> summary(Depthmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: Depth ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 284.1

Scaled residuals:

Min 1Q Median 3Q Max

-1.71470 -0.50375 0.04157 0.55793 2.94344

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.6956 0.834

Residual 15.5779 3.947

Number of obs: 69, groups: Pond:Sampling.station, 24

fit warnings:

fixed-effect model matrix is rank deficient so dropping 1 column / coefficient

> anova(Depthmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 503.88 71.983 4.6208

Instar 2 362.90 181.449 11.6478

Pond:Instar 13 1034.78 79.598 5.1097

Correlation matrix not shown by default, as p = 23 > 12.

Use print(x, correlation=TRUE) or

vcov(x) if you need it

> summary(DOCmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: DOC ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 276.8

Scaled residuals:

Min 1Q Median 3Q Max

-1.97665 -0.36294 -0.02728 0.27763 3.04141

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.2715 0.521

Residual 10.5331 3.245

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(DOCmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 4294.3 613.46 58.241

Instar 2 2354.3 1177.14 111.756

Pond:Instar 14 3066.4 219.03 20.794

> summary(NH4model)

Linear mixed model fit by REML ['lmerMod']

Formula: NH4 ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: -306.3

Scaled residuals:

Min 1Q Median 3Q Max

-2.15488 -0.40975 0.00522 0.43464 1.77713

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.000e+00 0.000000

Residual 5.725e-05 0.007566

Number of obs: 72, groups: Pond:Sampling.station, 24

Fixed effects:

> anova(NH4model)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 0.0109285 0.00156121 27.2715

Instar 2 0.0001612 0.00008061 1.4081

Pond:Instar 14 0.0013670 0.00009764 1.7056

> summary(N03N02model)

Linear mixed model fit by REML ['lmerMod']

Formula: N03N02 ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: -237

Scaled residuals:

Min 1Q Median 3Q Max

-2.79116 -0.48939 -0.02978 0.34200 2.92102

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 1.359e-20 1.166e-10

Residual 2.425e-04 1.557e-02

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(N03N02model)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 0.0114501 0.00163574 6.7449

Instar 2 0.0009528 0.00047640 1.9644

Pond:Instar 14 0.0135852 0.00097037 4.0013

> summary(TotalPmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: LogTotalP ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 38.8

Scaled residuals:

Min 1Q Median 3Q Max

-4.3942 -0.2139 0.0022 0.2082 2.8052

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.004099 0.06403

Residual 0.071928 0.26819

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(TotalPmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 6.3992 0.91417 12.7094

Instar 2 0.7990 0.39949 5.5540

Pond:Instar 14 3.8260 0.27329 3.7994

> summary(pHmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: pH ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: -11.7

Scaled residuals:

Min 1Q Median 3Q Max

-3.4857 -0.0908 0.0319 0.2064 2.2367

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.0004628 0.02151

Residual 0.0254517 0.15954

Number of obs: 66, groups: Pond:Sampling.station, 24

> anova(pHmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 0.91644 0.13092 5.1438

Instar 2 2.02070 1.01035 39.6967

Pond:Instar 12 1.61470 0.13456 5.2868

> summary(conductmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: logConduc ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: -66

Scaled residuals:

Min 1Q Median 3Q Max

-3.0296 -0.3370 -0.0691 0.2698 3.4443

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.001307 0.03615

Residual 0.007144 0.08452

Number of obs: 71, groups: Pond:Sampling.station, 24

> anova(conductmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 5.7778 0.82541 115.546

Instar 2 2.3409 1.17043 163.845

Pond:Instar 14 1.0262 0.07330 10.261

> summary(Domodel)

Linear mixed model fit by REML ['lmerMod']

Formula: DoPerc ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 357.6

Scaled residuals:

Min 1Q Median 3Q Max

-2.08764 -0.35175 -0.05346 0.43699 1.92720

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 10.75 3.279

Residual 49.19 7.014

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(Domodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 2205.5 315.08 6.4053

Instar 2 2363.8 1181.90 24.0276

Pond:Instar 14 3754.5 268.18 5.4519

> summary(tempmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: Temp ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 169.7

