Package 'CCAMLRGIS'

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Type Package

Title Antarctic Spatial Data Manipulation

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Description Loads and creates spatial data, including layers and tools that are relevant to the activities of the Commission for the Conservation of Antarctic Marine Living Resources. Provides two categories of functions: load functions and create functions. Load functions are used to import existing spatial layers from the online CCAMLR GIS such as the ASD boundaries. Create functions are used to create layers from user data such as polygons and grids.

Depends R (>= 4.0), sp, sf

License GPL-3

URL https://github.com/ccamlr/CCAMLRGIS#readme

Encoding UTF-8

LazyData true

Imports dplyr, geosphere, terra, graphics, raster, grDevices, magrittr, stars

RoxygenNote 7.2.1

Suggests knitr, rmarkdown, testthat

VignetteBuilder knitr

NeedsCompilation no

Author Stephane Thanassekos [aut, cre], Keith Reid [aut], Lucy Robinson [aut], Michael D. Sumner [ctb], Roger Bivand [ctb]

Maintainer Stephane Thanassekos <stephane.thanassekos@ccamlr.org>

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R topics documented:

add_col *Add colors*

Description

Given an input variable, generates either a continuous color gradient or color classes. To be used in conjunction with add_Cscale.

Usage

```
add_col(var, cuts = 100, cols = c("green", "yellow", "red"))
```

Arguments

var	numeric vector of the variable to be colorized. Either all values (in which case all values will be assigned to a color) or only two values (in which case these are considered to be the range of values).
cuts	numeric, controls color classes. Either one value (in which case n=cuts equally spaced color classes are generated) or a vector (in which case irregular color classes are generated e.g.: c(-10,0,100,2000)).
cols	character vector of colors (see R standard color names here). cols are interpolated along cuts. Color codes as those generated, for example, by rgb may also be used.

Value

list containing the colors for the variable var (given as $varcol in the output) as well as the single cols and cuts, to be used as inputs in add_Cscale.

See Also

add_Cscale, create_PolyGrids, R colors.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#52-adding-colors-to-data

MyPoints=create_Points(PointData)
MyCols=add_col(MyPoints$Nfishes)
plot(st_geometry(MyPoints),pch=21,bg=MyCols$varcol,cex=2)
```

add_Cscale *Add a color scale*

Description

Adds a color scale to plots. Default behavior set for bathymetry. May also be used to place a legend.

Usage

```
add_Cscale(
  pos = "1/1",
  title = "Depth (m)",
  width = 18,
  height = 70,
  cuts = Depth_cuts,
  cols = Depth_cols,
  minVal = NA,
  maxVal = NA,
  fontsize = 1,
  offset = 100,
  lwd = 1,
  mode = "Cscale"
)
```

Arguments

pos	character, fraction indicating the vertical position of the color scale (which, by default, is on the right side of plots). if pos="1/1", the color scale will be centered. if pos="1/2", the color scale will be centered on the top half of the plotting region. if pos="2/2", the color scale will be centered on the bottom half of the plotting region.
title	character, title of the color scale.
width	numeric, width of the color scale box, expressed in % of the width of the plotting region.
height	numeric, height of the color scale box, expressed in % of the height of the plotting region.
cuts	numeric, vector of color classes. May be generated via add_col.
cols	character, vector of color names. May be generated via add_col.
minVal	numeric, if desired, the color scale may be generated starting from the value minVal. See examples.
maxVal	numeric, if desired, the color scale may be generated up to the value maxVal. See examples.
fontsize	numeric, size of the text in the color scale.

offset	numeric, controls the horizontal position of the color scale.
lwd	numeric, thickness of lines.
mode	character, if 'Cscale', the default, the function builds a color scale. if 'Legend', the function gives you the location of a legend, arguments pos, offset and height may be used for adjustments. See examples.

See Also

load_Bathy, SmallBathy, Depth_cuts, Depth_cols, Depth_cuts2, Depth_cols2, add_col, R colors, legend.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#5-adding-colors-legends-and-labels


#Example 1: Adding two color scales

plot(SmallBathy,breaks=Depth_cuts,col=Depth_cols,legend=FALSE,axes=FALSE,box=FALSE)
add_Cscale(pos='1/2',height=45,maxVal=0,minVal=-4000,fontsize=0.8)
#Some gridded data
MyGrid=create_PolyGrids(GridData,dlon=2,dlat=1)
Gridcol=add_col(MyGrid$Catch_sum,cuts=10)
plot(st_geometry(MyGrid),col=Gridcol$varcol,add=TRUE)
#Add color scale using cuts and cols generated by add_col, note the use of 'round'
add_Cscale(pos='2/2',height=45,title='Catch (t)',
           cuts=round(Gridcol$cuts,1),cols=Gridcol$cols,fontsize=0.8)

#Example 2: Adding a color scale and a legend

#Create some point data
MyPoints=create_Points(PointData)

#Crop the bathymetry to match the extent of MyPoints
library(terra)
BathyCr=crop(rast(SmallBathy),extend(ext(MyPoints),100000))
plot(BathyCr,breaks=Depth_cuts,col=Depth_cols,legend=FALSE,axes=FALSE,mar=c(0,0,0,7))
add_Cscale(pos='1/2',height=45,maxVal=0,minVal=-4000,fontsize=0.8)

#Plot points with different symbols and colors (see ?points)
Psymbols=c(21,22,23,24)
Pcolors=c('red','green','blue','yellow')
plot(st_geometry(MyPoints[MyPoints$name=='one',]),pch=Psymbols[1],bg=Pcolors[1],add=TRUE)
plot(st_geometry(MyPoints[MyPoints$name=='two',]),pch=Psymbols[2],bg=Pcolors[2],add=TRUE)
plot(st_geometry(MyPoints[MyPoints$name=='three',]),pch=Psymbols[3],bg=Pcolors[3],add=TRUE)
plot(st_geometry(MyPoints[MyPoints$name=='four',]),pch=Psymbols[4],bg=Pcolors[4],add=TRUE)

#Add legend with position determined by add_Cscale
Loc=add_Cscale(pos='2/2',height=45,mode='Legend')
legend(Loc,legend=c('one','two','three','four'),title='Vessel',pch=Psymbols,
```

```
pt.bg=Pcolors,xpd=TRUE)
```

---

add_labels *Add labels*

Description

Adds labels to plots. Three modes are available: In `'auto'` mode, labels are placed at the centres of polygon parts of spatial objects loaded via the `load_` functions. Internally used in conjunction with `Labels`. In `'manual'` mode, users may click on their plot to position labels. An editable label table is generated to allow fine-tuning of labels appearance, and may be saved for external use. To edit the label table, double-click inside one of its cells, edit the value, then close the table. In `'input'` mode, a label table that was generated in `'manual'` mode is re-used.

