

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.

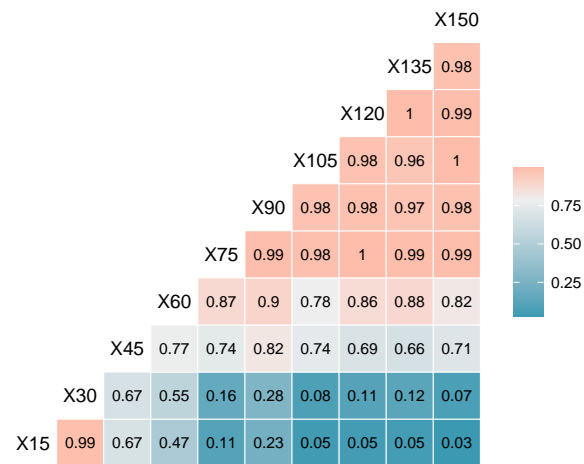
CO2 acumulation



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



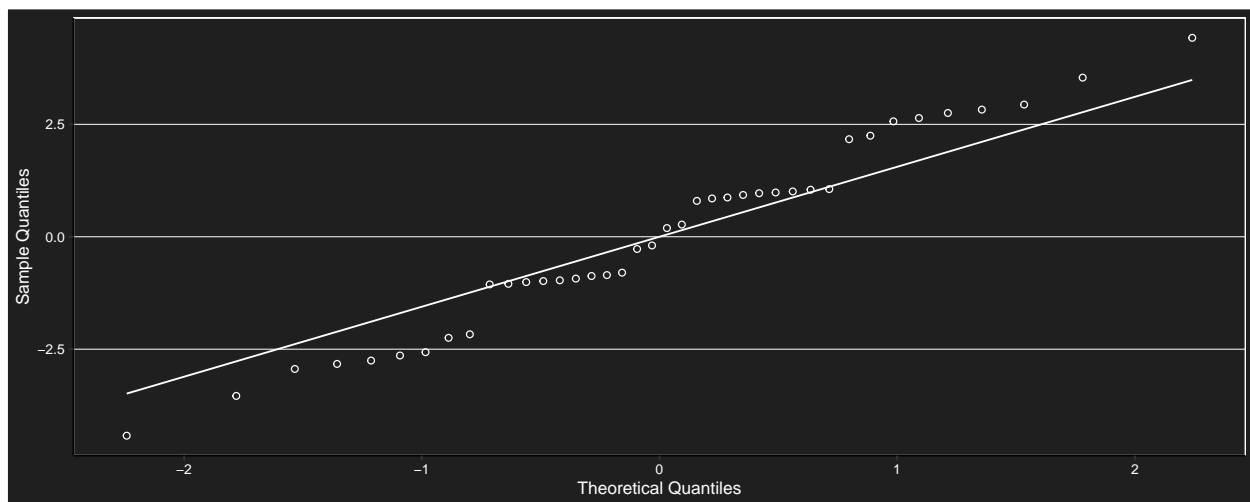
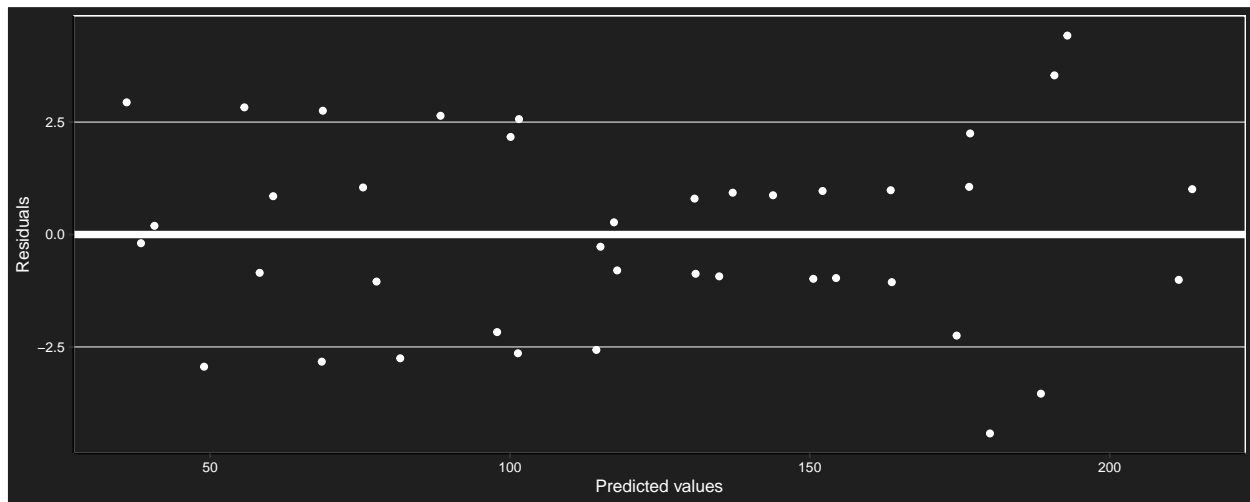
Covariance matrix

