

Package: Tivy (via r-universe)

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Type Package

Title Toolkit for Investigation and Visualization of Young Anchovies

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Description Specialized toolkit for processing biological and fisheries data from Peru's anchovy (*Engraulis ringens*) fishery. Provides functions to analyze fishing logbooks, calculate biological indicators (length-weight relationships, juvenile percentages), generate spatial fishing indicators, and visualize regulatory measures from Peru's Ministry of Production. Features automated data processing from multiple file formats, coordinate validation, spatial analysis of fishing zones, and tools for analyzing fishing closure announcements and regulatory compliance. Includes built-in datasets of Peruvian coastal coordinates and parallel lines for analyzing fishing activities within regulatory zones.

URL <https://github.com/HansTtito/Tivy>

BugReports <https://github.com/HansTtito/Tivy/issues>

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Contents

add_variables	3
apply_catch_weighting	4
calas_bitacora	5
calculate_distances_vectorized	6
calculate_fish_weight	7
calculate_juvenile_percentage	7
calculate_juvenile_statistics	8
coast_distance	9
convert_numbers_to_weight	10
convert_to_date	11
create_fishery_dashboard	12
dms_to_decimal	13
extract_numeric_values	14
extract_pdf_data	15
faenas_bitacora	16
fetch_fishing_announcements	17
find_column	18
find_columns_by_pattern	19
format_extracted_data	20
get_length_range	21
land_points	21
merge_length_fishing_trips_hauls	23
peru_coast_parallels	24
peru_coastline	24
peru_isoparalitoral_areas	25
plot_fishing_zones	26
plot_juvenile_analysis	27
plot_zones_interactive	29
plot_zones_static	30
prepare_polygons	31
process_fishing_trips	31
process_hauls	32

add_variables 3

<code>process_length</code>	33
<code>summarize_juveniles_by_group</code>	33
<code>tallas_bitacora</code>	34
<code>validate_fishing_trip_data</code>	35
<code>validate_haul_data</code>	35
<code>validate_length_data</code>	36
<code>validate_polygon_data</code>	36
<code>weight_by_catch</code>	37

Index 39

<code>add_variables</code>	<i>Add variables for juveniles, sample length, distance to coast, and distance category</i>
----------------------------	---

Description

Adds new variables to a dataset, including the proportion of juveniles, the total number of individuals in the sample, the distance to the coast, and the distance category.

Usage

```
add_variables(  
  data,  
  JuvLim = 12,  
  distance_type = "haversine",  
  window = 0.5,  
  unit = "nm",  
  coastline = NULL,  
  suppress_warnings = TRUE  
)
```

Arguments

<code>data</code>	Data frame that must contain latitude (<code>lat_initial</code>) and longitude (<code>lon_initial</code>) coordinates, as well as columns with individual length.
<code>JuvLim</code>	Length threshold to consider juveniles.
<code>distance_type</code>	Type of distance calculation to the coast.
<code>window</code>	Window parameter to smooth the coastline.
<code>unit</code>	Distance unit used in the calculation ("nm", "km", etc.).
<code>coastline</code>	Data frame with coastline coordinates. Must have columns named Long and Lat. If NULL, uses internal dataset <code>peru_coastline</code> .
<code>suppress_warnings</code>	Logical. If TRUE, warnings are suppressed.

Value

Data frame with new variables: `juv` (proportion of juveniles), `sample` (total individuals), `dc` (distance to coast), and `dc_cat` (categorical distance).

Examples

```
## Not run:
data_hauls <- process_hauls(data_hauls = calas_bitacora)
data_fishing_trips <- process_fishing_trips(data_fishing_trips = faenas_bitacora)
hauls_length <- process_length(data_length = tallas_bitacora)

data_length_trips <- merge(
  x = data_fishing_trips,
  y = hauls_length,
  by = 'fishing_trip_code'
)
data_total <- merge_length_fishing_trips_hauls(
  data_hauls = data_hauls,
  data_length_fishing_trips = data_length_trips
)

results <- add_variables(data = data_total)

## End(Not run)
```

`apply_catch_weighting` *Apply catch weighting to data frame*

Description

Applies catch weighting to length frequency columns in a data frame. Supports parallel processing for large datasets.

Usage

```
apply_catch_weighting(
  data,
  length_cols,
  catch_col,
  a,
  b,
  parallel = FALSE,
  num_cores = NULL,
  block_size = 10000,
  silence_warnings = TRUE
)
```

Arguments

<code>data</code>	Data frame containing length columns and catch data.
<code>length_cols</code>	Character vector of length column names.
<code>catch_col</code>	Name of the catch column.
<code>a</code>	Coefficient of the length-weight relationship.
<code>b</code>	Exponent of the length-weight relationship.
<code>parallel</code>	Logical. Use parallel processing.
<code>num_cores</code>	Number of cores for parallel processing. If NULL, auto-detect.
<code>block_size</code>	Block size for parallel processing.
<code>silence_warnings</code>	Logical. Suppress warnings.

Value

Data frame with original columns plus weighted length columns (prefixed with "weighted_").

Examples

```
## Not run:
length_cols <- c("8", "8.5", "9", "9.5", "10", "10.5", "11", "11.5")
weighted_data <- apply_catch_weighting(
  data = fishery_data,
  length_cols = length_cols,
  catch_col = "total_catch",
  a = 0.0001,
  b = 2.984
)

## End(Not run)
```

<code>calas_bitacora</code>	<i>Fishing hauls</i>
-----------------------------	----------------------

Description

Dataset containing information about fishing hauls in the Peruvian sea. Hauls are specific locations where fishing activities are conducted.

