

## Use of smartphones (iPhone™, Android™, etc.) for the field identification of European crayfish

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Received February 10, 2011

Revised July 7, 2011

Accepted July 11, 2011

### ABSTRACT

**Key-words:**  
*crayfish,*  
*identification*  
*key,*  
*taxonomy,*  
*smartphone,*  
*iPhone*

Species identification keys are the most precise and unambiguous tools to properly identify a specimen down to the species or infra-species level. This is especially true when the key is richly illustrated with precise pictures or videos. Recent smartphones (iPhone™, Android™, etc.) can access through the 3G network to an unlimited and rapidly growing set of multimedia data on each species (photos, videos, audios). They become convenient tools to use in the field instead of traditional paper field-guides with a limited number of illustrations. A student project at the University of Nice, France, proposed to adapt to smartphones the Holdich and Vigneux “key to crayfish in Europe”. A prototype, in English, has been prepared and presented to the European Crayfish Congress in Poitiers, France, 26–29 October, 2010. It needs now to be discussed with taxonomy and field specialists in order to (1) increase the number of photos and videos and (2) complete and improve its audio part. Then, a multilingual version could be designed, so that field specialists of all European countries may use it. As the database underlying the project is wiki-compatible, a multilingual version could be designed as a collaborative effort within the crayfish community. Data on each species (biology, ecology, distribution, etc.) could be added in a second phase, as a geolocalisation module is linked to the database. Then the identification of invasive species could be quickly related to maps, in order to alert the crayfish community.

### RÉSUMÉ

Utilisation de smartphones (iPhone™, Android™) pour identifier sur le terrain les Écrevisses d'Europe

**Mots-clés :**  
*Écrevisses,*  
*clé*  
*d'identification,*  
*taxonomie,*  
*smartphone,*  
*iPhone*

Les clés d'identification sont les outils les plus précis qui existent pour déterminer le nom scientifique d'un animal au niveau spécifique ou infra-spécifique. Ceci est particulièrement vrai lorsque les caractères à observer sont richement illustrés par des photos et des vidéos précises. Les smartphones récents (iPhone™, Android™, etc.) permettent d'accéder, *via* le réseau 3G, à un nombre illimité de données multimédias concernant telle ou telle espèce (photos, vidéos, audios). Ils deviennent ainsi des outils très commodes pour un usage sur le terrain à la place des supports papiers traditionnels qui n'ont qu'un nombre limité d'illustrations et sont très coûteux à éditer. Un projet mené par des étudiants de l'Université de

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Nice, France, propose d'adapter aux smartphones la clé « *Key to crayfish in Europe* » de Holdich et Vigneux. Un prototype, en Anglais, a été réalisé et présenté au Congrès Européen sur les Écrevisses, Poitiers (France), 26–29 octobre 2010. Ce prototype doit maintenant être soumis à des spécialistes de la taxonomie de ce groupe, de manière à (1) continuer à enrichir la clé de photos et vidéos et (2) compléter la partie audio. Ensuite, ce premier modèle pourra évoluer en une version multilingue, pour que tous les utilisateurs européens puissent s'en servir sur le terrain. La base de données sous-jacente étant wiki-compatible, la version multilingue pourra être élaborée de manière collaborative par l'ensemble de la communauté des spécialistes des Écrevisses. Des données complémentaires sur chaque espèce (biologie, écologie, distribution, etc.) pourront être réunies dans un second temps et les données de géolocalisation pourront être traitées également. Ainsi, l'identification sur le terrain d'espèces invasives pourra être signalée en temps réel, de manière à alerter la communauté scientifique et les gestionnaires de ces espèces patrimoniales.

## INTRODUCTION

Identifying unknown specimens of plants and animals has always been a concern for field research and an extensive literature has been published over the past two centuries, mainly as printed field guides. The advent of computers did not change this pattern until recently, as their size, complexity, small degree of autonomy and fragility were not advantageous over a good, sturdy, book.

