

An updated estimate of the wintering population of Sanderling *Calidris alba* (J.F. Gmelin, 1788) in Sicily for the years 2015-2022

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ABSTRACT

The Sanderling *Calidris alba* (J.F. Gmelin, 1788) overwinters along the sandy coasts of Italy with an average of about 546 individuals for the years 2006-2010, showing a positive long-term increase. The species regularly overwinters in Sicily, for which the latest estimate reports 30–130 individuals in the years 2000–2004. Since no further updated estimates are available, new data were collected every winter on the field during the years 2015–2022, monitoring the most suitable stretches of beaches and collecting additional data from birdwatchers and photographers. A wintering regional population with an average of 100 individuals per year (65–136) was recorded, with an estimate of 145 individuals per year (110–180). The sandy coast of the Gulf of Gela hosts 54% of the recorded regional wintering population and about 10% of the whole Italian population and can therefore be considered a “site of national importance”. Other important areas are the Gulf of Catania, which hosts 24% of the regional population and 4.57% of the Italian population, and some sandy coasts of Ragusa’s province. This survey shows an increase of the regional wintering population in the last decades, highlighting Sicily’s role at national level for the wintering of the species. Conservation measures and sustainable management of Sicilian sandy coasts are strongly recommended to support the wintering of *C. alba* and other species of shorebirds.

KEY WORDS

Gulf of Catania; Gulf of Gela; IWC; overwintering; shorebirds monitoring.

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INTRODUCTION

The Sanderling *Calidris alba* (J.F. Gmelin, 1788) is a high-arctic breeding shorebird which in Europe only breeds in the Svalbard Islands with about 50 estimated pairs, showing an increase of the European wintering populations (Keller et al., 2020). It is categorised as “Least Concern (LC)” in the latest IUCN European red list (BirdLife In-

ternational, 2021). In the Mediterranean basin, *C. alba* mainly overwinters along the sandy coasts of Spain, Italy, Morocco, Algeria, Tunisia, Libya, Egypt and Turkey (Chandler, 2009; Svensson et al., 2012) with no less than 3100 individuals (Spagnesi & Serra, 2003), with higher concentrations in the area of the Ebro Delta, south-eastern coast of Spain (SEO/BirdLife, 2012). In Italy, it is considered a local winter visitor with a positive

long-term increase and a range of about 150–800 wintering individuals for the period 2000–2010 (Brichetti & Fracasso, 2018). The latest available data report an average of 562 individuals for the years 2001–2005 in 32 different sites and an average of 546 individuals for 2006–2010 in 33 sites, with wintering contingents mainly concentrated along the northern coasts of the Adriatic Sea (Zenatello et al., 2014). The most important Italian region for the wintering of *C. alba* is Emilia Romagna, for which are reported up to 304 individuals for the years 2006–2009 (Tinarelli et al., 2010), with higher concentrations in the areas of Comacchio-Mezzano and Po Delta (Zenatello et al., 2014). Other important regions are Apulia (especially the areas of Lake of Lesina and Varano), Sardinia and Sicily (Zenatello et al., 2014).

In the last 150 years, *C. alba* has shown in Sicily a stable regional trend and it is considered to be a scarce wintering species from many authors, with the exception of Whitaker, who indicated the species as a common wintering for the region (Massa et al., 2021). Only few relevant reports are available from the previous decades: 4 records of groups up to a maximum of 17 wintering individuals in the '80s (Iapichino & Massa, 1989); an average of 18 individuals is reported for the eastern Sicily for the years 1990–1995 (Corso, 1995); an estimate of 30–50 individuals for the whole Sicily in the years 1996–1999 (Corso, 1999). Two Sicilian locations, the Gulf of Catania and the mouth of Simeto River (Catania), were listed as “site of national importance” for the wintering of this species in the years 1991–2000 (Baccetti et al., 2002). The last regional estimate reports 30–130 wintering individuals, and thus an average of 40 individuals per year, for 8 different locations in the years 2000–2004 (Corso, 2005). More recently, an average of 51 individuals was reported for the only Gulf of Gela in the years 2011–2016 (Zafarana, 2017) and, subsequently, an average of 23 individuals for the only Gulf of Catania (Fig. 1) in the years 2016–2020 (Galasso et al., 2021), suggesting an increase or and under-estimation of the Sicilian wintering population of *C. alba*. Being Sicily one of the most important Italian regions for the wintering of this species and not being available further updated estimates, new data were collected in the years 2015–2022.

