

Package ‘galah’

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Type Package

Title Biodiversity Data from the GBIF Node Network

Version 2.1.0

Description The Global Biodiversity Information Facility ('GBIF', <<https://www.gbif.org>>) sources data from an international network of data providers, known as 'nodes'. Several of these nodes - the "living atlases" (<<https://living-atlases.gbif.org>>) - maintain their own web services using software originally developed by the Atlas of Living Australia ('ALA', <<https://www.ala.org.au>>). 'galah' enables the R community to directly access data and resources hosted by 'GBIF' and its partner nodes.

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apply_profile	<i>Apply a data quality profile</i>
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Description

A 'profile' is a group of filters that are pre-applied by the ALA. Using a data profile allows a query to be filtered quickly to the most relevant or quality-assured data that is fit-for-purpose. For example, the "ALA" profile is designed to exclude lower quality records, whereas other profiles apply filters specific to species distribution modelling (e.g. CDSM).

Note that only one profile can be loaded at a time; if multiple profiles are given, the first valid profile is used.

For more bespoke editing of filters within a profile, use `filter.data_request()`.

Usage

```
apply_profile(.data, ...)
```

```
galah_apply_profile(...)
```

Arguments

`.data` An object of class `data_request`

`...` a profile name. Should be a string - the name or abbreviation of a data quality profile to apply to the query. Valid values can be seen using `show_all(profiles)`

Value

An updated `data_request` with a completed `data_profile` slot.

See Also

[show_all\(\)](#) and [search_all\(\)](#) to look up available data profiles. [filter.data_request\(\)](#) can be used for more bespoke editing of individual data profile filters.

Examples

```
## Not run:
# Apply a data quality profile to a query
galah_call() |>
  identify("reptilia") |>
  filter(year == 2021) |>
  apply_profile(ALA) |>
  atlas_counts()

## End(Not run)
```

`arrange.data_request` *Order rows using column values*

Description**[Experimental]**

`arrange.data_request()` arranges rows of a query on the server side, meaning that the query is constructed in such a way that information will be arranged when the query is processed. This only has an effect when used in combination with [count\(\)](#) and [group_by\(\)](#). The benefit of using `arrange()` within a `galah_call()` pipe is that it is sometimes beneficial to choose a non-default order for data to be delivered in, particularly if [slice_head\(\)](#) is also called.

Usage

```
## S3 method for class 'data_request'
arrange(.data, ...)

## S3 method for class 'metadata_request'
arrange(.data, ...)
```

Arguments

<code>.data</code>	An object of class <code>data_request</code>
<code>...</code>	A variable to arrange the resulting tibble by. Should be one of the variables also listed in <code>group_by()</code> .

Value

An amended `data_request` with a completed arrange slot.

Examples

```
## Not run:

# Arrange grouped counts by ascending year
galah_call() |>
  identify("Crinia") |>
  filter(year >= 2020) |>
  group_by(year) |>
  arrange(year) |>
  count() |>
  collect()

# Arrange grouped counts by ascending record count
galah_call() |>
  identify("Crinia") |>
  filter(year >= 2020) |>
  group_by(year) |>
  arrange(count) |>
  count() |>
  collect()

# Arrange grouped counts by descending year
galah_call() |>
  identify("Crinia") |>
  filter(year >= 2020) |>
  group_by(year) |>
  arrange(desc(year)) |>
  count() |>
  collect()

## End(Not run)
```

Description

If a `data.frame` was generated using `atlas_occurrences()`, and the `mint_doi` argument was set to `TRUE`, the DOI associated with that dataset is appended to the resulting `data.frame` as an attribute. This function simply formats that DOI as a citation that can be included in a scientific publication. Please also consider citing this package, using the information in `citation("galah")`.

Usage

```
atlas_citation(data)
```

Arguments

`data` `data.frame`: occurrence data generated by `atlas_occurrences()`

Value

A string containing the citation for that dataset.

Examples

```
## Not run:  
atlas_citation(doi)  
  
## End(Not run)
```

`collapse.data_request` *Generate a query*

Description

`collapse()` constructs a valid query so it can be inspected before being sent. It typically occurs at the end of a pipe, traditionally begun with `galah_call()`, that is used to define a query. As of version 2.0, objects of class `data_request` (created using `request_data()`), `metadata_request` (from `request_metadata()`) or `files_request` (from `request_files()`) are all supported by `collapse()`. Any of these objects can be created using `galah_call()` via the `method` argument.

Usage

```
## S3 method for class 'data_request'  
collapse(x, ..., mint_doi, .expand = FALSE)  
  
## S3 method for class 'metadata_request'  
collapse(x, .expand = FALSE, ...)  
  
## S3 method for class 'files_request'  
collapse(x, thumbnail = FALSE, ...)
```

Arguments

x	An object of class data_request, metadata_request or files_request
...	Arguments passed on to other methods
mint_doi	Logical: should a DOI be minted for this download? Only applies to type = "occurrences" when atlas chosen is "ALA".
.expand	Logical: should the query_set be returned? This object shows all the requisite data needed to process the supplied query. Defaults to FALSE; if TRUE will append the query_set to an extra slot in the query object.
thumbnail	Logical: should thumbnail-size images be returned? Defaults to FALSE, indicating full-size images are required.

Value

An object of class query, which is a list-like object containing at least the slots type and url.

collect.data_request *Retrieve a database query*

Description

collect() attempts to retrieve the result of a query from the selected API.

Usage

```
## S3 method for class 'data_request'
collect(x, ..., wait = TRUE, file = NULL)

## S3 method for class 'metadata_request'
collect(x, ...)

## S3 method for class 'files_request'
collect(x, ...)

## S3 method for class 'query'
collect(x, ..., wait = TRUE, file = NULL)

## S3 method for class 'computed_query'
collect(x, ..., wait = TRUE, file = NULL)
```

Arguments

x	An object of class data_request, metadata_request or files_request (from galah_call()); or an object of class query_set or query (from collapse() or compute())
...	Arguments passed on to other methods

wait	logical; should galah wait for a response? Defaults to FALSE. Only applies for type = "occurrences" or "species".
file	(Optional) file name. If not given, will be set to data with date and time added. The file path (directory) is always given by galah_config()\$package\$directory.

