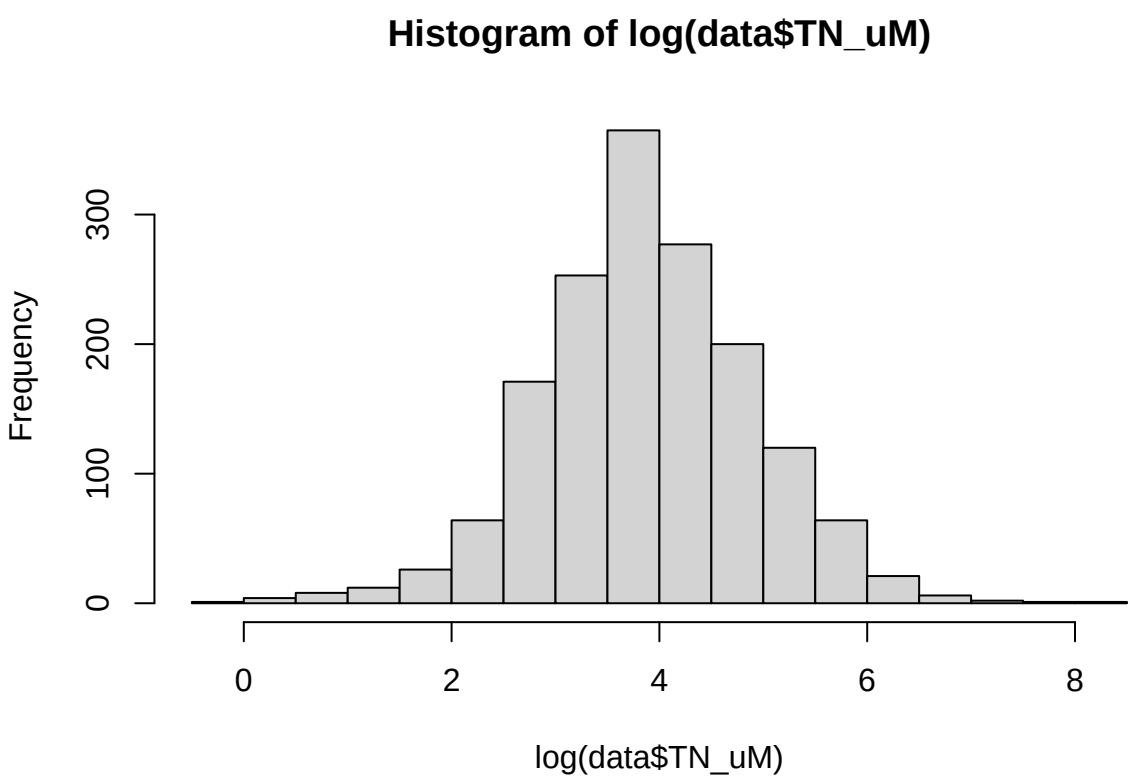
```
ecoreg.AIC
```

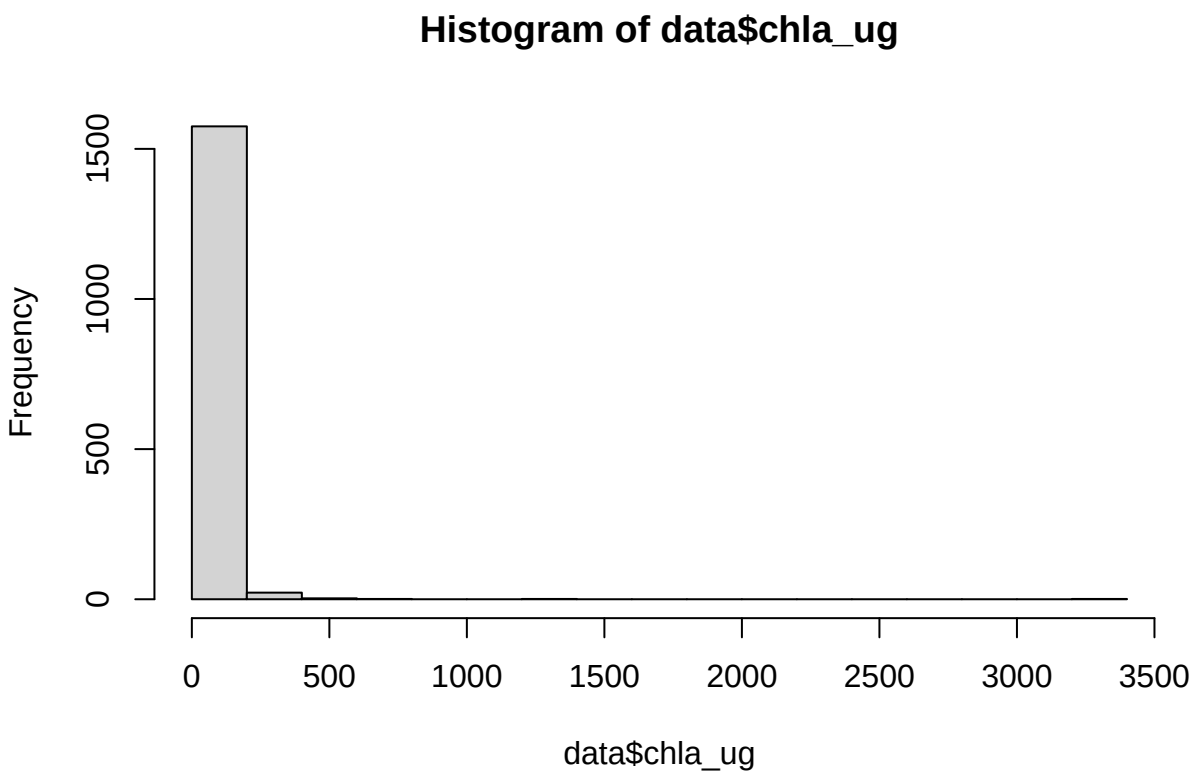
```
## [1] 4376.928
```

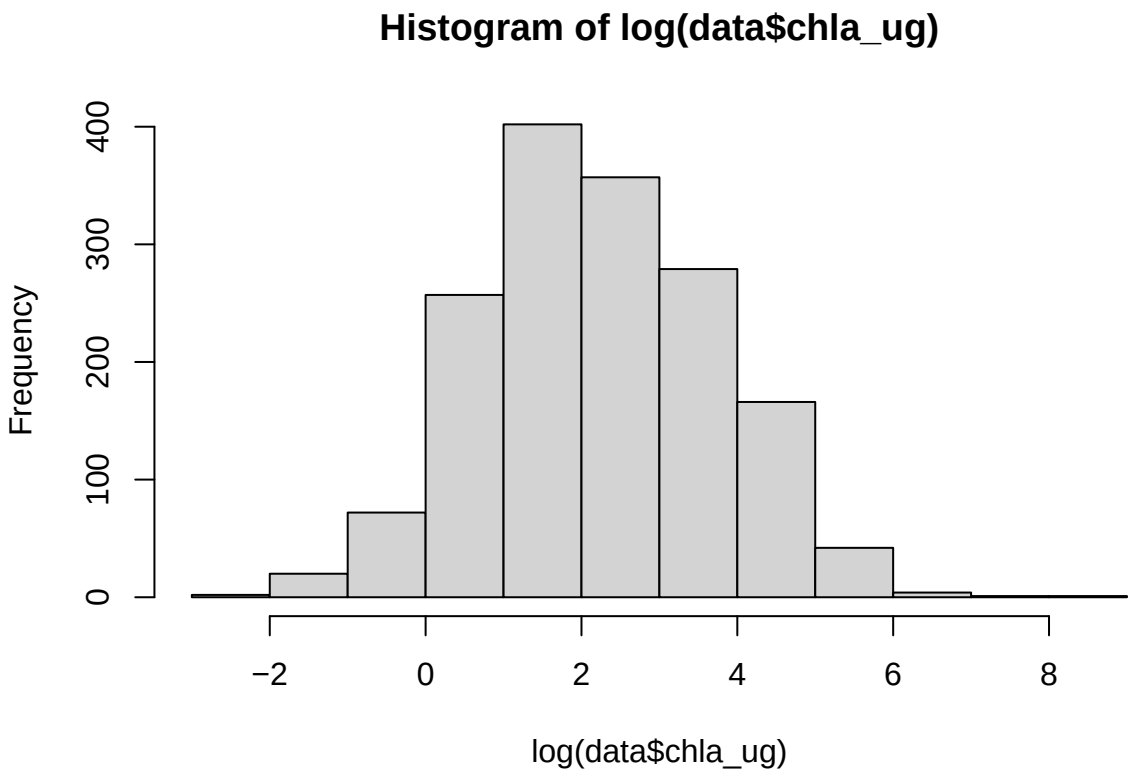
```
global.AIC
```

```
## [1] 4719.188
```




Histogram of log(data$TN_uM)
Frequency
0
100
200
300
0
2
4
6
8
log(data$TN_uM)

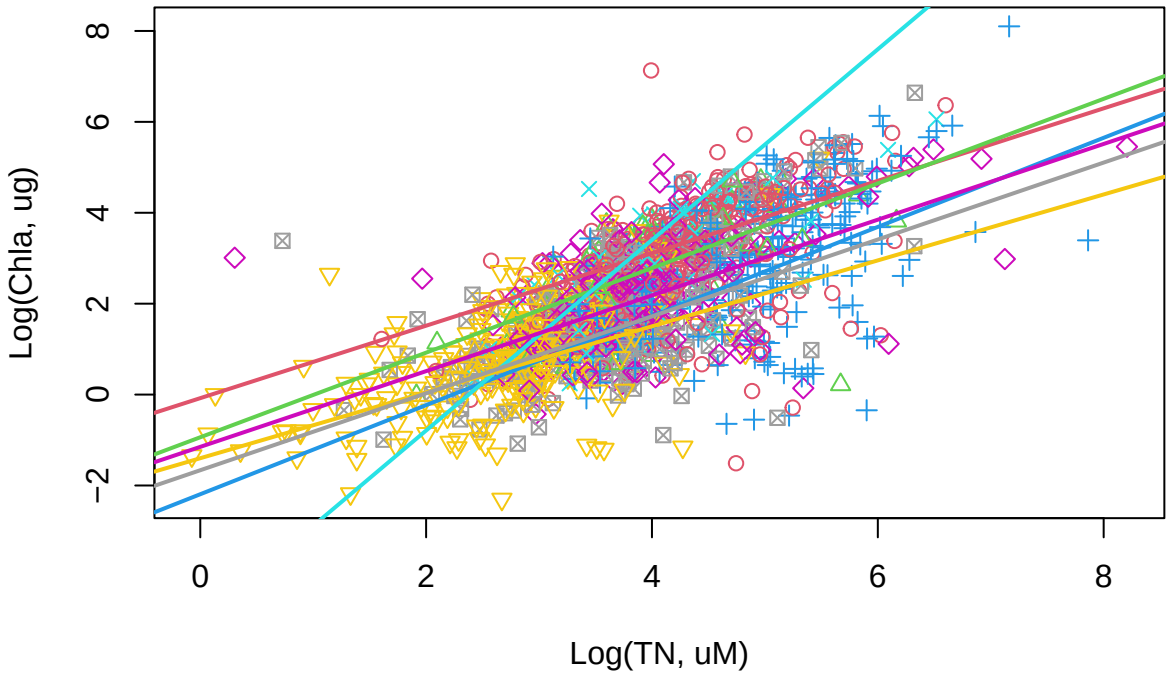

Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

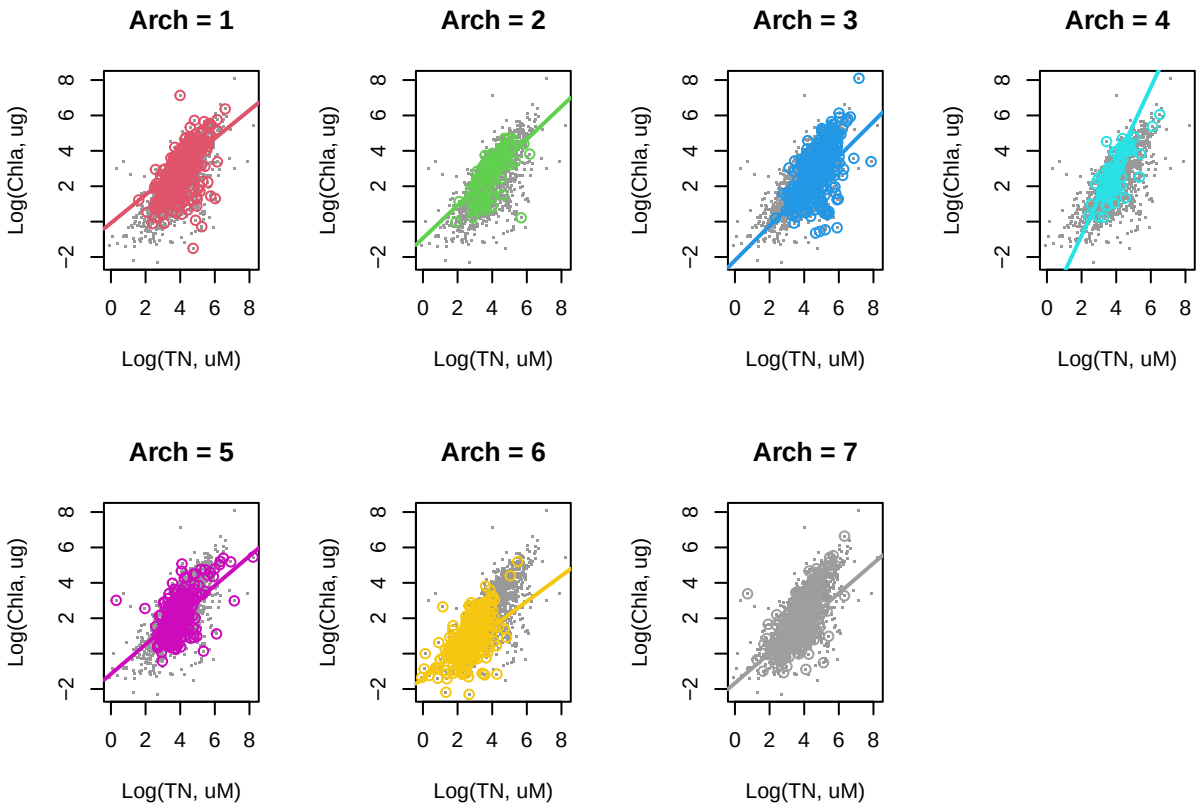



```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(TN_uM) + log(TN_uM):w.arch2 + log(TN_uM):w.arch3 +
##     log(TN_uM):w.arch4 + log(TN_uM):w.arch5 + log(TN_uM):w.arch6 +
##     log(TN_uM):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.5611 -0.5751  0.0663  0.6423  4.7257
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -0.07871    0.50604  -0.156  0.87642
## w.arch2            -0.85990    1.07000  -0.804  0.42172
## w.arch3            -2.11399    0.74084  -2.854  0.00438 **
## w.arch4            -4.90530    1.19567  -4.103 4.29e-05 ***
## w.arch5            -1.07159    0.80109  -1.338  0.18120
## w.arch6            -1.32150    0.62399  -2.118  0.03435 *
## w.arch7            -1.58550    0.70583  -2.246  0.02482 *
## log(TN_uM)          0.79700    0.11858   6.721 2.50e-11 ***
## w.arch2:log(TN_uM)  0.13367    0.25894   0.516  0.60579
## w.arch3:log(TN_uM)  0.18322    0.16512   1.110  0.26733
## w.arch4:log(TN_uM)  1.29980    0.28630   4.540 6.05e-06 ***
## w.arch5:log(TN_uM)  0.03605    0.19230   0.187  0.85133
## w.arch6:log(TN_uM) -0.07161    0.16232  -0.441  0.65913
```

```
## w.arch7:log(TN_uM)  0.04907    0.17679   0.278  0.78139
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9993 on 1582 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.5473, Adjusted R-squared:  0.5436
## F-statistic: 147.1 on 13 and 1582 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(TN_uM) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.9154 -0.6246  0.0604  0.7104  4.4403
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -1.02601    0.26878  -3.817  0.00014 ***
## log(TN_uM)           0.96522    0.06431  15.010  < 2e-16 ***
## max.arch            -0.07349    0.05392  -1.363  0.17312
## log(TN_uM):max.arch -0.01590    0.01376  -1.156  0.24776
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.038 on 1592 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.5085, Adjusted R-squared:  0.5076
## F-statistic: 549.1 on 3 and 1592 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(TN_uM) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.8132 -0.5837  0.0670  0.6501  4.6638
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -0.784346   0.432850  -1.812 0.070169 .
## log(TN_uM)             0.909789   0.104188   8.732  < 2e-16 ***
## ag_eco9NAP            -2.507537   0.650558  -3.854 0.000121 ***
## ag_eco9NPL            -1.645599   0.693506  -2.373 0.017770 *
## ag_eco9SAP            -0.972773   0.587432  -1.656 0.097926 .
## ag_eco9SPL            -1.018141   0.618890  -1.645 0.100147
## ag_eco9TPL            -1.182309   0.585807  -2.018 0.043734 *
## ag_eco9UMW            -0.523126   0.576658  -0.907 0.364456
## ag_eco9WMT            -0.885965   0.473462  -1.871 0.061495 .
## ag_eco9XER            -0.860724   0.556592  -1.546 0.122204
## log(TN_uM):ag_eco9NAP  0.597203   0.178343   3.349 0.000831 ***
## log(TN_uM):ag_eco9NPL  0.094901   0.148977   0.637 0.524203
## log(TN_uM):ag_eco9SAP  0.252038   0.152331   1.655 0.098216 .
```

```
## log(TN_uM):ag_eco9SPL  0.124669   0.143595   0.868 0.385415
## log(TN_uM):ag_eco9TPL  0.200756   0.134768   1.490 0.136518
## log(TN_uM):ag_eco9UMW -0.040052   0.141770  -0.283 0.777584
## log(TN_uM):ag_eco9WMT -0.003408   0.120760  -0.028 0.977489
## log(TN_uM):ag_eco9XER  0.018101   0.137646   0.132 0.895394
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.015 on 1578 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.534,  Adjusted R-squared:  0.529
## F-statistic: 106.4 on 17 and 1578 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(TN_uM), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.5870 -0.6361  0.0803  0.7601  4.8058
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -1.66193    0.10555  -15.75   <2e-16 ***
## log(TN_uM)   0.99863    0.02631   37.95   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.072 on 1594 degrees of freedom
##   (7 observations deleted due to missingness)
## Multiple R-squared:  0.4747, Adjusted R-squared:  0.4744
## F-statistic:  1440 on 1 and 1594 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
0
2
4
6
8
Log(TN, uM)




