

# Documentation Sphenotron

## Introduction

Sphenotron is a program written in the Python programming language, which serves as an interacting interface with RFID (Radio Frequency IDentification) database. Originally developed to work with penguin databases, Sphenotron requires a MySQL server and a compatible database to function.

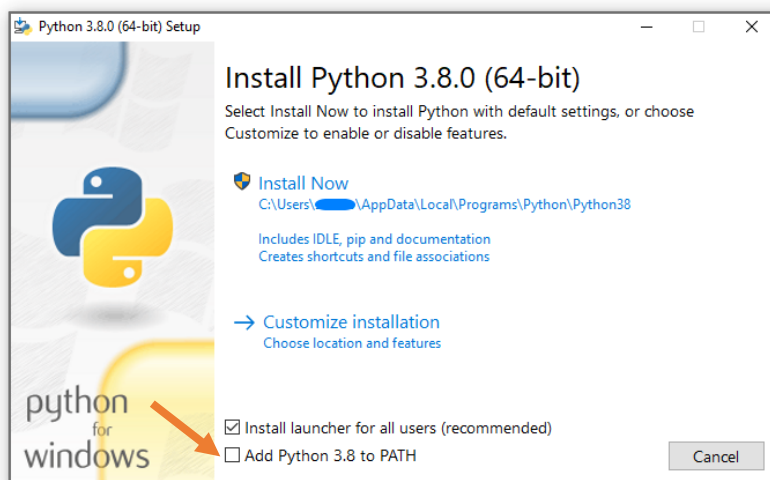
## Installation

Sphenotron doesn't require an installation process, but you do need a compatible version of Python and packages used by the program. Sphenotron has been tested with Python versions 3.7 to 3.9.

### 1) Python installation

#### Windows:

To install Python, download the Windows Installer X86 from the files section of the Python website (e.g. <https://www.python.org/downloads/release/python-3913/>). During installation, make sure to check 'Add Python X.X to PATH' to register Python location with your OS.



#### Mac or Linux:

For Mac users, Python is pre-installed on your machines. However, if you need to install a different version of Python, you can download and install it from the official Python website:

<https://www.python.org/downloads/mac-osx/>

For Linux users, you can install Python from your distribution's package manager. For example, on Ubuntu, you can use the following command in the terminal to install Python 3: **sudo apt-get install python3**

## 2) Installation of Sphenotron

- Clone the GitHub directory of Sphenotron and unzip the folder where you want to store Sphenotron.
- Open the command prompt in Sphenotron location (on Windows, right-click in the folder and select 'open command prompt').
- Execute the following command to install packages: **python -m pip install -r requirements.txt**
- Wait for the installation to complete. Once all the packages are installed, you can run Sphenotron by executing the following command in the terminal: **python sphenotron\_main.py**
- The software should open but an error information may appear as the connection with the database is not set up.

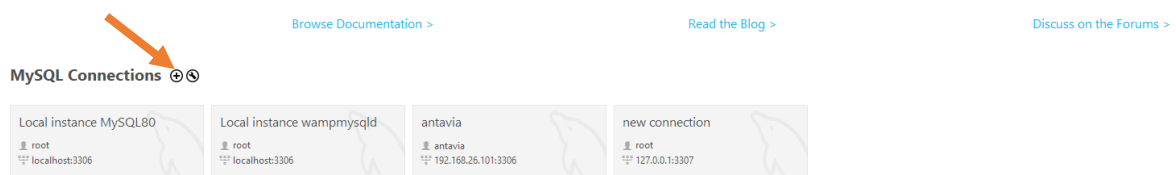
## 3) Installation of a MySQL server

If you do not already have a MySQL 8 server on your computer, download MYSQL 8 server from <https://dev.mysql.com/downloads/mysql/> and follow the installer's steps. Choose the latest version of the MySQL 8 server. Change the port if you already have a MySQL server installed on your computer (e.g., use 3307).

To simplify database importing and navigation, we recommend installing MySQL Workbench from <https://dev.mysql.com/downloads/workbench/>. After installing MySQL Workbench, add a connection by clicking the '+' button next to MySQL connections. Use the information you provided during the MySQL server installation (change the port if necessary).

