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**NeOn: Lifecycle Support for Networked Ontologies**

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## **D7.1.1 WP7 User Requirements**

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## Executive Summary

This document describes the user requirements for the fisheries ontologies lifecycle, related knowledge tools and fisheries stock depletion alert system.

The document provides an overview of the Work package 7 (Chapter 1), and of the fisheries domain and data (Chapter 2). It introduces the Ontology-based Fisheries Stock Depletion Alert System components (Chapter 3), and the user requirements for: (a) the fisheries ontologies lifecycle (Chapter 4), and (b) the ontology driven Fisheries Stock Depletion Alert System (FSDAS) (Chapter 5).

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# 1 Introduction

The effective management of shared fish stocks is one of the great challenges facing the goal of achieving long-term sustainable fisheries.

The FAO Fisheries department has several information and knowledge organization systems to facilitate and secure the long-term, sustainable development and utilization of the world's fisheries and aquaculture. These systems are developed and maintained by different people, who interact with experts and users worldwide. Each system has its own community, which currently constitutes a separate knowledge collective.

FAO Fishery systems manage and disseminate statistical data on fishing, GIS data, information on aquaculture, geographic entities, description of fish stocks, etc. Although much of the data are 'structured', they are not necessarily interoperable. In addition, there are information resources that are not available through databases but as parts of websites, or as individual documents or images, etc. All, or even only some, of these data sources could be better exploited by bringing together related and relevant information, along with the use of the fishery ontologies, to provide inference-based services, enabling policy makers and national governments to make informed decisions.

The aim of NeOn - to create the first ever service-oriented, open infrastructure, and associated methodology to support the development lifecycle for a new generation of semantic applications - provides FAO Fishery systems with a great opportunity to develop an appropriate framework to manage the fishery ontologies and their lifecycles, as well as to implement a semantic fishery stock depletion alert system that exploits those ontologies.

## 1.1 Objectives of Work package 7

The ultimate goal of the case study in Work package 7 (WP7) is to make information on fishery stocks more accessible, and to provide adequate information to allow policy makers, at national and international level, to make informed decisions.

The major objectives of WP7 are to:

1. Improve the interoperability of FAO information systems in the fisheries domain by integrating and using networked ontologies and related methods and technologies.

Success indicators:

- a) Qualitative: current individual information systems will provide as a minimum the same functionality offered prior to integrating the ontologies.
  - b) Quantitative: increased number of Information Systems exploiting and sharing the fisheries networked ontologies.
  - c) Quantitative: increased number of KOS contributing to the networked ontologies.
2. Put mechanisms in place which will allow all actors involved in the process to create and maintain distributed ontologies (and ontology mappings), in the fishery knowledge community deploying NeOn

methodologies and technologies. These mechanisms need to include the creation and maintenance of data models, contents, relationships and mappings for ontology validity, integrity, versioning, modularization and relevance (as well as functionalities for ontology-learning), customized to the fisheries domain in order to ensure their continuous growth.

Success indicators:

- a) Qualitative: partial or total replacement of resource discovery functions currently provided by the Fisheries Reference Data Management System (RTMS).
  - b) Quantitative/qualitative: additional relationships and knowledge associations discovered and added to fisheries RTMS based KOS.
  - c) Quantitative: number of concepts, instances and relationships in the networked ontologies and their evolution in time.
  - d) Quantitative: staff involved in the ontology lifecycle can be instructed to apply the NeOn methodologies and use the NeOn toolkit during training course of limited length.
3. Design and implement ontologies in the fisheries domain that could become widely used standards and a reference for the fisheries community around the world. This objective is directly linked to the normative work on standardization of classifications for fisheries.

Success indicators:

- a) Qualitative: increased awareness and greater collaboration in the exchange of information through standards and semantics in the fisheries domain.
- b) Qualitative: enhanced accessibility to data and multilingual information on fisheries to and from non-FAO resources.

4. Exploit ontologies within web applications, and develop an alert system.

Success indicators:

- a) Qualitative: improvement in the modelling of the fisheries knowledge collective, and facilitation of reusability of 'parts' of ontologies within maximal fishery knowledge collective.
- b) Qualitative: improved assessment and monitoring of fisheries stocks in FAO member countries.
- c) Quantitative: increased number of non-FAO resources accessed through the use of the FI ontologies.
- d) Qualitative: increased sharing and reuse of data and knowledge among different web applications in the fisheries domain.

These major objectives are in line with the NeOn project vision, where ontologies will be networked, dynamic, shared and contextualized.

## 1.2 Scope of Work package 7

NeOn will be organized around various feedback cycles involving the:

- initial development of methods and tools, and collection of feedback from the case studies;
- improvement of methods and tools based on feedback; and
- collection through a second round of feedback from previous improvements, applied to finding better case study solutions.

WP7 is a case study intended to implement, test and demonstrate the effectiveness of NeOn methodologies and infrastructure (toolkit and open APIs), within the fisheries sector. For this purpose, WP7 will develop an Ontology-based Fishery Stock Depletion Alert System (FSDAS), to exploit large volumes of data and multilingual information sets available in the fishery domain.

Figure 1 provides an overview of the interaction between the different NeOn work packages. WP7 will directly interact with WP5 and WP6 by using their methodologies and tools; it will also interact with the research and development work packages, WP1-WP4, by providing them with requirements and feedback.

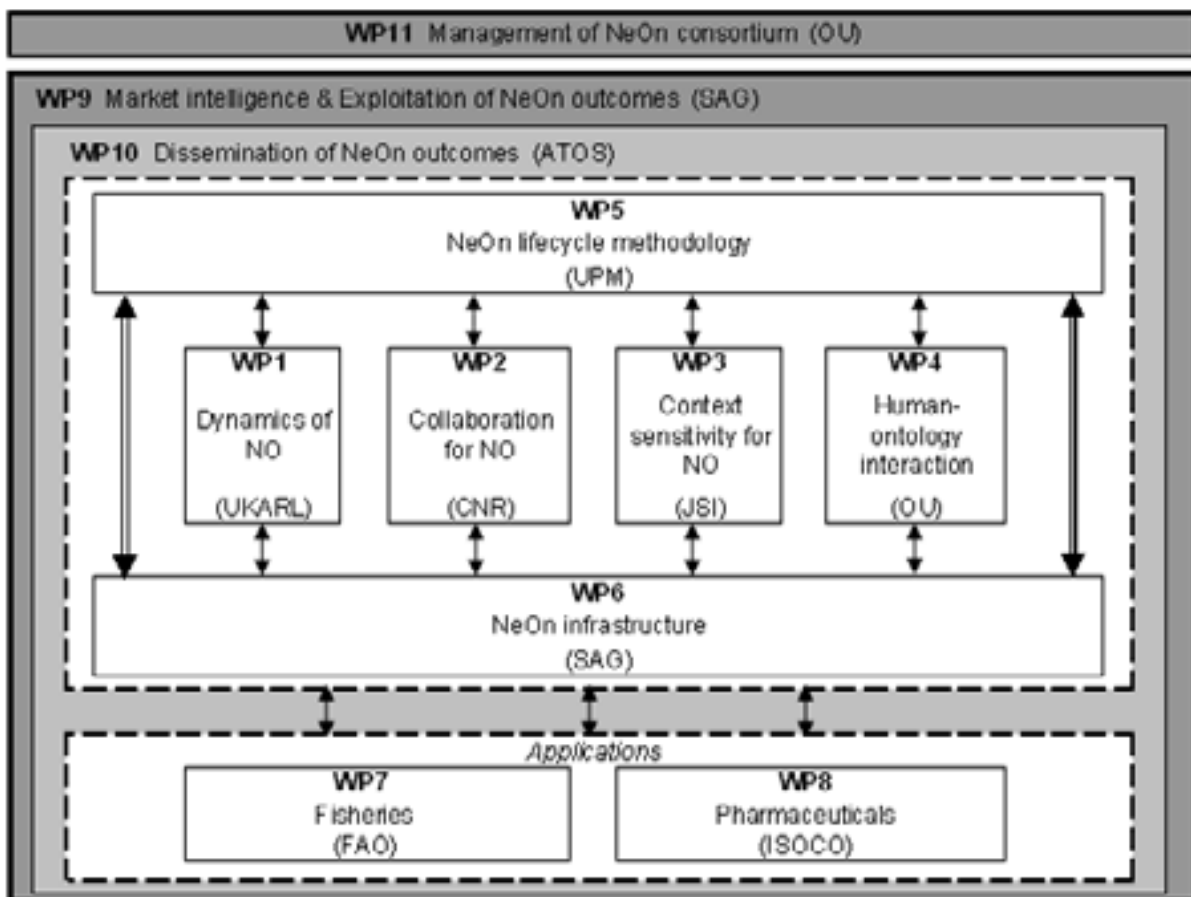


Figure 1 - Dynamics of the NeOn work packages

The FSDAS, developed in WP7, will be a component-based system exploiting networked ontologies in the fisheries domain and relying on a number of reusable components provided by other NeOn WPs.

The scope of WP7 is to:

- gather, analyze and consolidate requirements for the fisheries ontologies lifecycle and alert system (including use cases and scenarios), liaising with user groups of fisheries experts and information systems managers; and
- analyze the current fishery ontology (see Annex I) versus the “NeOn vision”, and further develop and implement a set of networked ontologies suited to the fisheries domain and contexts.

These ontologies will be built on the basis of NeOn methodologies (WP5), using fisheries data, metadata, reference data, reference metadata and data schemas together with the knowledge of fisheries experts. Ontologies will be improved through the feedback cycles described above and by incorporating the results and findings of research and development work packages (WP1-WP4).

- carry out experiments on ontology learning from text corpora, using text/data mining tools and other methods in order to keep the ontologies up-to-date;
- develop an appropriate business layer and APIs, customizing the NeOn toolkit to the fisheries domain, in order to manage the ontologies lifecycle and ensure linkages with other services sharing the ontologies: RTMS, Agricultural Ontology Service (AOS) based on AGROVOC, ASFA thesaurus/ontology, etc.;

WP7 will provide requirements for the NeOn toolkit, customized to the fisheries domain. The requirements will be implemented by WP6. WP7 will also test and customize the NeOn tools and APIs and will provide feedback and refinement on the requirements as needed;

- design, test and implement a business layer and APIs to exploit the ontologies via the alert system. This would also include a set of APIs for the presentation layer support (browsing, visualization, etc), where input and feedback from other WPs will be required in order to allow different types of user interaction with the case study application and ontologies.

### 1.3 Deliverables of Work package 7

The major deliverables of WP7 are:

- D7.1.1 User requirements specifications for the fishery ontologies lifecycle, knowledge tools and alert system (Report/Restricted)

The user specifications report will identify the different communities of users for the fishery ontologies, knowledge extraction and management tools, and web-based alert system. Detailed use cases, and success criteria benchmark will be included.

- D7.2.1. Inventory of the Fisheries Resources and Systems (Report/Restricted)

The inventory needs to include the relevant Knowledge Organization Systems, Information Systems and databases that will be exploited in the context of the fishery ontology and alert system.

- D7.3.1. Revised and enhanced fisheries ontologies (Prototype, Report/Public)

The fishery ontologies will be created, updated and maintained using the NeOn methodologies and technologies; the focus will be on their modularity, and annotations will be used to facilitate reusability of ‘parts’ of ontologies within a maximal fishery knowledge collective.

- D7.4. Web based Ontology-driven Stock depletion alert system. v1 and v2 (Prototype, Report/Public)

- D7.5. Evaluation report about the prototype alert system (v1, v2). This will include recommendations to research for other work packages. (Report/Public)

## 1.4 Overview of Deliverable 7.1.1

The document “Deliverable D.7.1.1” provides the user requirements for the fisheries ontologies lifecycle, related knowledge tools and stock depletion alert system.

The rest of this document is organized as follows:

Chapter 2, “The fisheries domain and data”, provides an overview of the fisheries domain and the diversity of types of information users and providers (biologists, economists, engineers, etc). It introduces concepts for fish stocks, and related factors and indicators. It also provides an initial list of fishery resources to feed into the ontologies or to be exploited by the alert system.

Chapter 3, “Overview of the Ontology-based FSDAS”, presents the high-level components of the FSDAS, including ontologies, resources, tools, and the alert system itself. Chapter 3 also highlights the dependence of FSDAS on the availability of methodologies, models, tools and services, provided by or developed together with other NeOn partners.

Chapter 4, “Fishery ontology lifecycle requirements”, represents the core of this document, since it details the problems and user requirements that need to be addressed in order for life-size distributed ontologies to be created, maintained and used by people and web applications. It specifies three user groups involved in the ontologies lifecycle; it gives user requirements for each group, and provides a set of use cases to illustrate the major functions to be made available during the lifecycle. Finally, it provides the software requirements for the fishery ontology lifecycle.

Chapter 5, “FSDAS requirements”, provides an overview of the FSDAS system, gives its user requirements, describe a set of important use cases, and the relevant software requirements.

## 2 The Fisheries domain and data

Although at first glance the fisheries domain might seem to be mostly about tattooed sailors hauling nets over the gunwale, it is in reality a knowledge domain that cuts a swath across a very wide variety of disciplines. Biologists, oceanographers and ecologists study species and their environments while food safety experts examine health effects. Engineers concern themselves with vessels, gear and fishing techniques while managers study fishing sectors as they seek to balance the competing interests of industrial, commercial and artisan fishers. Economists study production, commodities and trade while sociologists look at the impact that changes can have on fishery communities. As resources dwindle, legal issues at national, regional and global level become increasingly prominent, and the brokering of treaties and their enforcement is of ever greater importance for sustained conservation of fishery resources.

Looking at this situation from an information management perspective, the information systems currently available are often not sufficiently integrated. The variety of data sources and provenance, the mixture of disciplines and expertise involved in the process of data collection and analysis, the wide geographic areas covered by FAO, all play a role. There are a number of encouraging initiatives taking place, from the continuation of long-running, standards-setting bodies such as the Coordinating Working Party on Fisheries Statistics<sup>1</sup> (CWP), to the focus on common schemas by groups such as the Ocean Bio-geographic Information System<sup>2</sup> (OBIS) Movements towards representing fisheries in the semantic web have also begun, as evidenced by FAO's work in agricultural ontologies, of which fishery ontologies are but only one aspect<sup>3</sup>.

Though there is evidence of some cross-disciplinary information systems such as FIGIS<sup>4</sup>, efforts are often hampered by the lack of global schemas, legacy systems and undocumented APIs. Indeed, WP7, beyond creating an ontologically-based decision support system for fisheries stocks, will hopefully provide the semantics and tools necessary for wider integration of fisheries information systems.

### 2.1 About fish stocks

A fish stock is a group of individuals in a species occupying a well defined spatial range, independent of other stocks of the same species. Random dispersal and directed migrations due to seasonal or reproductive activity can occur. A stock can be regarded as an entity for management or assessment purposes. Some species form a single stock (e.g. southern bluefin tuna) while others are composed of several stocks (e.g. albacore tuna in the Pacific Ocean comprises separate Northern and Southern stocks). The impact of fishing on a species cannot be determined without knowledge of this stock structure. (Definition taken from [FI-GLOS])

Managing the world's fish stocks is a major challenge, both now and in the future. If the FSDAS is successful, it will contribute towards, or even show the way to keeping track of fisheries across the world by taking information from a wide variety of sources and providing decision-makers with rapid, real-time information. Fish currently provide at least 20 percent of the animal protein needs of over 2.5 billion people in the world, but some fish stocks are being rapidly reduced due to over-fishing, poor fishing practices, and

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<sup>1</sup> <http://www.cwpnet.org>

<sup>2</sup> <http://www.iobis.org>.

<sup>3</sup> <http://www.fao.org/DOCREP/MEETING/005/AC493E.HTM>

<sup>4</sup> <http://www.fao.org/fi/figis>

environmental degradation. Through an alert system, FAO can assist member countries in monitoring fisheries and levels of fish stocks, as well as implementing strategies for improving information on status and trends of capture in the world's fishing areas.<sup>5</sup>

FAO collects fish stocks statistics from its member countries on a regular basis. However, these statistics are often incomplete or not provided as frequently as needed. Additional information about factors affecting fish stock abundance, or revealing risk levels of resources under stress (see Table 1) is, nonetheless, available on the FAO website, and that of other organizations and institutions.

- Factors affecting fish stocks abundance:
  - more fishing effort: fleet movements, technological improvements;
  - natural environment: oceanographic changes, species introduction, disasters, pollution;
  - socio-economic environment: market trends, subsidies, management and enforcement measures
- Factors revealing risk of resource under stress:
  - reduced catches or Basic Catch Per Unit Effort (CPUE), reduced biodiversity, reduced size of fish,
  - increased duration of fishing trips.

**Figure 2- Major factors affecting fish stock abundance and revealing risk of resources under stress**

In aquatic sciences, all these factors and indicators can be integrated into mathematical models in order to assess the state and trends of fish stocks. However, these advanced mechanisms are reserved mostly for important commercial stocks, and/or for fish resources of developed countries. At a worldwide level, most fishery resources are not properly assessed.

Nevertheless, there are a lot of documents and databases providing information on single factors influencing or reflecting over-fishing, but often comparisons between information sources are not made, and conclusions not drawn.

By integrating these scattered sources of information, and identifying co-occurrence of risk factors in the same fish stock, a network of shared fishery ontologies would be able to detect probabilities of over-fishing. The fishery ontologies would therefore assist in replacing or complementing the quantitative assessment models with qualitative approaches. In addition, it would provide direct access to highly relevant source documentation (where these factors are described), to experts in charge of monitoring. The natural starting point for these fishery ontologies lies in the highly structured FAO documents and the FAO information systems. See Fig. 2 below for an overview of current fisheries data and information exchange among FAO and non-FAO systems.

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<sup>5</sup> <http://www.fao.org/newsroom/en/news/2006/1000251/index.html>

## 2.2 Fisheries data and information resources

For the purpose of the ontology-based FSDAS some systems have already been identified as crucial to feed into the fisheries ontologies. Work on completing the inventory of resources is on-going and will be included in deliverable D7.2.1 of this WP.

### 2.2.1 Resources owned by FAO

#### FAO Fisheries Global Information System (FIGIS)

(<http://www.fao.org/figis/servlet/static?dom=root&xml=index.xml>): is a 3-tier web application serving statistics and XML based fact sheets and maps. It is also a suite of software tools and information standards enabling the implementation of a truly distributed architecture: FIGIS disseminates data assembled from various systems sharing common information standards. FIGIS is a multiple domain, with multiple information types powering different websites. Its design is articulated around a core Reference Table Management System (RTMS), and each data domain is modelled by a schema. It powers the Fishery Resources Monitoring System, and provided the source of the prototype ontology (FOS) described in Annex I.

