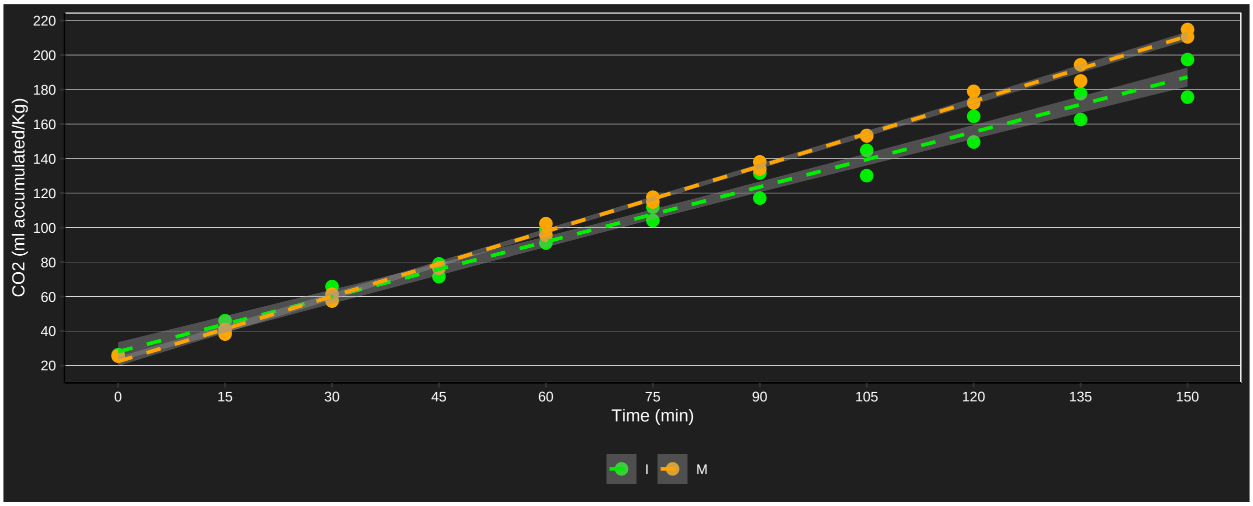
Respiration essay in Hexachlamys edulis

Figure 1: A caption

Immature and mature ubajay fruits were selected and randomly distributed in 4 jars, 2 immature and 2 mature, then respiration was quantified from accumulated CO_2 every 15 minutes for 150 minutes.

CO2 acumulation



Descriptive table

```
## # A tibble: 20 x 7
## # Groups:   time_min [10]
##    time_min matu  carbon_ac_n carbon_ac_Mean carbon_ac_sd carbon_ac_min carbon_ac_max
##    <fct>    <fct>       <int>          <dbl>        <dbl>         <dbl>         <dbl>
##  1 15       I               2           42.5        4.97           39.0          46.1
##  2 15       M               2           39.6        1.86           38.3          40.9
##  3 30       I               2           62.2        5.13           58.5          65.8
##  4 30       M               2           59.4        2.79           57.4          61.4
##  5 45       I               2           75.2        5.23           71.5          78.9
##  6 45       M               2           76.6        0.110          76.6          76.7
##  7 60       I               2           94.9        5.39           91.1          98.7
##  8 60       M               2           99.0        4.66           95.7         102.
##  9 75       I               2          108.         5.50          104.          112.
## 10 75       M               2          116.         1.97          115.          118.
## 11 90       I               2          124.        10.3           117.          132.
## 12 90       M               2          136.         2.91          134.          138.
## 13 105      I               2          137.        10.4           130.          145.
## 14 105      M               2          153.         0.221         153.          153.
## 15 120      I               2          157.        10.5           150.          164.
## 16 120      M               2          176.         4.77          172.          179.
## 17 135      I               2          170.        10.6           163.          178.
## 18 135      M               2          190.         6.59          185.          194.
## 19 150      I               2          186.        15.4           176.          197.
## 20 150      M               2          213.         3.02          211.          215.
```

