Wintering status of Kentish plover *Anarhynchus alexandrinus* along the Lazio coastline, Italy

Loris Pietrelli*, Massimo Biondi, Sergio Muratore

Abstract - In this paper we examine the distribution and habitat use of wintering Kentish Plover (KP) along the Lazio coastline (299 km long). Data were collected between December and January from 1986 to 2025. The species in Lazio represents about 4.0% of the population wintering in Italy. A total of 50.3% of sightings involve 1-2 isolated individuals, almost always recorded on sandy beaches. Wintering individuals were also observed in association with other migrants such as *Calidris alba* (24.8%) and *Pluvialis squatarola* (13.1%). A decline in wintering numbers was detected: 78 birds at 10 sites during the 2009 winter and 32 winterers in 2022 at 4 sites. Over the years, the Roman littoral has been the most important wintering area for Kentish Plover (70.3% of individuals). A relative uniformity in habitat use was observed; the species typically forages on sandy and muddy substrates. Since the late 1990s, some areas formerly used by the Kentish Plover have been converted into harbor areas. Although the mechanisms underlying some winter behaviors are still unclear, the analysis of the data shows that habitat quality of some areas in certain areas is critical for the survival of this species.

Key words: disturbance, flock size, habitat use, sites transformation.

Riassunto - Svernamento del fratino euroasiatico (*Anarhynchus alexandrinus*) lungo la costa laziale, Italia.

In questo articolo esaminiamo la distribuzione e la selezione dell'habitat del fratino svernante lungo la costa laziale, che si estende per 299 km e comprende 236 km di spiagge sabbiose e 63 km di spiagge rocciose. I dati sono stati raccolti tra dicembre e gennaio, in particolare da dicembre 1986 a gennaio 2025. I fratini svernanti nel Lazio rappresentano circa il 4,0% della popolazione svernante in Italia. Il 50,3% degli avvistamenti riguarda 1-2 individui isolati, quasi sempre avvistati su spiagge sabbiose, mentre il gruppo più numeroso, di 28 individui, è stato osservato nel 1994 in uno stagno salmastro. Sono stati osservati individui svernanti insieme ad altri migratori come *Calidris alba* (24,8%) e *Pluvialis squatarola* (13,1%). A parte la fluttuazione annuale, ci sono chiare indicazioni di un declino nei numeri svernanti: 78 individui osservati durante l'inverno 2009 in 10 siti e 32 svernanti nel 2022 in 4 siti. Il litorale romano può essere considerato, nel corso degli anni, l'area di svernamento più rilevante per il fratino (70,3% degli individui). Durante il lungo monitoraggio invernale della specie si può osservare una relativa uniformità nell'uso dell'habitat, che utilizza per il foraggiamento i substrati sabbiosi e fangosi. Dalla fine degli anni '90 alcune aree visitate dal fratino sono state convertite in aree portuali. Sebbene i meccanismi che determinano alcuni comportamenti invernali non siano molto chiari, l'analisi dei dati mostra che la qualità dell'habitat di alcune aree è anch'essa critica per la sopravvivenza di questa specie.

Parole chiave: dimensione stormi, disturbo, fratino, svernamento, trasformazione habitat.

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INTRODUCTION

The winter period represents the longest phase of the annual cycle for birds; nevertheless, it remains one of the least studied stages of bird ecology. For example, birds are rarely territorial in winter, therefore they move frequently and often occupy less accessible or poorly surveyed locations. In contrast, the breeding season is usually considered the key-period for improving the knowledge regarding the population dynamics of the birds. During the non-breeding season, the habitat use focuses primarily on foraging opportunities and safety from predators. However, habitat quality also plays a crucial role, particularly in terms of disturbance levels at foraging and roosting sites, which may directly affect individual fitness and survival probabilities (Piersma *et al*., 2016; Gibson *et al*., 2018).

The winter ecology of Kentish plover includes a broad range of habitat requirements; the species typically exploits sandy beaches, intertidal mud- and sandflats, saltpans and salinas, brackish ponds and seasonal wetlands as well as cultivated areas adjacent to wetlands (Cramp & Simmons 1983). This ecological flexibility allows the species to persist in dynamic coastal environments but also exposes it to multiple anthropogenic pressures.

