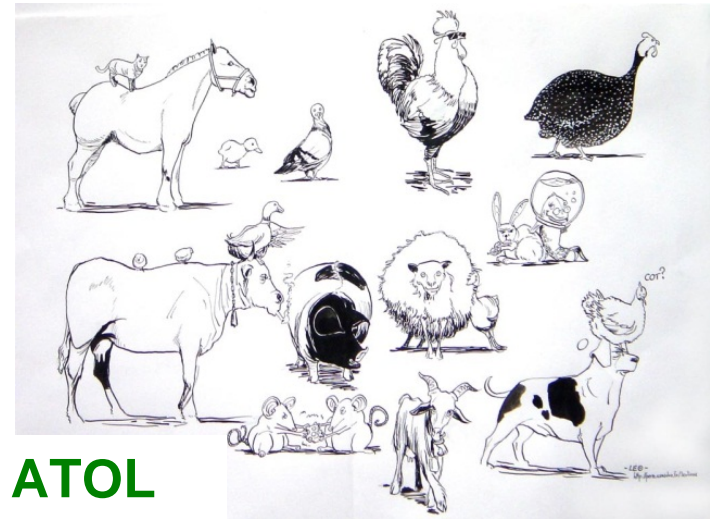


ATOL : an ontology for livestock

**ATOL : Animal Trait Ontology
for Livestock**



**M.C. Meunier-Salaün, J. Bugeon, O. Dameron, , A. Fatet,
I. Hue, C. Hurtaud, C. Nedellec, M. Reichstadt, J. Vernet,
J. Reecy, C. Park, P.Y. Le Bail**

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ATOL - a tool for the livestock precision farming

Livestock precision farming challenges: to have

- * efficient, robust and adaptable animals
- * efficient management of the production systems

- **increased knowledge of the biological diversity**

- **change of paradigm:** from an analytic to integrated and systemic approach

Research issues

- Development and exploitation of genomic data
- Phenotyping approach
- Describing genotype/phenotype relationships



- * more and more complicated knowledge
- * increasing amount of informations
- * diversification of community of users

ATOL - a tool for the livestock precision farming

- * more and more complicated knowledge
- * increasing amount of informations
- * diversification of community of users

Need to storage and analyse huge mass of information on the basis of a language understanding by computer and any users

Necessary to have a shared language

a language usable by software for database management, semantic analysis or modeling approach using concepts and relationships between concepts

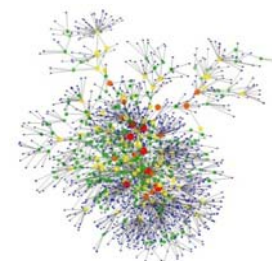
Ontology tool

What is an ontology ?

Definition: formal representation of concepts and of relationships between these concepts within a subject or a specific area.

Characteristics :

- It describes a field of interest with concepts and relationships
- The concepts and the relationships are **clearly defined**
- The meaning of an item is used in **an unequivocal way.**
- The concepts are organized in **a structural way** (often an hierarchy)
- The items have to **be easily used by computer** (for bibliographic research).



ATOL ontology - Context and objectives

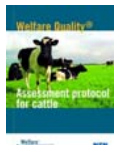
The context



- Numerous ontologies in biology (**Disease** Ontology, **Gene** Ontology...)
- Those focused on phenotypage mainly concern the human or animal models

The objectives for building an ontology on livestock issues

1. To have **a reference ontology** for phenotyping of farm animals shared by international scientific and teaching community.
2. To have a **language usable by software** (data basis management, semantic analysis, modeling...)
3. To have the traits as **generic** as possible
4. To have the ontology **efficient** for user, close to technical measurements
5. To have a structure applied to **production** targets



ATOL : What is it ?

an ontology of normalized traits for farm animal and applied to productions targets

French network : PY Lebail (coord)
(5 curators, panel of experts)



- Animal Welfare (MC Meunier-Salaün)
- Egg (C Hurtaud)
- Growth and meat production (J Bregeon)
- Mammary Gland and milk production (C Hurtaud)
- Nutrition/feed efficiency (J Vernet)
- Reproductive system (A. Fatet)

ATOL: hierarchy of traits

Trait: single feature or measurable characteristic of an organism : molecular, morphological, anatomical, physiological or behavioural item

