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Birds of Gelsari and Lentini marshes, special protection area for the protection and maintenance of aquatic avifauna in central Mediterranean

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ABSTRACT

Gelsari and Lentini marshes are two large wetlands extending along the southern coast of the Gulf of Catania, in Sicily (Italy), which have always been studied extensively by naturalists of the past for their undisputed environmental value. The draining works of these areas, which have occurred in the last century, has led to a loss of interest for the marshes, which were considered lost from the naturalistic point of view. Thus, the scientific studies ceased and, in particular, stopped the recording of avifauna data. In more recent times, the temporary breakdown of pumping stations, that occurred from 2008 to 2010, has enabled the marshes to take back a natural hydrological regime for a period of a few years, short but enough to make habitats of community interest and for an extremely important birdlife to reappear.

Therefore, a monitoring activity has been started, allowing collecting in systematic way information on species present between 2010 and 2016. The aim of this work is to make known the situation regarding the presence of birds in recent years and compare it with what is available from historical data and to highlight its value, despite the anthropic pressure to which the area is subject.

Finally, management proposals are put forward, aimed at fulfilling the full potential of this important site.

1. Introduction

Eastern Sicily, due to its central position in the Mediterranean, is a natural bridge between Africa and continental Europe, playing a strategic role for the birds during migration, as has long been shown (Moreau, 1953; Casement, 1966); in particular, the sector located in the provinces of Catania, Siracusa, Ragusa and Caltanissetta, this is because of the presence of large water-rich plains throughout the year, offering many chances of rest and refreshment to the wide migratory flow of birds in transit. However, a massive process of environmental transformation has affected these areas, much like the rest of Sicily, mainly in the last century, between 1920 and 1950, causing a drastic reduction of the wetlands, whose total land mass, across the entire island, has thus dropped from about 100,000 ha recorded in 1865, to 47,174 ha reclamation in the early 1930s (Rallo and Pandolfi, 1988), to approximately 5,000, in the present day.

The surviving wetlands, due to their richness in terms of species and number of hosted birds, ranks today among the most interesting sites in Italy (Gariboldi et al., 2000) and also in Europe (Grimmett and Jones, 1989). These wetlands, in addition to being a stopover point for migratory birds, often maintain significant populations of nesting or overwintering birds (Massa and Iapichino, 1998).

This paper shows the history of two extended marshes mainly within the province of Siracusa, which, since the 1920s and 1950s, respectively, are annually dried up by a regional Reclamation Consortium of Sicily, the reason being to obtain cultivable surfaces, through two pumping stations which drain the waters and discharge them into the sea. Thanks to the breakdown of the draining pumps, in recent years the area has returned to floodwater, regaining its characteristics of wetland and attracting important contingents of birds (De Pietro, 2011; De Pietro and De Pietro, 2012). The aim of this work is to show the framework of the presence of birds recorded in recent years and to compare it with that available from the historical data. The work also highlights the value of the area, despite the enormous anthropic pressure under which it has been subject, and the potential role that it could take if a management model with a naturalistic orientation were to be applied.

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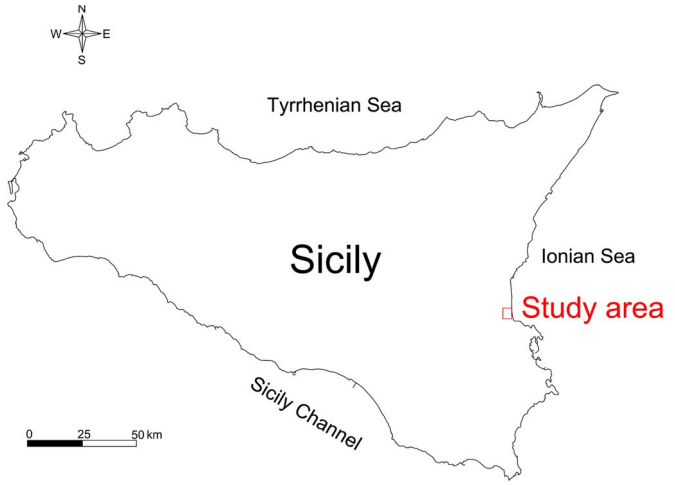

Fig. 1. Location map of the study area.