Usage

```
calas_bitacora
```

Format

A data.frame with sample data of hauls made by vessels in the Peruvian sea.

Source

Randomly generated data.

Examples

```
data(calas_bitacora)
```

```
calculate_distances_vectorized
```

Calculate vectorized distances to coastline

Description

Internal function to calculate distances between multiple points and a coastline. Supports different distance calculation methods and spatial filtering.

Usage

```
calculate_distances_vectorized(  
  lon_point,  
  lat_point,  
  coast_lon,  
  coast_lat,  
  distance_type,  
  window,  
  unit,  
  resolution = 0.25  
)
```

Arguments

lon_point	Vector of point longitudes.
lat_point	Vector of point latitudes.
coast_lon	Vector of coastline longitudes.
coast_lat	Vector of coastline latitudes.
distance_type	Distance calculation method.
window	Spatial filter window in degrees.
unit	Distance unit.
resolution	Grid resolution (only used if distance_type = "grid").

Value

List with distance vectors and corresponding indices.

calculate_fish_weight *Calculate fish weight from length*

Description

Estimates individual fish weight from length using the length-weight relationship: $W = a * L^b$

Usage

```
calculate_fish_weight(length, a, b)
```

Arguments

length	Numeric vector of fish lengths.
a	Coefficient of the length-weight relationship.
b	Exponent of the length-weight relationship.

Details

The length-weight relationship follows the allometric equation $W = a * L^b$, where W is weight, L is length, and a and b are species-specific parameters.

Value

Numeric vector of estimated weights.

References

Froese, R. (2006). Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *Journal of Applied Ichthyology*, 22(4), 241-253.

calculate_juvenile_percentage
Calculate juvenile percentage

Description

Calculates the percentage of individuals considered juveniles based on a length threshold.

Usage

```
calculate_juvenile_percentage(  
  frequency,  
  length,  
  juvenile_limit = 12,  
  silence_warnings = FALSE  
)
```

Arguments

frequency	Numeric vector of length frequencies.
length	Numeric vector of corresponding lengths.
juvenile_limit	Length threshold for juvenile classification.
silence_warnings	Logical. Suppress warnings.

Details

Juvenile percentage calculations are essential for fisheries management decisions, particularly in determining fishing quotas and closure periods.

Value

Percentage of juveniles in the sample.

References

IMARPE (2020). Protocolo Elaboración de la Tabla de Decisión para la determinación del Límite Máximo Total Permisible por temporada de pesca en la pesquería del stock norte-centro de la anchoveta peruana. IMP-DGIRP/AFDPERP, Edición: 05, Revisión 00, 40p.

calculate_juvenile_statistics

Calculate juvenile statistics for a group

Description

Helper function that calculates juvenile percentages in number and weight. Used internally by summarize_juveniles_by_group.

Usage

```
calculate_juvenile_statistics(
  frequencies,
  length_values,
  juvenile_limit = 12,
  a = 0.0012,
  b = 3.1242
)
```

Arguments

frequencies	Numeric vector of frequencies by length.
length_values	Numeric vector of corresponding lengths.
juvenile_limit	Length threshold for juveniles.
a	Coefficient of length-weight relationship.
b	Exponent of length-weight relationship.

Value

Data frame with juvenile statistics.

Examples

```
frequencies <- c(10, 15, 25, 30, 20, 10)
lengths <- c(8, 9, 10, 11, 12, 13)
stats <- calculate_juvenile_statistics(frequencies, lengths)
```

coast_distance	<i>Vectorized distance to coast</i>
----------------	-------------------------------------

Description

Estimates the distance between a set of points (lon, lat) and a coastline defined by coordinates. Can be executed sequentially or in parallel, and also return the indices of the nearest coastal points.

Usage

```
coast_distance(
  lon,
  lat,
  coastline = NULL,
  return_indices = FALSE,
  distance_type = "haversine",
  unit = "nm",
  window = 1,
  parallel = FALSE,
  cores = 4
)
```

Arguments

lon	Numeric vector with the longitudes of the points of interest.
lat	Numeric vector with the latitudes of the points of interest.
coastline	Data frame with coastline coordinates. Must have columns named Long and Lat. If NULL, uses internal dataset peru_coastline.
return_indices	Logical. If TRUE, also returns the indices of the nearest coastline points.
distance_type	Type of geographic distance to use: "haversine", "euclidean", "grid".
unit	Unit of measurement for distance: "nm" (nautical miles), "km", etc.
window	Search window in degrees around the point to limit calculations and improve efficiency.
parallel	Logical. If TRUE, performs the calculation in parallel using multiple cores.
cores	Number of cores to use for parallel processing.

Value

If `return_indices = FALSE`, returns a numeric vector with distances to the coast for each point. If `return_indices = TRUE`, returns a list with distance and index components.

Examples

```
## Not run:
data_hauls <- process_hauls(data_hauls = calas_bitacora)
distances <- coast_distance(
  lon = data_hauls$lon_final,
  lat = data_hauls$lat_final,
  distance_type = "haversine",
  unit = "nm",
  parallel = TRUE,
  cores = 2
)

## End(Not run)
```

`convert_numbers_to_weight`*Convert numbers to weight*

Description

Converts numerical length frequencies to weight estimates using length-weight relationship.

