Package 'RAIeR'

October 29, 2024

Title Relative abundance index and encounter rate estimation camera traps

Version 0.0.0.9000

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Description The main objective of this package is to calculate the relative abundance index (RAI) and the encounter rate (eR) with data obtained from camera traps.

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Encoding UTF-8

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Depends R (>= 2.10)

LazyData true

URL https://github.com/SMandujanoR/RAIeR

BugReports https://github.com/SMandujanoR/RAIeR/issues

Suggests knitr, rmarkdown

VignetteBuilder knitr

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Contents

`CTs_habitat` *Example of data of coordinates and covariates of each camera trap.*

Description

Example of data of coordinates and covariates of each camera trap.

Usage

```
CTs_habitat
```

Format

`CTs_habitat` Data frame with 24 rows and 5 variables:

Camera name camera trap

X X coordinate

Y Y coordinate

Location Study area

Veg_type Covariate, vegetation types

CTs_habitat2 — *Example of second data of coordinates and covariates of each camera trap.*

Description

Example of second data of coordinates and covariates of each camera trap.

Usage

```
CTs_habitat2
```

Format

`CTs_habitat2` Data frame with 5 rows and 6 variables:

Camera name camera trap

X X coordinate

Y Y coordinate

Var1 Covariable 1

Var2 Covariable 2

Veg_type Covariate, vegetation types

CTs_Operativity — *Example of data of camera traps (CTs) operativity*

Description

These data.frame was previously processed with the `camtrapR` to obtain a `.csv` file.

Usage

```
CTs_Operativity
```

Format

`CTs_Operativity`

X X-axes coordinates

Y Y-axes coordinates

Station name camera trap

Fecha_colocacion The first day the camera trap was installed

Fecha_retiro The last day that the camera trap was removed

Problem1_from First day that the camera trap stopped working due to some problem

Problem1_to Last day the camera trap stopped working due to some problem

CTs_Spp — *Example of data of mammal species in camera traps.*

Description

A data set of mammal species photographed on camera traps in a locality of the Biosphere Reserve in Mexico.

Usage

```
CTs_Spp
```

Format

`CTs_Spp` Data frame with 90 rows and 6 variables:

Station name camera trap

Species Species photographed

DateTimeOriginal Date and time format

Date Date of photo

Time Time of photo

HierarchicalSubject Species and, in some cases, information of category of the animal in the photo as sex, age, identified individual, and other

Details

These data.frame was previously processed with the `camtrapR` to obtain a `.csv` file. Unnecessary columns were deleted.

CTs_Spp2 — *Second example of data of mammal species in camera traps.*

Description

A data set of mammal species photographed on camera traps in a locality of the Biosphere Reserve in Mexico.

Usage

```
CTs_Spp2
```

Format

CTs_Spp2 Data frame with 32 rows and 7 variables:

Camera Name camera trap

Species Species photographed

Events Number of independet photos

Effort Number of sampling effort

Location Study area

Year Sampling year

Season Sampling season

---

dataFormat *Format the previous file data/Location_lys.csv*

Description

Function to format the previous file data/Location_lys.csv as required in this package

Usage

```
dataFormat(Location, data_Spp, data_CT, Problem)
```

Arguments

Location	Select study or sampling location
data_Spp	Data of species
data_CT	Data of camera traps
Problem	Logical. If DataOriginal...

Value

Save a reformated data.frame grouping all data

Author(s)

"Eva López-Tello and SMandujanoR"

Examples

```
## Not run:
data_Spp <- read.csv("data/CB_Lys.csv", header = T)
data_Spp <- data_Spp[, -1]

CTs <- read.csv("data/CT_Operativity.csv", header = T)

dataFormat(Location = "CB", data_Spp = data_Spp, data_CT = CTs, Problem = T)

## End(Not run)
```

dataFormatDF *Format each data.frame of location, year and season*

Description

Function specific to format each data.frame of location, year and season.

