Package: MLpreemption (via r-universe)

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Type Package

Title Maximum Likelihood Estimation of the Niche Preemption Model

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Description Provides functions for obtaining estimates of the parameter of the niche preemption model (also known as the geometric series), in particular a maximum likelihood estimator (Graffelman, 2021) <doi:10.1101/2021.01.27.428381>. The niche preemption model is a widely used model in ecology and biodiversity studies.

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`Fattorini` *Australian bird abudances.*

Description

The data sets consists of the names and abundances of 31 Australian birds.

Usage

```
data("Fattorini")
```

Format

A data frame with 31 observations on the following 2 variables.

`Species` a character vector

`Abundance` a numeric vector

References

Fattorini, S. (2005) A simple method to fit geometric series and broken stick models in community ecology and island biogeography. Acta Oecologica 28: pp. 199-205.

Examples

```
data(Fattorini)
```

`Ganeshaiah` *Indian dung beetles from Ganeshaiah et al. (1997)*

Description

The data sets consists of the names and abundances of 16 dung beetles

Usage

```
data(Ganeshaiah)
```

Format

A data frame with 16 observations on the following 2 variables.

`Species` a character vector

`Abundance` a numeric vector

References

Ganeshaiah, K.N., Chandrashekara, K. and Kuma A.R.V. (1997) Avalanche index: a new measure of biodiversity based on biological heterogeneity of the communities. Current Science 73, pp. 128-133.

Magurran, A.E. (2004) Measuring biological diversity, Blackwell Publishing, Oxford, UK.

Examples

```
data(Ganeshaiah)
```

---

k_hetang *Preemption parameter estimation by He and Tang*

Description

Calculates the He-Tang estimator for the geometric series.

Usage

```
k_hetang(x)
```

Arguments

x	A vector of counts

Value

a real number

Note

Zero counts are discarded prior to calculation of the estimator.

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

He, F. and Tang, D. 2008. Estimating the niche preemption parameter of the geometric series. Acta Oecologica, 33:105–107

See Also

k_ls,k_ml,k_may

Examples

```
data("Ganeshaiah")
x <- Ganeshaiah[,2]
k_hetang(x)
```

---

k_ls *Preemption parameter estimation by least squares regression*

Description

Calculates the least-squares estimator for the geometric series.

Usage

```
k_ls(x)
```

Arguments

x	A vector of ordered counts (from large to small)

Value

khat	estimate of the preemption parameter
k.ll	lower limit of the confidence interval
k.ul	upper limit of the confidence interval
aic	Akaike's information criterion
logl	log-likelihoood

Note

counts should be ordered from large to small.

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Magurran, A. 2004. Measuring biological diversity. Blackwell Publishing, Oxford, UK.

See Also

k_ml,k_hetang,k_may

Examples

```
data("Ganeshaiah")
x <- Ganeshaiah[,2]
k_ls(x)
```

---

k_may *Preemption parameter estimation by the equation of May*

Description

Calculates the estimator of May for the geometric series.

Usage

```
k_may(xs, exclude = TRUE)
```

Arguments

xs	A vector of ordered counts
exclude	Automatically exclude zeros (if exclude=TRUE)

Details

Solves May equation by using uniroot.

Value

a real value

Note

counts should be ordered from large to small.

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

May, R. 1975. Patterns of species abundance and diversity. In Cody, M. and Diamond, M., editors, Ecology and Evolution of Communities, pages 81–120. Harvard Univ. Press.

See Also

k_ls,k_hetang,k_ml

Examples

```
data("Ganeshaiah")
x <- Ganeshaiah[,2]
k_may(x)
```

---

k_ml *Preemption parameter estimation by maximum likelihood.*

Description

Calculates the maximum likelihood estimator for the geometric series.

Usage

```
k_ml(xs, closed = FALSE, ll = 0.001, ul = 0.999)
```

Arguments

xs	A vector of ordered counts (form large to small)
closed	If closed=TRUE a closed form approximation to the ML estimator will be calculated; otherwise the exact ML estimator is calculated iteratively.
ll	Lower limit for the root searching algorithm
ul	Upper limit for the root searching algorithm

Value

a real value

Note

counts should be ordered from large to small.

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Graffelman, J. (2021) Maximum likelihood estimation of the geometric niche preemption model.

See Also

k_ls,k_hetang,k_may

Examples

```
data("Ganeshaiah")
x <- Ganeshaiah[,2]
k_ml(x)
```

Mehrabi *Costa Rica dung beetle counts from Mehrabi et al. (2014)*

Description

The data sets consists of the names and total abundances of 31 dung beetles along 16 transects (A, B, ... P). Transects A, C, ..., O used randomly placed traps (control), whereas transects B, D, ..., P used microhabitat standardized traps (treatment).