Phenotype : all observable state of trait(s) which characterise an individual result of the expression of genotype and its interactions with environment

On line !

www.atol-ontology.com



ATOL - Hierarchy of traits (*webprotégé*)



My WebProtégé ATOL x

ATOL x

Ontology: ATOL. Search: Search

Class Tree

- animal trait of livestock
 - animal welfare trait
 - egg trait
 - growth and meat production trait
 - mammary gland and milk production trait
 - nutrition trait
 - reproduction trait

Hierarchy



Properties

| Identifiant | Species |
|-----------------|----------------------|
| Identifiant: | <input type="text"/> |
| Name: | <input type="text"/> |
| Similar to: | <input type="text"/> |
| Definition: | <input type="text"/> |
| Source: | <input type="text"/> |
| Synonyms Exact: | <input type="text"/> |
| Related: | <input type="text"/> |
| Comment: | <input type="text"/> |

Class Tree

Class Tree

- animal trait of livestock
 - animal welfare trait
 - egg trait
 - growth and meat production trait
 - mammary gland and milk production trait
 - nutrition trait
 - reproduction trait

ATOL - Hierarchy of traits (*webprotégé*)



My WebProtégé ATOL x

ATOL x

Ontology: ATOL. Search: Search

Class Tree

- animal trait of livestock
 - animal welfare trait
 - egg trait
 - growth and meat production trait
 - mammary gland and milk production trait
 - nutrition trait
 - reproduction trait

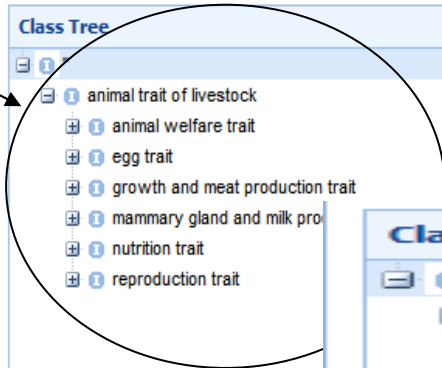
Properties

| Identifiant | Species |
|--------------|----------------------|
| Identifiant: | <input type="text"/> |
| Name: | <input type="text"/> |

Class Tree

- animal trait of livestock
 - animal welfare trait
 - animal performance trait
 - animal production trait
 - body conformation
 - body weight
 - health trait
 - disease susceptibility trait
 - health body trait
 - immunity system trait
 - psychoneuroendocrinological state trait
 - behavior trait
 - biological rhythm trait
 - cognitive functions trait
 - emotional functions trait
 - metabolism trait
 - pain responses trait
 - reflex response trait
 - sensory capacities trait
 - stress responses trait

Hierarchy



ATOL - trait : properties

Properties of milk lactose yield

The screenshot shows the ATOL ontology interface. The top bar includes 'My WebProtégé' and 'ATOL'. The main area is divided into a 'Class Tree' on the left and a 'Properties' panel on the right. The 'Class Tree' shows a hierarchy of traits, with 'milk lactose yield' selected and highlighted. A blue banner at the top left reads 'Mammary gland and milk production'. A black arrow points from the 'Properties' tab in the Class Tree to the 'Properties' panel. Another black arrow points from the word 'trait' to the 'milk lactose yield' entry in the Class Tree. The 'Properties' panel displays the following information:

| Identifiant | Species |
|-----------------|---|
| Identifiant: | ATOL:0000618 |
| Name: | milk lactose yield |
| Similar to: | VT:0010286 |
| Definition: | any measurable or observable characteristic related to the total amount in milk of lactose (CHEBI:17716), which is the major sugar found in colostrum and milk. It is composed of a molecule of glucose and a molecule of galactose |
| Source: | VTO:CP "Cari Park, Iowa State University Curator" INRA:PHASE "INRA PHASE" |
| Synonyms Exact: | |
| Related: | |
| Comment: | |

Mammary gland and milk production

trait

ATOL - trait : identification – definition (1)

