

Webinar 2

Resolving Nomenclature: Making Appropriate Taxonomic Choices

- **Advances in biodiversity science**, combined with emerging technologies and the ability to handle “big data” **have greatly improved** and expanded our capability to explore biodiversity in an unprecedented fashion. We can now **link data** from growing repositories (**trees, occurrences, traits**) **and computational tools/approaches to integrate evolution and ecology at broad scale**. This new synthesis is reshaping views of ecology/evolution with important conservation implications.
- **Scaling biogeographic analyses** from a small number of species or genera to explore patterns of evolution and diversity for thousands or tens of thousands of taxa on continental and global scales **requires software tools that automate and parallelize computational tasks to make analyses practically feasible, efficient, with reasonable timelines**.

Allen et al.. 2019. Biodiversity synthesis across the green branches of the tree of life. *Nature Plants* 5:11-13.

**Learn why and how to treat nomenclatural
data that will be used in multiple
biodiversity analysis**

Biological Objectives:

- ✓ **Introduce the reasoning for making nomenclatural decisions.**

Technological Objectives :

- ✓ **Introduce technological tools available for making nomenclatural decisions.**

1. **Exploring Concepts: why ensuring nomenclature is an important first step in this workflow!**
2. **Demonstrations: manual and automated ways of properly treating nomenclature decisions**
3. **Exercises: practice automated ways of treating nomenclature**
4. **Session Summary, Q&A and Discussion**

Why do we have to make nomenclatural decisions?

Ensure taxa names are ready for integration on a large scale!

Names must be...

- ✓ **accepted**
- ✓ **unique**
- ✓ **consistent**

Demonstration: showing manual ways of properly treating nomenclature decisions:

- a) Useful for smaller datasets,**

- b) Tool to subset large datasets and verify procedures**

Demonstration: Manual

1615	1614	<i>Dioscorea marginata</i>	<i>Dioscorea albinervia</i> , <i>Dioscorea cynanchifolia</i>
1616	1615	<i>Dioscorea sincorensis</i>	NA
1617	1616	<i>Dioscorea stenophylla</i>	<i>Dioscorea stenophylla paucinervis</i>
1618	1617	<i>Diospyros sericea</i>	<i>Diospyros praetermissa</i> , <i>Diospyros vestita</i> , <i>Maba sericea</i> , <i>Ebenus sericea</i>
1619	1618	<i>Diplococcium dendrocalami</i>	NA
1620	1619	<i>Diplopterys hypericifolia</i>	<i>Banisteria hypericifolia</i> , <i>Banisteria rigida</i> , <i>Banisteriopsis hypericifolia</i>
1621	1620	<i>Diplusodon adpressipilus</i>	NA
1622	1621	<i>Diplusodon aggregatifolius</i>	NA
1623	1622	<i>Diplusodon alatus</i>	NA
1624	1623	<i>Diplusodon appendiculosus</i>	NA
1625	1624	<i>Diplusodon argenteus</i>	NA
1626	1625	<i>Diplusodon argyrophyllus</i>	NA
1627	1626	<i>Diplusodon bahiensis</i>	NA
1628	1627	<i>Diplusodon bradei</i>	NA
1629	1628	<i>Diplusodon buxifolius</i>	<i>Diplusodon buxifolius naudinii</i> , <i>Diplusodon vaccinifolius</i> , <i>Friedlandia buxifolia</i> , <i>Friedlandia vaccinifolia</i>
1630	1629	<i>Diplusodon canastrensis</i>	NA
1631	1630	<i>Diplusodon candollei</i>	<i>Diplusodon candollei</i>
1632	1631	<i>Diplusodon ciliiflorus</i>	NA
1633	1632	<i>Diplusodon cordifolius</i>	NA
1634	1633	<i>Diplusodon decussatus</i>	NA

1 – Downloaded lists with accepted names (from REFLOA) and synonyms from ITIS, GBIF and TROPICOS

Demonstration: Manual



CLEAR FILTERS

SEARCH

Home

Team

Current Status of Taxa

Publications/References

Access to Data

News

Name

Group

Flora e Funga

Family

all

Genus

Dioscorea

Species

marginata

Author

Vernacular name

Full Name

Description

Only taxa with Description

Images

Having Images

Life Form and Substrate

Life Form

all

Substrate

all

Flora e Funga do Brasil

2010, Brazil met Target 1 established by the Global Strategy for Plant Conservation (GSPC-CDB), within the scope of the

