Notes on a new breeding site for the endangered Kentish Plover (*Charadrius alexandrinus*) in a touristic beach of Friuli-Venezia Giulia, Italy

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Abstract - We describe a new breeding site for the endangered Kentish Plover (*Charadrius alexandrinus*), the first recorded in recent years along the coastline of Friuli-Venezia Giulia (NE Italy), and report the impact of the first protective measures implemented at this site. Throughout the breeding season, we recorded a total of 8 nests, 10 eggs, and 6 fledglings. These results show that simple measures have a highly positive effect on nesting attempts and on the overall reproductive success, and they highlight the possible coexistence of conservation measures and tourism.

Keywords: Kentish Plover, nesting site, breeding, protective actions, tourism-conservation coexistence, Friuli-Venezia Giulia.

Riassunto - Note su un nuovo sito riproduttivo per il fratino (*Charadrius alexandrinus*), specie in pericolo di estinzione, in una spiaggia turistica del Friuli-Venezia Giulia, Italia.

Descriviamo un nuovo sito riproduttivo per il fratino (*Charadrius alexandrinus*), il primo registrato negli ultimi anni lungo la costa del Friuli-Venezia Giulia (NE Italia) e riportiamo l'impatto delle prime misure di protezione implementate in questo sito. Durante la stagione riproduttiva abbiamo registrato un totale di 8 nidi, 10 uova, e 6 pulcini involati. Questi risultati dimostrano che semplici misure di conservazione hanno un effetto altamente positivo sui tentativi di nidificazione e sul successo riproduttivo complessivo, ed evidenziano la possibile coesistenza di misure di conservazione ed il turismo.

Parole chiave: fratino, siti di nidificazione, riproduzione, misure di protezione, coesistenza turismo-conservazione, Friuli-Venezia Giulia.

The Kentish Plover (*Charadrius alexandrinus*) is a small ground-nesting shorebird with a vast geographical distribution. The global population of the Kentish Plover is considered in rapid numerical decline, with a drop estimated up to 50% every 10 years in Italy (IUCN, 2023). For this, the species is listed in the Annex I of the Birds Directive (2009/147/EC), and in the International Union for Conservation of Nature (IUCN) Red List. The worldwide numerical decrease recorded is mostly due to the wide impacts of anthropogenic activity at the sites suitable for nesting. In fact, the use of sandy beaches as nesting sites has put the species in competition with humans, which extensively use coastline areas for recreation and tourism. The main Anthropogenic criticalities for the Kentish Plover's populations are: the mechanical beach cleaning, resulting in the removal of dune vegetation and beached material, but also in the direct destruction of nests and eggs; the disturbance from continuous passage of beach users near nests; dog disturbance and nest predation (Barbera *et al.*, 2019; Rondinini *et al.*, 2022).

In the Italian northeastern region of Friuli-Venezia Giulia, the coastline is one of the major tourist attractions; the small town of Lignano Sabbiadoro (45.7016° N; 13.1593° E) alone hosted a total of 3,495,091 tourists in the 2019 summer (Passon & Cappello, 2020). Inevitably, the negative impact on the biodiversity and the dune ecosystem due to the anthropization of the coastline for tourism has also impacted Kentish Plovers, which virtually disappeared as nesting birds from the whole region (Guzzon *et al.*, 2021). Despite these adverse conditions, in recent years, the species has been observed regularly during the breeding season in a small portion of beach in Lignano Sabbiadoro. In May 2020, following an unusually quiet spring due to COVID restrictions, a pair was present and, after an unsuccessful nesting attempt in June, the pair completed nesting at the end of July with two chicks (Matteo Toller and Giosuè Cuccurullo, unpublished data). This was the first nesting attempt ever recorded in Lignano Sabbiadoro.