MATERIAL AND METHODS

All available recent bibliography was analysed. New data were systematically collected on the field by authors in every winter and exclusively in January, in the period of the study 2015–2022, following the International Waterbird Census (IWC) guidelines (Serra et al., 1997; Baccetti et al., 2002; Zenatello et al., 2014). Census covered all the most important and suitable Sicilian sandy coastal sites and fresh water stream mouths, also including some protected areas, for a total of 21 sites/macro-areas and approximately 100 km of sandy coastline investigated. Each site was investigated at least once for winter, for a total of about 300 outings on the field in 8 different winters.

Census were carried out by means of standardized transects method, executed by walking on foot and following the shoreline (Bibby et al., 2000), or from fixed observation points. In some cases, as for example for the area of “Stagnone di Marsala”, coastline was investigated by car driving along the road skirting the beach. When the species was recorded more than once in the same site for the same winter, only maximum recorded numbers have been considered. Transects were always performed with good weather conditions and no wind, using binoculars and telescopes for counting.

A Kilometric Abundance Index (KAI) was calculated for the sandy coasts regularly monitored every winter, being the ratio between the average number of individuals recorded and the transect length covered (Buckland et al., 1993; Vincent et al., 1991).

To the data directly collected on the fields by authors, additional data from birdwatchers and ornithologists were evaluated and in some cases integrated, often by means of digital platforms such as Ornitho.it, Ubird, eBird and INaturalist. Data provided by members of Facebook groups (Fauna Siciliana, EBN ITALIA and AFNI - Sezione Sicilia) were evaluated and integrated as well. A distribution map of the main wintering Sicilian sites of *C. alba* was produced by means of QGIS software.

RESULTS AND DISCUSSION

A total of 800 wintering individuals of *C. alba* were recorded in the period 2015–2022 (Table 1),



Figure 1. A flock of sanderlings resting along the sandy coast of Catania's Gulf (photo by P. Galasso).

with an average of 100 individuals per year and a maximum of 136 recorded in January 2020. Minimum numbers recorded in January 2021, probably due to the reduced field investigations (fewer field outings and kilometres investigated) linked to the COVID-19 national restrictive measures. The estimation for the region is an average of 145 individuals (min. 110, max 180) per year during the period of the study (Fig. 2). Some areas with interesting concentrations have been found (Fig. 3): the most important Sicilian wintering area is represented by the Gulf of Gela, whose importance was already highlighted by one of the author (Zafarana, 2017). In this area indeed, *C. alba* has been regularly recorded every winter with an average of 54 (54.4) individuals per year and records up to 82 individuals in January 2017 and 2020. Highest records and number density were observed between the mouth of the river Dirillo and "Costa Fenicia", with an average of 30 (30.37) individuals per year (max of 71 in January 2020) and a KAI of 2.57 (30.37 ind./12 km). Another important site is the mouth of "Torrente Comunelli" (Gela), where up to 57 individuals were observed on January 2017 and an average KAI of 0.8 (16 ind./20 km) was calculated for the period of the study. On the other hand, *C. alba* was never recorded in the stretch of beach between Licata and Marina di Butera, probably due to the strong erosion of the shoreline and the disturbance caused

by the regular presence of stray dogs. No records also along the waterfront of "Federico II di Svevia" (Gela), perhaps for the same causes.

The population of the Gulf of Gela represents about 54% of the whole recorded regional population and almost 10% (9.89%) of the whole national wintering population, on the basis of the last available data (Zenatello et al., 2014). It can be then considered a "site of national importance", hosting more than 1% of the national wintering population.

