

附录1 R程序包SP2000的安装、配置和使用指南

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附录 1 文档由 R 程序包 *rmarkdown* (Allaire et al, 2020) 自动生成。使用 R 程序包 SP2000 之前, 用户需要安装 R 和 RStudio 软件, 该程序包可在 Windows、MacOS、Linux 等多个操作系统上运行。R 软件下载的地址为: <http://cran.r-project.org/bin/windows/base/>, 用户根据自己的计算机操作系统, 选取相应 R 软件, 建议用户下载最新版的 R, 因为涉及到字符编码转换, R 版本不低于 3.0.0; RStudio 软件下载的地址为: <https://rstudio.com/products/rstudio/download/>, 用户根据安装的 R 软件选取相应的 RStudio 软件, 因为旧版本不能运行 Python 代码, 建议用户下载最新版的 RStudio。下文重点介绍 R 程序包 SP2000 的安装、配置和使用指南。

1. 安装 SP2000

```
#Current official release
install.packages("SP2000", repos = "https://cran.r-project.org")

#Current beta / GitHub release:
# if (!requireNamespace("devtools", quietly = TRUE))
#   install.packages("devtools")

devtools::install_github("Otoliths/SP2000")

#or
devtools::install_git("git://github.com/Otoliths/SP2000.git")

#or
devtool::install_gitlab("Otoliths/SP2000")

#Check if reticulate is installed
```

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```
if (!requireNamespace("reticulate", quietly = TRUE))
  install.packages("reticulate")
```

2. 使用指南

R 程序包 SP2000 主要包含 8 个函数: `set_search_key`、`search_family_id`、`search_taxon_id`、`search_checklist`、`get_redlist_china`、`get_col_global`、`find_synonyms` 和 `get_col_taiwan`, 下面以“鳗鲡科(Anguillidae)”为例, 详细介绍以上函数的使用和测试代码的操作系统, 并且通过 R 包 `reticulate` 包提供 `repl_python()` 和 `exit` 命令, 实现 Python 代码的进入和退出, 可以使用 Python 调用 R 运行的结果, 调用方式 `r.*`。

2.1 加载 SP2000

```
#Load the SP2000 package
library("SP2000")

# Welcome to R Package SP2000 0.1.0 !!!

# To start with the SP2000, please digit:

# https://cran.r-project.org/package=SP2000(R)

# https://pypi.org/project/SP2000(Python)

# Load the reticulate package
library("reticulate")

# install IPython package
reticulate::py_install (packages = "IPython", pip = TRUE)
```

2.2 `set_search_key` 设置 Species 2000 密钥

注意: 在运行函数 `search_family_id`、`search_taxon_id`、`search_checklist` 之前需先申请“Species 2000”密钥, 注册物种 2000 中国节点 <http://www.sp2000.org.cn> 网站, 点击“用户信息”便可获取一个自己独享的 API 密钥服务, 然后调用一次函数 `set_search_key`(“your key”), 便可运行所有 `search_*` 函数。

#Note: You need to apply for the apiKey <<http://www.sp2000.org.cn>>

#to run search_ functions of this package.*

```
set_search_key("06319834*****")
```

2.3 `search_family_id` 查询中国生物物种名录的科 id

```
#Search family IDs via family name
#Family name, or part of family name, supports Latin and Chinese names.
str (search_family_id (query = "鳗鲡科"))

