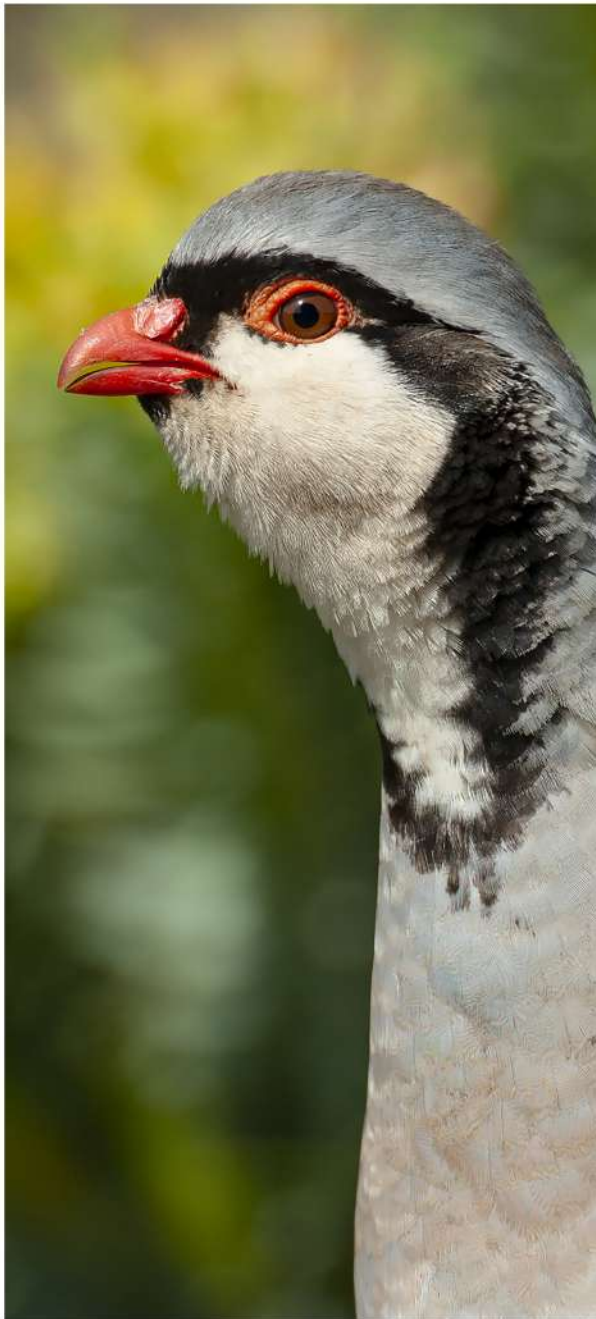


# LIFE ON ISLANDS

## BIODIVERSITY IN SICILY AND SURROUNDING ISLANDS

Studies dedicated to **Bruno Massa**



*edizioni danaus*

Tommaso La Mantia, Emilio Badalamenti, Attilio Carapezza,  
Pietro Lo Cascio & Angelo Troia (Editors)

# LIFE ON ISLANDS. 1

Biodiversity in Sicily and surrounding islands

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On the front cover a Sicilian rock partridge, *Alectoris graeca whitakeri* Schiebel, 1934 and an Egyptian locust, *Anacridium aegyptium* (Linnaeus, 1764); on the back cover a summer image of Linosa Island (photos T. Puma).

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## HOW AVIFAUNA CHANGES: FORTY YEARS OF OBSERVATIONS ON THE STATUS OF BIRDS IN A REPRESENTATIVE AREA OF SICILY (ROCCAPALUMBA, PALERMO)

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**SUMMARY:** Over the last 40 years, we have been regularly conducting observations in a typical hinterland area of Sicily around the inhabited centre of Roccapalumba. The heterogeneity of the territory made up of strips of natural woods, reforestation, cultivated areas (especially arable lands and small orchards), pastures, bushy areas, isolated rocks, a river and many small artificial lakes has created suitable habitats for almost all species of hilly environments in Sicily. During the study period, no substantial changes have occurred in the landscape at the level of land-use macro-categories, with the exception of new pine afforestation. Major changes have been observed, however, within agro-ecosystems (with the disappearance of almond groves) and in the management of agro-ecosystems and marginal areas. Changes in birdlife are due either to changes in the status of a given species at local or global level, or to the above-mentioned reasons.

**KEY WORDS:** agriculture, landscape ecology, afforestation, history.

**RIASSUNTO:** Come cambia l'avifauna: quaranta anni di osservazioni sullo status degli uccelli in un'area rappresentativa della Sicilia interna (Roccapalumba, Palermo). Durante gli ultimi 40 anni sono state compiute con regolarità osservazioni in un'area tipica delle aree interne della Sicilia, attorno al centro abitato di Roccapalumba. La eterogeneità del territorio costituito da lembi di boschi naturali, rimboschimenti, aree coltivate soprattutto seminativi e piccoli frutteti, pascoli, zone cespugliate, rocce isolate, un fiume, molti piccoli laghetti artificiali crea habitat idonei ad ospitare quasi tutte le specie di ambienti collinari della Sicilia. Inoltre, in questi 40 anni, non si sono verificati cambiamenti sostanziali nel paesaggio cioè a livello di macro categorie di uso del suolo ad eccezione della realizzazione di una pineta ma invece grosse modifiche interne agli agroecosistemi con la sparizione dei mandorleti e nella gestione degli agroecosistemi e delle aree marginali. Le modifiche nell'avifauna sono riconducibili o a variazioni nello status delle specie a livello locale o globale o a questi cambiamenti.

**PAROLE CHIAVE:** agricoltura, ecologia del paesaggio, rimboschimenti, storia.

### INTRODUCTION

Long-term studies conducted on bird populations provide a better understanding of the dynamics of the species. For this purpose, atlases are particularly valuable and Sicilian avifauna now is described by three atlases, placing Sicily among the most data-rich regions in Italy (Ientile & Massa 2008; Lo Valvo *et al.* 1993). However, often differing levels of exploration between different atlases may positively affect the distribution of one species, not reflecting its real dynamics. This limitation becomes obvious in a broader context, such as that concerning the species at Italian or European level. If the reasons for population dynamics can be framed in a wider and non-local context, local surveys provide valuable information on the reasons underlying these dynamics. In fact, the more general factors, for example, climatic factors, to which most of the changes are usually attributed, may play a contradictory role, at least at national level. For instance, some typically nordic species are expanding their

range in Italy (e.g. *Somateria mollissima*) while others are spreading from the south, such as the *Spilopelia senegalensis*.

The current research, carried out for an extended period in the Roccapalumba area, a representative area of the Sicilian hills, allowed us to investigate the reasons for certain locally-determined dynamics. Due to the very nature of the study area and the fact that it is representative, the same reasons become more general and certainly generalizable on a larger scale.

### MATERIAL AND METHODS

#### Study area

The study area centres around the town of Roccapalumba (PA) (Fig. 1). The toponyms mentioned in the text and shown in figure 1 are: the "Rocca", the limestone massif contiguous to the town to which it gave its name, as it hosts a thriving

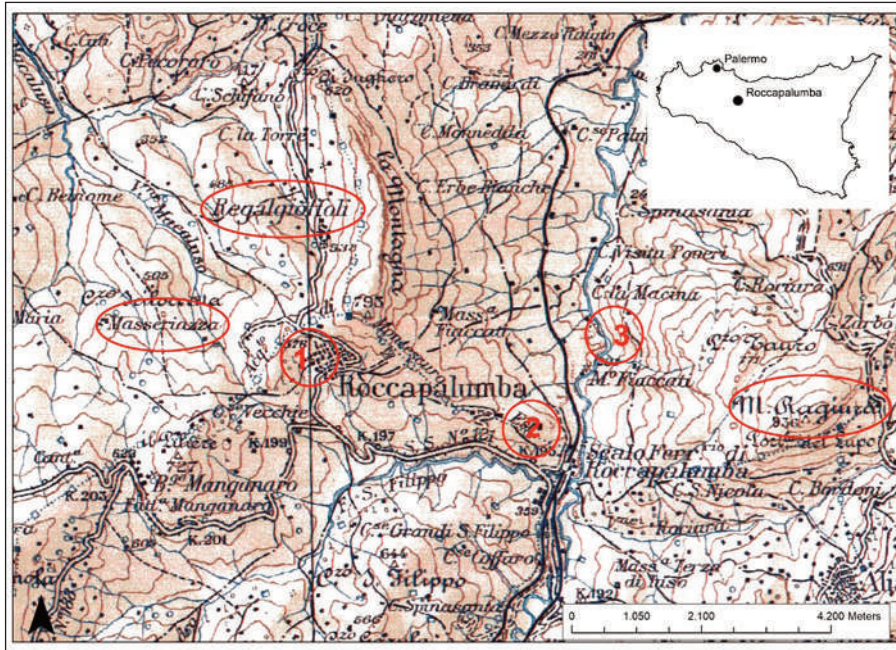


Figure 1. Part of the map (1: 100,000) highlighting the areas repeatedly cited in the text: point 1 indicates the “Rocca” (Fig. 4), point 2 the “Rocche” (Fig. 11) and point 3 the Torto river.

ing population of pigeons; the “Rocche”, isolated rocks near the station, also important on an archaeological level (Giardina Lo Bianco 2007); the “Roxiura” wood (known as Raciura or Ragiura); and the “Torto” river, which maintains a certain water flux throughout the year.

Roccapalumba is located in a hilly area at an average elevation of 500 m a.s.l., with mean annual precipitation of approximately 561 mm, and average annual temperature of 15.7 °C (SIAS: <http://www.sias.regione.sicilia.it>). The geological aspects of the area can be found in Basilone (2018).