Convention on Biological Diversity with the publication of the "Catálogo de Plantas e Fungos do Brasil" (see above

do Brasil". The

articles and their

do Brasil 2020"

descriptions,

end of 2020,

available in a

consequence

the inclusion of

ers were also

tion (by states

in Brazil, endemism and Phytogeographic Domains), in addition to including valuable data on life forms, substrate and

vegetation types for the species worked. It is important to note that high resolution images of exsiccates, as well as images of

species in nature and scientific illustrations are also associated with taxa to aid in their recognition. However, the monographs

completed for Algae and for Fungi were not able to cover the real diversity of these groups in Brazil and this was a stimulus for

the beginning of this new phase of the project, now called **Flora e Funga do Brasil**. This change aims to seek a more

inclusive biological terminology for the Fungi Kingdom and a greater engagement of the mycological and lichenological

community, both for the improvement of the list of species occurring in the country, and for the elaboration of monographs.

2 – MANUALLY compared synonyms from ITIS, GBIF and TROPICOS with the ones listed in REFLORA!

Search result NEW QUERY

- has as a syn *Hymenocallis* Ome
- has as a syn *Hyperocarpa* (Uline) G.M.Barroso et al.
- has as a syn *Nanarepenta* Matuda
- has as a syn *Oncorhiza* Pers.
- has as a syn *Oncus* Lour.
- has as a syn *Polynome* Salisb.
- has as a syn *Rajania* L.
- has as a syn *Rhizemys* Raf.
- has as a syn *Schizocapsa* Hance
- has as a syn *Sismondaea* Delponte
- has as a syn *Strophis* Salisb.
- has as a syn *Tamnus* Mill.
- has as a syn *Tamus* L.
- has as a syn *Testudinaria* Salisb. ex Burch.
- has as a syn *Ubium* J.F.Gmel.
- has as a syn *Ricophora* Mill.
- has as a syn *Borderea* Miégev.
- has as a syn *Botryosicyos* Hochst.
- has as a syn *Elephantodon* Salisb.
- has as a syn *Epipetrum* Phil
- Dioscorea marginata* Griseb.**
 - has as a syn *Dioscorea spicata* (Vell.) Pedralli
 - has as a syn *Dioscorea albinervia* R.Knuth

[Bryophytes](#)
[Hornworts](#)
[Liverworts](#)

Information Images Voucher

Dioscorea marginata Griseb. FB7395

Accepted Name, Correct name

Taxonomic Hierarchy

Flora e Funga → Angiosperms → Dioscoreaceae R.Br. → *Dioscorea* L.
→ *Dioscorea marginata* Griseb.

Images from the field

Published by: Ricardo Sousa Couto
Author: Ricardo S. Couto
Date of inclusion: 27/12/2013 - 10:48:06

Demonstration: Manual

1482	Accepted	Angiosperms	1614	Dioscorea marginata	Dioscorea albinervia, <i>Dioscorea cynanchifolia</i> , <i>Dioscorea spicata</i>
1483	Accepted	Angiosperms	1615	Dioscorea sincorensis	NA
1484	Accepted	Angiosperms	1616	Dioscorea stenophylla	Dioscorea stenophylla var. paucinervis
1485	Accepted	Angiosperms	1617	Diospyros sericea	<i>Diospyros praetermissa</i> , <i>Diospyros vestita</i> , <i>Maba sericea</i> , <i>Ebenus sericea</i>
1486	Accepted	Angiosperms	1619	Diplopterys hypericifolia	Banisteria hypericifolia, Banisteria rigida, Banisteriopsis hypericifolia
1487	Accepted	Angiosperms	1620	Diplusodon adpressipilus	NA
1488	Accepted	Angiosperms	1621	Diplusodon aggregatifolius	NA
1489	Accepted	Angiosperms	1622	Diplusodon alatus	NA
1490	Accepted	Angiosperms	1623	Diplusodon appendiculosus	NA
1491	Accepted	Angiosperms	1624	Diplusodon argenteus	NA
1492	Accepted	Angiosperms	1625	Diplusodon argyrophyllus	NA
1493	Accepted	Angiosperms	1626	Diplusodon bahiensis	NA
1494	Accepted	Angiosperms	1627	Diplusodon bradei	NA, <i>Diplusodon rupestris</i>
1495	Accepted	Angiosperms	1628	Diplusodon buxifolius	<i>Diplusodon buxifolius naudinii</i> , <i>Diplusodon vaccinifolius</i> , <i>Friedlandia buxifolia</i> , <i>Friedlandia vaccinifolia</i>
1496	Accepted	Angiosperms	1629	Diplusodon canastrensis	NA
1497	Accepted	Angiosperms	1630	Diplusodon candollei	NA
1498	Accepted	Angiosperms	1631	Diplusodon ciliiflorus	NA, <i>Diplusodon psammophilus</i>
1499	Accepted	Angiosperms	1632	Diplusodon cordifolius	NA
1500	Accepted	Angiosperms	1633	Diplusodon decussatus	NA
1501	Accepted	Angiosperms	1634	Diplusodon epilobioides	<i>Friedlandia epilobioides</i>
1502	Accepted	Angiosperms	1635	Diplusodon ericoides	NA
1503	Accepted	Angiosperms	1636	Diplusodon fastigiatus	NA
1504	Accepted	Angiosperms	1637	Diplusodon glaucescens	<i>Friedlandia glaucescens</i> , <i>Friedlandia nummularifolia</i>

