Functional Traits Thesauri: sharing and reusing knowledge through semantic resources

Jessica Titocci, Martina Pulieri, Angela Carluccio, Cristina Di Muri, Andrea Tarallo, Enrica Nestola, Alberto Basset, Ilaria Rosati

The LifeWatch ERIC Biodiversity &Ecosystem eScience Conference
22-24 May 2023, Seville, Spain

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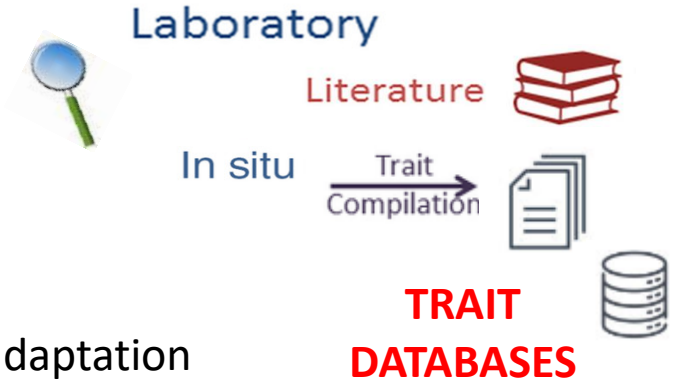
Functional traits & e-Science

Species occurrence, distribution & diversity

Functional Traits

Describe

Documenting key traits
Spatial distribution of traits
Trait-environment relationships

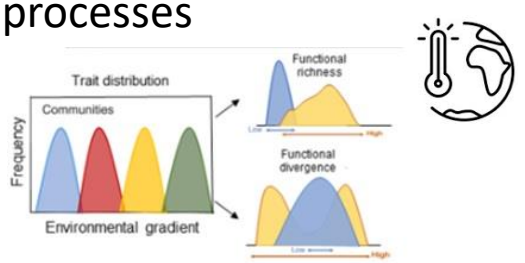


Explain

Traits variation and adaptation
Community assembly and structure
Traits trade-off and traits dynamics

Predict

Traits response to environmental changes
Consequences of trait loss for ecosystem functioning and processes



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How ecologists define and use functional trait terms?

Ecology and Evolution
Open Access

REVIEW ARTICLE | Open Access

The traits of "trait ecologists": An analysis of the use of trait and functional trait terminology

Samantha K. Dawson, Carlos Pérez Carmona, Manuela González-Suárez, Mari Jönsson, Filipe Chichorro, Max Mallen-Cooper, Yolanda Melero, Helen Moor, John P. Simaika, Alexander Bradley Duthie

Trait: a well-defined, measurable property of organisms, usually measured at the individual level and used comparatively across species.

Functional Trait: morphological, physiological, phenological, or behavioral characteristic of organisms that strongly influence performance or fitness. (Violle 2007, McGill 2006)

486 survey responses

712 reviewed papers

Urgent need to clarify and find an agreement on how ecologists define and use traits terminologies !!

Trait-based Interoperable Research

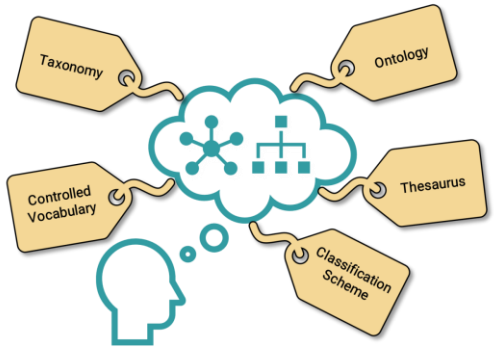
Collecting trait-data

Mobility
Diet
Distribution
Shape
Toxicity
Body weight
Size
Biomass
Growth rate
Feeding behavior
Clutch size
Habitat preference

Raw data

W3C Semantic Web

XML
JSON
RDF
OWL
CSV
SKOS

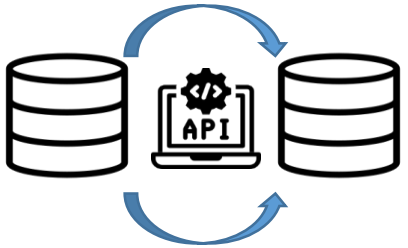


Structural

Semantic

Making trait data FAIR

Processed data



Standardizing and integrating trait data and metadata

The integration of the trait data is a key issue which can be resolved through semantic and syntactic data integration

Functional Traits Thesauri

A thesaurus is a **controlled and structured vocabulary** in which concepts are organized so that **relationships** between them are made explicit.

