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## THE DECLINE OF GROUND-NESTING BIRDS IN THE AGRARIAN LANDSCAPE OF ITALY

Bruno MASSA<sup>1</sup> & Tommaso LA MANTIA<sup>2</sup>

RÉSUMÉ.— *Le déclin des oiseaux terrestres dans les paysages agricoles d'Italie.*— Les auteurs résument le statut historique et actuel de quelques oiseaux granivores liés à l'environnement agricole en Italie, en l'occurrence l'Alouette des champs (*Alauda arvensis*), l'Alouette lulu (*Lullula arborea*), le Cochevis huppé (*Galerida cristata*), l'Alouette calandre (*Melanocorypha calandra*), l'Alouette calandrelle (*Calandrella brachydactyla*) et le Bruant proyer (*Emberiza calandra*). Ils soulignent que l'Alouette calandre (sédentaire) et l'Alouette calandrelle (migratrice transaharienne) sont les espèces qui déclinent le plus, l'Alouette des champs (à la fois sédentaire et migratrice partielle) décline moins tandis que le Cochevis huppé (sédentaire), l'Alouette lulu et le Bruant proyer (tous deux à la fois sédentaires et migrateurs partiels) sont plus ou moins stables. Toutes ces espèces sont essentiellement associées à l'agriculture «extensive» pratiquée sur de grandes surfaces mais qui, en réalité, l'est de manière «intensive», ce que les auteurs tiennent pour être la raison principale du déclin de ces oiseaux. Les réformes de développement planifiées pour la période 2007-2013 apparaissent comme une opportunité à saisir pour résoudre quelques effets dangereux dus aux mesures appliquées dans la période précédente. Les mesures agro-environnementales encourageant les agriculteurs à améliorer leurs terres de manière à fournir à la faune sauvage de la nourriture, des abris et des sites de reproduction, devraient être mieux subventionnées en accord avec l'importance des bénéfices offerts à l'environnement.

SUMMARY.— Authors summarize the historical and current status of some granivorous birds linked to agri-environments in Italy, namely Skylark (*Alauda arvensis*), Woodlark (*Lullula arborea*), Crested Lark (*Galerida cristata*), Calandra Lark (*Melanocorypha calandra*), Short-toed Lark (*Calandrella brachydactyla*) and Corn Bunting (*Emberiza calandra*), pointing out that the most declining species are Calandra Lark (sedentary) and Short-toed Lark (transaharian migrant), less Skylark (sedentary and short-distance migrant), more or less stable Crested Lark (sedentary), Woodlark and Corn Bunting (both sedentary and short-distance migrants); all of them are mainly associated with “extensive” agriculture, which is practised in wide farmlands, but actually with “intensive” methods, that authors consider the main cause of depletion of these birds. The rural development reforms planned for the 2007-2013 period appear to be an opportunity to resolve some environmentally harmful effects arisen from the measure application in the previous period; agri-environment measures, rewarding farmers improving farmland with land able to provide food, shelter and nesting sites for wildlife, should be more competitively funded and paid in accordance with the importance of the environmental benefits provided.

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In the last decades a very unusual decline of some species linked to steppes and agri-environments has been observed, particularly involving ground-nesting birds. Generally, all

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the researchers agree that the main reason of this decline is the intensification of grassland management to provide better grazing and higher yield of forage grasses; this comprises an increasing use of fertilizers, drainage, regular ploughing and re-seeding with a limited range of competitive, nitrogen-responsive grass species (Perkins *et al.*, 2000), which in turn may threaten farmland bird communities (Brambilla *et al.*, 2007). Also pastoral abandonment in mountainous areas has been considered as an important cause of species decline, as well as high level of mechanization, clearance of field margins, and large monocultures (e.g.: Laiolo *et al.*, 2004; Scozzafava *et al.*, 2006; Bolliger *et al.*, 2007). In addition, “rural depopulation” caused a significant increasing cover of woody plants and a decline of birds of open habitats (Farina, 1997; Preiss *et al.*, 1997).

This results in the loss of food resources (seeds and invertebrates) and of habitats suitable for birds; some of them have been called “farmland specialists” and recognized as most endangered by the development of agriculture in UK, being declined by 30 % on average between 1968 and 1995 (Siriwardena *et al.*, 1998). A number of these birds have been added to the red list of conservation concern and identified as species requiring urgent action to reverse their declines (Vickery *et al.*, 2002). This decline occurred in many European countries with very intensively-developed agriculture, Italy included, and it gave cause for concern because the status of some species does not seem to be improved.

In northern Italy, arable land for fodder maize cultivation markedly increased over the last 50 years to the detriment of permanent grasslands; the use of chemicals has removed the need for planting of non-cereal crops and for fallow lands, once used to maintain soil fertility (Laiolo, 2004). Differently, in southern regions of Italy and islands a parallel trend of agriculture has not been noticed and permanent grassland and cereal crops still cover a discrete land surface. In spite of all, some “farmland specialists” are declining, giving cause for concern.

For this reason, we put together all the information that we could find to present a picture, as precise as possible, of the situation in Europe and particularly in Mediterranean region and in Italy; we hope it shall be a spur for future researches on this topic.

## MATERIALS AND METHODS

### CHOICE OF TARGET SPECIES

We choose six granivorous passerines, strictly linked to open space and extensive agriculture, namely: Skylark (*Alauda arvensis*), Woodlark (*Lullula arborea*), Crested Lark (*Galerida cristata*), Calandra Lark (*Melanocorypha calandra*), Short-toed Lark (*Calandrella brachydactyla*) and Corn Bunting (*Emberiza calandra*). We excluded species of the genus *Anthus*, which are less associated with agrarian landscape and prefer natural habitats.

### SOURCE AND ORGANIZATION OF DATA

Authors paid particular attention to some species, as Skylark and Corn Bunting, while overlooked others, thus there is an objective disproportion among published data. However, we consulted all possible references on the six cited species, particularly in the Italian regions, where the historical reconstruction of their past and present status is not available. Italian trend of each species has been compared with that of other European and North African countries. Nevertheless, often old authors gave only qualitative information, not quantitative, on the presence of species. Cited Italian regions and localities are reported in Fig. 1. North-West Italian regions include Aosta Valley, Liguria, Lombardy and Piedmont; North-East comprises Emilia-Romagna, Friuli Venetia Giulia, Trentino Alto Adige/Südtirol and Veneto, Central includes Latium, Marches, Tuscany, Umbria; South Italy comprises Basilicata, Campania, Calabria, Apulia, Molise and islands of Sicily and Sardinia.

