

ACUP__Transect__

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Set Up & read in data

```
rm(list = ls())

## Step 0: Load library----
library(ggplot2)
library(dplyr)

##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##   filter, lag
## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union

library(tidyr)
library(lubridate)

##
## Attaching package: 'lubridate'
## The following objects are masked from 'package:base':
##
##   date, intersect, setdiff, union

library(ggfortify)
library(lme4)

## Loading required package: Matrix
##
## Attaching package: 'Matrix'
## The following objects are masked from 'package:tidyr':
##
##   expand, pack, unpack

library(lmerTest)

##
## Attaching package: 'lmerTest'
## The following object is masked from 'package:lme4':
```

```
##
## lmer
## The following object is masked from 'package:stats':
##
## step
## Step 1: Import the data----
Quantityx <- read.csv("ACUP_Transsect_Location.csv")
```

```
str(Quantityx)
```

```
## 'data.frame': 360 obs. of 6 variables:
## $ Terrain.type : chr "Back-beach Vegetation" "Back-beach Vegetation" "Back-beach Vegetation" ...
## $ Transect.number : int 44 45 8 14 48 49 11 12 46 47 ...
## $ Survey.Location : int 1 2 3 4 5 6 7 8 9 10 ...
## $ Location..Beach.Number.: num 23 23 24 24 24 24 25 26 26 26 ...
## $ Type : chr "Consumables..kg." "Consumables..kg." "Consumables..kg." "Consumables..kg." ...
## $ Weight_kg : num 1 0.5 1.5 0 0.5 1 1 0.5 0.2 1 ...
```

```
summary(Quantityx)
```

```
## Terrain.type Transect.number Survey.Location Location..Beach.Number.
## Length:360 Min. : 1.00 Min. : 1.00 Min. :23.00
## Class :character 1st Qu.:15.75 1st Qu.: 5.75 1st Qu.:24.00
## Mode :character Median :30.50 Median :10.50 Median :26.50
## Mean :30.50 Mean :10.50 Mean :27.70
## 3rd Qu.:45.25 3rd Qu.:15.25 3rd Qu.:30.62
## Max. :60.00 Max. :20.00 Max. :36.00
## Type Weight_kg
## Length:360 Min. : 0.000
## Class :character 1st Qu.: 0.000
## Mode :character Median : 0.500
## Mean : 2.507
## 3rd Qu.: 2.000
## Max. :70.000
```

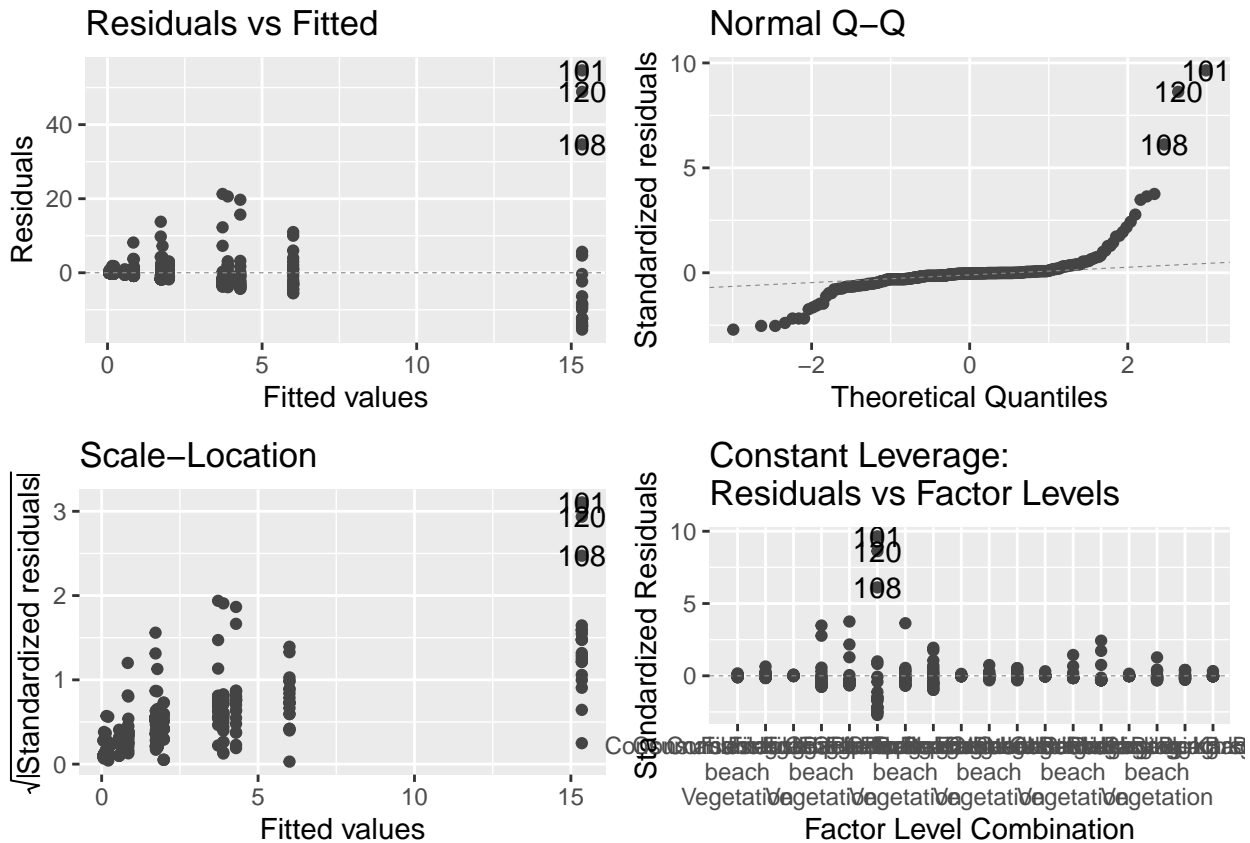
Step 1: Fit model

```
mod1. <- lm(Weight_kg~Type*Terrain.type, data=Quantityx)
```