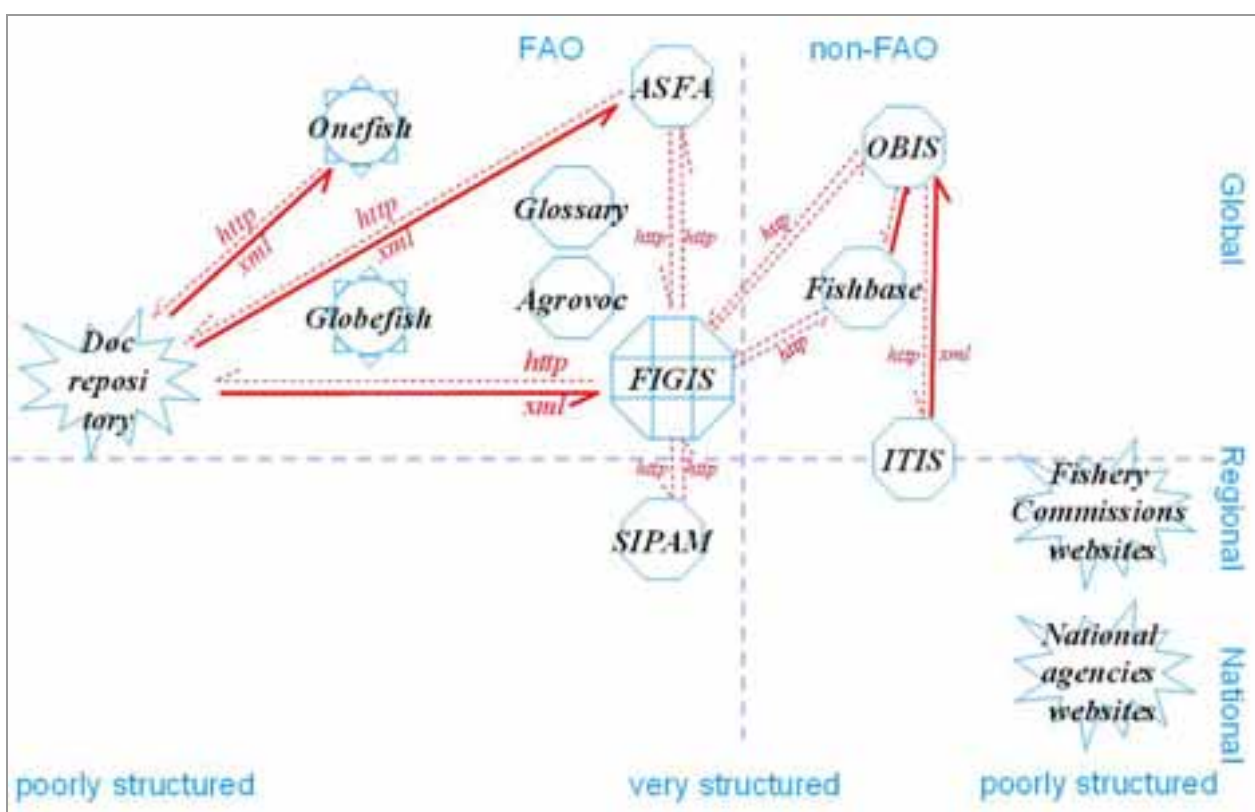


Figure 3 - Current fisheries data and information exchange<sup>6</sup>.

Areas of particular interest within FIGIS:

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<sup>6</sup> Octagons symbolize highly structured resources, while star-shaped clouds symbolize non-highly structured resources. Dotted lines represents the protocol used for information exchange to and from FIGIS, while the solid lines the format exchanged.



- **Reference Table Management System (RTMS)** (<http://www.fao.org/figis/servlet/RefServlet>): - the backbone of the system, the RTMS contains downloadable lists of all classification systems and hierarchies used to deliver statistics, and most available fact sheets.
- **Fishery resources monitoring system (FIRMS)** (<http://firms.fao.org>): a global monitoring system, which provides access to a wide range of high quality information on the status, and trends of marine fishery resources, including their management. FIRMS brings together a partnership of international organizations, regional fishery bodies and, in the future, national scientific institutes, collaborating under a formal agreement to report and share information on fisheries resources. FIRMS is powered by FIGIS, and its information structure is articulated around a worldwide inventory of fishery resources. With its worldwide partnership, authoritative inventory, and policy of traceability towards source information, FIRMS (and in a near future its sister site, Fishcode-STF) is considered the primary candidate for providing the central anchor of FSDAS.
- **Electronic Information Management System (EIMS)**  
(<http://www.fao.org/figis/servlet/static?dom=root&xml=refer/pubsearch.xml>) - EIMS contains metadata records of fisheries publications (configurable to return Dublin Core-compliant XML records)
- **News and Events Management System (NEMS)**
- (<http://www.fao.org/figis/servlet/static?dom=root&xml=refer/nemssearch.xml>) - Fisheries News and events (configurable to return an RSS stream)
- **FAOLEX**
- (<http://www.fao.org/figis/servlet/static?dom=root&xml=legalframework/faolexsearch.xml>) - Search Fisheries legal texts (can return proprietary XML)
- **FIGIS Search** (<http://www.fao.org/figis/servlet/static?dom=root&xml=fssearch/index.xml>) - FIGIS search engine (is currently being configured to return Dublin Core-compliant XML)
- **FIGIS/RDF**  
(<http://www.fao.org/figis/servlet/FiRefServlet?ds=staticXML&xml=webapps/figis/reftables/format/refobject.xml&xsl=webapps/figis/reftables/format/selectRefObj.xslt>) – (a service that returns RDF XML of reference data instances)

**Globefish** (<http://www.globefish.org/index.php?id=481&easysitestatid=-277727447Globefish>): a database for trade and markets of fish products, based on a time series and news of fish products, fed by an information network. It contains unstructured fisheries commodities data.

**Fisheries glossary** (<http://www.fao.org/fi/glossary/default.asp>): contains illustrated definitions of technical terms used for fisheries management purposes.

**Aquaculture glossary** (<http://www.fao.org/fi/glossary/aquaculture>): multilingual, multidisciplinary glossary containing more than 2,900 terms, definitions, related terms, synonyms and images used in the aquaculture sector.

**AGROVOC** ([http://www.fao.org/aims/ag\\_intro.html](http://www.fao.org/aims/ag_intro.html)): FAO's agricultural thesaurus developed together with the Commission of the European Communities in the early 1980s, and used primarily for document indexing and retrieval. AGROVOC contains approximately 2,000 fishery related descriptors out of about 16,000 descriptors. Additional details are provided in the Sec. 2.4.2 below.

**Aquatic Sciences Fisheries Abstracts (ASFA)** (<http://www4.fao.org/asfa/asfa.htm>): a database of bibliographic references and related abstracts in the field of aquatic sciences, fed by an information network. It supports an abstracting and indexing service covering the world's literature on the science, technology, management, and conservation of aquatic resources and environments, including their socio-economic and

legal aspects. It consists of more than 6,000 descriptors. Additional details are provided in the section regarding thesauri below.

**FAO Corporate Document Repository** ( <http://www.fao.org/documents/> ): provides free access to more than 20,000 FAO publications, meeting documents and research papers, in full-text HTML.

**Information System for the Promotion of Aquaculture in the Mediterranean** (<http://www.faosipam.org/>): a repository of statistical data, reports, laws and regulations about aquaculture in Europe.

## 2.2.2 Non-FAO resources in which FAO participates

**Fishbase** (<http://www.fishbase.org/home.htm> ): structured data on fish species.

**Onefish** (<http://www.onefish.org/global/index.jsp> ): XML-based Content management system based on a structured set of fisheries topics

**Oceans Atlas** (<http://www.oceansatlas.org/Oceans Atlas> ): XML-based Content management system based on a structured and comprehensive set of topics relevant to the world's oceans (transport, oceanography, tourism, geology, meteorology, fisheries, law of the sea, etc).

## 2.2.3 Other non-FAO resources of interest

**Ocean Biogeographic Information System** (OBIS - <http://www.iobis.org/>): OBIS is a web-based provider of global geo-referenced information on marine species. Thanks to web-based protocols, it dynamically gathers Lat-Long x taxonomic information from OBIS partner agencies (Fishbase, research institutes, museums), and disseminates the map once constructed.

**Integrated Taxonomic information System** (ITIS - <http://www.itis.usda.gov/>): contains taxonomic information on plants, animals, fungi, and microbes of North America and the world. ITIS is a [partnership](#) of U.S., [Canadian](#), and [Mexican](#) agencies ([ITIS-North America](#)), other organizations, and taxonomic specialists.

**FIRMS partners' web sites**: these regional level web sites, rich in fish stock assessment and fisheries information, can be accessed through the FIRMS website. Source documents to the FIRMS Marine resources fact sheets are available from these web sites [http://firms.fao.org/figis/servlet/static?xml=FIRMS\\_org.xml&dom=org&xp\\_nav=2,3&xp\\_inav=](http://firms.fao.org/figis/servlet/static?xml=FIRMS_org.xml&dom=org&xp_nav=2,3&xp_inav=)

National fishery research institute web sites: many such web sites are eligible within the scope of FSDAS. These will be carefully selected during the inventory phase of Work package 7.

## 2.3 RTMS managed taxonomies

The RTMS is the central storage system for reference data for the Fisheries Department. Maintained by the statistical unit (FIDI), it is a key system and is accessed by a galaxy of applications. All Fisheries department statistics, whether delivered on the web or within the Fishstat+ application, use the RTMS to build their time-series. The FIGIS system also relies on the RTMS to serve its XML fact sheets, each of which is associated with an entry in the RTMS. Searches within FIGIS access the RTMS to look for reference objects meeting queries. GIS mapping services also use the RTMS to make correlations between Fisheries department geographic entities, and GIS polygons in order to build maps using the FAO KIMS/KIDS mapping service, to display the geographic locations of fish populations.

Another set of Java-based business services relies on the RTMS to create statistical query pages by reading the RTMS, extracting reference data, converting it to XML, and displaying it to the end user via XSL. It is envisioned to replace this system with ontologies and the NeOn toolkit. The most likely approach would be to

maintain the external RTMS API for applications that use it to retrieve reference data, while on the inside using the NeOn services to extract the reference data from the ontologies.

The RTMS maintains and delivers data on classification systems, taxonomies and hierarchies and associated filters on the following subject areas: Land areas, Water areas, Biological entities, Fishery commodities, Vessel size categories, Fishing techniques, Keywords, Stock objects, Data sources, User defined areas, Fishery objects, Fisheries and Aquaculture Issues, Introduced Species, Country Profiles, GIS Bibliography and Data Collections.

## 2.4 Agriculture and Fisheries thesaurus

### 2.4.1 ASFA

The Aquatic Sciences and Fisheries Abstracts thesaurus (ASFA) provides a standard set of terms with which to describe the subject area covering the world's literature on science, technology, management and conservation of marine, brackish water, and freshwater resources and environments, including their socio-economic and legal aspects. When applied to the indexing of a database, it indicates to a searcher which terms to use to retrieve the maximum number of relevant documents.

The thesaurus terms are also used by indexers to describe the contents of publications in a consistent, comprehensive and concise manner. These terms are defined as Descriptors, because they describe the main topics of an article. The use of a thesaurus can greatly improve user searches by allowing them to quickly find approved terms for the topic of interest.

The thesaurus can be browsed for terms hierarchically, alphabetically, or by rotated index.

Each term may be followed by<sup>7</sup>:

- **Notes:** comments providing additional information about the term, e.g. definitions and usage history.
- **Broader Terms and Narrower Terms:** labels reflecting the hierarchical nature of the descriptors, e.g. DISEASES is a broader term, relative to FISH DISEASES.
- **Related Terms:** non-hierarchical relations that direct the users to alternative descriptors in the event that the initial term is conceptually inappropriate, or there is a need to broaden the search.
- **USE FOR Terms:** non-descriptor terms for which the main term should be used instead. USE FOR and USE terms always go together and this relationship is used in a variety of situations, such as when to use synonyms or near synonyms, e.g. USE Artificial Lakes FOR Man-made lakes.

Taxonomic terms are also included as descriptors: these are used to search for information about a species. Names are in the Latin systematic form: 'Salmo salar' for 'Atlantic salmon'.

Currently ASFA contains more than 20,000 English terms. It has recently been enriched and converted to OWL (Web Ontology Language) [OWL]: the conversion is meant to render the thesaurus more semantically expressive, by adding formal semantics to the relationships used in a traditional thesaurus.

### 2.4.2 AGROVOC

AGROVOC ( [http://www.fao.org/aims/ag\\_intro.html](http://www.fao.org/aims/ag_intro.html) ) is a multilingual structured and controlled vocabulary designed to cover the terminology of all subject fields in agriculture, forestry, fisheries, food and related domains (e.g. the environment). It is a thesaurus, i.e. a controlled set of words or expressions (terms), in different languages and organized in relationships (e.g. "broader term" or BT, "narrower term" or NT, "related term" or RT), used to identify or search resources. As a traditional thesaurus, AGROVOC is mainly used for

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<sup>7</sup> <http://www.csa1.co.uk/factsheets/supplements/asfathes.php>

indexing and retrieving data in agricultural information systems both inside and outside FAO. Its main role is to standardize the indexing process in order to make searching simpler and more efficient, and to provide the user with the most relevant resources.

The AGROVOC Thesaurus was developed by FAO and the Commission of the European Communities in the early 1980s. Since then it has been updated continuously by FAO. It is now available in the five FAO official languages, namely: English, French, Spanish, Chinese and Arabic, as well as in Czech, Portuguese, Japanese, Thai, Slovak and Lao. Other languages such as German, Italian, Korean, Hungarian, are currently under translation and revision.

AGROVOC terms are divided into descriptors and non-descriptors (mainly synonyms or acronyms); totalling around 35,000 terms per language. Descriptors are indexing terms which consist of one or more words representing always one and the same concept. Non-descriptors are terms which help the user to find the appropriate descriptor(s). Terms used as descriptors are marked as “use” or USE, while the associated non-descriptors are marked as “use for” or UF. For indexing purposes, it is important that only descriptor terms are used. Descriptors are linked by the usual hierarchical (BT, NT) and non-hierarchical relations (RT). Scope notes are also used in AGROVOC to clarify the meaning of both descriptors and non-descriptors.

Until recently AGROVOC was updated on a yearly basis. The decision has now been taken to provide updates on a periodic basis - on average every three months. AGROVOC users are encouraged to propose terms for inclusion in the database. Their suitability for inclusion in the thesaurus is then assessed by the AGROVOC team in FAO.

AGROVOC is the foundation that underpins the development of the Agricultural Ontology Service<sup>8</sup> (AOS) initiative. By making use of knowledge contained in vocabulary systems and thesauri such as AGROVOC, AOS is committed to developing specialized domain-specific terminologies and concepts, organized in ontologies that will better support information management for the web environment.

FAO is currently working on the development of the backbone system and the tools to support AOS: more semantics will be added in AGROVOC in order to create a *Concept Server* [LAU06]. Tools for distributed and collaborative maintenance of the Concept Server are going to be developed, in order to support multilingual representation of agricultural concepts.

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<sup>8</sup> <http://www.fao.org/aims/>

### 3 Overview of the Ontology-based FSDAS

The FSDAS will be an ontology-driven decision support system for fisheries managers, policy makers and researchers. It will be a web-based intelligent agent that uses networked ontologies consisting of various fisheries, taxonomic, and geographical ontologies, together with their mappings and contexts, to aid users in discovering resources and relationships related to stock depletion.

Fisheries ontologies, which bring together concepts from a number of existing knowledge organization systems, will help to improve language-independent extraction and the discovery of information. Their development in the NeOn context will allow for managing the complexity of fishery knowledge communities, their meaning negotiation and their deployment by worldwide authorities.

These objectives imply addressing the issue of information exchange in a networked environment. The solution is to use integrated, agreed-upon ontologies, which can be maintained and improved over time. These ontologies, will allow for the creation of intelligent ontology-based multilingual systems using distributed and disaggregated information resources.

Some of the functionalities the alert-system will provide are: a search environment, user customization based on user knowledge level, user specification of updates (e.g. email notifications or RSS feeds) and alerts based on countries or species.

Figure 3 below provides a high-level depiction of the Ontology-based FSDAS architecture, including the major components required to enrich and keep ontologies updated.

The system described in this chapter relies on a group of components, some of which have associated user interfaces. Some components will be built by WP7 while others will be provided by NeOn partners and, if needed, adapted/customized by WP7.

The ontology-driven FSDAS will comprise the FSDAS user interface, a network of ontologies, and a number of web services extending the NeOn toolkit infrastructure.

End users will experience FSDAS as a browsable and queryable web application that returns organized, ranked, quality-rated, linked results that can be used to make decisions about the state and trends of various fish stocks. Fisheries resources will be exploited by ontologies to return time-series statistics on capture, production, commodities and fleets by stock, together with direct links to related documents, web pages, news items, images and multi-media.

The user interface will support query refinement, assistance on query formulation (of the type Google suggests”), and multilingualism (FAO official languages: Arabic, Chinese, English, French and Spanish).

Users will be able to perform browse-based and query-based searches on single ontologies or on union, intersection or complement of more than one ontology. They will also be able to navigate the associated data instances.

To the extent possible, the FSDAS will directly introduce and/or combine resources into the web page to create dynamic, synthetic views of the state of fish stocks. Users will be able to query and filter results based on their user profile.

Details on the FSDAS user requirements and functionalities are provided in Chapter 5 of this document.

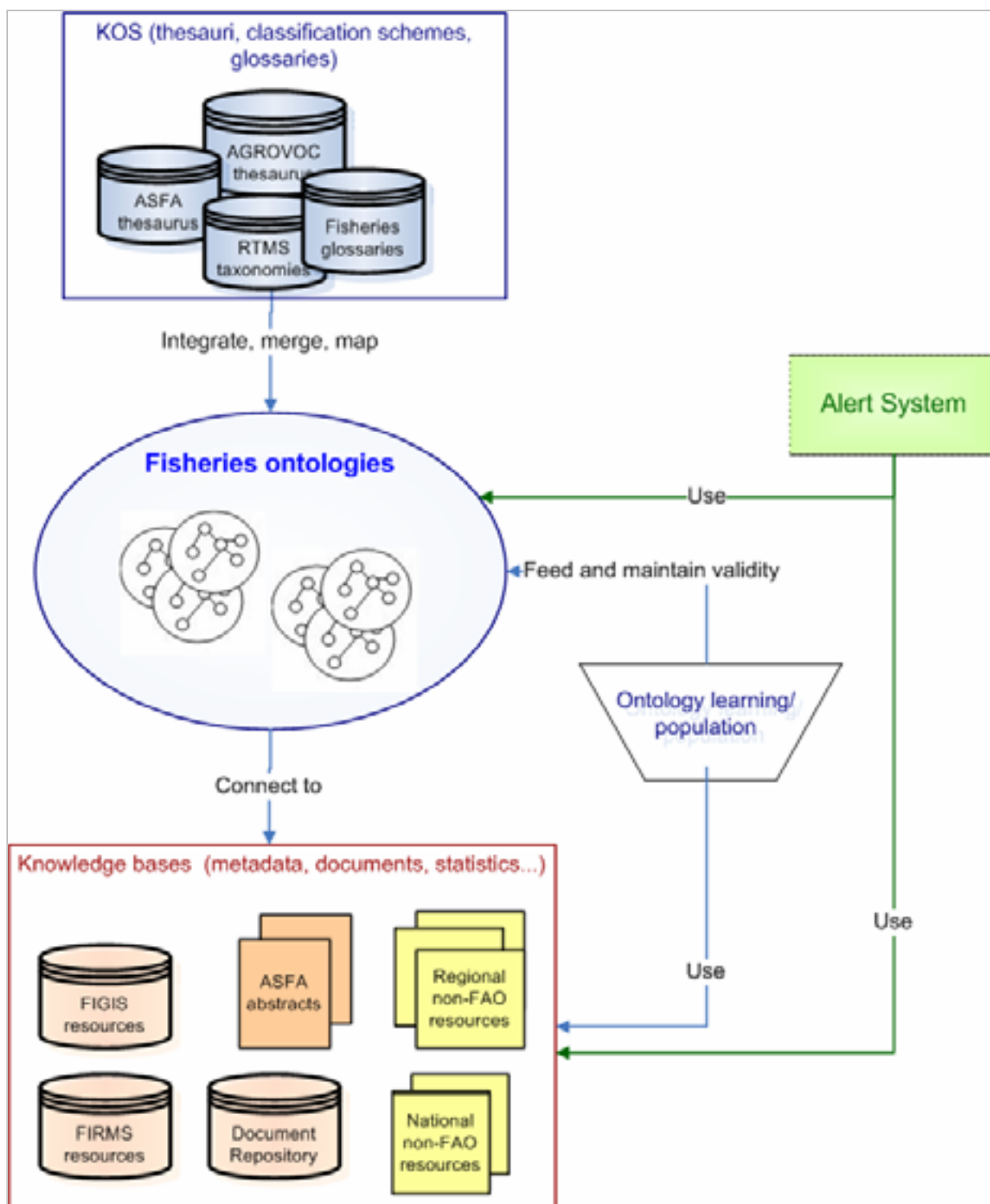


Figure 4 – Overview of the ontology-driven FSDAS

### 3.1 Product Perspective

The successful implementation of the alert-system depends on methodologies, models, tools and services provided by, or developed together, with other NeOn partners.

Whilst the implementation of the FSDAS system will require the development of a web application re-using or customizing as much as possible NeOn toolkit components and services, it is envisaged that the whole lifecycle support for the Fisheries distributed ontologies will rely on the NeOn toolkit and infrastructure.

