European Ornithological Trust Survey System

DABB

The European Ornithological Trust (EOT) is an international voluntary (not for profit) organization. Its mission is to promote the conservation of wild bird species through the provision of accurate technical and scientific data. This data covers bird populations in the wild and the threats to those populations, particularly the threats caused by human activity.

EOT has recently received funding from a major charitable trust and donations of hardware and software from the computer industry to set up the Digital Atlas of Breeding Birds (DABB). Atlases of breeding birds are usually produced on a national or regional basis and for each species that is found in that country or region they show where it can be found breeding. This is done by dividing the map area up into squares and showing a dot in every square where the species breeds. Figure 1 shows an example of such a map for the United Kingdom (UK). The size of the squares depends on the scale of the map and the size of the country or region being presented. For a country the size of the UK, squares with sides of 10 km are normal, whereas for the whole of Europe squares with sides of 50 km would be more appropriate. Together with the simple information about the presence or absence of each species in each square, the project aims to gather information about the numbers of each species. For this purpose, techniques such as territory mapping (see below) are required.

Figure 1. *Example Map from Breeding Birds Atlas*

The aim of the DABB project is to provide this kind of information at three different scales for the whole of Europe. The number of maps required would be too great to present in a book, and so the intention is to make them available on DVD-ROM and on-line via the Internet.

This is a long-term project, which will accumulate very large volumes of data over many years. However, the EOT is aware that the kind of people who will participate in the survey work are the very people who take action to preserve bird species or who campaign against the threats to birds' habitats. EOT does not want these people to be so busy collecting data

that they do not take action against immediate threats, so EOT is investigating ways of using computers in the field to gather data and make it more efficient.

Territory mapping

Territory mapping is a survey technique that is used to gather information about how many pairs of different bird species are breeding in a particular area. The person carrying out the survey visits the site regularly at least ten times over the breeding season. On each occasion, he or she plots onto a map sightings of birds exhibiting territorial behaviour. Territorial behaviour includes birds singing and calling, conflict between birds (usually at or near the boundary between territories), collecting nesting material or food and observations of birds at the nest. Each observation is plotted onto the map with a code for the species, for example 'R' for Robin or 'WW' for Willow warbler, and some additional information, such as a circle for a bird singing or the word 'food' if the bird is collecting food.

When the survey has been completed, over the course of the breeding season, the observations for each species are collated onto a single map. Each observation of a species is then coded with a different letter for each visit, usually A, B, C etc. These are all transferred onto the species map together with the information about whether the bird was singing, gathering food, etc. The observer then uses this information for each species to try to determine how many territories there are. This is done by clustering together observations that appear to represent the same pair of birds over the series of site visits, and separating out observations that are definitely different birds, for example where there is a territorial conflict or where two male birds are singing against one another simultaneously from within their own territories. This information is then used to draw approximate territory boundaries. From this the number of breeding pairs in the area can be calculated.

The manual approach to territory mapping has a number of drawbacks. Firstly, maps of the scale required can be unwieldy to handle in the field. Secondly, inexperienced observers can get confused about the meaning of the codes that they enter onto a map, for example entering 'MI', 'MT' and 'MS' for Mistle thrush on different occasions. This makes the interpretation of the data difficult. Thirdly and most importantly, the task of copying all the observations from one set of maps to another set, usually by tracing them, is extremely time-consuming.

It has been proposed that using portable computers with touch screens could help to solve all three of these problems with the manual approach. The portable computers would have a screen on which the map could be scrolled around. The observers would be able to select birds by name from a menu, so that the computer would select the code. Most importantly, producing maps by species from data collected by visit would simply be a matter of the computer plotting all the observations for a particular species instead of all the observations for a particular visit.

The data from such a system would be collated in a central system, where it would be subject to quality control procedures, and where the raw data about observations would be converted into data suitable for the atlas and used as the basis of population estimates.

Two further possibilities have been suggested, but it is not thought that they would bring such clear benefits. Firstly, it would be possible to link a Global Positioning System (GPS) receiver to each portable computer, or use a GPS-enabled smartphone, in order to accurately record the position of the observer at the time of each observation. This may be useful in areas where there are few landmarks, such as paths, buildings or rivers, on the map by which to judge position, but is not essential. Secondly, it may be possible to develop an expert system approach to analysing the species data in order to estimate the territory boundaries. However, this is likely to be very complex to develop and is not part of the current requirements.

