

*Carduelis cabaret* in the lowlands, the stricter criteria as defined for the breeding Atlas must be fulfilled.

The survey squares are located at altitudes between 200 and 2500 m asl. Since the breeding period in the higher zones starts later than in the lowlands, there are recommendations concerning the survey period, there are no fixed time limits. As the thaw in the mountains can fluctuate markedly from year to year, a strict limitation on the survey period would be unreasonable. In squares below 1200m ASL, visits should be made between 15<sup>th</sup> April and mid June at the latest. Between 1200m ASL and the timberline we recommend that fieldwork is conducted between 25<sup>th</sup> April and 1<sup>st</sup> July. Above the timberline, the first visit should take place when a large proportion of the square is free of snow and the second by 10<sup>th</sup> July. It is one of our aims to keep survey effort comparable from year to year. Thus, the survey route (average length: 4.6 km) must remain the same and the time spent in the square should not vary too much. For this reason, new surveyors are told how much time their predecessor had spent in a square. On average, it takes fieldworkers about 45 minutes to cover one kilometre-square.

On the field maps all visual and sound records of potential breeding birds are noted. Compared with the traditional territory mapping method, the number of potential symbols for the observations is reduced. Thus, for example, there are not different symbols to say a bird has been heard or seen. However, surveyors are recommended to mark simultaneous observations because this helps to define the territories later on. To register a territory, a single observation is sufficient. This is a simplification compared to the genuine territory mapping method. This can be justified by the fact that there are only three visits to each survey square. From a sample coverage of additional visits, this finds method approximately 90% of the effectively existing species and about 85% of all territories. Once fieldwork has ended, the volunteers analyse their survey results themselves and complete a standardized recording form. Now, the majority of surveyors uses TerriMap, and produces a CD-ROM, which contains all the maps and data files. Subsequently, they send all field maps and the CD-ROM to our institute. Here we make a thorough check and give individual feedback to each volunteer.

### 3.5.4 When to count: a case study in the Mediterranean Basin

*Sergi Herrando and Lluís Brotons*

The objective of most census methodologies is to obtain information on bird abundance as precisely and accurately as possible. To achieve that, there are many important aspects related to the timing of the census. Here we present some



considerations on this topic in the framework of the Catalan Common Bird Survey and other ongoing schemes from the Mediterranean countries.

### **Which season?**

Most common bird census schemes focus on breeding populations. Consequently, we should ascertain when the main period that identifies the breeding population in the region is. Monitoring projects in southern European countries might require slightly different seasonal designs than their northern counterparts.

Due to strong climate constraints, the great majority of the species that live in northern latitudes concentrate their breeding periods in narrow time-windows at the end of spring. However, this pattern progressively changes as we move towards southern Europe. In Mediterranean regions, some resident passerines start breeding very early, in February or March or even earlier, whereas some Trans-Saharan migrants only arrive at the beginning of May. Nevertheless, the time-window available for censusing breeding birds in the Mediterranean region may not be as extensive as these patterns suggest. This can partially be explained by the results of studies showing that some populations of both resident and migratory species breed later than populations further north (Blondel and Aronson 1999, Shirihi *et al.* 2001, Moreno 2004) and that the duration of the breeding season may be constrained by hot and dry summers as well (Moreno 2004).

Therefore, in the Mediterranean region, the optimal census period can differ greatly, depending on the particular species. Another important point to be considered, is that breeding birds often overlap in space and time with wintering and migrant individuals of the same species, which may even sing very actively during this period. As we cannot easily distinguish the former from the latter, confusing results may arise if the census period starts too early. Consequently, monitoring schemes tend to set conservative initial censusing dates, in order to enhance the confidence on the census results as reliable estimators of breeding population numbers.

Two main counting strategies are applicable: 1) to concentrate efforts when all species can, at least to some extent, be detected, or 2) to split the sampling strategy into at least two counting periods, a first one for early breeders and a second one for late breeders. The Italian MITO2000 follows the first approach, while the French and the Iberian schemes follow the second one (Table 3.2). However, the definition of precise time intervals is not a trivial task and differences of more than one month are found even among the Mediterranean breeding bird schemes (Table 3.2).



**Table 3.2.** Seasonal time schedules applied in 2006 for the existing national and regional census schemes that are located in the Mediterranean region.