# Welcome to MySQL Workbench

MySQL Workbench is the official graphical user interface (GUI) tool for MySQL. It allows you to design, create and browse your database schemas, work with database objects and insert data as well as design and run SQL queries to work with stored data. You can also migrate schemas and data from other database vendors to your MySQL database.



Setup New Connection

Connection Name: MySQL Server 8 Type a name for the connection

Connection Method: Standard (TCP/IP) Method to use to connect to the RDBMS

Parameters SSL Advanced

Hostname: 127.0.0.1 Port: 3306 Name or IP address of the server host - and TCP/IP port.

Username: root Name of the user to connect with.

Password: Store in Vault ... Clear The user's password. Will be requested later if it's not set.

Default Schema: The schema to use as default schema. Leave blank to select it later.

Configure Server Management... Test Connection Cancel OK

#### 4) Import of database

- Open MySQL Workbench and the MySQL server 8.
- Open the import tool (server > data import).
- Select 'Import from Self-Contained File' and select the .sql dump of the database that you want to import.
- Click on 'New' to create a new target schema and named it. For our penguin databases, the name must contain 'cro' or 'ddu' to be recognized as a database containing Crozet or Dumont d'Urville penguin data.
- Click on 'Start Import'.

Data Import

Import from Disk Import Progress

Import Options

☐ Import from Dump Project Folder C:\Users\gael\Documents\dumps

Select the Dump Project Folder to import. You can do a selective restore.

☒ Import from Self-Contained File C:\Users\gael\Documents\dumps\antavia\_cro.sql

Select the SQL/dump file to import. Please note that the whole file will be imported.

Default Schema to be Imported To

Default Target Schema: antavia\_cro\_example New...

The default schema to import the dump into.  
NOTE: this is only used if the dump file doesn't contain its schema, otherwise it is ignored.

Select Database Objects to Import (only available for Project Folders)

Imp... Schema

Imp... Schema Objects

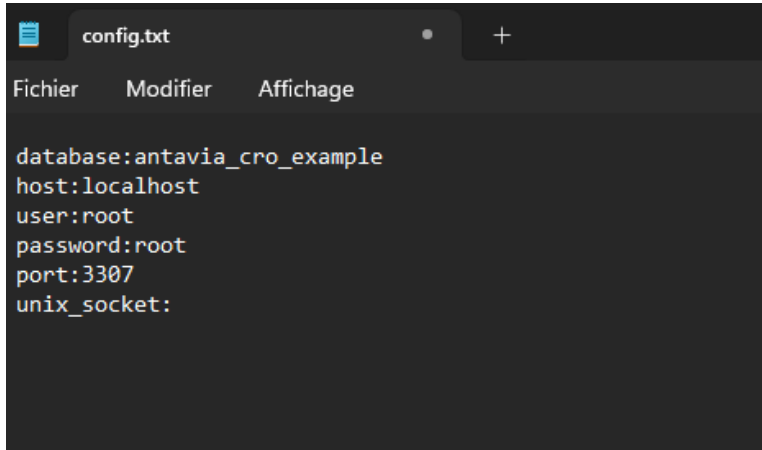
Dump Structure and Data Select Views Select Tables Unselect All

Press [Start Import] to start... Start Import

Note: If you decided not to use MySQL workbench, you must manually create the database with MySQL commands and import the SQL file using 'source' command.

## 5) Configuration of database connection

You must configure the database connection by setting up the `mysql_connection/config.txt` file in Sphenotron folder with your MySQL Server information and the name of the database you used as a new target schema. Save and quit the `config.txt` file.