```
aa.r.sq
```

```
## [1] 0.5435783
```

```
max.arch.r.sq
```

```
## [1] 0.5076073
```

```
ecoreg.r.sq
```

```
## [1] 0.529019
```

```
global.r.sq
```

```
## [1] 0.4743763
```

```
aa.AIC
```

```
## [1] 4542.833
```

```
max.arch.AIC
```

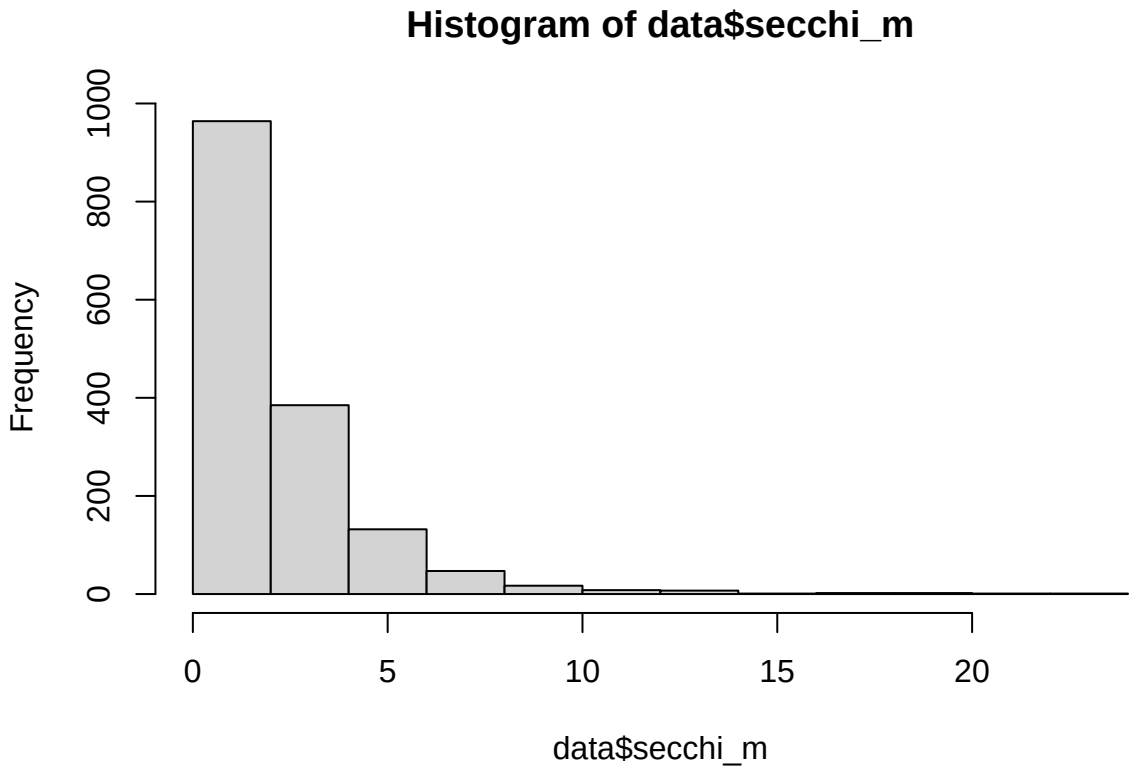
```
## [1] 4653.962
```

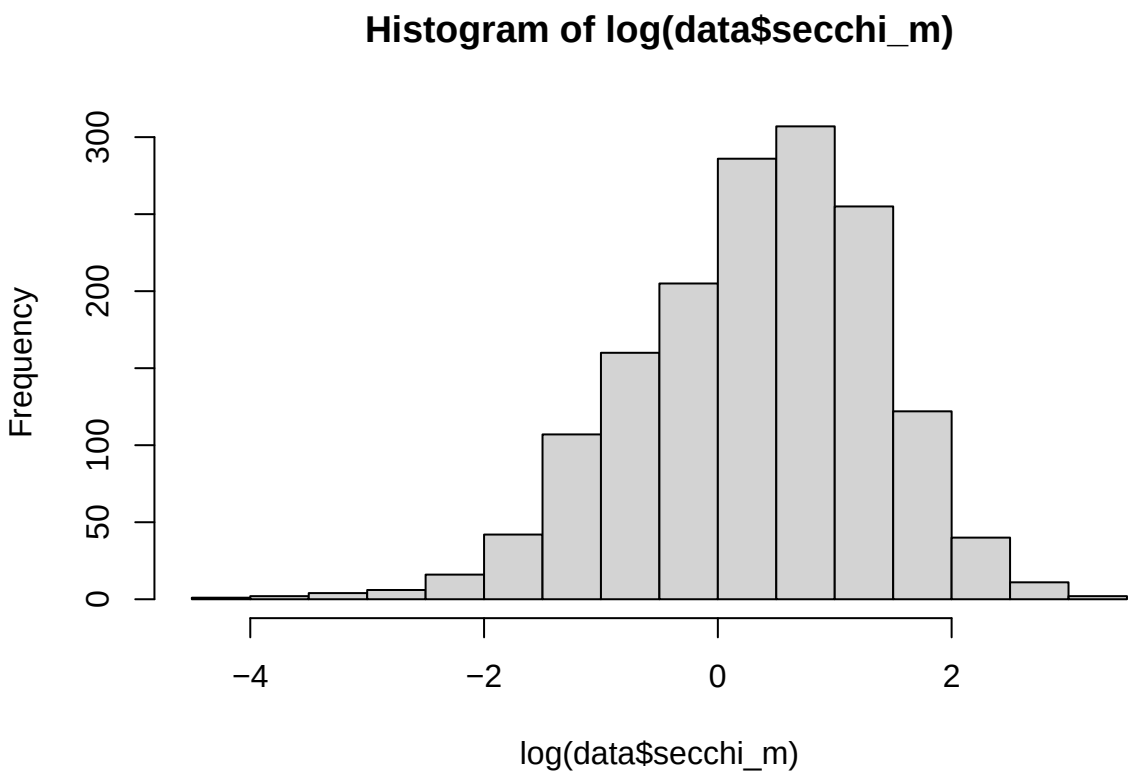
```
ecoreg.AIC
```

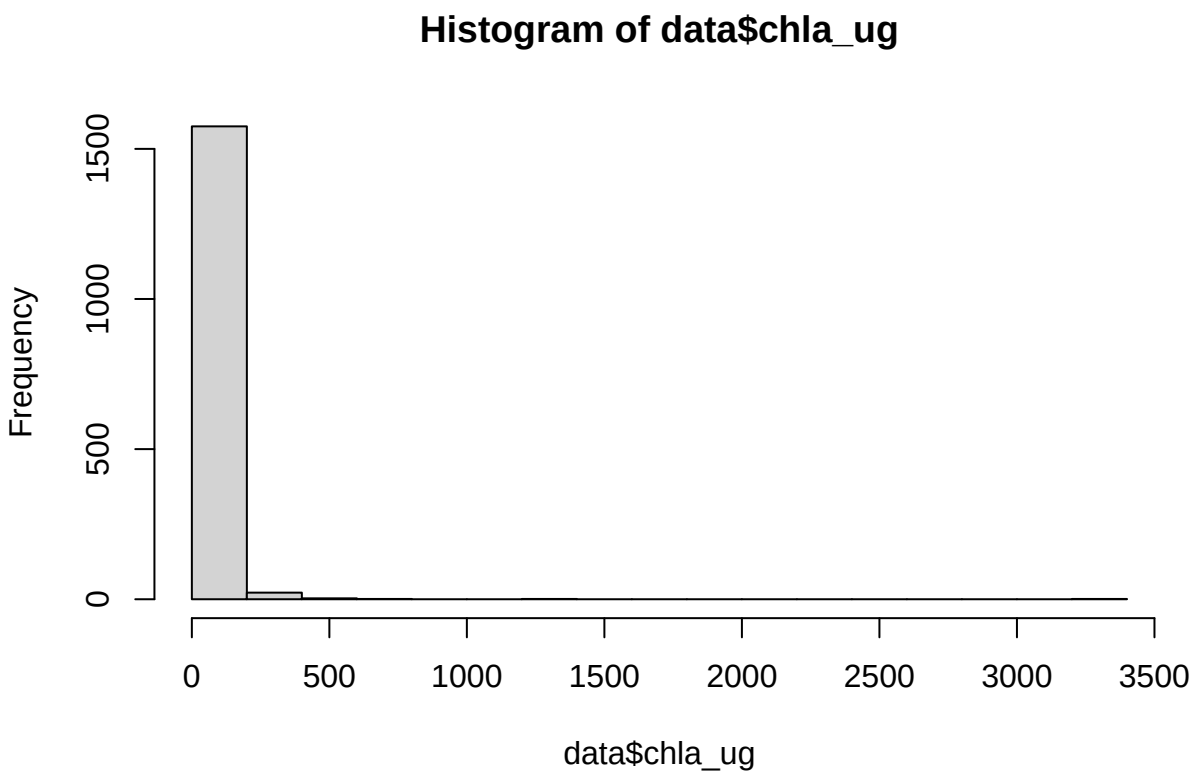
```
## [1] 4596.908
```

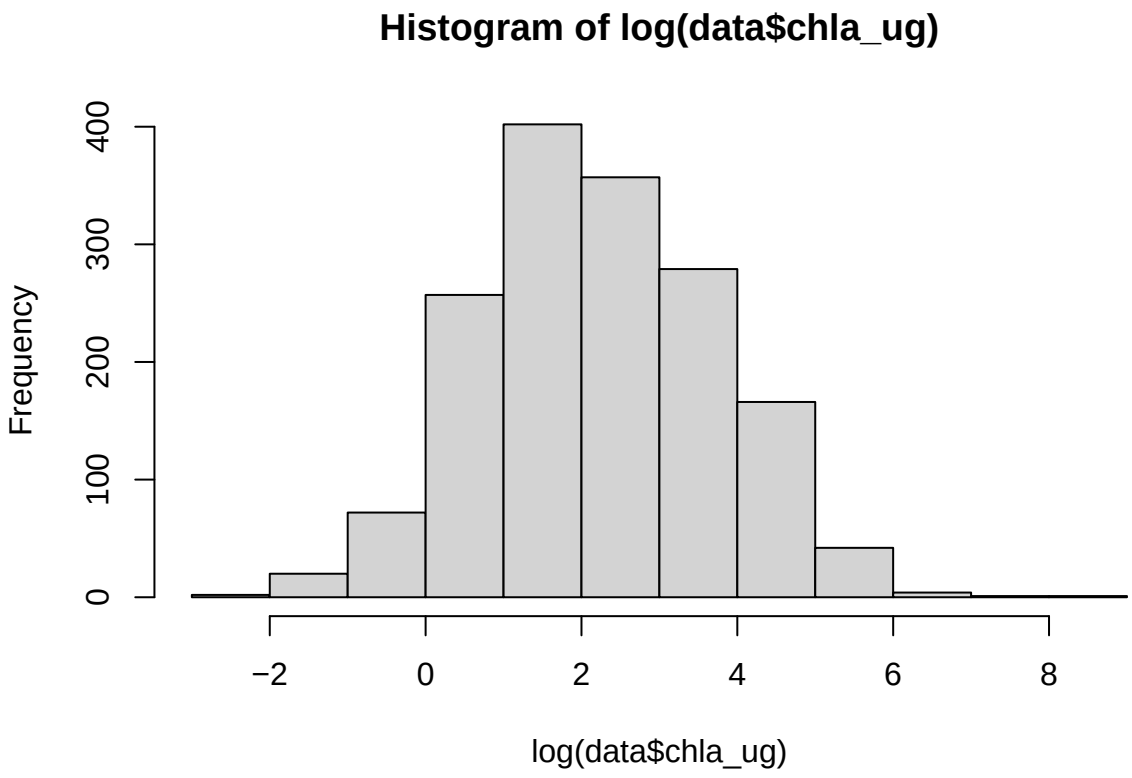
```
global.AIC
```