The screenshot displays the ATOL database interface for a trait. The 'Properties' tab is selected. The 'Identifiant' field contains 'ATOL:0000618', which is highlighted in green and labeled 'Identification within the database'. The 'Name' field contains 'milk lactose yield', highlighted in green and labeled 'Name of the trait'. The 'Similar to' field contains 'VT:0010286', highlighted in green and labeled 'Reference of similar trait in the VT base'. The 'Definition' field contains a generic definition 'any measurable or observable' (highlighted in green) and a specific definition 'Any measurable or observable characteristic related to the total amount in milk of lactose which is the major sugar found in colostrum and milk'. The 'Source' field contains 'VTO:CP "Cari Park, Iowa State University Curator"' and 'INRA:PHASE "INRA PHASE"', with the first part highlighted in green and labeled 'Reference of curator (US, F or both) or other database'. The 'Synonyms' section shows 'Exact: flesh quality (for fishes) for meat quality (growth and meat production traits)'. The 'Related' section shows 'puberty for gonadosomatic index trait (reproduction traits)'. The 'Comment' section contains 'data such as : phenotype, genes, epigenetic regulation, ARNm, Protein, QTL, ...'.

Properties

Identifiant Species

Identifiant: ATOL:0000618

Name: milk lactose yield

Similar to: VT:0010286

Definition: Generic definition *any measurable or observable*
Any measurable or observable characteristic related to the total amount in milk of lactose which is the major sugar found in colostrum and milk

Source: VTO:CP "Cari Park, Iowa State University Curator"
INRA:PHASE "INRA PHASE"

Synonyms
Exact: *flesh quality (for fishes) for meat quality (growth and meat production traits)*

Related: *puberty for gonadosomatic index trait (reproduction traits)*

Comment: *data such as : phenotype, genes, epigenetic regulation, ARNm, Protein, QTL, ...*

ATOL – trait applied to species

Ontology: ATOL. Search: Search

Class Tree

- animal trait of livestock
 - animal welfare trait
 - egg trait
 - growth and meat production trait
 - mammary gland and milk production trait
 - mammary gland production trait
 - colostrum trait
 - lactation duration
 - milk ejection trait
 - milk trait
 - milk composition trait
 - milk carbohydrate trait
 - milk lactose trait
 - milk lactose concentration
 - milk lactose yield**
 - milk oligosaccharide trait
 - milk cell count
 - milk dry matter concentration
 - milk energy concentration
 - milk fat trait
 - milk hormone concentration trait
 - milk mineral trait
 - milk nitrogen trait
 - milk organic acid trait
 - milk organoleptic traits
 - milk structure trait
 - milk technological trait
 - milk yield

trait



Properties

Identifiant Species

Mammals

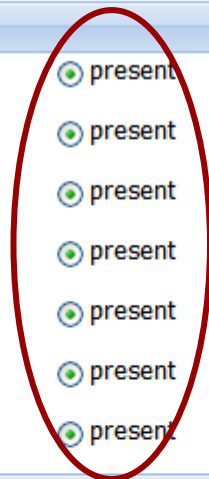
| | | | |
|---------|--|------------------------------|-------------------------------|
| Cattle: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Goat: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Horse: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Mouse: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Pig: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Sheep: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |
| Rabbit: | <input checked="" type="radio"/> present | <input type="radio"/> absent | <input type="radio"/> unknown |

