OSO Parr Length Weight Summary

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2022-11-06T00:00:00-07:00

Table of contents

Osoyoos Lake Sockeye Parr: Length and Weight Summary

```
parr <- read.csv("data/OSO_ATS_age0_summary_nov4.2022.csv")  # Read in csv.
# Add season factor. Arbitrary right now.
parr$season <- case_when(
    between(parr$month, 4, 9) ~ "W",   # September to March is Winter.
    !between(parr$month, 4, 9) ~ "S"   # April to August is Summer.
)
# Add day of the month
parr$day <- parr[,1] %>% strsplit('/') %>% simplify2array %>% `[`(2,) %>% as.numeric
# Add day of the Julian year
parr$jday <-with(parr, DOJY(month,day)) # 1 to 365 not 366
# Add day of parr and presmolt life, across calendar year end.
parr$smolt_day <- parr$jday  # default, unless
j <- with( parr, year==smolt_yr); # obs of smolt life is in 2nd calendar year
parr$smolt_day[j] <- parr$smolt_day[j]+365 # so smolt_day greater than jday

noquote(colnames(parr)) #  99 rows 12 cols
```

```
 [1] sample_date    year           month          brood_yr       smolt_yr
 [6] fish           length_mean_cm length_sd_cm   mass_mean_g    mass_sd_g
[11] density_ha.1   season         day            jday           smolt_day
```

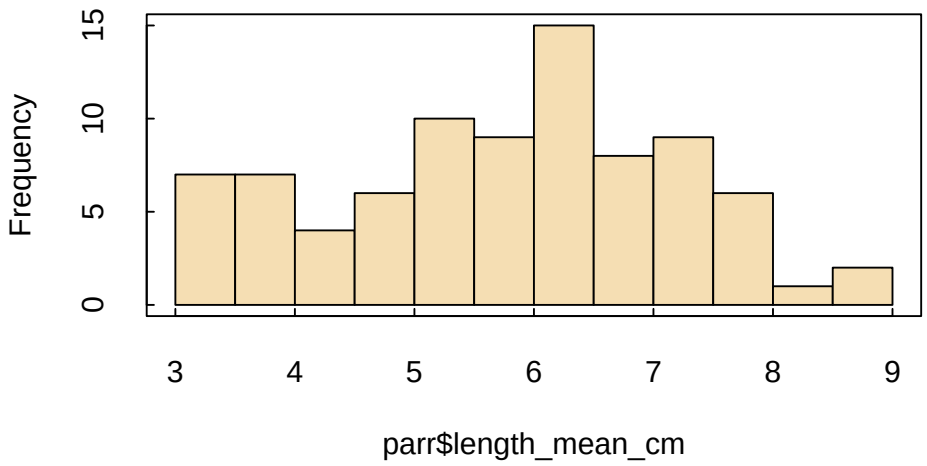
Explore Lengths

Summary statistics and frequency distribution.

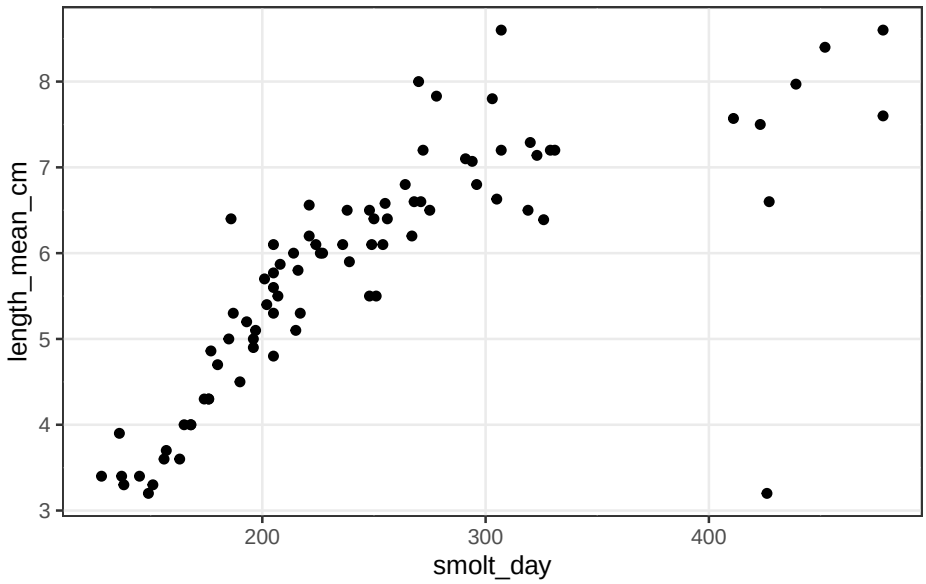
```
summary(parr$length_mean_cm);
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
  3.200   4.890   6.000   5.803   6.607   8.600      15
```

```
par(tcl=0.2)
hist(parr$length_mean_cm, col = "wheat", main='')
box()
```




```
ggplot (data=parr, aes(x=smolt_day, y=length_mean_cm))+ Custom_Theme+
    geom_point()
```