## RESULTS AND DISCUSSION

### SKYLARK (*ALAUDA ARVENSIS*)

There is some interesting evidence of its past abundance in Italy. As regards Italian peninsula, Doderlein (1869-74), treating the area of Modena province, wrote that it was abundant



Figure 1.— Regions of Italy and other localities cited in the text.

there as a breeding bird on the plains, as well as on the mountains. Salvadori (1872) considered the Skylark very common in Italy and very abundant during March and October migrations, pointing out that very many bred on the mountains as well as on cultivated plains and grassland; in addition he wrote that in the Neaples area there was a tradition to catch huge numbers during the night, trampling on them with the aid of a lamp. Another nocturnal traditional catch was practised in Apulia, where local people used to pursue Skylark flocks with the aid of a handbell, getting them tired (Foschi, 1986). Giglioli (1889, 1890) recorded it as common, very common or abundant in North, Central and South Italy during the breeding season and very abundant in autumn and winter. Additionally, Giglioli (1907) wrote that it migrated in Italy in “immense” numbers in October-November and March-April. Arrigoni degli Oddi (1929) considered the Skylark common and abundant everywhere in Italy, but much more abundant during migration seasons (October-November and March-April). Duse & Toschi (1930) reported from ringing stations of Lombardy abundant numbers of migrant Skylarks in early-mid October to early November.

In North Africa the Skylark was an abundant winter bird too, as Whitaker (1905) stated: "Near the town of Tunis large numbers of Sky-Larks are netted and brought to the market. The netting of Larks and other small birds in the Regency, however, is fortunately not carried out on the large scale that it is in some parts of Italy, where wholesale slaughter with these 'engines of destruction' is so common. According to good authority it seems the proportion of birds taken by these means in Italy is small in comparison with the vast numbers which pass through the country". Even though Italian (and Tunisian) trappers took away a good percentage of migrating Skylarks, it was considered very small in comparison with the millions and millions of individuals passing through these countries.

Toschi (1969) was one of the first Italian ornithologists to notice that Skylarks were declining with respect to the recent past, and his considerations were coherent with the drastic decline and ensuing disappearance of traditional hunting activities on migrating flocks in Italy. Foschi (1986) devoted a particular interest to the decrease of Skylarks, proposing that the excessive use of biocides and frequent tillage on breeding areas of East Europe could be one of the reasons of their decline. More recently, De Carli *et al.* (1998) have reported in Lombardy a 50 % decrease in 1992-1995, and Bricchetti & Fracasso (2007) have recorded in Brescia province a 65 % decrease from 1960 to 1980; also Bani (2008) considers it declining in Lombardy, while Lapini (1997) reports that no significant variations were noticed in Tuscany in 1982-1992 compared to previous century. In Calabria it was abundant during the autumn migration along coasts, where it was also wintering (Lucifero, 1898-1901). Sardinian population seems to be more or less stable, locally declining (H. Schenk, pers. comm.; A.A.V.V., 2004-2005).

Currently, in Italy it is a regular migrating bird in spring from mid-February through March until April-early May, in autumn from September-October until November. Specimens show biometric differences, possibly due to different origin of migrating populations (Licheri & Spina, 2002), as recorded above; this aspect is much important and points out that Mediterranean countries during migration and wintering host Skylark populations originating from different countries of Central and East Europe, giving to them a further responsibility in the conservation of the species.

Sedentary population of Sicily may be considered stable and is linked to altitudes over 900-1000 m (Ientile & Massa, 2008). The past abundance of migrating Skylark in Sicily is noteworthy. Rafinesque Schmaltz (1814) wrote a small paper on the arrival dates of Skylarks next to Palermo (Sicily) in autumn: "Their arrival starts on autumnal equinox [23 September] and lasts about one month. They fly slowly just above the surface of the water and rise in the sky only when they reach the coast. I calculated that about one million birds cross the Gulf of Palermo in good passage days, and it may be reasonably supposed that during the autumn migration, only in the Gulf of Palermo (about 35 km) more than 10 million Skylarks arrive". He also described in detail the traditional hunting of Palermo's people towards larks, peaking in some days with one hundred of small boats with gunners and more than three hundred hunters dispersed along the coasts. It is easy to imagine numbers of Skylarks killed by them. Afterwards, Doderlein (1869-74) wrote that these figures were not exaggerated and reported additional notes on this kind of hunting traditionally practiced by Palermo's people, pointing out that some days in October the number of hunters was so high that it might give the image of a battlefield; according to him, many of these Skylarks were wintering in the inland plains and ploughed fields. Whitaker (1905) again described the traditional hunting of Skylarks in the Gulf of Palermo: "Though there is comparatively little bird-netting carried on in the neighbourhood of Palermo, lark-shooting is in great vogue among the native sportsmen of the place, and on certain days in October, when the passage of these birds is in full swing, the Bay of Palermo presents an unusual and extraordinary spectacle; numbers of small boats, each with one or two gunners in them, lining the roadstead, their occupants keeping up a lively fusillade at the poor birds as they arrive in small flocks. This may be carried on for several hours, and any stranger arriving in Palermo by the daily postal steamer might imagine that a miniature naval battle was being waged, or that a revolution had broken out!". This abundance of migrating Skylarks and their traditional hunting in the Gulf of Palermo continued until the 1960s and was decreasing in the 1970s, up to the complete decline both of the lark passage and hunting activity. The early

passage on the coast of Palermo has been confirmed by our personal observations and by some elderly hunters who told us with a wealth of details many aspects of the traditional hunting from small rowing boats. We were in touch with people who practised this kind of hunting and described us this activity in the same terms as those recorded by the above cited authors: flocks of hundreds, sometimes thousands of Skylarks crossing the Gulf of Palermo between late September and mid October. Because in autumn huge numbers crossed much of the North coast of Sicily, we may consider that tens of million Skylarks crossed Sicily to winter there or in North Africa. Today, only small flocks of tens pass during autumn migration and total numbers are possibly only 10 % of those recorded above; a modest passage is also noticed in small islands surrounding Sicily. According to Giglioli (1889, 1890) in the Messina Strait first spring observations of migrating Skylarks were noticed in mid-February, peaking in March, last individuals passing on late April, while in autumn they passed from mid-October, peaking on late October until early November. Angelini (1896) reported also an important passage of Skylarks in the Messina Strait, mainly from 20 October to mid-November. Thousands (8-10,000) of them were shot (Pistone & Ruggieri *in* Giglioli, 1890; Angelini, 1896). It is noteworthy that in the West coast of Sicily migration of Skylarks occurred between mid-September to mid-October, peaking in late September-early October, while on the East coast the autumn passage was delayed about one month, matching with dates provided by authors from other regions (e.g. Duse & Toschi, 1930). It is possible that flocks were originating from different countries. Spaepen & Van Cauteren (1968) have hypothesized that the birds migrating through Italian peninsula probably come from central and southern Russia but, referring to Italy, they write that "More details about wintering in this region and in more southern part of Italy are desirable". More recently, Spaepen (1995) wrote "Autumn migration occurs mainly in southwestern direction. ... Southward migration is also rare. This conclusion needs some reservation, because, contrary to expectations, few recoveries and ringing data were available from Italy".

