Depletion Estimates of Abundance

1 Initialization

```
> library(FSA)
> setwd("C://aaaWork/Class Materials//MnDNR_ShortCourse//Readings//depletion//")
```

2 Little Silver Lake Largemouth Bass

2.1 Leslie – Step-by-Step Regression

```
> data(SMBassLS)
> SMBassLS
```

```
   day catch effort
1    1   131      7
2    2    69      7
3    3    99      7
4    4    78      7
5    5    56      7
6    6    76      7
7    7    49      7
8    8    42      7
9    9    63      7
10  10    47      7
```

```
> attach(SMBassLS)
> cpe <- catch/effort
> cpe
```

```
 [1] 18.714286  9.857143 14.142857 11.142857  8.000000 10.857143  7.000000  6.000000
 [9]  9.000000  6.714286
```

```
> K <- cumsum(catch) - catch
> K
```

```
 [1]   0 131 200 299 377 433 509 558 600 663
```

```
> les1 <- lm(cpe ~ K)
> summary(les1)
```

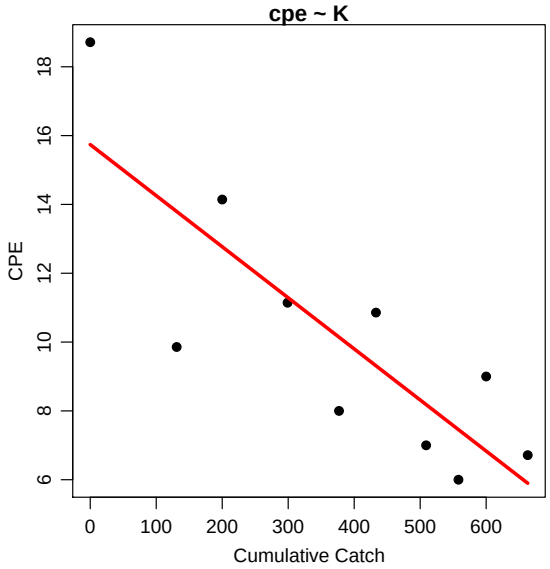
```
Call:
lm(formula = cpe ~ K)

Residuals:
    Min      1Q  Median      3Q     Max
-3.9373 -1.3879  0.3295  1.5023  2.9752
```

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 15.73906    1.51266  10.405 6.31e-06 ***
K           -0.01484    0.00352  -4.216  0.00293 **
---
Signif. codes:  0 Ś***Š 0.001 Ś**Š 0.01 Ś*Š 0.05 Ś.Š 0.1 Ś Š 1

Residual standard error: 2.295 on 8 degrees of freedom
Multiple R-Squared: 0.6897,        Adjusted R-squared: 0.6509
F-statistic: 17.78 on 1 and 8 DF,  p-value: 0.00293
```

```
> fit.plot(les1, xlab = "Cumulative Catch", ylab = "CPE")
```



2.2 Leslie – Using `depletion()` function

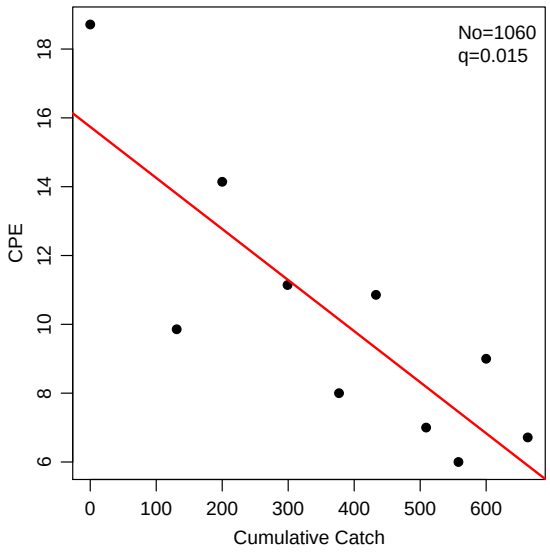
```
> les2 <- depletion(catch, effort)
> summary(les2)

