

Short Communication

First cases of unsuccessful breeding of the Mediterranean shag *Gulosus aristotelis desmarestii* in the Italian northern Adriatic (Friuli-Venezia Giulia region, northeastern Italy)

Paolo Utmar¹, Maurizio Spoto¹, Davide Scridel^{1,2*}

Abstract - This short note documents the first two recorded nesting events of the Mediterranean shag (*Gulosus aristotelis desmarestii*) in the Italian northern Adriatic, specifically within the Duino Cliffs Regional Nature Reserve (Duino-Aurisina municipality, province of Trieste, Friuli-Venezia Giulia region, Italy). One case involved egg-laying, while the other was limited to nest building; both attempts ultimately failed. It is hypothesized that these unusually late breeding attempts, which occurred between late April and May 2024, beyond the species' typical breeding period (i.e., December to early May), may represent re-nesting efforts following failures at the Croatian colony, where most of the Adriatic population breeds. These observations are particularly significant, as they mark the first confirmed nesting of the species in the Italian Adriatic north of the Tremiti Islands (Puglia), located approximately 450 km to the south, and represent the northernmost known nesting site in the Mediterranean Sea. The nearest known breeding colony, however, lies 70 km away in Croatia (Regata Island, municipality of Poreč, Istria). The Mediterranean shag, an endemic subspecies protected under EU legislation and considered a valuable bioindicator of marine ecosystem health, has experienced a marked decline in the non-breeding population across the Adriatic in recent years, particularly in the Gulf of Trieste. These findings therefore carry notable conservation value, underscoring the need for regular monitoring and targeted protection measures.

Key words: seabirds, Phalacrocoracidae, Gulf of Trieste, Duino Cliffs Regional Nature Reserve, NATURA 2000.

Riassunto - Primi casi di nidificazione senza successo di marangone dal ciuffo *Gulosus aristotelis desmarestii* nell'adriatico settentrionale italiano (Friuli-Venezia Giulia, Italia nord-orientale).

Nella presente nota si segnalano i primi due casi di nidificazione del marangone dal ciuffo (*Gulosus aristotelis desmarestii*) nell'alto Adriatico italiano, all'interno della Riserva Naturale Regionale delle Falesie

di Duino (Comune di Duino-Aurisina, provincia di Trieste, Friuli-Venezia Giulia, Italia). In un caso è stata osservata la presenza di uova, mentre nell'altro si è registrata soltanto la costruzione del nido; entrambi i tentativi di riproduzione non hanno avuto esito positivo. Si ipotizza che queste nidificazioni, insolitamente tardive e avvenute tra la fine di aprile e maggio 2024, oltre il consueto periodo riproduttivo della specie (dicembre-inizio maggio) possano essere il risultato di nuovi tentativi riproduttivi successivi a fallimenti avvenuti presso le colonie croate, dove si riproduce la maggior parte della popolazione adriatica. Queste osservazioni sono significative, in quanto rappresentano la prima nidificazione confermata della specie nell'Adriatico italiano a nord delle Isole Tremiti (Puglia), situate circa 450 km più a sud, e costituiscono il sito di nidificazione più settentrionale nel Mediterraneo. La colonia riproduttiva conosciuta più vicina si trova tuttavia in Croazia (Regata, provincia di Poreč, Istria), a circa 70 km a sud dell'area di studio. Il marangone dal ciuffo mediterraneo, sottospecie endemica protetta dalla normativa europea e considerata un prezioso bioindicatore della salute degli ecosistemi marini, ha mostrato un marcato declino in Adriatico durante il periodo non riproduttivo negli ultimi anni, in particolare nel Golfo di Trieste. Questi dati rivestono dunque un importante valore conservazionistico, evidenziando la necessità di un monitoraggio regolare e di misure di tutela mirate.

Parole chiave: uccelli marini, Phalacrocoracidae, Golfo di Trieste, Riserva Naturale Regionale delle Falesie di Duino, NATURA 2000.

The Mediterranean shag *Gulosus aristotelis desmarestii* is a coastal seabird of high conservation concern, endemic to the Mediterranean and Black Seas (Orta *et al.*, 2021). It is considered an important indicator species for the health of marine ecosystems and climate change (Gremillet *et al.*, 2020; Acker *et al.*, 2021; Scridel *et al.*, 2024). In Italy, the breeding population is estimated at 1500-2000 pairs, predominantly along the Tyrrhenian coast (Nardelli *et al.*, 2015; Bricchetti & Fracasso, 2018; Lardelli *et al.*, 2022). Some populations, such as those in the Tuscany and Lazio regions, have experienced a contraction in their distribution compared to the 1970s and 1980s, while others, such as the Sardinian population, appear stable (Meschini & Frugis, 1993; Corso *et al.*, 2009; Lardelli *et al.*, 2022). In the Italian Adriatic Sea, the species is a very rare breeder, with the Tremiti Islands representing the only known (up to this short note) nesting site (i.e., 2-6 breeding pairs recorded between 2016 and 2023; Liuzzi *et al.*, 2020). However, the total breeding population in the entire

¹WWF AMP Miramare, Trieste, Italy.

