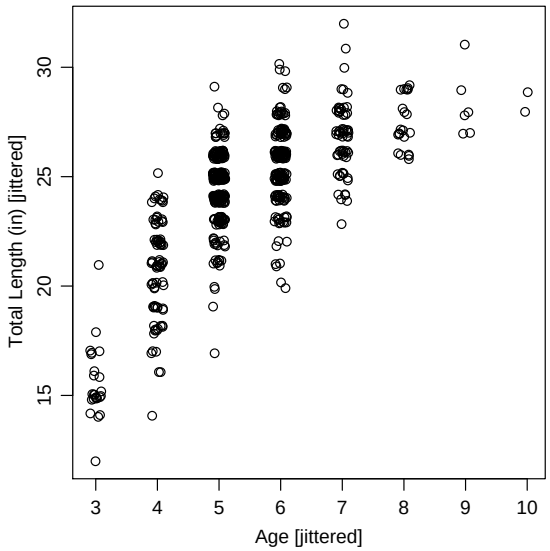
Size-At-Age Models

1 Initialization

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

2 Traditional Von Bertalanffy Example – Rainbow Trout

```
> library(FSA)
> data(TroutBR)
> str(TroutBR)

'data.frame':        851 obs. of  3 variables:
 $ tl     : int  16 16 17 17 17 17 17 17 17 17 ...
 $ age    : int  4 4 2 3 3 3 3 3 3 4 ...
 $ species: Factor w/ 2 levels "Brown","Rainbow": 1 1 1 1 1 1 1 1 1 1 ...

> rbt <- subset(TroutBR, species == "Rainbow")
> attach(rbt)
> plot(jitter(tl, 1) ~ jitter(age, 0.5), xlab = "Age [jittered]", ylab = "Total Length (in) [jitte
```



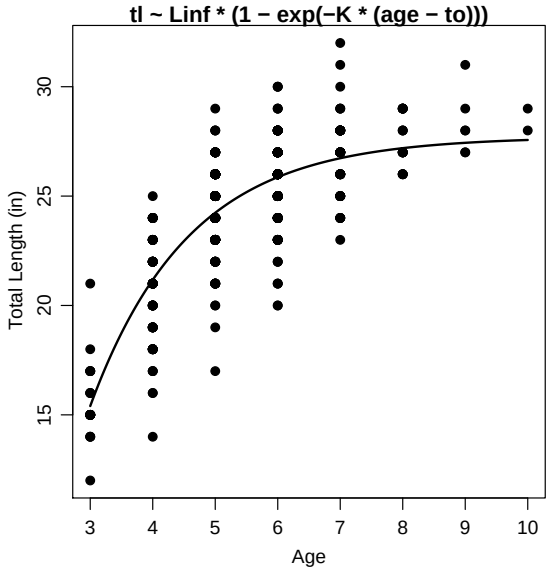

```
> Summary(tl)

        n        NAs    Valid n       Mean    St. Dev.       Min.    1st Qu.     Median
627.000000   0.000000 627.000000  24.363636   3.045211  12.000000  23.000000  25.000000
   3rd Qu.       Max.
 26.000000  32.000000
```

The following command is interactive and cannot be shown in this document

```
> growmodel.sim("vb", age, tL, max.len = 35)
```

```
> svb <- list(Linf = 31.3, K = 0.3, to = 0.6)
> vbl1 <- nls(tl ~ Linf * (1 - exp(-K * (age - to))), start = svb)
> summary(vbl1)

Formula: tl ~ Linf * (1 - exp(-K * (age - to)))

Parameters:
     Estimate Std. Error t value Pr(>|t|)
Linf 27.71185    0.28382   97.64   <2e-16 ***
K     0.63243    0.04248   14.89   <2e-16 ***
to    1.71688    0.10159   16.90   <2e-16 ***
---
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: 1.775 on 624 degrees of freedom

Number of iterations to convergence: 7
Achieved convergence tolerance: 3.009e-07
```

```
> fit.plot(vbl1, xlab = "Age", ylab = "Total Length (in)")
```



The following `boot.case()` function requires that the `alr3` package be installed and loaded. The `boot.case()` function requires patience – the example below took 3-4 minutes to process.

