Package 'growthmodels'

February 20, 2015

Type Package

Title Nonlinear Growth Models

Version 1.2.0

Date 2013-11-23

Author Daniel Rodriguez Perez

Maintainer Daniel Rodriguez Perez <daniel.rodriguez.perez@gmail.com>

Description A compilation of nonlinear growth models used in many areas

License GPL-3

URL https://github.com/drodriguezperez/growthmodels

BugReports https://github.com/drodriguezperez/growthmodels/issues

Collate 'negativeExponential.R' 'monomolecular.R' 'mitcherlich.R'
'gompertz.R' 'logistic.R' 'chapmanRichards.R' 'richard.R'
'vonBertalanffy.R' 'weibull.R' 'loglogistic.R' 'mmf.R'
'schnute.R' 'stannard.R' 'brody.R' 'growthmodels.R'
'blumberg.R'

NeedsCompilation no

Repository CRAN

Date/Publication 2013-11-23 17:11:06

R topics documented:

`growthmodels-package` *growthmodels: Nonlinear Growth Models*

Description

A compilation of nonlinear growth models used in many areas.

Details

Package:	growthmodels
Version:	1.2.0
License:	GPL-3

Author(s)

Daniel Rodriguez Perez <daniel.rodriguez.perez@gmail.com>

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

M. M. Kaps, W. O. W. Herring, and W. R. W. Lamberson, "Genetic and environmental parameters for traits derived from the Brody growth curve and their relationships with weaning weight in Angus cattle.," Journal of Animal Science, vol. 78, no. 6, pp. 1436-1442, May 2000.

A. Tsoularis and J. Wallace, "Analysis of logistic growth models.," Math Biosci, vol. 179, no. 1, pp. 21-55, Jul. 2002.

A. Khamiz, Z. Ismail, and A. T. Muhammad, "Nonlinear growth models for modeling oil palm yield growth," Journal of Mathematics and Statistics, vol. 1, no. 3, p. 225, 2005.

http://en.wikipedia.org/wiki/Generalised_logistic_function

`blumberg` *Blumberg growth model*

Description

Computes the Blumberg growth model and its inverse

$$y(t) = \frac{\alpha * (t + t_0)^m}{w_0 + (t + t_0)^m}$$

Usage

```
blumberg(t, alpha, w0, m, t0 = 0)

blumberg.inverse(x, alpha, w0, m, t0 = 0)
```

Arguments

`t`	time
`x`	size
`alpha`	upper asymptote
`w0`	a reference value at t = t0
`m`	slope of growth
`t0`	time shift (default 0)

References

A. Tsoularis and J. Wallace, "Analysis of logistic growth models.," Math Biosci, vol. 179, no. 1, pp. 21-55, Jul. 2002.

Examples

```
growth <- blumberg(0:10, 10, 2, 0.5)
# Calculate inverse function
time <- blumberg.inverse(growth, 12, 2, 0.5)
```

brody *Brody growth model*

Description

Computes the Brody growth model and its inverse

$$y(t) = \alpha - (\alpha - w_0)exp(-kt)$$

Usage

```
brody(t, alpha, w0, k)

brody.inverse(x, alpha, w0, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
w0	the value at t = 0
k	growth rate

References

M. M. Kaps, W. O. W. Herring, and W. R. W. Lamberson, "Genetic and environmental parameters for traits derived from the Brody growth curve and their relationships with weaning weight in Angus cattle.," Journal of Animal Science, vol. 78, no. 6, pp. 1436-1442, May 2000.

Examples

```
growth <- brody(0:10, 10, 5, 0.3)
# Calculate inverse function
time <- brody.inverse(growth, 10, 5, 0.3)
```

chapmanRichards *Chapman-Richards growth model*

Description

Computes the Chapman-Richards growth model and its inverse

$$y(t) = \alpha(1 - \beta exp(-kt)^{1/(1-m)})$$

Usage

```
chapmanRichards(t, alpha, beta, k, m)

chapmanRichards.inverse(x, alpha, beta, k, m)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate
m	slope of growth

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- chapmanRichards(0:10, 10, 0.5, 0.3, 0.5)
# Calculate inverse function
time <- chapmanRichards.inverse(growth, 10, 0.5, 0.3, 0.5)
```

---

generalisedLogistic *Generalised Logistic growth model*

Description

Computes the Generalised Logistic growth model

$$y(t) = A + \frac{U - A}{1 + \beta exp(-k(t - t_0))}$$

Usage

