



The LifeWatch ERIC Biodiversity
& Ecosystem eScience Conference

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Bridging biodiversity and ecosystem data with an ontology-driven approach

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DI PALERMO

Background

WHY?

- Heterogeneous data in the ecological domain. Need to find new ways to integrate data



WHAT

- Building a knowledge graph: an entity web connected with explicit semantic relationships



HOW?

- Mapping data to a light-weight ontology, transforming them in RDF triples and populating the knowledge graph



WHERE?

- Launch of the first version of the LifeWatch Italy Semantic Platform in 2023!

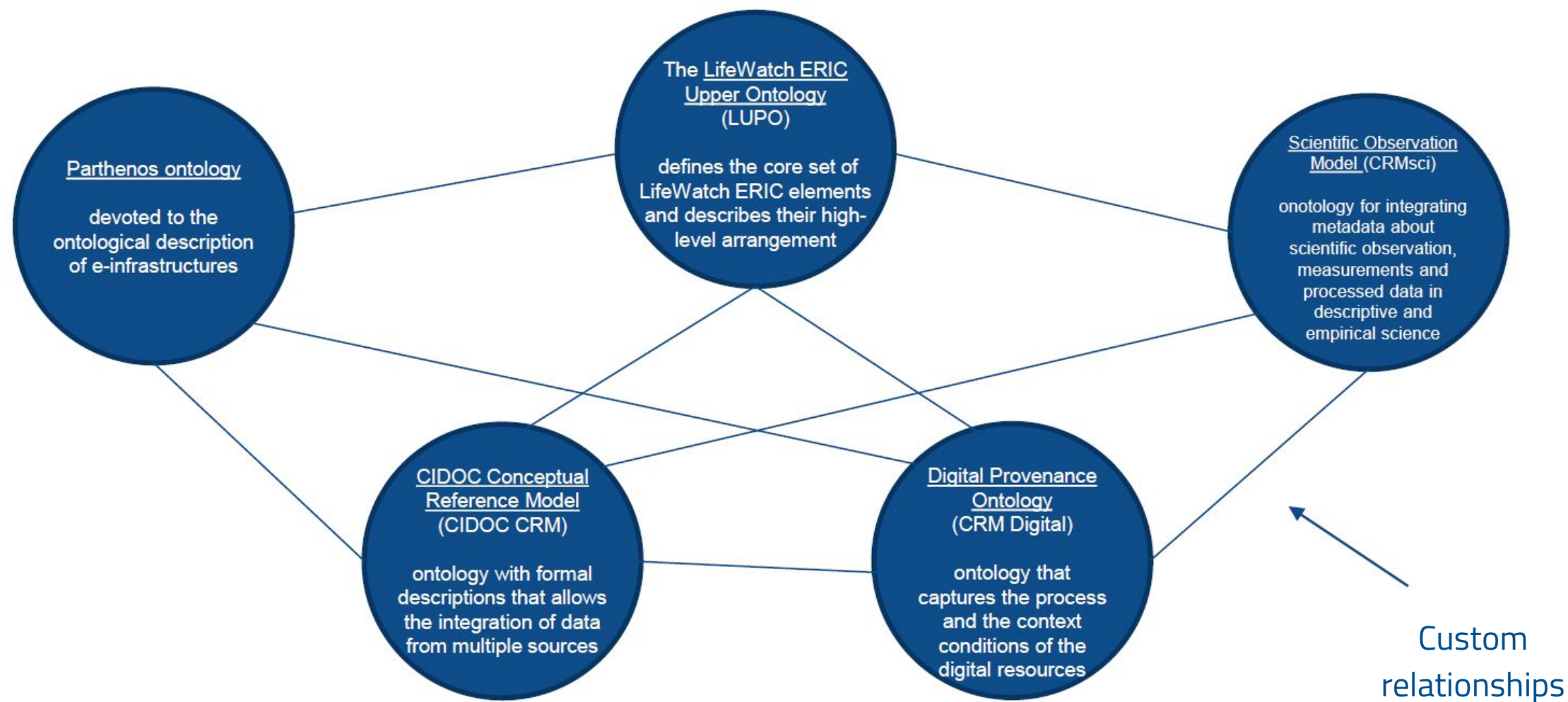
Where we left off

LifeWatch Italy Semantic Platform

- Search and access the LifeWatch Italy resources with the help of semantically enriched queries.



The ontological model



Simple Search

To use the simple search, type at least two characters in the search box.