Usage

```
add_labels(
  mode = NULL,
  layer = NULL,
  fontsize = 1,
  fonttype = 1,
  angle = 0,
  col = "black",
  LabelTable = NULL
)
```

Arguments

`mode`	character, either `'auto'`, `'manual'` or `'input'`. See Description above.
`layer`	character, in `'auto'` mode, single or vector of characters, may only be one, some or all of: `c("ASDs","SSRUs","RBs","SSMUs","MAs","MPAs","EEZs")`.
`fontsize`	numeric, in `'auto'` mode, size of the text.
`fonttype`	numeric, in `'auto'` mode, type of the text (1 to 4), where 1 corresponds to plain text, 2 to bold face, 3 to italic and 4 to bold italic.
`angle`	numeric, in `'auto'` mode, rotation of the text in degrees.
`col`	character, in `'auto'` mode, color of the text.
`LabelTable`	in `'input'` mode, name of the label table that was generated in `'manual'` mode.

Value

Adds labels to plot. To save a label table generated in `'manual'` mode, use: `MyLabelTable=add_labels(mode='auto')`. To re-use that label table, use: `add_labels(mode='input',LabelTable=MyLabelTable)`.

See Also

Labels, load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_EEZs, load_MPAs, R colors.

Examples

```
#Example 1: 'auto' mode
#label ASDs in bold and red
ASDs=load_ASDs()
plot(st_geometry(ASDs))
add_labels(mode='auto',layer='ASDs',fontsize=1,fonttype=2,col='red')
#add EEZs and their labels in large, green and vertical text
EEZs=load_EEZs()
plot(st_geometry(EEZs),add=TRUE,border='green')
add_labels(mode='auto',layer='EEZs',fontsize=2,col='green',angle=90)


#Example 2: 'manual' mode (you will have to do it yourself)
#Examples 2 and 3 below are commented (remove the # to test)
#plot(SmallBathy)
#ASDs=load_ASDs()
#plot(st_geometry(ASDs),add=TRUE)
#MyLabels=add_labels(mode='manual')


#Example 3: Re-use the label table generated in Example 2
#plot(SmallBathy)
#plot(st_geometry(ASDs),add=TRUE)
#add_labels(mode='input',LabelTable=MyLabels)
```

---

add_PieLegend *Add a legend to Pies*

Description

Adds a legend to pies created using create_Pies.

Usage

```
add_PieLegend(
  Pies = NULL,
  PosX = 0,
```

```
  PosY = 0,
  Size = 25,
  lwd = 1,
  Boxexp = c(0.2, 0.2, 0.12, 0.3),
  Boxbd = "white",
  Boxlwd = 1,
  Labexp = 0.3,
  fontsize = 1,
  LegSp = 0.5,
  Horiz = TRUE,
  PieTitle = "Pie chart",
  SizeTitle = "Size chart",
  PieTitleVadj = 0.5,
  SizeTitleVadj = 0.3,
  nSizes = 3,
  SizeClasses = NULL
)
```

Arguments

`Pies`	Spatial object created using create_Pies.
`PosX`	numeric, horizontal adjustment of legend.
`PosY`	numeric, vertical adjustment of legend.
`Size`	numeric, controls the size of pies.
`lwd`	numeric, line thickness of pies.
`Boxexp`	numeric, vector of length 4 controls the expansion of the legend box, given as `c(xmin,xmax,ymin,ymax)`.
`Boxbd`	character, color of the background of the legend box.
`Boxlwd`	numeric, line thickness of the legend box.
`Labexp`	numeric, controls the distance of the pie labels to the center of the pie.
`fontsize`	numeric, size of the legend font.
`LegSp`	numeric, spacing between the pie and the size chart (only used if `SizeVar` was specified in create_Pies).
`Horiz`	logical. Set to FALSE for vertical layout (only used if `SizeVar` was specified in create_Pies).
`PieTitle`	character, title of the pie chart.
`SizeTitle`	character, title of the size chart (only used if `SizeVar` was specified in create_Pies).
`PieTitleVadj`	numeric, vertical adjustment of the title of the pie chart.
`SizeTitleVadj`	numeric, vertical adjustment of the title of the size chart (only used if `SizeVar` was specified in create_Pies).
`nSizes`	integer, number of size classes to display in the size chart. Minimum and maximum sizes are displayed by default. (only used if `SizeVar` was specified in create_Pies).
`SizeClasses`	numeric, vector (e.g. c(1,10,100)) of size classes to display in the size chart (only used if `SizeVar` was specified in create_Pies). If set, overrides `nSizes`.

Value

Adds a legend to a pre-existing pie plot.

See Also

create_Pies, PieData, PieData2.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#23-create-pies

#Pies of constant size, all classes displayed:
#Create pies
MyPies=create_Pies(Input=PieData,
                   NamesIn=c("Lat","Lon","Sp","N"),
                   Size=50
                   )
#Plot Pies
plot(st_geometry(MyPies),col=MyPies$col)
#Add Pies legend
add_PieLegend(Pies=MyPies,PosX=-0.1,PosY=-1,Boxexp=c(0.5,0.45,0.12,0.45),
              PieTitle="Species")
```

---

add_RefGrid *Add a Reference grid*

Description

Add a Latitude/Longitude reference grid to maps.

Usage

```
add_RefGrid(
  bb,
  ResLat = 1,
  ResLon = 2,
  LabLon = NA,
  LatR = c(-80, -45),
  lwd = 1,
  lcol = "black",
  fontsize = 1,
  fontcol = "black",
  offset = NA
)
```

Arguments

bb	bounding box of the first plotted object. for example, bb=st_bbox(SmallBathy) or bb=st_bbox(MyPolys).
ResLat	numeric, latitude resolution in decimal degrees.
ResLon	numeric, longitude resolution in decimal degrees.
LabLon	numeric, longitude at which Latitude labels should appear. if set, the resulting Reference grid will be circumpolar.
LatR	numeric, range of latitudes of circumpolar grid.
lwd	numeric, line thickness of the Reference grid.
lcol	character, line color of the Reference grid.
fontsize	numeric, font size of the Reference grid's labels.
fontcol	character, font color of the Reference grid's labels.
offset	numeric, offset of the Reference grid's labels (distance to plot border).

See Also

load_Bathy, SmallBathy.

Examples