The second most important area for the wintering of *C. alba* in Sicily is the sandy coast of the Gulf of Catania, as recently reported by one of the author (Galasso et al., 2021), where an average of 24 (23.8) individuals per year and an KAI of 1.6 was recorded (23.8 ind./15 km), representing 24% of the whole regional population and 4.57% of the national population. Most of the birds were observed at the "Playa of Catania" and near the mouths of "Canale Arci" and river "San Leonardo". Despite the mouth of the river Simeto has been considered in the past a "site of national importance" (Baccetti et al., 2002), the species was only observed there once, with 2 individuals in January 2017 (the sites was investigated 24 times in 8 winters). This confirms the degradation of this area, already highlighted by one of the authors (Galasso et al., 2021, 2022), and the drastic decrease in wintering shorebirds in the recent decades, probably due to the

Area	Site	2015	2016	2017	2018	2019	2020	2021	2022
Messina	Beaches from Tindari to Milazzo	0	0	0	0	0	0	0	0
	Beaches of Milazzo	0	0	0	0	0	0	0	0
	Total km of sandy coast: 52 km Total km investigated: 10 km	0	0	0	0	0	0	0	0
Gulf of Catania	Playa of Catania, mouths of Fiume Simeto and Fiume San Leonardo	24	25	25	34	24	22	22	16
	Total km of sandy coast: 20 km Total km investigated: 18 km	24	25	25	34	24	22	22	16
Coast of Syracuse	Marina of Priolo and beaches of Syracuse	1	0	1	0	0	0	0	10
	Beaches of Avola and Noto, Nature Reserve of Vendicari	0	4	0	0	0	Ni	Ni	0
	Beaches of Marzamemi, Portopalo, Costa dell'Ambra and Granelli	Ni	0	3	0	0	0	0	0
	Total km of sandy coast: 20 km Total km investigated: 8 km	1	4	4	0	0	0	0	10
Coast of Ragusa	Mouth of Pantano Longarini, Santa Maria del Focallo and beach of Pozzallo	0	8	0	12	22	30	20	22
	Beaches from Maganuco to Marina di Ragusa e Punta Secca	Ni	Ni	0	0	0	0	0	0
	Beach of Punta Braccetto, Randello, Passo Marinaro and Scoglitti	Ni	0	7	0	0	Ni	Ni	0
	Total km of sandy coast: 40 km Total km investigated: 17 km	0	0	7	12	22	30	20	22
Gulf of Gela	From Licata to Marina di Butera	0	0	0	0	0	0	0	0
	From the mouth of Torrente Rizzuto to mouth of Fiume Gela	25	10	57	6	6	11	5	8
	From the mouth of Fiume Dirillo to Costa Fenicia	31	40	25	39	19	71	10	8
	Total km of sandy coast: 60 km Total km investigated: 40 km	56	60	82	45	25	82	15	16
Coast of Trapani	Alcamo Marina	Ni	Ni	Ni	Ni	12	Ni	8	6
	Litorale Marsala - Petrosino	0	0	Ni	Ni	0	Ni	0	Ni
	Mazara del Vallo (Laguna di Tonnarella)*	7	1	0	0	4	1	0	0
	Beaches of Campobello di Mazara and Triscina	Ni	Ni	Ni	3	21	Ni	Ni	17
	Saline di Trapani*	0	0	0	0	0	2	0	0
	Stagnone di Marsala*	0	0	0	0	0	0	0	0
	Total km of sandy coast: 9 km Total km investigated: 12 km	7	1	0	3	37	3	8	23
Coast of Palermo	Beach of Balestrate	Ni	Ni	Ni	Ni	Ni	0	Ni	0
	Total km of sandy coast: 1 km Total km investigated: 1 km	Ni	Ni	Ni	Ni	Ni	0	Ni	0

Table 1. Investigated sites and related records of *C. alba* in the winters 2015–2022. Ni= not investigated that year. *Please note that the area of “Saline di Trapani e Marsala” and “Mazara del Vallo” were not covered by means of linear transect of beach but investigating a total surface of about 700 hectares by car.

many sources of disturbance and the severe erosion to which the shoreline of the mouth of Simeto River is subjected. Sanderling also regularly winters along some beaches of Ragusa's province with flocks of 12–30 individuals, mainly recorded along the beach between the city of Pozzallo and the mouth of "Pantano Longarini" (Ispica), for which it is already reported as a regular wintering (Galasso et al., 2021b), with an average KAI of 0.9 (14.25 ind./15 km).

