93RD ADVISORY FORUM
VIRTUAL, 02-03 OCTOBER 2024

PATHOGENS IN FOODS DATABASE PROJECT

Winy Messens (EFSA)
Ursula Gonzales-Barron (Instituto Politécnico de Bragança)
Pauline Kooh (Anses)

EUROPEAN FOOD SAFETY AUTHORITY

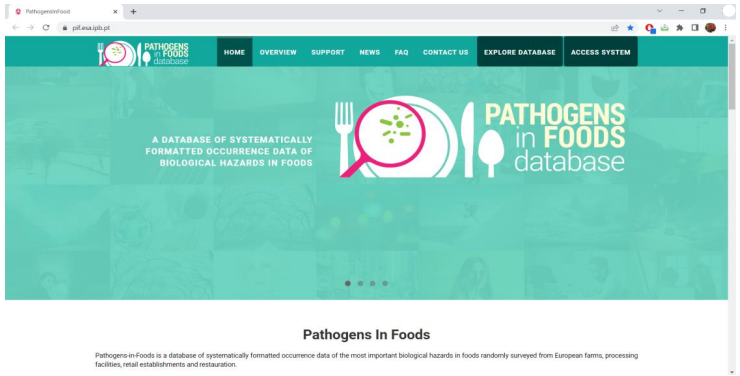
PATHOGENS IN FOODS (PIF) DATABASE

- prevalence and enumeration data of biological hazards in foods, extracted from peer-reviewed articles and reports published since 2000; currently > 7000 entries

Food categories
Meat and meat products
Eggs and egg products
Milk and milk products (dairy)
Grains and grain-based products
Aquatic based food
Fruit and primary derivatives thereof
Garden vegetables and primary derivatives thereof
Legumes, nuts and oilseeds
Beverages
Composite dishes
Sugar and similar
Confectionery including chocolate
Herbs, spices and similar
Animal and vegetable fats and oils and primary derivatives thereof

Pathogens

Salmonella spp.	bacteria
Campylobacter spp.	bacteria
Shigatoxin producing *Escherichia coli*	bacteria
Listeria monocytogenes	bacteria
Yersinia enterocolitica	bacteria
Bacillus cereus	bacteria
Clostridium perfringens	bacteria
Staphylococcus aureus	bacteria
Norovirus	viruses
Hepatitis A virus	viruses
Hepatitis E virus	viruses
Cryptosporidium spp.	parasites
Toxoplasma gondii	parasites
Giardia duodenalis	parasites



Accessible through https://pif.esa.ipb.pt/

- reliable and ready-to-be-used data for microbial risk assessments by EFSA and the Member States improving the efficiency, speed, and quality of those assessment
- valuable data source for the research community
- web application (R-Shiny): data search, descriptive statistical analysis, meta-analysis

PATHOGENS IN FOODS PARTNERS

2018-2022

Development of the PIF database

2021

Support at the 80th AF meeting

2022-2026

EFSA supports the initiative

GP/EFSA/BIOHAW/2022/01
GP/EFSA/BIOHAW/2023/05

ipb INSTITUTO POLITÉCNICO DE BRAGANÇA

anses

efsa EUROPEAN FOOD SAFETY AUTHORITY

CURRENT GRANT AGREEMENTS AND OUTPUTS

to communicate about and maintain the PIF database and make improvements

- protocol: guidelines
- screening process: DistillerSR and AI
- terminology: EFSA's catalogue

GP/EFSA/BIOHAW/2022/01

GP/EFSA/BIOHAW/2023/05

to populate the PIF database with data on

- ✓ *Vibrio* spp. in seafood
- ✓ parasites in fishery products

Three protocols

Database updates

- ✓ info on the data contained in PIF
- ✓ case study

Training material

Dissemination

EXAMPLES OF USE OF THE DATABASE

Vibrio bacteria in seafood: increased risk due to climate change and antimicrobial resistance

Published: 23 July 2024 | 4 minutes read

Share:

The *prevalence* of *Vibrio* in seafood is expected to increase both globally and in Europe because of climate change, especially in low-salinity or brackish waters, according to EFSA's latest assessment. Additionally, resistance to last-resort antibiotics is increasingly found in some *Vibrio species* .

Public health aspects of *Vibrio* spp. related to the consumption of seafood in the EU

https://www.efsa.europa.eu/en/efsajournal/pub/8896

Many farmed fish parasite-free but more data needed

Published: 18 April 2024 | 2 minutes read

Share:

Many of the most commonly farmed and consumed fish in the EU/EFTA show no evidence of parasites that can infect humans. However, parasites were found in some farmed *species* and more data is needed to determine how prevalent certain parasites are in farmed fish.

Re-evaluation of certain aspects of the EFSA Scientific Opinion of April 2010 on risk assessment of parasites in fishery products, based on new scientific data. Part 1: ToRs1–3

https://www.efsa.europa.eu/en/efsajournal/pub/8719

anses

Avis de l'Anses
Saisine n° 2019-SA-0033

Le directeur général

Maisons-Alfort, le 19 janvier 2022

AVIS
de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

relatif aux modalités de maîtrise du risque lié à la présence de dangers microbiologiques dans les fromages et autres produits laitiers fabriqués à partir de lait cru

Anses opinion related to the control of microbial hazards in raw milk cheese Part 1: Risk ranking of biological hazards in raw milk cheeses produced in France

https://www.anses.fr/fr/system/files/BIORISK2019SA0033.pdf

Food and Agriculture Organization of the United Nations

World Health Organization

Summary report of the Joint FAO/WHO Expert Meeting on microbiological risk assessment of Listeria monocytogenes in foods

Food and Agriculture Organization of the United Nations

World Health Organization

Joint FAO/WHO Expert meeting on microbiological risk assessment of *Listeria monocytogenes* in foods
FAO HQ, Rome, Italy: 24 - 28 October 2022

SUMMARY AND CONCLUSIONS

Issued in November 2022

JEMRA MRA 47 Risk assessment of Listeria monocytogenes in foods: Part 1 Formal models

Report to be published

WHAT IS NEXT IN THE PROJECT?

1. **Enlarge the user base:** Information on PIF is being shared with important user groups encouraging them to use it (e.g., the BIOHAZ Panel experts and the MS representatives of the Scientific Network for Microbial Risk Assessment)

2. **Decide on the future course:** The project will run a feasibility study in 2025 to support the further exploitation of the PIF database. The study will:
   - Take note of user groups and use cases
   - Explore possible enhancements in terms of content (e.g., more pathogens or matrices, inclusion of AMR) or usability (e.g. interface to help the various use cases)
   - Identify resources (funds and knowledge) to support PIF's sustainability

SUPPORT FROM THE ADVISORY FORUM

To promote the use of the database in the MS

To advise EFSA on new potential user groups to approach

To stimulate MS interest in the forthcoming feasibility study of the project

To indicate possible resources (funds & knowledge) that could support PIF's long-term sustainability

ACKNOWLEDGEMENTS AND CONTACTS

The Polytechnic Institute of Bragança

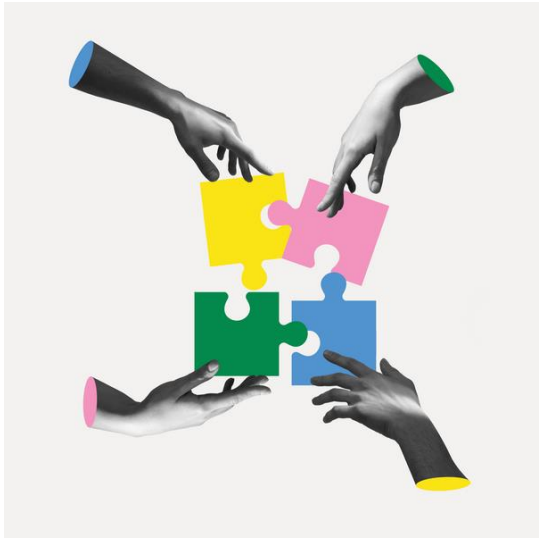
- Vasco Cadavez
- Ana Sofia Faria

Anses

- Anne Thébault
- Laurent Guillier

EFSA

- Fulvio Barizzone
- Frank Boelaert
- Gorgias Garofalakis
- Irene Pilar Munoz Guajardo
- Beatriz Guerra/Michaela Hempen