```
## [1] 4756.199
```




Histogram of log(data$secchi_m)
Frequency
0
50
100
200
300
−4
−2
0
2
log(data$secchi_m)

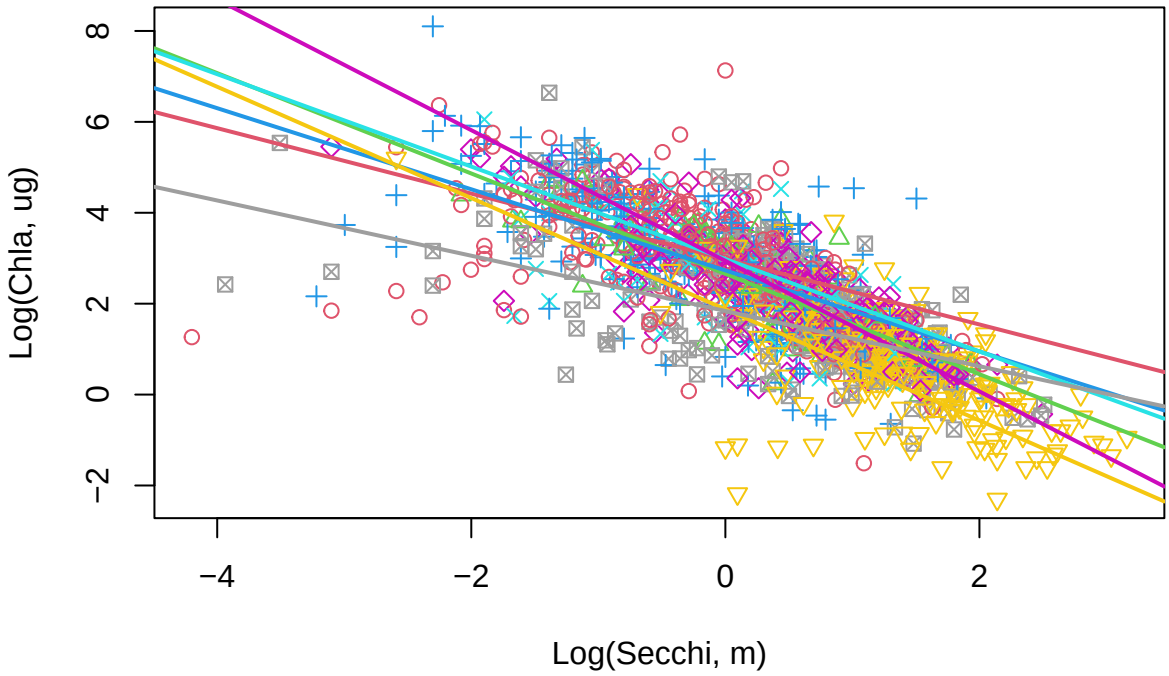

Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

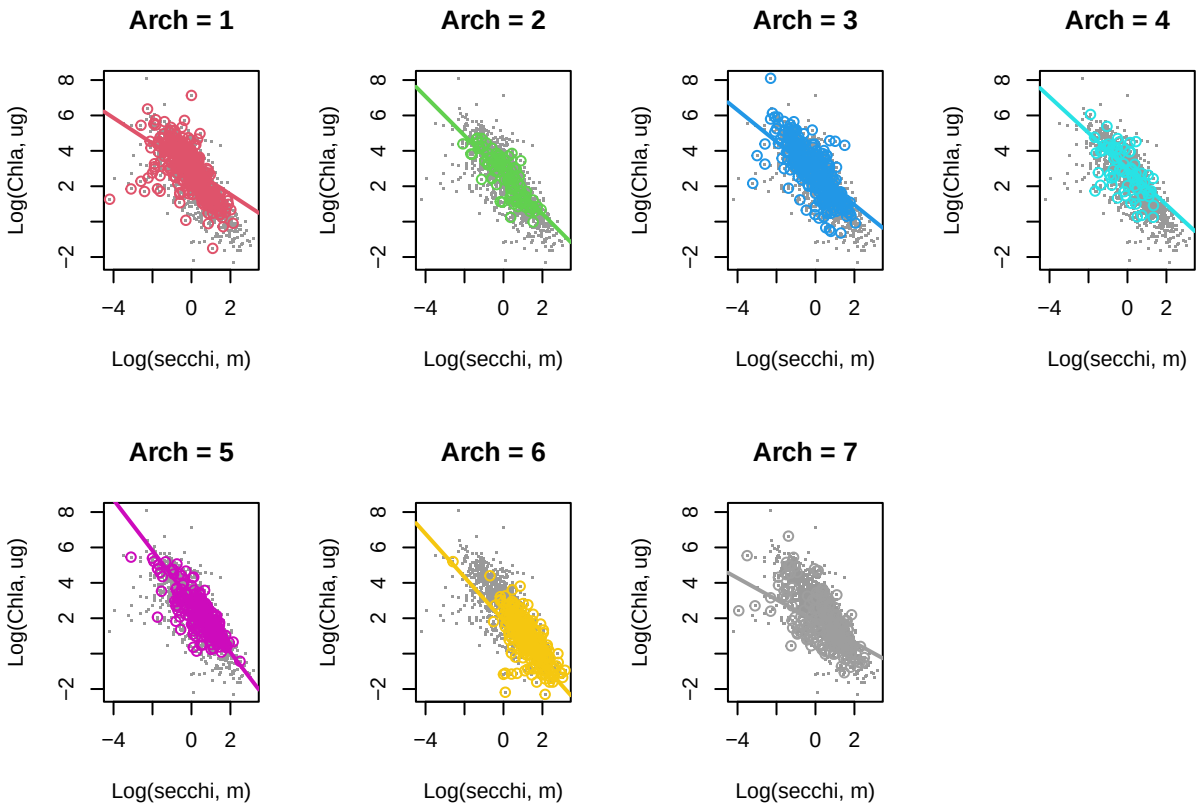



```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(secchi_m) + log(secchi_m):w.arch2 +
##     log(secchi_m):w.arch3 + log(secchi_m):w.arch4 + log(secchi_m):w.arch5 +
##     log(secchi_m):w.arch6 + log(secchi_m):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0552 -0.4539  0.0232  0.5212  4.3253
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             2.9820986  0.0992012  30.061  < 2e-16 ***
## w.arch2                -0.3259789  0.1966798  -1.657 0.097639 .
## w.arch3                -0.2495364  0.1388168  -1.798 0.072436 .
## w.arch4                 0.0002519  0.2324507   0.001 0.999135
## w.arch5                -0.0390209  0.1684452  -0.232 0.816838
## w.arch6                -1.1050714  0.2176993  -5.076 4.32e-07 ***
## w.arch7                -1.1424787  0.1602208  -7.131 1.53e-12 ***
## log(secchi_m)          -0.7198205  0.1024082  -7.029 3.11e-12 ***
## w.arch2:log(secchi_m) -0.3842823  0.2084208  -1.844 0.065406 .
## w.arch3:log(secchi_m) -0.1722615  0.1490781  -1.156 0.248059
## w.arch4:log(secchi_m) -0.2969351  0.2493856  -1.191 0.233966
## w.arch5:log(secchi_m) -0.7171880  0.1659541  -4.322 1.65e-05 ***
## w.arch6:log(secchi_m) -0.5038120  0.1492030  -3.377 0.000752 ***
```

```
## w.arch7:log(secchi_m)  0.1120946  0.1496777   0.749 0.454027
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8955 on 1552 degrees of freedom
##   (36 observations deleted due to missingness)
## Multiple R-squared:  0.6405, Adjusted R-squared:  0.6375
## F-statistic: 212.7 on 13 and 1552 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(secchi_m) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.8390 -0.4736  0.0348  0.5544  4.2890
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)              2.941445   0.048242  60.973  < 2e-16 ***
## log(secchi_m)           -1.007273   0.050450 -19.966  < 2e-16 ***
## max.arch                -0.099535   0.012073  -8.244 3.48e-16 ***
## log(secchi_m):max.arch -0.007364   0.010968  -0.671    0.502
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9206 on 1562 degrees of freedom
##   (36 observations deleted due to missingness)
## Multiple R-squared:  0.6175, Adjusted R-squared:  0.6168
## F-statistic: 840.6 on 3 and 1562 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(secchi_m) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3854 -0.4509  0.0386  0.5095  4.2593
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                2.795098   0.070467  39.665  < 2e-16 ***
## log(secchi_m)             -1.091707   0.089901 -12.143  < 2e-16 ***
## ag_eco9NAP                -0.054675   0.134445  -0.407 0.684308
## ag_eco9NPL                -0.297968   0.112551  -2.647 0.008194 **
## ag_eco9SAP                -0.032791   0.107193  -0.306 0.759718
## ag_eco9SPL                -0.396453   0.110215  -3.597 0.000332 ***
## ag_eco9TPL                 0.076544   0.092270   0.830 0.406912
## ag_eco9UMW                 0.002192   0.102083   0.021 0.982869
## ag_eco9WMT                -0.482759   0.116079  -4.159 3.37e-05 ***
## ag_eco9XER                -0.602062   0.109832  -5.482 4.91e-08 ***
## log(secchi_m):ag_eco9NAP -0.208670   0.142390  -1.465 0.142992
## log(secchi_m):ag_eco9NPL -0.067610   0.126726  -0.534 0.593754
## log(secchi_m):ag_eco9SAP -0.245346   0.133500  -1.838 0.066283 .
```

```
## log(secchi_m):ag_eco9SPL  0.337571   0.114691   2.943 0.003296 **
## log(secchi_m):ag_eco9TPL  0.024634   0.109658   0.225 0.822283
## log(secchi_m):ag_eco9UMW -0.071210   0.117584  -0.606 0.544860
## log(secchi_m):ag_eco9WMT -0.063866   0.109739  -0.582 0.560662
## log(secchi_m):ag_eco9XER  0.259507   0.113074   2.295 0.021866 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9022 on 1548 degrees of freedom
##   (36 observations deleted due to missingness)
## Multiple R-squared:  0.636,  Adjusted R-squared:  0.632
## F-statistic: 159.1 on 17 and 1548 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(secchi_m), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0019 -0.4720  0.0500  0.5491  4.5499
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.58098    0.02495  103.45   <2e-16 ***
## log(secchi_m) -1.11557    0.02311  -48.28   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9427 on 1564 degrees of freedom
##   (36 observations deleted due to missingness)
## Multiple R-squared:  0.5985, Adjusted R-squared:  0.5982
## F-statistic:  2331 on 1 and 1564 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
−4
−2
0
2
Log(Secchi, m)




```
aa.r.sq
```

```
## [1] 0.6374602
```

```
max.arch.r.sq
```

```
## [1] 0.6167828
```

```
ecoreg.r.sq
```

```
## [1] 0.6319664
```

```
global.r.sq
```

```
## [1] 0.5982177
```

```
aa.AIC
```

```
## [1] 4114.205
```

```
max.arch.AIC
```