Skylark inhabits a wide range of temperate open habitats and is considered one of the most abundant and widespread larks, breeding in Eurasia between 35° N and 65° N, but reaching as far north as 72° N (Norway) (Donald, 2004); even if it is so widespread, it shows a remarkable variation in numbers and trends, eventually depending on aridity fluctuation, which should cause a decline on chick growth rate, clutch size, number of clutches laid and nest survival rates (Tieleman, 2005). Populations of this species in many European countries are poorly known and estimates in most countries outside Europe are unreliable; according to BirdLife International (2004) it is a widespread breeder across most of Europe, with a population between 40 and 80 million breeding pairs over a breeding range of 8 million km<sup>2</sup>, and an overall trend of decline, mainly in West Europe. Greatest numbers breed in Belarus, Denmark, Germany, Latvia, Lithuania, Poland, Russia, Spain, Ukraine and United Kingdom, but good numbers are also recorded for Bulgaria, Czech Republic, France and Turkey. Massa & Fontana (2004) reported also a good population from Georgia, very common on cereal and sunflowers fields. It underwent a large decline between 1970-1990; although the decline continued in many western countries in the 1990-2000 decade, eastern populations remained stable and the species probably declined only slightly overall but its populations are considered far below the level that preceded their decline. Nevertheless, it has been provisionally evaluated as depleted and recorded as Spec3.

Declines have been greatest on intensively managed lowland habitats; its breeding population on lowland farmland of UK declined by 55 % since the mid-1970s (Chamberlain & Crick, 1999), but declines have been reported also in upland farmland (Fuller *et al.*, 2002). Its decline is reported from different countries and its populations have decreased substantially in many European countries (Wilson *et al.*, 1997; Kragten *et al.*, 2008). A steep decline has been recorded in Central and Western Europe, where the population has halved since the middle of the 1970s (Tucker & Heath, 1994; Siriwardena *et al.*, 1998). In a Central European country (Czech Republic) skylarks showed a negative trend both in 1982-1990 and 1991-2003 periods, but this trend was significantly less negative in 1991-2003 (Reif *et al.*, 2008). Otherwise, in Iberian Peninsula, breeding densities in cereal farmland resulted similar to those found in central Europe, while densities obtained in shrub-steppes resulted higher than those recorded for pasture in Britain; in addition, in winter Skylarks concentrated in dry pasture, where they reached

densities 10- or 20-fold those found in Iberian shrublands and in Central Europe (Suárez *et al.*, 2003). Some studies show the importance of grasslands and grazing management to improve the habitat for Skylarks in Spain (Martínez-Padilla & Fargallo, 2008). Other researches (Eraud *et al.*, 2000) pointed out the importance of cultivated habitats for breeding; Eraud & Corda (2004) wrote “Our results suggest that stubble fields are key habitats for conservation because they provide an important food supply”, and Eraud & Boutin (2002) pointed out the importance of diversity, of diminution of fertilizers and field size for Skylark conservation; they also observed the relationship between the density of Skylarks and vegetation size. Set-aside and Lucerne (*Medicago sativa*) play an important role to maintain vital populations of this bird. In recent decades changes in agricultural practices in Spain were characterized by the decrease in the surface occupied by fallow and the increase of non suitable agricultural habitats, which had critical consequences for wintering Skylarks (Suárez *et al.*, 2003). During a research carried out by Laiolo (2004) in northern Italy winter stubble resulted the almost exclusive foraging habitat of the Skylark.

In North Europe, where there is little vegetation in spring, due to slower vegetation growth and the majority of crops being spring-sown, breeding of skylarks is associated with areas containing over-wintered vegetation. There, it appears to be the absence, rather than the excess of vegetation, that limits their numbers (Piha *et al.*, 2003). Wilson *et al.* (1996) state that, except where nests were destroyed by cutting, set-aside supports high densities of successfully breeding Skylarks and also strongly favours foraging Skylarks outside the breeding season. Additionally, Siriwardena *et al.* (2008) have shown that seed supplementary resources in farmland are used by granivorous birds mostly in late winter, when natural sources of food have generally disappeared. They also proposed to revise existing agri-environment measures (AEM), extending the period over which seed-rich habitats are retained into spring. The causes of decline are not well understood, being population trends in habitats other than farmland poorly known. According to Wilson *et al.* (1997) and Donald *et al.* (2001a), the change from spring- to autumn-sowing of cereals is likely to have been an important contributor to recent population declines; autumn-sown cereals tend to be too tall for nesting attempts of Skylarks; tall and dense vegetation renders most sites unsuitable for Skylarks to nest and feed. It shows a preference for young grass or clover lays, common components of traditional crop rotations (Chamberlain *et al.*, 1999). British Bird Index, developed to complement indicators measuring the state of species and habitats of particular conservation value, includes the Skylark, as farmland bird indicator (Gregory *et al.*, 2004). Following O’Connor & Shrubbs (1986) and Chamberlain & Crick (1999), major changes have occurred in the management of agricultural land, which have been involved as a cause in the decline. In UK in the past, cereals were sown in the spring, grown through the summer and harvested in the early autumn; now they are sown in the autumn, grown through the winter and are harvested in the early summer. An increased trend to autumn-sown cereals has reduced the number of essential winter stubble fields and may provide unsuitable habitat in comparison with spring-sown varieties; the winter-grown fields are much too dense in summer for the Skylark to be able to walk and run between the wheat stems to find its food; when the crop grows, areas without crop seeds become areas of low vegetation, where Skylarks can easily hunt insects, and can build their well camouflaged ground nests. These areas of low vegetation are very good for Skylarks, but the wheat in the rest of the field becomes too closely packed and too tall for the bird to seek food.

