



D14.1

Prototype of a web-based annotation tool ready for user testing

WORK PACKAGE 14 - Citizen Observatories and Participative Science

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ABSTRACT

Ifremer in association with the SEM Noveltis (Labège, France) developed a web-based application linked with a structured database. The software is built as a game with a dedicated mission. The goal of each mission is to annotate a series of images extracted from archived video sequences coming from our deep-sea observatories. The annotation tool has been developed and is currently under test by experienced scientists before being tested in the fall by beta testers from several backgrounds. For this, Ifremer is in contact with the center for the discovery of ocean Oceanopolis (Brest, France) and the Academy of Rennes (Britany, France) to diffuse the game towards the general public.

Project internal reviewer(s):

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PROJECT SUMMARY

ENVRIplus is a Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe. It is driven by three overarching goals: 1) promoting cross-fertilization between infrastructures, 2) implementing innovative concepts and devices across RIs, and 3) facilitating research and innovation in the field of environment for an increasing number of users outside the RIs.

ENVRIplus aligns its activities to a core strategic plan where sharing multi-disciplinary expertise will be most effective. The project aims to improve Earth observation monitoring systems and strategies, including actions to improve harmonization and innovation, and generate common solutions to many shared information technology and data related challenges. It also seeks to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIplus develops guidelines to enhance transdisciplinary use of data and data-products



supported by applied use-cases involving RIs from different domains. The project coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts.

ENVRIplus is expected to facilitate structuration and improve quality of services offered both within single RIs and at the pan-RI level. It promotes efficient and multi-disciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The resulting solutions, services and other project outcomes are made available to all environmental RI initiatives, thus contributing to the development of a coherent European RI ecosystem.

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Prototype of a web-based annotation tool for user testing

INTRODUCTION

Scientific background

Most of the current knowledge of deep-sea environments is based on punctuated, at best yearly, oceanographic cruises. Since 2006, deep-sea ecosystems are continuously being monitored using video cameras deployed on deep-sea platforms. The acquisition of high-frequency video data from deep-sea observatories like EMSO-Azores (European Multidisciplinary Seafloor Observatory) or Ocean Networks Canada/NEPTUNE (NorthEast Pacific Time-series Underwater Networked Experiments) provide for the first time information on species behaviour, feeding habits, growth, possibly reproduction and organisms' response to changes in environmental conditions. Cameras deployed on those observatories acquire hourly video data representing thousands of hours and Tera Bytes of footages that require 10 times more hours of viewing to extract useful information. Since their first deployment in 2006, more than 5 Tb of video data from both the Atlantic and the Pacific oceans were acquired that cannot possibly be analyzed by few researchers. Only with the help of citizen scientists we will be able to process the huge archive of imagery.

Objective of the project

The main objective of the project is to build a web-based application for manual imagery processing that will help gather useful information for scientists as well as raise awareness among the general public to deep-sea ecosystems, including the resources they provide and the state-of-the art scientific knowledge of these environments.

In order to meet this goal the specific objectives are to:

- Develop an online image annotation program that will allow participants to simultaneously perform defined tasks on the extracted images.
- Organise the output information in a searchable database compatible with existing Ifremer and EMSO databases following ENVRI + standards.

Ifremer, in association with the SEM Noveltis (Labège, France), developed the web-based application linked with a structured database. The software is built as a game with dedicated missions. The goal of each mission is to annotate a series of images extracted from archived video sequences acquired with deep-sea observatories. The information obtained by annotation is stored and exported in a structured database.

THE ONLINE APPLICATION SYSTEM

A prototype of the online image annotation program has been developed and is currently under test by experienced scientists before being tested in the fall by beta testers from several backgrounds. For this, Ifremer is in contact with the center for the discovery of ocean Oceanopolis (Brest, France) and the Academy of Rennes (Britany, France) to diffuse the game towards the general public.



A description of the prototype is given below.

Description of the prototype

❖ Registration page and connection

When the participants go on the online application system, the loading page appears (Figure 1). Then, the participants land on a registration page (Figure 2). On this page they can access the “Demo” page (Figure 2 ①) allowing them to annotate one image without logging in. The participants can also access a “Project description” page (Figure 2 ②, Figure 3) which briefly summarizes the background scientific objectives, and the “Terms of service” page (Figure 2 ③, still not functional).

