

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.

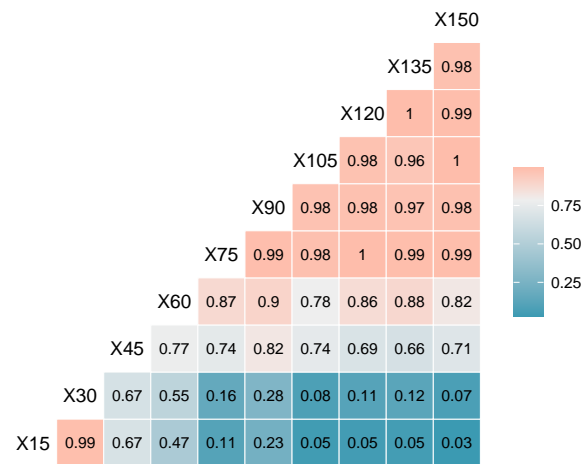
CO2 acumulation



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 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



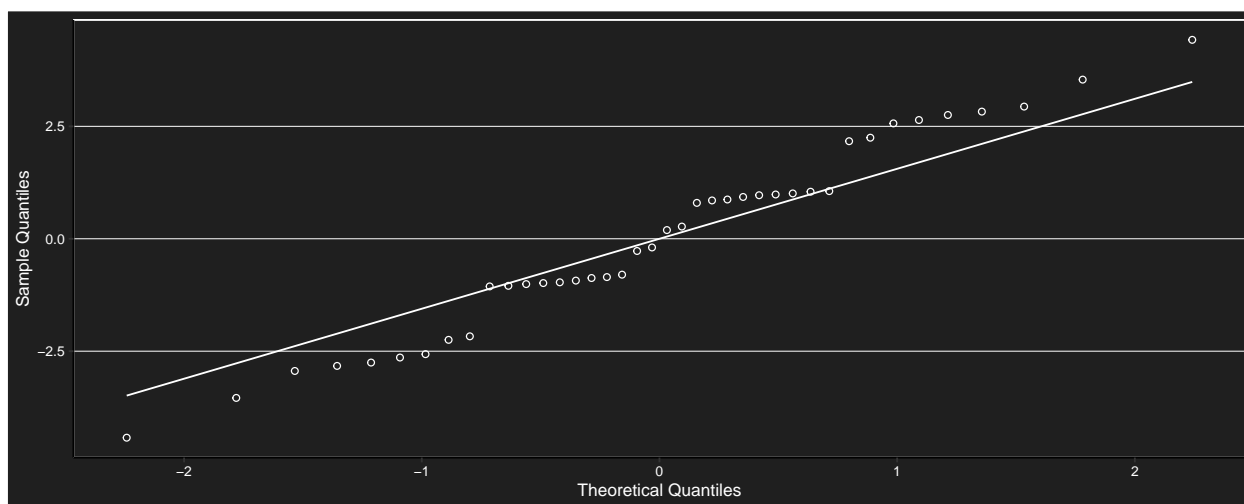
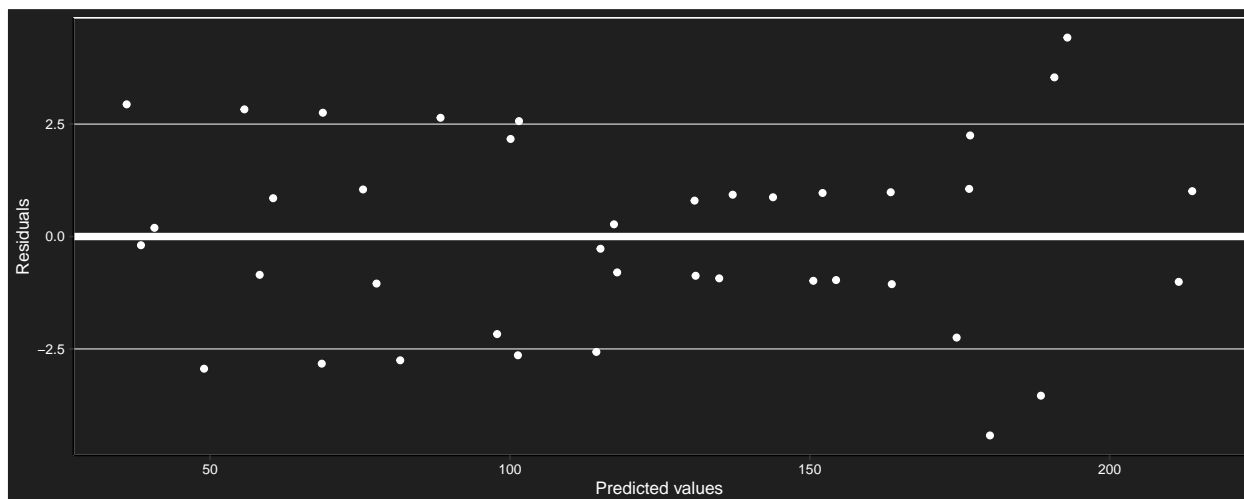
Covariance matrix