²DOPPS BirdLife Slovenia, Ljubljana, Slovenia.

* Corresponding author: dscridel@gmail.com

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Adriatic is estimated at 1600-2000 pairs (Kralj *et al.*, 2013), with the majority concentrated along the coasts of the central and northern Croatian islands (Jurinović *et al.*, 2024; Meštrović & Dujmović, 2024), and a smaller population of 10-24 pairs recorded in Albania (UNEP-AEWA, 2023). The total non-breeding population in the Adriatic is estimated at approximately 5000 individuals, with a significant decline of 44.7% recorded in the Gulf of Trieste between 2010 (n=4066) and 2022 (n=2248; Scridel *et al.*, 2024). The species is considered a partial migrant, with a small proportion of individuals from Croatian colonies remaining in the area year-round (Scridel *et al.*, 2024). However, the majority migrate northward during the non-breeding season (May-November), primarily to the Gulf of Trieste (both in Italy and Slovenia; Koce, 2018) and the Lagoon of Venice (Sartori *et al.*, 2017), and to a lesser extent along the coast of Emilia-Romagna (Sponza *et al.*, 2010; Sponza *et al.*, 2013; Scridel *et al.*, 2024). This migratory behavior emerged in the 1980s, when the Gulf of Trieste experienced an increasing post-breeding influx of individuals from southern Istria and Dalmatia (Croatia; Perco & Utmar, 1987; Parodi, 1999). It has been hypoth-

esized that rising fishing pressure in the breeding areas triggered this shift (Sponza *et al.*, 2010; Cosolo *et al.*, 2011; Sponza *et al.*, 2013; Lipej *et al.*, 2016). The shallow waters, relative abundance of food resources, and the availability of suitable resting and roosting structures, particularly mussel farm buoys (Bordjan *et al.*, 2013; Scridel *et al.*, 2020), likely favored the consolidation of this behavior.

Before this study, there were no documented cases of Mediterranean shag breeding in the Gulf of Trieste (both in Italy and Slovenia), nor anywhere along the Italian Adriatic coast north of the Tremiti Islands in Puglia, located approximately 450 km to the south. In contrast, the nearest known breeding colony in the Croatian Adriatic is at Regata, in Poreč province, Istria, approximately 70 km south of the study area. This absence of breeding records is particularly noteworthy given the regular presence of the species in the Gulf of Trieste even during the breeding season, when tens of individuals (although mostly immature birds) are regularly observed (Utmar *et al.*, 2025). This occurs despite the presence of potentially suitable coastal habitats, similar to those used for nesting in central and