Correlations over time

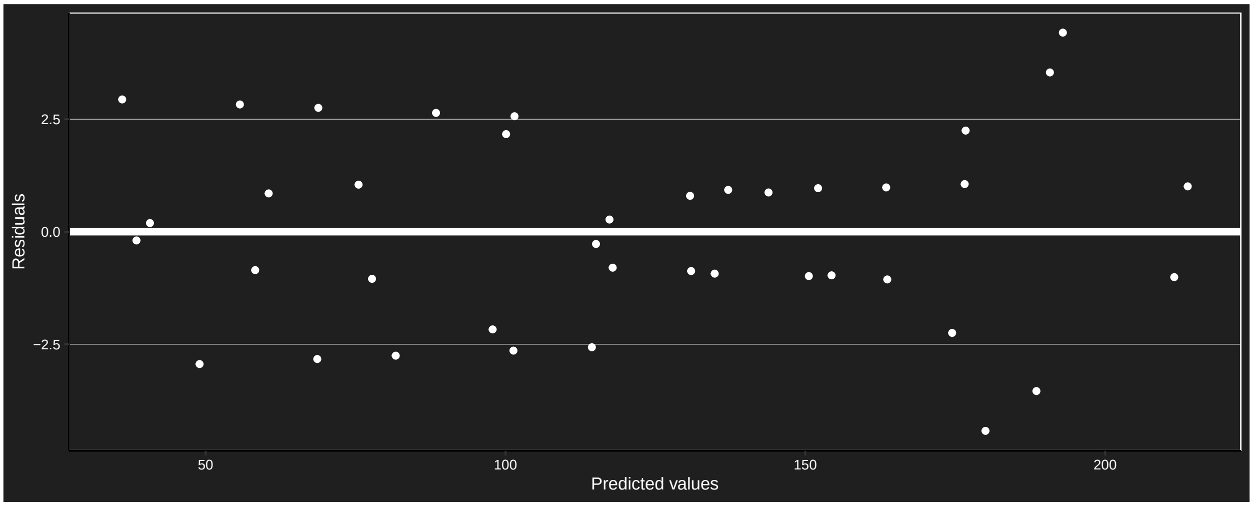
Covariance matrix

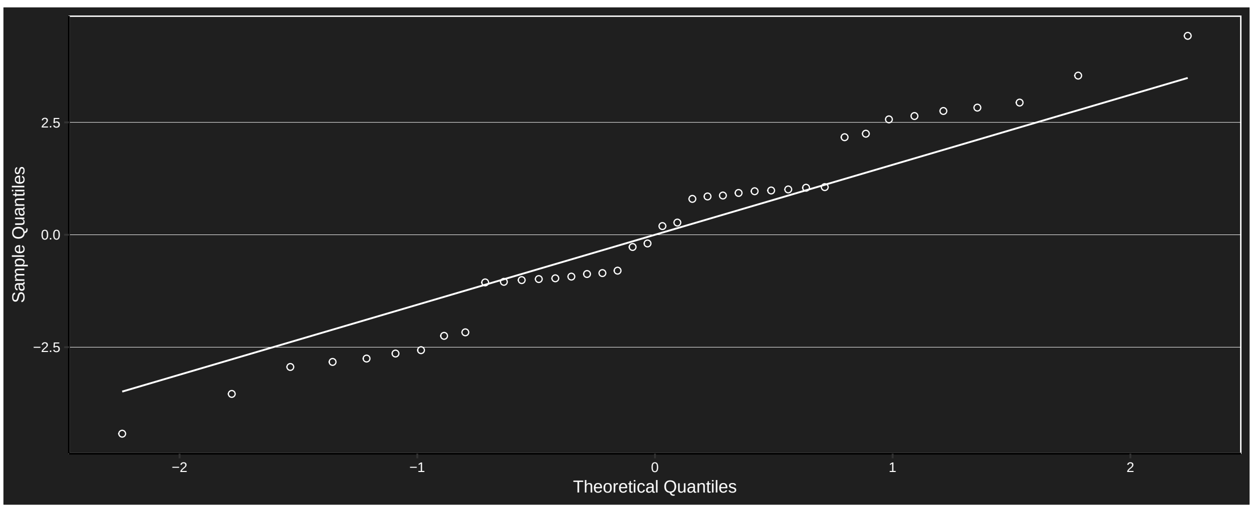
```
##         15    30    45    60     75     90    105    120    135    150
## 15   12.28 12.95  7.38  7.79   2.21   7.31   1.73   2.14   2.50   1.66
## 30   12.95 13.93  7.77  9.75   3.59   9.42   3.25   5.23   6.22   4.90
## 45    7.38  7.77  9.77 11.46  13.46  23.37  25.37  27.07  27.76  38.97
## 60    7.79  9.75 11.46 22.55  24.26  38.94  40.66  51.74  56.09  68.14
## 75    2.21  3.59 13.46 24.26  34.14  52.90  62.77  73.57  77.63 102.21
## 90    7.31  9.42 23.37 38.94  52.90  83.40  97.35 112.92 118.82 157.38
## 105   1.73  3.25 25.37 40.66  62.77  97.35 119.47 134.76 140.36 191.45
## 120   2.14  5.23 27.07 51.74  73.57 112.92 134.76 159.43 168.68 220.61
## 135   2.50  6.22 27.76 56.09  77.63 118.82 140.36 168.68 179.37 231.42
## 150   1.66  4.90 38.97 68.14 102.21 157.38 191.45 220.61 231.42 309.86
```