Type at least two characters in the search box

Structured Search



Title	Type
Atlas of Phytoplankton	Service
Atlas of Phytoplankton	Linguistic Appellation
Atlas of Phytoplankton - https://metadatalogue.lifewatch.eu/srv/eng/catalog.search#/metadata/3ca7867c-0178-4310-a825-5c8bedaf5465	Linguistic Appellation
It is a catalogue of geometrical models for calculating biovolume and surface area of phytoplankton taxa. It includes illustrative schemes of simple and complex shapes.	Linguistic Object
Other Phytoplankton	BT22_Class
Other Phytoplankton	BT19_Phylum
Phytoplankton	Type
Phytoplankton Data Template	Linguistic Appellation

General search

Simple Search

To use the simple search, type at least two characters in the search box.

Type at least two characters in the search box

- maldives (Place)
- FEA2EC5B-744B-3A05-B9B2-0F45C76F046F (Linguistic Object)
- Phytoplankton communities data collected in Maldivian lagoon ecosystems in 2012. (Linguistic Appellation)
- Maldives (Type)
- Outside European biogeographical regions and the regional seas - Maldives (Linguistic Object)
- Phytoplankton communities data collected in Maldivian lagoon ecosystems in 2012. (Dataset)

structured search

source you wis

Punctual search

Structured search

- The structured search reflected the main classes on the previous ontological model.
- Integration through predefined SPARQL queries.



Dataset



Service



Person



Organisation



VRE



Observation



SPARQL queries



Recent Queries Global Queries Personal Queries

⋮

Test - Test for simple query

My first Query - My first Query

⌵

⌵

Create New Set

<<

```
1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 SELECT * WHERE {
4   ?sub ?pred ?obj .
5 } LIMIT 10
```

Repository: (from context) ▼ Execute Save

Template	Author	Modified	Actions	
My first Query	admin	February 9, 2023 10:23 AM	📄 Copy IRI	🗑 Delete
Test	admin	February 9, 2023 10:21 AM	📄 Copy IRI	🗑 Delete

Issues found

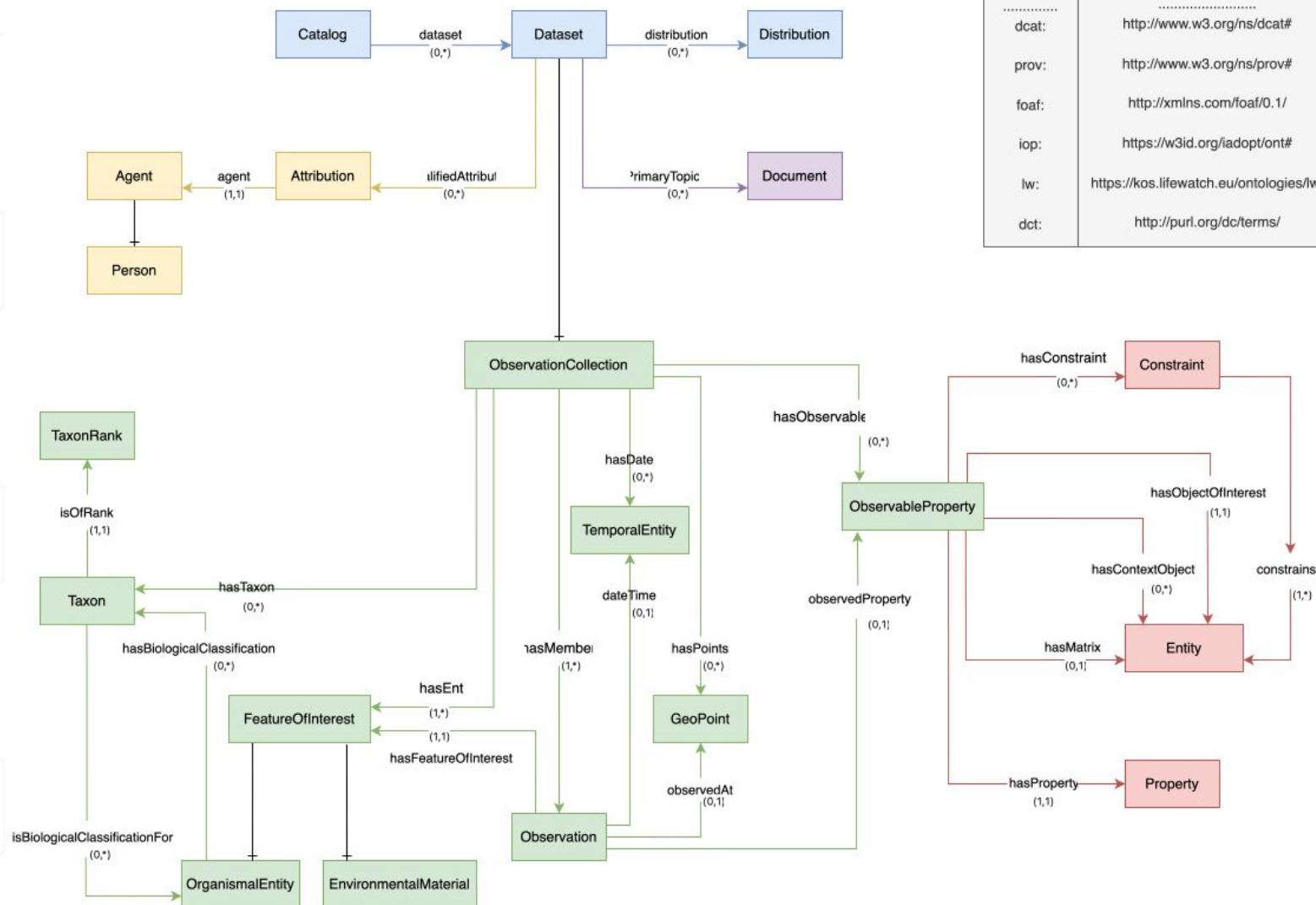
- **Partial relationships.** The ontological model, because of the ontology reused, was not catching the relationships among variables at the observation level.
- **Integration issues.** The ontological model was not integrating in the correct way data from different datasets.
- **Missing functionalities.** Some key features were missing (e.g., download of the integrated dataset).