Winy Messens: Winy.MESSENS@efsa.europa.eu

Ursula Gonzales-Barron: ubarron@ipb.pt

Pauline Kooh: Pauline.KOOH@anses.fr

ANNEX

#OpenEFSA

Pathogens-in-Foods Database

Ursula Gonzales-Barron and Pauline Kooh

Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

French Agency for Food, Environmental and Occupational Health & Safety (ANSES), 14 rue Pierre et Marie Curie, 94701 Maisons-Alfort, Paris, France

Content

1. Overview of the Pathogens in Foods (PIF) database
2. Approach for feeding data
3. Extracted information
4. Type of users and registration steps
5. Example of data search and extraction
6. Extent of information currently contained in PIF
7. The NewPIF project
8. Documentation
9. Final considerations

1. Overview

- Studies addressing the occurrence of pathogens in foods surveyed in the farm-to-fork chain
  - vital in the development of pathogens' risk assessment models
  - risk management tools
  - risk ranking

- Yet, the existing data is mostly dispersed, disharmonised or not easily accessible

How to solve this issue?

PIF - Pathogens In Foods

- PIF is a database of systematically formatted occurrence data of the most important biological hazards in foods randomly surveyed from European farms, processing facilities, retail establishments and restauration
- PIF brings together prevalence and enumeration data of pathogenic bacteria, parasites and viruses in foods

Accessible through the website
https://pif.esa.ipb.pt/

PIF - Pathogens In Foods

- Data are extracted from peer-reviewed articles retrieved through systematic literature searches using a publicly available protocol describing the search and screening process

Systematic Review Protocol for the "Pathogens in Foods"

Database: Prevalence and Concentration of Main

Biological Hazards in Food Matrices

Accessible through the website https://doi.org/10.5281/zenodo.7850017

Conceptualisation

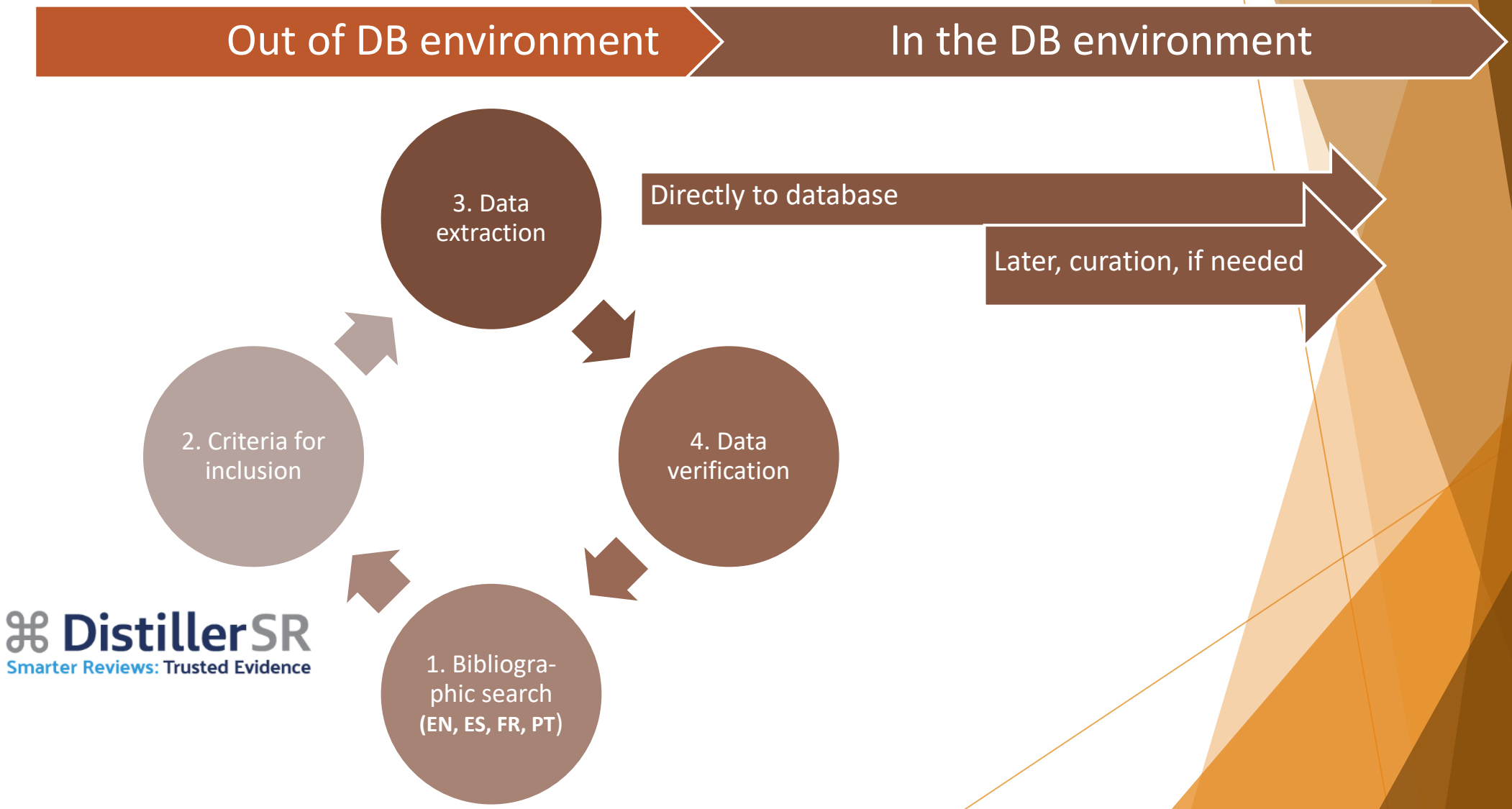
Database

- Registration of new primary studies
- Insertion of new data
- Curation of inserted data
- Search of data and retrieval

Interactive Dashboards

- Dynamic graphs for data description and simple statistics
- Summary statistics and meta-analysis

2. Approach for feeding data



2. Approach for feeding data: systematic review (SR)

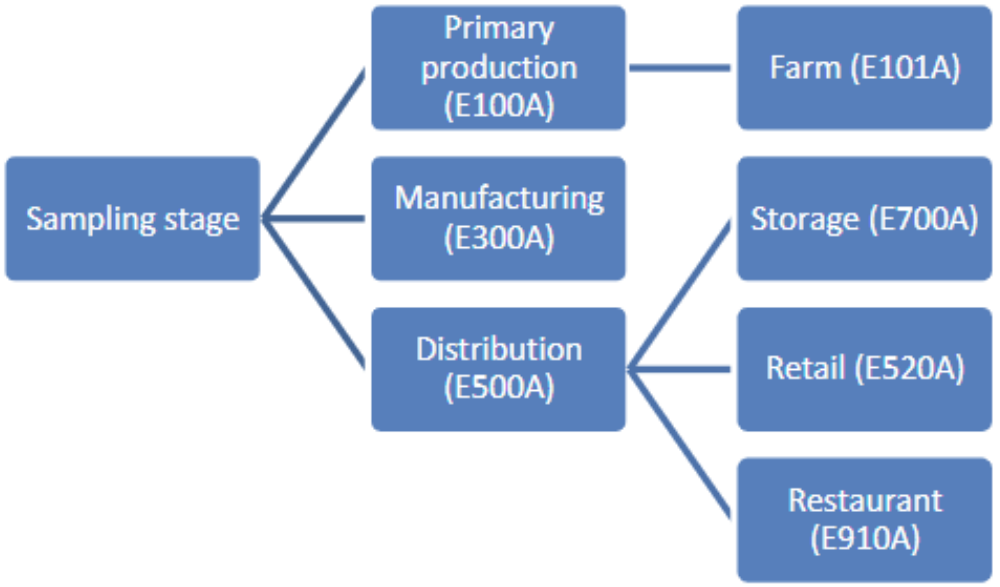
2.1. Review Question

- **“What is the occurrence (i.e., prevalence and/or concentration) of the most important biological hazards in the various foods and food products produced and/or commercialised in Europe?“**