In the south-eastern coast of Sicily, in the province of Syracuse, only few records were collected, mainly referring to irregular single individuals or small flocks of 3–4, up to maximum of 6, along the beaches of "Marina di Priolo", ex salt-pans of Syracuse and nature reserve of Vendicari.

In the Trapani's province the most suitable beaches are located in the Gulf of Castellammare, near "Alcamo Marina", where *C. alba* was irregularly recorded with flocks of 6–12 individuals

and along the beach between "Tre Fontane", Triscina and Selinunte with flock of 3–21 individuals; both areas were investigated in only 3 winters.

In the nature reserve "Saline di Trapani and Marsala" the presence of *C. alba* must be currently considered as occasional, with only 1 individual recorded on 6 January 2012 (Zenatello et al., 2014; Surdo, 2016; Surdo, 2018) and another record of 2 individuals on 5 January 2020, during the years of this study (Belardi in www.ornitho.it). The area of "Capo Feto" and "Margi Spanò" (Trapani) was not regularly investigated and despite the species was not recorded, it may have casually been left out of the census, since these beaches can be considered as highly suitable for its wintering. Some sanderlings have been instead irregularly observed in the nearby area of "Laguna di Tonnarella".

Calidris alba was never recorded along the investigated beaches of the province of Messina, despite having been constantly monitored during the years of the study (Torre A., personal

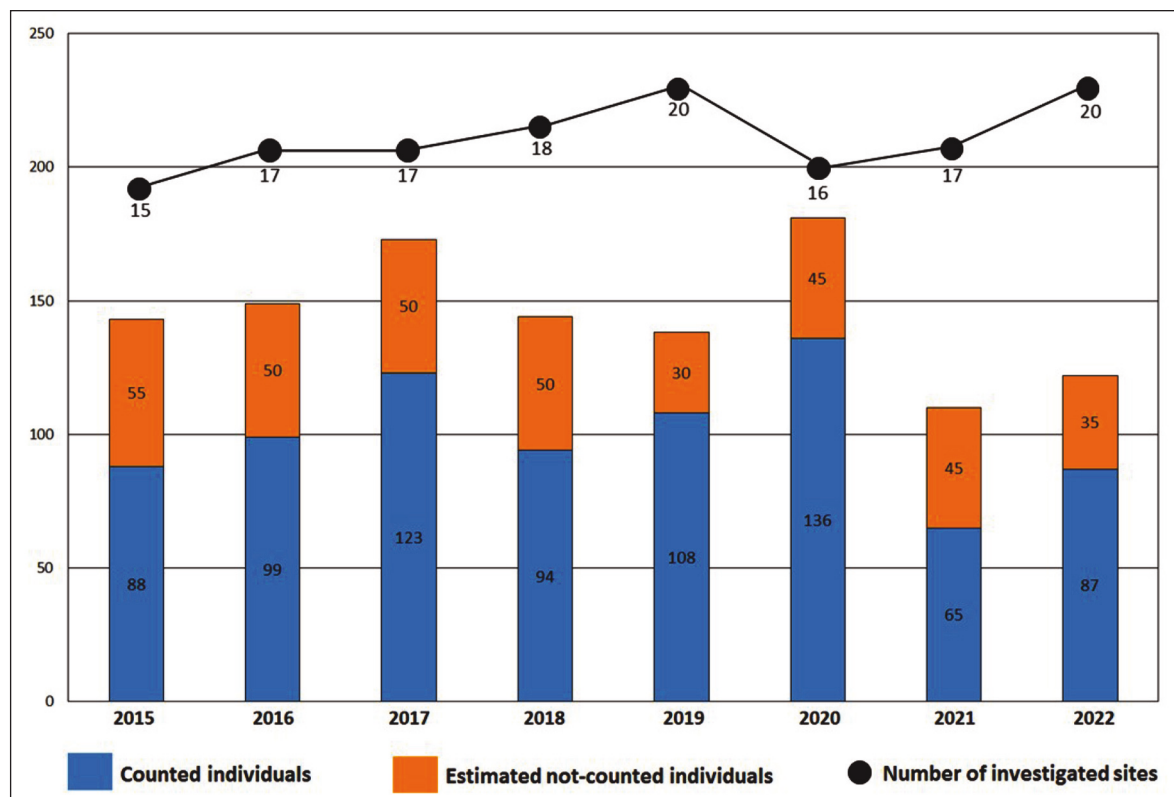


Figure 2. Trend of *C. alba* wintering population in the years 2015–2022: estimates of not counted individuals (in orange) were calculated on the basis of data from the years preceding this study, suitability of not investigated stretches of coast and related distance from investigated sites.