Birds

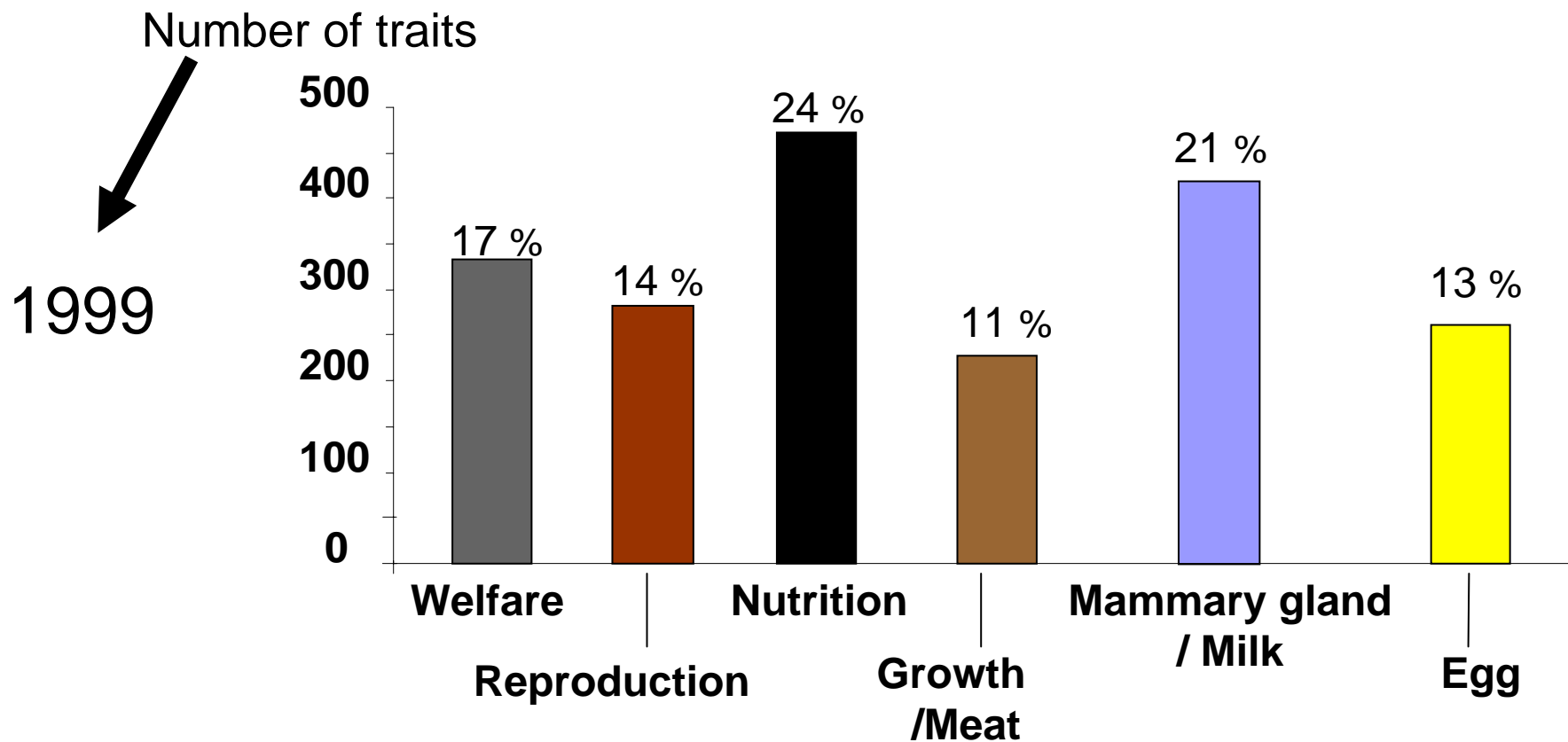
| | | | |
|----------|-------------------------------|---|-------------------------------|
| Chicken: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Turkey: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |

Fish

| | | | |
|------------|-------------------------------|---|-------------------------------|
| Carp: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Cod: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Salmon: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| SeaBass: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| SeaBream: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Tilapia: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Trout: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |
| Zebrafish: | <input type="radio"/> present | <input checked="" type="radio"/> absent | <input type="radio"/> unknown |



