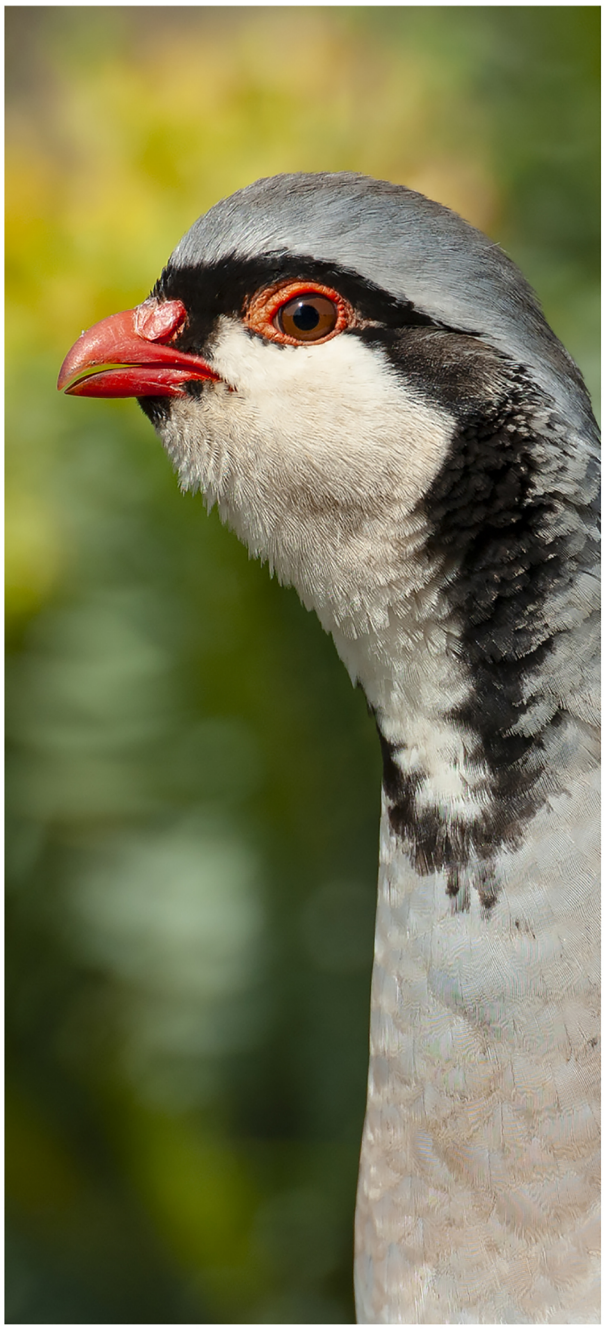
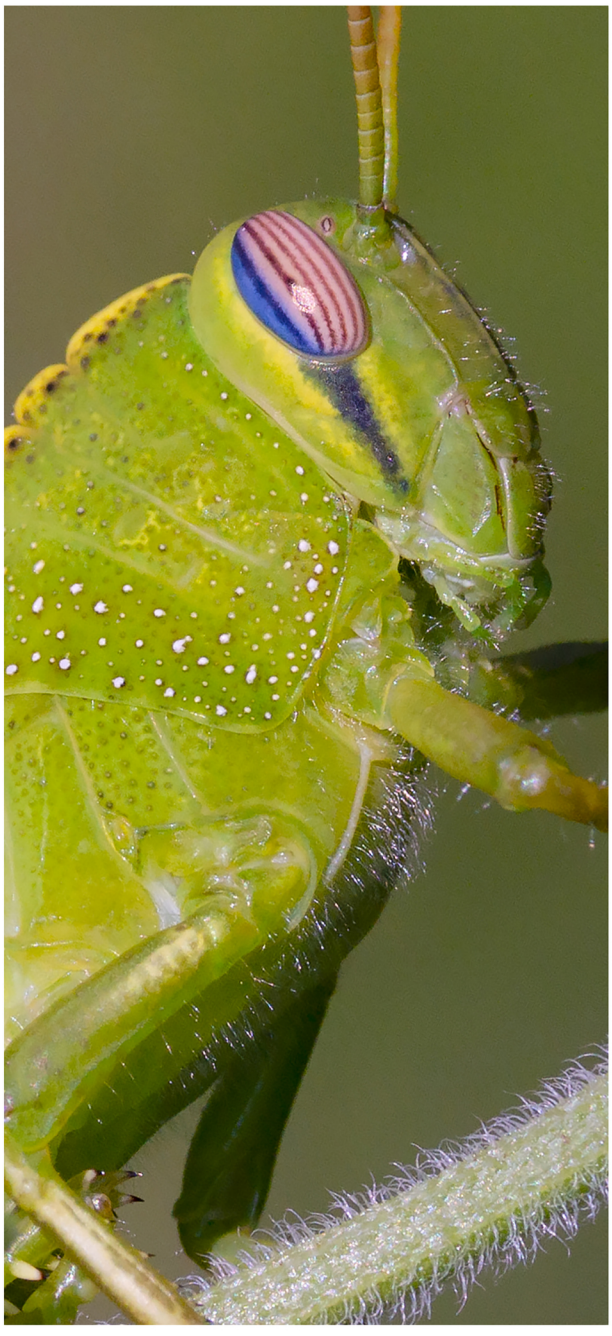
LIFE ON ISLANDS