Step 2:Check assumptions

```
autoplot(mod1., smooth.colour = NA)
```

```
## Warning: `arrange()` is deprecated as of dplyr 0.7.0.
## Please use `arrange()` instead.
## See vignette('programming') for more help
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_warnings()` to see where this warning was generated.
## Warning: Removed 360 row(s) containing missing values (geom_path).
## Warning: Removed 360 row(s) containing missing values (geom_path).
```



```
##statistics
```

```
anova(mod1.)
```

```
## Analysis of Variance Table
##
## Response: Weight_kg
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Type           5  2302.6   460.53  13.6306 3.846e-12 ***
## Terrain.type    2    18.3     9.13   0.2703  0.7633
## Type:Terrain.type 10  2159.7   215.97   6.3922 4.967e-09 ***
## Residuals      342 11554.9    33.79
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(mod1.)
```

```
##
## Call:
## lm(formula = Weight_kg ~ Type * Terrain.type, data = Quantityx)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -15.350  -1.275  -0.210   0.119   54.650
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.5575     1.2997   0.429  0.6682
```

```

## TypeFishing.Gear..k.          3.7375      1.8381      2.033      0.0428
## TypeFlip.flops..kg.          3.3325      1.8381      1.813      0.0707
## TypeFragments..kg.          1.2175      1.8381      0.662      0.5082
## TypeOther.debris..kg.        0.2775      1.8381      0.151      0.8801
## TypePackaging..kg.          1.2225      1.8381      0.665      0.5064
## Terrain.typeBeach            0.2955      1.8381      0.161      0.8724
## Terrain.typeKarst           -0.5015      1.8381     -0.273      0.7851
## TypeFishing.Gear..k.:Terrain.typeBeach -0.8680      2.5995     -0.334      0.7386
## TypeFlip.flops..kg.:Terrain.typeBeach  1.8195      2.5995      0.700      0.4844
## TypeFragments..kg.:Terrain.typeBeach -0.0855      2.5995     -0.033      0.9738
## TypeOther.debris..kg.:Terrain.typeBeach  0.5920      2.5995      0.228      0.8200
## TypePackaging..kg.:Terrain.typeBeach -0.3405      2.5995     -0.131      0.8959
## TypeFishing.Gear..k.:Terrain.typeKarst 11.5565      2.5995      4.446 1.19e-05
## TypeFlip.flops..kg.:Terrain.typeKarst -3.2575      2.5995     -1.253      0.2110
## TypeFragments..kg.:Terrain.typeKarst -1.0630      2.5995     -0.409      0.6828
## TypeOther.debris..kg.:Terrain.typeKarst -0.2585      2.5995     -0.099      0.9208
## TypePackaging..kg.:Terrain.typeKarst -1.1260      2.5995     -0.433      0.6652
##
## (Intercept)
## TypeFishing.Gear..k.          *
## TypeFlip.flops..kg.          .
## TypeFragments..kg.
## TypeOther.debris..kg.
## TypePackaging..kg.
## Terrain.typeBeach
## Terrain.typeKarst
## TypeFishing.Gear..k.:Terrain.typeBeach
## TypeFlip.flops..kg.:Terrain.typeBeach
## TypeFragments..kg.:Terrain.typeBeach
## TypeOther.debris..kg.:Terrain.typeBeach
## TypePackaging..kg.:Terrain.typeBeach
## TypeFishing.Gear..k.:Terrain.typeKarst ***
## TypeFlip.flops..kg.:Terrain.typeKarst
## TypeFragments..kg.:Terrain.typeKarst
## TypeOther.debris..kg.:Terrain.typeKarst
## TypePackaging..kg.:Terrain.typeKarst
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.813 on 342 degrees of freedom
## Multiple R-squared:  0.2794, Adjusted R-squared:  0.2436
## F-statistic: 7.801 on 17 and 342 DF,  p-value: < 2.2e-16