```
#Example 1: Circumpolar grid with Latitude labels at Longitude 0

plot(SmallBathy,breaks=Depth_cuts, col=Depth_cols, legend=FALSE,axes=FALSE,box=FALSE)
add_RefGrid(bb=st_bbox(SmallBathy),ResLat=10,ResLon=20,LabLon = 0)

#Example 2: Local grid around created polygons

MyPolys=create_Polys(PolyData,Densify=TRUE)
BathyC=raster::crop(SmallBathy,MyPolys) #crop the bathymetry to match the extent of MyPolys
Mypar=par(mai=c(0.5,0.5,0.5,0.5)) #Figure margins as c(bottom, left, top, right)
par(Mypar)
plot(BathyC,breaks=Depth_cuts, col=Depth_cols, legend=FALSE,axes=FALSE,box=FALSE)
add_RefGrid(bb=st_bbox(BathyC),ResLat=2,ResLon=6)
plot(st_geometry(MyPolys),add=TRUE,col='orange',border='brown',lwd=2)
```

---

assign_areas *Assign point locations to polygons*

Description

Given a set of polygons and a set of point locations (given in decimal degrees), finds in which polygon those locations fall. Finds, for example, in which Subarea the given fishing locations occurred.

Usage

```
assign_areas(
  Input,
  Polys,
  AreaNameFormat = "GAR_Long_Label",
  Buffer = 0,
  NamesIn = NULL,
  NamesOut = NULL
)
```

Arguments

Input	dataframe containing - at the minimum - Latitudes and Longitudes to be assigned to polygons. If NamesIn is not provided, the columns in the Input must be in the following order: Latitude, Longitude, Variable 1, Variable 2, ... Variable x..
Polys	character vector of polygon names (e.g., Polys=c('ASDs','RBs')). Must be matching the names of the pre-loaded spatial objects (loaded via e.g., ASDs=load_ASDs()).
AreaNameFormat	dependent on the polygons loaded. For the Secretariat's spatial objects loaded via 'load_' functions, we have the following: 'GAR_Name' e.g., 'Subarea 88.2' 'GAR_Short_Label' e.g., '882' 'GAR_Long_Label' (default) e.g., '88.2' Several values may be entered if several Polys are used, e.g.: c('GAR_Short_Label','GAR_Name'), in which case AreaNameFormat must be given in the same order as Polys.
Buffer	numeric, distance in nautical miles to be added around the Polys of interest. Can be specified for each of the Polys (e.g., Buffer=c(2,5)). Useful to determine whether locations are within Buffer nautical miles of a polygon.
NamesIn	character vector of length 2 specifying the column names of Latitude and Longitude fields in the Input. Latitudes name must be given first, e.g.: NamesIn=c('MyLatitudes','MyLongitudes').
NamesOut	character, names of the resulting column names in the output dataframe, with order matching that of Polys (e.g., NamesOut=c('Recapture_ASD','Recapture_RB')). If not provided will be set as equal to Polys.

Value

dataframe with the same structure as the Input, with additional columns corresponding to the Polys used and named after NamesOut.

See Also

load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_MPAs, load_EEZs.

Examples

```
#Generate a dataframe
MyData=data.frame(Lat=runif(100,min=-65,max=-50),
                  Lon=runif(100,min=20,max=40))

#Assign ASDs and SSRUs to these locations (first load ASDs and SSRUs)
ASDs=load_ASDs()
SSRUs=load_SSRUs()

MyData=assign_areas(Input=MyData,Polys=c('ASDs','SSRUs'),NamesOut=c('MyASDs','MySSRUs'))

#View(MyData)
table(MyData$MyASDs) #count of locations per ASD
table(MyData$MySSRUs) #count of locations per SSRU
```

CCAMLRGIS

Loads and creates spatial data, including layers and tools that are relevant to CCAMLR activities. All operations use the Lambert azimuthal equal-area projection (via EPSG:6932).

Description

This package provides two broad categories of functions: load functions and create functions.

Load functions

Load functions are used to import CCAMLR geo-referenced layers and include:

- load_ASDs
- load_SSRUs
- load_RBs
- load_SSMUs
- load_MAs
- load_Coastline
- load_MPAs
- load_EEZs
- load_Bathy

Create functions

Create functions are used to create geo-referenced layers from user-generated data and include:

- create_Points
- create_Lines
- create_Polys
- create_PolyGrids
- create_Stations
- create_Pies

Vignette

To learn more about CCAMLRGIS, start with the GitHub ReadMe (see https://github.com/ccamlr/CCAMLRGIS#table-of-contents).

See Also

The CCAMLRGIS package relies on several other package which users may want to familiarize themselves with, namely sf (https://CRAN.R-project.org/package=sf) and terra (https://CRAN.R-project.org/package=terra).

CCAMLRp *CCAMLRGIS Projection*

Description

The CCAMLRGIS package uses the Lambert azimuthal equal-area projection (see https://en.wikipedia.org/wiki/Lambert_azimuthal_equal-area_projection). Source: http://gis.ccamlr.org/. In order to align with recent developments within Geographic Information Software, this projection will be accessed via EPSG code 6932 (see https://epsg.org/crs_6932/WGS-84-NSIDC-EASE-Grid-2-0-South.html).

Usage

```
data(CCAMLRp)
```

Format

character string

Value

"+proj=laea +lat_0=-90 +lon_0=0 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs"

Clip2Coast *Clip Polygons to the Antarctic coastline*

Description

Clip Polygons to the Coast (removes polygon parts that fall on land) and computes the area of the resulting polygon. Uses an sf object as input which may be user-generated or created via buffered points (see create_Points), buffered lines (see create_Lines) or polygons (see create_Polys).

Usage

```
Clip2Coast(Input)
```

Arguments

Input	sf polygon(s) to be clipped.

Value

sf polygon carrying the same data as the Input.

See Also

Coast, create_Points, create_Lines, create_Polys, create_PolyGrids.

Examples

```
MyPolys=create_Polys(PolyData,Densify=TRUE,Buffer=c(10,-15,120))
plot(st_geometry(MyPolys),col='red')
plot(st_geometry(Coast[Coast$ID=='All',]),add=TRUE)
MyPolysClipped=Clip2Coast(MyPolys)
plot(st_geometry(MyPolysClipped),col='blue',add=TRUE)
#View(MyPolysClipped)
```

Coast *Simplified and subsettable coastline*

Description

Coastline polygons generated from load_Coastline and sub-sampled to only contain data that falls within the boundaries of the Convention Area. This spatial object may be subsetted to plot the coastline for selected ASDs or EEZs (see examples). Source: http://gis.ccamlr.org/

Usage