Usage

```
convert_numbers_to_weight(data, length_cols, a, b)
```

Arguments

<code>data</code>	Data frame with length frequency columns.
<code>length_cols</code>	Vector of length column names or numeric values.
<code>a</code>	Coefficient of the length-weight relationship.
<code>b</code>	Exponent of the length-weight relationship.

Value

Data frame with original columns plus weight columns (prefixed with "weight_").

Examples

```
## Not run:
weight_data <- convert_numbers_to_weight(
  data = frequency_data,
  length_cols = c("8", "8.5", "9", "9.5", "10"),
  a = 0.0012,
  b = 3.1242
)

## End(Not run)
```

convert_to_date	<i>Convert dates to standard format</i>
-----------------	---

Description

Converts a vector of dates in various formats to a standard date format. The function tries to parse each date using predefined formats and returns the first valid date found for each entry. If a date cannot be interpreted, it is assigned as NA.

Usage

```
convert_to_date(date_vector, output_type = c("date", "datetime"))
```

Arguments

`date_vector` A character vector containing dates in various formats.
`output_type` Type of object to return: "date" for Date, "datetime" for POSIXct.

Value

A vector of Date or POSIXct objects, or NA if the date cannot be converted.

Examples

```
dates <- c("2025-04-10", "10/04/2025", "April 10, 2025")
converted_dates <- convert_to_date(dates)
print(converted_dates)
```

```
create_fishery_dashboard
```

Create fishery dashboard

Description

Generates a comprehensive dashboard for fishery analysis including juvenile analysis, catch trends, spatial distribution, and summary statistics. This function consolidates all dashboard functionality.

Usage

```
create_fishery_dashboard(  
  data,  
  date_col = NULL,  
  length_cols = NULL,  
  a = 1e-04,  
  b = 2.984,  
  latitude_col = NULL,  
  longitude_col = NULL,  
  catch_col = NULL,  
  juvenile_col = NULL,  
  map_xlim = c(-85, -70),  
  map_ylim = c(-20, 0),  
  color_palette = NULL,  
  date_breaks = NULL,  
  sort_comparison = FALSE,  
  comparison_title = NULL,  
  catch_title = NULL,  
  map_title = NULL,  
  trend_title = NULL  
)
```

Arguments

<code>data</code>	Data frame with complete fishery data.
<code>date_col</code>	Date column name. If NULL, auto-detect.
<code>length_cols</code>	Length frequency column names. If NULL, auto-detect.
<code>a</code>	Length-weight coefficient.
<code>b</code>	Length-weight exponent.
<code>latitude_col</code>	Latitude column name. If NULL, auto-detect.
<code>longitude_col</code>	Longitude column name. If NULL, auto-detect.
<code>catch_col</code>	Catch column name. If NULL, auto-detect.
<code>juvenile_col</code>	Juvenile percentage column name. If NULL, auto-detect.
<code>map_xlim</code>	Map longitude limits.

map_ylim	Map latitude limits.
color_palette	Custom color palette.
date_breaks	Date axis breaks.
sort_comparison	Sort comparison plot.
comparison_title	Comparison plot title.
catch_title	Catch plot title.
map_title	Map plot title.
trend_title	Trend plot title.

Value

List with individual plots and combined dashboard (if patchwork available).

Examples

```
## Not run:
dashboard <- create_fishery_dashboard(
  data = complete_fishery_data,
  date_col = "date",
  length_cols = paste0("length_", seq(8, 15, 0.5)),
  catch_col = "total_catch",
  latitude_col = "latitude",
  longitude_col = "longitude"
)

dashboard$comparison
dashboard$catch_trends
dashboard$spatial_map
dashboard$trends
dashboard$dashboard

## End(Not run)
```

dms_to_decimal

Convert latitude or longitude to decimal degrees

Description

Converts coordinates expressed in degrees, minutes and seconds (DMS) or degrees and minutes (DM) format to decimal degrees. By default, coordinates are assumed to be in the southern hemisphere (negative latitudes). The function can automatically correct common errors such as minutes or seconds greater than 60.

Usage

```
dms_to_decimal(coordinates, hemisphere = "S", correct_errors = TRUE)
```

Arguments

`coordinates` Character vector. Each element should be in formats such as: "D M S", "D M", "17 26 S"

`hemisphere` Character indicating hemisphere when not specified in the coordinate. One of "N", "S", "E", "W" or "O". "S" and "W"/"O" generate negative values.

`correct_errors` Logical. If TRUE, automatically corrects out-of-range values.

Value

Numeric vector with coordinates converted to decimal degrees.

Examples

```
dms_to_decimal(c("73 15 0"), hemisphere = "W")
```

```
extract_numeric_values
```

Extract length values from column names

Description

Helper function to extract numerical length values from column names. Handles different naming patterns like "length_8.5", "weighted_9", "8", etc. Uses multiple extraction strategies to ensure robust parsing of column names.

Usage

```
extract_numeric_values(
  column_names,
  use_fallback = TRUE,
  fallback_type = "sequential",
  verbose = FALSE
)
```

Arguments

`column_names` Character vector of column names.

`use_fallback` Logical. If TRUE, uses fallback strategy when numeric values cannot be extracted.

`fallback_type` Character. Type of fallback to use when `use_fallback = TRUE`. Options: "sequential", "ones", "zeros".

`verbose` Logical. Print information about extraction strategy used.