# Request returned successfully!!!
# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:00
# List of 1
# $ 鳗鲡科:List of 2
# ..$ meta:List of 5
# ...$ code :int 200
# ...$ limit :int 20
# ...$ count :int 1
# ...$ page :int 1
```

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```
# ...$ message: chr "success"
# ..$ data: tibble [1 × 14] (S3: tbl_df/tbl/data.frame)
# ...$ family_c : chr "鳗鲡科"
# ...$ phylum_c : chr "脊索动物门"
# ...$ superfamily : logi NA
# ...$ kingdom : chr "Animalia"
# ...$ record_id : chr "3851c5311bed46c19529cb155d37aa9b"
# ...$ phylum : chr "Chordata"
# ...$ kingdom_c : chr "动物界"
# ...$ family : chr "Anguillidae"
# ...$ class : chr "Actinopterygii"
# ...$ class_c : chr "辐鳍鱼纲"
# ...$ order_c : chr "鳗鲡目"
# ...$ order : chr "Anguilliformes"
# ...$ superfamily_c: logi NA
# ...$ download_date: Date[1:1], format: "2020-08-03"

familyid <- search_family_id (query = "Anguillidae")

# Request returned successfully!!!
# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:00

#Calling R from Python
repl_python ()

from pprint import pprint

pprint (r.familyid)

# {'Anguillidae': {'data': family_c phylum_c superfamily ... order superfamily_c download_date
# 0 鳗鲡科 脊索动物门 True ... Anguilliformes True 2020-08-03
#
# [1 rows x 14 columns],
# 'meta': {'code': 200,
# 'count': 1,
# 'limit': 20,
# 'message': 'success',
# 'page': 1}}
exit
```

2.4 search_taxon_id 查询中国生物物种名录的种 id

```
#Search taxon IDs via familyID
query1 = familyid$Anguillidae$data$record_id

taxonid1 <- search_taxon_id (query = query1, name = "familyID")

# Request returned successfully!!!
# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:00
# Research type: familyID

str(taxonid1[["3851c5311bed46c19529cb155d37aa9b"]] [["meta"]])

# List of 5
# $ code : int 200
# $ limit : int 20
# $ count : int 5
```

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```
# $ page : int 1
# $ message: chr "success"

#Search taxon IDs via scientificName
queries <- c ("Anguilla marmorata", "Anguilla japonica", "Anguilla bicolor", "Anguilla nebulosa", "Anguilla luzonensis")

taxonid2 <- search_taxon_id (query = queries)

# Request returned successfully!!!
# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:02
# Research type: scientificName
```

2.5 search_checklist 查询中国生物物种名录信息

```
#Download detailed lists via species or infraspecies ID
query2 <- taxonid1[["3851c5311bed46c19529cb155d37aa9b"]] [["data"]][["namecode"]]

x1 <- search_checklist (query = query2)

# Request returned successfully!!!
# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:01
# Records - Found: 5

str(x1[["Anguilla bicolor"]])

# List of 2
# $ meta:List of 2
# ..$ code : int 200
# ..$ message: chr "success"
# $ data:List of 12
# ..$ searchCodeStatus: chr "accepted name"
# ..$ Synonyms :'data.frame': 1 obs. of 2 variables:
# ...$ synonym: chr "Anguilla foochowensis"
# ...$ refs :List of 1
# ....$ : list()
# ..$ namecode : chr "1bcb107bcbf74c6eb81554e398beb840"
# ..$ scientificName : chr "Anguilla bicolor"
# ..$ author : chr "McClelland, 1844"
# ..$ Refs : chr [1:2] "McClelland J. (1844) Apodal fishes of Bengal. Calcutta Journal of Natural History, 5 (18):151-226." ""
# ..$ taxonTree : tibble [1 × 8] (S3: tbl_df/tbl/data.frame)
# ...$ phylum : chr "Chordata"
# ...$ genus : chr "Anguilla"
# ...$ species : chr "bicolor"
# ...$ infraspecies: chr ""
# ...$ family : chr "Anguillidae"
# ...$ kingdom : chr "Animalia"
# ...$ class : chr "Actinopterygii"
# ...$ order : chr "Anguilliformes"
# ..$ chineseName : chr "双色鳗鲡"
# ..$ searchCode : chr "1bcb107bcbf74c6eb81554e398beb840"
# ..$ CommonNames : chr "福州鳗"
# ..$ SpecialistInfo :'data.frame': 3 obs. of 4 variables:
# ...$ E-Mail : chr [1:3] "zhangcg@ioz.ac.cn" "zoskt@gate.sinica.edu.tw" ""
# ...$ Address : chr [1:3] "1 Beichen West Road, Chaoyang District, Beijing 100101, P.R.China(北京市朝阳区北辰西路 1 号院 5 号 中国科学院动物研究所)" "()" "No.999, Huchenghuan Rd , Nanhui New City, Shanghai, P.R. China(上海市浦东新区沪城环路 999 号)"
# ...$ name : chr [1:3] "Zhang Chunguang(张春光)" "Shao, Kwang-Tsao(邵广昭)" "Wu Hanlin(伍汉霖)"
```

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```
# ...$ Institution: chr [1:3] "Institute of Zoology, Chinese Academy of Sciences(中国科学院动物研究所)" "(中央研究院生物多样性研究中心)" "College of Life Science & Technology, Shanghai Ocean University(上海海洋大学生命科学与技术学院)"
# ..$ download_date : Date[1:1], format: "2020-08-03"
```