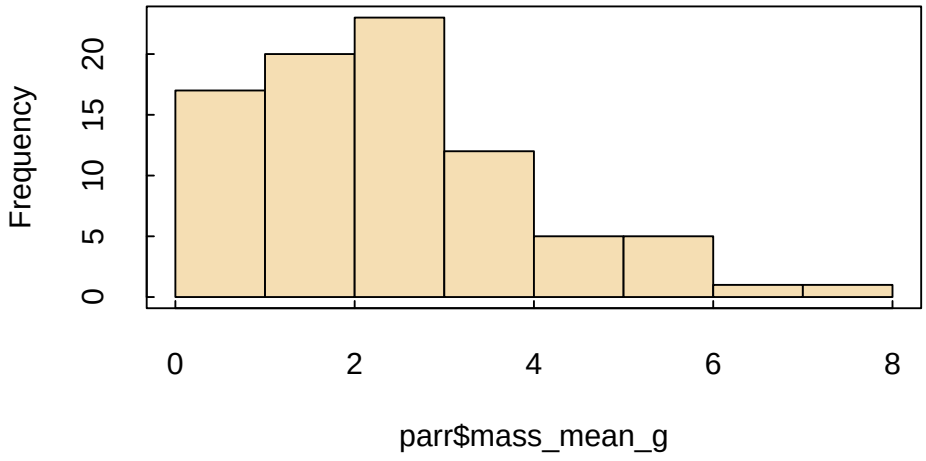
Explore Weights

Summary statistics and frequency distribution.

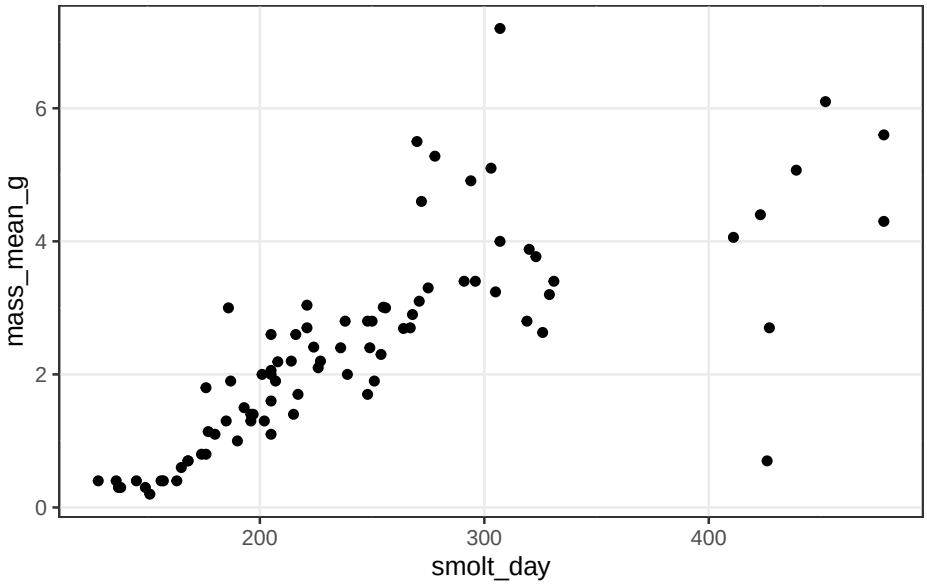
```
summary(parr$mass_mean_g);
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
  0.200   1.300   2.250   2.406   3.125   7.200      15
```

```
par(tcl=0.2)
hist(parr$mass_mean_g,col="wheat", main=''); box()
```