Mechanisms of modern agriculture adversely affect bird populations, the use of herbicides and fertilizers decreases food availability, the shift from spring to winter cereals provides unfavourable breeding conditions, increasing harvesting efficiency prevents feeding on unharvested seeds and loss of uncultivated areas within arable land takes away breeding and feeding habitat availability. Habitat loss might have been a more important cause of population declines than agricultural intensity alone (Reif *et al.*, 2008). The use of herbicides on some farmlands was also reported by Moltoni (1973) as the possible reason of very few wintering individuals on Pantelleria Is. (Sicily). Early silage cutting destroys nests and exposes Skylarks to predators; intensive management of arable fields reduces ephemeral weeds and insect prey through the use of agrochemicals. Overall, changes in agricultural management are the most probable cause of the Skylark decline; conversely, breeding per-

formance per nesting attempt has improved: both clutch and brood size increased significantly between early 1970s and late 1990s, mainly in agricultural habitats (Chamberlain & Crick, 1999). Climate warming may have influenced its phenology; analysis of the 132 year-old data set recording the spring arrival dates of Skylarks in southern Estonia advanced 6-14 days (Ahas & Aasa, 2004). Autumn migration lasts in Central Europe from early September, continuing to November, while in the Mediterranean area it occurs between late September and early November. In South Italy, until the 1960s a single hunter was easily able to shoot down a hundred of Skylarks in one day. Today migration and wintering of Skylarks are much decreased from many of its traditional places, where they were plentiful. The history of gradual decline of Skylark in Europe may be considered as a symbolic warning; it is, indeed, a species once as abundant as it was impossible to consider it within vulnerable taxa, but today in many areas its scarcity has been noticed and it has been included as “at lower risk” by IUCN Red List (2006).

This small bird is still included within hunting bird lists in Mediterranean countries, where in autumn-winter many individuals are certainly shot. According to Donald (2004) an estimated 4-6 million birds are still killed, legally or illegally, by hunters in Europe each year, but these figures seem unrealistic and possibly they may be largely underestimated. In most countries, indeed, it is impossible to gather precise data on hunting bag, due to the general unreliability of the source. In France during the hunting season 1998-1999, it has been estimated that 637 570 birds were shot and further 600 000 were trapped (Barbier *et al.*, 2000). From 1894 to 1929 (35 years) Duse & Toschi (1930) recorded 54 735 Skylarks trapped at a ringing station on Garda lake (Lombardy).

However, in spite of possible large numbers shot by European hunters, we believe that the main problem of the Skylark is not hunting, but serious changes in its elective breeding and wintering habitat.

#### WOODLARK (*LULLULA ARBOREA*)

As regards the status in Italy, authors in the past generally reported it as common and widespread, while recently they consider it declining. Doderlein (1869-1974) reported it as partially sedentary, not much common in Modena province, fairly common in Sicily, mainly in winter. He also wrote that in October very many flocks migrated to winter in Sicily on lowlands and arable lands. According to Salvadori (1872) it was sedentary in Italy and very abundant only during migration seasons; he also noticed that it was plentiful in Sicily and Sardinia. Giglioli (1889, 1907) reported it as sedentary and migrant through Italian regions; he also recorded a good passage in autumn of flocks wintering in southern Mediterranean regions. Lucifero (1898-1901) wrote that in Calabria it was sedentary, but generally bred on the highlands and moved from the mountains to the coast in autumn-winter. Arrigoni degli Oddi (1929) considered it as much abundant in the South Italian regions and Sicily, mainly in winter, much more abundant during migration seasons, mainly from mid-October to late November, less in April. Toschi (1986) reported it as sedentary and migrant bird (October-November and April), fairly common. According to Foschi (1986) it was fairly common in the Romagna region, but in the last decades it became less common, both as migrant as well as breeder bird. Lapini (1997) reports it as more or less stable in Tuscany, locally declining. Bricchetti & Fracasso (2007) and Massimino (2008) consider it as decreasing, disappearing in regions above Po Valley, elsewhere more or less stable; migrant birds are much scarcer than in the past. Sardinian population seems to be stable (H. Schenk, pers. comm.). On the whole, it seems that this lark is more or less stable on breeding grounds all over Italy, while migrant birds, once common, today appear scarce and difficult to detect; the flocks of hundreds generally observed and recorded by different authors in southern Italian regions are missing today. This could be explained only by searching for the reasons of its decline outside Italy, North of Po Valley. Possibly, among the species here considered, the Woodlark is less declining, probably due to the fact that, even though in winter it occurs in the same habitats as Calandra Lark and Skylark, during the breeding season it is linked to clearings and wood edges, habitats less threatened than pseudosteppes.



Mixed flocks of Woodlarks and Skylarks were regularly observed in South Italy and Sicily in winter, but the migration of Woodlark through Italy has been generally overlooked (e.g. Doderlein, 1869-74; Brichetti & Fracasso, 2007). Thus, it is not possible to establish if nowadays this species is as frequent as in the past in its Italian wintering areas. As a breeding bird, it is generally stable in Italy, islands included (Brichetti & Fracasso, 2007); in Sicily it is locally increasing at the edge of reafforestations, with a coverage increased by 8.0 % in the 1993-2006 period (Ientile & Massa, 2008).

Data from other European countries are more substantial. According to BirdLife International (2004) it is a widespread breeder across most of Europe, with a population between 1 300 000 and 3 300 000 breeding pairs over a more than 75 % of its global breeding range, that is about 5 000 000 km<sup>2</sup>, but underwent a large decline between 1970-1990. Although decline continued in a few countries during 1990-2000, it stopped in most of Europe and now the species seems stable overall. Nevertheless, its population size remains far below the level preceding its decline; for this reasons it is evaluated as depleted and listed as Spec2. Greatest numbers breed in Armenia, Azerbaijan, Belarus, Bulgaria, Croatia, France, Germany, Greece, Hungary, Italy, Lithuania, Poland, Portugal, Romania, Russia, Spain and Turkey. In Greece it is regarded as an indicator species of rural mosaics, small fields and pastures of low intensity land use, separated by thick hedgerows and tree lines, which are particularly threatened in the Mediterranean countries (Kati & Sekercioglu, 2006).