1) *Term research and selection phase*

Determine Scope → **Identify Sources** → **Gather Terms**

Editors

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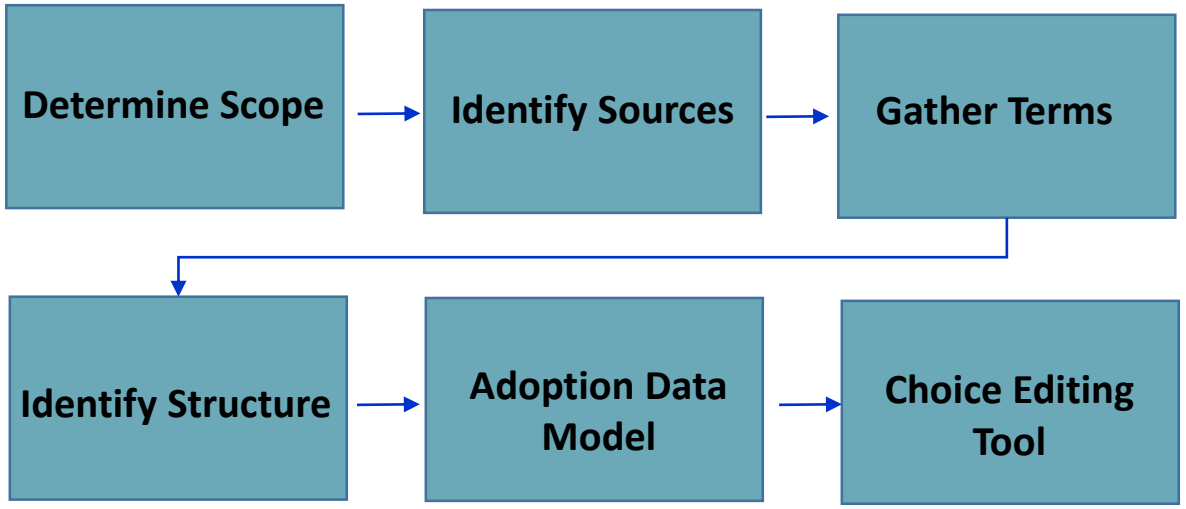

