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The potential role of the yellow-legged gull, *Larus michahellis* as a seed disperser of an invasive plant species in the Tuscan Archipelago

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Abstract - Gulls have a significant role as seed dispersers in coastal habitats and as drivers of plant movements within and between islands. We report the observed interaction between the Yellow-legged gull (*Larus michahellis*) and species of cacti of the genus *Opuntia* in Capraia Island, in the Tuscan Archipelago.

Key words: seed dispersers, invasive alien species, *Opuntia* spp., *Larus michahellis*.

Riassunto - I gabbiani svolgono un ruolo significativo nei processi di dispersione dei semi negli ecosistemi costieri e favoriscono il movimento delle piante all'interno e tra le isole. In questo contributo riportiamo l'interazione osservata tra il gabbiano reale zampegialle (*Larus michahellis*) e specie di cactus del genere *Opuntia* sull'isola di Capraia, nell'Arcipelago Toscano.

Parole chiave: dispersione dei semi, specie aliene invasive, *Opuntia* spp., *Larus michahellis*.

Capraia Island is the third largest island of the Tuscan Archipelago and it is part of the Arcipelago Toscano National Park. As the majority of Mediterranean islands, Capraia has experienced, over the last few decades, important socio-economic transformations that also affected its vegetation and enhanced the risk of alien plant and animal species invasions (Foggi *et al.* 2011).

One of the most concerning invasive plant species, *Opuntia stricta* (Haw.) Haw., has been reported as present on the island since 1839 (Moris and De Notaris, 1839). *Opuntia stricta* is currently the most widespread alien plant on Capraia, covering over 70 hectares, approximately 3.6% of the island's surface. It occurs at higher densities near human settlements, although it is also found outside the settlements, including in areas already inside the National Park (Misuri *et al.* 2024). In addition to *O. stricta*, two other species of the genus *Opuntia* have been introduced to Capraia: *O. ficus-indica* (L.) Mill. and *O. monacantha* (Willd.) Haw. (Lazzaro *et al.* 2014). However, their abundancy is considerably more limited compared to *O. stricta*, which dominates the landscape in both disturbed and natural settings (Fig. 1).

Due to their tolerance to salinity and water scarcity, many species of *Opuntia* are particularly adapted to dry areas in many parts of the world (Vila & Gimeno, 2003). Understanding the germination and longevity of *Opuntia stricta* seeds, dispersal mechanisms and the interactions with local fauna, is crucial for assessing its potential to invade new areas (Nogales *et al.*, 2001) and plan effective eradication campaigns.

According to previous studies (Padrón *et al.*, 2011), animal species belonging to different taxa, such as elephants in South Africa, baboons in the Arabian Peninsula, and lizards in the Canary Islands, have been identified as dispersers of *Opuntia* spp. seeds.

Gulls have a significant role as seed dispersers in coastal habitats, and drivers of plant movements within and between islands (Cavino-Cancelas, 2011; Padron *et al.*, 2011). They transport seeds in the plant material they use to build their nests, and in the regurgitated pellets and droppings after consuming fruits (Calvino-Cancela, 2011). Gulls play a significant role in dispersing *Opuntia spp.* seeds in the Mediterranean basin (Padron *et al.* 2011).

In early March, the authors have found, in the proximity of the dock and near the castle, pellets regurgitated by the yellow-legged gull *Larus michahellis* containing mainly *Opuntia spp.* seeds (Fig. 2). The authors also observed distinctive beak marks in several *Opuntia stricta* fruits and fruit remnants were frequently found in the areas typically inhabited by gulls near the harbour and in the cliffs near the village.

On the 14th of March, an adult yellow-legged gull was seen taking flight with an *Opuntia* fruit in the beak. The observation took place at dusk near the viewpoint in proximity of the heliport.

The role of the yellow-legged gull in *Opuntia spp.* seed dispersal had been already observed in Benidorm island, Alicante, Spain (Padron *et al.*, 2011) during a research, carried out in the Balearic islands, in Cap de Creus (Catalogna) and Benidorm and Canary Islands, that highlighted the active role of vertebrates in dispersing *Opuntia stricta*, *O. maxima* e *O.dillenii* seeds within and among islands. In particular, the raven, *Corvus corax* and the Western Canaria Lizard *Gallotia galloti* were the most important dispersers in Canary islands, while the main vectors in the Balearic islands, were *Corvus corax* and a few small mammals. On Benidorm Island, the yellow-legged gull, *Larus michahellis*, has been identified as the most efficient vector for seed dispersal, primarily through their pellets. By testing and comparing the germination success of dispersed seeds, researchers found that seeds passing through the digestive tract, such as those dispersed by rabbits, exhibited a lower germinability compared to seeds expelled through pellets (Padrón *et al.*, 2011). According to Vila and Gimeno (2003), *Opuntia spp.* show greater seed germination rates in introduced areas compared to their native habitats, where vegetative propagation is more frequent.

Another recent study highlights how the daily movements of yellow-legged gulls have contributed to the dispersal of olive seeds within and among the islands of the Balearic archipelago (Ando *et al.*, 2024). Both studies underscore how the yellow-legged gull can be considered a significant vector for the long-distance dispersal of large fleshy fruits in island ecosystems where large specialised frugivores are absent.

According to Misuri *et al.* 2024 and local inhabitants (pers. comm), *Corvus corax* is also known to consume *Opuntia spp.* fruits in Capraia island.

Since the yellow-legged gull can retain seeds up to 9,5h before regurgitating them (Nogales *et al.*, 2001), it is of extreme importance to investigate the role of gulls as seed dispersers, especially when planning invasive plant species eradication strategies and programmes.

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Fig. 1 – The fruiting season of *O. stricta* in Capraia starts around September and ends in March.



Fig. 2 – Pellets of yellow-legged gull containing *Opuntia* spp. seeds.