Coming soon

- LifeWatch Italy Semantic Platform version 2.0 is almost ready to be published!
- Kept most of the previous functionalities:
 - Simple Search
 - Structured Search
 - SPARQL endpoint
- But with an **improved model!**

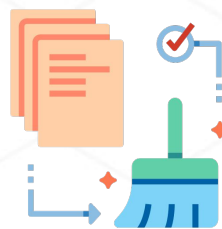
New ontological model



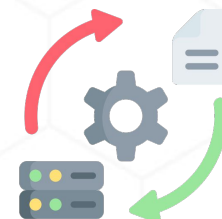
Prefix	URI	Standard	Label
dcat:	http://www.w3.org/ns/dcat#	Data Catalog Vocabulary	
prov:	http://www.w3.org/ns/prov#	The PROV Ontology	
foaf:	http://xmlns.com/foaf/0.1/	FOAF Vocabulary Specification	
iop:	https://w3id.org/iadopt/ont#	I-ADOPT Framework	
lw:	https://kos.lifewatch.eu/ontologies/lw/	LifeWatch Italy Domain Ontology	
dct:	http://purl.org/dc/terms/	DCMI Metadata Terms	

LifeWatch Italy Semantic Platform Ontology
 IRI: <https://kos.lifewatch.eu/ontologies/spo/>
 Knowledge Representation Language and Data Modeling Vocabulary:
 • OWL 2
 • RDF Schema 1.1
 October 2024

Mapping workflow



Data cleaning and
class attribute
mapping



(Meta)data mapping
to the ontological
model



Upload of the RDF
triples in Semantic
Platform triplestore



New features – Browse Datasets

Metadata

Analytics

Observable Properties

Taxa

Georeferenced Points

Temporal Entities

Observation Measurements

Main ontology's classes

This dataset contains 6 observable properties.

▼ FILTERS

Quick Search



Label	Definition	Type
Body Length	The distance along the major axis of the body of an organism.	https://kos.lifewatch.eu/thesauri/traits/c_d266fb02
Wet Weight	The weight of a whole fresh organism.	https://kos.lifewatch.eu/thesauri/traits/c_54f8447a
Sex	The sex of the biological individual(s) represented in the dwc:Occurrence.	http://rs.tdwg.org/dwc/iri/sex
Water Temperature	Any measurable characteristic related to the temperature of water.	http://vocabs.lter-europe.net/EnvThes/22313
Residual	Residuals of oxygen consumption adjusted for the body mass (wet weight) of the organism and for the water temperature. It represents the difference between the organism's observed SMR and the predicted SMR for an organism of the same body mass based on the overall experimental population-level relationship.	
Metabolic Rate	A measure of the rate of metabolic activity in a living organism. Determined as oxygen consumption over a given period.	http://vocabs.lter-europe.net/EnvThes/msa0652