Marginal model with first-order autoregressive structure

```
## gls(model = (carbon_ac) ~ time_min * matu + basal, data = resp2w,
##     correlation = corAR1(form = ~1 | rep))
```

Assumptions






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.97616, p-value = 0.5498
```

Model coefficients

```
##       (Intercept)        time_min30        time_min45        time_min60        time_min75
##     -1088.3098594        19.6250543        32.7084238        52.3334782        65.4168477
##        time_min90       time_min105       time_min120       time_min135       time_min150
##        81.7897236        94.8730931       114.4981474       127.5815169       143.9543928
##             matuM             basal  time_min30:matuM  time_min45:matuM  time_min60:matuM
##        24.0203019        43.2170578         0.1712202         4.3272497         7.0553453
##  time_min75:matuM  time_min90:matuM time_min105:matuM time_min120:matuM time_min135:matuM
```

```
##        11.2113748        14.6347734        18.7908030        21.5188986        22.4853372
## time_min150:matuM
##        29.0983267
```

Anova

```
## Denom. DF: 19
##              numDF   F-value p-value
## (Intercept)      1 12422.598  <.0001
## time_min         9   497.680  <.0001
## matu             1    23.524  0.0001
## basal            1    18.306  0.0004
## time_min:matu    9     4.645  0.0024
```

Simple effects

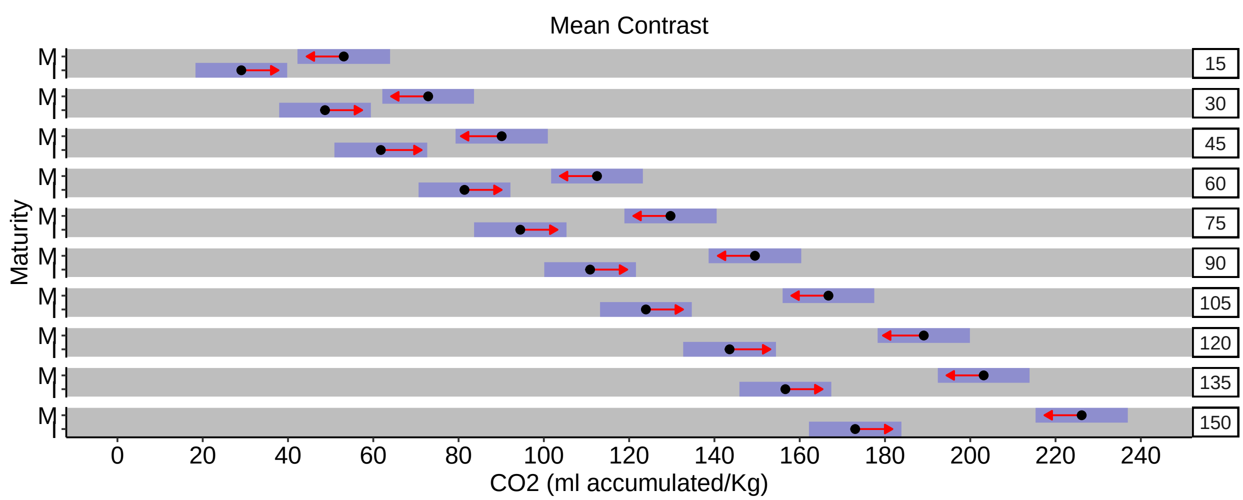
```
## $emmeans
## time_min = 15:
##  matu emmean SE   df lower.CL upper.CL
##  I      29.1  4 4.35     18.3     39.8
##  M      53.1  4 4.23     42.2     63.9
##
## time_min = 30:
##  matu emmean SE   df lower.CL upper.CL
##  I      48.7  4 4.34     37.9     59.4
##  M      72.9  4 4.35     62.1     83.6
##
## time_min = 45:
##  matu emmean SE   df lower.CL upper.CL
##  I      61.8  4 4.21     50.9     72.6
##  M      90.1  4 4.27     79.3    100.9
##
## time_min = 60:
##  matu emmean SE   df lower.CL upper.CL
##  I      81.4  4 4.33     70.6     92.2
##  M     112.5  4 4.34    101.7    123.2
##
## time_min = 75:
##  matu emmean SE   df lower.CL upper.CL
##  I      94.5  4 4.25     83.6    105.3
##  M     129.7  4 4.28    118.9    140.5
##
## time_min = 90:
##  matu emmean SE   df lower.CL upper.CL
##  I     110.8  4 4.35    100.1    121.6
##  M     149.5  4 4.23    138.6    160.4
##
## time_min = 105:
##  matu emmean SE   df lower.CL upper.CL
##  I     123.9  4 4.34    113.2    134.7
##  M     166.7  4 4.35    156.0    177.5
##
```