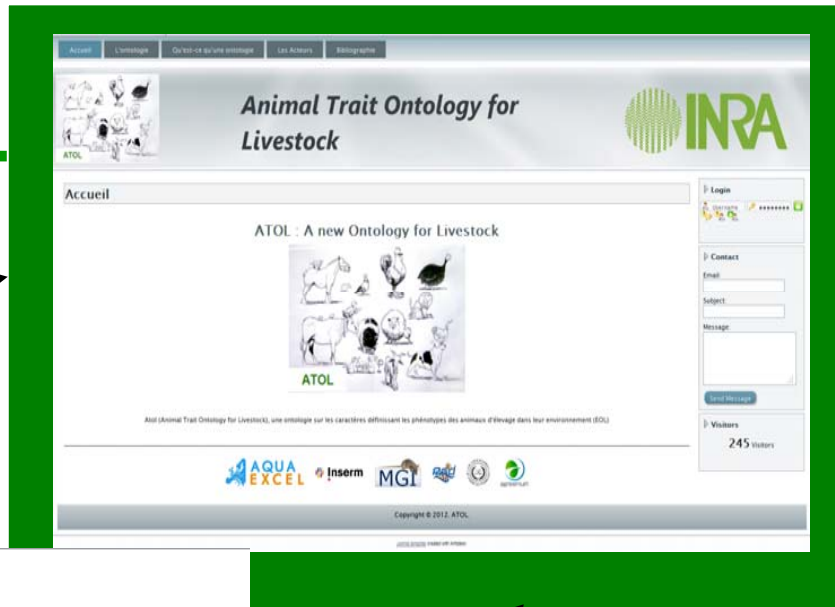
Ontology : review of traits



ATOL : links

Other ontologies

- Aquaexcel
- EOL environment



My WebProtégé

Ontologies

| Name | Description |
|----------------|--|
| ATOL | ontology of animal trait for livestock |
| AquaExcel-ATOL | ontology of fish trait for livestock |
| EOL | ontology of environment for livestock |

EOL : ontology of environment for livestock

My WebProtégé EOL x

ATOL x

Ontology: EOL. Search: Search

Class Tree

- environment ontology for livestock
 - feed characteristic
 - livestock farming environment
 - livestock farming structure
 - rearing structure material
 - rearing structure physical dimension
 - type of rearing structure
 - livestock farming system**
 - aquaculture farming system
 - terrestrial farming system
 - ecosystem support
 - housing system
 - cage system**
 - non-cage system**
 - so-called enriched cage **
 - VEA-system
 - manure removal
 - rearing stage system
 - species association system

Properties

Identifiant

Identifiant: EOL:0000002

Name: livestock farming system

Similar to:

Definition: any measurable or observable characteristic related to the differents types of systems for livestock farming

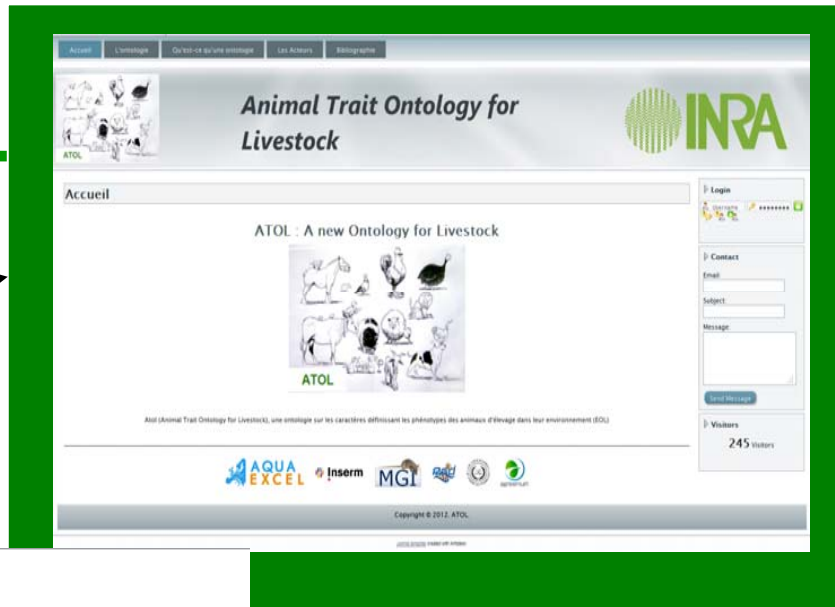
Synonyms

Exact:

Related:

Any measurable or observable characteristic related to different types of systems for livestock farming

ATOL : links



Other ontologies

- Aquaexcel
- EOL environment

| My WebProtégé | |
|----------------|--|
| Ontologies | |
| Name | Description |
| ATOL | ontology of animal trait for livestock |
| AquaExcel-ATOL | ontology of fish trait for livestock |
| EOL | ontology of environment for livestock |