Scaled residuals:

Min 1Q Median 3Q Max

-2.12295 -0.52100 0.01306 0.38961 1.91187

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.2294 0.479

Residual 0.9702 0.985

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(tempmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 216.73 30.96 31.912

Instar 2 2030.88 1015.44 1046.612

Pond:Instar 14 219.98 15.71 16.195

> summary(FPOMmodel)

Linear mixed model fit by REML ['lmerMod']

Formula: FPOM\_adjust ~ Pond \* Instar + (1 | Pond:Sampling.station)

Data: SSwaterdata

REML criterion at convergence: 164.9

Scaled residuals:

Min 1Q Median 3Q Max

-1.7408 -0.3060 -0.0123 0.2666 3.3063

Random effects:

Groups Name Variance Std.Dev.

Pond:Sampling.station (Intercept) 0.01103 0.105

Residual 1.03955 1.020

Number of obs: 72, groups: Pond:Sampling.station, 24

> anova(FPOMmodel)

Analysis of Variance Table

Df Sum Sq Mean Sq F value

Pond 7 26.4626 3.7804 3.6365

Instar 2 5.5886 2.7943 2.6880

Pond:Instar 14 24.1509 1.7251 1.6594

> subsetpredicators<- subset(SSwaterdata, select = c(FPOM\_adjust, DOC, N03N02, LogTotalP, Temp, logConduc, DoPerc, pH, Depth))

> cor(subsetpredicators)

> cor(subsetpredicators, use = "pairwise.complete.obs")

> round(cor(subsetpredicators, use = "pairwise.complete.obs"),2)

Depth DOC NH4 N03N02 LogTotalP pH logConduc DoPerc FPOM\_adjust

Depth 1.00 0.04 -0.06 0.08 0.16 -0.17 -0.37 -0.17 -0.03

DOC 0.04 1.00 0.47 -0.02 0.16 0.26 0.24 0.11 -0.07

NH4 -0.06 0.47 1.00 0.08 0.18 -0.12 0.28 -0.28 0.10

N03N02 0.08 -0.02 0.08 1.00 -0.24 -0.23 0.22 0.25 -0.11

LogTotalP 0.16 0.16 0.18 -0.24 1.00 0.00 0.00 -0.27 0.30

pH -0.17 0.26 -0.12 -0.23 0.00 1.00 0.16 0.18 0.15

logConduc -0.37 0.24 0.28 0.22 0.00 0.16 1.00 0.17 0.37

DoPerc -0.17 0.11 -0.28 0.25 -0.27 0.18 0.17 1.00 -0.21

FPOM\_adjust -0.03 -0.07 0.10 -0.11 0.30 0.15 0.37 -0.21 1.00

Pond meanDepth meanDOC meanNH4 meanN03N02 meanTotalP meanConduc meanTemp meanDoPerc meanpH meanFPOM\_adjust

*<fct>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>* *<dbl>*

1 East 14.6 29.7 0.0597 0.0446 0.00699 146 7.94 73.7 6.30 1.88

2 Golf 11.6 17.3 0.0261 0.0275 0.00513 222 13.2 77.5 6.68 2.04

3 Ice 20.6 19.6 0.0249 0.0186 0.00667 88.8 6.93 77.7 6.47 1.56

4 NoOil 16.4 34.3 0.0565 0.0310 0.0399 800 12.0 66.1 6.48 3.24

5 Oil 14.2 22.5 0.0310 0.0572 0.00983 911 6.53 93.0 6.49 3.04

6 Vulgaris 20.6 39.8 0.0383 0.0204 0.0533 107 10.2 82.0 6.50 2.15

7 Vulgaris small 16.7 31.6 0.0319 0.0204 0.0148 214 10.3 79.7 6.69 2.86

8 Waterfall 17.8 38.7 0.0403 0.0275 0.00530 197 11.1 80.0 6.56 1.61

> summary(BiofilmProdmodel)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: BiofilmProd ~ Perim\_1 + Area\_1 + Area\_loss + meanDepth + meanDOC +

meanNH4 + meanN03N02 + meanlogTotalP + meanlogConduc + meanDoPerc + meanpH + meanTemp + meanFPOM\_adjust + (1 | Pond)

Data: biofilmpondata

REML criterion at convergence: 60.5

Scaled residuals:

Min 1Q Median 3Q Max

-1.1352 -0.5521 0.1457 0.4261 1.0857

Random effects:

Groups Name Variance Std.Dev.