Future development

The EOT believes that the software will be of use to other wildlife organizations. It could, for example, be used for recording observations of mammals or insects. However, the observation types would not necessarily be the same as for birds, and it might be used simply

to count observations rather than convert observations into territories. The design of the system must allow for different sets of observation types to be used.

Requirements

The immediate requirements have been identified as follows. These include some decisions about the user interface that have been determined through a user study.

1. To develop a system to record observations of bird species on a digital map.

1.1 The user will be able to select the species from a menu or by entering the code or species name directly via a keyboard. The Latin name of each species must be displayed as a verification that the correct species has been selected.

1.2 The list of species will be localized to different countries or regions, and the same code may be used in different countries to represent different birds, but these will be converted to a set of international codes when the data is collated centrally.

1.3 The user will be able to select the type of observation from a menu or enter it directly from the keyboard using keyboard shortcuts.

1.4 The map that is used may be a digital vector map (made up of digitally stored points and lines) or it may be a bitmap representation (possibly a map that has been scanned into a computer).

1.5 The map will be geo-coded so that the location of the site is known accurately according to a standard global geographical grid system, such as latitude and longitude, or a standard national or regional system such as the UK Ordnance Survey grid system.

1.6 The user will be able to enter data about each observation visit to the site, such as date, time and weather conditions. Date and time will default from the current system date and time. Weather conditions will default from the previously entered weather conditions.

1.7 The system will have a touch screen that can be used for precise positioning of entries, probably with a stylus to ensure the greatest possible accuracy.

1.8 The user will be able to change the scale of the map display (zoom in and out) and scroll east-west and north-south.

2. To allow the observation data to be analysed by bird species or by visit.

2.1 The user will be able to select a species and have all the observations for that species (and no other) displayed on the map, coded by visit and observation type.

2.2 The maps showing species data will be able to be printed out.

2.3 The user will be able to select observations on the map by drawing arbitrary polygons around them to assign them to a possible territory.

2.4 The system will provide basic consistency checking, for example that a proposed territory does not contain observations of two male birds singing against one another on the same occasion.

2.5 It will be possible to display and print the map with the proposed territories for a species with or without the detailed observations for that species.

3. To allow the data to be transferred to the central system for collation.

3.1 The user will be able to select the entire set of territory data or territory data for specific species, with or without the detailed observations for output into a file that can be submitted to the central system.

3.2 The system will provide a mechanism for electronic transfer of the data file to the central system, probably by FTP (File Transfer Protocol).

4. To allow configuration data to be transferred from the central system.

4.1 The user will be able to download the species list for their country and sets of maps from the central system, probably by FTP (File Transfer Protocol).

4.2 Alternatively, the data will be loaded from a DVD-ROM.

5. To allow for future developments

5.1 To allow the recording of other kinds of wildlife (for example mammals, reptiles, amphibians and insects) by configuring the observation types.

Interview with Director of Research

The following is the transcript of an interview with Pierre Marceau, Director of Research for EOT, conducted by Tomas Vanderpauw, consultant for the software house that is carrying out the project.

Tomas Vanderpauw: Monsieur Marceau, I believe that you have some ideas about how you would envisage this system working in the field. Would you like to explain your ideas?

Pierre Marceau: Yes, I'd be happy to. I've given quite a lot of thought to this, having done this kind of work myself.

TV: Can we start at the beginning then? What does this device look like?

PM: I see it as a tablet PC, mostly screen, but with a keyboard along the bottom, and a stylus for interacting with it rather than a mouse. The stylus has to be tied on so that it can't get lost.

TV: So it's one of those ruggedized tablet PCs, is it?

PM: Yes, it would have to be strong and waterproof, and about the size of an A4 pad of paper.

TV: Okay then. What would you expect a field worker to do before they go out on a field trip?

PM: They would need to ensure that the correct map is loaded into the system for the site that they plan to survey.

TV: Where would the map come from?

PM: It would probably be on a DVD—probably the PC would have an external DVD drive. Ideally, the survey software would prompt the field worker for the name of a place or for some kind of grid reference. When they have entered it, a map of that area would be displayed. The field worker would then mark a rectangle on the map showing the area that they plan to survey. That section of digital map would then be extracted into a file and stored on the hard drive of the survey PC.