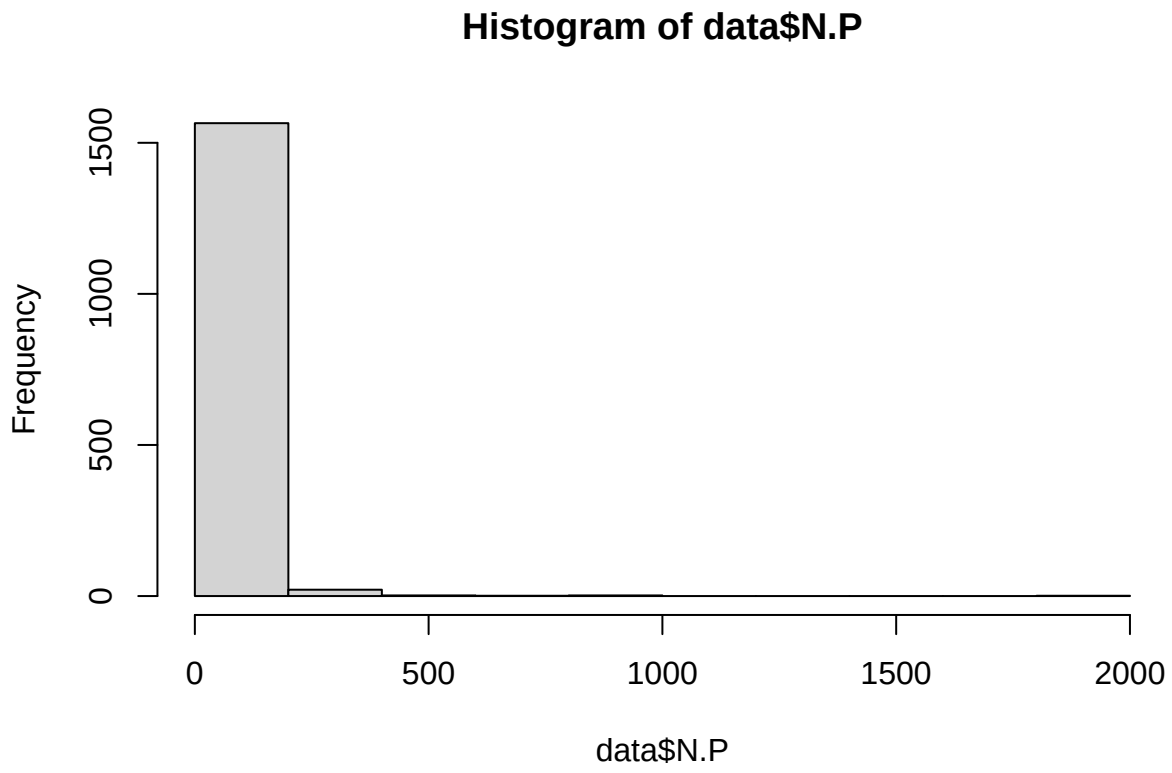
```
## [1] 4191.126
```

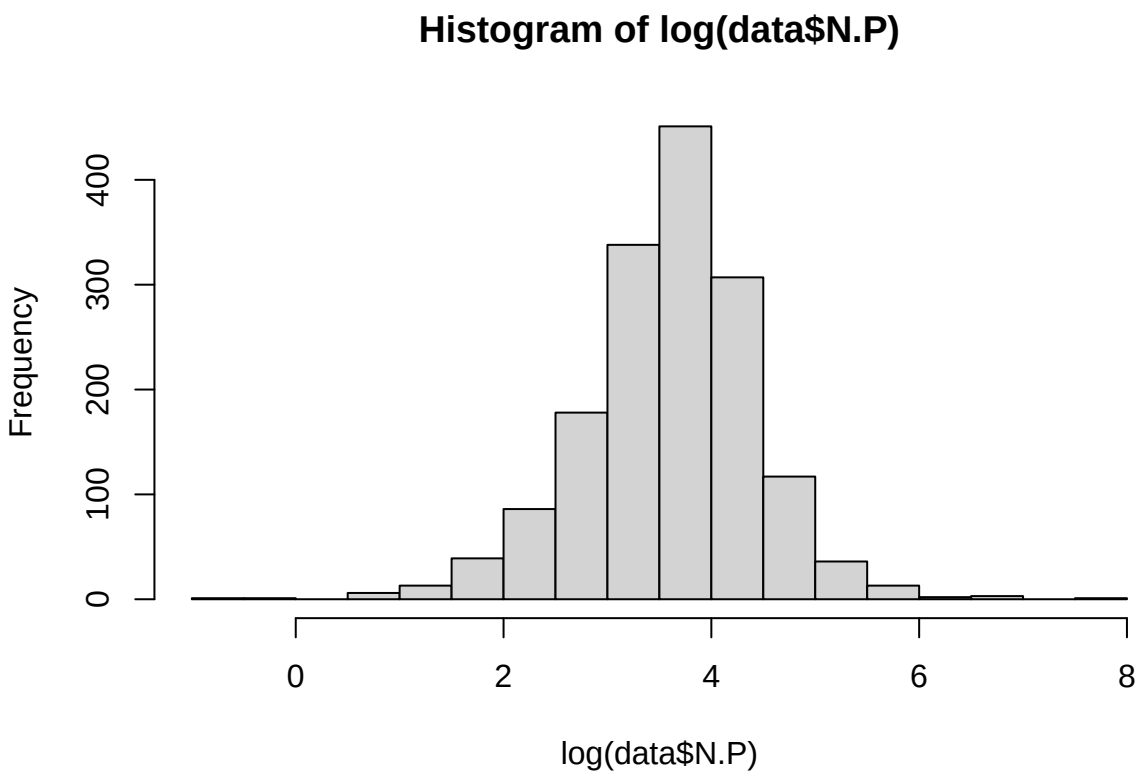
```
ecoreg.AIC
```

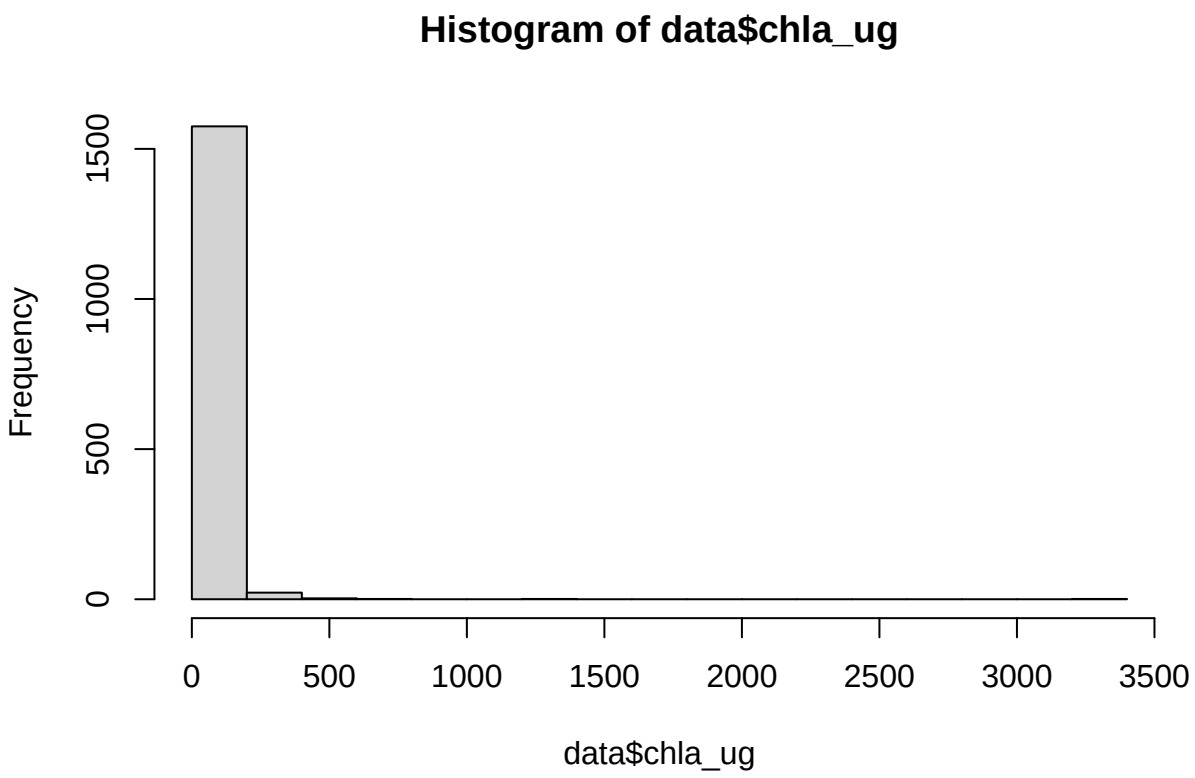
```
## [1] 4141.716
```

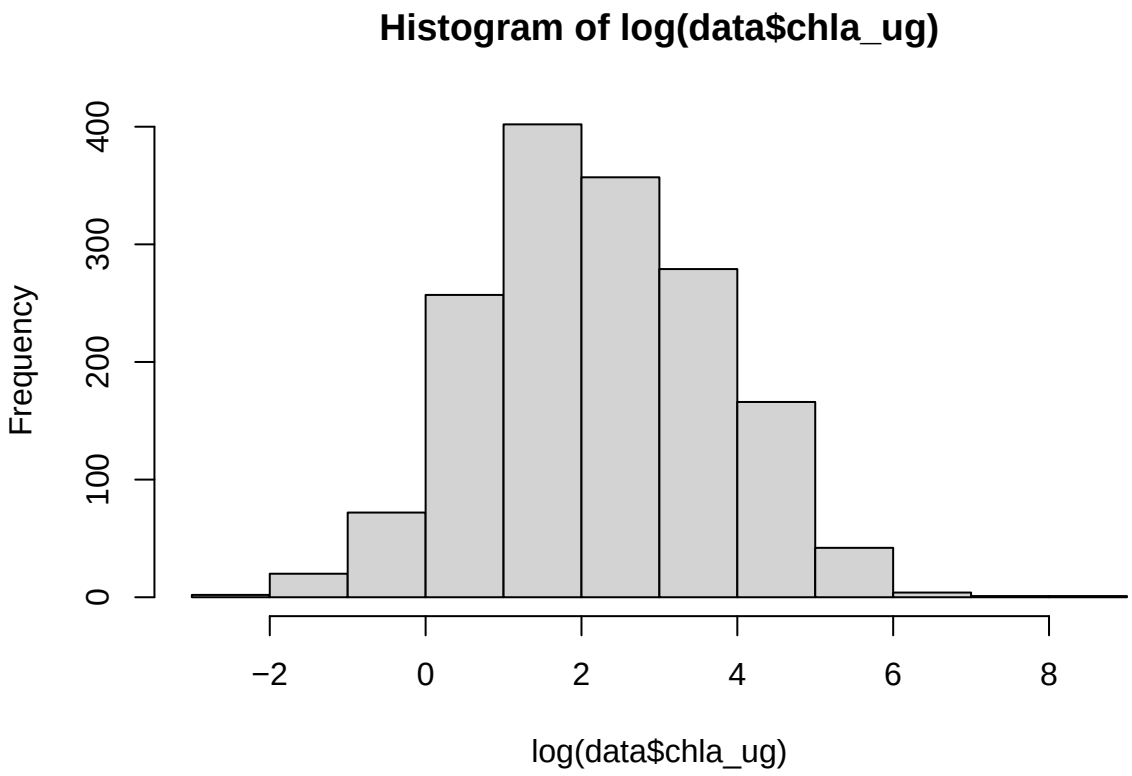
```
global.AIC
```

```
## [1] 4263.215
```




Histogram of log(data$N.P)
Frequency
0
100
200
300
400
0
2
4
6
8
log(data$N.P)

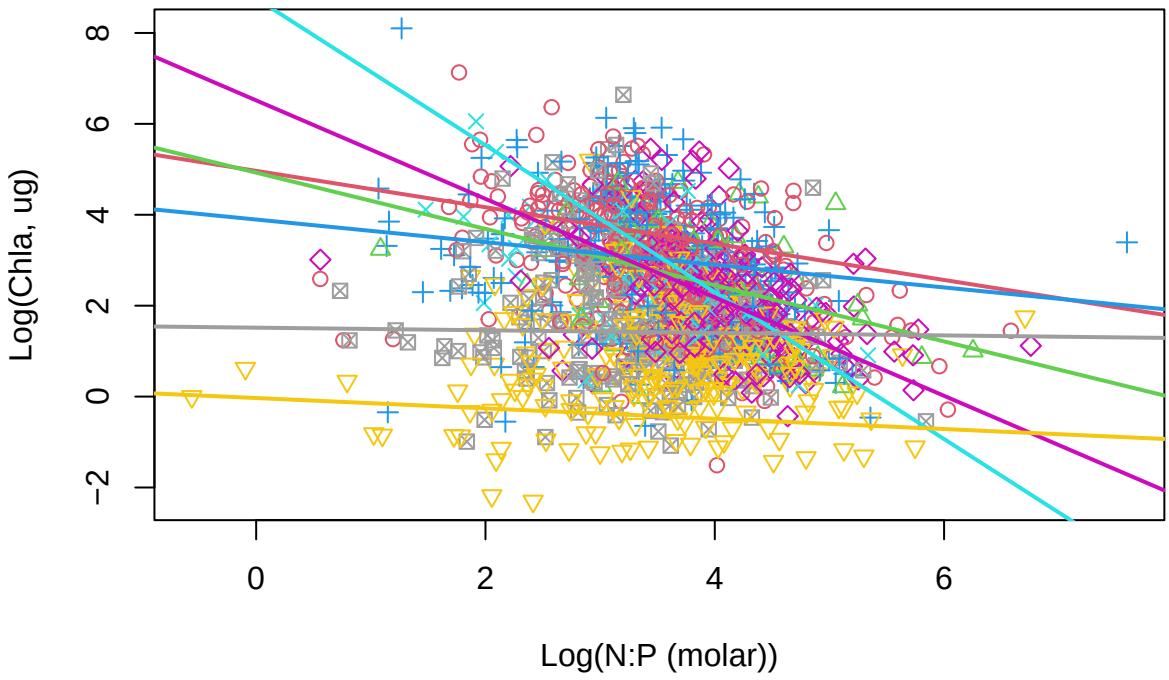

Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

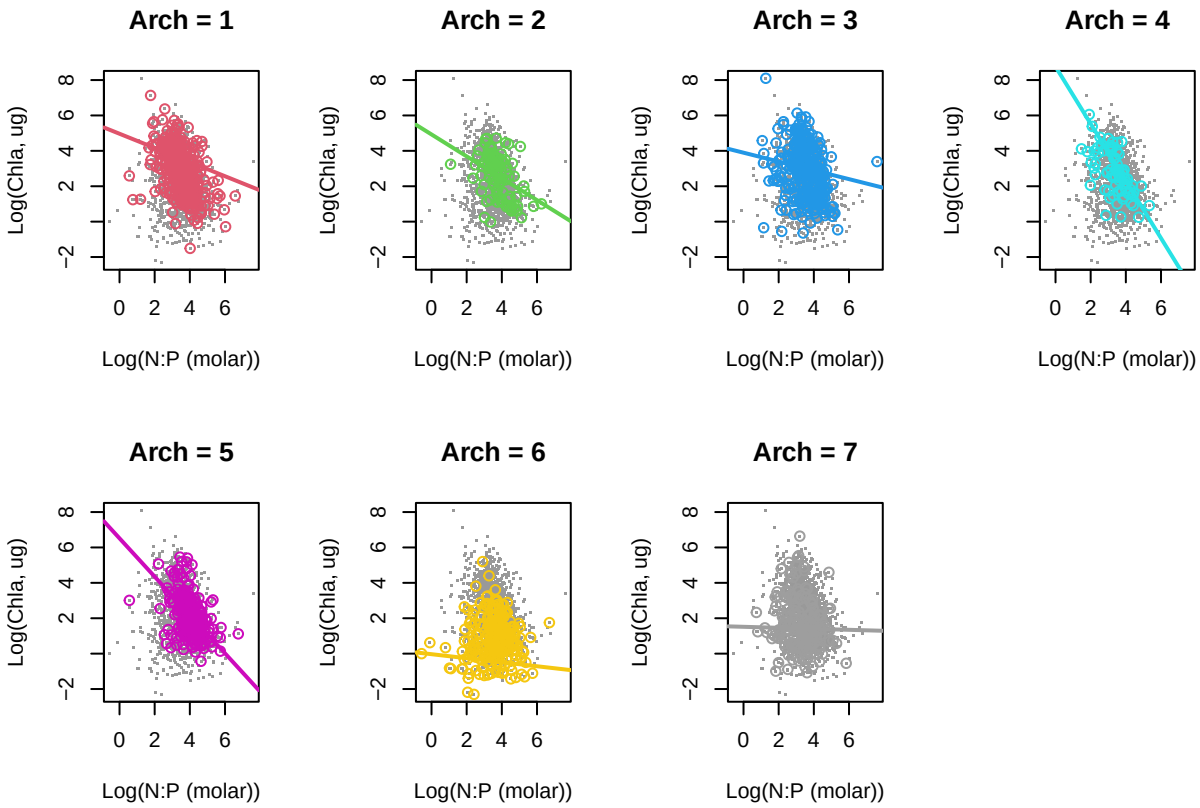



```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(N.P) + log(N.P):w.arch2 + log(N.P):w.arch3 +
##     log(N.P):w.arch4 + log(N.P):w.arch5 + log(N.P):w.arch6 +
##     log(N.P):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.2342 -0.7209 -0.0219  0.6873  4.9610
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       4.96569    0.52078   9.535  < 2e-16 ***
## w.arch2          -0.03884    1.18495  -0.033 0.973856
## w.arch3          -1.07050    0.78324  -1.367 0.171896
## w.arch4           3.79442    1.16550   3.256 0.001156 **
## w.arch5           1.55094    0.97260   1.595 0.110995
## w.arch6          -4.99721    0.72502  -6.893 7.90e-12 ***
## w.arch7          -3.44962    0.79694  -4.329 1.59e-05 ***
## log(N.P)         -0.40004    0.14463  -2.766 0.005743 **
## w.arch2:log(N.P) -0.21901    0.30672  -0.714 0.475304
## w.arch3:log(N.P)  0.15101    0.21329   0.708 0.479032
## w.arch4:log(N.P) -1.21565    0.33133  -3.669 0.000252 ***
## w.arch5:log(N.P) -0.68325    0.25822  -2.646 0.008225 **
## w.arch6:log(N.P)  0.28636    0.20207   1.417 0.156646
```

```
## w.arch7:log(N.P)  0.37164    0.22587   1.645 0.100097
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.14 on 1578 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.4108, Adjusted R-squared:  0.406
## F-statistic: 84.65 on 13 and 1578 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(N.P) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.1886 -0.8655 -0.0521  0.7993  5.2541
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)        6.52351    0.30215  21.590  < 2e-16 ***
## log(N.P)          -0.90404    0.08354 -10.822  < 2e-16 ***
## max.arch          -0.68072    0.06530 -10.425  < 2e-16 ***
## log(N.P):max.arch  0.11251    0.01814   6.202 7.09e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.279 on 1588 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.2537, Adjusted R-squared:  0.2523
## F-statistic: 179.9 on 3 and 1588 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(N.P) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.2216 -0.7923 -0.0144  0.7524  5.4928
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)          5.60333    0.41611  13.466  < 2e-16 ***
## log(N.P)            -0.75625    0.11501  -6.576 6.57e-11 ***
## ag_eco9NAP           1.28579    0.88381   1.455 0.145916
## ag_eco9NPL          -2.31488    0.61862  -3.742 0.000189 ***
## ag_eco9SAP          -0.65677    0.64577  -1.017 0.309292
## ag_eco9SPL          -1.12871    0.64589  -1.748 0.080739 .
## ag_eco9TPL           0.37506    0.55949   0.670 0.502723
## ag_eco9UMW          -0.57665    0.63644  -0.906 0.365044
## ag_eco9WMT          -4.40053    0.51267  -8.584  < 2e-16 ***
## ag_eco9XER          -2.48208    0.56512  -4.392 1.20e-05 ***
## log(N.P):ag_eco9NAP -0.55848    0.22704  -2.460 0.014008 *
## log(N.P):ag_eco9NPL  0.55507    0.17311   3.206 0.001371 **
## log(N.P):ag_eco9SAP  0.03710    0.17480   0.212 0.831921
```

```
## log(N.P):ag_eco9SPL  0.24830    0.18183   1.366 0.172273
## log(N.P):ag_eco9TPL -0.05691    0.15437  -0.369 0.712434
## log(N.P):ag_eco9UMW  0.03469    0.16386   0.212 0.832365
## log(N.P):ag_eco9WMT  0.70067    0.14435   4.854 1.33e-06 ***
## log(N.P):ag_eco9XER  0.35217    0.16261   2.166 0.030480 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.224 on 1574 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.3235, Adjusted R-squared:  0.3162
## F-statistic: 44.28 on 17 and 1574 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(N.P), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.0779 -0.9534 -0.0066  0.9855  4.8585
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.80414    0.16021   23.74   <2e-16 ***
## log(N.P)    -0.44239    0.04344  -10.18   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.434 on 1590 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.06124,    Adjusted R-squared:  0.06065
## F-statistic: 103.7 on 1 and 1590 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
0
2
4
6
Log(N:P (molar))