In 2020 the population of Kentish Plover wintering in Europe_28 was estimated at 7,400-13,500 individuals and, according to the IUCN Red list (Birdlife International, 2025), the trend is currently decreasing. This decline can be considered as part of a broader negative trend across the species' entire range (Birdlife International, 2025). Habitat loss, disturbance, and increased predation pressure are widely recognized as key drivers of this negative trend.

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In Italy, wintering population estimates have shown a marked decline over recent decades. Number decreased from 2,952 individuals at 61 different sites for the years 1991-1995 (Serra *et al*., 1997); 2402 individuals in 79 different sites for 1996-2000 (Baccetti *et al*., 2002); 2000 individuals in 91 different sites for 2001-2005; 1522 individuals in 83 sites for 2006-2010 (Zenatello *et al*., 2014), and only 525 individuals in 104 sites for 2018 (Zenatello *et al*., 2018). It is important to underline that these data may be underestimated as they mainly concern large wintering sites and rarely account for smaller sites where single individuals or small flocks can be observed.

The highest numbers for the years 2009-2010 were reported for Sardinia with 1387 individuals, Veneto with 247, Apulia with 216-719 and Sicily with 200-400 (Biondi & Pietrelli, 2011). According to the EURING Migration Atlas, Central European breeders migrate mainly towards SW Europe and the western Mediterranean while birds breeding in South-Central Europe, including Italy, are largely short-distance migrants (migrationatlas.org/node/1709).

Currently in Lazio region the Kentish Plover is classified as a migratory, nesting, wintering and partially sedentary species (Brunelli *et al*, 2019). Historical accounts already emphasized its regular presence along the coast, Alexander (1927) wrote about the species: "Resident, breeding in fair numbers along the coast. Numbers appear on migration, on 8 Oct. 1911 (…..) was estimated that there were a thousand in a flock. Few remain through the winter…". Despite this long-standing presence, detailed information on winter distribution and long-term trends in Lazio has remained scarce.

Sandy beaches are mainly appreciated for their recreational opportunities rather than for their ecological functions and properties. However, these coastal habitats may represent important areas for resident and migrant plovers. Consequently, intensive development of coastal habitats and increasing recreational activities during winter (e.g. kitesurfing, off-road vehicles and beach maintenance operations) can be considered major factors in the species' decline in many areas.

The present study aims to use data collected over more than 35 years of systematic monitoring to illustrate temporal trends, spatial distribution, habitat use, and potential drivers of change in the wintering population of the Kentish Plover along the Lazio coastline.

MATERIAL AND METHODS

Wintering Kentish Plover were surveyed between December 1986 and January 2025 along the Lazio coastline which extends for 299 km and includes both sandy (236 km) and rocky (63 km) shorelines. Along the coast several notable areas can be identified: an extensive (3.1 km) inaccessible dune system (Castelporziano Presidential Estate), a military service zone (Furbara 1 km long), a large (4.2 km, from the Fiora River Mouth to Montalto energy plant) privately owned inaccessible beach (La Rovere farm), an important sandy saltmarsh (Circeo National Park) and the decommissioned saltpans of Tarquinia. The climate of Lazio is predominantly Mediterranean along the coasts, in the thirty-year period (1991-2020) the average temperatures in January were: T_{max}= 13.3°C and T_{min}=3.6°C (ENAV weather station 41°47′53.66″N 12°14′22.36″E).

Searches were conducted by monitoring coastal beaches and salt ponds from December to January; all Kentish Plovers observed on the coast during this period were classified as wintering individuals regardless of flock size or behaviour.

For analytical purposes, the coastline was divides into three main sectors as shown in Figure 1: Northern Lazio (from Tarquinia saltpan to the Natural Macchiatonda Nature Reserve), Central Lazio (around the mouth of the Tiber River, characterized by a variety of habitats such as industrial areas and beach resorts, and including the Castelporziano Presidential Estate and finally Southern Lazio coast (from Sabaudia to the Garigliano River mouth including Circeo National Park). This subdivision reflects both geographical continuity and differences in habitat composition, land use, and, overall, levels of anthropogenic disturbance.

RESULTS AND DISCUSSION

Distribution and long-term trends

Kentish Plover individuals wintering in Lazio represent about 4.0% of the Italian wintering population (Brichetti & Fracasso, 2018). Figure 2 shows the numbers of individuals and wintering sites. Apart from annual fluctuations there is clear evidence of a decline in wintering numbers: 58 birds observed at 18 sites during the 1995 winter, 78 individuals at 10 sites in 2009; and 32-34 winterers in at 4-5 sites during 2022-25.