Pond (Intercept) 6.467e-13 8.042e-07

Residual 2.171e-01 4.659e-01

Number of obs: 22, groups: Pond, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) 8.770e+00 1.357e+01 8.000e+00 0.646 0.536

Perim\_1 5.579e-03 6.737e-03 8.000e+00 0.828 0.432

Area\_1 3.722e-04 3.640e-04 8.000e+00 1.022 0.337

Area\_loss -9.677e-04 1.410e-03 8.000e+00 -0.686 0.512

meanDepth 1.248e-01 7.125e-02 8.000e+00 1.751 0.118

meanDOC -3.522e-03 9.942e-02 8.000e+00 -0.035 0.973

meanNH4 -1.150e+01 3.542e+01 8.000e+00 -0.325 0.754

meanN03N02 2.411e+01 1.342e+01 8.000e+00 1.797 0.110

meanlogTotalP -1.013e-01 8.786e-01 8.000e+00 -0.115 0.911

meanlogConduc -1.751e-01 8.372e-01 8.000e+00 -0.209 0.840

meanDoPerc 1.370e-02 4.017e-02 8.000e+00 0.341 0.742

meanpH -2.186e+00 2.036e+00 8.000e+00 -1.074 0.314

meanTemp 2.413e-01 1.570e-01 8.000e+00 1.537 0.163

meanFPOM\_adjust -1.573e-01 3.506e-01 8.000e+00 -0.449 0.666

Correlation matrix not shown by default, as p = 14 > 12.

Use print(x, correlation=TRUE) or

vcov(x) if you need it

fit warnings:

Some predictor variables are on very different scales: consider rescaling

> summary(Grazingpressuremodel)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: Grazingpressure ~ Perim\_1 + Area\_1 + Area\_loss + meanDepth +

meanDOC + meanNH4 + meanN03N02 + meanlogTotalP + meanlogConduc + meanDoPerc + meanpH + meanTemp + meanFPOM\_adjust + (1 | Pond)

Data: biofilmpondata

REML criterion at convergence: 121.2

Scaled residuals:

Min 1Q Median 3Q Max

-1.5949 -0.2485 0.0404 0.2069 1.7677

Random effects:

Groups Name Variance Std.Dev.

Pond (Intercept) 3.609 1.90

Residual 137.961 11.75

Number of obs: 23, groups: Pond, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -1.487e+02 2.453e+02 8.598e+00 -0.606 0.5600

Perim\_1 2.046e-01 1.417e-01 8.409e-01 1.444 0.4162

Area\_1 -4.881e-03 8.515e-03 6.995e-01 -0.573 0.6983

Area\_loss -2.526e-02 2.316e-02 1.550e+00 -1.090 0.4163

meanDepth -4.773e-01 1.885e+00 8.960e+00 -0.253 0.8059

meanDOC 1.999e+00 1.871e+00 8.921e+00 1.068 0.3134

meanNH4 -9.608e+02 7.915e+02 8.976e+00 -1.214 0.2557

meanN03N02 5.740e+02 3.266e+02 3.558e+00 1.757 0.1625

meanlogTotalP -2.094e+01 1.996e+01 4.357e+00 -1.049 0.3488

meanlogConduc 1.179e+01 2.102e+01 1.111e+00 0.561 0.6669

meanDoPerc -1.857e+00 9.110e-01 8.509e+00 -2.038 0.0738 .

meanpH 3.335e+01 4.389e+01 8.326e+00 0.760 0.4683

meanTemp -2.351e+00 3.619e+00 3.061e+00 -0.650 0.5614

meanFPOM\_adjust -4.633e+00 5.520e+00 8.657e+00 -0.839 0.4239

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> summary(Eastmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = East2018)