The recent development of smartphones such as the Apple iPhone™ or its various clones using an Android interface (Samsung™, Nokia™ . . .) may change the above pattern and put an end to the “paper” field guides in the near future.

Smartphones have indeed a lot of qualities appealing to users in the field. They are small and relatively easy to protect from shocks and humidity, provide instant access to the entire internet and are able to produce text, images, videos and audio resources in high resolution. And more than that, they potentially represent a straightforward access to all the literature and data available on any subject, whatever the specialization, from wherever you ask your questions.

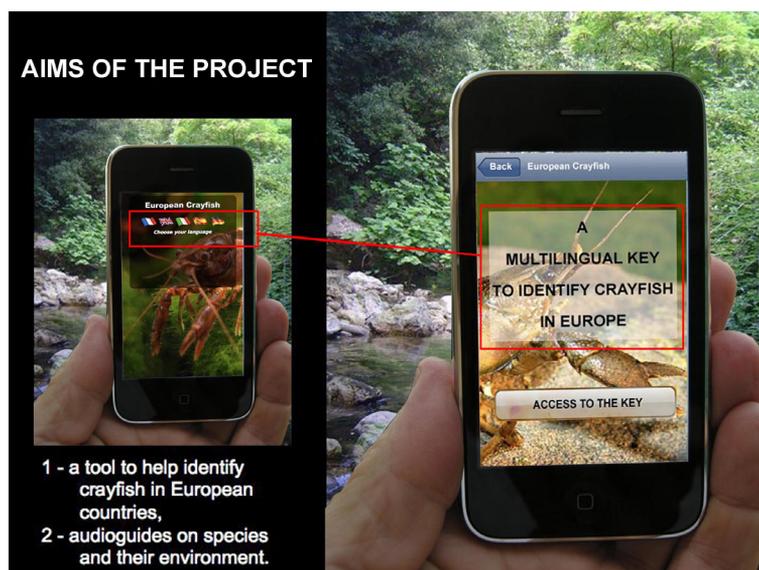
A smartphone version of a *key to european crayfish* may fulfill the two above requirements : (1) to give access to an unlimited corpus of data on those species and (2) to access those data from anywhere in the world/Europe and at any time (day/month/year).

This paper reports on an ongoing experiment to collaboratively develop, on smartphones, an illustrated ID key to the european crayfish, to help identify unknown specimens in the field. The “field” aspect of this project is especially important as native european crayfish are more and more threatened by introduced species (Gherardi and Holdich, 1999; Holdich and Sibley, 2009) which may carry fungal diseases, lethal to the native species (Diéguez-Uribeondo, 2006). To properly identify introduced species in a pond or river where they were never present in the past may be of crucial interest to protect native species (Pöckl *et al.*, 2006).

This effort must be collaborative as each European country will need to access the key through its own language and the specific, local, ways of dealing with those species (Souty-Grosset *et al.*, 2010). Only a collaborative work from the various groups of scientists and technicians dealing with crayfish in Europe may produce a set of useful reference data : first a multilingual, richly illustrated key, then all sorts of data on each species (biology, ecology, distribution, economic value, etc.) (Holdich *et al.*, 2006).

## MATERIAL AND METHODS

The European Crayfish ID-Bio project is centred on a PHP-mysql database (DB). All the necessary media (texts, pictures, videos, audios) are available/listed on specific files of the DB (1 file/media).



**Figure 1**

Presentation of the project on an Apple iPhone™, Poitiers 2010 meeting (Souty-Grosset et al., 2010). The first entry will be to specify the user language (e.g. English in 2010, French in 2011, etc.).

Figure 1

Présentation du projet sur un iPhone™ d'Apple. La première entrée sera d'indiquer la langue de l'utilisateur (ex. anglais en 2010, français en 2011, etc.).

From the DB one has access to a multiwindows platform where:

- (1) the reference text (in this case the crayfish ID key) is typed using a built-in word processor. The text is of a hierarchical XML type, suitable for dichotomous keys,
- (2) all media previously listed in the DB are accessible. They are linked to the key, using a drag-and-drop procedure where the pictogram of the media is directly placed in the text, so that contextual information helps understanding the scientific text of the key,
- (3) XML exports of the text and pictograms are regularly made,
- (4) a "Mobility" widget is present to test how the project will show on any smartphone.