#### 3.1.1 Methodologies and models

Models and methodologies for the creation and maintenance of ontologies and mappings and knowledge associations among them, are necessary. Since concepts in fisheries are continuously evolving, it is essential to be able to incorporate and continuously reflect these changes in the ontologies. Models for managing evolution, change propagation, mapping of ontologies to earlier ontology versions are very important. Guidance from partners on modelling the single ontologies, bearing in mind the dynamicity and multilingualism of knowledge, will be necessary. Moreover, fishery knowledge is widespread and reflects objects, regulations and techniques bound to local geographic areas or different levels of expertise (economists, managers, policy makers, etc). Models to incorporate or manage the contextualized view of different users (biologists, economists, decision makers, etc...) would be necessary.

Foreseen collaboration/guidance from other Work packages:

- WP1: assistance in ontology design, expression and modularization;
- WP2: assistance in ontology creation and data mining;
- WP3: assistance in ontological context and possibly data mining;
- WP4: assistance in interface design methodology;
- WP5: guidance with development methods.

#### 3.1.2 Tools

Editing and management environment for ontologies come under the heading of “tools”, described in detail in Section 4.7.1.

#### 3.1.3 Services and APIs

The Services and API relevant for the alert system are: concept service, inference service and data warehouse. They are described in detail in Section 4.7.2.

### 3.2 Constraints

The NeOn toolkit must be compliant with the standard FAO HW/SW environment. This is necessary in order for the NeOn toolkit to be customized to the fisheries domain, and to take advantage of the FAO infrastructure already in place.

Currently, FAO recommends using ORACLE as the RDBMS and Java as the programming language for medium to large applications, while LAMP<sup>9</sup> platforms are allowed for small to medium applications. The minimum set of requirements for web interfaces are provided in Annex II: "WAICENT checklist for the clearance of web sites". Furthermore, if the system has to be distributed, portability will be an issue.

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<sup>9</sup> L.A.M.P. = Linux (operating system), Apache (Web server), MySQL (RDBMS), PHP scripting/programming languages.



## 4 Fishery ontologies lifecycle requirements

In order for the FSDAS to be effective, it is important that the ontologies and resources it builds on be maintained and kept up-to-date, and that when applying changes (to single ontologies or networks) all dependencies between systems continue to hold. The experiment with FOS (cf. Annex I) suggests that instead of building one large, comprehensive and difficult to maintain ontology, it is preferable to use (relatively) small ontologies, connected together and organized in a network. While this approach fosters the process of maintaining the internal coherence of single ontologies, it raises issues related to the maintenance of a network evolving over time and whose nodes have different ownership.

The organization of this chapter is as follows:

- Section 4.1 gives a high-level description of the typical scenario and problems for the ontology lifecycle within FAO;
- Section 4.2 characterizes three groups of users involved in the ontology lifecycle: ontology experts (in charge of all issues related to ontology design), ontology editors (in charge of the daily editing and maintenance work), and application developers (in charge of the development of APIs and applications interfacing with ontologies);
- Section 4.3 describes the user requirements for ontology experts;
- Section 4.4 describes requirements for ontology editors;
- Section 4.5 describes requirements for application developers;
- Section 4.6 provides a set of use cases to illustrate the main functionalities necessary for the ontology lifecycle;
- Section 4.7 provides software requirements for the lifecycle. Section 4.7 organizes the system specifications around Tools and Services.

### 4.1 Introduction

Many large KOSs are already available and used within FAO, such as AGROVOC and FIGIS reference tables (RTMS). Some of them are used for document indexing, others for organization and retrieval of statistical data, and others as standards to be used by international bodies. In the transition from structures (KOSs) to networked ontologies, we need to keep the different usage of these structures into account.

Given the scenario described above, it is important to have a **methodology to assess whether existing KOSs are suitable for inclusion in a network**. In case they need to be divided into smaller parts, there should be a methodology to decide how to do it, and what should be the minimum/maximum number of concepts included. Also, if new ontologies need to be built from scratch and added to the network, how do we define the suitability of an ontology to be included in a network? A methodology should be elaborated for dividing KOSs up into smaller parts when necessary, and for setting the minimum/maximum number of concepts.

Lastly, in order for ontologies to be kept up-to-date, it is vital that (semi)automatic mechanisms to populate existing ontologies, learn new concepts and instances, and possibly new ontologies, are in place and integrated in the ontology editing environment.

Sometimes it may be useful to select fragments from a possibly big ontology. In this document the expression *ontology modules* is used as a synonym for such fragments. They will be used for:

- duty distribution among several authors for editing/revision;
- visualization and printing; and
- development of domain-specific applications via web services and APIs.

It is important that modules be defined and checked for consistency in a (semi)automatic way. The following issues should be addressed: how to automatically define a module within an ontology; if and when a module can become an independent ontology; and whether a module is fixed once for all, i.e. whether it can be modified over time, or if this depends on the application it is used by.

Assuming that we have a notion of what a node in the network is, we need to exactly define what kind of **linking/mapping system** will connect the ontologies in the network. Given the amount of data (e.g. classification schemas, ontologies, thesauri) available at FAO, mappings should be established, updated and checked for consistency in a (semi)automatic way. We need to know what the semantics associated to a mapping are (for example: equivalence relation vs. ad hoc type relation); we also need to address the following issues: how to define new mappings/linking; and how to assess when a mapping is no longer valid (depending on the changes applied to the ontology(ies)/concepts involved in the mapping). When defining and managing mappings, it should be taken into account that although the resources in the network are often shared by several departments, usually only one department has editing rights.

Since all nodes involved in the network (ontologies, modules and mappings) are going to change over time (although possibly at different speeds), it is necessary to **version** all of them. In FAO, the level of interdependency between systems is very high: for example, AGROVOC is also used to index bibliographic repositories on fisheries, and the FIGIS Reference Tables are used to access statistics on fisheries and also as a browsable structure *per se*. In such a setting, the deletion/replacement of ontologies that are used or referred to by other systems should be avoided; instead, a carefully designed versioning system should ensure that references are not lost. The versioning system should support the creation of new versions (either manually or automatically created), and their testing before release in the production environment. Moreover, the versioning system should support versioning of different objects (i.e., entire ontologies, single nodes and ontology modules), including the maintenance of mappings/linking across different versions.

**Multilinguality** is central to all FAO's activities. In fact, official documents and resources produced by FAO must be made available in all the five FAO languages (Arabic, Chinese, English, French, and Spanish). The management of multilinguality should be such that the following cases are covered: a) thesauri and ontologies are first produced in one language and then translated, with possible lack of one-to-one correspondence between concepts (as in names of varieties of rice or other plants that only grow in certain regions); b) the correspondence between names in different languages is given, therefore the one-to-one correspondence is ensured (as in the names of countries). The fact that in case a) there is no one-to-one correspondence between concepts in different languages implies that in the lifecycle of networked ontologies the multilingual level of an ontology should be independent from the ontology design level (cf. section below). As far as the multilingual level is concerned, the efficient management of long distance, collaborative work, is especially important. These functionalities should be integrated with modularization and versioning facilities.

In order to ensure a sound and sustainable ontology lifecycle, editors should be supported in their daily maintenance work of ontology editing and mapping creation. Therefore, the editing environment should include **tools to propose classes and relations** to populate ontologies (in the rest of this document we will use the word "**candidate**" to refer to classes, relations and instances that proposed (usually by a tool integrated into the editorial environment) for inclusion in an ontology, albeit not yet validated), and **tools to propose candidate mappings (between ontologies) to editors**. As for the former type of tools, they may be based on learning algorithms taking examples, such as sets of class-subclasses, as input. These algorithms could be selected by means of appropriate experiments, where the corpora of sentences are annotated with respect to the desired classes which are used. Annotation tasks are always very time

consuming, and in our specific case they should be performed by subject experts (see next section). Therefore, this issue will deserve careful analysis. Tools to support editors by providing candidate classes and relations should also support the human validation of the proposed candidates. Different degrees of approvals (e.g. "temporary", "final", etc.) should be supported, corresponding to the different editing rights of the various editors, so that only the elements (e.g. classes, instances, relations) approved in final should be incorporated in the ontology. As for tools to suggest automatically detected candidate mappings across pairs of ontologies, these candidates could be found on the basis of textual evidence, in a similar way to finding relations between concepts within an ontology. These issues will be further explored within T7.3.

Finally, we draw attention to the fact that in order for the networked ontologies to be maintained and kept alive, it is of fundamental importance that the NeOn toolkit can be successfully used by the editors of the ontologies, i.e. subject experts and IT experts who do not typically have a specific background on ontology modelling issues. For this reason, different graphical interfaces in the toolkit should be tailored to suit these groups of users. Also, during the course of the project, suitable documentation, training materials and demos should be made available to the different group of users, in order to **train and build up the capacities of editors**.

## 4.2 User groups

The following user groups are involved in the networked ontologies lifecycle.

**Ontology experts** are experts in ontology modelling issues and techniques; have from basic to advanced knowledge of ontology tools such as editorial tools and inference engines, but may know little about the domain to be modelled. Typically, ontology experts are in charge of defining the original skeleton of the ontology, and in so doing, they take into account the purpose of the ontology, possible interactions with legacy systems, and other relevant issues. FAO departments may have only a few ontology experts who will be in charge of the initial modelling; the maintenance of the ontology will be done by subject experts and information management and technology experts.

**Ontology editors** are either subject experts or information management specialists, who will be in charge of the everyday editing and maintenance work of the networked ontologies. Their duties also involve the creation of multilingual versions of ontologies. **Subject experts** know about the domain to be modelled, but usually know little or nothing about ontology design issues or software for ontologies. Subject experts can be in charge of developing specific fragments of ontologies, revise work done by others, and develop multilingual versions of ontologies. Subject experts should be provided with more intuitive interfaces than those available to ontology experts and application developers; in particular interfaces for subject experts should conceal much of the purely ontological and engineering decisions. **Information management and technology (IM/IT) experts** are specialists in the entire information management lifecycle, have some programming skills, or at least familiarity with implementation issues, and also have understanding of issues related to domain and domain modelling. IM/IT experts will often work on ontology maintenance, possibly in conjunction with subject experts.

**Application developers** are software engineers who develop applications that use or are used by ontology components or systems (e.g. plug-ins, APIs, software for automatic indexing based on ontologies, etc). Application developers may not need to know anything about ontology modelling issues; therefore it is important that the documentation about the NeOn toolkit also takes into account this type of user.

Finally, there is a fourth group of users that, even if not involved in the ontology lifecycle, does use some of its outcome. These are "end users" outside the Fisheries department, who only browse and download the resources (ontologies, classification schemas, reference tables) that are disseminated through the FAO web site. The selection of formats into which ontologies are converted for dissemination also depends on requests made by these users.

### 4.3 Requirements for ontology experts

The requirements listed in this section concern the design and planning of networked ontologies, which are tasks assumed to be carried out by ontology experts. Ontology experts can also perform editing and maintenance actions (see Section 4.4 below), but in order to give a realistic account of the ontology lifecycle, the two types of actions have been kept apart.

#### 4.3.1 Editing/Building

For this type of user the main activity is building.

- The editing environment should allow ontology experts to include legacy systems in the networked ontologies. FAO legacy systems are: thesauri (e.g., AGROVOC, ASFA thesaurus), classification schemes (e.g., the Fishery International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP), existing FAO's KOSs, such as FAOTERM, Fisheries Glossary, etc.). For this purpose ontology experts should be able to:
  - (RTMS) import from DBMS the entire database or parts of it. When doing so, special care should be paid to the way data is accessed from the database (in particular, primary and foreign keys);
  - import legacy systems in thesaurus format and (semi)automatically convert them into an ontology format; and
  - automatically create relevant metadata concerning the ontology design, such as UML-like diagrams, and documentation concerning the relations and properties used. These metadata should be readable with little effort by the editors.
- When creating new ontologies, it should be possible to import in view mode:
  - ontologies and all relevant mappings involved. There should be an automatic way to select relevant mappings and it should be possible to add/remove them;
  - classification schemes (such as the Fishery International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP)); with the possibility to edit and/or create new ones;
  - existing KOSs: e.g. FAO systems such as FAOTERM, Glossary, etc.
- When creating new ontologies, it should be possible to include (copy) into the ontology being edited, the following elements from the imported sources:
  - concepts, instances, modules.

#### 4.3.2 Modularization

- It should be possible to modularize an ontology:
  - manually; and
  - according to (semi)automatic methods (e.g. entire branches of a hierarchy, subclass skeleton) specifying the properties to be included.

## 4.4 Requirements for Editors

The requirements specified in this section concern the everyday editorial work that is likely to be carried out by subject experts and IM/IT experts. Obviously, ontology experts are also allowed to perform these actions.

### 4.4.1 Editing/Building

For this type of user (editors), the major effort will be placed on editing.

- The editing environment should allow ontology editors to manage the following types of annotations:
  - date of creation/editing of the node and author (automatically);
  - “scope note” of a concept;
  - (commonly used in thesauri). For example, a scope note for “Cows”: “Use only for cattle and zebu cattle; for other species use ‘females’ plus the descriptor for the species” (example taken from AGROVOC);
  - images;
  - comments;
  - history notes, to account for changes applied to a concept;
  - annotations for distance collaborative work. This type of comment could be visible only to the editors working on the same ontology fragment, and/or used within a workflow process. Finally;
  - annotations on multilingual layers (see Section 4.4.3).
- The editing environment should allow editors to edit two or more ontologies at the time (assuming the appropriate editing rights are granted).
- Support editorial workflow. A typical workflow cycle starts with proposals for changes: these proposals are discussed; then, if an update is made, it will have to be approved by one or more of the editors in charge. After that, the change will be considered definitive and permanently added to the structure. All editors involved in the process will be informed via a warning message at log on.
- When revising work done by others, editors (typically, subject experts) should be provided with mechanisms for checking the quality of the development of the ontology to be revised:
  - check for duplicates and similar concepts;
  - compare with other ontologies; and
  - provide summary statistics about the ontology: depth, number of child nodes, number of relations and properties, number of concepts per “branch”.
- Subject experts should be provided with a simplified interface for all editing actions.

### 4.4.2 Support to editing: ontology population

Ontology population tools should be accessible through the editorial environment. In particular:

- On the basis of given textual corpora, the tool should provide the author with a list of candidate elements of the ontology:
  - classes;
  - instances;
  - relations between concepts.
- The tool should show the documents and excerpts supporting the extracted terminology, including document metadata such as title of the document, author, data owner, publication date.
- The tool should provide the editor with a way to inspect and select the appropriate candidate, and add the selected ones to the ontology.
- Before final inclusion in the ontology, it should be possible to check the ontology, as well as the newly added element, for consistency.

#### 4.4.3 Support to editing: mapping creation

Tools supporting editors in the creation of mapping between ontologies should be available.

- Let us say the editors have two ontologies available: Ontology1 and Ontology2. The user should be able to draw mappings between:
  - a concept from Ontology1 and a concept from Ontology2
  - a module from Ontology1 and a module from Ontology2
  - Ontology1 (or Ontology2) and a classification schema. This functionality is especially important for indexing purposes in order to allow for comparison and integration of keywords used for annotation. These mappings should be integrated / shared / interoperable with other mappings involving resources within FAO.
- Mappings can be drawn manually, but editors should also be supported by the system that will suggest automatically detected candidate mappings
- The system should allow for types of mappings beyond the equivalence mappings. These types and their number will be better specified at a later stage

#### 4.4.4 Browsing and visualizing

- Ontologies and fragments/modules of them should be visualized in different ways, depending on the task to be performed (e.g. editing vs. revision of the ontology, indexing, domain browsing), and the purpose and the preference of the editor/author. The following view modes should be allowed:
  - diagram-like, indented tree, node by node, possibly together with parents and children.
- It should be possible to display more than one visualization type at the time (in individual windows) and switch among them.
- It should be possible to print out the chosen visualization(s).

- When modules are used to share the authorial/editorial duty, each author (or the designated coordinator) should be able to view changes made by other authors, even without editing permission.
- In order to work with a network of ontologies, ontology experts should be able to visualize more than one ontology at a time, including ontologies for which they do not have editing rights. They should be able to:
  - highlight any overlapping between ontologies (in terms of concepts and instances);
  - visualize mappings, list of relations used in each of them; and
  - highlight salient information about the visualized ontologies: provenance, which system they are used by, by whom they are edited frequency of changes, fragment/domain of the ontology changed at fastest rate.
- (RTMS) Workflow visualization.

#### 4.4.5 Data export

- It should be possible to export ontologies in several formats in order to promote data exchange and uniformity with existing FAO resources (e.g. AGROVOC, ASFA). In particular, there should be an option to export ontologies in thesaurus format, which implies:
  - conversion into formats such as TagText, RDBMS, ISO2709, SKOS, TBX.
  - when not given, the system should automatically identify descriptors over non-descriptors, and reduce the type of relationships available;

#### 4.4.6 Search within ontologies

- While editing an ontology, editors should be able to perform the following types of searches within the ontology being edited, and across several available ontologies, legacy systems, classification schemas, terminology systems:
  - searches that exploit the structure of the ontology: concepts having parent X, concepts having child Y, pairs of concepts holding relation Z, concepts having property P, concepts having instances such as Q (or, such that a given constraints is met);
  - textual searches across the whole ontology, independently of whether the text appears in a concept label, annotation, property name, etc.;
  - searches in URIs to find similar/ related ontologies and concepts.

#### 4.4.7 Multilinguality

- Editors also deal with the multilingual aspect of FAO resources. They should be able to:
  - incorporate a new language for an entire ontology;
  - select at least two languages (or more, if required), one in view mode, the other in editing mode;
  - add/edit/delete multilingual labels to individual concepts;

- cope with specificities of translation (i.e., no lexicalization available for concepts, available lexicalization corresponds to more than once concept or conversely, several lexicalizations are possible).

#### **4.4.8 Training and capacity building**

- Material should be available to instruct ontology editors on the tasks to be undertaken: user manuals, online tutorials and material for training, demos.
- A common messaging service or a shared forum should be incorporated to allow editors to interact directly with each other.

### **4.5 Requirements for application developers**

- Software development methodologies adapted to include requirements of semantic web applications are needed. These methodologies should cover the following issues:
  - conversion of legacy systems into a new format, so that compatibility with third party applications/tools using the systems is ensured;
  - I/O interfaces for applications interacting with the networked ontologies.



## 4.6 Use cases

### 4.6.1 Create new ontology

#### ACTORS

- Ontology expert

#### DESCRIPTION

- Create a new ontology

#### PRECONDITIONS

- User logs in
- System selects the appropriate profile and grants the associated privileges

#### TRIGGERING EVENT:

- User selects “create new ontology” from menu

#### POST CONDITION:

- System creates a new ontology

#### FLOW OF EVENTS:

##### a. BASIC FLOW

- User selects the option “create new ontology” from menu
- A pop-up window is opened to allow the user to browse the file system
- User chooses format for the ontology from a list
- User assigns a name to the ontology. If the name is already in use, the user receives a message asking him/her to change the name or replace the existing file.
- User saves the ontology in appropriate location

##### b. ALTERNATIVE FLOW: user chooses a name already used by other ontology

- System returns error message and asks the user to change the name or replace the existing ontology.

#### NOTES/ISSUES:

- Permitted formats for the ontology must include RDFs, OWL

The user should, preferably, be allowed to save on shared directories (not only locally)

- Allowed names should not be subjected to constraints due to the platform used: implementation issue.

#### 4.6.2 Include a selection from an existing ontology

##### ACTORS

- Ontology expert

##### DESCRIPTION

- Include a selection from an existing ontology

##### PRECONDITIONS

- Ontology is open

##### TRIGGERING EVENT:

- User selects “include ontology” from menu

##### POST CONDITION:

- Ontology includes selection from other ontology

##### b. BASIC FLOW:

- User selects “include ontology” from menu
- System presents a window to browse the file system and select an ontology to open
- User selects an ontology from chosen location and opens it
- User selects the entire ontology (or parts of it) and selects “copy selection”
- User selects location in the target ontology
- User selects “paste selection”

##### RELATED USE CASES:

- Create new ontology
- Edit existing ontology
- Visualize ontology

##### NOTES/ISSUES:

- N/a

### 4.6.3 Edit existing ontology: add objects

#### ACTORS:

- Ontology expert

#### DESCRIPTION:

- Edit existing ontology

#### PRECONDITION:

- Ontology is open for editing

#### TRIGGERING EVENT:

- User selects one of the “add ...” option from menu: “add class,” “add property,” “add instance”

#### POST CONDITION:

- Object has been added

#### FLOW OF EVENTS:

##### a. BASIC FLOW 1: Add class

- User selects location in the ontology where to add new class
- User selects option “add class” from menu or icon
- System adds class
- User is requested to add the following pieces of information: class name. User may also add comments.