communication), probably due to the structure of the sediment, which is not strictly sandy but often containing a gravelly, albeit very fine, component. The coastline of the province of Agrigento, and specifically the stretches of beaches of “Cipolluzze”, “Cannatello” and between “Porto Empedocle” and “Eraclea Minoa”, including the nature reserve of Torre Salsa, were not investigated despite of their high suitability and presence of few fresh water stream mouths, due to lack of coverage of the area. After a careful analysis of previous data and satellite maps, for this area has been prudently estimated a probable regular presence of 15-25 wintering individuals along about 35 km of beach.

The Province of Palermo was barely investigated (only in the years 2020 and 2022), due to the lack of coverage and the low suitability of its coast, with no records.

Only few recovery data concerning Italian ringed sanderlings are available, related to birds from SW Norway, Sweden and Slovakia (Brichetti

& Fracasso, 2018), and only 2 of them refer to wintering subjects (1 from south-eastern of Sardinia and 1 from south of Calabria), probably due to the low number of individuals wintering in Italy (Spina & Volponi, 2008).

We report a sanderling ringed at the island of Griend (Netherlands) as adult on July 25, 2018 and observed during the period of this study in Alcamo Marina (Trapani) on January 5, 2019 and on January 10, 2021 (Cumbo, personal communication). It represents the third Italian record of a ringed wintering individual of *C. alba*.

CONCLUSIONS

Generally, most of the Sicilian sandy coasts resulted strongly disturbed in all the winters of the study, regularly frequented by stray dogs, quads, motocross, anglers and sometimes subjected to actions of mechanical beach cleaning also during the