#### CRESTED LARK (*GALERIDA CRISTATA*)

Its status in Italy is reported in the past as stable by many authors, and little declining only recently. According to Doderlein (1869-1874) it was a sedentary species in Modena province and in Sicily, where it was very common, sometimes also in the urban surroundings. Salvadori (1872) considered it as a very common species in Italy, partially sedentary in northern regions, sedentary in central-southern regions and Sicily, where it could be considered as a “landscape character”. Giglioli (1889, 1907) reported it as common or very common sedentary species all over Italy, with the exception of Sardinia, where it was absent in the past, as well as in the present. According to Lucifero (1898-1901) it was sedentary and very common everywhere in Calabria, mainly at low altitudes. Arrigoni degli Oddi (1929) considered it a sedentary breeder, common everywhere, but not abundant, evidently declining, in some areas nearly disappeared. Toschi (1986) considered it sedentary in most Italian regions, vagrant in winter from northern to southern regions, absent and local in some areas. According to Foschi (1986) it was very common in the Romagna region up to 1940, but afterwards it was disappearing. In Tuscany it is still widespread in lowlands, even if decreasing in intensively cultivated areas (Lapini, 1997). Brichetti & Fracasso (2007) consider it as decreasing in the Po Valley and generally in the northern regions up to Tuscany, stable in central-southern regions and Sicily. Overall, a small decline trend has been recorded in Central-North Italian regions. In Sicily it is one of the commonest birds, with a visible increase of 10.4 % of territories in the 1993-2006 period (Ientile & Massa, 2008). Because the Crested Lark did never show any migratory habit, generally its populations did not increase during the winter in the past, as well as in the present days. The habit of the Crested Lark to exploit mainly edges of open habitats is possibly one of the reasons of its stability in Sicily.

According to BirdLife International (2004) it is a widespread resident across much of Europe (except the North), with a population between 3 600 000 and 7 600 000 breeding pairs over a range of about 5 000 000 km<sup>2</sup>, but underwent a moderate decline between 1970-1990. Although it was stable (or increasing in south-eastern countries) during 1990-2000, compensating for decline farther North, its population size has clearly not yet recovered to the level preceding its decline; for this reasons it is evaluated as depleted and recorded as Spec3. Greatest numbers breed in Armenia, Azerbaijan, Bulgaria, Croatia, Cyprus, France, Greece, Hungary, Italy, Macedonia, Portugal, Romania, Russia, Serbia and Montenegro, Spain, Turkey and Ukraine. Massa & Fontana (2004) reported also good numbers from Georgia, very common on cereal and sunflowers fields.

#### SHORT-TOED LARK (*CALANDRELLA BRACHYDACTYLA*)

In Italy across more than one century it underwent a notable decline. Doderlein (1869-1874) wrote that thousands of individuals arrived in southern coasts of Sicily in April, after they spread on the lowlands and bred; many also migrated through Sicily and Messina Straits and hunters caught them with guns and nets. According to Salvadori (1872) in April and October very many individuals migrated through northern and central regions of Italy; he considered it as breeder only in Sicily (and Malta) and perhaps in Sardinia. Giglioli (1889, 1907) reported it as a migrant breeder in some northern regions, mainly in southern regions, Sicily and Sardinia, where he considered it as common everywhere in lowlands; additionally he noticed a very good passage from March through April-May and less in September-October until November. Lucifero (1898-1901) considered it as an abundant migrant bird in March along the coasts of Calabria, less common in autumn, and scarce as breeder. According to Arrigoni degli Oddi (1929) in Italy it was a summer breeder, much abundant in central-southern regions, Sicily and Sardinia, mainly during migration seasons (March-April and September-October), less common and irregular in the Po Valley. Toschi (1986) considered it a summer breeder in central-southern Italian regions, Sicily and Sardinia, scarce in the Po Valley, and migrant in March-April and September-October (today spring migrants are ringed between mid-March and May: Licheri & Spina, 2002). He also pointed out that its irregular frequency was dependent on the presence of uncultivated land. According to Foschi (1986) it was breeding in the southern part of Romagna region, where it became very rare. In Tuscany it is scarce, but stable and seemingly not threatened (Arcamone, 1997). Brichetti & Fracasso (2007) report it as declining, with very few pairs scattered in northern regions, more common in central-southern regions, mainly in undisturbed lands. Sardinian population is also considered declining (H. Schenk, pers. comm.).

On the whole, the Short-toed Lark underwent a very important decline in Italy, possibly since the 1980s, both as a migrant, as well as a breeding bird. Numbers declined possibly for changes in agriculture land, intensification and excessive use of fertilizers and biocides. This species is clearly linked to grassland and cerealicolous-zootechnical areas; where these habitats disappeared or were reduced, due to agriculture intensification or land abandonment and shrub spreading, their populations declined drastically. Good examples are the islands of Lampedusa and Pantelleria, where Steinfatt (1931) and Moltoni (1970, 1973) observed huge numbers of individuals (440 censused by Steinfatt on Pantelleria in April 1931), but recently it declined very much and its populations survive only in the area of the airports.

It is also declining in Sicily; according to Ientile & Massa (2008) in the period 1993-2006 a decrease of 21.2 % of breeding territories has been detected.

In accordance with BirdLife International (2004) it is a widespread summer visitor to southern and south-eastern Europe, with a population between 7 300 000 and 14 000 000 breeding pairs over a range of about 2 000 000 km<sup>2</sup>, but underwent a large decline between 1970-1990. Although several populations were stable or increased during 1990-2000, others declined and the species underwent a moderate decline (> 10 %) overall; for this reason it is evaluated as declining and recorded as Spec3. Greatest numbers breed in Armenia, Azerbaijan, Greece, Italy, Macedonia, Portugal, Russia, Spain and Turkey. Massa & Fontana (2004) reported also good numbers from Georgia, very common on cereal and sunflowers fields. It generally prefers ploughed fields, bare ground and short vegetation as nesting habitat.

#### CALANDRA LARK (*MELANOCORYPHA CALANDRA*)

In Italy and some other Mediterranean countries probably the present decline of this species has been overlooked. According to Doderlein (1869-1874) it was partially sedentary, but rare in the Emilia region, while it was very common and sedentary in Sicily, both on the lowlands and on the uplands; it was also wintering in some coastal plains. Salvadori (1872) considered it as sedentary, mainly in southern regions, from Tuscany to South, with very abundant populations in Sicily and Sardinia. Giglioli (1889, 1907) reported it as generally rare and accidental in northern regions of Italy, with the exception of Po Valley, sedentary in central-

southern regions, in some of which it was very plentiful and abundant (Apulia, Sicily and Sardinia). Lucifero (1898-1901) considered it sedentary and very common in Calabria and stated that in autumn it associated in large flocks along the coasts, causing serious damages to agriculture, feeding on the just sown seeds of corn and oat; he also believed that the increasing number in October-November was due to migrant birds wintering in South Italy. Arrigoni degli Oddi (1929) considered it as a common sedentary bird, mainly on central-southern regions of Italy and islands; he also recorded the presence of small populations living in the Po Valley. According to Toschi (1986) it was a local sedentary species in central-southern regions, Sardinia and Sicily, very scarce and vagrant in northern regions. Foschi (1986) considered it as rare, and pointed out that, following old authors, it bred in the Romagna region until the first years of 1900.

