Survival Analysis

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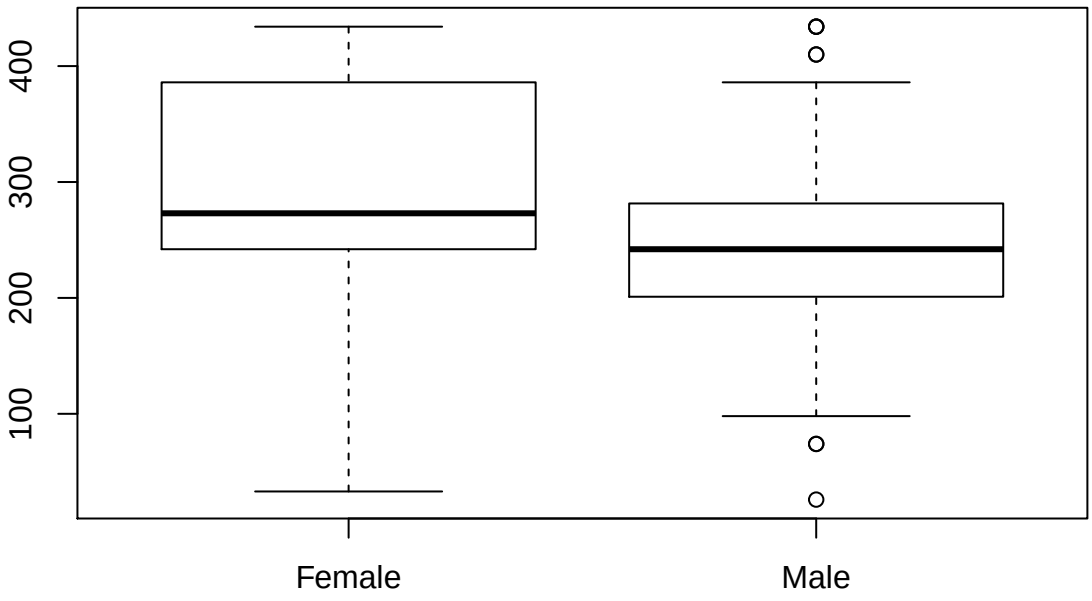
Preliminary Analysis

The following is preliminary/exploratory analysis of lethal responses of P. armatus. I ran an ANCOVA and on the main effects: site, sex, and block with crab size (CW) as a covariate. A significant block effect was detected. This prelimary analysis indicates that Sex was the strongest effect, followed by the covariate Carapace Width, and Site. There were no significant interactions.

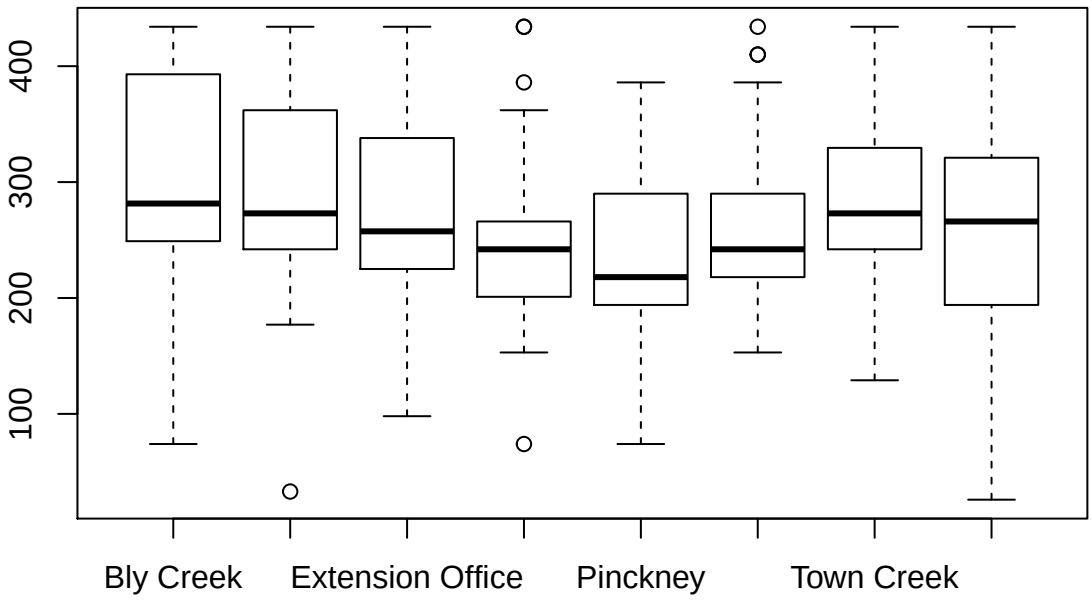
```
KM_Survival <- read.csv("~/Applied Quant Project/Survival/Trial1_survival.csv")
KM_Survival$Block=as.factor(KM_Survival$Block)
library(survival)

#ANCOVA of main effects: Lethal
options(contrasts=c("contr.sum", "contr.poly"))
fit1=(aov(lm(Duration~Site*Sex*Block+CW, data=KM_Survival)))
drop1(fit1,~.,test='F')
```

```
## Single term deletions
##
## Model:
## Duration ~ Site * Sex * Block + CW
##                Df Sum of Sq     RSS    AIC F value    Pr(>F)
## <none>                      1198838 2291.4
## Site            7    118349 1317187 2301.9  2.9757 0.0053631 **
## Sex             1     94372 1293210 2309.1 16.6099 6.501e-05 ***
## Block           2    130861 1329698 2314.3 11.5160 1.792e-05 ***
## CW              1     76666 1275504 2305.5 13.4936 0.0003035 ***
## Site:Sex        7     43662 1242500 2286.7  1.0978 0.3656944
## Site:Block     14     93862 1292700 2283.0  1.1800 0.2923580
## Sex:Block       2     30168 1229006 2293.9  2.6549 0.0726552 .
## Site:Sex:Block 14     87136 1285974 2281.7  1.0954 0.3632499
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

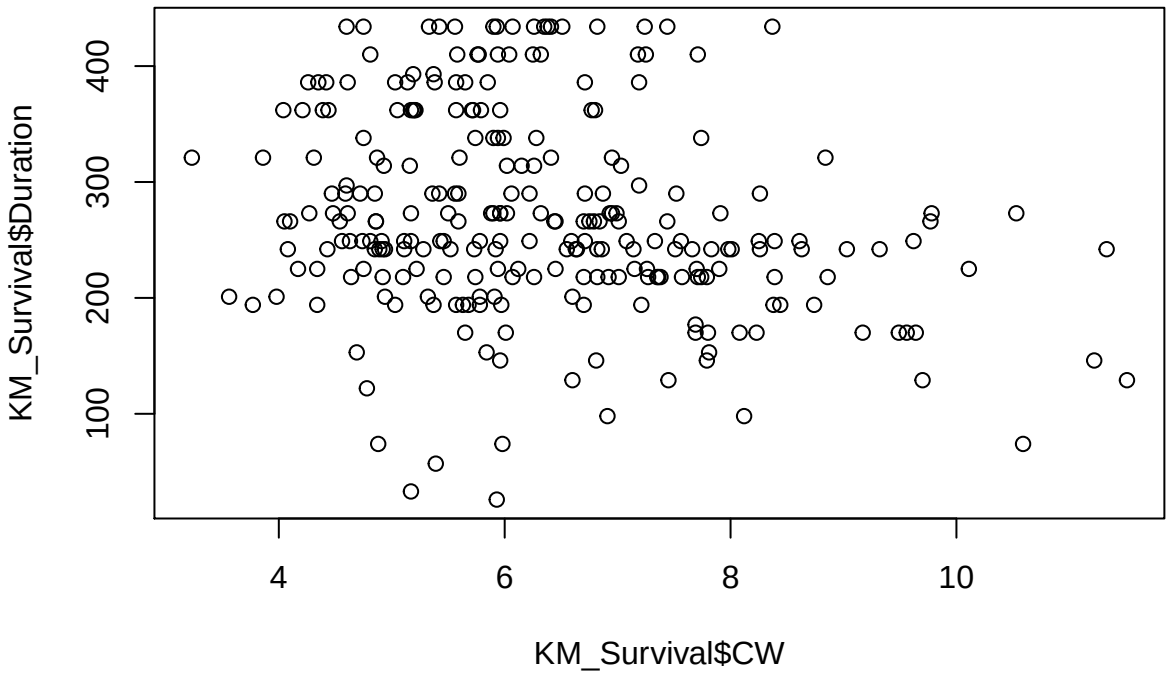
```
#Boxplots: Lethal
plot(KM_Survival$Sex, KM_Survival$Duration)
```



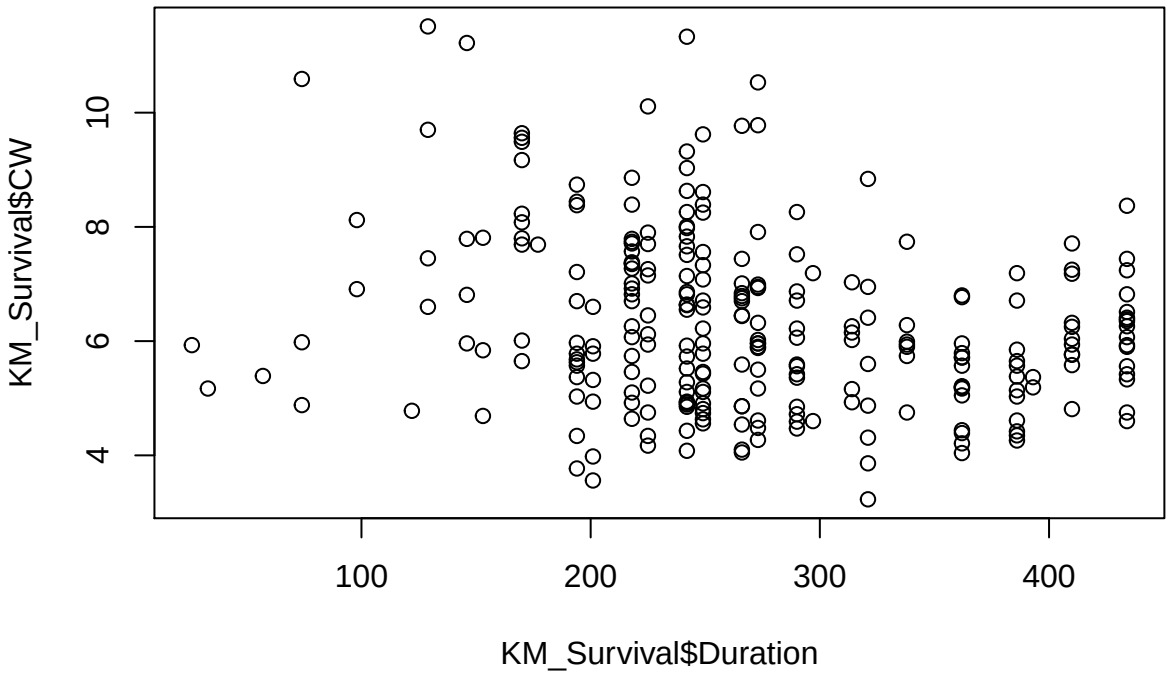