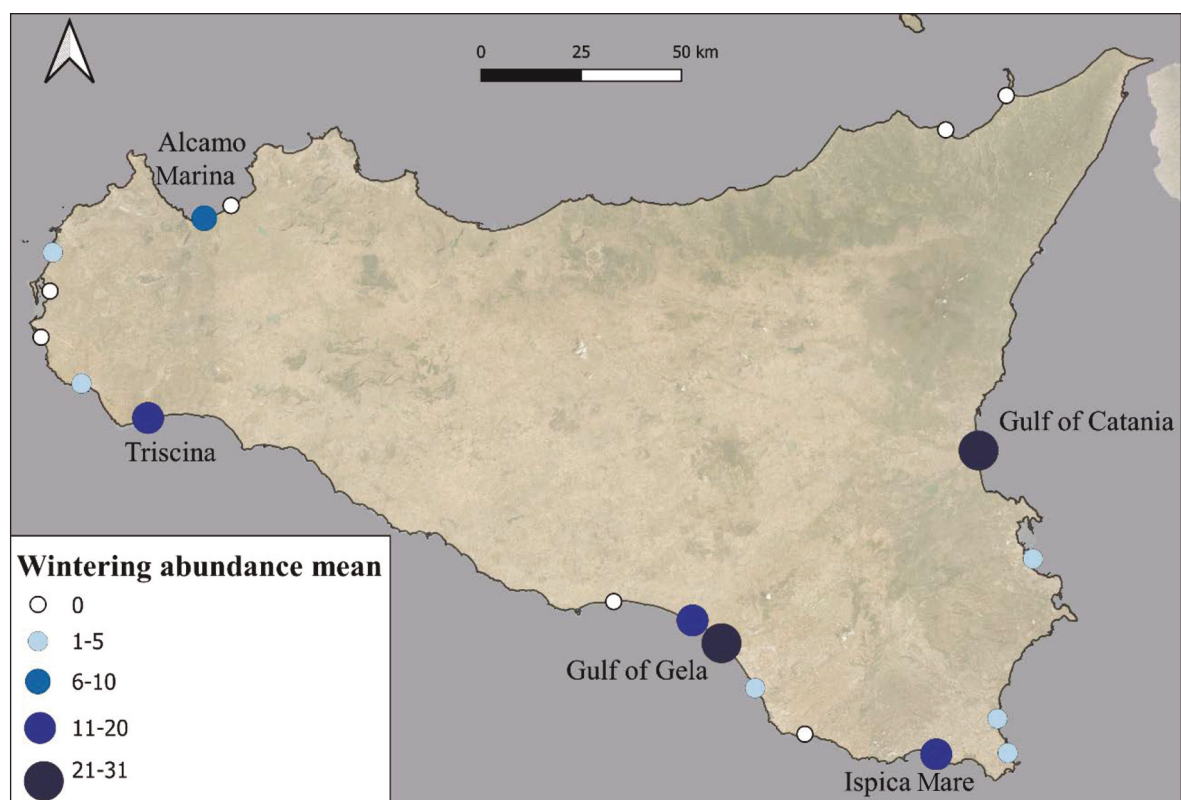


Figure 3. Qualitative-quantitative distribution of wintering *C. alba* along the Sicilian coast. Maximum concentration recorded in the area of the Gulf of Gela at the mouth of the river Dirillo, with a flock of 71 individuals. Other important areas are the Gulf of Catania, the beach of Triscina and Ispica.

winter. The coastline is often deeply anthropized in some stretches of Catania's Gulf, Gela, Ragusa and Palermo, sometimes with illegal buildings just few meters away from the shoreline, which have contributed to its erosion (Lapiana & Sparacio, 2010). All these factors limit the presence of wintering shorebirds along the shoreline, as already reported from one of the author (Galasso et al., 2021), including *C. alba*.

Fishing lines and hooks, left by anglers along the shoreline, represent a further threat for sanderlings and other shorebirds (Battisti et al., 2019) and may lead to traumas, wounds and infection, starvation, impaired mobility and consequent heightened risk of predation until, in the worst of cases, to amputation, choking and eventually to death (Chiapponi et al., 2005; Criddle et al., 2009; Gregory, 2009) as in the case of Fig. 4.

Degradation of fishing lines is very slow, which prolongs their persistence (and dangerousness) in the environment over a long time. Therefore, specific periodic cleaning to remove this neglected anthropogenic litter should be planned at local level from municipalities and local volunteer groups during the winter, at least along sandy beaches (Battisti et al., 2019). In addition, placing rubbish bins near the entrances to beaches, especially if they are heavily frequented by anglers could help mitigate this problem (Galasso et al., 2022).

A recent survey about foraging behavior of *C. alba* suggests as the number of people, type of activity and free dogs can significantly reduce the time spent in feeding, having a significant effect on the distances which sanderlings move and the type of response they have to approaching humans (Thomas et al., 2003). The same evaluations have been made during the period of this study and an average feeding range of about 12–15 km was observed in sanderling flocks in the beaches of Ragusa, Catania and Gela. The observations collected suggest that the impact of humans and their pets on shorebirds foraging, although considerable, could be significantly reduced by implementing simple policies governing the civic fruition of the beaches. First, based on the minimal approach distance experimented on the field and showing 100% of sanderlings responding to humans within 30 meters, people should be encouraged to stay a minimum of 30 meters away from shorebird flocks. Furthermore, leashed dog



Figure 4. A dead sanderling found along the beach of Catania's Gulf, due to a fishing line (photo by P. Galasso).

regulations should be strictly enforced at primary bird foraging sites: despite the fact that in Italy, such leash laws already exist, most of people still let their dogs run free and appropriate controls are very rarely applied on beaches. Lastly, although mechanical vehicles such as motocross and quads are forbidden on Italian beaches, much still needs to be done to enforce such a ban on so many of them.