### Data collection

Since the 1970s, near-daily observations have been collected, further supported in recent years by photographic documentation. Some past investigations were carried out to define the status of diurnal birds of prey (Cairone 1982) while others concerned single species also as part of broader investigations (Massa 1981a, 1981b). In some cases, reference has been made to birdlife in nearby areas in order to report particular events or because it may influence the status of the bird fauna in the study area. For each species present in the territory, the status and dynamic variations observed are briefly reported, with particular detail concerning variations that affected the breeding species. A comparison with data from other sources of literature is also included. The nomenclature and systematics of birds follow Brichetti & Fracasso (2015).

The definitions used to indicate the status of the species are, with reference to the period of

observation: sporadic (fewer than 5 observations), rare (observed occasionally but regularly), erratic (observed irregularly), common (observed every year and /or that nidify widely in the territory).

### Evaluation of land use changes

To evaluate land-use changes in the study area, the following periods and sources were considered: 1958, vectorization of the land-use map of Italy, scale 1:200,000 (CNR & TCI 1956-68);

1987, source AGEA – “Agenzia per le erogazioni in agricoltura” or Agricultural payments agency). The map, on a scale 1:25,000, reports information on level-4 Corine land Cover (CLC) for agricultural areas and level-1 for natural and anthropic areas;

2011, Land Use Map (CLC legend) of the Sicily Region on a scale 1:10,000 (Regional Department of the Territory and the Environment). The map derives from a 1:10,000 scale vectorization of “Carta della Natura” (<https://www.isprambiente.gov.it/it/news/carta-della-natura-online-il-nuovo-geoportale>). The information is with level-4 CLC detail (Regione Sicilia 2011). While the 1958 land-use map of Italy provides detailed information on traditional cultivation systems, the 1987 regional land-use map is less detailed as some land uses were grouped into macro-categories. Hence, they are heterogeneous maps which, however, provide reliable data on the dynamics and ongoing trends when properly interpreted (Table 1).

The quantification of the changes was made within a G.I.S. (Geographical information System) using the QGIS software.

Land use	Year		
	1958	1987	2011
Urban	32.09	22.31	168.66
Arable land	7,275.91	6864.85	5925.95
Arable land with trees	876.34		
Woody crops		74.98	326.05
Olive grove	122.47	1355.19	634.86
Almond grove	298.59		
Complex agricultural systems		0	412.04
Pasture and uncultivated	439.35		
Prairie and uncultivated			922.91
Coppices	30.32		
Wood (Natural)		757.74	
Afforestation			11.55
Deciduous forest			159.90
Riparian vegetation, lakes			166.88
Maquis and shrubland			343.48
Rocks			2.79
<b>Total</b>	<b>9075.07</b>	<b>9075.07</b>	<b>9075.07</b>

Table 1. Land use changes from 1958 to 2011 in the Roccapalumba territory (data are in hectares).

## RESULTS

### *Changes in land use*

Historical data has confirmed the significant presence of the almond (either as a specialized crop or as a main component of "Arable lands with trees"), as results from the description made by Gioacchino Di Marzo in 1855, who, commenting on the Dictionary by Vito Amico, wrote: "*The territory extends over 952.316 sal. ("sal." stands for "Salma", the old unit of measurement for agricultural surfaces at that time, equivalent to 17,415.37 m<sup>2</sup> (Palermo 1816; note of the author), subdivided into orchards (1,032), vegetable crops (0.390), cultivated reed beds (1.277), arable lands with trees (15.678), arable lands (660.147), pastures (164,241), olive groves (9,733), wooded vineyards (6,672), vineyards (72,009), prickly pear orchards (11.434), almond groves (8.790) and rural houses (0.913). This territory mainly exports wine, oil, wheat and almonds*". The same heterogeneity is confirmed by the data reported for 1929 by Scrofani (1962).

From the analysis of land-use changes from 1958 to 2011 (Table 1), there is a gradual decrease in arable land, accompanied by a sharp reduction in tree individuals and almond trees, which is not compensated by an increase in olive groves and agricultural woody crops. Olive groves have tended to become more specialized and to replace the small orchards, where individuals of different tree species, such as almond trees, olive trees and also pear, rowan and vines had coexisted. This is immediately evident from the coexistence of olive trees of different ages in these olive groves. An important increase in terms of surface concerned prickly pear orchards, which are partially mixed with other "industrial" crops in the open field, such as tomato and melon. From the second half of the last century, the territory has been "enriched" with small reforestations of eucalypts and pine trees that "flank" the natural forest of Ragiura. However, the hedges and isolated trees that characterized the landscape have disappeared and they have great importance in the conservation of local bird communities.

**Changes in bird fauna****Greylag goose *Anser anser***

Sporadically reported in the past. There were 1-2 killings near the Torto river.

**Common shelduck *Tadorna tadorna***

Sporadically present in artificial lakes, in movement but not wintering. Two individuals (one male and one female) were killed in January 1980.

**Eurasian wigeon *Anas penelope***

Sporadically observed, more frequently in the Torto river than in artificial lakes (Fig. 2).

**Mallard *Anas platyrhynchos***

In the past only migratory, perhaps due to hunting pressure. Recently it has been wintering and nesting in ponds for approx. 4 years. The same trend is occurring throughout the Sicilian territory: *“This species has colonized inland river stretches, artificial lakes, sometimes even small reservoirs, many of which have been built in the past decade for agriculture; some of these water bodies, characterized by the presence of riparian vegetation, have allowed the stopover and reproduction of some species of aquatic birds, including the Mallard”* (Ientile & Massa 2008). In April 2020 it reproduced in the Torto river (13 young observed). This increase is in line with increases at national level (Brichetti & Fracasso 2018).

**Northern Shoveler *Anas clypeata***

In the past more common than the *Anas acuta*, today rarely observed.

**Northern pintail *Anas acuta***

Rare migratory species.

**Garganey *Anas querquedula***

Very common up to 25 years ago. Many individuals were killed during spring migration. Today, it has become rare and this is in line with a general decline of the species at international (BirdLife International 2017, 2020) and national level (Gustin *et al.* 2016).

**Eurasian teal *Anas crecca***

Erratic but also wintering in small lakes and rivers.

**Common pochard *Aythya ferina***

Once regularly observed in larger ponds, now more rarely.

**Ferruginous duck *Aythya nyroca***

Rare in the past. It has not been observed since the 1980s.

**Sicilian partridge *Alectoris graeca whitakeri***

Once the Sicilian partridge could be considered common and it was not uncommon to observe it in groups of ten. In the middle of the last century, Palermo hunters, like the father of one of the authors (G. La Mantia), hunted partridges in the “Roxiura” wood, arriving at Roccapalumba station by train. Many individuals were killed using captive males which attracted the other males through song. The species has decreased throughout the island. According to Ientile & Massa (2008): *“Currently the situation of this interesting Sicilian en-*



Figure 2. Small ponds play an important role for the stopover and nesting of many birds (photo T. La Mantia).

*demis species is disheartening since in all areas, without exception, it is absent or in the process of disappearing completely*". It should be noted how the habitat of the species (which was once a regular visitor to arable land) has changed today towards seminatural habitats.

**Common quail *Coturnix coturnix***

Today it is present with very few pairs, living in arable land and uncultivated flat areas with low grasses. The species has undergone a substantial decrease in terms of population density and has been decimated due to illegal hunting using calls. The decrease is coherent with the dynamics of the species at national level (Gustin *et al.* 2016). In the 1960s, a nest with 12 eggs was found (this fact is not exceptional see Pazzucconi 1997).

**Common pheasant *Phasianus colchicus***

Its introduction was tried though with little success.

**Little grebe *Tachybaptus ruficollis***

Regular wintering, likely breeding, stable population.

**Black-necked grebe *Podiceps nigricollis***

Rare migratory species.

**Greater flamingo *Phoenicopterus roseus***

A juvenile observed in the 1990 on Lake Fanaco (Castronovo).

**Black stork *Ciconia nigra***

There was a historical record on 10 November 1985 (Cairone in Iapichino 1989). In 2018, a nesting individual was suspected to occur in the nearby Monte Cammarata.

A young specimen stopped over near the river for several days (Fig. 3) on 12 August 2019 (Margagliotta B.).

**White stork *Ciconia ciconia***

Uncommon during migration. On 2 May 2015, 92 individuals were observed. A pair nested at the Castronovo station for many years until 2017 (D. D'Amico *in verbis*). Between 2007 and 2009 another pair nested at the Filaga crossroads and there have been other summer sightings in subsequent years in nearby areas (Vicari and Castronovo), where it may have nested sporadically.

**Glossy ibis *Plegadis falcinellus***

Observed on Lake Fanaco.

**Little bittern *Ixobrychus minutus***

Rare migrant. It is generally a frequent visitor to the river but individuals were also captured during migration in the *Ampelodesmos mauritanicus* perennial grassland.



Figure 3. The young black stork individual which has stopped near the Torto river since 12 August 2019 (photo A. Cairone).

**Black-crowned night heron *Nycticorax nycticorax***

Occasional migrant. It nested at Lake Fanaco in 2019, where two young birds were observed.

**Squacco heron *Ardeola ralloides***

Rare during migrations in the past and no longer observed in recent years.

**Grey heron *Ardea cinerea***

Common during migration and increasing as wintering. In the past it was not observed whereas the red heron was common. In fact, as reported by La Mantia (2008) for Palermo, this species does not have a dialectal name, unlike the purple heron (*Russeddu*, for vernacular names see La Mantia & Massa 2008). In June 2019, a pair may have nested in the nearby Platani river.

