

Methods in evolutionary ecology WS25/26

Stefanos Siozios

Michael Gerth

Table of contents

About	5
Quarto	5
How to find your way around	6
 I R	 7
1 First steps	8
1.1 Operators and functions	8
1.2 Data types	11
1.3 Exercises	12
 2 Data structures	 14
2.1 Vectors	14
2.1.1 Exercises	19
2.2 Matrices	19
2.2.1 Exercise	22
2.3 Data frames	22
2.3.1 Exercise	35
 3 Data, packages, and some more functions	 36
3.1 Setting up your working environment	36
3.2 Functions	37
3.3 Loops	38
3.4 Plots	39
3.5 Exercises	41
 4 Tidyverse	 42
4.1 What is the tidyverse?	42
4.2 Our data set for today	43
4.3 <code>filter()</code> for filtering data frames	44
4.4 The pipe <code>%>%</code> for combining commands	57
4.5 Sort by column with <code>arrange()</code>	68
4.6 Select columns with <code>select()</code>	108
4.7 Create new variables with <code>mutate()</code>	170
4.8 Exercise	181

4.9	<code>group_by()</code> and <code>summarise()</code> as powerful data exploration tools	182
4.10	More exercises	183
5	The <code>ggplot2</code> package	184
5.1	Very (!) brief introduction	184
5.2	Building up the plot	184
5.3	Faceting	188
5.4	Some common plot types	190
5.5	Fine tuning plots	194
5.6	Exercise	195
II	UNIX	196
6	Introduction to Linux Environment and Command Line.	197
6.1	The Unix / Linux environment	197
6.2	Why learn Unix command line?	197
6.3	Some terminology	198
6.4	Some important rules	198
6.5	Accessing your Terminal	200
7	Part 1. Your first Unix commands - Navigating the Unix File-System Structure	201
7.1	Finding out where you are	202
7.2	The command <code>ls</code>	203
7.3	Relative vs absolute path and getting help	204
7.4	Moving around	204
7.5	Exercise	205
8	Part 2. Working with Files and Directories	206
8.1	Creating new directories and files	206
8.2	Move or Rename a File or Directory	207
8.3	Delete (remove) files and directories	208
8.4	Viewing and inspecting Files	209
8.5	A text editor for the terminal	210
9	Part 3. Redirection, Pipes, and Text Processing in Unix	211
9.1	Redirecting and piping	211
9.2	<code>cut</code> , <code>sort</code> , and <code>uniq</code>	212
9.3	<code>grep</code> and regular expressions	213
9.4	<code>awk</code>	213
III	Phylogenetics	215

IV Microbiome	216
References	217

About

This script covers the computational and bioinformatics parts of the module “Methods in Evolutionary Ecology”. We will introduce you to **R** and **BASH**, two of the most widely used scripting languages, and make you familiar with navigating in a UNIX environment. These skills are important for any biologist, irrespective of the field you may want to specialise in in the future. Building upon your new knowledge, we will learn how to reconstruct phylogenies from sequencing data, how to work with genomic data, and how to characterise microbiomes. At the end of three weeks computational work, you will tackle a small computational group project, putting your new skills into practise.

The script is designed to cover the entire course content. While we will go you through all of the material together in detail during the course, the script should also enable you to work through the content on your own, e.g., to recap after the course has finished and as a reference and starting point for future computational endeavours.

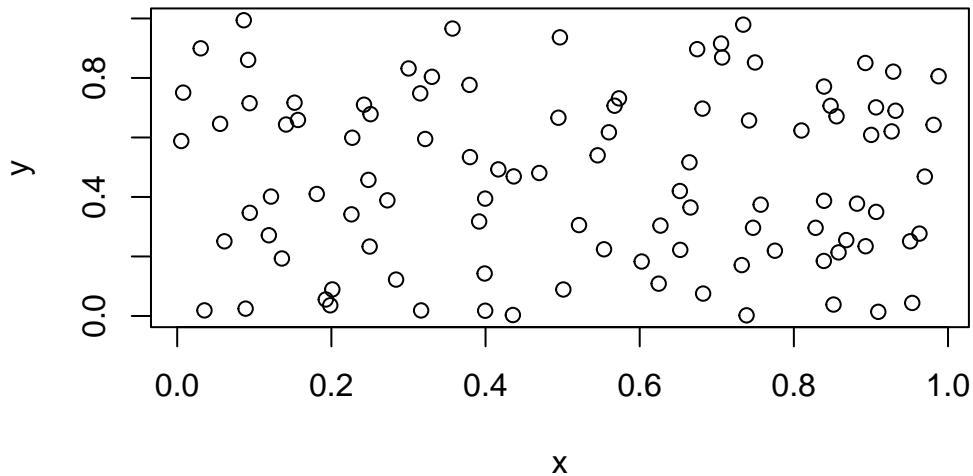
Quarto

The text is formatted using [Quarto](#), which comes with a number of benefits. It allows us to provide explanations as structured and nicely formatted regular text, and to include code blocks for all computational steps. When compiling Quarto documents, all of the code is run, which means that you not only see the code, but also the outputs it creates.

Here is an example:

This little block of **R** code generates 100 random coordinates and plots them. The code is shown below, together with the output the code has produced (in this case, a plot).

```
x <- runif(100)
y <- runif(100)
plot(x, y)
```



The code can conveniently be copied from the block into your own scripts.

Quarto supports many formats, we here provide the script as a webpage and a printable pdf. Writing Quarto documents is very simple and can be done using RStudio as an editor. The entire script is available for you on [github](#) – feel free to download it and modify it with your own comments, notes, and code. We will provide a short introduction to github and Quarto in the course.

How to find your way around

Simply use the navigation on the left to quickly access the different topics, or flip through the individual pages using the buttons at the bottom of the page. You may wish to download the pdf version of the script (click the pdf icon in the top left) which is ideal for printing. The script is organized by topics, rather than course days, because we will adapt the tempo according to your needs.

Please note: The script will very likely only be complete at the end of the course. We will still be modifying and correcting it throughout the three weeks you are with us. So make sure to check out the final version at the end of the course.

Part I

R

1 First steps

R is a statistical programming environment that has become a standard tool in the data and life sciences and many other fields. You may have used R already to run some statistics in a course you took in your studies, and this will be a likely use case for your remaining degree. However, R is much more: it can be used to analyse massive the datasets of the “omics”- age, build webpages, blogs, and interactive apps, and even for art!

Before taking full advantage of what the various R packages have to offer, we need to become familiar with its basic structure and commands. It pays off to invest a little effort in practicing the basics, because all R packages use the same syntax – a solid familiarity with base R thus allows you to explore the entire R universe independently.

1.1 Operators and functions

R can be used just like an arithmetic calculator. You are familiar with all of the basic syntax already, if you know how to use a calculator!

Some examples:

```
3 + 4
```

```
[1] 7
```

```
3 - 4
```

```
[1] -1
```

```
3 * 4
```

```
[1] 12
```

```
3 / 4
```

```
[1] 0.75
```

```
3 ^ 4 # power of
```

```
[1] 81
```

As with a regular calculator, there is operator precedence: power > multiplicative operations > additive operations:

```
(1 + 2) * 3
```

```
[1] 9
```

```
2^3 * 3
```

```
[1] 24
```

```
2^(3 * 3)
```

```
[1] 512
```

Square roots, exponentials, and logarithms also work just as with a calculator:

```
sqrt(9)
```

```
[1] 3
```

```
exp(3)
```

```
[1] 20.08554
```

```
log(3)
```

```
[1] 1.098612
```

```
log(exp(3)) # natural logarithm
```

```
[1] 3
```

```
log10(100) # logarithm to base 10
```

```
[1] 2
```

In order to “save” a value for use later on, you have to assign it to a variable! `<-` is the assignment operator you need to use for this (handy shortcut in RStudio is `ALT + -`).

```
x <- 3 + 4
```

Calling the variable will then print the result to the R console, and can be used in other calculations.

```
x
```

```
[1] 7
```

```
x + 10
```

```
[1] 17
```

You can call your variables whatever you want, but be careful: R will overwrite any variable if you tell it to, without a warning! You should also avoid giving your variables names that are already assigned to functions.

```
my_favourite_variable <- 100  
my_favourite_variable <- 50  
my_favourite_variable
```

```
[1] 50
```

All variables (among other things) are visible in the environment panel in RStudio (default: top right part of the screen).

“=” can also be used to assign variables but is discouraged, because the direction of the assignment is not immediately obvious. It is best practise to always start with the variable, followed by the assignment operator

1.2 Data types

You need to be familiar with at least three important data types in R: **logical**, **numeric**, and **character**. Data being stored in a different data type than required is one of the most frequent error messages you will encounter as an R beginner.

logical simply means true or false. R also understands the abbreviations T and F. To determine which types your data is in, you can use **mode** or **class**.

```
var1 <- TRUE
mode(var1)
```

```
[1] "logical"
```

numeric means numbers

```
var2 <- 10
class(10)
```

```
[1] "numeric"
```

A character is any form of text, a so called “string”. It must always be surrounded by quotation marks!

```
var3 <- "A so called string"
mode(var3)
```

```
[1] "character"
```

If in doubt, R will often convert or read in data as characters. Watch out for some common errors!

```
var4 <- "5"
var4
```

```
[1] "5"
```

```
is.numeric(var4)
```

```
[1] FALSE
```

```
var5 <- "TRUE"  
var5
```

```
[1] "TRUE"
```

```
is.logical(var5)
```

```
[1] FALSE
```

You can convert between types easily!

```
var6 <- as.numeric(var4)  
var6
```

```
[1] 5
```

```
class(var6)
```

```
[1] "numeric"
```

1.3 Exercises

- a) Sum the values of 1 to 5
- b) Create a variable v1 and assign it a character value
- c) Copy variable v1 to v2
- d) Compare the value of v1 against v2

Tip

Compare values and variables using the following operators

<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to

`==` equals
`!=` not equal

Please note, `=` and `==` do very different things! Don't mix them up.

2 Data structures

So far we've only looked at simple variables consisting of a single value or character. Typically, your data will be more complex. In R, there are three structures relevant for the data you will be working with.

2.1 Vectors

A **vector** is a number of elements of the same data type (`logical`, `numeric`, `character`). It can be generated by concatenating the elements using the function `c`.

```
vec1 <- c(T, F, T, F)
vec1
```

```
[1] TRUE FALSE TRUE FALSE
```

```
mode(vec1)
```

```
[1] "logical"
```

```
vec2 <- c(1, 2, 3, 4, 5)
vec2
```

```
[1] 1 2 3 4 5
```

```
mode(vec2)
```

```
[1] "numeric"
```

```
vec3 <- c("Spring", "Summer", "Autumn", "Winter")
vec3
```

```
[1] "Spring" "Summer" "Autumn" "Winter"
```

```
mode(vec3)
```

```
[1] "character"
```

Other ways to generate vectors are `rep` and `seq`. `rep` is used to repeat any number of elements any number of times.

```
rep(5, 10)
```

```
[1] 5 5 5 5 5 5 5 5 5 5
```

```
rep(vec3, 5)
```

```
[1] "Spring" "Summer" "Autumn" "Winter" "Spring" "Summer" "Autumn" "Winter"
[9] "Spring" "Summer" "Autumn" "Winter" "Spring" "Summer" "Autumn" "Winter"
[17] "Spring" "Summer" "Autumn" "Winter"
```

`seq` can be used to create numerical sequences.

```
seq(from = 0, to = 100, by = 5)
```

```
[1] 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
[20] 95 100
```

The command above is easy to read and understand for humans, which is good. R will also understand if you specify it as

```
seq(0, 100, 5)
```

```
[1] 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
[20] 95 100
```

As a shortcut for a common sequences, you can use

```
1:10
```

```
[1] 1 2 3 4 5 6 7 8 9 10
```

As mentioned above,, vectors can only combine elements of a single data type. Combining multiple different data types may result in some unwanted behaviour.

```
vec_mix1 <- c(5, TRUE, 65)
mode(vec_mix1)
```

```
[1] "numeric"
```

```
vec_mix2 <- c("blue", TRUE, "red")
mode(vec_mix2)
```

```
[1] "character"
```

In many cases you may wish to access a single element of a vector. You can do so using square brackets.

```
z <- c("order", "family", "genus", "species")
z[2]
```

```
[1] "family"
```

Similarly, you can access any combination of elements from the vector.

```
z[1:2]
```

```
[1] "order" "family"
```

```
i <- c(1, 3)
z[i]
```

```
[1] "order" "genus"
```

```
z[c(1, 1, 1, 4)]
```

```
[1] "order" "order" "order" "species"
```

```
z[-1]
```

```
[1] "family" "genus" "species"
```

The square brackets are also used if you need to change elements of the vector. Changes are made using the assignment operator which you already know.

```
x <- 1:5  
x
```

```
[1] 1 2 3 4 5
```

```
x[c(1, 4)] <- 10  
x
```

```
[1] 10 2 3 10 5
```

Which elements of a vector have certain characteristics? This is important for filtering/selecting in your dataset. You can combine different queries using logical operators.

```
x >= 5
```

```
[1] TRUE FALSE FALSE TRUE TRUE
```

```
x[x >= 5]
```

```
[1] 10 10 5
```

```
which(x >= 5)
```

```
[1] 1 4 5
```

```
z
```

```
[1] "order" "family" "genus" "species"
```

```
which(z == "genus")
```

```
[1] 3
```

```
z[z== "genus"]
```

```
[1] "genus"
```

```
z[z != "genus"]
```

```
[1] "order" "family" "species"
```

```
which(z== "genus" | z == "order")
```

```
[1] 1 3
```

Logical operators in R

	OR
&	AND
!	NOT

Conveniently, the elements of a vector can be named and accessed using the names. Let's first create a vector...

```
dmel <- c("Hexapoda", "Diptera", "Drosophilidae", "Drosophila", "Drosophila melanogaster")
dmel
```

```
[1] "Hexapoda"          "Diptera"
[3] "Drosophilidae"     "Drosophila"
[5] "Drosophila melanogaster"
```

... and then add names for each element

```
names(dmel) <- c("Class", "Order", "Family", "Genus", "Species")
dmel
```

	Class	Order	Family
	"Hexapoda"	"Diptera"	"Drosophilidae"
	Genus	Species	
	"Drosophila"	"Drosophila melanogaster"	

```
str(dmel)
```

```
Named chr [1:5] "Hexapoda" "Diptera" "Drosophilidae" "Drosophila" ...
- attr(*, "names")= chr [1:5] "Class" "Order" "Family" "Genus" ...
```

Now we can use the names to access the values

```
dmel[c("Class", "Species")]
```

Class	Species
"Hexapoda"	"Drosophila melanogaster"

```
dmel[names(dmel) == "Order"]
```

Order
"Diptera"

2.1.1 Exercises

- Create a vector consecutively numbering all days of the year 2026. Assign the correct weekday names for all elements of the vector.
- Use the vector to determine how many days in 2026 are weekend days.



Tip

If you struggle to assign the correct names, have a look at the help for `rep`.

2.2 Matrices

A **matrix** in R can be thought of as a two-dimensional vector. All elements must be of the same data type. There are various ways to create a matrix. For example, one can use the `matrix` function like this.

```
mat1 <- matrix(data = 1:12, nrow = 3, ncol = 4, byrow=T)
mat1
```

	[,1]	[,2]	[,3]	[,4]
[1,]	1	2	3	4
[2,]	5	6	7	8
[3,]	9	10	11	12

Alternatively, a vector can be transformed into a matrix

```
mat2 <- 1:12
dim(mat2) <- c(3, 4)
mat2
```

```
      [,1] [,2] [,3] [,4]
[1,]    1    4    7   10
[2,]    2    5    8   11
[3,]    3    6    9   12
```

Often you will want to combine multiple vectors into a matrix

```
dmel <- c("Hexapoda", "Diptera", "Drosophilidae", "Drosophila", "Drosophila melanogaster")
dhyd <- c("Hexapoda", "Diptera", "Drosophilidae", "Drosophila", "Drosophila hydei")
mat3 <- cbind(dmel, dhyd)
mat3
```

```
      dmel                      dhyd
[1,] "Hexapoda"                "Hexapoda"
[2,] "Diptera"                  "Diptera"
[3,] "Drosophilidae"            "Drosophilidae"
[4,] "Drosophila"                "Drosophila"
[5,] "Drosophila melanogaster" "Drosophila hydei"
```

```
mat4 <- rbind(dmel, dhyd)
mat4
```

```
      [,1]      [,2]      [,3]      [,4]
dmel "Hexapoda" "Diptera" "Drosophilidae" "Drosophila"
dhyd "Hexapoda" "Diptera" "Drosophilidae" "Drosophila"
      [,5]
dmel "Drosophila melanogaster"
dhyd "Drosophila hydei"
```

Just like vectors, matrix elements can have names

```
mat3
```

	dmel	dhyd
[1,]	"Hexapoda"	"Hexapoda"
[2,]	"Diptera"	"Diptera"
[3,]	"Drosophilidae"	"Drosophilidae"
[4,]	"Drosophila"	"Drosophila"
[5,]	"Drosophila melanogaster"	"Drosophila hydei"

```
colnames(mat3)
```

```
[1] "dmel" "dhyd"
```

```
rownames(mat3) <- c("Class", "Order", "Family", "Genus", "Species")
mat3
```

	dmel	dhyd
Class	"Hexapoda"	"Hexapoda"
Order	"Diptera"	"Diptera"
Family	"Drosophilidae"	"Drosophilidae"
Genus	"Drosophila"	"Drosophila"
Species	"Drosophila melanogaster"	"Drosophila hydei"

And just like with vectors, we can use square brackets to access and replace values. Because there are 2 dimensions, we need to provide 2 values (one for rows, one for columns, separated by ,).

```
mat3
```

	dmel	dhyd
Class	"Hexapoda"	"Hexapoda"
Order	"Diptera"	"Diptera"
Family	"Drosophilidae"	"Drosophilidae"
Genus	"Drosophila"	"Drosophila"
Species	"Drosophila melanogaster"	"Drosophila hydei"

```
mat3[1:3, 2]
```

Class	Order	Family
"Hexapoda"	"Diptera"	"Drosophilidae"

```
mat3[1:3, ]
```

	dmel	dhyd
Class	"Hexapoda"	"Hexapoda"
Order	"Diptera"	"Diptera"
Family	"Drosophilidae"	"Drosophilidae"

```
mat3[c("Class", "Species"), ]
```

	dmel	dhyd
Class	"Hexapoda"	"Hexapoda"
Species	"Drosophila melanogaster"	"Drosophila hydei"

2.2.1 Exercise

- create a matrix using with 20 rows & 5 columns, using 100 randomly generated numbers between 0 and 1000.
- replace all values in the 3rd column of this matrix that are larger than 500 with NA.

Tip

use the function `runif` to create random values

2.3 Data frames

Data frames are the R equivalent of spread sheets. Like matrices, they are two-dimensional, however they may combine different data types. Most biological data sets you will encounter will be data frames.

Lets create a data frame

```
# create some data
species <- rep(c("beech","ash","elm","maple", "sycamore"),40)
species
```

```

[1] "beech"      "ash"      "elm"      "maple"    "sycamore" "beech"
[7] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[13] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[19] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[25] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[31] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[37] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[43] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[49] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[55] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[61] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[67] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[73] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[79] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[85] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[91] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[97] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[103] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[109] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[115] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[121] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[127] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[133] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[139] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[145] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[151] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[157] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[163] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[169] "maple"    "sycamore" "beech"    "ash"      "elm"      "maple"
[175] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[181] "beech"    "ash"      "elm"      "maple"    "sycamore" "beech"
[187] "ash"      "elm"      "maple"    "sycamore" "beech"    "ash"
[193] "elm"      "maple"    "sycamore" "beech"    "ash"      "elm"
[199] "maple"    "sycamore"

```

```

dbh <- runif(200, 5, 40)
dbh

```

```

[1] 39.171624 29.354453 8.511445 9.015421 5.866658 22.095722 28.976364
[8] 18.329696 5.366893 37.251931 10.765113 13.469137 38.854988 10.337286
[15] 21.152701 15.993489 13.556158 20.961065 8.904899 34.219593 36.240084
[22] 38.026097 8.138498 24.750894 34.129659 38.383763 8.763782 17.862061

```

```

[29]  5.610953 15.160808 30.457407 13.337839 21.543856 20.346460 37.514182
[36] 35.934097  5.787530 33.095068 22.801033 39.593336  8.996938  6.869305
[43] 17.468191 22.067676 17.896435 25.608326 27.053396 17.781657 28.359862
[50] 26.042601 31.458590 13.206392 24.207700 36.725544 20.179190  5.484389
[57] 23.363020 24.870866 29.643865 28.135901 31.490755  7.996138 26.430836
[64] 11.124293  7.126850 18.402129 26.858513 27.504714 33.766651 16.107053
[71] 20.421185 21.933688 34.954567 25.646966 33.543890 36.037410 18.471618
[78] 25.007588 28.934443 17.556115 14.449312 34.319220 35.428884 19.321899
[85] 12.393099 19.875878 19.009552 28.815518 38.608227 34.535529 34.003920
[92] 10.575668 35.191652 37.195109 26.372176 39.227814 33.004892 27.691887
[99]  5.069858  7.156877  7.968223 14.766140 15.790334  9.856021 10.865953
[106] 30.910484 33.973620 32.253762 14.427263 29.855300 18.060493 16.067587
[113] 19.073215 33.169077 11.535413 31.700008 20.754432 38.266728 34.660448
[120]  7.215717 36.888130 21.932936 33.008854 28.625660 26.633746 22.377662
[127] 37.690641 22.930572 23.957767 16.026726 10.554301 39.406585 27.337139
[134] 27.721998 17.301347 19.060512 17.797035 26.806834 37.691099 30.549909
[141] 26.101633 11.629686 17.135724 37.749455 39.896284 39.402322 10.907947
[148] 25.088321 30.621222 13.592166 27.719039 33.168074 29.137881  9.823620
[155] 36.000652 30.117605 13.160646 29.131121 16.068469  8.290373 29.986205
[162] 27.720683 15.991990 15.067016 29.020528 11.080681 10.308304 11.257330
[169] 23.406682 35.700784 16.030586 37.981374  6.971275 38.544618 19.716088
[176] 17.858320 39.154087  8.175475  7.827535 13.827883 34.399319 21.947221
[183] 24.688441 33.833862  6.960915 38.889302 39.718427 38.171696  9.004418
[190]  9.152599 18.205276  8.903674  6.001105 20.499580 16.049651 39.591279
[197] 32.605250 31.273641 12.371225 29.534909

```

```

age <- as.integer(runif(200, 20, 120))
age

```

```

[1] 100  55  91  92  25  70  95  44  58  23  77  83 103  82  88  42  57  61
[19]  36  26  72  43 103  29  99 106  26  53  48  60  24  71  45  46  39  33
[37]  70  31  52  90 102  55  71  24 114  20  47  59  61  26 100 101  35  61
[55] 111  59  67  65 116  29  31  61  86  48  22  41 108  30  55  62  71 114
[73] 112  32  68  23  69  28  20  33  66  36  80 110  63 102  74  68  49  94
[91]  74 111  98  58  42 114  94  32  84  99  76  79  49  47  37  79  37  31
[109]  51  53 102 101  87  92  75  34  55  46 119  95  22  34  64  68  92 103
[127]  35  90  54  70  62  39  25  77  31  32  67  71 111  75  73  82 103 108
[145]  40 109 116  26  85  53  30  59  81  97  65  86 105  71  79  32  22  52
[163]  84  43  95  40  55  80  56  84  79  38  55  58  81  22  47  42  83  51
[181]  26  58  62  26  38  35  99  28  38  93 109 113  79  50  66  75  64  68
[199]  70 116

```

```
df1 <- data.frame(species, dbh, age)
df1
```

species	dbh	age
beech	39.171624	100
ash	29.354453	55
elm	8.511445	91
maple	9.015421	92
sycamore	5.866658	25
beech	22.095722	70
ash	28.976364	95
elm	18.329696	44
maple	5.366893	58
sycamore	37.251931	23
beech	10.765113	77
ash	13.469137	83
elm	38.854988	103
maple	10.337286	82
sycamore	21.152701	88
beech	15.993489	42
ash	13.556158	57
elm	20.961065	61
maple	8.904899	36
sycamore	34.219593	26
beech	36.240084	72
ash	38.026097	43
elm	8.138497	103
maple	24.750894	29
sycamore	34.129659	99
beech	38.383763	106
ash	8.763782	26
elm	17.862061	53
maple	5.610953	48
sycamore	15.160808	60
beech	30.457407	24
ash	13.337839	71
elm	21.543856	45
maple	20.346460	46
sycamore	37.514182	39
beech	35.934097	33
ash	5.787530	70

species	dbh	age
elm	33.095068	31
maple	22.801033	52
sycamore	39.593336	90
beech	8.996938	102
ash	6.869305	55
elm	17.468191	71
maple	22.067675	24
sycamore	17.896435	114
beech	25.608326	20
ash	27.053396	47
elm	17.781657	59
maple	28.359862	61
sycamore	26.042601	26
beech	31.458589	100
ash	13.206392	101
elm	24.207700	35
maple	36.725544	61
sycamore	20.179190	111
beech	5.484389	59
ash	23.363020	67
elm	24.870866	65
maple	29.643865	116
sycamore	28.135901	29
beech	31.490755	31
ash	7.996138	61
elm	26.430836	86
maple	11.124293	48
sycamore	7.126850	22
beech	18.402129	41
ash	26.858513	108
elm	27.504714	30
maple	33.766651	55
sycamore	16.107053	62
beech	20.421185	71
ash	21.933688	114
elm	34.954567	112
maple	25.646966	32
sycamore	33.543890	68
beech	36.037410	23
ash	18.471618	69
elm	25.007588	28

species	dbh	age
maple	28.934443	20
sycamore	17.556115	33
beech	14.449312	66
ash	34.319220	36
elm	35.428884	80
maple	19.321899	110
sycamore	12.393099	63
beech	19.875878	102
ash	19.009552	74
elm	28.815518	68
maple	38.608227	49
sycamore	34.535529	94
beech	34.003920	74
ash	10.575668	111
elm	35.191652	98
maple	37.195109	58
sycamore	26.372176	42
beech	39.227814	114
ash	33.004892	94
elm	27.691887	32
maple	5.069858	84
sycamore	7.156877	99
beech	7.968223	76
ash	14.766140	79
elm	15.790334	49
maple	9.856021	47
sycamore	10.865953	37
beech	30.910484	79
ash	33.973620	37
elm	32.253762	31
maple	14.427263	51
sycamore	29.855300	53
beech	18.060493	102
ash	16.067587	101
elm	19.073215	87
maple	33.169077	92
sycamore	11.535413	75
beech	31.700008	34
ash	20.754432	55
elm	38.266728	46
maple	34.660448	119

species	dbh	age
sycamore	7.215717	95
beech	36.888130	22
ash	21.932936	34
elm	33.008854	64
maple	28.625660	68
sycamore	26.633746	92
beech	22.377662	103
ash	37.690641	35
elm	22.930572	90
maple	23.957767	54
sycamore	16.026726	70
beech	10.554301	62
ash	39.406585	39
elm	27.337139	25
maple	27.721998	77
sycamore	17.301347	31
beech	19.060512	32
ash	17.797035	67
elm	26.806834	71
maple	37.691099	111
sycamore	30.549909	75
beech	26.101633	73
ash	11.629686	82
elm	17.135724	103
maple	37.749455	108
sycamore	39.896285	40
beech	39.402322	109
ash	10.907947	116
elm	25.088321	26
maple	30.621222	85
sycamore	13.592166	53
beech	27.719039	30
ash	33.168075	59
elm	29.137881	81
maple	9.823620	97
sycamore	36.000652	65
beech	30.117605	86
ash	13.160647	105
elm	29.131121	71
maple	16.068469	79
sycamore	8.290373	32

species	dbh	age
beech	29.986205	22
ash	27.720683	52
elm	15.991990	84
maple	15.067016	43
sycamore	29.020528	95
beech	11.080681	40
ash	10.308304	55
elm	11.257330	80
maple	23.406682	56
sycamore	35.700784	84
beech	16.030586	79
ash	37.981374	38
elm	6.971275	55
maple	38.544618	58
sycamore	19.716088	81
beech	17.858320	22
ash	39.154087	47
elm	8.175475	42
maple	7.827535	83
sycamore	13.827883	51
beech	34.399319	26
ash	21.947221	58
elm	24.688441	62
maple	33.833862	26
sycamore	6.960915	38
beech	38.889302	35
ash	39.718427	99
elm	38.171696	28
maple	9.004418	38
sycamore	9.152599	93
beech	18.205276	109
ash	8.903674	113
elm	6.001105	79
maple	20.499579	50
sycamore	16.049651	66
beech	39.591279	75
ash	32.605250	64
elm	31.273641	68
maple	12.371225	70
sycamore	29.534909	116