2.6 get_col_global 查询全球生物物种名录信息

```
#Get Catalogue of Life Global checklist via species name and id
x2 <- get_col_global (query = queries, option = "name")

# Download date: 2020-08-04
# Research type: name
# |=====| 100%, Elapsed 00:03

str (x2[["Anguilla bicolor"]][["meta"]])

# List of 8
# $ id : chr ""
# $ name : chr "Anguilla bicolor"
# $ total_number_of_results : int 3
# $ number_of_results_returned: int 3
# $ start : int 0
# $ error_mexage : NULL
# $ version : chr "1.9 rev 2126ab0"
# $ rank : chr ""
```

2.7 get_redlist_china 查询中国物种红色名录信息

```
#Query Redlist of Chinese Biodiversity
get_redlist_china (query = "Anguilla", option = "Scientific Names")

## Download date: 2020-08-04

## # A tibble: 4 x 11
## `Chinese Family... Family` `Chinese Names` `ScientificNames` Status
## <chr> <chr> <chr> <chr> <chr>
## 1 鳗鲡科 Angui... 日本鳗鲡 Anguilla japon... EN
## 2 鳗鲡科 Angui... 花鳗鲡 Anguilla marmo... EN
## 3 鳗鲡科 Angui... 双色鳗鲡 Anguilla bicol... NT
## 4 鳗鲡科 Angui... 云纹鳗鲡 Anguilla nebul... NT
## # ... with 6 more variables: `Assessment Criteria` <chr>, `Endemic` <chr>,
## # `Taxon` <chr>, `Chinese Taxon` <chr>, `Group` <chr>, `Chinese Group` <chr>
```

2.8 find_synonyms 查询全球生物物种同物异名

```
#Find synonyms via species name from Catalogue of Life Global
find_synonyms (queries)

# Download date: 2020-08-04
# |=====| 100%, Elapsed 00:03
## Find 8 results of synonyms for Anguilla marmorata are as follows:
## Find 6 results of synonyms for Anguilla japonica are as follows:
## Find 23 results of synonyms for Anguilla bicolor are as follows:
## Find 4 results of synonyms for Anguilla nebulosa are as follows:
## Find 1 results of synonyms for Anguilla luzonensis are as follows:
```

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```
## $`Anguilla marmorata`
## [1] "Anguilla fidiensis" "Anguilla hildebrandti" "Anguilla johannae"
## [4] "Anguilla labrosa" "Anguilla marmorata" "Anguilla mauritiana"
## [7] "Muraena manillensis" "Muraena mossambica"
##
## $`Anguilla japonica`
## [1] "Anguilla angustidens" "Anguilla breviceps" "Anguilla manabei"
## [4] "Anguilla nigricans" "Anguilla remifera" "Muraena pekinensis"
##
## $`Anguilla bicolor`
## [1] "Anguilla amblodon" "Anguilla australis"
## [3] "Anguilla bicolor bicolor" "Anguilla bicolor pacifica"
## [5] "Anguilla bicolor" "Anguilla bicolor bicolor"
## [7] "Anguilla bleekeri" "Anguilla cantori"
## [9] "Anguilla dussumieri" "Anguilla malabarica"
## [11] "Anguilla malgumora" "Anguilla mauritiana"
## [13] "Anguilla moa" "Anguilla mowa"
## [15] "Anguilla pacifica" "Anguilla sidat"
## [17] "Anguilla spengeli" "Anguilla virescens"
## [19] "Muraena halmaherensis" "Muraena macrocephala"
## [21] "Muraena moa" "Muraena mossambica"
## [23] "Muraena virescens"
##
## $`Anguilla nebulosa`
## [1] "Anguilla bengalensis" "Anguilla elphinstonei"
## [3] "Anguilla nebulosa nebulosa" "Muraena maculata"
##
## $`Anguilla luzonensis`
## [1] "Anguilla huangi"
```

2.9 get_col_taiwan 查询台湾生物物种名录信息