Referential of SOP:
Standard Operating Procedure

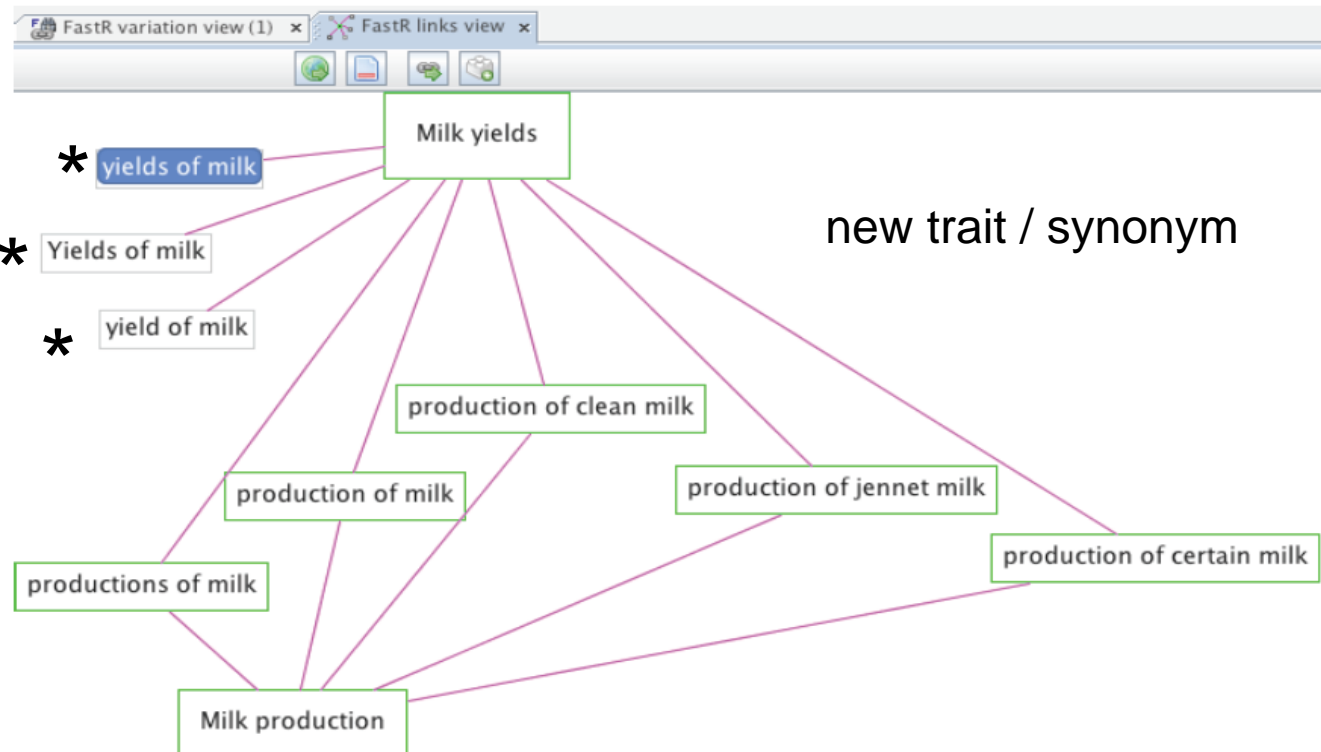
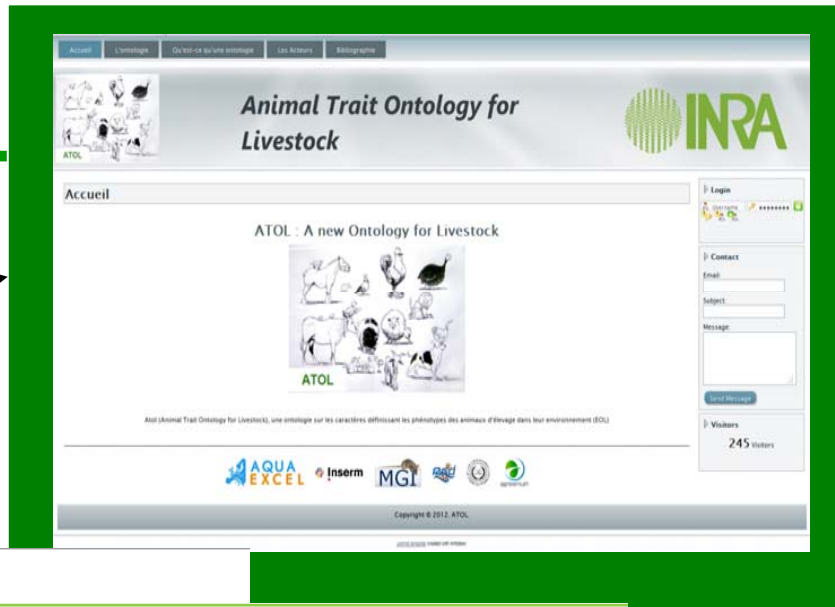
| | | | | | | |
|------|---------|--------|--------------------|-----------|----------------|-------------|
| Unit | Species | Method | Biologic substrate | Procedure | Contact person | Publication |
|------|---------|--------|--------------------|-----------|----------------|-------------|

