

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 CO₂ every 15 minutes for 150 minutes.

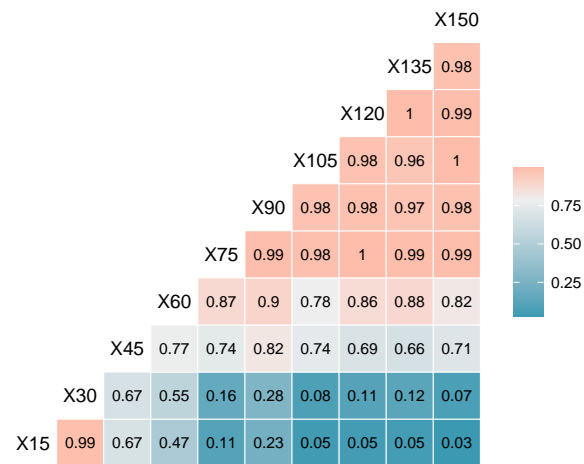
CO2 acumulation



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
##   <fct>     <fct>      <int>      <dbl>      <dbl>      <dbl>
## 1 15       I           2        42.5       4.97       39.0
## 2 15       M           2        39.6       1.86       38.3
## 3 30       I           2        62.2       5.13       58.5
## 4 30       M           2        59.4       2.79       57.4
## 5 45       I           2        75.2       5.23       71.5
## 6 45       M           2        76.6       0.110      76.6
## 7 60       I           2        94.9       5.39       91.1
## 8 60       M           2        99.0       4.66       95.7
## 9 75       I           2       108.       5.50      104.
## 10 75      M           2       116.       1.97      115.
## 11 90       I           2       124.      10.3      117.
## 12 90       M           2       136.       2.91      134.
## 13 105      I           2       137.      10.4      130.
## 14 105      M           2       153.       0.221     153.
## 15 120      I           2       157.      10.5      150.
## 16 120      M           2       176.       4.77      172.
## 17 135      I           2       170.      10.6      163.
## 18 135      M           2       190.       6.59      185.
## 19 150      I           2       186.     15.4      176.
## 20 150      M           2       213.       3.02     211.
## # i 1 more variable: carbon_ac_max <dbl>
```

Correlations over time



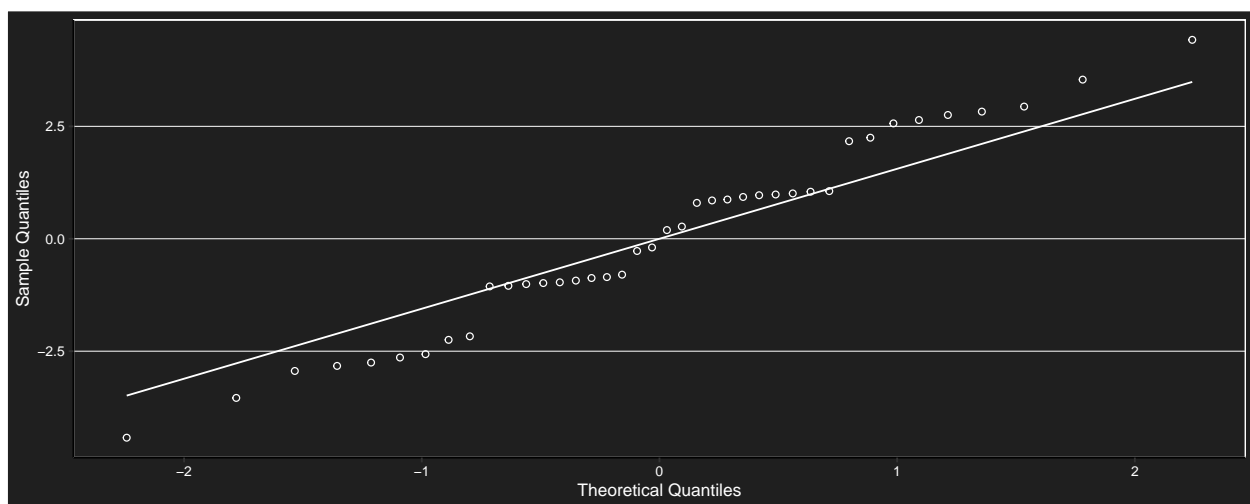