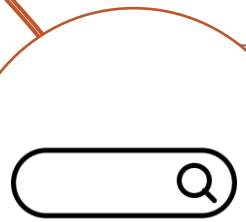
- Descriptive question with a simple PO (*population* and *outcome*) structure with the following key elements

2.1. Review Question

Population – Foods	Outcome – Biological Hazards
Food products in general produced and/or placed on the market in Europe: • Beverages • Meat and meat products • Eggs and egg products • Milk and dairy products • Seafood and fishery products • Fruits • Vegetables • Legumes • Grains and cereal products • Fats and oils • Sugars • Composite foods • Confectionery	Occurrence of at least one of the following biological hazards, expressed as either prevalence or concentration measured in the population: • *Bacillus cereus* • *Campylobacter* spp. • *Clostridium perfringens* • *Listeria monocytogenes* • *Salmonella* spp. • Shiga toxin-producing *Escherichia c* • *Staphylococcus aureus* • *Yersinia enterocolitica* • *Cryptosporidium* spp. • *Giardia* spp. • *Toxoplasma gondii* • Hepatitis A virus, • Hepatitis E virus • Norovirus



2.2. Searching for individual studies

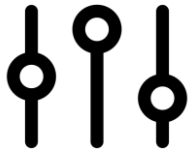


SEARCH STRATEGY

- General terms AND Biological hazards AND foods
- NOT restriction terms

INFORMATION SOURCES

- PubMed
- Web of Science Core Collection
- Scopus
- SciELO



FILTERS APPLIED

- Type of publication: only primary research articles and reviews
- Database insertion date
- Country: European countries + unknown
- Languages: English, Spanish, French, Portuguese

2.3. Criteria for inclusion of individual studies

STUDY DESIGN

- Occurrence data must originate from observational survey studies (cross-sectional or longitudinal) where food units have been sampled by a randomised design, either simple or stratified

POPULATION

- Foods, as finished product or during production/processing, sampled from farms, processing facilities, retail or restauration, must be produced and/or placed on the market in Europe
- The food chain stage where samples were extracted must be specified

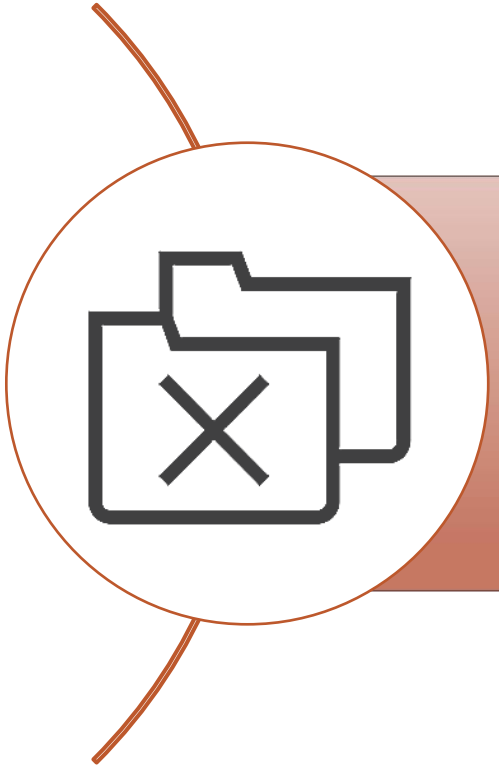
OUTCOME

- Occurrence data must be given for any of the 14 pre-defined foodborne pathogens
- For prevalence: at least provide sample size and number of positive samples
- For enumeration: at least sample size and a measurement of concentration

STUDY CHARACTERISTICS

- The study must describe the microbiological method used (or alternatively provide a reference); and the sample size must be higher than 3 units

2.4. Deduplication of individual studies



The volume of bibliographic citations are documented and managed in a project built on Distiller[SR] software, which are set to identify duplicate references. Duplicates are carefully checked and deleted.

DistillerSR
Smarter Reviews: Trusted Evidence

2.5. Selecting the individual studies

1. Title/abstract screening

Titles and abstracts assessed

2. Examining full-text reports

Resolution of conflicts with senior reviewer

3. Identification of possible duplicate publications

To avoid double counting, records are linked

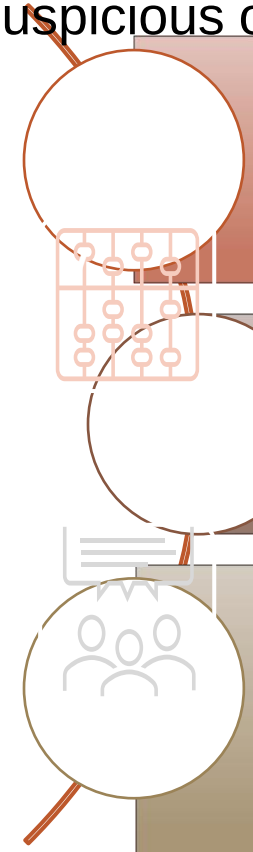
4. Scanning of references

References at the end of reviews are scanned to identify studies that may not have been retrieved in the searches

Flow of number of citations to be recorded in PRISMA chart

2.6. Assessment of methodological quality

Each eligible primary study will undergo a quality assessment. The results of a study will be signalled as *having potential for bias* if there is any suspicious of:



SELECTION BIAS

- In situations where there is a suspicion that proper randomisation of the food units was not achieved
- Ex: microbiological analysis of food sampled at retail but close to the end of shelf life