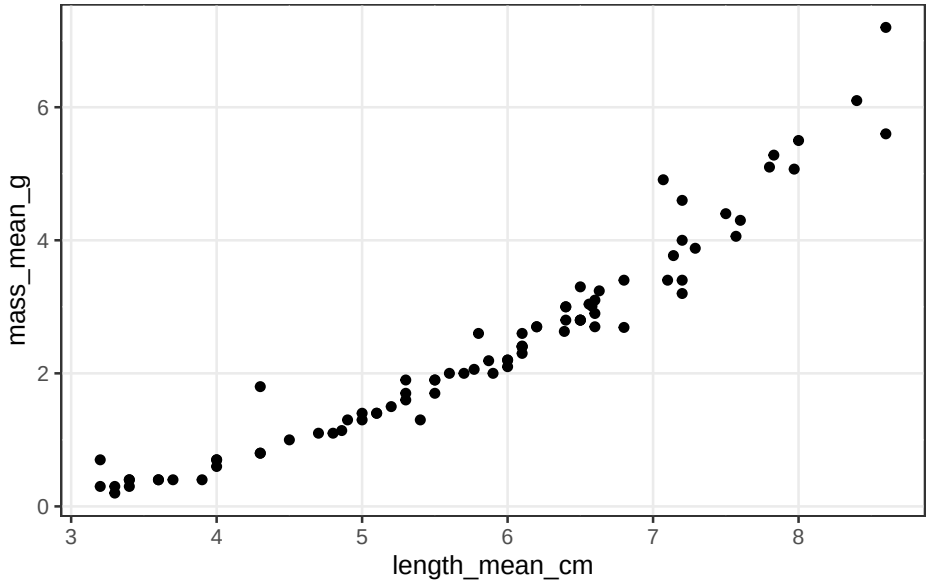

```
ggplot (data=parr, aes(x=smolt_day, y=mass_mean_g))+ Custom_Theme+
    geom_point()
```



Length-Weight Regressions

First, linear

```
ggplot(data = parr) + Custom_Theme+
  geom_point(aes(x = length_mean_cm,
                 y = mass_mean_g))
```



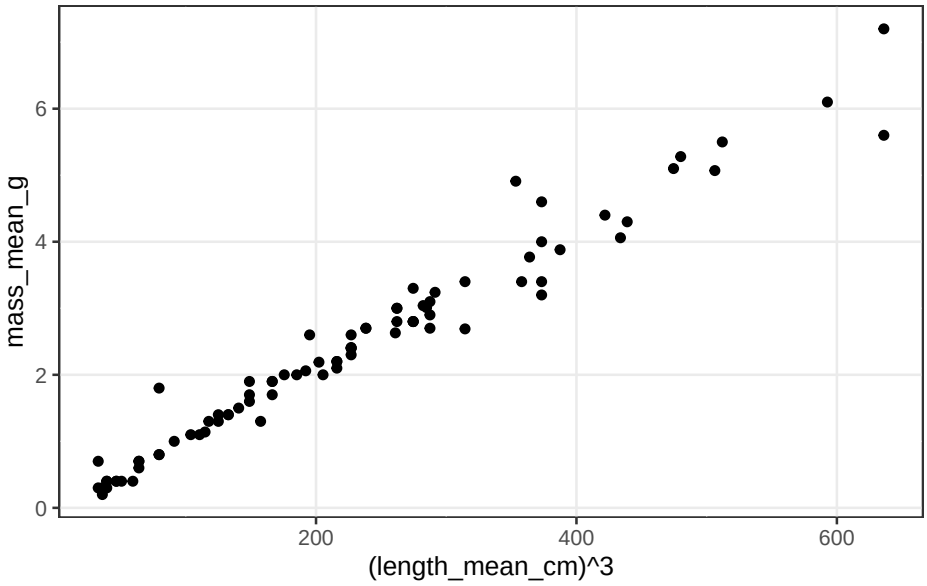

```
summary(lm( mass_mean_g ~ length_mean_cm, data=parr))
```

```
Call:
lm(formula = mass_mean_g ~ length_mean_cm, data = parr)

Residuals:
    Min      1Q  Median      3Q     Max
-0.7551 -0.3004 -0.1282  0.1886  1.8789

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    -3.64205    0.21687  -16.79   <2e-16 ***
length_mean_cm  1.04223    0.03635   28.67   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.462 on 82 degrees of freedom
  (15 observations deleted due to missingness)
Multiple R-squared:  0.9093,    Adjusted R-squared:  0.9082
```

```
F-statistic:   822 on 1 and 82 DF,  p-value: < 2.2e-16
```