No synonyms listed under any of the databases!

Demonstration: Manual

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1503	Accepted	Angiosperms	1636	Diplusodon fastigiatus	NA
1504	Accepted	Angiosperms	1637	Diplusodon glaucescens	<i>Friedlandia glaucescens</i> , <i>Friedlandia nummularifolia</i>

**Synonyms listed ONLY
in REFLORA!**

Demonstration: Manual

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1504	Accepted	Angiosperms	1637	Diplusodon glaucescens	<i>Friedlandia glaucescens</i> , <i>Friedlandia nummularifolia</i>

**Synonyms NOT listed
in REFLORA!**

Demonstration: Manual

Original list, synonyms compiled from ITIS, TROPICOS and GBIF

Dioscorea marginata

Dioscorea albinervia, Dioscorea cynanchifolia



Dioscorea marginata

Dioscorea albinervia, ~~Dioscorea cynanchifolia~~, Dioscorea spicata

Synonym listed in both REFLORA and compiled list

Synonym NOT listed in REFLORA!

Synonym listed ONLY in REFLORA!

Time to Exercise!

**What happens when there is a large dataset?
Should we manually check 40,000 records?**



**We use BiotaPhy tools to automate
nomenclatural decision making!**



Let's put the automated framework developed by BiotaPhy to test!

How to resolve a species list name:

3 steps:

- ✓ **Data Preparation**
- ✓ **Run Tutorial**
- ✓ **Inspect Output**

Input: species list

Input: Wrangler configuration file

Input: Script parameter file

Data preparation

Input: species list

Use an existing or prepare a new species list, a text file with one name per line. This file is specified in the script parameter file described below.

1. The tutorial example species list is [heuchera.txt](#).



2. Some resources:

1. [World Flora Online, WFO](#)

2. Query GBIF, i.e. [heuchera query](#)

```
1 Heuchera nana (A. Gray) Rydb.  
2 Heuchera alpina (S. Watson) Blank.  
3 Heuchera versicolor Greene  
4 Heuchera sitgreavesii Rydb.  
5 Heuchera townsendii Rydb.  
6 Heuchera racemosa S.Watson  
7 Heuchera mexicana W. Schaffn. ex Rydb.  
8 Heuchera amoena Rosend. & Butters & Lakela  
9 Heuchera divaricata Fisch. ex Ser.  
10 Heuchera drummondii G.Nicholson  
11 Heuchera x easthamii Calder & Savile  
12 Heuchera flabellifolia Rydb.  
13 Heuchera foliosa Rahn.  
14 Heuchera gracilis Rydb.
```