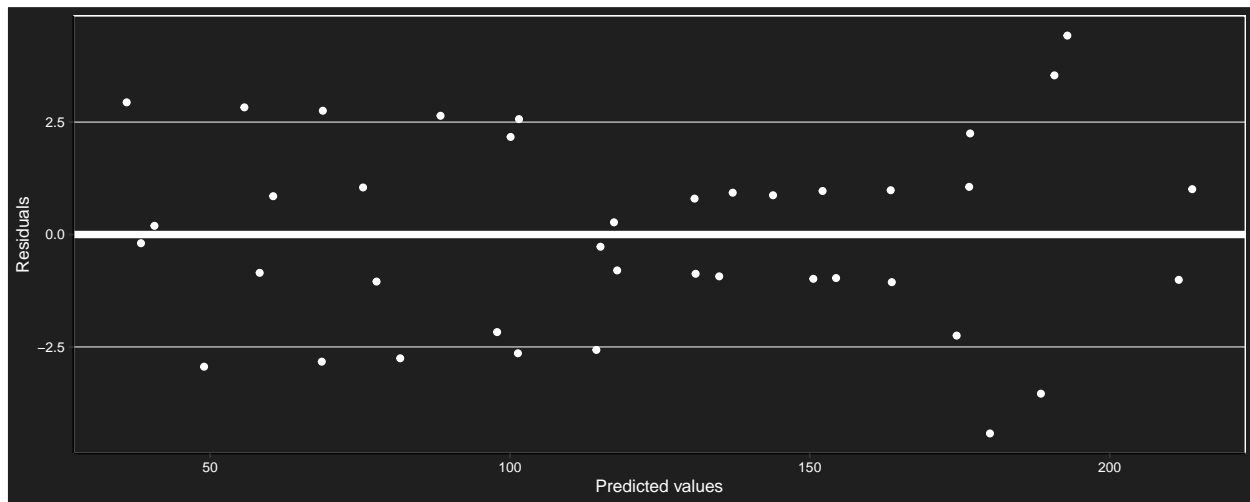
Covariance matrix

##	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
## -1088.3098591    19.6250543    32.7084238    52.3334782
##      time_min75      time_min90      time_min105      time_min120
##   65.4168477    81.7897236    94.8730931    114.4981474
##      time_min135      time_min150      matuM      basal
##  127.5815169    143.9543928    24.0203019    43.2170578
## time_min30:matuM time_min45:matuM time_min60:matuM time_min75:matuM
```

```
##          0.1712202          4.3272497          7.0553453          11.2113748
## time_min90:matuM time_min105:matuM time_min120:matuM time_min135:matuM
##          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 4.38    18.3    39.8
## M      53.1  4 4.26    42.2    63.9
##
## time_min = 30:
## matu emmean SE    df lower.CL upper.CL
## I      48.7  4 4.37    37.9    59.4
## M      72.9  4 4.38    62.1    83.6
##
## time_min = 45:
## matu emmean SE    df lower.CL upper.CL
## I      61.8  4 4.23    50.9    72.6
## M      90.1  4 4.30    79.3    100.9
##
## time_min = 60:
## matu emmean SE    df lower.CL upper.CL
## I      81.4  4 4.35    70.6    92.1
## M     112.5  4 4.37   101.7   123.2
##
## time_min = 75:
## matu emmean SE    df lower.CL upper.CL
## I      94.5  4 4.28    83.7   105.3
## M     129.7  4 4.31   118.9   140.5
##
## time_min = 90:
## matu emmean SE    df lower.CL upper.CL
## I     110.8  4 4.38   100.1   121.6
## M     149.5  4 4.26   138.7   160.3
##
## time_min = 105:
## matu emmean SE    df lower.CL upper.CL
## I     123.9  4 4.37   113.2   134.7
```

```

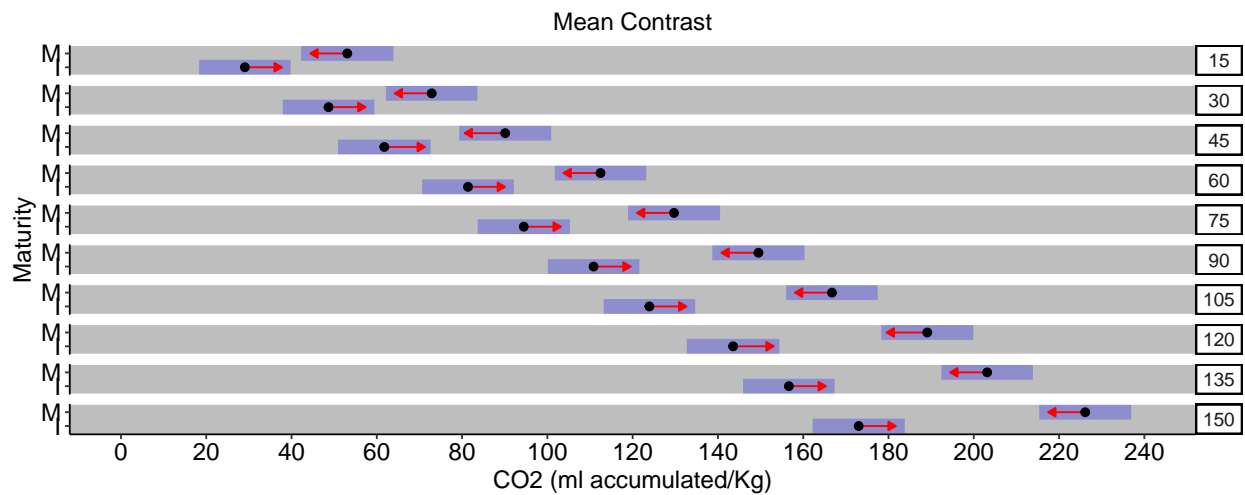