To access values, we can use the same approaches as for matrices:

```
df1[1:12, 1:2]
```

species	dbh
beech	39.171624
ash	29.354453
elm	8.511445
maple	9.015421
sycamore	5.866658
beech	22.095722
ash	28.976364
elm	18.329696
maple	5.366893
sycamore	37.251931
beech	10.765113
ash	13.469137

but can also access and filter the columns directly using their names like this:

```
df1$species
```

```
[1] "beech"  "ash"    "elm"    "maple"  "sycamore" "beech"
[7] "ash"    "elm"    "maple"  "sycamore" "beech"    "ash"
[13] "elm"    "maple"  "sycamore" "beech"    "ash"      "elm"
[19] "maple"  "sycamore" "beech"    "ash"      "elm"      "maple"
[25] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[31] "beech"  "ash"      "elm"      "maple"    "sycamore" "beech"
[37] "ash"    "elm"      "maple"    "sycamore" "beech"    "ash"
[43] "elm"    "maple"    "sycamore" "beech"    "ash"      "elm"
[49] "maple"  "sycamore" "beech"    "ash"      "elm"      "maple"
[55] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[61] "beech"  "ash"      "elm"      "maple"    "sycamore" "beech"
[67] "ash"    "elm"      "maple"    "sycamore" "beech"    "ash"
[73] "elm"    "maple"    "sycamore" "beech"    "ash"      "elm"
[79] "maple"  "sycamore" "beech"    "ash"      "elm"      "maple"
[85] "sycamore" "beech"    "ash"      "elm"      "maple"    "sycamore"
[91] "beech"  "ash"      "elm"      "maple"    "sycamore" "beech"
[97] "ash"    "elm"      "maple"    "sycamore" "beech"    "ash"
[103] "elm"    "maple"    "sycamore" "beech"    "ash"      "elm"
```

```

[109] "maple"      "sycamore" "beech"     "ash"       "elm"       "maple"
[115] "sycamore"   "beech"     "ash"       "elm"       "maple"     "sycamore"
[121] "beech"      "ash"       "elm"       "maple"     "sycamore"   "beech"
[127] "ash"        "elm"       "maple"     "sycamore"   "beech"     "ash"
[133] "elm"        "maple"     "sycamore"   "beech"     "ash"       "elm"
[139] "maple"      "sycamore"   "beech"     "ash"       "elm"       "maple"
[145] "sycamore"   "beech"     "ash"       "elm"       "maple"     "sycamore"
[151] "beech"      "ash"       "elm"       "maple"     "sycamore"   "beech"
[157] "ash"        "elm"       "maple"     "sycamore"   "beech"     "ash"
[163] "elm"        "maple"     "sycamore"   "beech"     "ash"       "elm"
[169] "maple"      "sycamore"   "beech"     "ash"       "elm"       "maple"
[175] "sycamore"   "beech"     "ash"       "elm"       "maple"     "sycamore"
[181] "beech"      "ash"       "elm"       "maple"     "sycamore"   "beech"
[187] "ash"        "elm"       "maple"     "sycamore"   "beech"     "ash"
[193] "elm"        "maple"     "sycamore"   "beech"     "ash"       "elm"
[199] "maple"      "sycamore"

```

```
df1[df1$dbh > 15, ]
```

	species	dbh	age
1	beech	39.17162	100
2	ash	29.35445	55
6	beech	22.09572	70
7	ash	28.97636	95
8	elm	18.32970	44
10	sycamore	37.25193	23
13	elm	38.85499	103
15	sycamore	21.15270	88
16	beech	15.99349	42
18	elm	20.96106	61
20	sycamore	34.21959	26
21	beech	36.24008	72
22	ash	38.02610	43
24	maple	24.75089	29
25	sycamore	34.12966	99
26	beech	38.38376	106
28	elm	17.86206	53
30	sycamore	15.16081	60
31	beech	30.45741	24
33	elm	21.54386	45
34	maple	20.34646	46

	species	dbh	age
35	sycamore	37.51418	39
36	beech	35.93410	33
38	elm	33.09507	31
39	maple	22.80103	52
40	sycamore	39.59334	90
43	elm	17.46819	71
44	maple	22.06768	24
45	sycamore	17.89644	114
46	beech	25.60833	20
47	ash	27.05340	47
48	elm	17.78166	59
49	maple	28.35986	61
50	sycamore	26.04260	26
51	beech	31.45859	100
53	elm	24.20770	35
54	maple	36.72554	61
55	sycamore	20.17919	111
57	ash	23.36302	67
58	elm	24.87087	65
59	maple	29.64386	116
60	sycamore	28.13590	29
61	beech	31.49076	31
63	elm	26.43084	86
66	beech	18.40213	41
67	ash	26.85851	108
68	elm	27.50471	30
69	maple	33.76665	55
70	sycamore	16.10705	62
71	beech	20.42119	71
72	ash	21.93369	114
73	elm	34.95457	112
74	maple	25.64697	32
75	sycamore	33.54389	68
76	beech	36.03741	23
77	ash	18.47162	69
78	elm	25.00759	28
79	maple	28.93444	20
80	sycamore	17.55611	33
82	ash	34.31922	36
83	elm	35.42888	80
84	maple	19.32190	110

	species	dbh	age
86	beech	19.87588	102
87	ash	19.00955	74
88	elm	28.81552	68
89	maple	38.60823	49
90	sycamore	34.53553	94
91	beech	34.00392	74
93	elm	35.19165	98
94	maple	37.19511	58
95	sycamore	26.37218	42
96	beech	39.22781	114
97	ash	33.00489	94
98	elm	27.69189	32
103	elm	15.79033	49
106	beech	30.91048	79
107	ash	33.97362	37
108	elm	32.25376	31
110	sycamore	29.85530	53
111	beech	18.06049	102
112	ash	16.06759	101
113	elm	19.07322	87
114	maple	33.16908	92
116	beech	31.70001	34
117	ash	20.75443	55
118	elm	38.26673	46
119	maple	34.66045	119
121	beech	36.88813	22
122	ash	21.93294	34
123	elm	33.00885	64
124	maple	28.62566	68
125	sycamore	26.63375	92
126	beech	22.37766	103
127	ash	37.69064	35
128	elm	22.93057	90
129	maple	23.95777	54
130	sycamore	16.02673	70
132	ash	39.40659	39
133	elm	27.33714	25
134	maple	27.72200	77
135	sycamore	17.30135	31
136	beech	19.06051	32
137	ash	17.79703	67

	species	dbh	age
138	elm	26.80683	71
139	maple	37.69110	111
140	sycamore	30.54991	75
141	beech	26.10163	73
143	elm	17.13572	103
144	maple	37.74946	108
145	sycamore	39.89628	40
146	beech	39.40232	109
148	elm	25.08832	26
149	maple	30.62122	85
151	beech	27.71904	30
152	ash	33.16807	59
153	elm	29.13788	81
155	sycamore	36.00065	65
156	beech	30.11761	86
158	elm	29.13112	71
159	maple	16.06847	79
161	beech	29.98620	22
162	ash	27.72068	52
163	elm	15.99199	84
164	maple	15.06702	43
165	sycamore	29.02053	95
169	maple	23.40668	56
170	sycamore	35.70078	84
171	beech	16.03059	79
172	ash	37.98137	38
174	maple	38.54462	58
175	sycamore	19.71609	81
176	beech	17.85832	22
177	ash	39.15409	47
181	beech	34.39932	26
182	ash	21.94722	58
183	elm	24.68844	62
184	maple	33.83386	26
186	beech	38.88930	35
187	ash	39.71843	99
188	elm	38.17170	28
191	beech	18.20528	109
194	maple	20.49958	50
195	sycamore	16.04965	66
196	beech	39.59128	75

	species	dbh	age
197	ash	32.60525	64
198	elm	31.27364	68
200	sycamore	29.53491	116

2.3.1 Exercise

- Using `df1`, select only entries corresponding to ash and maple with an age over 50 and a diameter less than 30.
- Add a new column to the dataframe called “year”. Generate data for this column so that there are 10 different years and the same number of entries for each tree species per year.

 Tip

Use the function `rep` for this exercise

3 Data, packages, and some more functions

3.1 Setting up your working environment

Usually when working in R, you want to look at your own data, and not generate it from random distributions. To read in a data file, we first need to tell R where the working directory is located.

```
setwd("/home/of22haqi/Documents/TEACHING/MEE-WS25-26/")
```

The path will look different on your machine of course.

Now that `R` knows where to find it, we are ready to read in a data file.

```
# The table contains headers, and the fields are separated by commas
be <- read.table("data/butterfly_ecology.csv", header = TRUE, sep = ",")

# Let's have a glimpse at the data
head(be)
```

[illegible]

	con-	fam-	ser-	con-	OWS	OWS	SV	ser-	WSP_Fe-	ELT_sin-	FM_Av-	AFB_Av-	AFB_min-	AFB_an-	AFB_min-	power
species	ang	pau	ov	pa	egg	va	gc	ac	cn	hy	gn	gn	gn	gn	gn	gn
Aglycydidae	4	4	N	N	N	N	1	0	0	0.025	0.6	0.5	N	N	N	N
adacregidae	4	5	5	0	1	0	0	1	0	0	0	0	0	0	0	0
adacregidae	4	5	5	0	1	0	0	1	0	0	0	0	0	0	0	0

Use a text editor outside of Rstudio to look at the data file as well. Why do you think this is a good format to store data in? What is the advantage to e.g., an Excel file? What does using a text file format mean for your data entry requirements?

In order to save your entire working environment, so you don't have to re-run potentially time intensive pieces of your code, just save it and load it back into your work space the next time you use R.

```
save.image("myenv.Rdata")
```

You can also use the panel “Environment” in RStudio to save and load your data.

All of the functions we used today are so “base R” functions, which means they come preinstalled with R. Lots of the functionality of R is in external packages which need to be installed manually. The majority of relevant packages are found on [CRAN \(The Comprehensive R Archive Network\)](#), and there is a special archive for packages relevant to the life sciences ([Bioconductor](#)). In order to install packages from CRAN, simply run

```
install.packages("tidyverse", dependencies = TRUE)
```

Here, **tidyverse** is the package we want to install we ask to also install any packages that **tidyverse** may require to function. You can find a list of all packages currently installed in the packages tab in the panel on the bottom left in RStudio. It is good practise to keep the packages, as well as your R installation up to date.

3.2 Functions

We have already used plenty of functions. Most of them require at least an object on which to perform the function, and may also have some options. For example, consider the following function:

```
mean(be$range.size, na.rm = TRUE)
```

```
[1] 261.4116
```

`mean` is the function, `be$range.size` is the object (1 vector from the dataframe we just read into R) and `na.rm = TRUE` is the option to remove NAs from the vector before calculating the mean.

In some cases, you may want to do things to your data that cannot be addressed by a single function. In this case, you may have to perform a number of different operations on the dataset. If you are likely to use the same set of operations in the future, it may be advisable to use your own functions.

A very simple example. Let's assume the mean function didn't exist and we would need to write our own.

```
mean2 <- function(x){  
  x <- na.omit(x)  
  sum(x) / length(x)  
}  
  
mean2(be$range.size)
```

```
[1] 261.4116
```

We define `mean2` as a function that requires an object (here called `x` as an input). Looking into the function, we can see that it first removes the NAs from the object and next calculates the sum of `x` divided by the number of elements of `x` (this is how the mean is defined). Testing it, we can see that it gives the same result as the native mean function.

3.3 Loops

In many cases, we need to apply a function to a number of elements. In this case, loops come in handy. In the simple examples below, the structure of a for loop is illustrated.

```
for(i in 1:10) # how often is the loop repeated  
{  
  print(i)    # what is to be done each iteration  
}
```

```
[1] 1
[1] 2
[1] 3
[1] 4
[1] 5
[1] 6
[1] 7
[1] 8
[1] 9
[1] 10
```

```
j<-0
for(i in 1:5)
{
  j<-i+j
  print(j)
}
```

```
[1] 1
[1] 3
[1] 6
[1] 10
[1] 15
```

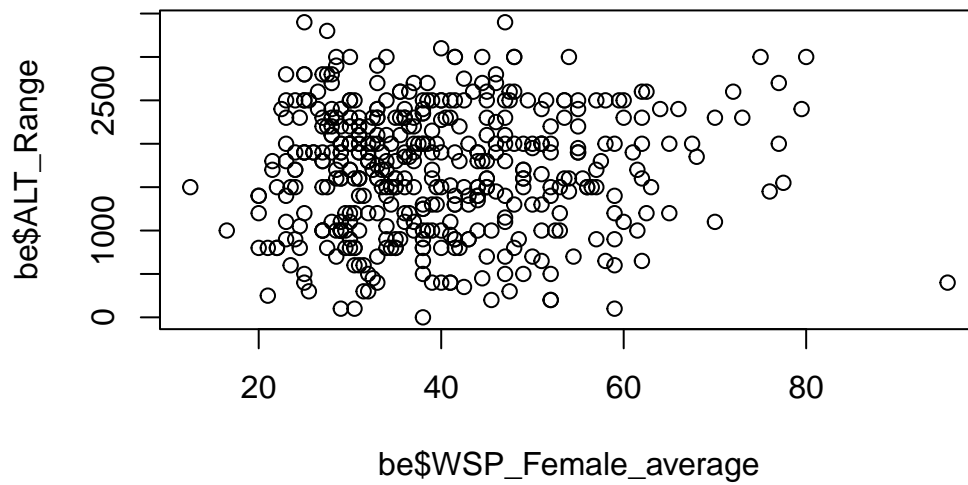
Observe and try to explain what happens in each iteration to the variables used in these examples.

3.4 Plots

For many use cases `ggplot2` is the best approach of plotting, and we will get to know this package later. However, for very simple and quick plots, base R plotting functions are sufficient and superior to other options because of simplicity and speed.

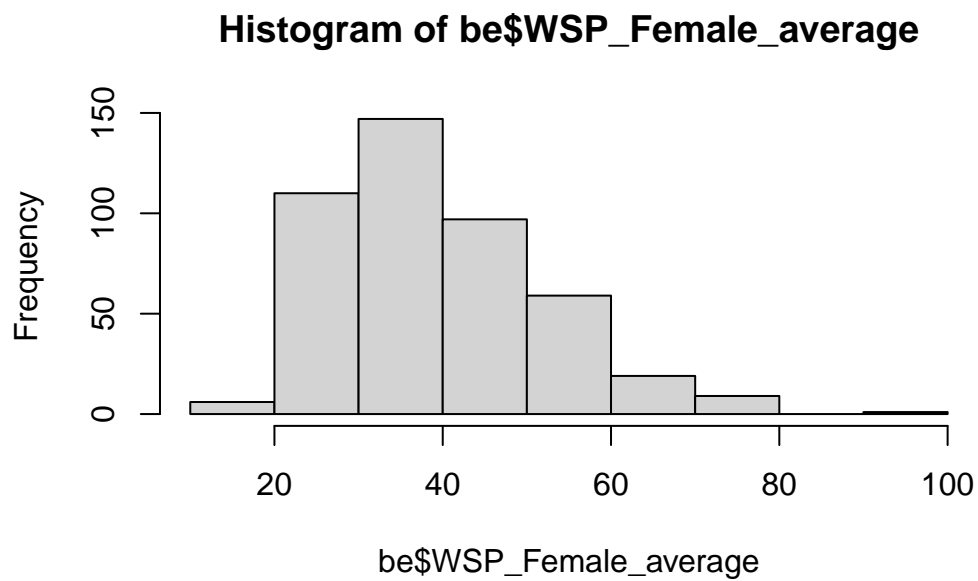
Scatter plots can be created by just naming the variables to be plotted against each other.

```
plot(be$WSP_Female_average, be$ALT_Range)
```



Histograms showing frequency distributions are also very easily generated

```
hist(be$WSP_Female_average)
```



3.5 Exercises

- a) Using a loop, plot histograms for the columns “WSP_Female_average”, “Alt_Range”, “Alt_min”, and “range.size”.
- b) Write a function that creates these plots with only the dataframe as argument.

4 Tidyverse

4.1 What is the tidyverse?

- A collection of R packages for data science
- All packages share a “philosophy” about design and data structure
- All packages are highly compatible and functions complement each other

We will only be looking at a couple of functions from a 2 packages (`dplyr` & `ggplot2`). All functions are about **data manipulation and visualisation** and are especially well suited for exploring very large data sets.

You can install all tidyverse packages by running

```
install.packages("tidyverse", dependencies = TRUE)
```

The following package(s) will be installed:

- tidyverse [2.0.0]

These packages will be installed into "~/work/MEE-WS25-26/MEE-WS25-26/renv/library/R-4.2/x86_64-pc-linux-gnu".

```
# Installing packages -----
- Installing tidyverse ...           OK [linked from cache]
Successfully installed 1 package in 5.4 milliseconds.
```

Let's refresh what we learned earlier this week:

1. What different types of data structures are used in R?
2. Which of these do you think is most likely to be used in the `tidyverse`?

(Remember, you can just add the answers into this document for future reference!)

4.2 Our data set for today

We will be looking at a data set of ecological traits of european butterflies. Download the table and read it into R.

```
# The table contains headers, and the fields are separated by commas
be <- read.table("data/butterfly_ecology.csv", header = TRUE, sep = ",")

# Let's have a glimpse at the data
head(be)
```

[illegible]

Each of the rows contains data for 1 European species, and the columns contain the following information:

Trait abbreviation	Meaning	States	Notes
OWS	Overwintering stage	egg, larvae, pupae, adult	
GEN	Generations	average, min, max, range	
WSP	Wingspan	average, range	Measured in mm
HSI	Hostplant index	N/A	Measured from 0-1
LEV	Larval environment	buried, ground layer, field layer, shrub layer, canopy layer	
ELT	Egg laying type	single, small batch, large batch	
ALT	Altitude	min, range	
FM	Flight months	average, range	
AFB	Adult feeding behaviour	herb flower, grass, shrub flower, honeydew, sap, animal, mineral	

Now that we are familiar with the dataset, lets look at some `tidyverse` functions.

4.3 `filter()` for filtering data frames

As the name suggests, this is used to filter data frames, with a simple and efficient syntax:

```
# first, we have to load the tidyverse packages
library(tidyverse, quietly = TRUE)

# the command always takes a dataframe as first argument, and a filtering criterion as second
# Here, we only look butterflies that overwinter as eggs
filter(be, OWS_egg == 1)
```

	con-	fam-	serv-	con-	OWS	OWS	GEN	GEN	WSP	WSP	Fe-	Fe-	ELT	ELT	FM	FM	AFB	AFB	AFB	AFB
species	range	size	OWS	OWS	page	egg	avg	min	max	range	avg	min	max	range	avg	min	max	range	avg	min
Argynnis	1	1	0	0	1.00	0.01	0.00	0.62	0.25	0.80	1	0	0	1	0	0	0	23	002	1
Nymphalis	1	1	0	0	1.00	0.01	0.00	0.62	0.25	0.80	1	0	0	1	0	0	0	23	002	1
yn-i-	1	1	0	0	1.00	0.01	0.00	0.62	0.25	0.80	1	0	0	1	0	0	0	23	002	1
nisdpa-	1	1	0	0	1.00	0.01	0.00	0.62	0.25	0.80	1	0	0	1	0	0	0	23	002	1
phia	1	1	0	0	1.00	0.01	0.00	0.62	0.25	0.80	1	0	0	1	0	0	0	23	002	1

[illegible]

Species	con-fam-	ser-con-	size	OVS	OWS	sup-pag	Vag	GEN	Av- male	WSP_Fe-er	WSP_Fe-er	ELT	sin-er	FM_Av-er	AFB_AFB-ey-	AFB_AFB-i-	AFB_AFB-an-	AFB_AFB-min-	AFB_AFB-power						
																				AFB_AFB					
EreNy5641-5	1	1	0	0	0.75	51.00	541.00	0.18	31	1	0	0	1	0	0	0	250	3002	1	0	0	0	0	0	1
biai-ligea																									
dae																									
EreNy8971-5	1	1	0	0	0.50	50.50	039.00	0.30	160	1	0	0	1	0	0	90	1600	3000	1	0	0	0	0	0	0
biai-manto																									
dae																									
FalNy8881-5	1	1	0	0	1.00	0.01	00.05	3.9	0.50	000	1	0	0	1	0	0	230	3053	1	0	1	0	0	0	1
ciaia_adippe																									
dae																									
FalNy8971-5	1	1	0	0	1.00	0.01	00.04	9.0	1.00	000	1	0	0	1	0	0	400	1600	3000	1	0	0	0	0	0
ciaia_elisa																									
dae																									
FalNy6461-4	1	1	0	0	1.00	0.01	00.04	9.9	0.40	81	1	0	0	1	0	0	250	2053	1	0	0	0	0	0	0
ciaia_niobe																									
dae																									
FavLy7775	5	1	0	0	0	1.00	0.01	00.03	2.0	0.40	80	0	0	1	1	0	0	200	3002	0	0	0	1	0	1
niusaquidae																									
cus																									
GegHe6555	5	1	1	1	1	3.00	0.03	00.03	2.0	0.20	80	1	0	0	1	0	0	190	3000	1	0	0	0	0	0
tropéri-																									
daidae																									
GorRe6433	3	1	1	1	3.00	0.03	00.06	1.53	0.50	770	0	1	1	1	0	0	300	170004	1	0	0	0	0	0	0
uledae																									
HeHe8075	5	1	1	0	0	1.00	0.01	00.03	1.0	0.30	31	1	0	0	1	0	0	220	3053	1	0	0	0	0	0
pe-peri-																									
riaidamma																									
IsNy9761-5	1	1	1	1	2.00	0.03	02.04	2.5	0.40	81	1	0	0	1	0	0									

species	family	range	size	con-	serv-	OWS	SVS	Sap-	GEN_Av-	male_av-	WSP_Fe-	WSP_Fe-										FM_Av-	AFB_Av-	AFB_an-	AFB_min-	power			
												er-WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-	er-WSP_Fe-	er-	ey-	i-						AFB_min-	er-WSP_Fe-	er-
LyLy689	caenidae	4	1	1	0	0	1.00	0.01	0.00	0.30	5.0	0.28	91	1	0	0	1	0	0	0	2500	0.51	1	0	0	0	0	0	
LyLy405	dracacidae	5	1	0	0	0	1.00	0.01	0.00	0.39	6.0	1.00	00	1	0	0	NANANA	500	100	000	1	0	0	0	0	0	1		
LyLy575	dracacidae	4	1	0	0	0	1.50	0.02	0.01	0.33	6.0	1.00	01	0	0	0	1	0	0	100	240	000	1	0	0	0	0	1	1
LyLy505	dracacidae	5	1	0	0	0	2.00	0.02	0.00	0.34	4.0	1.00	00	1	0	0	1	0	0	100	900	7.00	1	0	0	0	0	0	1
MuMu885	periidae	5	1	0	0	0	1.00	0.01	0.00	0.34	5.0	0.57	71	1	0	0	1	0	0	0	2000	002	1	0	0	0	0	0	1
PaPa401	siusidae	1	1	1	1	3.00	0.03	0.00	0.45	5.0	0.10	21	1	0	0	1	0	0	0	100	02.0	0	0	1	1	1	0	0	
PaPa415	siusidae	1	1	1	1	3.00	0.03	0.00	0.37	5.0	0.10	21	1	0	0	1	0	0	0	200	02.0	0	0	1	1	1	0	0	
PaPa354	siusidae	4	1	1	0	0	1.00	0.01	0.00	0.80	6.0	0.20	41	0	0	0	1	1	0	0	3000	0.51	1	0	0	0	0	0	0
PaPa371	siusidae	5	1	0	0	0	1.00	0.01	0.00	0.58	0.02	0.35	41	0	0	0	1	0	0	0	2500	000	1	0	0	0	0	0	0
PaPa484	siusidae	4	1	1	0	0	1.00	0.01	0.00	0.65	6.0	0.15	81	1	0	0	1	0	0	1600	020	000	1	0	0	0	0	0	0
PiePie412	thidae	1	1	1	1	3.00	0.03	0.00	0.62	5.0	0.28	91	1	1	0	0	1	1	200	120	02.0	1	0	0	0	0	0	0	0

[illegible]

[illegible]

The filtering criterion can be specified using the methods you are already familiar with (e.g., `>`, `>=`, `!=`, `%in%`).

Notice that the variable names can be used directly here, so instead of using `be$OWS_egg`, `filter()` lets you use `OWS_egg` directly. All `tidyverse` functions work like that. Let's look at more complex filtering:

```
# combine 2 filters with boolean "AND" ...
filter(be, OWS_egg == 1 , ALT_Min > 500)
```


[illegible]

[illegible]

	con- fam- species	ser- rang	com- prize	OVS cwa	SWS pagg	CNTN Cadm	GEN Gad	Av- ma	male_av- er-WSP_Fe-	WSP_Fe- SLE	ELT_sin- er-	FM_Av- er-	AFB_AFB- ey-i-	AFB-an- AFB_min-															
Geg-Hes55	5	-1	1	1	1	3.00	0.03	0.00	0.03	2.4	0.28	90	1	0	0	1	0	0	0	0	0	1							
tropéri- danidae																													
Gor-Hes3	3	-1	1	1	1	3.00	0.03	0.00	0.06	1.53	0.57	70	0	1	1	1	0	0	300	1700	4	1	0	0	0	0	0		
uledae																													
Hes-Hes80	5	1	1	0	0	1.00	0.01	0.00	0.03	1.6	0.33	31	1	0	0	1	0	0	0	220	3053	1	0	0	0	0	0		
pe-peri- riaidamma																													
Hy-Ny14	3	-1	0	1	0	0	1.00	0.01	0.00	0.04	5.6	0.16	91	1	0	0	1	0	0	0	230	4055	1	0	0	1	1	0	0
poniephele_lupina dae																													
Is-Ny97	3	-1	1	1	1	1	2.00	0.03	0.02	0.04	2.5	0.40	81	1	0	0	1	0	0	0	275	5006	1	0	0	0	0	0	1
so-i- riadaeth- o- nia																													
Lar-Hes8	3	-1	0	0	0	0	1.00	0.01	0.00	0.02	7.6	0.70	71	0	0	1	1	0	0	100	1500	0	1	0	0	0	0	0	
boraenidae																													
Lar-Hes36	5	1	1	1	0	3.00	0.03	0.00	0.03	3.6	0.05	80	1	0	0	1	0	0	0	270	9000	1	0	0	0	0	0	0	
descabridae																													
cus																													
Le-PicNA5	5	0	0	1	0	2.00	0.03	0.02	0.03	8.00	1.00	00	1	0	0	1	0	0	0	200	6004	0	0	1	1	1	1	1	
tidere- ali																													
Li-Ny52	3	-1	0	1	0	0	1.00	0.01	0.00	0.05	6.8	0.28	90	0	1	1	1	0	0	0	150	3002	1	1	1	1	1	1	1
meini- tis daemilla																													
Li-Ny41	3	-1	0	1	0	0	2.00	0.03	0.02	0.05	0.8	0.57	70	0	1	0	1	0	0	0	195	5004	1	0	1	1	1	1	1
meini- tis dne- ducta																													
Lop-Ny27	3	-1	0	1	0	0	1.00	0.01	0.00	0.04	4.8	0.08	61	1	0	0	1	0	0	100	1400	51	1	0	0	1	1	0	1
i- dae																													
Ly-Ly38	3	5	0	1	0	0	2.00	0.03	0.02	0.03	7.8	0.40	81	1	0	0	1	1	0	0	100	6051	1	0	1	1	0	0	0
caenidae par																													

[illegible]

[illegible]

[illegible]

NOTE

`filter()` (and many other `tidyverse` functions) return a data frame. In the `tidyverse`, these are called `tibble()` and behave slightly different to regular data frames. For our purposes however, these differences are not important.

4.4 The pipe %>% for combining commands

The filtering using `filter()` is very useful, but you can see that the commands can become very long when you have many filters. Also, trying out many different filters to see what they do with the data can be cumbersome. This where `%>%` comes in really handy.