**Purple heron *Ardea purpurea***

In the past common during migrations, today rare.

**Western great egret *Ardea alba***

Rarely observed during migrations.

**Little egret *Egretta garzetta***

Occasionally observed during migrations.

**Great cormorant *Phalacrocorax carbo***

It is increasing as a winter visitor in the study area as well as throughout Sicily (Ientile & Massa 2008), where it is a frequent visitor to lakes and feeds on carps.

**Western osprey *Pandion haliaetus***

Observed twice in recent times: on 9 September and 23 October 2019.

**Egyptian vulture *Neophron percnopterus***

It is regularly observed in summer when it visits from nearby areas where nesting.



European Honey buzzard *Pernis apivorus*

Migratory, observed in summer at the “Roxiura” forest (1 September 1991 and 6 June 1992).

Booted eagle *Aquila pennata*

Regular winter visitor since the late 1970s. It was observed catching a male kestrel.

Golden eagle *Aquila chrysaetos*

It was sporadically observed in the past, today more frequently.

Bonelli's eagle *Aquila fasciata*

It is observed sporadically but more frequently than the Golden eagle. In the past, it was observed preying on European rabbits (*Oryctolagus cuniculus*), whilst today it is observed hunting on the common pigeon, particularly abundant in the study area.

Eurasian sparrowhawk *Accipiter nisus*

It was absent in the past whilst today it is undergoing a process of expansion throughout Sicily (Ientile & Massa 2008; La Mantia *et al.* 2014), where it is nesting in eucalypt trees. It is frequently observed catching *Passer hispaniolensis*, especially males near country houses.

Western marsh harrier *Circus aeruginosus*

In the past it was not observed whilst it is increasingly observed in recent years during migration.

Hen harrier *Circus cyaneus* and Montagu's harrier *Circus pygargus*

Regular migrants. In the neighboring territories, summer observations of *Circus pygargus* (in July) in the 1970s-1980s.

Red kite *Milvus milvus*

Once common, it was considered a threat to chicks (significantly in Baucina, a town approx. 35 km from Roccapalumba, it was referred to as “chick-eater” *Mancia-puddicini*, Pitrè 1889). For the area of Prizzi (a town approx. 33 km from Roccapalumba), Oliveri (1988) wrote: “The Red kite is still quite frequent in the skies of Prizzi and it has not given up its old behaviour of “courting” the chicks, according to the saying “the Red kite comes and goes, but its eye is always on the chicks” (*lu nigghiu gira e torna, ma l'occhi su sempri a lu puddicinu*).

It nested in the Roccapalumba territory in isolated rocks until the 1970s, and it nested and wintered with numerous pairs in nearby areas. In particular, more than 100 individuals wintered in a *Eucalyptus* wood between Prizzi and Roccapalumba. In the early 1980s, signs of dozens of evening killings in this dormitory were found.

According to the most recent data (2015-2016), there are 28 individuals wintering in Sicily

while only 2-3 are estimated to be nesting pairs (Sarà in Cillo & Laterza 2014).

Black kite *Milvus migrans*

Uncommon but regular migrant.

Common buzzard *Buteo buteo*

The biological aspects of this species were studied in the 1980s (Cairone 1982), when observations on its density and biology began (Cairone *et al.* 2012; Surdo *et al.* 2019). The species appeared in decline, probably also due to difficulty in finding suitable trees for nesting. A widely used tree in the past was the black poplar (*Populus nigra*), characterizing riparian vegetation, however, the tree species has markedly decreased in the last few decades (see discussion and conclusions) (La Mantia & Barbera 2007; Marchetti *et al.* 2002). The species has also nested in low olive trees, with no reproductive success. Today, it appears to be slowly recovering. Some individuals prey on domestic pigeons or retrieve the pigeons that fall on the roofs of town houses when killed by peregrine falcons. In the 1980s the predation of a pullus of Buzzard by pine martens was observed in a nest built on a downy oak that grew between two rocky walls at Raxiura.

Little bustard *Tetrax tetrax*

This species is extinct in Sicily. Next to the Torto river, between Roccapalumba and the locality of Marcato Bianco, there is a plain called “*Chianu rii Pitarri*”, (Plain of Pitarra). “*Pitarra*” is the dialectal name used throughout Sicily to indicate the now extinct Little bustard (La Mantia & Massa 2008) which lived on the plains.

Water rail *Rallus aquaticus*

It nests on the river, and it may have decreased due to increased disturbance of riparian vegetation.

Corn crane *Crex crex*

Uncommon, It was frequently shot during migration at the end of September in past years in the clearings of the “Raxiura” forest.

Spotted crane *Porzana porzana*

Rarely observed during migrations.

Common moorhen *Gallinula chloropus*

The species has decreased compared to the past but continues to nest in ponds and rivers.

Eurasian coot *Fulica atra*

It wintered in the past even on small lakes, whilst in recent years it has no longer been observed.

Common crane *Grus grus*

It is regularly observed during autumn and spring migration, sometimes with flocks of hundreds of

individuals, as on 16 November 2018. Occasionally, a few individuals stopover during migration.

Eurasian stone-curlew *Burhinus oedicnemus*

It is nesting in flat areas near the river, but the extent of the current population is unknown.

Northern lapwing *Vanellus vanellus*

Once very common as a wintering species, with flocks of as many as hundreds of individuals, it is now present only in small flocks. The habitat it visits has changed: in the past it was a frequent visitor to arable lands with stagnant water, whilst now it is more commonly found in areas near rivers. This is happening throughout Sicily (pers. obs.) and is probably due to reduced annual rainfall. The most famous place for observing (and hunting!) the lapwing was the area called “*U chianu ‘ru curreri*” (The courier’s plain) where the postal courier used to stop, an arable land famous because the land remained sodden. There are other two other preferential sites for the species in this territory.

European golden plover *Pluvialis apricaria*

Now in sharp decline, it was once common and widespread especially near river plains in ploughed land.

Eurasian dottorel *Charadrius morinellus*

In the past, it was hunted. In recent times it has no longer been reported.

Eurasian woodcock *Scolopax rusticola*

Wintering and migrant, in the past it was more common and observed even in agricultural areas characterized by the presence of scattered trees or olive groves.

Jack snipe *Lymnocyptes minimus*

It once wintered along the river, where many individuals were killed. However, it has no longer been observed in recent times. It is noteworthy that the species is considered as a “*scarce and localized partial winter visitor*” (Corso 2005).

Common snipe *Gallinago gallinago*

It was very frequent as a winter visitor in the past, but now it has decreased.

Black-tailed godwit *Limosa limosa*

Some individuals were observed or killed during migrations.

Whimbrel *Numenius* sp.

Few observations or killings during migrations.

Green sandpiper *Tringa ochropus*

It is observable during migrations.

Common sandpiper *Actitis hypoleucos*

It is wintering, but some summer visitors along the river have also been observed.

Yellow-legged gull *Larus michahellis*

The species is increasing, which is in line with expansion of the species at national level. It is regularly observed moving in autumn towards artificial lakes, such as Fanaco, where it also frequently winters in ploughed fields near the lake. In Roccapalumba, it has been summering in recent years on an artificial lake near the station and finding food in the fields.

Common pigeon *Columba livia*

It nests abundantly in the “*Rocca*”, but also in the “*Rocche*”, near the Roccapalumba station with most individuals manifesting characteristics of the wild pigeon and not the feral pigeon. It should be noted that the name “*de Palumbis*” dates back to the Aragonese period and refers to the Rocca overlooking Roccapalumba (La Mantia 1917; Alfano 2016), testifying to an ancient presence of the species on the “*Rocca*” (Fig. 4) (“*in the cleft, the wild pigeon nests, hence the name of the fiefdom came first and then that of the town*” Oliveri 1985).

Common wood pigeon *Columba palumbus*

The population is increasing in the study area as throughout Italy (Brichetti & Fracasso 2020). It now nests regularly in rocks, with 6–7 pairs currently nesting in the “*Rocca*”. The first observation of nesting in the rocks dates back to 24 April 2008, with two eggs detected at the “*Rocche*”. In the past, nesting on rocks seemed to be linked to the absence of trees (an observation also carried out in the mid-2000s at the “*Maccalube of Aragona*”; T. La Mantia, pers. obs.). Chicks were observed to be predated in the nest by rats.

European turtle dove *Streptopelia turtur*

In the past, this species was very common, with dozens of individuals frequently visiting a number of famous dormitories, such as the olive groves and almond groves of the “*Massariazza*” or the small oak wood known as the “*Vallone della cicuta*” (Valley of the hemlock). Some 50 years ago, turtle doves gathered in their dozens in the “*Aie*”, the areas once used for wheat threshing. The species was in decline following a common trend all over Italy (Gustin *et al.* 2016; Brichetti & Fracasso 2020); however, it is currently recovering slightly throughout the island (Ientile & Massa 2008).

Eurasian collared dove *Streptopelia decaocto*

It is widespread and found near housing, even in the countryside.

Common cuckoo *Cuculus canorus*

Migratory species declining (see Brichetti & Fracasso 2020).



Figure 4. An image of the “Rocca” of Roccapalumba, which is a hotspot for the biodiversity of the area, although being incorporated in the town (photo A. Cairone).

#### Western barn owl *Tyto alba*

The Western barn owl has decreased due to the collapse of houses where it used to nest (Cairone *et al.* 2012; Surdo *et al.* 2019) (Fig. 5). In a house, which was destroyed in the 1980s, the documentary “Ali nelle soffitte” (‘Wings in the Attics’) by G. Massa about the Western barn owl

was made. A census carried out in 2019 found five to seven pairs in the “Rocca”. Such a high density in a small area is unusual and may depend on the lack of suitable nesting sites and increased trophic supply due to a rise in the rat population. In the 1980s, a nest inside a hollow *Populus nigra* trunk was found.