```
data(Coast)
```

Format

sf

See Also

Clip2Coast, load_Coastline.

Examples

```
#Complete coastline:
plot(st_geometry(Coast[Coast$ID=='All',]),col='grey')

#ASD 48.1 coastline:
plot(st_geometry(Coast[Coast$ID=='48.1',]),col='grey')
```

---

create_Lines *Create Lines*

Description

Create lines to display, for example, fishing line locations or tagging data.

Usage

```
create_Lines(
  Input,
  NamesIn = NULL,
  Buffer = 0,
  Densify = FALSE,
  Clip = FALSE,
  SeparateBuf = TRUE
)
```

Arguments

Input	input dataframe. If NamesIn is not provided, the columns in the Input must be in the following order: Line name, Latitude, Longitude. If a given line is made of more than two points, the locations of points must be given in order, from one end of the line to the other.

NamesIn	character vector of length 3 specifying the column names of line identifier, Latitude and Longitude fields in the Input. Names must be given in that order, e.g.: NamesIn=c('Line ID','Line Latitudes','Line Longitudes').
Buffer	numeric, distance in nautical miles by which to expand the lines. Can be specified for each line (as a numeric vector).
Densify	logical, if set to TRUE, additional points between points of equal latitude are added prior to projection (see examples).
Clip	logical, if set to TRUE, polygon parts (from buffered lines) that fall on land are removed (see Clip2Coast).
SeparateBuf	logical, if set to FALSE when adding a Buffer, all spatial objects are merged, resulting in a single spatial object.

Value

Spatial object in your environment. Data within the resulting spatial object contains the data provided in the Input plus additional "LengthKm" and "LengthNm" columns which corresponds to the lines lengths, in kilometers and nautical miles respectively. If additional data was included in the Input, any numerical values are summarized for each line (min, max, mean, median, sum, count and sd).

To see the data contained in your spatial object, type: View(MyLines).

See Also

create_Points, create_Polys, create_PolyGrids, create_Stations, create_Pies.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#create-lines

#Densified lines (note the curvature of the purple line)

MyLines=create_Lines(Input=LineData,Densify=TRUE)
plot(st_geometry(MyLines),lwd=2,col=rainbow(nrow(MyLines)))
```

`create_Pies` *Create Pies*

Description

Generates pie charts that can be overlaid on maps. The `Input` data must be a dataframe with, at least, columns for latitude, longitude, class and value. For each location, a pie is created with pieces for each class, and the size of each piece depends on the proportion of each class (the value of each class divided by the sum of values). Optionally, the area of each pie can be proportional to a chosen variable (if that variable is different than the value mentioned above, the `Input` data must have a fifth column and that variable must be unique to each location). If the `Input` data contains locations that are too close together, the data can be gridded by setting `GridKm`. Once pie charts have been created, the function add_PieLegend may be used to add a legend to the figure.

Usage

```
create_Pies(
  Input,
  NamesIn = NULL,
  Classes = NULL,
  cols = c("green", "red"),
  Size = 50,
  SizeVar = NULL,
  GridKm = NULL,
  Other = 0,
  Othercol = "grey"
)
```

Arguments

`Input`	input dataframe.
`NamesIn`	character vector of length 4 specifying the column names of Latitude, Longitude, Class and value fields in the `Input`. Names must be given in that order, e.g.: `NamesIn=c('Latitude','Longitude','Class','Value')`.
`Classes`	character, optional vector of classes to be displayed. If this excludes classes that are in the `Input`, those excluded classes will be pooled in a 'Other' class.
`cols`	character, vector of two or more color names to colorize pie pieces.
`Size`	numeric, value controlling the size of pies.
`SizeVar`	numeric, optional, name of the field in the `Input` that should be used to scale the area of pies. Must be unique to locations in the input.
`GridKm`	numeric, optional, cell size of the grid in kilometers. If provided, locations are pooled by grid cell and values are summed for each class.
`Other`	numeric, optional, percentage threshold below which classes are pooled in a 'Other' class.
`Othercol`	character, optional, color of the pie piece for the 'Other' class.

Value

Spatial object in your environment, ready to be plotted.

See Also

add_PieLegend, PieData, PieData2.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#23-create-pies

#Pies of constant size, all classes displayed:
#Create pies
MyPies=create_Pies(Input=PieData,NamesIn=c("Lat","Lon","Sp","N"),Size=50)
#Plot Pies
plot(st_geometry(MyPies),col=MyPies$col)
#Add Pies legend
add_PieLegend(Pies=MyPies,PosX=-0.1,PosY=-1,Boxexp=c(0.5,0.45,0.12,0.45),
              PieTitle="Species")
```

---

create_Points *Create Points*

Description

Create Points to display point locations. Buffering points may be used to produce bubble charts.

Usage

```
create_Points(
  Input,
  NamesIn = NULL,
  Buffer = 0,
  Clip = FALSE,
  SeparateBuf = TRUE
)
```

Arguments

Input	input dataframe. If NamesIn is not provided, the columns in the Input must be in the following order: Latitude, Longitude, Variable 1, Variable 2, ... Variable x.

NamesIn	character vector of length 2 specifying the column names of Latitude and Longitude fields in the Input. Latitudes name must be given first, e.g.: NamesIn=c('MyLatitudes','MyLongitudes').
Buffer	numeric, radius in nautical miles by which to expand the points. Can be specified for each point (as a numeric vector).
Clip	logical, if set to TRUE, polygon parts (from buffered points) that fall on land are removed (see Clip2Coast).
SeparateBuf	logical, if set to FALSE when adding a Buffer, all spatial objects are merged, resulting in a single spatial object.

Value

Spatial object in your environment. Data within the resulting spatial object contains the data provided in the Input plus additional "x" and "y" columns which corresponds to the projected points locations and may be used to label points (see examples).

To see the data contained in your spatial object, type: View(MyPoints).

See Also

create_Lines, create_Polys, create_PolyGrids, create_Stations, create_Pies.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#create-points

#Simple points with labels

MyPoints=create_Points(Input=PointData)
plot(st_geometry(MyPoints))
text(MyPoints$x,MyPoints$y,MyPoints$name,adj=c(0.5,-0.5),xpd=TRUE)
```

---

create_PolyGrids *Create a Polygon Grid*

Description

Create a polygon grid to spatially aggregate data in cells of chosen size. Cell size may be specified in degrees or as a desired area in square kilometers (in which case cells are of equal area).