##	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 = 0.97616, 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        29.05593 3.996413 4.38  18.32747  39.78439
## M        53.07623 3.996413 4.26  42.24267  63.90980
##
## time_min = 30:
## matu      emmean      SE    df  lower.CL  upper.CL
## I        48.68099 3.996413 4.37  37.94735  59.41462
## M        72.87251 3.996413 4.38  62.14744  83.59757
##
## time_min = 45:
## matu      emmean      SE    df  lower.CL  upper.CL
## I        61.76435 3.996413 4.23  50.90664  72.62207
## M        90.11191 3.996413 4.30  79.31519 100.90863
##
## time_min = 60:
## matu      emmean      SE    df  lower.CL  upper.CL
## I        81.38941 3.996413 4.35  70.64128  92.13754
## M       112.46506 3.996413 4.37 101.73142 123.19869
##
## time_min = 75:
## matu      emmean      SE    df  lower.CL  upper.CL
## I        94.47278 3.996413 4.28  83.65659 105.28897
## M       129.70446 3.996413 4.31 118.91264 140.49627
##
## time_min = 90:
## matu      emmean      SE    df  lower.CL  upper.CL
## I       110.84565 3.996413 4.38 100.11719 121.57412
## M       149.50073 3.996413 4.26 138.66717 160.33429
##
## time_min = 105:
## matu      emmean      SE    df  lower.CL  upper.CL
## I       123.92902 3.996413 4.37 113.19539 134.66266
```

```

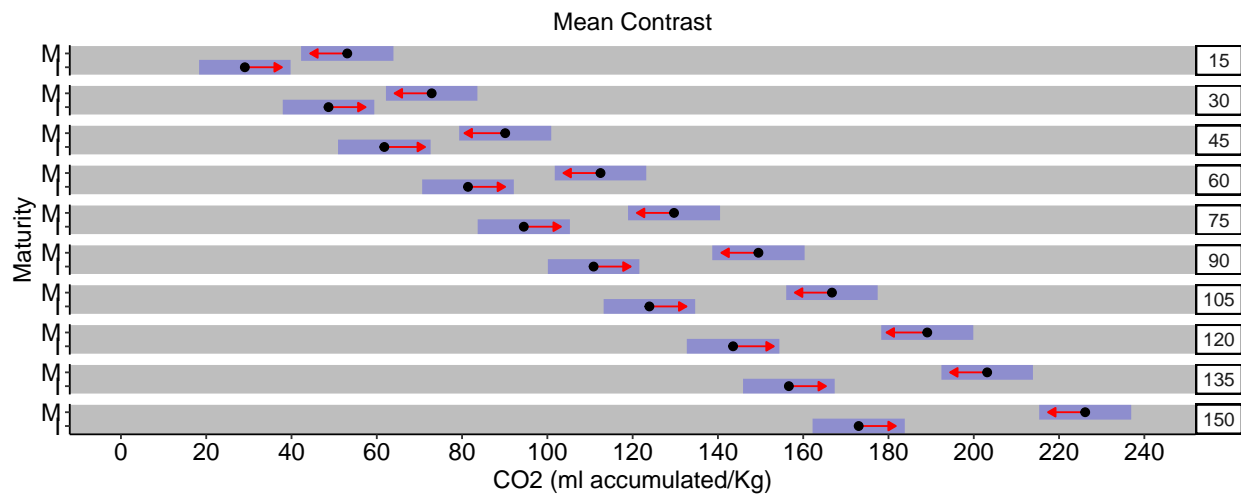
## M      166.74013 3.996413 4.38 156.01506 177.46520
##
## time_min = 120:
##      matu      emmean      SE      df lower.CL upper.CL
## I      143.55408 3.996413 4.23 132.69637 154.41179
## M      189.09328 3.996413 4.30 178.29656 199.89000
##
## time_min = 135:
##      matu      emmean      SE      df lower.CL upper.CL
## I      156.63745 3.996413 4.35 145.88932 167.38558
## M      203.14309 3.996413 4.37 192.40945 213.87672
##
## time_min = 150:
##      matu      emmean      SE      df lower.CL upper.CL
## I      173.01032 3.996413 4.28 162.19413 183.82652
## M      226.12895 3.996413 4.31 215.33714 236.92077
##
## 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      -24.02030 7.197624 6.29  -3.337  0.0146
##
## time_min = 30:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -24.19152 7.197624 6.30  -3.361  0.0141
##
## time_min = 45:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -28.34755 7.197624 4.51  -3.938  0.0135
##
## time_min = 60:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -31.07565 7.197624 6.28  -4.317  0.0045
##
## time_min = 75:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -35.23168 7.197624 6.24  -4.895  0.0024
##
## time_min = 90:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -38.65508 7.197624 6.29  -5.371  0.0015
##
## time_min = 105:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -42.81110 7.197624 6.30  -5.948  0.0008
##
## time_min = 120:
##      contrast estimate      SE      df t.ratio p.value
## I - M      -45.53920 7.197624 4.51  -6.327  0.0021
##

```

```
## time_min = 135:
## contrast estimate SE df t.ratio p.value
## I - M -46.50564 7.197624 6.28 -6.461 0.0005
##
## time_min = 150:
## contrast estimate SE df t.ratio p.value
## I - M -53.11863 7.197624 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