Value

In most cases, collect() returns a tibble containing requested data. Where the requested data are not yet ready (i.e. for occurrences when wait is set to FALSE), this function returns an object of class query that can be used to recheck the download at a later time.

collect_media	<i>Collect media files</i>
---------------	----------------------------

Description

This function downloads full-sized or thumbnail images and media files using information from atlas_media to a local directory.

Usage

```
collect_media(df, thumbnail = FALSE, path)
```

Arguments

df	tibble: returned by atlas_media() or a pipe starting with request_data(type = "media").
thumbnail	logical: If TRUE will download small thumbnail-sized images, rather than full size images (default).
path	string: [Deprecated] Use galah_config(directory = "path-to-directory") instead. Supply a path to a local folder/directory where downloaded media will be saved to.

Value

Invisibly returns a tibble listing the number of files downloaded, grouped by their HTML status codes. Primarily called for the side effect of downloading available image & media files to a user local directory.

Examples

```
## Not run:
# Use `atlas_media()` to return a `tibble` of records that contain media
x <- galah_call() |>
  identify("perameles") |>
  filter(year == 2015) |>
  atlas_media()
```

```

# To download media files, add `collect_media()` to the end of a query
galah_config(directory = "media_files")
collect_media(x)

#' # post version 2.0, it is possible to run all steps in sequence
# first, get occurrences, making sure to include media fields:
occurrences_df <- request_data() |>
  identify("Regent Honeyeater") |>
  filter(!is.na(images), year == 2011) |>
  select(group = "media") |>
  collect()

# second, get media metadata
media_info <- request_metadata() |>
  filter(media == occurrences_df) |>
  collect()

# the two steps above + `right_join()` are synonymous with `atlas_media()`
# third, get images
request_files() |>
  filter(media == media_df) |>
  collect(thumbnail = TRUE)
# step three is synonymous with `collect_media()`

## End(Not run)

```

compute.data_request *Compute a query*

Description

compute() is useful for several purposes. It's original purpose is to send a request for data, which can then be processed by the server and retrieved at a later time (via collect()).

Usage

```

## S3 method for class 'data_request'
compute(x, ...)

## S3 method for class 'metadata_request'
compute(x, ...)

## S3 method for class 'files_request'
compute(x, ...)

## S3 method for class 'query'
compute(x, ...)

```


Arguments

x An object of class `data_request`, `metadata_request` or `files_request` (i.e. constructed using a pipe) or `query` (i.e. constructed by `collapse()`)

... Arguments passed on to other methods

Value

An object of class `computed_query`, which is identical to class `query` except for occurrence data, where it also contains information on the status of the request.

count.data_request *Count the observations in each group*

Description

`count()` lets you quickly count the unique values of one or more variables. It is evaluated lazily.

Usage

```
## S3 method for class 'data_request'
count(x, ..., wt, sort, name)
```

Arguments

x An object of class `data_request`, created using `galah_call()`

... currently ignored

wt currently ignored

sort currently ignored

name currently ignored

filter.data_request *Keep rows that match a condition*

Description

The `filter()` function is used to subset a data, retaining all rows that satisfy your conditions. To be retained, the row must produce a value of `TRUE` for all conditions. Unlike 'local' filters that act on a tibble, the `galah` implementations work by amending a query which is then enacted by `collect()` or one of the `atlas_` family of functions (such as `atlas_counts()` or `atlas_occurrences()`).

Usage

```
## S3 method for class 'data_request'
filter(.data, ...)

## S3 method for class 'metadata_request'
filter(.data, ...)

## S3 method for class 'files_request'
filter(.data, ...)

galah_filter(..., profile = NULL)
```

Arguments

.data	An object of class <code>data_request</code> , <code>metadata_request</code> or <code>files_request</code> , created using <code>galah_call()</code> or related functions.
...	Expressions that return a logical value, and are defined in terms of the variables in the selected atlas (and checked using <code>show_all(fields)</code>). If multiple expressions are included, they are combined with the <code>&</code> operator. Only rows for which all conditions evaluate to <code>TRUE</code> are kept.
profile	[Deprecated] Use <code>galah_apply_profile</code> instead.

Details*Syntax*

`filter.data_request()` and `galah_filter()` uses non-standard evaluation (NSE), and are designed to be as compatible as possible with `dplyr::filter()` syntax. Permissible examples include:

- `==` (e.g. `year == 2020`) but not `=` (for consistency with `dplyr`)
- `!=`, e.g. `year != 2020`)
- `>` or `>=` (e.g. `year >= 2020`)
- `<` or `<=` (e.g. `year <= 2020`)
- OR statements (e.g. `year == 2018 | year == 2020`)
- AND statements (e.g. `year >= 2000 & year <= 2020`)

Some general tips:

- Separating statements with a comma is equivalent to an AND statement; Ergo `filter(year >= 2010 & year < 2020)` is the same as `_filter(year >= 2010, year < 2020)`.
- All statements must include the field name; so `filter(year == 2010 | year == 2021)` works, as does `filter(year == c(2010, 2021))`, but `filter(year == 2010 | 2021)` fails.
- It is possible to use an object to specify required values, e.g. `year_value <- 2010; filter(year > year_value)`.
- `solr` supports range queries on text as well as numbers; so `filter(cl22 >= "Tasmania")` is valid.

- It is possible to filter by 'assertions', which are statements about data validity, such as `filter(assertions != c("INVA"))`. Valid assertions can be found using `show_all(assertions)`.

Exceptions

When querying occurrences, species, or their respective counts (i.e. all of the above examples), field names are checked internally against `show_all(fields)`. There are some cases where bespoke field names are required, as follows.