2) Formalization phase

ICT

Editors

SKOS

VOC BENCH

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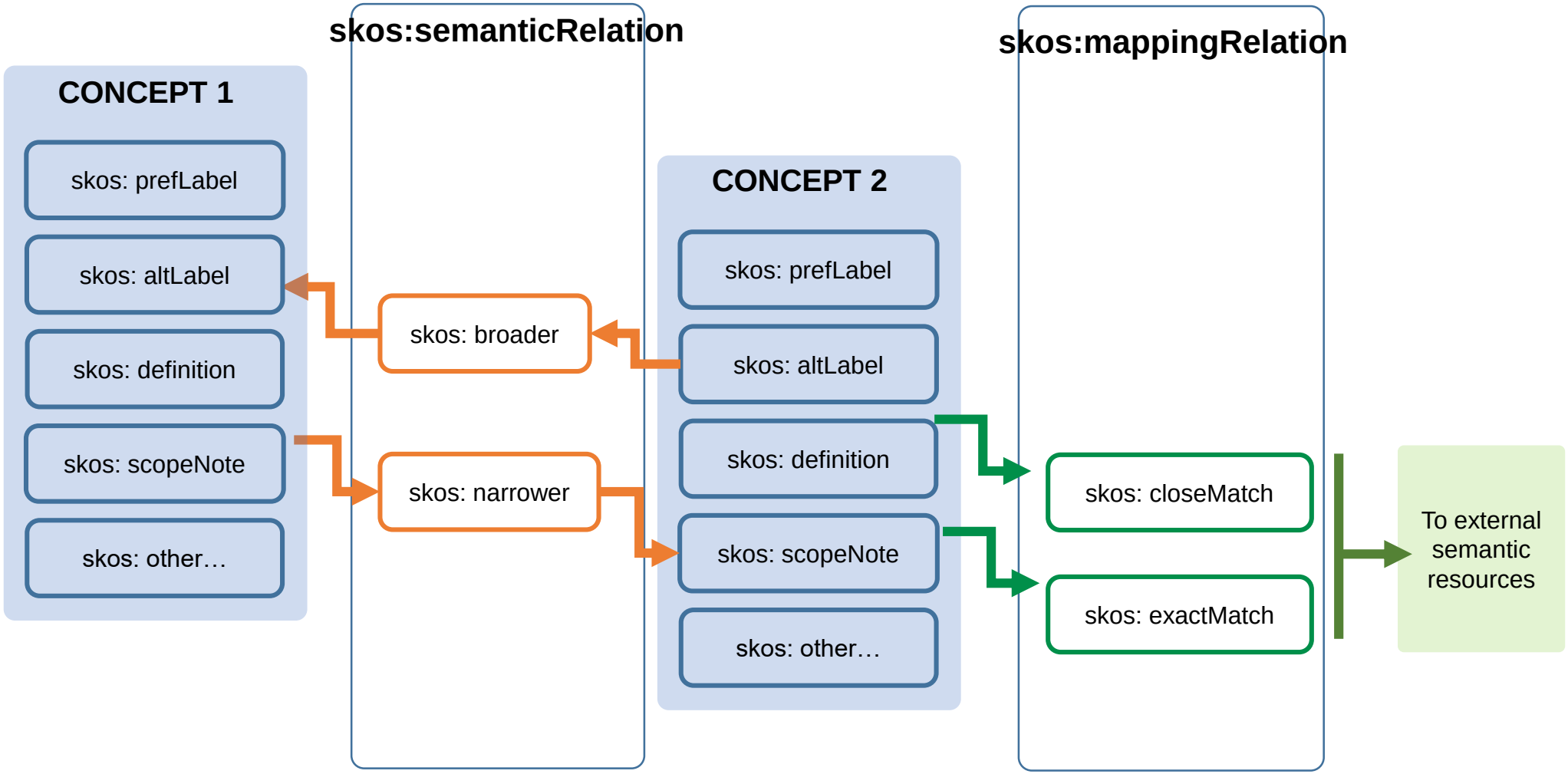
Functional Traits Thesauri

2) Formalization phase: SKOS model



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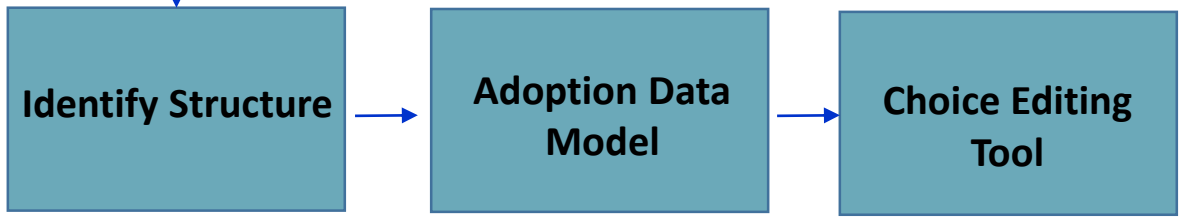
Functional Traits Thesauri

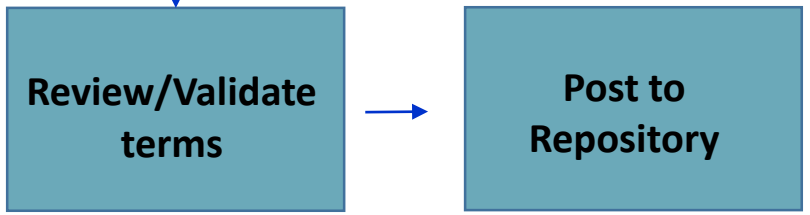
A thesaurus is a **controlled and structured vocabulary** in which concepts are organized so that **relationships** between them are made explicit.