Currently, according to Bricchetti & Fracasso (2007) it is partially sedentary and breeding in Sardinia, Sicily, Apulia and Basilicata, scarcer and local in Latium and Calabria, rare in Abruzzo, Molise and Campania, probably extinct in Tuscany (where it was declining since the 1960s), Umbria and Emilia-Romagna. In Sardinia it is declining, too (H. Schenk, pers. comm.). Even though in decline, only Sardinia and Apulia populations may be still considered plentiful, others are in danger of extinction or became extinct.

On the whole, this species may be considered as endangered all over Italy; the reasons of its decline may be again changes in agriculture. A possibly minor problem for populations of this bird in the past was the fact that traditionally it was in great demand by people for its song; many individuals were trapped each year in Sicily and sold as cagebirds (Doderlein, 1869-1874). According to Whitaker (1905), in southern Italy it was greatly prized for its song, and caged birds of this species could frequently be seen. It was frequent until the 1980s to find in the Sicilian market both Calandra Lark and a special cage to accommodate it, where the roof was replaced by a hard-wearing material to prevent damage to its head.

Concerning North African countries, Whitaker (1905) wrote that in Tunisia it was extremely common throughout the northern and central districts and, less plentifully, in some of the more southern parts; he also reported that it was both resident and migratory and that during the winter vast flocks of this lark could be observed frequenting the cultivated fields and open country interspersed with patches of corn-land, where food was abundant. Also Heim de Balsac & Mayaud (1962) reported this species as common throughout all the Maghreb, pointing out its habit to associate in large flocks between summer months and mid-March, that is in the non-breeding season. Isenmann *et al.* (2005), confirming the current abundance of Calandra Lark in Tunisia, report also the winter presence of vagrants, possibly coming from Balkanic area; they also point out that it is associated with cereal crops.

According to many authorities (Doderlein, Salvadori, Giglioli, etc.), Calandra Lark was formerly common both in cornfields and grasslands; today it is one of the most declining species in all Italian regions. In addition, as regards migration habits of Calandra Larks, Doderlein (1869-1874, manuscript notes) noticed that in autumn considerable flocks passed, together with Skylarks, through Ustica Is. and along the Sicilian coasts. It is noteworthy that Giglioli (1890) wrote about the enormous winter mixed flocks of Skylarks and Calandra Larks in Sicily; we have already mentioned the decline of the former, as regards the latter, according to Carvana (*in* Giglioli 1890) "in February, when the so-called 'Marzuddo' wheat [a variety of hard wheat sown in March and harvested in July, used until the 1960s on inland areas of Sicily] is sown, great numbers may be captured by means of traps, popularly called arbalest". Giglioli (1891) reported the opinion of local ornithologists about some decreasing species; two of them (L. Dellafonte & O. Garofalo), both from Siracusa (Sicily), wrote that in the Modica area many species were declining for different reasons, among which the misuse of copper sulphate by farmers during sowing, that caused the depletion of Calandra Lark, Crested Lark, Quail (*Coturnix coturnix*) and Rock Partridge (*Alectoris graeca*).

On a Sicilian sample area of 68 km<sup>2</sup>, Salvo (1997) estimated the possible population of 500 pairs in 1965, while mapped 75 pairs in 1990 and 37 in 1995, showing the dramatic decline of this species in the island, demonstrated also by the small number of observations between July and October in 1995 (81) and 1996 (42). Sicilian Atlas (Ientile & Massa, 2008) reports for

the period 1979-1992 a total amount of 101 10 x 10 km squares inhabited by this species, while in the period 1993-2006 only 37 squares covered by it, with a decrease of 21.5 % of occupied territories.

According to BirdLife International (2004) it is a widespread breeder in southern and south-eastern Europe (except the North), with a population between 10 000 000 and 24 000 000 breeding pairs over a range of about 2 000 000 km<sup>2</sup>, but underwent a moderate decline between 1970-1990. Although certain populations were stable or increased during 1990-2000, the species declined across much of its European range and probably underwent a moderate decline (> 10 %) overall; for this reasons it is provisionally evaluated as declining and listed as Spec3. Greatest numbers breed in Azerbaijan, Cyprus, Macedonia, Romania, Russia, Spain, Turkey and Ukraine; Massa & Fontana (2004) reported also good numbers from Georgia, very common on cereal and sunflowers fields. Generally, it inhabits fallow fields, but occurs also on stubbles, which, after the breeding season, offer access to a great abundance of seeds.

#### CORN BUNTING (*EMBERIZA CALANDRA*)

Italian populations of this species are more stable than those of other European countries. Doderlein (1869-1874) considered it as common and partially sedentary in Emilia region, sedentary and common in Sicily, where it was also wintering. Salvadori (1872) stated that it was common all over Italy, particularly in Sardinia, where he found it very abundant and widespread. According to Giglioli (1889, 1907) it was a partially sedentary species in northern Italian regions, common everywhere in Sicily and Sardinia; additionally he reported a regular passage in April and September-October, showing that there were populations which wintered in southern Mediterranean regions and bred in central European ones. Lucifero (1898-1901) considered it very common along the coasts of Calabria, pointing out that in September and October huge flocks arrived to winter there and flying back to North in spring. Arrigoni degli Oddi (1929) reported it as sedentary, very abundant everywhere, partially migrant from northern to southern regions in September-November and April. According to Toschi (1986) in Italy it was a sedentary breeder everywhere and migrant (September-November and March-April), wintering in southern regions. Foschi (1986) wrote that once it was very common in the Romagna region, but in the last decades it was disappearing. According to Moiana & Massimino (2008) in Lombardy in the last 20 years it was declining in the lowlands, but now it appears possibly stable. Concerning the islands, following Ientile & Massa (2008) an increase of 8.7 % of territories has been detected in Sicily in the 1993-2006 period. Sardinian population is also stable (H. Schenk, pers. comm.).