Details

The function uses the following extraction strategies in order:

1. Specific prefixes: "length_", "weighted_", "pond_" followed by numbers
2. Purely numeric column names
3. General pattern: extracts first number found in each name
4. Fallback: uses specified fallback strategy if previous methods fail

Value

Numeric vector of length values extracted from column names.

Examples

```
extract_numeric_values(c("length_8.5", "weighted_10", "pond_12"))
extract_numeric_values(c("8", "10.5", "12"))
extract_numeric_values(c("size_8", "data_10.5", "value_12"))
extract_numeric_values(c("length_8", "no_numbers"), use_fallback = FALSE)
extract_numeric_values(c("bad_name1", "bad_name2"), fallback_type = "ones")
```

extract_pdf_data

Extract data from PDF announcements

Description

Processes PDF files containing official fishing announcements and extracts relevant information such as dates, coordinates, and nautical miles. Handles both local files and URLs.

Usage

```
extract_pdf_data(
  pdf_sources = NULL,
  temp_dir = NULL,
  verbose = TRUE,
  max_retries = 3
)
```

Arguments

pdf_sources	Character vector of PDF file paths or URLs.
temp_dir	Temporary directory for downloaded files. If NULL, uses tempdir().
verbose	Show processing messages.
max_retries	Maximum download retries for URLs.

Value

Data frame with extracted announcement information including coordinates, dates, and nautical mile distances.

Examples

```
## Not run:
pdf_files <- c("announcement1.pdf", "announcement2.pdf")
results <- extract_pdf_data(pdf_sources = pdf_files)

pdf_urls <- c(
  "https://example.com/announcement1.pdf",
  "https://example.com/announcement2.pdf"
)
results <- extract_pdf_data(pdf_sources = pdf_urls)

## End(Not run)
```

faenas_bitacora

Fishing trips

Description

Dataset containing information about fishing trips conducted along the Peruvian littoral.

Usage

```
faenas_bitacora
```

Format

A data.frame with sample data of fishing trips made by vessels in the Peruvian sea.

Source

Randomly generated data.

Examples

```
data(faenas_bitacora)
```

`fetch_fishing_announcements`*Fetch fishing announcements from external sources*

Description

Retrieves fishing announcements from official websites within a specified date range. This function is specifically designed for PRODUCE (Peru) but can be adapted for other sources.

Usage

```
fetch_fishing_announcements(  
  start_date,  
  end_date,  
  download = FALSE,  
  download_dir = "downloads",  
  batch_size = 10,  
  verbose = TRUE,  
  source_url = NULL,  
  max_records = 5000  
)
```

Arguments

<code>start_date</code>	Start date in "dd/mm/yyyy" format.
<code>end_date</code>	End date in "dd/mm/yyyy" format.
<code>download</code>	Logical. Download PDF files.
<code>download_dir</code>	Directory for downloaded files.
<code>batch_size</code>	Records per request.
<code>verbose</code>	Print detailed information.
<code>source_url</code>	Base URL for the announcement source. Defaults to the PRODUCE page: https://consultasenlinea.produce.gob.pe/ConsultasEnLinea/consultas.web/comunicados/suspensionPreventiva
<code>max_records</code>	Maximum records to retrieve.

Value

Data frame with announcement information and download links.

Examples

```
## Not run:  
announcements <- fetch_fishing_announcements(  
  start_date = "01/01/2023",  
  end_date = "31/12/2023"
```

```
)  
  
announcements <- fetch_fishing_announcements(  
  start_date = "01/01/2023",  
  end_date = "31/01/2023",  
  download = TRUE,  
  download_dir = "announcements"  
)  
  
## End(Not run)
```

find_column	<i>Find column by pattern matching</i>
-------------	--

Description

Searches for a column in a data frame using multiple pattern options. If multiple columns match, warns the user and returns the first match.

Usage

```
find_column(patterns, column_names, verbose = FALSE)
```

Arguments

patterns	Character vector of regex patterns to search for.
column_names	Character vector of column names to search in.
verbose	Logical. If TRUE, prints detailed matching information.

Value

Integer index of the first matching column, or NULL if no match found.

Examples

```
cols <- c("codigo_faena", "numero_cala", "especie", "especies_capturadas")  
species_patterns <- c("especie", "species", "sp")  
col_index <- find_column(species_patterns, cols)
```

```
find_columns_by_pattern
```

Find columns by pattern

Description

Identifies columns in a data frame that match a specific pattern. Useful for finding length columns, weight columns, etc.

Usage

```
find_columns_by_pattern(data, pattern = "weighted_", sort = TRUE)
```

Arguments

data	Data frame to search.
pattern	Regular expression pattern to match.
sort	Logical. Sort results numerically.

Value

Character vector of matching column names.

Examples

```
# Create dummy data
data <- data.frame(
  weighted_8.5 = c(1, 2, 3),
  weighted_10 = c(4, 5, 6),
  `8` = c(7, 8, 9),
  other = c(10, 11, 12)
)

# Find weighted columns
weighted_cols <- find_columns_by_pattern(data, pattern = "weighted_")

# Find numeric-only named columns (e.g., "8")
length_cols <- find_columns_by_pattern(data, pattern = "")
```

format_extracted_data *Format extracted announcement data*

Description

Formats and filters data extracted from announcements, converting dates to proper formats and allowing filtering by date range.

