IA301 COURSE : LOGICS AND SYMBOLIC AI

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Ontology project report

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1 Description and purpose of the designed ontology

As part of the IA301 course, one of the exam modalities is to do a project on ontologies. We have decided within the team to construct an ontology that helps solving a UN SDG (Sustainable Development Goal) problem [1]. While browsing the UN website, our choice landed on the goal number 14 also known as "life below water" displayed within the list of all 17 goals. For the purpose of the this project, we choose to limit our focus on the species living in French freshwater bodies (lakes, rivers, streams, etc).
Our Fish Ontology is an ontology created as a classification of freshwater fish in France following the Wikipedia page "List of freshwater fish in metropolitan France"[2] as the main reference, which covers the list of freshwater fish species in France, with an emphasis on fish characteristics and the level of endangerment of each specie.

On the UN website, we can find targets and indicators in the tab dedicated to goal 14. One of them is to effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible.
This ontology is created with the mindset of preserving the biodiversity of life underwater in France. By categorizing fish based on the attributes of the fish specimen, we are able to identify the species it belongs to, and then deduce its potential vulnerability. Finally and thanks to the inferred ontology, we can know if a given specie of fish is fishable [3] or not.

Our Fish Ontology contains 4 main classes : colors, endangerment, fish, location, and a total of 60 classes.
In order to distinguish between the different fish species, we created the class "colors" and the class "shape" which is a subclass of the class "fish". These 2 classes enable us to make a classification based on the attributes of the fish specimen. In order to be more thorough with this classification, we added the class "location" to specify the type of water bodies which constitute the natural habitat of each given specie.
The class "fish" is the most important one. It contains all the species handled in this ontology. To each and every specie, a level of threat is associated thanks to the class "endangerment". Therefore, when the ontology is given as an input a fish name and its characteristics it can infer the family to which it belongs and then deduce the level of danger of said fish to finally decide whether this particular fish is fishable or not.
In the next section, we describe in detail the hierarchy of the different classes, data properties and data objects in order to have a better grasp on the ontology design decisions.

[1] `https://sdgs.un.org/goals`

[2] `https://fr.wikipedia.org/wiki/Liste_des_poissons_d%27eau_douce_en_France_m%C3%A9tropolitaine`

[3] Able to be fished legally

2 Different screenshots of the ontology

The class hierarchy highlights the different classes mentioned previously. The class "endangerment" contains two sub-classes: levels and type. On one hand, the sub-class type defines the nature or the thing that is responsible of the endangerment of given species of fish. On the other hand, the sub-class levels allows us to know whether a given specie is fishable or not.