```
#Search Catalogue of Life Taiwan checklist
```

```
get_col_taiwan (query="Anguillidae", level="family")
```

```
## Download date: 2020-08-04
```

```
## # A tibble: 5 x 23
```

```
## name_code kingdom kingdom_c phylum phylum_c class class_c order order_c family
```

```
## <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
```

```
## 1 380710 Animal... 動物界 Chord... 脊索動物門... Acti... 條鰭魚綱... Angu... 鰻形目 Angui...
```

```
## 2 395489 Animal... 動物界 Chord... 脊索動物門... Acti... 條鰭魚綱... Angu... 鰻形目 Angui...
```

```
## 3 380711 Animal... 動物界 Chord... 脊索動物門... Acti... 條鰭魚綱... Angu... 鰻形目 Angui...
```

```
## 4 395491 Animal... 動物界 Chord... 脊索動物門... Acti... 條鰭魚綱... Angu... 鰻形目 Angui...
```

```
## 5 380712 Animal... 動物界 Chord... 脊索動物門... Acti... 條鰭魚綱... Angu... 鰻形目 Angui...
```

```
## # ... with 13 more variables: family_c <chr>, genus <chr>, genus_c <chr>,
```

```
## # species <chr>, infraspecies_marker <chr>, infraspecies <chr>,
```

```
## # infraspecies2_marker <chr>, infraspecies2 <chr>, author <chr>,
```

```
## # author2 <chr>, common_name_c <chr>, endemic <chr>, dataprovider <chr>
```

2.10 测试环境

```
#Collect Information About the Current R Session
```

```
sessionInfo ()
```

```
# R version 4.0.0 (2020-04-24)
```

```
# Platform: x86_64-apple-darwin17.0 (64-bit)
```

```
# Running under: macOS Catalina 10.15.5
```

```
#
```

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```
# Matrix products: default
# BLAS: /System/Library/Frameworks/Accelerate.framework/Versions/A/Frameworks/vecLib.framework/Versions/A/libBLAS.dylib
# LAPACK: /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRlapack.dylib
#
# locale:
# [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
#
# attached base packages:
# [1] stats graphics grDevices utils datasets methods base
#
# other attached packages:
# [1] SP2000_0.1.0 reticulate_1.16
#
# loaded via a namespace (and not attached):
# [1] Rcpp_1.0.5 rstudioapi_0.11 xml2_1.3.2 magrittr_1.5 lattice_0.20-41
# [6] rlang_0.4.7 fansi_0.4.1 tools_4.0.0 parallel_4.0.0 DT_0.14
# [11] grid_4.0.0 data.table_1.12.8 png_0.1-7 utf8_1.1.4 cli_2.0.2
# [16] htmltools_0.5.0 ellipsis_0.3.1 assertthat_0.2.1 yaml_2.2.1 digest_0.6.25
# [21] tibble_3.0.3 lifecycle_0.2.0 crayon_1.3.4 Matrix_1.2-18 pbmcapply_1.5.0
# [26] purrr_0.3.4 vctrs_0.3.1 htmlwidgets_1.5.1 curl_4.3 rlist_0.4.6.1
# [31] glue_1.4.1 compiler_4.0.0 pillar_1.4.6 XML_3.99-0.5 jsonlite_1.7.0
# [36] pkgconfig_2.0.3
```

参考文献

Allaire J, Xie YH, McPherson J, Luraschi J, Ushey K, Atkins A, Wickham H, Cheng J, Chang W, Iannone R (2020) rmarkdown: Dynamic Documents for R. R package version 2.1. <https://rmarkdown.rstudio.com>. (accessed on 2020-06-08)