BIODIVERSITY IN SICILY AND SURROUNDING ISLANDS

Studies dedicated to Bruno Massa





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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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THE EURASIAN SPOONBILL *PLATALEA LEUCORODIA* IN SICILY BETWEEN 1972 AND 2018, DISTRIBUTION AND ECOLOGY

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Summary: The observations of the Eurasian spoonbill made in Sicily between 1972 and 2018 were collected and analyzed. The presences, initially scarce and referred to a few sites, have consolidated over time, and gradually have affected an increasing number of sites. The observations were concentrated in the coastal salt pans and ex-salt pans systems, secondarily in the mouths and in inland waters, below 100 m a.s.l.. The greatest number of Eurasian spoonbill was found in the migration period, both post and pre-reproductive; in the summer the lowest values. The average number of birds per flock, compared to subsequent years, from November to January did not vary significantly, while it was variable in the remaining periods of the year. In the main sites, the fluctuations in the number of individuals are discordant; this suggests a distribution conditioned by local environmental factors, although no correlation was found between the amount of rainfall and the number of individuals. The increasing presence of the Eurasian spoonbill in Sicily is greatly influenced by the increase of the breeding populations in Central-Eastern Europe, and the simultaneous improvement of the environmental conditions of wetlands in Sicily, following the establishment of a network of protected areas. Sicily, interested by important migration flows, plays a key role for the stopover and hosts important wintering flocks of national relevance.

Key Words: wetlands, phenology, migration, central Mediterranean.

Riassunto: *Distribuzione ed ecologia della Spatola* Platalea leucorodia *in Sicilia tra il 1972 e il 2018* - Sono state raccolte ed analizzate le osservazioni di Spatola effettuate in Sicilia tra il 1972 e il 2018. Le presenze inizialmente scarse e riferite a pochi siti, nel tempo, si sono consolidate, e, gradualmente, hanno interessato un numero crescente di zone. Le osservazioni sono concentrate nei sistemi costieri di saline ed ex-saline, secondariamente nelle foci e in acque interne, principalmente al di sotto dei 100 metri s.l.m.. Il maggior numero di spatole è stato rilevato in periodo migratorio, sia post che pre-riproduttivo, in estate i valori più bassi. Il numero medio di uccelli per stormo, ad un confronto in anni successivi, da novembre a gennaio non è variato in maniera significativa, mentre è stato variabile nei restanti periodi dell'anno. Nei principali siti le fluttuazioni del numero di soggetti sono tra di loro discordanti; ciò suggerisce una distribuzione condizionata da fattori ambientali locali. L'abbondanza della Spatola, localmente, non è direttamente correlata alla piovosità; nelle zone umide alimentate dalle precipitazioni non è stata trovata una correlazione tra quantità di pioggia caduta e numero di individui. L'incremento della presenza di Spatola in Sicilia è da ricondurre ad una concomitanza di fattori, la crescita della popolazione nidificante in Europa centro orientale e il contestuale miglioramento delle condizioni ambientali delle zone umide in Sicilia, determinato dall'istituzione di una rete di aree protette. La Sicilia, interessata da importanti flussi migratori, riveste un ruolo chiave per la sosta e accoglie importanti nuclei svernanti, di rilevanza nazionale.

Parole chiave: zone umide, fenologia, migrazione, Mediterraneo centrale.

INTRODUCTION

The *Platalea leucorodia* is a migrant bird in Italy, regularly wintering from the 60s onwards, and breeding since 1989 (Canova & Ceccarelli 1992). The wintering groups, between 1991 and 2010, have increased; in some years there have been overall peaks slightly less than a thousand individuals, distributed in just 60 sites in Sardinia, Sicily, Tuscany and Apulia and, recently, on the Po delta (Zenatello *et al*. 2014). The nesting population is also growing, distributed in 8 sites and with 230-240 couples in the Po Valley (Nardelli *et al*. 2015). The nesting Eurasian spoonbills in Italy are part of the metapopulation of Central-Eastern Europe, which includes Hungary, Austria, Serbia, Croatia, Czech Republic and Greece. The other metapopulation is that of Western Europe, which is different in terms of distribution, migration routes and wintering areas (AEWA-STC 2019). While the populations of western Europe have doubled between 2007 and 2018, in the same years, those of Central-Eastern Europe have decreased (mainly in Hungary); only in Italy, the species has increased (Champagnon *et al*. 2019). This work provides a picture of the presences of the Eurasian spoonbill in Sicily, resulting from a comparison of data collected between 1972 and

2018. Finally, considerations on the evolution of status, trends and some eco-ethological aspects of the species were developed.