Usage

```
data("Mehrabi")
```

Format

A data frame with 31 observations on the following 16 variables.

`A` a numeric vector

`B` a numeric vector

`C` a numeric vector

`D` a numeric vector

`E` a numeric vector

`F` a numeric vector

`G` a numeric vector

`H` a numeric vector

`I` a numeric vector

`J` a numeric vector

`K` a numeric vector

`L` a numeric vector

`M` a numeric vector

`N` a numeric vector

`O` a numeric vector

`P` a numeric vector

References

Mehrabi, Z., Slade, E.M., Solis, A. and Mann, D.J. (2014) The Importance of Microhabitat for Biodiversity Sampling (2014) PLoS ONE 9(12) e114015. doi 10.1371/journal.pone.0114015

Examples

```
data(Mehrabi)
```

`preemption.fit` *Estimation of the preemption parameter of a geometric series by various methods*

Description

Function `preemption.fit` can estimate the preemption parameter of a geometric series by four specifici methods, or list all estimates simultaneously for comparison.

Usage

```
preemption.fit(x, method = "ml", closed = FALSE, verbose = TRUE)
```

Arguments

`x`	Vector of counts (abundances of species)
`method`	Estimation method ("ml" = maximum likelihood, "ls" = least squares, "May" = May's equation, "HT" = He-Tang's equation, "all" = lists all four estimators)
`closed`	If `closed=FALSE` the exact value of the ML estimator will be calculated by iteration, if `closed=TRUE` a good closed-form approximation is given
`verbose`	The function is silent if `verbose=FALSE` or prints results if `verbose=TRUE`

Value

`khat`	the estimate of the preemption parameter
`ll`	lower limit of 95 confidence interval
`ul`	upper limit of 95 confidence interval

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Graffelman, J. (2021) Maximum likelihood estimation of the geometric niche preemption model

See Also

`preemption.t`

Examples

```
data(Ganeshaiah)
preemption.fit(Ganeshaiah[,2])
```

preemption.t *Preemption t test*

Description

Function preemption.t implements a t test for comparing the preemption parameters of the geometric series for two samples.

Usage

```
preemption.t(x1, x2, verbose = TRUE)
```

Arguments

x1	Species counts for the first sample
x2	Species counts for the second sample
verbose	The function is silent if verbose=FALSE or prints results if verbose=TRUE

Value

Tstat	The t statistic
df	The degrees of freedom
pval	The p-value of the test

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Graffelman, J. (2021) Maximum likelihood estimation of the geometric niche preemption model

See Also

preemption.fit

Examples

```
data(Mehrabi)
x <- sort(Mehrabi[,1],decreasing=TRUE)
y <- sort(Mehrabi[,2],decreasing=TRUE)
results <- preemption.t(x,y)
```

raplot *Rank-abundance plot*

Description

Function raplot creates a rank-abundance plot online, and can show decaying lines fitted by various method.

Usage

```
raplot(x, xlab = "Species rank", ylab = "log (Relative abundance)",
     main = "Rank-Abundance plot", reflines = c(1, 2, 3, 4), alpha = 0.05, leg = FALSE)
```

Arguments

x	Vector of counts (species abundances)
xlab	Label for the x axis
ylab	Label for the y axis
main	Title for the plot
reflines	Lines to be drawn in the plot: 1=ML, 2=LS, 3=May, 4=He-Tang
alpha	Signifance level (0.05 by default)
leg	Show legend leg=TRUE or not leg=FALSE

Value

NULL

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Graffelman, J. (2021) Maximum likelihood estimation of the geometric niche preemption model

Examples

```
data(Fattorini)
raplot(Fattorini[,2])
```

raplot.paired *Rank-abundance plot for two samples*

Description

Function raplot.paired creates a rank-abundance plot on screen, and can show decaying lines with uncertainty zones for two samples fitted by maximum likelihood.

Usage

```
raplot.paired(x, y, xlab = "Species rank", ylab = "log (Relative abundance)",
              main = "Rank-abundance", sym = c(1, 2), alpha = 0.05)
```

Arguments

x	Count vector of the first sample
y	Count vector of the second sample
xlab	Label x axis
ylab	Label y axis
main	Main title for the plot
sym	Symbols for first and second sample (c(1,2) by default)
alpha	Significance level (0.05 by default)

Value

NULL

Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

References

Graffelman, J. (2021) Maximum likelihood estimation of the geometric niche preemption model

See Also

raplot

Examples

```
data("Mehrabi")
raplot.paired(Mehrabi[,1],Mehrabi[,2])
```

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