       Estimate    Std. Err.
No 1.060296e+03 1.692676e+02
q  1.484403e-02 3.520491e-03

> confint(les2)

        95% LCI      95% UCI
No 6.699638e+02 1.450627e+03
q  6.725759e-03 2.296229e-02


> plot(les2)
```




```
> summary(les2, type = "lm")

Call:
lm(formula = cpe ~ K)

Residuals:
    Min      1Q  Median      3Q     Max
-3.9373 -1.3879  0.3295  1.5023  2.9752

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 15.73906    1.51266  10.405 6.31e-06 ***
K           -0.01484    0.00352  -4.216  0.00293 **
---
Signif. codes:  0 Ś***Š 0.001 Ś**Š 0.01 Ś*Š 0.05 Ś.Š 0.1 Ś Š 1

Residual standard error: 2.295 on 8 degrees of freedom
Multiple R-Squared: 0.6897,        Adjusted R-squared: 0.6509
F-statistic: 17.78 on 1 and 8 DF,  p-value: 0.00293

> confint(les2, parm = "lm")

                 2.5 %       97.5 %
(Intercept) 12.25084983 19.227259511
K           -0.02296229 -0.006725759
```

2.3 Leslie – with Ricker Modification

```
> les3 <- depletion(catch, effort, ricker.mod = TRUE)
> summary(les3)

       Estimate    Std. Err.
No 1.077571e+03 1.778035e+02
q  1.525078e-02 3.911632e-03
```

```
> confint(les3)

        95% LCI      95% UCI
No 6.675556e+02 1.487587e+03
q  6.230542e-03 2.427102e-02
```

2.4 Delury – Using `depletion()` function

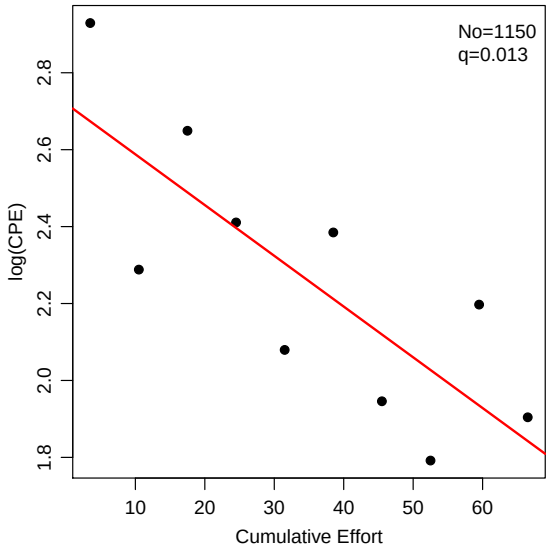
```
> del1 <- depletion(catch, effort, type = "Delury", ricker.mod = TRUE)
> summary(del1)

       Estimate    Std. Err.
No 1.150420e+03 1.876083e+02
q  1.319375e-02 3.585777e-03

> confint(del1)

        95% LCI      95% UCI
No 7.177940e+02 1.583045e+03
q  4.924937e-03 2.146257e-02


> plot(del1)
```



2.5 Zippin Removal Method – Using `removal()` function

```
> zip1 <- removal(catch)
> summary(zip1)

The Zippin's K-Pass Removal Method was used.
Estimates with Standard Errors
       Estimate   Std. Err.
No 1.119000e+03 90.13437063
p  9.568733e-02  0.01211940
```

```
> confint(zip1)

        95% LCI      95% UCI
No 942.33987979 1295.6601202
p    0.07193375    0.1194409
```

2.6 Carle-Strub Removal Method – Using `removal()` function

```
> cs1 <- removal(catch, type = "CarleStrub")
> summary(cs1)

The Carle & Strub's K-Pass Removal Method was used.
Estimates with Standard Errors
       Estimate   Std. Err.
No 1.108000e+03 84.99912700
p  9.712722e-02  0.01211456

> confint(cs1)

        95% LCI      95% UCI
No 941.40477237 1274.5952276
p    0.07338313    0.1208713
```