When requesting a data download from a DOI, the field `doi` is valid, i.e.:

```
galah_call() |>
  filter(doi = "a-long-doi-string") |>
  collect()
```

For taxonomic metadata, the `taxa` field is valid:

```
request_metadata() |>
  filter(taxa == "Chordata") |>
  unnest()
```

For building taxonomic trees, the `rank` field is valid:

```
request_data() |>
  identify("Chordata") |>
  filter(rank == "class") |>
  atlas_taxonomy()
```

Media queries are more involved, but break two rules: they accept the `media` field, and they accept a tibble on the rhs of the equation. For example, users wishing to break down media queries into their respective API calls should begin with an occurrence query:

```
occurrences <- galah_call() |>
  identify("Litoria peronii") |>
  select(group = c("basic", "media")) |>
  collect()
```

They can then use the `media` field to request media metadata:

```
media_metadata <- galah_call("metadata") |>
  filter(media == occurrences) |>
  collect()
```

And finally, the metadata tibble can be used to request files:

```
galah_call("files") |>
  filter(media == media_metadata) |>
  collect()
```

Value

A tibble containing filter values.

See Also

[select\(\)](#), [group_by\(\)](#) and [geolocate\(\)](#) for other ways to amend the information returned by [atlas_\(\)](#) functions. Use [search_all\(fields\)](#) to find fields that you can filter by, and [show_values\(\)](#) to find what values of those filters are available.

Examples

```
## Not run:
galah_call() |>
  filter(year >= 2019,
         basisOfRecord == "HumanObservation") |>
  count() |>
  collect()

## End(Not run)
```

galah_call

Start building a query

Description

To download data from the selected atlas, one must construct a query. This query tells the atlas API what data to download and return, as well as how it should be filtered. Using `galah_call()` allows you to build a piped query to download data, in the same way that you would wrangle data with `dplyr` and the tidyverse.

Usage

```
galah_call(method = c("data", "metadata", "files"), type, ...)

request_data(
  type = c("occurrences", "occurrences-count", "occurrences-doi", "species",
          "species-count"),
  ...
)

request_metadata(
  type = c("fields", "apis", "assertions", "atlases", "collections", "datasets",
          "licences", "lists", "media", "profiles", "providers", "ranks", "reasons", "taxa",
          "identifiers")
)

request_files(type = "media")
```

Arguments

method	string: what request function should be called. Should be one of "data" (default), "metadata" or "files"
type	string: what form of data should be returned? Acceptable values are specified by the corresponding request function
...	Zero or more arguments passed to <code>collapse()</code> to alter a query. Currently only <code>mint.doi</code> (for occurrences) and <code>thumbnail</code> (for media downloads) are supported. Both are logical.

Details

In practice, `galah_call()` is a wrapper to a group of underlying `request_` functions, selected using the `method` argument. Each of these functions can begin a piped query and end with `collapse()`, `compute()` or `collect()`, or optionally one of the `atlas_` family of functions. For more details see the object-oriented programming vignette: `vignette("object_oriented_programming", package = "galah")`

Accepted values of the `type` argument are set by the underlying `request_` functions. While all accepted types can be set directly, some are affected by later functions. The most common example is that adding `count()` to a pipe updates `type`, converting `type = "occurrences"` to `type = "occurrences-count"` (and ditto for `type = "species"`).

The underlying `request_` functions are useful because they allow `galah` to separate different types of requests to perform better. For example, `filter.data_request` translates filters in R to `solr`, whereas `filter.metadata_request` searches using a search term.

Value

Each sub-function returns a different object class: `request_data()` returns `data_request`. `request_metadata` returns `metadata_request`, `request_files()` returns `files_request`. These objects are list-like and contain the following slots:

- `filter`: edit by piping `filter()` or `galah_filter()`.
- `select`: edit by piping `select` or `galah_select()`.
- `group_by`: edit by piping `group_by()` or `galah_group_by()`.
- `identify`: edit by piping `identify()` or `galah_identify()`.
- `geolocate`: edit by piping `st_crop()`, `galah_geolocate()`, `galah_polygon()` or `galah_bbox()`.
- `limit`: edit by piping `slice_head()`.
- `doi`: edit by piping `filter(doi == "my-doi-here")`.

See Also

`collapse.data_request()`, `compute.data_request()`, `collect.data_request()`

Examples

```

## Not run:
# Begin your query with `galah_call()`, then pipe using `%>%` or `|>`

# Get number of records of *Aves* from 2001 to 2004 by year
galah_call() |>
  identify("Aves") |>
  filter(year > 2000 & year < 2005) |>
  group_by(year) |>
  atlas_counts()

# Get information for all species in *Cacatuidae* family
galah_call() |>
  identify("Cacatuidae") |>
  atlas_species()

# Download records of genus *Eolophus* from 2001 to 2004
galah_config(email = "your-email@email.com")

galah_call() |>
  identify("Eolophus") |>
  filter(year > 2000 & year < 2005) |>
  atlas_occurrences() # synonymous with `collect()`

# galah_call() is a wrapper to various `request_` functions.
# These can be called directly for greater specificity.

# Get number of records of *Aves* from 2001 to 2004 by year
request_data() |>
  identify("Aves") |>
  filter(year > 2000 & year < 2005) |>
  group_by(year) |>
  count() |>
  collect()

# Get information for all species in *Cacatuidae* family
request_data(type = "species") |>
  identify("Cacatuidae") |>
  collect()

# Get metadata information about supported atlases in galah
request_metadata(type = "atlases") |>
  collect()

## End(Not run)

```

Description

The `galah` package supports large data downloads, and also interfaces with the ALA which requires that users of some services provide a registered email address and reason for downloading data. The `galah_config` function provides a way to manage these issues as simply as possible.

Usage

```
galah_config(...)
```

Arguments

...