phenotypic measure , reference article
Standardized Procedure / Quality policy

ATOL : links

Other ontologies

- Aquaexcel
- EOL environment

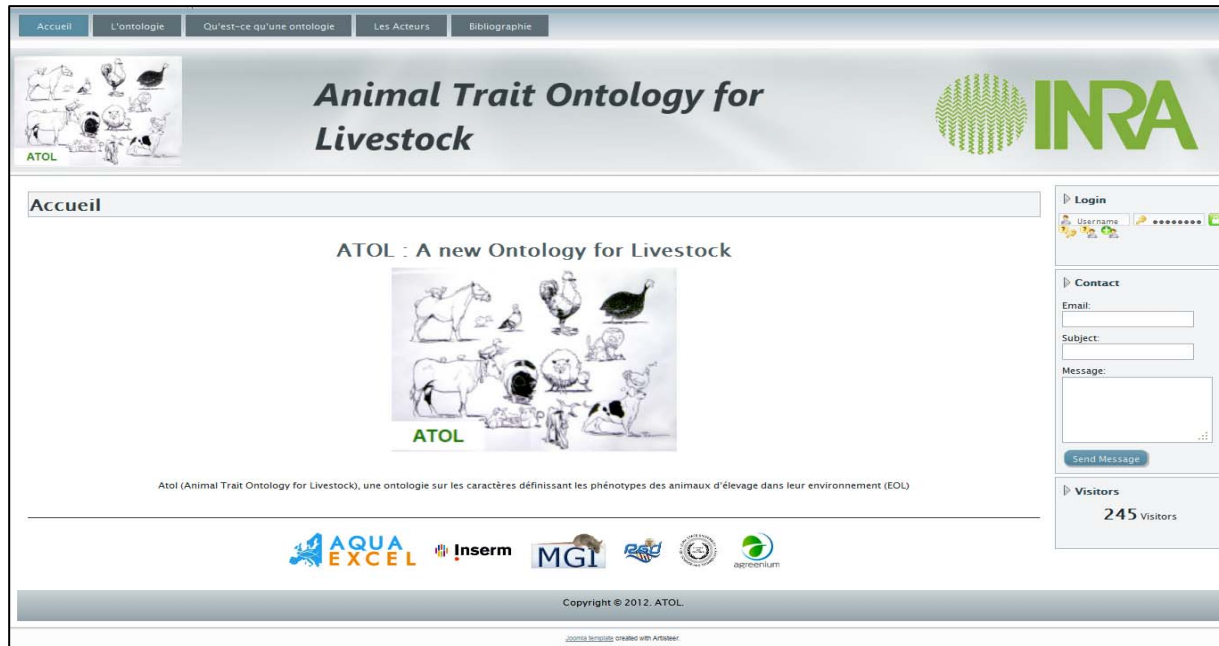


**ATOL used
as reference index
for scientific journal**

ATOL enriched by
terms extracted from
corpus of the journal
« Animal »
(Semantic analysis)



Conclusion: ATOL challenge



The screenshot shows the homepage of the Animal Trait Ontology for Livestock (ATOL) website. The page features a navigation menu at the top with links for 'Accueil', 'L'ontologie', 'Qu'est-ce qu'une ontologie', 'Les Acteurs', and 'Bibliographie'. The main header includes the ATOL logo (a collection of animal icons) and the title 'Animal Trait Ontology for Livestock' next to the INRA logo. The central content area is titled 'Accueil' and features a sub-header 'ATOL : A new Ontology for Livestock' above a grid of animal illustrations. Below the grid, a brief description reads: 'Atol (Animal Trait Ontology for Livestock), une ontologie sur les caractères définissant les phénotypes des animaux d'élevage dans leur environnement (EOL)'. A right-hand sidebar contains a 'Login' section with fields for 'Username' and a password field, a 'Contact' section with fields for 'Email', 'Subject', and 'Message', and a 'Visitors' section showing '245 Visitors'. The footer includes logos for AQUA EXCEL, Inserm, MGI, RAG, and agreenium, along with the copyright notice 'Copyright © 2012. ATOL'.