To start the game, for the first connection, the participant has to “Create an account” (Figure 2 ④, Figure 4) and provide personal information (Pseudonym, Password, Sexe, Age, Email, Country, Language, Job, Figure 4). Once the account created the participant will have to log on the registration page with its pseudonym and password (Figure 2 ⑤⑥, Figure 5). The sound and the video can also be started and stopped by the participant.

To start the game, the participant clicks on “DIVE” (Figure 2 ⑦). Starting the game graphically provides the participant with a diving impression (for the first image of the session). This includes some sense of reaching depth, darkness, high pressure.

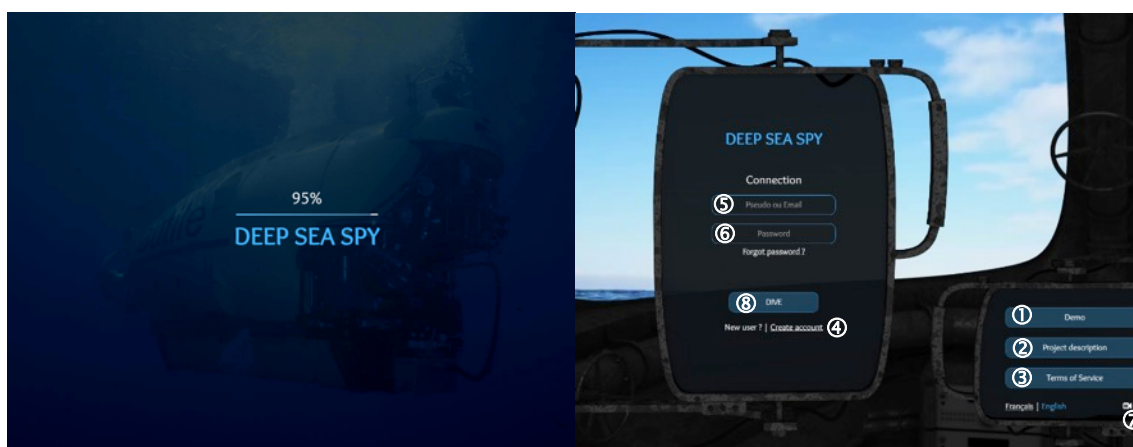


FIGURE 1. DOWNLOAD OF THE ONLINE APPLICATION SYSTEM.

FIGURE 2. THE REGISTRATION PAGE. ACCESS TO: ① : DEMO PAGE, ② : PROJECT DESCRIPTION PAGE, ③ : TERMS OF SERVICES PAGE, ④ : CREATE AN ACCOUNT, ⑤ : PSEUDONYM, ⑥ : PASSWORD, ⑦ : START AND STOP VIDEO AND SOUND, ⑧ : DIVE

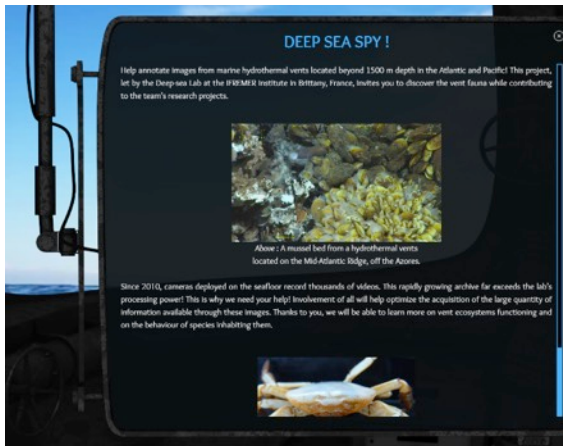


FIGURE 3. THE PROJECT DESCRIPTION PAGE.