Despite the bad general conditions of most of Sicilian beaches, the results of this study show how the regional wintering population has been probably underestimated or strongly increased in the past years, currently being more than double that estimated in the years 1996–1999. That highlights Sicily's important role at national level for the wintering of this species, including two sites of national importance, the Gulf of Gela and the Gulf of Catania, which together host 78% of the recorded regional wintering population. It is interesting to note as the most suitable beaches for the wintering of *C. alba*, and especially the ones with the highest densities (Gulf of Gela, Gulf of Catania, Beach of Triscina and Ragusa's beaches), correspond to the same used for the wintering of Kentish Plover *Charadrius alexandrinus*, according to recently published results on the status of this species in Sicily (Galasso et al., 2022). This confirms the importance, the ecological role and the appropriate structures of such beaches for the wintering of shorebirds.

The lack of available published data about recent trends of this species, as well as for many other, both at national and regional level, reflects the current direction of modern ornithological studies towards fields mainly related to genetics, statistics and modelling. Despite the importance of such new interesting and stimulating surveys, data collection on the field and monitoring of wintering populations should not be overlooked, or we risk creating growing data gaps that prevent accurate assessments of the status of populations in the near future.

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REFERENCES

- Baccetti N., Dall'Antonia P., Magagnoli P., Melega L., Serra L., Soldatini C. & Zenatello M. 2002. Risultati dei censimenti degli uccelli acquatici svernanti in Italia: distribuzione, stima e trend delle popolazioni nel 1991–2000. *Biol. Cons. Fauna* 111: 1–240. Istituto Nazionale per la Fauna Selvatica.
- Battisti C., Kroha S., Kozuharova E., De Michelis S., Fanelli G., Poeta G., Pietrelli L. & Cerfolli F., 2019. Fishing lines and fish hooks as neglected marine litter: first data on chemical composition, densities, and biological entrapment from a Mediterranean beach. *Environmental Sciences and Pollution Research*, 26: 1000–1007. <https://doi.org/10.1007/s11356-018-3753-9>.
- BirdLife International, 2021. European Red List of Birds 2021. Luxembourg: Publications office of the European Union, 2022.
- Bibby C.J., Burgess N.D., Hill D.A. & Mustoe S.H., 2000. *Bird Census Techniques*. Second edition. Academic Press, London, UK.
- Brichetti P. & Fracasso G., 2018. *The Birds of Italy*. Vol. 1. Anatidae-Alcidae. Edizioni Belvedere (LT).
- Buckland S. T., Anderson D. R., Burnham K. P., Laake J., 1993. *Distance Sampling: Estimating Abundance of Biological Populations*. Chapman & Hall, London.
- Chandler R., 2009. *Shorebirds of the northern hemisphere*. Christopher Helm, London.
- Chiappone M., Dienes H., Swanson D.W. & Miller S.L., 2005. Impacts of lost fishing gear on coral reef sessile invertebrates in the Florida Keys National Marine Sanctuary. *Biological Conservation*, 121: 221–230.
- Corso A., 1995. I limicoli svernanti nelle zone umide costiere della Sicilia sud-orientale. *Avocetta*, 19: 82.
- Corso A., 1999. I Limicoli svernanti in Sicilia orientale: aggiornamento 1996–1999. *Aves Ichnusae*, 2: 47–64.
- Corso A., 2005. *Avifauna di Sicilia*. L'Epos editore, Palermo, 324 pp.
- Criddle K. R., Amos A. F., Carroll P., Coe J. M., Donohue M. J., Harris J. H., Kim K., MacDonald A., Metcalf K., Rieser A. & Young N. M., 2009. Tackling marine debris in the 21st century. The National Academies Press, Washington, DC.
- Gregory M. R., 2009. Environmental implications of plastic debris in marine settings-entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philosophical Transactions of the Royal Society*, 364: 2013–2025.
- Keller V., Herrando S., Voříšek P., Franch M., Kipson M., Milanesi P., Martí D., Anton M., Klvaňová A., Kalyakin M. V., Bauer H.-G. & Foppen R. P. B., 2020. *European Breeding Bird Atlas 2: Distribution, Abundance and Change*. European Bird Census Council & Lynx Edicions, Barcelona.
- Galasso P., Grimaldi D., Aiello L. & Galasso G., 2021. Wintering Shorebird in sandy coasts of Catania's gulf (Sicily, Italy): 2011–2020. *Rivista Italiana di Ornitologia*, 91: 27–38. <https://doi.org/10.4081/rio.2021.506>.
- Galasso P., Cappuzzello C., Gambino E., Torre G., Galasso G. & Patti N., 2021b. Avifauna of “Sicilian southeast swamp lakes” and surroundings areas (Ragusa and Syracuse, Sicily) with commented records of interest. *Biodiversity Journal*, 12: 441–462. <https://doi.org/10.31396/Biodiv.Jour.2021.12.2.441.462>.
- Galasso P., Spinella G., Zafarana M. A., Barbera A., Cusmano A., Cumbo G., D'Amico D., Grimaldi D., Ientile R., Laspina F., Pepi D., Torre A., Torre G. & Surdo S., 2022. Status, distribution and conservation of Kentish plover *Charadrius alexandrinus* (Aves, Charadriiformes) in Sicily. *Natural History Sciences. Atti Società italiana di Scienze Naturali del Museo civico di Storia naturale di Milano*, 9: 51–62.
- Iapichino C. & Massa B., 1989. *The Birds of Sicily*. British Ornithologists' Union. Check-list n°11, London.