```
aa.r.sq
```

```
## [1] 0.4059898
```

```
max.arch.r.sq
```

```
## [1] 0.2522727
```

```
ecoreg.r.sq
```

```
## [1] 0.3161952
```

```
global.r.sq
```

```
## [1] 0.06064919
```

```
aa.AIC
```

```
## [1] 4952.176
```

```
max.arch.AIC
```

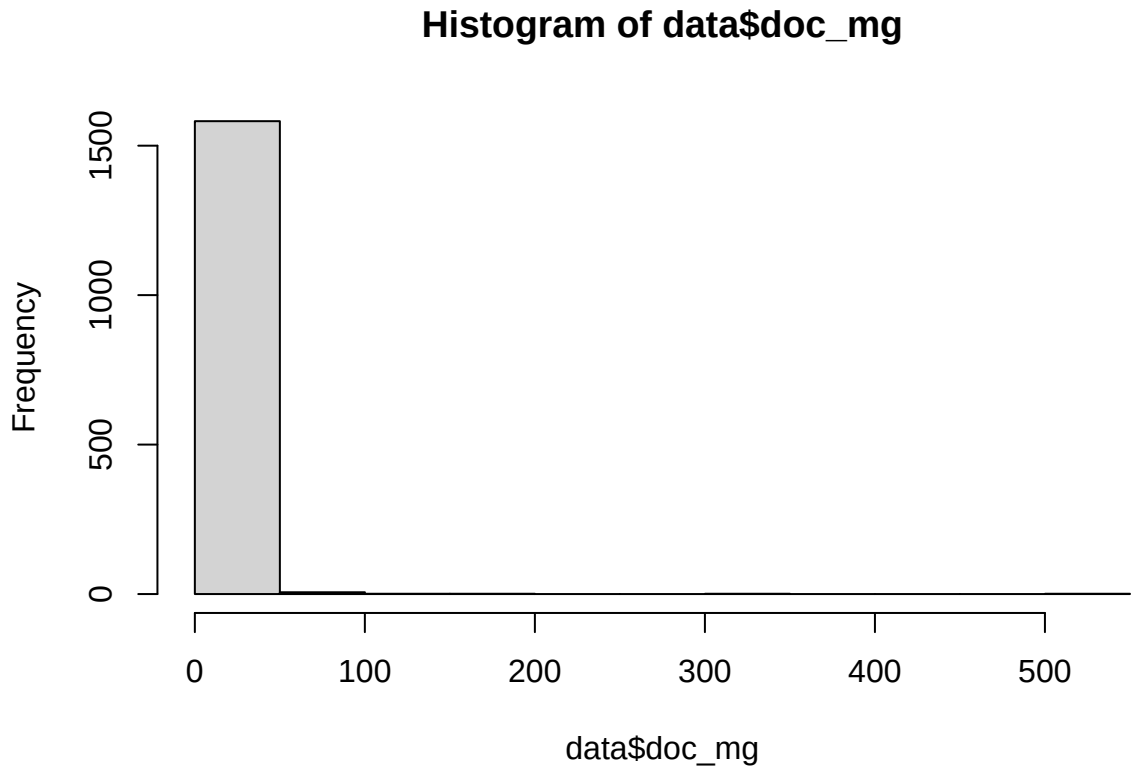
```
## [1] 5308.619
```

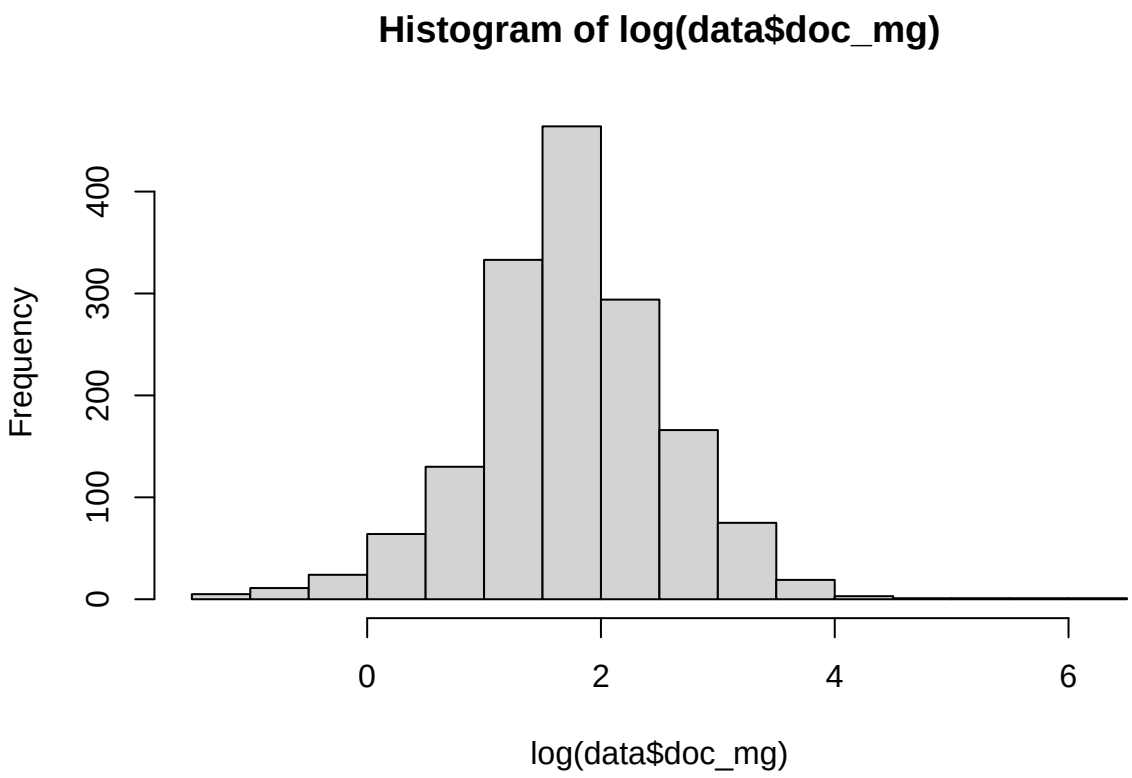
```
ecoreg.AIC
```

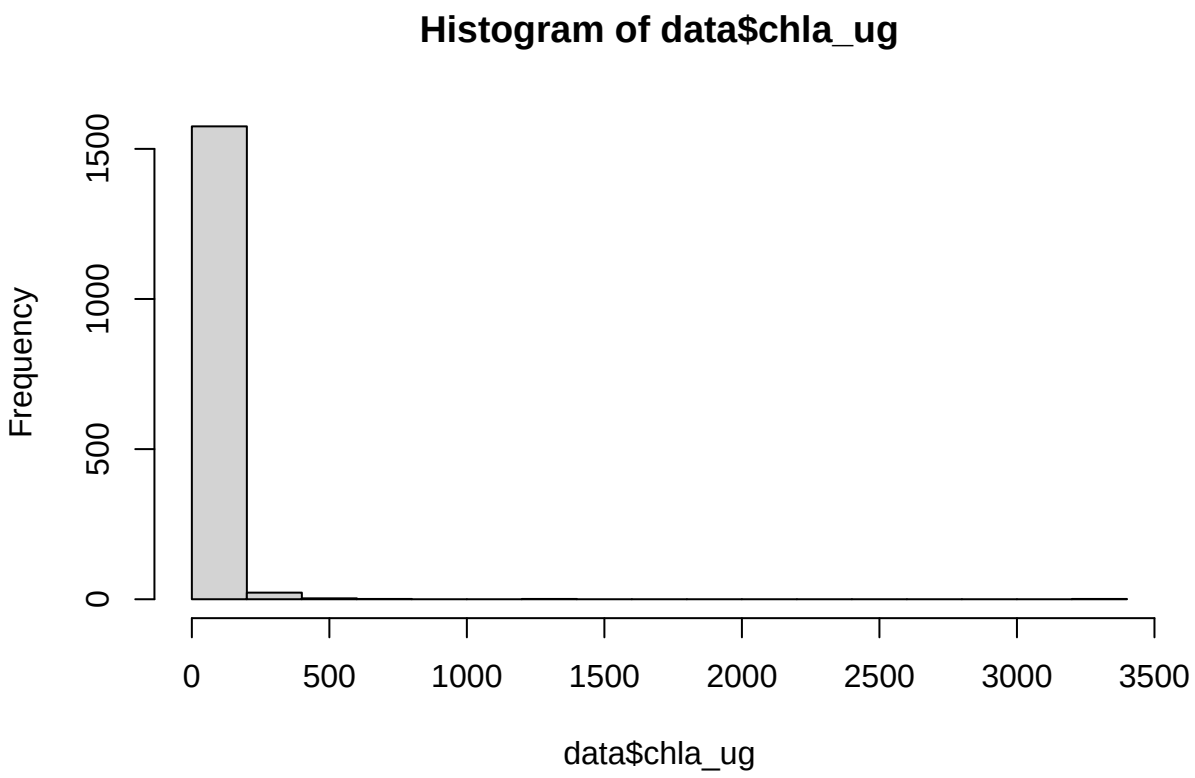
```
## [1] 5180.251
```

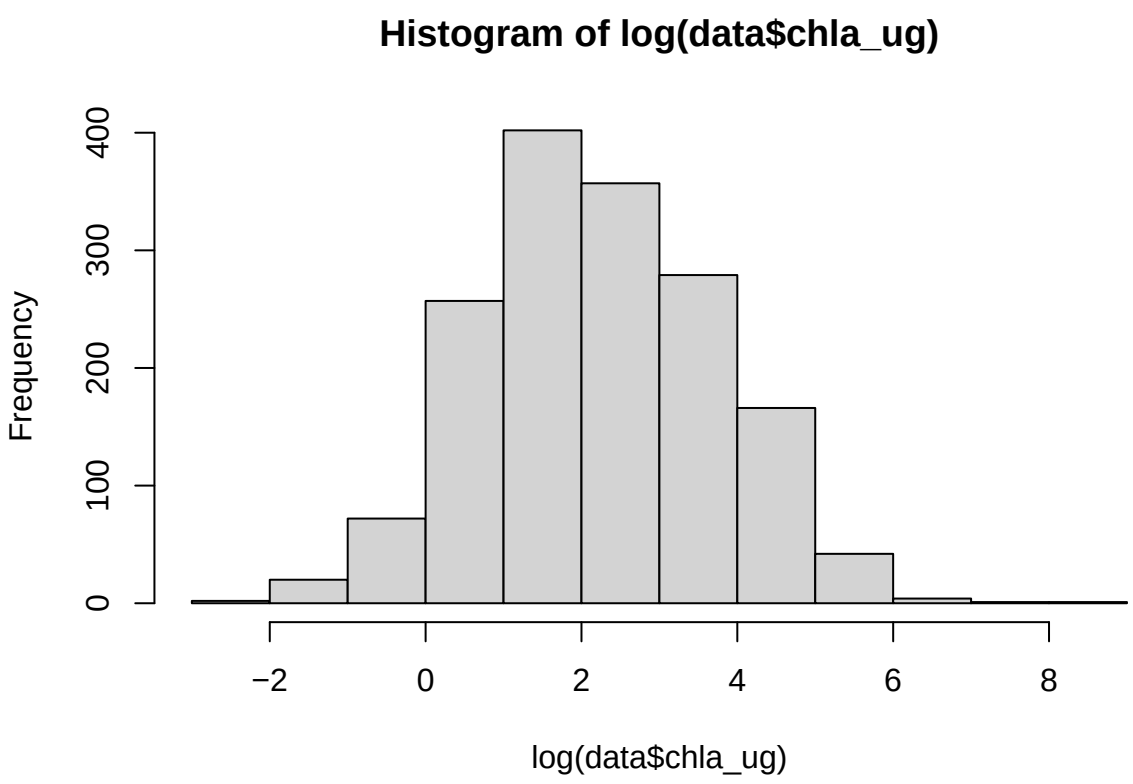
```
global.AIC
```

```
## [1] 5669.839
```




Histogram of log(data$doc_mg)
Frequency
0
100
200
300
400
0
2
4
6
log(data$doc_mg)

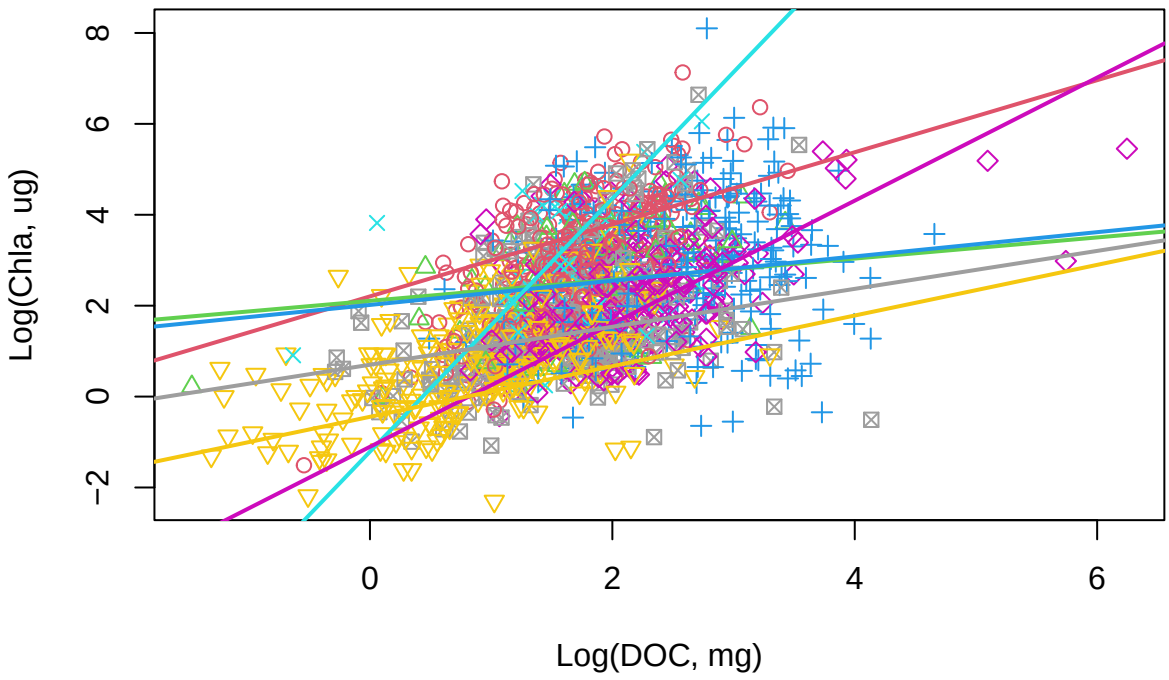

Histogram of data$chla_ug
Frequency
0
500
1000
1500
0
500
1000
1500
2000
2500
3000
3500
data$chla_ug

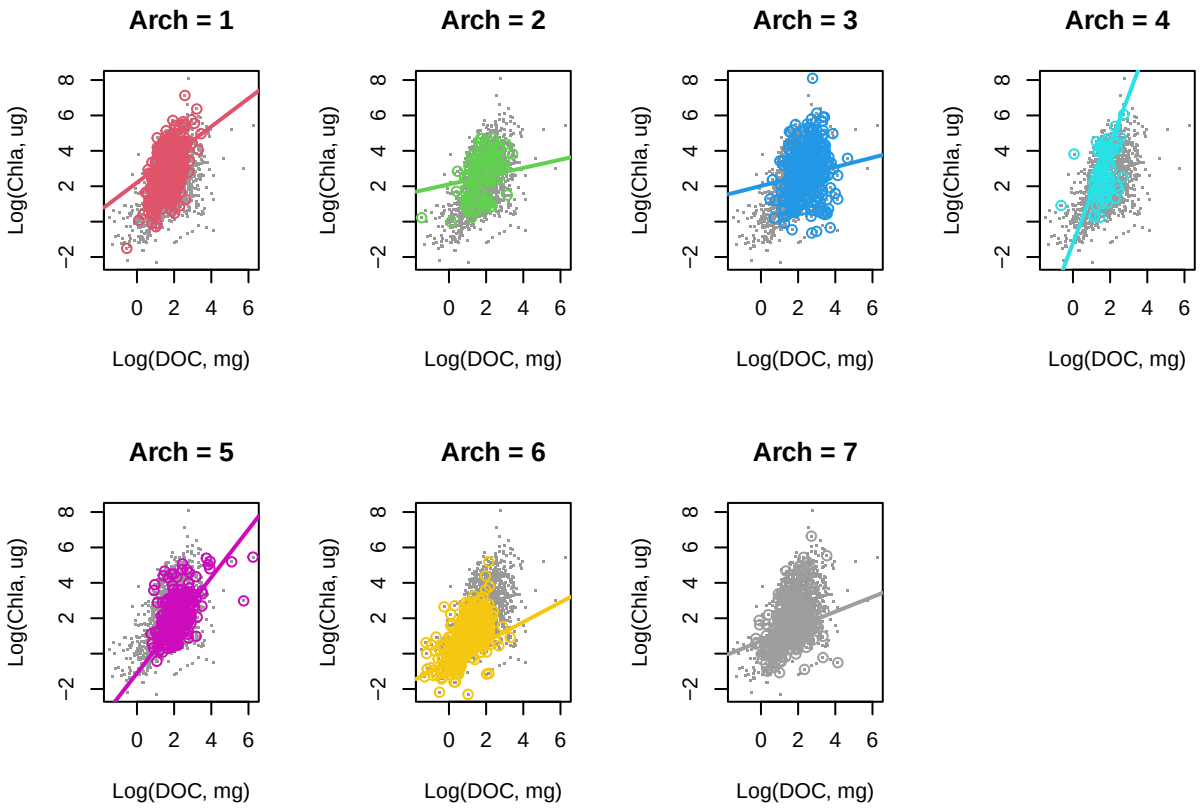



```
##
## Call:
## lm(formula = log(chla_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(doc_mg) + log(doc_mg):w.arch2 + log(doc_mg):w.arch3 +
##     log(doc_mg):w.arch4 + log(doc_mg):w.arch5 + log(doc_mg):w.arch6 +
##     log(doc_mg):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.8090 -0.7120 -0.0767  0.7154  4.7780
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            2.20398    0.35024   6.293 4.03e-10 ***
## w.arch2               -0.09771    0.69040  -0.142 0.887474
## w.arch3               -0.18770    0.50658  -0.371 0.711034
## w.arch4               -3.41529    0.87971  -3.882 0.000108 ***
## w.arch5               -3.30874    0.58267  -5.679 1.61e-08 ***
## w.arch6               -2.64908    0.41595  -6.369 2.49e-10 ***
## w.arch7               -1.50325    0.46030  -3.266 0.001115 **
## log(doc_mg)            0.79281    0.18658   4.249 2.27e-05 ***
## w.arch2:log(doc_mg)   -0.56024    0.35269  -1.588 0.112382
## w.arch3:log(doc_mg)   -0.52596    0.23663  -2.223 0.026376 *
## w.arch4:log(doc_mg)    1.99045    0.47670   4.175 3.14e-05 ***
## w.arch5:log(doc_mg)    0.56105    0.27814   2.017 0.043847 *
## w.arch6:log(doc_mg)   -0.23566    0.22967  -1.026 0.305012
```