2. Area of study

Gelsari and Lentini are two marshy areas extending along the eastern Sicilian coast, on the border between the province of Catania and Siracusa, near the final stretch of San Leonardo river, in the municipalities of Carlentini (Siracusa), Augusta (Siracusa) and Catania (Fig. 1).

A large part of Lentini is below sea level, while Gelsari is slightly above. Although the current hydrological contributions play a lesser role than in the past (following the construction of hydraulic works designed to remove part of the water supply from the flooded watercourses and hill areas), in the winter months, these marshes, if no water drainage activities are carried out, reach a maximum depth of just over one meter and extend for no less than 600 ha; the marshes therefore account for a surface that represents more than 10% of all wetlands in Sicily. Under such conditions Gelsari and Lentini marshes tend to configure in much the same way as the original ones. This can be seen from Fig. 2a–c, which compare the surfaces that the marshes occupied at the beginning of the last century with those of recent times in the absence of water pumping.

The importance of the environmental transformations that happened from 2008 to 2010, due to the breakdown of the draining pumps, has led to the recognition of a special protection zone, through the updating, collated in 2013, of the existing SPA “Biviere di Lentini, tratto mediano e foce del fiume Simeto e area antistante la foce” ITA070029 (De Pietro, 2016).

The following restoration of the pumping system has, however, subjected these wetlands to a water pumping regime similar to the past, when there was no environmental protection; since then, the pumps are again periodically operated, in order to forcibly maintain the water table below the bottom of the marshes to avoid waterlogging. In spite of this preventive pumping activity, significant rainfall is capable of forming large bodies of water; in such a case, however, the land Reclamation Consortium intervenes, activating the pumping stations until the drainage of the marshes is reached (Fig. 3).

The serious environmental damage that the activity of the Land Reclamation Consortium causes for habitat and species can be highlighted through benchmarking of rainfall data and satellite photos related to the areas under examination, as shown in Fig. 4; the example shown compares an image related to the partial filling of the marshes, which happened following significant atmospheric precipitation previously (a), with an image related to their following drainage, caused by the activation of the pumping stations (b).

3. Materials and methods

All the known information about the area has been brought together by an in-depth bibliographic analysis and unpublished data was collected by conducting censuses periodically.

The observations were conducted between 2010 and the 2016. A total of 53 visits were made, on average 15 per year. The on-site inspections have been concentrated in the winter months and in the spring; at this time of year, the marshes, fed by rainwater, showed normal levels, during the period of the breakdown of draining pumps, and strongly reduced levels with highly altered dynamics of variation, during the period of reactivation of the plants. Observations were carried out using 10× binoculars and a 20–60× birdwatching telescope; many of the sightings have been documented taking photos with digital cameras equipped with telephoto lenses.

A full list of known species has been drawn up. The nomenclature and the systematic order adopted are those reported by del Hoyo and Collar (2014, 2016).

It has been specified if the presence of species is “historical”, or antecedent to the environmental change made by man during the nineteenth century, and/or “current”.

Besides the available scientific literature, the catalogues of major Sicilian bird collections have been consulted: Priolo (Priolo and Di Palma, 1995), Whitaker (Lo Valvo and Massa, 2000), Trischitta (Di Palma et al., 1989), Baglieri (Grasso and Ientile, 1997), Baglieri and Benanti (Grasso and Ientile, 1999).

Table 1 lists the all species recorded. The species of main conservational concern are also highlighted; in this case the benchmark adopted has been the inclusion of species in Annex I of the Birds Directive (2009/147/EC).

4. Species list results and discussion

It is only right to make it clear that the outcome of this survey is to be regarded as not sufficient to give a comprehensive framework of the ornithological value of this site, for the following reasons. Historical information found is fragmentary and also non-exhaustive, because no on-site systematic research has been carried out despite the fact that the wetland complex is of international importance, as many naturalists have testified in past centuries (Lilford, 1875; Lopriore, 1901; Jany, 1959).