```
## time_min = 120:
##  matu emmean SE   df lower.CL upper.CL
##  I     143.6  4 4.21    132.7    154.4
##  M     189.1  4 4.27    178.3    199.9
##
## time_min = 135:
##  matu emmean SE   df lower.CL upper.CL
##  I     156.6  4 4.33    145.9    167.4
##  M     203.1  4 4.34    192.4    213.9
##
## time_min = 150:
##  matu emmean SE   df lower.CL upper.CL
##  I     173.0  4 4.25    162.2    183.9
##  M     226.1  4 4.28    215.3    236.9
##
## Degrees-of-freedom method: satterthwaite
## Results are given on the ( (not the response) scale.
## Confidence level used: 0.95
##
## $contrasts
## time_min = 15:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -24.0 7.2 6.25  -3.337  0.0147
##
## time_min = 30:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -24.2 7.2 6.26  -3.361  0.0142
##
## time_min = 45:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -28.3 7.2 4.48  -3.938  0.0136
##
## time_min = 60:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -31.1 7.2 6.24  -4.317  0.0046
##
## time_min = 75:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -35.2 7.2 6.21  -4.895  0.0025
##
## time_min = 90:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -38.7 7.2 6.25  -5.371  0.0015
##
## time_min = 105:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -42.8 7.2 6.26  -5.948  0.0009
##
## time_min = 120:
##  contrast estimate  SE   df t.ratio p.value
##  I - M       -45.5 7.2 4.48  -6.327  0.0022
##
## time_min = 135:
##  contrast estimate  SE   df t.ratio p.value
```

```
##   I - M        -46.5 7.2 6.24  -6.461  0.0006
##
## time_min = 150:
##   contrast estimate   SE   df t.ratio p.value
##   I - M        -53.1 7.2 6.21  -7.380  0.0003
##
## Note: contrasts are still on the ( scale
## Degrees-of-freedom method: satterthwaite
```

Statistically significant differences were found in the CO2 respiration rate in each time between immature and mature Hexachlamys edulis fruits.

Comparison chart



Fitted model plot