##### a. BASIC FLOW 2: Add property

- User selects option “add property from menu or icon toolbar”
- User is requested to add the following pieces of information: property name, property type, domain and range.

##### a. BASIC FLOW 2: Add instance

- User selects a class
- User selects option “add instance” from menu or icon toolbar
- User is requested to add the following pieces of information: instance name, property values.

#### RELATED USE CASES:

- Create new ontology
- Edit existing ontology: modify objects
- Visualize ontology

NOTES/ISSUES:

- N/a

#### 4.6.4 Export legacy data into OWL ontology format

ACTOR:

- Ontology expert

DESCRIPTION:

- User converts legacy data into ontology format

PRECONDITION:

- User is logged in with the appropriate profile

POST CONDITION:

- New ontology is created

TRIGGERING EVENT:

- User selects option “export into ontology format” from menu

FLOW OF EVENTS:

a. BASIC FLOW

- User selects legacy data from location, and opens it
- User selects option “export in OWL” from menu
- System presents the user with a window to select the schema to adopt for conversion
- User selects schema and starts conversion
- Saves converted ontology, by assigning a name and placing it in selected location

b. ALTERNATIVE FLOW: user selects legacy data in a non-supported format

- System returns error message

b. ALTERNATIVE FLOW: selected schema is not suitable for exporting

- System returns error message and lets user choose between:
  - select different schema
  - edit schema
  - create new schema

RELATED USE CASE:

- Create new ontology

NOTES/ISSUES:

- Typical legacy data are thesauri

- Acceptable input formats include: RDF, RDFs, and thesaurus formats (e.g. SKOS)
- There could be other formats for export apart from OWL
- When we write OWL, we always refer to OWL-DL

#### 4.6.5 Modify schema for export into OWL

ACTOR:

- Ontology expert

DESCRIPTION:

- User is logged in with appropriate rights
- User edits schema for exporting legacy data into OWL ontology format

PRECONDITION:

- Legacy data is opened
- User is logged in with appropriate rights

POST CONDITION:

- Legacy data is exported into OWL format

TRIGGERING EVENT:

- User selects “open schema for editing”

c. BASIC FLOW:

- User opens select and opens the schema to edit
- User edits the schema
- User selects “save” or “save as”

d. ALTERNATIVE FLOW: schema cannot be saved

- System returns error message and asks user to change name of the schema, or its location

RELATED USE CASE:

- Create new ontology

NOTES/ISSUES:

- N/a

#### 4.6.6 Visualizes an ontology as a diagram

ACTOR:

- Ontology expert

DESCRIPTION:

- Visualize ontology diagrammatically

PRECONDITION:

- Ontology is opened

TRIGGERING EVENT:

- User selects “visualize as diagram”

POST CONDITION:

- Ontology is visualized as a diagram

FLOW OF EVENTS:

a. BASIC FLOW:

- User selects option “visualize as diagram” from menu or icon toolbar
- User is requested to select parameters for visualization
- System visualizes the ontology in separate window

b. ALTERNATIVE FLOW: the ontology is too big for visualization in a diagram-like format

- System returns warning
- User is requested to select a smaller part of the ontology to visualize, typically a branch

RELATED USE CASES:

- N/a

NOTES/ISSUES:

- Parameters for visualization will include: representation style for properties and instances
- Selection of “smaller part” of the ontology is not represented here as a use case



#### 4.6.7 Create ontology module

PRIMARY ACTOR:

- Ontology expert

DESCRIPTION:

- Create a module from an existing ontology

PRECONDITION

- Ontology is open for editing

TRIGGERING EVENT:

- User selects option “create module” from menu

POST CONDITION

- A module is created

FLOW OF EVENTS:

a. BASIC FLOW:

- User opens an existing, non-empty ontology
- User selects the option “create module” from menu
- User is requested to select a branch of the ontology, or a set of concepts
- User is requested to select a set of properties to include
- User is requested to select the instances to include, if available
- System records metadata (i.e. author, creation date) about the module, which the user can save
- User can give a name to the module and add comments that will be saved together with the metadata

b. ALTERNATIVE FLOW OF EVENTS: ontology is empty

- System produces error message

c. ALTERNATIVE FLOW OF EVENTS: user selects concepts that are not related to one another

- System produces error message and suggests solutions.

d. ALTERNATIVE FLOW OF EVENTS: user selects properties whose values have not been selected for the module

- System produces error message and suggests solutions

RELATED USE CASE

- Create mappings between concepts
- Create mappings between ontologies or modules
- Create ontology, convert legacy data

NOTES/ISSUES:

- Since a formal definition of ontology modules is not yet available, the “alternative flow of events” proposed here is tentative

#### 4.6.8 Create manual mappings between concepts

ACTOR:

- Ontology expert

DESCRIPTION:

- Create mapping between pairs of concepts belonging to different ontologies

PRECONDITION:

- Two ontologies are selected and opened

TRIGGERING EVENT:

- User selects “establish mapping” from menu

POST CONDITION:

- Mapping is drawn between pairs of concepts from two ontologies

FLOW OF EVENTS:

a. BASIC FLOW:

- User selects option “draw mapping” from menu or icon toolbar
- User is requested to chose a type of mapping
- User is requested to select two concepts from the two ontologies
- User selects two concepts from the two ontologies (one each)

b. ALTERNATIVE FLOW: the selected pair is not suitable for mapping

- System returns error
- User is requested to change selection

RELATED USE CASES:

- Create mapping between ontologies, create mapping between modules

NOTES/ISSUES:

- The type of mapping chosen will have consequences on the order of selection of the concepts: for equivalence mapping the order in which concepts are chosen is not important. Where typed mappings are available, the order may matter.

#### 4.6.9 Create manual mappings between ontology modules

ACTOR:

- Ontology expert

DESCRIPTION:

- Create mapping between pairs of ontology modules

PRECONDITION:

- Two ontologies are selected and opened

TRIGGERING EVENT:

- User selects “establish mapping between ontology modules” from menu

POST CONDITION:

- Mapping is drawn between two ontology modules

FLOW OF EVENTS:

a. BASIC FLOW:

- User selects option “establish mapping” from menu or icon toolbar
- User is requested to choose a type of mapping
- User is requested to select two ontology modules
- User selects two modules (one from each ontology)
- User clicks OK

b. ALTERNATIVE FLOW: only one ontology is opened in the editor

- System returns error and requests user to select a second ontology

RELATED USE CASES:

- Create mapping between concepts in ontologies, System-supported creation of mappings between concepts, Create module

NOTES/ISSUES:

- Here the assumption is that mapping is created between objects of the same type: ontology-ontology, module-module. These constraints will be better defined or relaxed on the basis of results from WP1 and WP5.
- The type of interaction with the user to select the two ontologies when they are opened in the editing environment is to be decided. The user could click on the root nodes, or a button “select entire ontology” could be available.
- The possibility of drawing mappings between two ontologies that are not opened in the editing environment (selected from file system) should be investigated.

- See Notes/issues of Use Case Manually create mapping between concepts

#### 4.6.10 System-supported creation of mappings between concepts

ACTOR:

- Ontology expert

DESCRIPTION:

- System supports user in selection of concepts to be mapped, user then decides which concepts to map

PRECONDITION:

- Two ontologies are selected and opened

TRIGGERING EVENT:

- User selects “suggest concepts to map” from menu

POST CONDITION:

- Mapping is drawn between pairs of concepts from two ontologies

FLOW OF EVENTS:

a. BASIC FLOW:

- User selects option “search for candidate mappings among concepts”
- System requests to choose a type of mapping
- User inspects the proposed candidates one by one (by clicking on them and visualizing the candidate concepts and the surrounding ontology fragment)
- User selects the appropriate candidate and confirms the proposed mapping

RELATED USE CASES:

- Manually create mapping between ontologies, create mapping between modules

NOTES/ISSUES:

- N/a

#### 4.6.11 System-supported creation of mappings across ontologies

ACTOR:

- Ontology expert

DESCRIPTION:

- System supports user in selection of concepts to be mapped, user then decides which concepts to map

PRECONDITION:

- One ontology is selected and opened

TRIGGERING EVENT:

- User selects “suggest ontology to map” from menu

POST CONDITION:

- A list of candidate ontologies for mappings is presented to the user for validation

FLOW OF EVENTS:

a. BASIC FLOW:

- User selects option “search for candidate mappings for this ontology”
- System requests user to choose a type of mapping
- System requests user to select a location (local or in the network) to look for candidate ontologies to map
- User inspects the proposed candidates (by clicking on them and visualizing them)
- User selects the appropriate candidate and confirms the proposed mapping

RELATED USE CASES:

- Create manual mappings between concepts, Create manual mappings between ontologies (modules), System-supported creation of mappings between concepts

NOTES/ISSUES:

- N/a

#### 4.6.12 Free-text search within an ontology

##### ACTOR:

- Ontology editor

##### DESCRIPTION

- Search for concepts, relations, instances and text contained in those objects

##### PRECONDITION

- Ontology is open

##### TRIGGERING EVENT

- User pushes search button

##### POST CONDITION

- Search results are returned to the user

##### FLOW OF EVENTS:

##### BASIC FLOW

- User types in a string in the search box
- User hits search button
- System returns search results

##### a. ALTERNATIVE CASE: system finds no results

- System returns a warning message and presents the search box again

##### RELATED USE CASES

- Typed search within ontology
- Structural search within ontology

##### NOTES/ISSUES:

- A search box should always be available to the user, and free text search is considered to be the default search.



### 4.6.13 Advanced search within an ontology

#### ACTOR:

- Ontology editor

#### DESCRIPTION

- Search for concepts, relations, instances and text contained in those objects

#### PRECONDITION

- Ontology is open

#### TRIGGERING EVENT

- User pushes search button

#### POST CONDITION

- Search results are returned to the user

#### FLOW OF EVENTS:

##### a. BASIC FLOW

- User selects the option “advanced search” from menu or by clicking on icon
- User selects the type of object to look for among: concepts, instances, properties
- User types in the string to look for
- System returns search results

##### b. ALTERNATIVE CASE: system finds no results

- System returns a warning message and presents the search box again

#### RELATED USE CASES

- Free-text search within ontology
- Structural search within ontology

#### NOTES/ISSUES:

- N/a

#### 4.6.14 Structural search within an ontology

##### ACTOR:

- Ontology editor

##### DESCRIPTION

- Search for concepts, relations, instances and text contained in those objects

##### PRECONDITION

- Ontology is open

##### TRIGGERING EVENT

- User pushes search button

##### POST CONDITION

- Search results are returned to the user

##### FLOW OF EVENTS:

###### a. BASIC FLOW

- User selects “structural search” from menu or icon
- User selects the type of object to look for, among concepts, instances, properties
- User selects the type of constraint to impose:
- System returns search results

###### c. ALTERNATIVE CASE: system finds no results

- System returns a warning message and re-presents the search box

##### RELATED USE CASES

- Free-text search within ontology
- Typed search within ontology

##### NOTES/ISSUES:

- The set of possible constraints to impose must be fixed. Examples are: “having parent such that ...”, “having child such that ...”, “for instances: being an instance of ...”, “for properties: attached to ...”, “linking ...”

#### 4.6.15 Add a new language to multilingual ontologies

ACTOR:

- Ontology editors

DESCRIPTION:

- Add a new language to a multilingual ontology

PRECONDITION

- Ontology is open

TRIGGERING EVENT:

- User selects 'add new language' from menu

POST CONDITION:

- Ontology is set for adding a language

FLOW OF EVENTS:

- User selects "add new language" from menu
- User is requested to specify which elements of the ontology should be multilingual: user can select classes, instances, properties, or the entire ontology
- Systems add a "language layer" to the ontology
- System asks the user to select a dictionary for spell-checking purposes
- User selects the dictionary
- System saves the association between language and dictionary

RELATED USE CASES:

- Create ontology
- Create module

NOTES/ISSUES:

- This approach to multilinguality applies to cases where there is a clear and fixed one-to-one correspondence between lexicalizations of a concept
- The exact modelling of a "language layer" is yet to be defined.

## 4.7 Software requirements

Based on the NeOn basic reference architecture presented by WP6:

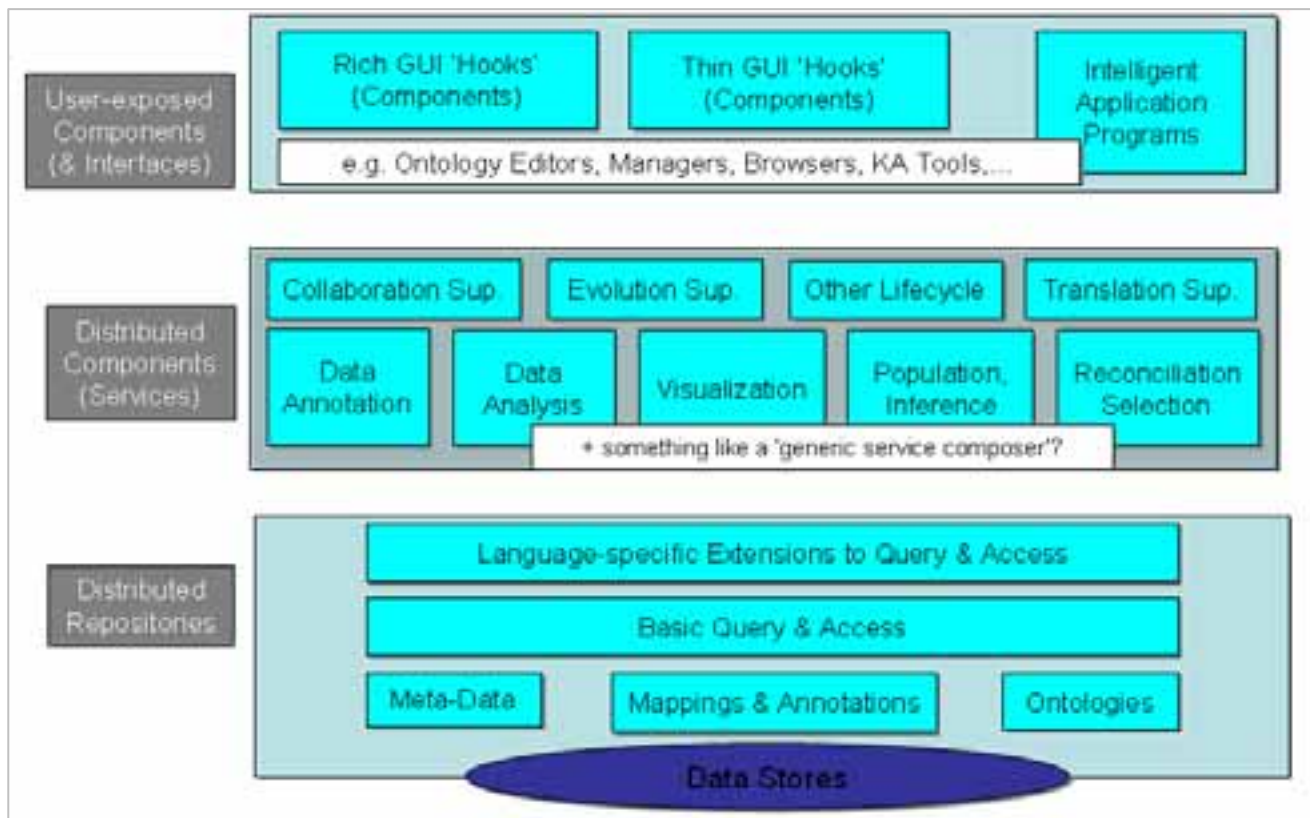


Figure 5 - NeOn toolkit basic architecture

### 4.7.1 Tools

User interfaces will be implemented on top of the NeOn toolkit and services. Figure 4 is taken from the NeOn project proposal. Ontology lifecycle management tools need to be integrated and customized to the fisheries domain.

#### Ontology editor/manager:

The ontology editor/manager needs to be capable of creating and editing one or more ontologies, including cross-ontology mapping and context; and these must be usable by domain experts who are not ontology engineers. This is expected to be part of the NeOn toolkit (WP6). Detailed user requirements for this tool are provided in Chapter 4, together with the expected types of users. It is anticipated that customization of this tool to the fisheries domain would be minimal for the ontology expert users, although some customization of the user interface would be probably necessary for the fisheries subject experts. The system should be easy to use for all types of users (ontology experts, ontology editors, applications developers), within any particular ontology domain or context. This would suggest the following possibilities/needs:

- an expert mode, and a novice mode;
- an accompanying help system.

Functions:

- Creation and editing of classes, properties and relations;
- creation and editing of mappings and modules;
- comparison of pairs of ontologies (intersections/unions/complements);
- users should be able to execute commands directly upon the graphic representations of ontology concepts, properties and relations.

Ontology visualization and browsing:

- Visualization of single ontologies, and of two ontologies at a time including their mappings and modules;
- ontology browsing by following nodes and their relations;
- visualization of ontologies together with their context;
- visualization mode adapted to user groups and actions.

Ontology learning/population:

A tool for ontology learning and population should be available, so that HTML pages, XML files, relational database tables, CSV files, emails, and MS-Word documents, can be analyzed to discover candidate concepts and relations for inclusion in any ontology.

This tool should allow for manual and semi-automatic discovery of ontological concepts and relationships. Given a set of access methods, the component will be able to mine electronic records such as databases of documents, web pages, reference terms, classification systems, schemas, and discover possible new relationships. The candidate concepts and relations will then be verified by a combination of ontology engineers and domain experts.

Ideally, the tool could trigger services that periodically verify whether the data (upon which the ontologies, or concepts or relations or properties were based) has changed and, if so, respond accordingly: perhaps by alerting ontology managers and/or modifying the ontology and flagging the draft changes.

Basic ontology mining and creation tools are foreseen to be provided by WP2. It is anticipated that the tools, services or APIs provided within the NeOn toolkit will need to be customized to adapt to the needs of the fisheries ontology.

#### **4.7.2 Services and APIs**

Some web services or APIs will need to be implemented, based on the NeOn infrastructure, in order to build life-size web applications that could exploit the fisheries ontologies (or modules). These web services will access the resources (cf., Figure 4) mentioned in Section 2.2, and will be shared by various FAO web-based systems in different contexts, including the alert system.

The following services are crucial for the case study.

Ontology concept service:

This web service will deliver concepts, relations and properties in a standard format (e.g. OWL) to ad-hoc queries and within performance constraints that allow it to be used in a production environment that delivers dynamic results to end-users.

Operations:

- load/unload ontology;
- comparison of ontologies to check for commonalities: e.g. classes, instances, relations
- return concepts, instances, properties, mappings, modules;
- search matching concepts/relations/instances; and
- return similar concepts according to some similarity criterion.

Protocols:

- SOAP or REST.

Supported MIME types:

- RDF+XML.

Ontology learning/population service:

This service will integrate reusable components for knowledge systems (reasoning, automatic knowledge acquisition, metadata annotation etc). It will be built on top of the distributed component layer in the NeOn architecture where interoperability will be based on web services or APIs.

The inference service will:

- mine and monitor HTML pages, XML files, relational database tables, CSV files, emails and word documents for changes, and to discover instances matching concepts and relations in the ontology;
- structure data as instances of the ontologies according to a standard framework;
- perform context-based search; and
- use various combinations of ontologies and their associated mappings.

It is expected that this service will interact with the Ontology concept service.

Operations:

- select data sources;
- configure data source mapping;
- mine data sources (using currently loaded ontologies/contexts loaded in Ontology concept service);
- query data sources (combination of currently loaded ontologies/contexts loaded in Ontology concept service and user queries).

Protocols:

- SOAP or REST;
- TCP or HTTP/Binary (would be useful if/when large amounts of data are returned).

MIME types:

- text (HTML, XML, plain, tab-separated-values, comma-separated-values);
- application (XML, XHTML+XML, RDF+XML, PDF, MS Word, PowerPoint);
- image (JPEG, GIF, PNG, BMP);
- video (QuickTime, MPEG).

#### Reasoning service:

Reasoning capabilities will be injected into the NeOn framework. This service will provide the means to access these capabilities. Reasoning includes ontology consistency checking and inference.

