Package 'aLBI'

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Type Package

Title Estimating Length-Based Indicators for Fish Stock

Version 0.1.8

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Description Provides tools for estimating length-based indicators from length frequency data to assess fish stock status and manage fisheries sustainably. Implements methods from Cope and Punt (2009) <doi:10.1577/C08-025.1> for data-limited stock assessment and Froese (2004) <doi:10.1111/j.1467-2979.2004.00144.x> for detecting overfishing using simple indicators. Key functions include:
FrequencyTable(): Calculate the frequency table from the collected and also the extract the length frequency data from the frequency table with the upper length_range. A numeric value specifying the bin width for class intervals. If not provided, the bin width is automatically calculated using Sturges (1926) <doi:10.1080/01621459.1926.10502161> formula.
CalPar(): Calculates various lengths used in fish stock assessment as biological length indicators such as asymptotic length (Linf), maximum length (Lmax), length at sexual maturity (Lm), and optimal length (Lopt).
FishPar(): Calculates length-based indicators (LBIs) proposed by Froese (2004) <doi:10.1111/j.1467-2979.2004.00144.x> such as the percentage of mature fish (Pmat), percentage of optimal length fish (Popt), percentage of mega spawners (Pmega), and the sum of these as Pobj. This function also estimates confidence intervals for different lengths, visualizes length frequency distributions, and provides data frames containing calculated values.
FishSS(): Makes decisions based on input from Cope and Punt (2009) <doi:10.1577/C08-025.1> and parameters calculated by FishPar() (e.g., Pobj, Pmat, Popt, LM_ratio) to determine stock status as target spawning biomass (TSB40) and limit spawning biomass (LSB25).
LWR(): Fits and visualizes length-weight relationships using linear regression, with options for log-transformation and customizable plotting.

Depends R (>= 4.0.0)

Imports dplyr, openxlsx, stats, graphics, grDevices, ggplot2, utils

Suggests testthat, knitr, rmarkdown, devtools, readxl

License GPL-3

Encoding UTF-8

LazyData true

URL https://github.com/Ataher76/aLBI

BugReports https://github.com/Ataher76/aLBI/issues

RoxygenNote 7.3.2

VignetteBuilder knitr

NeedsCompilation no

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Contents

`CPdata` *CPdata: Example dataset for aLBI package*

Description

This dataset contains description of CPdata.

Usage

```
data(CPdata)
```

Format

A data frame with 11 columns:

- `A` Probability values
- `B` Probability values
- `C` Probability values
- `D` Probability values

E Probability values

F Probability values

G Probability values

H Probability values

I Probability values

J Probability values

Tx Target column compared with LM_ratio to pick probability values

Source

A decision table described by Cope and Punt (2009)

Examples

```
data(CPdata, package = "aLBI")
head(CPdata)
```

ExData *ExData: Example raw length dataset for aLBI package*

Description

This dataset contains description of ExData.

Usage

```
data(ExData)
```

Format

A data frame with 1 column:

Length Sampled length data (cm)

Source

Data collected for fish stock assessment studies

Examples

```
data(ExData, package = "aLBI")
head(ExData)
```

FishPar *Calculate Length-Based Indicators with Monte Carlo Simulation*

Description

This function calculates length-based indicators using Monte Carlo simulation for length parameters and non-parametric bootstrap for Froese indicators. Plots are displayed in the plot panel, and PDFs and an Excel file of results are saved to the current working directory.

Usage

```
FishPar(data, resample = 1000, progress = FALSE, Linf = NULL, Linf_sd = 0.5, Lmat = NULL,
  Lmat_sd = 0.5)
```

Arguments

data	A data frame containing two columns: Length and Frequency.
resample	An integer indicating the number of Monte Carlo samples or bootstrap resamples (default: 1000).
progress	A logical value indicating whether to display a progress bar (default: FALSE).
Linf	A numeric value for the asymptotic length (optional). If provided, overrides the default Lmax/0.95 calculation.
Linf_sd	A numeric value for the standard deviation of random variation added to Linf (default: 0.5). Only used if Linf is provided.
Lmat	A numeric value for the length at maturity (optional). If provided, overrides the default Monte Carlo estimation.
Lmat_sd	A numeric value for the standard deviation of random variation added to Lmat (default: 0.5). Only used if Lmat is provided.

Value

A list containing estimated length parameters, Froese indicators, and other metrics.

FishSS *Assess Stock Status Based on Calculated Parameters*

Description

This function assesses the stock status based on parameters calculated by the FishPar function.

Usage

```
FishSS(data, LM_ratio, Pobj, Pmat, Popt)
```

Arguments

data	A data frame containing the necessary columns for stock status calculation.
LM_ratio	A numeric value representing the length at maturity ratio.
Pobj	A numeric value representing the percentage objective.
Pmat	A numeric value representing the percentage of mature fish.
Popt	A numeric value representing the percentage of optimally sized fish.

Value

A numeric vector containing TSB40 and LSB25.