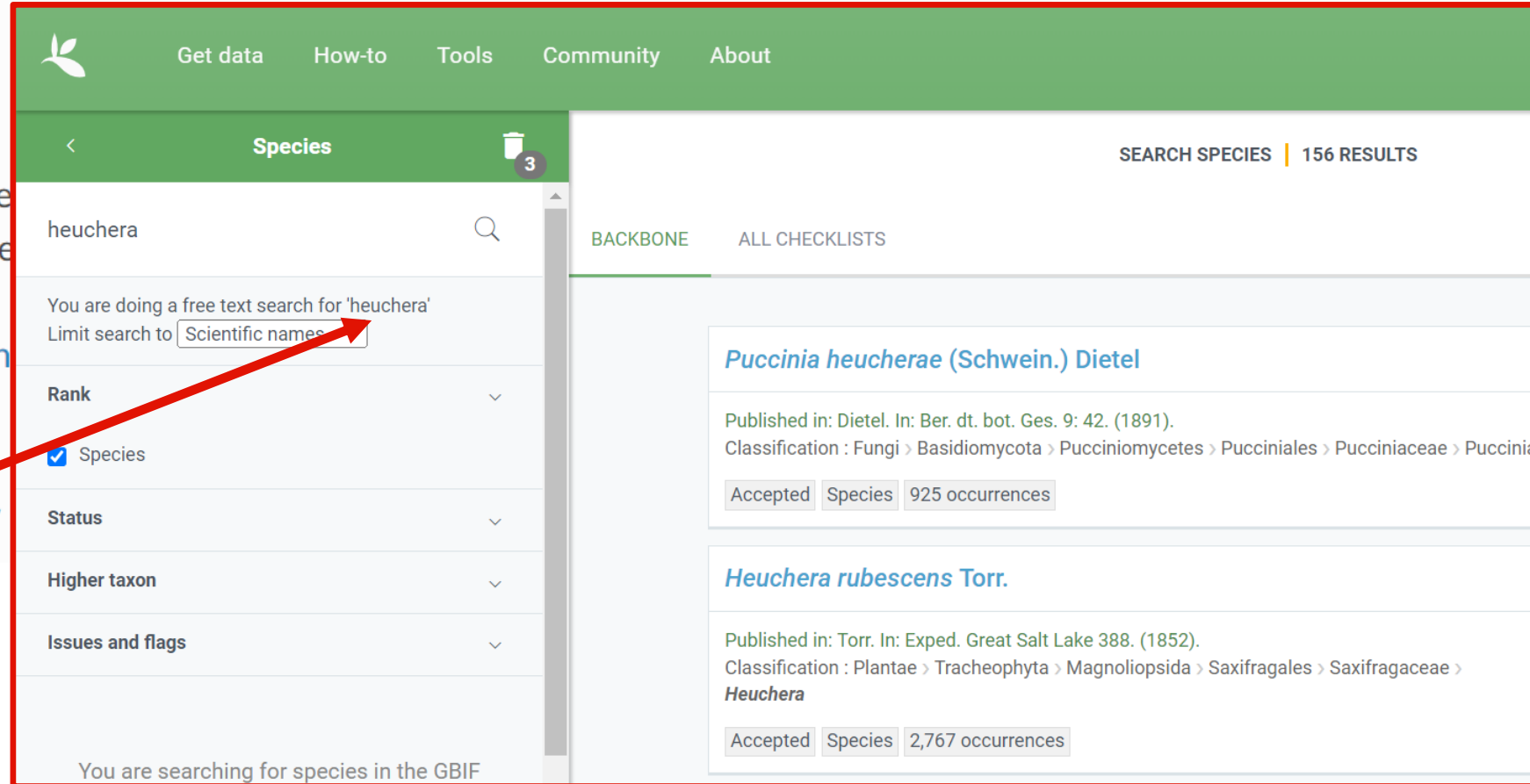
Data Preparation: species list

Data preparation

Input: species list

Use an existing or prepare a new species list in the script parameter file described below.

1. The tutorial example species list is here
2. Some resources:
 1. [World Flora Online, WFO](#)
 2. Query GBIF, i.e. [heuchera query](#)



The screenshot shows the BiotaPhy web interface. The top navigation bar includes 'Get data', 'How-to', 'Tools', 'Community', and 'About'. The main header is 'Species' with a search icon and a notification badge '3'. The search bar contains 'heuchera' and a dropdown menu for 'Limit search to' is open, showing 'Scientific names' selected. Below the search bar are filters for 'Rank' (Species checked), 'Status', 'Higher taxon', and 'Issues and flags'. The search results are displayed in two columns: 'BACKBONE' and 'ALL CHECKLISTS'. The first result is *Puccinia heucherae* (Schwein.) Dietel, published in 1891, with 925 occurrences. The second result is *Heuchera rubescens* Torr., published in 1852, with 2,767 occurrences. A red arrow points from the text 'heuchera query' in the list to the search bar.

Data Preparation: wrangler file

Input: Wrangler configuration file

A data wrangler configuration is a file containing a JSON list of zero or more wranglers - each performs a different operation, and each has its own parameters. More information on file format, available wrangler types, and the required and/or optional parameters for each are at [Species List: Wrangling](#).