##	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 = 0.9761627, p-value = 0.549824
```

Model coefficients

```
##      (Intercept)      time_min30      time_min45      time_min60      time_min75
## -1088.309859117    19.625054307    32.708423844    52.333478151    65.416847689
##      time_min90      time_min105      time_min120      time_min135      time_min150
##      81.789723552    94.873093090    114.498147397    127.581516934    143.954392798
##      matuM          basal  time_min30:matuM  time_min45:matuM  time_min60:matuM
##      24.020301930    43.217057762      0.171220178      4.327249699      7.055345302
## time_min75:matuM  time_min90:matuM  time_min105:matuM  time_min120:matuM  time_min135:matuM
```

```
##      11.211374823      14.634773444      18.790802965      21.518898568      22.485337162
## time_min150:matuM
##      29.098326710
```

Anova

```
## Denom. DF: 19
##      numDF      F-value p-value
## (Intercept)      1 12422.59816 <.0001
## time_min      9   497.67981 <.0001
## matu      1    23.52445 0.0001
## basal      1    18.30623 0.0004
## time_min:matu      9    4.64451 0.0024
```

Simple effects

```
## $emmeans
## time_min = 15:
## matu      emmean      SE df    lower.CL    upper.CL
## I      29.0559310 3.99641289 4.38  18.3274684  39.7843936
## M      53.0762329 3.99641289 4.26  42.2426703  63.9097956
##
## time_min = 30:
## matu      emmean      SE df    lower.CL    upper.CL
## I      48.6809853 3.99641289 4.37  37.9473496  59.4146210
## M      72.8725074 3.99641289 4.38  62.1474410  83.5975738
##
## time_min = 45:
## matu      emmean      SE df    lower.CL    upper.CL
## I      61.7643548 3.99641289 4.23  50.9066429  72.6220667
## M      90.1119065 3.99641289 4.30  79.3151857 100.9086272
##
## time_min = 60:
## matu      emmean      SE df    lower.CL    upper.CL
## I      81.3894091 3.99641289 4.35  70.6412810  92.1375372
## M     112.4650564 3.99641289 4.37 101.7314207 123.1986921
##
## time_min = 75:
## matu      emmean      SE df    lower.CL    upper.CL
## I      94.4727787 3.99641289 4.28  83.6565866 105.2889707
## M     129.7044554 3.99641289 4.31 118.9126401 140.4962708
##
## time_min = 90:
## matu      emmean      SE df    lower.CL    upper.CL
## I     110.8456545 3.99641289 4.38 100.1171919 121.5741172
## M     149.5007299 3.99641289 4.26 138.6671673 160.3342926
##
## time_min = 105:
## matu      emmean      SE df    lower.CL    upper.CL
## I     123.9290241 3.99641289 4.37 113.1953884 134.6626598
## M     166.7401290 3.99641289 4.38 156.0150626 177.4651953
##
```