The “pipe” `%>%` (keyboard shortcut: **Ctrl+Shift+M**) simply passes the result of one function to the next function. For the next function, one does not have to specify the data frame. Let’s see an example.

```
# this is how we filtered our data frame earlier
filter(be, OWS_egg == 1)
```

[illegible]

	con-	GEN_Av-	WSP_Fe-	FM_Av-	AFB_Av-	AFB_an-																						
fam- serv- con-	GEN_Av-	WSP_Fe-	FM_Av-	AFB_Av-	AFB_an-	AFB_min-																						
species	range	size	OWS	SVS	supu-	er-WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-	power																
Breny1995	1	0	0	0	1.00	0.01	0.00	0.40	8	0.40	80	1	0	0	1	0	0	25	22	75	00	1	0	0	0	0	0	0
this_hecate																												
dae																												
Breny1995	1	1	0	0	1.00	0.01	0.00	0.37	8	0.20	41	1	0	0	1	1	0	0	200	251	1	0	1	0	0	0	0	0
this_ino																												
dae																												
CaPi1991	NAN	NAN	1	1	1	3.00	0.03	0.00	0.50	0.00	NAN	0	0	1	1	1	1	0	0	200	0.0	NAN	NAN	NAN	NAN	NAN	NAN	NAN
siliaflo-																												
rella																												
CoPi1975	5	1	1	0	0	1.00	0.01	0.00	0.47	0.00	0.70	71	1	0	0	1	0	0	0	250	000	1	0	1	0	0	0	0
l_ dae																												
ias_palaeno																												
CyLy1945	5	1	1	1	1	3.00	0.03	0.00	0.27	5	0.28	90	1	0	0	0	1	0	203	300	NAN	1	0	0	0	0	0	0
clyrusida-																												
bianus																												
Danys1988	NAN	NAN	1	1	1	3.00	0.03	0.00	0.70	0.00	0.35	40	1	0	0	NAN	NAN	0	110	0.3	1	0	0	0	0	0	0	0
pui-																												
dae																												
EreNy1945	1	1	0	0	0	0.50	0.50	0.50	0.34	0	0.50	000	1	0	0	NAN	NAN	1200	05000	1	0	0	0	0	0	0	0	
biai-eri-																												
phydae																												
EreNy1945	1	1	0	0	0	0.75	0.51	0.00	0.54	0	0.09	60	1	0	0	1	0	0	600	190002	1	0	0	0	0	0	0	0
biai-eu-																												
ryadae																												
EreNy1945	1	1	0	0	0	0.75	0.51	0.00	0.54	0.00	0.18	31	1	0	0	1	0	0	0	2500002	1	0	0	0	0	0	0	1

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

```
# Multiple filters are connected by pipes
be %>%
  filter(OWS_egg == 1) %>%
  filter(LEV_ground_layer == 1) %>%
  filter(AFB_honeydew == 1)
```

```
# As always in R, assign the result to a new variable using "<-"
be_filtered <- be %>%
  filter(OWS_egg == 1) %>%
  filter(LEV_ground_layer == 1) %>%
  filter(AFB_honeydew == 1)
```

4.5 Sort by column with arrange()

This doesn't change the dataframe itself, it simply orders the columns (similar to the sort function in Excel):

```
# sort by age (ascending) and weight (descending)
be %>%
  arrange(conserv.eu, -range.size)
```

[illegible]

Species	con-fam-ly	size	con-OWS	OWS	SV	sup-pu-er	WSP_Fe-										FM_Av-				AFB_AFB-an-								
							GEN_Av-	male_av-	WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-	AFB_max-	AFB_min-	AFB_max-	AFB_min-	AFB_max-										
Paranysius	Nymphalidae	1	1	1	3.00	0.03	0.00	0.45	5.3	0.10	21	1	0	0	1	0	0	0	100	12.0	0	0	1	1	1	0	0		
Pieris	Pieridae	1	1	1	3.00	0.03	0.00	0.62	5.5	0.28	9	1	1	1	0	0	1	1	20	12.0	1	0	0	0	0	0	0		
Nymphalis	Nymphalidae	0	0	1	1.50	0.02	0.01	0.62	0.02	0.13	6	0	0	1	1	0	0	1	0	26	0.57	1	0	1	0	1	1	1	
Lopidea	Nymphalidae	1	0	0	1.00	0.01	0.00	0.44	8.0	0.08	6	1	1	0	0	1	0	0	100	14.0	0.51	1	0	0	1	1	0	1	
Phryx	Nymphalidae	3	0	1	0	0	1.00	0.01	0.00	0.34	4.0	1.00	0	1	1	0	0	1	100	15.0	0.00	1	0	0	0	0	0	0	
Coenonympha	Nymphalidae	0	0	0	1.00	0.01	0.00	0.30	4.0	0.15	4	0	1	0	0	1	0	0	0	80	3.53	1	0	1	0	0	0	0	
Pyris	Nymphalidae	3	1	1	0	0	1.00	0.01	0.00	0.27	2.0	0.40	0	1	0	0	0	0	100	3.00	2	1	0	0	0	0	0	1	
Coenonympha	Nymphalidae	3	0	1	0	0	2.50	0.03	0.01	0.44	8.0	0.40	0	1	0	0	0	0	150	7.00	0	1	0	0	0	0	0	0	
Bolita	Nymphalidae	0	1	0	0	0	1.00	0.01	0.00	0.41	5.0	0.20	NAN	NAN	NAN	NAN	NAN	1	0	0	100	13.0	0.53	NAN	NAN	NAN	NAN	NAN	
Erebia	Nymphalidae	0	1	0	0	0	1.00	0.01	0.00	0.28	3.0	1.00	NAN	NAN	NAN	NAN	NAN	1	0	0	60	16.0	0.51	1	0	0	0	0	0
Polysia	Nymphalidae	3	3	NAN	NAN	NAN	1.00	0.01	0.00	0.33	6.0	0.50	7	NAN	NAN	NAN	NAN	NAN	40	16.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	
Eupebia	Nymphalidae	3	0	0	1	0	1.50	0.02	0.01	0.34	4.0	0.50	0	1	0	0	0	1	1	0	80	4.00	1	0	0	0	0	0	0

[illegible]

species	range	size	con-	fam-	ser-	con-	OVS	WSp	sup-	GEN_Av-	male_av-	er-WSP_Fe-	WSP_Fe-										ELT_sin-	er-	FM_Av-				ey-	i-	AFB_an-				AFB_min-	power		
													GEN_Av-	male_av-	er-WSP_Fe-	ELT_sin-	er-	FM_Av-	ey-	i-	AFB_an-	AFB_min-																
Lys-5751	4	1	0	0	0	1.50	0.02	0.1	0.033	0	1.00	0.01	0	0	0	1	0	0	100	240	000	1	0	0	0	0	0	1	1									
dracacoidae																																						
don																																						
Li-Ny-5261	4	0	1	0	0	1.00	0.01	0.0	0.077	0	1.00	0.01	0	0	1	1	0	0	100	150	051	0	0	0	0	0	1	1	0									
meni-																																						
tis-dep-																																						
uli																																						
Ly-Ly-5195	4	0	1	0	0	1.00	0.01	0.0	0.034	0	0.57	0.71	1	0	0	1	0	0	250	000	1	0	0	0	0	0	0	0										
caeracidae																																						
ci-																																						
phron																																						
Thy-Ho-496	4	0	1	0	0	1.50	0.02	0.1	0.024	0	0.10	0.80	1	0	0	0	1	0	250	053	1	0	0	0	0	0	0	0										
cuspoiteon																																						
idae																																						
Me-Ny-4671	4	0	1	0	0	1.50	0.02	0.1	0.035	0	0.12	0.61	1	0	0	0	0	1	100	210	055	1	0	0	0	0	0	1										
taei-di-																																						
amide																																						
Hip-Ny-3661	4	0	1	0	0	1.00	0.01	0.0	0.045	0	0.12	0.31	1	0	0	1	0	0	250	004	1	0	1	0	0	1	1											
parhia_statil-																																						
i- dae																																						
nus																																						
PaPa-354	4	1	1	0	0	1.00	0.01	0.0	0.080	0	0.20	0.41	0	0	0	1	1	0	300	051	1	0	0	0	0	0	0	0										
naspil-																																						
siusonpollo																																						
idae																																						
Ph-Ny-354	4	0	1	0	0	1.00	0.01	0.0	0.036	0	0.57	0.71	1	0	0	1	1	0	100	200	000	1	0	0	0	0	0	0										
garacidae																																						
con																																						
Cha-Ny-3531	4	0	1	0	0	1.00	0.01	0.0	0.055	0	0.33	0.31	1	0	0	1	1	0	250	004	1	0	0	0	0	1	1											
arai-bri-																																						
seidae																																						
Pol-Ly-330	4	0	1	0	0	1.50	0.02	0.1	0.032	0	0.20	0.41	1	0	0	1	0	0	100	220	000	1	0	0	0	0	0	0										
omacidae																																						
tus-do-																																						
ry-																																						
las																																						

[illegible]

		WSP_Fe-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
con-		GEN_Av-										FM_Av-					AFB_Av-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
fam- serv- con-		OWS_Fe-					er-WSP_Fe-					ELT_sin-					er-					ey- i- AFB_min-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
species	range	size	OWS	supu-	agg	%C	GEN	ENM	R	SL	IN	VE	TE	EL	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE

[illegible]

		WSP_Fe-																	
		con-		GEN_Av-		male_av-		FM_Av-		AFB_Av-		AFB_an-							
		fam-	serv-	con-	OVS	WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-								
		species	range	size	WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-									
Hip-Ny-NA4	1	0	1	0	0	1.00	01.00	052.0	0.28	NAN	NAN	NAN	NAN	NAN	NAN	200	2.00		
parhia_sbordidae																			
Man-Ny-NA4	1	0	1	0	0	1.00	01.00	044.5	0.28	91	1	0	0	1	1	0	0		
iola_hali-cardae																			
nas-sus																			
Pol-Ly-NA4	4	NAN	NAN	NAN	1.00	01.00	030.5	1.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN	200	2.00		
omnidae																			
tus_nepho-hip-ta-menos																			
Pol-Ly-1476	5	0	1	0	0	2.50	04.03	028.51	0.10	41	1	0	0	1	0	0	0		
omnidae																			
tus_icarus																			
Pie-Pie-1475	5	0	0	1	0	2.00	03.02	040.06	0.10	41	1	0	0	1	0	0	0		
dae																			
Van-Ny-1374	5	0	0	0	1	2.00	03.02	054.06	0.08	30	1	0	0	1	0	0	0		
duiidae																			
Co-Ny-1371	5	0	0	0	0	2.00	03.02	028.00	0.09	60	1	0	0	1	0	0	0		
philusdae																			
Pie-Pie-1363	5	0	0	1	0	2.00	03.02	044.51	0.10	81	1	0	0	0	1	0	0		
paedae																			
Pie-Pie-1353	5	0	0	1	0	2.50	03.01	057.02	0.10	51	1	0	0	0	1	1	0		
si-dae																			
cae																			
Van-Ny-1345	5	0	0	0	1	2.00	03.02	059.53	0.30	60	1	0	0	1	0	0	0		
lanta																			
dae																			
Ly-Ly-1340	5	0	1	0	0	2.00	03.02	026.51	0.33	31	0	0	0	1	0	0	0		
caenidae																			
Man-Ny-1289	5	0	1	0	0	1.00	01.00	041.9	0.28	91	1	0	0	0	1	0	0		
iola_ju-rtidae																			

[illegible]

[illegible]

[illegible]

species	range	size	con-	fam-	ser-	con-	OVS	WSP	sup-	GEN_Av-	male_av-	er-WSP_Fe-	WSP_Fe-	ELT_sin-	er-	FM_Av-	AFB_Av-	AFB_an-	AFB_min-	power
FavLy-775	5	1	0	0	0	1.00	01.00	032.0	0.40	80	0	0	1	1	0	0	0	1	0	1
niusacridae																				
cus																				
PleLy-774	5	1	0	0	0	1.50	02.01	024.5	0.04	10	1	0	0	1	0	0	1	0	0	0
be-caenidae																				
jus_idas																				
Ly-Ly-756	5	0	1	0	0	1.00	01.00	027.0	0.40	81	0	0	0	1	0	0	1	0	0	0
caenidae																				
gau-																				
reae																				
IphPa-755	5	0	0	1	0	2.00	03.02	077.06	0.10	51	1	0	0	1	0	0	1	0	0	1
i- pil-																				
cliden-po-																				
dalidae																				
ius																				
CuLy-753	5	0	1	0	0	1.50	02.01	023.0	0.10	50	1	0	0	1	0	0	1	0	0	1
pidcaenidae																				
imus																				
CoenLy-761	5	0	1	0	0	1.25	01.50	037.0	0.10	90	1	0	0	1	1	0	1	0	0	0
ca-i-																				
niadae																				
AriLy-700	5	0	1	0	0	2.00	03.02	025.0	0.10	21	1	0	0	1	0	0	1	0	0	1
ciaacridae																				
BreLy-699	5	1	1	0	0	1.00	01.00	037.8	0.20	41	1	0	0	1	1	0	1	0	0	0
this_ino																				
dae																				
CoPic-682	5	0	1	1	0	2.50	03.01	045.00	0.20	41	1	0	0	1	0	0	1	0	0	0
l- dae																				
ias_hyale																				
Ly-Ly-673	5	0	1	0	0	2.00	03.02	030.0	0.10	36	1	0	0	1	0	0	1	0	0	0
caenidae																				
MeLy-671	5	0	1	0	0	1.50	02.01	035.9	0.20	91	1	0	0	0	0	1	0	0	0	0
taen_cinxia																				
dae																				
TheLy-628	5	1	0	0	0	1.00	01.00	035.00	0.12	90	0	1	0	1	0	0	1	0	0	0
clacanthidae																				
tu-																				
lae																				

[illegible]

Species	con-fam-	con-serv-	con-size	OVS	SV	sup-pag	WSP_Fe-										FM_Av-			AFB_AFB-an-							
							GEN_Av-	Av-male_av-	er-WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-	AFB_max-	AFB_min-	AFB_max-	AFB_min-	AFB_max-								
SatLyri555_w- albcaenidae	1	0	0	0	1.00	0.01	0.00	0.30	0.0	0.06	50	0	1	1	1	0	0	0	1700	000	1	0	0	1	0	0	0
PolLy544_5 omcaenidae	5	0	1	0	0	1.50	0.02	0.01	0.31	0.0	0.20	41	1	0	0	1	0	0	10200	000	1	0	0	0	0	0	1
tus_aman- dus																											
EuNy538_5 phydryas_au- rinidae	0	1	0	0	0	1.00	0.01	0.00	0.36	0.53	0.10	21	1	0	0	0	0	1	0	2600	053	1	0	0	0	0	0
ApNy528_5 atua_ilia dae	0	1	0	0	0	1.50	0.02	0.01	0.68	0.8	0.26	70	0	1	1	1	0	0	50185	053	1	0	0	1	1	1	1
Li-Ny526_5 mei- tis_daemilla	0	1	0	0	0	1.00	0.01	0.00	0.56	0.8	0.28	90	0	1	1	1	0	0	0	1500	002	1	1	1	1	1	1
MeNy525_5 taei_phoebe dae	0	1	0	0	0	1.50	0.02	0.01	0.44	0.51	0.16	40	1	0	0	0	0	1	0	2700	055	1	0	0	0	0	0
PyNy515_5 ro-i- niadathonus	0	1	0	0	0	1.00	0.01	0.00	0.36	0.0	0.08	11	1	0	0	1	0	0	0	2300	053	1	0	1	0	0	0
HaNy495_5 cina- dinidae	0	0	1	0	0	1.00	0.01	0.00	0.32	0.3	0.57	71	1	0	0	0	1	0	0	1700	000	1	0	0	0	0	0
CoPie494_5 l- dae	5	0	1	0	0	2.50	0.03	0.01	0.43	0.3	0.16	71	1	0	0	1	0	0	0	2600	051	1	0	0	0	0	0
ias_al- facarien- sis																											
SatLyri485_5 caenidae	0	0	0	0	0	1.00	0.01	0.00	0.30	0.0	0.16	70	0	1	0	1	1	0	0	2000	051	1	0	1	1	0	0
AgLy480_5 adesacompdae tilete	5	0	1	0	0	1.00	0.01	0.00	0.25	0.8	0.20	81	1	0	0	1	0	0	0	2800	000	1	0	1	0	0	1
BolNy478_5 ria_i-aquilonar- dae	0	1	0	0	0	1.00	0.01	0.00	0.36	0.8	0.28	91	1	0	0	1	0	0	10190	002	1	0	1	0	0	0	0

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

species	fam-	ser-	con-	size	OVS	Wsp	sup-	GEN	Av-	male_av-	WSP_Fe-										FM_Av-	er-	AFB_AFB_an-					
											er-WSP_Fe-	ELT_sin-	er-	ey-	i-	AFB_min-	AFB_max-	AFB_min-	AFB_max-	power								
CuLy674	5	0	1	1	0	2.50	0.03	0.01	0.25	0	0.2580	1	0	0	NAN	NAN	0	120000	1	0	0	0	0	0	0	0	0	0
pidcaedae																												
col-																												
oratus																												
LepPic675	5	0	0	1	0	2.00	0.02	0.00	0.38	0	0.4081	1	0	0	1	0	0	240000	1	0	0	0	0	0	0	0	0	0
tidcaeduponcheli																												
EreNy651	5	0	1	0	0	1.00	0.01	0.00	0.43	0	0.3533	NAN	NAN	NAN	NAN	NAN	NAN	900000	1	0	0	0	0	0	0	0	1	
biai-al-																												
berdae																												
gana																												
EreNy651	5	0	1	0	0	1.00	0.01	0.00	0.37	0	1.0001	1	0	0	1	0	0	150000	1	0	0	0	0	0	0	0	1	
biai-cas-																												
sioidae																												
GegH655	5	0	1	1	1	3.00	0.03	0.00	0.32	0	0.2890	1	0	0	1	0	0	190000	1	0	0	0	0	0	0	0	1	
troperi-																												
dandae																												
AgLy635	5	0	1	0	0	1.00	0.01	0.00	0.26	0	0.2580	NAN	NAN	NAN	NAN	1	0	800000	1	0	0	0	0	0	0	0	1	
adescomidae																												
bit-																												
u-																												
lus																												
EuPic635	5	0	0	1	0	2.00	0.02	0.00	0.40	0	0.3541	0	0	0	1	0	0	150000	1	0	0	0	0	0	0	0	0	0
chlaebelemia																												
CoenNy611	5	0	1	0	0	1.00	0.01	0.00	0.31	0	0.5777	NAN	NAN	NAN	NAN	1	0	800000	1	0	0	0	0	0	0	0	0	0
i-																												
dae																												
PonPic605	5	0	0	1	0	1.50	0.02	0.01	0.47	0	0.1021	0	0	0	1	0	0	340000	1	0	0	0	0	0	0	0	0	0
tiaaal-																												
lidice																												
EreNy591	5	0	1	0	0	0.50	0.50	0.50	0.36	0	0.1877	NAN	NAN	NAN	NAN	NAN	NAN	100000	1	0	0	0	0	0	0	0	0	0
biai-pharte																												
dae																												
EuNy581	5	0	1	0	0	0.70	0.51	0.00	0.37	0	0.2891	1	0	0	0	1	1	900000	1	0	0	0	0	0	0	0	0	0
phydryas_cyn-																												
thialae																												

[illegible]

[illegible]

[illegible]

[illegible]

species	con-	fam-	ser-	con-	OVS	WSP	sup-	GEN_Av-	male_av-	er-WSP_Fe-	WSP_Fe-										ELT_sin-	er-	FM_Av-			ey-	i-	AFB_an-			AFB_min-	power
											WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-	WSP_Fe-			FM_Av-	FM_Av-	FM_Av-							
PolLy275	5	0	1	0	0	1.00	01.00	032.0	1.00	00	1	0	0	NAN	NAN	A90300	2.00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
omacidae																																
tus_ful-																																
gens																																
PsdLy275	5	0	1	0	0	1.50	02.01	020.0	0.35	40	1	0	0	NAN	NAN	A1001400	000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
doplatoids																																
ra-																																
gus																																
MeNy261	5	0	1	0	0	1.50	02.01	044.0	0.4	NAN	NAN	NAN	NAN	NAN	NAN	A0	1	1	0	1800	51	1	0	0	0	0	0	0	0	0	0	1
taci_aetherie																																
dae																																
EreNy251	5	0	1	0	0	0.70	51.00	551.00	0.7	NAN	NAN	NAN	NAN	NAN	NAN	NAN	A2002000	000	1	0	0	0	0	0	0	0	0	0	0	0	0	0
biai-styx																																
dae																																
EreNy251	5	0	1	0	0	1.00	01.00	035.0	0.5	NAN	NAN	NAN	NAN	NAN	NAN	NAN	A1200500	002	1	0	0	0	0	0	0	0	0	0	0	0	0	0
biai-tyndaridae																																
SpiHe255	5	0	1	0	0	1.00	01.00	027.0	0.5	NAN	NAN	NAN	NAN	NAN	NAN	NAN	A0	2200	000	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN
aliaphe-																																
mididae																																
PolLy245	5	0	1	0	0	1.00	01.00	035.0	1.0	NAN	NAN	NAN	NAN	NAN	NAN	A1	0	0	2000	002.00	1	0	0	0	0	0	0	0	0	0	0	0
omacidae																																
tus_do-																																
lus																																
EreNy221	5	0	1	0	0	0.70	51.00	036.0	0.5	000	1	0	0	NAN	NAN	A1500100	000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
biai-mnes-																																
tradae																																
MulHe225	5	0	1	0	0	1.00	01.00	033.5	0.5	NAN	NAN	NAN	NAN	NAN	NAN	NAN	A0	1900	051	1	0	0	0	0	0	0	0	0	0	0	0	0
sel-peri-																																
lunidae																																
AgLy215	5	0	1	0	0	0.70	51.00	523.0	0.28	90	1	0	0	NAN	NAN	A0	9003.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN
adesacridale																																
PsdLy205	5	0	0	1	0	1.00	01.00	027.0	0.5	770	1	0	0	1	0	0	500100	000	1	0	1	0	0	0	0	0	0	0	0	0	0	0
doplatoids																																
ebav-																																
ius																																
AnPie195	5	0	0	1	0	1.00	01.00	039.5	1.0	NAN	NAN	NAN	NAN	NAN	NAN	A1	0	0	0	1300	002	1	0	0	0	0	0	0	0	0	0	0
thocharis_da-																																
mone																																

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

		WSP_Fe-																				
		con-	GEN_Av-		male_av-														FM_Av-	AFB_Av-		AFB_an-
		fam- sercon-	OVS- sup-	er-WSP_Fe-		ELT_sin-												er-	ey- i-	AFB_min-		
species	range	size	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag	Wsp	pag		
Tan- cusca- midpa- stus	4 5 5	NANANAN	3.00	03.00	021.0	0.35	40	0	1	0	1	0	0	0	250	6.00	NANANANANANAN					
HipNymp- parhia_pel- lu-dae cida	5 0 1 0 0	1.00	01.00	051.06	0.28	91	1	0	0	1	0	0	0	1000	02	1	0	0	0	1	0	
ManNymp- iola- chia dae	5 0 1 0 0	1.00	01.00	041.9	0.28	91	1	0	0	1	1	0	0	800	5.00	1	0	0	0	0	0	
HipNymp- parhia_chris- tendae	5 NANANAN	1.00	01.00	051.06	0.28	91	NANANANANANANAN							250	652.02	NANANANANANAN						
Psd- dop- plaidis- barba- giae	1 5 5 0 1 0 0	1.00	01.00	022.0	1.00	00	1	0	0	NANAN				700	800.00	1	0	0	0	0	0	
CalHes- chaperi- o- idae dus_tripoli- nus	5 5 NANANAN	3.00	03.00	030.8	1.00	NANANANANANANAN								0	25000	NANANANANANAN						
CyLyNA- clyrius- bianus	5 5 1 1 1 1	3.00	03.00	027.5	0.28	90	1	0	0	0	1	0	200	300	NAN	1	0	0	0	0	0	
EreNymp- biai-ron- doudae	5 0 1 0 0	1.00	01.00	038.8	1.00	NANANANANANANAN								1500	200	1	0	0	0	0	0	
EuPien- chlaechar- lonia	5 5 0 0 1 0	2.50	03.01	034.0	0.03	61	1	0	0	1	1	0	0	300	51	1	0	0	0	0	0	
EuPien- chlae- ev- ersi	5 5 0 0 1 0	2.00	02.00	040.8	0.28	91	NANANANAN							1700	4.00	1	0	0	0	0	0	
EuPien- chlae- granca- narien- sis	5 NANANAN	2.00	02.00	040.8	1.00	NANANANANANANAN								50	19000	NANANANANANAN						

[illegible]

[illegible]

		WSP_Fe-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		con-	GEN_Av- male_av-										FM_Av-		AFB_Av- AFB_an-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
		fam- sercon-	OVS	SV	supu-	er-WSP_Fe-										ELT_sin-		er-		ey- i- AFB_min-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		size	Wsp	pag	Wsp	GEN	Av	male	av	WSP_Fe-	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin	ELT	Sin

[illegible]

[illegible]

[illegible]

```
# choose which columns to keep
be %>%
  select(species, range.size, conserv.eu, FM Average, WSP_Female average)
```

species	range.size	conserv.eu	FM_Average	WSP_Female_average
Aglais_io	1136	5	7.5	53.5
Aglais_urticae	1271	5	7.5	48.0
Agriades_aquilo	21	5	3.0	23.0
Agriades_dardanus	2	4	4.0	25.0
Agriades_glandon	45	5	2.0	23.0
Agriades_optilete	480	5	3.0	25.0
Agriades_orbitulus	63	5	3.0	26.0
Agriades_pyrenaicus	5	5	NA	25.0
Agriades_zullichii	2	2	3.0	23.5
Anthocharis_cardamines	1245	5	4.0	40.5
Anthocharis_damone	19	5	3.0	39.5
Anthocharis_euphenoides	131	5	3.5	37.0
Anthocharis_gruneri	36	5	4.0	33.0
Apatura_ilia	528	5	4.5	68.0
Apatura_iris	571	5	2.5	70.0
Apatura_metis	47	5	4.0	62.0
Aphantopus_hyperantus	1002	5	3.0	38.5
Aporia_crataegi	894	5	3.5	62.5
Araschnia_levana	626	5	5.0	33.5
Archon_apollinus	13	5	3.5	57.0
Arethusana_arethusa	229	5	3.5	41.0
Argynnis_laodice	100	4	2.0	55.0
Argynnis_pandora	320	5	5.0	72.0
Argynnis_paphia	1024	5	4.0	62.0
Aricia_agestis	700	5	7.0	25.0
Aricia_anteros	43	5	5.0	28.0
Aricia_artaxerxes	435	5	4.0	27.5
Aricia_cramera	138	5	9.5	25.0
Aricia_montensis	32	5	4.0	27.5
Aricia_morronensis	15	5	4.0	28.0
Aricia_nicias	78	5	2.0	25.5
Azanus_jesous	NA	NA	NA	21.5
Azanus_ubaldus	NA	NA	NA	12.5
Boloria_aquilonaris	478	5	2.0	36.0
Boloria_chariclea	22	4	1.5	38.0
Boloria_dia	554	5	5.5	33.0
Boloria_eunomia	311	5	3.0	36.5
Boloria_euphrosyne	963	5	4.0	36.0
Boloria_freija	144	5	2.5	34.5
Boloria_frigga	145	5	2.0	42.5

species	range.size	conserv.eu	FM_Average	WSP_Female_average
Boloria_graeca	37	5	4.0	36.0
Boloria_improba	6	2	2.0	32.5
Boloria_napaea	112	5	3.0	39.0
Boloria_pales	101	5	3.0	36.0
Boloria_polaris	18	3	2.5	41.5
Boloria_selene	998	5	3.5	36.5
Boloria_thore	79	5	2.0	44.0
Boloria_titania	141	5	3.0	39.5
Borbo_borbonica	1	NA	4.5	29.0
Brenthis_daphne	323	5	3.5	47.0
Brenthis_hecate	190	5	3.0	40.0
Brenthis_ino	699	5	2.5	37.0
Brintesia_circe	416	5	4.5	73.0
Cacyreus_marshalli	33	NA	8.0	23.5
Callophrys_avis	37	5	3.0	35.5
Callophrys_rubi	1192	5	6.0	23.0
Carcharodus_alceae	615	5	8.0	30.0
Carcharodus_baeticus	56	5	4.0	30.0
Carcharodus_floccifera	277	5	4.5	30.0
Carcharodus_lavatherae	146	4	4.0	31.0
Carcharodus_orientalis	54	5	4.5	29.0
Carcharodus_stauderi	2	NA	8.0	30.0
Carcharodus_tripolinus	NA	5	7.0	30.0
Carterocephalus_palaemon	585	5	2.5	27.0
Carterocephalus_silvicola	222	5	2.5	25.0
Catopsilia_florella	NA	NA	11.0	50.0
Celastrina_argiolus	1190	5	7.0	27.0
Charaxes_jasius	127	5	6.5	79.5
Chazara_briseis	353	4	4.0	55.0
Chazara_prieuri	8	5	2.0	60.0
Coenonympha_arcania	736	5	3.5	37.0
Coenonympha_corinna	17	5	4.5	29.0
Coenonympha_dorus	107	5	3.0	31.0
Coenonympha_gardetta	61	5	4.0	31.0
Coenonympha_glycerion	574	5	3.0	28.0
Coenonympha_hero	173	3	3.5	30.0
Coenonympha_leander	27	5	3.5	33.0
Coenonympha_oedippus	52	5	3.0	38.0
Coenonympha_orientalis	11	NA	3.0	30.5
Coenonympha_pamphilus	1371	5	7.0	28.0

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Coenonympha_rhodopensis	39	5	2.5	33.0
Coenonympha_thyrsis	9	5	5.0	32.0
Coenonympha_tullia	553	5	2.0	31.5
Colias_alfacariensis	494	5	6.5	43.5
Colias_aurorina	14	5	5.0	55.0
Colias_caucasica	13	5	3.0	52.0
Colias_chrysotheme	36	3	7.0	44.0
Colias_crocea	1028	5	7.0	48.0
Colias_erate	138	5	4.5	49.0
Colias_hecla	24	4	3.0	43.0
Colias_hyale	682	5	6.5	45.0
Colias_myrmidone	94	1	5.5	47.0
Colias_palaeno	417	5	3.0	47.0
Colias_phicomone	83	4	3.5	45.0
Colias_tyche	6	5	3.0	45.0
Colotis_evagore	10	NA	9.0	33.0
Cupido_alcetas	146	5	7.0	29.0
Cupido_argiades	478	5	6.0	29.0
Cupido_decoloratus	67	5	5.0	25.0
Cupido_lorquinii	17	5	3.0	25.0
Cupido_minimus	753	5	6.0	23.0
Cupido_osiris	131	5	6.0	27.0
Cyaniris_semiargus	930	5	6.0	29.0
Cyclus_webbianus	NA	5	NA	27.5
Danaus_chrysippus	38	NA	10.5	70.0
Danaus_plexippus	15	NA	11.0	95.5
Erebia_aethiopella	10	5	2.0	38.0
Erebia_aethiops	326	5	3.5	47.0
Erebia_albergana	65	5	3.0	43.0
Erebia_calcarius	9	5	3.0	38.0
Erebia_cassioides	65	5	3.0	37.0
Erebia_christi	1	3	2.5	38.0
Erebia_claudina	8	4	3.0	35.0
Erebia_disa	36	5	2.0	45.5
Erebia_embla	123	5	2.0	47.5
Erebia_epiphron	137	5	2.5	38.0
Erebia_epistygne	24	4	3.0	47.0
Erebia_eriphyle	34	5	3.0	34.0
Erebia_euryale	203	5	3.0	44.0
Erebia_flavofasciata	5	4	3.0	35.0

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Erebia_gorge	92	5	3.0	37.0
Erebia_gorgone	13	5	2.0	41.0
Erebia_hispania	17	5	2.5	38.0
Erebia_lefebvrei	12	5	3.0	44.0
Erebia_ligea	564	5	3.0	41.0
Erebia_manto	89	5	3.0	39.0
Erebia_medusa	361	5	3.5	38.0
Erebia_melampus	56	5	3.0	33.0
Erebia_melas	31	5	3.5	45.0
Erebia_meolans	139	5	4.0	46.0
Erebia_mnestra	22	5	2.0	36.0
Erebia_montana	38	5	3.0	47.0
Erebia_neoridas	48	5	2.5	41.0
Erebia_nivalis	14	5	1.5	32.0
Erebia_oeme	89	5	3.0	42.0
Erebia_orientalis	5	5	2.5	30.5
Erebia_ottomana	42	5	3.0	39.0
Erebia_palarica	5	5	3.0	58.0
Erebia_pandrose	194	5	2.5	40.0
Erebia_pharte	59	5	2.0	36.0
Erebia_pluto	51	5	2.5	45.0
Erebia_polaris	16	5	1.5	39.0
Erebia_pronoe	81	5	3.5	46.0
Erebia_rhodopensis	10	5	1.5	36.5
Erebia_rondoui	NA	5	2.0	38.0
Erebia_scipio	9	5	2.0	48.0
Erebia_sthenno	10	5	2.5	42.0
Erebia_stiria	17	5	3.0	49.0
Erebia_styx	25	5	3.0	51.0
Erebia_sudetica	13	3	2.5	28.5
Erebia_triarius	72	5	4.0	47.0
Erebia_tyndarus	25	5	3.0	35.0
Erebia_zapateri	6	5	3.5	38.0
Erynnis_marloyi	31	5	6.0	31.0
Erynnis_tages	842	5	4.0	30.0
Euchloe_ausonia	352	5	5.0	44.0
Euchloe_bazae	5	3	4.0	34.0
Euchloe_belemia	63	5	5.0	40.0
Euchloe_charltonia	NA	5	8.5	34.0
Euchloe_crameri	197	5	3.0	44.0