The current framework of the presence of birds, instead, is strongly conditioned by the artificial water control and, more generally, by the absence of an environmental protection regime. It should be noted in this connection that during the study period, on several occasions, has been observed harassment both direct (hunting) and indirect (agricultural and livestock activities) against avifauna, which is detrimental to the permanence of the birds.

The results presented are therefore to be considered completely minimal if compared to those that are, and have been in the past, the real receptive capacities of the area. However, the result obtained, with all its limitations, highlights a very significant framework of the presence of birds and is of great international importance.

There are 94 surveyed species, of which 57 are aquatic, thus amounting to a little more than half of the total of detected species. The high number of aquatic birds highlights the importance of the site, motivating the apposition of special conservation measures, such as international treaties promoted for environmental protection; above all the International Convention of Ramsar in 1971, aimed precisely at the protection of wetlands in general.

The list reported in Table 1 includes 70 species detected in the time frame indicated as current, 18 in the historical and current period, and only 8 historical. This comparison highlights poor historical knowledge; in fact, the 70 reported species, of which there is no historical evidence, in the past had a wider distribution than today and it's perfectly possible that they were present even without explicit references. Instead, the 8 species known only historically are very rare in Sicily (*Pelecanus onocrotalus*, *Melanitta fusca*, *Cygnus cygnus, Cygnus olor*, *Acrocephalus melanopogon* and *Acrocephalus palustris*); only one of them is rather common and probably went unnoticed during the censuses (*Larus genei*).

Fig. 2. Comparison between the wet surfaces that the marshes assumed at the beginning of the last century under conditions of maximum (a) and minimum (b) water height (authors' elaboration from Rossi, 1901) and those assumed under the partial breakdown of pumping stations (c) (authors' elaboration from photos of "Google Earth" on 6 April 2012).

Fig. 3. Lentini marsh in the way it would typically look in the winter months in the absence of water pumping. The photo is dated 26 December 2016, which was when the pumping station was activated, causing the drainage of the marsh.

A particularly important fact that emerges from the analysis of the list is the presence of 26 species listed in Annex I of the Birds Directive; they are species for which the European Community provides for the implementation of special conservation measures. The presence of some of these species is particularly significant. We believe, in particular, that this area represents a key site for the international conservation of Ferruginous Duck (*Aythya nyroca*) and Eurasian Spoonbill (*Platalea leucorodia*) (Figs. 5 and 6).

The Ferruginous Duck is a species that has suffered a strong decline in Europe; important groups of many hundreds of individuals cross south eastern Sicily (Campo et al., 2001), making stops near Lentini, expecially during the post-breeding migration (Ciaccio and Priolo,

Fig. 4. Example of drainage of the marshes following the activation of the pumping stations: (a) wet surfaces on the 25th January 2017, (b) wet surfaces on the 7th February 2017 (authors' elaboration from the satellite photos of “Sentinel 2”).

Table 1
Synoptic Table of the species reported in Gelsari and Lentini marshes. Listing all the historical and recent data, obtained by bibliography and censuses carried out between 2010 and 2016. For each species the number of reports has been recorded and, in brackets, the maximum amount of individuals counted has been specified.