Usage

```
create_PolyGrids(
  Input,
  NamesIn = NULL,
  dlon = NA,
  dlat = NA,
  Area = NA,
  cuts = 100,
  cols = c("green", "yellow", "red")
)
```

Arguments

`Input`	input dataframe. If `NamesIn` is not provided, the columns in the `Input` must be in the following order: Latitude, Longitude, Variable 1, Variable 2 ... Variable x.
`NamesIn`	character vector of length 2 specifying the column names of Latitude and Longitude fields in the `Input`. Latitudes name must be given first, e.g.: `NamesIn=c('MyLatitudes','MyLongitudes')`.
`dlon`	numeric, width of the grid cells in decimal degrees of longitude.
`dlat`	numeric, height of the grid cells in decimal degrees of latitude.
`Area`	numeric, area in square kilometers of the grid cells. The smaller the `Area`, the longer it will take.
`cuts`	numeric, number of desired color classes.
`cols`	character, desired colors. If more that one color is provided, a linear color gradient is generated.

Value

Spatial object in your environment. Data within the resulting spatial object contains the data provided in the `Input` after aggregation within cells. For each Variable, the minimum, maximum, mean, sum, count, standard deviation, and, median of values in each cell is returned. In addition, for each cell, its area (AreaKm2), projected centroid (Centrex, Centrey) and unprojected centroid (Centrelon, Centrelat) is given.

To see the data contained in your spatial object, type: `View(MyGrid)`.

Also, colors are generated for each aggregated values according to the chosen `cuts` and `cols`.

To generate a custom color scale after the grid creation, refer to `add_col` and `add_Cscale`. See Example 4 below.

See Also

`create_Points`, `create_Lines`, `create_Polys`, `create_Stations`, `create_Pies`, `add_col`, `add_Cscale`.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#create-grids

#Simple grid, using automatic colors

MyGrid=create_PolyGrids(Input=GridData,dlon=2,dlat=1)
#View(MyGrid)
plot(st_geometry(MyGrid),col=MyGrid$Col_Catch_sum)
```

`create_Polys` *Create Polygons*

Description

Create Polygons such as proposed Research Blocks or Marine Protected Areas.

Usage

```
create_Polys(
  Input,
  NamesIn = NULL,
  Buffer = 0,
  Densify = TRUE,
  Clip = FALSE,
  SeparateBuf = TRUE
)
```

Arguments

`Input`	input dataframe. If `NamesIn` is not provided, the columns in the `Input` must be in the following order: Polygon name, Latitude, Longitude. Latitudes and Longitudes must be given clockwise.
`NamesIn`	character vector of length 3 specifying the column names of polygon identifier, Latitude and Longitude fields in the `Input`. Names must be given in that order, e.g.: `NamesIn=c('Polygon ID','Poly Latitudes','Poly Longitudes')`.
`Buffer`	numeric, distance in nautical miles by which to expand the polygons. Can be specified for each polygon (as a numeric vector).

Densify	logical, if set to TRUE, additional points between points of equal latitude are added prior to projection (compare examples 1 and 2 below).
Clip	logical, if set to TRUE, polygon parts that fall on land are removed (see Clip2Coast).
SeparateBuf	logical, if set to FALSE when adding a Buffer, all spatial objects are merged, resulting in a single spatial object.

Value

Spatial object in your environment. Data within the resulting spatial object contains the data provided in the Input after aggregation within polygons. For each numeric variable, the minimum, maximum, mean, sum, count, standard deviation, and, median of values in each polygon is returned. In addition, for each polygon, its area (AreaKm2) and projected centroid (Labx, Laby) are given (which may be used to add labels to polygons).

To see the data contained in your spatial object, type: View(MyPolygons).

See Also

create_Points, create_Lines, create_PolyGrids, create_Stations, add_RefGrid.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#create-polygons


#Densified polygons (note the curvature of iso-latitude lines)

MyPolys=create_Polys(Input=PolyData)
plot(st_geometry(MyPolys),col='red')
text(MyPolys$Labx,MyPolys$Laby,MyPolys$ID,col='white')
```

---

create_Stations *Create Stations*

Description

Create random point locations inside a polygon and within bathymetry strata constraints. A distance constraint between stations may also be used if desired.

Usage

```
create_Stations(
  Poly,
  Bathy,
  Depths,
  N = NA,
  Nauto = NA,
  dist = NA,
  Buf = 1000,
  ShowProgress = FALSE
)
```

Arguments

Poly	single polygon inside which stations will be generated. May be created using create_Polys.
Bathy	bathymetry raster with the appropriate projection, such as this one.
Depths	numeric, vector of depths. For example, if the depth strata required are 600 to 1000 and 1000 to 2000, Depths=c(-600,-1000,-2000).
N	numeric, vector of number of stations required in each depth strata, therefore length(N) must equal length(Depths)-1.
Nauto	numeric, instead of specifying N, a number of stations proportional to the areas of the depth strata may be created. Nauto is the maximum number of stations required in any depth stratum.
dist	numeric, if desired, a distance constraint in nautical miles may be applied. For example, if dist=2, stations will be at least 2 nautical miles apart.
Buf	numeric, distance in meters from isobaths. Useful to avoid stations falling on strata boundaries.
ShowProgress	logical, if set to TRUE, a progress bar is shown (create_Stations may take a while).

Value

Spatial object in your environment. Data within the resulting object contains the strata and stations locations in both projected space ("x" and "y") and decimal degrees of Latitude/Longitude.

To see the data contained in your spatial object, type: View(MyStations).

See Also

create_Polys, SmallBathy.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#22-create-stations
```

```
#First, create a polygon within which stations will be created
MyPoly=create_Polys(
 data.frame(Name="mypol",
            Latitude=c(-75,-75,-70,-70),
            Longitude=c(-170,-180,-180,-170))
 ,Densify=TRUE)

par(mai=c(0,0,0,0))
plot(st_geometry(Coast[Coast$ID=='88.1',]),col='grey')
plot(st_geometry(MyPoly),col='green',add=TRUE)
text(MyPoly$Labx,MyPoly$Laby,MyPoly$ID)

#Create a set numbers of stations, without distance constraint:
library(terra)
#optional: crop your bathymetry raster to match the extent of your polygon
BathyCroped=crop(rast(SmallBathy),ext(MyPoly))

#Create stations
MyStations=create_Stations(MyPoly,BathyCroped,Depths=c(-2000,-1500,-1000,-550),N=c(20,15,10))