Options can be defined using the form `name = "value"`. Valid arguments are:

- `api-key` string: A registered API key (currently unused).
- `atlas` string: Living Atlas to point to, Australia by default. Can be an organisation name, acronym, or region (see [show_all_atlases\(\)](#) for admissible values)
- `directory` string: the directory to use for the cache. By default this is a temporary directory, which means that results will only be cached within an R session and cleared automatically when the user exits R. The user may wish to set this to a non-temporary directory for caching across sessions. The directory must exist on the file system.
- `download_reason_id` numeric or string: the "download reason" required by some ALA services, either as a numeric ID (currently 0–13) or a string (see `show_all(reasons)` for a list of valid ID codes and names). By default this is NA. Some ALA services require a valid `download_reason_id` code, either specified here or directly to the associated R function.
- `email` string: An email address that has been registered with the chosen atlas. For the ALA, you can register at [this address](#).
- `password` string: A registered password (GBIF only)
- `run_checks` logical: should `galah` run checks for filters and columns. If making lots of requests sequentially, checks can slow down the process and lead to HTTP 500 errors, so should be turned off. Defaults to TRUE.
- `send_email` logical: should you receive an email for each query to [atlas_occurrences\(\)](#)? Defaults to FALSE; but can be useful in some instances, for example for tracking DOIs assigned to specific downloads for later citation.
- `username` string: A registered username (GBIF only)
- `verbose` logical: should `galah` give verbose such as progress bars? Defaults to FALSE.

Value

For `galah_config()`, a list of all options. When `galah_config(...)` is called with arguments, nothing is returned but the configuration is set.

Examples

```
## Not run:
# To download occurrence records, enter your email in `galah_config()`.
# This email should be registered with the atlas in question.
galah_config(email = "your-email@email.com")

# Turn on caching in your session
galah_config(caching = TRUE)

# Some ALA services require that you add a reason for downloading data.
# Add your selected reason using the option `download_reason_id`
galah_config(download_reason_id = 0)

# To look up all valid reasons to enter, use `show_all(reasons)`
show_all(reasons)

# Make debugging in your session easier by setting `verbose = TRUE`
galah_config(verbose = TRUE)

## End(Not run)
```

geolocate

Narrow a query to within a specified area

Description

Restrict results to those from a specified area. Areas can be specified as either polygons or bounding boxes, depending on type. Alternatively, users can call the underlying functions directly via `galah_polygon()`, `galah_bbox()` or `galah_radius()`. It is possible to use `sf` syntax by calling `st_crop()`, which is synonymous with `galah_polygon()`.

Use a polygon If calling `galah_geolocate()`, the default type is "polygon", which narrows queries to within an area supplied as a POLYGON or MULTIPOLYGON. Polygons must be specified as either an `sf` object, a 'well-known text' (WKT) string, or a shapefile. Shapefiles must be simple to be accepted by the ALA.

Use a bounding box Alternatively, set `type = "bbox"` to narrow queries to within a bounding box. Bounding boxes can be extracted from a supplied `sf` object or a shapefile. A bounding box can also be supplied as a `bbox` object (via `sf::st_bbox()`) or a `tibble/data.frame`.

[Experimental] Use a point radius Alternatively, set `type = "radius"` to narrow queries to within a circular area around a specific point location. Point coordinates can be supplied as latitude/longitude coordinate numbers or as an `sf` object (`sf_c_POINT`). Area is supplied as a radius in kilometres. Default radius is 10 km.

Usage

```
geolocate(..., type = c("polygon", "bbox", "radius"))
```

```
galah_geolocate(..., type = c("polygon", "bbox", "radius"))
```



```
galah_polygon(...)

galah_bbox(...)

galah_radius(...)

## S3 method for class 'data_request'
st_crop(x, y, ...)
```

Arguments

...	For <code>st_crop</code> , additional arguments (currently ignored). Otherwise a single <code>sf</code> object, WKT string or shapefile. Bounding boxes can be supplied as a <code>tibble/data.frame</code> or a <code>bbox</code>
<code>type</code>	string: one of <code>c("polygon", "bbox")</code> . Defaults to <code>"polygon"</code> . If <code>type = "polygon"</code> , a multipolygon will be built via <code>galah_polygon()</code> . If <code>type = "bbox"</code> , a multipolygon will be built via <code>galah_bbox()</code> . The multipolygon is used to narrow a query to the ALA.
<code>x</code>	An object of class <code>data_request</code> , created using <code>galah_call()</code>
<code>y</code>	A valid Well-Known Text string (<code>wkt</code>), a <code>POLYGON</code> or a <code>MULTIPOLYGON</code>

Details

If `type = "polygon"`, WKT strings longer than 10000 characters and `sf` objects with more than 500 vertices will not be accepted by the ALA. Some polygons may need to be simplified. If `type = "bbox"`, `sf` objects and shapefiles will be converted to a bounding box to query the ALA. If `type = "radius"`, `sfc_POINT` objects will be converted to lon/lat coordinate numbers to query the ALA. Default radius is 10 km.

Value

If `type = "polygon"` or `type = "bbox"`, length-1 string (class character) containing a multipolygon WKT string representing the area provided. If `type = "radius"`, list of lat, long and radius values.