The DB and the multiwindows platform need a login and password to be fully accessed and edited. These are controlled by the local structure in charge of a specific project. Login and password are not regulated by the ID-Bio team at the local level.

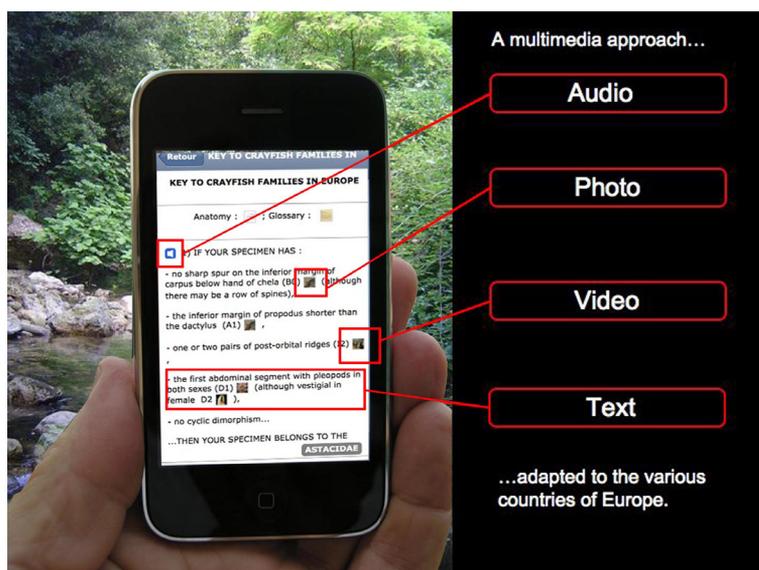
The graphic layout of the prototype is kept very basic, as development of the various functions is still in progress and may change slightly from one smartphone to the other.

As a final step, tests were made in the field to check how fast it was possible to access the crayfish key as a function of network availability (wifi, Edge, 3G) and providers (SFR, Bouygues, Orange). In remote places where access to the Edge or 3G network was too difficult or impossible, an alternative method was tested: an XML export of the entire project was installed on a small PC Netbook acting as a server, with internal wifi. The 1.2 kg Netbook was carried around in a small backpack. Up to ten people were able to simultaneously connect to the PC wifi in a 20 m radius, sufficient for a small multilingual group in the field.

## RESULTS

A smartphone prototype of the Holdich and Vigneux (2006) identification *Key to European Crayfish* was presented to astacologists from various European countries at the Poitiers 2010 meeting (Souty-Grosset et al., 2010) (Figure 1):

The scientific text of the key is enriched with various media (photos, videos, audios), following the famous adage "a picture is worth a thousand words" (Figure 2). The use of precise,



**Figure 2**  
A multimedia approach to ID keys, to be used directly in the field.

Figure 2  
Approche multimédia pour les clés d'identité, pour être utilisé directement sur le terrain.

contextual media helps understanding of the text of the key, as it may use a lot of specialized terms (e.g. anatomy, biology), most of them only familiar to scientists or specialists. This is the price to pay for precision. With photos, videos and audio assistance, it is much easier to know exactly what one has to look for on an unknown crayfish, even if one doesn't know the exact definition of each scientific term.

If an audio pictogram is placed at the beginning of a paragraph, it means that the morphological characters to look for are also explained through a spoken commentary, whether it is an interview or a text-to-speech translation obtained with synthetic voice software. In the future the key will be accessible either as a "text-to-media" structure (as in the actual prototype) or an "audio-to-media" structure, easier to use on small-screen smartphones whenever reading a text is difficult (e.g. because of small letters, too much ambient light, etc.).