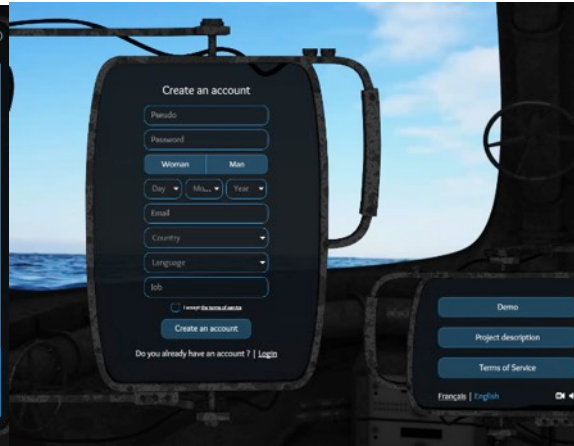


FIGURE 4. HOW TO CREATE AN ACCOUNT

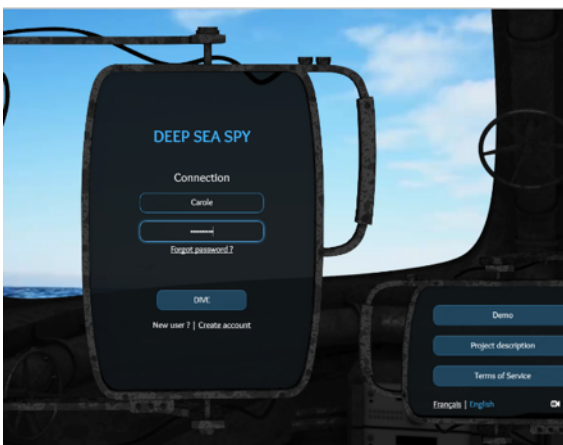


FIGURE 5. CONNECTION WITH PSEUDONYM AND PASSWORD

❖ Participant interface

On the left, the interface displays basic statistics including:

- Observer's pseudonym (Figure 6 ①)
- Advancement of the ongoing mission (progress bar) (Figure 6 ②)
- Number of images annotated by the current participant in the current mission (Figure 6 ③)
- Number of images annotated by the current participant in total (Figure 6 ④)
- Rewards obtained (Figure 6 ⑤)

The participants can access the project website, the information page with the project description, and the tutorial (Figure 6 ⑥). They can also start and stop the video and sound (Figure 6 ⑦).

At the center of the page, the name of the ongoing mission is given as well as a description of the mission (Figure 6 ⑧).

On the right, graphics and buttons similar to a submarine are represented (Figure 6 ⑨).

To start the mission and image annotation, the participant has to click on “Start the mission” (Figure 6 ⑩).



FIGURE 6. PARTICIPANT INTERFACE. ① : PSEUDONYM, ② AND ③ : PROGRESS BAR AND NUMBER OF IMAGES ANNOTATED, ④ : NUMBER OF IMAGES ANNOTATED IN TOTAL, ⑤: REWARDS OBTAINED, ⑥ : LINKS TO PROJECT PAGE, DESCRIPTION OF THE PROJECT AND DEMO, ⑦ : START AND STOP VIDEO AND SOUND ⑧ : NAME AND DESCRIPTION OF THE MISSION ⑨ : GRAPHIC AS IN A SUBMARINE, ⑩ : « START THE MISSION ».

❖ Image annotation interface (English version still in progress)

When the mission starts, an image appears at the center of the window (Figure 7 ①). Below the image, a tool bar allows the participant to perform the required tasks (Figure 7 ②). The participant can:

- annotate the image (count, measure or contour organisms according to species) (Figure 7 ③, Figure 8, Figure 9, Figure 10)
- display a grid on the image (Figure 7 ④, Figure 11)
- zoom on the image (Figure 7 ⑤, Figure 12)
- leave a free comments on the image (Figure 7 ⑥, Figure 13)

Below the tool bar, the name of the site (Juan de Fuca Ridge or Mid-Atlantic ridge) and the different species to be annotated are listed, accompanied by an image and a tutorial explaining

how to annotate (Figure 7 ⑩, Figure 8, Figure 9, Figure 10). When the participants want to annotate a species, they have to click on it.

The participants can quit the game, save the annotation or validate before moving to the next image (Figure 7 ⑦⑧⑨). When the participants validate their annotations, a pop-up window appears offering to move on to the next image (Figure 14, Figure 15).

When the participants reach a given number of annotated images, a pop-up window offers the possibility to answer a quiz in order to reach the next level (Figure 16). The participants have the choice to click “YES” or “NO” in order to remain at the same level.

On this page, the participants can also access the project website, the information page with the project description, and the tutorial. They can also start and stop the video and sound (below the pseudonym).

