

Building a Global Aquatic Resources Knowledge Base for Fisheries

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Outline

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Introduction

2048

When will fish go extinct?

The world's oceans could virtually be emptied for fish by 2048. A study shows that if nothing changes, we will run out of seafood for normal consumption in 2048. If we want to preserve the ecosystems of the sea, change is needed.

source: <https://www.theworldcounts.com/challenges/planet-earth/oceans/overfishing-statistics> (Sep 2024)

Overfishing puts more than one-third of all sharks, rays, and chimaeras at risk of extinction

More than one-third of all sharks, rays, and chimaeras are now at risk of extinction because of overfishing, according to a new study re-assessing their IUCN Red List of Threatened Species extinction risk status. Governments and regional fisheries bodies must act now to stop overfishing and prevent a global extinction crisis.



source: <https://www.worldwildlife.org/threats/overfishing> (Sep 2024)

Introduction

- Fisheries management plays a crucial role in
 - Sustainable use of resources
 - Conservation of marine Ecosystems
 - Regulation of fishing practices
 - Monitoring and data collection
 - Enforcement of laws and regulations
 - Protecting endangered species
 - Prevent overfishing



It is therefore important that the description of relevant information (e.g. species) is **accurate** and **complete**

Motivation

- How to identify and refer to marine resources (e.g. species) ?



Red mullet



Κουτσομούρα



Triglia fi fango



Trejjazzula



Mullus barbatus



MUT

126985

790

169419

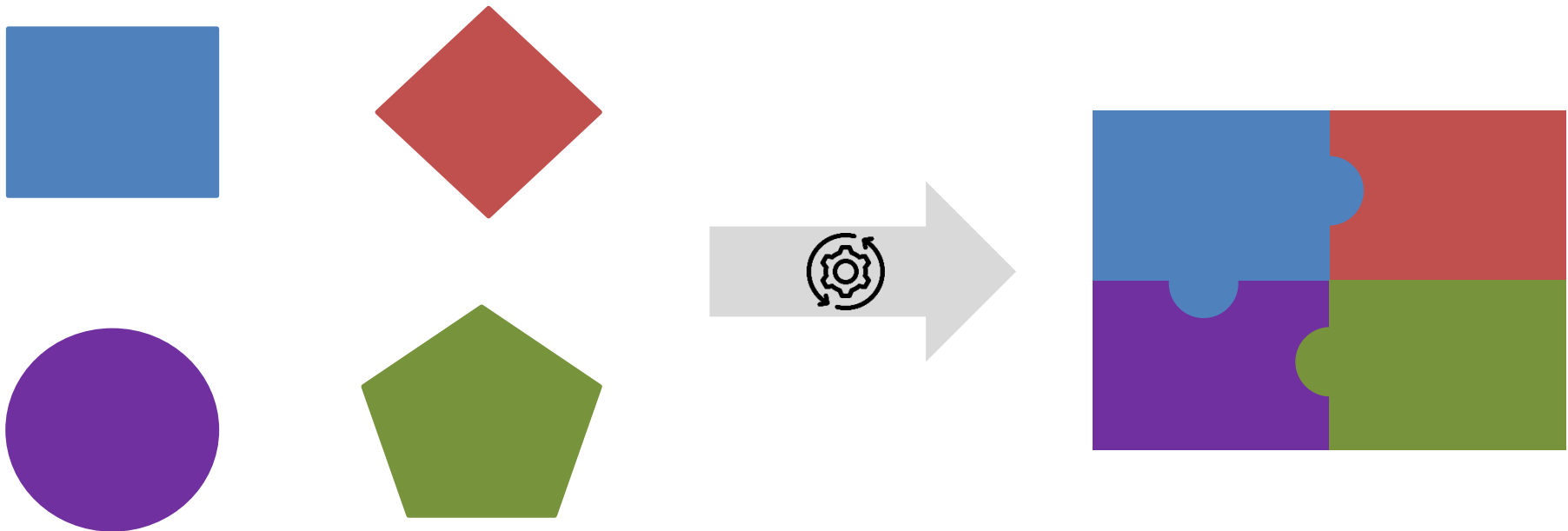
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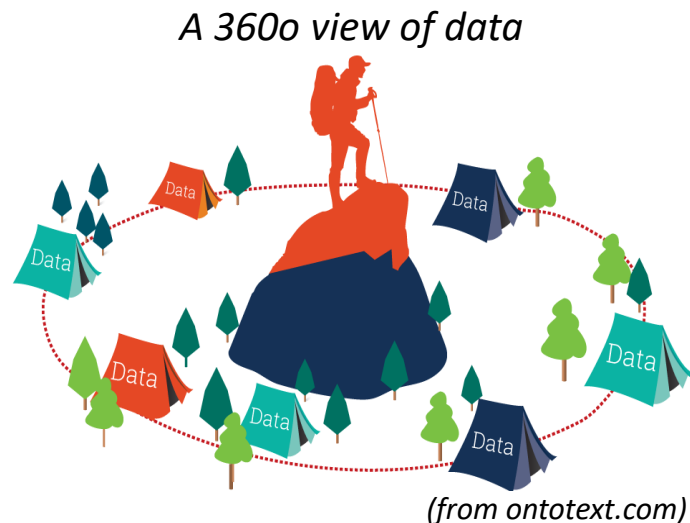
Motivation

- To alleviate with these problems, we have implemented a process that relies on semantic web technologies
 - **Collects** information from **different data sources**
 - Describes them using a **single model** (i.e. ontology)
 - **Transforms** the collected data into a single **knowledge base**.