Examples

```
## Not run:
# Search for records within a polygon using a shapefile
location <- sf::st_read("path/to/shapefile.shp")
galah_call() |>
  identify("vulpes") |>
  geolocate(location) |>
  count() |>
  collect()

# Search for records within the bounding box of a shapefile
location <- sf::st_read("path/to/shapefile.shp")
```

```
galah_call() |>
  identify("vulpes") |>
  geolocate(location, type = "bbox") |>
  count() |>
  collect()

# Search for records within a polygon using an `sf` object
location <- "POLYGON((142.3 -29.0,142.7 -29.1,142.7 -29.4,142.3 -29.0))" |>
  sf::st_as_sfc()
galah_call() |>
  identify("reptilia") |>
  galah_polygon(location) |>
  count() |>
  collect()

# Search for records using a Well-known Text string (WKT)
wkt <- "POLYGON((142.3 -29.0,142.7 -29.1,142.7 -29.4,142.3 -29.0))"
galah_call() |>
  identify("vulpes") |>
  st_crop(wkt) |>
  count() |>
  collect()

# Search for records within the bounding box extracted from an `sf` object
location <- "POLYGON((142.3 -29.0,142.7 -29.1,142.7 -29.4,142.3 -29.0))" |>
  sf::st_as_sfc()
galah_call() |>
  identify("vulpes") |>
  galah_geolocate(location, type = "bbox") |>
  count() |>
  collect()

# Search for records using a bounding box of coordinates
b_box <- sf::st_bbox(c(xmin = 143, xmax = 148, ymin = -29, ymax = -28),
  crs = sf::st_crs("WGS84"))
galah_call() |>
  identify("reptilia") |>
  galah_geolocate(b_box, type = "bbox") |>
  count() |>
  collect()

# Search for records using a bounding box in a `tibble` or `data.frame`
b_box <- tibble::tibble(xmin = 148, ymin = -29, xmax = 143, ymax = -21)
galah_call() |>
  identify("vulpes") |>
  galah_geolocate(b_box, type = "bbox") |>
  count() |>
  collect()

# Search for records within a radius around a point's coordinates
galah_call() |>
  identify("manorina melanocephala") |>
  galah_geolocate(lat = -33.7,
```

```

        lon = 151.3,
        radius = 5,
        type = "radius") |>
count() |>
collect()

# Search for records with a radius around an `sf_POINT` object
point <- sf::st_sfc(sf::st_point(c(-33.66741, 151.3174)), crs = 4326)
galah_call() |>
  identify("manorina melanocephala") |>
  galah_geolocate(point,
                 radius = 5,
                 type = "radius") |>
count() |>
collect()

## End(Not run)

```

group_by.data_request *Group by one or more variables*

Description

Most data operations are done on groups defined by variables. `group_by()` takes a query and adds a grouping variable that can be used in combination with `count()` to give information on number of occurrences per level of that variable.

Usage

```

## S3 method for class 'data_request'
group_by(.data, ...)

galah_group_by(...)

```

Arguments

<code>.data</code>	An object of class <code>data_request</code>
<code>...</code>	Zero or more individual column names to include

Value

If any arguments are provided, returns a `data.frame` with columns name and type, as per `select.data_request()`.

Examples

```

## Not run:
galah_call() |>
  group_by(basisOfRecord) |>
  counts() |>

```

```
collect()

## End(Not run)
```

identify.data_request *Narrow a query by passing taxonomic identifiers*

Description

When conducting a search or creating a data query, it is common to identify a known taxon or group of taxa to narrow down the records or results returned. `identify()` is used to identify taxa you want returned in a search or a data query. Users to pass scientific names or taxonomic identifiers with pipes to provide data only for the biological group of interest.

It is good to use [search_taxa\(\)](#) and [search_identifiers\(\)](#) first to check that the taxa you provide to `galah_identify()` return the correct results.

Usage

```
## S3 method for class 'data_request'
identify(x, ...)

## S3 method for class 'metadata_request'
identify(x, ...)

galah_identify(..., search = NULL)
```

Arguments

<code>x</code>	An object of class <code>metadata_request</code> , created using request_metadata()
<code>...</code>	One or more scientific names.
<code>search</code>	[Deprecated] <code>galah_identify()</code> now always does a search to verify search terms; ergo this argument is ignored.

Value

A tibble containing identified taxa.

See Also

[filter\(\)](#) or [geolocate\(\)](#) for other ways to filter a query. You can also use [search_taxa\(\)](#) to check that supplied names are being matched correctly on the server-side; see [taxonomic_searches](#) for a detailed overview.

Examples

```
## Not run:
# Use `galah_identify()` to narrow your queries
galah_call() |>
  identify("Eolophus") |>
  count() |>
  collect()

# If you know a valid taxon identifier, use `filter()` instead.
id <- "https://biodiversity.org.au/afd/taxa/009169a9-a916-40ee-866c-669ae0a21c5c"
galah_call() |>
  filter(lsid == id) |>
  count() |>
  collect()

## End(Not run)
```

print_galah_objects *Print galah objects*

Description

As of version 2.0, galah supports several bespoke object types. Classes `data_request`, `metadata_request` and `files_request` are for starting pipes to download different types of information. These objects are parsed using `collapse()` into a query object, which contains one or more URLs necessary to return the requested information. This object is then passed to `compute()` and/or `collect()`. Finally, `galah_config()` creates an object of class `galah_config` which (unsurprisingly) stores configuration information.

Usage

```
## S3 method for class 'data_request'
print(x, ...)

## S3 method for class 'files_request'
print(x, ...)

## S3 method for class 'metadata_request'
print(x, ...)

## S3 method for class 'query'
print(x, ...)

## S3 method for class 'computed_query'
print(x, ...)

## S3 method for class 'query_set'
print(x, ...)
```

```
## S3 method for class 'galah_config'
print(x, ...)
```

Arguments

x an object of the appropriate class
 ... Arguments to be passed to or from other methods

Value

Print does not return an object; instead it prints a description of the object to the console

Examples

```
## Not run:
# The most common way to start a pipe is with `galah_call()`
# later functions update the `data_request` object
galah_call() |> # same as calling `request_data()`
  filter(year >= 2020) |>
  group_by(year) |>
  count()

# Metadata requests are formatted in a similar way
request_metadata() |>
  filter(field == basisOfRecord) |>
  unnest()

# Queries are converted into a `query_set` by `collapse()`
x <- galah_call() |> # same as calling `request_data()`
  filter(year >= 2020) |>
  count() |>
  collapse()
print(x)

# Each `query_set` contains one or more `query` objects
x[[3]]

## End(Not run)
```

search_all

Search for record information

Description

The living atlases store a huge amount of information, above and beyond the occurrence records that are their main output. In *galah*, one way that users can investigate this information is by searching for a specific option or category for the type of information they are interested in. Functions prefixed

with search_ do this, displaying any matches to a search term within the valid options for the information specified by the suffix.