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Euchloe_eversi	NA	5	4.0	40.0
Euchloe_grancanariensis	NA	5	7.0	40.0
Euchloe_hesperidum	NA	5	6.0	40.0
Euchloe_insularis	16	5	5.0	34.5
Euchloe_penia	14	5	5.0	34.0
Euchloe_simplonia	32	5	4.0	43.0
Euchloe_tagis	56	5	3.0	35.0
Eumedonia_eumedon	441	5	4.0	28.0
Euphydryas_aurinia	538	5	3.5	36.5
Euphydryas_cynthia	58	5	3.0	37.0
Euphydryas_desfontainii	41	4	3.0	46.0
Euphydryas_iduna	24	4	2.0	41.0
Euphydryas_intermedia	28	5	3.0	40.0
Euphydryas_maturna	210	5	2.5	41.5
Fabriciana_adippe	888	5	3.5	53.5
Fabriciana_elisa	8	5	3.0	49.0
Fabriciana_niobe	646	4	2.5	49.5
Favonius_quercus	777	5	5.0	32.0
Freyeria_trochylus	19	5	8.0	16.5
Gegenes_nostrodamus	65	5	9.0	32.0
Gegenes_pumilio	76	5	9.0	32.0
Glaucopsyche_alexis	609	5	5.0	29.0
Glaucopsyche_melanops	103	5	2.0	27.0
Glaucopsyche_paphos	NA	5	NA	29.0
Gonepteryx_cleobule	NA	3	4.0	61.5
Gonepteryx_cleopatra	303	5	7.5	59.0
Gonepteryx_farinosa	50	5	11.0	60.0
Gonepteryx_maderensis	NA	2	9.0	61.5
Gonepteryx_rhamni	1177	5	8.0	58.0
Hamearis_lucina	497	5	6.0	32.5
Hesperia_comma	807	5	3.5	31.0
Heteropterus_morpheus	270	5	3.0	33.5
Hipparchia_aristaeus	13	5	4.5	52.0
Hipparchia_autonoe	NA	NA	2.0	54.0
Hipparchia_azorina	NA	5	5.0	41.0
Hipparchia_bacchus	NA	3	2.0	59.0
Hipparchia_blachieri	9	NA	4.5	52.0
Hipparchia_christenseni	1	5	2.0	51.0
Hipparchia_cretica	9	5	5.5	56.0
Hipparchia_cypriensis	NA	5	9.0	56.5

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Hipparchia_fagi	309	4	4.5	66.0
Hipparchia_fatua	48	5	6.5	57.5
Hipparchia_fidia	92	5	3.5	59.0
Hipparchia_gomera	NA	5	5.0	59.0
Hipparchia_hermione	237	4	2.0	61.0
Hipparchia_leighebi	1	4	4.0	52.0
Hipparchia_maderensis	NA	5	3.0	44.0
Hipparchia_mersina	3	NA	4.5	51.0
Hipparchia_miguelensis	NA	5	4.0	41.0
Hipparchia_neapolitana	NA	5	3.0	NA
Hipparchia_neomiris	9	5	3.0	48.0
Hipparchia_pellucida	2	5	4.0	51.0
Hipparchia_sbordonii	NA	4	2.0	52.0
Hipparchia_semele	814	5	3.5	51.0
Hipparchia_senthes	56	5	7.0	52.0
Hipparchia_statilinus	360	4	4.0	45.0
Hipparchia_syriaca	54	5	5.5	65.0
Hipparchia_tamadabae	NA	5	6.0	55.5
Hipparchia_tilosi	NA	3	3.0	59.0
Hipparchia_volgensis	42	5	4.0	53.5
Hipparchia_wyssii	NA	5	3.0	59.0
Hyponephele_lupina	143	5	4.5	45.0
Hyponephele_lycaon	365	5	3.5	38.0
Iolana_debilitata	NA	NA	5.0	39.0
Iolana_iolas	102	4	4.0	39.0
Iphiclides_feisthamelii	NA	NA	7.5	77.0
Iphiclides_podalirius	755	5	6.0	77.0
Issoria_lathonia	976	5	7.0	42.5
Kirinia_climene	9	5	2.5	47.0
Kirinia_roxelana	86	5	6.5	60.0
Kretania_eurypilus	2	NA	2.0	29.5
Kretania_hesperica	8	5	4.0	30.0
Kretania_psylorita	5	5	2.0	24.5
Kretania_pylaon	16	NA	2.0	29.5
Kretania_sephirus	NA	5	NA	31.0
Kretania_trappi	6	NA	3.0	31.0
Laeosopis_roboris	82	5	3.0	27.0
Lampides_boeticus	361	5	9.0	33.0
Lasiommata_maera	888	5	5.5	47.5
Lasiommata_megera	1053	5	6.5	42.5

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Lasiommata_paramegaera	15	5	6.0	42.5
Lasiommata_petropolitana	352	5	3.5	38.0
Leptidea_duponcheli	67	5	5.0	38.0
Leptidea_juvernica	NA	NA	3.0	42.0
Leptidea_morsei	49	2	5.0	41.5
Leptidea_reali	NA	5	6.0	38.0
Leptidea_sinapis	1089	5	6.0	38.0
Leptotes_pirithous	287	5	8.0	25.0
Libythea_celtis	181	5	6.5	44.5
Limenitis_camilla	526	5	3.0	56.0
Limenitis_populi	529	4	2.5	77.5
Limenitis_reducta	410	5	5.0	50.0
Lopinga_achine	275	3	2.5	44.0
Luthrodes_galba	NA	NA	NA	20.0
Lycaena_alciphron	519	4	4.0	34.0
Lycaena_candens	NA	5	3.5	34.5
Lycaena_dispar	383	5	6.5	37.0
Lycaena_helle	148	5	6.0	24.0
Lycaena_hippothoe	689	4	4.5	30.5
Lycaena_ottomana	37	5	7.0	29.0
Lycaena_phlaeas	1340	5	9.5	26.5
Lycaena_thersamon	199	5	9.0	30.0
Lycaena_thetis	6	NA	2.0	27.5
Lycaena_tityrus	673	5	7.0	30.0
Lycaena_virgaureae	756	5	5.0	27.0
Lysandra_albicans	40	5	3.0	39.0
Lysandra_bellargus	601	5	7.0	31.0
Lysandra_coridon	575	4	3.0	33.0
Lysandra_corydonius	NA	NA	3.0	33.0
Lysandra_hispana	50	5	7.0	34.0
Maniola_chia	2	5	5.0	41.5
Maniola_cypricola	NA	5	4.0	NA
Maniola_halicarnassus	NA	4	3.0	44.5
Maniola_jurtina	1289	5	5.0	41.5
Maniola_megala	2	NA	3.5	41.5
Maniola_nurag	5	5	3.5	38.0
Maniola_telmessia	7	5	7.5	41.5
Melanargia_arge	33	5	2.0	53.0
Melanargia_galathea	802	5	3.5	47.5
Melanargia_ines	79	5	4.0	48.0

species	range.size	conserv.eu	FM_Average	WSP_Female_average
Melanargia_lachesis	111	5	2.5	49.0
Melanargia_larissa	73	5	4.0	55.0
Melanargia_occitanica	85	5	2.5	51.0
Melanargia_pherusa	4	5	2.5	48.0
Melanargia_russiae	111	5	3.0	55.0
Melitaea_aetherie	26	5	2.5	44.0
Melitaea_arduinna	14	5	3.5	44.0
Melitaea_asteria	15	5	2.0	29.0
Melitaea_athalia	1011	5	3.5	35.5
Melitaea_aurelia	268	5	2.0	30.0
Melitaea_britomartis	99	4	3.0	33.0
Melitaea_celadussa	NA	NA	3.0	35.5
Melitaea_cinxia	673	5	4.0	35.5
Melitaea_deione	108	5	4.5	39.0
Melitaea_diamina	461	4	3.5	35.5
Melitaea_didyma	621	5	5.5	37.0
Melitaea_ornata	NA	NA	4.0	41.5
Melitaea_parthenoides	172	5	3.0	33.0
Melitaea_phoebe	521	5	4.5	44.5
Melitaea_trivia	260	4	5.0	33.0
Melitaea_varia	41	5	3.0	34.0
Minois_dryas	48	5	3.0	62.0
Muschampia_cribellum	7	4	3.0	29.0
Muschampia_proto	88	5	4.0	34.5
Muschampia_tessellum	22	5	4.5	33.5
Neptis_rivularis	150	5	3.5	52.0
Neptis_sappho	104	5	4.5	54.0
Nymphalis_antiope	910	5	5.5	67.5
Nymphalis_polychloros	845	3	6.5	62.0
Nymphalis_vaulbum	72	5	3.5	63.0
Nymphalis_xanthomelas	113	4	4.5	62.0
Ochlodes_sylvanus	1058	5	4.0	30.0
Oeneis_bore	19	5	1.5	43.0
Oeneis_glacialis	46	5	3.0	53.0
Oeneis_jutta	166	5	2.5	53.0
Oeneis_norna	54	4	2.0	47.0
Papilio_alexanor	49	5	4.0	64.0
Papilio_hospiton	14	5	3.0	76.0
Papilio_machaon	1224	5	6.5	75.0
Pararge_aegeria	1178	5	7.0	40.0

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Pararge_xiphia	NA	2	12.0	45.5
Pararge_xiphioides	NA	5	12.0	37.5
Parnassius_apollo	354	4	4.5	80.0
Parnassius_mnemosyne	371	5	3.0	58.0
Parnassius_phoebus	48	4	3.0	65.0
Pelopidas_thrax	1	NA	10.0	39.5
Phengaris_alcon	354	4	3.0	36.0
Phengaris_arion	522	2	4.0	36.0
Phengaris_nausithous	188	4	3.0	35.0
Phengaris_teleius	252	3	3.0	34.0
Pieris_balcana	NA	5	7.0	38.5
Pieris_brassicae	1353	5	7.0	57.0
Pieris_bryoniae	114	5	4.0	38.5
Pieris_cheiranthi	NA	2	12.0	62.5
Pieris_ergane	125	5	7.5	42.0
Pieris_krueperi	51	5	8.0	46.0
Pieris_mannii	203	5	7.5	43.0
Pieris_napi	1405	5	5.5	40.0
Pieris_rapae	1363	5	9.5	44.5
Plebejidea_loewii	3	NA	3.5	28.5
Plebejus_argus	991	5	4.0	22.5
Plebejus_argyrognomon	290	5	4.0	31.0
Plebejus_bellieri	10	5	3.0	23.0
Plebejus_idas	774	5	5.0	24.5
Polygonia_c-album	1098	5	6.5	46.0
Polygonia_egea	158	5	8.5	45.0
Polyommatus_admetus	57	5	3.0	34.0
Polyommatus_amandus	544	5	3.0	31.0
Polyommatus_aroaniensis	13	5	3.0	30.5
Polyommatus_celina	NA	NA	11.0	27.0
Polyommatus_damocles	NA	NA	2.5	31.5
Polyommatus_damon	163	4	2.0	32.0
Polyommatus_daphnis	305	5	3.0	35.0
Polyommatus_dolus	24	5	2.0	35.0
Polyommatus_dorylas	330	4	4.0	32.0
Polyommatus_eros	88	4	3.0	31.0
Polyommatus_escheri	167	5	3.0	28.0
Polyommatus_fabressei	11	5	3.0	30.5
Polyommatus_fulgens	27	5	2.0	32.0
Polyommatus_golgus	3	3	2.0	28.0

species	range.size	conserv.eu	FM_Average	WSP_Female_average
Polyommatus_humedasae	2	2	2.0	30.5
Polyommatus_icarus	1476	5	7.0	28.5
Polyommatus_iphigenia	2	NA	2.5	30.0
Polyommatus_nephohipta- menos	NA	4	2.0	30.5
Polyommatus_nivescens	26	4	4.0	33.0
Polyommatus_orphicus	9	3	NA	33.0
Polyommatus_ripartii	59	4	4.0	31.0
Polyommatus_thersites	351	5	7.0	29.0
Polyommatus_violetae	3	3	2.0	31.0
Pontia_callidice	60	5	4.0	47.0
Pontia_chloridice	11	5	6.0	38.5
Pontia_daplidice	921	5	5.5	41.5
Pontia_edusa	NA	5	5.5	41.5
Proterebia_phegea	5	NA	2.5	46.0
Pseudochazara_amymone	NA	3	2.5	53.0
Pseudochazara_anthelea	45	5	4.0	51.0
Pseudochazara_cingovskii	2	NA	2.0	52.0
Pseudochazara_euxina	NA	NA	3.0	54.5
Pseudochazara_geyeri	6	5	2.0	49.0
Pseudochazara_graeca	19	5	3.0	51.0
Pseudochazara_mercurius	6	NA	2.0	50.0
Pseudochazara_orestes	1	3	3.0	53.5
Pseudochazara_williamsi	5	NA	3.0	50.0
Pseudophilotes_abencerragus	27	5	2.0	20.0
Pseudophilotes_barbagiae	1	5	4.0	22.0
Pseudophilotes_baton	222	5	5.0	24.0
Pseudophilotes_bavius	20	5	3.0	27.0
Pseudophilotes_panoptes	41	4	6.0	21.5
Pseudophilotes_vicrama	212	4	5.0	23.0
Pyrgus_alveus	476	5	3.5	28.5
Pyrgus_andromedae	83	5	3.0	28.5
Pyrgus_armoricanus	311	5	5.5	26.0
Pyrgus_cacaliae	55	5	2.5	28.5
Pyrgus_carlinae	30	5	2.0	29.0
Pyrgus_carthami	264	5	5.0	32.0
Pyrgus_centaureae	162	5	2.5	29.5
Pyrgus_cinarae	14	5	4.0	31.0
Pyrgus_cirsii	94	3	3.0	27.0
Pyrgus_foulquieri	29	NA	3.0	28.5

species	range.size	conserv.eu	FM_Aver- age	WSP_Female_aver- age
Pyrgus_malvae	959	5	5.0	23.0
Pyrgus_malvoides	NA	5	3.5	23.0
Pyrgus_onopordi	105	5	7.0	25.0
Pyrgus_serratulae	318	4	3.0	28.0
Pyrgus_sidae	77	5	4.0	35.0
Pyrgus_warrenensis	29	5	2.0	24.5
Pyronia_bathseba	104	5	4.5	37.0
Pyronia_cecilia	219	5	3.5	31.0
Pyronia_tithonus	515	5	3.5	36.0
Satyrium_acaciae	349	5	3.0	30.0
Satyrium_esculi	106	5	4.0	32.0
Satyrium_ilicis	586	5	4.0	34.0
Satyrium_ledereri	1	NA	3.5	29.0
Satyrium_pruni	408	5	3.0	31.5
Satyrium_spini	483	5	3.5	30.0
Satyrium_w-album	553	5	3.0	30.0
Satyrus_actaea	73	5	3.0	55.0
Satyrus_ferula	144	5	4.0	55.0
Scolitantides_orion	260	4	5.0	27.5
Speyeria_aglaja	1132	5	3.5	51.5
Spialia_orbifer	129	5	5.5	25.0
Spialia_phlomidis	25	5	4.0	27.0
Spialia_rosae	NA	NA	NA	20.0
Spialia_sertorius	380	5	7.0	24.0
Spialia_therapne	7	5	5.0	24.0
Tarucus_balkanicus	19	5	7.0	20.0
Tarucus_theophrastus	4	5	6.0	21.0
Thecla_betulae	628	5	4.5	35.0
Thymelicus_acteon	496	4	4.5	24.0
Thymelicus_christi	NA	5	9.0	24.0
Thymelicus_hyrax	10	5	3.0	32.5
Thymelicus_lineola	926	5	3.5	25.5
Thymelicus_sylvestris	832	5	4.5	26.5
Tomares_ballus	51	5	4.0	29.0
Tomares_callimachus	NA	NA	3.0	28.0
Tomares_nogelii	2	0	3.5	32.5
Turanana_taygetica	3	2	4.0	21.0
Vanessa_atalanta	1343	5	8.5	59.5
Vanessa_cardui	1373	5	8.0	54.0
Vanessa_virginiensis	12	NA	10.0	45.0

species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
---------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

species	range	size	con- serv- er	GEN_Av- con- serv- er	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- range										ELT_sin- er-				FM_Av- er-				AFB_Av- ey- i- AFB_min-			
						GEN_Av- con- serv- er	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	ELT_sin- er-	ELT_sin- er-	ELT_sin- er-	ELT_sin- er-	FM_Av- er-	FM_Av- er-	FM_Av- er-	FM_Av- er-	AFB_Av- ey- i- AFB_min-	AFB_Av- ey- i- AFB_min-	AFB_Av- ey- i- AFB_min-	AFB_Av- ey- i- AFB_min-
Aph-Ny-1005	15	1.00	1.01	0.03	8.57	0.06	3	1	1	0	0	1	1	0	0	200	0	0	1	0	1	0	1	0	0	0	0
to- i-																											
pus- dy-																											
per-																											
an-																											
tus																											
Apo-Pie-8945	5	1.00	1.01	0.06	2.51	0.08	2	0	1	1	0	0	0	1	0	260	0	51	1	1	0	1	0	0	0	1	
ria- crataegi																											
Aras-Ny-6205	15	2.00	1.03	0.02	0.33	5.11	0.70	7	0	1	0	0	0	1	1	0	170	0	02	1	0	1	0	0	0	0	
nia- ilev-																											
ana- dae																											
Ar- Pa-134	5	1.00	1.01	0.05	7.6	0.50	7	0	1	0	0	0	1	0	0	900	3.53	1	0	0	0	0	0	0	0	0	
chom- pilapolli-																											
nus- ion-																											
idae																											
Are-Ny-2295	15	1.00	1.01	0.04	1.6	0.36	3	1	1	0	0	0	1	0	0	230	0	51	1	0	0	0	0	0	0	0	
sana- arethusa																											
dae																											
Arg-Ny-1005	14	1.00	1.01	0.05	5.10	0.70	7																				
yn- i-																											
nis- daodice																											
Arg-Ny-3205	15	1.50	1.02	0.01	0.72	0.6	5.17	7	1	1	0	0	1	0	0	0	260	0	04	1	0	0	0	0	1	1	
yn- i-																											
nis- dan-																											
dora																											
Arg-Ny-1005	15	1.00	1.01	0.06	2.8	0.26	8	0	1	0	0	1	0	0	0	230	0	02	1	0	1	1	0	0	1		
yn- i-																											
nis- dae-																											
phia																											
Ari-Ly-7005	5	2.00	1.03	0.02	0.25	0.6	0.10	2	1	1	0	0	1	0	0	0	190	0	00	1	0	0	0	0	1	1	
cia- cagostidae																											
Ari-Ly-434	5	2.00	1.03	0.02	0.28	0.8	0.28	9	0	1	0	0	1	0	0	300	210	0	00	1	0	0	0	0	0	0	
cia- can-																											
ter-																											
ros																											
Ari-Ly-4355	5	1.00	1.01	0.02	7.57	0.06	6	1	1	0	0	1	0	0	0	220	0	00	1	0	0	0	0	0	0	0	
cia- can-																											
tax-																											
erxes																											

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

[illegible]

species	range	size	con- serva- tion	GEN_Av- er- age	WSP_Fe- male_av- er- age	WSP_Fe- range	HIS_EVE	KEY_EVE	FAT_EVE	ELT_sin- gular	ELT_sin- gular	ELT_sin- gular	ELT_sin- gular	FM_Av- er- age	FM_Av- er- age	AFB_Av- er- age	AFB_Av- er- age	AFB_an- i- AFB_min- AFB_max	AFB_min- AFB_max
Brenthys thisi-ino dae	695	5	1.00	0.01	0.00	0.37	0.8	0.20	4	1	1	0	0	1	1	0	0	200	251
Brinthis te- i- sia_darce	116	5	1.00	0.01	0.00	0.73	0.4	0.20	4	1	1	0	0	0	1	0	0	230	453
Ca-Ly-33 cyrenidae shalli	NANA	3.00	0.03	0.00	0.23	0.5	1.00	NANA	NANA	NANA	NANA	1	0	0	0	150	0.00	1	0
Cal-Ly-37 lophyrinae isidais	5	5	1.00	0.01	0.00	0.35	0.3	0.25	NANA	NANA	NANA	NANA	1	0	0	100	0.00	1	0
Cal-Ly-119 lophyrinae isidabi	2	5	1.25	0.01	0.50	0.52	0.6	0.00	3	1	1	1	0	1	0	0	230	602	1
CarHes-615 charperi- o- idae dus_al- ceae	5	5	2.50	0.03	0.01	0.30	0.8	0.10	7	0	1	0	0	1	0	0	300	804	1
CarHes-56 charperi- o- idae dus_baeti- cus	5	5	2.50	0.03	0.01	0.30	0.4	0.40	8	1	1	0	0	1	0	0	500	1104	1
CarHes-277 charperi- o- idae dus_floc- cifera	4	5	1.50	0.02	0.01	0.30	0.4	0.10	4	0	1	0	0	1	0	0	200	451	1
CarHes-146 charperi- o- idae dus_lavatherae	4	4	1.00	0.01	0.00	0.31	0.6	0.40	8	1	1	0	0	1	0	0	160	402	1
CarHes-54 charperi- o- idae dus_ori- en- talis	5	5	2.50	0.03	0.01	0.29	0.2	0.50	7	NANA	NANA	NANA	NANA	NANA	NANA	NANA	NANA	200	451