#add custom colors to the bathymetry to indicate the strata of interest
MyCols=add_col(var=c(-10000,10000),cuts=c(-2000,-1500,-1000,-550),cols=c('blue','cyan'))
plot(BathyCroped,breaks=MyCols$cuts,col=MyCols$cols,legend=FALSE,axes=FALSE)
add_Cscale(height=90,fontsize=0.75,width=16,lwd=0.5,
offset=-130,cuts=MyCols$cuts,cols=MyCols$cols)
plot(st_geometry(MyPoly),add=TRUE,border='red',lwd=2,xpd=TRUE)
plot(st_geometry(MyStations),add=TRUE,col='orange',cex=0.75,lwd=1.5,pch=3)
```

`Depth_cols` *Bathymetry colors*

Description

Set of standard colors to plot bathymetry, to be used in conjunction with Depth_cuts.

Usage

```
data(Depth_cols)
```

Format

character vector

See Also

Depth_cols2, add_col, add_Cscale, SmallBathy.

Examples

```
plot(SmallBathy,breaks=Depth_cuts,col=Depth_cols,axes=FALSE)
```

`Depth_cols2` *Bathymetry colors with Fishable Depth range*

Description

Set of colors to plot bathymetry and highlight Fishable Depth range (600-1800), to be used in conjunction with Depth_cuts2.

Usage

```
data(Depth_cols2)
```

Format

character vector

See Also

`Depth_cols`, `add_col`, `add_Cscale`, `SmallBathy`.

Examples

```
plot(SmallBathy,breaks=Depth_cuts2,col=Depth_cols2,axes=FALSE,box=FALSE)
```

`Depth_cuts` *Bathymetry depth classes*

Description

Set of depth classes to plot bathymetry, to be used in conjunction with Depth_cols.

Usage

```
data(Depth_cuts)
```

Format

numeric vector

See Also

`Depth_cuts2`, `add_col`, `add_Cscale`, `SmallBathy`.

Examples

```
plot(SmallBathy,breaks=Depth_cuts,col=Depth_cols,axes=FALSE,box=FALSE)
```

Depth_cuts2 *Bathymetry depth classes with Fishable Depth range*

Description

Set of depth classes to plot bathymetry and highlight Fishable Depth range (600-1800), to be used in conjunction with Depth_cols2.

Usage

```
data(Depth_cuts2)
```

Format

numeric vector

See Also

Depth_cuts, add_col, add_Cscale, SmallBathy.

Examples

```
plot(SmallBathy,breaks=Depth_cuts2,col=Depth_cols2,axes=FALSE,box=FALSE)
```

get_C_intersection *Get Cartesian coordinates of lines intersection in Euclidean space*

Description

Given two lines defined by the Latitudes/Longitudes of their extremities, finds the location of their intersection, in Euclidean space, using this approach: https://en.wikipedia.org/wiki/Line-line_intersection.

Usage

```
get_C_intersection(Line1, Line2, Plot = TRUE)
```

Arguments

Line1	Vector of 4 coordinates, given in decimal degrees as: c(Longitude_start,Latitude_start,Longitude_end,Latitude_end).
Line2	Same as Line1.
Plot	logical, if set to TRUE, plots a schematic of calculations.

Examples

```
#Example 1 (Intersection beyond the range of segments)
get_C_intersection(Line1=c(-30,-55,-29,-50),Line2=c(-50,-60,-40,-60))

#Example 2 (Intersection on one of the segments)
get_C_intersection(Line1=c(-30,-65,-29,-50),Line2=c(-50,-60,-40,-60))

#Example 3 (Crossed segments)
get_C_intersection(Line1=c(-30,-65,-29,-50),Line2=c(-50,-60,-25,-60))

#Example 4 (Antimeridian crossed)
get_C_intersection(Line1=c(-179,-60,-150,-50),Line2=c(-120,-60,-130,-62))

#Example 5 (Parallel lines - uncomment to test as it will return an error)
#get_C_intersection(Line1=c(0,-60,10,-60),Line2=c(-10,-60,10,-60))
```

---

get_depths *Get depths of locations from a bathymetry raster*

Description

Given a bathymetry raster and an input dataframe of point locations (given in decimal degrees), computes the depths at these locations (values for the cell each point falls in). The accuracy is dependent on the resolution of the bathymetry raster (see `load_Bathy` to get high resolution data).

Usage

```
get_depths(Input, Bathy, NamesIn = NULL)
```

Arguments

`Input`	dataframe with, at least, Latitudes and Longitudes. If `NamesIn` is not provided, the columns in the `Input` must be in the following order: Latitude, Longitude, Variable 1, Variable 2, ... Variable x.
`Bathy`	bathymetry raster with the appropriate `projection`, such as `this one`. It is highly recommended to use a raster of higher resolution than `SmallBathy` (see `load_Bathy`).
`NamesIn`	character vector of length 2 specifying the column names of Latitude and Longitude fields in the `Input`. Latitudes name must be given first, e.g.: `NamesIn=c('MyLatitudes','MyLongitudes')`.

Value

dataframe with the same structure as the `Input` with an additional depth column `'d'`.

See Also

`load_Bathy`, `create_Points`, `create_Stations`, `get_iso_polys`.

Examples

```
#Generate a dataframe
MyData=data.frame(Lat=PointData$Lat,
Lon=PointData$Lon,
Catch=PointData$Catch)

#get depths of locations
MyDataD=get_depths(Input=MyData,Bathy=SmallBathy)
#View(MyDataD)
plot(MyDataD$d,MyDataD$Catch,xlab='Depth',ylab='Catch',pch=21,bg='blue')
```

---

get_iso_polys *Generate Polygons from Isobaths*

Description

From an input bathymetry and chosen depths, turns areas between isobaths into polygons. An input polygon may optionally be given to constrain boundaries. The accuracy is dependent on the resolution of the bathymetry raster (see `load_Bathy` to get high resolution data).

Usage

```
get_iso_polys(Bathy, Poly = NULL, Depths)
```

Arguments

`Bathy`	bathymetry raster with the appropriate projection, such as `SmallBathy`. It is highly recommended to use a raster of higher resolution (see `load_Bathy`).
`Poly`	optional, single polygon inside which isobaths will be computed. May be created using `create_Polys` or by subsetting an object obtained using one of the `load_` functions (see examples).
`Depths`	numeric, vector of desired isobaths. For example, `Depths=c(-2000,-1000,-500)`.

Value

Spatial object in your environment. Data within the resulting object contains a polygon in each row. Columns are as follows: `ID` is a unique polygon identifier; `Iso` is an isobath identifier; `Min` and `Max` is the depth range of isobaths; `Grp` is a group identifier (e.g., a seamount constituted of several isobaths); `AreaKm2` is the polygon area in square kilometers; `Labx` and `Laby` can be used to label groups (see examples).

See Also

`load_Bathy`, `create_Polys`, `get_depths`.

Examples