MATERIAL AND METHODS

The observations of the Eurasian spoonbill made in Sicily between 1972 and 2018 including unpublished data, sightings recorded on "www.ornitho.it" and bibliographical references were grouped in a database. The number of birds detected by phenological period was compared over four decades (1979-1988; 1989-1998; 1999-2008; 2009-2018), where the Kruskal-Wallis test was applied to test differences in the mean number of individuals per flock across decades. The phenological periods considered are in general those indicated by Cramp (1983), but modified and adapted to the local situation as follows: wintering from November to January, pre-breeding migration from February to April; summering from May to July; post-breeding migration from August to October.

The distribution of the sites is shown on the map (Fig. 1).

The trend of the number of sites where the species was reported each year as well as over the years, was tested with Spearman correlation.

In the sites where the species has been reported in over twenty years, the trend in the number of individuals was compared, in order to verify whether the fluctuations were constant between wetlands. The Chi square test was applied in a contingency table for phenological period with the numbers of individuals (maximum record) in wetlands, over the years. To avoid the recount, attributable to local movements, wetlands less than 10 km apart were considered as unique sites. The three groups of sites adopted are Trapani (includes Saline di Trapani, Marausa and Stagnone), South Siracusa (Vendicari and Pantani di Pachino, which includes the marshes Longarini, Cuba, Bruno, Gorgo Salato, Morghella, Auruca, Baronello, Ciaramiraro, Ponterio, Morghella and Marzamemi) and North Siracusa (Saline di Siracusa, Priolo and Augusta).

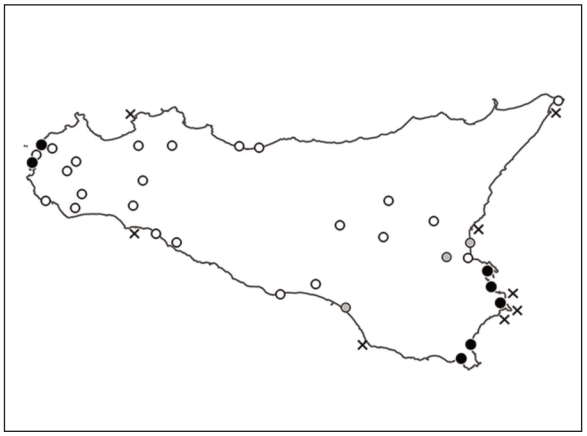

Figure 1. Map of the presence of the Eurasian spoonbill in Sicily. The circles indicate the stations where the species has been recorded in more than twenty years (in black), from 10 to 20 years (in gray) and in less than 10 years (in white). The crosses indicate the points where flocks in migration were observed. The observations in small circumsicilian islands have been excluded from the map.

Finally, for each month, the correlation between rainfall (data provided by the closest stations, Noto, Siracusa province, and Augusta, Siracusa province) and the number of observed individuals (the monthly maximum) was assessed with the Spearman index. Then, the test was repeated, with data related to the rainfall of the current month, cumulated to the previous two and three months. Active salt marshes and wetlands connected with the sea were excluded from the analyzes, therefore only the two group of sites in south-eastern Sicily (South Siracusa and North Siracusa) were considered. Additionally, we only considered years in which the species was detected. In all analyzes, if the number of individuals recorded in the field had been reported as an estimate or interval, then it was transformed into an absolute value and we used the mean of the intervals, rounded down. We adopted $p < 0.01$ as been statistically significant.

RESULTS

Dataset

2,014 observations of the Eurasian spoonbill made in Sicily were brought together between 1972 and 2018. The origin of the data is distributed as follows: 1,024 unpublished observations, 912 observations published on the "ornitho.it" and 78 records cited in literature (Ciaccio & Priolo 1997; Iapichino 1983; Iapichino 1985; Iapichino 1989; Iapichino 1993; Ientile 2001; Lo Valvo & Massa 1999; Massa *et al.* 2015; Termine *et al.* 2008). Literature information without quantitative and/or temporal references was ignored. The birdwatchers who entered their observations on the website ornitho.it and granted the use of such data are listed in full in the acknowledgements.