```
plot(KM_Survival$Site, KM_Survival$Duration)
```




```
plot(KM_Survival$CW,KM_Survival$Duration)
```




```
plot(KM_Survival$Duration, KM_Survival$CW )
```

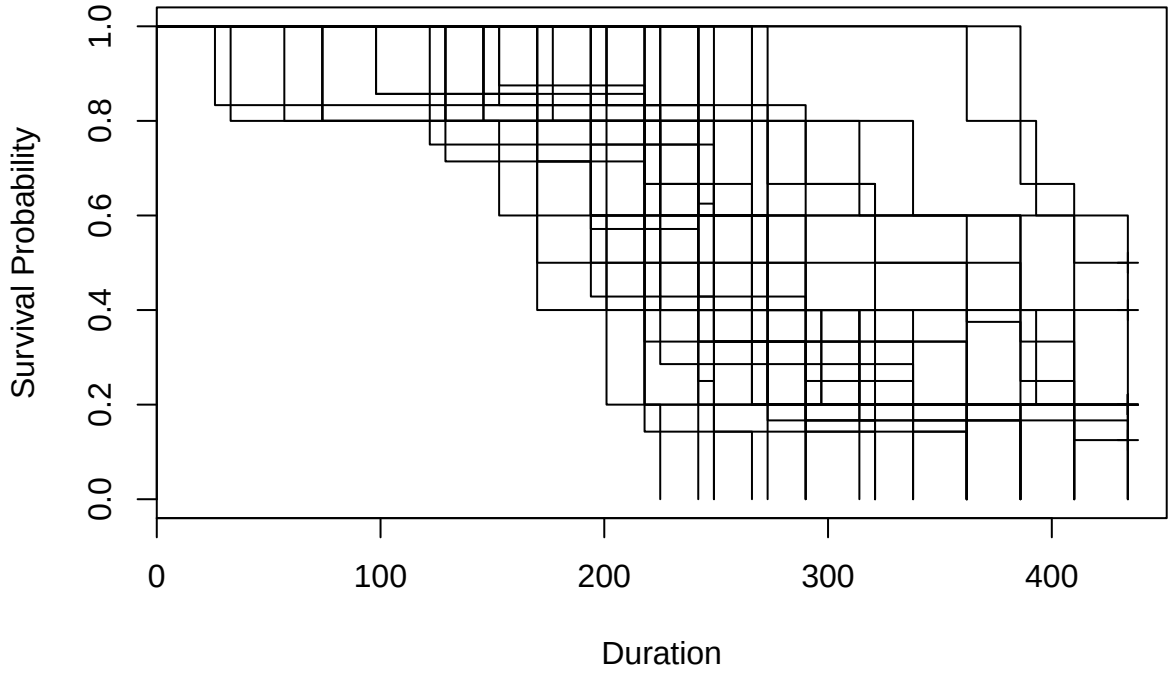



```
#closley related to sex. Examine males and females separetely?
```

Analysis of Main Effects

The following is analysis of lethal responses of P. armatus. I tested the main effects: site, sex, block and crab size (CW) by generating Kaplan-Meier curves, main effects were tested with a Log Rank test. I next fitted these curves to a Cox proportional hazards model to determine differences in hazard risk between main effects, which were tested with ANOVA. A significant block effect was detected. Significant differences in survival were detected for all the main effects.

```
#KM Curves of main effects
let_mod1=survfit(Surv(Duration,Status)~Block+Site+Sex, data=KM_Survival)
plot(let_mod1, ylab='Survival Probability', xlab='Duration')
```