1) *Term search and selection phase*

2) Formalization phase

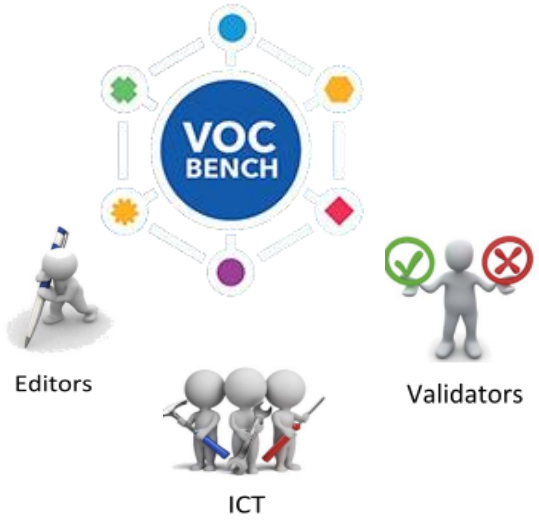


3) Editing, validation and publication phase



Functional Traits Thesauri

3) Editing, validation…



A stable reference resource

- URI
- Version history

Human readable	Machine readable	Discoverable	Interoperable

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<dc:creator>LifeWatch Italy</dc:creator>
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<dc:language>en</dc:language>
<skos:Concept rdf:about=http://thesauri.lifewatchitaly.eu/PhytoTraits/?tema=15 >
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Morphological characteristic, easy to measure, conspicuous, ecologically important, related to the overall physical magnitude of an organism, comparable across taxa and which may be extremely variable through time and space.
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Schmidt et al. 2006 doi:10.1016/j.earscirev.2006.05.004
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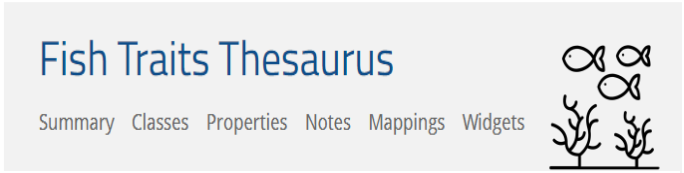
Functional Traits Thesauri