```
## w.arch7:log(doc_mg) -0.37548    0.25545  -1.470 0.141794
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.114 on 1578 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.4441, Adjusted R-squared:  0.4395
## F-statistic: 96.98 on 13 and 1578 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(doc_mg) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3545 -0.8127 -0.0566  0.7680  4.8763
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           1.50204    0.17625   8.522  < 2e-16 ***
## log(doc_mg)           0.89056    0.09274   9.603  < 2e-16 ***
## max.arch             -0.19057    0.03451  -5.523 3.89e-08 ***
## log(doc_mg):max.arch -0.02164    0.01935  -1.119    0.263
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.18 on 1588 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.3719, Adjusted R-squared:  0.3708
## F-statistic: 313.5 on 3 and 1588 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(chla_ug) ~ log(doc_mg) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.0982 -0.7505 -0.0618  0.7255  5.4598
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)              1.506335   0.284921   5.287 1.42e-07 ***
## log(doc_mg)              0.783839   0.148573   5.276 1.51e-07 ***
## ag_eco9NAP              -1.525571   0.431809  -3.533 0.000423 ***
## ag_eco9NPL              -1.151903   0.530155  -2.173 0.029947 *
## ag_eco9SAP              -1.027245   0.376463  -2.729 0.006430 **
## ag_eco9SPL              -0.279757   0.403048  -0.694 0.487720
## ag_eco9TPL              -0.051194   0.379006  -0.135 0.892570
## ag_eco9UMW              -1.602139   0.435465  -3.679 0.000242 ***
## ag_eco9WMT              -1.410035   0.304569  -4.630 3.96e-06 ***
## ag_eco9XER              -0.802383   0.368187  -2.179 0.029459 *
## log(doc_mg):ag_eco9NAP   0.332986   0.251264   1.325 0.185284
## log(doc_mg):ag_eco9NPL  -0.005293   0.212588  -0.025 0.980139
## log(doc_mg):ag_eco9SAP   0.694090   0.236334   2.937 0.003363 **
```

```
## log(doc_mg):ag_eco9SPL -0.071480   0.194663  -0.367 0.713521
## log(doc_mg):ag_eco9TPL  0.006055   0.187757   0.032 0.974279
## log(doc_mg):ag_eco9UMW  0.267214   0.214203   1.247 0.212408
## log(doc_mg):ag_eco9WMT  0.089058   0.168522   0.528 0.597253
## log(doc_mg):ag_eco9XER -0.086685   0.196788  -0.440 0.659636
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.168 on 1574 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:   0.39,  Adjusted R-squared:  0.3834
## F-statistic: 59.19 on 17 and 1574 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(chla_ug) ~ log(doc_mg), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.8803 -0.8977 -0.0979  0.9059  4.9717
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.58956    0.07375   7.994  2.5e-15 ***
## log(doc_mg)  0.91391    0.03786  24.138  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.273 on 1590 degrees of freedom
##   (11 observations deleted due to missingness)
## Multiple R-squared:  0.2682, Adjusted R-squared:  0.2677
## F-statistic: 582.7 on 1 and 1590 DF,  p-value: < 2.2e-16
```


Log(Chla, ug)
8
6
4
2
0
−2
0
2
4
6
Log(DOC, mg)




```
aa.r.sq
```

```
## [1] 0.4395444
```

```
max.arch.r.sq
```

```
## [1] 0.3707593
```

```
ecoreg.r.sq
```

```
## [1] 0.3833691
```

```
global.r.sq
```

```
## [1] 0.267719
```

```
aa.AIC
```

```
## [1] 4876.641
```

```
max.arch.AIC
```

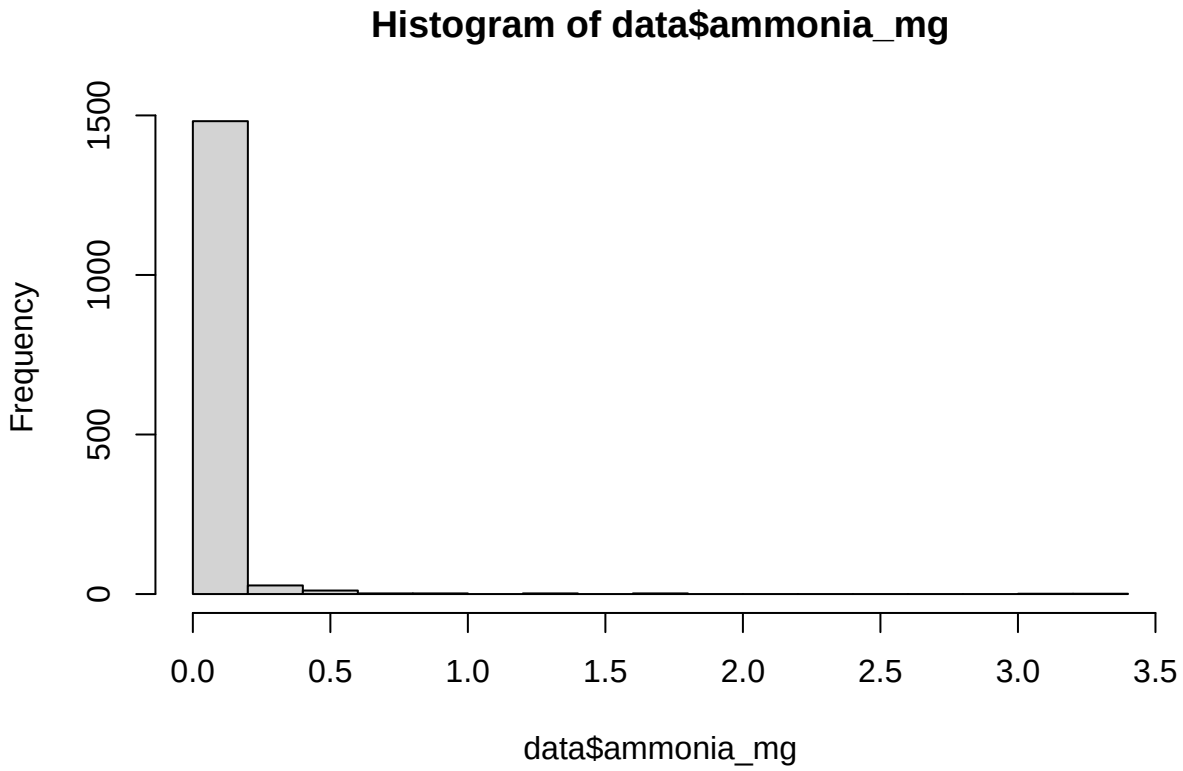
```
## [1] 5050.994
```

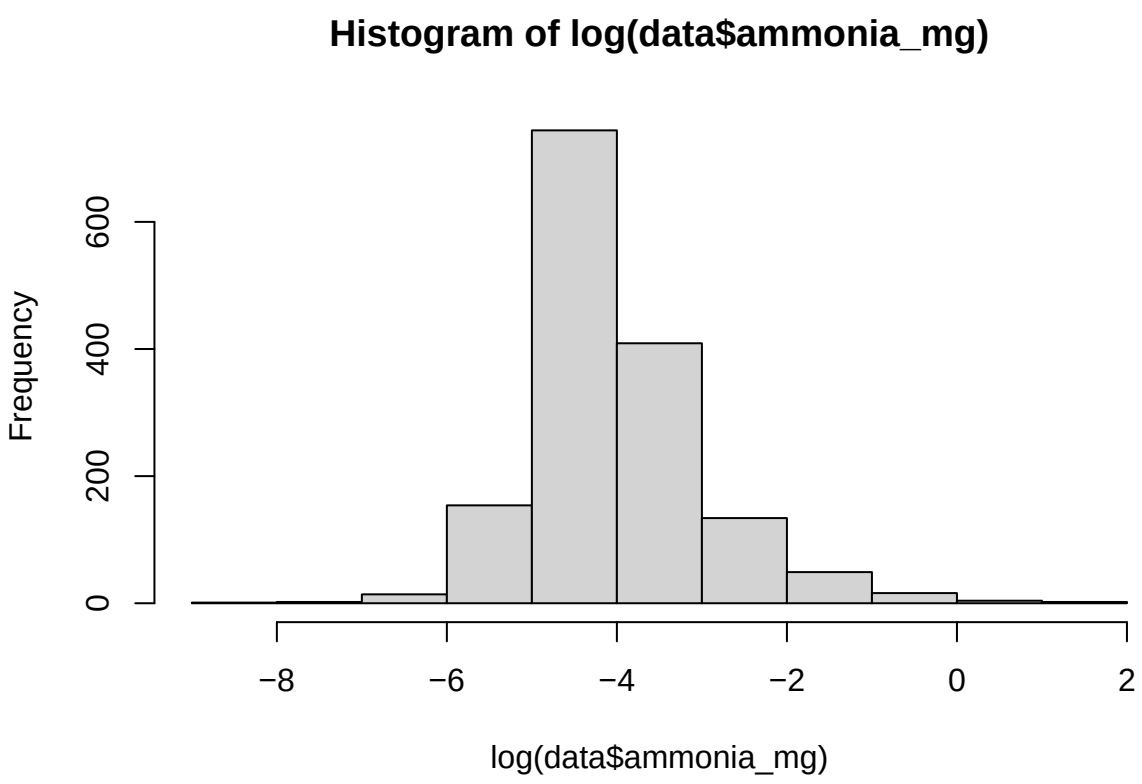
```
ecoreg.AIC
```

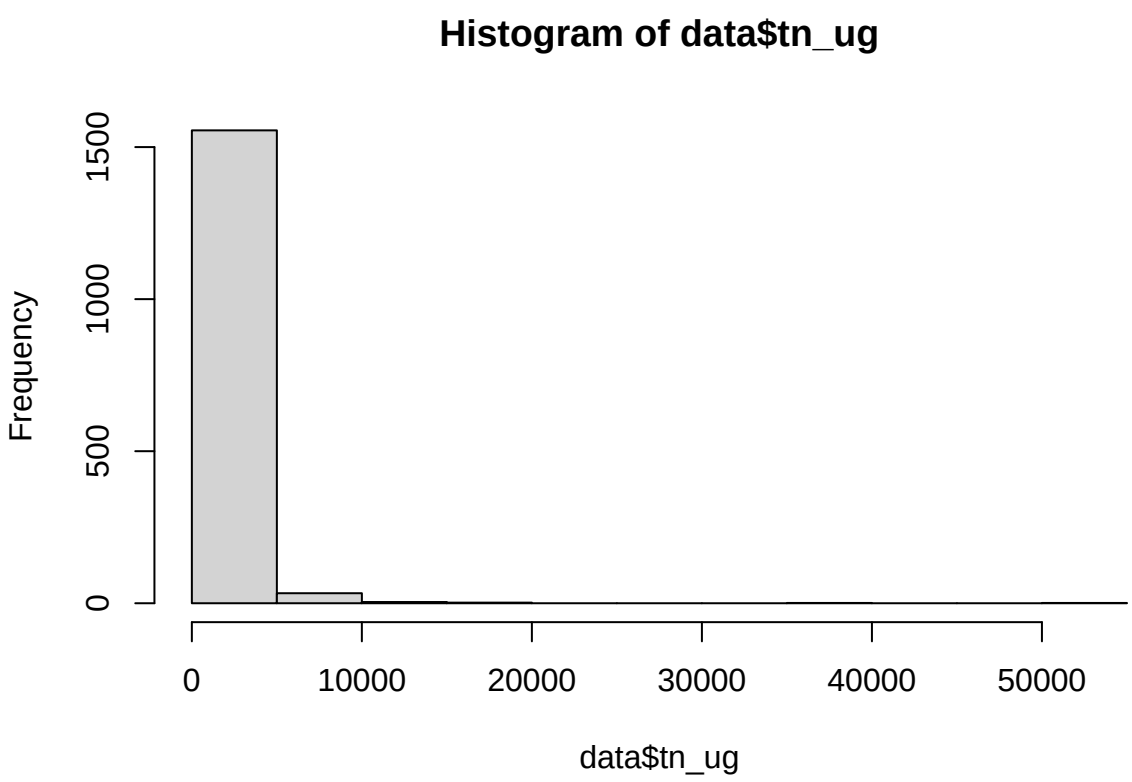
```
## [1] 5032.669
```

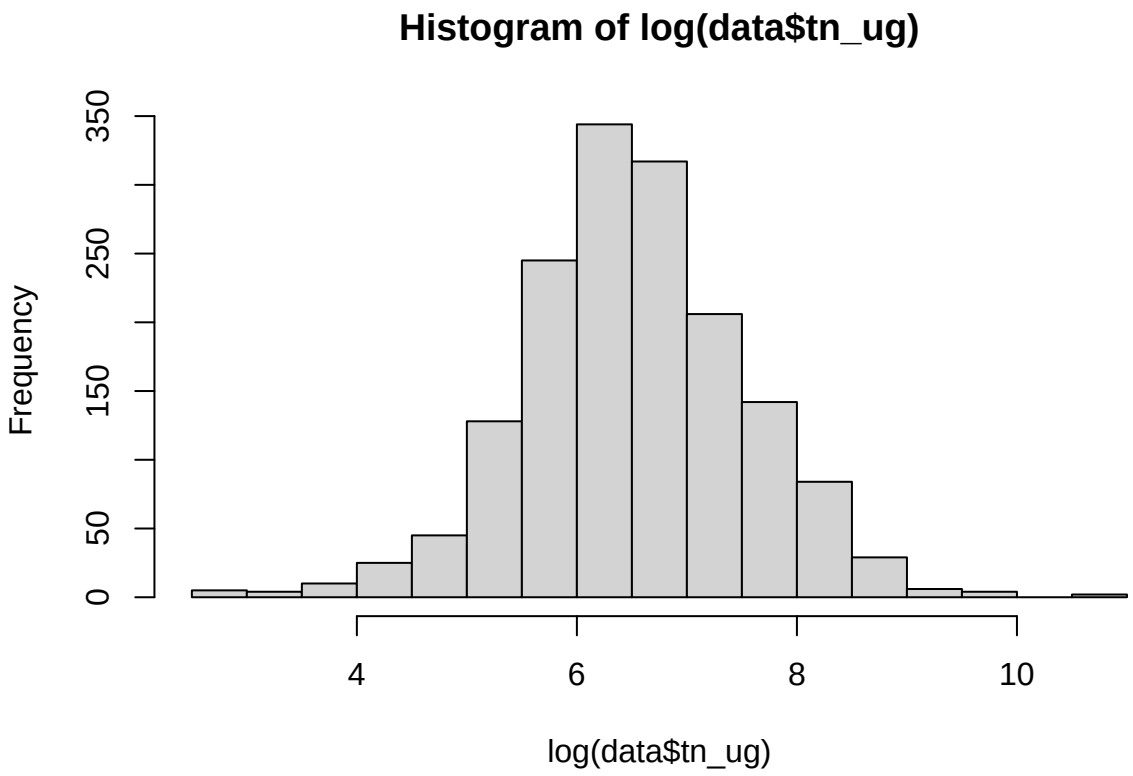
```
global.AIC
```