TV: Would this happen on every occasion that they prepare for a survey?

PM: No, once they have set up the map for a particular survey site, they should be able to retrieve it from the hard drive whenever they go to carry out a survey on that site. So the information about the survey site and the map associated with it would need to be stored in the system.

TV: So, they've loaded up the map. What other information would they store about the site?

PM: The name of the site, the map file and information about the kinds of habitat, for example woodland, moorland, coastal dunes, or whatever. A single site could cover more than one type of habitat.

TV: And for a single site, they could conduct several surveys?

PM: Yes, when they start a survey in the field, they should be able to select the site and then enter details about that particular survey.

TV: What sort of details?

PM: Date, start time and finish time, general weather conditions, name and contact details of the field worker.

TV: What do you include in the weather conditions?

PM: Approximate wind speed and direction, percentage cloud cover, approximate temperature. For example, 'light, south-westerly, 20% cloud cover, 25ºC'. The first two could be selected from lists, the last two keyed in.

TV: What about the name and contact details of the field worker?

PM: They should be stored on the survey PC and default each time a survey is carried out.

TV: Okay, so the field worker has selected the survey site and filled in the details of this particular survey, what happens then?

PM: Right. He or she starts the survey. The map is displayed and down the left-hand side of the map, there should be a toolbar. On the toolbar will be buttons for all the types of observation they can make: singing bird, calling bird, bird at nest, bird carrying food, bird displaying, and so on. There should be an icon for each, and a tooltip that displays when they put the stylus on that toolbar button.

TV: So they'd select a button, and then point the stylus at the place on the map that they want to associate with that observation?

PM: Precisely. They would then be prompted for the code for that bird. Probably you could display a list of letters down the right hand-side or across the bottom of the screen, so they could select a letter that way or via the keyboard. When they select a letter, it should display all the codes that begin with that letter, so the user can select the one they want.

TV: How would you check that they'd selected the right code?

PM: At that point, it should pop up a dialogue box showing the code, the local name for the bird, for example, suppose they are using the English version and they enter 'CH', then the English name 'chaffinch' and the Latin name 'Fringilla coelebs' will be displayed. If they are surveying in French, then they would enter 'PA', and 'pinson des arbres' and 'Fringilla coelebs' would be displayed. If they are surveying in Dutch, then they would enter 'V.', and 'vink' and 'Fringilla coelebs' would be displayed. It's important that the user can choose the language they want to use. In some parts of southern Europe, the culture of hunting is still stronger than the culture of bird protection, so we may have to use volunteers from other countries to carry out the survey work.

TV: So we need to have the local code and name for every bird for every language in Europe.

PM: Yes, exactly. That information will be set up by our central data management team, based here in Geneva, and placed on DVDs or transferred electronically to the field workers PCs. We will allocate a unique code to each bird species and record its Latin name, then for each language there will need to be a species record with the local code and name.

TV: I need to come back to details of who else is working on the project later, but for now, can you tell me more about how the survey work would be carried out?

PM: Surely. Assuming the right bird name has been selected and displayed in the dialogue box, then the date, time and weather conditions should be set as default values. The field worker can change them if they want, but in over 95% of observations, they will accept the defaults.

TV: What happens in the other 5% of observations?

PM: They may change the time, because they made the observation a short while ago and did not record it straight away. More likely they will make a change to the weather conditions. The new weather conditions they enter will then be the default for the next observation, and so on.

TV: Will they need to record anything else?

PM: Yes, they may need to add some notes. There should be a free text notes field.

TV: Then they click the Okay button do they?

PM: Yes, and that should create and store the new observation. They should also be able to click Cancel and the observation will not be made.

TV: What if they selected the wrong species of bird, but want to record the rest of the defaults?

PM: Yes, they should be able to re-enter the code, and select a different species the same way as they selected it in the first place.

TV: Okay, so they repeat that process for all the observations in that survey on that occasion.

PM: Yes, and as each observation is stored, it gets displayed on the map, with the code for the bird displayed like this.