```

MEM

```
mem1 <- lmer(log(Weight_kg+1) ~ Type * Terrain.type + (1|Survey.Location/Transect.number), data = Quant.
```

```
anova(mem1, type=1)
```

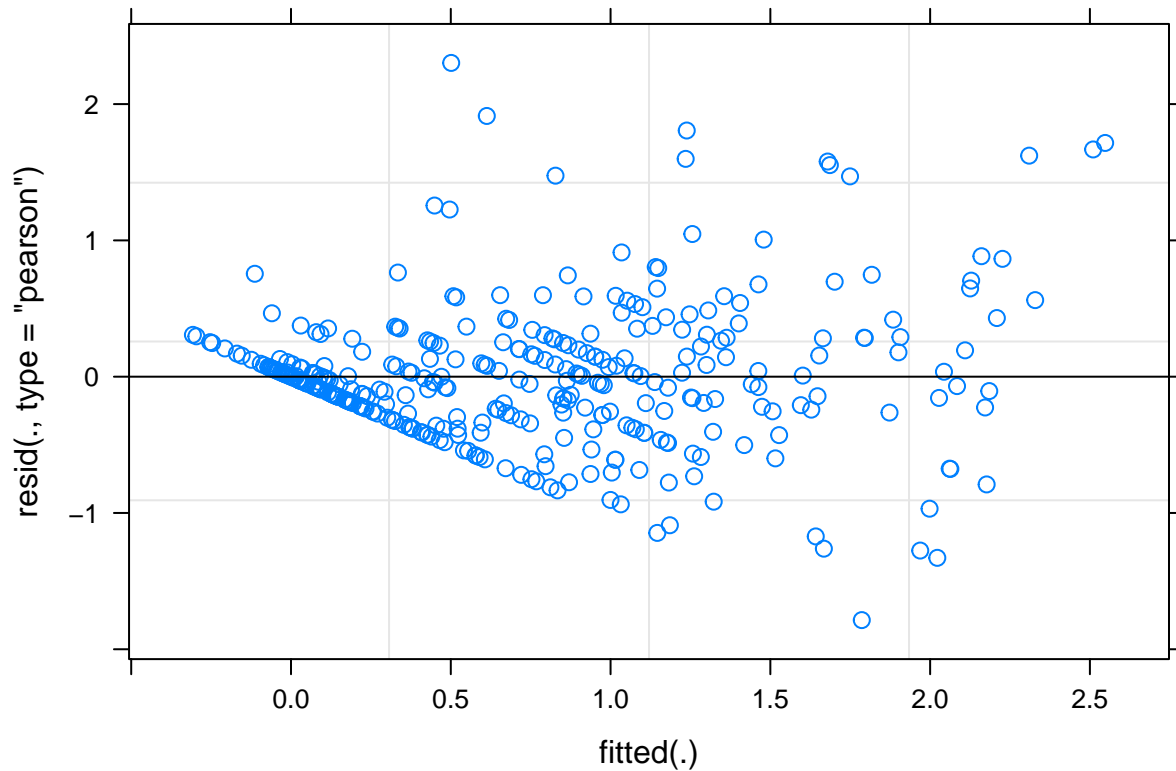
```

## Type I Analysis of Variance Table with Satterthwaite's method
##              Sum Sq Mean Sq NumDF DenDF F value    Pr(>F)
## Type          63.101  12.6202     5   285  42.058 < 2.2e-16 ***
## Terrain.type    8.727   4.3633     2    38  14.541 2.043e-05 ***
## Type:Terrain.type 44.897   4.4897    10   285  14.962 < 2.2e-16 ***
## ---