```
# For more examples, see:
# https://github.com/ccamlr/CCAMLRGIS#46-get_iso_polys


Poly=create_Polys(Input=data.frame(ID=1,Lat=c(-55,-55,-61,-61),Lon=c(-30,-25,-25,-30)))
IsoPols=get_iso_polys(Bathy=SmallBathy,Poly=Poly,Depths=seq(-8000,0,length.out=10))

plot(st_geometry(Poly))
for(i in unique(IsoPols$Iso)){
  plot(st_geometry(IsoPols[IsoPols$Iso==i,]),col=rainbow(9)[i],add=TRUE)
}
```

GridData *Example dataset for create_PolyGrids*

Description

To be used in conjunction with create_PolyGrids.

Usage

```
data(GridData)
```

Format

data.frame

See Also

`create_PolyGrids`.

Examples

```
#View(GridData)

MyGrid=create_PolyGrids(Input=GridData,dlon=2,dlat=1)
plot(st_geometry(MyGrid),col=MyGrid$Col_Catch_sum)
```

Labels *Polygon labels*

Description

Labels for the layers obtained via 'load_' functions. Positions correspond to the centroids of polygon parts. Can be used in conjunction with add_labels.

Usage

```
data(Labels)
```

Format

data.frame

See Also

add_labels, load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_EEZs, load_MPAs.

Examples

```
#View(Labels)

ASDs=load_ASDs()
plot(st_geometry(ASDs))
add_labels(mode='auto',layer='ASDs',fontsize=1,fonttype=2)
```

LineData *Example dataset for create_Lines*

Description

To be used in conjunction with create_Lines.

Usage

```
data(LineData)
```

Format

data.frame

See Also

create_Lines.

Examples

```
#View(LineData)

MyLines=create_Lines(LineData)
plot(st_geometry(MyLines),lwd=2,col=rainbow(5))
```

load_ASDs *Load CCAMLR statistical Areas, Subareas and Divisions*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_ASDs()
```

See Also

load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_Coastline, load_MPAs, load_EEZs.

Examples

```
#When online:
ASDs=load_ASDs()
plot(st_geometry(ASDs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

`load_Bathy` *Load Bathymetry data*

Description

Download the up-to-date projected GEBCO data from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. This functions can be used in two steps, to first download the data and then use it. If you keep the downloaded data, you can then re-use it in all your scripts.

Usage

```
load_Bathy(LocalFile, Res = 5000)
```

Arguments

`LocalFile`	To download the data, set to `FALSE`. To re-use a downloaded file, set to the full path of the file (e.g., `LocalFile="C:/Desktop/GEBCO2021_5000.tif"`).
`Res`	Desired resolution in meters. May only be one of: 500, 1000, 2500 or 5000.

Details

To download the data, you must either have set your working directory using `setwd`, or be working within an Rproject. In any case, your file will be downloaded to the folder path given by `getwd`.

It is strongly recommended to first download the lowest resolution data (set `Res=5000`) to ensure it is working as expected.

To re-use the downloaded data, you must provide the full path to that file, for example:

`LocalFile="C:/Desktop/GEBCO2021_5000.tif"`.

This data was reprojected from the original GEBCO Grid after cropping at 40 degrees South. Projection was made using the Lambert azimuthal equal-area projection (`CCAMLRp`), and the data was aggregated at several resolutions.

Value

Bathymetry raster.

References

GEBCO Compilation Group (2021) GEBCO 2021 Grid (doi:10.5285/c6612cbe-50b3-0cff-e053-6c86abc09f8f)

See Also

add_col, add_Cscale, Depth_cols, Depth_cuts, Depth_cols2, Depth_cuts2, get_depths, create_Stations, get_iso_polys, SmallBathy.

Examples

```
#The examples below are commented. To test, remove the '#'.

##Download the data. It will go in the folder given by getwd():
#Bathy=load_Bathy(LocalFile = FALSE,Res=5000)
#plot(Bathy, breaks=Depth_cuts,col=Depth_cols,axes=FALSE)

##Re-use the downloaded data (provided it's here: "C:/Desktop/GEBCO2021_5000.tif"):
#Bathy=load_Bathy(LocalFile = "C:/Desktop/GEBCO2021_5000.tif")
#plot(Bathy, breaks=Depth_cuts,col=Depth_cols,axes=FALSE)
```

---

load_Coastline *Load the full CCAMLR Coastline*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp) Note that this coastline expands further north than Coast.

Usage

```
load_Coastline()
```

See Also

load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_MPAs, load_EEZs.

Examples

```
#When online:
Coastline=load_Coastline()
plot(st_geometry(Coastline))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

---

load_EEZs *Load Exclusive Economic Zones*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_EEZs()
```

See Also

load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_Coastline, load_MPAs.

Examples

```
#When online:
EEZs=load_EEZs()
plot(st_geometry(EEZs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

load_MAs *Load CCAMLR Management Areas*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_MAs()
```

See Also

load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_Coastline, load_MPAs, load_EEZs.

Examples

```
#When online:
MAs=load_MAs()
plot(st_geometry(MAs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

load_MPAs *Load CCAMLR Marine Protected Areas*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_MPAs()
```

See Also

load_ASDs, load_SSRUs, load_RBs, load_SSMUs, load_MAs, load_Coastline, load_EEZs.

Examples

```
#When online:
MPAs=load_MPAs()
plot(st_geometry(MPAs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

---

load_RBs *Load CCAMLR Research Blocks*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_RBs()
```

See Also

load_ASDs, load_SSRUs, load_SSMUs, load_MAs, load_Coastline, load_MPAs, load_EEZs.

Examples

```
#When online:
RBs=load_RBs()
plot(st_geometry(RBs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

load_SSMUs *Load CCAMLR Small Scale Management Units*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_SSMUs()
```

See Also

load_ASDs, load_SSRUs, load_RBs, load_MAs, load_Coastline, load_MPAs, load_EEZs.

Examples

```
#When online:
SSMUs=load_SSMUs()
plot(st_geometry(SSMUs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

load_SSRUs *Load CCAMLR Small Scale Research Units*

Description

Download the up-to-date spatial layer from the online CCAMLRGIS (http://gis.ccamlr.org/) and load it to your environment. See examples for offline use. All layers use the Lambert azimuthal equal-area projection (CCAMLRp)

Usage

```
load_SSRUs()
```

See Also

load_ASDs, load_RBs, load_SSMUs, load_MAs, load_Coastline, load_MPAs, load_EEZs.