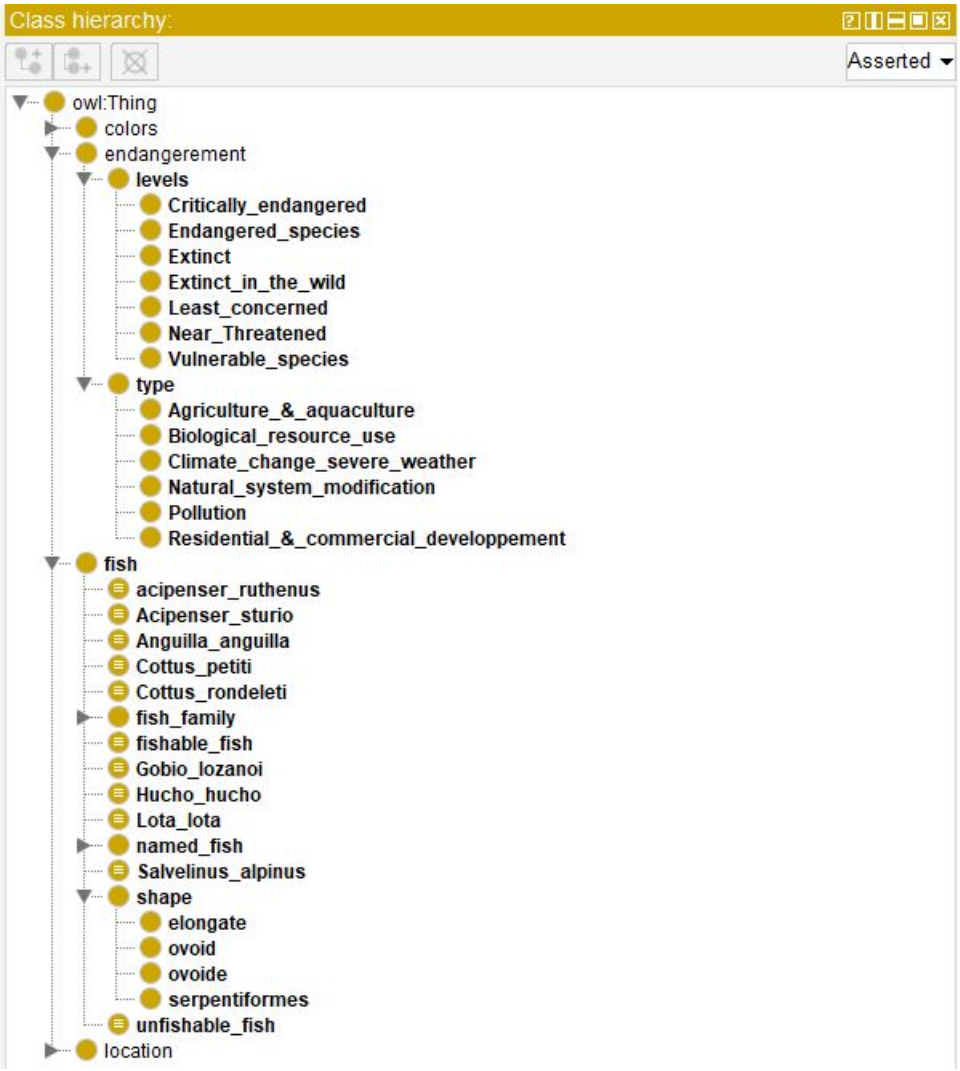


Figure 1: Ontology classes.

The figures 2 and 3 highlight the data property hierarchy and the object property hierarchy. The object properties allow us to define the fish attributes (color and shape), specify the source and level of a threat and describe its natural habitat.

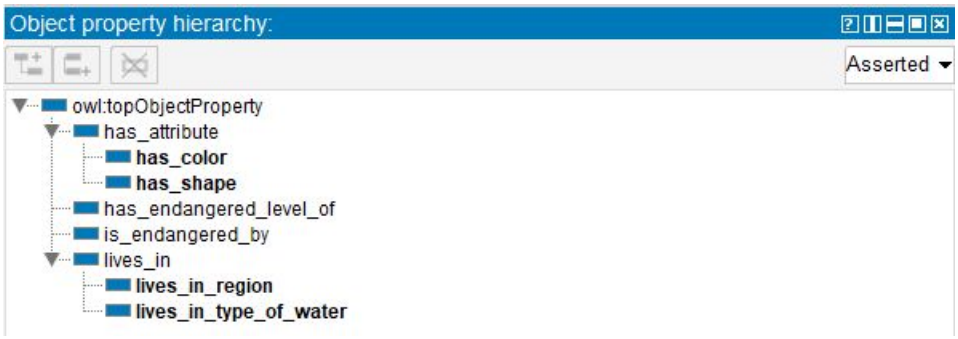


Figure 2: Objects property.

The data properties **has_length** and **has_width** are here to add more details while describing the fish attributes.

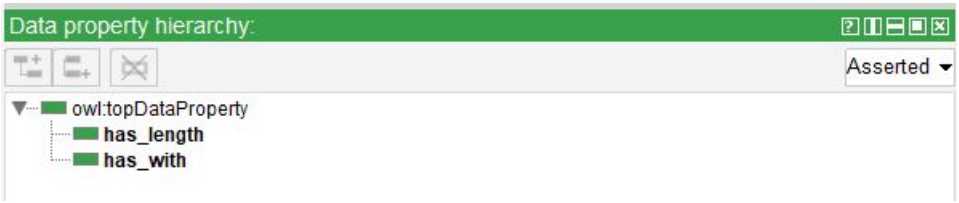


Figure 3: Data property.

The class "fish" before invoking the reasoner is illustrated in the figure 4.

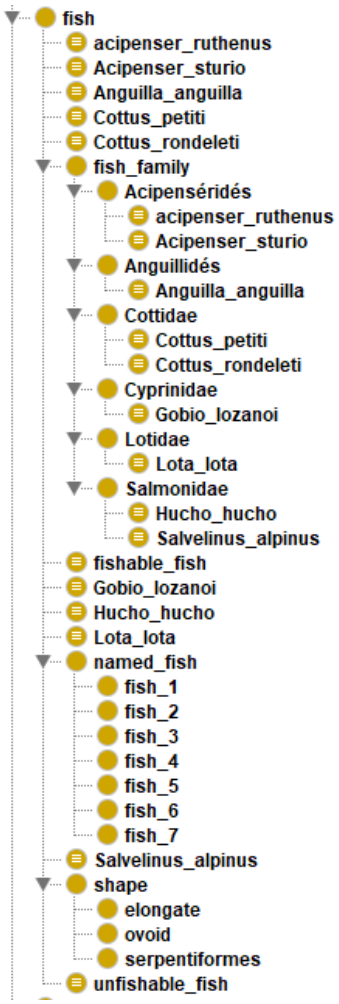
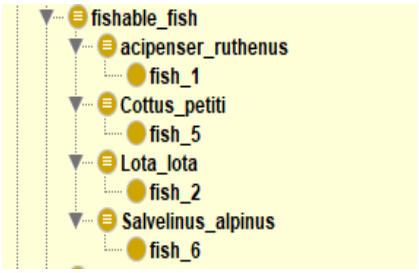
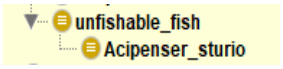


Figure 4: The class "fish" before invoking the reasoner.