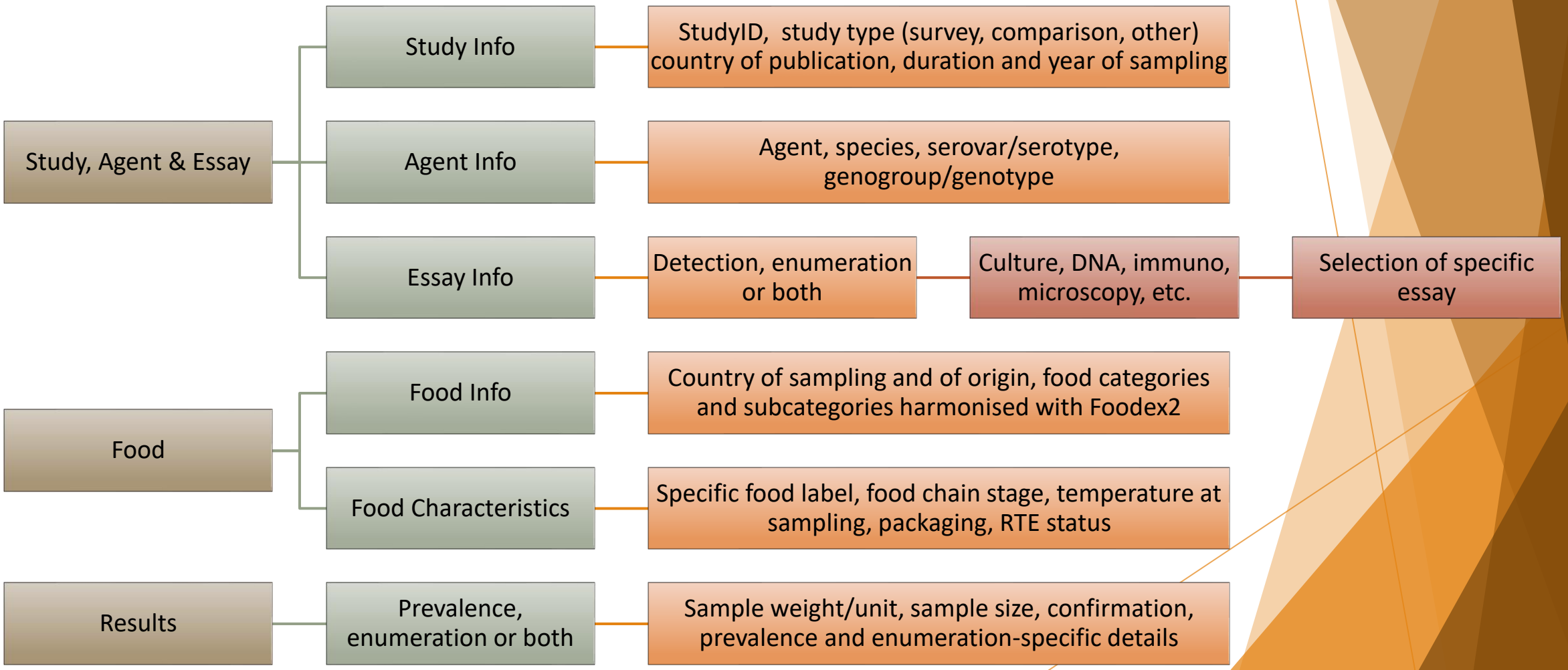
AGGREGATION BIAS OR REPORTING BIAS

- Prevalence or enumeration results are combined for distinct food classes within the same food category
- Ex: prevalence results combined for raw sausage and fermented sausage

DETECTION BIAS

- c1. Detection and/or quantification of the biological hazard is not undertaken using an approved or known microbiological method
- c2. Amount (weight, volume, surface or whole unit) of the analytical sample is not explicitly indicated in the study

3. Extracted Information

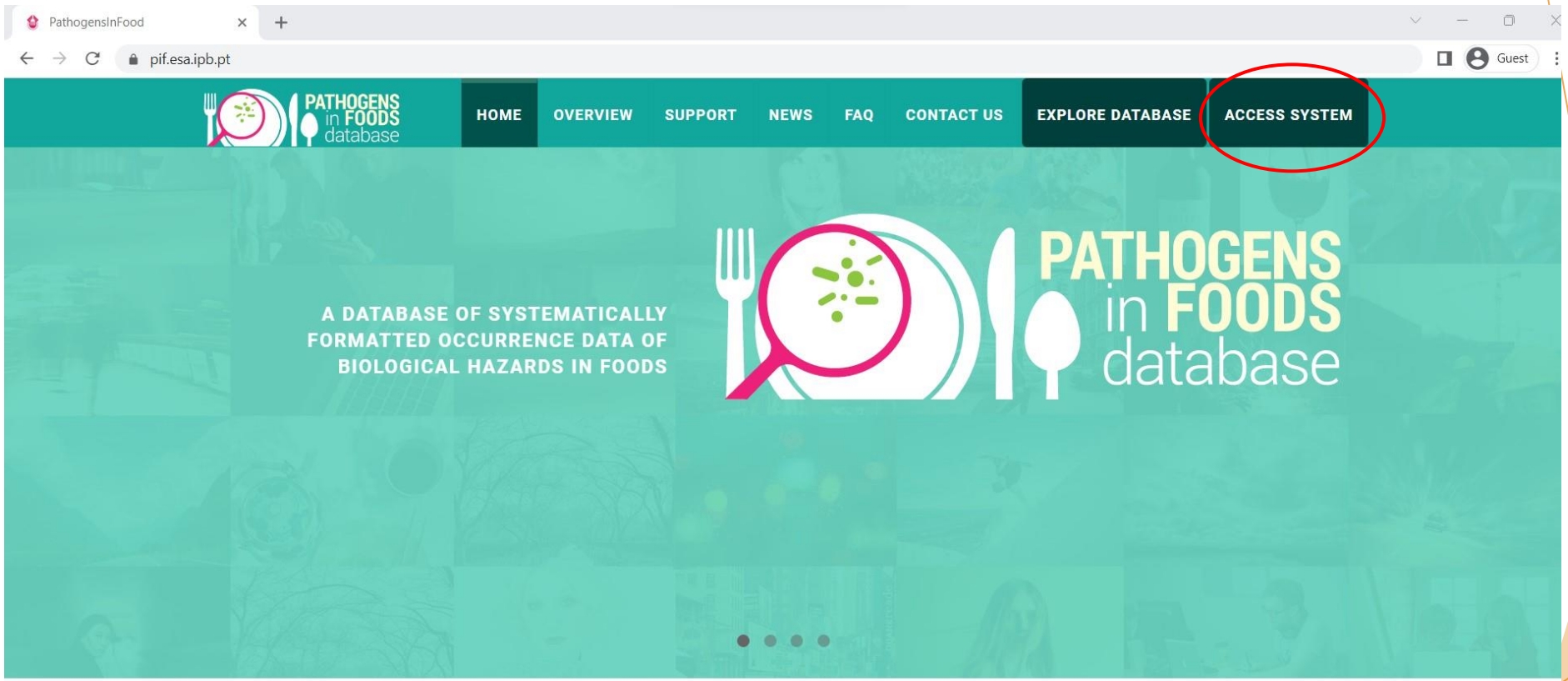


4. Type of users

Basic User	• Can make searches and visualise data • Cannot download data in csv nor sources in bib
Advanced user	• Can make searches and visualise data • Can download data in csv and their sources in bib
Curator	• Can register new primary studies • Can insert and curate data
Admin	• PLUS Can delete sources

