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Proyecto AVIS: a Spanish open access bird database available for research

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Abstract. Proyecto AVIS¹ is an open access citizen science database that stores information collected by amateur ornithologists about bird occurrences and abundance in Spain. Proyecto AVIS was launched in 2005 and today stores data from 415 species (*ca.* 90% of bird species in Spain); it covers 30% of the Spanish territory, including the Canary Islands in the Atlantic Ocean and the Balearic Islands in the Mediterranean Sea. Here, we acknowledge the work of all the volunteers that have gathered bird records in the field and uploaded these observations over the last 10 years, and introduce Proyecto AVIS to a broader community of biogeographers and macroecologists to promote its use for research.

Compilation of bird observations

As of December 2014, Proyecto AVIS contains more than 87,000 entries, containing records of around 4,500,000 individual birds, uploaded by 145 registered users. These users may be individual volunteers or NGOs with several volunteers, like the two most dynamic contributors: Colectivo Ornitológico Cigüeña Negra² and El Bosque Animado³, which have uploaded 15,685 and 10,002 observations of 244 and 130 species, respectively, over the last 10 years. The work of the volunteers has been essential in assembling this large database, and thus we would like to acknowledge and recognize their contribution. In addition, we encourage Spanish ornithologists and amateur bird-watchers to upload their observations to Proyecto AVIS in order to keep this project alive. Registration is simple and free and the website is multilingual (Spanish and English).

Structure of the database

The database is programmed in MySQL, an open-source relational database management system.

Proyecto AVIS has two groups of tables: data tables and dictionary tables. Data tables compile the names of observers, bird observations, observation periods per day and observer effort per period. Dictionary tables show standardized information per field: species, age, sex, UTM coordinates, Spanish region, reproductive status, phenological category, habitat, altitude and atmospheric conditions (visibility, wind speed, rainfall, etc.). The robustness of the data stored in Proyecto AVIS has been promoted by the standardization of its fields. Users select the species, habitat and other main variables from a list of pre-defined categories. Thus, spelling mistakes and synonyms (e.g. species or habitat synonyms) are avoided. The Proyecto AVIS database only allows free text in the 'Notes' field, where extra information can be added.

Users must enter bird records using the 'New observation' formulary, which consists of several fields. The first seven fields are mandatory and the others are optional. Below we describe the fields, indicating which are text and which are

1 <http://proyectoavis.com>, last accessed 05/12/2014

2 <http://coen.tarifainfo.com>, last accessed 05/12/2014

3 <http://aeaelbosqueanimado.blogspot.de>, last accessed 05/12/2014

numeric. In Proyecto AVIS, the term ‘observation’ refers to an entry in the database in which a species is recorded as part of a single field survey or observation period; each observation contains one or more individual birds of the species.

Bird observations

1. *Especie* [Species name]. Text. Scientific and standardized common name based on the Bird List of Spain from SEO/BirdLife (Gutiérrez et al. 2012). Users have the option to view the species name depicted in Spanish or English.
2. *Número de individuos* [Number of individuals]. Numeric. Number of individuals from a single observation.
3. *Periodo de observación* [Observation period]. Numeric. This field identifies all observations made in the same field survey. Users can create a new period describing observation conditions and then add all species recorded.
4. *Fecha* [Date]: Día/Mes/Año [Day/Month/Year]. Date.
5. *Comunidad Autónoma* [Autonomous community]. Text. This field identifies the Spanish administrative region where the species was observed.
6. *Provincia* [Province]. Text. Province of the observation.
7. *Cuadrícula UTM 10x10* [10x10 km UTM square]. Text. Bird occurrences in Proyecto AVIS database are georeferenced using the projected 10x10km UTM square system and the MGRS labelling convention (Military Grid Reference System). UTM/MGRS is the standard system for mapping bird occurrences in Spain and it is used in reliable Spanish bird atlases (Martí and Moral 2002, SEO/BirdLife 2012). To help users identify the UTMs where they recorded the species, the Proyecto AVIS web page includes an easy-to-use tool to geo-reference the observations based on a Google Maps™ routine.
8. *Hora* [Hour]. Numeric. Hour of the observation.
9. *Edad* [Age]. Text. Users must choose from a list of four pre-defined categories: nestling, juvenile, adult or indeterminate.
10. *Sexo* [Sex]. Text. Users must choose from a list of five pre-defined categories: male, female, indeterminate, couple or males and females.
11. *Interés* [Interest]. Text. Users must choose from a list of twenty-four pre-defined categories (e.g. unusual concentrations, unusual date, known cause of mortality, rarity).
12. *Grado de Reproducción* (GR) [Reproductive status]. Text. Users must choose from a list of sixteen categories defined by the main Spanish bird atlases (Martí and Moral 2002, SEO/BirdLife 2012).
13. *Categoría fenológica* (CF) [Phenological category]. Text. Users must choose from a list of six categories defined by the main Spanish bird atlases (Martí and Moral 2002, SEO/BirdLife 2012).
14. *Hábitat* [Habitat]. Text. Users must choose from a list of nine pre-defined categories: forest, scrubland, meadow, cropland, anthropized area, continental wetland, rocky formation, coastal habitats and others.
15. *Hábitat (código completo)* [Habitat – complete list]. Text. User must choose from a list of ninety-four categories codified by the SEO/BirdLife (Sociedad Española de Ornitología⁴).
16. *Altura de vuelo* [Flying height]. Text. Users must choose from a list of six pre-defined categories: perched, very low, low, medium, high and very high.
17. *Observaciones* [Notes]. Text. A field to add additional information.