Regarding territorial distribution, the central sector (Roma littoral) can be considered the most important wintering area for the species hosting 70.3% of the total wintering regional population with the remaining

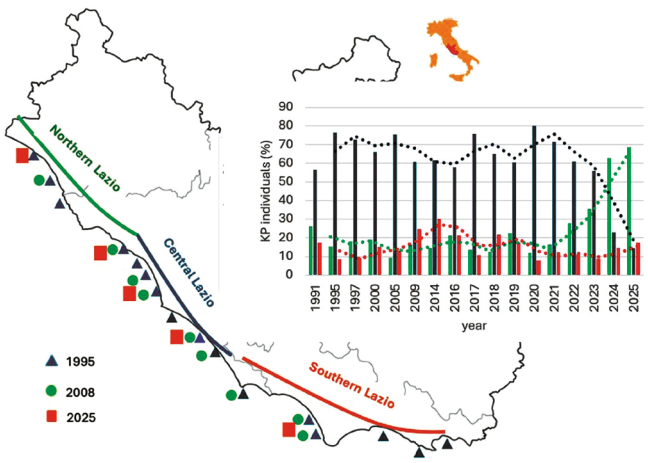

Fig. 1 - Schematic representation of the winter distribution of the Kentish plover over the years along the Lazio coastline. The histogram (1a) represents the variation (%) in individuals over the years along the 3 sectors of the coastline. / Rappresentazione schematica della distribuzione invernale del fratino euroasiatico nel corso degli anni lungo il litorale laziale. L'istogramma (1a) illustra la variazione (%) del numero di esemplari nel corso degli anni lungo i tre settori del litorale.

individuals in the northern (16.2%) and Southern sectors (13.4%). In Figure 1 the schematic representation of the winter distribution of the Kentish plover over the years is shown. Although the species winters consistently at some sites (e.g. Circeo National Park) over the years there has been a gradual abandonment of several sites in the central sector of the coast (Fig. 1a) (e.g. Maccarese, with 24 individuals in 2018 and only 7 individuals during the 2024/25 winter season) and an increase in individuals (not only wintering) at northern sites (e.g. Montalto Marina, none until 2018 and 13 in 2024).

Only four wintering sites have full protection status: Circeo National Park, the Presidential Park of Castelporziano, Tarquinia saltpans, and the La Rovere property (Montalto marina) but this has not produced substantial differences in wintering occupancy (c^2=1.8, P=0.25).

During the 1990s the most important wintering sites were the Tarquinia saltplan hosting around 30 % of winterers and Circeo N. Park, confirming their importance for waders and for Kentish Plover in particular (Biondi *et al*., 1999). Beginning in the early 2000s, the species gradually abandoned the salt pans, partially in winter and completely during the breeding season, most likely due to the strong increment of predators following the cessation of salt production in 1998.

Recovery/observation of ringed birds suggest that some wintering individuals move from nearby Toscana (Orbetello) or the Adriatic coasts (Molise) (Biondi & Pietrelli, 2021), essentially not far from the breeding sites confirming the connection between the Italian coasts. On the contrary, a female ringed during the breeding season in Kursuntsi (Odessa, Ukraine) was observed in the winter 2015-2016 along the Roman littoral (over 1,650 km away) and remained together with six other individuals until late March, when it joined a flock of 20 Kentish Plovers and eight Sandpipers. The same female was again observed at Maccarese beach in November 2016, departing in April 2017 (Biondi *et al*., 2016); considering the daily movements, its wintering range extended roughly 20-30 km large. According to these observations the central Italian coasts may occasionally be visited in winter by easterly breeders, as previously reported (migrationatlas.org/node/1709).

Kentish plovers often were observed alone (53.2%), but wintering individuals also joined other coastal migrants such as *Calidris alba* (24.8%), *Pluvialis squatarola* (13.1%) *Calidris alpina* (5.0%) *Pluvialis apricaria* (2.1%) and *Charadrius dubius* (1.9%).

No significance differences (c^2=1.6, P=0.25) were found between sexes among winterers; the average sex-ratio (MM/FF) was 0.66 (min 0.45 - max 0.69) indicating a slightly predominance of males.