```

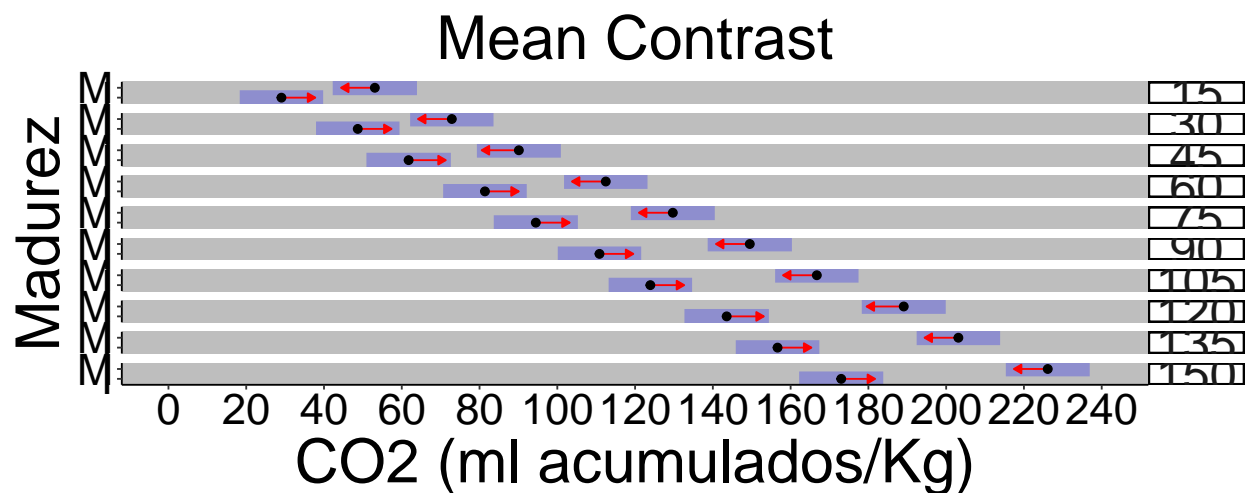
## time_min = 120:
##   matu      emmean      SE    df    lower.CL    upper.CL
##   I      143.5540784 3.99641289 4.23 132.6963665 154.4117903
##   M      189.0932789 3.99641289 4.30 178.2965581 199.8899996
##
## time_min = 135:
##   matu      emmean      SE    df    lower.CL    upper.CL
##   I      156.6374479 3.99641289 4.35 145.8893198 167.3855760
##   M      203.1430870 3.99641289 4.37 192.4094513 213.8767227
##
## time_min = 150:
##   matu      emmean      SE    df    lower.CL    upper.CL
##   I      173.0103238 3.99641289 4.28 162.1941317 183.8265159
##   M      226.1289524 3.99641289 4.31 215.3371371 236.9207678
##
## 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      -24.0203019 7.19762359 6.29  -3.337  0.0146
##
## time_min = 30:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -24.1915221 7.19762359 6.30  -3.361  0.0141
##
## time_min = 45:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -28.3475516 7.19762359 4.51  -3.938  0.0135
##
## time_min = 60:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -31.0756472 7.19762359 6.28  -4.317  0.0045
##
## time_min = 75:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -35.2316768 7.19762359 6.24  -4.895  0.0024
##
## time_min = 90:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -38.6550754 7.19762359 6.29  -5.371  0.0015
##
## time_min = 105:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -42.8111049 7.19762359 6.30  -5.948  0.0008
##
## time_min = 120:
##   contrast      estimate      SE    df t.ratio p.value
##   I - M      -45.5392005 7.19762359 4.51  -6.327  0.0021
##
## time_min = 135:
##   contrast      estimate      SE    df t.ratio p.value

```

```
## I - M    -46.5056391 7.19762359 6.28  -6.461  0.0005
##
## time_min = 150:
## contrast      estimate          SE    df t.ratio p.value
## I - M    -53.1186286 7.19762359 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