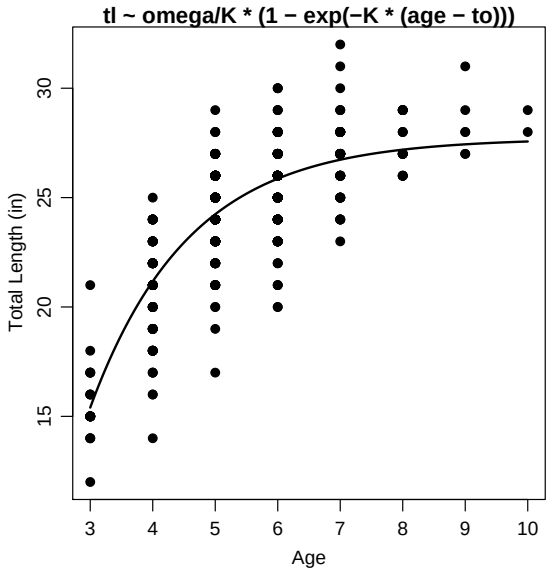
```
> library(alr3)
> coef.boot <- boot.case(vbl1)
> ci.bc(coef.boot)

        95% LCI    95% UCI
Linf 27.2217215 28.2557533
K     0.5556447  0.7151777
to    1.5060227  1.8903305
```

```
> ho.bc(coef.boot, 1, 28.5, alt = "greater")

 Ho Value  p value
     28.5 0.997998

> predict(vbl1, data.frame(age = 8))

[1] 27.19074

> linf.bc <- coef.boot[, 1]
> k.bc <- coef.boot[, 2]
> to.bc <- coef.boot[, 3]
> pv <- linf.bc * (1 - exp(-k.bc * (8 - to.bc)))
> quantile(pv, c(0.025, 0.975))

    2.5%    97.5%
26.87676 27.51393
```

3 Galucci and Quinn Von Bertalanffy Example – Rainbow Trout

The following commands assume that the rainbow trout data frame created above is still attached.

```
> growmodel.sim("vbgq", Age, TL, max.len = 35)


> svb2 <- list(omega = 10, K = 0.3, to = 0.6)
> vbl2 <- nls(tl ~ omega/K * (1 - exp(-K * (age - to))), start = svb2)
> summary(vbl2)

Formula: tl ~ omega/K * (1 - exp(-K * (age - to)))

Parameters:
      Estimate Std. Error t value Pr(>|t|)
omega 17.52584    1.01720   17.23   <2e-16 ***
K      0.63243    0.04248   14.89   <2e-16 ***
to     1.71688    0.10159   16.90   <2e-16 ***
---
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: 1.775 on 624 degrees of freedom

Number of iterations to convergence: 5
Achieved convergence tolerance: 2.114e-06

> fit.plot(vbl2, xlab = "Age", ylab = "Total Length (in)")
```




```
> coef.boot2 <- boot.case(vbl2)
> ci.bc(coef.boot2)

          95% LCI    95% UCI
omega 15.7252097 19.4807003
K      0.5566017  0.7136926
to     1.5091226  1.8946154

> predict(vbl2, data.frame(age = 8))

[1] 27.19074

> omega.bc <- coef.boot2[, 1]
> k.bc2 <- coef.boot2[, 2]
> to.bc2 <- coef.boot2[, 3]
> pv2 <- omega.bc/k.bc2 * (1 - exp(-k.bc * (8 - to.bc)))
> quantile(pv2, c(0.025, 0.975))

    2.5%    97.5%
26.66526 27.78304


> detach(rbt)
```