```
#disregard, this figure is not for publication

#Log Rank test of main effects tests for differences
let_mod1_dif=survdiff(Surv(Duration,Status)~Block+Site+Sex, data=KM_Survival)
let_mod1_dif
```

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Site + Sex,
##     data = KM_Survival)
##
##                                          N Observed Expected (O-E)^2/E
## Block=1, Site=Bly Creek       , Sex=Female 5        5    11.40   3.59237
## Block=1, Site=Bly Creek       , Sex=Male   5        5     4.92   0.00137
## Block=1, Site=Bowens Island   , Sex=Female 5        3     9.92   4.83023
## Block=1, Site=Bowens Island   , Sex=Male   5        5     4.35   0.09694
## Block=1, Site=Extension Office, Sex=Female 5        5     6.29   0.26469
## Block=1, Site=Extension Office, Sex=Male   5        4     4.63   0.08646
## Block=1, Site=Grice           , Sex=Female 5        4     5.75   0.53179
```

```
## Block=1, Site=Grice           , Sex=Male   5        5     4.52   0.05075
## Block=1, Site=Pinckney        , Sex=Female 5        5     3.42   0.72953
## Block=1, Site=Pinckney        , Sex=Male   5        5     1.73   6.19696
## Block=1, Site=Roebling House  , Sex=Female 8        7    10.51   1.17490
## Block=1, Site=Roebling House  , Sex=Male   6        6     4.73   0.34353
## Block=1, Site=Town Creek      , Sex=Female 5        4     9.95   3.56003
## Block=1, Site=Town Creek      , Sex=Male   5        5     4.58   0.03775
## Block=1, Site=Trask           , Sex=Female 6        3    14.76   9.37077
## Block=1, Site=Trask           , Sex=Male   7        7     3.74   2.85205
## Block=2, Site=Bly Creek       , Sex=Female 5        5     7.44   0.80201
## Block=2, Site=Bly Creek       , Sex=Male   5        4     8.18   2.13432
## Block=2, Site=Bowens Island   , Sex=Female 5        5     4.54   0.04702
## Block=2, Site=Bowens Island   , Sex=Male   5        5     4.87   0.00336
## Block=2, Site=Extension Office, Sex=Female 5        4     6.16   0.75589
## Block=2, Site=Extension Office, Sex=Male   6        6     5.38   0.07193
## Block=2, Site=Grice           , Sex=Female 5        5     5.51   0.04711
## Block=2, Site=Grice           , Sex=Male   4        4     1.73   2.99484
## Block=2, Site=Pinckney        , Sex=Female 6        6     8.18   0.58178
## Block=2, Site=Pinckney        , Sex=Male   7        7     2.61   7.39686
## Block=2, Site=Roebling House  , Sex=Female 6        6     4.07   0.91582
## Block=2, Site=Roebling House  , Sex=Male   6        6     5.89   0.00216
## Block=2, Site=Town Creek      , Sex=Female 6        6    10.00   1.60085
## Block=2, Site=Town Creek      , Sex=Male   5        5     3.51   0.63396
## Block=2, Site=Trask           , Sex=Female 5        5     4.74   0.01468
## Block=2, Site=Trask           , Sex=Male   5        5     3.50   0.63819
## Block=3, Site=Bly Creek       , Sex=Female 4        4     3.23   0.18392
## Block=3, Site=Bly Creek       , Sex=Male   6        6     4.26   0.70776
## Block=3, Site=Bowens Island   , Sex=Female 5        5     5.79   0.10717
## Block=3, Site=Bowens Island   , Sex=Male   5        5     4.36   0.09349
## Block=3, Site=Extension Office, Sex=Female 6        6     4.71   0.35136
## Block=3, Site=Extension Office, Sex=Male   7        7     5.42   0.46354
## Block=3, Site=Grice           , Sex=Female 5        5     3.56   0.58207
## Block=3, Site=Grice           , Sex=Male   5        5     1.20  12.09192
## Block=3, Site=Pinckney        , Sex=Female 5        5     3.57   0.57659
## Block=3, Site=Pinckney        , Sex=Male   7        7     2.97   5.48374
## Block=3, Site=Roebling House  , Sex=Female 5        5     2.90   1.52619
## Block=3, Site=Roebling House  , Sex=Male   5        5     1.90   5.03062
## Block=3, Site=Town Creek      , Sex=Female 5        5     5.81   0.11167
## Block=3, Site=Town Creek      , Sex=Male   5        5     1.46   8.60607
## Block=3, Site=Trask           , Sex=Female 6        6     3.40   1.99317
## Block=3, Site=Trask           , Sex=Male   6        6     2.97   3.08346
##                                          (O-E)^2/V
## Block=1, Site=Bly Creek       , Sex=Female   4.60437
## Block=1, Site=Bly Creek       , Sex=Male     0.00157
## Block=1, Site=Bowens Island   , Sex=Female   6.07318
## Block=1, Site=Bowens Island   , Sex=Male     0.10973
## Block=1, Site=Extension Office, Sex=Female   0.31725
## Block=1, Site=Extension Office, Sex=Male     0.10387
## Block=1, Site=Grice           , Sex=Female   0.63788
## Block=1, Site=Grice           , Sex=Male     0.06139
## Block=1, Site=Pinckney        , Sex=Female   0.82936
## Block=1, Site=Pinckney        , Sex=Male     6.81986
## Block=1, Site=Roebling House  , Sex=Female   1.45614
## Block=1, Site=Roebling House  , Sex=Male     0.39152
```

```
## Block=1, Site=Town Creek      , Sex=Female   4.60902
## Block=1, Site=Town Creek      , Sex=Male     0.04330
## Block=1, Site=Trask           , Sex=Female  12.47399
## Block=1, Site=Trask           , Sex=Male     3.22429
## Block=2, Site=Bly Creek       , Sex=Female   0.96850
## Block=2, Site=Bly Creek       , Sex=Male     2.67385
## Block=2, Site=Bowens Island   , Sex=Female   0.05450
## Block=2, Site=Bowens Island   , Sex=Male     0.00392
## Block=2, Site=Extension Office, Sex=Female   0.91135
## Block=2, Site=Extension Office, Sex=Male     0.08305
## Block=2, Site=Grice           , Sex=Female   0.05438
## Block=2, Site=Grice           , Sex=Male     3.28004
## Block=2, Site=Pinckney        , Sex=Female   0.68620
## Block=2, Site=Pinckney        , Sex=Male     8.12426
## Block=2, Site=Roebling House  , Sex=Female   1.03650
## Block=2, Site=Roebling House  , Sex=Male     0.00255
## Block=2, Site=Town Creek      , Sex=Female   1.98289
## Block=2, Site=Town Creek      , Sex=Male     0.71383
## Block=2, Site=Trask           , Sex=Female   0.01740
## Block=2, Site=Trask           , Sex=Male     0.72030
## Block=3, Site=Bly Creek       , Sex=Female   0.20784
## Block=3, Site=Bly Creek       , Sex=Male     0.80231
## Block=3, Site=Bowens Island   , Sex=Female   0.12853
## Block=3, Site=Bowens Island   , Sex=Male     0.10654
## Block=3, Site=Extension Office, Sex=Female   0.39943
## Block=3, Site=Extension Office, Sex=Male     0.52988
## Block=3, Site=Grice           , Sex=Female   0.66758
## Block=3, Site=Grice           , Sex=Male    12.79241
## Block=3, Site=Pinckney        , Sex=Female   0.65200
## Block=3, Site=Pinckney        , Sex=Male     6.09177
## Block=3, Site=Roebling House  , Sex=Female   1.69230
## Block=3, Site=Roebling House  , Sex=Male     5.48309
## Block=3, Site=Town Creek      , Sex=Female   0.13192
## Block=3, Site=Town Creek      , Sex=Male     9.30973
## Block=3, Site=Trask           , Sex=Female   2.23163
## Block=3, Site=Trask           , Sex=Male     3.44977
##
##  Chisq= 121  on 47 degrees of freedom, p= 2.02e-08
```

```
#Cox proportional hazards model fit
let_mod1_cox=coxph(Surv(Duration,Status)~Block+Site+Sex+CW, data=KM_Survival)
summary(let_mod1_cox)
```

```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Site + Sex +
##     CW, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## Block1 -0.39229   0.67551  0.09621 -4.077 4.55e-05 ***
## Block2 -0.14404   0.86585  0.09133 -1.577 0.114768
## Site1  -0.50792   0.60175  0.17696 -2.870 0.004101 **
## Site2  -0.27543   0.75925  0.17729 -1.554 0.120297
```

```
## Site3  -0.19566   0.82229  0.16736 -1.169 0.242347
## Site4   0.36378   1.43876  0.17778  2.046 0.040731 *
## Site5   0.55657   1.74467  0.16525  3.368 0.000757 ***
## Site6   0.22134   1.24774  0.16163  1.369 0.170876
## Site7  -0.23649   0.78939  0.17460 -1.354 0.175594
## Sex1   -0.31918   0.72674  0.06835 -4.670 3.02e-06 ***
## CW      0.22285   1.24963  0.04778  4.664 3.10e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## Block1    0.6755     1.4804    0.5594    0.8157
## Block2    0.8659     1.1549    0.7239    1.0356
## Site1     0.6017     1.6618    0.4254    0.8512
## Site2     0.7592     1.3171    0.5364    1.0747
## Site3     0.8223     1.2161    0.5923    1.1415
## Site4     1.4388     0.6950    1.0155    2.0385
## Site5     1.7447     0.5732    1.2620    2.4120
## Site6     1.2477     0.8014    0.9090    1.7128
## Site7     0.7894     1.2668    0.5606    1.1115
## Sex1      0.7267     1.3760    0.6356    0.8309
## CW        1.2496     0.8002    1.1379    1.3723
##
## Concordance= 0.691  (se = 0.023 )
## Rsquare= 0.295   (max possible= 1 )
## Likelihood ratio test= 90.9  on 11 df,   p=1.11e-14
## Wald test            = 92.43  on 11 df,   p=5.551e-15
## Score (logrank) test = 96.38  on 11 df,   p=8.882e-16
```