Figure 5. This remarkable bell tower of the “Massariazza”, was demolished to make room for the building right behind, hosted, on the two levels still partially visible, a family of kestrels and one of barn owls (photo T. La Mantia).

### Eurasian scops owl *Otus scops*

The owl is sedentary and subject to fluctuations, mostly related to climatic factors; for instance, in years with intense snowfall, the population decreases. The Eurasian scops owl probably carries out modest vertical migrations within the territory to escape adverse climate conditions. In the past, it was found nesting inside hollow almond trees, whilst today it is found inside holes in walls or old buildings (Fig. 6). This change seems to be disadvantageous for the species as the young leave the nest early by moving along branches even when they are not still able to fly (observations also made in the orchards of the Conca d'Oro, T. La Mantia). In some cases, the species has nested in holes in town houses, but the juvenile individuals, because of this habit, are not able to fly away and fall to the ground.



Figure 6. This old, composite and fascinating ruin ("Mulinazzu") may offer, having numerous holes, excellent sites for nesting of diurnal and nocturnal small birds of prey (photo T. La Mantia).

### Tawny owl *Strix aluco*

Increasing slightly, the tawny owl is found near rocks for nesting on the condition that they are surrounded by arboreal vegetation, even if not dense. It is not anthropophilic, choosing not to nest on rocks close to human settlements. In the territory, there are an estimated 2-3 pairs.

### Little owl *Athene noctua*

Population is decreasing and is linked to the habitat locally known as "chirchiarì" (La Mantia 2010), that is "islands" of rocks within arable land or pastures, even of modest size; however, it also nests in holes in walls or in old country houses. In the past, it also nested in the "Rocca". Observations made over many years (A. Cairone unpublished) have ascertained that the Lanner often tries to capture it.

### Long-eared owl *Asio otus*

Roccapalumba is one of the first areas in Sicily where the nesting of this species was recorded

and where its feeding behaviour was studied (Siracusa *et al.* 1996). Its occurrence has been recorded for several years with a varying abundance, one/five pairs breeding from two to three young. It is closely related to conifers for nesting, but depends on a minimum of 6-7 trees. Fires destroyed the historical site where it was first found (Siracusa *et al.* 1996). Currently, a few pairs nest in the cypresses or pines in the cemetery (Fig. 7).

### Short-eared owl *Asio flammeus*

Prior to the 1980s, many individuals were killed in December during late migration. Today is rare.

### European nightjar *Caprimulgus europaeus*

Uncommon migratory species.

### Alpine swift *Apus melba*

Observed during migration.

### Common swift *Apus apus*

It nests both under the roof tiles in the town and in the "Rocca", with an estimated population of around 250 pairs.

### European roller *Coracias garrulus*

The species has now disappeared and is in decline throughout the island and Italy (Ientile & Massa 2008). Until the end of the 1980s, there was a population of approx. four pairs which nested in holes in walls along the railway track; however, impacts with trains caused the death of some individuals. It also nested in old farm houses, as occurs throughout the rest of the island

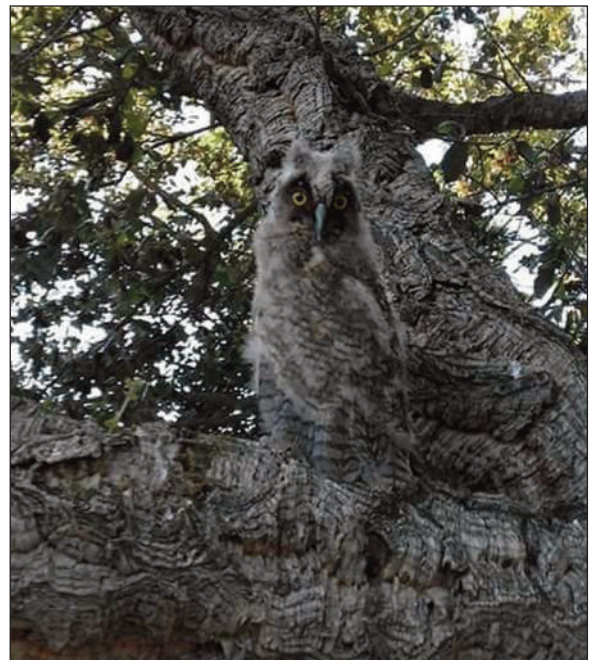


Figure 7. This young common owl, rescued from the cemetery, shows its mimetic qualities even on a cork (photo A. Cairone).

(Ientile & Massa 2008). The species was found near almond groves and it used trees as perches to prey on insects.

Common kingfisher *Alcedo atthis*  
Observed during migration.

European bee-eater *Merops apiaster*  
The species abundance increased in the study area, as occurred throughout Sicily; now the population seems to be stable.

Eurasian hoopoe *Upupa epops*  
Decreasing as a breeder. This species chooses holes in walls and, more rarely, hollow trunks as a nesting site.

Eurasian wryneck *Jynx torquilla*  
Once common as a breeder, in recent years it has not nested in the study area (it is declining in Italy, see Brichetti & Fracasso 2000). Eurasian wryneck used hollow almond trees and, in one case, nested in a *Phoenix canariensis* stem.

Great spotted woodpecker *Dendrocopos major*  
In the past, the species increased both in Sicily (La Mantia *et al.* 2002) and in Italy (Brichetti & Fracasso 2000); now the population is stable.

Lesser kestrel *Falco naumanni*  
It nested in country houses and was the subject of a dedicated publication (Cairone 1982). It became extinct as a breeder in the mid-1980s. Until 2018, a colony nested in a nearby area. In 2019, however, this colony dissolved, leaving only one pair in reproduction while the other adults were dispersed in the Roccapalumba territory without reproducing. This may have been due to lack of food resources. Up to October 2019, around 30 individuals were recorded in the Roccapalumba territory.

Common kestrel *Falco tinnunculus*  
A study on the reproductive success of the species was carried out in the 1980s (Cairone 1982). It suffered a sharp decrease due to the collapse of old houses where it nested (Cairone *et al.* 2012; Surdo *et al.* 2019). In the 1980s, two nests were found in trees - in old corvid nests in one eucalypt and one almond tree. As reported by Lo Valvo *et al.* (1993), during the period of maximum expansion, more than one pair in the same building could be found: that is two and, in one case, three pairs (Cairone & La Mantia, pers. obs.). The few surviving pairs nest in rocks (Fig. 8), including the "Rocca".

In June 2020 a pair nested and raised three young in a planter on the balcony of an inhabited house in the village of Roccapalumba. This would

seem to indicate the need to find protected nesting sites from the corvids (Fig. 9). On average, they raise three chicks.

Red-footed falcon *Falco vespertinus*  
Sporadically observed during migrations, up to 12 individuals.

Merlin *Falco columbarius*  
Rarely observed during migration.

Eurasian hobby *Falco subbuteo*  
Observed during migration. Until the 2000s, it has regularly nested in eucalypt trees. At national level, there are diverging opinions; the species considered as decreasing by Gustin *et al.* (2016), and as increasing by Brichetti & Fracasso (2000).

Lanner falcon *Falco biarmicus*  
The species was present with two pairs at two sites. It has not nested at one of these sites (con-



Figure 8. These small walls called "Acqua da Rinella" offer sufficient shelter from corvids and humans; indeed, they are a historical site for the kestrel nesting (photo T. La Mantia).



Figure 9. Three young kestrels raised in June 2020 in a planter in a house in the village of Roccapalumba (photo A. Cairone).

sidered the historical site) since the 1990s where it coexisted for a few years with a pair of peregrine falcons, which continued to nest in the area until the 2000s. At the other site, the species nested after the 1990s; the same pair may have moved from site to site (this pair has raised three, two and one offspring in the three surveyed years, respectively). Attempts to take the chicks led to their early fledging and the death of two of the chicks. The species nested in this area up to 5 years ago. Today, the peregrine falcon is often present in the area. The rarefaction of the species is consistent with the general trend at national level (Gustin *et al.* 2016).

#### Peregrine falcon *Falco peregrinus* (Fig.10)

A pair permanently nests in the territory and the biology of this species will be the subject of a specific publication (Cairone, in preparation). It has been reported that the female captures only wild/domestic pigeons while the male is specialized in the capture of small birds, especially starlings. We recorded four chicks fledge in 2017, two in 2018 and three in 2019.



Figure 10. The photographer took a moment of intimacy between the two Peregrine falcons (photo A. Cairone).

#### Red-backed shrike *Lanius collurio*

Migratory species. The decrease is consistent with the dynamics of the species at national level (Gustin *et al.* 2016).

#### Lesser grey shrike *Lanius minor*

The species has not bred in the historical nesting site at Roccapalumba since the early 1990s (Massa & Priolo 1981). It laid 4-5 eggs: in one case two nests were found approx. 15 m apart from each other, both in almond trees with heights ranging from 3 to 5 meters (La Mantia 1985). It was nesting until the early 90s and the most typical habitat was dry arboriculture sites planted with almond trees (Fig. 11). The disappea-

rance is consistent with the dynamics of the species at national level (Gustin *et al.* 2016; Brichetti & Fracasso 2000).

#### Woodchat shrike *Lanius senator*

The species has markedly declined, and a negative trend has already been reported in Roccapalumba as early as the 1980s (La Mantia 1985). Currently, it is present with very few pairs and is a frequent visitor to the same environments as the Lesser grey shrike (*Lanius minor*). It is also present, however, in shrublands with *Pyrus spinosa* and *Crataegus monogyna*, shrubs in which it builds its nest. It is decreasing throughout Italy (Gustin *et al.* 2016; Brichetti & Fracasso 2000).