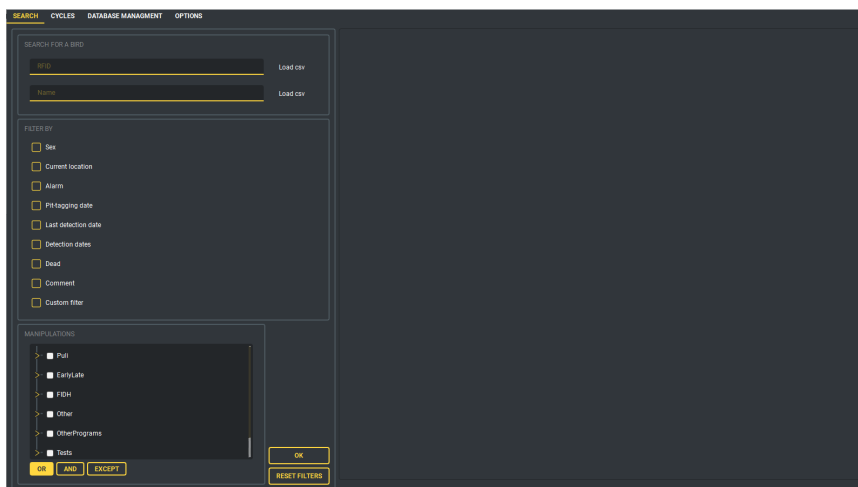
## 6) Run Sphenotron

To run Sphenotron, execute the command `python sphenotron_main.py` in your command prompt or run the `run.bat` file on Windows.

# General

Once installed, the software can be started from Sphenotron folder, and you can create a shortcut on your desktop to execute `run.bat`. MySQL server must be running for Sphenotron to work; you can turn it on by opening it in MySQL Workbench.

## 1) Search



When opening Sphenotron, you should be directed to the Search Window. This window is divided into two sections. It allows to execute queries on the database and displays a filtered list of individuals.

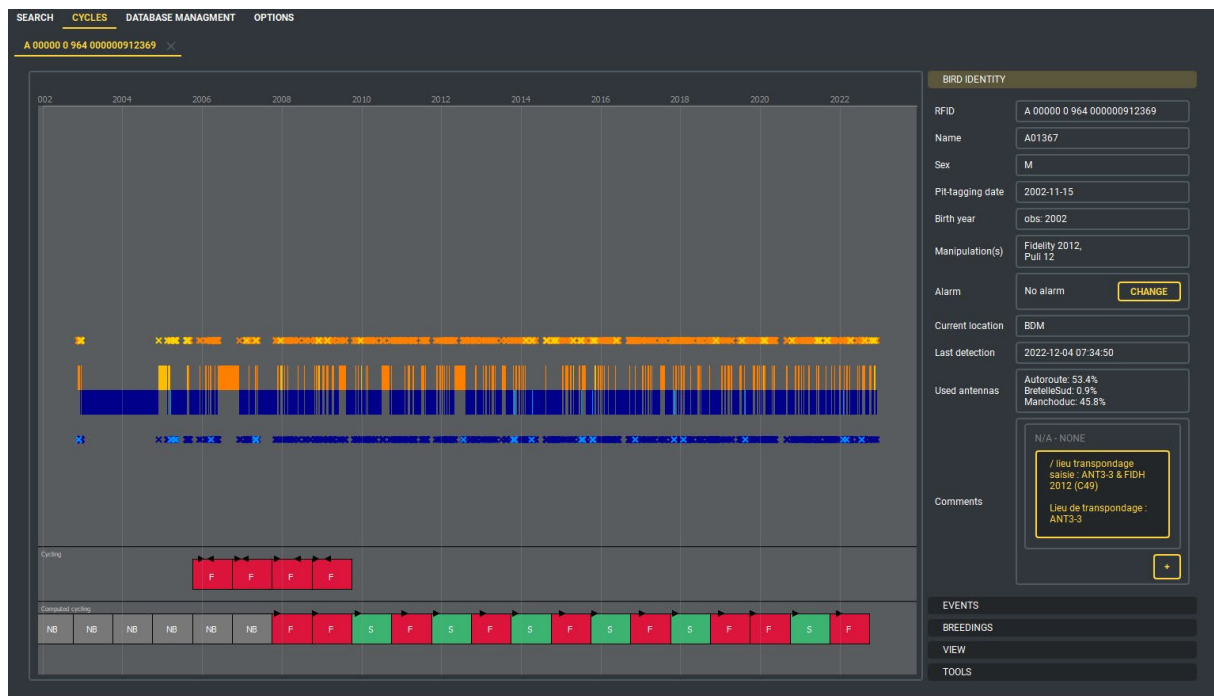
- In the left section, filters can be used to select a chosen list of individuals.
- RFID and name filters can contain several elements that must be separated by commas. The 'load CSV' button allows the user to import a list of RFID or names into the filters, taking the first column of the loaded CSV. The header of the loaded CSV should be either none, 'rfid' or 'name' for RFID and name, respectively.
- The 'Manipulation' section allows you to select birds from one or multiple chosen manipulation(s). Clicking on the right arrow (on the left of combobox) will display the different manipulations of each class.