Scientific name	Common name	Recent sightings	Historical sources
Cygnus olor	Mute Swan		Massa (1891); Zuccarello-Patti (1845)
Cygnus cygnus	Whooper Swan		Massa (1890, 1891)
Melanitta fusca	Velvet Scoter		Zuccarello-Patti (1856)
Tadorna tadorna	Common Shelduck	8 (max. 24 ind.)	
Aythya nyroca	Ferruginous Duck	2 (max. 13 ind.)	
Spatula querquedula	Garganey	4 (max. 6 ind.)	
Spatula clypeata	Northern Shoveler	3 (max. 50 about)	Coll. Priolo
Mareca strepera	Gadwall	1 (2 ind.)	
Mareca penelope	Eurasian Wigeon	1 (17 ind.)	
Anas platyrhynchos	Mallard	10 (max. 5 ind.)	Benoit (1840); Doderlein (1869–74); Coll. Priolo
Anas acuta	Northern Pintail	1 (2 ind.)	Coll. Priolo
Anas crecca	Common Teal	1 (2 ind.)	
Tachybaptus ruficollis	Little Grebe	7 (max, 4) breeding	Coll. Priolo
Podiceps cristatus	Great Crested Grebe	6 (max. 15 ind.)	Coll. Trischitta
Podiceps nigricollis	Black-necked Grebe	3 (max. 4 ind.)	
Phoenicopterus roseus	Greater Flamingo	2 (max. 6 ind.)	
Columba livia	Feral Pigeon	Common Max. 250 ind.	
Columba palumbus	Common Woodpigeon	Common Max. 50 ind.	
Apus apus	Common Swift	Common	
Gallinula chloropus	Common Moorhen	3 (max. 4 ind.)	
Fulica atra	Common Coot	17 (max. 338 ind.) breeding	
Ciconia ciconia	White Stork	32 (max. 73 ind.) 1 cp breeding	
Platalea leucorodia	Eurasian Spoonbill	6 (max. 22 ind.)	
Plegadis falcinellus	Glossy Ibis	5 (max. 22 ind.)	
Ixobrychus minutus	Common Little Bittern	1 (1 ind.)	Jany in Stresemann (1943); Coll. Priolo
Nycticorax nycticorax	Black-crowned Night-heron	1 (1 ind.)	
Ardeola ralloides	Squacco Heron	12 (max. 6 ind.)	
Bubulcus ibis	Cattle Egret	20 (max. 130 ind.), 1 in 1971 (Sorci et al., 1972)	
Ardea cinerea	Grey Heron	14 (max. 14 ind.)	Zuccarello-Patti (1845)
Ardea purpurea	Purple Heron	3 (max. 2 ind.)	
Ardea alba	Great White Egret	17 (max. 5 ind.)	
Egretta garzetta	Little Egret	40 (max. 77 ind.)	
Pelecanus onocrotalus	Great White Pelican		Orlando (1958), Ciaccio and Priolo (1997)
Phalacrocorax carbo	Great Cormorant	2 (max. 3 ind.)	Benoit (1840), Ciaccio and Priolo (1997)
Burhinus oedicnemus	Eurasian Thick-knee	2 (max. 2 ind.)	
Recurvirostra avosetta	Pied Avocet	1 (1 ind.)	
Himantopus himantopus	Black-winged Stilt	22 (max 72. ind.) breeding	
Pluvialis apricaria	Eurasian Golden Plover	2 (max. 161 ind.)	Coll. Priolo
Charadrius dubius	Little Ringed Plover	3 (max. 6 ind.)	
Vanellus vanellus	Northern Lapwing	7 (max. 80 ind. about)	
Numenius arquata	Eurasian Curlew	1 (18 ind.)	
Limosa limosa	Black-tailed Godwit	2 (max. 2 ind.)	
Calidris pugnax	Ruff	10 (max. 16 ind.)	
Calidris ferruginea	Curlew Sandpiper	3 (max. 15 ind.)	
Calidris alpina	Dunlin	3 (max. 28 ind.)	Coll. Priolo
Calidris minuta	Little Stint	3 (max. 10 ind.)	Coll. Priolo
Gallinago gallinago	Common Snipe	5 (max. 7 ind.)	
Actitis hypoleucos	Common Sandpiper	1 (1 ind.)	Coll. Trischitta
Tringa ochropus	Green Sandpiper	1 (1 ind.)	Coll. Priolo
Tringa erythropus	Spotted Redshank	2 (max. 7 ind.)	
Tringa nebularia	Common Greenshank	14 (max. 21 ind.)	
Tringa totanus	Common Redshank	5 (1 ind.)	
Tringa glareola	Wood sandipiper	8 (max. 70 ind. about)	
Larus genei	Slender-billed Gull		Coll. Priolo
Larus ridibundus	Black-headed Gull	18 (max. 1000 ind. about)	
Larus fuscus	Lesser Black-backed Gull	1 (1 ind.)	
Larus michahellis	Yellow-legged Gull	4 (max. 50 ind. about)	
Gelochelidon nilotica	Common Gull-billed Tern	1 (1 ind.)	
Chlidonias hybrida	Whiskered Tern	1 (1 ind.)	
Chlidonias niger	Black Tern	1 (1 ind.)	
Tyto alba	Common Barn-owl	3 (1 ind.)	
Asio flammeus	Short-eared Owl	1 in 2.II.1942 (Ciaccio and Priolo, 1997)	
Pandion haliaetus	Osprey	3 (1 ind.)	
Hieraaetus pennatus	Booted Eagle	3 (1 ind.)	
Circus aeruginosus	Western Marsh-harrier	19 (max. 2 ind.)	Benoit (1840)
Circus macrourus	Pallid Harrier	1 (1 ind.)	
Buteo buteo	Eurasian Buzzard	25 (max. 3 ind.)	
Upupa epops	Common Hoopoe	3 (1 ind.)	
Merops apiaster	European Bee-eater	2 (max. 1 ind.)	
Alcedo atthis	Common Kingfisher	1 (1 ind.)	
Falco tinnunculus	Common Kestrel	28 (max. 2 ind.)	
Falco vespertinus	Red-footed Falcon	1 (1 ind.)	
Pica pica	Eurasian Magpie	Common	