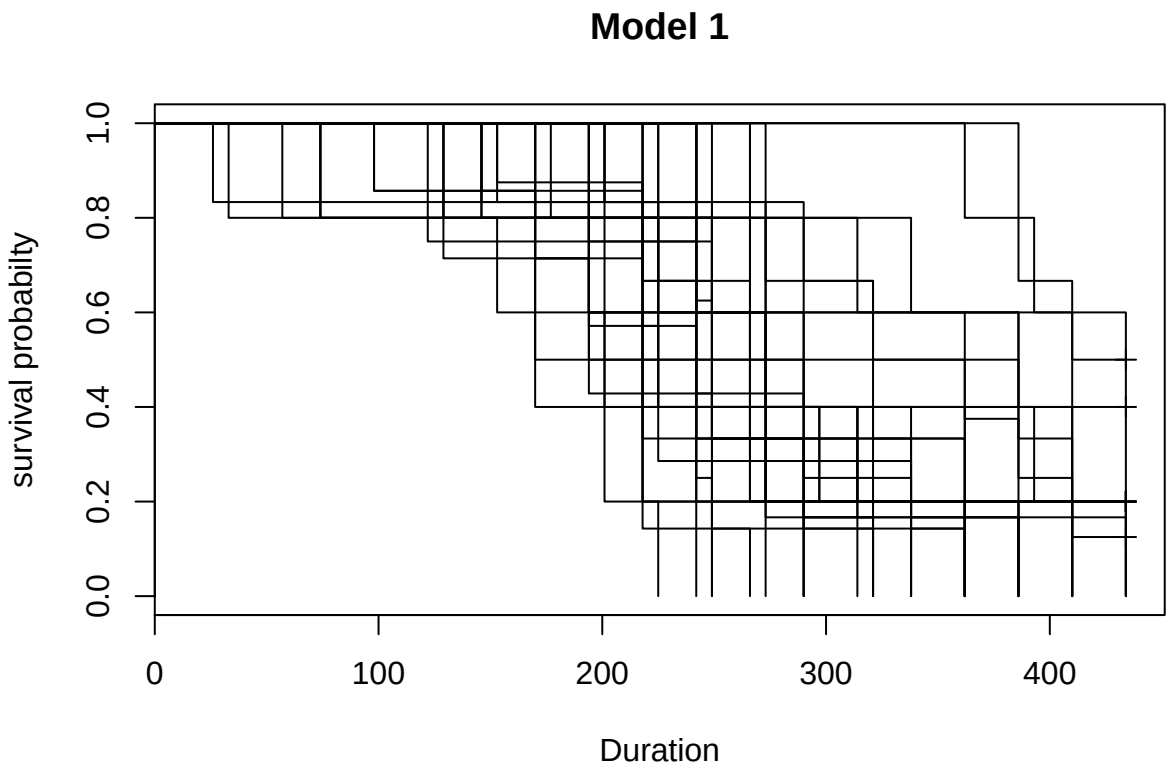
```
#ANOVA of main effects
anova(let_mod1_cox)
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##        loglik  Chisq Df Pr(>|Chi|)
## NULL  -1172.0
## Block -1159.0 25.987  2  2.275e-06 ***
## Site  -1151.0 15.896  7    0.02608 *
## Sex   -1136.9 28.205  1  1.091e-07 ***
## CW    -1126.5 20.815  1  5.058e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Analysis of Spatial Scale

The following is analysis of lethal responses of P. armatus at three spatial scales. I tested the main effects, grouping data by site, location, and region, to determine inter-site and region differences in survival. Differences in survival exist between sites, and regions, but were not detcted between locations.

```
##Analysis by SITE
#KM Curves of main effects
let_site=survfit(Surv(Duration,Status)~Block+Site+Sex, data=KM_Survival)
plot(let_site, ylab='survival probabilty', xlab='Duration', main='Model 1')
```




```
#disregard figure

#Log Rank test of main effects tests for differences
let_site_dif=survdiff(Surv(Duration,Status)~Block+Site+Sex, data=KM_Survival)
let_site_dif
```

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Site + Sex,
##     data = KM_Survival)
##
##                                          N Observed Expected (O-E)^2/E
## Block=1, Site=Bly Creek       , Sex=Female 5        5    11.40   3.59237
## Block=1, Site=Bly Creek       , Sex=Male   5        5     4.92   0.00137
## Block=1, Site=Bowens Island   , Sex=Female 5        3     9.92   4.83023
## Block=1, Site=Bowens Island   , Sex=Male   5        5     4.35   0.09694
## Block=1, Site=Extension Office, Sex=Female 5        5     6.29   0.26469
## Block=1, Site=Extension Office, Sex=Male   5        4     4.63   0.08646
## Block=1, Site=Grice           , Sex=Female 5        4     5.75   0.53179
## Block=1, Site=Grice           , Sex=Male   5        5     4.52   0.05075
## Block=1, Site=Pinckney        , Sex=Female 5        5     3.42   0.72953
## Block=1, Site=Pinckney        , Sex=Male   5        5     1.73   6.19696
## Block=1, Site=Roebling House  , Sex=Female 8        7    10.51   1.17490
```

```
## Block=1, Site=Roebling House  , Sex=Male   6        6     4.73   0.34353
## Block=1, Site=Town Creek      , Sex=Female 5        4     9.95   3.56003
## Block=1, Site=Town Creek      , Sex=Male   5        5     4.58   0.03775
## Block=1, Site=Trask           , Sex=Female 6        3    14.76   9.37077
## Block=1, Site=Trask           , Sex=Male   7        7     3.74   2.85205
## Block=2, Site=Bly Creek       , Sex=Female 5        5     7.44   0.80201
## Block=2, Site=Bly Creek       , Sex=Male   5        4     8.18   2.13432
## Block=2, Site=Bowens Island   , Sex=Female 5        5     4.54   0.04702
## Block=2, Site=Bowens Island   , Sex=Male   5        5     4.87   0.00336
## Block=2, Site=Extension Office, Sex=Female 5        4     6.16   0.75589
## Block=2, Site=Extension Office, Sex=Male   6        6     5.38   0.07193
## Block=2, Site=Grice           , Sex=Female 5        5     5.51   0.04711
## Block=2, Site=Grice           , Sex=Male   4        4     1.73   2.99484
## Block=2, Site=Pinckney        , Sex=Female 6        6     8.18   0.58178
## Block=2, Site=Pinckney        , Sex=Male   7        7     2.61   7.39686
## Block=2, Site=Roebling House  , Sex=Female 6        6     4.07   0.91582
## Block=2, Site=Roebling House  , Sex=Male   6        6     5.89   0.00216
## Block=2, Site=Town Creek      , Sex=Female 6        6    10.00   1.60085
## Block=2, Site=Town Creek      , Sex=Male   5        5     3.51   0.63396
## Block=2, Site=Trask           , Sex=Female 5        5     4.74   0.01468
## Block=2, Site=Trask           , Sex=Male   5        5     3.50   0.63819
## Block=3, Site=Bly Creek       , Sex=Female 4        4     3.23   0.18392
## Block=3, Site=Bly Creek       , Sex=Male   6        6     4.26   0.70776
## Block=3, Site=Bowens Island   , Sex=Female 5        5     5.79   0.10717
## Block=3, Site=Bowens Island   , Sex=Male   5        5     4.36   0.09349
## Block=3, Site=Extension Office, Sex=Female 6        6     4.71   0.35136
## Block=3, Site=Extension Office, Sex=Male   7        7     5.42   0.46354
## Block=3, Site=Grice           , Sex=Female 5        5     3.56   0.58207
## Block=3, Site=Grice           , Sex=Male   5        5     1.20  12.09192
## Block=3, Site=Pinckney        , Sex=Female 5        5     3.57   0.57659
## Block=3, Site=Pinckney        , Sex=Male   7        7     2.97   5.48374
## Block=3, Site=Roebling House  , Sex=Female 5        5     2.90   1.52619
## Block=3, Site=Roebling House  , Sex=Male   5        5     1.90   5.03062
## Block=3, Site=Town Creek      , Sex=Female 5        5     5.81   0.11167
## Block=3, Site=Town Creek      , Sex=Male   5        5     1.46   8.60607
## Block=3, Site=Trask           , Sex=Female 6        6     3.40   1.99317
## Block=3, Site=Trask           , Sex=Male   6        6     2.97   3.08346
##                                          (O-E)^2/V
## Block=1, Site=Bly Creek       , Sex=Female   4.60437
## Block=1, Site=Bly Creek       , Sex=Male     0.00157
## Block=1, Site=Bowens Island   , Sex=Female   6.07318
## Block=1, Site=Bowens Island   , Sex=Male     0.10973
## Block=1, Site=Extension Office, Sex=Female   0.31725
## Block=1, Site=Extension Office, Sex=Male     0.10387
## Block=1, Site=Grice           , Sex=Female   0.63788
## Block=1, Site=Grice           , Sex=Male     0.06139
## Block=1, Site=Pinckney        , Sex=Female   0.82936
## Block=1, Site=Pinckney        , Sex=Male     6.81986
## Block=1, Site=Roebling House  , Sex=Female   1.45614
## Block=1, Site=Roebling House  , Sex=Male     0.39152
## Block=1, Site=Town Creek      , Sex=Female   4.60902
## Block=1, Site=Town Creek      , Sex=Male     0.04330
## Block=1, Site=Trask           , Sex=Female  12.47399
## Block=1, Site=Trask           , Sex=Male     3.22429
```

```
## Block=2, Site=Bly Creek       , Sex=Female   0.96850
## Block=2, Site=Bly Creek       , Sex=Male     2.67385
## Block=2, Site=Bowens Island   , Sex=Female   0.05450
## Block=2, Site=Bowens Island   , Sex=Male     0.00392
## Block=2, Site=Extension Office, Sex=Female   0.91135
## Block=2, Site=Extension Office, Sex=Male     0.08305
## Block=2, Site=Grice           , Sex=Female   0.05438
## Block=2, Site=Grice           , Sex=Male     3.28004
## Block=2, Site=Pinckney        , Sex=Female   0.68620
## Block=2, Site=Pinckney        , Sex=Male     8.12426
## Block=2, Site=Roebling House  , Sex=Female   1.03650
## Block=2, Site=Roebling House  , Sex=Male     0.00255
## Block=2, Site=Town Creek      , Sex=Female   1.98289
## Block=2, Site=Town Creek      , Sex=Male     0.71383
## Block=2, Site=Trask           , Sex=Female   0.01740
## Block=2, Site=Trask           , Sex=Male     0.72030
## Block=3, Site=Bly Creek       , Sex=Female   0.20784
## Block=3, Site=Bly Creek       , Sex=Male     0.80231
## Block=3, Site=Bowens Island   , Sex=Female   0.12853
## Block=3, Site=Bowens Island   , Sex=Male     0.10654
## Block=3, Site=Extension Office, Sex=Female   0.39943
## Block=3, Site=Extension Office, Sex=Male     0.52988
## Block=3, Site=Grice           , Sex=Female   0.66758
## Block=3, Site=Grice           , Sex=Male    12.79241
## Block=3, Site=Pinckney        , Sex=Female   0.65200
## Block=3, Site=Pinckney        , Sex=Male     6.09177
## Block=3, Site=Roebling House  , Sex=Female   1.69230
## Block=3, Site=Roebling House  , Sex=Male     5.48309
## Block=3, Site=Town Creek      , Sex=Female   0.13192
## Block=3, Site=Town Creek      , Sex=Male     9.30973
## Block=3, Site=Trask           , Sex=Female   2.23163
## Block=3, Site=Trask           , Sex=Male     3.44977
##
##  Chisq= 121  on 47 degrees of freedom, p= 2.02e-08
```

```
#Cox proportional hazards model fit
let_site_cox=coxph(Surv(Duration,Status)~Block+Site+Sex+CW, data=KM_Survival)
summary(let_site_cox)
```