Phenology and frequency

In Table 1, the number of records per month, and the maximum number of individuals, counted or estimated (in round brackets), are reported. The species has been recorded every year, although, the observations made between 1972 and 1989 were mainly referred to single individ-

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
1972									1 (1)				1 (1)
1973					1 (1)		1 (1)						2 (1)
1974				5 (4)	4 (9)	4 (12)	2 (1)	2 (1)	4 (7)	1 (2)			22 (12)
1975		1 (35)		1 (1)	4 (6)			1 (3)					7 (35)
1976			1 (15)		2 (5)	1 (1)	1 (2)	1 (1)	1 (2)				7 (15)
1977				4 (4)	4 (5)			5 (60)	4 (15)	3 (26)			20 (60)
1978	3 (4)	1 (1)	5 (2)	6 (10)	5 (7)	1 (4)		2 (1)	1 (5)	1 (5)			25 (10)
1979		3 (3)	3 (20)	2 (1)	6 (4)	2 (1)	2 (3)	4 (17)	6 (15)	6 (2)	1 (1)		35 (20)
1980				5 (4)	2 (3)			2 (5)	1 (5)	1 (1)			11 (5)
1981							1 (14)	1 (1)	1 (2)				3 (14)
1982		2 (2)		6 (2)	2 (6)	2 (1)	1 (1)	6 (5)	5 (16)	1 (5)			25 (16)
1983				2 (2)	4 (8)	1 (1)	1 (2)	2 (1)	2 (3)	1 (1)			13 (8)
1984			1 (2)	4 (17)	1 (3)	1 (2)	3 (5)	2 (12)	4 (2)	2 (34)		1 (1)	19 (34)
1985		1 (1)		4 (20)	3 (7)	1 (2)	3 (5)	2 (5)					14 (20)
1986			1 (106)	3 (6)	5 (7)	3 (6)	2 (3)	1 (3)	4 (10)	2 (7)	1 (10)	1 (1)	23 (106)
1987	3 (2)		2 (9)	4 (11)	2 (1)			1 (1)	2 (2)				14 (11)
1988	2 (8)	1 (8)	1 (150)	1 (5)				2 (2)	2 (1)				9 (150)
1989			2 (232)	1 (13)	1 (3)			1 (1)		1 (20)			6 (232)
1990		2 (1)	1 (15)	1 (3)	1 (7)	1 (7)		6 (16)	11 (15)	6 (21)			29 (21)
1991			4 (47)	10 (32)	15 (14)	8 (10)	3 (5)		3 (6)	3 (150)	4 (70)	2 (17)	52 (150)
1992	1 (1)				3 (4)	4 (10)	3 (15)	2 (2)	3 (80)	8 (150)		1 (70)	25 (150)
1993	3 (60)	8 (62)	8 (100)	7 (10)	4 (7)	1 (15)	4 (3)	6 (6)	10 (110)	3 (120)	1 (2)	3 (60)	58 (120)
1994	2 (45)	2 (3)	2 (80)	3 (7)	3 (2)	1 (2)	5 (12)	6 (120)	4 (230)			1 (45)	29 (230)
1995	4 (11)	4 (3)	5 (45)	4 (7)	1 (1)		3 (50)	2 (5)	3 (16)	3 (340)		1 (105)	30 (340)
1996	3 (105)	1 (1)	2 (27)	4 (12)	2 (2)		6 (20)	10 (10)	24 (40)	12 (32)	13 (27)	19 (40)	96 (105)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
1997	9 (60)	7 (36)	12 (76)	3 (9)	6 (12)	12 (8)	5 (11)	7 (22)	6 (18)	4 (31)	7 (15)	2 (65)	80 (76)
1998	5 (40)	5 (23)	4 (54)	6 (6)	8 (7)			5 (15)	5 (105)	2 (2)	5 (27)	5 (8)	50 (105)
1999	6 (110)	2 (46)	1 (9)	4 (6)	4 (7)	1 (9)	3 (6)		2 (7)	4 (200)	1 (1)	8 (100)	36 (200)
2000	11 (95)	4 (33)	9 (91)	6 (15)	8 (20)	3 (4)	3 (8)	6 (18)	7 (9)	8 (30)	5 (41)		70 (95)
2001	6 (121)	3 (13)	8 (33)	4 (20)	1 (23)	2 (20)		5 (77)	3 (12)	4 (12)	1 (9)	3 (65)	40 (121)
2002	4 (8)	2 (55)		1 (7)	2 (4)	5 (9)	1 (3)	2 (3)	1 (14)	4 (5)	3 (9)	3 (3)	28 (55)
2003	3 (11)	2 (8)	8 (15)		1 (29)	4 (4)	1 (2)	2 (15)	1 (5)	1 (83)	4 (46)	1 (1)	28 (83)
2004	5 (46)	8 (57)	4 (45)	1 (4)	1 (1)	3 (14)	2 (8)		3 (27)	1 (1)	3 (53)	3 (47)	34 (57)
2005	6 (91)				1 (2)	2 (14)	1 (13)	3 (11)	3 (8)	1 (83)	2 (1)	8 (45)	27 (91)
2006	2 (36)	4 (85)	2 (32)	2 (4)	1 (2)		1 (21)		5 (29)	1 (7)			18 (85)
2007	4 (80)	3 (19)	8 (11)	7 (7)	2 (4)	1 (7)	1 (20)	3 (27)	9 (20)	8 (80)			46 (80)
2008	1 (16)	1 (13)	2 (9)	1 (1)	6 (6)			2 (3)	1 (2)	2 (8)	3 (17)	4 (7)	23 (17)
2009		1 (1)	2 (4)	3 (4)	4 (6)	3 (9)			1 (6)	7 (5)	2 (10)	1 (15)	24 (15)
2010	1 (5)	1 (2)	1 (7)		1 (2)				5 (10)	7 (23)	1 (8)	3 (7)	20 (23)
2011	5 (47)	5 (44)	2 (3)	4 (22)		3 (10)		1 (1)	1 (5)	4 (28)	13 (65)	6 (25)	44 (65)
2012	8 (17)	14 (24)	12 (15)	2 (11)	6 (20)		3 (10)	6 (100)	12 (51)	7 (10)	5 (20)	8 (40)	84 (100)
2013	10 (8)	9 (10)	15 (42)	15 (25)	11 (7)	1 (1)		4 (32)	10 (170)	14 (152)	11 (111)	15 (86)	116 (170)
2014	17 (75)	14 (100)	14 (100)	21 (25)	11 (27)	4 (5)	7 (11)	7 (25)	7 (64)	9 (110)	8 (70)	7 (40)	127 (110)
2015	11 (101)	2 (14)	14 (55)	16 (36)	7 (14)	5 (13)	1 (8)	4 (20)	15 (220)	17 (148)	13 (40)	17 (48)	122 (220)
2016	18 (48)	15 (100)	18 (28)	24 (25)	17 (19)	12 (33)	7 (29)	15 (100)	13 (151)	19 (210)	17 (139)	16 (105)	191 (210)
2017	10 (80)	20 (61)	15 (60)	9 (41)	5 (13)	5 (15)	8 (44)	8 (40)	10 (110)	14 (170)	16 (153)	10 (60)	130 (170)
2018	6 (60)	8 (72)	13 (60)	10 (15)	5 (6)	7 (5)	6 (12)	6 (27)	12 (93)	12 (160)	8 (35)	6 (40)	99 (160)
	169 (121)	156 (100)	203 (232)	216 (41)	183 (29)	104 (33)	91 (50)	153 (120)	229 (230)	205 (340)	148 (153)	155 (105)	