Species List Wrangler Types



Wrangler types that perform different operations when dealing with species lists! You add the name of the corresponding wrangler after the parameter: "*wrangler_type*"

Species List Wrangler Types

AcceptedNameSpeciesListWrangler

- optional
 - name_map (str or dict): A dictionary or filename containing a dictionary of original name to accepted name. Defaults to None, but either this or name_resolver **must be** provided.
 - name_resolver (str or Method): Use this method for getting new accepted names. If set to 'gbif' or 'otol', use GBIF or OTOL name resolution respectively. Defaults to None, but either this or name_map must be provided.
 - out_map_filename (str): Output for name-mapping between original and accepted names. This file is then acceptable for use as a **name-map** input for subsequent name wrangling. Defaults to None.
 - map_write_interval (int): Interval at which to write records to disk. Used to ensure that if something fails, all is not lost. Defaults to 100.
 - out_map_format (str): Type of file format for out_map_filename, defaults to "json".

IntersectionSpeciesListWrangler

- required
 - species_list (str): Filename containing species list to intersect

MatchMatrixSpeciesListWrangler

- required
 - matrix (str): Filename containing matrix to match

MatchTreeSpeciesListWrangler

- required
 - tree (str): Filename containing tree to match

UnionSpeciesListWrangler


- required
 - species_list (str): Filename containing species list to join

Data Preparation: wrangler file

main ▾ tutorials / data / wranglers / **splist_wranglers_gbif.json**

Go to file



 zzeppozz doc ✓

Latest commit 5e23b7c 5 days ago  History

1 contributor

9 lines (9 sloc) | 247 Bytes

Raw

Blame



```
1 [
2   {
3     "wrangler_type": "AcceptedNameSpeciesListWrangler",
4     "name_resolver": "gbif",
5     "out_map_filename": "/volumes/output/heuchera_name_map.json",
6     "map_write_interval": 100,
7     "out_map_format": "json"
8   }
9 ]
```

**Specifies how to get
the accepted names**

**Output: name map
where original names
inputted are connected
to the accepted names
retrieved!**

Data Preparation: script file

Input: Script parameter file


A JSON parameter file is required for this command. The tutorial parameter file is [wrangle_species_list_gbif.json](#). These are the required and optional parameters:

Required:


- in_species_list_filename: Input filename containing species list, described in the section above. The tutorial example species list is [heuchera.txt](#).
- wrangler_configuration_file: species list wrangler configuration file, described in the previous input section. The tutorial example wrangler configuration contains one wrangler, the AcceptedNameSpeciesListWrangler, and is in [splist_wranglers_gbif.json](#)
- out_species_list_filename: output filename for resolved species list.

Optional

- log_filename: Output filename to write logging data
- log_console: 'true' to write log to console
- report_filename: output filename with data modifications made by wranglers



```
1 Heuchera nana (A. Gray) Rydb.
2 Heuchera alpina (S. Watson) Blank.
3 Heuchera versicolor Greene
4 Heuchera sitgreavesii Rydb.
5 Heuchera townsendii Rydb.
6 Heuchera racemosa S.Watson
7 Heuchera mexicana W. Schaffn. ex Rydb.
8 Heuchera amoena Rosend. & Butters & Lakela
9 Heuchera divaricata Fisch. ex Ser.
10 Heuchera drummondii G.Nicholson
```



The file we just saw in the previous slide!



??????

Data Preparation: script file

main ▾ tutorials / data / config / wrangle_species_list_gbif.json Go to file ...

zpeppozz testing ✓ Latest commit 12b731e 22 hours ago History

1 contributor

8 lines (8 sloc) | 383 Bytes Raw Blame 🗨 📄 ✎ 🗑

```
1 {
2   "log_filename": "/volumes/output/wrangle_species_list1.log",
3   "log_console": true,
4   "report_filename": "/volumes/output/wrangle_species_list1_rpt.json",
5   "in_species_list_filename": "/volumes/data/input/heuchera.txt",
6   "wrangler_configuration_file": "/volumes/data/config/splist_wranglers_gbif.json",
7   "out_species_list_filename": "/volumes/output/heuchera_accepted1.txt"
8 }
```

Optional parameters

Required parameters

Especially important to help visualize what is happening and to make sure code is running smoothly! **Optional, BUT HIGHLY RECOMMENDED!**

Let's run this tutorial!

Hands-on: Run tutorial with 'gbif' service

Initiate the process with the following:

```
./run_tutorial.sh wrangle_species_list data/config/wrangle_species_list_gbif.json
```

Windows users will run
with: **run_tutorial.bat**

Remember, you will **RUN** this code in
the terminal or in the command
prompt for Windows!