Examples

```
utils::data("CPdata", package = "aLBI")
FishSS(CPdata, 0.75, 100, 30, 25)
```

FrequencyTable *FrequencyTable Generate a Frequency Distribution Table for Fish Length Data*

Description

Creates a frequency distribution table for fish length data using either a custom bin width or Wang's formula for automatic bin width calculation. The bin width is rounded to the nearest integer if calculated. The results are saved to an Excel file and returned as a list of data frames.

Usage

```
FrequencyTable(
  data,
  bin_width = NULL,
  Lmax = NULL,
  output_file = "FrequencyTable_Output.xlsx"
)
```

Arguments

data	A numeric vector or data frame containing fish length measurements. If a data frame is provided, the first numeric column is used.
bin_width	Numeric value specifying the bin width for class intervals. If NULL (default), bin width is calculated using Wang's formula.
Lmax	Numeric value for the maximum observed fish length. Required only if 'bin_width' is NULL and Wang's formula is used. Defaults to NULL.
output_file	Character string specifying the output Excel file name. Defaults to "FrequencyTable_Output.xlsx".

Value

A list containing two data frames:

lfqTable Frequency table with length ranges and their frequencies.

lfreq Table with upper limits of bins and their frequencies.

Examples

```
# Load required package
library(dplyr)

# Generate random fish length data
set.seed(123)
fish_lengths <- runif(200, min = 5, max = 70)

# Create frequency table with automatic bin width
FrequencyTable(data = fish_lengths, output_file = tempfile(fileext = ".xlsx"))

# Create frequency table with custom bin width and output file
FrequencyTable(data = fish_lengths, bin_width = 5, output_file = tempfile(fileext = ".xlsx"))
```

`lenfreq01` *lenfreq01: Example dataset for aLBI package*

Description

This dataset contains description of lenfreq01.

Usage

```
data(lenfreq01)
```

Format

A data frame with 2 columns:

`Frequency` Observed individuals in each length class

`Length` Upper value of each length class (cm)

Source

Data collected for fish stock assessment studies

Examples

```
data(lenfreq01, package = "aLBI")
head(lenfreq01)
```

lenfreq02 *lenfreq02: Example dataset for aLBI package*

Description

This dataset contains description of lenfreq02.

Usage

```
data(lenfreq02)
```

Format

A data frame with 2 columns:

`Frequency` Observed individuals in each length class

`LengthClass` Upper value of each length class (cm)

Source

Data collected for fish stock assessment studies

Examples

```
data(lenfreq02, package = "aLBI")
head(lenfreq02)
```

LWdata *LWdata: Example length-weight dataset for aLBI package*

Description

This dataset contains length and weight measurements for fish.

Usage

```
data(LWdata)
```

Format

A data frame with 2 columns:

`Length` Length of sampled fish (cm)

`Weight` Weight of sampled fish (g)

Source

Data collected for fish stock assessment studies

Examples

```
data(LWdata, package = "aLBI")
head(LWdata)
```

LWR *Plot and Model Length-Weight Relationships with Optional Log Transformation*

Description

This function visualizes and models the relationship between length and weight (or any two continuous variables) using linear regression. It supports both standard and log-transformed models, producing a ggplot2-based plot with a fitted line, optional confidence interval shading, and annotations for the regression equation, R^2, and p-value. When save_output is TRUE, the plot and model summary are saved to the working directory as a PDF and text file, respectively.

Usage

```
LWR(
  data,
  log_transform = TRUE,
  point_col = "black",
  line_col = "red",
  shade_col = "red",
  point_size = 2,
  line_size = 1,
  alpha = 0.2,
  main = "Length-Weight Relationship",
  xlab = NULL,
  ylab = NULL,
  save_output = TRUE
)
```

Arguments

`data`	A data frame with at least two columns: the first for length, the second for weight.
`log_transform`	Logical. Whether to apply a log-log transformation to the variables. Default is `TRUE`.
`point_col`	Color of the data points. Default is `"black"`.
`line_col`	Color of the regression line. Default is `"red"`.
`shade_col`	Color for the confidence interval ribbon. Default is `"red"`.

point_size	Size of the data points. Default is 2.
line_size	Size of the regression line. Default is 1.
alpha	Transparency for the confidence interval ribbon. Default is 0.2.
main	Title of the plot. Default is "Length-Weight Relationship".
xlab	Optional. Custom x-axis label. If NULL, a label is generated based on log_transform.
ylab	Optional. Custom y-axis label. If NULL, a label is generated based on log_transform.
save_output	Logical. Whether to save the plot as a PDF and the model summary as a text file. Default is TRUE.

Value

A list containing:

model	The fitted lm object
intercept	The estimated intercept (back-transformed if log_transform = TRUE)
slope	The estimated slope
r_squared	R-squared value
correlation_r	Correlation coefficient (r)
p_value	P-value for slope
plot	The ggplot object for further customization

Examples

```
data(LWdata, package = "aLBI")
result <- LWR(LWdata, log_transform = TRUE, save_output = FALSE)
print(result$plot)
```

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