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

species	con-fam-1	GEN_serv-2	GEN_serv-3	GEN_serv-4	GEN_serv-5	GEN_serv-6	GEN_serv-7	GEN_serv-8	GEN_serv-9	GEN_serv-10	GEN_serv-11	GEN_serv-12	GEN_serv-13	GEN_serv-14	GEN_serv-15	GEN_serv-16	GEN_serv-17	GEN_serv-18	GEN_serv-19	GEN_serv-20	GEN_serv-21	GEN_serv-22	GEN_serv-23	GEN_serv-24	GEN_serv-25	GEN_serv-26	GEN_serv-27	GEN_serv-28	GEN_serv-29	GEN_serv-30	GEN_serv-31	GEN_serv-32	GEN_serv-33	GEN_serv-34	GEN_serv-35	GEN_serv-36	GEN_serv-37	GEN_serv-38	GEN_serv-39	GEN_serv-40	GEN_serv-41	GEN_serv-42	GEN_serv-43	GEN_serv-44	GEN_serv-45	GEN_serv-46	GEN_serv-47	GEN_serv-48	GEN_serv-49	GEN_serv-50	GEN_serv-51	GEN_serv-52	GEN_serv-53	GEN_serv-54	GEN_serv-55	GEN_serv-56	GEN_serv-57	GEN_serv-58	GEN_serv-59	GEN_serv-60	GEN_serv-61	GEN_serv-62	GEN_serv-63	GEN_serv-64	GEN_serv-65	GEN_serv-66	GEN_serv-67	GEN_serv-68	GEN_serv-69	GEN_serv-70	GEN_serv-71	GEN_serv-72	GEN_serv-73	GEN_serv-74	GEN_serv-75	GEN_serv-76	GEN_serv-77	GEN_serv-78	GEN_serv-79	GEN_serv-80	GEN_serv-81	GEN_serv-82	GEN_serv-83	GEN_serv-84	GEN_serv-85	GEN_serv-86	GEN_serv-87	GEN_serv-88	GEN_serv-89	GEN_serv-90	GEN_serv-91	GEN_serv-92	GEN_serv-93	GEN_serv-94	GEN_serv-95	GEN_serv-96	GEN_serv-97	GEN_serv-98	GEN_serv-99	GEN_serv-100	GEN_serv-101	GEN_serv-102	GEN_serv-103	GEN_serv-104	GEN_serv-105	GEN_serv-106	GEN_serv-107	GEN_serv-108	GEN_serv-109	GEN_serv-110	GEN_serv-111	GEN_serv-112	GEN_serv-113	GEN_serv-114	GEN_serv-115	GEN_serv-116	GEN_serv-117	GEN_serv-118	GEN_serv-119	GEN_serv-120	GEN_serv-121	GEN_serv-122	GEN_serv-123	GEN_serv-124	GEN_serv-125	GEN_serv-126	GEN_serv-127	GEN_serv-128	GEN_serv-129	GEN_serv-130	GEN_serv-131	GEN_serv-132	GEN_serv-133	GEN_serv-134	GEN_serv-135	GEN_serv-136	GEN_serv-137	GEN_serv-138	GEN_serv-139	GEN_serv-140	GEN_serv-141	GEN_serv-142	GEN_serv-143	GEN_serv-144	GEN_serv-145	GEN_serv-146	GEN_serv-147	GEN_serv-148	GEN_serv-149	GEN_serv-150	GEN_serv-151	GEN_serv-152	GEN_serv-153	GEN_serv-154	GEN_serv-155	GEN_serv-156	GEN_serv-157	GEN_serv-158	GEN_serv-159	GEN_serv-160	GEN_serv-161	GEN_serv-162	GEN_serv-163	GEN_serv-164	GEN_serv-165	GEN_serv-166	GEN_serv-167	GEN_serv-168	GEN_serv-169	GEN_serv-170	GEN_serv-171	GEN_serv-172	GEN_serv-173	GEN_serv-174	GEN_serv-175	GEN_serv-176	GEN_serv-177	GEN_serv-178	GEN_serv-179	GEN_serv-180	GEN_serv-181	GEN_serv-182	GEN_serv-183	GEN_serv-184	GEN_serv-185	GEN_serv-186	GEN_serv-187	GEN_serv-188	GEN_serv-189	GEN_serv-190	GEN_serv-191	GEN_serv-192	GEN_serv-193	GEN_serv-194	GEN_serv-195	GEN_serv-196	GEN_serv-197	GEN_serv-198	GEN_serv-199	GEN_serv-200	GEN_serv-201	GEN_serv-202	GEN_serv-203	GEN_serv-204	GEN_serv-205	GEN_serv-206	GEN_serv-207	GEN_serv-208	GEN_serv-209	GEN_serv-210	GEN_serv-211	GEN_serv-212	GEN_serv-213	GEN_serv-214	GEN_serv-215	GEN_serv-216	GEN_serv-217	GEN_serv-218	GEN_serv-219	GEN_serv-220	GEN_serv-221	GEN_serv-222	GEN_serv-223	GEN_serv-224	GEN_serv-225	GEN_serv-226	GEN_serv-227	GEN_serv-228	GEN_serv-229	GEN_serv-230	GEN_serv-231	GEN_serv-232	GEN_serv-233	GEN_serv-234	GEN_serv-235	GEN_serv-236	GEN_serv-237	GEN_serv-238	GEN_serv-239	GEN_serv-240	GEN_serv-241	GEN_serv-242	GEN_serv-243	GEN_serv-244	GEN_serv-245	GEN_serv-246	GEN_serv-247	GEN_serv-248	GEN_serv-249	GEN_serv-250	GEN_serv-251	GEN_serv-252	GEN_serv-253	GEN_serv-254	GEN_serv-255	GEN_serv-256	GEN_serv-257	GEN_serv-258	GEN_serv-259	GEN_serv-260	GEN_serv-261	GEN_serv-262	GEN_serv-263	GEN_serv-264	GEN_serv-265	GEN_serv-266	GEN_serv-267	GEN_serv-268	GEN_serv-269	GEN_serv-270	GEN_serv-271	GEN_serv-272	GEN_serv-273	GEN_serv-274	GEN_serv-275	GEN_serv-276	GEN_serv-277	GEN_serv-278	GEN_serv-279	GEN_serv-280	GEN_serv-281	GEN_serv-282	GEN_serv-283	GEN_serv-284	GEN_serv-285	GEN_serv-286	GEN_serv-287	GEN_serv-288	GEN_serv-289	GEN_serv-290	GEN_serv-291	GEN_serv-292	GEN_serv-293	GEN_serv-294	GEN_serv-295	GEN_serv-296	GEN_serv-297	GEN_serv-298	GEN_serv-299	GEN_serv-300	GEN_serv-301	GEN_serv-302	GEN_serv-303	GEN_serv-304	GEN_serv-305	GEN_serv-306	GEN_serv-307	GEN_serv-308	GEN_serv-309	GEN_serv-310	GEN_serv-311	GEN_serv-312	GEN_serv-313	GEN_serv-314	GEN_serv-315	GEN_serv-316	GEN_serv-317	GEN_serv-318	GEN_serv-319	GEN_serv-320	GEN_serv-321	GEN_serv-322	GEN_serv-323	GEN_serv-324	GEN_serv-325	GEN_serv-326	GEN_serv-327	GEN_serv-328	GEN_serv-329	GEN_serv-330	GEN_serv-331	GEN_serv-332	GEN_serv-333	GEN_serv-334	GEN_serv-335	GEN_serv-336	GEN_serv-337	GEN_serv-338	GEN_serv-339	GEN_serv-340	GEN_serv-341	GEN_serv-342	GEN_serv-343	GEN_serv-344	GEN_serv-345	GEN_serv-346	GEN_serv-347	GEN_serv-348	GEN_serv-349	GEN_serv-350	GEN_serv-351	GEN_serv-352	GEN_serv-353	GEN_serv-354	GEN_serv-355	GEN_serv-356	GEN_serv-357	GEN_serv-358	GEN_serv-359	GEN_serv-360	GEN_serv-361	GEN_serv-362	GEN_serv-363	GEN_serv-364	GEN_serv-365	GEN_serv-366	GEN_serv-367	GEN_serv-368	GEN_serv-369	GEN_serv-370	GEN_serv-371	GEN_serv-372	GEN_serv-373	GEN_serv-374	GEN_serv-375	GEN_serv-376	GEN_serv-377	GEN_serv-378	GEN_serv-379	GEN_serv-380	GEN_serv-381	GEN_serv-382	GEN_serv-383	GEN_serv-384	GEN_serv-385	GEN_serv-386	GEN_serv-387	GEN_serv-388	GEN_serv-389	GEN_serv-390	GEN_serv-391	GEN_serv-392	GEN_serv-393	GEN_serv-394	GEN_serv-395	GEN_serv-396	GEN_serv-397	GEN_serv-398	GEN_serv-399	GEN_serv-400	GEN_serv-401	GEN_serv-402	GEN_serv-403	GEN_serv-404	GEN_serv-405	GEN_serv-406	GEN_serv-407	GEN_serv-408	GEN_serv-409	GEN_serv-410	GEN_serv-411	GEN_serv-412	GEN_serv-413	GEN_serv-414	GEN_serv-415	GEN_serv-416	GEN_serv-417	GEN_serv-418	GEN_serv-419	GEN_serv-420	GEN_serv-421	GEN_serv-422	GEN_serv-423	GEN_serv-424	GEN_serv-425	GEN_serv-426	GEN_serv-427	GEN_serv-428	GEN_serv-429	GEN_serv-430	GEN_serv-431	GEN_serv-432	GEN_serv-433	GEN_serv-434	GEN_serv-435	GEN_serv-436	GEN_serv-437	GEN_serv-438	GEN_serv-439	GEN_serv-440	GEN_serv-441	GEN_serv-442	GEN_serv-443	GEN_serv-444	GEN_serv-445	GEN_serv-446	GEN_serv-447	GEN_serv-448	GEN_serv-449	GEN_serv-450	GEN_serv-451	GEN_serv-452	GEN_serv-453	GEN_serv-454	GEN_serv-455	GEN_serv-456	GEN_serv-457	GEN_serv-458	GEN_serv-459	GEN_serv-460	GEN_serv-461	GEN_serv-462	GEN_serv-463	GEN_serv-464	GEN_serv-465	GEN_serv-466	GEN_serv-467	GEN_serv-468	GEN_serv-469	GEN_serv-470	GEN_serv-471	GEN_serv-472	GEN_serv-473	GEN_serv-474	GEN_serv-475	GEN_serv-476	GEN_serv-477	GEN_serv-478	GEN_serv-479	GEN_serv-480	GEN_serv-481	GEN_serv-482	GEN_serv-483	GEN_serv-484	GEN_serv-485	GEN_serv-486	GEN_serv-487	GEN_serv-488	GEN_serv-489	GEN_serv-490	GEN_serv-491	GEN_serv-492	GEN_serv-493	GEN_serv-494	GEN_serv-495	GEN_serv-496	GEN_serv-497	GEN_serv-498	GEN_serv-499	GEN_serv-500	GEN_serv-501	GEN_serv-502	GEN_serv-503	GEN_serv-504	GEN_serv-505	GEN_serv-506	GEN_serv-507	GEN_serv-508	GEN_serv-509	GEN_serv-510	GEN_serv-511	GEN_serv-512	GEN_serv-513	GEN_serv-514	GEN_serv-515	GEN_serv-516	GEN_serv-517	GEN_serv-518	GEN_serv-519	GEN_serv-520	GEN_serv-521	GEN_serv-522	GEN_serv-523	GEN_serv-524	GEN_serv-525	GEN_serv-526	GEN_serv-527	GEN_serv-528	GEN_serv-529	GEN_serv-530	GEN_serv-531	GEN_serv-532	GEN_serv-533	GEN_serv-534	GEN_serv-535	GEN_serv-536	GEN_serv-537	GEN_serv-538	GEN_serv-539	GEN_serv-540	GEN_serv-541	GEN_serv-542	GEN_serv-543	GEN_serv-544	GEN_serv-545	GEN_serv-546	GEN_serv-547	GEN_serv-548	GEN_serv-549	GEN_serv-550	GEN_serv-551	GEN_serv-552	GEN_serv-553	GEN_serv-554	GEN_serv-555	GEN_serv-556	GEN_serv-557	GEN_serv-558	GEN_serv-559	GEN_serv-560	GEN_serv-561	GEN_serv-562	GEN_serv-563	GEN_serv-564	GEN_serv-565	GEN_serv-566	GEN_serv-567	GEN_serv-568	GEN_serv-569	GEN_serv-570	GEN_serv-571	GEN_serv-572	GEN_serv-573	GEN_serv-574	GEN_serv-575	GEN_serv-576	GEN_serv-577	GEN_serv-578	GEN_serv-579	GEN_serv-580	GEN_serv-581	GEN_serv-582	GEN_serv-583	GEN_serv-584	GEN_serv-585	GEN_serv-586	GEN_serv-587	GEN_serv-588	GEN_serv-589	GEN_serv-590	GEN_serv-591	GEN_serv-592	GEN_serv-593	GEN_serv-594	GEN_serv-595	GEN_serv-596	GEN_serv-597	GEN_serv-598	GEN_serv-599	GEN_serv-600	GEN_serv-601	GEN_serv-602	GEN_serv-603	GEN_serv-604	GEN_serv-605	GEN_serv-606	GEN_serv-607	GEN_serv-608	GEN_serv-609	GEN_serv-610	GEN_serv-611	GEN_serv-612	GEN_serv-613	GEN_serv-614	GEN_serv-615	GEN_serv-616	GEN_serv-617	GEN_serv-618	GEN_serv-619	GEN_serv-620	GEN_serv-621	GEN_serv-622	GEN_serv-623	GEN_serv-624	GEN_serv-625	GEN_serv-626	GEN_serv-627	GEN_serv-628	GEN_serv-629	GEN_serv-630	GEN_serv-631	GEN_serv-632	GEN_serv-633	GEN_serv-634	GEN_serv-635	GEN_serv-636	GEN_serv-637	GEN_serv-638	GEN_serv-639	GEN_serv-640	GEN_serv-641	GEN_serv-642	GEN_serv-643	GEN_serv-644	GEN_serv-645	GEN_serv-646	GEN_serv-647	GEN_serv-648	GEN_serv-649	GEN_serv-650	GEN_serv-651	GEN_serv-652	GEN_serv-653	GEN_serv-654	GEN_serv-655	GEN_serv-656	GEN_serv-657	GEN_serv-658	GEN_serv-659	GEN_serv-660	GEN_serv-661	GEN_serv-662	GEN_serv-663	GEN_serv-664	GEN_serv-665	GEN_serv-666	GEN_serv-667	GEN_serv-668	GEN_serv-669	GEN_serv-670	GEN_serv-671	GEN_serv-672	GEN_serv-673	GEN_serv-674	GEN_serv-675	GEN_serv-676	GEN_serv-677	GEN_serv-678	GEN_serv-679	GEN_serv-680	GEN_serv-681	GEN_serv-682	GEN_serv-683	GEN_serv-684	GEN_serv-685	GEN_serv-686	GEN_serv-687	GEN_serv-688	GEN_serv-689	GEN_serv-690	GEN_serv-691	GEN_serv-692	GEN_serv-693	GEN_serv-694	GEN_serv-695	GEN_serv-696	GEN_serv-697	GEN_serv-698	GEN_serv-699	GEN_serv-700	GEN_serv-701	GEN_serv-702	GEN_serv-703	GEN_serv-704	GEN_serv-705	GEN_serv-706	GEN_serv-707	GEN_serv-708	GEN_serv-709	GEN_serv-710	GEN_serv-711	GEN_serv-712	GEN_serv-713	GEN_serv-714	GEN_serv-715	GEN_serv-716	GEN_serv-717	GEN_serv-718	GEN_serv-719	GEN_serv-720	GEN_serv-721	GEN_serv-722	GEN_serv-723	GEN_serv-724	GEN_serv-725	GEN_serv-726	GEN_serv-727	GEN_serv-728	GEN_serv-729	GEN_serv-730	GEN_serv-731	GEN_serv-732	GEN_serv-733	GEN_serv-734	GEN_serv-735	GEN_serv-736	GEN_serv-737	GEN_serv-738	GEN_serv-739	GEN_serv-740	GEN_serv-741	GEN_serv-742	GEN_serv-743	GEN_serv-744	GEN_serv-745	GEN_serv-746	GEN_serv-747	GEN_serv-748	GEN_serv-749	GEN_serv-750	GEN_serv-751	GEN_serv-752	GEN_serv-753	GEN_serv-754	GEN_serv-755	GEN_serv-756	GEN_serv-757	GEN_serv-758	GEN_serv-759	GEN_serv-760	GEN_serv-761	GEN_serv-762	GEN_serv-763	GEN_serv-764	GEN_serv-765	GEN_serv-766	GEN_serv-767	GEN_serv-768	GEN_serv-769	GEN_serv-770	GEN_serv-771	GEN_serv-772	GEN_serv-773	GEN_serv-774	GEN_serv-775	GEN_serv-776	GEN_serv-777	GEN_serv-778	GEN_serv-779	GEN_serv-780	GEN_serv-781	GEN_serv-782	GEN_serv-783	GEN_serv-784	GEN_serv-785	GEN_serv-786	GEN_serv-787	GEN_serv-788	GEN_serv-789	GEN_serv-790	GEN_serv-791	GEN_serv-792	GEN_serv-793	GEN_serv-794	GEN_serv-795	GEN_serv-796	GEN_serv-797	GEN_serv-798	GEN_serv-799	GEN_serv-800	GEN_serv-801	GEN_serv-802	GEN_serv-803	GEN_serv-804	GEN_serv-805	GEN_serv-806	GEN_serv-807	GEN_serv-808	GEN_serv-809	GEN_serv-810	GEN_serv-811	GEN_serv-812	GEN_serv-813	GEN_serv-814	GEN_serv-815	GEN_serv-816	GEN_serv-817	GEN_serv-818	GEN_serv-819	GEN_serv-820	GEN_serv-821	GEN_serv-822	GEN_serv-823	GEN_serv-824	GEN_serv-825	GEN_serv-826	GEN_serv-827	GEN_serv-828	GEN_serv-829	GEN_serv-830	GEN_serv-831	GEN_serv-832	GEN_serv-833	GEN_serv-834	GEN_serv-835	GEN_serv-836	GEN_serv-837	GEN_serv-838	GEN_serv-839	GEN_serv-840	GEN_serv-841	GEN_serv-842	GEN_serv-843	GEN_serv-844	GEN_serv-845	GEN_serv-846	GEN_serv-847	GEN_serv-848	GEN_serv-849	GEN_serv-850	GEN_serv-851	GEN_serv-852	GEN_serv-853	GEN_serv-854	GEN_serv-855	GEN_serv-856	GEN_serv-857	GEN_serv-858	GEN_serv-859	GEN_serv-860	GEN_serv-861	GEN_serv-862	GEN_serv-863	GEN_serv-864	GEN_serv-865	GEN_serv-866	GEN_serv-867	GEN_serv-868	GEN_serv-869	GEN_serv-870	GEN_serv-871	GEN_serv-872	GEN_serv-873	GEN_serv-874	GEN_serv-875	GEN_serv-876	GEN_serv-877	GEN_serv-878	GEN_serv-879	GEN_serv-880	GEN_serv-881	GEN_serv-882	GEN_serv-883	GEN_serv-884	GEN_serv-885	GEN_serv-886	GEN_serv-887	GEN_serv-888	GEN_serv-889	GEN_serv-890	GEN_serv-891
---------	-----------	------------	------------	------------	------------	------------	------------	------------	------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------

[illegible]

species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
---------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

	con- fam- 1	GEN_Av- serv- range	GEN_Min- size	GEN_Max- age	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- min	WSP_Fe- max	ELT_sin- er- range	ELT_max	FM_Av- er- range	FM_Min	FM_Max	AFB_Av- ey- range	AFB_Min	AFB_Max	AFB_an- i- AFB_min- power								
Cyan- ar- gus	Hy-3305	5	1.25	0.01	50.529	0.8	0.169	0	1	0	0	1	0	0	0	2400	0.00	1	0	0	0	0	0	
Cy-Ly- clyriac- bianus	NA5	5	3.00	0.03	00.027	5	0.289	0	1	0	0	0	1	0	2003	300	NANA	1	0	0	0	0	0	
Dan- pus i- dae	Nys-380	NA5	3.00	0.03	00.070	0.20	0.364	0	1	0	0	NANA	NANA	0	1100	0.5	1	0	0	0	0	0	0	
Dan- ip- i- pus dae	Nys-15	NA5	3.00	0.03	00.095	5.3	0.500	0	1	0	0	1	0	0	0	400	11.2	1	0	1	0	0	0	
Ere- bia i- dae	Nyp-10	5al5	1.00	0.01	00.038	0.4	1.000	NANA	NANA	NANA	NANA	NANA	NANA	NANA	1800	0.00	NANA	NANA	NANA	NANA	NANA	NANA	NANA	
Ere- bia i- dae	Nyp-32	5al5	1.00	0.01	00.047	0.10	0.043	1	1	0	0	1	0	0	0	2000	0.51	1	0	0	0	0	0	
Ere- bia i- ber-dae gana	Nyp-65	5al5	1.00	0.01	00.043	0.6	0.353	NANA	NANA	NANA	NANA	NANA	NANA	NANA	900	1.30	0.00	1	0	0	0	0	1	
Ere- bia i- cal- car-dae ius	Nyp-9	5al5	1.00	0.01	00.038	0.4	0.500	NANA	NANA	NANA	NANA	NANA	NANA	NANA	1600	3.00	1	0	0	0	0	0	0	
Ere- bia i- cas- sioidae	Nyp-65	5al5	1.00	0.01	00.037	0.6	1.000	0	1	1	0	0	1	0	0	1500	1.00	0.02	1	0	0	0	0	1
Ere- bia i- christi dae	Nyp-1	3al3	0.50	0.50	50.038	0.4	1.000	NANA	NANA	NANA	NANA	NANA	NANA	NANA	1300	0.25	1	0	0	0	0	0	1	
Ere- bia i- clau- d- dae ina	Nyp-8	4al4	0.75	0.51	00.535	0.2	0.500	0	1	0	0	NANA	NANA	1400	0.02	1	0	0	0	0	0	0	0	

	con- fam- species	GEN_ size range	Av- size range	WSP_Fe- male_av- er- WSP_Fe-	ELT_sin- er-	FM_Av- er-	AFB_16S ey-i-	AFB_an- AFB_min-
Ere-Ny365al5 bia_i-disa dae	0.50	0.50	0.50	0.45	7	0.57	NANANANANANANANANA	A3002002.00 NANANANANANANANA
Ere-Ny185al5 bia_i-em- bla dae	1.00	0.01	0.00	0.47	7	0.20	4 0 1 0 0 NANANANA	1003002.00 NANANANANANANANA
Ere-Ny185al5 bia_i-epiphron dae	0.75	0.51	0.00	0.53	8	0.20	4 0 1 0 0 0 1 0 0 3502352	0.51 1 0 0 0 0 0 0 0
Ere-Ny244al4 bia_i-epistygne dae	1.00	0.01	0.00	0.47	6	1.00	NANANANANANANANANA	A40011500 1 0 0 0 0 0 0 0
Ere-Ny345al5 bia_i-eri- phyllae	0.50	0.50	0.50	0.34	0	0.50	0 0 1 0 0 NANANANA	A12000500 1 0 0 0 0 0 0 0
Ere-Ny205al5 bia_i-eu- ryaldae	0.75	0.51	0.00	0.54	0	0.09	6 0 1 0 0 0 1 0 0 6001900	0.02 1 0 0 0 0 0 0 0
Ere-Ny544al4 bia_i-flavo- fas-dae ci-ata	0.50	0.50	0.50	0.35	2	1.00	NANANANANANA	A1 0 0 180003.00 1 0 0 0 0 0 0 0
Ere-Ny985al5 bia_i-gorge dae	0.50	0.50	0.50	0.37	6	0.30	6 0 1 0 0 NANANANA	A16000500 1 0 0 0 0 0 0 0
Ere-Ny185al5 bia_i-igor- gonidae	1.00	0.01	0.00	0.41	2	0.57	NANANANANANANANANA	A15000502.00 1 0 0 0 0 0 0 0
Ere-Ny175al5 bia_i-his- panidae	1.00	0.01	0.00	0.38	8	1.00	NANANANANANANANANA	A1650250.51 1 0 0 0 0 0 0 1
Ere-Ny185al5 bia_i-lefeb- vreidae	1.00	0.01	0.00	0.44	8	0.70	NANANANANANA	A1 0 0 160000.00 NANANANANANANANA
Ere-Ny565al5 bia_i-ligea dae	0.75	0.51	0.00	0.54	1	0.18	3 1 1 0 0 0 1 0 0 0 25000	0.02 1 0 0 0 0 0 0 1

species	range	size	con- serva- tion	GEN_Av- er- age	WSP_Fe- male_av- er- WSP_Fe- range										ELT_sin- er- age					FM_Av- er- age					AFB_Av- ey- i- AFB_min- AFB_max									
					GEN_min	GEN_max	WSP_min	WSP_max	WSP_range	WSP_avg	WSP_std	WSP_coef	WSP_coef2	WSP_coef3	WSP_coef4	WSP_coef5	WSP_coef6	WSP_coef7	WSP_coef8	WSP_coef9	WSP_coef10	WSP_coef11	WSP_coef12	WSP_coef13	WSP_coef14	WSP_coef15	WSP_coef16	WSP_coef17	WSP_coef18	WSP_coef19	WSP_coef20	WSP_coef21	WSP_coef22	WSP_coef23
Ere-Ny-89	5	5	1	0.50	0.50	0.03	0.10	0.30	0.6	0	1	0	0	1	0	0	900	1600	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- manto dae																																		
Ere-Ny-36	5	5	1	0.75	0.51	0.00	0.53	0.8	0.20	0.4	1	1	0	0	1	0	0	200	2350	151	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- medusa dae																																		
Ere-Ny-56	5	5	1	1.00	0.01	0.00	0.33	0.6	0.28	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	800	1600	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- melam- pus dae																																		
Ere-Ny-31	5	5	1	1.00	0.01	0.00	0.45	0.6	1.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	200	2600	151	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- melas dae																																		
Ere-Ny-135	5	5	1	1.00	0.01	0.00	0.46	0.6	0.20	0	1	1	0	0	1	0	0	150	2250	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- me- olandae																																		
Ere-Ny-22	5	5	1	0.75	0.51	0.00	0.36	0.4	0.50	0	0	1	0	0	NAN	NAN	NAN	1500	100	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- mnes- tra dae																																		
Ere-Ny-38	5	5	1	1.00	0.01	0.00	0.47	0.6	0.36	0.4	1	0	0	0	NAN	NAN	NAN	1100	1400	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- mon- tanadae																																		
Ere-Ny-48	5	5	1	1.00	0.01	0.00	0.41	0.6	0.28	0	0	1	0	0	1	0	0	500	1100	151	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- ne- ori- dae																																		
das																																		
Ere-Ny-14	5	5	1	0.50	0.50	0.50	0.32	0.4	1.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	1	0	0	2100	1500	1.51	1	0	0	0	0	0	0	0	0	0	0
bia_i- ni- valisdae																																		
Ere-Ny-89	5	5	1	0.75	0.51	0.00	0.54	0.8	0.10	0	1	1	0	0	1	0	0	800	1800	100	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- oeme dae																																		
Ere-Ny-5	5	5	1	1.00	0.01	0.00	0.30	0.3	0.28	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	1800	100	2.51	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- ori- en- dae																																		
talis																																		
Ere-Ny-42	5	5	1	1.00	0.01	0.00	0.39	0.6	0.70	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	450	2150	100	2	1	0	0	0	0	0	0	0	0	0	0	0	0
bia_i- ot- tomdae																																		

[illegible]

species	family	range	size	con- serv	GEN_Av- er- WSP_Fe- range	GEN_Min- range	GEN_Max- range	WSP_Fe- range	WSP_Min- range	WSP_Max- range	ELT_sin- er- range	ELT_Min- range	ELT_Max- range	FM_Av- er- range	FM_Min- range	FM_Max- range	AFB_Av- er- range	AFB_Min- range	AFB_Max- range	AFB_an- i- AFB_min- AFB_max					
Ere-Nympha- bia_isude- t- dae ica	13	3	1.00	0.01	0.00	0.28	0.5	1.00	NANANANANA	1	0	0	600	1600	2.51	1	0	0	0	0	0				
Ere-Nympha- bia_istri- ar- dae ius	72	5	1.00	0.01	0.00	0.47	0.6	0.28	9	1	1	0	0	NANANA	400	2100	1.00	1	0	0	0	0	0	1	
Ere-Nympha- bia_ityn- dar- dae	25	5	1.00	0.01	0.00	0.35	0.2	0.50	NANANANANANANANANA	1	200	1500	0.02	1	0	0	0	0	0	0	0				
Ere-Nympha- bia_iza- p- dae a- teri	6	5	1.00	0.01	0.00	0.38	0.4	0.28	NANANANANANANANANA	1	1000	650	3.51	1	0	0	0	0	0	0	0				
Erythr- nis_pari- loyiidae	31	5	2.00	0.03	0.02	0.31	0.6	1.00	NANANANANANANANANA	0	2100	604	1	0	0	0	0	0	0	0	0				
Erythr- nis_pari- loyiidae	34	5	1.50	0.02	0.01	0.30	0.4	0.10	9	0	1	0	0	1	0	0	0	2000	1.04	1	0	0	0	0	0
Eu-Pieris- chloa- so- nia	35	5	2.00	0.03	0.02	0.44	0.8	0.10	6	0	1	0	0	1	0	0	0	1900	1.02	1	0	0	0	0	0
Eu-Pieris- chloa- bazae	51	3	1.50	0.02	0.01	0.34	0.4	0.50	0	1	0	0	0	1	1	0	0	800	1.00	1	0	0	0	0	0
Eu-Pieris- chloa- belemia	63	5	2.00	0.02	0.00	0.40	0.8	0.35	4	1	0	0	0	1	0	0	0	1500	1.00	1	0	0	0	0	0
Eu-Pieris- chloa- char- lonia	NA	5	2.50	0.03	0.01	0.34	0.4	0.06	6	1	1	0	0	1	1	0	0	3000	1.51	1	0	0	0	0	0
Eu-Pieris- chloa- crameri	19	5	1.50	0.02	0.01	0.44	0.8	0.10	4	0	1	0	0	1	0	0	NANA	3.00	1	0	0	0	0	0	0
Eu-Pieris- chloa- ev- ersi	NA	5	2.00	0.02	0.00	0.40	0.8	0.28	NANANANANANA	1	0	0	1700	800	1.00	1	0	0	0	0	0	0	0	0	

species	range	size	con- serv	GEN_Av- er	WSP_Fe- male_av- er	WSP_Fe- range	ELT_sin- er	FM_Av- er	AFB_Av- er	AFB_an- i	AFB_min- AFB_max	AFB_low- AFB_high
Eu-Pier- chloa- granca- narien- sis	NA5	5	2.02	0.02	0.04	0.8	1.0	NANANANANANANANA	50	190	0.0	NANANANANANANA
Eu-Pier- chloa- ches- peridum	NA5	5	2.02	0.02	0.04	0.8	0.28	NANANANANANANANA	0	406	6.00	1 0 0 0 0 0 0
Eu-Pier- chloa- ain- su- laris	16	5	5	1.75	0.52	0.53	4.3	0.26	0 0 1 0 0 1 0 0 0	130	6.00	1 0 0 0 0 0 0
Eu-Pier- chloa- ape- nia	14	5	5	1.50	0.02	0.10	3.4	0.40	8 1 1 0 0 1 0 0 0	210	6.00	1 0 0 0 0 0 0
Eu-Pier- chloa- sim- plo- nia	32	5	5	0.75	0.51	0.05	4.3	0.36	3 1 1 0 0 1 1 0 1	100	14.00	1 0 0 0 0 0 0
Eu-Pier- chloa- tagis	56	5	5	1.00	0.01	0.03	5.0	0.50	7 1 1 1 0 1 0 0 0	160	6.00	1 0 0 0 0 0 0
Eu-Ly- me-caenidae do- nia_eu- me- don	44	15	5	1.00	0.01	0.02	8.8	0.20	8 1 1 0 0 1 0 0 0	240	6.00	1 0 0 0 0 0 0
Eu-Ny- phydryas_au- rinidae	53	5	5	1.00	0.01	0.03	6.5	0.10	2 1 1 0 0 0 0 1 0	260	1.53	1 0 0 0 0 0 0
Eu-Ny- phydryas_cyn- thiidae	58	5	5	0.75	0.51	0.05	3.7	0.28	9 1 1 0 0 0 1 1 1	900	220	6.00 1 0 0 0 0 0 0
Eu-Ny- phydryas_des- fonti	41	4	4	1.00	0.01	0.04	6.0	1.00	0 0 1 0 0 0 0 1 0	280	6.00	1 0 0 0 0 0 0
Eu-Ny- phydryas_iduna dae	24	4	4	1.00	0.01	0.04	1.8	0.30	6 0 1 0 0 0 1 0 0	300	102.00	NANANANANANANA

[illegible]

[illegible]

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

[illegible]

species	fam-	con-	serv-	cor-	GEN_Av-	male_av-	WSP_Fe-										FM_Av-			AFB_Av-			AFB_an-					
							er-	WSP_Fe-	ELT_sin-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-			
range	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size	size			
La-Nympha	15	5	5	3.03	0.03	0.00	0.42	5	0.35	4	0	1	0	0	1	0	0	0	1500	0.00	1	0	0	0	0	0	0	
sioni-																												
matdapa-																												
matdapa-																												
La-Nympha	15	5	5	1.50	0.02	0.01	0.38	6	0.26	8	0	1	0	0	1	0	0	100	1250	0.53	1	0	0	0	0	0	1	
sioni-																												
matdapa-																												
matdapa-																												
LepPieris	67	5	5	2.00	0.02	0.00	0.38	8	0.40	8	1	1	0	0	1	0	0	0	2400	0.00	1	0	0	0	0	0	0	
tideda-																												
tideda-																												
LepPieris	NA	NA	NA	1.00	0.01	0.00	0.42	0	NA	0	0	1	0	0	1	0	0	NA	NA	3.00	1	0	1	0	0	0	0	
tideda-																												
tideda-																												
ver-																												
nica																												
LepPieris	49	4	2	2.00	0.02	0.00	0.41	5	0.50	7	0	1	0	0	1	0	0	0	1400	0.00	1	0	0	0	0	0	1	
tideda-																												
tideda-																												
sei																												
LepPieris	NA	5	5	2.00	0.03	0.02	0.38	0	1.00	0	0	1	0	0	1	0	0	0	2000	0.04	0	0	1	1	1	1	1	
tideda-																												
tideda-																												
ali																												
LepPieris	108	5	5	2.00	0.03	0.02	0.38	0	0.10	4	0	1	0	0	1	0	0	0	2000	0.04	1	0	0	0	0	0	1	
tideda-																												
tideda-																												
LepLy-	28	5	5	3.03	0.03	0.00	0.25	0	0.00	5	0	1	0	0	1	0	0	0	1900	0.00	1	0	1	0	0	0	0	
totesa-																												
totesa-																												
hous																												
Liby-Nympha	18	5	5	1.25	0.01	0.50	0.54	4	0.70	7	0	0	0	1	1	0	0	0	1800	0.53	1	0	0	0	0	0	1	
i-																												
dae																												
Li-Nympha	50	5	5	1.00	0.01	0.00	0.56	8	0.28	9	0	0	1	1	1	0	0	0	1500	0.02	1	1	1	1	1	1	1	
memi-																												
tis_damilla																												
Li-Nympha	50	5	5	1.00	0.01	0.00	0.77	5	0.50	7	0	0	0	1	1	0	0	0	100	1550	0.51	0	0	0	0	1	1	0
memi-																												
tis_dap-																												
uli																												
Li-Nympha	10	5	5	2.00	0.03	0.02	0.50	8	0.50	7	0	0	1	0	1	0	0	0	1950	0.04	1	0	1	1	1	1	1	
memi-																												
tis_dae																												
ducta																												

[illegible]

species	family	con- serva- tion	GEN_Av- er- age	GEN_Av- er- age	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- male_av- er- WSP_Fe- range	ELT_sin- er- age	ELT_sin- er- age	FM_Av- er- age	FM_Av- er- age	AFB_Av- er- age	AFB_Av- er- age	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AFB_max	AFB_an- i- AFB_min- AF
---------	--------	------------------------	-----------------------	-----------------------	--	--	------------------------	------------------------	----------------------	----------------------	-----------------------	-----------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	--------------------------------------	---------------------------------

[illegible]

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

[illegible]