Generally, in the past this species in winter was abundant in Mediterranean countries, and Whitaker (1905) wrote that during autumn and winter small flocks could be observed on Tunisian stubble fields, in the company of other species, feeding on grains and seeds, and roosting at night on the ground with larks. Currently, in Italy it is a sedentary and partially migrant bird, in spring from early March, peaking on late April and continuing until May, in autumn from September until early November (Spina & Licheri, 2003).

Originally a species of steppes, it is today a typical resident of wide, open agricultural areas; its typical land utilization is an open, cultivated landscape, with at least a few bushes, trees, border stones, poles, etc.; preferred biotopes are older fallow lands as well as other extensive or unused habitats, such as filed borders, where arthropods are more plentiful (Meyer *et al.*, 2007). According to Baillie *et al.* (2001) the Corn Bunting is a characteristic resident species of lowland arable farmland, largely dependent on cropped land. It is a characteristic resident of lowland cereal farming, especially barley, although some individuals breed in other habitats, as lays and hayfields. Most birds remain in the main areas of cereal cultivation in winter while small numbers migrate to the south and east coast. In winter they feed in flocks, often on stubbles and weedy fields. Their diet includes seeds (especially cereals), plant material (such as shoots and buds of grasses) and a range of insects and other invertebrates during the breeding season (e.g. grasshoppers, earwigs and snails). This species is declining over much of north-west Europe, but remains common and widespread in southern Europe. Its numbers and distribution have been declining since the last century, in most areas since the early 1970s.

It is one of the 36 bird species of greatest conservation concern in Britain and was declining sharply in geographical range and numbers since the mid '70. The results of the Common Bird Census suggest that there was a 76 % decline between 1968 and 1991; the number of breeding pairs per territory has declined by approximately 85 % over the last 25 years. Additionally, a 32 % decline between the two breeding British atlas periods (1968-72 and 1988-91) has been recorded. In recent years (1994-1999) there has been a further 22 % decline in England (Bricke & Harper, 2002). It declined by more than 20 % in Germany from 1975 to 1999 (Meyer *et al.*, 2007). Although the precise factors remain unclear, the loss of extensive mixed farming would appear to be the key to its decline, and in particular loss of alternative nesting habitats, advancement of harvest dates and reduction in seed and invertebrate availability (O'Connor & Shrubbs, 1986; Donald & Aebischer, 1997; Bricke & Harper, 2002). Also, loss of winter food is thought to be a probable cause of the population decline. Baillie *et al.* (2001) observed that in 1992-93 weedy stubble fields were by far the most important feeding habitat during the winter; this kind of habitat has been greatly reduced in recent decades, due to the switch from spring-sown to autumn-sown cereals, the decline in mixed farming and the disappearance of undersowing. Additionally, increased herbicide and fertilizer use has reduced the abundance of wildflower seeds. These causes are much similar to those resulting important in the Skylark decline.

The intensification of farming practices, such as the increased use of pesticides and fertilizers, has reduced the availability of insects which are essential as chick food. Changes in grazing/mowing regimes may reduce nest site availability and breeding success on grassland, and the decline in mixed farming has led to the disappearance of insect-rich (and reduced input) undersown spring cereals. Rotational set-aside will have benefited the species, although this has been significantly reduced in recent years. Generally, it prefers cereal fields with tall and dense vegetation; stubbles after the breeding season offer access to a great abundance of seeds.

According to BirdLife International (2004) the Corn Bunting is a widespread breeder across much of Europe, its breeding population is very large, between 7 900 000 and 22 000 000 breeding pairs over about 5 000 000 km<sup>2</sup> and was stable between 1970-1990; although some populations (e.g.: in Bulgaria and Romania) remained stable or increased in 1990-2000 decade, it declined across much of Europe, including Turkey, and underwent a moderate decline (>10 %). For this reason it has been provisionally evaluated as declining and recorded as Spec2. Greatest numbers are reported from Armenia, Azerbaijan, Bulgaria, Croatia, Cyprus, Denmark, France, Greece, Hungary, Italy, Macedonia, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Spain, Turkey and Ukraine.

## CONCLUDING REMARKS

The decline of birds linked to agroecosystems is a subject of many papers and books, which demonstrated deterioration in the quality of farmland habitats, affecting both birds and other elements of biodiversity; this influenced some changes in the Community Policy (Commission European Communities, 2004; Gregory *et al.*, 2008). Results of regular researches on the decline of the six above treated species are available only from some European countries [e.g. Great Britain, Spain, Germany, France (cf. STOC programme on [http://www2.mnhn.fr/vigie-nature/spip.php?rubrique2#\[219\]](http://www2.mnhn.fr/vigie-nature/spip.php?rubrique2#[219]))].

The seed-eating, or granivorous birds, are among most vulnerable birds to the adverse effect of intensive agriculture (Siriwardena *et al.*, 1998; Donald *et al.*, 2001a). In western European countries the decline of seed-eaters is mainly the result of shrinking stubble field area due to abandonment of spring sown cereals in favour of winter varieties, as well as disappearance of wild growing weeds wiped out by the massive use of herbicides (Robinson & Sutherland, 2002). Another damaging factor is the loss of breeding sites following the destruction of unfarmed landscape elements (field margins, hedgerows) as a consequence of increasing field sizes (Gillings & Fuller, 1998). The role of stubble fields as foraging places for birds

in winter is associated with the occurrence of many weed seeds and spilled grain, including maize (Orłowski, 2006).

In southern Italy and islands, the most declining species are Calandra Lark and Short-toed Lark, which are mainly associated with agriculture. However, a small decline trend has been recorded also for Crested Lark in Central-North Italian regions, showing that some agricultural changes in those lands were eventually responsible of the number decrease. Also in Tunisia Calandra Lark, Short-toed Lark, together with Skylark are linked to cerealicolous farmlands, while Crested Lark, Woodlark and Corn Bunting are less dependent from this kind of habitat (Isenmann *et al.*, 2005). Corn Bunting is linked to extensive agroecosystems, and benefits very much by the presence of perches.