Usage

```
format_extracted_data(  
  data,  
  min_date = NULL,  
  max_date = NULL,  
  convert_coordinates = TRUE  
)
```

Arguments

data	Data frame with structure from extract_pdf_data.
min_date	Minimum date for filtering (YYYY-MM-DD format or Date/POSIXct object).
max_date	Maximum date for filtering (YYYY-MM-DD format or Date/POSIXct object).
convert_coordinates	Logical. Convert DMS coordinates to decimal.

Value

Data frame with formatted and filtered announcement data.

Examples

```
## Not run:  
formatted_data <- format_extracted_data(raw_data)  
  
filtered_data <- format_extracted_data(  
  data = raw_data,  
  min_date = "2024-11-01",  
  max_date = "2024-12-31"  
)  
  
## End(Not run)
```

get_length_range	<i>Get length range from frequencies</i>
------------------	--

Description

Finds the minimum or maximum length with positive frequency.

Usage

```
get_length_range(frequency, length, type = "min")
```

Arguments

frequency	Numeric vector of length frequencies.
length	Numeric vector of corresponding lengths.
type	Either "min" or "max" to specify which range to return.

Value

Minimum or maximum length value with frequency > 0.

Examples

```
freq <- c(0, 0, 1, 2, 3, 4, 2, 1, 0)
lengths <- c(5, 6, 7, 8, 9, 10, 11, 12, 13)
min_length <- get_length_range(freq, lengths, type = "min")
max_length <- get_length_range(freq, lengths, type = "max")
```

land_points	<i>Points on land</i>
-------------	-----------------------

Description

Classifies a set of geographic coordinates (longitude and latitude) as "land" or "sea" according to their relative position to a coastline. A point is considered to be on land if its longitude is greater than that of its nearest point on the coastline.

Usage

```
land_points(
  x_point,
  y_point,
  coastline = NULL,
  parallel = FALSE,
  cores = 4,
  distance_type = "haversine",
  window = 0.5,
  unit = "nm"
)
```

Arguments

<code>x_point</code>	Numeric vector of longitudes (in decimal degrees).
<code>y_point</code>	Numeric vector of latitudes (in decimal degrees).
<code>coastline</code>	Data frame with coastline coordinates. Must have columns named Long and Lat. If NULL, uses internal dataset <code>peru_coastline</code> .
<code>parallel</code>	Logical. If TRUE, performs the calculation in parallel using multiple cores.
<code>cores</code>	Number of cores to use for parallel processing.
<code>distance_type</code>	Type of geodesic distance to use in the calculation.
<code>window</code>	Geographic window in degrees to reduce the number of coastline points to consider.
<code>unit</code>	Unit of measurement for distance: "km" or "nm".

Value

Text vector of the same length as `x_point`, indicating whether each point is on "land" or "sea". NA values are maintained as NA.

Examples

```
## Not run:
data_hauls <- process_hauls(data_hauls = calas_bitacora)
result <- land_points(
  x_point = data_hauls$lon_final,
  y_point = data_hauls$lat_final
)
table(result)

## End(Not run)
```

`merge_length_fishing_trips_hauls`*Merge fishing trips, length and hauls data*

Description

Joins data from fishing trips, length and hauls, combining catches by species, length ranges (minimum and maximum) and spatial-temporal information of each haul.

Usage

```
merge_length_fishing_trips_hauls(data_hauls, data_length_fishing_trips)
```

Arguments

`data_hauls` Data frame processed with `process_hauls()`.
`data_length_fishing_trips`
Data frame with length data by fishing trip and haul.

Value

Data frame with consolidated data from fishing trips, length and hauls.

Examples

```
## Not run:  
data_hauls <- process_hauls(data_hauls = calas_bitacora)  
data_fishing_trips <- process_fishing_trips(data_fishing_trips = faenas_bitacora)  
data_length <- process_length(data_length = tallas_bitacora)  
  
data_length_fishing_trips <- merge(  
  x = data_length,  
  y = data_fishing_trips,  
  by = "fishing_trip_code",  
  all = TRUE  
)  
  
data_total <- merge_length_fishing_trips_hauls(  
  data_hauls = data_hauls,  
  data_length_fishing_trips = data_length_fishing_trips  
)  
  
## End(Not run)
```

peru_coast_parallel *Lines parallel to the Peruvian coast*

Description

Dataset containing lines parallel to the Peruvian coast at different distances. These lines are useful for spatial analyses related to fishery management.

Usage

```
peru_coast_parallel
```

Format

A list of data.frames, each representing a line parallel to the Peruvian coast.

Each data frame contains:

lon Longitude corresponding to the isoparalittoral area

lat Latitude corresponding to the isoparalittoral area

dc Distance to coast category (10-200)

Source

Indicate the data source

Examples

```
data(peru_coast_parallel)
```

peru_coastline *Peruvian coastline*

Description

Dataset containing the coastline of Peru represented as a spatial object.

Usage

```
peru_coastline
```

Format

A data.frame with the following fields:

Long Longitude of the Peruvian coastline

Lat Latitude of the Peruvian coastline

Source

Marine Institute of Peru (IMARPE)

Examples

```
data(peru_coastline)
```

```
peru_isoparalitoral_areas  
      Isoparalittoral areas
```

Description

Dataset containing isoparalittoral areas of the Peruvian coast. These areas represent zones with similar characteristics along the littoral.