#### Eurasian golden oriole *Oriolus oriolus*

Migratory, especially during spring. It is sharply declining.

#### Eurasian jay *Garrulus glandarius*

The population of the species is increasing. In the past, it was present only in oak woods whilst today it is ubiquitous, where trees are present.

#### Eurasian magpie *Pica pica*

The population is increasing.

#### Western jackdaw *Corvus monedula*

The jackdaw historically nests in the "Rocca"; however, it suffered from a sharp decrease around 15 years ago, probably due to the distribution of rat poison on city rooftops. Today, there is an estimated population of 40 pairs.

#### Hooded crow *Corvus cornix*

The population of the species is increasing. The species, like other corvidae, is involved in complex ecological relationships, also studied in the study area (from Bueno *et al.* 2020). Due to the aggressiveness and abundance of the species, it is considered a detrimental factor for small birds of prey (Cairone *et al.* 2012).

#### Northern raven *Corvus corax*

The population is stable, with one pair that nests in the area. Until 1998, another pair nested in a small wall near Regalgiofoli.

#### Coal tit *Periparus ater*

The species has been established for approx. 10 years in the pine forest near the town, confirming its expansion throughout the island (La Mantia *et al.* 2014).

#### Eurasian blue tit *Cyanistes caeruleus*

The species has a stable population in the area. It nests both in holes in houses and in the hollows of suitable trees, which are increasingly rare.



Figure 11. The landscape of Roccapalumba in the past was supposed to be like this: cereal crops with an important presence of almond trees (photo T. La Mantia).

#### Great tit *Parus major*

The population is stable. It nests in the same sites as the blue tit but it is more versatile as it can also use the holes in light poles, etc. Predation in a great tit nest by a rat has been documented.

#### Eurasian penduline tit *Remiz pendulinus*

The species is a breeder, with few pairs occurring along the river. An in-depth study of the species was carried out in a nearby area with similar characteristics (Cuti 2004).

#### Woodlark *Lullula arborea*

The population has been decreasing. The characteristic song and the peculiar ways in which it sings makes its monitoring easier. The typical environment of the species, i.e. small stony and uncultivated hills, is severely disturbed by fires.

#### Eurasian skylark *Alauda arvensis*

Once very common as a winter visitor and during migrations, the species has undergone a decline at European level and in wintering populations on the island (Ientile & Massa 2008; Massa & La Mantia 2010). Accordingly, the species is now uncommon. It was so common as a winter visitor that during winters, hunters would come to Roccapalumba from Tuscany to shoot skylark after attracting them with mirrors and other means (calls, owl).

#### Crested lark *Galerida cristata*

The population has been decreasing.

#### Greater short-toed lark *Calandrella brachydactyla*

The dynamics of the species at regional and national level are the same as for the Calandra lark. However, a few pairs are still present, above all in arable lands left to rest, and this evidence seems to confirm the negative effects of agrochemicals. The decrease is consistent with the general trend at national level (Gustin *et al.* 2016; Brichetti & Fracasso 2000).

#### Calandra lark *Melanocorypha calandra*

The species is now extinct in the study area, where it was commonly found until the 1970s. It was customary for local farmers to bring home Calandra lark chicks, present in large numbers in arable lands, to their children to play with at home. Today, the species has significantly decreased in Sicily (see Massa & La Mantia 2010; La Mantia *et al.* 2014) but it now has a stable population (Bondi *et al.* 2019). In the rest of the country (Gustin *et al.* 2016), it is recorded as “vulnerable” (Peronace *et al.* 2012). La Mantia *et al.* (2014) attributed its marked decrease to the following factors: 1) changes in crops, consisting in a decrease in average size of wheat field coupled with an increase in their number; 2) the abandonment of traditional farming systems, such as complex cropping systems and almond groves.

Local observations have revealed a change in the management of arable crops, in particular with the introduction of the use of herbicides in cereal crops. Recent investigations by Bondi *et al.* (2019) have confirmed the need for the species to have large areas of cereals and pastures.

Barn swallow *Hirundo rustica*

In the past, it nested only inside country houses particularly in stables. For approx.15 years, it has also nested in the town of Roccapalumba under low balconies, where some nests have been destroyed.

Eurasian crag martin *Ptyonoprogne rupestris*

The species has been nesting on the “Rocca” since 2020 with two pairs and since 2012 on the “Rocche” (Fig.12) with 2-4 pairs. The species is expanding across the island.

Common house martin *Delichon urbicum*

In the past, the species was only migratory. It nested in the country for about 15 years. For nest building, the species chooses high balconies. It is increasing in the study area and throughout the island.

Cetti’s warbler *Cettia cetti*

The population is stable, but its extent depends on the conservation of riparian vegetation.

Sicilian long-tailed tit *Aegithalos caudatus siculus*

The species is present with some nesting pairs in pine forests and it occurs in woodlands. At the “Raxiura” wood it nests in wild olive trees.

Common chiffchaff *Phylloscopus collybita*

The species is a common wintering visitor.

Zitting cisticola *Cisticola juncidis*

The population is stable.

Eurasian blackcap *Sylvia atricapilla*

The species is linked to humid woods, such as downy oak woods. It appears to be slightly in reduction, maybe due to increased predation by rats. Indeed, predations on nests have been observed.

Garden warbler *Sylvia borin*

The species is mostly a spring migratory. The population has been decreasing, which is consistent with the dynamics of the species at national level (Gustin *et al.* 2016).

Spectacled warbler *Sylvia conspicillata*

The population has been decreasing slightly, maybe due to a decrease in suitable habitats caused by frequent fires. Massa (1981a) conducted studies in the area on the ecological niche of this species, in addition to the two following species.

Subalpine warbler *Sylvia cantillans*

The status of the species is similar to *Sylvia conspicillata*.

Sardinian warbler *Sylvia melanocephala*

The population has been decreasing for the same reasons highlighted in the previous species.

Common firecrest *Regulus ignicapilla*

The species is less frequent than the Goldcrest but it has undergone the same populations dynamics.



Figure 12. The “Rocche”, apart from being an important site from an archaeological point of view, are important for the nesting of many bird species (photo A. Cairone).



**Goldcrest *Regulus regulus***

In the past, the species was common in the pine forest near the town as a winter visitor, but today it has no longer been observed.

**Eurasian wren *Troglodytes troglodytes***

Once very common, the population is now decreasing, probably due to frequent fires and the expansion of rats.

**Short-toed treecreeper *Certhia brachydactyla***

The species is in sharp decline, though once widespread in old almond trees. Research conducted in Sicily has proved there is a close link between tree size and the presence of the species (trees with > 18 cm in trunk diameter are necessary) (La Mantia *et al.* 2014). The disappearance of large almond trees has led to a reduction in the population. As an exception, the species once nested inside a wooden railroad sleeper.

**Common starling *Sturnus vulgaris***

The species is a common winterer.

**Spotless starling *Sturnus unicolor***

The population is increasing in the study area as throughout Sicily. It nests under the roof tiles of houses in the town of Roccapalumba (Fig. 13).

**Common blackbird *Turdus merula***

The population has decreased probably due to habitat modification caused by recurrent fires. An adult, killed by a rat whilst hatching, was observed.

**Song thrush *Turdus philomelos***

The species is migratory, especially during spring and it is in sharp decline as a wintering resident.

**Mistle thrush *Turdus viscivorus***

The species is a rare migrant, whilst being more common in the past.

**Spotted flycatcher *Muscicapa striata***

Today the species is observed only during migration. In the past, it was uncommon as a nester in wooded areas, including eucalypt woods.

**Robin *Erithacus rubecula***

The species has decreased as a winter visitor. Some summer observations of territorial pairs in suitable areas of woods with downy oaks and *Calicotome* sp. have been made.

**Common nightingale *Luscinia megarhynchos***

The species is in sharp decline. It lives in small streams and wetlands with dense shrubby vegetation, such as brambles (*Rubus* sp.).



Figure 13. The black starling nests on the roofs of the village houses and is a habitual prey for the male peregrine falcon (photo A. Cairone).

**Collared flycatcher *Ficedula albicollis* and European pied flycatcher *Ficedula hypoleuca***

The species is a spring migrant, uncommon in the past, whilst in recent times it has no longer been observed.

**Black redstart *Phoenicurus ochruros***

The species is a winter visitor, but lives in the houses of the town, too. It is very common.

**Blue rock thrush *Monticola solitarius***

The population is stable. Two pairs nest on the "Rocca".

**Whinchat *Saxicola rubetra***

Decreasing migrant.

**European stonechat *Saxicola torquatus***

The population has been decreasing. It nests very early and it is common to observe young feeding as early as the beginning of March. The strategy adopted, consisting in nesting above the ground, allows this species to escape fires and predation by snakes. It nests at the uncultivated edges of cultivated areas, above all at the base of *Carduus* spp., which provides protection from the trampling of herbivores.

**Northern wheatear *Oenanthe oenanthe***

The species was once common as a breeder, but has been in subsequent decline for approx. 10 years. It nests in holes in walls.

Spanish sparrow *Passer hispaniolensis*

The species has undergone a notable decrease, which seems to depend on the changed conditions in the countryside. The species attended in considerable number during the winter to areas (once numerous) near cattle sheds, called “*fumazzari*”, (manure piles where they found undigested wheat) where they fed. Today the animal breeding system has completely changed and small chicken coops that guaranteed food resources for the sparrows have also decreased.

Eurasian tree sparrow *Passer montanus*

The specie is sharply declining.

Rock sparrow *Petronia petronia*

The population is stable. The species nests on the “*Rocca*” with around 15 pairs, but also at the “*Rocche*” of the station.