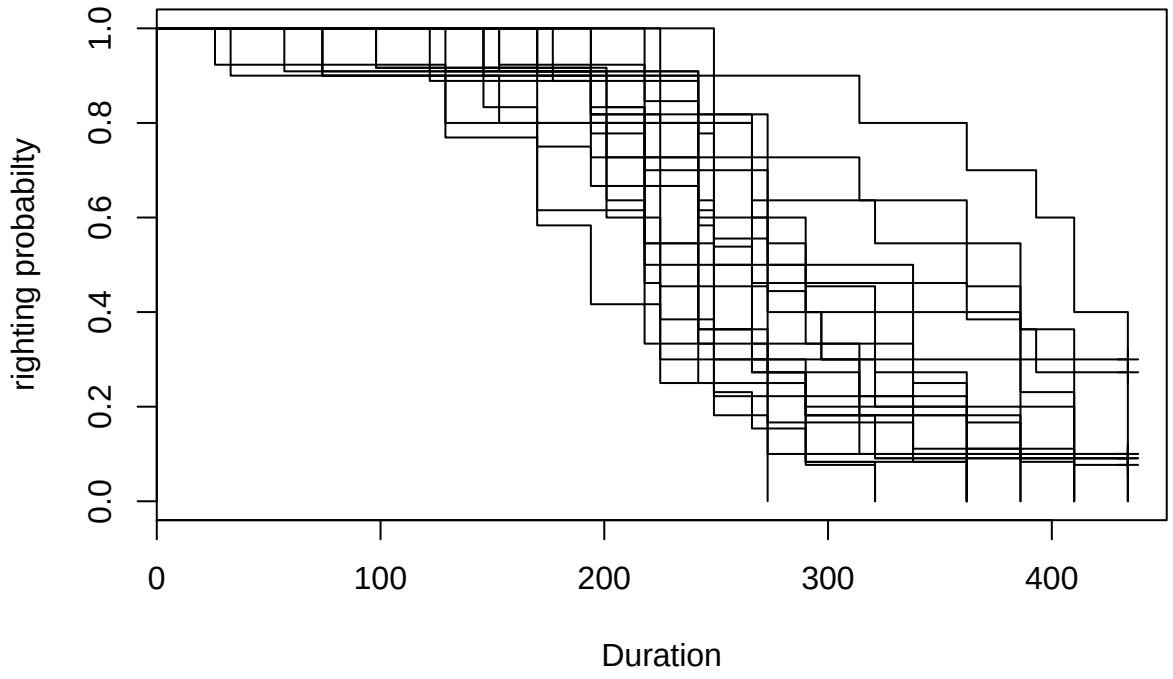
```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Site + Sex +
##     CW, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##            coef exp(coef) se(coef)      z Pr(>|z|)
## Block1 -0.39229   0.67551  0.09621 -4.077 4.55e-05 ***
## Block2 -0.14404   0.86585  0.09133 -1.577 0.114768
## Site1  -0.50792   0.60175  0.17696 -2.870 0.004101 **
## Site2  -0.27543   0.75925  0.17729 -1.554 0.120297
## Site3  -0.19566   0.82229  0.16736 -1.169 0.242347
## Site4   0.36378   1.43876  0.17778  2.046 0.040731 *
## Site5   0.55657   1.74467  0.16525  3.368 0.000757 ***
## Site6   0.22134   1.24774  0.16163  1.369 0.170876
```

```
## Site7  -0.23649   0.78939  0.17460 -1.354 0.175594
## Sex1   -0.31918   0.72674  0.06835 -4.670 3.02e-06 ***
## CW      0.22285   1.24963  0.04778  4.664 3.10e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## Block1    0.6755     1.4804    0.5594    0.8157
## Block2    0.8659     1.1549    0.7239    1.0356
## Site1     0.6017     1.6618    0.4254    0.8512
## Site2     0.7592     1.3171    0.5364    1.0747
## Site3     0.8223     1.2161    0.5923    1.1415
## Site4     1.4388     0.6950    1.0155    2.0385
## Site5     1.7447     0.5732    1.2620    2.4120
## Site6     1.2477     0.8014    0.9090    1.7128
## Site7     0.7894     1.2668    0.5606    1.1115
## Sex1      0.7267     1.3760    0.6356    0.8309
## CW        1.2496     0.8002    1.1379    1.3723
##
## Concordance= 0.691  (se = 0.023 )
## Rsquare= 0.295   (max possible= 1 )
## Likelihood ratio test= 90.9  on 11 df,   p=1.11e-14
## Wald test            = 92.43  on 11 df,   p=5.551e-15
## Score (logrank) test = 96.38  on 11 df,   p=8.882e-16
```

```
#ANCOVA of main effects
anova(let_site_cox)
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##        loglik  Chisq Df Pr(>|Chi|)
## NULL  -1172.0
## Block -1159.0 25.987  2  2.275e-06 ***
## Site  -1151.0 15.896  7    0.02608 *
## Sex   -1136.9 28.205  1  1.091e-07 ***
## CW    -1126.5 20.815  1  5.058e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##Analysis by LOCATION
#KM Curves of main effects
let_location=survfit(Surv(Duration,Status)~Block+Location+Sex, data=KM_Survival)
plot(let_location, ylab='righting probabilty', xlab='Duration', main='Model 1')
```




```
#disregard everything

#Log Rank test of main effects tests for differences
let_location_dif=survdiff(Surv(Duration,Status)~Block+Location+Sex,
                      data=KM_Survival)
let_location_dif
```