Following this successful reproductive event, a group of regional volunteer associations (i.e. LIPU FVG; Tringa FVG; Astore FVG; WWF FVG; Legambiente FVG; Terra è; LAC FVG; Comitato nazionale tutela del Fratino; Foce del Tagliamento O.D.V.) obtained the Region's biodiversity office's and the local administrations' permits to create the "Spiaggia del Fratino" ('Kentish Plover Beach'), a fenced area of about 2.5 hectares managed by the Municipality of Lignano Sabbiadoro (Western sector) and the Municipality of Marano Lagunare (Eastern sector) to protect the Kentish Plovers's nests. The area was

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chosen according to the known birds preference and it is the only unexploited stripe of sand in Lignano Sabbiadoro (Fig. 1), free from bathing facilities and with no periodical heavy vehicles work carried out. Only occasionally, the area is affected by sand mining for the nourishment of the surrounding beaches. The area is usually used by dog-owners and tourists for walking. The site, neighbouring the Special Area of Conservation and Site of Conservation Interest named "Laguna di Marano e Grado" (ZSC IT3320037), is made of washed up algae and sedimentary deposits, now hosting sparse *psammophilous* plants, such as *Ammophila arenaria* and *Cakile maritima.* Of particular interest in the site are the beached plant material and two temporary salt pools, which proved to be fundamental in supplying food to a number of bird species.

The data used for the following study was obtained by volunteers working on the first year of creation of a 'Kentish Plover Beach' in Friuli-Venezia Giulia. On the 1st of April 2022 volunteers positioned the wooden poles and synthetic red netting (with 20 cm mesh) used to fence the aforementioned area. Initially, the fenced area was divided in two smaller parts, but after the first month, on the 3rd of May, only one single larger area was fenced (as per Fig. 1). Information boards were installed to explain the aim of the restrictive measures to beach users and contact details were made available for those that were interested in the project. Daily and biweekly observations were carried out to check on the net maintenance and the presence of birds, and to record behavioural data, respectively. All observations were carried out by Giosué Cuccurullo (GC), Matteo Toller, and Paolo Grion from 1st April to the 31st of July 2022 with a telescope Konus (20-60x100) and Zeiss binoculars (8x42).

Unfortunately, at this time we were unable to ring the birds, making individuals' identification impossible. For this, here we present only data on nest numbers, the num-