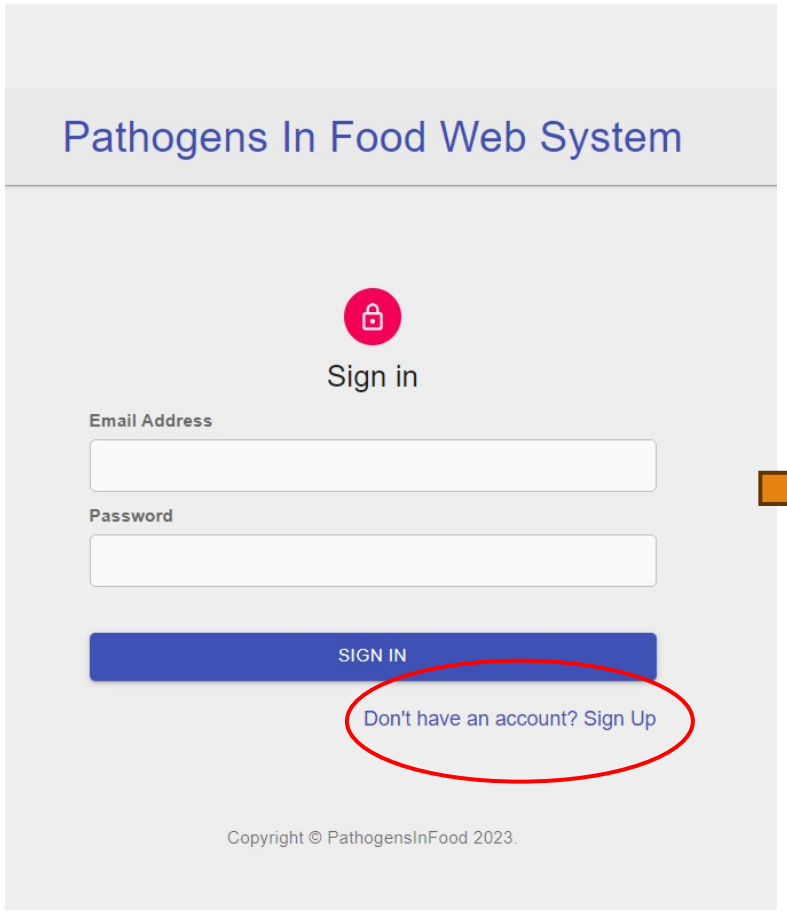
4.1. Basic user

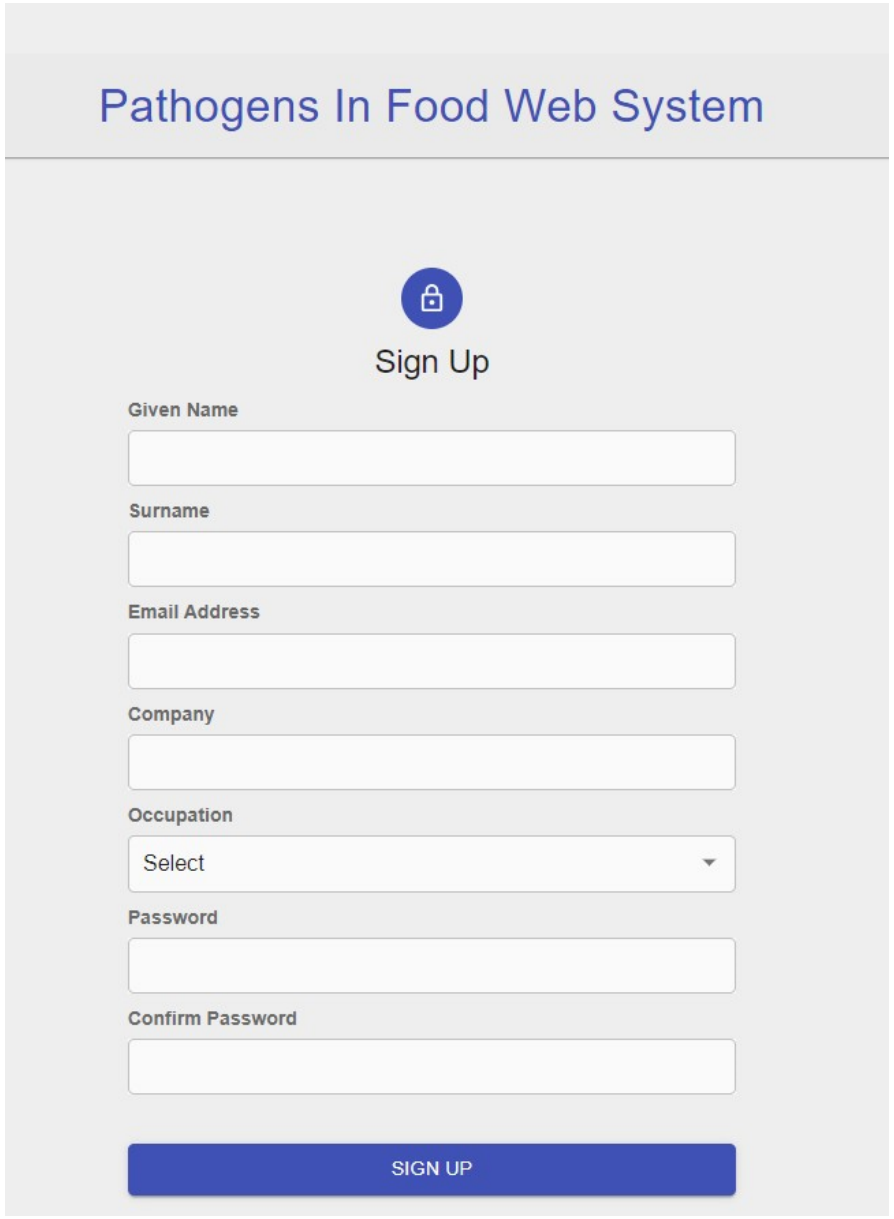
How to register



Pathogens In Foods

Pathogens-in-Foods is a database of systematically formatted occurrence data of the most important biological hazards in foods randomly surveyed from European farms, processing facilities, retail establishments and restauration.





By completing all the requested information and signing up, the account will be created.

4.2. Advanced User

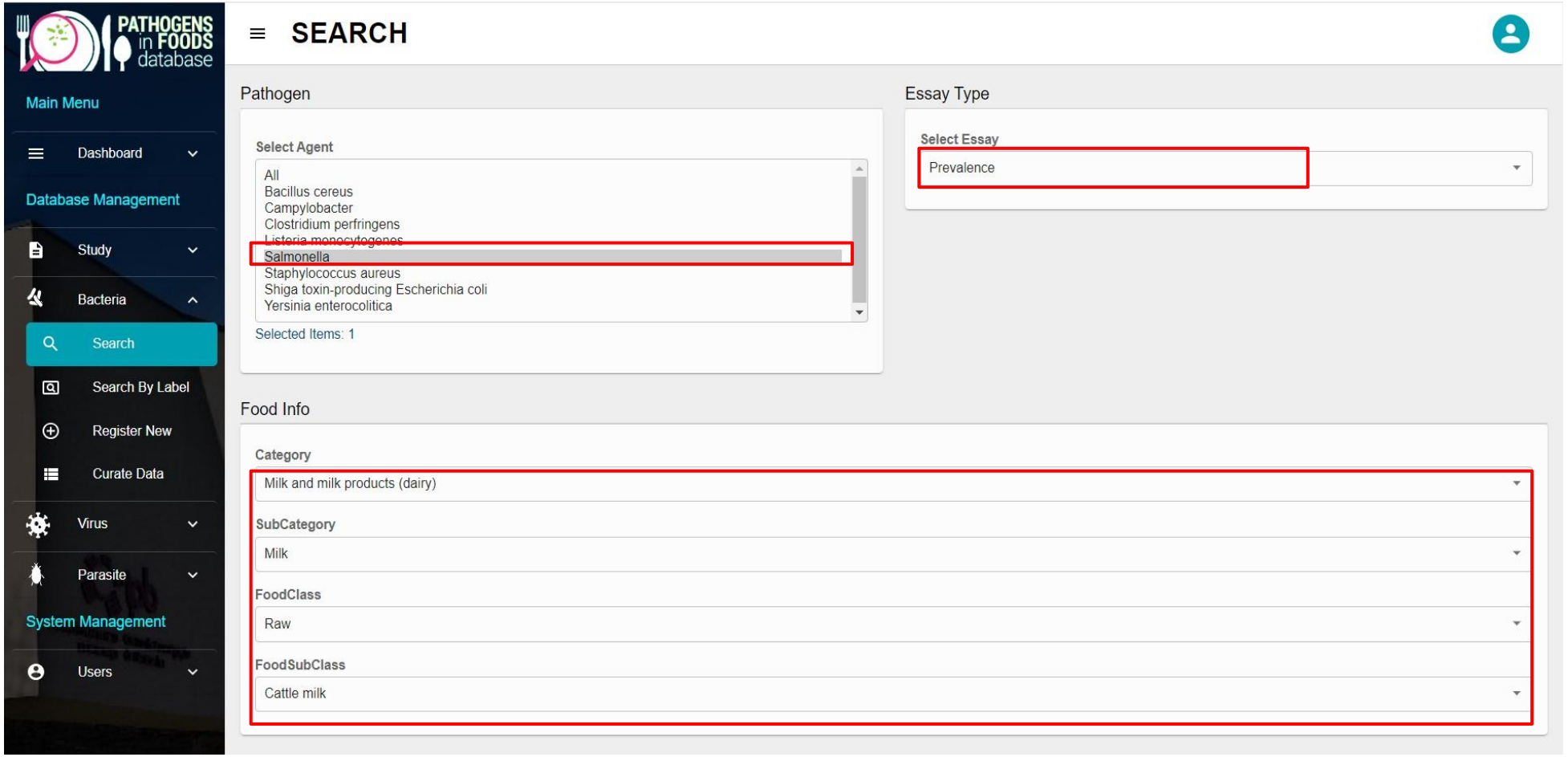
- **A Basic user can upgrade their account by filling a form**