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Location +
##     Sex, data = KM_Survival)
##
##                                           N Observed Expected (O-E)^2/E
## Block=1, Location=Baruch     , Sex=Female 10        9    21.35  7.145244
## Block=1, Location=Baruch     , Sex=Male   10       10     9.50  0.026098
## Block=1, Location=Charleston , Sex=Female 10        7    15.67  4.798339
## Block=1, Location=Charleston , Sex=Male   10       10     8.87  0.143531
## Block=1, Location=Hilton Head, Sex=Female 11        8    18.18  5.701496
## Block=1, Location=Hilton Head, Sex=Male   12       12     5.46  7.819663
## Block=1, Location=Savannah   , Sex=Female 13       12    16.81  1.373953
## Block=1, Location=Savannah   , Sex=Male   11       10     9.36  0.043941
## Block=2, Location=Baruch     , Sex=Female 11       11    17.44  2.380851
## Block=2, Location=Baruch     , Sex=Male   10        9    11.69  0.617532
## Block=2, Location=Charleston , Sex=Female 10       10    10.05  0.000225
## Block=2, Location=Charleston , Sex=Male    9        9     6.60  0.874230
## Block=2, Location=Hilton Head, Sex=Female 11       11    12.92  0.284800
## Block=2, Location=Hilton Head, Sex=Male   12       12     6.11  5.671041
## Block=2, Location=Savannah   , Sex=Female 11       10    10.23  0.005032
## Block=2, Location=Savannah   , Sex=Male   12       12    11.27  0.047908
```

```
## Block=3, Location=Baruch     , Sex=Female  9        9     9.03  0.000132
## Block=3, Location=Baruch     , Sex=Male   11       11     5.72  4.871468
## Block=3, Location=Charleston , Sex=Female 10       10     9.35  0.045478
## Block=3, Location=Charleston , Sex=Male   10       10     5.56  3.550349
## Block=3, Location=Hilton Head, Sex=Female 11       11     6.96  2.339456
## Block=3, Location=Hilton Head, Sex=Male   13       13     5.94  8.394449
## Block=3, Location=Savannah   , Sex=Female 11       11     7.61  1.509755
## Block=3, Location=Savannah   , Sex=Male   12       12     7.32  2.991769
##                                          (O-E)^2/V
## Block=1, Location=Baruch     , Sex=Female  9.749961
## Block=1, Location=Baruch     , Sex=Male    0.030632
## Block=1, Location=Charleston , Sex=Female  6.117986
## Block=1, Location=Charleston , Sex=Male    0.170556
## Block=1, Location=Hilton Head, Sex=Female  7.506947
## Block=1, Location=Hilton Head, Sex=Male    8.879273
## Block=1, Location=Savannah   , Sex=Female  1.741060
## Block=1, Location=Savannah   , Sex=Male    0.052327
## Block=2, Location=Baruch     , Sex=Female  3.032027
## Block=2, Location=Baruch     , Sex=Male    0.760511
## Block=2, Location=Charleston , Sex=Female  0.000266
## Block=2, Location=Charleston , Sex=Male    1.013305
## Block=2, Location=Hilton Head, Sex=Female  0.344812
## Block=2, Location=Hilton Head, Sex=Male    6.427399
## Block=2, Location=Savannah   , Sex=Female  0.006023
## Block=2, Location=Savannah   , Sex=Male    0.057356
## Block=3, Location=Baruch     , Sex=Female  0.000156
## Block=3, Location=Baruch     , Sex=Male    5.535126
## Block=3, Location=Charleston , Sex=Female  0.054564
## Block=3, Location=Charleston , Sex=Male    4.019969
## Block=3, Location=Hilton Head, Sex=Female  2.677422
## Block=3, Location=Hilton Head, Sex=Male    9.503508
## Block=3, Location=Savannah   , Sex=Female  1.730973
## Block=3, Location=Savannah   , Sex=Male    3.425467
##
##  Chisq= 77.2  on 23 degrees of freedom, p= 9.04e-08
```

```
#Cox proportional hazards model fit
let_location_cox=coxph(Surv(Duration,Status)~Block+Location+Sex+CW,
                  data=KM_Survival)
summary(let_location_cox)
```

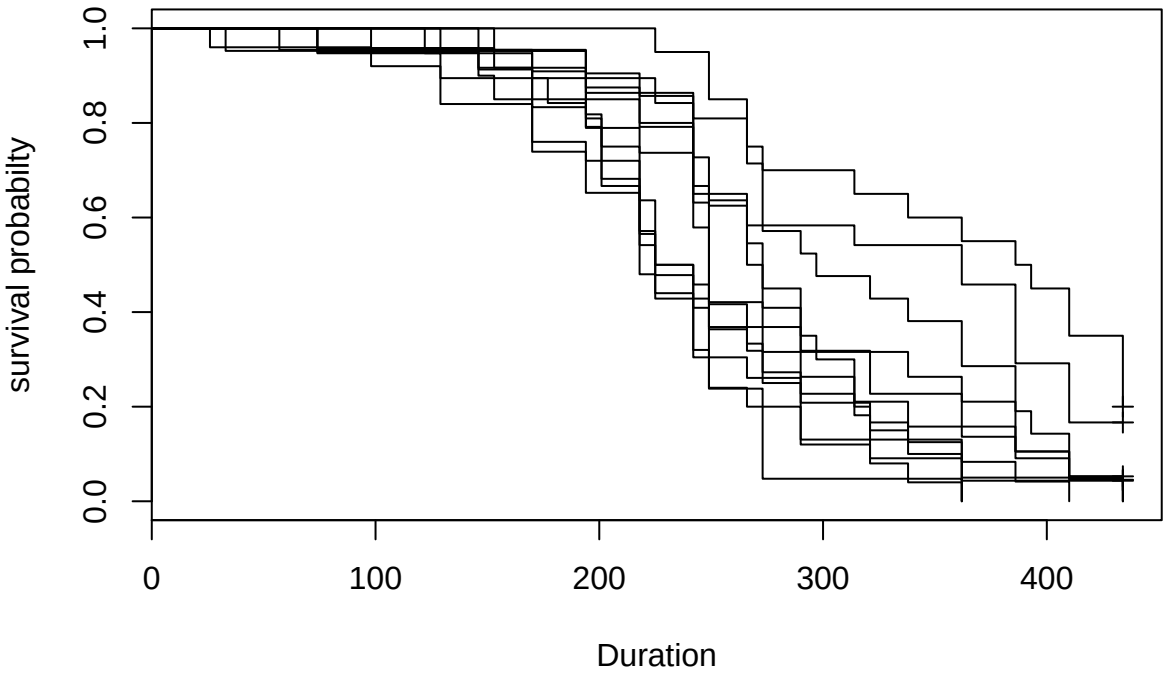
```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Location + Sex +
##     CW, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##               coef exp(coef) se(coef)      z Pr(>|z|)
## Block1    -0.38092   0.68323  0.09429 -4.040 5.35e-05 ***
## Block2    -0.12836   0.87954  0.09136 -1.405  0.16003
## Location1 -0.35037   0.70443  0.11538 -3.037  0.00239 **
## Location2  0.01763   1.01778  0.11481  0.154  0.87797
## Location3  0.30889   1.36191  0.10950  2.821  0.00479 **
## Sex1      -0.29348   0.74567  0.06753 -4.346 1.39e-05 ***
```