To execute the query and display the list of individuals in the right section, you can click on 'OK' button or press Enter key. The filters can be reset by clicking on the 'Reset filters' button.

NAME	RFID	MANIPULATIONS	ALARM	RFID DATE	LAST DETECTION	SEX
A01361	A 00000 0 964 000000912363	Puli 12		2002-11-15	2002-12-18 09:36:50	M
A01362	A 00000 0 964 000000912364	Puli 12		2002-11-15	2006-04-25 14:06:01	M
A01363	A 00000 0 964 000000912365	Puli 12		2002-11-15	2021-04-19 07:26:02	M
A01366	A 00000 0 964 000000912368	Puli 12		2002-11-15	2005-04-20 08:13:10	M
A01367	A 00000 0 964 000000912369	Fidelity 2012, Puli 12		2002-11-15	2022-12-04 07:34:50	M
A01370	A 00000 0 964 000000912373	Puli 12		2002-11-15	2012-02-07 12:30:36	M
A01371	A 00000 0 964 000000912374	Puli 12		2002-11-15	2002-12-09 04:28:53	M
A01376	A 00000 0 964 000000912379	Fidelity 2012, Fidelity 2015, ...		2002-11-15	2022-12-17 14:04:01	M
A01378	A 00000 0 964 000000912381	Puli 12		2002-11-15	2010-06-29 08:20:08	M
A01381	A 00000 0 964 000000912384	Puli 12		2002-11-15	2004-03-05 12:49:22	M
A01382	A 00000 0 964 000000912385	Puli 12		2002-11-15	2005-04-15 06:14:12	M
A01383	A 00000 0 964 000000912386	Puli 12		2002-11-15	2010-06-02 17:46:18	M
A01384	A 00000 0 964 000000912387	Puli 12		2002-11-15	2005-11-08 07:01:13	M
A01385	A 00000 0 964 000000912388	Puli 12		2002-11-15	2009-11-07 04:22:59	M
A01386	A 00000 0 964 000000912389	Puli 12		2002-11-15	2016-04-29 05:31:31	M
A01388	A 00000 0 964 000000912391	Fidelity 2015, Puli 12		2002-11-16	2017-03-01 11:52:20	M
A01389	A 00000 0 964 000000912392	Puli 12		2002-11-16	2002-12-13 18:35:05	M
A01391	A 00000 0 964 000000912394	Puli 12		2002-11-16	2002-12-10 04:09:14	M
A01394	A 00000 0 964 000000912397	Puli 12		2002-11-16	2021-07-26 09:08:37	M
A01395	A 00000 0 964 000000912398	Puli 12		2002-11-16	2009-06-29 08:54:19	M
A01396	A 00000 0 964 000000912399	Fidelity 2012, Fidelity 2013, ...		2002-11-16	2022-12-08 06:02:24	M
A01398	A 00000 0 964 000000912501	Puli 12		2002-11-16	2002-12-22 16:48:21	M
A01399	A 00000 0 964 000000912502	Puli 12		2002-11-16	2002-12-15 09:17:30	M
A01400	A 00000 0 964 000000912503	Puli 12		2002-11-16	2002-12-08 06:25:48	M
A01402	A 00000 0 964 000000912505	Puli 12		2002-11-16	2012-04-30 06:49:46	M
A01404	A 00000 0 964 000000911970	Puli 12		2002-11-16	2005-04-27 06:18:47	M

- Columns can be sorted by clicking on headers.
- Individual data can be accessed by double-clicking on the rows, and multiple rows can be selected by dragging the mouse or using Ctrl+click. To select all individuals, use the Ctrl+A shortcut.
- The list of individuals can be opened in several tabs or in a single tab by clicking on the bottom right buttons (see 'Cycles' section).