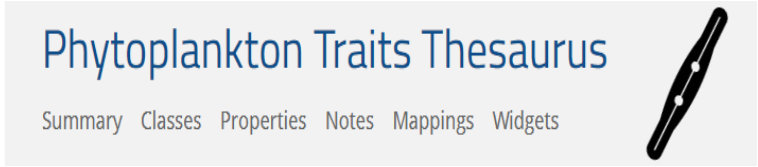
…and publication

211 traits



127 traits

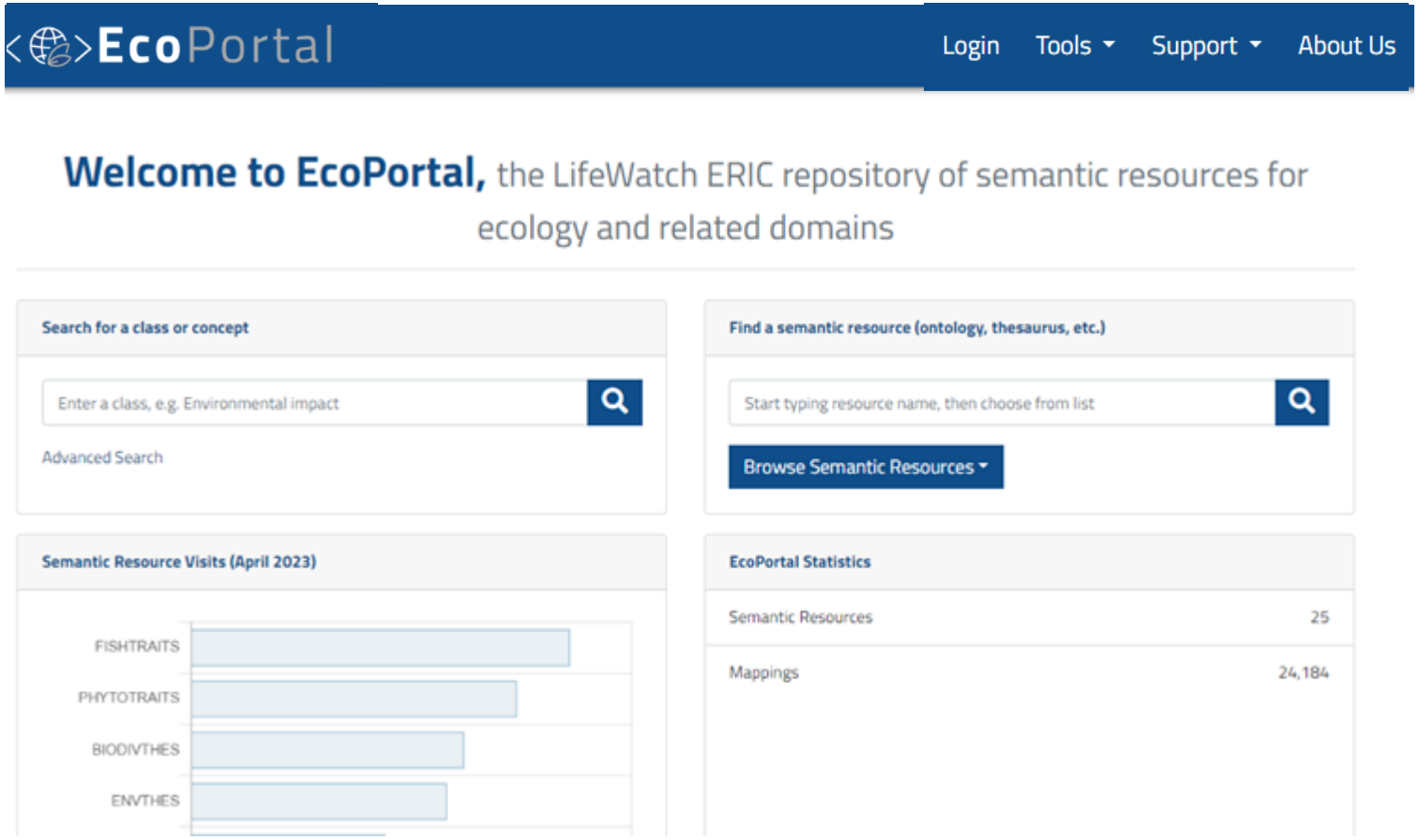
120 traits



90 traits

Rosati *et al.*, 2017 Ecological Informatics

Kechagioglou *et al.*, 2021 CEUR Workshop Proceedings



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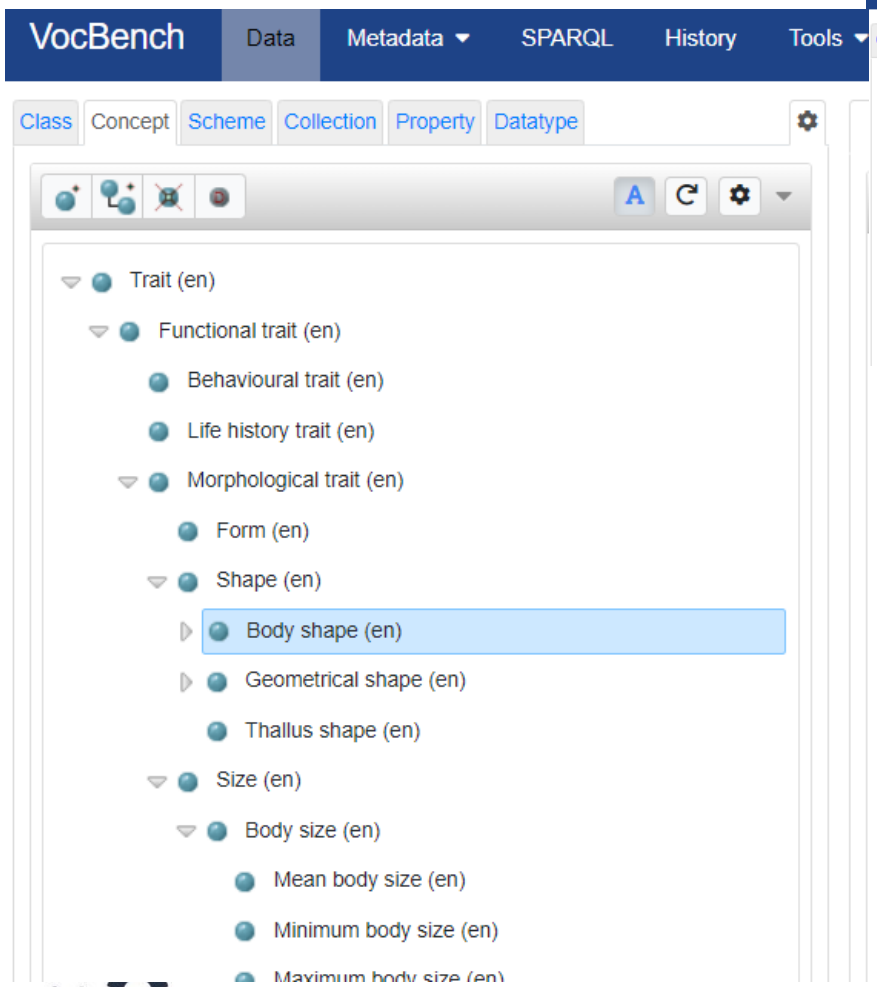
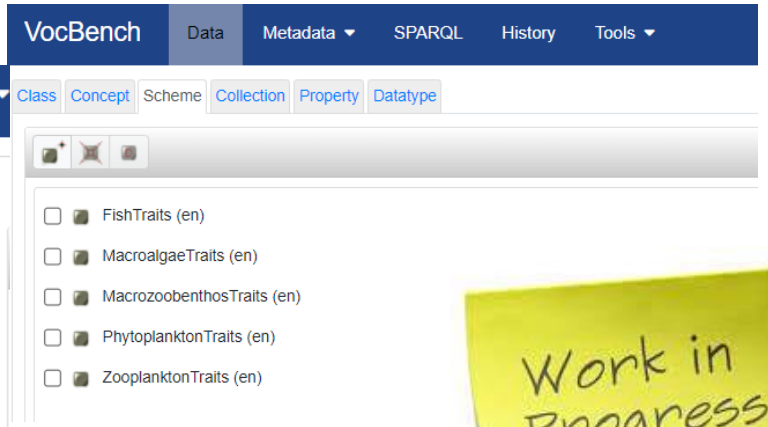
Functional Traits Thesauri





Behavioral
Demographic
Life-history
Morphological
Phenological
Physiological

Thesauri alignment and mapping

1 thesaurus
Different schemes

Functional Traits Thesaurus

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Trait terminologies and standards

BEeS

LifeWatch ERIC

FishBase ver. (02/2023)

BIOTIC - Biological Traits Information Catalogue