```
## CW         0.21608   1.24120  0.04669  4.628 3.70e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##           exp(coef) exp(-coef) lower .95 upper .95
## Block1       0.6832     1.4636    0.5680    0.8219
## Block2       0.8795     1.1370    0.7353    1.0520
## Location1    0.7044     1.4196    0.5619    0.8832
## Location2    1.0178     0.9825    0.8127    1.2746
## Location3    1.3619     0.7343    1.0989    1.6879
## Sex1         0.7457     1.3411    0.6532    0.8512
## CW           1.2412     0.8057    1.1327    1.3601
##
## Concordance= 0.685  (se = 0.023 )
## Rsquare= 0.259   (max possible= 1 )
## Likelihood ratio test= 77.91  on 7 df,   p=3.675e-14
## Wald test            = 80.82  on 7 df,   p=9.326e-15
## Score (logrank) test = 83.74  on 7 df,   p=2.331e-15
```

```
#ANCOVA of main effects
anova(let_location_cox)
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##           loglik   Chisq Df Pr(>|Chi|)
## NULL     -1172.0
## Block    -1159.0 25.9873  2  2.275e-06 ***
## Location -1155.6  6.8166  3    0.07798 .
## Sex      -1143.2 24.7699  1  6.460e-07 ***
## CW       -1133.0 20.3366  1  6.495e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##Analysis by REGION
#KM Curves of main effects
let_region=survfit(Surv(Duration,Status)~Block+Region+Sex, data=KM_Survival)
plot(let_region, ylab='survival probabilty', xlab='Duration', main='Model 1')
```




```
#disregard everything

#Log Rank test of main effects tests for differences
let_region_dif=survdiff(Surv(Duration,Status)~Block+Region+Sex, data=KM_Survival)
let_region_dif
```

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Region +
##     Sex, data = KM_Survival)
##
##                                      N Observed Expected (O-E)^2/E (O-E)^2/V
## Block=1, Region=North, Sex=Female 20       16     37.0  11.93787  17.42294
## Block=1, Region=North, Sex=Male   20       20     18.4   0.14397   0.17704
## Block=1, Region=South, Sex=Female 24       20     35.0   6.41953   9.04528
## Block=1, Region=South, Sex=Male   23       22     14.8   3.47571   4.19448
## Block=2, Region=North, Sex=Female 21       21     27.5   1.53308   2.00563
## Block=2, Region=North, Sex=Male   19       18     18.3   0.00443   0.00552
## Block=2, Region=South, Sex=Female 22       21     23.1   0.19878   0.25149
## Block=2, Region=South, Sex=Male   24       24     17.4   2.52357   3.06907
## Block=3, Region=North, Sex=Female 19       19     18.4   0.02074   0.02570
## Block=3, Region=North, Sex=Male   21       21     11.3   8.37880   9.82152
## Block=3, Region=South, Sex=Female 22       22     14.6   3.78371   4.49983
## Block=3, Region=South, Sex=Male   25       25     13.3  10.39589  12.27229
##
##  Chisq= 61.6  on 11 degrees of freedom, p= 4.65e-09
```

```r
#Cox proportional hazards model fit
let_region_cox=coxph(Surv(Duration,Status)~Block+Region+Sex+CW, data=KM_Survival)
summary(let_region_cox)
```

```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Region + Sex +
##     CW, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##              coef exp(coef) se(coef)      z Pr(>|z|)
## Block1  -0.37121   0.68990  0.09396 -3.951 7.80e-05 ***
## Block2  -0.14423   0.86569  0.09123 -1.581  0.11389
## Region1 -0.16736   0.84589  0.06461 -2.590  0.00959 **
## Sex1    -0.28586   0.75137  0.06682 -4.278 1.89e-05 ***
## CW       0.19637   1.21698  0.04640  4.232 2.31e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## Block1     0.6899     1.4495    0.5739    0.8294
## Block2     0.8657     1.1552    0.7239    1.0352
## Region1    0.8459     1.1822    0.7453    0.9601
## Sex1       0.7514     1.3309    0.6591    0.8565
## CW         1.2170     0.8217    1.1112    1.3328
##
## Concordance= 0.675  (se = 0.023 )
## Rsquare= 0.241   (max possible= 1 )
## Likelihood ratio test= 71.68  on 5 df,   p=4.585e-14
## Wald test            = 73.92  on 5 df,   p=1.565e-14
## Score (logrank) test = 76.84  on 5 df,   p=3.886e-15
```

```r
#ANOVA of main effects
anova(let_region_cox)
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##         loglik   Chisq Df Pr(>|Chi|)
## NULL   -1172.0
## Block  -1159.0 25.9873  2  2.275e-06 ***
## Region -1156.5  4.8904  1    0.02701 *
## Sex    -1144.7 23.6814  1  1.137e-06 ***
## CW     -1136.1 17.1168  1  3.515e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Analysis of Presentation Figures

The following is analysis of each of the presentation figures

Figure 1: Lethal Site

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Site, data = KM_Survival)
##
##                                 N Observed Expected (O-E)^2/E (O-E)^2/V
## Block=1, Site=Bly Creek        10       10    16.32   2.44575   3.10156
## Block=1, Site=Bowens Island    10        8    14.27   2.75758   3.42441
## Block=1, Site=Extension Office 10        9    10.92   0.33862   0.41520
## Block=1, Site=Grice            10        9    10.27   0.15691   0.19304
## Block=1, Site=Pinckney         10       10     5.15   4.57252   5.19882
## Block=1, Site=Roebling House   14       13    15.24   0.32942   0.40752
## Block=1, Site=Town Creek       10        9    14.54   2.10860   2.67782
## Block=1, Site=Trask            13       10    18.50   3.90320   5.12100
## Block=2, Site=Bly Creek        10        9    15.62   2.80638   3.58152
## Block=2, Site=Bowens Island    10       10     9.41   0.03699   0.04392
## Block=2, Site=Extension Office 11       10    11.54   0.20437   0.24694
## Block=2, Site=Grice             9        9     7.24   0.43018   0.49629
## Block=2, Site=Pinckney         13       13    10.79   0.45281   0.53380
## Block=2, Site=Roebling House   12       12     9.96   0.41927   0.49674
## Block=2, Site=Town Creek       11       11    13.51   0.46630   0.57379
## Block=2, Site=Trask            10       10     8.24   0.37552   0.44342
## Block=3, Site=Bly Creek        10       10     7.49   0.83931   0.96812
## Block=3, Site=Bowens Island    10       10    10.15   0.00219   0.00262
## Block=3, Site=Extension Office 13       13    10.13   0.81394   0.95074
## Block=3, Site=Grice            10       10     4.76   5.77918   6.55986
## Block=3, Site=Pinckney         12       12     6.53   4.57567   5.21883
## Block=3, Site=Roebling House   10       10     4.80   5.62723   6.28750
## Block=3, Site=Town Creek       10       10     7.26   1.03138   1.20835
## Block=3, Site=Trask            12       12     6.37   4.97549   5.66560
##
##  Chisq= 55.6  on 23 degrees of freedom, p= 0.000161

## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Site, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##            coef exp(coef) se(coef)      z Pr(>|z|)
## Block1 -0.39620   0.67287  0.09644 -4.108 3.99e-05 ***
## Block2 -0.06702   0.93518  0.09068 -0.739   0.4599
## Site1  -0.33010   0.71885  0.17384 -1.899   0.0576 .
## Site2  -0.27233   0.76160  0.17666 -1.542   0.1232
## Site3  -0.10621   0.89924  0.16658 -0.638   0.5237
## Site4   0.25873   1.29529  0.17614  1.469   0.1419
## Site5   0.40990   1.50667  0.16278  2.518   0.0118 *
## Site6   0.25464   1.29000  0.16105  1.581   0.1138
## Site7  -0.20184   0.81723  0.17121 -1.179   0.2384
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## Block1    0.6729     1.4862    0.5570    0.8129
## Block2    0.9352     1.0693    0.7829    1.1171
## Site1     0.7189     1.3911    0.5113    1.0107
## Site2     0.7616     1.3130    0.5387    1.0767
```

```
## Site3     0.8992     1.1121    0.6488    1.2464
## Site4     1.2953     0.7720    0.9171    1.8294
## Site5     1.5067     0.6637    1.0951    2.0729
## Site6     1.2900     0.7752    0.9408    1.7688
## Site7     0.8172     1.2237    0.5843    1.1431
##
## Concordance= 0.624  (se = 0.023 )
## Rsquare= 0.149   (max possible= 1 )
## Likelihood ratio test= 41.88  on 9 df,   p=3.452e-06
## Wald test            = 42.72  on 9 df,   p=2.426e-06
## Score (logrank) test = 44.23  on 9 df,   p=1.28e-06
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##       loglik  Chisq Df Pr(>|Chi|)
## NULL   -1172
## Block  -1159 25.987  2  2.275e-06 ***
## Site   -1151 15.896  7    0.02608 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 2: Lethal Region

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Region, data = KM_Survival)
##
##                          N Observed Expected (O-E)^2/E (O-E)^2/V
## Block=1, Region=North 40       36     55.4     6.792    10.421
## Block=1, Region=South 47       42     49.8     1.224     1.803
## Block=2, Region=North 40       39     45.8     1.003     1.427
## Block=2, Region=South 46       45     40.5     0.495     0.676
## Block=3, Region=North 40       40     29.7     3.604     4.676
## Block=3, Region=South 47       47     27.8    13.198    16.903
##
##  Chisq= 31.5  on 5 degrees of freedom, p= 7.63e-06
```

```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Region, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## Block1  -0.39177   0.67586  0.09434 -4.153 3.29e-05 ***
## Block2  -0.05495   0.94654  0.08969 -0.613   0.5401
## Region1 -0.14110   0.86841  0.06393 -2.207   0.0273 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## Block1     0.6759      1.480    0.5618    0.8131
## Block2     0.9465      1.056    0.7940    1.1284
```

```
## Region1    0.8684      1.152    0.7661    0.9843
##
## Concordance= 0.598  (se = 0.022 )
## Rsquare= 0.112   (max possible= 1 )
## Likelihood ratio test= 30.88  on 3 df,   p=9.02e-07
## Wald test            = 31.32  on 3 df,   p=7.277e-07
## Score (logrank) test = 32.4  on 3 df,   p=4.305e-07
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##         loglik   Chisq Df Pr(>|Chi|)
## NULL   -1172.0
## Block  -1159.0 25.9873  2  2.275e-06 ***
## Region -1156.5  4.8904  1    0.02701 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 3: Lethal Sex

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Sex, data = KM_Survival)
##
##                       N Observed Expected (O-E)^2/E (O-E)^2/V
## Block=1, Sex=Female 44       36     72.0     18.01     32.13
## Block=1, Sex=Male   43       42     33.2      2.33      3.08
## Block=2, Sex=Female 43       42     50.6      1.47      2.14
## Block=2, Sex=Male   43       42     35.7      1.13      1.50
## Block=3, Sex=Female 41       41     33.0      1.96      2.58
## Block=3, Sex=Male   46       46     24.5     18.77     23.75
##
##  Chisq= 54.9  on 5 degrees of freedom, p= 1.4e-10
```

```
## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Sex, data = KM_Survival)
##
##   n= 260, number of events= 249
##
##            coef exp(coef) se(coef)      z Pr(>|z|)
## Block1 -0.35282   0.70270  0.09399 -3.754 0.000174 ***
## Block2 -0.08689   0.91678  0.09008 -0.965 0.334756
## Sex1   -0.32176   0.72487  0.06542 -4.918 8.73e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## Block1    0.7027      1.423    0.5845    0.8448
## Block2    0.9168      1.091    0.7684    1.0938
## Sex1      0.7249      1.380    0.6376    0.8240
##
## Concordance= 0.634  (se = 0.022 )
## Rsquare= 0.175   (max possible= 1 )
```

```
## Likelihood ratio test= 50.11  on 3 df,   p=7.557e-11
## Wald test            = 50.83  on 3 df,   p=5.322e-11
## Score (logrank) test = 52.77  on 3 df,   p=2.05e-11

## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##        loglik  Chisq Df Pr(>|Chi|)
## NULL  -1172.0
## Block -1159.0 25.987  2  2.275e-06 ***
## Sex   -1146.9 24.126  1  9.023e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 4: Lethal Sex by Region