For more information about taxonomic searches using search_taxa(), see ?taxonomic_searches.

[Stable] search_all() is a helper function that can do searches for multiple types of information, acting as a wrapper around many search_ sub-functions. See Details (below) for accepted values.

Usage

search_all(type, query)

search_assertions(query)

search_apis(query)

search_atlases(query)

search_collections(query)

search_datasets(query)

search_fields(query)

search_identifiers(...)

search_licences(query)

search_lists(query)

search_profiles(query)

search_providers(query)

search_ranks(query)

search_reasons(query)

search_taxa(...)

Arguments

type	A string to specify what type of parameters should be searched.
query	A string specifying a search term. Searches are not case-sensitive.
...	A set of strings or a tibble to be queried; see Details.

Details

There are five categories of information, each with their own specific sub-functions to look-up each type of information. The available types of information for search_all() are:

Category	Type	Description	Sub-fun
configuration	atlases	Search for what atlases are available	search_
	apis	Search for what APIs & functions are available for each atlas	search_
	reasons	Search for what values are acceptable as 'download reasons' for a specified atlas	search_
taxonomy	taxa	Search for one or more taxonomic names	search_
	identifiers	Take a universal identifier and return taxonomic information	search_
	ranks	Search for valid taxonomic ranks (e.g. Kingdom, Class, Order, etc.)	search_
filters	fields	Search for fields that are stored in an atlas	search_
	assertions	Search for results of data quality checks run by each atlas	search_
	licenses	Search for copyright licences applied to media	search_
group filters	profiles	Search for what data profiles are available	search_
	lists	Search for what species lists are available	search_
data providers	providers	Search for which institutions have provided data	search_
	collections	Search for the specific collections within those institutions	search_
	datasets	Search for the data groupings within those collections	search_

Value

An object of class `tbl_df` and `data.frame` (aka a tibble) containing all data that match the search query.

See Also

Use the `show_all()` function and `show_all_()` sub-functions to show available options of information. These functions are used to pass valid arguments to `filter()`, `select()`, and related functions. Taxonomic queries are somewhat more involved; see [taxonomic_searches](#) for details.

Examples

```
## Not run:
# Search for fields that include the word "date"
search_all(fields, "date")

# Search for fields that include the word "marine"
search_all(fields, "marine")

# Search using a single taxonomic term
# (see `?search_taxa()` for more information)
search_all(taxa, "Reptilia") # equivalent

# Look up a unique taxon identifier
# (see `?search_identifiers()` for more information)
search_all(identifiers,
            "https://id.biodiversity.org.au/node/apni/2914510")

# Search for species lists that match "endangered"
search_all(lists, "endangered") # equivalent

# Search for a valid taxonomic rank, "subphylum"
search_all(ranks, "subphylum")
```



```
# An alternative is to download the data and then `filter` it. This is
# largely synonymous, and allows greater control over which fields are searched.
request_metadata(type = "fields") |>
  collect() |>
  dplyr::filter(grepl("date", id))

## End(Not run)
```

select.data_request *Keep or drop columns using their names*

Description

Select (and optionally rename) variables in a data frame, using a concise mini-language that makes it easy to refer to variables based on their name. Note that unlike calling `select()` on a local tibble, this implementation is only evaluated at the `collapse()` stage, meaning any errors or messages will be triggered at the end of the pipe.

`select()` supports dplyr **selection helpers**, including:

- `everything`: Matches all variables.
- `last_col`: Select last variable, possibly with an offset.

Other helpers select variables by matching patterns in their names:

- `starts_with`: Starts with a prefix.
- `ends_with`: Ends with a suffix.
- `contains`: Contains a literal string.
- `matches`: Matches a regular expression.
- `num_range`: Matches a numerical range like x01, x02, x03.

Or from variables stored in a character vector:

- `all_of`: Matches variable names in a character vector. All names must be present, otherwise an out-of-bounds error is thrown.
- `any_of`: Same as `all_of()`, except that no error is thrown for names that don't exist.

Or using a predicate function:

- `where`: Applies a function to all variables and selects those for which the function returns TRUE.

Usage

```
## S3 method for class 'data_request'
select(.data, ..., group)

galah_select(..., group)
```

Arguments

<code>.data</code>	An object of class <code>data_request</code> , created using <code>galah_call()</code> .
<code>...</code>	Zero or more individual column names to include.
<code>group</code>	string: (optional) name of one or more column groups to include. Valid options are "basic", "event", "taxonomy", "media" and "assertions".

Details

GBIF nodes store content in hundreds of different fields, and users often require thousands or millions of records at a time. To reduce time taken to download data, and limit complexity of the resulting tibble, it is sensible to restrict the fields returned by occurrence queries. The full list of available fields can be viewed with `show_all(fields)`. Note that `select()` and `galah_select()` are supported for all atlases that allow downloads, with the exception of GBIF, for which all columns are returned.

Calling the argument `group = "basic"` returns the following columns:

- `decimalLatitude`
- `decimalLongitude`
- `eventDate`
- `scientificName`
- `taxonConceptID`
- `recordID`
- `dataResourceName`
- `occurrenceStatus`

Using `group = "event"` returns the following columns:

- `eventRemarks`
- `eventTime`
- `eventID`
- `eventDate`
- `samplingEffort`
- `samplingProtocol`

Using `group = "media"` returns the following columns:

- `multimedia`
- `multimedialicence`
- `images`
- `videos`
- `sounds`

Using `group = "taxonomy"` returns higher taxonomic information for a given query. It is the only group that is accepted by `atlas_species()` as well as `atlas_occurrences()`.

Using `group = "assertions"` returns all quality assertion-related columns. The list of assertions is shown by `show_all_assertions()`.

For `atlas_occurrences()`, arguments passed to `...` should be valid field names, which you can check using `show_all(fields)`. For `atlas_species()`, it should be one or more of:

- `counts` to include counts of occurrences per species.
- `synonyms` to include any synonymous names.
- `lists` to include authoritative lists that each species is included on.