The Marine Life Information Network for Britain and Ireland

MarLIN The Marine Life Information Network for Britain & Ireland

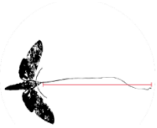
WRiMS terminology

polytraits

AlgaeTraits

EcologicalTraitData/ **ETS**

A Data Standard for Ecological Trait Datasets



List of terms

Glossary

Thesauri

Ontologies

TRY

BIOTIC - Biological Traits Information Catalogue

Home | About BIOTIC | Browse | Search | Get Traits | Traits Resources

TaxonWorks

ThesauForm - T-SITA

Thesaurus for Soil Invertebrate Trait-based Approaches

AusTraits

Vertebrate Trait Ontology

Coastal Wiki

WoRMS World Register of Marine Species

Ecotaxonomy DATABASE traits and species

Marine Species Traits

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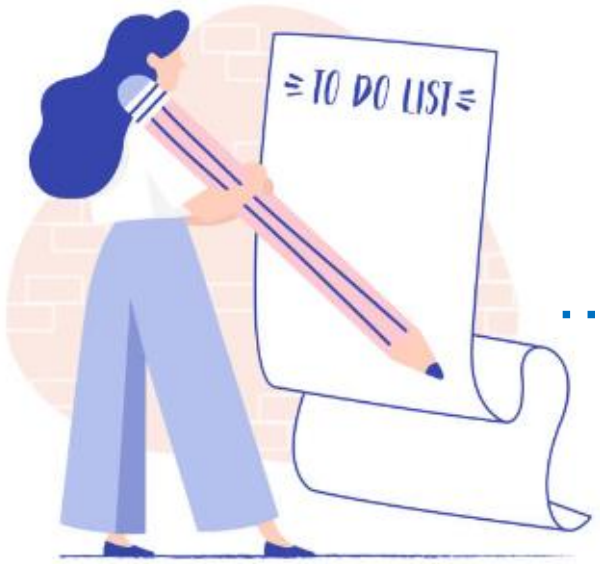
Future perspectives