## 2) Cycles

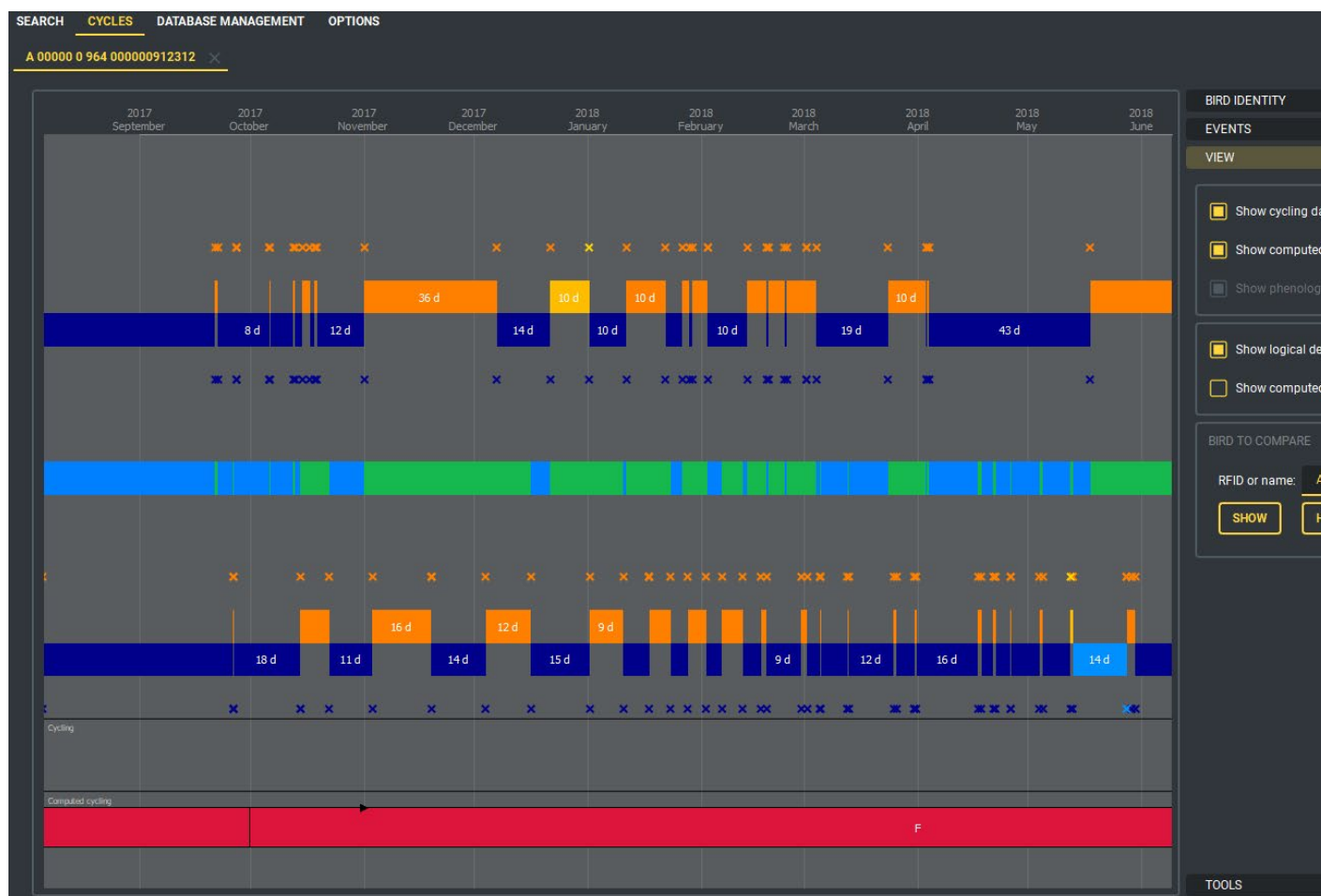


'Cycles' window showing presence/absence pattern (in and out) of an individual (here A01367). The right panel displays the individual's information. The central chart displays the lifetime locations of the individual: inside the colony in orange, and outside the colony in blue. Yellow and light blue correspond respectively to inside corrected location and outside corrected location (with the algorithm of missing detection correction). Each cross corresponds to one detection (with the same colour scheme). The bottom panel displays the breeding cycles analysed by human experts (top) and by RFIDeep function (bottom): Success in green, Failure in red, and Non-Breeding in grey. Black triangles correspond to the Breeding dates. In the right panel, alarm associated with the individual can be modified with the 'Change' button and new comments can be added with the '+' button.