Usage

```
dataFormatDF(dframe, data_CT, Problem)
```

Arguments

dframe	Data of species
data_CT	Data of camera traps
Problem	Logical. Define possible problem in DataOriginal

Value

Save a formated data.frame

Author(s)

"SMandujanoR"

Examples

```
## Not run:
dataFormatDF(dframe = "data/df/Cb_2012_1.csv", data_CT = CTs, Problem = T)
dataFormatDF(dframe = "data/df/Cb_2012_2.csv", data_CT = CTs, Problem = T)
dataFormatDF(dframe = "data/df/Cb_2013_1.csv", data_CT = CTs, Problem = T)
dataFormatDF(dframe = "data/df/Cb_2013_2.csv", data_CT = CTs, Problem = T)

## End(Not run)
```

date_LYS *Format date as "Ymd HM" to "mdY HM"*

Description

Function to 1) format date as "Ymd HM" to "mdY HM", 2) create new columns (Location, Year, Season), and 3) save subsets of data.frames

Usage

```
date_LYS(
  df_Spp,
  Location,
  mdY,
  Jan,
  Feb,
  Mar,
  Apr,
  May,
  Jun,
  Jul,
  Aug,
  Sep,
  Oct,
  Nov,
  Dec,
  Y.init,
  Y.end,
  S.init,
  S.end
)
```

Arguments

df_Spp	Data of species
Location	Select location
mdY	Logical. Define TRUE/FALSE if the DateTimeOriginal column in the data.frame actually is mdY or not
Jan	Factor. Define the season (1,2,3...) of this mounth
Feb	Factor. Define the season (1,2,3...) of this mounth
Mar	Factor. Define the season (1,2,3...) of this mounth
Apr	Factor. Define the season (1,2,3...) of this mounth
May	Factor. Define the season (1,2,3...) of this mounth
Jun	Factor. Define the season (1,2,3...) of this mounth
Jul	Factor. Define the season (1,2,3...) of this mounth
Aug	Factor. Define the season (1,2,3...) of this mounth
Sep	Factor. Define the season (1,2,3...) of this mounth
Oct	Factor. Define the season (1,2,3...) of this mounth
Nov	Factor. Define the season (1,2,3...) of this mounth
Dec	Factor. Define the season (1,2,3...) of this mounth
Y.init	First year
Y.end	Laste year
S.init	First season
S.end	Laste season

Value

This create new columns LYS, the subcarpet df and a new data.frame

Author(s)

"SMandujanoR and C. García-Vital"

Examples

```
## Not run:
data_Spp <- read.csv("data/CT_Spp.csv", header = T) # Read the original data
data_Spp <- data_Spp[,-1] # If necesesary delete this column
Example 1:
dateSubsets_LYS(df_Spp = data_Spp,
       Location = "CB",
       mdY = T,
       Jan="1",
       Feb="1",
       Mar="1",
       Apr="1",
       May="1",
       Jun="2",
       Jul="2",
       Aug="2",
       Sep="2",
       Oct="2",
       Nov="2",
       Dec="1",
       Y.init = 2012,
       Y.end = 2013,
       S.init = 1,
       S.end = 2)
Example 2: is not necesary modify mdY
dateSubsets_LYS(df_Spp = table2, Location = "CBlanca", mdY = F,
Jan="1", Feb="1", ...
Y.init = 2012, Y.end = 2013,
S.init = 1, S.end = 2)

## End(Not run)
```

---

eR_CTs *Estimate eRs per camera and species*

Description

Function to estimate eRs per camera and species, and create plots

Usage

```
eR_CTs(new.mat, Ymax, SaveFolder)
```

Arguments

new.mat	Data of species
Ymax	Define maxime value of Y-axis
SaveFolder	Directory to save plot

Value

Table with eRs for species in each camera, and plots

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_CTs(datos, Ymax = 15, SaveFolder = "Results")

## End(Not run)
```

---

eR_facet *Facet graph eR by species by years and sesons*

Description

Function to facet graph eR by species by years and sesons

Usage

```
eR_facet(df, bubSize, fontSize, SaveFolder)
```

Arguments

df	Data of species
bubSize	Size of the circles
fontSize	Size of the fonts
SaveFolder	Directory to save plot

Value

Facet graph eR by species by years and sesons

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_facet(df = datos, bubSize = 7, fontSize = 6, SaveFolder = "Results")

## End(Not run)
```

---

eR_Gen *Estimate of encounter rate (eR), naive occupation, and events percent for each species*

Description

Function to estimate of encounter rate (eR), naive occupation, and events percent for each species, and create plots

Usage

```
eR_Gen(new.mat, SaveFolder)
```

Arguments

new.mat	Data of species
SaveFolder	Directory to save plot

Value

Table with estimates of encounter rate (eR), naive occupation, and events percent for each species, and plot

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_Gen(new.mat = datos, SaveFolder = "Results")