(*continued on next page*)

Table 1 (*continued*)

Scientific name	Common name	Recent sightings	Historical sources
Corvus monedula	Eurasian Jackdaw	1 (2 ind.)	
Corvus corone cornix	Carrion Crow	Common	
Calandrella brachydactyla	Greater Short-toed Lark	1 (5 ind.) breeding	
Alauda arvensis	Eurasian Skylark	Common	
Galerida cristata	Crested Lark	Common, breeding	
Cisticola juncidis	Zitting cisticola	Common, breeding	Coll. Priolo
Acrocephalus paludicola	Aquatic Warbler		Benoit (1840)
Acrocephalus melanopogon	Moustached Warbler		Coll. Priolo
Acrocephalus palustris	Marsh Warbler		Arrigoni degli Oddi (1929)
Acrocephalus scirpaceus	Common Reed-warbler	Common, breeding	Coll. Priolo
Acrocephalus arundinaceus	Great Reed-warbler	1 (1 ind.)	
Hirundo rustica	Barn Swallow	Common, breeding	
Phylloscopus collybita	Common Chiffchaff	Common	
Sturnus vulgaris	Common Starling	Common (max. c. 2000 ind.)	Orlando (1965)
Sturnus unicolor	Spotless Starling	Common (max. 200 ind.)	
Phoenicurus ochruros	Black Redstart	Common	
Anthus pratensis	Meadow Pipit	Common, wintering	
Motacilla flava ssp.	Western Yellow Wagtail	Common, migrant	
Motacilla f. flava		1 (1 ind.)	
Motacilla f. feldegg		1 (1 ind.)	
Motacilla alba	White Wagtail	Common	Coll. Priolo
Carduelis carduelis	European Goldfinch	Common, breeding	
Emberiza calandra	Corn Bunting	Common, breeding	

Fig. 5. Ferruginous Ducks (*Aythya nyroca*) in Lentini marsh during the period of the breakdown of the pumping stations (April 2012).

1997); Italy also hosts significant nesting contingents, concentrated in Sicily, precisely in the areas surrounding the site, recognized as key sites for the species at national level (Melega, 2007).

The European populations of Eurasian Spoonbill migrate through Sicily, partly overwintering, and the Sicilian wetlands represent a key site stopover (Pigniczki et al., 2016); in the surrounding marshes and with the right environmental conditions, important concentrations, up to 340 individuals, have been reported (Ciaccio and Priolo, 1997).

The site can also play an important role for two other species: the Common Gull-billed Tern (*Gelochelidon nilotica*) and the Purple Swamphen (*Porphyrio porphyrio*) (Fig. 7). The Common Gull-billed Tern is very rare in Europe and in 1995 nested in the "Biviere di Lentini" (Ciaccio and Priolo, 1997), just a few kilometers from the study area. The temporary low water conditions in the "Biviere di Lentini" in 1995, no longer exist for filling the reservoir, have been favorable for the establishment for this tern; the study area, due to its characteristics, could offer optimal conditions for nesting.