Observation periods

Users can optionally group their observations in the same ‘period’ (field trip). To create a new observation period, users must complete a form with the following fields:

1. *Código de periodo* [Period code]. Numeric. The system creates this information by default.
2. *Método* [Observation method]. Text. This variable includes three categories: observation point (e.g. point count), itinerary by car (e.g. transect carried out by car), and itinerary by foot (e.g. walked transect).

⁴ www.seo.org, last accessed 05/12/2014

3. *Observatorio conocido* [Known observatory]. Text. The user can choose from a list of places commonly used for bird watching. Once a place on the list is selected, the next three fields are automatically populated.
4. *Comunidad Autónoma* [Autonomous community] Text. This identifies the Spanish administrative region where the species was found.
5. *Provincia* [Province]. Text. List of Spanish provinces.
6. *Cuadrícula UTM 10x10* [UTM 10x10 km square]. Described above.
7. *Cuadrícula UTM 1x1* [UTM 1x1 km square]. Numeric. 1x1 square within the 10x10 km UTM square where the observation point or itinerary is delimited.
8. *Fecha* [Date]: Día/Mes/Año [Day/Month/Year]. Date.
9. *Hora de comienzo* [Start hour]. Numeric. Hour when the observation period begins.
10. *Hora de finalización* [Finish hour]. Numeric. Hour when the observation period ends.
11. *Cielo* [Cloudiness]. Text. User must choose from a list of eight pre-defined categories: clear, slightly cloudy, moderately cloudy, nearly overcast, totally overcast, misty, dense fog or haze.
12. *Precipitaciones* [Precipitation]. Text. Users must choose from a list of seven pre-defined categories: absent, drizzle, rain, downpour, deluge, snow or hail.
13. *Temperatura* [Temperature]. Numeric. The temperature measured during the observation period in degrees Celsius.
14. *Velocidad del viento* [Wind speed]. Text. Users must choose from a list of fifteen pre-defined categories.
15. *Dirección del viento* [Wind direction]. Text. Users must choose from a list of eight defined categories, all represented by angular values from 0 to 360°.