Examples

```
#When online:
SSRUs=load_SSRUs()
plot(st_geometry(SSRUs))

#For offline use, see:
#https://github.com/ccamlr/CCAMLRGIS#32-offline-use
```

PieData *Example dataset for create_Pies*

Description

To be used in conjunction with create_Pies. Count and catch of species per location.

Usage

```
data(PieData)
```

Format

data.frame

See Also

create_Pies.

Examples

```
#View(PieData)

#Create pies
MyPies=create_Pies(Input=PieData,
                   NamesIn=c("Lat","Lon","Sp","N"),
                   Size=50
)
#Plot Pies
plot(st_geometry(MyPies),col=MyPies$col)
#Add Pies legend
add_PieLegend(Pies=MyPies,PosX=-0.1,PosY=-1.6,Boxexp=c(0.5,0.45,0.12,0.45),
              PieTitle="Species")
```

PieData2 *Example dataset for create_Pies*

Description

To be used in conjunction with create_Pies. Count and catch of species per location.

Usage

```
data(PieData2)
```

Format

data.frame

See Also

create_Pies.

Examples

```
#View(PieData2)

MyPies=create_Pies(Input=PieData2,
                   NamesIn=c("Lat","Lon","Sp","N"),
                   Size=5,
                   GridKm=250
)
#Plot Pies
plot(st_geometry(MyPies),col=MyPies$col)
#Add Pies legend
add_PieLegend(Pies=MyPies,PosX=-0.8,PosY=-0.3,Boxexp=c(0.5,0.45,0.12,0.45),
              PieTitle="Species")
```

PointData *Example dataset for create_Points*

Description

To be used in conjunction with create_Points.

Usage

```
data(PointData)
```

Format

data.frame

See Also

create_Points.

Examples

```
#View(PointData)

MyPoints=create_Points(PointData)
plot(st_geometry(MyPoints))
text(MyPoints$x,MyPoints$y,MyPoints$name,adj=c(0.5,-0.5),xpd=TRUE)
plot(st_geometry(MyPoints[MyPoints$name=='four',]),bg='red',pch=21,cex=1.5,add=TRUE)
```

PolyData *Example dataset for create_Polys*

Description

To be used in conjunction with create_Polys.

Usage

```
data(PolyData)
```

Format

data.frame

See Also

create_Polys.

Examples

```
#View(PolyData)

MyPolys=create_Polys(PolyData,Densify=TRUE)
plot(st_geometry(MyPolys),col='green')
text(MyPolys$Labx,MyPolys$Laby,MyPolys$ID)
plot(st_geometry(MyPolys[MyPolys$ID=='three',]),border='red',lwd=3,add=TRUE)
```

project_data *Project user-supplied locations*

Description

Given an input dataframe containing locations given in decimal degrees or meters (if projected), projects these locations and, if desired, appends them to the input dataframe. May also be used to back-project to Latitudes/Longitudes provided the input was projected using a Lambert azimuthal equal-area projection (CCAMLRp).

Usage

```
project_data(
  Input,
  NamesIn = NULL,
  NamesOut = NULL,
  append = TRUE,
  inv = FALSE
)
```

Arguments

Input	dataframe containing - at the minimum - Latitudes and Longitudes to be projected (or Y and X to be back-projected).
NamesIn	character vector of length 2 specifying the column names of Latitude and Longitude fields in the Input. Latitudes (or Y) name must be given first, e.g.: NamesIn=c('MyLatitudes','MyLongitudes').
NamesOut	character vector of length 2, optional. Names of the resulting columns in the output dataframe, with order matching that of NamesIn (e.g., NamesOut=c('Y','X')).
append	logical (T/F). Should the projected locations be appended to the Input?
inv	logical (T/F). Should a back-projection be performed? In such case, locations must be given in meters and have been projected using a Lambert azimuthal equal-area projection (CCAMLRp).

See Also

assign_areas.

Examples

```
#Generate a dataframe
MyData=data.frame(Lat=runif(100,min=-65,max=-50),
                  Lon=runif(100,min=20,max=40))
```

```
#Project data using a Lambert azimuthal equal-area projection
MyData=project_data(Input=MyData,NamesIn=c("Lat","Lon"))
#View(MyData)
```

---

seabed_area *Calculate planimetric seabed area*

Description

Calculate planimetric seabed area within polygons and depth strata in square kilometers.

Usage

```
seabed_area(Bathy, Poly, PolyNames = NULL, depth_classes = c(-600, -1800))
```

Arguments

Bathy	bathymetry raster with the appropriate projection. It is highly recommended to use a raster of higher resolution than SmallBathy, see load_Bathy.
Poly	polygon(s) within which the areas of depth strata are computed.
PolyNames	character, column name (from the polygon object) to be used in the output.
depth_classes	numeric vector of strata depths. for example, depth_classes=c(-600,-1000,-2000). If the values -600,-1800 are given within depth_classes, the computed area will be labelled as 'Fishable_area'.

Value

dataframe with the name of polygons in the first column and the area for each strata in the following columns.

See Also

load_Bathy, SmallBathy, create_Polys, load_RBs.

Examples

```
#create some polygons
MyPolys=create_Polys(PolyData,Densify=TRUE)
#compute the seabed areas
FishDepth=seabed_area(SmallBathy,MyPolys,PolyNames="ID",
depth_classes=c(0,-200,-600,-1800,-3000,-5000))
#Result looks like this (note that the 600-1800 stratum is renamed 'Fishable_area')
#View(FishDepth)
```

SmallBathy *Small bathymetry dataset*

Description

Bathymetry dataset derived from the GEBCO 2021 (see https://www.gebco.net/) dataset. Sub-sampled at a 10,000m resolution. Projected using the CCAMLR standard projection (CCAMLRp). To highlight the Fishable Depth range, use Depth_cols2 and Depth_cuts2. To be only used for large scale illustrative purposes. Please refer to load_Bathy to get higher resolution data.

Usage

```
data(SmallBathy)
```

Format

raster

References

GEBCO Compilation Group (2021) GEBCO 2021 Grid (doi:10.5285/c6612cbe-50b3-0cff-e053-6c86abc09f8f)

See Also

load_Bathy, add_col, add_Cscale, Depth_cols, Depth_cuts, Depth_cols2, Depth_cuts2, get_depths, create_Stations.

Examples

```
plot(SmallBathy,breaks=Depth_cuts,col=Depth_cols,axes=FALSE,box=FALSE)
```

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