[illegible]

species	fam- range	con- serv- size	GEN_Av- con- size	WSP_Fe- male_av- er- WSP_Fe- range	ELT_sin- er- range	FM_Av- er- range	AFB_Av- ey- range	AFB_an- i- range	AFB_min- power	WSP_Fe- range									
										1	0	0	0	1	1	0	600	2700	1000
Pieris- oniadae	Pieris- oniadae	5	1.50	0.02.01.038.5	3	0.204	1	0	0	0	1	1	0	600	2700	1000	1	0	0
Pieris- thi dae	Pieris- thi dae	2	3.00	0.03.00.062.5	3	0.289	1	1	1	0	0	1	1	200	1200	1200	1	0	0
Pieris- gandae	Pieris- gandae	5	2.00	0.03.02.042.0	2	0.408	1	1	0	0	1	0	0	220	755	1	0	0	0
Pieris- dae	Pieris- dae	5	4.00	0.04.00.046.0	8	0.707	0	1	0	0	1	0	0	200	800	1	0	0	0
Pieris- nii dae	Pieris- nii dae	5	3.00	0.03.00.043.0	6	0.408	1	1	0	0	1	0	0	200	755	1	0	0	0
Pieris- dae	Pieris- dae	5	2.00	0.03.02.040.0	6	0.104	1	1	0	0	1	0	0	250	557	1	0	1	0
Pieris- pae dae	Pieris- pae dae	5	2.00	0.03.02.044.5	1	0.108	1	1	0	0	0	1	0	300	551	1	0	0	0
Ple-Ly-3 be- caenidae	Ple-Ly-3 be- caenidae	NANA	1.00	0.01.00.028.3	3	0.707	NANA	NANA	NANA	NANA	NANA	NANA	NANA	0	300	551	1	0	0
jidea_loewii	jidea_loewii	5	1.50	0.02.01.022.5	9	0.069	1	1	0	0	1	0	0	240	100	1	0	0	0
Ple-Ly-9915 be- caenidae	Ple-Ly-9915 be- caenidae	5	1.50	0.02.01.022.5	9	0.069	1	1	0	0	1	0	0	240	100	1	0	0	0
jus_ar- gus	jus_ar- gus	5	1.50	0.02.01.031.0	6	0.204	0	1	0	0	1	0	0	300	1400	1000	1	0	0
Ple-Ly-2905 be- caenidae	Ple-Ly-2905 be- caenidae	5	1.50	0.02.01.031.0	6	0.204	0	1	0	0	1	0	0	300	1400	1000	1	0	0
jus_ar- gy- rog- nomon	jus_ar- gy- rog- nomon	5	1.00	0.01.00.023.0	6	0.354	NANA	NANA	NANA	NANA	NANA	NANA	NANA	0	1400	1000	1	0	0
Ple-Ly-10 be- caenidae	Ple-Ly-10 be- caenidae	5	1.00	0.01.00.023.0	6	0.354	NANA	NANA	NANA	NANA	NANA	NANA	NANA	0	1400	1000	1	0	0
jus_bel- lieri	jus_bel- lieri	5	1.50	0.02.01.024.5	5	0.041	0	1	0	0	1	0	0	100	2300	1000	1	0	0
Ple-Ly-7745 be- caenidae	Ple-Ly-7745 be- caenidae	5	1.50	0.02.01.024.5	5	0.041	0	1	0	0	1	0	0	100	2300	1000	1	0	0
jus_idas	jus_idas	5	1.50	0.02.01.024.5	5	0.041	0	1	0	0	1	0	0	100	2300	1000	1	0	0
Poly-Nympha- go- i- nia_dae	Poly-Nympha- go- i- nia_dae	15	2.00	0.03.02.046.0	2	0.060	0	1	1	1	1	0	0	2700	657	1	0	1	1
album	album	15	2.00	0.03.02.046.0	2	0.060	0	1	1	1	1	0	0	2700	657	1	0	1	1

species	family	range	size	con-	GEN_Av-	WSP_Fe-	male_av-	er-	WSP_Fe-	ELT_sin-	er-	FM_Av-	AFB_Av-	AFB_an-	AFB_min-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
																er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-	er-

species	range	size	con-	GEN_Av-	WSP_Fe-	male_av-	er-	WSP_Fe-	ELT_sin-	er-	FM_Av-	AFB_Av-	AFB_i-	AFB_min-	AFB_max-	AFB_low-	AFB_high-	AFB_mid-	AFB_std-	AFB_var-	AFB_skew-	AFB_kurt-	AFB_mom-	AFB_flat-	AFB_sharp-	AFB_power
PolyLy-3304	4	1.50	1.02	0.01	0.32	0.4	0.20	4	1	1	0	0	1	0	0	100	220	100	1	0	0	0	0	0	0	0
ommaenidae																										
tus_do-																										
ry-																										
las																										
PolyLy-88	4	4	1.00	0.01	0.00	0.31	0.0	0.40	8	0	1	0	0	1	0	0	600	2100	100	1	0	0	0	0	0	1
ommaenidae																										
tus_eros																										
PolyLy-1675	5	1.00	0.01	0.00	0.28	0.8	0.50	0	1	1	0	0	1	0	0	100	1900	100	1	0	0	0	0	0	0	0
ommaenidae																										
tus_es-																										
cheri																										
PolyLy-11	5	5	1.00	0.01	0.00	0.30	0.5	1.00	0	0	1	0	0	NANANA	900	600	3.00	1	0	0	0	0	0	0	1	
ommaenidae																										
tus_fab-																										
res-																										
sei																										
PolyLy-27	5	5	1.00	0.01	0.00	0.32	0.4	1.00	0	0	1	0	0	NANANA	900	300	2.00	1	0	0	0	0	0	0	0	
ommaenidae																										
tus_ful-																										
gens																										
PolyLy-3	3	3	1.00	0.01	0.00	0.28	0.4	1.00	0	1	1	0	0	1	0	0	1900	100	2.00	1	0	0	0	0	0	0
ommaenidae																										
tus_gol-																										
gus																										
PolyLy-2	2	2	1.00	0.01	0.00	0.30	0.5	1.00	NANANANANANANANANANA	1000	0	2.00	1	0	0	0	0	0	0	0	0	0	0	0	0	
ommaenidae																										
tus_humedasae																										
PolyLy-1476	5	2.50	0.04	0.03	0.28	0.1	0.10	4	1	1	0	0	1	0	0	0	2900	700	1	0	0	0	0	1	1	
ommaenidae																										
tus_icarus																										
PolyLy-2	NANA	1.00	0.01	0.00	0.30	0.4	1.00	NANANANANANANANANA	500	2300	1.51	NANANANANANANANA														
ommaenidae																										
tus_iphi-																										
ge-																										
nia																										

species	range	size	con- serva- tion	GEN_Av- er- age	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- range	ELT_sin- er-	FM_Av- er-	AFB_Av- er-	AFB_an- i-	AFB_min- power																	
PolyLy-NA4	4	1.00	0.01	0.00	0.03	0.5	1.00	NANANANANANANANA	1200	2.00	NANANANANANANANA																	
ommaenidae																												
tus_nepho-																												
hip-																												
ta-																												
menos																												
PolyLy-26	4	4	1.00	0.01	0.00	0.03	0.6	1.00	0	1	1	0	0	0	1	0	0	0	0	0	1							
ommaenidae																												
tus_nivescens																												
PolyLy-9	3	3	1.00	0.01	0.00	0.03	0.6	0.5	7	NANANANANANANANANA	400	160	NANANANANANANANANA															
ommaenidae																												
tus_or-																												
phi-																												
cus																												
PolyLy-59	5	4	1.00	0.01	0.00	0.03	1.6	0.4	7	1	1	0	0	1	0	0	100	190	1.00	1	0	0	0	0	0	0		
ommaenidae																												
tus_ri-																												
par-																												
tii																												
PolyLy-35	15	5	2.00	0.03	0.02	0.02	9.6	0.5	0	1	1	0	0	1	0	0	0	220	70	1.00	1	0	0	0	0	0	0	
ommaenidae																												
tus_ther-																												
sites																												
PolyLy-3	3	3	1.00	0.01	0.00	0.03	1.6	1.00	0	1	0	0	NANANA	1200	2.00	1	0	0	1	0	0	1						
ommaenidae																												
tus_vi-																												
o-																												
le-																												
tae																												
PonPier-60	5	5	1.50	0.02	0.01	0.04	7.0	0.1	0	2	1	0	0	0	1	0	0	0	340	40	1.00	1	0	0	0	0	0	0
tia_dad-																												
lidice																												
PonPier-11	5	5	2.50	0.03	0.01	0.03	8.3	0.2	6	0	1	0	0	1	0	0	0	250	60	0.4	NANANANANANANANA							
tia_dad-																												
ridice																												
PonPier-21	15	5	3.00	0.03	0.00	0.04	1.5	0.0	6	1	0	1	0	0	1	1	0	0	300	5	0.53	1	0	0	0	0	0	0
tia_dap-																												
lidice																												

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

	con- fam- serv- con- GEN_Av- male_av- er- WSP_Fe- ELT_sin- FM_Av- AFB_Av- AFB_an- AFB_min-															
species	range	size	GEN_Av- male_av- er- WSP_Fe- ELT_sin- FM_Av- AFB_Av- AFB_an- AFB_min-	range	size	GEN_Av- male_av- er- WSP_Fe- ELT_sin- FM_Av- AFB_Av- AFB_an- AFB_min-										
Pseudocampidocidae	1	1.00	0.01	0.05	0.04	1.00	NANANANANANANANANA	1400	0.00	1	0	0	0	0	0	0
ara_mercurius	3	1.00	0.01	0.05	0.3	0.28	NANANANANANANANANA	300	0.02	1	0	0	0	0	0	0
Pseudocampidocidae	1	1.00	0.01	0.05	0.04		NANANANANANANANANA	200	0.00	1	0	0	0	0	0	1
ara_williamsi	5	1.50	0.02	0.01	0.20	0.4	0 1 0 0	NANANA	100	0.00	1	0	0	0	0	1
Pseudocampidocidae	1	1.00	0.01	0.05	0.04	1.00	0 1 0 0	NANANA	700	0.00	1	0	0	0	0	0
Pseudocampidocidae	5	1.50	0.02	0.01	0.24	0.1	0 0 1 0 0 1 0 0	100	0.00	1	0	0	0	0	0	0
Pseudocampidocidae	5	1.00	0.01	0.05	0.07	0.5	0 0 1 0 0 1 0 0	500	0.00	1	0	1	0	0	0	0
Pseudocampidocidae	4	2.00	0.02	0.00	0.21	0.5	0	NANANANANANANANANA	200	0.00	1	0	0	0	0	1
Pseudocampidocidae	4	1.50	0.02	0.01	0.23	0.0	0 0 1 0 0	NANANA	0	0.00	1	0	0	0	0	0
Pseudocampidocidae	5	1.00	0.01	0.05	0.28	0.3	0 0 1 0 0 1 0 0	230	0.53	1	0	0	0	0	0	0
Pseudocampidocidae	5	1.00	0.01	0.05	0.28	0.28	NANANANANANANANANA	160	0.02	1	0	0	0	0	0	0

species	family	range	con- serva-	GEN- size	WSP_Fe-		male_av- er	WSP_Fe- er	ELT_sin-								FM_Av- er	AFB- ey-								AFB- i-	AFB- an-	AFB- min-
					GEN- N	WSP_Fe- R			ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-		ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-	ELT- sin-				
PyrHes3115	gus_pari-	5	5	1.50	0.02	0.01	0.26	0.1	0.18	3	0	1	1	0	1	0	0	0	1900	0.55	1	0	0	0	0	0	1	
moridae																												
i-																												
canus																												
PyrHes555	gus_pai-	5	5	1.00	0.01	0.00	0.28	0.5	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	1800	0.2	1	0	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHes305	gus_pai-	5	5	1.00	0.01	0.00	0.29	0.6	0.50	NA	NA	NA	NA	NA	NA	NA	NA	NA	1500	0.2	1	0	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHes2645	gus_pai-	5	5	1.00	0.01	0.00	0.32	0.4	0.20	8	1	1	0	0	1	1	0	0	1800	0.00	1	0	0	0	0	0	1	
moridae																												
i-																												
canus																												
PyrHes1625	gus_pai-	5	5	1.00	0.01	0.00	0.29	0.5	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	100	0.2	1	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHes145	gus_pai-	5	5	1.00	0.01	0.00	0.31	0.2	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	200	0.2	1	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHes943	gus_pai-	3	3	1.00	0.01	0.00	0.27	0.2	0.40	8	1	1	0	0	1	0	0	0	1000	0.2	1	0	0	0	0	0	1	
moridae																												
i-																												
canus																												
PyrHes29	gus_pai-	NA	NA	1.00	0.01	0.00	0.28	0.3	0.50	NA	NA	NA	NA	NA	NA	NA	NA	NA	1000	0.3	0.2	1	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHes955	gus_pai-	5	5	1.50	0.02	0.01	0.23	0.6	0.10	2	0	1	0	0	1	0	0	0	2500	0.04	1	0	0	0	0	0	0	
moridae																												
i-																												
canus																												
PyrHesNA5	gus_pai-	5	5	1.50	0.02	0.01	0.23	0.6	NA	0	1	1	0	0	1	0	0	0	1800	0.53	1	0	0	0	0	0	1	
moridae																												
i-																												
canus																												
PyrHes1055	gus_pai-	5	5	2.50	0.03	0.01	0.25	0.6	0.50	7	1	1	0	0	1	0	0	0	2800	0.00	1	0	0	0	0	0	1	
moridae																												
i-																												
canus																												

species	range	pop_size	GEN_av- con- serv	GEN_av- com- er	WSP_Fe-		WSP_Fe- male_av- er								ELT_sin-				FM_Av- er				AFB_av- ey-i				AFB_av- an- AFB_min- power			
					GEN_Fe- min	GEN_Fe- max	WSP_Fe- min	WSP_Fe- max	WSP_Fe- min	WSP_Fe- max	WSP_Fe- min	WSP_Fe- max	WSP_Fe- min	WSP_Fe- max	ELT_sin- min	ELT_sin- max	ELT_sin- min	ELT_sin- max	FM_Av- min	FM_Av- max	FM_Av- min	FM_Av- max	AFB_av- min	AFB_av- max	AFB_av- min	AFB_av- max	AFB_av- min	AFB_av- max		
PyrHes318	4	1.00	0.01	0.00	0.28	0.0	0.30	6	1	1	0	0	1	0	0	0	2800	0.02	1	0	0	0	0	0	0	0				
gus_pari- rat-idae																														
u- lae																														
PyrHes77	5	5	1.00	0.01	0.00	0.35	0.6	0.36	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	0	2300	0.02	1	0	0	0	0	0	1				
gus_pridae idae																														
PyrHes29	5	5	1.00	0.01	0.00	0.24	0.5	0.57	NAN	NAN	NAN	NAN	NAN	NAN	NAN	NAN	1800	0.02	0.00	NAN	NAN	NAN	NAN	NAN	NAN	NAN				
gus_puar- renidae																														
Py-Nyn109	5	5	1.00	0.01	0.00	0.37	0.2	0.36	4	1	1	0	0	1	0	0	100	1900	0.51	1	0	0	0	0	0	0				
ro-i- nia_dath- seba																														
Py-Nyn219	5	5	1.00	0.01	0.00	0.31	0.2	0.17	7	0	1	0	0	1	0	0	0	2300	0.51	1	0	0	0	0	0	1				
ro-i- nia_dae cilia																														
Py-Nyn515	5	5	1.00	0.01	0.00	0.36	0.4	0.08	1	1	1	0	0	1	0	0	0	2300	0.53	1	0	1	0	0	0	0				
ro-i- nia_dichonus																														
Satyrjum349	5	5	1.00	0.01	0.00	0.30	0.4	1.00	0	1	0	1	0	0	0	0	2000	0.02	1	0	1	0	0	0	0	0				
ciaecaenidae																														
Satyrjum106	5	5	1.00	0.01	0.00	0.32	0.4	0.70	7	0	0	1	1	1	0	0	100	1200	0.00	1	0	0	0	0	0	0				
culicaenidae																														
Satyrjum586	5	5	1.00	0.01	0.00	0.34	0.4	0.10	2	0	0	1	0	1	0	0	0	1800	0.00	0	0	1	0	0	0	0				
cis caenidae																														
Satyrjum_NAN	1	1	1.00	0.01	0.00	0.29	0.4	0.57	7	0	0	1	0	1	0	0	600	1900	0.53	1	0	0	0	0	0	0				
ererraenidae																														
Satyrjum408	5	5	1.00	0.01	0.00	0.31	0.5	0.16	4	0	0	1	0	1	0	0	100	600	0.00	1	0	1	1	0	0	0				
caenidae																														
Satyrjum483	5	5	1.00	0.01	0.00	0.30	0.4	0.16	7	0	0	1	0	1	1	0	0	2000	0.51	1	0	1	1	0	0	0				
caenidae																														
Satyrjum553	5	5	1.00	0.01	0.00	0.30	0.4	0.06	5	0	0	1	1	1	0	0	0	1700	0.00	1	0	0	1	0	0	0				
albumenidae																														

species	range	size	con- serv	GEN_Av- con- serv	WSP_Fe- male_av- er- WSP_Fe- range	WSP_Fe- range	ELT_sin- er-	FM_Av- er-	AFB_Av- ey- i-	AFB_an- AFB_min-
Satyris taci- dae	53	15	1.00	0.01	0.05	5.00	0.26	1 1 0 0 1 0 0 100	190	0 0 1 0 0 0 0 0 0
Satyris ula i- dae	145	15	1.00	0.01	0.05	5.00	0.50	1 1 0 0 0 1 0 0 220	102	1 0 0 0 0 0 1 1
Scolytus i- caenidae	260	4	1.50	0.02	0.01	0.27	5.00	0.33	0 1 0 0 1 0 0 0 150	0 0 1 0 0 0 0 0 0
Speyeria e- i- ria_dajaja	132	15	1.00	0.01	0.05	1.50	0.50	1 1 0 0 1 0 0 0 250	0.53	1 0 0 0 0 0 1 1
Spi-Hes alipor- ifer idae	129	5	1.50	0.02	0.01	0.25	0.25	NANANANANANANANAO	250	0.53 1 0 0 0 0 0 0
Spi-Hes aliphi- mididae	25	5	1.00	0.01	0.05	0.27	0.50	NANANANANANANANAO	220	0 0 NANANANANANANA
Spi-Ly- alicaenidae	NANANA	3	0.03	0.03	0.00	0.20	0.28	NANANANANANANANAO	140	NANANANANANANANANA
Spi-Hes alipser- to- idae	380	5	2.00	0.03	0.02	0.24	0.01	1.00	1 1 0 0 1 0 0 0 170	0.04 1 0 0 0 0 0 0
Spi-Hes aliphier- a- idae	7	5	2.00	0.02	0.00	0.24	0.01	1.00	1 1 0 0 1 0 0 0 150	0 0 NANANANANANANA
Tarucus i- cus	19	5	3.00	0.03	0.00	0.20	0.01	0.26	7 0 1 0 0 1 0 0 0 120	0 0 1 0 0 0 0 0 0
Tarucus cantharus- tus	4	5	3.00	0.03	0.00	0.21	0.02	0.35	4 0 0 1 0 1 0 0 0 250	6.00 NANANANANANANA

species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123
---------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

species	isrange	fam- rang	con- serv	GEN_ size	Av- con-	GEN_ size	Av- con-	WSP_Fe- male_av- er- WSP_Fe-<
---------	---------	--------------	--------------	--------------	-------------	--------------	-------------	---

```
# contains is another useful command to select columns.
be %>%
  select(species, contains("LEV")) %>%
  drop_na()
```

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Aglais_io	0	0	1	0	0
Aglais_urticae	0	0	1	0	0
Agriades_aquilo	0	0	1	0	0
Agriades_glandon	0	0	1	0	0
Agriades_optilete	0	1	1	0	0
Agriades_pyrenaicus	0	1	0	0	0
Agriades_zullichii	1	1	1	0	0
Anthocharis_cardamines	0	0	1	0	0
Anthocharis_euphenoides	0	0	1	0	0
Apatura_ilia	0	0	0	1	1
Apatura_iris	0	0	0	1	0
Apatura_metis	0	0	0	1	1
Aphantopus_hyperantus	0	1	1	0	0
Aporia_crataegi	0	0	1	1	0
Araschnia_levana	0	0	1	0	0
Archon_apollinus	0	0	1	0	0
Arethusana_arethusa	0	1	1	0	0
Argynnis_pandora	1	1	1	0	0
Argynnis_paphia	0	0	1	0	0
Aricia_agestis	0	1	1	0	0
Aricia_anteros	0	0	1	0	0
Aricia_artaxerxes	0	1	1	0	0
Aricia_cramera	0	1	1	0	0
Aricia_morroneis	0	0	1	0	0
Aricia_nicias	0	0	1	0	0
Azanus_ubaldus	0	0	0	1	0
Boloria_aquilonaris	0	1	1	0	0
Boloria_dia	0	0	1	0	0
Boloria_eunomia	0	0	1	0	0
Boloria_euphrosyne	0	0	1	0	0
Boloria_freija	0	0	0	1	0
Boloria_frigga	0	0	0	1	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Boloria_graeca	0	0	1	0	0
Boloria_improba	0	0	1	0	0
Boloria_napaea	0	1	1	0	0
Boloria_pales	0	0	1	0	0
Boloria_selene	0	0	1	0	0
Boloria_thore	0	0	1	0	0
Boloria_titania	0	0	1	0	0
Borbo_borbonica	0	1	1	0	0
Brenthis_daphne	0	0	0	1	0
Brenthis_hecate	0	0	1	0	0
Brenthis_ino	0	1	1	0	0
Brintesia_circe	0	1	1	0	0
Callophrys_rubi	0	1	1	1	0
Carcharodus_alceae	0	0	1	0	0
Carcharodus_baeticus	0	1	1	0	0
Carcharodus_floccifera	0	0	1	0	0
Carcharodus_lavatherae	0	1	1	0	0
Carterocephalus_palaemon	0	0	1	0	0
Carterocephalus_silvicola	0	0	1	0	0
Catopsilia_florella	0	0	0	1	1
Celastrina_argiolus	0	0	0	1	1
Charaxes_jasius	0	0	0	0	1
Chazara_briseis	0	1	1	0	0
Coenonympha_arcania	0	0	1	0	0
Coenonympha_dorus	0	0	1	0	0
Coenonympha_glycerion	0	0	1	0	0
Coenonympha_hero	0	0	1	0	0
Coenonympha_leander	0	0	1	0	0
Coenonympha_oedippus	0	0	1	0	0
Coenonympha_pamphilus	0	0	1	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Coenonympha_rhodopen- sis	0	0	1	0	0
Coenonympha_thyr- sis	0	0	1	0	0
Coenonympha_tullia	0	0	1	0	0
Colias_alfacariensis	0	1	1	0	0
Colias_aurorina	0	0	1	0	0
Colias_caucasica	0	0	1	0	0
Colias_chrysotheme	0	1	1	0	0
Colias_crocea	0	0	1	0	0
Colias_hecla	0	1	0	0	0
Colias_hyale	0	1	1	0	0
Colias_myrmidone	0	0	1	0	0
Colias_palaeno	0	1	1	0	0
Colias_phicomone	0	1	0	0	0
Colias_tyche	0	1	0	0	0
Colotis_evagore	0	0	1	0	0
Cupido_alcetas	0	0	1	0	0
Cupido_argiades	0	0	1	0	0
Cupido_decoloratus	0	0	1	0	0
Cupido_lorquinii	0	0	1	0	0
Cupido_minimus	0	0	1	0	0
Cupido_osiris	0	0	1	0	0
Cyaniris_semiargus	0	0	1	0	0
Cyclotrius_webbianus	0	0	1	0	0
Danaus_chrysippus	0	0	1	0	0
Danaus_plexippus	0	0	1	0	0
Erebia_aethiops	0	1	1	0	0
Erebia_cassioides	0	1	1	0	0
Erebia_claudina	0	0	1	0	0
Erebia_embla	0	0	1	0	0
Erebia_epiphron	0	0	1	0	0
Erebia_eriphyle	0	0	1	0	0
Erebia_euryale	0	0	1	0	0
Erebia_gorge	0	0	1	0	0
Erebia_ligea	0	1	1	0	0
Erebia_manto	0	0	1	0	0
Erebia_medusa	0	1	1	0	0
Erebia_meolans	0	1	1	0	0
Erebia_mnestra	0	0	1	0	0
Erebia_montana	0	1	0	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Erebia_neoridas	0	0	1	0	0
Erebia_oeme	0	1	1	0	0
Erebia_palarica	0	1	1	0	0
Erebia_pandrose	0	1	1	0	0
Erebia_pluto	0	1	1	0	0
Erebia_polaris	0	0	1	0	0
Erebia_triarius	0	1	1	0	0
Erynnis_tages	0	0	1	0	0
Euchloe_ausonia	0	0	1	0	0
Euchloe_bazae	0	1	0	0	0
Euchloe_belemia	0	1	0	0	0
Euchloe_charlonia	0	1	1	0	0
Euchloe_crameri	0	0	1	0	0
Euchloe_insularis	0	0	1	0	0
Euchloe_penia	0	1	1	0	0
Euchloe_simplonia	0	1	1	0	0
Euchloe_tagis	0	1	1	1	0
Eumedonia_eumedon	0	1	1	0	0
Euphydryas_aurinia	0	1	1	0	0
Euphydryas_cynthia	0	1	1	0	0
Euphydryas_desfontainii	0	0	1	0	0
Euphydryas_iduna	0	0	1	0	0
Euphydryas_intermedia	0	1	0	1	0
Euphydryas_materna	0	0	1	1	1
Fabriciana_adippe	0	0	1	0	0
Fabriciana_elisa	0	0	1	0	0
Fabriciana_niobe	0	1	1	0	0
Favonius_quercus	0	0	0	0	1
Gegenes_nostrodamus	0	0	1	0	0
Gegenes_pumilio	0	0	1	0	0
Glaucopsyche_alexis	0	0	1	0	0
Glaucopsyche_melanops	0	0	1	0	0
Glaucopsyche_paphos	0	0	1	0	0
Gonepteryx_cleobule	0	0	0	1	1

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Gonepteryx_cleopatra	0	0	0	1	0
Gonepteryx_farinosa	0	0	0	1	0
Gonepteryx_rhamni	0	0	0	1	0
Hamearis_lucina	0	1	1	0	0
Hesperia_comma	0	1	1	0	0
Heteropterus_morphheus	0	0	1	0	0
Hipparchia_azorina	0	0	1	0	0
Hipparchia_cypriensis	0	1	1	0	0
Hipparchia_fagi	0	1	1	0	0
Hipparchia_fatua	0	1	1	0	0
Hipparchia_fidia	0	0	1	0	0
Hipparchia_hermione	0	1	1	0	0
Hipparchia_maderensis	0	0	1	0	0
Hipparchia_pellucida	0	1	1	0	0
Hipparchia_semele	0	1	1	0	0
Hipparchia_statilinus	0	1	1	0	0
Hipparchia_syriaca	0	1	1	0	0
Hipparchia_volgensis	0	1	1	0	0
Hipparchia_wyssii	0	1	1	0	0
Hyponephele_lupina	0	1	1	0	0
Hyponephele_lycaon	0	0	1	0	0
Iolana_iolas	0	1	1	0	0
Iphiclides	0	0	0	1	0
Iphiclides_feisthamelii					
Iphiclides_podalirius	0	1	1	0	0
Issoria_lathonia	0	1	1	0	0
Kirinia_climene	0	1	1	0	0
Kretania_eurypilus	0	0	1	0	0
Kretania_hesperica	0	0	1	0	0
Kretania_psyllorita	0	0	1	0	0
Kretania_pylaon	0	0	1	0	0
Kretania_trappi	0	1	1	0	0
Laeosopis_roboris	0	1	0	0	1
Lampides_boeticus	0	0	1	0	0
Lasiommata_maera	0	0	1	0	0
Lasiommata_megera	0	0	1	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Lasiom-	0	0	1	0	0
mata_paramegaera					
Lasiom-	0	0	1	0	0
mata_petropolitana					
Leptidea_duponcheli	0	1	1	0	0
Leptidea_juvernica	0	0	1	0	0
Leptidea_morsei	0	0	1	0	0
Leptidea_reali	0	0	1	0	0
Leptidea_sinapis	0	0	1	0	0
Leptotes_pirithous	0	0	1	0	0
Libythea_celtis	0	0	0	0	1
Limenitis_camilla	0	0	0	1	1
Limenitis_populi	0	0	0	0	1
Limenitis_reducta	0	0	0	1	0
Lopinga_achine	0	1	1	0	0
Lycaena_alciphron	0	1	1	0	0
Lycaena_candens	0	1	0	0	0
Lycaena_dispar	0	1	1	0	0
Lycaena_helle	0	0	1	0	0
Lycaena_hippothoe	0	1	1	0	0
Lycaena_phlaeas	0	1	0	0	0
Lycaena_tityrus	0	1	1	0	0
Lycaena_virgaureae	0	1	0	0	0
Lysandra_albicans	0	0	1	0	0
Lysandra_bellargus	0	1	0	0	0
Lysandra_coridon	0	1	0	0	0
Lysandra_corydonius	0	1	1	0	0
Lysandra_hispana	0	0	1	0	0
Maniola_chia	0	1	1	0	0
Maniola_cypricola	0	1	1	0	0
Maniola_halicarnas-	0	1	1	0	0
sus					
Maniola_jurtina	0	1	1	0	0
Maniola_megala	0	1	1	0	0
Maniola_nurag	0	1	1	0	0
Maniola_telmessia	0	1	1	0	0
Melanargia_galathea	0	1	1	0	0
Melanargia_ines	0	0	1	0	0
Melanargia_lachesis	0	1	1	0	0
Melanargia_larissa	0	1	1	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Melanargia_occitanica	0	1	1	0	0
Melanargia_russiae	0	1	1	0	0
Melitaea_arduinna	0	1	0	0	0
Melitaea_asteria	0	1	1	0	0
Melitaea_athalia	0	1	1	0	0
Melitaea_aurelia	0	0	1	0	0
Melitaea_britomartis	0	0	1	0	0
Melitaea_cinxia	0	1	1	0	0
Melitaea_deione	0	1	1	0	0
Melitaea_diamina	0	1	1	0	0
Melitaea_didyma	0	0	1	0	0
Melitaea_ornata	0	0	1	0	0
Melitaea_parthenoides	0	0	1	0	0
Melitaea_phoebe	0	0	1	0	0
Melitaea_trivia	0	0	1	0	0
Melitaea_varia	0	1	1	0	0
Minois_dryas	0	1	1	0	0
Muschampia_proto	0	1	1	0	0
Nymphalis_antiope	0	0	0	1	1
Nymphalis_poly-chloros	0	0	0	1	1
Nymphalis_vaulsleyana	0	0	0	0	1
Nymphalis_xanthomelas	0	0	0	0	1
Ochlodes_sylvanus	0	0	1	0	0
Oeneis_bore	0	0	1	0	0
Oeneis_jutta	0	0	1	0	0
Oeneis_norna	0	0	1	0	0
Papilio_alexanor	0	0	1	0	0
Papilio_hospiton	0	1	1	0	0
Papilio_machaon	0	0	1	0	0
Pararge_aegeria	0	0	1	0	0
Pararge_xiphia	0	1	1	0	0
Pararge_xiphioides	0	1	1	0	0
Parnassius_apollo	0	1	0	0	0
Parnassius_mnemosyne	0	1	0	0	0
Parnassius_phoebus	0	1	1	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Pelopidas_thrax	0	0	1	0	0
Phengaris_alcon	1	1	1	0	0
Phengaris_arion	1	1	1	0	0
Phengaris_nausithous	1	1	1	0	0
Phengaris_teleius	1	1	1	0	0
Pieris_brassicae	0	1	1	0	0
Pieris_bryoniae	0	1	0	0	0
Pieris_cheiranthi	0	1	1	1	0
Pieris_ergane	0	1	1	0	0
Pieris_krueperi	0	0	1	0	0
Pieris_mannii	0	1	1	0	0
Pieris_napi	0	1	1	0	0
Pieris_rapae	0	1	1	0	0
Plebejus_argus	0	1	1	0	0
Plebejus_argyrogonomon	0	0	1	0	0
Plebejus_idas	0	0	1	0	0
Polygonia_c-album	0	0	1	1	1
Polygonia_egea	0	0	1	0	0
Polyommatus_admetus	1	1	1	0	0
Polyommatus_aman-dus	0	1	1	0	0
Polyommatus_aroaniensis	0	0	1	0	0
Polyommatus_damon	0	1	0	0	0
Polyommatus_daph-nis	0	1	1	0	0
Polyommatus_dory-las	0	1	1	0	0
Polyommatus_eros	0	0	1	0	0
Polyommatus_escheri	0	1	1	0	0
Polyommatus_fabres-sei	0	0	1	0	0
Polyommatus_ful-gens	0	0	1	0	0
Polyommatus_golgus	1	1	1	0	0
Polyommatus_icarus	0	1	1	0	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Polyommatus_nivescens	0	1	1	0	0
Polyommatus_ripar-tii	0	1	1	0	0
Polyommatus_ther-sites	0	1	1	0	0
Polyommatus_viole-tae	0	0	1	0	0
Pontia_callidice	0	1	0	0	0
Pontia_chloridice	0	0	1	0	0
Pontia_daplidice	0	0	1	0	0
Pontia_edusa	0	1	0	0	0
Proterebia_phegea	0	1	1	0	0
Pseudochazara_an-thelea	1	1	1	0	0
Pseu-dophilotes_abencer-ragus	0	0	1	0	0
Pseu-dophilotes_barbagiae	0	0	1	0	0
Pseudophilotes_ba-ton	0	0	1	0	0
Pseudophilotes_bav-ius	0	0	1	0	0
Pseudophilotes_vi-crama	0	0	1	0	0
Pyrgus_alveus	0	0	1	0	0
Pyrgus_armoricanus	0	0	1	1	0
Pyrgus_carthami	0	1	1	0	0
Pyrgus_cirsii	0	1	1	0	0
Pyrgus_malvae	0	0	1	0	0
Pyrgus_malvoides	0	1	1	0	0
Pyrgus_onopordi	0	1	1	0	0
Pyrgus_serratulae	0	1	1	0	0
Pyronia_bathseba	0	1	1	0	0
Pyronia_cecilia	0	0	1	0	0
Pyronia_tithonus	0	1	1	0	0
Satyrium_acaciae	0	1	0	1	0
Satyrium_esculi	0	0	0	1	1
Satyrium_ilicis	0	0	0	1	0
Satyrium_ledereri	0	0	0	1	0

species	LEV_buried_layer	LEV_ground_layer	LEV_field_layer	LEV_shrub_layer	LEV_canopy_layer
Satyrium_pruni	0	0	0	1	0
Satyrium_spini	0	0	0	1	0
Satyrium_w-album	0	0	0	1	1
Satyrus_actaea	0	1	1	0	0
Satyrus_ferula	0	1	1	0	0
Scolitantides_orion	0	0	1	0	0
Speyeria_aglaja	0	1	1	0	0
Spialia_sertorius	0	1	1	0	0
Spialia_therapne	0	1	1	0	0
Tarucus_balkanicus	0	0	1	0	0
Tarucus_theophrastus	0	0	0	1	0
Thecla_betulae	0	0	0	1	0
Thymelicus_acteon	0	0	1	0	0
Thymelicus_christi	0	0	1	0	0
Thymelicus_lineola	0	0	1	0	0
Thymelicus_sylvestris	0	0	1	0	0
Tomares_ballus	0	0	1	0	0
Tomares_callimachus	1	1	1	0	0
Vanessa_atalanta	0	0	1	0	0
Vanessa_cardui	0	0	1	0	0
Vanessa_virginiensis	0	0	1	0	0
Vanessa_vulcania	0	0	1	0	0
Ypthima_asterope	0	0	1	0	0
Zegris_eupheme	0	0	1	0	0
Zerynthia_cassandra	0	0	1	0	0
Zerynthia_cerisy	0	0	1	0	0
Zerynthia_cretica	0	0	1	0	0
Zerynthia_polyxena	0	0	1	0	0
Zerynthia_rumina	0	1	1	0	0