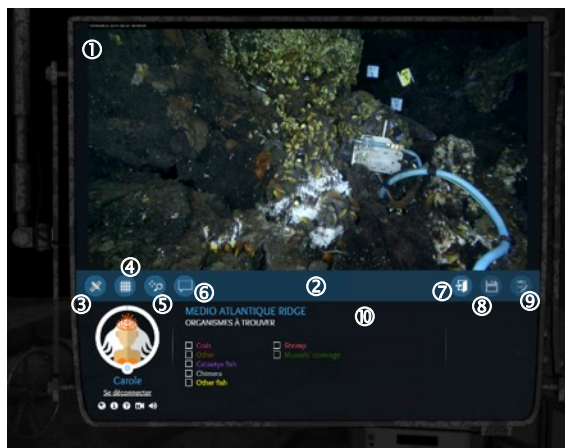


FIGURE 7. IMAGE ANNOTATION INTERFACE. ① : IMAGE, ② : TOOL BAR, ③ : ADD OR EDIT ANNOTATION, ④ : SHOW A GRID, ⑤ : ZOOM, ⑥ : ADD A COMMENT ⑦ : QUIT, ⑧ : SAVE ANNOTATIONS, ⑨ : VALIDATE ANNOTATIONS, ⑩ : SITE NAME AND SPECIES TO BE FOUND.

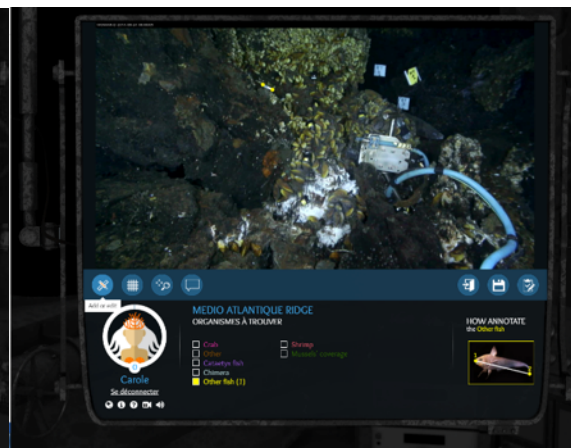


FIGURE 8. ADD OR EDIT ANNOTATIONS, EXAMPLE OF THE MEASUREMENT OF A FISH.

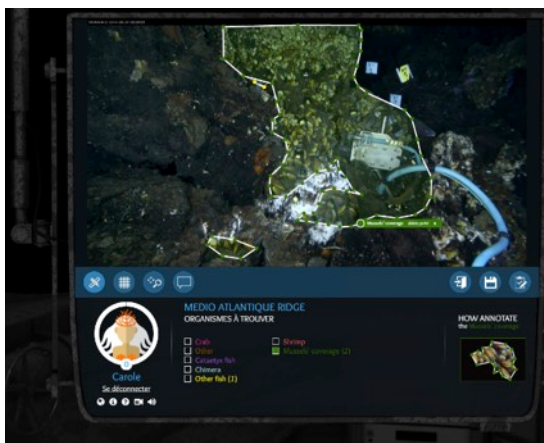


FIGURE 9. EXAMPLE OF ANNOTATION: CONTOUR MUSSELS.

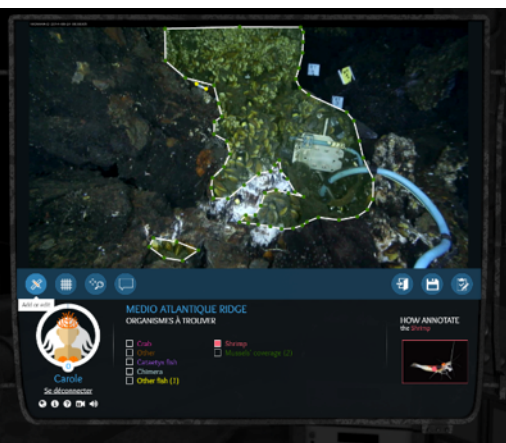


FIGURE 10. EXAMPLE OF ANNOTATION: COUNT SHRIMP.

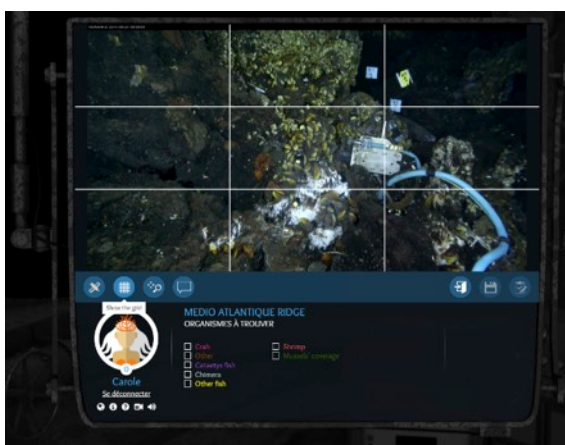


FIGURE 11. SHOW A GRID.