Background – Semantic Data Integration

- Semantic Data Integration offers
 - Holistic view of data resources
 - Enhanced interoperability
 - Re-usable resources
 - Complex query answering
 - Unified and homogeneous data
 - More comprehensive understanding of data
 - Simplified data access
- The key element is the definition of a proper ontology, able to capture clearly the semantics of a particular domain
 - MarineTLO, SWEET, BioTop, Uberon, and others.
 - In our work we have adopted MarineTLO, a top-level-ontology for marine ecosystems (also applicable to freshwater, brackish, and terrestrial ecosystems)



Aquatic Species Knowledge Base – The Data Sources



FAO ASFIS List of Species for Fishery Statistics Purposes

Code list of marine species

Scientific names

Taxonomic information

Common names [en, fr, sp, ru, ar, cn]



World Register of Marine Species

Scientific names

Synonyms

Taxonomic information

Distribution Maps

Bibliographic References



Global Biodiversity Info System

Life-cycle and history of fish species

Scientific names

Distribution

Morphology and ecology

Taxonomic information

Common names



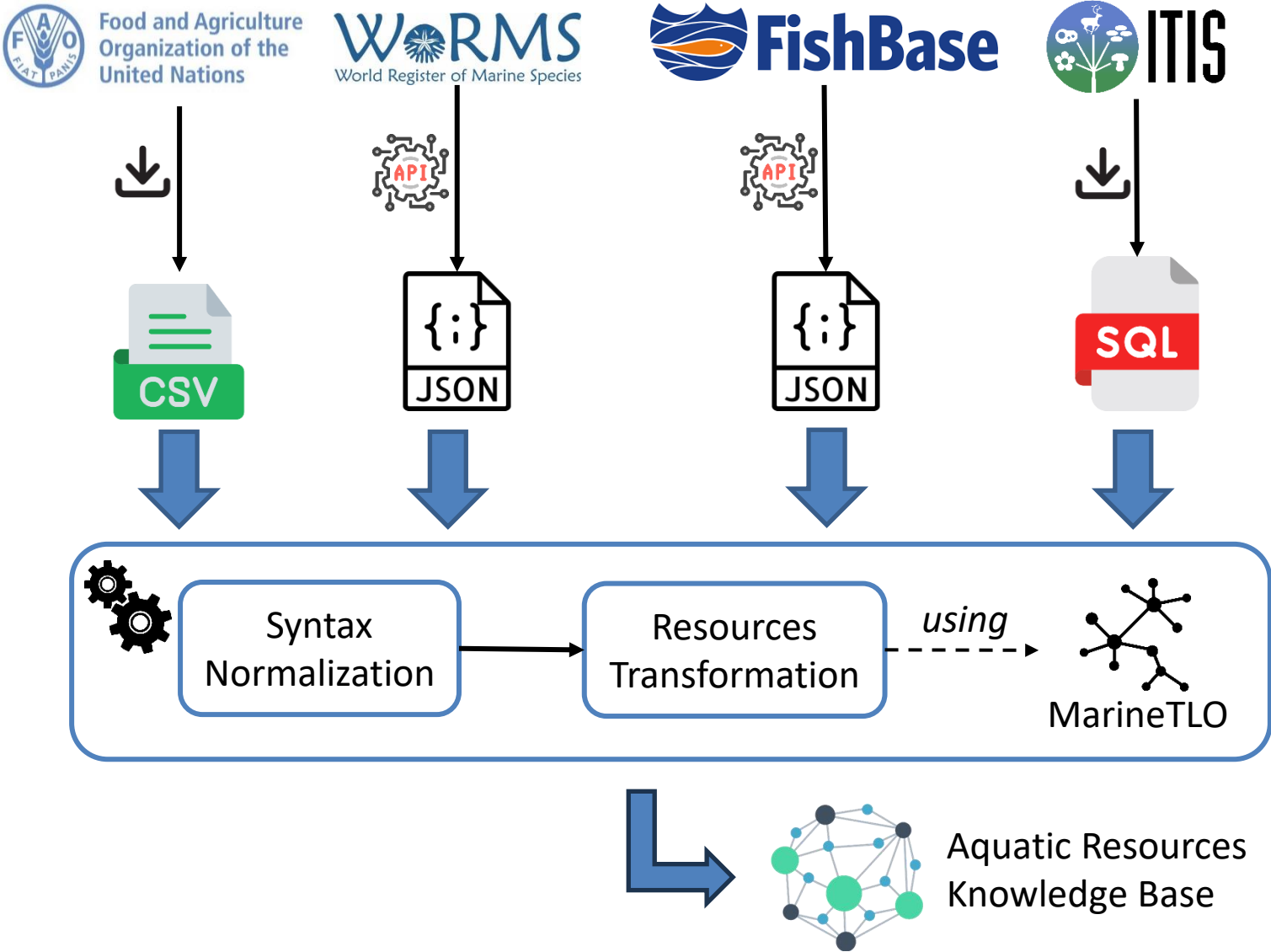
Scientific Names

Taxonomic information

+




Aquatic Species Knowledge Base – The process




Aquatic Resources Knowledge Base – Contents








MUT [FAO 3-Alpha code] 