## End(Not run)
```

eR_glm *Estimate eR according with a GLM*

Description

Function to estimate eR according with a GLM

Usage

```
eR_glm(new.mat, family, SaveFolder)
```

Arguments

new.mat	Data of species
family	Define "poisson", "quasipoisson"
SaveFolder	Directory to save plot

Value

Table with eR estimation follwing Poisson GLM

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_glm(datos, family = "poisson", SaveFolder = "Results")

## End(Not run)
```

eR_LYS *Plot eR for species in different locations and years*

Description

Function to graph the eR for species in different locations and years

Usage

```
eR_LYS(df, Factor, Name, bubSize, fontSize, SaveFolder)
```

Arguments

df	Data of species
Factor	Factor. Select Location, Year or Season
Name	Name of Location, Year or Season
bubSize	Size of the circles
fontSize	Size of the fonts
SaveFolder	Directory to save plot

Value

Graphs of eR for species in different locations and years

Author(s)

"A. Zavaleta & SMandujanoR"

Examples

```
## Not run:
eR_LYS(
  df = datos,
  Factor = datos$Location,
  Name = "Location",
  bubSize = 15,
  fontSize = 12,
  SaveFolder = "Results"
)

eR_LYS(
  df = datos,
  Factor = datos$Year,
  Name = "Year",
  bubSize = 15,
  fontSize = 12,
  SaveFolder = "Results"
)

eR_LYS(
  df = datos,
  Factor = datos$Season,
  Name = "Season",
  bubSize = 15,
  fontSize = 12,
  SaveFolder = "Results"
)

## End(Not run)
```

---

eR_matx *Create tables of Species-eR, and Species-Events*

Description

Function to create tables of Species-eR, and Species-Events

Usage

```
eR_matx(SaveFolder)
```

Arguments

SaveFolder	Directory to save plot

Value

Tables of Species-eR, and Species-Events

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_matx(SaveFolder = "Results")

## End(Not run)
```

`eR_resTab` *Create a final table*

Description

Function to create a final table

Usage

```
eR_resTab(new.mat, SaveFolder)
```

Arguments

`new.mat`	Data of species
`SaveFolder`	Directory to save plot

Value

Create Table of results

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_resTab(datos, SaveFolder = "Results")

## End(Not run)
```

eR_test *Statistical test*

Description

Function to test statistical diferences through parametric ANOVA, and posteriori HSD and Tukey tests

Usage

```
eR_test(Ymax, SaveFolder)
```

Arguments

Ymax	Define maxime value of Y-axis
SaveFolder	Directory to save plot

Value

Anova test and plots of posteriori test

Author(s)

"SMandujanoR"

Examples

```
## Not run:
eR_test(Ymax = 15, SaveFolder = "Results")

## End(Not run)
```

MapCatgRAI *Create a map of the RAI selected category*

Description

To create a map of the RAI selected category as sex, age, other

Usage

```
MapCatgRAI(Catg, map, pointSize, colors, SaveFolder)
```

Arguments

Catg	Factor. Define the category to map RAI
map	shapefile of the study area
pointSize	Define the size of the circles
colors	Name of your own palete colors
SaveFolder	Directory to save results

Value

Map plot of RAI of selected category as sex, age, other

Author(s)

"SMandujanoR"

Examples

```
## Not run:
MapSexRAI(
  Sex = "Female",
  map = mapProje,
  pointSize = 0.05,
  colors = my_colors,
  SaveFolder = "Cb"
)

## End(Not run)
```

MapCT *Map the camera traps*

Description

Function to map the camera traps in the study area

Usage

```
MapCT(map, CTs, mapColor, pointColor, SaveFolder)
```

Arguments

map	Shapefile of the study area
CTs	Coordinates XY of camera traps
mapColor	Select 1 or -1 to define viridis color
pointColor	Define color to camera trap point
SaveFolder	Directory to save plot

Value

plot of camera traps in the study area

Author(s)

"SMandujanoR"

Examples

```
## Not run:
MapCT(map = mapProje,
     CTs = habitat.data,
     mapColor = 1,
     pointColor = "black",
     SaveFolder = "Results")

## End(Not run)
```

`MapEsriCTs` *Map Esri of the camera traps*

Description

Function to map of the camera traps in Esri

Usage

```
MapEsriCTs(CTs, Proje, reProje)
```

Arguments

`CTs`	Coordinates XY of camera traps
`Proje`	Projection 1 crs
`reProje`	Projection 2 sp::CRS