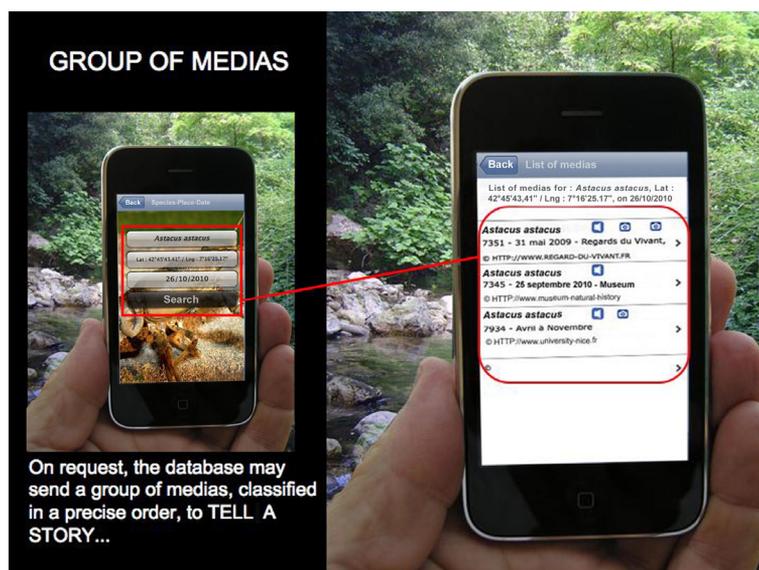
The media being listed in a database, it is possible to organize them as into groups, where audios, photos and videos are playlisted in a specific order (Figure 3). This is especially useful when complex information is needed on a specific subject (behaviour, protection, legislation, etc.) and to avoid too much back and forth between screens.

Access to the crayfish key with a smartphone is direct when using a FlashCode/QR-Code app, freely available on any smartphone or already installed on devices since 2009.

## DISCUSSION

The ID-Bio software designed by Dr. de Vaugelas and his students at the University of Nice-Sophia Antipolis (France) enables a collaborative creation of smartphone applications dedicated to the precise identification of living species, directly in the field.

A prototype, based on an ID Key to European Crayfish (Holdich and Vigneux, 2006) is under completion. In this first version described here, the crayfish key is proposed as text-based information, where all media are accessible through pictograms inserted directly in the text. This is a convenient and simple way to enrich a text, but it is not really optimized for smartphones, as reading a text on a small screen is not easy in the field.



**Figure 3**

A group of medias provides information on complex topics. One such media may belong to several groups, making the system very flexible.

Figure 3

Un groupe de médias fournit des informations sur des sujets complexes. Un même support peut appartenir à plusieurs groupes, rendant le système très flexible.

It is therefore planned to set up two versions of the same key: (1) the actual one with its text-centered structure and (2) a second one where the audio part will be the main entry. A full audio version of the key, still linked to photos and videos, would be better adapted to smartphones as it is more efficient to listen to something while looking at the crayfish specimen rather than going from text to specimen and back.

The Poitiers 2010 version of the software needs now to be discussed with taxonomy and field specialists in order to (1) increase the number and quality of photos and videos (Holdich, 2009), (2) complete and improve the audio part and (3) attract collaborators from the main European countries where crayfish are important heritage species.

Only through a collaborative efforts from the crayfish community, can a multilingual version of the key be designed, with the help of students from all over Europe.

Data on each species (biology, ecology, distribution, etc.) will be added to the database, as well as a geolocalisation module. Then the identification of introduced/invasive species can be quickly related to maps, in order to alert the crayfish community (Holdich *et al.*, 2009).

## ACKNOWLEDGMENTS

The authors would like to thank the astacologists present at the Poitiers 2010 meeting for their cheerful interest in this preliminary work. J. Carral, L. Füreder, F. Gherardi, Y. Machino, J. Madec, M. Pöckl, P. Smietana, T. Taugbol and E. Vigneux are also acknowledged for their decisive contributions to the ID key and the Atlas of European crayfish. Thanks are also due to Julian Reynolds for her careful corrections of the manuscript.

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