#### Context service:

This service will allow for the building of user profiles and for establishing behaviour patterns which will, in turn, permit the creation of customized, user-focused services.

#### Query service:

NeOn will allow users to formulate queries using common standard languages and to execute them against the knowledge contained within. This knowledge includes both ontology data and legacy data.

#### Summarization service:

This service is meant to build reports with the most relevant ontology properties. These parameters are still to be defined.

#### Provenance service:

Associated to the summarization service, this service will log and provide information about events occurring in particular ontologies throughout their lifecycle. This information will include changes, the users who introduced them, and the different existing versions of the ontology.

#### Distributed repository service:

This service will be built on top of the distributed repository layer of the NeOn infrastructure. It should provide access to storing and indexing resources, for querying and browsing of structured (i.e. databases) and semi-structured (e.g. XML) data.

## 5 Requirements for the Fisheries Stock Depletion Alert System

### 5.1 Introduction

The ontology-driven FSDAS will comprise the FSDAS user interface, a network of ontologies, and a number of web services extending the NeOn infrastructure.

Users will experience FSDAS as a browsable and queryable web application that returns organized, quality-rated, linked results that can be used to make decisions about the state and trends of various fish stocks. Fisheries resources will be exploited using ontologies to return time-series statistics on capture, production, commodities and fleets by stock, together with direct links to related documents, web pages, news items, images and multi-media.

The user interface will support query refinement, assistance on query formulation (for example to avoid spelling errors) and multilingualism (FAO official languages: Arabic, Chinese, English, French and Spanish).

Users will be able to perform browse-based and query-based searches using a single ontology or the union, intersection or complement of various ontologies; they will also be able to navigate the associated data instances.

To the extent possible, the FSDAS will directly introduce and/or combine resources in the web page to create dynamic and synthetic views of the state of fish stocks. Users will be able to query and filter results based on their user profile.

#### 5.1.1 Purpose

Currently, FAO fisheries experts producing fisheries and stock assessments are forced to access numerous different information systems in order to locate the data they need to create their reports. This seriously hampers both searching for data and citing it. In addition, the necessity of searching through numerous systems means that reports may possibly neglect some data source one year, and use it the next, creating possible inconsistencies across years.

A one-stop shop for information resources would speed the process of preparing such reports, as well as increase consistency of reports both across stocks and fisheries as well as across reporting years. Consistent presentation of citations and bibliography would enhance both efficiency and data traceability. Reports partially or entirely based on templates will especially benefit from this system

Another consideration to bear in mind is the nature of queries, which often vary widely across systems, both in their interfaces and their query capacities. An ontology-backed knowledge base such as FSDAS would offer a consistent query interface together with advanced query features such as query disambiguation, synonym searches, and multilingual searches.

The FSDAS would therefore assist in replacing or complementing the quantitative assessment models with qualitative approaches. In addition, it would provide direct access to highly relevant source documentation (where these factors are described), to experts in charge of monitoring.



### 5.1.2 Scope

Although the title of the system is Fisheries Stock Depletion Alert System, the system will not trigger automatic “alerts” about fish depletion, but will provide mechanisms to allow fisheries experts to detect probabilities of over-fishing using the networked fisheries ontologies, integrating scattered multilingual sources of information, and identifying co-occurrence of risk factors on the same fish stock.

In this sense the FSDAS will be a decision support tool that will combine fisheries data from disparate sources into a common set of meanings, in order to allow Fisheries experts to gain easier access to the data they need to make diagnosis and prognoses on the state and trends of fishery resources

In order to achieve such a service, the ontological model would need to be shaped starting from highly structured FAO information systems, and to develop a learning capacity from this model to incorporate data and information from other less structured systems and resources.

FSDAS will be built on a Service Oriented Architecture re-using some components from the NeOn architecture. FSDAS will not be used to create, edit or in any way manage ontologies. It is strictly a queryable knowledge base. While it depends on the Fisheries ontologies managed with a Neon Toolkit customized to the Fisheries domain, the Fisheries distributed ontologies do not depend on the FSDAS.

## 5.2 User requirements

### 5.2.1 Users

FSDAS users will be mainly officers in FAO Fisheries Department (including Fishery Policy and Planning Division, Fisheries Resources Division, Fishery industry Division, as well as the Fishery Information, Data and Statistics Unit) attached to FAO headquarters and regional and sub-regional offices around the world.

In this sense, the user classes are all fisheries experts within some domain of fisheries: Fisheries Scientists, Fisheries Managers, Marine Biologists, Oceanographers, Fisheries economists, Fisheries legal experts, Fisheries engineers, Fisheries policy makers.

### 5.2.2 Requirements

Users will use the FSDAS to gather, analyze and produce information on the status and trends of fish stock. For this purpose, the ontology-based FSDAS will allow authorized users to browse and query a knowledge base of fisheries digital resources (FAO and selected non-FAO). The major user requirements for the FSDAS are:

- It shall allow authorized users to browse or search fisheries concepts and relations and use them to seek out related concept instances that have been identified using the NeON reasoning and inference modules together with the set of fisheries ontologies.
- Users shall be able to navigate and query concepts, relations and concept instances.
- Users shall be able to view all concepts, relations and the application interface in the five languages of FAO (when available).
- Users shall be able to view the digital resources related to the concept instances within the appropriate application on their desktop computer. Data instances may be links to the data or the actual data itself:
  - links should lead directly to the data instance;
  - actual data should be presented within its context and associated metadata, crucial to understanding, should also be displayed;

- quality and/or ranking data should be displayed;
  - provenance should be displayed;
  - last known modification of the data should be displayed;
  - creation date of the data should be displayed.
- Users should be able to input ad-hoc queries, both using free-text and concepts/relationships suggested by the currently loaded ontology set that should return either related data instances or related concepts/relationships found in the currently loaded ontology set. In this context Boolean logic, phrase matching and query refinement should be supported by the system.
  - Data instances returned by a query shall be grouped according to their related concepts and relationships; it should be possible to re-organize results according to any of the concepts/relationships that were used to select the result.
  - Users will be able to maintain a profile and store favourite queries or sessions.
  - Users will be able to email formatted results

## 5.3 Scenarios

### 5.3.1 FSDAS User Scenario 1

Jose Dali, a fisheries scientist, is preparing his annual stock assessment for North Atlantic Cod. He opens the FSDAS web application and logs in with his FAODOMAIN user name and password.

The system loads his default set of ontologies and displays either his “favourite concepts” or his “last saved session” if it exists. The system also displays an input box and a link to browse the ontology by concept or by concept instance.

Jose types into the input box “Bacal” and clicks a button labelled “buscar conceptos.”

The system responds that it has found concepts for “Atlántico” and “Norte” but not for “Bacal.” It asks whether perhaps he meant to type “Bacalao”.

Jose selects “Bacalao” and the system returns a web of related concepts in Spanish, with “Bacalao Atlántico Norte” in the middle. Among the concepts, there is one named “Estadísticas.”

Jose selects “Estadísticas” and clicks “Conceptos relacionados.” “Estadísticas” moves to the middle of the web of concepts and the application displays a set of related concepts, among them “Serie Temporal”.

Jose drags “Serie Temporal” to the query area and it is added to the query.

Jose drags “Bacalao Atlántico Norte” to the query area and it is added to the query.

Jose clicks the “Preguntar” button and the system returns with a web of related concepts, a list of potential resources with information, e.g.:

[http://www.fao.org/figis/servlet/TabLandArea?tb\\_ds=Capture&tb\\_mode=TABLE&tb\\_act=SELECT&tb\\_grp=COUNTRY](http://www.fao.org/figis/servlet/TabLandArea?tb_ds=Capture&tb_mode=TABLE&tb_act=SELECT&tb_grp=COUNTRY)

[http://www.fao.org/figis/servlet/TabLandArea?tb\\_ds=Production&tb\\_mode=TABLE&tb\\_act=SELECT&tb\\_grp=COUNTRY](http://www.fao.org/figis/servlet/TabLandArea?tb_ds=Production&tb_mode=TABLE&tb_act=SELECT&tb_grp=COUNTRY)

[http://www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/sum\\_e.htm](http://www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/sum_e.htm)

<http://www.defra.gov.uk/environment/statistics/coastwaters/kf/cwkwf07.htm>

[http://www.st.nmfs.gov/st1/recreational/queries/catch/time\\_series.html](http://www.st.nmfs.gov/st1/recreational/queries/catch/time_series.html) )

The system also indicates related concepts for which it has instances, e.g. “Bacalao Atlántico Sud”, “Bacalao Atlántico”, “Merluza”, “Colín”, “Materia Prima Bacalao”, “Atlántico Norte Acuerdo Legal”, “Bacalao técnica de pesca”, “Bacalao biología”.

Jose goes to the language bar and clicks the “English” button. The application, including menus, buttons, text and concepts is subsequently displayed in English.

Then he selects the button “Refine query”.

Jose selects the first link and clicks “go”, which displays the URI in a newly opened browser window.

Jose selects “e-mail results”. The system opens a web-browser with a web-mailer page pre-filled with Jose’s email address and the applicable concepts in the subject area.

Jose inputs a colleague’s email and clicks “send”.

The system sends an HTML-formatted message containing the links and concepts to Jose’s colleague.

Jose looks at the list of related concepts and clicks “refine ontology”.

The system displays a list of currently loaded ontologies, e.g. “Fisheries Biology, Fisheries techniques, Fisheries legislation, Fisheries commodities, Fisheries territories...”

Jose selects “Fisheries techniques and Fisheries legislation” and clicks “unload”.

The system returns to the previous screen with a modified set of related concepts:

“Cod, South Atlantic”, “Cod, Atlantic”, “Hake”, “Pollock”, “Cod commodities”, “Cod Biology”.

Jose clicks on “Cod biology”.

The system returns to the first page and displays “Cod biology” at the centre of a web of related concepts. The system also displays a list of the most recent concepts displayed, i.e. “Cod, North Atlantic” and “Time-series”

Jose selects the concept “Cod” linked to “Cod biology” and clicks “provenance”.

The system returns the concept together with information about the ontology(ies) it belongs to, the person who validated the concept, synonyms, language versions, and relations, i.e. any metadata related to the concept.

Jose drags “Cod biology” to the query area and selects “Launch query”

The system returns with a web of related concepts and their associated concept instances, e.g.

<http://www.fao.org/figis/servlet/species?fid=2218>

<http://www.fao.org/figis/servlet/species?fid=2219>

[http://www.fao.org/fi/eims\\_search/advanced\\_s\\_result.asp?JOB\\_NO=T0243](http://www.fao.org/fi/eims_search/advanced_s_result.asp?JOB_NO=T0243)

<http://www.fishbase.org/Summary/speciesSummary.php?ID=69&genusname=Gadus&speciesname=morhua>

<http://www.ucd.ie/codtrace/codbio.htm>

Jose selects the first link and clicks “details”.

The system displays any available metadata about the concept instance, such as when it was attached to the concept, the last time it was updated, whether it has been validated, by whom and when, usage statistics, and any metadata that may be retrieved from the resource itself such as the creator, the data, the title, etc.

Jose selects the first link and clicks “go”, which displays the URI in the previously opened browser window.

Jose clicks “add to favourite concepts” and the system adds the concept to a set of favourites saved against the user profile.

Jose returns to the application and selects “save for next session”, which saves the current state of the application against his user account for the next session.

Jose selects “modify user profile”.

The system opens a user profile page containing a default set of ontologies to load and a default concept to load. The user can select “set current session as default”. The user can select “RSS feed” in which case a browser opens to the URL for a tailored RSS feed based on the user’s set of ontologies, adding items to the feed when new concept instances have been added or existing instances modified.

Jose closes the application.

### 5.3.2 FSDAS User Scenario 2

The price of fish F in country C is increasing, but the reason for this is unclear to Ms. Jones, a FAO fisheries economist, who is in charge of clarifying the issue.

Ms Jones goes to the FSDAS website and starts her research. FSDAS allows her to type any word in a search box, or to select an area from a map and let the system automatically search for relevant information about the area. Ms Jones starts from the search box and types in the common name of the fish to get a complete fact sheet of data about it. Since the common name she typed in is ambiguous, she chooses the species she is looking for among a list of results, and gets a fact sheet concerning fish F which contains:

- 1) maps of stock distribution of F around the world;
- 2) maps of the migratory movement of F;
- 3) list of local names of F according to the countries declaring captures of F;
- 4) information about features, habitat, size, interest to fisheries, nutrition, reproduction;
- 5) fishing techniques, with reference to the zone where they are used;
- 6) links to all available statistics concerning F.

Ms Jones then selects various countries reporting captures of F, a time range of 5 years and other variables related to F as available (e.g. prices/costs, captures, exports, ...). She searches for data concerning the fishing of F in international seas, inspects the data and statistics found and saves/prints the most significant ones.

By comparing the selected statistics, Ms Jones finds that: a) over the past 5 years the proportion of fish F fished by the country C and its neighbouring countries has remained stable, b) during the last year, the fishing of country C has dropped, but c) the fishing in the neighbouring country has remained stable. From this, Ms Jones infers that some local factors must be playing a role in this contrasting scenario, so she goes back to FSDAS and looks again at the fact sheet about food and reproductive habits of F. Now she finds that: d) the preferred diet of F is D, e) that natural reproduction cycle is R; and f) fish stocks of F tend to migrate only short distances.

The system presents links to the available data relative to each section in the fact sheet (N.B. the systems “remembers” that Ms Jones is looking for fish F and country C, she only needs to set the time interval and extra variables where appropriate). Ms Jones selects and compares the statistics she finds most interesting. She finds that: a) dramatic drop of D in C from January on; b) D is stable in neighbouring countries.

Finally, from the news-service included in the web site and automatically filtered by topic (fish) and geographical zone, Ms Jones reads that in January an accident occurred on the coast of C, with resulting chemical pollution of the area. Further research (outside the scope of FSDAS) reveals that the chemical spilled into the water has a known effect on food D and consequently on the fish stock F.

### 5.3.3 FSDAS User Scenario 3

Ms Lopez is a fisheries scientist who is going to write a report on the state of Albacore tuna stocks in the Mediterranean Sea. First of all, she is interested in surveying reports produced in the last year by the regional bodies involved in the study and protection of Albacore tuna.

Ms Lopez logs in the FSDAS system, inspects her profile and adds to it the ontology of factors revealing risk of resource under stress (i.e. reduced catches or Basic Catch Per Unit Effort (CPUE), reduced biodiversity, reduced size of fish, increased duration of fishing trips, ...). Ms Lopez browses the ontology and selects the following factors: catches, fish size, fishing trips duration.

From the FSDAS interface, Ms Lopez selects all available collections of reports concerning the Albacore tuna in the Mediterranean Sea, and activates the search. The system selects all documents in the collections where risk factors appear associated (i.e. close in the document) to Albacore tuna. The selected documents are presented to Ms Lopez in order of likely relevance, and the salient words occurring in them are highlighted: all the selected risk factors, all available names for Albacore tuna, including scientific and common names, Mediterranean sea and its sub-areas (according to the international divisions also used to map tuna stocks).

The system presents the retrieved documents grouped by language, together with a link to translated versions, where available. Since both the selected ontology and the collections of documents are multilingual, Ms Lopez narrows down her search by inspecting only documents (originally) written in Arabic. The corresponding English word for each risk factor occurring in the Arabic document is available on request, by right clicking on it. This is especially useful because Ms Lopez does have a good understanding of written Arabic, but that is not her primary language of work.

After skimming a few of the retrieved documents, Ms Lopez decides to further narrow her search to only look at “catches” and “fish size.” Very quickly, thanks of the combination of retrieval and filtering on the document collection, and of the visual cues used for in the document highlighting, Ms Lopez can select the reports most interesting for her study. Then, she starts comparing the data presented in those reports with other statistical databases accessible from FSDAS (as hinted in previous scenarios).

## 5.4 Use cases

This section is currently described by a set of use cases that illustrate the major functional features of the system. It should be formalized in future to better document the functional requirements.

### 5.4.1 Login

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- User logs into the system

#### PRECONDITIONS

- Application launch

#### TRIGGERING EVENT(s)

- Application launch

#### POST CONDITIONS

- User is logged in

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User inputs name and password.
- User is authenticated
- System loads last saved session or default profile

##### b. ALTERNATIVE FLOW

- User not found, is invited to try again
- User not found, is invited to register

#### RELATED USE CASES

- Register

#### NOTES / ISSUES

- N/A

## 5.4.2 Logout

### ACTORS

- Fisheries scientist

### DESCRIPTION

- User logs out

### PRECONDITIONS

- User is logged in

### TRIGGERING EVENT(s)

- User selects logout

### POST CONDITIONS

- User is logged out, system returns to login screen

### FLOW OF EVENTS

#### a. BASIC FLOW

- User selects logout
- System asks if user wants to save non-saved data she is working on
- System logs user out
- System returns to login screen

#### b. ALTERNATIVE FLOW

- User not found, is invited to try again or register

### RELATED USE CASES

- Register

### NOTES / ISSUES

- N/A

### 5.4.3 Register

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Register

#### PRECONDITIONS

- Application launch

#### TRIGGERING EVENT(S)

- User selection of “register” link from login page

#### POST CONDITIONS

- Registration request is sent to admin
- System displays a success page to the user

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User inputs: name, email (twice), desired password (twice)
- User clicks “submit”
- Registration request is sent to the system administrator with details
- System displays a success page to the user

##### b. ALTERNATIVE FLOW: email or password double entries do not match

- System invites user to repair input

##### c. ALTERNATIVE FLOW: mandatory field(s) is missing

- System invites user to repair input

##### d. ALTERNATIVE FLOW: mandatory field(s) is missing

- System invites user to repair input

#### RELATED USE CASES

- Login
- Logout

#### NOTES / ISSUES

- Registration is sent for approval by system administrator



- Defaults access rights should be “read only”
- Administrator will establish more detailed privileges

### 5.4.4 Modify Profile

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- User modifies her profile

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User clicks “modify profile” from main page

#### POST CONDITIONS

- Profile is modified
- User is shown main page

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User clicks “modify profile” from main page and system loads profile page
- System loads profile page
- User modifies user details, including default language, ontologies and favourite concepts
- User validates changes
- System returns to main page

##### b. ALTERNATIVE FLOW

- User abandons action by clicking “cancel”
- System returns to main page, no changes are made

##### c. ALTERNATIVE FLOW

- User makes some kind of invalid input
- System invites user to try again

#### RELATED USE CASES

- Save session

#### NOTES / ISSUES

- The user profile contains information about the user (name, organization, email, editing rights, ...) and all preferred options including list of ontologies and collections of documents and statistics commonly used for search, browsing and reading.