Table 1. Summary of observations including the number of records and the maximum number of individuals observed (in round brackets).

uals or small groups, in migration or summering. From 1990 onwards, records became constant in at least 8-9 months a year. Since December 1992, the first wintering groups were registered, and they have become regular since 2000. At Trapani, 100 to 150 individuals started wintering, while in south Siracusa (Vendicari and Pachino marshes) the number ranged from 2 to 27 individuals. From 2014 to 2018, the observations became recurrent almost throughout the year.

As for the monthly distribution, two peaks were evident, coinciding with the migration phases. The first peak was in February and March, the second, of greater magnitude, in September and October. The most conspicuous groups were: 340 individuals on 8.X.1985 at Biviere di Lentini (Ciaccio & Priolo 1997), and 232 individuals on 27.III.1989 at Biviere di Gela (Iapichino 1993). The lowest numbers were recorded in May and June, with maximum peaks of 29 and 33 individuals, respectively.

In the four decades analyzed, the average number of birds observed has significantly varied over the course of the year and between decades. There are no significant differences in the average number of birds for flocks only in the wintering period during the three decades from 1989 to 2018. In all other cases the difference are high (Table 2).

Periods	1979-1988	1989-1998	1999-2008	2009-2018	n	H	p
Win	-	15.07	19.65	16.13	606	6.160	0.0460
Pre-br	11.05	15.15	10.81	10.60	398	7.648	0.0539
Sum	3.25	6.07	6.25	7.00	348	14.467	0.0023
Post-br	4.33	19.41	13.35	29.89	560	34.228	0.00001

Table 2. Average values of the number of individuals per flock, in four decades, and by phenological period (Wintering, Pre-breeding migration, Summering and Post-breeding migration) with respective total number of observations (n), value of the Kruskal-Wallis test (H) and its significance level (p).

Distribution

The Eurasian Spoonbill has been recorded in 33 wetlands (Fig. 1), which are listed in Table 3. Most of the records (1,974) were related to coastal sites or in any case to sites located at altitudes below 100 m a.s.l.; only 40 sightings were made in locations at altitudes above 100 m a.s.l. The highest places where the species has been observed are Pergusa (665 m a.s.l) and Piana degli Albanesi (610 m a.s.l) (Fig. 2). The main sites for the species (the first seven reported in table 3) are: salt pans, ex-salt pans, brackish ponds and, in the case of the Stagnone, a lagoon. The remaining wetlands are river mouths or internal water bodies. In particular, in the last fifteen years,

Figure 2. A group of 21 spoonbills observed in the Piana degli Albanesi lake (23/09/2012) the last one on the right was ringed (photo A. La Mantia).