Scheme	Location	1 <sup>st</sup> period	2 <sup>nd</sup> period	Info source
MITO2000	Italy	1 <sup>st</sup> May - 30 <sup>th</sup> June		<a href="http://www.mito2000.it/downloads/istruzioni_mito.pdf">www.mito2000.it/downloads/istruzioni_mito.pdf</a>
STOC-EPS	France	1 <sup>st</sup> April - 8 <sup>th</sup> May	9 <sup>th</sup> May-15 <sup>th</sup> June	<a href="http://www2.mnhn.fr/vigie-nature/spip.php?rubrique2">http://www2.mnhn.fr/vigie-nature/spip.php?rubrique2</a>
SOCA	Andorra	15 <sup>th</sup> April -15 <sup>th</sup> May	16 <sup>th</sup> May-15 <sup>th</sup> June	<a href="http://www.adn-andorra.org/index.php?option=com_wrapper&amp;Itemid=43">http://www.adn-andorra.org/index.php?option=com_wrapper&amp;Itemid=43</a>
	Catalonia & Balearic Islands	15 <sup>th</sup> April -15 <sup>th</sup> May	16 <sup>th</sup> May-15 <sup>th</sup> June	<a href="http://www.ornitologia.org/monitoratge/soccinstruccions.pdf">www.ornitologia.org/monitoratge/soccinstruccions.pdf</a> and <a href="http://www.gobmallorca.com/ornit/sac/index.htm">www.gobmallorca.com/ornit/sac/index.htm</a>
SACRE	Spain	15 <sup>th</sup> April -15 <sup>th</sup> May	16 <sup>th</sup> May-15 <sup>th</sup> June	<a href="http://www.seo.org/media/docs/Instrucciones%20sacre06.pdf">www.seo.org/media/docs/Instrucciones%20sacre06.pdf</a>
CAC	Portugal	1 <sup>st</sup> April - 30 <sup>th</sup> April	1 <sup>st</sup> May-31 <sup>st</sup> May	<a href="http://www.spea.pt/conteudos/CACInstrucoes_Mar2007.pdf">www.spea.pt/conteudos/CACInstrucoes_Mar2007.pdf</a>

Similar principles should be taken into consideration to develop a bird monitoring project in the winter season. The Mediterranean zone has a shorter winter time-window than that of the Boreal zone. Designs of winter schemes also need to minimise the influence of bird movements, something that may be impossible to some extent in a season in which unpredictable resource availability and/or weather conditions may induce erratic movements from one area to another. The wintering censuses of the Catalan Common Bird Survey start on 1<sup>st</sup> December and finish on 31<sup>st</sup> January, but further research would probably be required in order to determine the influences of the time-window on the estimation of winter populations.

Finally, it is worth raising the issue of another particular characteristic of the Mediterranean region with respect to many other regions in Europe: the altitudinal gradient. When designing a monitoring project in any Mediterranean country, as well as in many other European countries, one should take into account its complex topography. Altitudinal changes of more than 2,000 m asl are common all around the basin, which could be equivalent to latitudinal effects of moving thousands of kilometres to the north or south. A first obvious solution to this problem could be to allow flexibility in censusing date, in order to allow matching the sampling to local differences in bird detectability associated with altitude. In the Catalan case, breeding censuses carried out in subalpine and alpine belts are allowed to be delayed from one to four weeks depending on the altitude (the higher the altitude, the greater the delay). However, at present, there is not a standardised rule, since factors other than altitude itself, such as slope,



orientation and winter snowfall, can play a determining role in the snow melting, and each observer has to select the best days for conducting the censuses. The Italian MITO2000 is another example in which the census period is also adjusted, according to both altitude and latitude.

### What time of day?

Detectability is a crucial aspect to determine the duration of a particular census and the precise time of day in which it should be carried out. If detectability does not vary through the day, censuses could potentially be conducted at any time, be very long and accumulate many field records. Obviously, this is not the case. It is well-known that breeding passerines are much more detectable early in the morning than in the middle of the day, and have a second but shorter peak close to dusk (Robbins 1981); however this pattern may also depend on the latitude. Probably, daily changes in detectability are more marked in southern Europe, where high temperatures around the middle of the day sharply reduce bird detection. Breeding bird monitoring schemes in northern European countries allow up to 5-6 consecutive hours of field work (e.g. Koskimies and Väisänen 1991), but a time-window of 3-4 hours is commonly advised in the Mediterranean region.

Daily patterns of detectability have been less studied in the winter. Again, differences between the Boreal and Mediterranean regions are clear. In the northern countries, all daylight hours may be needed to conduct a single census in winter (e.g. Koskimies and Väisänen 1991). In the Mediterranean region, where there would be time to conduct more than one count per day, morning and afternoon censuses may show significant differences in bird richness and abundance (Herrando *et al.* 2007).

## 3.5.5 Detectability and distance sampling: principles of bird surveys

Marc Kéry

### Surveys and censuses

Bird *censuses*, i.e. complete enumerations (counts of all individuals in an area), hardly exist in practice, instead we usually deal with population *surveys*, i.e. incomplete enumerations (counts of a proportion of individuals in an area). Fundamentally, 'counting' birds means sampling a population. Two kinds of sampling processes can be distinguished in surveys, a spatial sample and a sample of individuals (Williams *et al.* 2002). Surveys must be designed and analysed in a way that permits unambiguous interpretation of the resulting data.

### The first principle: Bird surveys as spatial samples

Typically, the area of interest is much bigger than the area that can be surveyed; for instance, when inference about an entire country is desired. Usually, only a number of sampling units (e.g. 1km<sup>2</sup> quadrats) can be surveyed. To be able