126985 [APHIA ID] 

790 [FishBase ID] 

169419 [TSN ID] 

1704100702 [Tax. Code] 

Mullus barbatus
[Scientific Name]    

Red Mullet
[Common Name - EN]  

Triglia fi fango
[Common Name - IT] 

Koutsomoura
[Common Name - GR] 

羊魚
[Common Name - CN] 

Mullus
[Genus]  

Mullidae
[Family]  

Mulliformes
[Order] 

Teleostei
[Class] 

Chordata
[Phylum] 

Aquatic Resources Knowledge Base – Contents (cont'd)

- SPARQL endpoint

SPARQL Query Editor About Tables Conductor Permalink

Extensions: [cxml](#) [save to div](#) [sponge](#) [User: SPARQL](#)

Default Data Set Name (Graph IRI)

Query Text

```
PREFIX crm: <http://www.ics.forth.gr/isl/ontology/MarineTLO/>

SELECT ?aphia_id ?fishbase_id ?scientific_name
FROM <http://grsfVocabularies>
WHERE{
?spec a mtl0:BT27_Species. ?spec mtl0:LX4_has_appellation ?cname_uri. ?cname_uri rdfs:label "Red mullet" .

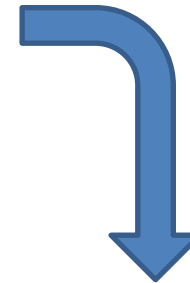
?spec mtl0:LX1_is_identified_by ?aphia_id_uri. ?aphia_id_uri rdfs:label ?aphia_id.
?aphia_id_uri mtl0:LX3_has_type ?aphia_id_type_uri . ?aphia_id_type_uri rdfs:label "APHIA ID".

?spec mtl0:LX1_is_identified_by ?fb_id_uri. ?fb_id_uri rdfs:label ?fishbase_id.
?fb_id_uri mtl0:LX3_has_type ?fb_id_type_uri . ?fb_id_type_uri rdfs:label "FishBase ID".

?spec mtl0:LX4_has_appellation ?scname_uri. ?scname_uri rdfs:label ?scientific_name.
?scname_uri mtl0:LX3_has_type ?scname_type_uri. ?scname_type_uri rdfs:label "scientific name".
}
```

Results Format HTML

[Execute Query](#) [Reset](#)



SPARQL | HTML5 table

| aphia_id | fishbase_id | scientific_name |
|----------|-------------|-------------------|
| "126985" | "790" | "Mullus barbatus" |

- [Web Application](#)

| ASFIS ID | APHIA ID | FishBase ID | TSN ID | Taxonomic Code | Scientific Name |
|----------|----------|-------------|--------|----------------|-----------------------|
| | | | | | Mullus × |
| MUX | | | | 17041007XX | Mullus spp |
| | 159418 | FB-1093 | 169417 | | Mullus auratus |
| MWU | 273661 | FB-14063 | 620934 | 1704100703 | Mullus argentinae |
| MUR | 126986 | FB-1327 | 169418 | 1704100701 | Mullus surmuletus |
| | 1525520 | FB-25966 | | | Mullus ponticus |
| MUT | 126985 | FB-790 | 169419 | 1704100702 | Mullus barbatus |

Aquatic Resources Knowledge Base – Contents (cont'd)

- **Species**




- FAO ASFIS list of species, WoRMS, FishBase, ITIS, **GBIF, IUCN Red List**

- **Water areas**

- FAO major fishing areas, LMEs, Marine Regions, GFCM geographical subareas, national jurisdictional areas, ISO3166 codes

- **Fishing gears**

- FAO International Standard Statistical Classification of Fishing Gear (ISSCFG)

| Resource Type | Size (during paper writing) | Size (now) |
|---|-----------------------------|------------|
|  Species | 40,564 | 378,913 |
|  Water areas | 3,316 | 3,304 |
|  Fishing Gears | 88 | 88 |

The Knowledge Base is actively used by the **Global Record of Stocks and Fisheries (GRSF)** for **harmonizing** and **updating** the collected information



Conclusion

- Process for the construction of a Knowledge Base for aquatic resources
- Can be used as a reference towards harmonizing fishery management resources
- Focus on species, water areas and fishing gears
 - Also applicable for other entities or resources (e.g. countries, management authorities, etc.)
- Future extensions:
 - Addition of more data sources
 - Focus on the automation of the construction process
- This work has received funding from the European Union's Horizon projects
 - **Blue-Cloud 2026** (Grant Agreement No 101094227)
 - **VeriFish** (Grant Agreement No 101156426)



Conclusion – Meet the Authors



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