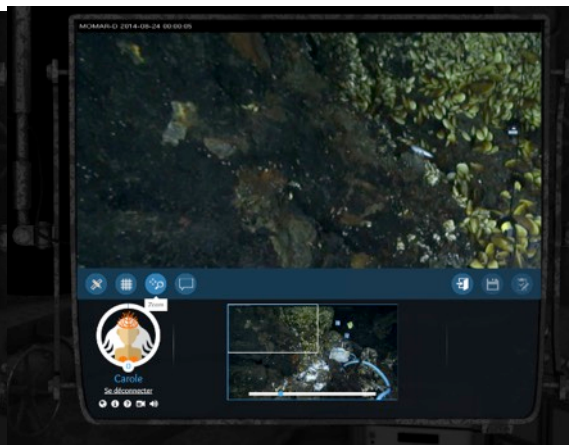


FIGURE 12. ZOOM ON THE IMAGE.

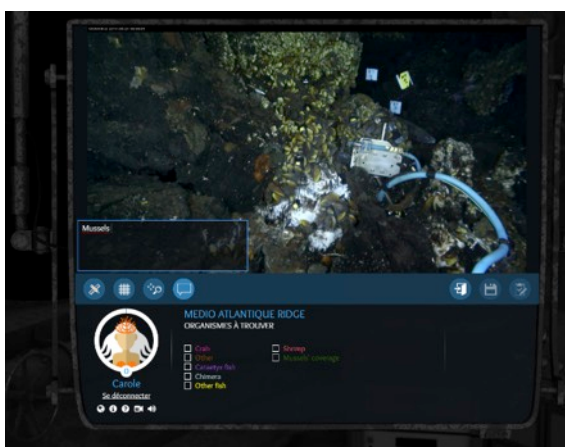


FIGURE 13. WRITE A FREE COMMENT.

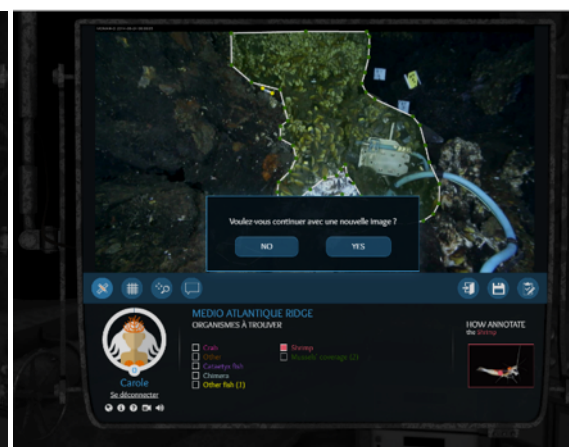


FIGURE 14. DO YOU WANT TO MOVE TO THE NEXT IMAGE ?

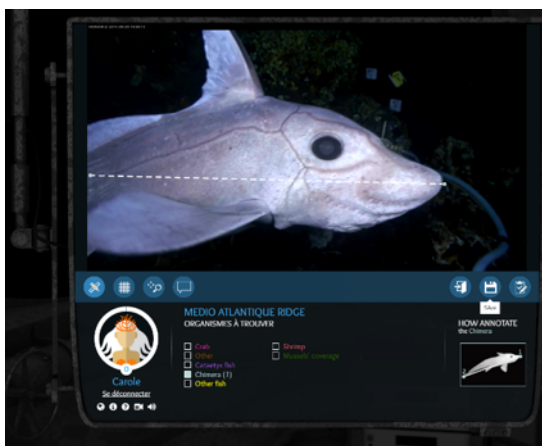


FIGURE 15. NEXT IMAGE.