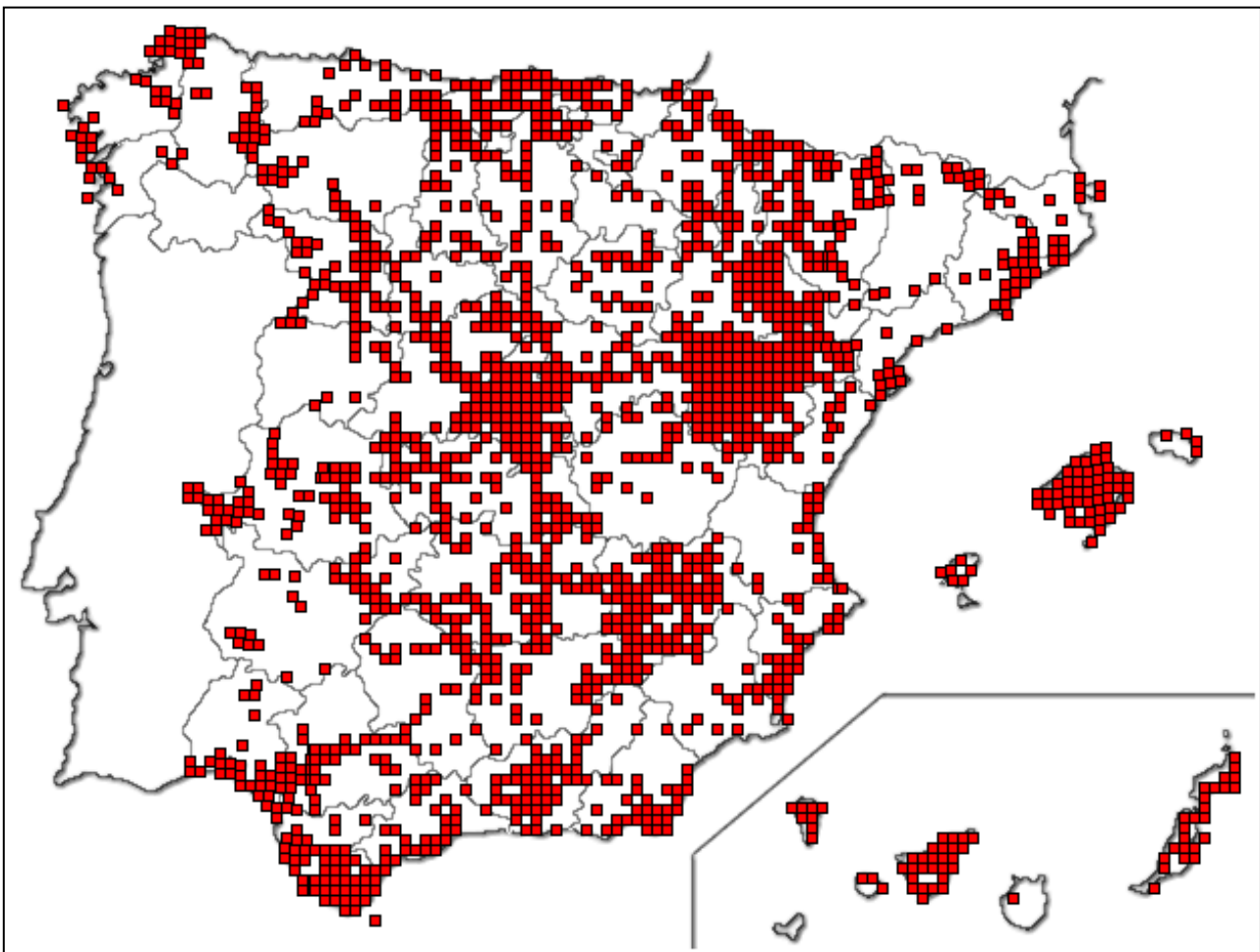


Figure 1. The 1750 distinct 10x10 km UTM squares with bird occurrences stored in Proyecto AVIS. Inset shows the Canary Islands.

Table 1. Summary of the time employed and the number of bird species detected in the observation periods stored in Proyecto AVIS.

Observation periods	N	Duration of the observations (hours)			Number of species		
		mean	maximum	minimum	mean	maximum	minimum
by foot	64	3:21	11:11	0:30	9.7	48	1
by car	82	4:49	11:20	0:30	13.98	46	1
stationary	778	4:26	9:20	<30 min	6.07	51	1

16. *Visibilidad* [Visibility]. Text. The linear distance the user can see ahead (metres). Users must choose from a list of eleven pre-defined categories.

17. *Observaciones* [Notes]. Text. A field to add additional information.

18. *Observadores* [Observers]. List of observers enrolled in a certain observation period and time spent by each one of them. After being associated with an observation period, users can add their own observations to the list.