Flock size

The number of plovers at wintering sites varies and may be proportional to migration distance with smaller flocks more likely to occur at the edges of the non-breeding range or linked to reproductive success (Nol, 2019). Figure 3 shows the frequency distribution of flock sizes: 50% of sightings involve 1-2 isolated individuals, almost always on sandy beaches. Following ringed individuals or those with identifiable morphological traits (e.g. crooked or missing limb), movements (often of single individuals) along the coastline extend to a maximum of 50 kilometers. For example, some individuals ringed in nearby Tuscany region wintered between the coasts of Lazio and Tuscany.

The largest flock, 28 individuals, was recorded in December 1994 in the ponds of the Circeo National Park; such a large flock has not been observed again along the Lazio coasts. However, flocks of 22-24 individuals were regularly observed at Maccarese beach during the 2017/2019 winters.

Habitat use and overlapping with the breeding areas

Wintering habitats provide food resources and low predation risk; constraints arise mainly from disturbance

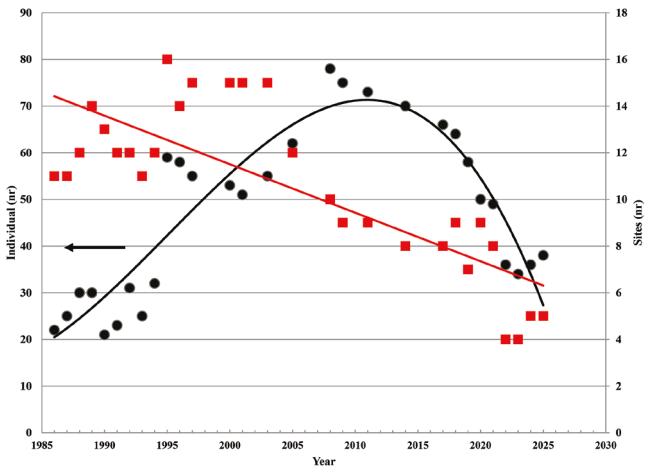

Fig. 2 - Number of wintering individuals and sites (r=0,7884, n=30, p<0.05). / Numero di individui svernanti e di siti (r = 0,7884, n = 30, p < 0,05).

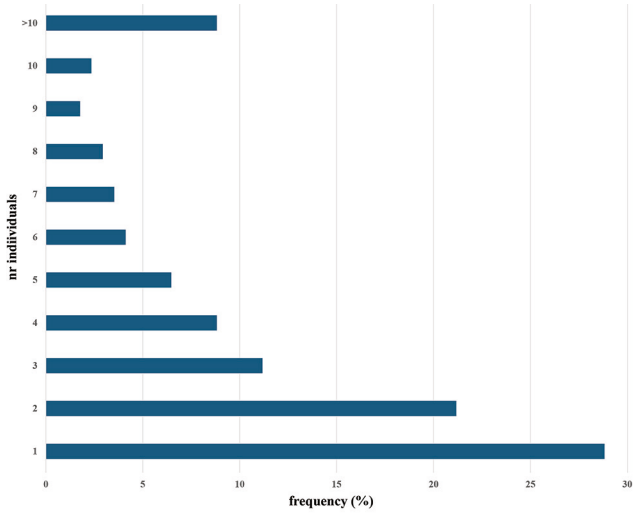

Fig. 3 - Flocks dimension and frequency of observation. / Dimensione degli stormi e frequenza di osservazione.

or habitat loss due to transformation. For example, in the 1990s, an abandoned shipyard where a small pond had been created was frequented in winter by Kentish plovers and served as a breeding site for Black-winged Stilts and Little Ringed Plovers (Pietrelli *et al*., 1993). The resumption of harbour development in Civitavecchia led to the loss of these semi-natural man-made environments. Similarly, in 1998 construction began on the "Tourist port of Rome" (41°46'16" N 12°46'13" E) transforming an area of over 200,000 m^2, once used for breeding by Kentish Plover and Little Ringed Plover, into port infrastructure. The increase in beach facilities along the Lazio coast (particularly in the central part) since the early 2000s as well as strong coastal erosion along some beaches of the Lazio coastline, has altered the distribution of wintering (and nesting) individuals.