Label, definition and URIs of the observable datasets' properties

New features – Browse Datasets

Metadata	Analytics	Observable Properties	Taxa	Georeferenced Points	Temporal Entities	Observation Measurements
▼ FILTERS Download CSV Quick Search						
Dataset Title	Observation Id	Coordinates	Country	Locality	Event Date	10 Rows Taxon Name Observable Property Value Unit
Intrinsic and extrinsic factors influencing the foraging behaviour of Poecilia sphenops in experimental conditions	7efc7e8f-69af-4137	34.7202, 33.332565	Cyprus	Zygi	2023-02-16	Poecilia sphenops Residual -0.630941526 Milligrams of oxygen per hour
Intrinsic and extrinsic factors influencing the foraging behaviour of Poecilia sphenops in experimental conditions	7efc7e8f-69af-4137	34.7202, 33.332565	Cyprus	Zygi	2023-02-16	Poecilia sphenops Residual -0.630941526 Milligrams of oxygen per hour
Intrinsic and extrinsic factors influencing the foraging behaviour of Poecilia sphenops in experimental conditions	7f35d489-8565-441c	34.7202, 33.332565	Cyprus	Zygi	2023-02-27	Poecilia sphenops Sex M male/female
Intrinsic and extrinsic factors influencing the foraging behaviour of Poecilia sphenops in experimental conditions	7f35d489-8565-441c	34.7202, 33.332565	Cyprus	Zygi	2023-02-27	Poecilia sphenops Sex M male/female

Observable properties, their values and unit of measurements related to the taxon

New features – Browse characteristics

Label	Definition	URL
Aluminium	Aluminium (or aluminum) is a chemical element in the boron group with symbol Al and atomic number 13. It is a silvery white, soft, ductile metal. Aluminium is the third most abundant element (after oxygen and silicon), and the most abundant metal, in the Earth's crust (occurs widely in nature in clays). It makes up about 8% by weight of the Earth's solid surface. Aluminium metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals. Aluminium became implicated as an environmental health hazard in the 1980s on two counts. Biomedical scientists looking for possible causes of Alzheimer's disease, the premature senility indicated by loss of memory and confusion, found a circumstantial link with aluminium. The theory is a controversial one.	http://vocabs.lter-europe.net/EnvThes/20800
Arsenic	A toxic metalloid element, existing in several allotropic forms, that occurs principally in realgar and orpiment and as the free element. It is used in transistors, lead-based alloys, and high temperature brasses.	http://opendata.inra.fr/anaeeThes/c2_2341
Ash Free Dry Weight	The ash free dry weight is the dry weight (inorganic + organic contents) minus the weight of the ash (inorganic contents only) obtained after combustion at high temperature.	https://kos.lifewatch.eu/thesauri/traits/c_4eb7719f
Ash Weight	The weight of inorganic material obtained after muffle furnace combustion at 450-500 °C for 6/12 hours or longer for larger quantities. Ash weight is determined by subtracting the tare weight. Ash weight is often expressed as a percentage of dry weight or wet weight.	https://kos.lifewatch.eu/thesauri/traits/c_c50e466a

Labels from datasets

URLs from controlled vocabularies

New features – Browse characteristics

Metadata

Analytics

Records

Table of all records associated with the **Calcium** Observable property

▼ FILTERS

Download CSV

Quick Search

10 Rows ▼

Dataset Title	Observation Id	Coordinates	Country	Locality	Event Date	Taxon Name	Value	Unit
Elemental composition of non-indigenous marine species of potential commercial interest	0602f2c5-c34e-4320	44.28745, 12.38869999	Italy	Ravenna	2022-03-12	Anadara transversa	1864.0	mg/kg of dry weight (ppm)
Elemental composition of non-indigenous marine species of potential commercial interest	0a5edbc4-3c46-4040	35.41, 24.962	Greece	Fodele	2022-08-08	Pterois miles	1048.0	mg/kg of dry weight (ppm)
Elemental composition of non-indigenous marine species of potential commercial interest	0b82ccbb-e1ca-48a3	39.855044, 18.169488	Italy	Ugento	2022-10-08	Callinectes sapidus	2731.0	mg/kg of dry weight (ppm)
Elemental composition of non-indigenous marine species of potential commercial interest	0bcc9a72-30a1-430b	35.41, 24.962	Greece	Fodele	2022-08-08	Siganus rivulatus	703.0	mg/kg of dry weight (ppm)
Elemental composition of non-indigenous marine species of potential commercial interest	0c1359d8-82c1-44f7	39.855044, 18.169488	Italy	Ugento	2022-10-08	Callinectes sapidus	1807.0	mg/kg of dry weight (ppm)

Single dataset's observation

Future work

■ Back-end

- Improve the transformation workflow by employing AI agents.
- Adding more source data repositories to expand knowledge integration.

■ Front-end

- Improve platform usability.
- Feedbacks are always welcome!

<https://semantics.lifewatchdev.eu/>



HELP DESK



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THANK YOU!

Questions?

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