Value

A tibble specifying the name and type of each column to include in the call to `atlas_counts()` or `atlas_occurrences()`.

See Also

`filter()`, `st_crop()` and `identify()` for other ways to restrict the information returned; `show_all(fields)` to list available fields.

Examples

```
## Not run:
# Download occurrence records of *Perameles*,
# Only return scientificName and eventDate columns
galah_config(email = "your-email@email.com")
galah_call() |>
  identify("perameles")|>
  select(scientificName, eventDate) |>
  collect()

# Only return the "basic" group of columns and the basisOfRecord column
galah_call() |>
  identify("perameles") |>
  select(basisOfRecord, group = "basic") |>
  collect()

# When used in a pipe, `galah_select()` and `select()` are synonymous.
# Hence the previous example can be rewritten as:
galah_call() |>
  galah_identify("perameles") |>
  galah_select(basisOfRecord, group = "basic") |>
  collect()

## End(Not run)
```

show_all	<i>Show valid record information</i>
----------	--------------------------------------

Description

The living atlases store a huge amount of information, above and beyond the occurrence records that are their main output. In *galah*, one way that users can investigate this information is by showing all the available options or categories for the type of information they are interested in. Functions prefixed with `show_all_` do this, displaying all valid options for the information specified by the suffix.

[Stable] `show_all()` is a helper function that can display multiple types of information from `show_all_` sub-functions.

Usage

```
show_all(..., limit = NULL)
```

```
show_all_apis(limit = NULL)
```

```
show_all_assertions(limit = NULL)
```

```
show_all_atlases(limit = NULL)
```

```
show_all_collections(limit = NULL)
```

```
show_all_datasets(limit = NULL)
```

```
show_all_fields(limit = NULL)
```

```
show_all_licences(limit = NULL)
```

```
show_all_lists(limit = NULL)
```

```
show_all_profiles(limit = NULL)
```

```
show_all_providers(limit = NULL)
```

```
show_all_ranks(limit = NULL)
```

```
show_all_reasons(limit = NULL)
```

Arguments

...	String showing what type of information is to be requested. See Details (below) for accepted values.
limit	Optional number of values to return. Defaults to NULL, i.e. all records

Details

There are five categories of information, each with their own specific sub-functions to look-up each type of information. The available types of information for show_all_ are:

Category	Type	Description	Sub-function
Configuration	atlases	Show what atlases are available	show_all_at
	apis	Show what APIs & functions are available for each atlas	show_all_ap
	reasons	Show what values are acceptable as 'download reasons' for a specified atlas	show_all_re
Data providers	providers	Show which institutions have provided data	show_all_pr
	collections	Show the specific collections within those institutions	show_all_co
	datasets	Shows all the data groupings within those collections	show_all_da
Filters	assertions	Show results of data quality checks run by each atlas	show_all_as
	fields	Show fields that are stored in an atlas	show_all_fi
	licenses	Show what copyright licenses are applied to media	show_all_li
	profiles	Show what data profiles are available	show_all_pr
Taxonomy	lists	Show what species lists are available	show_all_li
	ranks	Show valid taxonomic ranks (e.g. Kingdom, Class, Order, etc.)	show_all_ra

Value

An object of class `tbl_df` and `data.frame` (aka a tibble) containing all data of interest.

References

- Darwin Core terms <https://dwc.tdwg.org/terms/>

See Also

Use the `search_all()` function and `search_()` sub-functions to search for information. These functions are used to pass valid arguments to `filter()`, `select()`, and related functions.

Examples

```
## Not run:
# See all supported atlases
show_all(atlases)

# Show a list of all available data quality profiles
show_all(profiles)

# Show a listing of all accepted reasons for downloading occurrence data
show_all(reasons)

# Show a listing of all taxonomic ranks
show_all(ranks)

# `show_all()` is synonymous with `request_metadata() |> collect()`
request_metadata(type = "fields") |>
  collect()
```

```
## End(Not run)
```

show_values	<i>Show or search for values within a specified field</i>
-------------	---

Description

Users may wish to see the specific values *within* a chosen field, profile or list to narrow queries or understand more about the information of interest. `show_values()` provides users with these values. `search_values()` allows users for search for specific values within a specified field.

Usage

```
show_values(df)
```

```
search_values(df, query)
```

Arguments

df	A search result from <code>search_fields()</code> , <code>search_profiles()</code> or <code>search_lists()</code> .
query	A string specifying a search term. Not case sensitive.

Details

Each **Field** contains categorical or numeric values. For example:

- The field "year" contains values 2021, 2020, 2019, etc.
- The field "stateProvince" contains values New South Wales, Victoria, Queensland, etc. These are used to narrow queries with `filter()` or `galah_filter()`.

Each **Profile** consists of many individual quality filters. For example, the "ALA" profile consists of values:

- Exclude all records where spatial validity is FALSE
- Exclude all records with a latitude value of zero
- Exclude all records with a longitude value of zero

Each **List** contains a list of species, usually by taxonomic name. For example, the Endangered Plant species list contains values:

- *Acacia curranii* (Curly-bark Wattle)
- *Brachyscome papillosa* (Mossgiel Daisy)
- *Solanum karsense* (Menindee Nightshade)

Value

A tibble of values for a specified field, profile or list.

Examples

```
## Not run:
# Show values in field 'cl22'
search_fields("cl22") |>
  show_values()

# This is synonymous with `request_metadata() |> unnest()`.
# For example, the previous example can be run using:
request_metadata() |>
  filter(field == "cl22") |>
  unnest() |>
  collect()

# Search for any values in field 'cl22' that match 'tas'
search_fields("cl22") |>
  search_values("tas")

# See items within species list "dr19257"
search_lists("dr19257") |>
  show_values()

## End(Not run)
```

slice_head.data_request

Subset rows using their positions

Description**[Experimental]**

slice() lets you index rows by their (integer) locations. For objects of classes data_request or metadata_request, only slice_head() is currently implemented, and selects the first n rows.