Instead, the Purple Swamphen, which became extinct in Sicily in the 1960′ and was reintroduced between 2000 and 2003 (Andreotti and Ientile, 2004), has not been sighted, however the site presents the environmental conditions suitable for the species, thus not allowing us to exclude the possibility of being able to host an important nucleus of this species in the future.

The definitive restoration of the wetland in this geographical sector would certainly have a positive impact on the species mentioned here and in general on all waterfowl populations that migrate and stop throughout the central Mediterranean. The data collected highlights the extraordinary resilience of the site. Many species have shown a marked ability to recolonize the site quickly and in suboptimal conditions.

5. Proposals for the management of the wetland

At the beginning of the last century, the decision to keep the pumping stations active was because of having to drain the wetlands to convert them into agricultural land; for this reason, the high costs were accepted and the environmental damage associated with it was not evaluated and probably not even considered. At present this choice

Fig. 6. Eurasian Spoonbills (*Platalea leucorodia*) in Lentini marsh (May 2016).

proves to be outdated, placing itself in contrast with the scientific, cultural and legislative acquisitions that, at international level, have long admitted the importance of wetlands and the need for their protection. The operation to maintain these areas forcibly drained is in contrast to their natural disposition to reconstitute a marshy environment, proving, for this reason, irrational, as well as expensive and not respectful of the existence of environmental constraints arising from the application of EU regulations.

The marshes are partly cultivated in arable land; their permanence is incompatible with the presence of the marsh areas and is not justified by the costs that must be borne to keep the areas always dry. An alternative use of these areas could foresee the partial conversion into pastures, as already occurs in a large part of Lentini marsh. The pastures, in fact, besides being economically cheaper than arable land, could coexist with wetlands, since grazing activities could be conducted in the marginal areas of the marshes, adapting to the natural seasonal variations of wet surfaces. A conversion to this effect would take the area back to how it was in the past (De Grazia, 1930).

The management of the water levels could be easily done with a criterion that's easy to implement: activate the pumping stations only when specified heights above sea level are exceeded. In this way, the wet surfaces of maximum expansion of the marshes would be defined.

Unlike what happened in past, antecedent to the work of “hydraulic reclamation”, Gelsari and Lentini marshes are hydraulically separated and the water levels are managed by two different pumping stations. It is therefore possible to set two distinct maximum heights for each marsh, in order to establish not to activate the respective drainage systems until the water levels are kept below them.

For Lentini the maximum expansion height can be set equal to that relating to the configuration that the marsh made between the end of winter and the beginning of spring 2012, corresponding to an area of about 3.9 km^2 (Fig. 2c). For Gelsari, the height of maximum expansion related to the configuration that the marsh has taken in the same period, corresponding to an area of about 2.4 km^2, which could lead to a conflict with illegal structures in absence of any law enforcement in the northern portion of the marsh. This height can be reduced to around 1 m, making it possible to maintain a considerably smaller but significant wetland.

Fig. 7. Common Gull-billed Tern (*Gelochelidon nilotica*), with a flock of Glossy Ibises, in Lentini Marsh (April 2016).

6. Conclusions

The data shown demonstrates how the Gelsari and Lentini marshes are important for the conservation of birds and biodiversity and how minimal interventions can restore a high level of natural character. These elements, together with the great extension of the marshes, make this ecosystem unique and precious and allows us to understand the enormous potential that it could have in the supranational framework for the protection of migratory species between Europe and Africa, but only if the anthropogenic pressures stopped or were reduced.

In line with the European policy for preserving biodiversity, such as the AEWA international agreement for the protection of migratory waterfowl, it is necessary and advantageous to adopt measures for the management and preservation of this wetland. Modest interventions, or better still “non-interventions”, would contribute, at very low cost, to an important work of environmental restoration, partly restoring the deterioration of the wetland system of south-east Sicily.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ocecoaman.2018.12.010.

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