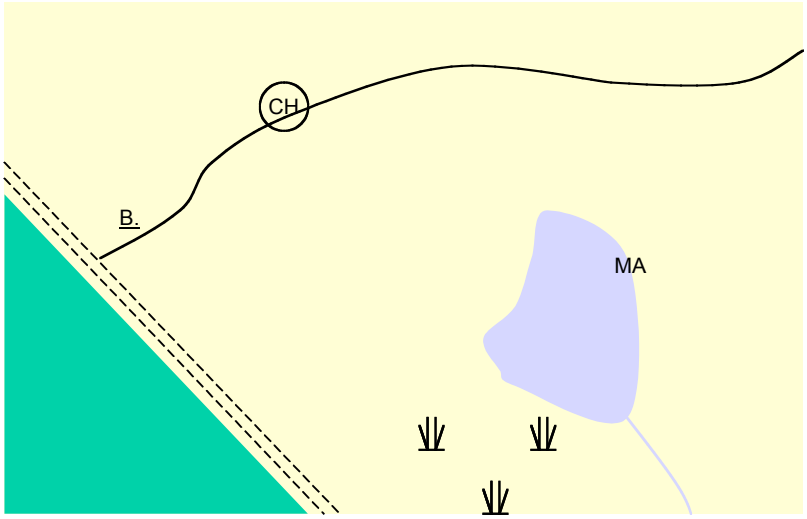

Figure 2. *Map showing survey observations for three birds*

TV: Right, so the map has to be updated each time they add an observation, and these different symbols—the code in a circle, the underlined code—they relate to the different kinds of observation, like bird singing, bird calling etc. Is that right?

PM: Yes and yes. Also, it is important that the user interface responds quickly. They may need to enter several observations within a short space of time.

TV: How long should it take as a maximum to record an observation if they just accept the defaults then?

PM: No more than three seconds.

TV: That's going to be a challenge.

PM: Not everyone will be that fast, but an experienced field worker in a busy setting would need to be able to work at that pace for short bursts.

TV: Do you know what kind of computer experience your field workers have?

PM: No. They will be a mixture of local volunteers and staff from bird protection societies across Europe. We would like the interface to be as easy to use as possible, but we expect that they will need some training. We look to you for guidance on that.

TV: Is there anything else we need to say about the survey before we move on to the way in which it will be analysed?

PM: Yes, the field worker needs to record the time when they stop surveying.

TV: Fine, we can do that.

PM: Good.

TV: So, what about the way in which they will analyse the observations?

PM: Right. A field worker will analyse a set of observations for a particular site. So the first thing they will do is select the site. Then they will go through all the species that were observed on the site, one by one, so they need a list of observed species.

TV: Okay, so they have a list of species, and say they select 'chaffinch', to use your earlier example.

PM: Yes, then they'd need to see the map of the site with all the chaffinch observations over all the survey occasions, each observation showing on the map should be displayed with the number of the survey instead of the code for the bird, like this.

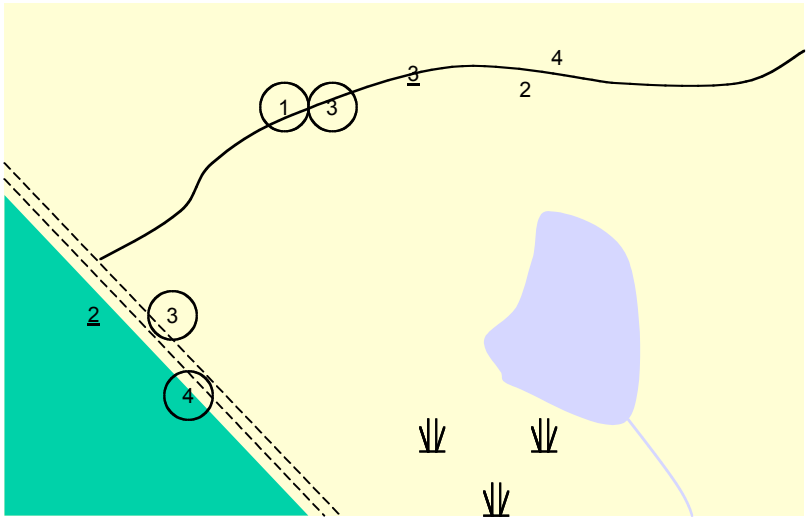

Figure 3. *Map showing survey observations for chaffinch on different occasions*

TV: Right, so now they can see all the occasions when they recorded chaffinches.