Contact form to request an advanced access to Pathogens-in-foods database

Full name	
Address	
Email	
Organization	
Organization type	*(Research Institute, National Agency, National Competent Authority, European / international organization, Industry, Other)*
Position	
Purpose of the use of pathogens in food data	*Describe briefly the outline of the research* *Provide details of planned publications*
Dates of the research	*Provide dates*
Description of the requested data	*Provide details of PIF variables that are relevant for your research*

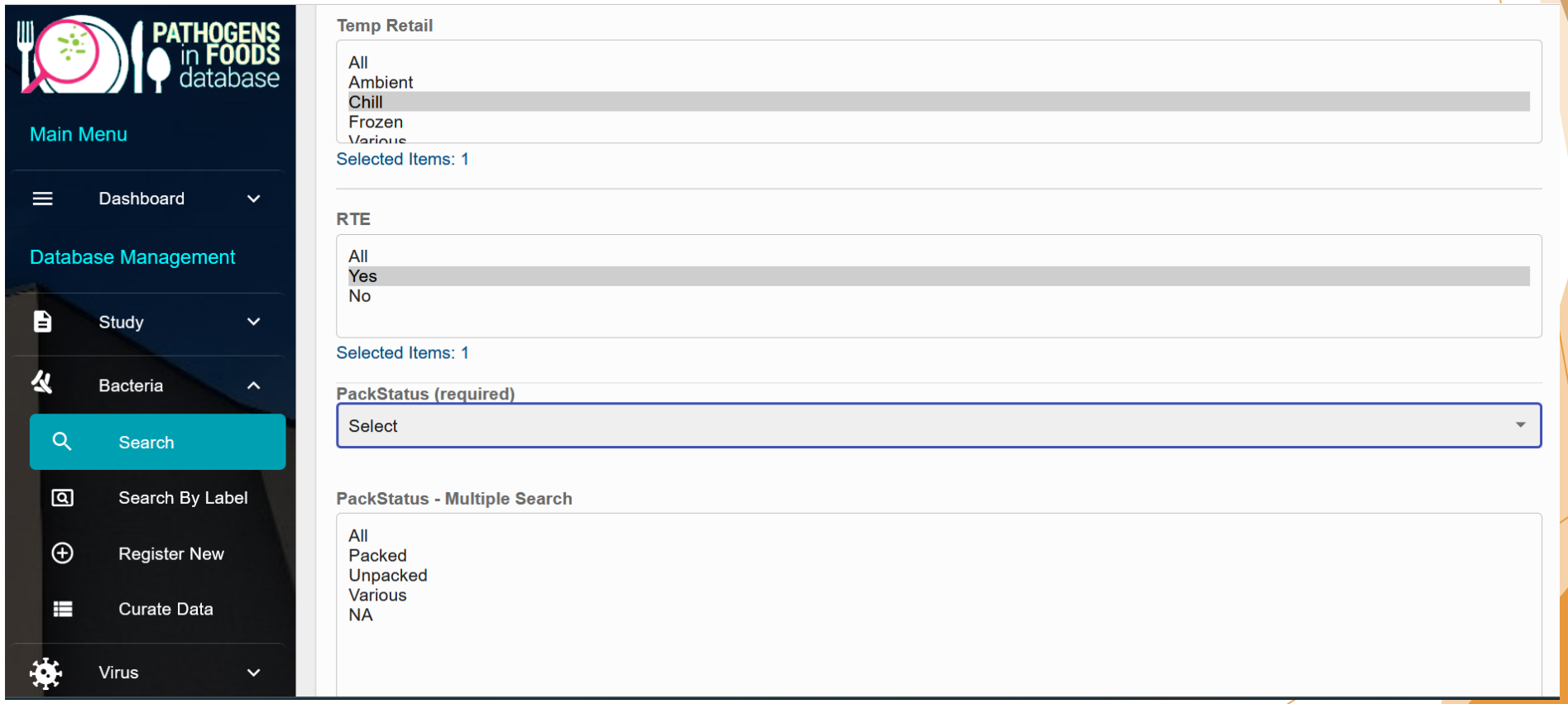
5. Example of data search and extraction