Calandra Lark, Short-toed Lark and Skylark, mainly associated with steppic or pseudosteppic environments and cerealicolous extensive fields, more and more reducing habitats in South Italy, may have undergone a large decline due to use of herbicides and inorganic fertilizers, as well as for the pesticide treatment of seeds before sowing. The current use of terms “extensive” and “intensive” is probably misleading. According to Encyclopaedia Britannica (<http://www.britannica.com>), extensive agriculture is a “system of crop cultivation using small amounts of labour and capital in relation to area of land being farmed. The crop yield in extensive agriculture depends primarily on the natural fertility of the soil, terrain, climate, and the availability of water. Extensive agriculture is distinguished from intensive agriculture in that the latter, employing large amounts of labour and capital, enables one to apply fertilizers, insecticides, fungicides, and herbicides and to plant, cultivate, and often harvest mechanically. Because extensive agriculture produces a lower yield per unit of land, its use commercially requires large quantities of land in order to be profitable. This demand for land means that extensive agriculture must be carried on where land values are low in relation to labour and capital, which in turn means that extensive agriculture is practised where population densities are low and thus usually at some distance from primary markets”. Generally, birds we are speaking of are considered associated with extensive agriculture, confusing the fact that they live in farmlands characterized by wide extent but not considering that “extensive” agriculture is actually carried out with intensive methods.

The traditional agricultural system was as follows: cereal cultivation for two years, fallow for 2-3 years, then the farm was ploughed to re-initiate the rotation cycle; the mosaic landscape resulted in cereal cultivation, fallow land, pastures and ploughed fields, and was based on the extensive cultivation of cereals in a rotation scheme. Cereals generally are sown in September-November and harvested in June-July, depending on altitude and varieties; once the resulting stubbles were grazed by livestock. The main impact of agricultural intensification should be a loss of fallow land, which would influence negatively the populations of Calandra Lark and Short-toed Lark. Also different types of cereals have probably different impacts on the bird populations; according to Delgado & Moreira (2002) oat seems to be the best choice in terms of avian conservation, and barley seems to have greater value than wheat. Disturbance of the soil surface and creation of bare earth patches by grazing activity may also benefit seed-eaters by bringing buried seeds to the surface which would not otherwise be accessible to them (Perkins *et al.*, 2000).

Field studies in the USA with granules of aldicarb, carbofuran, disulfoton, phorate, and terbufos demonstrated that pesticides pose a hazard to birds and mammals and sometimes other taxa; they concluded that fields treated with granular pesticides may constitute a potential hazard to birds, which forage on fields and may inadvertently or intentionally pick up these granules either as grit or, less likely, for food (Luttik & de Snoo, 2004). Intensification process concerned also southern regions of Europe; since the second post-war period commercialization of synthetic fertilizers and herbicides spread very much in southern Italy and islands. The fertilization technique provided for the use of a granular fertilizer before the sowing time (biammonic phosphate 18-46, containing 18 % of nitrogen in the ammoniacal shape and 46 % of phosphoric anhydrid) and another treatment in January-February with granular ammonium nitrate (27 % of nitrogen, half in the ammoniacal shape, half in the nitric shape). The pre-sowing fertilizing must be very tragic for birds, because granules and seeds were spread at the

same time and birds very probably ate both, without distinguishing them. Indeed, some elderly farmers remind that they found tens and tens of Calandra Larks and Corn Buntings dead after granular fertilizers ingestion. Nowadays, due to the high cost of fertilizers, pre-sowing fertilizing is often simplified, using the urea in late December; it may also result dangerous, due to its granular shape. Notwithstanding, farmers charge the main responsibility with herbicide use in February-March; birds, indeed, follow tractors during tillage and sowing to eat seeds and emerged invertebrates, and they follow also them when farmers are spreading herbicides. Only few statistics on this subject are available; in Sicily mechanization increased remarkably, the horse-power passed from 223 000 in 1961 to 6 183 000 in 1991 and the mechanical power/hectares also increased from 880 in 1971 to 4300 in 1999. Among all pesticides the use of herbicides increased from 9100 kg in 1961 to 1 613 700 in 1999 while fumigants came from 165 300 to 3 875 600 kg (Massa & La Mantia, 2007).

As a matter of fact, one of the main reasons of bird abundance decrease in agricultural areas observed throughout many parts of Europe is a drastic restriction of winter food supply, caused by changes in farming practices (Donald *et al.*, 2001b; Robinson & Sutherland, 2002).

Farmlands are threatened by further intensification, especially due to eastern countries having joined the EU; crops subsidies accepted in EU, as part of Common Agriculture Policy, may stimulate not only higher amounts of pesticides, mineral fertilizers and herbicides, but also negative changes in farmland structure, enlargement of crop fields by the removal of marginal habitats, very important for bird diversity (Kujawa, 2002; Báldi *et al.*, 2005). On the whole, this will result in a further decline of these species that probably will enter into the category “on verge of extinction”.

Results of a previous research (Massa & Siracusa, 2009) suggest that AEM are the right track; the direction for future farmland biodiversity research should be to investigate the close relationships between agricultural land use and animal populations, in particular the influence of management practices on survival rates of bird populations, year round ranging behaviour of farmland birds to verify the temporal and spatial exploitation of cropped and non-cropped habitats and the relationships between farmland and non farmland populations of each species. AEM are the most important policy instruments to preserve European biodiversity in agricultural landscapes. However, “they are currently not targeted enough to effectively halt biodiversity losses, and recommend better regionalization by offering landscape-context specific measures, stronger focus on maintenance and improvement of landscape diversity, avoidance of counterproductive development, and improvement of the coverage of specific conservation measures” (Wrbka *et al.*, 2008).

True “extensive” agriculture plays an important role in biodiversity conservation, because it involves wide areas of semi-natural habitats such as grasslands or pseudosteppes, housing some endangered or rare plant and animal species. The EU Biodiversity Strategy has set some objectives for agriculture in order to favour the integration of biodiversity conservation in the agricultural framework; in particular its aim is to promote the conservation and sustainable use of agroecosystems through integration of biodiversity objectives into the Common Agricultural Police, promotion of low-intensity farming practices, standards of good agricultural practice and encouragement of the ecological function of rural areas.

The rural development reforms planned for the 2007-2013 period appear to be an opportunity to resolve some environmentally harmful effects arisen from the measure application in the previous period. In particular AEM, rewarding farmers who improve farmland with land able to provide food, shelter and nesting sites for wildlife, should be better designed, more competitively funded and paid in accordance with the importance of the environmental benefits provided (de la Concha, 2005). Besides, the effects of abandonment on the birds are more evident on Mediterranean than on Euro-Siberian species (Suárez *et al.*, 2002).

In conclusion, following Ormerod & Watkinson (2000), if farming and agricultural practices have hitherto been responsible for the reduction of bird populations, they should be able to restore the losses.

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