Sampling effort

The 87,000+ observations in Proyecto AVIS cover 1750 different 10x10 km UTM squares, representing 30% of the total area of Spain (Fig. 1). Unfortunately, UTM coverage is geographically uneven: there are regions with few records (e.g. Galicia, in the northwest of the Iberian Peninsula) while other areas have almost 100% coverage (e.g. Mallorca). We hope that the currently unsampled UTM squares will receive increasing attention in the near future. We are also now working to extend map coverage to North Africa, to obtain data from the Strait of Gibraltar, an essential migration route between Africa and Europe where some bird conservation societies work, such as COCN⁵.

Some of the observations include information about the sampling effort of the volunteers (hours in the field). At the time of writing this paper, Proyecto AVIS contained such information for 64 transects covered by foot, 82 transects covered by car and 778 stationary observations. On average, observers spent approximately 4 hours in the field per survey, with maximum values exceeding 11 hours (Table 1). Transects by car allowed de-

tection of more species than other methods, and stationary observations the fewest (Table 1).

The web interface

The Proyecto AVIS web page¹ allows queries to explore the database and obtain general information and statistics about observations. In the 'Maps and Queries' section, (*Mapas y Consultas*) any user (registered or not) can find tables, maps and graphs from observations included in the database. Below, we describe different query possibilities.

1. *Advanced queries*: in this section users can obtain observations by filtering using different fields, and can display the results as a list of observations or by grouping them by different criteria such as species, date, regions or UTM squares. Moreover, it is possible to plot graphs and distribution maps using UTM squares with the presence of the selected species. Registered users can also download the information in data files (.csv). Registration is simple and free.
2. *Observation periods*: users can view periods, select one and get the number of observations by species, the list of contributors as well as all the general information about the period (weather, duration, etc.).
3. *Monthly and annual summaries*: users can aggregate the information in the database by month or year.
4. *Species*: the list of all species with the number of observations, number of individuals, number of UTMs with presences, and number of different observers of each species. Users can select particular species to obtain detailed informa-