```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(mem1, smooth.colour = NA)
```



```
summary(mem1)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [  
## lmerModLmerTest]  
## Formula:  
## log(Weight_kg + 1) ~ Type * Terrain.type + (1 | Survey.Location/Transect.number)  
## Data: Quantityx  
##  
## REML criterion at convergence: 663.4  
##  
## Scaled residuals:  
##      Min       1Q   Median       3Q      Max   
## -3.2607 -0.4608 -0.0507  0.3640  4.2026   
##  
## Random effects:  
## Groups                Name      Variance Std.Dev.  
## Transect.number:Survey.Location (Intercept) 0.04480  0.2117  
## Survey.Location          (Intercept) 0.03489  0.1868  
## Residual                  0.30007  0.5478  
## Number of obs: 360, groups:  
## Transect.number:Survey.Location, 60; Survey.Location, 20  
##  
## Fixed effects:  
##                Estimate Std. Error    df  
## (Intercept)      0.405202   0.137797 258.803078  
## TypeFishing.Gear..k. 0.812143   0.173225 285.000032
```

```

## TypeFlip.flops..kg.          0.856281  0.173225 285.000032
## TypeFragments..kg.          0.525402  0.173225 285.000032
## TypeOther.debris..kg.      -0.109581  0.173225 285.000032
## TypePackaging..kg.         0.425910  0.173225 285.000032
## Terrain.typeBeach          0.089830  0.185707 260.839918
## Terrain.typeKarst          -0.358900  0.185707 260.839918
## TypeFishing.Gear..k.:Terrain.typeBeach -0.243075  0.244977 285.000033
## TypeFlip.flops..kg.:Terrain.typeBeach  0.362086  0.244977 285.000033
## TypeFragments..kg.:Terrain.typeBeach -0.034335  0.244977 285.000033
## TypeOther.debris..kg.:Terrain.typeBeach  0.033644  0.244977 285.000033
## TypePackaging..kg.:Terrain.typeBeach -0.008824  0.244977 285.000033
## TypeFishing.Gear..k.:Terrain.typeKarst  1.280958  0.244977 285.000033
## TypeFlip.flops..kg.:Terrain.typeKarst -0.796011  0.244977 285.000033
## TypeFragments..kg.:Terrain.typeKarst -0.425590  0.244977 285.000033
## TypeOther.debris..kg.:Terrain.typeKarst  0.120411  0.244977 285.000033
## TypePackaging..kg.:Terrain.typeKarst -0.372279  0.244977 285.000033
##                               t value Pr(>|t|)
## (Intercept)                 2.941  0.00357 **
## TypeFishing.Gear..k.         4.688 4.27e-06 ***
## TypeFlip.flops..kg.         4.943 1.31e-06 ***
## TypeFragments..kg.          3.033  0.00264 **
## TypeOther.debris..kg.       -0.633  0.52750
## TypePackaging..kg.          2.459  0.01454 *
## Terrain.typeBeach            0.484  0.62899
## Terrain.typeKarst           -1.933  0.05437 .
## TypeFishing.Gear..k.:Terrain.typeBeach -0.992  0.32192
## TypeFlip.flops..kg.:Terrain.typeBeach  1.478  0.14050
## TypeFragments..kg.:Terrain.typeBeach -0.140  0.88864
## TypeOther.debris..kg.:Terrain.typeBeach  0.137  0.89086
## TypePackaging..kg.:Terrain.typeBeach -0.036  0.97129
## TypeFishing.Gear..k.:Terrain.typeKarst  5.229 3.31e-07 ***
## TypeFlip.flops..kg.:Terrain.typeKarst -3.249  0.00130 **
## TypeFragments..kg.:Terrain.typeKarst -1.737  0.08342 .
## TypeOther.debris..kg.:Terrain.typeKarst  0.492  0.62344
## TypePackaging..kg.:Terrain.typeKarst -1.520  0.12971
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Correlation matrix not shown by default, as p = 18 > 12.
## Use print(x, correlation=TRUE) or
##     vcov(x)         if you need it

```