PM: Yes. It would be nice if they could selectively switch on and off the display of the observations for particular occasions, but that's not essential.

TV: Right. I'd guess from what I know that they would now try to group the observations into territories.

PM: Exactly. The key thing in this example is that they have two male chaffinches singing from different places on the same survey occasion, and two groups of observations. Obviously, the field worker also knows the site, so they'd know if there was a tree here in the hedge and here beside the track that the birds used as songposts. It looks to me very much like we've got two territories here.

TV: So they then want to be able to draw a line round each territory?

PM: Yes. So it ends up looking something like this.

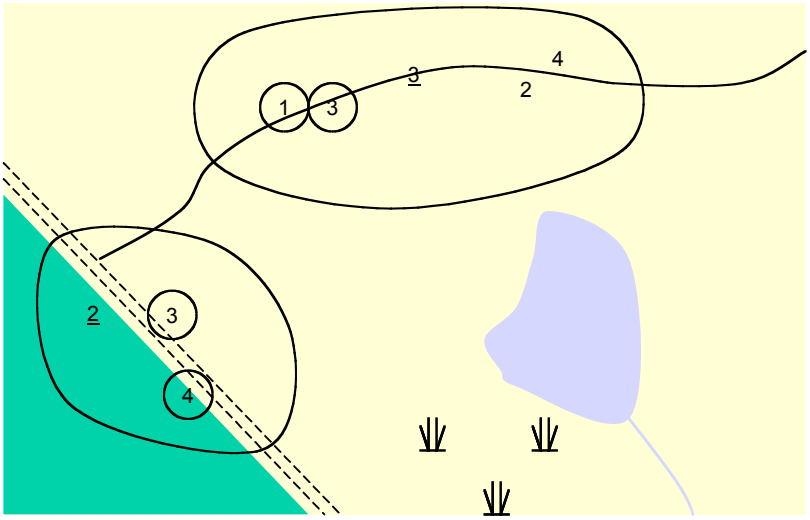

Figure 4. *Map showing territories for chaffinch*

TV: I see. So then the territories would be stored would they?

PM: Yes, and all the observations within the territory belong to that territory.

TV: Okay. I'm sure we can do that.

PM: Good. Then they would go through that process for every species they observed, but there might be some for which they can't establish any territories: perhaps because there are too few observations, perhaps because the birds were seen overflying the site, that kind of thing.

TV: But you want to be able to upload either all the observations with territories, or just all the observations, is that right?

PM: Yes. It should be possible to transfer the data one site at a time. I've heard about XML. is that what you'd use?

TV: We might. It would depend on the volume of data and the capacity of the communications links. XML tends to use a lot of bandwidth. If you've got people dialling into the Internet in eastern Europe, you may want them to have to spend as little time as possible connected.

PM: We hope that we will be able to set up partnerships with universities. They tend to have fast, permanent Internet connections, so that's likely to be less of a problem.

TV: What about security, if this data is coming over the Internet? You mentioned the hunting culture of southern Europe. You presumably wouldn't want data about the breeding sites of rare birds being intercepted and used to plan hunting trips.

PM: Certainly not. I think the data would have to be encrypted before it is transmitted. Can you do that in a secure way?

TV: Yes, I think so, though it may add to the cost. I'll get someone to look into that.

PM: Fine. Anything else today?

TV: Yes. You mentioned your central data management department here in Geneva. Any other people involved in the project?

PM: Me. I am project director. Then in each country, or in a few cases group of countries, we have a project manager. Then there are the field workers in each country. Some of them will work for national bird protection agencies, some will be academics and some will be volunteers. The project managers are responsible for the equipment, recruiting and training volunteers and ensuring the best possible coverage of their own country.

TV: And here at headquarters?

PM: The data management team. There are three of them. They are responsible for setting up the data that is sent out to the field workers and for managing the data that is returned. We also have a quality team of two people who sample the data and check it. Finally, we have the team that will be working on the design of the actual atlas and the supporting website. They are sub-contracted to us from a design company, so they don't necessarily work full-time on the project.

TV: Thank you. That gives me plenty to think about. I'll get back to you again in a few weeks with some ideas from our team, and possibly a prototype to have a look at.

PM: That would be good. I look forward to hearing from you.