⁵ <http://cocn.tarifainfo.com>, last accessed 05/12/2014

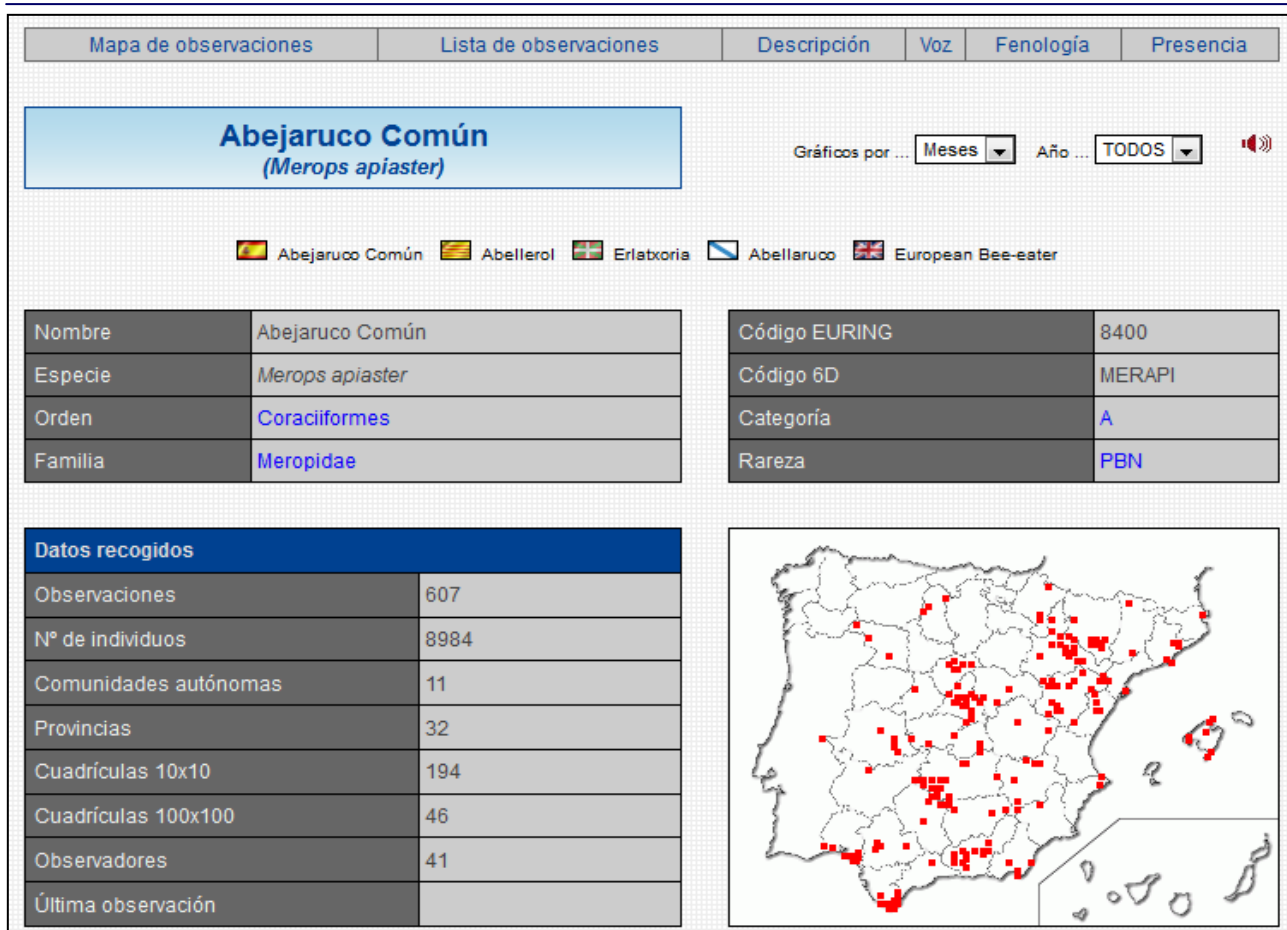


Figure 2. Example of the web interface showing taxonomic information (order and family), a summary of stored data (number of records, number of individuals, number of UTM squares, etc.), and a map with the recorded occurrences of *Merops apiaster* (European bee-eater).

tion (see Fig. 2) including: taxonomic information (order, family, etc.); the map of recorded occurrences; graphics with different parameters by month; the EURING code for the species (a standard number for identifying the bird species given by the European Union for Bird Ringing; Noordwijk *et al.*, 2003); a 6-digit code (*Código 6D*) based on the first three letters of the binomial name; their rarity category from the Spanish Birds Rarities Committee⁶; whether the species breeds in the Spanish territory or not; and the name of the species in Galician, Basque, Catalanian and English.

5. *Order and family*: a list of the species classified by orders and families.
6. *Contributors*: the list of all people who have contributed their observations to the database.

rAvis R-package

We have recently developed *rAvis*⁷, an R-package to download and visualize the data from Proyecto AVIS in the R-environment (Varela *et al.* 2014). The *rAvis* package is part of the *rOpenSci* project⁸, which enables scientists to easily use the data stored in open access databases for research.

Potential uses of Proyecto AVIS

In spite of being one of the oldest citizen science web projects (started in 2005), macroecologists and biogeographers are mostly not aware of the existence of Proyecto AVIS. We would therefore like to conclude the presentation of Proyecto AVIS by encouraging researchers to use this large bird database.

⁶ <http://www.seo.org/conocenos/grupos-de-trabajo/comite-de-rarezas/>, last accessed 05/12/2014

⁷ <http://cran.r-project.org/web/packages/rAvis/index.html>, last accessed 05/12/2014

⁸ www.ropensci.org, last accessed 05/12/2014

Potential applications are very wide. The database can be explored using the `rAvis` R-package and the downloaded information can be combined with the researcher's own data or with other online bird databases in order to complete the species samples (e.g. eBird⁹ or GBIF¹⁰). Occurrence data can be used to calibrate ecological niche models and project them into different climatic scenarios to map species' distributions in the past or in the future. Detailed information about particular species, combined with GIS layers, could help researchers to understand the impacts of the land-use change in Spain. Further, seasonal information about species' occurrences could be used to analyze changes in species diversity during the year, or information from several years could be used to assess long-term changes in bird species diversity. Finally, conservation strategies could be tested with these temporal series of species' occurrences.

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Submitted: 13 July 2014

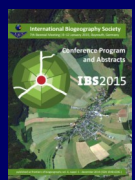
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⁹ www.ebird.org, last accessed 05/12/2014

¹⁰ www.gbif.org, last accessed 05/12/2014



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