```
generalisedLogistic(t, A, U, k, beta, t0)

generalisedLogistic.inverse(x, A, U, k, beta, t0 = 0)
```

Arguments

t	time
x	size
A	the lower asymptote
U	the upper asymptote
k	growth range
beta	growth range
t0	time shift (default 0)

References

http://en.wikipedia.org/wiki/Generalised_logistic_function

Examples

```
growth <- generalisedLogistic(0:10, 5, 10, 0.3, 0.5, 3)
# Calculate inverse function
time <- generalisedLogistic.inverse(growth, 5, 10, 0.3, 0.5, 3)
```

---

generalisedRichard *Generalised Richard growth model*

Description

Computes the Generalised Richard growth model and its inverse

$$y(t) = A + \frac{U - A}{(1 + \beta exp(-k(t - t_0)))^{(1/m)}}$$

Usage

```
generalisedRichard(t, A, U, k, m, beta, t0)

generalisedRichard.inverse(x, A, U, k, m, beta, t0 = 0)
```

Arguments

t	time
x	size
A	the lower asymptote
U	the upper asymptote
k	growth range
m	slope of growth
beta	growth range
t0	time shift (default 0)

References

http://en.wikipedia.org/wiki/Generalised_logistic_function

Examples

```
growth <- generalisedRichard(0:10, 5, 10, 0.3, 0.5, 1, 3)
time <- generalisedRichard.inverse(growth, 5, 10, 0.3, 0.5, 1, 3)
```

---

gompertz *Gompertz growth model*

Description

Computes the Gompertz growth model and its inverse

$$y(t) = \alpha exp(-\beta exp(-k^t))$$

Usage

```
gompertz(t, alpha, beta, k)

gompertz.inverse(x, alpha, beta, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth displacement
k	growth rate

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- gompertz(0:10, 10, 0.5, 0.3)
# Calculate inverse function
time <- gompertz.inverse(growth, 10, 0.5, 0.3)
```

logistic *Logistic growth model*

Description

Computes the Logistic growth model

$$y(t) = \frac{\alpha}{1 + \beta exp(-kt)}$$

Usage

```
logistic(t, alpha, beta, k)

logistic.inverse(x, alpha, beta, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- logistic(0:10, 10, 0.5, 0.3)
# Calculate inverse function
time <- logistic.inverse(growth, 10, 0.5, 0.3)
```

loglogistic *Log-logistic growth model*

Description

Computes the Log-logistic growth model

$$y(t) = \frac{\alpha}{1 + \beta exp(-klog(t)}$$

Usage

```
loglogistic(t, alpha, beta, k)

loglogistic.inverse(x, alpha, beta, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate

References

A. Khamiz, Z. Ismail, and A. T. Muhammad, "Nonlinear growth models for modeling oil palm yield growth," Journal of Mathematics and Statistics, vol. 1, no. 3, p. 225, 2005.

Examples

```
growth <- loglogistic(0:10, 10, 0.5, 0.3)
# Calculate inverse function
time <- loglogistic.inverse(growth, 10, 0.5, 0.3)
```

---

mitcherlich *Mitcherlich growth model*

Description

Computes the Mitcherlich growth model

$$y(t) = (\alpha - \beta k^t)$$

Usage

```
mitcherlich(t, alpha, beta, k)

mitcherlich.inverse(x, alpha, beta, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- mitcherlich(0:10, 10, 0.5, 0.3)
# Calculate inverse function
time <- mitcherlich.inverse(growth, 10, 0.5, 0.3)
```

`mmf` *Morgan-Mercer-Flodin growth model*

Description

Computes the Morgan-Mercer-Flodin growth model

$$y(t) = \frac{(w_0\gamma + \alpha t^m)}{\gamma} + t^m$$

Usage

```
mmf(t, alpha, w0, gamma, m)

mmf.inverse(x, alpha, w0, gamma, m)
```

Arguments

`t`	time
`x`	size
`alpha`	upper asymptote
`w0`	the value at t = 0
`gamma`	parameter that controls the point of inflection
`m`	growth rate

References

A. Khamiz, Z. Ismail, and A. T. Muhammad, "Nonlinear growth models for modeling oil palm yield growth," Journal of Mathematics and Statistics, vol. 1, no. 3, p. 225, 2005.