## M      166.7  4 4.38   156.0   177.5
##
## time_min = 120:
##   matu emmean SE    df lower.CL upper.CL
## I      143.6  4 4.23   132.7   154.4
## M      189.1  4 4.30   178.3   199.9
##
## time_min = 135:
##   matu emmean SE    df lower.CL upper.CL
## I      156.6  4 4.35   145.9   167.4
## M      203.1  4 4.37   192.4   213.9
##
## time_min = 150:
##   matu emmean SE    df lower.CL upper.CL
## I      173.0  4 4.28   162.2   183.8
## M      226.1  4 4.31   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 6.29  -3.337  0.0146
##
## time_min = 30:
##   contrast estimate SE    df t.ratio p.value
## I - M      -24.2 7.2 6.30  -3.361  0.0141
##
## time_min = 45:
##   contrast estimate SE    df t.ratio p.value
## I - M      -28.3 7.2 4.51  -3.938  0.0135
##
## time_min = 60:
##   contrast estimate SE    df t.ratio p.value
## I - M      -31.1 7.2 6.28  -4.317  0.0045
##
## time_min = 75:
##   contrast estimate SE    df t.ratio p.value
## I - M      -35.2 7.2 6.24  -4.895  0.0024
##
## time_min = 90:
##   contrast estimate SE    df t.ratio p.value
## I - M      -38.7 7.2 6.29  -5.371  0.0015
##
## time_min = 105:
##   contrast estimate SE    df t.ratio p.value
## I - M      -42.8 7.2 6.30  -5.948  0.0008
##
## time_min = 120:
##   contrast estimate SE    df t.ratio p.value
## I - M      -45.5 7.2 4.51  -6.327  0.0021
##

```

```
## time_min = 135:
## contrast estimate SE df t.ratio p.value
## I - M -46.5 7.2 6.28 -6.461 0.0005
##
## time_min = 150:
## contrast estimate SE df t.ratio p.value
## I - M -53.1 7.2 6.24 -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