### 5.4.5 Modify the set of ontologies in profile

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Modify the set of ontologies listed in the user profile

#### PRECONDITIONS

- User is logged in
- User profile is open for editing

#### TRIGGERING EVENT(s)

- User selects “modify ontology set”

#### POST CONDITIONS

- Set of ontologies is modified

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “modify ontology set”
- System shows the currently loaded ontologies and all available unloaded ontologies
- User modifies the set of loaded ontologies
- System stores the modified set

#### RELATED USE CASES

- Register
- Modify profile

#### NOTES / ISSUES

- All ontologies in the network are “available ontologies”

### 5.4.6 Search concept in ontology

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Search concepts within an ontology

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User enters text in search box and clicks “search concept”

#### POST CONDITIONS

- System displays retrieved concepts

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User enters text in search box
- User clicks “search concepts”
- System consults ontology server
- System displays results

##### b. ALTERNATIVE FLOW: no concepts found

- System returns message that no concepts were found
- User invited to try another query

##### c. ALTERNATIVE FLOW: closely matching concepts found

- System displays result with a warning that concepts are closely matching

##### d. ALTERNATIVE FLOW: search box is empty when user clicks “search concept”

- System shows alerts message

#### RELATED USE CASES

- Browse concepts
- Search for related concepts

#### NOTES / ISSUES

- N/a

### 5.4.7 Search for related concepts

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- User searches for concepts related to the one at hand

#### PRECONDITIONS

- User has selected a concept (after browsing or searching)

#### TRIGGERING EVENT(s)

- User selects a concept and clicks “search for related concepts”

#### POST CONDITIONS

- Related concepts are displayed

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects a concept
- User clicks “search for related concepts”
- System queries ontology server
- Related concepts are displayed

##### b. ALTERNATIVE FLOW

- Related concepts are displayed
- User is invited to try another query

#### RELATED USE CASES

- Browse concepts
- Search concepts in ontology

#### NOTES / ISSUES

The option “search for related concepts” is only available if a concept has been selected

### 5.4.8 Browse concepts

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- User browses concepts in an ontology

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(s)

- User clicks “browse concepts” from main page

#### POST CONDITIONS

- Browsable list of concepts displayed

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User clicks “browse concepts” from main page
- Systems queries ontology server for concepts
- Browsable list of concepts displayed

#### RELATED USE CASES

- Search concepts
- Search for related concepts

#### NOTES / ISSUES

- n/a

### 5.4.9 Change language of the interface

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Change language

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(s)

- User clicks a language icon in the toolbar

#### POST CONDITIONS

- User interface has changed to selected language

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User clicks a language icon in the toolbar
- User interface changes to selected language

#### RELATED USE CASES

- N/a

#### NOTES / ISSUES

- The languages at disposal of the user for the interface are the five languages of FAO: Arabic, Chinese, English, French, Spanish.
- The languages at disposal of the user for the content depend on the availability



### 5.4.10 Change language of the resource shown

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- User changes language of the resource being displayed

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User clicks a language icon among those associated with the resource being displayed

#### POST CONDITIONS

- The resource is displayed in the selected language

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User clicks a language among those associated to the resource being displayed
- The resource is displayed in the selected language

#### RELATED USE CASES

- Change language of the interface

#### NOTES / ISSUES

- A resource is any content being displayed: ontologies, documents, graphics, statistics, etc.
- The languages at disposal of the user for the interface are the five languages of FAO: Arabic, Chinese, English, French, Spanish.
- The languages at disposal of the user for the resource depend on the availability
- The possibility of setting preferences for associating language of interface with language of resource

### 5.4.11 Add concept to query

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Add concept to query

#### PRECONDITIONS

- User has selected a concept

#### TRIGGERING EVENT(s)

- User drags the selected concept to the query area

#### POST CONDITIONS

- Concept displayed in query area

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User drags a concept to the query area
- Concept is displayed in query area
- System adds the concept to the query being formulated

#### RELATED USE CASES

- Search concept in ontology
- Browse concept
- Modify set of ontologies

#### NOTES / ISSUES

- How many concepts will need to be added to the query area depends on the type of query being formulated, which depends, in turn, on the type of resource to query. For example, in order to query a statistical database, the user needs to specify at least *three* variables, i.e., time, space, and subject.

## 5.4.12 Query Concept instances

### ACTORS

- Fisheries scientist

### DESCRIPTION

- User queries available instances of concepts

### PRECONDITIONS

- At least one concept is in the query area

### TRIGGERING EVENT(s)

- User clicks “search concept instances”

### POST CONDITIONS

- System has displayed results as clickable titles linked to their parent concept classes
- System displays related concept instances, if available

### FLOW OF EVENTS

#### a. BASIC FLOW

- User clicks “search concept instances”
- System displays results as clickable titles linked to their parent concept classes
- System displays related concepts for which it has concept instances, if any

#### b. ALTERNATIVE FLOW: no results found

- System returns to previous page with message

### RELATED USE CASES

- Refine query
- Visualize concept instance
- Visualize concept instance metadata
- Add concept to query

### NOTES / ISSUES

- It is considered that “concept instances” are actual links to data resources associated to concept classes, e.g. a link to a “Yellowfin Tuna fact sheet” that is linked to the concept “Yellowfin Tuna”.

### 5.4.13 Visualize concept instance

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Visualize concept instance

#### PRECONDITIONS

- At least one concept instance is listed in the query results

#### TRIGGERING EVENT(S)

- User clicks on the title of the concept instance

#### POST CONDITIONS

- System has opened resource in associated application, e.g. browser, word, Acrobat, image viewer, etc.

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User clicks on the title of the concept instance
- System opens resource in associated application, e.g. browser, word, Acrobat, image viewer, etc.

##### b. ALTERNATIVE FLOW: there is no associated application

- System invites user to locate another application or to install needed application

#### RELATED USE CASES

- Query concept instances
- Refine query

#### NOTES / ISSUES

- N/a

#### 5.4.14 Refine query

##### ACTORS

- Fisheries scientist

##### DESCRIPTION

- Refine query

##### PRECONDITIONS

- At least one concept instance is listed in the query results

##### TRIGGERING EVENT(s)

- User clicks “refine query”

##### POST CONDITIONS

- System has returned to concept page with previously selected concepts still in the query area, and last searched or selected concept in centre of screen with related concepts

##### FLOW OF EVENTS

###### a. BASIC FLOW

- User clicks “refine query”
- System returns to concept page with previously selected concepts still in the query area, and last searched or selected concept in centre of screen with related concepts

##### RELATED USE CASES

- Visualize concept instance
- Query concept instances

##### NOTES / ISSUES

- N/a

### 5.4.15 View concept metadata

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- View concept metadata

#### PRECONDITIONS

- At least one concept is displayed

#### TRIGGERING EVENT(S)

- User selects a concept and clicks “view metadata”

#### POST CONDITIONS

- System displays concept together with associated metadata

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects a concept and clicks “view metadata”
- System queries ontology server and displays concept together with associated metadata

#### RELATED USE CASES

- View concept instance metadata
- Visualize concept instance

#### NOTES / ISSUES

- It is especially important that the visualized metadata include the provenance of the concept, i.e. who created/revised it

### 5.4.16 View concept instance metadata

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- View concept instance metadata

#### PRECONDITIONS

- At least one concept instance is displayed

#### TRIGGERING EVENT(S)

- User selects a concept instance and clicks “view provenance”

#### POST CONDITIONS

- System displays concept instance metadata, e.g. title, author, subject, last modified, etc.

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects a concept instance and clicks “view provenance”
- System queries ontology server and displays concept together with associated metadata

#### RELATED USE CASES

- View concept metadata
- Visualize concept instance

#### NOTES / ISSUES

- The selected instance can be the result of a query already performed

### 5.4.17 Email results

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Email results

#### PRECONDITIONS

- At least one concept or concept instance is displayed

#### TRIGGERING EVENT(s)

- From a results page user clicks “email results”

#### POST CONDITIONS

- System has emailed results

#### FLOW OF EVENTS

##### a. BASIC FLOW

- From a results page user clicks “email results”
- A form is displayed to allow the user to write and send an email message
- User inputs email and clicks “send”
- System sends HTML-formatted results, informs user of success and returns to previous result page

##### b. ALTERNATIVE FLOW: email is malformed

- System invites user to retry

#### RELATED USE CASES

- Browse concepts
- Search concepts
- Query concept instances

#### NOTES / ISSUES

- N/a



### 5.4.18 Propose ontology modification

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Propose to modify ontology

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User selects “propose modification to ontology”

#### POST CONDITIONS

- Proposal sent to ontology editors

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “propose modification to ontology”
- System queries ontology server and opens a page showing the currently loaded ontologies together with any contexts, unions or intersections modifying the overall ontology set and any available unloaded ontologies
- User selects the element(s) to modify (i.e. concepts, instances, entire branches, context), and writes the reason for changes
- User clicks “propose modification to ontology”
- The modification proposal is sent to the ontology editors

#### RELATED USE CASES

- Related concepts
- Browse concept
- Search concepts

#### NOTES / ISSUES

- N/a

### 5.4.19 Add to favourites

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Add to favourites

#### PRECONDITIONS

- A results page

#### TRIGGERING EVENT(s)

- User selects “add to favourites”

#### POST CONDITIONS

- System has added current set of query concepts to a list of favourites against the user profile
- The list appears under a heading of “favourites”

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “add to favourites”
- System durably writes parameters for current set of concepts and underlying ontology set to a favourites list
- The item is added to a list that appears under a heading of “favourites”

#### RELATED USE CASES

- Save session
- Modify profile

#### NOTES / ISSUES

- N/a

### 5.4.20 Save session

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Save session

#### PRECONDITIONS

- A search result page

#### TRIGGERING EVENT(s)

- User selects “save session”

#### POST CONDITIONS

- System has saved the session parameters against the user profile
- The list appears under a heading of “favourites”

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “save session”
- System durably writes parameters for current set of concepts and underlying ontology set against the user profile
- The user is made aware that the save was successful

#### RELATED USE CASES

- Add to favourites

#### NOTES / ISSUES

- N/a

### 5.4.21 Generate RSS feed

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- Generate RSS feed

#### PRECONDITIONS

- A results page is displayed

#### TRIGGERING EVENT(s)

- User selects “generate RSS feed”

#### POST CONDITIONS

- System has opened a browser with the URL for the RSS feed based on the current concept query set

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “generate RSS feed”
- System opens a browser with the URL for the RSS feed based on the current concept query set

#### RELATED USE CASES

- Add to favourites
- Modify profile

#### NOTES / ISSUES

- N/a

## 5.4.22 Annotate retrieved document with comments on quality

### ACTORS

- Fisheries scientist

### DESCRIPTION

- After reading a retrieved document, a user annotates it with a judgement and a comment about its usefulness

### PRECONDITIONS

- User is logged in with appropriate rights
- A document is opened

### TRIGGERING EVENT(s)

- User selects “assess this document”

### POST CONDITIONS

- System has attached an assessment to the document, together with relevant metadata concerning the user who issued the assessment.

### FLOW OF EVENTS

#### a. BASIC FLOW

- User selects “assess this document”
- System requests user to rank the document according to some criterion (e.g., reliability)
- User ranks the document
- System requests user to add a comment on the ranking

### RELATED USE CASES

- View concept instance

### NOTES / ISSUES

- Document generically refers to any type of annotatable resource, such as textual documents, graphics, statistical tables, ...
- The model of interaction with the system to produce the information requested in Basic Flow is to be defined. For example, the user could be requested to fill in a form, or follow a step-by-step process (first the ranking, then the comment)
- Annotation cannot be conflicting, as they express the personal view of the user who made them

### 5.4.23 Annotate retrieved document with keywords

#### ACTORS

- Fisheries scientist

#### DESCRIPTION

- After reading a retrieved document, user annotates it (or part of it) with keywords

#### PRECONDITIONS

- A document is opened

#### TRIGGERING EVENT(s)

- User selects “assign keywords to this document”

#### POST CONDITIONS

- System has attached keywords to the document

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “assign keywords to this document”
- System requests to select a classification schema, thesaurus, or ontology from which to extract the keywords
- User selects a thesaurus
- User selects the preferred keyword(s) and finishes the operation
- System annotates document with relevant keyword
- User may add a comment or not

##### b. ALTERNATIVE FLOW: user assigns keyword to part of the document

- User select an excerpt from the document
- User selects “assign keywords to this document”
- Process continues as above

#### RELATED USE CASES

- Annotate retrieved document with comments on quality, Annotate retrieved documents with comments

#### NOTES / ISSUES

- The possibility of adding keywords not taken from any resources could be discussed

- The possibility of letting the system suggest which keywords to assign to the document should also be investigated: for example, the system could show keywords already assigned to the document, or compare the document with a selected thesaurus or classification schema

#### 5.4.24 Annotate retrieved document with comments

##### ACTORS

- Fisheries scientist

##### DESCRIPTION

- After reading a retrieved document, user annotates it (or part of it) with keywords

##### PRECONDITIONS

- A document is opened

##### TRIGGERING EVENT(S)

- User selects “add your comment”

##### POST CONDITIONS

- System has attached user comment to the document

##### FLOW OF EVENTS

###### a. BASIC FLOW

- User selects “add your comment to this document”
- User writes comment

###### b. ALTERNATIVE FLOW: user writes comment concerning part of the document

- User selects an excerpt from the document
- User selects “add your comment”
- Process continues as above

##### RELATED USE CASES

- Annotate retrieved document with comments on quality, Annotate retrieved document with keywords

##### NOTES / ISSUES

- The possibility of adding keywords not taken from any resources could be discussed
- The possibility of letting the system suggest which keywords to assign to the document should also be investigated: for example, the system could show keywords already assigned to the document, or compare the document with a selected thesaurus or classification schema



### 5.4.25 Select ontologies to use for browsing documents or web pages

#### ACTORS

- All

#### DESCRIPTION

- User selects ontologies to support browsing and reading of documents and web pages

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User selects “add ontologies for browsing”

#### POST CONDITIONS

- Ontologies are selected and can be activated to be used to support browsing and reading

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “add ontology for browsing”
- System asks user to select an ontology from file system
- User selects ontology from file system
- System asks whether to select the entire ontology or a fragment of it
- User selects “entire ontology”
- System saves the selected ontology in the user profile

##### b. ALTERNATIVE FLOW: user selects fragment of an ontology

- System asks whether to select the entire ontology or a fragment of it
- User select “fragment”
- System opens the ontology
- User selects the desired fragment and finishes the operation
- System saves the selected fragment in the user profile

#### RELATED USE CASES

- Include a selection from an existing ontology (see Chapter 4)

#### NOTES / ISSUES

- N/a

### 5.4.26 Use ontology to support browsing

#### ACTORS

- All

#### DESCRIPTION

- User uses ontologies to support browsing and reading of documents and web pages

#### PRECONDITIONS

- User is logged in
- Ontologies are selected to support browsing

#### TRIGGERING EVENT(s)

- User selects “activate ontologies for browsing”

#### POST CONDITIONS

- Ontologies are activated to be used to support browsing and reading of ontologies

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects “activate ontologies for browsing”
- System loads the selected ontologies
- Words occurring both in the opened document or webpage and the ontologies are highlighted, and
- Information or services associated with the ontologies are shown to the user

#### RELATED USE CASES

- Select ontologies to use for browsing documents or web pages

#### NOTES / ISSUES

- Examples of pieces of information associated to an ontology are: available relations to other terms or documents, translation of a highlighted word in other languages, available definitions
- Examples of services associated with the ontology are: search for documents relevant to the highlighted term, search for documents annotated with the highlighted term (i.e. the term user as keyword).

### 5.4.27 Identify trend

#### ACTORS

- All

#### DESCRIPTION

- System presents the trend of one or more selected parameters

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User selects “identify trend”

#### POST CONDITIONS

- User is shown the trend of the selected parameter

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects one or more parameter to compute a trend
- User clicks “identify trend”
- System shows trends of the selected parameter

##### a. ALTERNATIVE FLOW

- System has no data about the trend
- System returns warning and suggestions about available “similar” trends

#### RELATED USE CASES

- N/a

#### NOTES / ISSUES

- Possible parameters of which to compute the trend include: marine areas, land areas, national fishing fleets, species, species groups, fisheries commodities, vessel types, time ranges

### 5.4.28 Compare data by reporter

#### ACTORS

- All

#### DESCRIPTION

- User compares data

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User clicks “compare”

#### POST CONDITIONS

- Two documents are shown side by side for comparison

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects a domain (e.g. capture, production, commodities, fleet, ...)
- User selects a species and/or a geographical area
- User click “search”
- System returns a list of results
- User selects “order by data source”
- User selects two items from the list and clicks “compare”
- System opens the two selected items, and shows them side by side

#### RELATED USE CASES

- N/a

#### NOTES / ISSUES

- By data source we mean the organization or body (national ministries, regional fisheries bodies, institutions, etc.) that released the data

### 5.4.29 Compare historical data

#### ACTORS

- All

#### DESCRIPTION

- User compares data

#### PRECONDITIONS

- User is logged in

#### TRIGGERING EVENT(S)

- User clicks “compare”

#### POST CONDITIONS

- Two documents about the same subject, but issued in different years, are shown side by side for comparison

#### FLOW OF EVENTS

##### a. BASIC FLOW

- User selects a domain, a species and/or a geographical area, and time range
- User selects a species and/or a geographical area
- User clicks “search”
- System returns a list of results
- User selects “order by data source”
- User selects two items from the list and clicks “compare”
- System opens the two selected items, and shows them side by side

#### RELATED USE CASES

- Compare data by reporter

#### NOTES / ISSUES

- N/a

## 5.5 Software requirements

Figure 6 (expanded from the grey rectangle in Figure 5) provides an overview of the major processes taking place inside the FSDAS when a query is received through the user interface. This does not yet provide details on how users are allowed to perform a query to the system (browsing, searching, etc.), but concentrates on the general processes applicable in all types of queries and user profiles.

The FSDAS query processor and FSDAS query compiler will use the ontologies to perform the tasks highlighted in Figure 6. It is expected that they will be able to use web services or a combination of web services provided within the NeOn infrastructure.