Residuals:

1 2 3 4 5

0.07980 -0.01058 -0.12082 -0.17996 0.23156

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 13.58548 0.14880 91.301 2.9e-06 \*\*\*

Day0 -0.08801 0.01074 -8.192 0.00381 \*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1889 on 3 degrees of freedom

Multiple R-squared: 0.9572, Adjusted R-squared: 0.9429

F-statistic: 67.11 on 1 and 3 DF, p-value: 0.003806

> summary(NoOilmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = NoOil2018)

Residuals:

17 18 19 20 21

0.3953 -0.3985 0.1609 -1.0762 0.9184

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 13.66992 0.70567 19.372 0.0003 \*\*\*

Day0 -0.06663 0.06960 -0.957 0.4090

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8837 on 3 degrees of freedom

Multiple R-squared: 0.234, Adjusted R-squared: -0.02131

F-statistic: 0.9165 on 1 and 3 DF, p-value: 0.409

> summary(Oilmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Oil2018)

Residuals:

22 23 24 25 26 27

0.2036 0.2815 -0.5345 -0.3183 0.2392 0.1286

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 14.29650 0.26254 54.455 6.81e-07 \*\*\*

Day0 -0.10172 0.02225 -4.571 0.0103 \*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.3813 on 4 degrees of freedom

Multiple R-squared: 0.8393, Adjusted R-squared: 0.7991

F-statistic: 20.89 on 1 and 4 DF, p-value: 0.01026

> summary(Golfmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Golf2018)

Residuals:

6 7 8 9 10

0.4137 0.2396 -0.6297 -0.7638 0.7401

Coefficients: (1 not defined because of singularities)

Estimate Std. Error t value Pr(>|t|)

(Intercept) 12.9921 0.2963 43.84 1.62e-06 \*\*\*

Day0 NA NA NA NA

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6626 on 4 degrees of freedom

> summary(Waterfallmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Waterfall2018)

Residuals:

38 39 40 41 42 43

-0.21531 -0.03643 0.57424 0.15265 -0.63420 0.15906

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 13.69856 0.33263 41.182 2.08e-06 \*\*\*

Day0 -0.04020 0.02435 -1.651 0.174

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.455 on 4 degrees of freedom

Multiple R-squared: 0.4054, Adjusted R-squared: 0.2567

F-statistic: 2.727 on 1 and 4 DF, p-value: 0.174

> summary(Vulgarismodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Vulgaris2018)

Residuals:

28 29 30 31 32

0.09661 0.19255 -0.37965 -0.15955 0.25004

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 16.23965 0.22881 70.975 6.16e-06 \*\*\*

Day0 -0.13209 0.02089 -6.324 0.00799 \*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.3047 on 3 degrees of freedom

Multiple R-squared: 0.9302, Adjusted R-squared: 0.907

F-statistic: 39.99 on 1 and 3 DF, p-value: 0.007993

> summary(Vsmallmodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Vsmall2018)

Residuals:

33 34 35 36 37

-0.24634 0.19796 0.25822 -0.22110 0.01127

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 15.14721 0.19127 79.192 4.44e-06 \*\*\*

Day0 -0.12966 0.01911 -6.786 0.00654 \*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2681 on 3 degrees of freedom

Multiple R-squared: 0.9388, Adjusted R-squared: 0.9184

F-statistic: 46.04 on 1 and 3 DF, p-value: 0.006543

> summary(Icemodel)

Call:

lm(formula = log(Totalpop) ~ Day0, data = Ice2018)

Residuals:

11 12 13 14 15 16

0.20284 0.30585 -0.45855 -0.50837 -0.09961 0.55783

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 12.79356 0.35143 36.405 3.4e-06 \*\*\*

Day0 -0.01345 0.02572 -0.523 0.629

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4808 on 4 degrees of freedom

Multiple R-squared: 0.064, Adjusted R-squared: -0.17

F-statistic: 0.2735 on 1 and 4 DF, p-value: 0.6286