```
## Call:
## survdiff(formula = Surv(Duration, Status) ~ Block + Sex + Region,
##     data = KM_Survival)
##
##                                    N Observed Expected (O-E)^2/E (O-E)^2/V
## Block=1, Sex=Female, Region=North 20       16     37.0  11.93787  17.42294
## Block=1, Sex=Female, Region=South 24       20     35.0   6.41953   9.04528
## Block=1, Sex=Male  , Region=North 20       20     18.4   0.14397   0.17704
## Block=1, Sex=Male  , Region=South 23       22     14.8   3.47571   4.19448
## Block=2, Sex=Female, Region=North 21       21     27.5   1.53308   2.00563
## Block=2, Sex=Female, Region=South 22       21     23.1   0.19878   0.25149
## Block=2, Sex=Male  , Region=North 19       18     18.3   0.00443   0.00552
## Block=2, Sex=Male  , Region=South 24       24     17.4   2.52357   3.06907
## Block=3, Sex=Female, Region=North 19       19     18.4   0.02074   0.02570
## Block=3, Sex=Female, Region=South 22       22     14.6   3.78371   4.49983
## Block=3, Sex=Male  , Region=North 21       21     11.3   8.37880   9.82152
## Block=3, Sex=Male  , Region=South 25       25     13.3  10.39589  12.27229
##
##  Chisq= 61.6  on 11 degrees of freedom, p= 4.65e-09

## Call:
## coxph(formula = Surv(Duration, Status) ~ Block + Sex + Region,
##     data = KM_Survival)
##
##   n= 260, number of events= 249
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## Block1  -0.35489   0.70125  0.09430 -3.764 0.000168 ***
## Block2  -0.08413   0.91931  0.09005 -0.934 0.350128
## Sex1    -0.31887   0.72697  0.06544 -4.872  1.1e-06 ***
## Region1 -0.13452   0.87413  0.06393 -2.104 0.035350 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##         exp(coef) exp(-coef) lower .95 upper .95
## Block1     0.7013      1.426    0.5829    0.8436
```

```
## Block2     0.9193      1.088    0.7706    1.0968
## Sex1       0.7270      1.376    0.6395    0.8265
## Region1    0.8741      1.144    0.7712    0.9908
##
## Concordance= 0.65  (se = 0.023 )
## Rsquare= 0.189   (max possible= 1 )
## Likelihood ratio test= 54.56  on 4 df,   p=4.019e-11
## Wald test            = 55.51  on 4 df,   p=2.535e-11
## Score (logrank) test = 57.47  on 4 df,   p=9.844e-12
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Duration, Status)
## Terms added sequentially (first to last)
##
##         loglik   Chisq Df Pr(>|Chi|)
## NULL   -1172.0
## Block  -1159.0 25.9873  2  2.275e-06 ***
## Sex    -1146.9 24.1262  1  9.023e-07 ***
## Region -1144.7  4.4456  1    0.03499 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 5: Lethal Size Regression

```
##
## Call:
## lm(formula = CW ~ Duration, data = lethal_males)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4819 -1.3047 -0.0008  0.9357  4.6002
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.571756   0.488933  17.532  < 2e-16 ***
## Duration    -0.007611   0.001907  -3.991 0.000109 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.653 on 130 degrees of freedom
## Multiple R-squared:  0.1092, Adjusted R-squared:  0.1023
## F-statistic: 15.93 on 1 and 130 DF,  p-value: 0.0001092
```

```
##
## Call:
## lm(formula = CW ~ Duration, data = lethal_females)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -2.040 -0.802 -0.149  0.688  3.708
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)  5.9518863  0.3510856  16.953   <2e-16 ***
## Duration    -0.0001611  0.0011297  -0.143    0.887
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.137 on 126 degrees of freedom
## Multiple R-squared:  0.0001614,  Adjusted R-squared:  -0.007774
## F-statistic: 0.02034 on 1 and 126 DF,  p-value: 0.8868
```