Extracting Information from Regression Objects

Quantitative Analysis of Vertebrate Populations

Get the data

```
sally <- read.table("Data/Salamander_Demographics.csv", hea
str(sally)
```

```
## 'data.frame':    3382 obs. of  20 variables:
##  $ line  : int  1861 1115 360 2897 1432 372 231 2739 223
##  $ page  : int  60 36 12 92 46 12 8 87 72 17 ...
##  $ dates : chr  "4/21/09" "9/9/08" "5/31/08" "5/7/11" ..
##  $ month : int  4 9 5 5 10 5 5 10 5 6 ...
##  $ day   : int  21 9 31 7 16 31 27 24 14 5 ...
##  $ year  : int  2009 2008 2008 2011 2008 2008 2008 2009
##  $ time  : chr  "N" "N" "N" "N" ...
##  $ plot  : chr  "5" NA "3" "7" ...
##  $ mass  : num  0.427 0.633 0.639 0.921 0.943 ...
##  $ svl   : int  33 37 42 43 45 46 47 48 NA NA ...
##  $ tl    : int  63 68 63 79 74 NA 75 89 87 NA ...
##  $ sex   : chr  NA NA NA NA ...
##  $ gravid: chr  "N" "N" "N" "N" ...
##  $ group : chr  NA NA NA NA ...
```

Run a regression

Using the Salamander Demographic Data run a regression of the affect of svl on mass

```
library(lme4)
```

```
## Loading required package: Matrix
```

```
lme1 <- lmer(mass ~ 1 + svl + (1 | plot), data = sally)
summary(lme1)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: mass ~ 1 + svl + (1 | plot)
##    Data: sally
##
## REML criterion at convergence: -4875.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
```

Examine object and summary object

```
str(lme1)
```

```
## Formal class 'lmerMod' [package "lme4"] with 13 slots
##   ..@ resp   :Reference class 'lmerResp' [package "lme4"
##   .. ..$ Ptr    :<externalptr>
##   .. ..$ mu     : num [1:3373] 0.512 0.858 0.911 0.968 1
##   .. ..$ offset : num [1:3373] 0 0 0 0 0 0 0 0 0 0 ...
##   .. ..$ sqrtXwt: num [1:3373] 1 1 1 1 1 1 1 1 1 1 ...
##   .. ..$ sqrtrwt: num [1:3373] 1 1 1 1 1 1 1 1 1 1 ...
##   .. ..$ weights: num [1:3373] 1 1 1 1 1 1 1 1 1 1 ...
##   .. ..$ wtres  : num [1:3373] -0.0851 -0.2188 0.0104 -0
##   .. ..$ y      : num [1:3373] 0.427 0.639 0.921 0.943 1
##   .. ..$ REML   : int 2
##   .. ..and 28 methods, of which 14 are  possibly relevan
##   .. ..  allInfo, copy#envRefClass, initialize, initial
##   .. ..  initializePtr, initializePtr#lmResp, objective
##   .. ..  setOffset, setResp, setWeights, updateMu, wrss
##   ..@ Gp     : int [1:2] 0 12
```