Functions like `contains` can be powerful for filtering and selecting. `starts_with` and `ends_with` work just the same way and are equally useful.

4.7 Create new variables with `mutate()`

This is a very powerful and flexible function that uses existing variables to create novel ones. Let's look at a simple example

```
# Create a new variable summarizing all the overwintering stages that are not adults
be %>%
  mutate(OWS_juvenile = 1-OWS_adult) %>%
  select(OWS_juvenile, OWS_adult) %>%
  drop_na()
```

[illegible]

[illegible]

OWS_juvenile	OWS_adult
1	0
1	0
1	0
1	0
1	0
1	0
1	0
0	1
0	1

```
# Determine how different the protection levels between EU and Europe and extract the species
be %>%
  mutate(protect_diff = abs(conserv.europe - conserv.eu)) %>%
  filter(protect_diff > 2)
```

					WSP_Fe-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
--	--	--	--	--	---------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4.8 Exercise

- From our dataset, filter out all butterflies with average wingspans larger than 60mm and smaller than 30mm. Only keep the species that have a conservation classification on the EU level. Only keep the species names and all variables associated with adult feeding, and store this in a new data frame. How many rows and columns does the new data frame have?
- Re-calculate the generation range from the provided minima and maxima. Check if your calculations match the original range values given in the data.

4.9 group_by() and summarise() as powerful data exploration tools

Although `dplyr` has a simpler syntax overall, everything we have looked at so far could have been done fairly easily with base R functions: data frame filtering, sorting, and adding and removing columns. One of the strengths of `dplyr` is explorative data analysis, and this is where `group_by()` and `summarize()` are really helpful. We'll only look at very simple examples today.

When browsing through the complete data table, it is very hard to recognize any patterns. Let's assume we wanted to compare the average wing span of butterflies with that overwinter as adults vs all other butterflies:

```
# Are butterflies that overwinter as adults larger than other species?
be %>%
  drop_na() %>%
  group_by(OWS_adult) %>%
  summarise(mean_wsp = mean(WSP_Female_average))
```

OWS_adult	mean_wsp
0	39.42489
1	51.85294

After choosing which variable to group by (here: `OWS_adult`), `summarise()` then calculates a function for each group. In our simple example, there are 2 groups: 0 (not overwintering as adult) and 1 (overwintering as adult); and the function to be calculated is the mean of the female wing span. This is a very flexible set of functions, because you can group by multiple groups and also use `summarise()` with many different functions (e.g., `mean()`, `sum()`, `min()`, `max()`, `median()` – just to name a few). Let's look at a more complex example:

```
# Let's add another group. How large is the standard deviation? How large is each group?
be %>%
  drop_na() %>%
  group_by(OWS_adult, LEV_ground_layer) %>%
  summarise(mean_wsp = mean(WSP_Female_average),
            sd = sd(WSP_Female_average),
            group_size=n())
```

``summarise()`` has grouped output by `'OWS_adult'`. You can override using the ``.groups`` argument.

OWS_adult	LEV_ground_layer	mean_wsp	sd	group_size
0	0	38.12174	12.312380	115
0	1	40.69492	12.181504	118
1	0	54.26667	9.460192	15
1	1	33.75000	12.374369	2

4.10 More exercises

Using `dplyr` functions, determine

- If butterflies overwintering as pupae have higher level of legal protection
- If butterflies occurring at higher altitudes on average have a higher level of protection
- If feeding on honeydew is more common in larger butterflies.
- How many butterfly species are there per family?

For a–c also determine how many species belong to each group.

5 The ggplot2 package

5.1 Very (!) brief introduction

ggplot2 is a graphing library, i.e., a tool to make graphs in R. Compared with base graphs and other graphics packages, it comes with a number of advantages:

- Beautiful!
- Highly customizable (which is not always necessary though)
- Easiest way to create very complex plots
- Tightly integrated into the **tidyverse**

Compared with other packages the major drawbacks would be that it comes with a steep(ish) learning curve and is probably less intuitive for beginners. The reason is that **ggplot2** doesn't have fixed commands for scatterplots, boxplots, barplots, etc, but rather creates the plot in layers. The most important elements (or layers) of a plot in **ggplot2** are:

- *Data*: as we are still in the **tidyverse**, this is always a data frame
- *Aesthetics*: i.e., **what** you want to plot. Often, this will correspond to variables (columns) in your dataframe
- *Geometric objects*: i.e., **how** you want to plot the data. This can be points, bars, boxplots, lines, etc..
- *Facets*: more about this later
- *Additional (optional) adjustments*: this includes themes that specify the overall design

5.2 Building up the plot

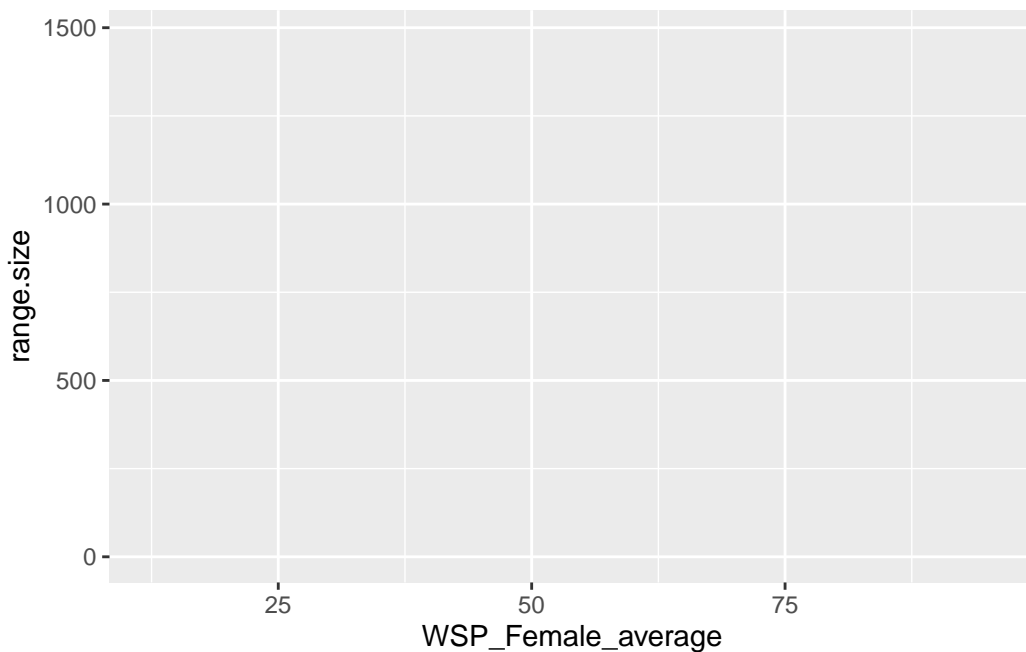
We will start off with a very simple scatterplot and gradually increase the complexity to illustrate **ggplot2** functionality.

```
# data and packages
library(tidyverse, quietly = TRUE)
```

```
-- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
v dplyr      1.1.4      v readr      2.1.6
v forcats    1.0.1      v stringr    1.6.0
v ggplot2    4.0.1      v tibble     3.3.1
v lubridate  1.9.4      v tidyr      1.3.2
v purrr      1.2.1
-- Conflicts ----- tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()     masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become
```

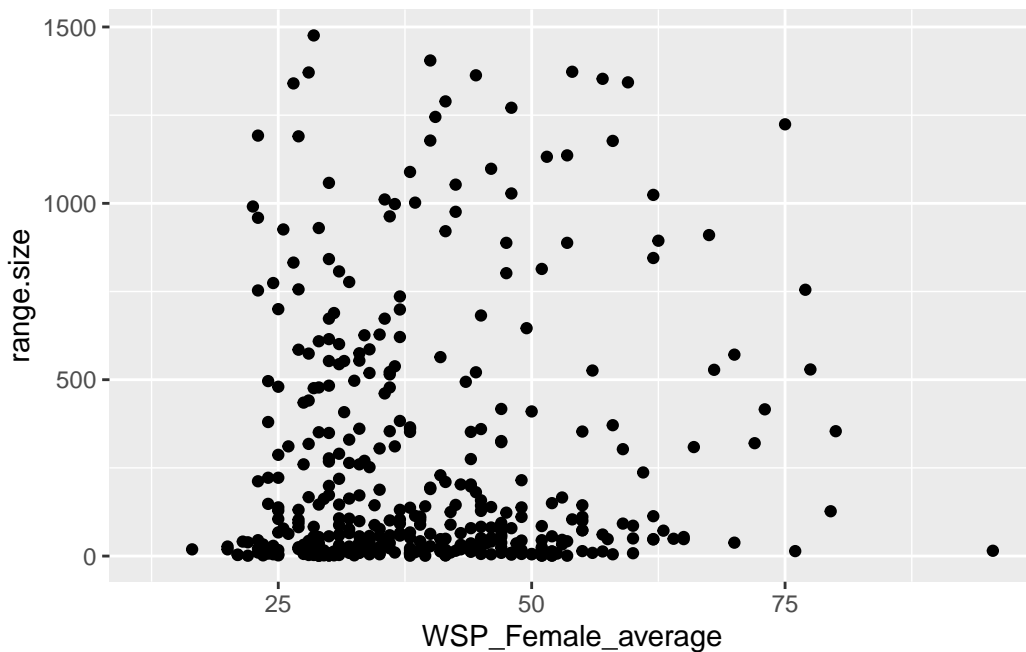
```
be <- read.table("data/butterfly_ecology.csv", header = TRUE, sep = ",")

# simple plot
be %>%                                # DATA
  ggplot(aes(x = WSP_Female_average, # AESTHETICS
             y = range.size))
```



In the above example, the data is the data frame that we have been using the whole time. Notice how we can simply pipe it to `ggplot2`. `aes` specifies our aesthetics, i.e., **what** we want to plot. What is missing?

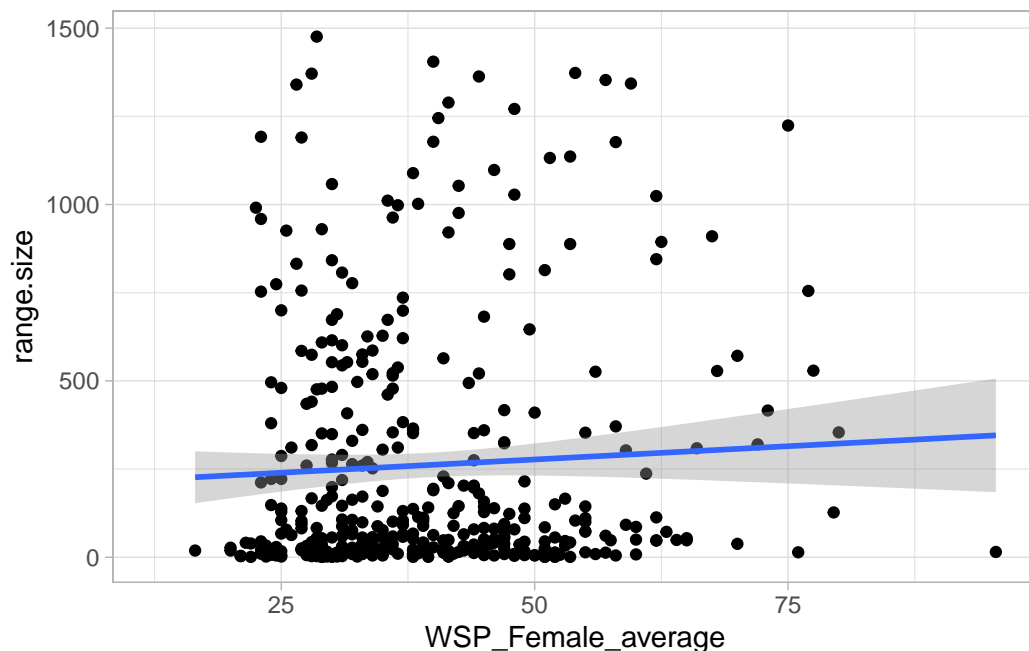
```
# simple scatter plot
be %>%                                # DATA
  ggplot(aes(x = WSP_Female_average, # Aesthetics
             y = range.size)) +
  geom_point()                        # Geometric object
```



The geometric object, i.e., **how** we want to plot our aesthetics. Notice that elements in `ggplot2` are added with the `+` symbol (this is specific to `ggplot2`). We can add more geometric objects that will use the same aesthetics:

```
# lets add another geom (a regression line), and also change the theme
be %>%                                # DATA
  ggplot(aes(x = WSP_Female_average, # Aesthetics
             y = range.size)) +
  geom_point() +                      # Geometric object
  geom_smooth(method = "lm") +        # Another geometric object
  theme_light()                      # Let's also change the theme
```

``geom_smooth()`` using formula = `'y ~ x'`



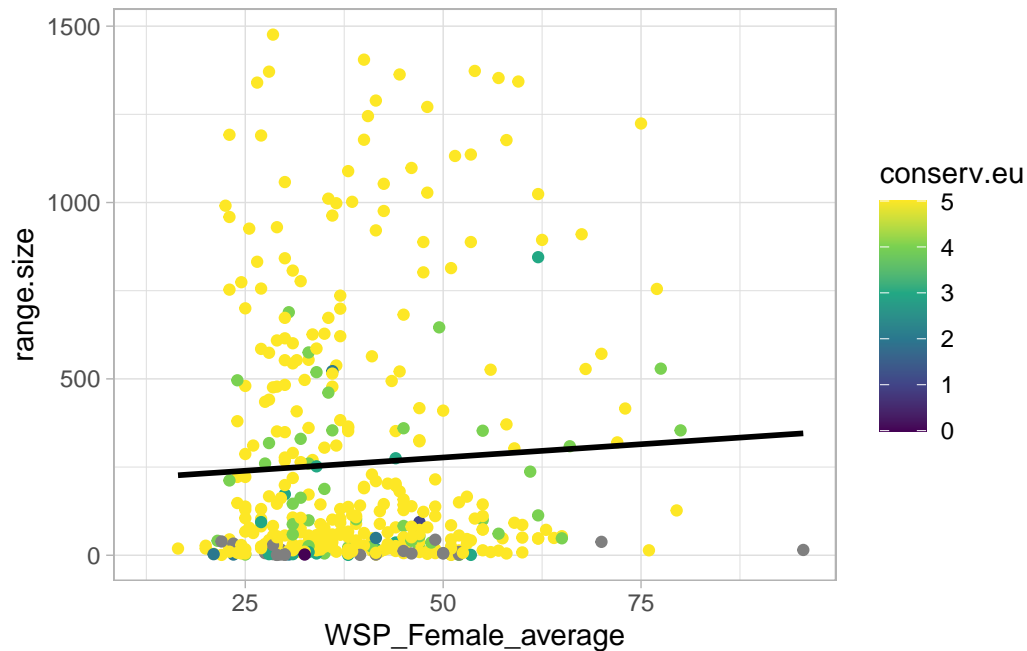
Changing the theme changes many layout options. For different applications, different themes might be appropriate. There are many additional themes available through packages such as [ggthemr](#) or [ggthemes](#).

A bit more on aesthetics: have you noticed that you only specify x and y once, and all geoms know **what** you want to plot. You can also specify additional aesthetics for each geom.

```
# Add additional aesthetics, here: we want to plot the sonsevation status. How? With colour

be %>%                                # DATA
  ggplot(aes(x = WSP_Female_average,    # Aesthetics
             y = range.size)) +
  geom_point(aes(color = conserv.eu)) + # aesthetics specific to the points only
  geom_smooth(method = "lm",
             color = "black",
             se = FALSE) +
  theme_light() +
  scale_color_viridis_c()              # let's use some nicer colors
```

```
`geom_smooth()` using formula = 'y ~ x'
```



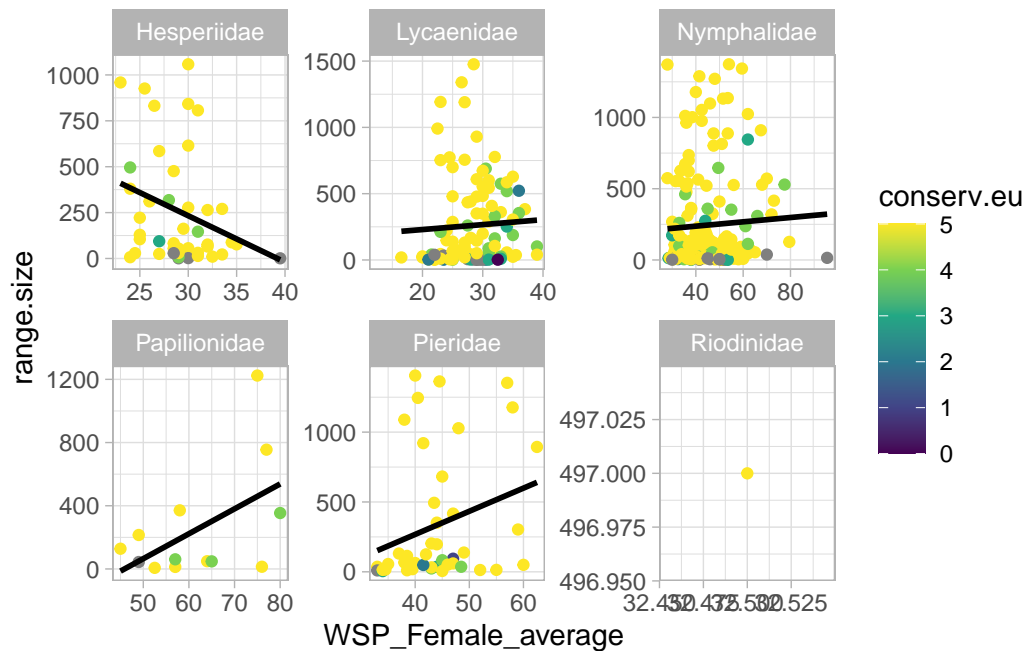
Aesthetics can be added through colors or shapes

5.3 Faceting

So far, we have cramped as much information as possible into the plot. This was useful to illustrate the functionality of `ggplot2`, but did not create very readable plots. Often, faceting is a better solution. The implementation in `ggplot2` is very straightforward.

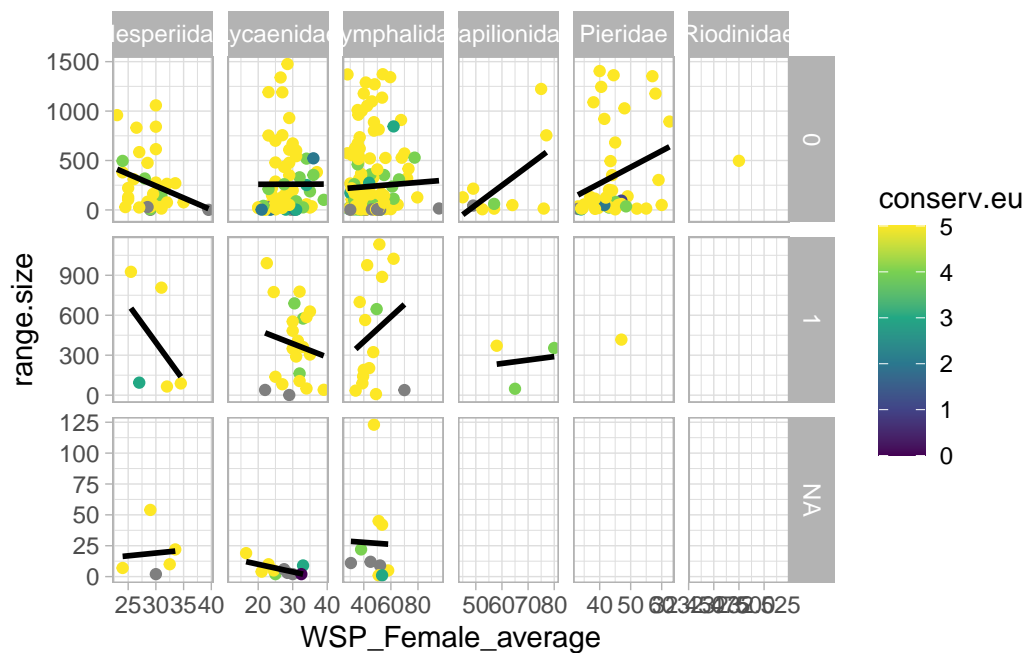
```
# Same example as before, faceted over family
be %>%
  ggplot(aes(x = WSP_Female_average,
             y = range.size)) +
  geom_point(aes(color = conserv.eu)) +
  geom_smooth(method = "lm",
             color = "black",
             se = FALSE) +
  theme_light() +
  scale_color_viridis_c() +
  facet_wrap(~family, scales = "free")
```

``geom_smooth()`` using formula = 'y ~ x'



```
# And now, faceting over 2 variables
be %>%
  ggplot(aes(x = WSP_Female_average,
             y = range.size)) +
  geom_point(aes(color = conserv.eu)) +
  geom_smooth(method = "lm",
             color = "black",
             se = FALSE) +
  theme_light() +
  scale_color_viridis_c() +
  facet_grid(OWS_egg ~ family, scales = "free") # faceting
```

`geom_smooth()` using formula = 'y ~ x'

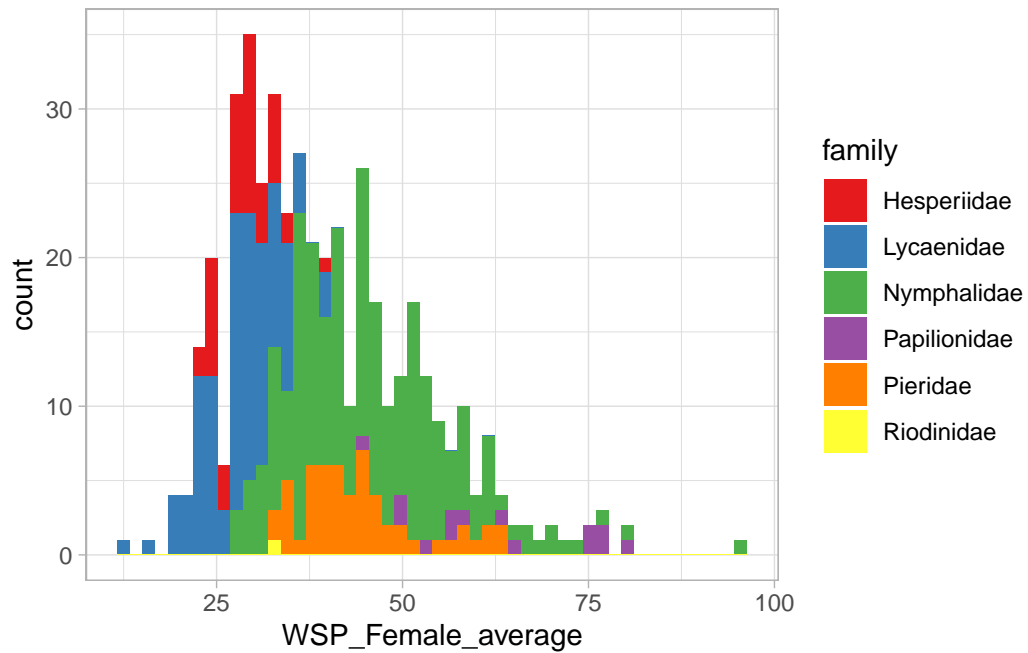


The above plot would need a little ‘cleaning up’. How would you do that?

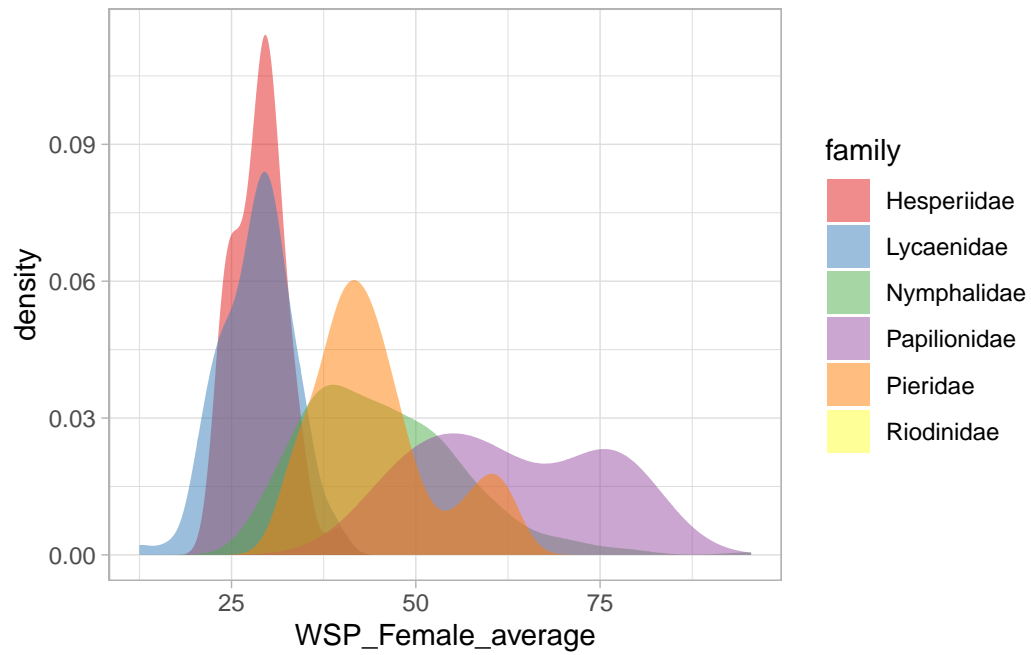
5.4 Some common plot types

We have looked at scatterplots, now let’s look at a number of other commonly used plots.