Usage

```
peru_isoparalitoral_areas
```

Format

A data.frame with the following attributes:

lon Longitude corresponding to the isoparalittoral area

lat Latitude corresponding to the isoparalittoral area

area Isoparalittoral Area code

grad Latitude category every 0.5 degrees (3 - 19.5)

dc Distance to coast category (10-200)

Source

Marine Institute of Peru (IMARPE)

Examples

```
data(peru_isoparalitoral_areas)
```

plot_fishing_zones *Plot fishing zones*

Description

Creates visualizations of fishing zones using either ggplot2 (static) or leaflet (interactive). This function consolidates all zone plotting functionality.

Usage

```
plot_fishing_zones(  
  data,  
  coastline = NULL,  
  parallels = NULL,  
  type = "static",  
  title = NULL,  
  colors = NULL,  
  show_legend = FALSE,  
  legend_title = NULL,  
  zone_labels = NULL,  
  add_grid = FALSE,  
  base_layers = FALSE,  
  minimap = FALSE  
)
```

Arguments

data	Data frame with fishing zone coordinates and metadata.
coastline	Data frame with coastline coordinates (columns "Long" and "Lat"). If NULL, uses internal dataset.
parallels	List of data frames with coast-parallel lines.
type	Plot type: "static" for ggplot2 or "interactive" for leaflet.
title	Plot title.
colors	Vector of colors for zones. If NULL, auto-generated.
show_legend	Logical. Show legend/layer control.
legend_title	Legend title.
zone_labels	Vector of custom labels for zones.
add_grid	Logical. Add coordinate grid (static only).
base_layers	Logical. Include multiple base map layers (interactive only).
minimap	Logical. Add minimap (interactive only).

Value

ggplot object (static) or leaflet object (interactive).

Examples

```
## Not run:
plot_fishing_zones(
  data = zone_data,
  coastline = coastline_data,
  type = "static",
  title = "Fishing Zones",
  show_legend = TRUE
)

plot_fishing_zones(
  data = zone_data,
  coastline = coastline_data,
  type = "interactive",
  base_layers = TRUE,
  minimap = TRUE
)

## End(Not run)
```

plot_juvenile_analysis

Plot juvenile analysis

Description

Creates comprehensive visualizations for juvenile fish analysis including bar charts, line plots, and comparative analyses. This function consolidates all juvenile plotting functionality.

Usage

```
plot_juvenile_analysis(
  data,
  x_var,
  fill_var = NULL,
  length_cols = NULL,
  a = 0.0012,
  b = 3.1242,
  x_date_breaks = NULL,
  plot_type = "bars",
  title = NULL,
  subtitle = NULL,
  sort_by = "x",
  color_palette = NULL,
  facet_var = NULL,
  facet_cols = 2,
  bar_position = "dodge",
```

```

y_limits = c(0, 100),
use_facet_wrap = TRUE,
group_by_type = TRUE,
reference_line = NULL,
theme_style = "light",
legend_position = "bottom",
rotate_x_labels = TRUE,
na_to_zero = FALSE
)

```

Arguments

<code>data</code>	Data frame with juvenile analysis data.
<code>x_var</code>	Column name for x-axis variable.
<code>fill_var</code>	Column name for fill/color variable.
<code>length_cols</code>	Vector of length frequency column names.
<code>a</code>	Length-weight relationship coefficient.
<code>b</code>	Length-weight relationship exponent.
<code>x_date_breaks</code>	Date breaks for x-axis (e.g., "1 day", "1 month").
<code>plot_type</code>	Plot type: "bars", "lines", "points", "mixed".
<code>title</code>	Plot title.
<code>subtitle</code>	Plot subtitle.
<code>sort_by</code>	Sorting method: "x", "number", "weight".
<code>color_palette</code>	Custom color palette.
<code>facet_var</code>	Variable for faceting.
<code>facet_cols</code>	Number of facet columns.
<code>bar_position</code>	Bar position: "dodge", "stack", "fill".
<code>y_limits</code>	Y-axis limits.
<code>use_facet_wrap</code>	Use facet wrap for juvenile type.
<code>group_by_type</code>	Group by juvenile type when not faceting.
<code>reference_line</code>	Reference line value (e.g., legal limit).
<code>theme_style</code>	Theme style: "classic", "minimal", "light", "dark".
<code>legend_position</code>	Legend position.
<code>rotate_x_labels</code>	Rotate x-axis labels.
<code>na_to_zero</code>	Convert NA values to zeros.

Value

ggplot object.

Examples

```
## Not run:
plot_juvenile_analysis(
  data = fishery_data,
  x_var = "date",
  length_cols = paste0("length_", seq(8, 15, 0.5))
)

plot_juvenile_analysis(
  data = fishery_data,
  x_var = "date",
  fill_var = "vessel",
  length_cols = length_columns,
  plot_type = "mixed",
  reference_line = 10,
  title = "Juvenile Analysis by Vessel and Date"
)

## End(Not run)
```

plot_zones_interactive

Generate interactive plot of polygons with leaflet

Description

Creates an interactive map using leaflet, showing polygons with popup information.

Usage

```
plot_zones_interactive(
  polygons,
  coastline,
  title,
  colors,
  show_legend = TRUE,
  labels = NULL,
  base_layers = TRUE,
  minimap = TRUE
)
```

Arguments

polygons	List of polygons. Each must have fields such as coords, announcement, dates and coordinates.
coastline	Data frame with the coastline (columns Long and Lat).
title	Title to display at the top of the map.

colors	Vector of colors. If NULL, they are automatically assigned with RColorBrewer::brewer.pal.
show_legend	Logical. If TRUE, the layers control (legend) is displayed.
labels	Optional vector of names to display in the legend and map labels.
base_layers	Logical. If TRUE, includes base layers such as satellite and ocean maps.
minimap	Logical. If TRUE, displays a minimap in the lower right corner.