Localities	N° years	N° records	Win	Pre-br	Sum	Post-br
Vendicari (SSR)	43	550	62	106	27	110
Pantani Pachino (SSR)	26	201	12	13	44	40
Saline di Siracusa (NSR)	35	186	26	22	20	40
Saline di Priolo (NSR)	25	99	13	4	12	18
Saline di Augusta (NSR)	21	91	25	10	4	5
Saline di Trapani (TP)	26	380	153	55	22	220
Stagnone (TP)	23	137	121	100	29	22
Marausa (TP)	8	50	28	36	15	1
Foce Simeto	16	32	14	7	11	22
Biviere di Lentini	15	61	105	100	50	340
Biviere di Gela	14	27	9	232	2	34
Ponte Barca	7	9	36	12		10
Lago Poma	7	20	3		1	34
Lago di Paceco	6	46	25	16	14	4
Lago Pozzillo	6	8	42		1	30
Mazara del Vallo	6	43	8	42	6	4
Gorgo Montallegro	4	7	5		2	8
Lago Arancio	3	3		1		1
Lago Comunelli	3	4	20	3		2
Pantano Gelsari	3	8		22	8	8
Pantano Leone	3	3			2	9
Foce Salso	2	2	3			1
Lago Ogliastro	2	2	6			
Lago Rubino	2	2	6		1	
Lago della Trinità	2	2			3	2
Lago Piana degli Albanesi	2	2		3		21
Termini Imerese	2	2	2			

Table 3. List of sites where the species was recorded, number of years in which at least one record was made, number of records, and maximum number of individuals observed together by phenological period (Wintering, Pre-breeding migration, Summering and Post-breeding migration). For some localities, in parentheses, the abbreviation of the group of sites which is a part (NSR North Siracusa, SSR South Siracusa and TP Trapani).

the species has been observed in many of the Sicilian artificial lake (Fig. 1). These basins, originating from barriers of watercourses, are characterized by strong man-induced water fluctuations. Singular is the case of the Biviere of Lentini, which was assiduously frequented by the Eurasian Spoonbill between 1991 and 2003 (Ciaccio & Priolo 1997). The stable presence in this site, often with large numbers of individuals, has coincided with the creation of the wetland and the maintenance of low waters, a management choice imposed by the need to settle the dam. After the initial phase, due to the rising water level, the lakes has lost those characteristics that made it particularly attractive for the species, so that its presence subsequently was aligned with those of other artificial lakes.

The number of localities where the species has been observed has steadily increased in time (Fig. 3), the two values are positively correlated (P = 0.836, P< 0.01, n 47).

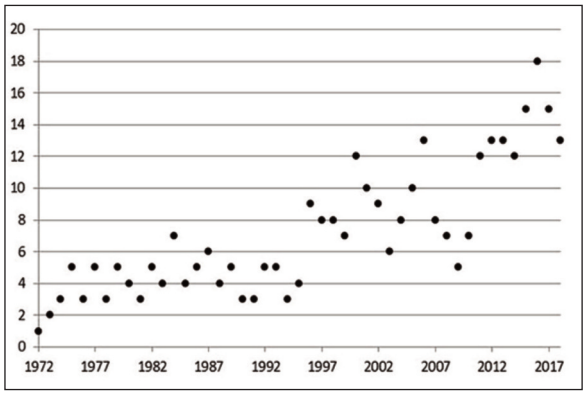

Figure 3. Relationship between the number of sites where the species has been reported (in the ordinate) and the year of observations (in the abscissa).

Individuals in flight, during migration, have been recorded in all the smaller islands and in 8 coastal locations of mainland Sicily (Fig. 1).

Seasonal trends

In the surveyed phenological periods, the fluctuations in the maximum number of individuals, between groups of sites, were never homogeneous. In all cases, the changes were significant, with a p value always smaller than 0.01. About the link between rainfall and the number of individuals observed, only for one series of data, values close to significance were found, referring to the observations in north Siracusa wetlands in the quarter June (P = -0.79, p< 0.10, n 8). In all other cases, the number of individuals was never related to the abundance of rainfall, neither in the current month nor in the two or three previous months.

DISCUSSION

The data presented here describe the evolution of the presence of the European spoonbill in Sicily in almost half a century. The increase of sightings and the permanence of wintering or summering groups from the second half of the 1980s is certainly attributable to a set of concomitant factors, mainly the increase in breeding populations in Central-Eastern Europe (Triplet *et al.* 2008) and in Italy (Volponi *et al.* 2008), associated with an improvement in the conditions of protection of the Sicilian wetland systems. In particular, we remember the establishment of the protected areas of Vendicari, Stagnone and Saline di Siracusa in 1984, of the Saline di Trapani in 1995 and of the Saline di Priolo in 2000. A higher frequency of observations has been recorded since 1990, in correspondence with the first cases of breeding of the species in Italy (Canova & Fasola 1989). These two events are directly connected to each other as many of the ringed individuals with coloured rings observed in Sicily are of Italian origin (Surdo *et al.* 2017; Surdo 2018).