In the right panel, 'View' tab displays the options for the 'Cycles' view. The different types of cycling data can be displayed or not, as well as the two types of corrected detections.

There is an option to compare the cycle of two individuals to identify if they are partners for a breeding season. Write the name or the RFID of the birds to compare. In the center of the graph, the colors indicate if at least one of the two individuals is at the colony (green) or if both are at sea (blue). Synchronous partners should have long continuous green periods, especially at the beginning of the breeding cycle when the stereotyped presence/absence patterns are constrained by the incubation and brooding duties and very synchronous between partners.



Tools tab allows to directly open the window to modify individual data (see next 'Database management' section).



### 3) Database management

‘Database management’ section can be used to modify individual data, add new individuals to the database, or import data in the database from CSV file.

SEARCH CYCLES DATABASE MANAGEMENT OPTIONS

MODIFY BIRD ADD BIRD IMPORT DATA

RFID: A 00000 0 964 000000911992 OK

IDENTITY

RFID: A 00000 0 964 000000911992

Name: A01219 MODIFY

Sex: M MODIFY

Birth year: 2002 MODIFY

Death: No data MODIFY

MANIPULATIONS

Fidelity 2012

Fidelity 2013

Pull 12

REMOVE SELECTED MANIPULATION

ADD MANIPULATION

COMMENTS

N/A - NONE

/ lieu transpondage saisie: ANT3-2 &  
FIDH 2012 (C47)  
FIDH 2013 (B07)

Lieu de transpondage: ANT3-2

MODIFY

DELETE

ADD NEW COMMENT

EVENTS

DATE	TYPE	BIRD STAGE	LOCATION	HANDLER	COMMENT
2002-11-11	pit-tagging	P-Mue	ANTAVIA	N/A	

MODIFY SELECTED EVENT

DELETE SELECTED EVENT

ADD NEW EVENT

MEASURES ASSOCIATED WITH SELECTED EVENT

MEASURE	VALUE	RAW VALUE	COMMENT
mass	9.9	None	
repletion	1.0	None	
lbeak_length	87.0	87;	
flipper_length_L	306.0	306;	

ADD NEW MEASURE

MODIFY SELECTED MEASURE

DELETE SELECTED MEASURE

#### a) Modify bird

The ‘Modify bird’ tab gives tools to modify individual data. This page is enabled when a valid RFID is entered. It can also be directly enabled when using the ‘Modify bird’s data’ button in the ‘Cycles’ tab.

All the modifications (except in ‘Manipulation’) are associated with a ‘handler’ name to track who (and when) the modifications were done. The RFID cannot be changed as it is the unique identifier of each individual. In the bottom section, the measure data in the right section correspond to those associated with the selected event in the left section.

SEARCH CYCLES DATABASE MANAGEMENT OPTIONS

MODIFY BIRD ADD BIRD IMPORT DATA

IDENTITY RECORD

RFID: CHECK

Name: CHECK

Sex: Unknown

Birth year: UNKNOWN 2023

Birth year type: None

RFID date: NONE 15/03/2023

RFID Stage: A-Brooding

Fish-tagging date: NONE 05/03/2023

Dead: No data

Manipulations

Ecophy ADD REMOVE SELECTED

RFID DATA

Handler\*: Adrien Gannier

Location\*: AD

Pit tag packing

Pit tag desinfectant

Mass: No

Beak: Upper length: mm Lower length: mm Height: mm Width: mm

Flipper length: Right: mm Left: mm

Hemi-tarsus length: Right: mm Left: mm

Repletion: 0-4

Circumference: mm

Sampling

blood\_g7 ADD REMOVE SELECTED

RESET SAVE

## b) Add bird

The 'Add bird' tab allows to add individuals to the database, one by one, by entering their known information. The 'RFID' and 'Name' fields must be filled in and validated with the CHECK button. If these fields are not validated, the individual cannot be added to the database. This validation allows to check if the RFID or the name is not a duplicate, if the RFID is of the right format (according to the templates stored in the text file: "accepted\_values.txt").

When all known data are filled in, click on 'Save' button to import the individual and the data in the database. Many checks are carried out before the data are integrated into the database. If something is not valid, information message pops up and the integration is canceled.