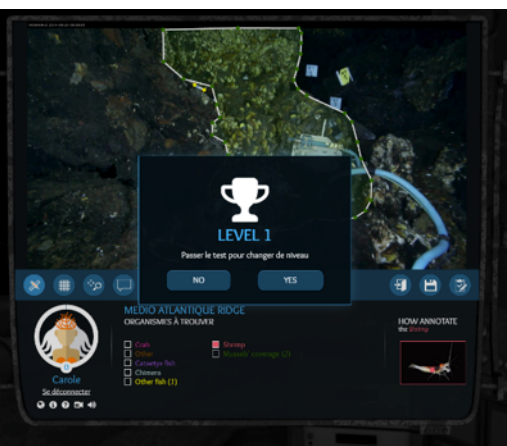


FIGURE 16. DO YOU WANT TO PASS THE LEVEL ONE TEST?

Missions

Participants can conduct different ‘annotation missions’ corresponding to different sets of images. They are informed of the objectives to be reached and a countdown/progress bar appears on the home page. To access a higher level, participants have to reach a certain number of annotated images, specific to each level and to go through an online quiz. Success will be defined following a threshold score. A ‘prize’ will be awarded to the participants once they reach a certain level. Prizes are virtual vent animals (Figure 17).

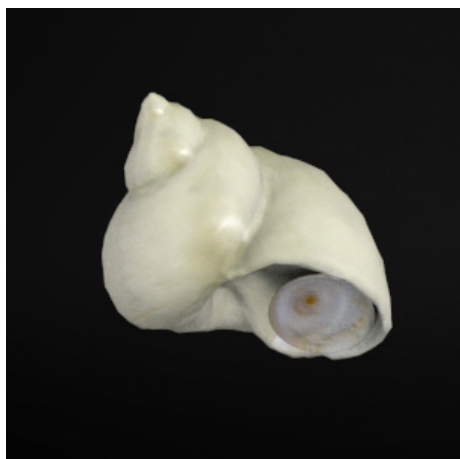


FIGURE 17. EXAMPLE OF PRIZE IN 2D FORMAT. THE 3D FORMAT WILL BE AWARDED TO THE PARTICIPANT.

THE ADMINISTRATOR WEB PAGE (ONLY FRENCH VERSION)

With the back office of DSS web site, it is possible to administrate pictures and users’ annotations (Figure 18). Missions can be seen, created and modified (Figure 18). Different

statistics are also available: number of annotations, number of annotated pictures, number of users, users' names... (Figure 20, Figure 21).

For each picture, annotations are saved and their validity can be controlled. All the data can be exported in excel format (Figure 21, Figure 22).

Finally, users' profiles, levels and awards associated can also be visualized (Figure 23).



FIGURE 18. ILLUSTRATION OF THE OPTION TO BE AVAILABLE ON THE ADMIN PAGE.



FIGURE 19. MISSIONS: LIST AND AN EXAMPLE OF THE FIRST ONE.

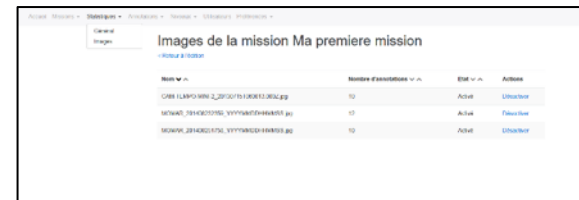


FIGURE 20. STATISTICS

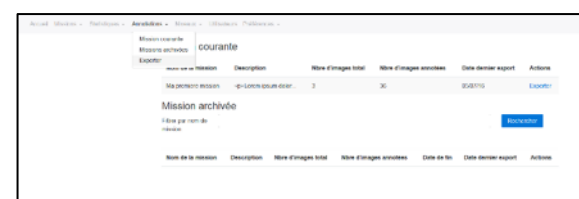
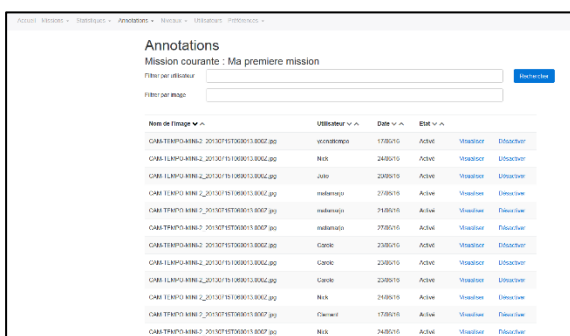



FIGURE 21. ANNOTATION INFORMATION

Accueil | Mon profil | Subscriptions | Paramètres | **Mon album** | **Discographie** | Paramètres -