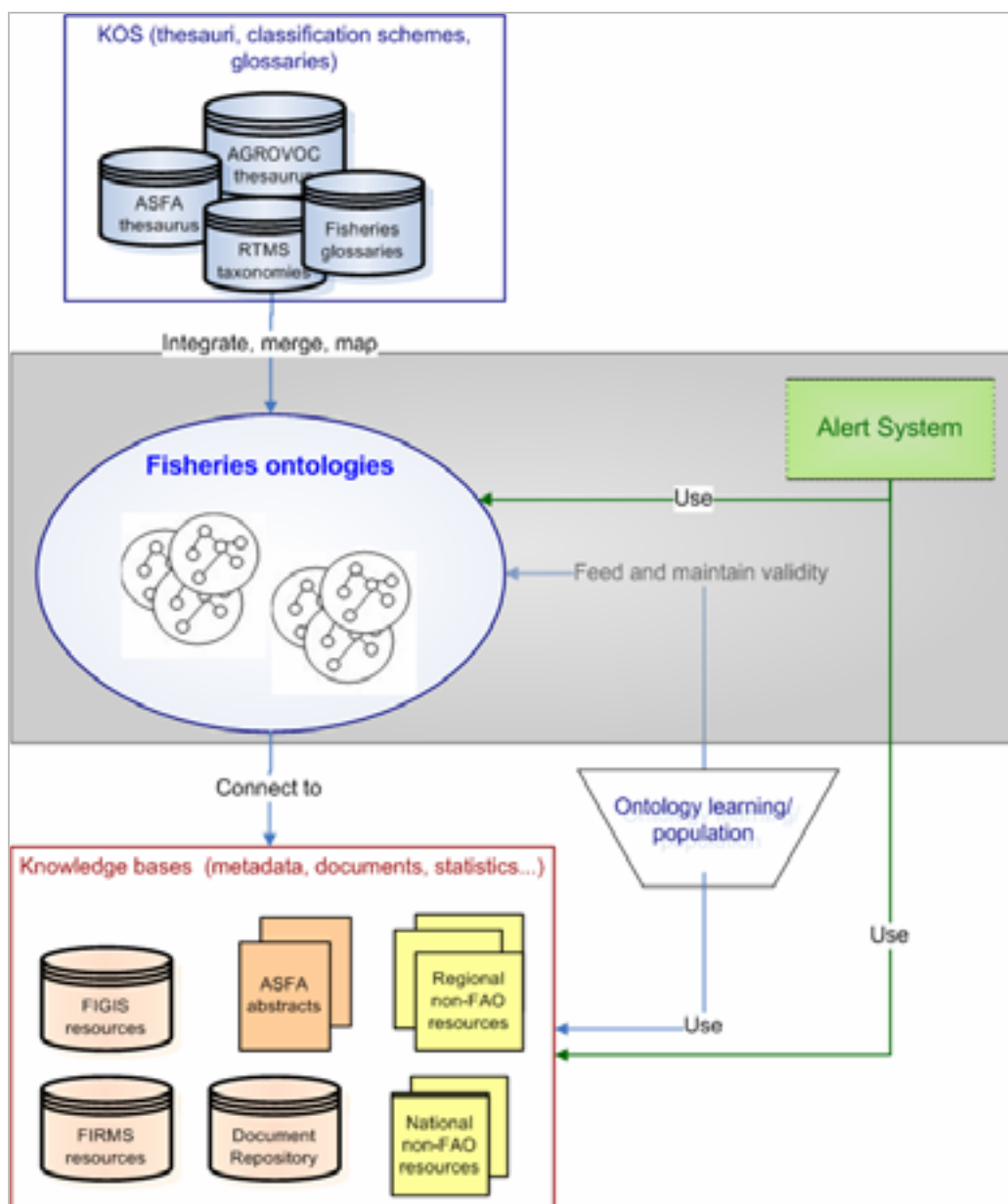


Figure 6 - FSDAS interaction with ontologies

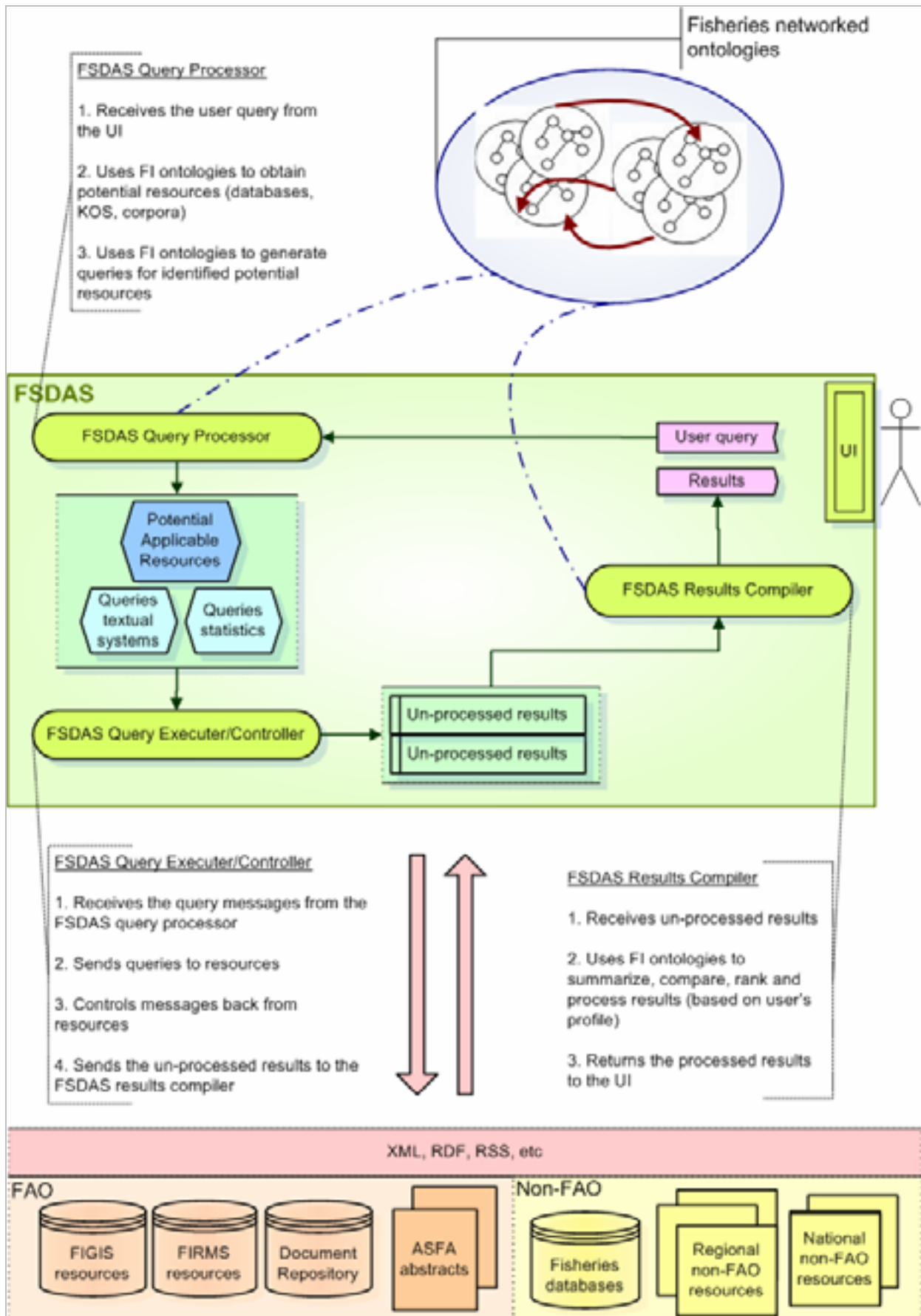


Figure 7 - FSDAS processes

## 5.5.1 External Interface Requirements

### 5.5.1.1 User Interface

The FSDAS user interface will be web-based and compatible with Microsoft Internet Explorer 6.0+ and Mozilla Firefox 1.5+. Given the large amount of data to be loaded and managed, the use of AJAX technology would need to be explored.

The FSDAS user interface needs to be multilingual to support the different languages of FAO. When a user selects a language for the user interface (e.g. Spanish), all navigation elements, controls, labels, action buttons, graphics and content will display in the selected language.

Management of language for the interface should be kept separate from the management of language content which will be managed by extending the NeOn service for language support.

When changing language, all elements of the user interface should display in the newly selected language. Content should display in the selected language, when available; if not available, the software should look for the equivalent piece of content in the following order: English, Spanish, French, Arabic and Chinese.

Content must be accessible in all the five languages (Arabic, Chinese, English, French and Spanish).

The user interface shall work in English, French and Spanish. A user interface that works in Arabic and Chinese is desirable but not mandatory, given the additional effort needed in terms of stylesheets and graphics. The user interface must be designed to allow the incorporation of other languages if necessary in the future.

In addition, the user interface must be compliant with the WAICENT checklist for the clearance of web sites provided in Annex II.

### 5.5.1.2 Software Interfaces

The software will need to interface with the NeOn infrastructure components and with ORACLE DBMS.

The FSDAS will exploit to the maximum the services provided within the NeOn infrastructure. Full specification of the software interfaces in terms of using NeOn components will be done at a later stage, when the specifications for the NeOn services are available.

The software may also need to interface with partner information repositories. Possible partner repositories are (to complement resources provided in section 2.2 of this document):

- <http://www.fao.org/fi/figis>
- <http://www.fao.org/fi/asfa/asfa.asp>
- <http://www.fao.org/eims/>
- <http://www.fao.org/NEMS/default.htm>
- <http://www.fishbase.org/>
- <http://www.onefish.org/global/index.jsp>
- <http://faostat.fao.org/default.aspx>
- [AgEcon](#) (WAEA)
- [AGRICOLA](#) (USDA)



- [Biocomplexity Thesaurus](#)(CSA & NBII)
- [CephBase](#) (cephalopods)
- [Code of Federal Regulations \(CFR\) Environmental Directory](#) (organizations)
- [ECOLEX](#) (environmental law)
- [EUROSTAT](#)
- [LarvalBase](#) (fish larvae)
- [OAIstr](#) (full text academic digital resources)
- [Seafood List](#) (FDA)
- [STATLANT](#) (ICES)
- [Stock Recruitment](#) (Dalhousie University)
- [TESS](#) (endangered species) (USFWS)

### 5.5.1.3 Communications Interfaces

Communication standards such as FTP and HTTP are likely to be used, as are message-passing protocols such as SOAP.

Message formatting is likely to involve RDF/OWL.

### 5.5.2 Operating Environment

Application/Server must operate on an Intel/Linux platform.

Client must function on Windows/Linux/Mac OS-X operating systems; e.g. in a browser.

### 5.5.3 Design and Implementation Constraints

- Application/Server shall be installed alongside other existing applications on the same hardware/operating system.
- Memory requirements should be below one gigabyte.
- Application should be able to use ORACLE as its DBMS.
- Application should be written in Java to take advantage of developer knowledge at FAO.
- Application must be able to work natively with UTF-8 in order to support FAO official languages (Arabic, Chinese, English, French and Spanish)
- Application must be capable of delivering results as XML in RDF/OWL.
- Application API should offer methods to return results in multiple formats to allow multiple output types.

- Application user security must be a separate component allowing for the use of FAO's current user authentication system (FAODOMAIN).
- Results should not take more than two seconds to display.
- Application must be capable of using components of the NeOn architecture and must be capable of correctly interpreting and displaying its responses (probably RDF/OWL)

#### **5.5.4 Assumptions and Dependencies**

FSDAS depends on the NeOn infrastructure for many of its features:

- Queries against the ontology(ies) and mappings
- Ontology visualization and browsing
- Unions, intersections and contexts of multiple ontologies
- Inference engine for discovering concept instances

FSDAS depends on the creation of a set of ontologies describing the fisheries domain.

FSDAS depends on the cooperation of a group of partner information repositories from which to draw its concept instances.

#### **5.5.5 Other Non functional Requirements**

##### **5.5.5.1 Performance Requirements**

Performance is an important requirement, especially for those fisheries officers in decentralized offices (Regional, Sub-regional or country offices) that would be accessing the FSDAS from FAO offices around the world.

It is envisaged that FSDAS users will be using its services from a FAO office, with a connection to the FAO intranet through the WAN. Although not all FAO offices have a connection to the WAN yet, the FAO WAN project will have been completed by the time the FSDAS is operational.

As a general performance requirement, page display should not take more than 2 seconds (assuming users are connected to FAO WAN).

Performance requirements for users outside the FAO WAN is difficult to estimate; FAO's information is accessed also from developing countries, which in some cases have a very low bandwidth and frequent network interruptions. The general FAO recommendation for public web pages is not to exceed 100 kb, but in the case of the kind of services the FSDAS is dealing with, this is completely out of scope.

##### **5.5.5.2 Security Requirements**

All users of the system will need to be authenticated as some concept instances and/or ontologies may not be part of the public domain.

The authentication service should be compatible with current FAO standard to allow FAO users to login with their network credentials.

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## Annex I – Previous work on the Fisheries Ontology (2003)

### Background

The Fishery Ontology Project (FOS), in operation from 2002 to 2003, was managed jointly by ISTC-CNR and FAO [GAN04] [GAN04WW]. It was designed for “the creation, integration and utilization of ontologies for information integration and semantic interoperability in fishery information systems.” At that time, integration and interoperability were interpreted as having one centralized, consistent library of ontologies that played the role of a *hub* helping the interoperability between different document servers or other information systems.

The approach adopted in FOS consisted of the following steps:

1. reengineering informal or semi-structured terminological and metadata resources (KOSs: knowledge organization systems) into formal ones;
2. organizing and aligning the reengineered KOSs within an appropriate layered and modular *ontology library*; and

When the project started, experience with ontologies in the semantic web framework was still limited. We have since learned that to ensure communication between different systems and resources, the reengineering of the resources is not enough, because scalability, ease of maintenance and continuity with legacy practices are crucial issues to address.

According to the NeOn vision, resources remain independent of each other, but techniques and methodologies to allow e.g. for mapping between them can be developed so that they can be organized into a network. Thus the focus is now on **bridging between ontologies** and the effective maintenance of these bridges. NeOn assumes that ontologies will be dynamic, networked, shared and contextualized: the understanding is that any function implemented in the NeOn toolkit, such as the mapping between ontologies, will be inflected according to each of these four assumptions<sup>10</sup>.

### The Fishery Ontologies in FOS

The FOS project used the following resources (details provided refer to the time the project was carried out):

1. **OneFish topic trees:** this was a hierarchy with average depth 3, organized into five disjoint categories, called ‘worldviews’ (subjects, ecosystems, geography, species, administration), plus one worldview (stakeholder) maintained by the users of the community. Topics listed under more than one parent are marked with @.
2. **A fragment of AGROVOC thesaurus related to fishery:** consisting of approximately 2,000 fishery related descriptors (out of 16,000 descriptors). The fragment was manually extracted;
3. **ASFA thesaurus;**
4. **FIGIS reference tables:** organized into five thematic sections (aquatic species, geographic objects, aquatic resources, marine fisheries, and fishing technologies) with approximately 200 top-level

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<sup>10</sup> For more details, see the document “NeOn requirements and vision” aka “The Darmstadt document”

concepts, with maximal depth of 4. It also contains 30,000 'objects' (mixed concepts and individuals), relations (specialized for each top category, but scarcely instantiated) and multilingual support.

The approach followed in FOS embodied a three-layered structure: a foundational layer, a core layer and a domain layer. The idea of this three-layered structure is that each top-class or property in domain ontology is a subclass of a class resp. property in the core ontology, and each top-class or property in the core ontology is a subclass of a class resp. property in the foundational ontology. For example, Yellow Tuna (domain ontology) `rdfs:subClassOf` Biological entity (core ontology), which `rdfs:subClassOf` Physical entity (foundational ontology). More in detail:

1. **A set of foundational ontologies**, (containing upper or top-level concepts and relations) has been used to describe very general concepts and relations, presumed to be valid across all domains. For example, "physical object" or "part-of" would typically be included in a foundational ontology. In the FOS project, this layer is inspired by the DOLCE foundational ontology [MAS04KR], extended with D&S [GAN03DNS][MAS04KR], the Plan ontology [GAN05], and some other modules. An ontological version of WordNet (OntoWordNet, [GAN03OWN]) has been also used in order to align some non-fishery concepts that are present in the reengineered resources.
2. **A set of core ontologies** has been designed to describe the central concepts and relations of a domain. For example, for the domain of fisheries, a core ontology could include "Ecosystems," "Institutions," "Vessels and Gears," et sim. The core layer, the Core Ontology of Fisheries (COF), designed in a modular way [GAN04], has been built by specializing some patterns extracted from the foundational ontologies.
3. **A set of domain ontologies**, reengineered from informal resources, has been produced in order to describe the most domain-specific fishery concepts and relations. Domain ontologies resulted to be modular in a way dependent on the original partition of resources. Agrovoc, ASFA, and the ontologies produced from the different reference tables in FIGIS (e.g. Vessels, Gear types, Commodities, Aquatic Resources, Geographic areas, etc.) were the resulting domain ontologies in the FOS library. Further attempts at modularizing domain ontologies, e.g. by merging ASFA and FIGIS aquatic resources, were envisaged, but not implemented for the lack of resources and automatic procedures. The only experiment has been done on the Vessels ontology, by merging ASFA, Agrovoc, and FIGIS vessel-related classes [GAN04WW].

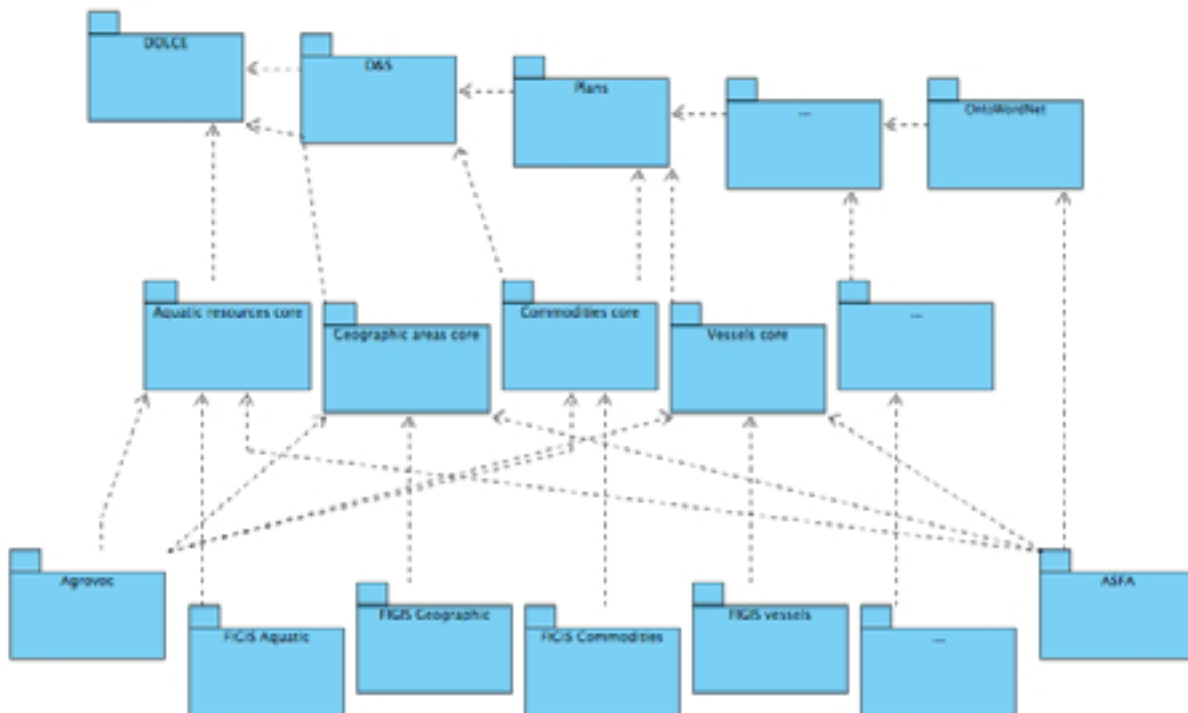


Figure I – A diagram representing FOS.

Figure I depicts the dependencies between some of the ontologies from the three layers of the FOS library. The topmost layer contains the reused *foundational* ontologies. The middle layer shows the *core* ontologies of fishery, the bottom layer shows some *domain* fishery ontologies that contain dependencies to the core ones.

### COF: the core ontology library designed and built within FOS

Candidate concepts for COF ontologies were: 1.600 top-level classes from ASFA, 83 from AGROVOC, 400 from FIGIS. In the end, only 10% of these candidates were included in COF, as some classes were found to be equivalent, others were excluded because not fishery specific, while still others were moved lower down the hierarchy, into domain ontologies.

After the definition of the COF library, the following operations were carried out:

- **Modularization and alignment.** Here alignment consists of “creating `rdfs:subClassOf` triples between the classes included in the proto-ontologies top-levels (i.e. the most general classes migrated from the informal resources) and the classes in the reference ontologies.” In practice, this means alignment of domain top level classes with the reference to available classes in the core or foundational ontologies. Alignment was required for a minimal interoperability between ontologies, and as a preliminary step toward merging.
- **Usage of COF for refinement and merging.** Merging is applied (using ONIONS, [GAN99]) in order to avoid the redundancy created during the step of alignment. The result is an ontology with fewer concepts and deeper hierarchy. Several other results, including cleaning-up of taxonomies, logical consistency checking, relation enrichment heuristics, have been achieved, as described in [GAN04] and [GAN04WW].

A workflow has been produced which includes the schema of the methods applied to reengineer resources, choosing the best meta-model, taking decisions on design choices, alignment, modularity, consistency, merging, exploitation, etc. The workflow is presented in [GAN04] and, in a more detailed way, as a deliverable of the EU WonderWeb project [GAN04WW].

### FOS and NeOn

After the completion of FOS, the resources on which the domain ontologies were built continued to evolve, while the fishery ontologies remained static. This happened because FOS ontologies did not enter the editorial cycle used by the people who maintained the original resources, and were barely integrated into the network of resources of the organization. Moreover, since there was no mechanism to automatically reflect updates from the sources to the ontologies (and back), it was natural for editors to keep working on the sources, and avoid duplicating addition/change of material.

Here we give an overview of the changes which took place in the resources used to produce the FOS ontologies.

Currently, the **AGROVOC thesaurus** contains entries in nine languages, each of which contains about 30,000 terms (counting both descriptors and non-descriptors). AGROVOC contains 39,095 terms in total, in English, 1,246 of which are top-terms (more details at [http://www.fao.org/aims/ag\\_figures.jsp](http://www.fao.org/aims/ag_figures.jsp)). AGROVOC is stored in a relational database and is available in various formats, including SKOS, MySQL, Postgres, MS Access, TagText, ISO2709 formats, OWL, SKOS. The AGROVOC fragment concerning fisheries has probably grown: but a detailed research should highlight the exact extent. **ASFA thesaurus** has remained pretty stable. **FIGIS reference tables** have changed considerably and now consist of 20,000 entries (classes); the **oneFish** topic tree has also changed significantly.

At the end of the FOS project the following questions were raised:

- How to adapt the fishery ontologies produced in FOS to the current, updated resources we have, without having to restart the entire process?
- Is the entire machinery of a three-layered structure necessary for our purposes?
- Is it possible to put together the resources we want without breaking their connections with the systems they exploit or are exploited by?

Answers to these questions could come from the NeOn project, as the NeOn starting point is that ontologies will be dynamic, networked, shared, and in a context. Below, we start from the assumptions made in NeOn and discuss them in the light of our needs and with references to the functionality that are more important for us, as they emerged from FOS.

### **Dynamic**

As ontologies and the corresponding metadata will evolve and change at a fast rate, this is probably the most important feature for FAO. Dynamics is to be applied to:

### **Editing, building, managing, browsing and visualization, mapping, versioning**

Editing, management, visualization and mapping are all intrinsically dynamic functionalities that must be supported (e.g. changes to concepts or mapping should immediately be visualized/browsable in the user interface). These are the issues to be addressed in order to render the system practicable, as a cumbersome (new) editing process means that authors will keep using the old and well-known systems.