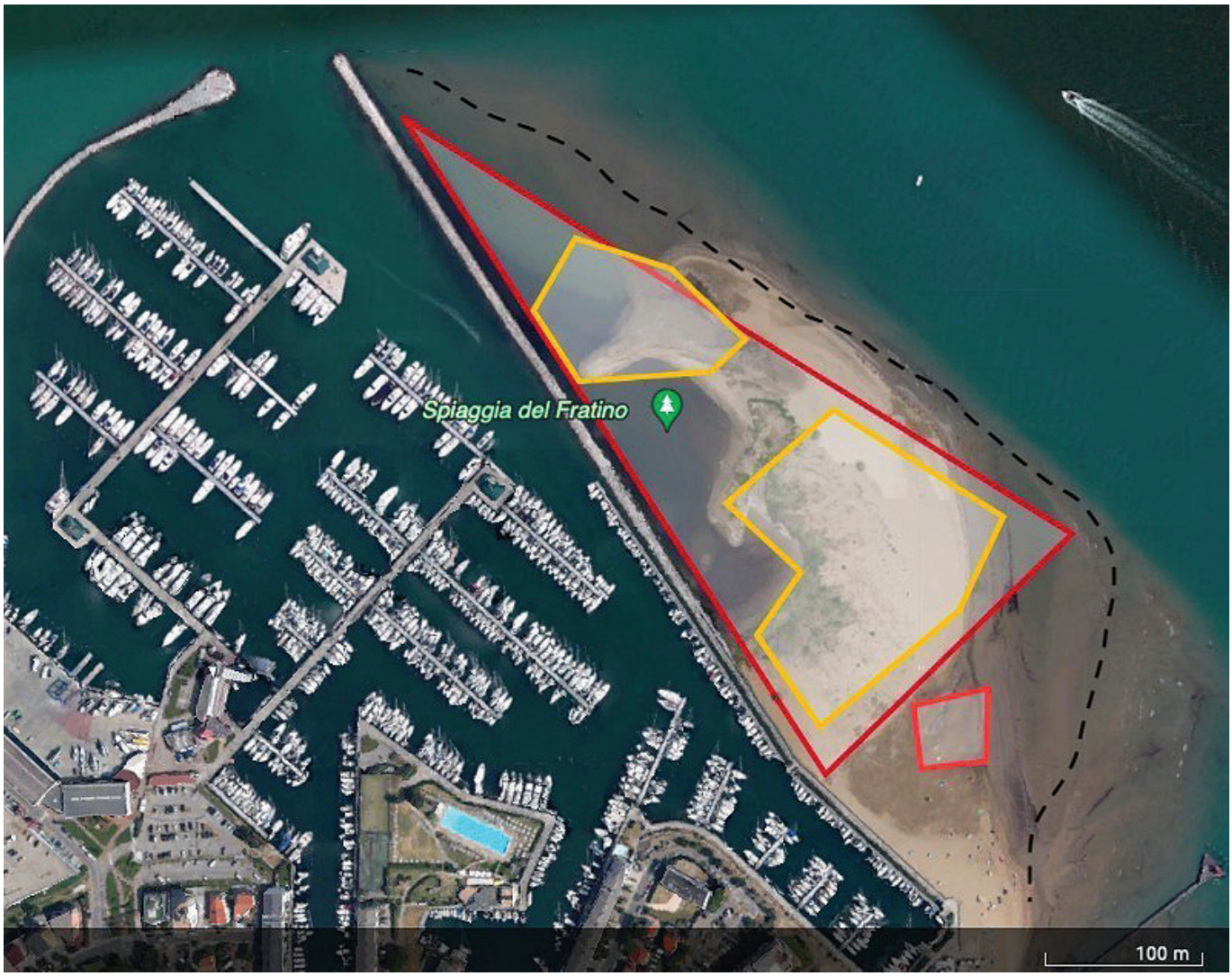

Fig. 1 - Aerial view of the breeding site in Lignano Sabbiadoro. In yellow the two areas fenced at the beginning; in red the final area. The smaller red net was positioned temporally to protect a nest that was found outside the main fenced area. Note that the fence left an open passage (dashed line) for beach users along the coast line. / Veduta aerea del sito di riproduzione di Lignano Sabbiadoro. In giallo le due aree recintate all'inizio della stagione; in rosso l'area finale. La rete rossa più piccola è stata posizionata temporaneamente, per proteggere un nido trovato al di fuori dell'area principale recintata. Si noti che la recinzione ha lasciato un passaggio aperto (linea tratteggiata) per gli utenti della spiaggia lungo la linea di costa.

ber of eggs laid per nest (when known), and the number of chicks and fledglings. Chicks and fledglings could be told apart and not confused or double counted in the final fledglings' count used for breeding success estimates thanks to their different timing of hatching, body size, and number of adults present with them. Moreover, in cases of doubtful identification of pairs and chicks, or uncertainty in the fate of the chicks, we used a conservative method, assuming that chicks had not fledged and were lost.

The site was first occupied in March, prior the positioning of the fence. By the 1st of April, 2 pairs were present, one of which had already attempted to nest unsuccessfully (the nest was probably washed away during high tide; GC personal observation). The last pair arrived on the 12th of June and nested soon after; the female was a ringed individual marked in 2018 in Bibione, Veneto Region, ca. 10 kilometers SW from the site (Lucio Panzarin, pers. comm.). Their nest was found on the 25th of June. By the end of the breeding season (end of July 2022), a minimum of six pairs had been recorded at the site and eight nests were detected. Of these, three were lost due to storm surge or high tides. In one of the five remaining nests it was not possible to count the number of eggs laid, whereas the other four had between 1-3 eggs each (mean clutch size = 2.25). Of these, at least six eggs hatched, and one chick hatched from the one nest with unknown number of eggs, for a total of seven chicks. Only one of the seven chicks was lost (possibly due to predation), the other six fledged and were seen again for most of the season.

We calculated four different measures of reproductive success (see Tab. 1): mean clutch size (number of eggs/number of nests; reported above); egg success (number of fledglings/number of eggs); nest success (number of nests that produced young/number of nests with eggs); fledgling success (number of fledglings/number of successful clutches) (Nice, 1957; Ricklefs, 1969; Skutch, 1985). Due to the difficulty of recognizing unringed adults at this time, we could not calculate the annual reproductive success per female (Murray, 2000). Results show that egg success at this site was 0.6 (6 fledglings/10 eggs), and nest success was 0.62 (5 successful nests/8 nests with eggs).