The sub-classes "fishable" and "unfishable" after invoking the reasoner.



(a) The sub-class fishable



(b) The sub-class unfishable

Figure 5: Results after invoking the reasoner

An example of showing what has correctly changed (inferred) after running the reasoner for fish 6.

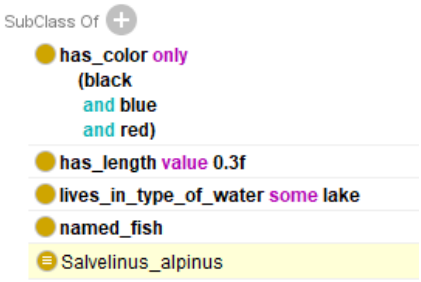


Figure 6: Fish 6 after the reasoner.

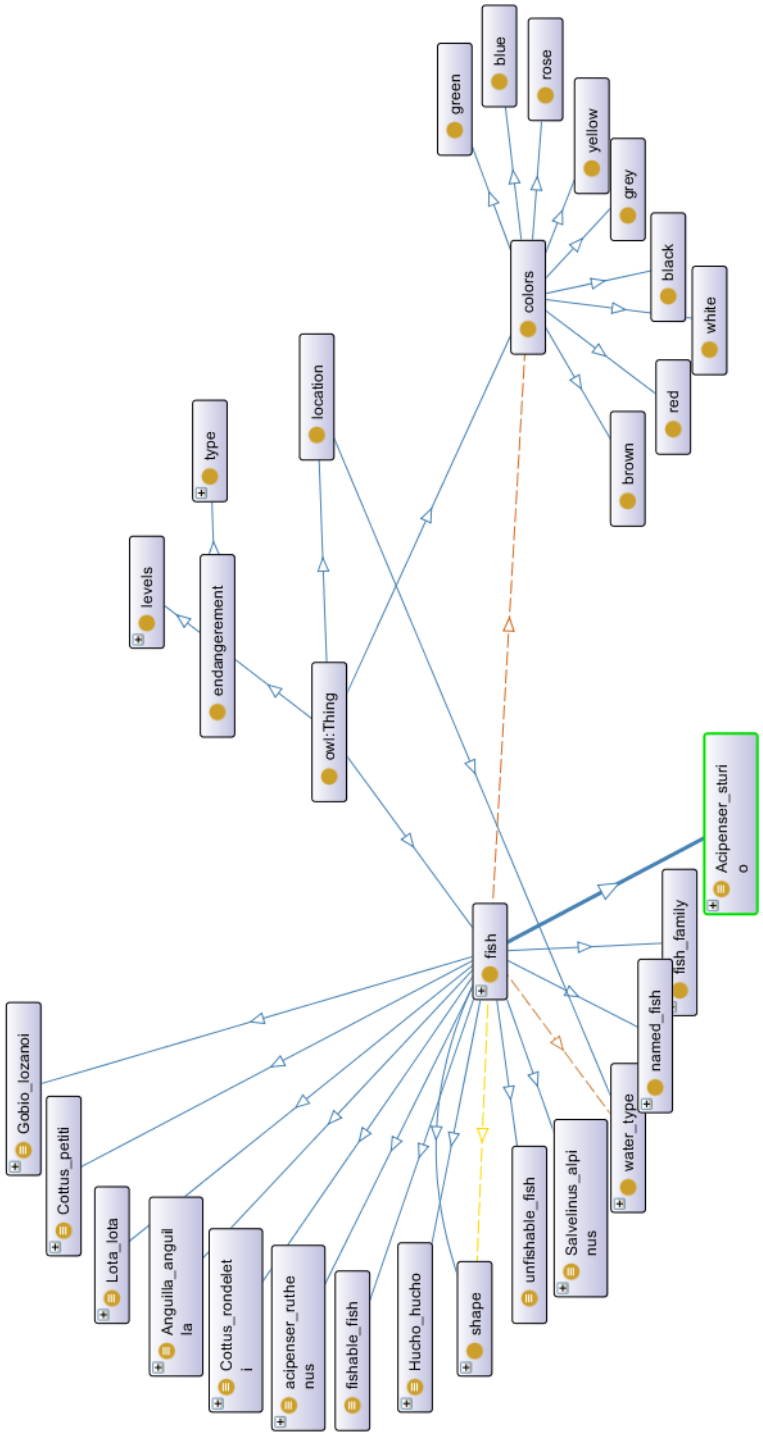


Figure 7: Full ontology graph.