```
## [1] 5290.425
```




Histogram of log(data$ammonia_mg)
Frequency
0
200
400
600
−8
−6
−4
−2
0
2
log(data$ammonia_mg)

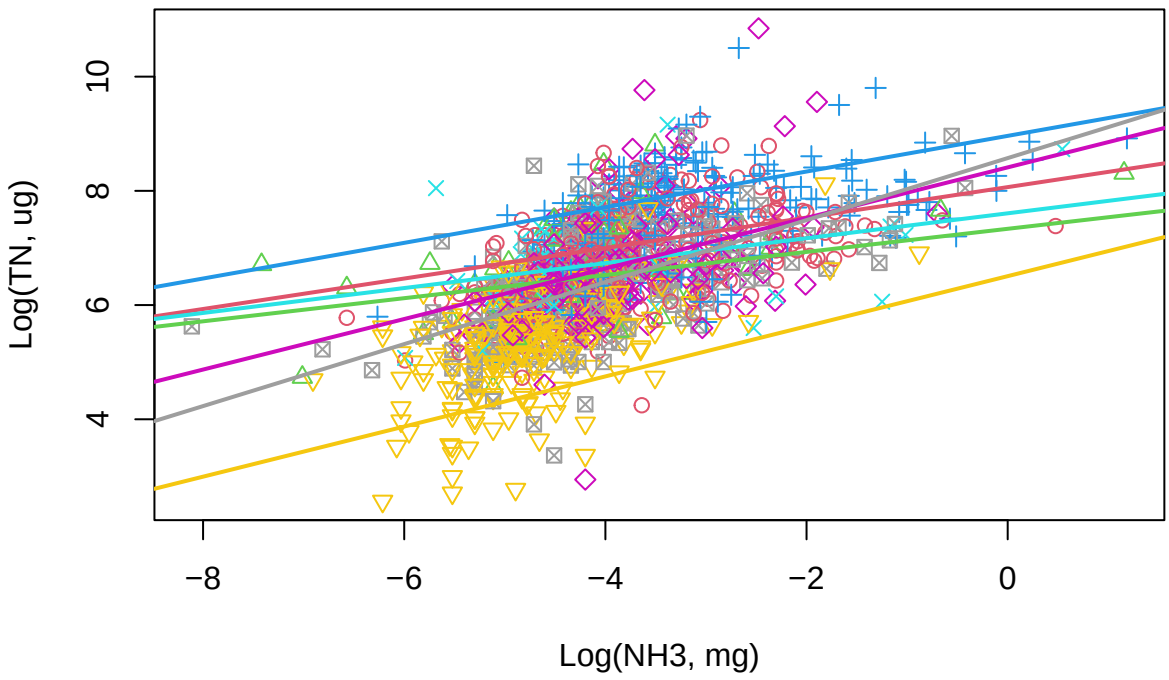

Histogram of data$tn_ug
Frequency
0
500
1000
1500
0
10000
20000
30000
40000
50000
data$tn_ug

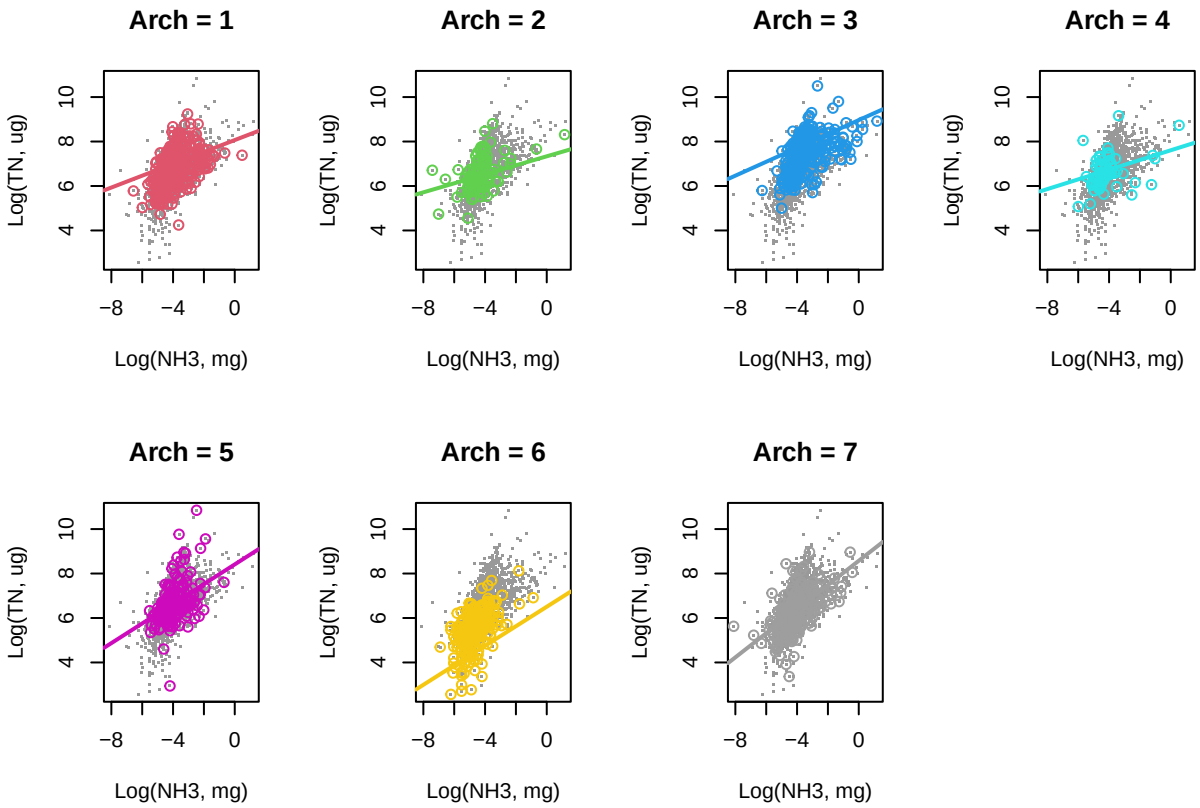



```
##
## Call:
## lm(formula = log(tn_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(ammonia_mg) + log(ammonia_mg):w.arch2 +
##     log(ammonia_mg):w.arch3 + log(ammonia_mg):w.arch4 + log(ammonia_mg):w.arch5 +
##     log(ammonia_mg):w.arch6 + log(ammonia_mg):w.arch7, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4176 -0.3829 -0.0441  0.3492  3.1555
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                8.06557    0.27532  29.296  < 2e-16 ***
## w.arch2                   -0.73010    0.57060  -1.280 0.200910
## w.arch3                    0.89720    0.35443   2.531 0.011461 *
## w.arch4                   -0.45872    0.63109  -0.727 0.467421
## w.arch5                    0.34565    0.51381   0.673 0.501233
## w.arch6                   -1.55932    0.53129  -2.935 0.003386 **
## w.arch7                    0.50821    0.42411   1.198 0.230989
## log(ammonia_mg)            0.26678    0.06892   3.871 0.000113 ***
## w.arch2:log(ammonia_mg) -0.06431    0.13317  -0.483 0.629234
## w.arch3:log(ammonia_mg)  0.04542    0.09180   0.495 0.620859
## w.arch4:log(ammonia_mg) -0.04868    0.15356  -0.317 0.751273
## w.arch5:log(ammonia_mg)  0.17580    0.12806   1.373 0.170026
## w.arch6:log(ammonia_mg)  0.17210    0.11832   1.455 0.145981
```

```
## w.arch7:log(ammonia_mg)  0.27608    0.10163   2.716 0.006673 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6399 on 1515 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.6152, Adjusted R-squared:  0.6119
## F-statistic: 186.3 on 13 and 1515 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(tn_ug) ~ log(ammonia_mg) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.3645 -0.4824 -0.0272  0.4721  3.4831
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                8.55153    0.16385  52.190  < 2e-16 ***
## log(ammonia_mg)            0.38745    0.04028   9.619  < 2e-16 ***
## max.arch                   0.06520    0.03975   1.640    0.101
## log(ammonia_mg):max.arch   0.04483    0.00939   4.775 1.97e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7755 on 1525 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.4311, Adjusted R-squared:  0.4299
## F-statistic: 385.1 on 3 and 1525 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(tn_ug) ~ log(ammonia_mg) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.6143 -0.3998 -0.0508  0.4057  3.2692
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  8.12904    0.21897  37.124  < 2e-16 ***
## log(ammonia_mg)              0.33333    0.05056   6.593 5.95e-11 ***
## ag_eco9NAP                  -0.67197    0.40120  -1.675  0.09417 .
## ag_eco9NPL                   0.90184    0.29124   3.097  0.00199 **
## ag_eco9SAP                   0.42488    0.40020   1.062  0.28856
## ag_eco9SPL                   0.83061    0.33175   2.504  0.01240 *
## ag_eco9TPL                   0.19408    0.27407   0.708  0.47896
## ag_eco9UMW                   0.05199    0.34354   0.151  0.87973
## ag_eco9WMT                   0.58444    0.31631   1.848  0.06484 .
## ag_eco9XER                   0.15937    0.31202   0.511  0.60959
## log(ammonia_mg):ag_eco9NAP   0.01241    0.09124   0.136  0.89179
## log(ammonia_mg):ag_eco9NPL   0.10659    0.07633   1.396  0.16277
## log(ammonia_mg):ag_eco9SAP   0.21544    0.09036   2.384  0.01724 *
```

```
## log(ammonia_mg):ag_eco9SPL  0.18476    0.08215   2.249  0.02465 *
## log(ammonia_mg):ag_eco9TPL -0.02019    0.06743  -0.299  0.76467
## log(ammonia_mg):ag_eco9UMW  0.05295    0.08273   0.640  0.52223
## log(ammonia_mg):ag_eco9WMT  0.35906    0.07083   5.069 4.49e-07 ***
## log(ammonia_mg):ag_eco9XER  0.13883    0.07383   1.880  0.06024 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7001 on 1511 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:  0.5405, Adjusted R-squared:  0.5353
## F-statistic: 104.6 on 17 and 1511 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(tn_ug) ~ log(ammonia_mg), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4842 -0.5340  0.0030  0.4887  3.3835
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      8.94831    0.08503  105.23   <2e-16 ***
## log(ammonia_mg)  0.59997    0.02047   29.31   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8219 on 1527 degrees of freedom
##   (73 observations deleted due to missingness)
## Multiple R-squared:   0.36,  Adjusted R-squared:  0.3596
## F-statistic: 859.1 on 1 and 1527 DF,  p-value: < 2.2e-16
```


Log(TN, ug)
4
6
8
10
−8
−6
−4
−2
0
Log(NH3, mg)




```
aa.r.sq
```

```
## [1] 0.6118763
```

```
max.arch.r.sq
```

```
## [1] 0.429945
```

```
ecoreg.r.sq
```

```
## [1] 0.5353458
```

```
global.r.sq
```

```
## [1] 0.3596288
```

```
aa.AIC
```

```
## [1] 2989.716
```

```
max.arch.AIC
```

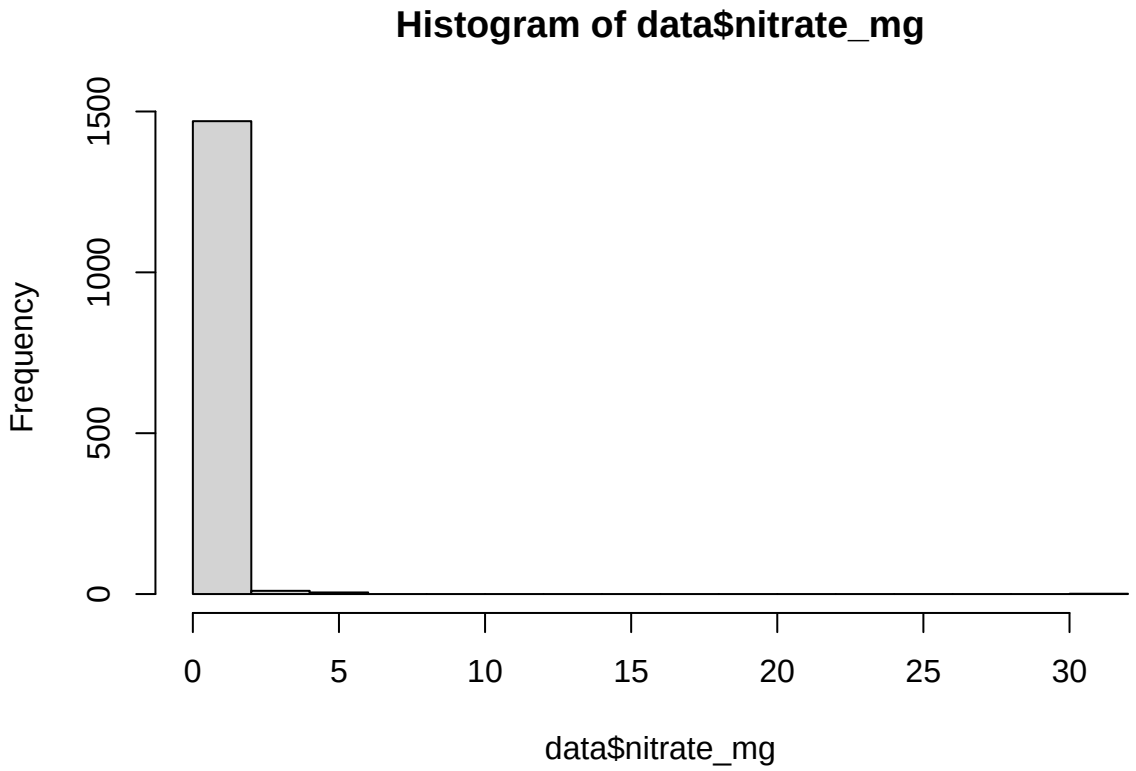
```
## [1] 3567.537
```

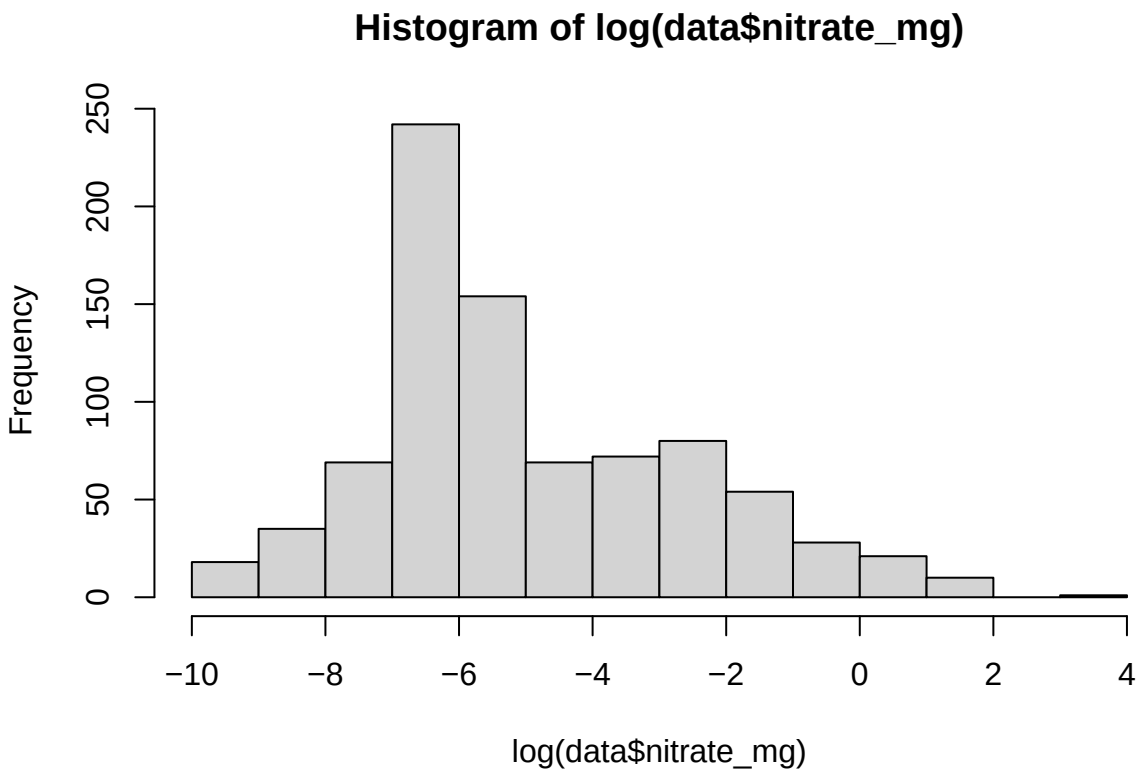
```
ecoreg.AIC
```

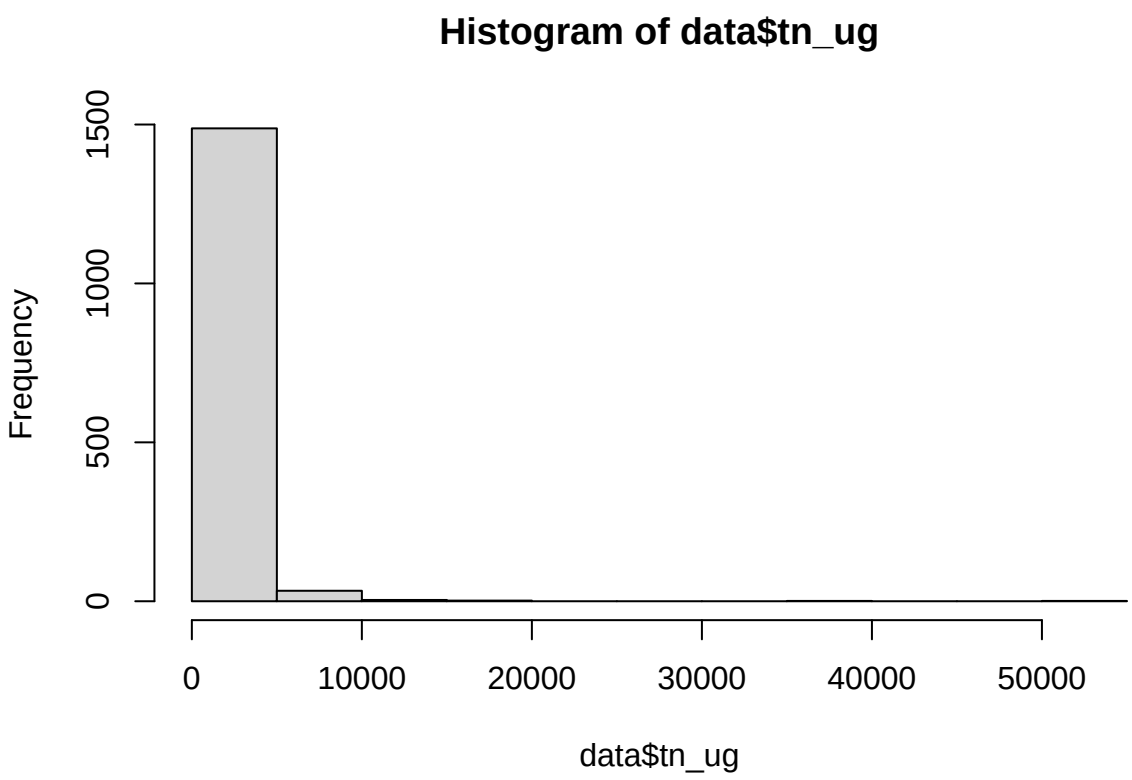
```
## [1] 3268.847
```

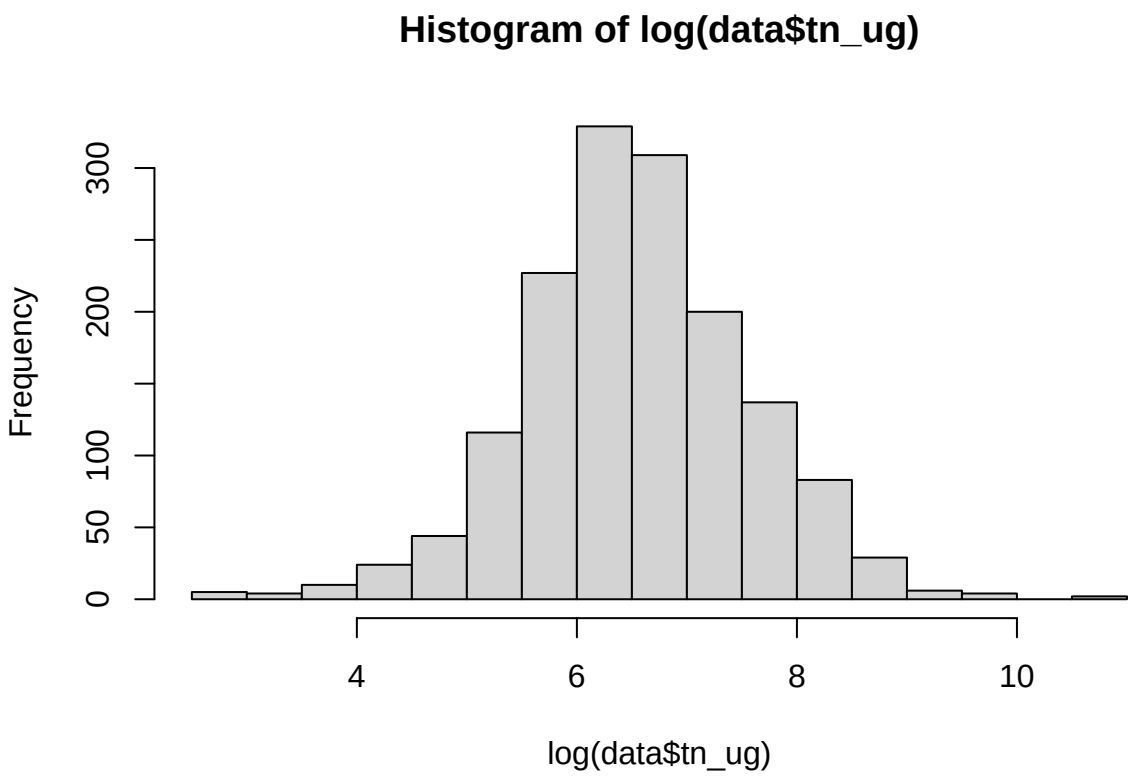
```
global.AIC
```