Value

map of the camera traps in Esri map projection in the RStudio Viewer

Author(s)

"G. Andrade-Ponce & SMandujanoR"

Examples

```
## Not run:
MapEsriCTs(CTs = habitat.data, Proje = proje2, reProje = "+proj=longlat +datum=WGS84")

## End(Not run)
```

MapEsriRAI *RAI Esri map*

Description

To project RAI of the selected species on Esri.WorldImagery

Usage

```
MapEsriRAI(Location, species, Proje, reProje, pointsize, SaveFolder)
```

Arguments

Location	Name location or study area
species	Select the species
Proje	Projection 1 crs
reProje	Projection 2 sp::CRS
pointsize	Define the size of the circles
SaveFolder	Directory to save plot

Value

Esri map of RAI for selected species

Author(s)

"SMandujanoR"

Examples

```
## Not run:
MapEsriRAI(
  Location = "Cb",
  species = "Pec_taj",
  Proje = proje2,
  reProje = "+proj=longlat +datum=WGS84",
  pointsize = 2,
  SaveFolder = "Venado"
)

## End(Not run)
```

MapEventsSpp *Plot XY of events*

Description

Function to plot XY of events in camera traps for the selected species

Usage

```
MapEventsSpp(new.mat, especie, parRow, parCol, pointSize, labels, SaveFolder)
```

Arguments

new.mat	Data of species
especie	Select the species to plot
parRow	Number of rows
parCol	Number of columnns
pointSize	Size of the circles
labels	Axes legends
SaveFolder	Directory to save plot

Value

Plot XY of events in camera traps for the selected species

Author(s)

"SMandujanoR"

Examples

```
## Not run:
MapEventsSpp(
  df = datos,
  Species = c("Syl_flo", "Odo_vir", "Can_lat", "Uro_cin"),
  parRow = 2,
  parCol = 2,
  pointSize = 0.5,
  labels = T,
  SaveFolder = "Results"
)

## End(Not run)
```

MapKernelSp *Create kernel utilization distribution*

Description

To create kernel utilization distribution for selected species by season and total (year+season)

Usage

```
MapKernelSp(
  Location,
  species,
  Season,
  map,
  Proje,
  my_colors,
  S.extent,
  UD95,
  UD50,
  pointSize,
  SaveFolder
)
```

Arguments

Location	Name location or study area
species	Select the species
Season	Define the season
map	shapefile of the study area
Proje	Define the projection
my_colors	Name of your own palete colors
S.extent	Extent
UD95	Utilization distribution ("Home range")
UD50	Utilization distribution ("Core area")
pointSize	Define the size of the circles
SaveFolder	Directory to save results

Value

Estimation, maps and raster of UDs

Author(s)

"SMandujanoR"

Examples

```
## Not run:
Season 1:
MapKernelSp(Location =  "Cb",
            species = "Odo_vir",
            Season = 1,
            map = mapProje,
            Proje = proje1,
            my_colors = my_colors,
            S.extent = 1,
            UD95 = 95,
            UD50 = 50,
            pointSize = 0.3,
            SaveFolder = "Venado")

MapKernelSp(Location =  "Cb",
            species = "Odo_vir",
            Season = 2,
            map = mapProje,
            Proje = proje1,
            my_colors = my_colors,
            S.extent = 1,
            UD95 = 95,
            UD50 = 50,
            pointSize = 0.3,
            SaveFolder = "Venado")

## End(Not run)
```

`MapRAI` *map of the RAI in CTs*

Description

Function to create a map of the RAI values in each camera trap for the selected species

Usage

```
MapRAI(Location, species, map, mapColor, pointColor, SaveFolder)
```

Arguments

`Location`	Name location or study area
`species`	Select the species
`map`	shapefile of the study area
`mapColor`	Select 1 or -1 to define viridis color
`pointColor`	Define color to camera trap point
`SaveFolder`	Directory to save results

Value

Map with RAI per camera trap

Author(s)

"SMandujanoR"

Examples

```
## Not run:
MapRAI(
  Location = "Cb",
  species = "Odo_vir",
  map = mapProje,
  mapColor = 1,
  pointColor = "black",
  SaveFolder = "Venado")

## End(Not run)
```

Map_extract *Extract information of raster layer for each camera trap*

Description

Function to extract information of each camera traps of the raster layer of the study area