Live

Discographie

iveaux

Discographie

Discographie

N°	Nom	Mini images	Récompenses	Action
0	niveau 0	0		Voir
1	niveau 1	13	Revisité	Voir
2	niveau 2	23	Cherché	Voir
3	niveau 3	33	Créé	Voir
4	niveau 4	43	Couleur	Voir
5	niveau 5	53	Mixte	Voir
6	niveau 6	63	Votre futur	Voir
7	niveau 7	73	Optique	Voir
8	niveau 8	83	Vie à l'école	Voir
9	niveau 9	93	Personnalité	Voir
10	niveau 10	100	Pyramide	Voir

[illegible]

FIGURE 22. LEVELS AND REWARDS

[Accueil](#)
[Connexion](#)
[Inscription](#)
[Mot de passe oublié](#)
[Aide](#)

Utilisateurs

[Ajouter un nouvel utilisateur](#)

Pseudo/Email	Adresse mail	Genre	Nbre images envoyées	Niveau	Date création du compte	Etat
laurianne		Femme	0	0	13/03/10	Actif Libérer Supprimer
Nick		Femme	0	0	13/03/10	Actif Libérer Supprimer
valentin		Femme	4	0	13/03/10	Actif Libérer Supprimer
guyonfante		Femme	4	0	13/03/10	Actif Libérer Supprimer
serenine		Femme	0	0	13/03/10	Actif Libérer Supprimer
Jade		Femme	2	0	13/03/10	Actif Libérer Supprimer
magali		Femme	0	0	21/03/10	Actif Libérer Supprimer
Catharine		Femme	0	250	03/04/10	Actif Libérer Supprimer
benoitbaker		Femme	0	0	21/03/10	Actif Libérer Supprimer
Thibaut		Femme	0	0	21/03/10	Actif Libérer Supprimer
gael		Femme	0	0	30/04/10	Actif Libérer Supprimer

FIGURE 23. USERS OF THE GAME.

THE DATABASE DESCRIPTION

It was decided to store the annotations and images' metadata and related data in an independent MySQL database associated with the Deep Sea Spy application. The "admin" interface will allow the administrator to trigger the data export into an XML file (through a clickable button). Whole information will be therefore retrieved manually at the end of the mission (without any filter).

The XML export file will be structured in a format compatible with the Ifremer Oracle database model in order to allow further data import.

Interoperability will be facilitated by sharing standard vocabularies between the Deep Sea Spy game's database and the Ifremer information system (e.g. countries codification list).

Below is listed the principal information collected by the system and that will be exploited by researchers.

Prerequisites:

- All annotations must be associated with an image
- All annotations must be associated with an observer
- All annotations will be stored in pixels

Data to be stored (Figure 24):

- **Data related to the image:**
 - Observatory (EMSO-Azores, Ocean Networks Canada)
 - Latitude (degrees decimal)
 - Longitude (degrees decimal)
 - Depth (meters)
 - Camera type/model
 - Zoom value
 - Date of acquisition (from the extraction)
 - Time of acquisition (from the extraction)
 - Still image ID (unique number)
 - 'Annotation Mission' name/ID
- **Data related to the participant**
 - Participant ID (unique number)
 - Date of registration of participant
 - Participant's age
 - Participant's pseudonym
 - Participant's professional occupation
 - Participant's email address
 - Participant's gender
 - Participant's ranking
 - Participant's annotations number
 - Participant's general statistics
- **Data related to the annotation**
 - Each annotation is associated to a **participant** and an **image**
 - Date of observation
 - Time of observation
 - Unit of measure (pixel)
 - Taxon (animal) name
 - Substratum (bottom) name
 - Position in pixel of each organism (online annotation)
 - Measurement in pixels of each organism (online annotation)
 - Area types' polygons pixels values (online annotation)
 - Comment