Examples

```
growth <- mmf(0:10, 10, 0.5, 4, 1)
# Calculate inverse function
time <- mmf.inverse(growth, 10, 0.5, 4, 1)
```

monomolecular *Monomolecular growth model*

Description

Computes the monomolecular growth model

$$y(t) = \alpha(1 - \beta exp(-kt))$$

Usage

```
monomolecular(t, alpha, beta, k)

monomolecular.inverse(x, alpha, beta, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- monomolecular(0:10, 10, 0.5, 0.3)
# Calculate inverse function
time <- monomolecular.inverse(growth, 10, 0.5, 0.3)
```

negativeExponential *Negative exponential growth model*

Description

Computes the negative exponential growth model

$$y(t) = \alpha(1 - exp(-kt))$$

Usage

```
negativeExponential(t, alpha, k)

negativeExponential.inverse(x, alpha, k)
```

Arguments

t	time
x	size
alpha	upper asymptote
k	growth rate

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- negativeExponential(0:10, 1, 0.3)
# Calculate inverse function
time <- negativeExponential.inverse(growth, 10, 0.3)
```

---

richard *Richard growth model*

Description

Computes the Richard growth model and its inverse

$$y(t) = \frac{\alpha}{(1 + \beta exp(-kt))^{(1/m)}}$$

Usage

```
richard(t, alpha, beta, k, m)

richard.inverse(x, alpha, beta, k, m)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate
m	slope of growth

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- richard(0:10, 10, 0.5, 0.3, 0.5)
time <- richard.inverse(growth, 10, 0.5, 0.3, 0.5)
```

`schnute` *Schnute growth model*

Description

Computes the Schnute growth model

$$y(t) = [r_0 + \beta exp(kt)]^m$$

Usage

```
schnute(t, r0, beta, k, m)

schnute.inverse(x, r0, beta, k, m)
```

Arguments

`t`	time
`x`	size
`r0`	reference value
`beta`	growth displacement
`k`	growth rate
`m`	slope of growth

References

A. Khamiz, Z. Ismail, and A. T. Muhammad, "Nonlinear growth models for modeling oil palm yield growth," Journal of Mathematics and Statistics, vol. 1, no. 3, p. 225, 2005.

Examples

```
growth <- schnute(0:10, 10, 5, .5, .5)
# Calculate inverse function
time <- schnute.inverse(growth, 10, 5, .5, .5)
```

stannard *Stannard growth model*

Description

Computes the Stannard growth model

$$y(t) = \alpha \left[1 + exp(-(\beta + kt)/m)\right]^{-m}$$

Usage

```
stannard(t, alpha, beta, k, m)

stannard.inverse(x, alpha, beta, k, m)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth displacement
k	growth rate
m	slope of growth

References

A. Khamiz, Z. Ismail, and A. T. Muhammad, "Nonlinear growth models for modeling oil palm yield growth," Journal of Mathematics and Statistics, vol. 1, no. 3, p. 225, 2005.

Examples

```
growth <- stannard(0:10, 1, .2, .1, .5)
# Calculate inverse function
time <- stannard.inverse(growth, 1, .2, .1, .5)
```

vonBertalanffy *von Bertalanffy growth model*

Description

Computes the von Bertalanffy growth model

$$y(t) = (\alpha^(1 - m) - \beta * exp(-kt))^(1/(1 - m))$$

Usage

```
vonBertalanffy(t, alpha, beta, k, m)

vonBertalanffy.inverse(x, alpha, beta, k, m)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate
m	slope of growth

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- vonBertalanffy(0:10, 10, 0.5, 0.3, 0.5)
# Calculate inverse function
time <- vonBertalanffy.inverse(growth, 10, 0.5, 0.3, 0.5)
```

---

weibull *Weibull growth model*

Description

Computes the Weibull growth model

$$y(t) = \alpha - \beta exp(-k * t^m)$$

Usage

```
weibull(t, alpha, beta, k, m)

weibull.inverse(x, alpha, beta, k, m)
```

Arguments

t	time
x	size
alpha	upper asymptote
beta	growth range
k	growth rate
m	slope of growth

References

D. Fekedulegn, M. Mac Siurtain, and J. Colbert, "Parameter estimation of nonlinear growth models in forestry," Silva Fennica, vol. 33, no. 4, pp. 327-336, 1999.

Examples

```
growth <- weibull(0:10, 10, 0.5, 0.3, 0.5)
# Calculate inverse function
time <- weibull.inverse(growth, 10, 0.5, 0.3, 0.5)
```

Index