Dunnock *Prunella modularis*

The species is wintering and in sharp decline. Their frequent habitat is characterized by low shrubs such as *Calicotome*, *Rubus* and *Asparagus*.

Western yellow wagtail *Motacilla flava*

The species is only migrant. In the past, the species would follow the numerous tractors during tillage in October, whilst now it is only found in small groups of 3-4 individuals.

Grey wagtail *Motacilla cinerea*

Only recently, some pairs of this species have nested at the base of the “*Rocca*”.

White wagtail *Motacilla alba*

The species is abundant as a winter visitor. Some pairs nest near the river. Like the congener *Motacilla flava*, this species would frequently follow the tractors during tillage.

Tawny pipit *Anthus campestris*

Up to the early 1980s, the species was less common as a nesting resident than the Calandra. It nested in similar contexts to the Calandra but in higher and more exposed areas. The disappearance of the species is consistent with its dynamics at national level (Gustin *et al.* 2016).

Meadow pipit *Anthus pratensis*

The species is wintering and decreasing.

Common chaffinch *Fringilla coelebs*

The species is wintering and stable.

Hawfinch *Coccothraustes coccothraustes*

Some wintering individuals were observed in the past. Today, the species has decreased, may be due to the decrease in almond trees; in Sicily this species is named “*Scacciamennuli*”, that is “which crushes almonds”.

European greenfinch *Chloris chloris*

The species is nesting but also wintering; the population increases in winter.

Common linnet *Linaria cannabina*

The species is decreasing slightly.

European goldfinch *Carduelis carduelis*

The population is stable. In the past, the species was affected by a massive poacher harassment with captures made with nets.

European serin *Serinus serinus*

The species was common as a breeder in the past. Now it is undergoing a slight decline.

Eurasian siskin *Spinus spinus*

The species is a winter visitor to the pine forest near the town of Roccapalumba.

Corn bunting *Emberiza calandra*

The species is in sharp decline like all bird species linked to open environments. The evaluation of the dynamics is based on the movements of the species towards dormitories. In the past, groups of 6-7 individuals were frequent, whilst today there are movements of only 1-2 individuals.

Cirl bunting *Emberiza cirlus*

The species has decreased due to recurrent fires, which destroyed the suitable vegetation.

## CONCLUSIONS

In the territory under study, a marked change in land use from 1958 to 2011 has occurred (Table 1). The disappearance of some land uses is not only dependent upon the different classification methods used but also on a real transformation that has had a considerable impact on the consistency of birdlife here and in other areas of Sicily (see La Mantia *et al.* 2014). The dynamics of nesting birds in Roccapalumba are summarized in Table 2. While some factors affect species dynamics throughout the distribution range, other local factors may also provide an important contribution. The main factors potentially causing a decrease in bird populations and species are: 1) changes in land use; 2) changes in management techniques of arable crops; 3) the spread of fire; 4) the destruction of old houses, warehouses, etc. (mostly for some species).

Regarding point 1, the Roccapalumba area was atypical Sicilian hilly landscape on which arable lands and dry arboriculture agrosystems, especially almond groves, were alternated. Roccapalumba was, in fact, once famous for almond cultivation. In one study conducted on the almond varieties

of Western Sicily (Barbera *et al.* 1983), four varieties from Roccapalumba were described (Barbera *et al.* 1983). Furthermore, this area was often included with the territories of Alia, Caccamo and Vicari due to the homogeneity of almond cultivation (Fatta Del Bosco 1979). However, at the end of the 1980s, referring to the area of Roccapalumba alone, 820 hectares were estimated, mainly wooded pasture or associated with olive trees (rarely pure), with irregular plants, with plants of decreasing age or of less increasing maturity (Fatta Del Bosco 1981). In a book from 1922 (Ravà 1922), a map of Roccapalumba reported, significantly, one “Cozzo delle mandorle”, (“Hill of almonds”) near the town (Fig.14), a toponym that has now disappeared. Oliveri (1985), in tracing the country’s economy, wrote that “*Arboreal crops are limited to almond and olive trees*”.

Bird species linked to arable lands (e.g. shrikes), in addition to those that use old trees for nesting (e.g. *Jynx torquilla*) have undergone the greatest decrease and, in some cases, have become extinct (Table 2). The reasons underlying these dynamics have historically been ascertained, and have remained fundamentally unchanged, as Tucker & Heath (1994) wrote concerning the main threats

to *Lanius minor*: “*The intensification of agriculture and the predominance of monocultures, replacing a mosaic of crops intermixed with tree groups, may have also contributed to the decline... A more recent threat is the reduction in the availability of large insects due to pollution and insecticide use... the species suffers high losses due to nest predation by natural predators, including corvids*”.

The same dynamics concern the arable land species represented by the now locally extinct *Melanocorypha calandra*, the reduction of which was attributable to changes in arable land management (see Massa & La Mantia 2010). A vast body of historical literature is available on the impact of changes in agronomic techniques - essentially the introduction of agrochemicals - although specific investigations in the study area are lacking. As Tucker & Heath (1994) wrote on *M. calandra* “The decline of this species in Europe is mainly related to agricultural intensification”. Confirmation of the substantial impact of intensification lies in the fact that species which frequented the most marginal areas of arable lands are still present in the territory, although with densities much lower than in the past (e.g. *Lullula arborea*, *Calandrella brachydactyla*).

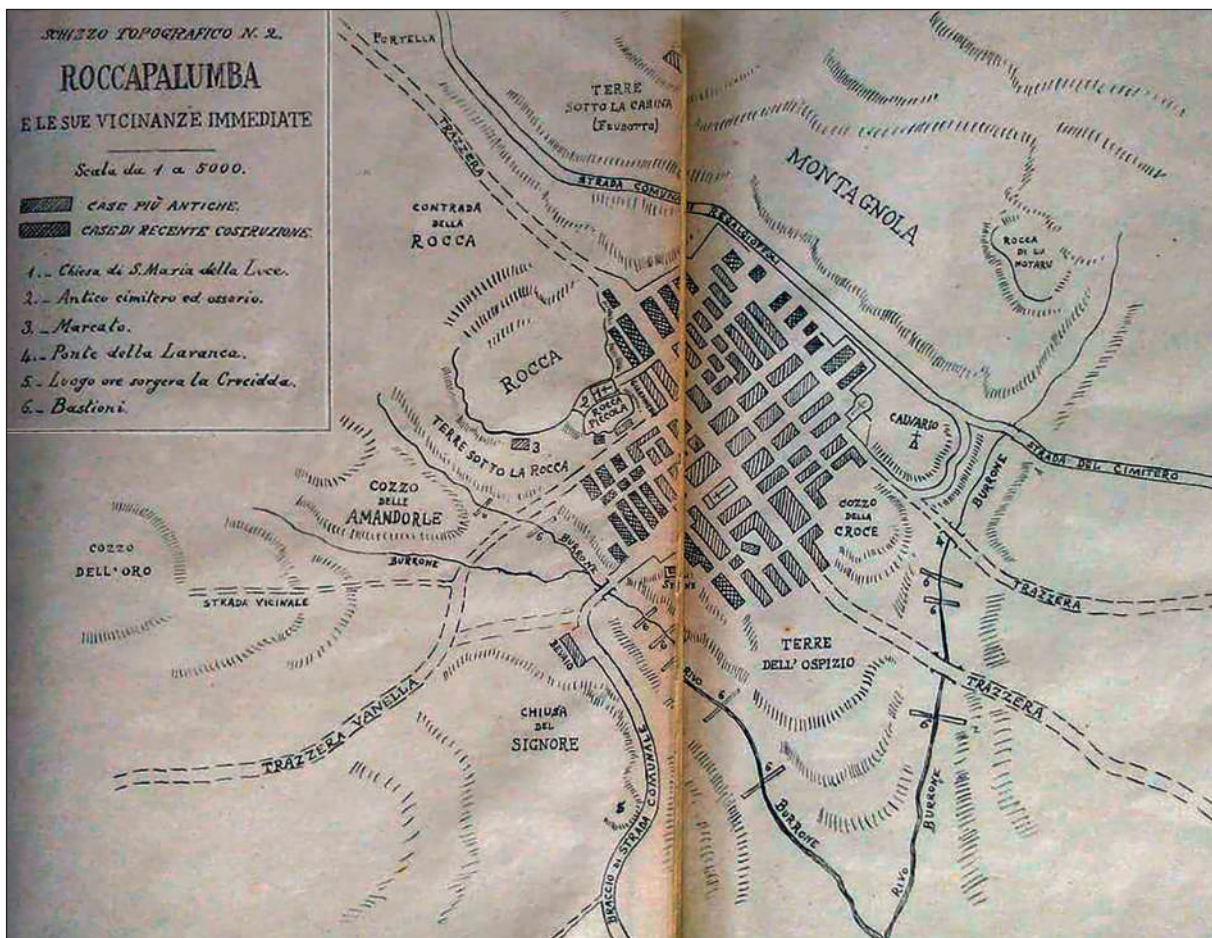


Figure 14. This map, taken from the 1922 volume of Rava, indicates the area near the town known as “Hill of almonds”.