- Implementation
- Mapping
- Alignment

Trait related semantic resources



gfbio GERMAN FEDERATION FOR BIOLOGICAL DATA Terminology Service

EcologicalTraitData/ **ETS**

A Data Standard for Ecological Trait Datasets

Open Traits Network

Ontology Alignment Evaluation Initiative OAEI

…through current and future collaborations!

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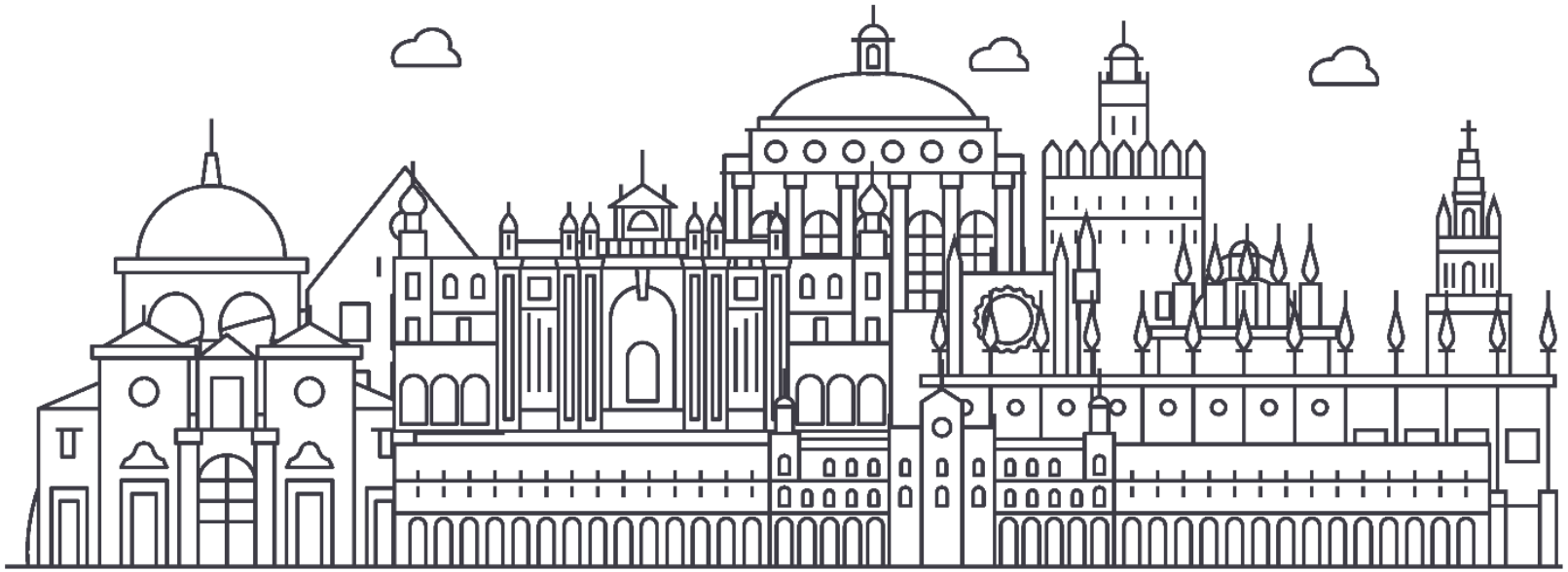

Seville
22-24/05/23

Threats and challenges to biodiversity and ecosystem conservation from an eScience perspective

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Contact: jessica.titocci@cnr.it

Thank you! | www.lifewatch.eu/bees-2023