- In the database, the Pathogen, Essay type and Food category can be selected

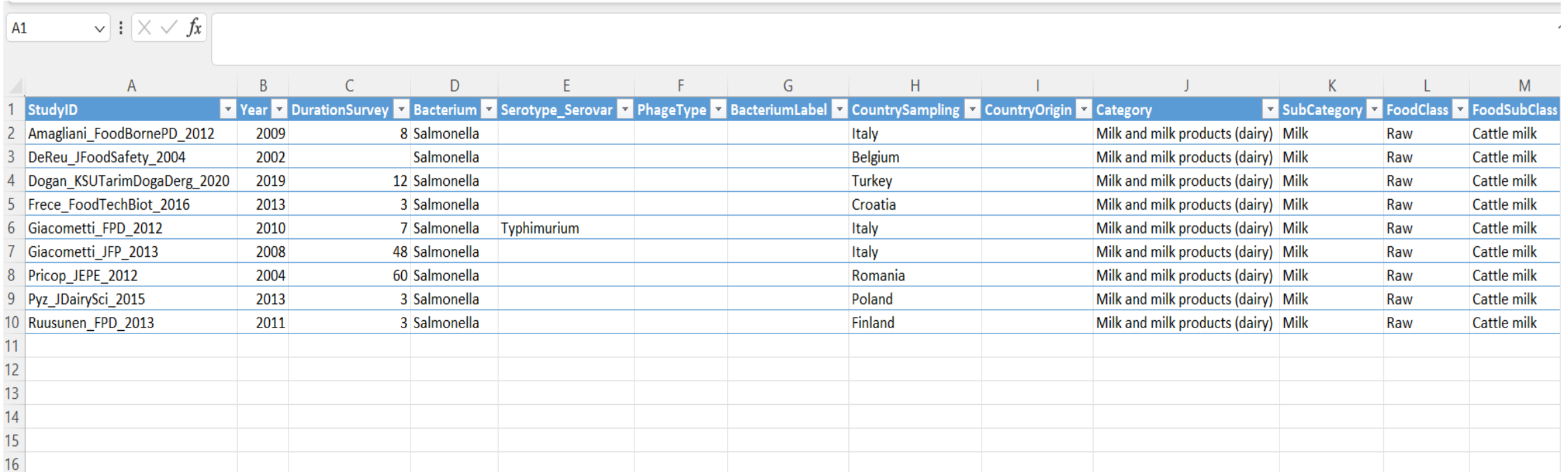


5. Example of data search and extraction

- Many more filters can be used



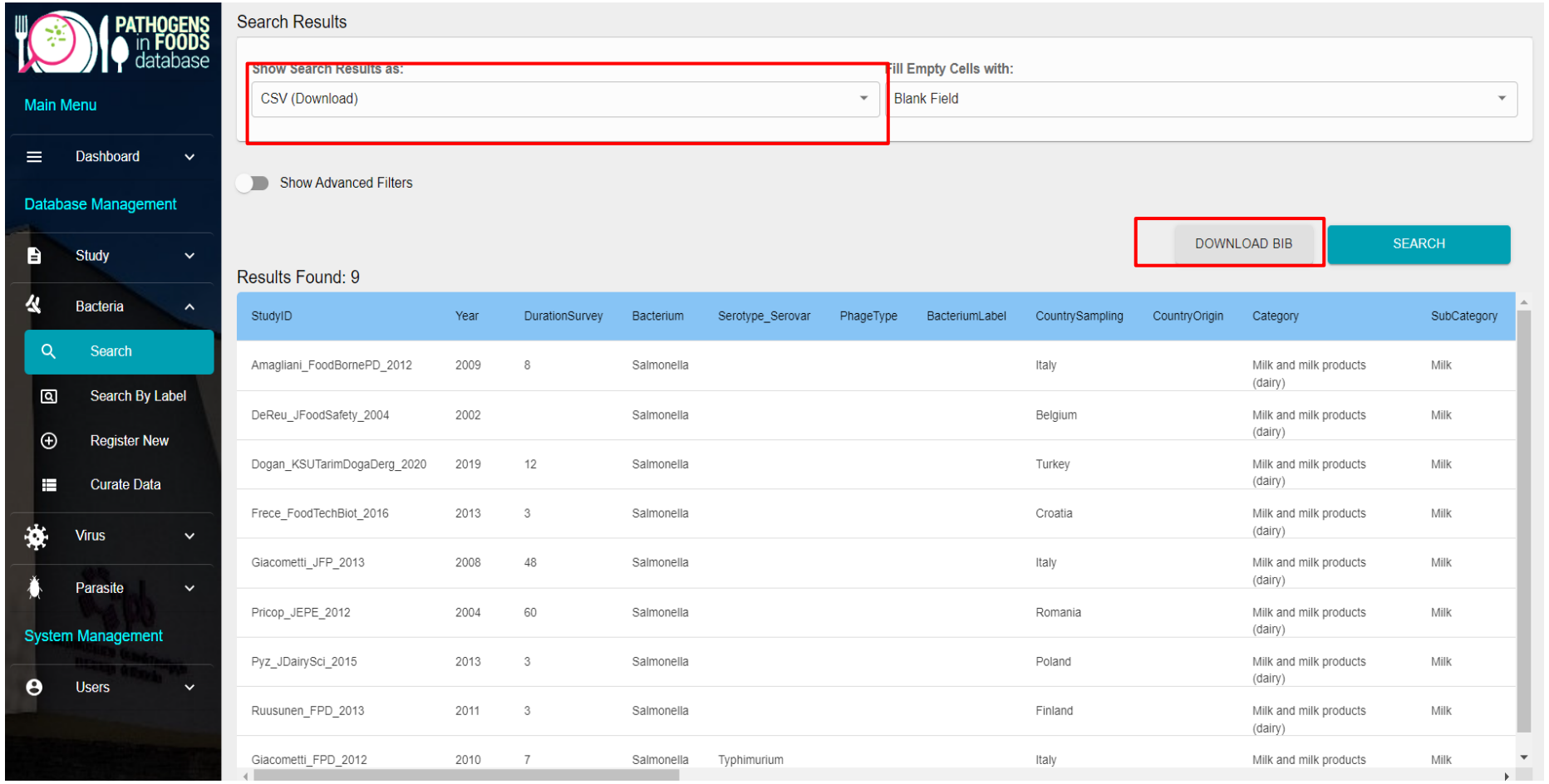
- The CSV option will allow to get a CSV file.



A1

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	StudyID	Year	DurationSurvey	Bacterium	Serotype_Serovar	PhageType	BacteriumLabel	CountrySampling	CountryOrigin	Category	SubCategory	FoodClass	FoodSubClass
2	Amagliani_FoodBornePD_2012	2009	8	Salmonella				Italy		Milk and milk products (dairy)	Milk	Raw	Cattle milk
3	DeReu_JFoodSafety_2004	2002		Salmonella				Belgium		Milk and milk products (dairy)	Milk	Raw	Cattle milk
4	Dogan_KSUTarimDogaDerg_2020	2019	12	Salmonella				Turkey		Milk and milk products (dairy)	Milk	Raw	Cattle milk
5	Frece_FoodTechBiot_2016	2013	3	Salmonella				Croatia		Milk and milk products (dairy)	Milk	Raw	Cattle milk
6	Giacometti_FPD_2012	2010	7	Salmonella	Typhimurium			Italy		Milk and milk products (dairy)	Milk	Raw	Cattle milk
7	Giacometti_JFP_2013	2008	48	Salmonella				Italy		Milk and milk products (dairy)	Milk	Raw	Cattle milk
8	Pricop_JEPE_2012	2004	60	Salmonella				Romania		Milk and milk products (dairy)	Milk	Raw	Cattle milk
9	Pyz_JDairySci_2015	2013	3	Salmonella				Poland		Milk and milk products (dairy)	Milk	Raw	Cattle milk
10	Ruusunen_FPD_2013	2011	3	Salmonella				Finland		Milk and milk products (dairy)	Milk	Raw	Cattle milk
11													
12													
13													
14													
15													
16													

- CSV file and Bibliographic papers can be downloaded
- ‘’CSV files’’ can be downloaded by selecting the **CSV option in ‘’Show Search Results’’ as CSV then selecting the option SEARCH**.
- Bibliography can be downloaded through **download BIB**



StudyID	Year	DurationSurvey	Bacterium	Serotype_Serovar	PhageType	BacteriumLabel	CountrySampling	CountryOrigin	Category	SubCategory
Amagliani_FoodBornePD_2012	2009	8	Salmonella				Italy		Milk and milk products (dairy)	Milk
DeReu_JFoodSafety_2004	2002		Salmonella				Belgium		Milk and milk products (dairy)	Milk
Dogan_KSUTarimDogaDerg_2020	2019	12	Salmonella				Turkey		Milk and milk products (dairy)	Milk
Frece_FoodTechBiot_2016	2013	3	Salmonella				Croatia		Milk and milk products (dairy)	Milk
Giacometti_JFP_2013	2008	48	Salmonella				Italy		Milk and milk products (dairy)	Milk
Pricop_JEPE_2012	2004	60	Salmonella				Romania		Milk and milk products (dairy)	Milk
Pyz_JDairySci_2015	2013	3	Salmonella				Poland		Milk and milk products (dairy)	Milk
Ruusunen_FPD_2013	2011	3	Salmonella				Finland		Milk and milk products (dairy)	Milk
Giacometti_FPD_2012	2010	7	Salmonella	Typhimurium			Italy		Milk and milk products	Milk

6. Extent of information currently contained in PIF (July 2024)

# primary studies	151	Number	Percentage
	BACTERIA entries	6545	86.1%
	PARASITES entries	335	4.7%
	VIRUS entries	700	9.2%
	TOTAL ENTRIES	7580	100%