Species	Environments	Trend	Species (N)
<i>Milvus milvus</i> , <i>Falco naumanni</i> , <i>Melanocorypha calandra</i> , <i>Anthus campestris</i>	C	E	4
<i>Coracias garrulus</i> , <i>Lanius minor</i>	CT	E	2
<i>Muscicapa striata</i>	W, CT	E	1
<i>Alectoris graeca whitakeri</i> , <i>Coturnix coturnix</i> , <i>Athene noctua</i> , <i>Falco biarmicus</i> , <i>Lullula arborea</i> , <i>Galerida cristata</i> , <i>Calandrella brachydactyla</i> , <i>Saxicola torquatus</i> , <i>Oenanthe oenanthe</i>	C	-	9
<i>Asio otus</i> , <i>Sylvia atricapilla</i> , <i>Sylvia conspicillata</i> , <i>Sylvia cantillans</i> , <i>Sylvia melanocephala</i>	S	-	5
<i>Falco tinnunculus</i> , <i>Linaria cannabina</i> , <i>Carduelis carduelis</i> , <i>Emberiza calandra</i>	C, CT	-	4
<i>Buteo buteo</i> , <i>Tyto alba</i>	C, CT, W	-	2
<i>Upupa epops</i> , <i>Lanius senator</i>	CT	-	2
<i>Rallus aquaticus</i> , <i>Gallinula chloropus</i>	H	-	2
<i>Emberiza cirulus</i>	CT, S	-	1
<i>Streptopelia turtur</i>	CT, S, W	-	1
<i>Passer montanus</i>	CT	-	1
<i>Luscinia megarhynchos</i>	H, S	-	1
<i>Serinus serinus</i>	S, CT	-	1
<i>Turdus merula</i>	S, CT, W	-	1
<i>Troglodytes troglodytes</i>	S, W	-	1
<i>Certhia brachydactyla</i>	W, CT	-	1
<i>Passer hispaniolensis</i>	U, C, CT	-	1
<i>Jynx torquilla</i>	W-S	-	1
<i>Pica pica</i> , <i>Corvus cornix</i>	CT	+	2
<i>Falco peregrinus</i>	C	+	1
<i>Hirundo rustica</i>	C, U	+	1
<i>Columba palumbus</i>	CT, W, S	+	1
<i>Garrulus glandarius</i>	S, CT, W	+	1
<i>Delichon urbicum</i>	U	+	1
<i>Sturnus unicolor</i>	U, C	+	1
<i>Accipiter nisus</i> , <i>Strix aluco</i>	W	+	
<i>Merops apiaster</i> , <i>Corvus corax</i> , <i>Cisticola juncidis</i> , <i>Monticola solitarius</i> , <i>Petronia petronia</i>	C	ST	5
<i>Parus major</i> , <i>Cyanistes caeruleus</i>	CT, S, W	ST	2
<i>Remiz pendulinus</i> , <i>Cettia cetti</i>	H	ST	2
<i>Streptopelia decaocto</i> , <i>Apus apus</i>	U	ST	2
<i>Dendrocopos major</i> , <i>Periparus ater</i>	W	ST	2
<i>Otus scops</i>	CT	ST	1
<i>Chloris chloris</i>	S, CT, W	ST	1
<i>Corvus monedula</i>	U, C, CT	ST	1
<i>Aegithalos caudatus</i>	W, S	ST	1

Table 2. Dynamics of nesting bird species in the study area. The environments considered are feeding sites, which could differ from nesting sites. For instance, the lesser kestrel nests on rocks but feeds in neighboring environments. C: cereal-zootechanical and marginal systems; CT: cereal-zootechanical trees and arboriculture systems; H: humid environments; S: shrublands and small groves; U: species linked to urban environments for nesting; W: woods. The signs “+” and “-” indicate the increasing and decreasing trend, respectively; ST indicates a stable population in the last ten years; E: extinct species. Recent nesting species (*Anas platyrhynchos*, *Motacilla cinerea*, *Ptyonoprogne rupestris*), species of unknown consistency or dubious nesting (*Tachybaptus ruficollis*, *Burhinus oedicnemus*) in addition to species at risk of hybridization (*Columba livia*) were excluded.

The role played by fires is unquestionably underestimated; here we do not refer to large fires that mainly affect forest areas, but to those that affect small scrublands, groves and riparian vegetation, often on the edge of arable lands and/or recently abandoned areas. These fires, which do not “affect” public opinion, as recorded in other areas (unpublished observation), are devastating for the conservation of biodiversity, also because they are recurrent in the same areas annually or even twice a year and are lit not only by shepherds but also, for example, by wild *Asparagus* pickers.

In conclusion, management of the territory aimed at safeguarding avian biodiversity requires the integration of multiple aspects including: 1) the protection of ecological niches linked to human activity which have stabilized over time, and, therefore, the restoration and/or maintenance of related agricultural and agroforestry systems; 2) the use of agronomic techniques with zero environmental impact and the exclusion of agrochemicals in these cultivation systems; 3) the protection of natural and semi-natural habitats through effective repression of fires.

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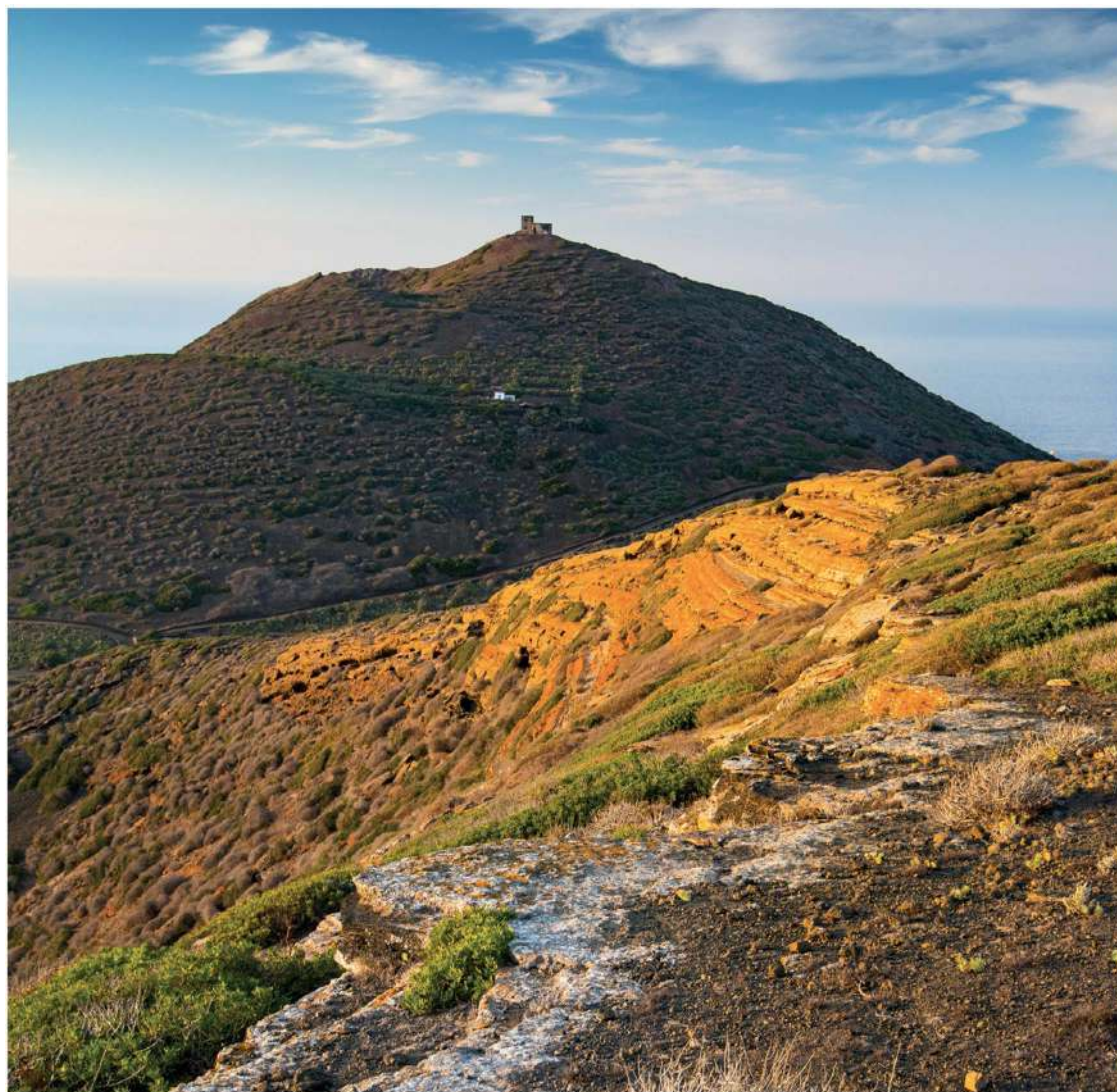
## REFERENCES