```
## [1] 3743.386
```




Histogram of log(data$nitrate_mg)
Frequency
0
50
100
150
200
250
−10
−8
−6
−4
−2
0
2
4
log(data$nitrate_mg)

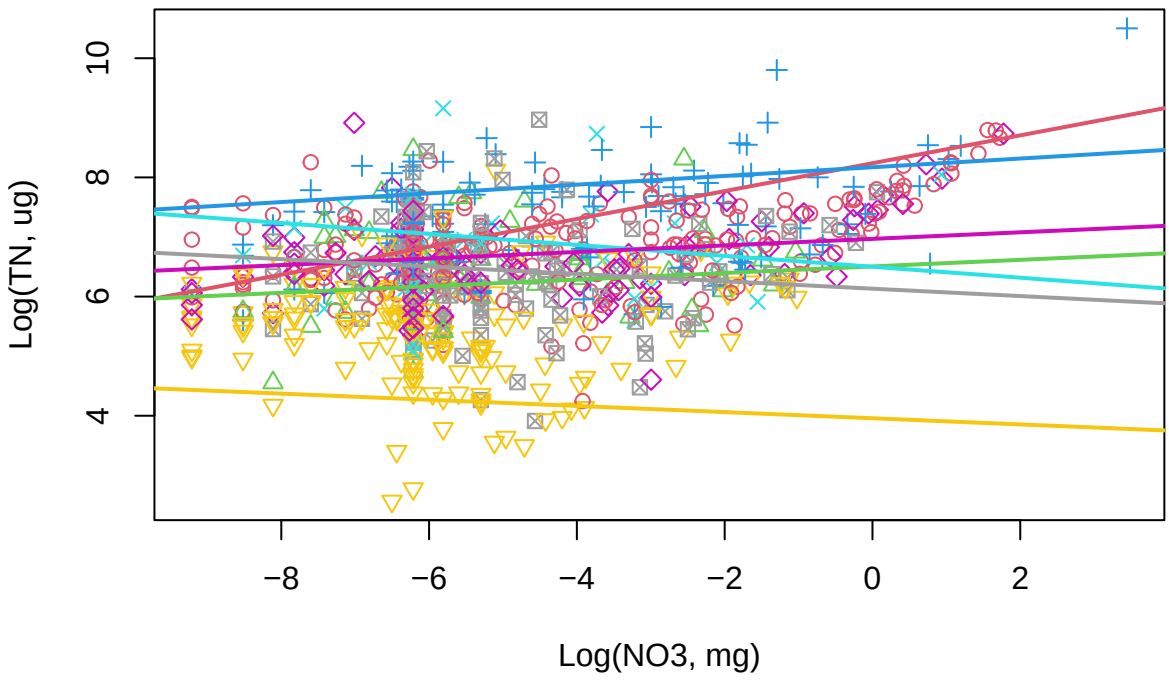

Histogram of data$tn_ug
Frequency
0
500
1000
1500
0
10000
20000
30000
40000
50000
data$tn_ug

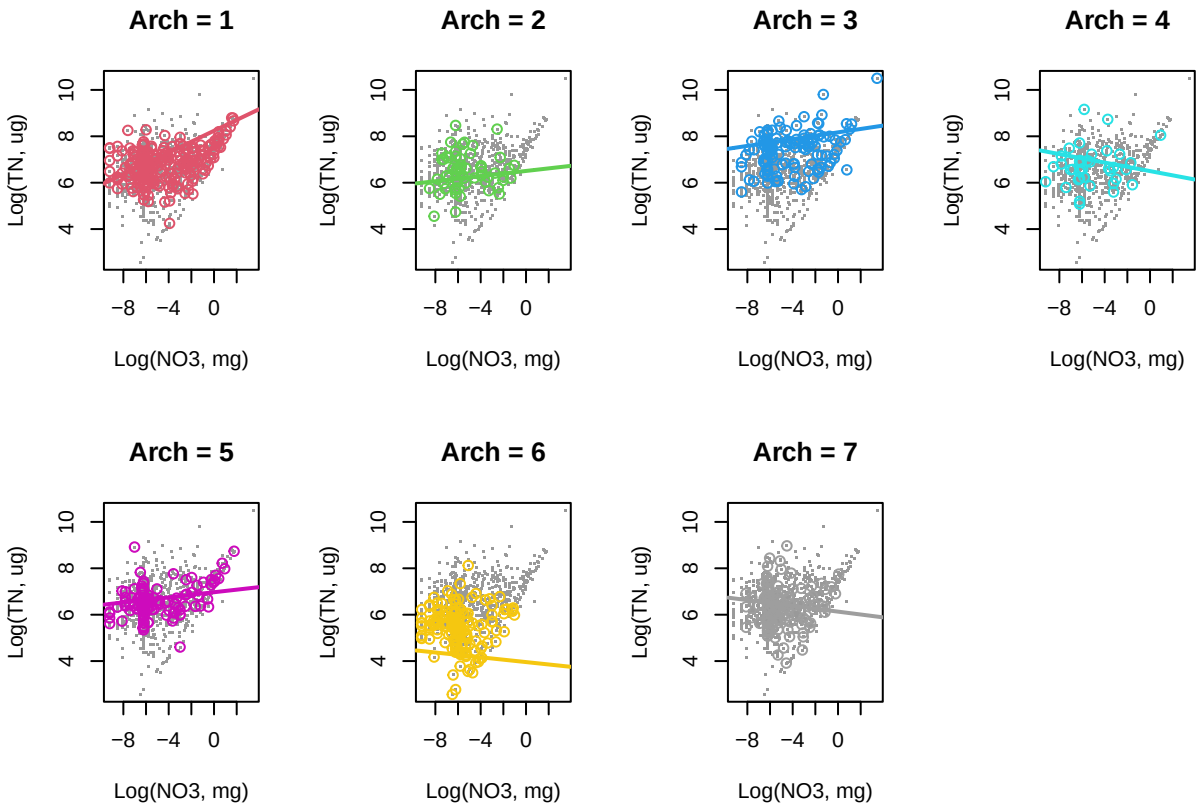



```
##
## Call:
## lm(formula = log(tn_ug) ~ w.arch2 + w.arch3 + w.arch4 + w.arch5 +
##     w.arch6 + w.arch7 + log(nitrate_mg) + log(nitrate_mg):w.arch2 +
##     log(nitrate_mg):w.arch3 + log(nitrate_mg):w.arch4 + log(nitrate_mg):w.arch5 +
##     log(nitrate_mg):w.arch6 + log(nitrate_mg):w.arch7, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.77721 -0.40690 -0.01076  0.38845  2.47462
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                8.23800    0.18079  45.566  < 2e-16 ***
## w.arch2                   -1.73196    0.43155  -4.013 6.52e-05 ***
## w.arch3                   -0.06753    0.29367  -0.230 0.818176
## w.arch4                   -1.73780    0.53628  -3.240 0.001240 **
## w.arch5                   -1.26951    0.37974  -3.343 0.000865 ***
## w.arch6                   -4.28034    0.40315 -10.617  < 2e-16 ***
## w.arch7                   -2.10554    0.35093  -6.000 2.93e-09 ***
## log(nitrate_mg)            0.23380    0.03557   6.573 8.62e-11 ***
## w.arch2:log(nitrate_mg)   -0.17847    0.08051  -2.217 0.026903 *
## w.arch3:log(nitrate_mg)   -0.16074    0.05861  -2.743 0.006221 **
## w.arch4:log(nitrate_mg)   -0.32561    0.10182  -3.198 0.001437 **
## w.arch5:log(nitrate_mg)   -0.17879    0.07001  -2.554 0.010832 *
## w.arch6:log(nitrate_mg)   -0.28548    0.07067  -4.040 5.84e-05 ***
```

```
## w.arch7:log(nitrate_mg) -0.29580    0.06782  -4.362 1.45e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6644 on 845 degrees of freedom
##   (110 observations deleted due to missingness)
## Multiple R-squared:  0.5455, Adjusted R-squared:  0.5385
## F-statistic: 78.01 on 13 and 845 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(tn_ug) ~ log(nitrate_mg) * max.arch, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4151 -0.5125  0.0002  0.5530  2.9193
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)               7.6108175  0.1232095  61.771  < 2e-16 ***
## log(nitrate_mg)           0.1151175  0.0237061   4.856 1.42e-06 ***
## max.arch                 -0.1435103  0.0326984  -4.389 1.28e-05 ***
## log(nitrate_mg):max.arch  0.0005439  0.0060024   0.091    0.928
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8641 on 855 degrees of freedom
##   (110 observations deleted due to missingness)
## Multiple R-squared:  0.2222, Adjusted R-squared:  0.2195
## F-statistic: 81.41 on 3 and 855 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = log(tn_ug) ~ log(nitrate_mg) * ag_eco9, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.0462 -0.4527 -0.0168  0.4114  3.0499
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  7.331820   0.179605  40.822  < 2e-16 ***
## log(nitrate_mg)              0.119572   0.032726   3.654 0.000274 ***
## ag_eco9NAP                  -1.246896   0.280689  -4.442 1.01e-05 ***
## ag_eco9NPL                   1.134091   0.290615   3.902 0.000103 ***
## ag_eco9SAP                  -0.509105   0.249030  -2.044 0.041229 *
## ag_eco9SPL                   0.115265   0.270504   0.426 0.670136
## ag_eco9TPL                   0.307388   0.228369   1.346 0.178660
## ag_eco9UMW                   0.043060   0.245899   0.175 0.861035
## ag_eco9WMT                  -1.660098   0.294023  -5.646 2.24e-08 ***
## ag_eco9XER                  -0.453593   0.259546  -1.748 0.080891 .
## log(nitrate_mg):ag_eco9NAP -0.104960   0.048182  -2.178 0.029653 *
## log(nitrate_mg):ag_eco9NPL  0.105926   0.057862   1.831 0.067504 .
## log(nitrate_mg):ag_eco9SAP -0.007065   0.046698  -0.151 0.879783
```

```
## log(nitrate_mg):ag_eco9SPL -0.005509   0.050877  -0.108 0.913803
## log(nitrate_mg):ag_eco9TPL -0.002866   0.043263  -0.066 0.947203
## log(nitrate_mg):ag_eco9UMW  0.008793   0.044182   0.199 0.842297
## log(nitrate_mg):ag_eco9WMT -0.110260   0.051996  -2.121 0.034252 *
## log(nitrate_mg):ag_eco9XER -0.022367   0.050424  -0.444 0.657458
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7729 on 841 degrees of freedom
##   (110 observations deleted due to missingness)
## Multiple R-squared:  0.3879, Adjusted R-squared:  0.3755
## F-statistic: 31.35 on 17 and 841 DF,  p-value: < 2.2e-16


##
## Call:
## lm(formula = log(tn_ug) ~ log(nitrate_mg), data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.6961 -0.5745  0.0188  0.6050  2.8401
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      7.17661    0.07317   98.08   <2e-16 ***
## log(nitrate_mg)  0.14080    0.01349   10.44   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9218 on 857 degrees of freedom
##   (110 observations deleted due to missingness)
## Multiple R-squared:  0.1128, Adjusted R-squared:  0.1117
## F-statistic: 108.9 on 1 and 857 DF,  p-value: < 2.2e-16
```


Log(TN, ug)
10
8
6
4
−8
−6
−4
−2
0
2
Log(NO3, mg)




```
aa.r.sq
```

```
## [1] 0.5385019
```

```
max.arch.r.sq
```

```
## [1] 0.2194558
```

```
ecoreg.r.sq
```

```
## [1] 0.3755316
```

```
global.r.sq
```

```
## [1] 0.1117469
```

```
aa.AIC
```

```
## [1] 1751.299
```

```
max.arch.AIC
```

```
## [1] 2192.821
```

```
ecoreg.AIC
```

```
## [1] 2015.004
```

```
global.AIC
```

```
## [1] 2301.867
```