- Lapiana F. & Sparacio I., 2010. Le dune e gli ambienti umidi costieri della Sicilia. Tra passato, presente e futuro. Il Brigantino. Le guide del Brigantino, Palermo, 2.
- Massa B., Ientile R., Aradis A., Surdo S., 2021. One hundred and fifty years of ornithology in Sicily, with an unknown manuscript by Joseph Whitaker. *Biodiversity Journal*, 12: 27–89
<https://doi.org/10.31396/Biodiv.Jour.2021.12.1.27.89>
- SEO/BirdLife. 2012. Atlas de las aves en invierno en España 2007–2010. Ministerio de Agricultura, Alimentación y Medio Ambiente-SEO/BirdLife. Madrid.
- Serra L., Magnani A., Dall’Antonia P. & Baccetti N., 1997. Risultati dei censimenti degli uccelli acquatici svernanti in Italia, 1991–1995. *Biologia e Conservazione della Fauna*, 101. Istituto Nazionale per la Fauna Selvatica.
- Spagnesi M. & Serra L. (a cura di), 2003. Uccelli d’Italia. Quaderni Conservazione Natura, 16. Ministero Ambiente - Istituto Nazionale Fauna Selvatica.
- Spina F. & Volponi S., 2008. Atlante della Migrazione degli Uccelli in Italia. 1. non-Passeriformi. Ministero dell’Ambiente e della Tutela del Territorio e del Mare, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA). Tipografia CSR-Roma, 800 pp..
- Surdo S., 2016. Note sui limicoli svernanti nelle zone umide costiere della Provincia di Trapani. *Il Naturalista siciliano* 40: 33–49.
- Surdo S., 2018. Check-List degli uccelli della R.N.O. “Saline di Trapani e Paceco” con lista commentata dei non Passeriformes. *Il Naturalista siciliano*, 42: 57–109.
- Svennson L., Mullarney K. & Zetterström D., 2012. Uccelli d’Europa, nord Africa e vicino oriente. Ricca editore, 447 pp.
- Thomas K., Kvitek R.G. & Bretz C., 2003. Effects of human activity on the foraging behavior of sanderlings *Calidris alba*. *Biological Conservation*, 109: 67–71.
[https://doi.org/10.1016/S0006-3207\(02\)00137-4](https://doi.org/10.1016/S0006-3207(02)00137-4).
- Tinarelli R., Giannella C. & Melega L. (a cura di), 2010. Lo svernamento degli uccelli acquatici in Emilia-Romagna: 1994–2009. Regione Emilia Romagna & AsOER ONLUS. Tecnograf, Reggio-Emilia, 344 pp.
- Vincent J.P., Gaillard J.M. & Bideau E., 1991. Kilometric index as biological indicator for monitoring forest roe deer populations. *Acta Theriologica*, 36: 315–328.
- Zafarana M.A., 2017. Limicoli costieri (Aves Charadriiformes) nel Golfo di Gela (Sicilia). *Il Naturalista siciliano*, 41: 161–182.
- 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.