- Alfano A. 2016. La diocesi di Cefalù tra alto e basso medioevo. Dati storici ed archeologici a confronto. *Notiziario Archeologico della Soprintendenza di Palermo*, 2: 1–39.
- Amico V. 1855. *Dizionario topografico della Sicilia - volume primo e secondo*, tradotto dal latino ed annotato da Dimarzo G. Tipografia di Pietro Morvillo, Palermo. Anastatic reprint of the 1855 edition by Sigma edizioni, Palermo, 2000.
- Barbera G., Fatta Del Bosco G. & Occorso G. 1983. Caratteri pomologici di 94 varietà di mandorlo della Sicilia occidentale. *Agricoltura e Ricerca*, 25/26: 51–59.
- Basilone L. 2018. *Lithostratigraphy of Sicily*. UNIPA Springer Series.
- BirdLife International 2017. *European birds of conservation concern: populations, trends and national responsibilities*. Cambridge, UK: BirdLife International.
- Bondi S. *et al.* 2019. Calandra e Citizen Science: lo status della popolazione siciliana, p. 76. In: Balestrieri R. & Bazzi G. (Eds.), *Libro degli Abstract del XX Convegno Italiano di Ornitologia*, Napoli 26–29 settembre 2019.
- Brichetti P. & Fracasso G. 2015. Check-list degli uccelli italiani aggiornata al 2014. *Rivista Italiana di Ornitologia - Research in Ornithology*, 85: 31–50.
- Brichetti P. & Fracasso G. 2018. *The birds of Italy. Volume 1. Anatidae-Alcidae*. Belvedere, Latina (Italy), “*Historia naturae*” (6), pp. 512.
- Brichetti P. & Fracasso G. 2020. *The birds of Italy. Volume 2. Pteroclididae-Locustellidae*. Belvedere, Latina (Italy), “*Historia naturae*” (7), pp. 416.
- Cairone A. 1982. Successo riproduttivo di Gheppio, Grillaio e Poiana nel territorio di Roccapalumba (Sicilia). *Avocetta*, 6: 35–40.
- Cairone A., Cuti N., La Mantia T. & Massa B. 2012. Variazioni decennali nelle popolazioni di rapaci in agroecosistemi complessi in Sicilia, p. 25. In: *Programma e riassunti dei contributi Comunicazioni orali e Poster, Il Convegno Italiano Rapaci Diurni e Notturmi*, Treviso, 12–13 ottobre 2012, CISO, AS.FA.VE.
- Cillo N. & Laterza M. 2014. Il nibbio reale in Italia. In: *Atti del convegno finale Life Save the flyers “La conservazione del nibbio reale in Europa”*. Santa Fiora (GR) (Santa Fiora, GR, 5-7 novembre 2014). ([http://www.lifesavetheflyers.it/index.php?option=com\\_content&view=article&id=6&Itemid=7&lang=it](http://www.lifesavetheflyers.it/index.php?option=com_content&view=article&id=6&Itemid=7&lang=it))
- CNR & TCI 1956–68. *Carta della utilizzazione del suolo d'Italia*. Centro Studi Geografia Economica del CNR.
- Corso A. 2005. *Avifauna di Sicilia. L'Epos*, Palermo.
- Cuti N. 2004. *Biologia del Pendolino (Remiz pendulinus) in un'area della Sicilia (Aves Remizidae)*. *Il Naturalista siciliano*, 28: 1205–1227.
- Fatta Del Bosco G., Barbera G., Di Marco L. & Occorso G. 1981. *Carta della Mandorlicoltura della Sicilia Occidentale con guida alla lettura*. Edizioni C.S.S., Palermo.
- Fatta Del Bosco G., Di Marco L., Barbera G. & Occorso G. 1979. Stato attuale della mandorlicoltura della Sicilia Occidentale, pp. 285–304. In: *Atti del Convegno Nazionale “Il miglioramento della coltura del mandorlo e del nocciolo. Aspetti genetici e tecnici”*, Messina-Siracusa, 29 novembre-1 dicembre 1979.
- Fulco E., Angelini J., Ceccolini G., De Lisio L., De Rosa D., De Sanctis A., Giannotti M., Giglio P., Grussu M., Minganti A., Panella M., Sarà M., Sigismondi A., Urso S. & Visceglia M. 2013. Il Nibbio reale *Milvus milvus* svernante in Italia, sintesi di cinque anni di monitoraggio. *Alula*, 24: 53–61.
- Giardina Lo Bianco D. 2007. Roccapalumba, pp. 99–102. In: *Vassallo S. (Ed.), Archeologia nelle vallate del Fiume Torto e Del San Leonardo*. Regione Siciliana, Palermo.
- Gustin M., Brambilla M. & Celada C. 2016. Stato di conservazione e valore di riferimento favorevole per le popolazioni di uccelli nidificanti in Italia. *Rivista Italiana di Ornitologia - Research in Ornithology*, 86: 3–58.

- Iapichino C. (Ed.) 1989. Rapporto ornitologico 1985/86. Il Naturalista siciliano, 13: 23–44.
- Ientile R. & Massa B. 2008. Uccelli (Aves), pp. 115–211. In: AA.VV., Atlante della Biodiversità della Sicilia: Vertebrati terrestri. ARPA Sicilia, Palermo.
- La Mantia G. 1917. Codice diplomatico dei re aragonesi di Sicilia (1282 – 1355). Vol. I, Scuola Tip. Boccone del Povero, Palermo.
- La Mantia T. & Barbera G. 2007. Le siepi e la biodiversità dei sistemi agrari e agroforestali. Alberi e Territorio, 3: 25–30.
- La Mantia T. & Massa B. 2008. I nomi dialettali degli uccelli in Sicilia, pp. 416–451. In: AA.VV., Atlante della biodiversità della Sicilia. Vertebrati terrestri. Studi e Ricerche, 6, ARPA Sicilia, Palermo.
- La Mantia T. 1985. Averla cenerina (*Lanius minor*); Averla capirossa (*Lanius senator*), pp. 172–175. In: Massa B. (Ed.), “Atlas Faunae Siciliae - Aves”. Il Naturalista siciliano, Il Naturalista siciliano, 9 (numero speciale).
- La Mantia T. 2008. I nomi dialettali dei vertebrati in Sicilia, pp. 393–411. In: AA.VV., Atlante della biodiversità della Sicilia. Vertebrati terrestri. Studi e Ricerche, 6, Arpa Sicilia, Palermo.
- La Mantia T. 2010. I cumuli di pietre denominati “Chirchiarì” in Sicilia, tra ecologia e storia. Il Naturalista siciliano, 34: 527–542.
- La Mantia T., Bonaviri L. & Massa B. 2014. Ornithological communities as indicators of recent transformations on a regional scale: the case of the Sicily island. Avocetta, 38: 67–81.
- La Mantia T., Lo Duca R., Massa B., Nocentini S. & Rühl J. 2014. La biodiversità dei boschi siciliani. Parte I: l’avifauna. L’Italia Forestale e Montana, 69: 173–193.
- La Mantia T., Spoto M. & Massa B. 2002. The colonisation of the Great Spotted Woodpecker (*Picoides major* L.) in Eucalypt woods and Poplar cultivations in Sicily. Ecologia Mediterranea, 28: 65–73.
- Lo Valvo M., Massa B. & Sarà M. (Eds.) 1993. Uccelli e paesaggio in Sicilia alle soglie del terzo millennio. Il Naturalista siciliano, 17 (suppl.): 1–373.
- Marchetti M., La Mantia T., Messina G. & Barbera G. 2002. Il significato dei popolamenti arborei ed arbustivi fuori foresta nel paesaggio agrario e la loro dinamica evolutiva in due aree campione della Sicilia. Italia Forestale e Montana, 4: 369–389.
- Massa B. & La Mantia T. 2010. The decline of ground-nesting birds in the agrarian landscape of Italy. Revue d’Écologie (La Terre et la Vie), 65: 73–90.
- Massa B. & Priolo A. 1981. A proposito della nidificazione dell’Averla cenerina, *Lanius minor*, in Sicilia. Rivista Italiana di Ornitologia, 51: 250–251.
- Massa B. 1981a. Primi studi sulla nicchia ecologica di cinque Silvidi (genere *Sylvia*) in Sicilia. Rivista Italiana di Ornitologia, 51: 167–178.
- Massa B. 1981b. Le régime alimentaire de quatorze espèces de Rapaces en Sicile. Rapaces méditerranéens, Annales du CROP, 1: 119–129.
- Oliveri F. 1988. Contrade e insediamenti nel comune di Prizzi. Comune di Prizzi. Arti grafiche Renna, Palermo.
- Oliveri F.S. 1985. Roccapalumba dalle origini al XX secolo. Mori, Palermo.
- Palermo G. 1816. Guida istruttiva per potersi conoscere con facilità tanto dal Siciliano che dal forestiere tutte le magnificenze, e gli oggetti degni di osservazione della città di Palermo Reale Stamperia, Palermo.
- Pazzucconi A. 1997. Uova e nidi degli uccelli d’Italia. Calderini. Bologna.
- Peronace V., Cecere J.G., Gustin M. & Rondinini C. 2012. Lista rossa degli uccelli nidificanti in Italia. Avocetta, 36: 11–58.
- Pitrè G. 1889. Usi e costumi, credenze e pregiudizi del popolo siciliano. Vol. 3–4. Libreria L. Pedone Lauriel di Carlo Clausen, reprint by G. Barbera Editore, Firenze.
- Ravà A. 1922. Le terre comuni e gli usi civici di Roccapalumba: studio e parere. Arti Grafiche G. Castiglia, Palermo.
- Regione Sicilia 2011. Carta dell’uso del suolo (Corine Land Cover). <http://www.sitr.regione.sicilia.it/carte-delluso-del-suolo>.
- Scrofani S. 1962. Sicilia, utilizzazione del suolo. E.S.A., Palermo.
- da Silveira Bueno R., Badalamenti E., Barone E., Cairone A., La Mantia A., Sala G. & La Mantia T. 2020. First assessment of natural regeneration and seed dispersal of Persian walnut (*Juglans regia* L.) in Mediterranean agroecosystems. Arboriculture & Urban Forestry, 46: 174–184.
- Siracusa M., Sarà M., La Mantia T. & Cairone A. 1996. Alimentazione del Gufo comune (*Asio otus*) in Sicilia. Il Naturalista Siciliano, 20: 313–320.
- Surdo S., Cairone A., Cusimano C., La Mantia T., Migliore L. & Massa B. 2019. Variazioni nella densità dei rapaci in due aree campione della Sicilia, p. 122. In: Balestrieri R. & Bazzi G. (Eds.), Libro degli Abstract del XX Convegno Italiano di Ornitologia, Napoli 26–29 settembre 2019.
- Tucker G.M. & Heath M.F. 1994. Birds in Europe: their conservation status. BirdLife Int., Cambridge.

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