## c) Import data

SEARCHCYCLESDATABASE MANAGEMENTOPTIONS

MODIFY BIRDAADD BIRDDIMPORT DATA

HIDE HELP

To import data from CSV files, please read this documentation.

1) Choose a type of import

- New pit-tagged birds allows importation of new birds with new RFID numbers and the data associated with the pit-tagging (Puli manipulation or Pit-tagging-E/L manipulation for Crozet, Cohorte manipulation for DDU)
- Fish-tagged birds allows importation of fish-tagged birds that are already in the database (pit-tagged birds) or new birds never pit-tagged (with RFID nomenclature A 99999 9% see below)
- Data of already pit-tagged birds for birds that are in the database

2) Choose the column headers above the table according to the first row of the table.

3) Check that the table corresponds to the csv file and check if each cell is well formatted

4) Click on CHECK TABLE button to run the automatic checking

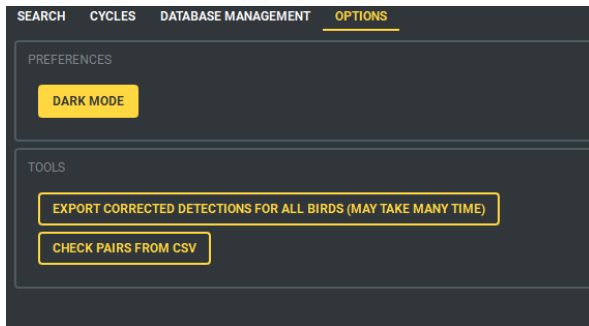
IMPORT TYPE:NEW PIT-TAGGED BIRDSOPEN CSV

name	rfid	rfid_date	manipulation	rfid_stage	location	mass	repletion	flipper_length_J	flipper_length_J	handler	comment
name	rfid	rfid_date	manipulation	rfid_stage	location	mass	repletion	flipper_length_J	flipper_length_J	handler	comment
TEST_import_1	A 00000 0 964 11111111111110	2020-11-19	Puli 30	P-DMU	ANT2	12.106	3	nan	300.0	Arnaud Farre	nan
TEST_import_2	A 00000 0 964 11111111111111	2020-11-19	Puli 30	P-DMU	ANT3	12.59	3	317.0	321.0	Pierre Carette	nan
TEST_import_3	A 00000 0 964 11111111111112	2020-11-19	Puli 30	P-DMU	ANT3	12.106	1	315.7	315.3	Arnaud Farre	blablabla
TEST_import_4	A 00000 0 964 11111111111113	2020-11-19	Puli 30	P-DMU	ANT1	13.2	1	312.3	312.0	Arnaud Farre	nan
TEST_import_5	A 00000 0 964 11111111111114	2020-11-19	Puli 30	P-DMU	ANT3	12.968	3	317.0	317.7	Pierre Carette	nan
TEST_import_6	A 00000 0 964 11111111111115	2020-11-19	Puli 30	P-DMU	ANT2	12.76	3	320.0	318.7	Arnaud Farre	nan

CHECK TABLESAVE

The 'Import data' tab allows to import data from a CSV. Help is available directly in the window. Three types of imports are available and allow the integration of most of the data collected in the field. When a CSV file is imported, it is displayed, and you have to choose what each column corresponds to from the drop-down list. If the name of the column already corresponds to a field in the list, it is selected automatically. Once all the columns have been associated with a field in the drop-down list, click on 'Check table' to import the data. This validation function checks that the columns are all associated with an existing field and that they are unique. Then, for each type of column, validations are performed for each cell. For measurements, warnings are given when the value is in the lowest or highest 5% of those existing in the database to avoid importing outliers or data in the wrong unit.

## 4) Options



The 'Options' tab offers additional features like it is possible to change the theme of Sphenotron by enabling or disabling the Dark Mode, or tools like the export of corrected detections allows to calculate the missing detections of all the individuals in the database and to export the result in CSV format (an interesting option to include the corrections of the detection data in other analyses). The option to check pairs of individuals is used to check a list of pairs of individuals from a CSV file (put your mouse on the button to display a help): this check option opens the 'Cycles' tab with comparison tool and allows the pair list to be loaded automatically, plus it automatically zooms to the given year.