The diffusion of the species in Sicily followed a very clear dynamic, as it has occupied only the coastal sites in the first study period, and only later also the internal basins. The current distribution would suggest a preference for coastal sites, probably because they are the optimal sites; however, it cannot be ruled out that the internal wetlands have been occupied only recently because in the past they were more affected by sources of disturbance (hunting and/or other human activities). The discordant trend in the number of individuals between wetlands in the same periods suggests that fluctuations are dependent on local environmental conditions (e.g. trophic) and therefore they seem to be independent of more general demographic factors affecting the population, as a uniform trend of its presence in all Sicilian wetlands might have suggested.

Excluding the migratory contingents, the presence of the species at Trapani and Marsala has reached densities which have remained almost stable over time; *viceversa*, in the wetlands of the south-eastern side of Sicily, fluctuating trends, characterized by large oscillations, were observed. The wetlands of south-eastern Sicily, although holding major elements of naturalness, being temporary ponds or former salt pans, are less permanently occupied areas. In these temporary wetlands, rainfall, as a unique factor, does not determine the abundance of the species as the quantity of water accumulated in the swamps does not correspond to a greater number of individuals. Presumably, the conditions that favour the assembly of the Eurasian Spoonbill are due to other concomitant factors. In this regard, in-

vestigations on feeding could provide insights and new elements to understand the distribution dynamics of the Eurasian Spoonbill in a wetland system, such as the Sicilian one. In any case, water represents an essential element, and the ongoing climate changes, altering the water supply regime of wetlands, could have indirectly negative effects on the Eurasian Spoonbill, as Bellisario (2018) pointed out.

CONCLUSIONS

Sicily, due to its geographical location, receive the migratory flows of the Eurasian Spoonbill populations of Central-Eastern Europe. During the pre- and post-breeding migration phase, the Sicilian wetlands represent important stopovers, offering optimal conditions for foraging and resting; this is a particularly important aspect for spoonbils because individuals may make long stopovers (staging sites), as widely documented by research conducted on individuals marked through radio tracking (Pigniczki *et al.* 2016). Some of these wetlands also play an important role during the wintering and summering phases, particularly the wetland system of western Sicily, represented by the salt pans of Trapani, Marsala and Stagnone. The salt pans of Trapani and Marsala are geographically and ecologically linked, confirmed by direct observations on marked spoonbills moving frequently between these areas (Surdo and Ientile, pers. obs.). Therefore, if these two salt pans are considered as a single site, it has all the requirements to be recognized as a site of national importance for spoonbill wintering (see Zenatello *et al.* 2014). In turn, observations in south-eastern Sicily are less regular and abundant, although at Vendicari, the practice of salt cultivation had created favourable conditions for birdlife (Ientile *et al.* 2011), thus the abandonment of this practice may have negatively affected this species.

As highlighted by Pigniczki (2010), the Eurasian Spoonbill should be considered a flagship species. Indeed, by improving the protection of the key sites for this species, many other species of aquatic migrants will benefit, once occupied sites coincide with the most valuable wetlands for the aquatic species in Sicily (Ientile & Massa 2008). Although today most of the Sicilian wetlands receive an adequate level of protection, some key places for the Eurasian Spoonbill are not yet sufficiently protected, particularly the Gelsari and Lentini marshes (De Pietro *et al.* 2019), the Saline di Augusta and some of the marshes of Pachino (Fig. 4).

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Figure 4. A Eurasian Spoonbill photographed (25.I.2010) at Pantano Longarini in the marshes of Pachino (photo T. Puma).

LITERATURE CITED

AEWA-STC 2019. Aewa technical committee recommendations for the delineation of selected AEWA populations on table 1 of the action plan. 15th meeting of the standing committee 11–13 December 2019, Bristol, United Kingdom. https://www.unepaewa.org/sites/default/files/document/aewa_stc15_7_proposals_for_revision_of_population_delineations.pdf

Bellisario B. 2018. Conserving migration in a changing climate, a case study: The Eurasian spoonbill, *Platalea leucorodia leucorodia*. Biological Conservation, 217: 222–231.

Canova L. & Ceccarelli P. 1992. Spatola *Platalea leucorodia*, pp 233–237. In: Brichetti P., De Franceschi P. & Baccetti N. 1992, Fauna d'Italia. Vol. XXIX. Aves I. Gaviidae - Phasianidae. Edizioni Calderini, Bologna.

Canova L. & Fasola M. 1989. Prima nidificazione di Spatola *Platalea leucorodia* in Italia. Rivista Italiana di Ornitologia, 59: 265–267.

Champagnon J., Pigniczki C. & Kralj J. 2019. An overview of Eurasian spoonbill trends, pp. 9–12 in: Champagnon J., Kralj J., Cano Alonso L.S. & Sundar K.S.G. (eds.). Proceedings of the IX Workshop of the AEWA Eurasian Spoonbill International Expert Group. IUCN-SSC Stork, Ibis and Spoonbill Specialist Group Special Publication 2. Arles, France.