Value

A leaflet object with the interactive map.

plot_zones_static *Generate static plot of polygons on a map*

Description

Creates a static plot using ggplot2 that displays geographic polygons on a coastline base. Colors are assigned by groups (announcements/labels), not individual polygons.

Usage

```
plot_zones_static(
  polygons,
  coastline,
  title,
  colors,
  show_legend = TRUE,
  name_legend = NULL,
  labels = NULL,
  add_grid = TRUE,
  theme = ggplot2::theme_minimal()
)
```

Arguments

polygons	List of polygons. Each polygon must contain a coords matrix with longitude and latitude columns.
coastline	Data frame with the coastline, with columns Long and Lat.
title	Main title of the plot.
colors	Vector of colors to fill the polygons. If NULL, colors are automatically assigned by groups.
show_legend	Logical. If TRUE, the legend is displayed.
name_legend	Name of the legend (optional). If NULL, legend has no title.
labels	Vector of labels for the polygons (optional).
add_grid	Logical. If TRUE, adds a geographic grid to the plot.
theme	ggplot2 theme to use.

Value

A ggplot object ready to be plotted.

prepare_polygons	<i>Prepare polygons from coordinate data</i>
------------------	--

Description

Helper function to process data and prepare polygons using preexisting parallel lines.

Usage

```
prepare_polygons(
  data,
  coastline,
  coast_parallels = NULL,
  column_names = c("lat", "lon", "dc")
)
```

Arguments

data	Data frame with coordinates.
coastline	Data frame with coastline.
coast_parallels	List of data frames with lines parallel to the coast.
column_names	Vector with column names in coast_parallels data frames.

Value

List of polygons for visualization.

process_fishing_trips	<i>Process fishing trip data from PRODUCE sitrapesca files</i>
-----------------------	--

Description

Processes fishing trip data from PRODUCE logbooks. Automatically detects required columns and creates standardized output with proper date conversion.

Usage

```
process_fishing_trips(data_fishing_trips, verbose = FALSE)
```

Arguments

data_fishing_trips Data frame with raw fishing trip data.
 verbose Logical. Print column mapping information.

Value

Data frame with 6 standardized columns including trip code, vessel information, and trip dates.

Examples

```
fishing_trips <- process_fishing_trips(data_fishing_trips = faenas_bitacora)
fishing_trips <- process_fishing_trips(data_fishing_trips = faenas_bitacora, verbose = TRUE)
```

process_hauls	<i>Process fishing haul data from PRODUCE sitrapesca files</i>
---------------	--

Description

Processes fishing haul data from PRODUCE logbooks. Automatically detects required columns and creates standardized output with coordinates converted to decimal degrees.

Usage

```
process_hauls(data_hauls, correct_coordinates = TRUE, verbose = FALSE)
```

Arguments

data_hauls Data frame with raw haul data.
 correct_coordinates Logical. Correct coordinate errors during conversion.
 verbose Logical. Print column mapping information.

Value

Data frame with 16 standardized columns including fishing trip code, haul number, dates, coordinates, species, and catch data.

Examples

```
processed_hauls <- process_hauls(data_hauls = calas_bitacora)
processed_hauls <- process_hauls(data_hauls = calas_bitacora, verbose = TRUE)
```

process_length	<i>Process length data from hauls</i>
----------------	---------------------------------------

Description

Processes length data from PRODUCE logbooks. Automatically detects required columns and transforms from long to wide format.

Usage

```
process_length(data_length, verbose = FALSE)
```

Arguments

data_length	Data frame with raw length data.
verbose	Logical. Print column mapping information.

Value

Data frame with length by haul in wide format with individual columns for each length class.

Examples

```
length_data <- process_length(data_length = tallas_bitacora)
length_data <- process_length(data_length = tallas_bitacora, verbose = TRUE)
```

summarize_juveniles_by_group	<i>Summarize juveniles by group</i>
------------------------------	-------------------------------------

Description

Calculates juvenile percentages by specified groups, both in number and weight. Uses modern dplyr approach for efficient processing. Can auto-detect length columns if not specified.

Usage

```
summarize_juveniles_by_group(  
  data,  
  group_cols,  
  length_cols = NULL,  
  juvenile_limit = 12,  
  a = 0.0012,  
  b = 3.1242,  
  remove_empty = TRUE,  
  verbose = FALSE  
)
```

Arguments

data	Data frame with length frequency data.
group_cols	Vector of column names for grouping.
length_cols	Vector of length column names or indices. If NULL, auto-detection is attempted.
juvenile_limit	Length threshold for juveniles.
a	Coefficient of length-weight relationship.
b	Exponent of length-weight relationship.
remove_empty	Logical. Remove groups with no data.
verbose	Logical. Print information about detected columns.

Value

Data frame with juvenile statistics by group.

Examples

```
## Not run:
juvenile_summary <- summarize_juveniles_by_group(
  data = fishery_data,
  group_cols = "date",
  juvenile_limit = 12
)

## End(Not run)
```

tallas_bitacora	<i>Length data sampled from hauls made by vessels in the Peruvian sea.</i>
-----------------	--

Description

Dataset containing information about lengths of marine species captured along the Peruvian littoral.