If .data has been grouped using group_by(), the operation will be performed on each group, so that (e.g.) slice_head(df, n = 5) will select the first five rows in each group.

Usage

```
## S3 method for class 'data_request'
slice_head(.data, ..., n, prop, by = NULL)

## S3 method for class 'metadata_request'
slice_head(.data, ..., n, prop, by = NULL)
```

Arguments

.data	An object of class data_request, created using galah_call()
...	Currently ignored

n	The number of rows to be returned. If data are grouped <code>group_by()</code> , this operation will be performed on each group.
prop	Currently ignored.
by	Currently ignored.

Value

An amended `data_request` with a completed slice slot.

Examples

```
## Not run:
# Limit number of rows returned to 3.
# In this case, our query returns the top 3 years with most records.
galah_call() |>
  identify("perameles") |>
  filter(year > 2010) |>
  group_by(year) |>
  count() |>
  slice_head(n = 3) |>
  collect()

## End(Not run)
```

taxonomic_searches	<i>Look up taxon information</i>
--------------------	----------------------------------

Description

`search_taxa()` allows users to look up taxonomic names, and ensure they are being matched correctly, before downloading data from the specified organisation.

By default, names are supplied as strings; but users can also specify taxonomic levels in a search using a `data.frame` or `tibble`. This is useful when the taxonomic *level* of the name in question needs to be specified, in addition to its identity. For example, a common method is to use the `scientificName` column to list a Latinized binomial, but it is also possible to list these separately under `genus` and `specificEpithet` (respectively). A more common use-case is to distinguish between homonyms by listing higher taxonomic units, by supplying columns like `kingdom`, `phylum` or `class`.

`search_identifiers()` allows users to look up matching taxonomic names using their unique `taxonConceptID`. In the ALA, all records are associated with an identifier that uniquely identifies the taxon to which that record belongs. Once those identifiers are known, this function allows you to use them to look up further information on the taxon in question. Effectively this is the inverse function to `search_taxa()`, which takes names and provides identifiers.

Note that when taxonomic look-up is required within a pipe, the equivalent to `search_taxa()` is `identify()` (or `galah_identify()`). The equivalent to `search_identifiers()` is to use `filter()` to filter by `taxonConceptId`.

Details

`search_taxa()` returns the taxonomic match of a supplied text string, along with the following information:

- `search_term`: The search term used by the user. When multiple search terms are provided in a tibble, these are displayed in this column, concatenated using `_`.
- `scientific_name`: The taxonomic name matched to the provided search term, to the lowest identified taxonomic rank.
- `taxon_concept_id`: The unique taxonomic identifier.
- `rank`: The taxonomic rank of the returned result.
- `match_type`: (ALA only) The method of name matching used by the name matching service. More information can be found on the [name matching github repository](#).
- `issues`: Any errors returned by the name matching service (e.g. homonym, indeterminate species match). More information can be found on the [name matching github repository](#).
- `taxonomic_names` (e.g. kingdom, phylum, class, order, family, genus)

See Also

[search_all\(\)](#) for how to get names if taxonomic identifiers are already known. [filter\(\)](#), [select\(\)](#), [identify\(\)](#) and [geolocate\(\)](#) for ways to restrict the information returned by [atlas_\(\)](#) functions.

Examples

```
## Not run:
# Search using a single string.
# Note that `search_taxa()` is not case sensitive
search_taxa("Reptilia")

# Search using multiple strings.
# `search_taxa()` will return one row per taxon
search_taxa("reptilia", "mammalia")

# Search using more detailed strings with authorship information
search_taxa("Acanthocladium F.Muell")

# Specify taxonomic levels in a tibble using "specificEpithet"
search_taxa(tibble::tibble(
  class = "aves",
  family = "pardalotidae",
  genus = "pardalotus",
  specificEpithet = "punctatus"))

# Specify taxonomic levels in a tibble using "scientificName"
search_taxa(tibble::tibble(
  family = c("pardalotidae", "maluridae"),
  scientificName = c("Pardalotus striatus striatus", "malurus cyaneus")))

# Look up a unique taxon identifier
search_identifiers(query = "https://id.biodiversity.org.au/node/apni/2914510")
```

```
## End(Not run)
```

tidyverse_functions *Non-generic tidyverse functions*

Description

Several useful functions from tidyverse packages are *generic*, meaning that we can define class-specific versions of those functions and implement them in galah; examples include `filter()`, `select()` and `group_by()`. However, there are also functions that are only defined within tidyverse packages and are not *generic*. In a few cases we have re-implemented these functions in galah. This has the consequence of supporting consistent syntax with tidyverse, at the cost of potentially introducing conflicts. This can be avoided by using the `::` operator where required (see examples).

Usage

```
desc(...)
```

```
unnest(.query)
```

Arguments

<code>...</code>	column to order by
<code>.query</code>	An object of class <code>metadata_request</code>

Details

The following functions are included:

- `desc()` (`dplyr`): Use within `arrange()` to specify arrangement should be descending
- `unnest()` (`tidyr`): Use to 'drill down' into nested information on fields, lists, profiles, or taxa

These galah versions all use lazy evaluation.

Value

- `galah::desc()` returns a tibble used by `arrange.data_request()` to arrange rows of a query.
- `galah::unnest()` returns an object of class `metadata_request`.

See Also

[arrange\(\)](#), [galah_call\(\)](#)

Examples

```
## Not run:
# Arrange grouped record counts by descending year
galah_call() |>
  identify("perameles") |>
  filter(year > 2019) |>
  count() |>
  arrange(galah::desc(year)) |>
  collect()

# Return values of field `basisOfRecord`
request_metadata() |>
  galah::unnest() |>
  filter(field == basisOfRecord) |>
  collect()

# Using `galah::unnest()` in this way is equivalent to:
show_all(fields, "basisOfRecord") |>
  show_values()

## End(Not run)
```

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