7. The NewPIF project

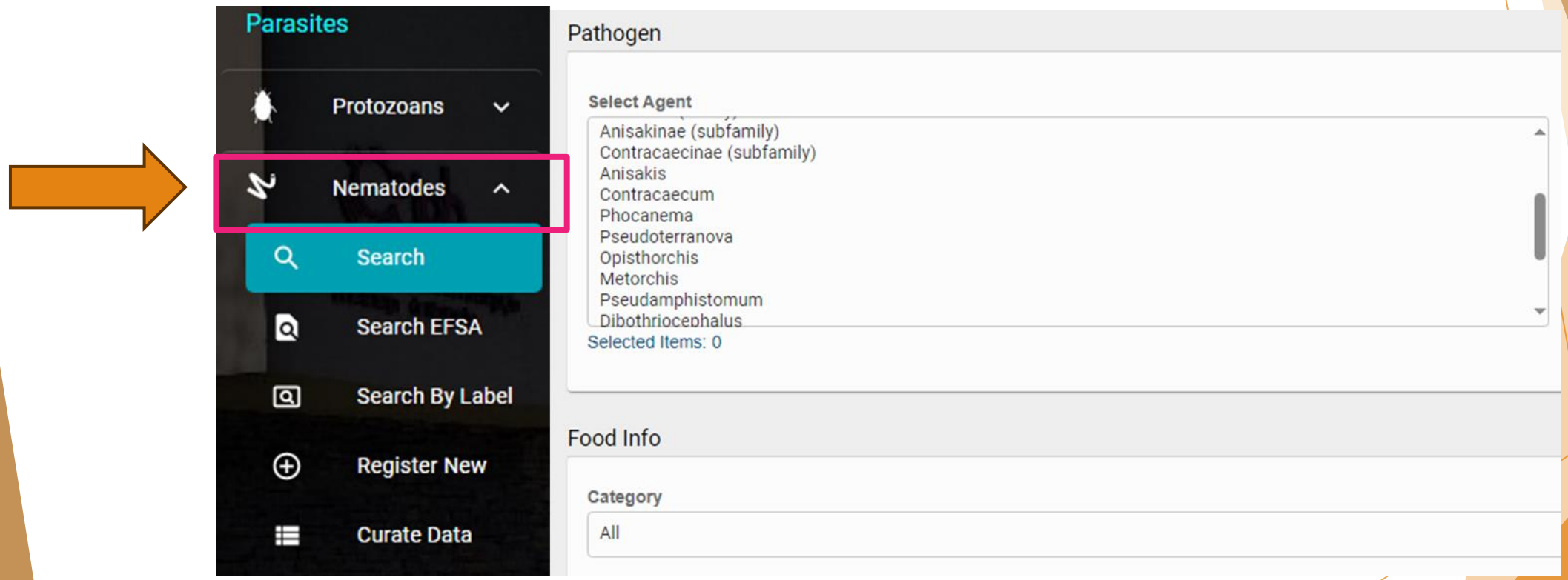
Under a new project started in September 2023, PIF will be extended with data on the occurrence of:

- Parasites of public health importance (amongst which members of the *Anisakidae* family (Anisakids) such as *Anisakis, Pseudoterranova* and *Contracaecum*) in fishery products

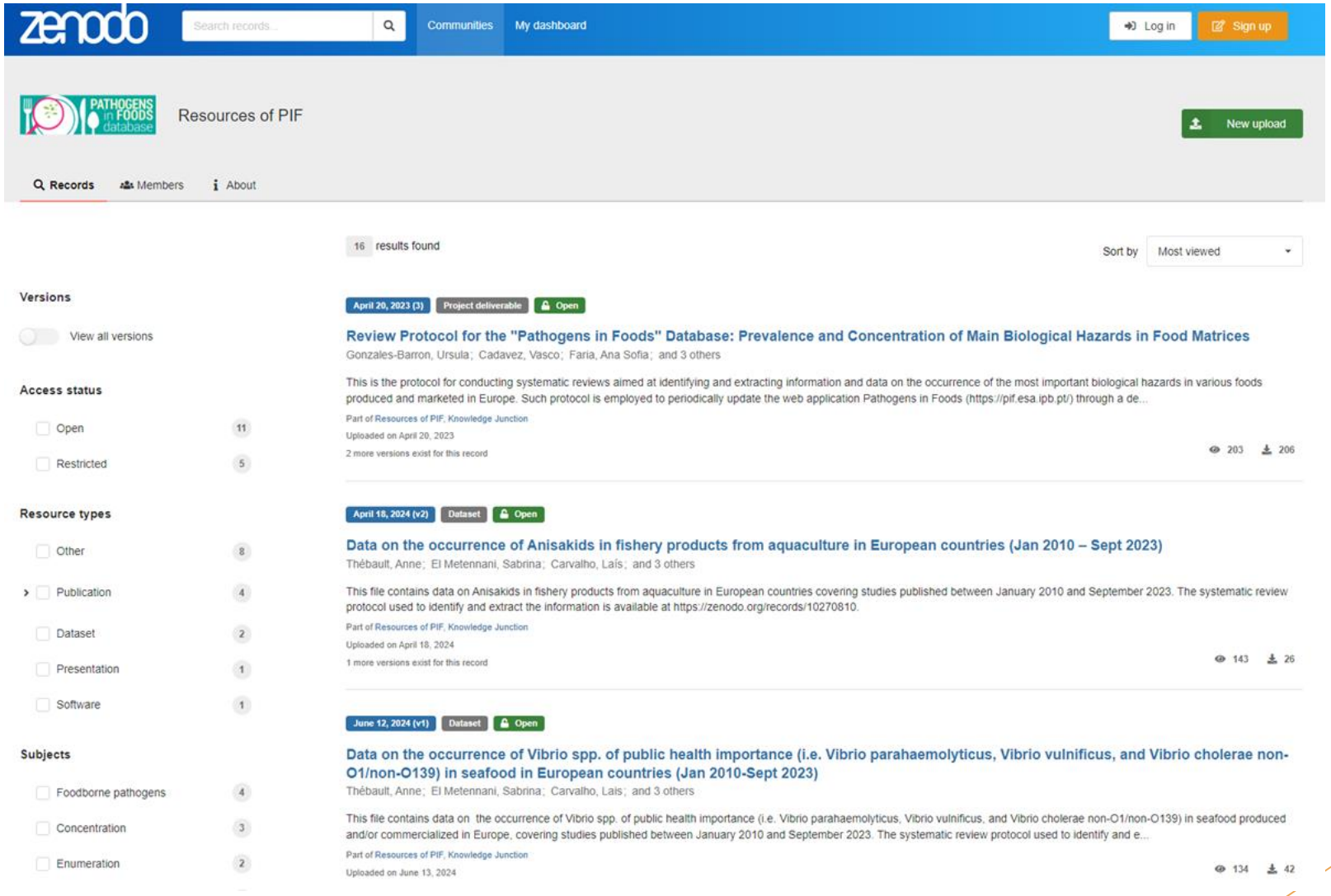
- *Vibrio parahaemolyticus, Vibrio vulnificus* and non-O1, non-O139 *Vibrio cholerae* in seafood

Implementation of Anisakids on PIF

- The Nematodes catalogue is a new feature of the database



8. PIF Documentation



Accessible through https://zenodo.org/communities/pif/

9. Final considerations

- PIF has been constructed to facilitate the access, visualisation and assessment of microbiological occurrence data from different sources
- PIF is a free tool for food safety researchers and policymakers, that gathers reliable and quality assessed data that can be used in microbiological risk assessment and help establish future food safety guidelines
- Feedback and suggestions to improve user experience of PIF are highly appreciated by its developers

Pathogens-in-Foods Database

Contacts :
CIMO Mountain Research Centre, Polytechnic Institute of Bragança, Portugal
•Ursula Gonzales-Barron (ubarron@ipb.pt)
•Acknowledgement: Vasco Cadavez, Ana Sofia Faria, Marcos Pereira

The French Agency for Food, Environmental and Occupational Health & Safety (Anses)
•Pauline Kooh (Pauline.KOOH@anses.fr)
•Acknowledgement: Anne Thébault, Laurent Guillier

European Food Safety Authority
• Winy Messens (Winy.MESSENS@efsa.europa.eu)
•Acknowledgement: Fulvio Barizzone, Frank Boelaert, Gorgias Garofalakis, Irene Pilar Munoz Guajardo

STAY CONNECTED

SUBSCRIBE TO
efsa.europa.eu/en/news/newsletters
efsa.europa.eu/en/rss
Careers.efsa.europa.eu – job alerts

LISTEN TO OUR PODCAST
Science on the Menu –Spotify, Apple Podcast and YouTube

FOLLOW US ON TWITTER
@efsa_eu @methods_efsa
@plants_efsa @animals_efsa

FOLLOW US ON LINKEDIN
Linkedin.com/company/efsa

FOLLOW US ON INSTAGRAM
@one_healthenv_eu

CONTACT US
efsa.europe.eu/en/contact/askefsa

efsa
EUROPEAN FOOD SAFETY AUTHORITY