The versioning is dynamic in the sense that we want to be able to keep a history (and therefore restore) each single element that can be edited.

Since ontologies that are connected in the network are, presumably, chosen by experts, the dynamics of selection and reuse of ontologies is not of primary concern for us.

### **Networked**

The modular, yet centralized approach adopted in FOS turned out to be unsuitable for the FAO setting: the process of finding a coherent backbone for the ontology library components was time-consuming and costly, part of the reason being that the resources used were all adopting different perspectives because they were used for different purposes.

A suitable architecture would build on small, task oriented and manageable ontologies, connected by mappings. As a consequence, this requirement impacts on the following functionalities:

- editing should be possible in a networked fashion, in the sense that authors can edit one or more ontologies at a time, together with the mappings that connect them;
- the browsing of individual ontologies should be possible in a seamless manner (although respecting property rights where appropriate);
- by mapping we mean the possibility of connecting ontologies among each other; this is the key issue to address in creating a network.

### **Shared**

Resources built within FAO are usually edited by more than one editor and used by more than one system. Therefore for us “shared” means both multi-edited and multi-tasking.

- The editing system should support more than one author working at the same time on the same ontology, and (or at least) notify authors when this happens (if possible with a precise list of the elements).



- Modularization can be useful to assign fragments of ontologies to authors for the purpose of editing, revision, and possibly visualization and connection. Both manual and automatic (if possible according to more than one criterion) modularization should be supported.

## Context

The interpretation of “context” in our setting is not straightforward, as we tend to look at an entire ontology as a context for a node (concept) in it.

## Conclusions

The FOS project has shown that ontology engineering techniques are needed to reach a real semantic interoperability between resources that are used in large, distributed networks of document servers. However, we identified the following limitations in FOS:

1. lack of an automatic way to keep the mapping between FOS ontologies, and the underlying resources when updated. In fact, the mappings were stored in conversion tables, but without an implemented mechanism to maintain the mappings over the dynamics of both ontologies and sources;
2. lack of integrated tools to create the domain ontologies by starting from the original resources. A formal workflow was defined, but not implemented in a set of integrated, smoothly-working tools;
3. lack of automatic methods to extract “modules” from the original resources and create the ontologies.

A system that aims at integrating at least the resources on which FOS was based, for the purpose of achieving interoperability of systems and resources, should provide the following functionalities:

- possibility of editing and visualizing any of the networked ontologies at the same time, i.e. from the same tool, together with the mapping between them;
- possibility to keep track of versions of data, ontologies and mappings;
- possibility of allowing more than one person at a time to edit and visualize, possibly with constraints (right permissions) imposed by the user profile; and
- possibility to annotate individual concepts, ontologies, and mappings, by more than one person and with special attention to annotation for the purpose of collaborative editing and/or peer-to-peer communication.

## References

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## Annex II – WAICENT checklist for the clearance of web sites

This Checklist provides information on the requirements for obtaining clearance from the Director, GIL when requesting publication of new web sites and Internet-accessible databases or information systems.

At its meeting on 12 December 2002, the WAICENT Committee decided the following:

In the Checklist, items labelled “Mandatory” must be implemented before the site is published, while the other items may be implemented after the site is published. The Checklist is not mandatory for existing web sites; in these cases, it should be considered as recommended good practice.

The Checklist is an integral part of the WAICENT [Web Guide](#).

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### MANDATORY

#### Browser compatibility

*(See Web Guide: 6.2b Browser compatibility)*

The web page must be compatible with the most recent version of common browsers. Browsers for all popular operating systems (such as Windows and Macintosh) should be considered.

The FAO’s Internet logs show that the most common browsers are: Microsoft Internet Explorer (version 6.0+), Mozilla Firefox (version 1.5+) and Apple Safari (1.0+). As a result, web pages should be compatible, at least, with these versions.

The web page should be compatible with XHTML 1.0 (transitional) – see [XHTML™ 1.0 The Extensible HyperText Markup Language \(Second Edition\)](#).

#### Language encoding

*(See Web Guide: 6.7 Language encoding)*

All Web pages should have their language encoding written in the HEAD section. Preference should be given to Unicode (UTF-8), to allow the presentation of multiple languages in the same page. For example: `<meta http-equiv="Content-Type" content="text/html; charset=utf-8">`

For a list of browsers that support Unicode see [Unicode and Multilingual Web Browsers](#).

If, for various reasons, the web pages cannot be delivered in UTF-8, the encoding should however be indicated as follows:

- For English, French and Spanish pages:  
`<meta http-equiv="content-type" content="text/html; charset=iso-8859-1">`
- For Arabic pages:  
`<meta http-equiv="content-type" content="text/html; charset=windows-1256">`
- For Chinese pages:  
`<meta http-equiv="content-type" content="text/html; charset=gb_2312-80">`

#### File naming

*(See Web Guide: 6.1 Management of files/naming)*

To avoid problems related to the use of FAO files in different Operating System (OS) environments, all folder and file names should be in lower case. This also applies for all links contained in all pages.

File names can exceed the DOS convention of 8 characters in length and 3 for the file extension. It is however recommended to keep the file names as short as possible and not to exceed the maximum number of characters allowed for CD (256 full path included). The file extensions considered valid for static files are both .htm and .html.

The file name for the home page should be one of the following: index, index\_ar, index\_zh, index\_en, index\_fr, index\_es, etc. Other names such as home/default/inicio/debut are not recommended but will be maintained for backward compatibility in old FAO Web sites only.

Categorization of information should be dealt with independently of the physical directory structure (e.g. through databases and navigation/menu components). The hierarchy of physical folders should reflect the site structure (e.g. www.fao.org/department/division/branch or www.fao.org/subject/subsubject) using simple and concise names in order to make the site address as intuitive as possible and complement the browsing/navigation links provided by the Web pages.

The language of each file needs to be identified and must use the ISO 639-1 code for its language: ar, zh, en, fr, es (and when needed ru, it, etc.). Language identification may be implemented by one of the following methods:

Use of the ISO 639-1 code to suffix filenames:

The files are organized according to the Organization's structure or thematic categorization and all the files corresponding to the same translated information are in the same folder with the same name plus the language suffix separated by an underscore (e.g. www.fao.org/site-root/page\_en.htm and www.fao.org/site-root/page\_zh.htm)

Use of the ISO 639-1 code to create language specific folders:

The files are organized and grouped according to their language, in a folder per language, at the root of the site structure and named with the ISO 639-1 code (e.g. www.fao.org/site-root/en/page.htm, www.fao.org/site-root/en/sub-folder/page.htm)

To facilitate the development and updating of a web site, language-independent elements (e.g. images, stylesheets, logos and pictures) should be placed in a top-level language-independent directory. (e.g. www.fao.org/site-root/images/icon.gif).

Special characters (except the underscore sign), as well as spaces and all accented characters, should not be used in file names. URLs may only include the alphanumeric 0-9, a-z and A-Z and the following special characters: \$ - \_ . + ! \* ' ( ) , .

## Domain names and aliases

(see *Web Guide: 6.11 Domains, URLs and aliases*)

fao.org is the domain under which, in principle, all information published by FAO on the Internet should be located. Appropriate root directories or sub domains under fao.org may be established to provide the required identity. Exceptions to this policy and the registration and use of a non-FAO domain can be made when there are compelling reasons; for instance when the use of such a domain was specified in the aforementioned formal agreement or when the use of the FAO domain would harm the collaborative nature of agreement. The Director or Head of Office or, in the case of field projects, the Director of the lead technical unit, responsible for the activity requiring an alias, sub domain or new domain should write by email to the Director, GIL, explaining the business case for the request. In the case of technological reasons, the request may be initiated by AFI and, in any case, should first be discussed with AFI.

For more information, see [Internet Domain Name Selection, Registration and Organization](#).

## Metadata

(See *Web Guide: 4.4 Metadata*)

Descriptive information about the Web page is to be included in the HEAD section, i.e. title (mandatory), keywords, description, author and other information.

Metadata should be in the language of the Web page.

### Unnecessary and orphan files

Temporary files and directories generated by Microsoft Office's FrontPage (such as \_vti\_cnf), Macromedia's HomeSite (such as ~ht ...) or other HTML editors should be deleted.

Orphan images and web pages should be deleted (orphan files are those that are not linked to, or by, any Web page).


### Language coverage


(See *Web Guide: 2.5 Language coverage policy*)

A web site to be launched should be available in at least three FAO languages. However, as requested by member countries, it is recommended to publish the Web site in all five FAO languages.

### Language links

(See *Web Guide: 2.5b Minimum current guidelines for language policy*)

Language icons should always be displayed in alphabetical order in the English language, i.e. Arabic, Chinese, English, French and Spanish. Thus languages on a web page are always listed as follows: 

 English, Français, Español.

On a web page the link to each language version should be written in that language (i.e. use “Español” and not “Spanish”). Flags of countries should not be used to refer to languages.

### FAO emblem and logos

(See *Web Guide: 2.4c Use of FAO emblem and logos*)

The FAO emblem and logos should not be re-invented, modified or animated. The FAO emblem must be displayed on any FAO web site and must be in the banner. Any other logo present should be of smaller size than the FAO emblem unless it is a partner organization in this case the logo must be the same size as the FAO emblem. In addition, the FAO emblem should not be used as a watermark.

The FAO emblem may only be UN blue, black or reversed-out white. To download FAO emblem files, as prepared by GII, see [Information for designers and illustrators](#).

The FAO emblem must link to the FAO home page in the same language as the originating page.

### Banners and site design

(See *Web Guide: 5.3b Corporate identity in design*)

Banners should use the full name of the Organization and the slogan “helping to build a world without hunger”. If there is a special need for an alternative slogan, you must request approval from the Director, GII. Banners should not contain animated elements.

### Images

(See *Web Guide: 6.4b Use of images on the Web*)

Images must be suitably sized. Images should be resized using graphic software, such as Adobe's Photoshop, and not by using HTML code to reduce the width and height. Images should not be animated, unless there is a special need (in which case justification is required when requesting clearance of a web site).

## Flash and other interactive animation

(See *Web Guide: 5.3c Web site design usability principles*)

Flash or other interactive animation plug-ins should not be used for navigation or design effects. They should only be used for specialized elements such as interactive maps or tutorials. In addition, the link for downloading these plug-ins should point to the official download page and not to a locally copied executable file.

## Country names, codes and flags

(See *Web Guide: 2.4a Country names, flags and maps*)

Should you need to include country names or codes use the FAOTERM [Names Of Countries database](#) (includes the names of countries or areas in Arabic, Chinese, English, French, Spanish and Italian and also UNDP/ISO country codes).

Flags can be found on the FAO Country Profiles and Mapping Information System (COIN) Web site under [FAO member countries and flags](#). This page displays the national flags of FAO's member nations. These flags are the official versions recognized by the United Nations.

## Copyright pages

(See *Web Guide: 6.8b Links to the FAO home page, FAO copyright and the Information Finder*)

It is important to include a link to the FAO copyright page from all pages (see [Copyright](#)) and refer to the current year (i.e. © FAO, 2006). The Copyright page must be in the same language as the originating page.

## Links

(See *Web Guide: 6.8 Link management*)

Links should be expressed as absolute (e.g. `<a href="http://www.etc...">`) or relative within a logical group of pages (e.g. `<a href="img/picture.jpg">`). Never refer to a local drive (`<a href="c:/my documents/etc...">`).

The link to the active web page, i.e. the one you are currently on, should not be clickable. Links to the other language versions should be managed consistently. For example, if a user clicks on the French language icon, the page should change to the French equivalent and not revert to the homepage of the French web site (i.e. `index_fr.htm`). A link to another language should only appear when that relative language page is available.

Avoid links to pages under construction or to non-existing pages. When a page is not available in a given language, the English version should become the default page to avoid "under construction" pages or dead links.

## Documents

(See *Web Guide: 4.2 FAO content repositories*)

### Corporate Document Repository (CDR)

Documents officially published by FAO should not be held in the web site but rather incorporated into the [Corporate Document Repository](#) and then linked. This applies to electronic documents such as HTML, Microsoft Word and Adobe Acrobat PDF. Incorporating documents into the Document Repository means that they can be quickly picked up by internal FAO search engines and external ones such as Google. For information on the processing of other types of documents and on how to get documents scanned, converted or simply placed in the Document Repository, please see [Corporate Document Repository - A guide for users](#) or contact [document-repository@fao.org](mailto:document-repository@fao.org). Statistics on the usage of the documents in the Corporate Document Repository, by department, can be provided by GIL.

Linking to document repository files

Documents already available in the Corporate Document Repository should be linked to, instead of copied. Documents unavailable in the Corporate Document Repository should be transferred first and later linked.

## Non-FAO documents

Non-FAO documents should not be copied to the Web site unless there is an agreement with the copyright holder. Non-FAO documents should only be included in the Corporate Document Repository with the related copyright permission.

## Information Finder

(See Web Guide: 6.8b Links to the FAO home page, FAO copyright and the Information Finder)

When linking the Information Finder from a search box, the language variable on the search form should be given to the search engine so the results page is presented in the corresponding language.

The web page called by the search engine should be the home page of the Information Finder. An example on how to implement this can be found here: [Including a quick search button on your homepage](#). This feature provides the user with additional search capabilities.

## Print-friendly pages

(See Web Guide: 6.9 Printable pages)

A web site should be printable on portrait A4 pages. This can be done by either adjusting the HTML code so that the content fits within a prescribed width, by using a print-friendly style sheet, or by creating a separate file for printing purposes. This applies to all web pages.

## HIGHLY RECOMMENDED

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### File size

(See Web Guide: 2.6e Target platform specifications)

To improve web site performance and reduce download times, the file size of each web page and its components should be as low as possible.

The maximum size for Adobe Acrobat's PDF files should not exceed 500 KB and should be of low resolution, i.e. 72 DPI or produced using Adobe Distiller's "minimum file size" setting. A PDF document can be divided into many files if necessary or compressed. PDF files should be compatible with the version 5 of Adobe Reader (as of May 2006).

### Alert messages

(See Web Guide: 4.3e How to write feedback, error messages)

Alert messages should be in the language of the web page.

### Font size and display resolution

(See Web Guide: 5.3c Web site design usability principles)

To increase the usability and accessibility of a Web site, the "Web Content Accessibility Guidelines 1.0" of the W3C suggests using relative rather than absolute units for font size (see checkpoint 3.4 of the Techniques for Web Content Accessibility Guidelines 1.0). Using the relative length unit "em" allows all browsers to resize the text.

A large proportion of Internet users still use monitors with a screen size of 800 x 600 pixels. Therefore, a web site should have a fixed width of 800 x 600 pixels so that it is easily accessible to most users.

### Photos

(See Web Guide: 6.4c Photos)

Photos should include their credits (perhaps via the "ALT" attribute – see the FAO homepage for examples) and provide a link to the source (if the photo has been taken from a catalogue or a system – again, see the FAO homepage for examples).

### **Opening a new browser window**

*(See Web Guide: 6.2c Frames, new windows and pop-ups)*

If you need to open a new window for a print-friendly version of the page or for linking to another web site, avoid opening too many windows by using the HTML code `target="_new"` instead of `target="_blank"`.

### **News and press releases**

*(See Web Guide: 6.12b Web site content management systems)*

These should be linked and not duplicated, according to their language version. The link should point to the appropriate press release in the Newsroom – see FAO Newsroom.

If you provide your own local news service, consider offering an RSS feed (Really Simple Syndication) of your news and press releases.

### **Information related to FAO projects**

FAO projects and related information should be linked to FPMIS (Field Programme Management Information System) rather than duplicated. TCOM should be contacted for more information and for issues related to the public availability of information contained in FPMIS. Please note that project summaries are now available in FPMIS.



## Annex III – List of Acronyms used in this deliverable

<b>AFI</b>	Information Systems and Technology Division, FAO of the UN
<b>AGROVOC</b>	FAO-Multilingual Agricultural Thesaurus
<b>AOS</b>	Agricultural Ontology Service
<b>API</b>	Application Programming Interface
<b>ASFA</b>	Aquatic Sciences Fisheries Abstracts
<b>ATOS</b>	Atos Origin S.A. (Madrid, Spain) (NeOn partner)
<b>BT</b>	Broader term
<b>CPUE</b>	Fishery Basic Catch Per Unit Effort
<b>CNR</b>	Consiglio Nazionale delle Ricerche (Rome, Italy) (NeOn partner)
<b>COF</b>	Core Ontology of Fisheries
<b>COIN</b>	Country Office Information Network
<b>CWP</b>	Coordinating Working Party on Fisheries Statistics
<b>CSV</b>	Comma Separated Value files
<b>DBMS</b>	Database Management System
<b>DOLCE</b>	Descriptive Ontology for Linguistic and Cognitive Engineering
<b>EIMS</b>	Electronic Information Management System
<b>FAOLEX</b>	FAO-Legislative database
<b>FAOTERM</b>	FAO-Terminology
<b>FI</b>	Fisheries Department, FAO of the UN
<b>FIDI</b>	Fishery Information, Data and Statistics Unit, FAO of the UN
<b>FIGIS</b>	Fisheries Global Information System
<b>FI-GLOS</b>	Fisheries Glossary
<b>FIRMS</b>	Fishery Resources Monitoring System
<b>FOS</b>	Fishery Ontology Project
<b>FPMIS</b>	Field Programme Management Information System
<b>FSDAS</b>	Fisheries Stock Depletion Alert System

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<b>FTP</b>	File Transfer Protocol
<b>GII</b>	Information Division, FAO of the UN
<b>GIS</b>	Geographical Information Systems
<b>GUI</b>	Graphical User Interface
<b>HTML</b>	HyperText Markup Language
<b>ISSCAAP</b>	Fishery International Standard Statistical Classification of Aquatic Animals and Plants
<b>ISO</b>	International Organization for Standardization
<b>ISO2709</b>	ISO standard on Information and documentation: Format for Information Exchange
<b>ISOCO</b>	Intelligent Software Components S.A. (Madrid, Spain) (NeOn partner)
<b>IST</b>	Programme of the Commission of the European Communities Information Society Technologies
<b>ISTC</b>	Istituto Scienze e Technologies della Cognizione
<b>IT</b>	Information Technology
<b>ITIS</b>	Integrated Taxonomic Information System
<b>JSI</b>	Institut 'Jožef Stefan' (Ljubljana, Slovenia) (NeOn partner)
<b>KIMS/KIDS</b>	Key Indicator Mapping System/Key Indicator Data System
<b>KOS</b>	Knowledge Organization System(s)
<b>L.A.M.P.</b>	Linux (operating system), Apache (Web server), MySQL (RDBMS), PHP scripting/programming languages.
<b>MIME</b>	Multipurpose Internet Mail Extensions
<b>MySQL</b>	My Structured Query Language (RDBMS)
<b>NT</b>	Narrower term
<b>OBIS</b>	Ocean Bio-geographic Information System
<b>OS</b>	(Computer) Operating System
<b>OU</b>	Open University (Milton Keynes, U.K.) (NeOn Coordinator)
<b>OWL</b>	Web Ontology Language
<b>RDBMS</b>	Relational Database Management System
<b>RDF</b>	Resource Description Framework
<b>REST</b>	Representational State Transfer
<b>RSS</b>	Really Simple Syndication

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<b>RT</b>	Related term
<b>RTMS</b>	Fisheries Reference Table Management System
<b>SAG</b>	Software AG (Darmstadt, Germany) (NeOn partner)
<b>SKOS</b>	Simple Knowledge Organization System
<b>SOAP</b>	Simple Object Access Protocol
<b>TCOM</b>	Field Operations Monitoring Service, FAO of the UN
<b>TBX</b>	TermBase eXchange
<b>UF</b>	Used for
<b>UKARL</b>	Universität Karlsruhe (Karlsruhe, Germany) (NeOn partner)
<b>UML</b>	Unified Modelling Language
<b>UNDP</b>	United Nations Development Programme
<b>URIs</b>	Universal Resource Identifiers
<b>UTF8</b>	8 bit Unicode Transformation Format
<b>WAICENT</b>	World Agricultural Information Centre at FAO
<b>WP</b>	Work package
<b>XML</b>	Extensible Markup Language
<b>XHTML</b>	EXtensible HyperText Markup Language
<b>XSL</b>	EXtensible Stylesheet Language