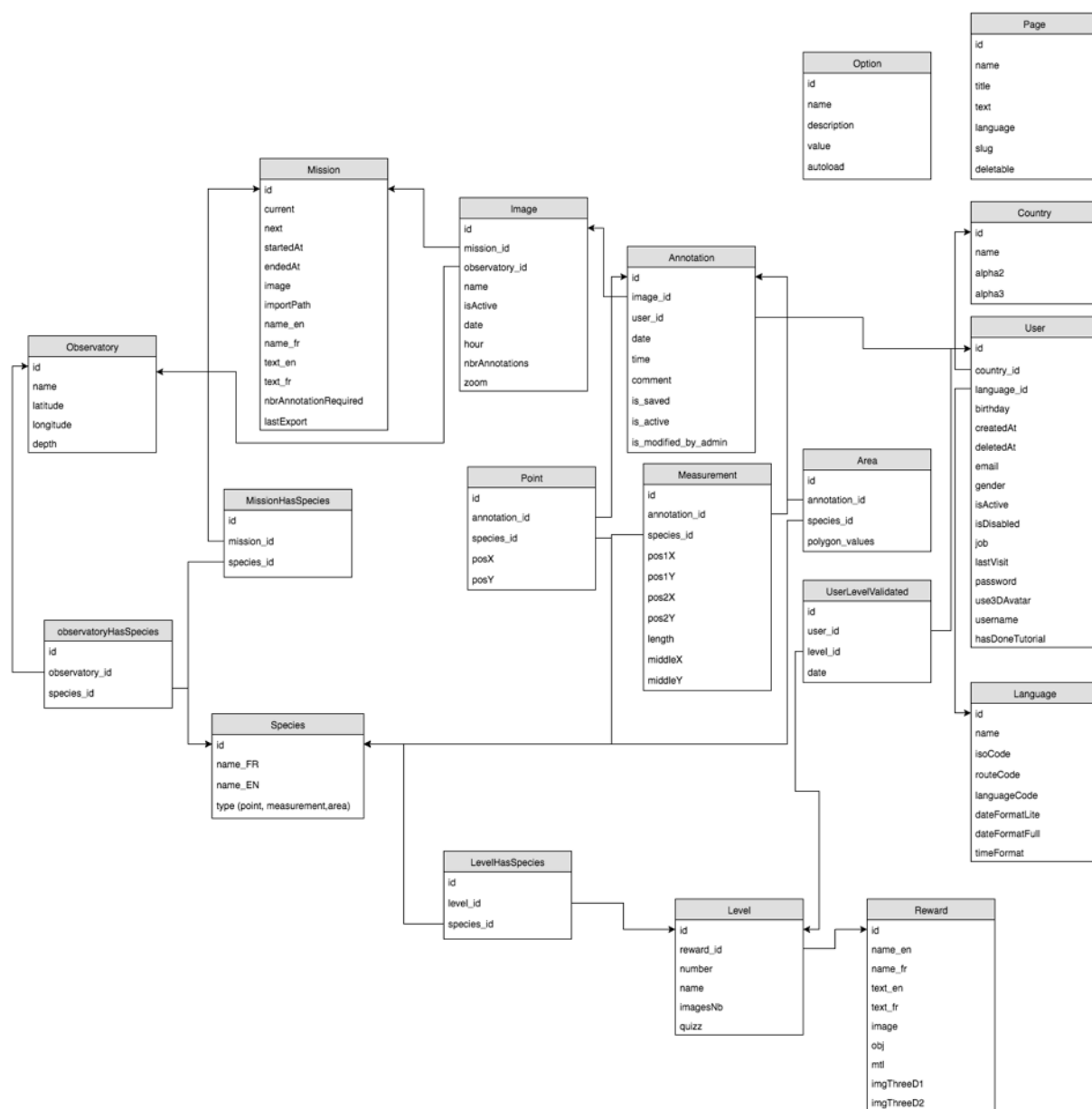


FIGURE 24. THE GENERAL STRUCTURE AND BASIC INFORMATION THAT SHOULD BE ARCHIVED IN THE DATABASE.

CONTACT WITH THE GENERAL PUBLIC

Discussions are in progress with Oceanopolis to include a multimedia kiosk to make the game available to visitors. The stand will be included in the existing deep-sea exhibition designed to raise awareness about deep-sea ecosystems among the general public, including the resources they provide and the state-of-the art scientific knowledge of these environments. Contacts have also been made with the Academy of Rennes to propose the game in the middle and high schools programs. Their interactions with the software and the accompanying pedagogic material will contribute to involve and raise pupils awareness about deep-sea ecosystems.

CONCLUSIONS

The annotation tool has been validated by the lead scientists. We actually worked on the online quiz and the tutorial. The English version is also under processing. The delivery of a first version of the game is planned for the end of July. A wide testing program will be launched in the fall.