During the long monitoring period of wintering KP, a clear uniformity in habitat use emerged: sandy beaches (Figure 4), river mouths, saltpans and brackish ponds behind the dunes (Circeo National Park). The species forages predominantly on sandy and muddy substrates rich in invertebrates (Cramp & Simmons, 1983). Roosting flocks (10-24 individuals) was constantly observed at Maccarese, an area with numerous beach structures; their presence may reduce predation risk from predators (mammalian) (Nol, 2019). The nocturnal roosts identified were located among beach cabins and within a drainage ditch, approximately 1.5 km from the daytime roost.

Wintering areas also have additional ecological significance for the species, as some sites are used for earliest nesting (first decade of March). Thus, along the central part of the Lazio coast there is an overlap between wintering and breeding sites. In contrast, in the southern region (Circeo National Park), the species winters regularly but breeds only rarely (Pietrelli & Biondi, 2012). Given the small flock sizes, no evidence of intra- or interspecific territoriality was observed, suggesting no food limitation (Nol, 2019).

Disturbance and area transformation

Human disturbance can be considered a form of environmental change. In general, anthropogenic disturbance represents one of the most significant threats to wintering Kentish Plovers, particularly in heavily modified coastal landscapes. A wide range of human activities, including recreational use of beaches, uncontrolled dogs and cats, infrastructure development, vehicle traffic, coastal engineering works, and routine beach maintenance, can substantially reduce habitat suitability during the non-breeding season. Along the Lazio coast, disturbing human activities are also widespread, year-round, near river estuaries, as many Municipalities dedicate these areas to recreational use, such as windsurfing, kitesurfing, motocross, etc. The maintenance of a network of estuaries is particularly important for many species and populations of migratory waterfowl using them for overwintering and migration (Davidson, 1991). Such activities often lead to repeated flushing events, forcing birds to interrupt foraging and roosting, thereby increasing energetic expenditure and reducing overall foraging efficiency. In addition to direct disturbance, large-scale habitat transformation has played a major role in shaping wintering distribution patterns. Since the late 1990s, several key coastal areas along the Lazio shoreline have been converted into port facilities, industrial zones, or urbanized waterfronts (e.g. Tiber River mouth transformed in the Touristic port of Rome, the realization of a semi-industrial zone north of Civitavecchia and Fiumicino and new urbanized areas north of the Lido di Tarquinia). These developments have resulted in the permanent loss or severe degradation



Fig. 4 - A little flocks wintering along the Lazio coastline. / Piccoli stormi che svernano lungo la costa laziale.

of natural and semi-natural habitats formerly used by Kentish Plovers for both wintering and breeding. Coastal stabilization measures (e.g. creation of barriers with concrete blocks north of Fiumicino) have further reduced habitat heterogeneity, limiting the availability of suitable foraging substrates.

The effects of disturbance and habitat loss are often cumulative and synergistic. Chronic, low-intensity disturbance (e.g. along the Maccarese beach which is constantly frequented for walks with dogs which are often left free) may be particularly detrimental during winter, when energetic budgets are already constrained and opportunities to compensate for lost foraging time are limited. Over time, such pressures may lead to site abandonment, reduced site fidelity, and increased reliance on suboptimal habitats. Consequently, the combined impact of habitat transformation and persistent human disturbance is likely to be a key factor contributing to the long-term decline in wintering Kentish Plover numbers observed along the Lazio coastline.

Collecting such information is essential for conservation to avoid unnecessary conflict between human activities and wildlife. In particular: 1) to understand the dynamics of each site to develop effective actions that can be taken to reduce threats; 2) working with local authorities to protect sites (e.g. employing best management practices) and, 3) increase the public interest in reducing impact on shorebird.

CONCLUSIONS

Although in small numbers, the Kentish plover regularly winters along the Lazio coastline and, given the scarcity of wetlands, sandy beaches represent a crucial habitat throughout the year, not only during the breeding season.

Based on identifiable individuals (ringed or with morphological traits) KP generally exhibit site fidelity across years, and considering the sex-ratio values no clear evidence of sexual segregation was detected during winter.

Long-term data strongly suggest that habitat loss and anthropogenic disturbance (in wintering and breeding seasons) are the main factors affecting the presence of the species along the Lazio coastline. Even a single habitat modification can be critical, although the species may find alternative sites. Direct anthropogenic disturbance on beaches also seriously affects both wintering and breeding season. Based on over 35 years of data, several conservation actions can be proposed for KP (and Plovers in general) populations, ranging from habitat conservation and maintenance measures aimed at reducing and controlling the disturbance factors.

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