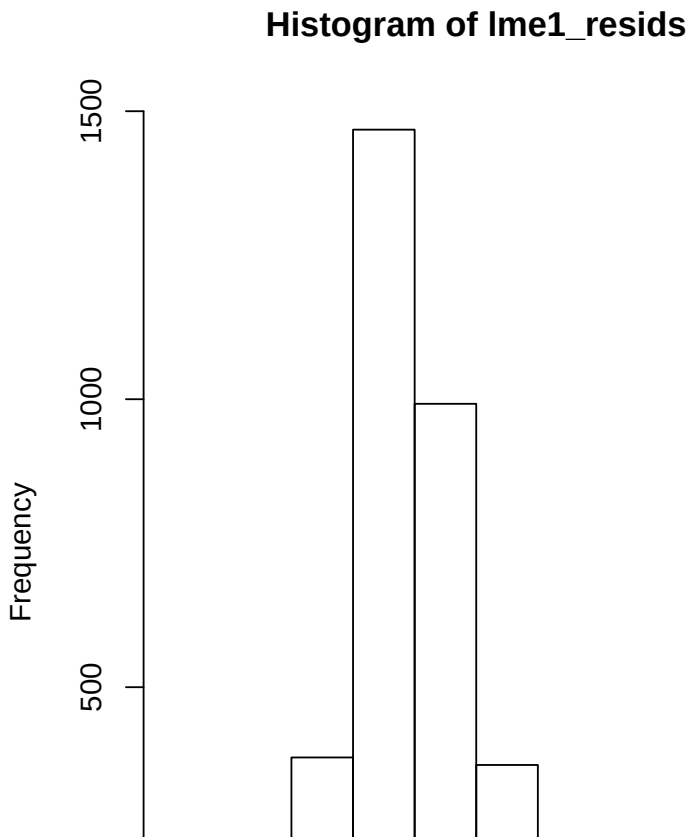
Examine object and summary object

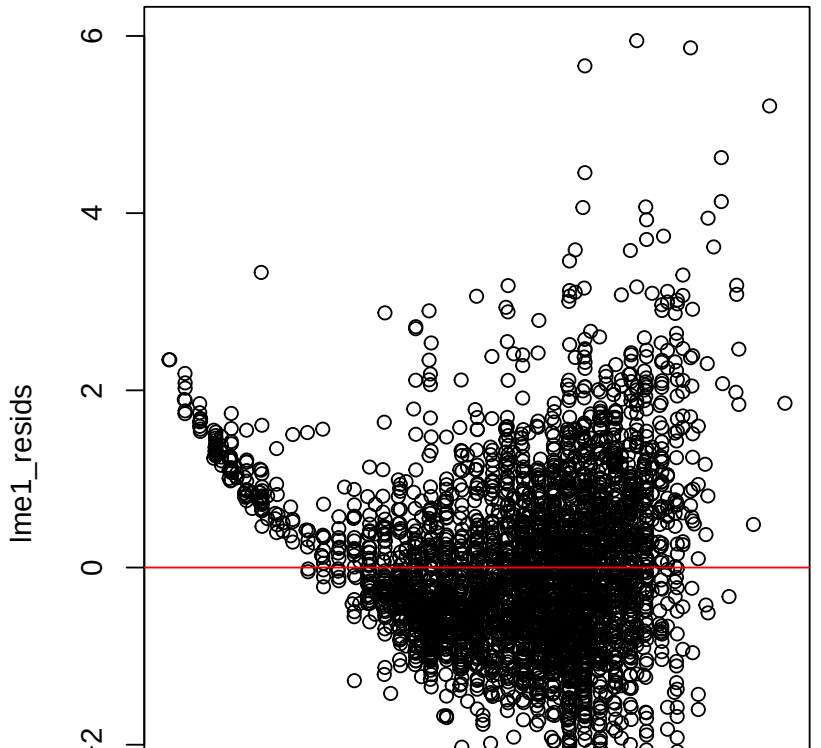
```
lme1_sum <- summary(lme1)
lme1_sum
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: mass ~ 1 + svl + (1 | plot)
##    Data: sally
##
## REML criterion at convergence: -4875.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.5969 -0.6518 -0.1338  0.5545  5.9471
##
## Random effects:
##  Groups   Name        Variance  Std.Dev.
##  plot     (Intercept) 7.475e-05 0.008646
##  Residual             1.367e-02 0.116939
## Number of obs: 3373, groups:  plot, 12
```

Get Fitted and Residuals and Plot

```
lme1_resids <- lme1_sum$residuals # or resid(lme1)
lme1_fits <- fitted(lme1)
par(mfrow = c(1, 2))
hist(lme1_resids)
plot(lme1_fits, lme1_resids)
abline(h = 0, col = "red")
```





Get random effects

```
lme1_ints <- ranef(lme1)
lme1_ints
```

```
## $plot
##       (Intercept)
## 1   -4.469993e-04
## 3   -8.752929e-04
## 4   -2.557974e-03
## 5   -5.282905e-04
## 7    1.344498e-02
## 8    3.561947e-03
## 9   -5.901732e-03
## Off  4.735069e-04
## T   -3.444650e-04
## T1  -7.681686e-03
## T2   7.829357e-04
## T3   7.307164e-05
```

Get Coefficients

```
coef(lme1)
```

```
## $plot
##     (Intercept)     svl
## 1    -0.7570483 0.03846
## 3    -0.7574765 0.03846
## 4    -0.7591592 0.03846
## 5    -0.7571295 0.03846
## 7    -0.7431563 0.03846
## 8    -0.7530393 0.03846
## 9    -0.7625030 0.03846
## Off  -0.7561277 0.03846
## T    -0.7569457 0.03846
## T1   -0.7642829 0.03846
## T2   -0.7558183 0.03846
## T3   -0.7565282 0.03846
##
## attr(,"class")
```

Plot Random Effects

```
Intercepts <- fixef(lme1)[1] + lme1_ints$plot[[1]]
Slope <- fixef(lme1)[2]
X <- seq(0, 60)
overall_intercept <- fixef(lme1)[1]
fit_line <- overall_intercept + Slope * X
plot(X, fit_line, type = "l", lwd = 2, xlab = "SVL (mm)", y
     xlim = c(30, 35),
     ylim = c(0.35, 0.6))
for(i in 1:length(Intercepts)) {
  rand_line <- Intercepts[i] + Slope * X
  lines(X, rand_line, col = "blue", lwd = 1)
}
lines(X, fit_line, lwd = 3)
```

Exercise

- Simulate data with random slopes and intercepts
- Run a linear mixed model on the data
- Plot the expected lines for each group