Second, allometric: weight is proportional to length cubed.

```
ggplot(data = parr) + Custom_Theme+
  geom_point(aes(x = (length_mean_cm)^3,
                 y = mass_mean_g))
```




```
summary(lm( mass_mean_g ~ I(length_mean_cm^3), data=parr))
```

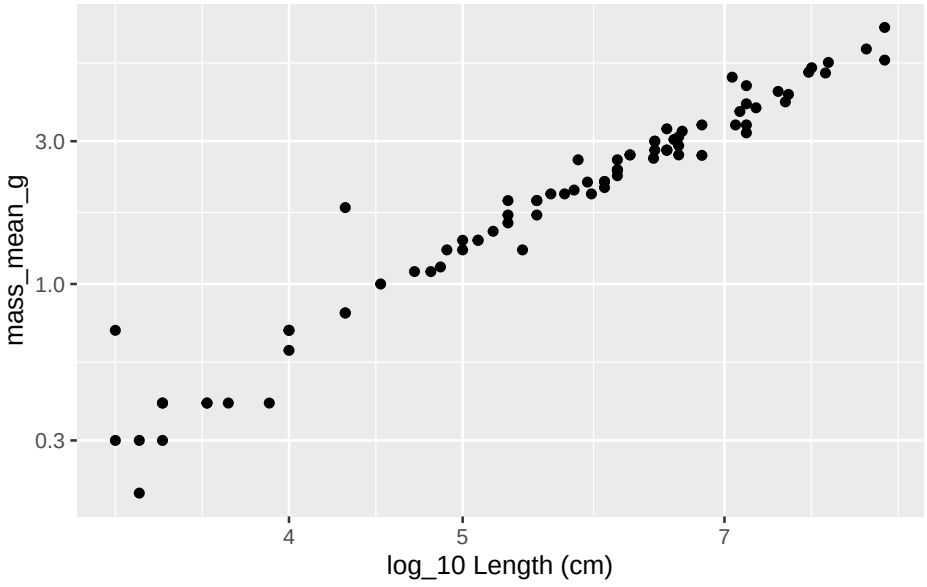
```
Call:
lm(formula = mass_mean_g ~ I(length_mean_cm^3), data = parr)

Residuals:
     Min       1Q   Median       3Q      Max
-0.97049 -0.11366 -0.02687  0.11466  1.22728

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)         0.0723414  0.0618267    1.17    0.245
I(length_mean_cm^3) 0.0102163  0.0002283   44.74   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.3043 on 82 degrees of freedom
  (15 observations deleted due to missingness)
Multiple R-squared:  0.9606,    Adjusted R-squared:  0.9602
F-statistic:  2002 on 1 and 82 DF,  p-value: < 2.2e-16
```

Third, power law

from $W = aL^b$, plot $\log(W) = \log(W)$.

```
ggplot(data = parr, aes(x= length_mean_cm, y= mass_mean_g),) +
        scale_x_log10() +scale_y_log10() + geom_point() +
    labs(x="log_10 Length (cm)", x="log_10 Weight (g)")
```




```
summary(lm( log(mass_mean_g) ~ log(length_mean_cm), data=parr))
```

```
Call:
lm(formula = log(mass_mean_g) ~ log(length_mean_cm), data = parr)

Residuals:
     Min       1Q   Median       3Q      Max
-0.57864 -0.06265  0.00868  0.05719  0.80127

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept)         -4.71738    0.13050  -36.15   <2e-16 ***
log(length_mean_cm)  3.08779    0.07474   41.31   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1771 on 82 degrees of freedom
  (15 observations deleted due to missingness)
Multiple R-squared:  0.9542,    Adjusted R-squared:  0.9536
F-statistic:  1707 on 1 and 82 DF,  p-value: < 2.2e-16
```

Did we learn anything?