➡ to extend the database on livestock traits

➡ to promote - links with environment and method databases
- standardization of database for users

Welcome to the website www.atol-ontology.com

Accueil

L'ontologie

Qu'est-ce qu'une ontologie

Les Acteurs

Bibliographie



Animal Trait Ontology for Livestock



Accueil

ATOL : A new Ontology for Livestock



Atol (Animal Trait Ontology for Livestock), une ontologie sur les caractères définissant les phénotypes des animaux d'élevage dans leur environnement (EOL)

Login

Username

Contact

Email:

Subject:

Message:

Send Message

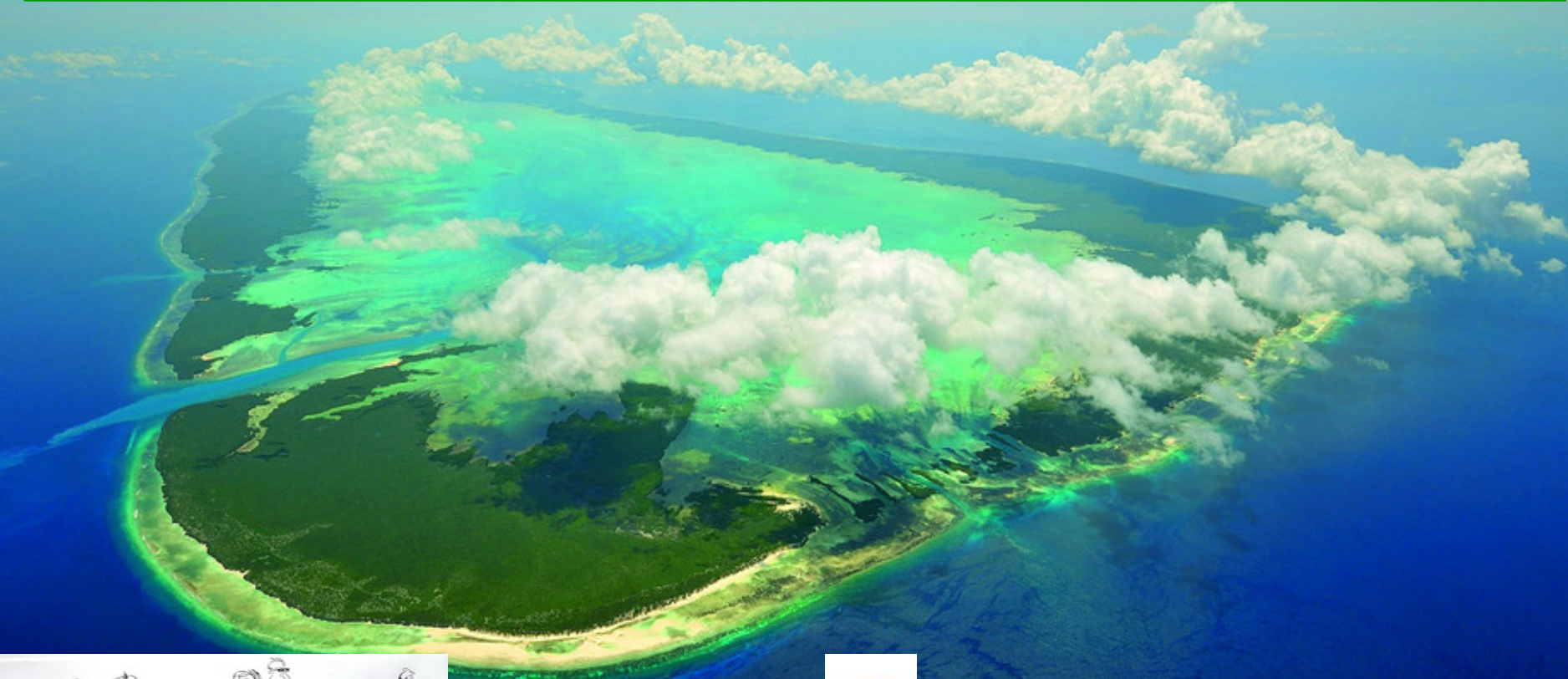
Visitors

251 Visitors



We will appreciate your comments

ATOL : Thanks for your attention



ATOL

EAAP 2012 Bratislava : Session 41