Usage

```
tallas_bitacora
```

Format

A data.frame with sample data of lengths sampled from hauls made by vessels in the Peruvian sea.

Source

Indicate the data source

Examples

```
data(tallas_bitacora)
```

validate_fishing_trip_data *Validate processed fishing trip data quality*

Description

Validates data quality metrics for processed fishing trip data.

Usage

```
validate_fishing_trip_data(processed_trips)
```

Arguments

processed_trips
Data frame returned by process_fishing_trips().

Value

List with data quality metrics including completeness scores and issue counts.

validate_haul_data *Validate processed haul data quality*

Description

Validates data quality metrics for processed haul data.

Usage

```
validate_haul_data(processed_hauls)
```

Arguments

processed_hauls
Data frame returned by process_hauls().

Value

List with data quality metrics including completeness scores and issue counts.

validate_length_data *Validate processed length data quality*

Description

Validates data quality metrics for processed length data.

Usage

```
validate_length_data(processed_length)
```

Arguments

processed_length
Data frame returned by process_length().

Value

List with data quality metrics including completeness scores and distribution statistics.

validate_polygon_data *Validate data for polygon creation*

Description

Validates that a data frame contains the necessary columns for creating fishing zone polygons. Checks for either coordinate-based or distance-based polygon definition data.

Usage

```
validate_polygon_data(data)
```

Arguments

data Data frame to validate. Must contain polygon definition columns.

Details

The function requires either:

- Coordinate-based: StartLatitude, EndLatitude, StartLongitude, EndLongitude
- Distance-based: StartLatitude, EndLatitude, StartNauticalMiles, EndNauticalMiles

Value

Returns TRUE invisibly if validation passes, otherwise throws an error.

Examples

```
# Coordinate-based polygon data
coord_data <- data.frame(
  StartLatitude = "15 30 S",
  EndLatitude = "15 45 S",
  StartLongitude = "75 30 W",
  EndLongitude = "75 45 W"
)
validate_polygon_data(coord_data)

# Distance-based polygon data
distance_data <- data.frame(
  StartLatitude = "15 30 S",
  EndLatitude = "15 45 S",
  StartNauticalMiles = 5,
  EndNauticalMiles = 15
)
validate_polygon_data(distance_data)
```

weight_by_catch

Weight length frequencies by total catch

Description

Scales observed length frequencies based on total recorded catch using length-weight relationship.

Usage

```
weight_by_catch(frequency, catch, length, a, b, silence_warnings = FALSE)
```

Arguments

frequency	Numeric vector of observed length frequencies.
catch	Total catch amount (in kg or tons).
length	Numeric vector of lengths corresponding to frequencies.
a	Coefficient of the length-weight relationship.
b	Exponent of the length-weight relationship.
silence_warnings	Logical. Suppress warning messages.

Details

Catch weighting is used to estimate the size composition of catches when only sub-samples are measured for length frequency analysis.

Value

Numeric vector of weighted frequencies.

References

IMARPE (2020). Protocolo Elaboración de la Tabla de Decisión para la determinación del Límite Máximo Total Permisible por temporada de pesca en la pesquería del stock norte-centro de la anchoveta peruana. IMP-DGIRP/AFDPERP, Edición: 05, Revisión 00, 40p.

Index

* datasets

- calas_bitacora, [5](#)
- faenas_bitacora, [16](#)
- peru_coast_parallelles, [24](#)
- peru_coastline, [24](#)
- peru_isoparalitoral_areas, [25](#)
- tallas_bitacora, [34](#)

[add_variables](#), [3](#)

[apply_catch_weighting](#), [4](#)

[calas_bitacora](#), [5](#)

[calculate_distances_vectorized](#), [6](#)

[calculate_fish_weight](#), [7](#)

[calculate_juvenile_percentage](#), [7](#)

[calculate_juvenile_statistics](#), [8](#)

[coast_distance](#), [9](#)

[convert_numbers_to_weight](#), [10](#)

[convert_to_date](#), [11](#)

[create_fishery_dashboard](#), [12](#)

[dms_to_decimal](#), [13](#)

[extract_numeric_values](#), [14](#)

[extract_pdf_data](#), [15](#)

[faenas_bitacora](#), [16](#)

[fetch_fishing_announcements](#), [17](#)

[find_column](#), [18](#)

[find_columns_by_pattern](#), [19](#)

[format_extracted_data](#), [20](#)

[get_length_range](#), [21](#)

[land_points](#), [21](#)

[merge_length_fishing_trips_hauls](#), [23](#)

[peru_coast_parallelles](#), [24](#)

[peru_coastline](#), [24](#)

[peru_isoparalitoral_areas](#), [25](#)

[plot_fishing_zones](#), [26](#)

[plot_juvenile_analysis](#), [27](#)

[plot_zones_interactive](#), [29](#)

[plot_zones_static](#), [30](#)

[prepare_polygons](#), [31](#)

[process_fishing_trips](#), [31](#)

[process_hauls](#), [32](#)

[process_length](#), [33](#)

[summarize_juveniles_by_group](#), [33](#)

[tallas_bitacora](#), [34](#)

[validate_fishing_trip_data](#), [35](#)

[validate_haul_data](#), [35](#)

[validate_length_data](#), [36](#)

[validate_polygon_data](#), [36](#)

[weight_by_catch](#), [37](#)