Goal: produce a file with
resolved species names
(**ONLY ACCEPTED NAMES**)

Let's look at the output!

Output

This process outputs files configured in the script parameter file:

2. If *report_filename* is specified in the script parameter file, a summary of name resolutions, like

`wrangle_species_list_gbif.log`

3. If *log_filename* is specified in the script parameter file, a report like `wrangle_species_list_gbif.rpt` containing a summary of the processing.

3. If *log_console* is specified in the script parameter file, logs will be written to the command prompt during execution.

4. an output species list named in the *out_species_list_filename*, like `heuchera_wrangled.txt` containing the modified species list, one name per line.

The process produces one additional file configured in the wrangler configuration file:

- An *out_map_filename* containing a name-map from the AcceptedNameSpeciesListWrangler. The name-map is a JSON file with pairs of names - the original name to the accepted name according to the specified authority. This name-map is suitable to use for input when resolving another dataset containing a subset of the same original names. A sample output name-map is

`splist_wrangle_gbif.namemap.`

**SECONDARY
OUTPUT**

**PRIMARY
OUTPUT**





Let's look at the output!

While it runs let's look at... SECONDARY OUTPUT

main ▾ **tutorials / data / easy_bake / wrangle_species_list_gbif.log** Go to file ...

 zzeppozz tutorial data ✓ Latest commit e696d1f 7 minutes ago History

1 contributor

135 lines (135 sloc) | 16.1 KB Raw Blame    


```
1 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera richardsonii R. Br. to Heuchera richardsonii
2 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera americana L. to Heuchera americana
3 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera x easthamii Calder & Savile to Heuchera easthamii
4 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Elmera racemosa (S.Watson) Rydb. to Elmera racemosa
5 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera halstedii Rydb. to Heuchera halstedii
6 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera macrophylla Lodd. ex G.Don to Heuchera macrophylla
7 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera flabellifolia Rydb. to Heuchera flabellifolia
8 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera macrorhiza Small to Heuchera villosa
9 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera merriamii Eastw. to Heuchera merriamii
10 09 Sep 2022 15:26 DEBUG AcceptedNameSpeciesListWrangler: Resolved Heuchera novamexicana Wheelock to Heuchera novamexicana
```

 **Logging of the process!**

Let's look at the output!

While it runs let's look at... SECONDARY OUTPUT


main ▾ **tutorials / data / easy_bake / wrangle_species_list_gbif.rpt** Go to file ...

 zzeppozz test, rename inputs, outputs ✓ Latest commit 6aee525 6 days ago History

1 contributor

8 lines (8 sloc) | 142 Bytes Raw Blame ✎ ▾ 📄 🗑️

```
1 [
2   {
3     "name": "AcceptedNameSpeciesListWrangler",
4     "version": "1.0",
5     "unresolved": 4,
6     "duplicates": 41
7   }
8 ]
```



Summary of the process!

Let's look at the output!

While it runs let's look at...

PRIMARY OUTPUT

Goal: produce a file with resolved species names
(**ONLY ACCEPTED NAMES**)

By product: **NAME-MAP**
connecting original and accepted names using **GBIF! !**

```
main - tut 82 lines (82 sloc) | 1.75 KB
zzeppozz data
1 contributor
129 lines (129 sloc)
1 {
2     "Heuchera maxima"
3     "Heuchera missouriensis"
4     "Heuchera hallii"
5     "Heuchera hemsleyana"
6     "Elmera cylindrica glabella"
7     "Heuchera rubescens versicolor"
8     "Heuchera novamexicana"
9     "Heuchera brevistaminea"
10    "Heuchera americana"
11    "Heuchera americana hirsuticaulis"
12    "Elmera hirsutissima"
13    "Heuchera elegans"
14    "Heuchera duranii"
15    "Heuchera parvifolia nivalis"
16    "Heuchera longipetala orizabensis"
17    "Heuchera parvifolia flavescens"
18    "Heuchera glabra"
19    "Heuchera pilosissima hemisphaerica"
```

1. **Species list must contain: ACCEPTED, UNIQUE and CONSISTENT names!**
2. **Manual ways of treating nomenclature: useful for small datasets and to subset large datasets.**
3. **Automated ways of treating nomenclature: useful for large datasets.**
4. **BiotaPhy framework is a great toolkit for automated pathway!**

Any questions??

Please, use the link to the Jamboard to write your question!