Usage

```
Map_extract(map, CTs, SaveFolder)
```

Arguments

map	Shapefile of the study area
CTs	Coordinates XY of camera traps
SaveFolder	Directory to save data

Value

a data.frame with new column named Habt_types

Author(s)

"SMandujanoR"

Examples

```
## Not run:
Map_extract(map = mapProje,
            CTs = habitat.data,
            SaveFolder = "data")

## End(Not run)
```

RAI_CTs *RAI for camera trap*

Description

Function to calculate the RAI in each camera trap

Usage

```
RAI_CTs(species, df, SaveFolder)
```

Arguments

species	Select the species
df	Data.frame with data of animals and camera traps
SaveFolder	Directory to save results

Value

RAI for each camera trap

Author(s)

"SMandujanoR"

Examples

```
## Not run:
RAI_CTs(species = "Pec_taj", df = datos, SaveFolder = "Pecari")

## End(Not run)
```

RAI_facet *Facet graph for RAI comparison*

Description

To comparison RAI by habitat type during each year and season, in a selected location

Usage

```
RAI_facet(Location, species, RAIsize, map, mapColor, pointColor, SaveFolder)
```

Arguments

Location	Name location or study area
species	Select the species
RAIsize	Define the point size
map	shapefile of the study area
mapColor	Select 1 or -1 to define viridis color
pointColor	Define color to camera trap point
SaveFolder	Directory to save results

Value

Facet plots

Author(s)

"SMandujanoR"

Examples

```
## Not run:
RAI_facet(
  Location = "Cb",
  species = "Odo_vir",
  RAIsize = 40,
  map = mapProje,
  mapColor = 1,
  pointColor = "black",
  SaveFolder = "Venado"
)

## End(Not run)
```

RAI_Habitat *Graphs of RAI by habitat types*

Description

To comparison RAI by habitat types during each year and season, in a selected location

Usage

```
RAI_Habitat(Location, species, fontSize, SaveFolder)
```

Arguments

Location	Name location or study area
species	Select the species
fontSize	Size of habitat types names in X-axes
SaveFolder	Directory to save results

Value

Linear model and facet plot

Author(s)

"SMandujanoR"

Examples

```
## Not run:
RAI_Habitat(
  Location = "Cb",
  species = "Odo_vir",
  fontSize = 8,
  SaveFolder = "Venado")

## End(Not run)
```

RAI_Loc *Graphs of RAI for Year and Season*

Description

To calculate the RAI of the selected species by year, season and season/year, for each studied location

Usage

```
RAI_Loc(Location, species, Ymax, SaveFolder)
```

Arguments

Location	Name location or study area
species	Select the species
Ymax	Define maxime Y-axes value
SaveFolder	Directory to save results

Value

graphs RAI per Year, Season and Year*Season

Author(s)

"SMandujanoR"

Examples

```
## Not run:
RAI_Loc(
  Location = "Cb",
  species = "Odo_vir",
  Ymax = 8,
  SaveFolder = "Venado"
)

## End(Not run)
```

RAI_LYS *Graph of RAI per location*

Description

To comparison RAI between locations, years and seasons

Usage

```
RAI_LYS(species, SaveFolder)
```

Arguments

species	Select the species
SaveFolder	Directory to save results

Value

Graph RAI by location, year and season

Author(s)

"SMandujanoR"

Examples

```
## Not run:
RAI_LYS(species = "Odo_vir",
     SaveFolder = "Venado")

## End(Not run)
```

SamplDesg *CTs field sampling designs*

Description

Function to create a camera grid for field sampling designs

Usage

```
SamplDesg(map, Proje, n1, n2, CTx, CTy, CTdist, legend, colors, SaveFolder)
```

Arguments

map	Shapefile of the study area
Proje	Projection 1 crs
n1	Number of camera traps in rows
n2	Number of camera traps in columns
CTx	Initial X-UTM
CTy	Initial Y-UTM
CTdist	Distance (meters) between cameras
legend	Position of legend
colors	Define the color palette
SaveFolder	Directory to save plot

Value

Map plot and XY coordinates of each camera trap in the grid

Author(s)

"SMandujanoR"

Examples

```
## Not run:
SamplDesg(
  map = mapProje,
  Proje = proje1,
  n1 = 5,
  n2 = 6,
  CTx = 691000,
  CTy = 2007500,
  CTdist = 1000,
  legend = "bottom",
  colors = my_colors,
  SaveFolder = "Results"
)

## End(Not run)
```

Index