Finally, the number of fledglings produced (6) per successful clutch (5) is 1.2. These measures of reproductive success indicate that 60% of eggs and 62% percent of clutches produced fledglings. These are surprisingly high success rates for a Kentish Plover population (see for reference Norte & Ramos, 2004; Colwell *et al.*, 2005; Bouakkaz *et al.* 2017).

Shorebirds incur high rate of clutch loss due to predation, trampling, or weather-related events, which are the main causes of breeding failure in many ground nesting species as well as for the Kentish Plover. In our study area, the implementation of a simple protective measure allowed the settling of at least five pairs that were able to reproduce successfully. With this experience, not only have we given to this species at risk of extinction the opportunity to exploit a new breeding ground, but we have also demonstrated the possible coexistence of protective actions and tourists' enjoyment in a stretch of coastline of a highly touristic town. Our assiduous field-presence and the careful dissemination of the project (through press, social media, posters) further allowed the two realities to not only be compatible, but also functional to one another: tourists took at heart the presence of the birds and followed the guidelines carefully. Dog owners continued to frequent the open part of the beach, but, by staying outside the nets, their dogs created no danger to the Kentish Plovers; on the contrary, dogs likely acted as deterrents for other predators (e.g. seagulls).

The only unexpected problem we encountered was the presence of a cat *Felis catus*, which we believe killed two adult individuals (found dead on site; GC personal observation). It is likely that this presence created other problems besides direct predation, acting as a disturbance and an element of alert for the brooding adults and the chicks themselves. It should also be remembered that the area has little and sparse vegetation, without dunes, and therefore does not provide ideal shelter opportunities for the chicks after hatching. The management of predation by domestic cats, as well as the construction of a dune ridge, are the two main points on which we believe we can act in the future to ensure a better recovery of the Kentish Plover population in this area. In particular, dune resto-

Tab. 1 - Summary of the breeding success at the site in Lignano Sabbiadoro for the 2022 season. Number of: broods; successful broods; eggs; chicks; fledglings are reported as counts. For the single nest that we could not approach for egg count, we added one egg to the total egg count, as per the one chick hatched. We report the mean clutch size (a nest with no egg count is not considered for this estimate); egg success; nest success; and calculated fledgling success. / Sintesi del successo riproduttivo nel sito di Lignano Sabbiadoro per la stagione 2022. Il numero di: covate; covate portate a buon fine; uova; pulcini; piccoli sono riportati come conteggi. Abbiamo aggiunto un uovo al conteggio totale delle uova per il nido che non abbiamo potuto avvicinare per il conteggio diretto, in modo tale da tenere conto del pulcino lì schiuso. Riportiamo la dimensione media della frizione (un nido senza conteggio delle uova non è considerato per questa stima), il successo delle uova, il successo del nido e il successo calcolato dei pulcini.

Broods number	No. of successful broods	No. of eggs	No. of chicks	No. of fledglings	Mean clutch size	Egg success	Nest success	Fledgling success
8	5	10	7	6	2.25	0.6	0.62	1.2

ration, with the creation of one or more vegetated dune belts, would also guarantee protection from storm surges and enhance biodiversity. This may, in turn, encourage nesting of other species, such as the Little Tern (*Sternula albifrons*), which currently breeds on a nearby island, and whose presence has been shown to guarantee greater reproductive success in shorebirds (Scarton *et al.*, 2013).

To conclude, our study provides the first data on a new Kentish Plovers' breeding site in Friuli-Venezia Giulia (NE Italy), a region in which the species had virtually disappeared as nesting bird. A simple protective measure, such as the fencing of ca. 2.5 hectares of beach, has allowed this species to reproduce successfully, reaching a remarkable 60% of egg- and 62% of nest-success rates. We can therefore conclude that the experience of the 'Kentish Plover Beach' in Lignano Sabbiadoro was an all-round success, as the public and administrations were also very interested and involved in the project. We believe that the cooperation between associations and administrations, the correct communication towards beach users, the choice of nets (instead of e.g. smaller nest cages) as delimitation tool, and the presence and supervision of volunteers were all fundamental for this first significant and representative success.

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