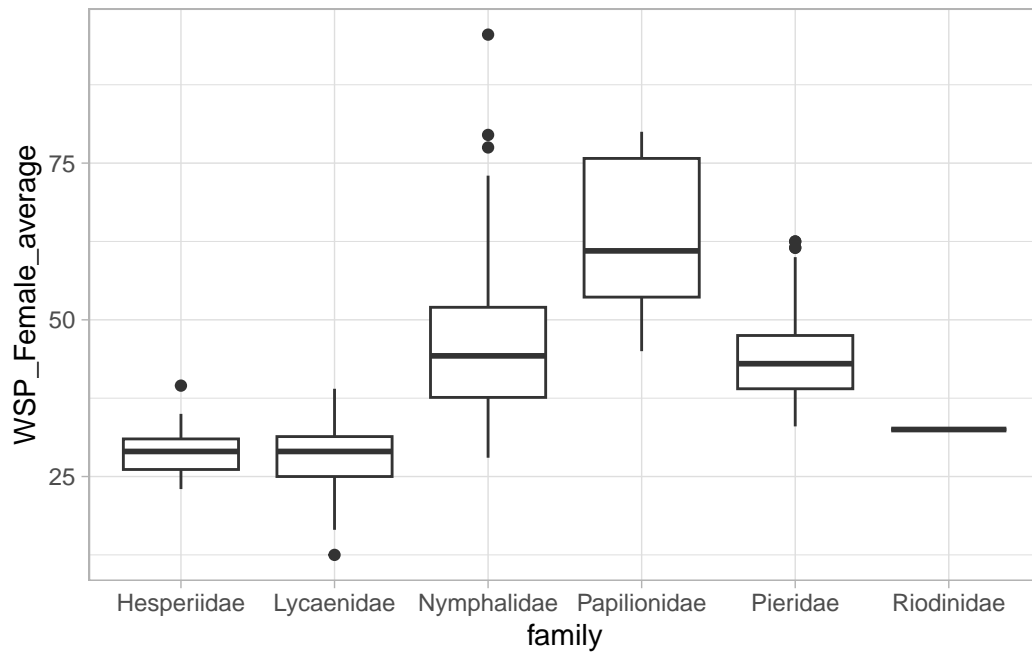
```
# histograms
be %>%
  ggplot(aes(x = WSP_Female_average, fill = family)) +
  geom_histogram(bins = 50) +
  theme_light() +
  scale_fill_brewer(palette = "Set1")
```



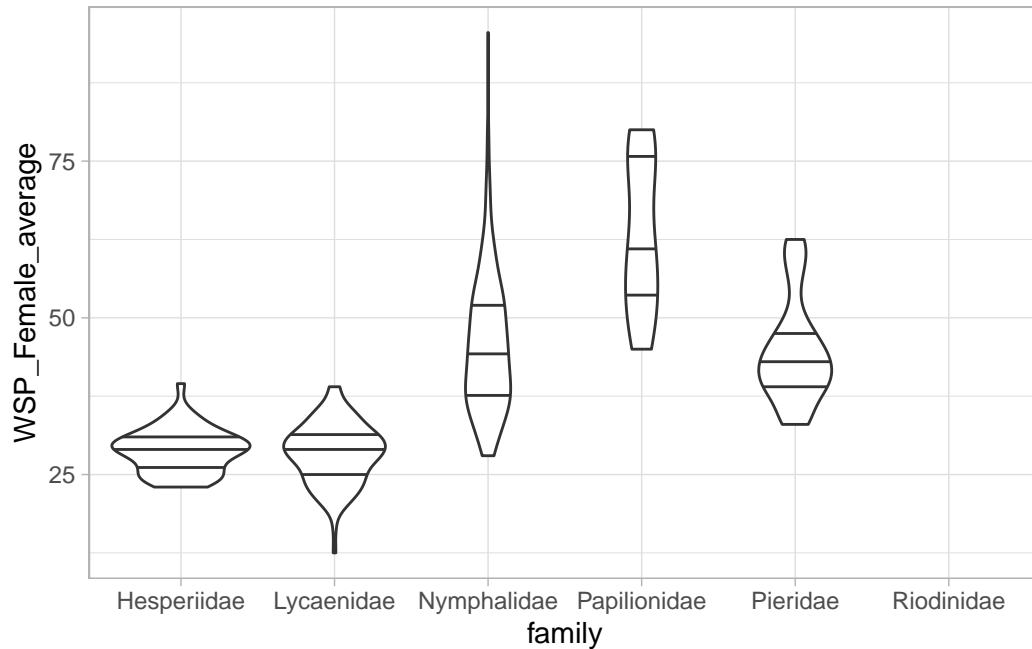
```
# better alternative are often density plots
be %>%
  ggplot(aes(x = WSP_Female_average, fill = family)) +
  geom_density(alpha = 0.5, colour = NA) +
  theme_light() +
  scale_fill_brewer(palette = "Set1")
```



```
# boxplots
be %>%
  ggplot(aes(y = WSP_Female_average, x = family)) +
  geom_boxplot() +
  theme_light()
```



```
# better alternative are violin plots
be %>%
  ggplot(aes(y = WSP_Female_average, x = family)) +
  geom_violin(draw_quantiles = c(0.25, 0.5, 0.75)) +
  theme_light()
```

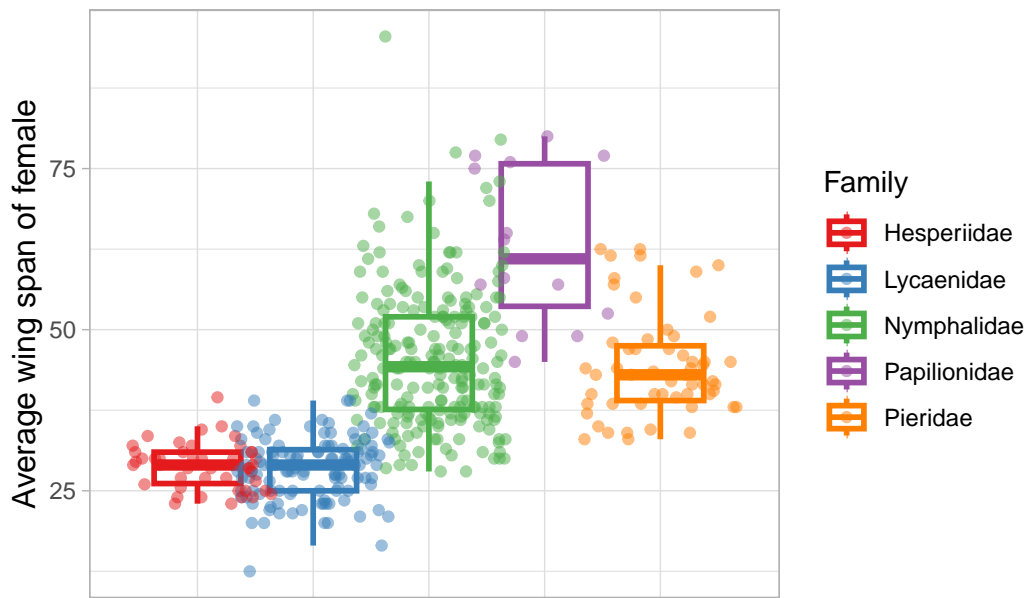


5.5 Fine tuning plots

We now know how to plot some common chart types but most of these don't look publishable yet. Lets return to one of our first examples and see how to polish it a little.

```
# A publication ready plot
be %>%
  filter(family != "Riodinidae") %>%
  ggplot(aes(y = WSP_Female_average, x = family, color = family)) +
  geom_boxplot(lwd = 1, outlier.shape = NA) +
  geom_point(position = position_jitterdodge(jitter.width = 2), alpha = 0.5) +
  theme_light() +
  labs(title = "Wing span across European butterfly families",
       y = "Average wing span of female")+
  theme(plot.title = element_text(face = "bold"),
        axis.title.y = element_text(size = 12),
        axis.title.x = element_blank(),
        axis.text.x = element_blank(),
        strip.text = element_text(size = 11)) +
  scale_color_brewer(palette = "Set1", name = "Family")
```

Wing span across European butterfly families



5.6 Exercise

Using `ggplot2`, explore how range size differs between butterfly families and plot check if butterflies with smaller ranges have higher protection status. Try to find appropriate plot types for this, use the help pages to find plot types that were not introduced to you yet. Explore other variables that may explain some trends in the data. Find a theme that you like! Remember, start with the **data**, add **aesthetics (what do you want to plot)**, and then think about **geometric objects (how do you want to plot the data)**. How can colour help in your visualisations? Does faceting make sense?

Part II

UNIX

6 Introduction to Linux Environment and Command Line.

6.1 The Unix / Linux environment

Unix and Linux (a variant of Unix) are operating systems (like Windows or macOS). They belong to a “family” of operating systems that share a common ancestor, have been around since 1969 and it’s not likely to disappear any time soon.

- Commonly used among the scientific and technical community (e.g. servers and scientific clusters).
- macOS is Unix-based system.
- Most supercomputers are powered by Unix-like operating systems.

6.2 Why learn Unix command line?

- Is the foundation of scientific computing (e.g. bioinformatics and data analysis)
- Powerful for working on large datasets and files
- Helps automate repetitive tasks (e.g. imagine you need to need to rename or modify 1,000 files?)
- Enables use of higher-powered computers elsewhere (clusters and servers/cloud-computing)

6.3 Some terminology

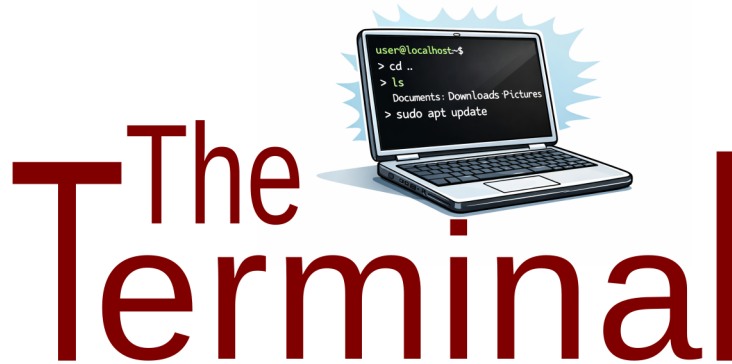


Figure 6.1: image1.png

As a user you can “communicate” with your Linux system either by a **Graphical User Interface (GUI)** or by typing instructions (commands) using a **Command Line Interface (CLI)**. At first it might look quite complex and confusing but once you understand the concept and the basics then its quite simple and intuitive!

Command Line: is the written instructions we type.

Terminal: also known as terminal emulator is the text-based environment (software) capable of taking input and providing output.

Shell: a program that interprets command-line input and executes commands. There are different shells available e.g bash, zsh, sh, csh etc. Each of them offering unique features and functionalities. Some are more basic and some are more fancy but all serve the same purpose, to interpret the commands provided by the user and output the results. The most commonly used is the **bash** shell.

6.4 Some important rules

1. **Be aware of the case!** The command line is case sensitive so be careful when typing. For example, typing **Echo** is not the same as **echo**, nor are the directory names “**/Results**” and “**/results**”.
2. **Spaces are having special use!** The command line uses spaces as separators between arguments. Using spaces in filenames or directory names will certainly cause problems sooner or later. Avoid using names that contain spaces, but rather it’s better to use

dashes (-) or underscores (_). e.g., “results_2026.txt” is preferred over “results 2026.txt”.

3. Apart from spaces there are several other characters (special characters) that can be used to perform special operations. See some examples below.

Character	Description
/	Directory separator, used to separate a string of directory names. Example: /usr/src/linux
\	Escape — (backslash) prevents the next character from being interpreted as a special character. This works outside of quoting, inside double quotes, and generally ignored in single quotes.
.	Current directory. Can also “hide” files when it is the first character in a filename.
..	Parent directory
~	The tilde is a representation of the current user’s home directory.
*	Represents 0 or more characters in a filename, or by itself, all files in a directory.
?	Represents a single character in a filename.
\$	Expansion — introduces various types of expansion: parameter expansion (e.g. \$var or \${var}), command substitution (e.g. \$(command)), or arithmetic expansion (e.g. \$((expression))). More on expansions later.
[]	Can be used to represent a range of values, e.g. [0-9], [A-Z], etc. Example: hello[0-2].txt represents the names hello0.txt, hello1.txt, and hello2.txt
	Pipe — send the output from one command to the input of another command. This is a method of chaining commands together. Example: echo “Hello beautiful.” grep -o beautiful.
>	Redirect output of a command into a new file. If the file already exists, over-write it. Example: ls > myfiles.txt
»	Redirect and appends the output of a command onto the end of an existing file.
<	Redirect a file as input to a program.

Character	Description
;	Command separator. Allows you to execute multiple commands on a single line. Example: cd /var/log ; ls -l
&&	Command separator as above, but only runs the second command if the first one finished without errors.
&	Background – when used at the end of a command, run the command in the background (do not wait for it to complete).
#	Comment — the # character begins a commentary that extends to the end of the line. Comments are notes of explanation and are not processed by the shell.

6.5 Accessing your Terminal

You are using a **Kubuntu** Linux system. In Kubuntu, the terminal emulator is called **Konsole**. You can start it in any of the following ways:

1. Press **Ctrl + Alt + T** to open **Konsole** instantly.
2. Open the **Krunner** by pressing **Alt + Space**, type **Konsole**, then press **Enter**.
3. Open the **Application Launcher** → **System** → **Konsole**.

Now you are ready to start typing your first commands!

7 Part 1. Your first Unix commands - Navigating the Unix File-System Structure

What will be cover:

1. The Unix file-system structure and how to navigate
2. Some general rules
3. Relative vs absolute path
4. Running some basic commands and general syntax

Unix systems, like most operating systems, store file locations in a hierarchical structure. In the UNIX file-system each file and directory has its own “address”, and that address is called a “**path**”.

There are two special locations in all Unix-based systems That you should be familiar. The “**root**” location is where the address system of the computer starts. The “**home**” location is where the current user’s location starts.

By default every time you open a new terminal you start in your own “**home**” directory(containing files and directories that only you can modify). The path of home directory is usually represented by the “~” character.

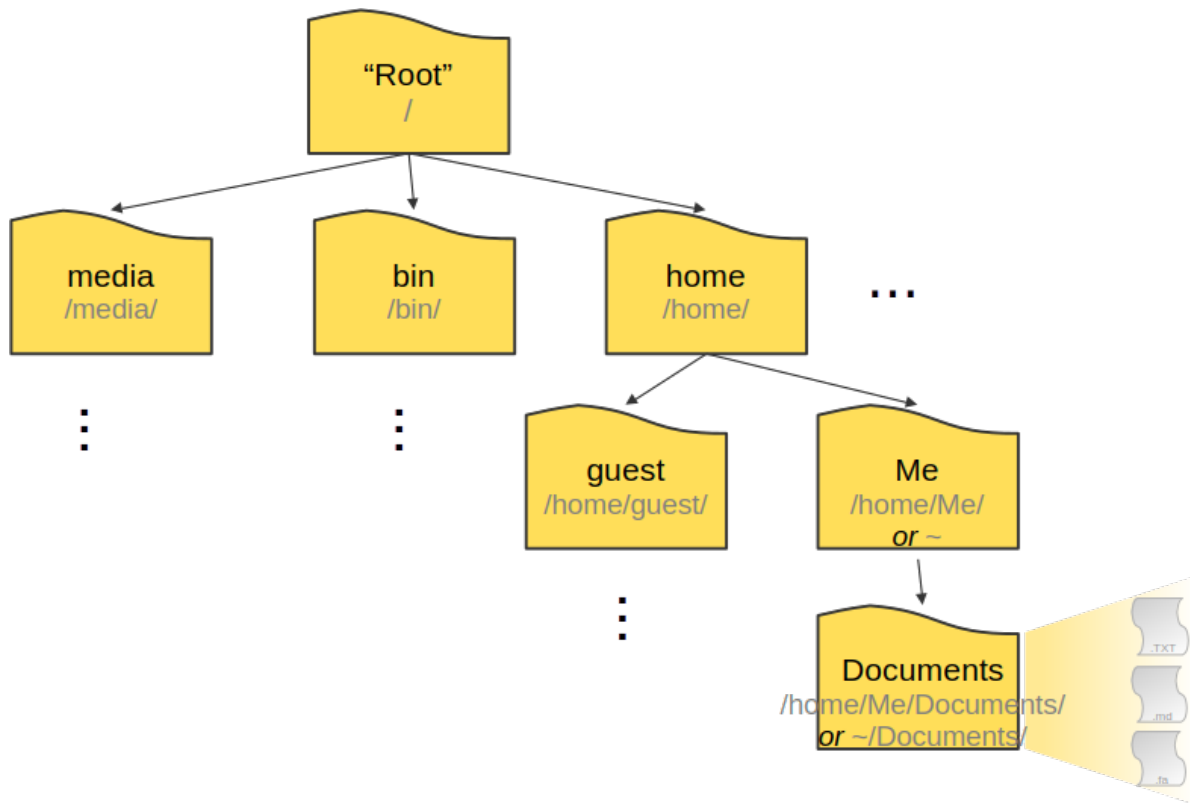


Figure 7.1: image2.png

Basic commands we will use

Command	Description
<code>pwd</code>	print working directory
<code>ls</code>	list items in directory
<code>cd</code>	change directory
<code>cd ..</code>	go one level up
<code>ls -l</code>	long format listing
<code>ls -lh</code>	human readable sizes

7.1 Finding out where you are

The `pwd` command in Linux is short for *print working directory*. It's only function is to print the absolute path of the current directory. It's handy when you're not exactly sure what directory you're in. So make it a good habit to get used to running the `pwd` command a lot.

```
# Example. Try running pwd. What do you see?
pwd
# What do you see if you run PWD instead?
PWD
# Try now to run this "echo $PWD". The command echo just prints the parameters we give it. Try
echo $PWD
```

7.2 The command `ls`

`ls` is short for *list*, and is used to list the files and sub-directories in your present working directory or some other directory if you specify one.

```
# Examples
# List the files and directories in your current directory
ls
# or
ls .
# ls can accept several options. Try running the following commands and observe how their output
ls -l
# or
ls -lh
# You can use ls to list the contents of any directory. Try the following.
ls -l /etc
```

Note

I. The anatomy of a command (or command syntax)

Each command is usually composed of three parts:

1. **The command** itself
2. **The options:** These are optional parameters that can be used to customise the behavior of a command. (e.g. on the previous examples `ls -l` shows the list of files in a long format)
3. **The arguments:** specify the target of the command. (e.g. on the previous example `ls -l /etc` you instructed the command to list the contents of the `/etc` directory)

II. Getting help

Most Unix commands can accept several parameters. How do we know which ones to use and why? Luckily, most Unix commands have built-in help documentation that we can access by providing `-help` as the only argument.

Try for example: `ls --help`

Another way to access the documentation for a command is by using the `man` command and providing the command's name as an argument. For example:

```
man ls
```

7.3 Relative vs absolute path and getting help

There are two ways to specify the path (the file's address on the computer):

- An **absolute path** starts from a fixed location, either the root directory (/) or the home directory (~). Note: A “full path” usually refers to an absolute path that starts from the root (/).
- A **relative path** starts from your current directory.

When working at the command line, it's important to always be aware of your current location in the system. One of the most common mistakes is trying to operate on a file that isn't where you think it is. To avoid this, it's good practice to use absolute paths, which clearly specify a file's exact location regardless of where you are.

7.4 Moving around

One of the most commonly used commands in Linux is the ***change directory*** command, or `cd`. It allows you to change your working directory from the current location to another directory you want to navigate to. The `cd` command takes a positional argument: the path (address) of the directory you want to move into. This path can be either **absolute** or **relative**. Let's try moving from our current directory to a directory present in your home directory called *Documents*.

```
# The relative way
cd Documents
# The absolute way (~ stands for /home/<user>/). Can you see the change in your command prompt?
cd ~/Documents
# But how do we go back "up" to the parent directory? We can use the ".." special characters
cd ..
# When you need to navigate back to the previous working directory from the current working directory
cd -
# Note: running the cd command without any arguments will always bring you back to your home directory
cd
```

7.5 Exercise

Practice moving around the filesystem with `cd` and listing directory contents with `ls`, including navigating by relative and absolute paths or using special characters “`..`” . Use `pwd` frequently to see your current working directory. Practice navigating home with `cd`.

8 Part 2. Working with Files and Directories

What we will cover:

1. Working with simple text files
2. Working with directories
3. Intro to a command-line text editor

8.1 Creating new directories and files

You can create a new directory using the **mkdir** command. It takes as a parameter a relative or absolute path to the directory to create

```
# Let's try some examples. From your home directory navigate to Documents/ and create 2 new directories
pwd
cd Documents
mkdir projects
cd projects
mkdir projects1
pwd
# Try to create a new directory with the same name e.g. projects1. What do you see?
```

Exercise

In the previous example we created the two directories in two separate steps. Can we do it in one step instead? (check the help page for **mkdir** command).

Now that we saw how to create a new directory let's see how we can create a new file. There are several ways to do this in Linux command line but we will start with the basic one. The command **touch** will create a new, empty file.

```
# Create an Empty File within the new directory project1.
touch notes.txt
# can you do it if you are outside the project1 directory?
```

8.2 Move or Rename a File or Directory

The **mv** command serves for both moving and renaming files and directories. Works by specifying a “source_path” and a “destination_path”, where “source_path” is the path (absolute or relative) of the file/directory to move or rename, and “destination_path” is the new name or location to give it.

Copying files and directories is similar operation, except that the original file or directory is not removed! We will use the **cp** command for this.

NOTE: copying, moving or renaming files at the command line will overwrite files if they have the same name!!

Let’s try them both.

```
# move the notes.txt file one directory up assuming your current directory is project1
mv notes.txt ../notes.txt
# rename the notes.txt to README.txt
mv ../notes.txt ../README.txt
# copy the README.txt file to project1 directory as README1.txt
cp ../README.txt ../README1.txt
```

Exercise

Try to make a copy of the complete project1 directory on the same parent location with the name project2. What do you see?

Note

Wildcards: friend and foe at the command prompt.

As we saw earlier some characters have special use in Unix command line. For example:

- the asterisk character “*” represents 0 or more characters in a filename, or by itself, all files in a directory.
- the square brackets [...] can be used define a range of values e.g. [0-9], [A-Z], etc.
- the question mark “?” can represent any single character.

These characters can be used as “Wildcards” to perform operations on multiple files at the same time. Lets see some examples.

```
# Create a directory with the name wildcard_practice and, inside it, create some empty files
mkdir wildcard_practice
cd wildcard_practice
touch file1.txt file2.txt file10.txt
touch image1.png image2.png imageA.png
touch data_2022.csv data_2023.csv data_2024.csv
# List all the .txt files
ls *.txt
# create a directory called data and move the .csv files into data/
mkdir data
mv *.csv data/
```

Exercise List only the .csv files with years 2022 or 2023

8.3 Delete (remove) files and directories

WARNING!!

Using the `rm` command permanently deletes files and directories without moving them to a trash or recycle bin. This action cannot be undone! Whenever you use the `rm` command, ALWAYS double-check your syntax.

```
# Lets remove some unwanted files and directories
rm ~/Documents/projects/README.txt
# the command rmdir can remove an empty directory, so it is safer!
mkdir test_dir
rmdir test_dir
# The dangerous way. Use rm recursively "-r" to remove a non-empty directory. BE CAUTIOUS! YOU CAN LOSE DATA!
rm -r ~/Documents/projects/project1
# check the help page for rm command. Is there a safer way to do this?
```

Exercise

1. Create a directory `data`.
2. Inside `data`, create three empty files: `sample1.txt`, `sample2.txt`, `sample3.txt`
3. Copy `sample1.txt` into a new directory called `backup`.
4. Rename `sample2.txt` to `s2.txt`.
5. Remove `sample3.txt`.

8.4 Viewing and inspecting Files

Sometimes we want to quickly look at files, either to inspect their structure or to get some basic information about their contents. These are some commands we can use to do so.

Command	Description
cat	print entire file
less	scroll through file
head	show first n lines
tail	show last n lines
wc	count (w ord c ount)

```
# Lets use the file "butterfly_ecology.csv" you previously used with R.
# You can either navigate to the folder you saved the file copy it to a new directory.
# You can use the "cat" command for viewing the contents of a file
cat butterfly_ecology.csv
# Another command for viewing the contents of a file is "less". This command allows to scroll
less butterfly_ecology.csv
# However, most of the time we only need to see part of a file rather than the entire file.
head butterfly_ecology.csv
tail butterfly_ecology.csv
# or you can specify the number of lines to print (by default will print 10)
head -n 2 butterfly_ecology.csv
tail -n 3 butterfly_ecology.csv
# The command wc (word count) is useful for counting how many lines, words, and characters there are
wc butterfly_ecology.csv
# Can you find an option for wc that will let us get only the number of lines of the file?
```

Note

The **cat** command can also be used to create new files or to concatenate existing files. Lets try:

```
cat > file1
Stefanos
# Exit by pressing Ctrl + D
cat > file2
some random text
# Exit by pressing Ctrl + D
cat file1 file2 > file3
```

8.5 A text editor for the terminal

A simple text editor available on most systems is nano. To run it, simply specify a file name to edit. If the file doesn't exist already, it will be created after saving.

```
nano NOTES.txt
```

9 Part 3. Redirection, Pipes, and Text Processing in Unix

9.1 Redirecting and piping

Redirection and piping are fundamental features of the UNIX command line that allow us to create powerful workflows for automating tasks. By default, when we run a command, its output is printed to the screen (the terminal). In many situations, however, we may want to save this output to a file or pass it directly to another command.

We have already seen how a command output can be redirected to a file. For example: `cat file1 file2 > combined_file`. In this command, the redirection operator `>` tells the shell to send the output of `cat` to a new file called `combined_file` instead of displaying it on the screen. Let look at another example.

```
# list the files in the /etc directory and save the output to a file called etc_content.txt.
ls /etc > etc_content.txt
less etc_content.txt
```

WARNING!!

It's important to remember that the `>` operator will overwrite a file if it already exists. If you want to append an output to an existing file, rather than overwrite it, you can use instead `>>`.

- Try it out yourself!

While redirection allows us to save a command's output to a file, UNIX also allows us to connect commands directly to one another. We can send the output of one command directly as input to another using the pipe (`|`) operator.

```
#list only the first 10 files of the /etc directory
ls /etc | head -n 10
```

Exercise

- Using the pipe operator, find a way to count all contents (files and directories) in the /etc directory.

9.2 cut, sort, and uniq

The `cut` command is used for extracting specific sections from lines of text in a file or piped data. It's a great tool for data manipulation. Let's try some examples:

```
# Selecting fields separated by a delimiter
echo "name,age,city,country" | cut -d ',' -f 3
# lets manipulate some real data
cat butterfly_ecology.csv | cut -d ',' -f 1,2 | head
# you can even change the delimiter in the output
cat butterfly_ecology.csv | cut -d ',' -f 1,2 --output-delimiter $'\t' | head
# or
cat butterfly_ecology.csv | cut -d ',' -f 1,2,5-7 --output-delimiter $'\t' | head
```

The `sort` command is used to arrange the lines of text files in a specified order, such as alphabetically or numerically. It can also handle options for sorting in reverse order or by specific columns. NOTE: `sort` command will not modify your file, it will only print the reordered content on the terminal! However, you can specify redirect the output to a separate file.

```
cat butterfly_ecology.csv | cut -d ',' -f 1-3 | sort
cat butterfly_ecology.csv | cut -d ',' -f 1-3 | sort -t ',' -k3 | less
```

The `uniq` command in Linux is used to filter out repeated lines from a text file or standard input, displaying only unique entries or counting repetitions. It works best when the input is sorted, as it only removes adjacent duplicate lines.

```
# families are represented in the butterfly_ecology.csv data?
cat butterfly_ecology.csv | cut -d ',' -f 2 | sort | uniq
```

Exercise

- Can you use `cut`, `sort` and `uniq` commands to count the number of species per family species per family?

9.3 grep and regular expressions

The **grep** (global regular expression) command in Linux is used to search for specific patterns or strings within files and display the matching lines. It is a powerful tool for text processing and can be customized with various options to refine search results. The basic usage is: **grep** “*searchword*” *filename*

```
# Let's say you wished to identify every line which contain the string "Papilionidae" from the
grep 'Papilionidae' butterfly_ecology.csv
# We can find the number of lines that matches the given string/pattern instead
grep -c 'Papilionidae' butterfly_ecology.csv
# Use -f option to read patterns from a file
cat > family.txt
Papilionidae
Hesperiidae
# exit by pressing Ctrl + D
grep -f family.txt butterfly_ecology.csv
# We can search for patterns in multiple files (e.g. all the files in the directory)
grep 'Papilionidae' *
```

grep command is particularly powerful when used in combination with Regular Expressions. A regular expression (regex) in Linux is a sequence of characters that defines a search pattern, similar to the wildcards, and are commonly used for searching and manipulating text.

Exercises

- In the `butterfly_ecology.csv` file find all “Aglais” species and save the fields species, family, range.size in a new file.
- The shell keeps a record of the commands you have previously run. You can display this list using the **history** command. Using this information, determine how many times you have used the **ls** command in your shell history. Hint: You may need to combine **history** with other command-line tools such as **grep**.

9.4 awk

awk is the Unix command to work with tabular data. The basic **awk** syntax is: **awk** [options] ‘pattern {action}’ input-file > output-file

```
awk -F ',' '{print $0}' butterfly_ecology.csv
```

```
awk -F ',' '$3 > 1000 && $3 != "NA" {print $0}' butterfly_ecology.csv
```

```
awk -F ',' '$3 > 1000 && $3 != "NA" {print $1, $3}' butterfly_ecology.csv
```

```
awk -F ',' '{if($3 > 1000 && $3 != "NA") {print $1 ":: "$3}}' butterfly_ecology.csv
```

A more complex example

Using only command line try calculate the average range.size for each family separately and store this information in a new file.

```
grep -v "^species" butterfly_ecology.csv | \
awk -F ',' '
$3 != "NA" {
    sum[$2] += $3
    count[$2]++
}
END {
    for (family in sum) {
        print family, sum[family] / count[family]
    }
}
' OFS=' ' > average_range_by_family.csv
```

Part III

Phylogenetics

Part IV

Microbiome

References