Ciaccio A. & Priolo A. 1997. Avifauna della foce del Simeto, del lago di Lentini e delle zone umide adiacenti (Sicilia, Italia). Il Naturalista siciliano, 21: 309–413.

Cramp S. 1983. Birds of Europe the Middle East and North Africa. The Birds of the Western Paleartic: Vol. 3: Waders to gulls. K. E. L. Simmons. Oxford University Press, Oxford, U.K.

De Pietro R., Ientile R., Puccia S. & Sabella G. 2019. Birds of Gelsari and Lentini marshes, special protection area for the protection and maintenance of aquatic avifauna in central Mediterranean. Ocean and Coastal Management, 169: 96–103. 10.1016/j.ocecoaman.2018.12.010.

Iapichino C. (red.) 1983. Rapporto Ornitologico Sicilia 1982. Lega Italiana Protezione Uccelli, Palermo.

Iapichino C. (red.) 1985. Rapporto Ornitologico Sicilia 1984. Picus, 11: 131–159.

Iapichino C. (red.) 1989. Rapporto Ornitologico Sicilia 1985/86. Il Naturalista siciliano,13: 23–44.

Iapichino C. (red.) 1993. Rapporto ornitologico Sicilia 1987–89. Il Naturalista siciliano, 17: 149–168.

Ientile R. 2001. L'avifauna acquatica delle saline megaresi (Siracusa, Sicilia). Il Naturalista siciliano, 25: 63–108.

Ientile R. & Massa B. 2008. Uccelli (Aves), pp. 115–211. In: AA.VV., Atlante della Biodiversità della Sicilia: Vertebrati terrestri. Arpa Sicilia, Palermo.

Ientile R., Rühl J., La Mantia T., Massa B. 2011. I cambiamenti nell'ecosistema della Riserva Naturale di Vendicari e gli effetti sull'avifauna. Edizioni Danaus, Palermo, pp. 1–96.

Lo Valvo F. & Massa B. 1999. Lista commentata dei vertebrati terrestri della Riserva Naturale Orientata "Isole dello Stagnone" (Sicilia). Il Naturalista siciliano, 23: 419–466.

Massa B., Lo Cascio P., Ientile R., Canale E.D. & La Mantia T. 2015. Gli Uccelli delle isole circumsiciliane. Il Naturalista siciliano, 39: 105–373.

Nardelli R., Andreotti A., Bianchi E., Brambilla M., Brecciaroli B., Celada C., Dupré E., Gustin M., Longoni V., Pirrello S., Spina F., Volponi S. & Serra L. 2015. Rapporto sull'applicazione della Direttiva 147/2009/CE in Italia: dimensione, distribuzione e trend delle popolazioni di uccelli (2008–2012). ISPRA, Serie Rapporti, 219/2015.

Pigniczki C. 2010. Dispersion and migration of Hungarian Spoonbills (*Platalea leucorodia*) based on recoveries of metal-ringed individuals. Aquila, 116–117: 17–32.

Pigniczki C., Kralj J., Volponi S., Žuljević A., Dakhli M.A., Mikuska T., Azafzaf H. & Végvàri Z., 2016. Migration routes and stopover sites of the Eurasian Spoonbill (*Platalea leucorodia*) between the Carpatian Basin and wintering areas. Ornis Hungarica, 24: 128–149.

Surdo S., La Mantia T. & D'Amico D. 2017. Aggiornamento della checklist degli uccelli della Riserva Naturale Orientata Isole dello Stagnone (Sicilia). Il Naturalista siciliano, 41 (1): 35–52.

Surdo S. 2018. Check-List degi uccelli della R.N.O. "Saline di Trapani e Paceco" con lista commentata dei non Passeriformes. Il Naturalista siciliano, 42: 57–109.

Termine R., Canale E.D., Ientile R., Cuti N., Di Grande S. & Massa B., 2008. Vertebrati della Riserva Naturale Speciale e Sito d'Importanza Comunitaria Lago di Pergusa. Il Naturalista siciliano, 32: 105–186.

Triplet P., Overdijk O., Smart M., Nagy S., Schneider-Jacoby M., Karauz E.S., Pigniczki C., Baha El Din S., Kralj J., Sandor A. & Navedo J.G. 2008. International Single Species Action Plan for the Conservation of the Eurasian Spoonbill *Platalea leucorodia*. AEWA Technical Series No. 35. Bonn: Vogelbescherming Nederland (BirdLife Netherlands).

Volponi S., Emiliani D. & Fasola M, 2008. An overview of Spoonbills in Italy. International Spoonbill Working Group Newsletter, 5: 3–5.

Zenatello M., Baccetti N. & Borghesi F. 2014. Risultati dei censimenti degli uccelli acquatici svernanti in Italia. Distribuzione, stima e trend delle popolazioni nel 2001–2010. ISPRA, Serie Rapporti, 206/2014.

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