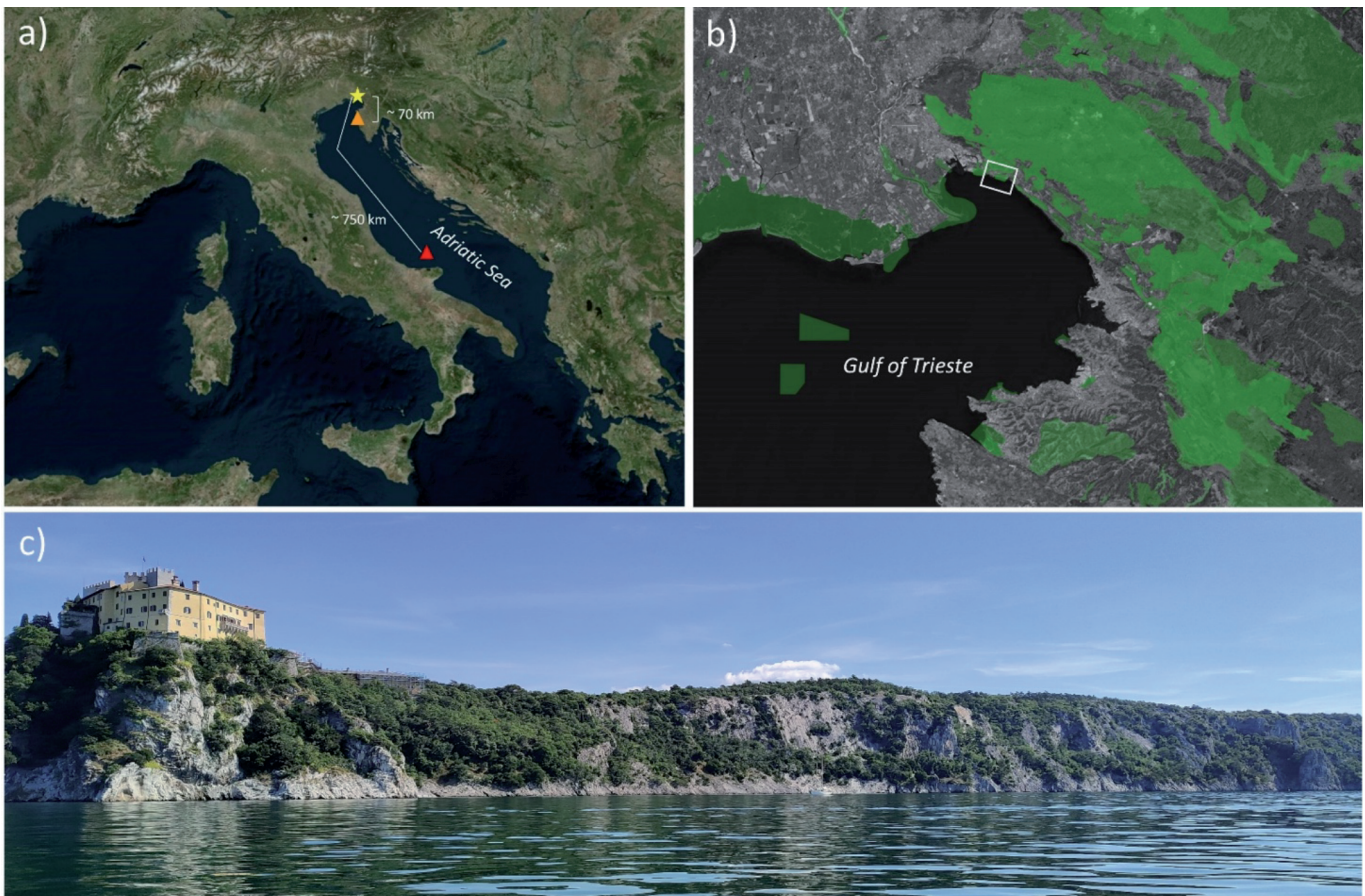


Fig. 1 – a) Location of the reported Mediterranean shag nests (yellow star) in the context of the Adriatic Sea. The orange triangle indicates the nearest known breeding colony in Croatia (approx. 70 km away), while the red triangle shows the closest breeding site in Italy (approx. 750 km away); b) location of the Duino Cliffs Regional Nature Reserve within the Gulf of Trieste, with green shading representing NATURA 2000 sites across Italy and Slovenia; c) panoramic view of the Duino Cliffs and Duino Castle. / a) Posizione geografica dei nidi di marangone dal ciuffo (stella gialla) nel contesto del Mar Adriatico. Il triangolo arancione indica la colonia riproduttiva più vicina nota in Croazia (circa 70 km di distanza), mentre il triangolo rosso mostra il sito riproduttivo più vicino in Italia (circa 750 km di distanza); b) localizzazione della Riserva Naturale Regionale delle Falesie di Duino all'interno del Golfo di Trieste, con l'ombreggiatura verde che rappresenta i siti della rete NATURA 2000 in Italia e Slovenia; c) veduta panoramica delle Falesie di Duino e del Castello di Duino.

southern Croatia, where shags typically breed on high sea cliffs (pers. comm. J. Kralj), which, however, are smaller in size and more exposed to anthropogenic disturbance than those in the Croatian range. One such site, where the breeding observation described in this note took place, is the Duino Cliffs Nature Reserve (45°46'18.5"N, 13°36'49.0"E), located in the northern part of the Gulf of Trieste and included within Natura 2000 sites (i.e., IT3340006/IT3341002 'Carso Triestino e Goriziano/Aree Carsiche della Venezia Giulia'). The Reserve covers a total area of 107 hectares, including 63 hectares of marine habitat (Fig. 1). Water depths range from 0 to 8 meters beneath the cliffs and reach up to 13 meters offshore. This area serves as an important nocturnal roosting site, especially during periods of strong wind, when hundreds of individuals can be observed. During the day, the site is used as a resting area by dozens of Mediterranean shags (Utmar *et al.*, 2025). It is characterized by steep white limestone cliffs rising up to 85 meters and climax vegetation of *Orno-Quercetum ilicis*, where Manna ash (*Fraxinus ornus*) represents the Illyrian element and Holm oak *Quercus ilex* the Mediterranean component (Poldini, 1980). Approximately 500 meters from the westernmost cliffs lies a large mussel farm cultivating Mediterranean mussels *Mytilus galloprovincialis*, whose floating buoys serve as important roosting and daytime resting sites for this and other species (Scridel *et al.*, 2020; Scridel *et al.*, 2024). The site

is nationally and internationally recognized for its importance as a breeding ground for the common eider *Somateria mollissima*, as well as other notable species such as the peregrine falcon *Falco peregrinus*, blue rock thrush *Monticola solitarius*, and, occasionally, the Eurasian eagle-owl *Bubo bubo* (Perco *et al.*, 1993; Kravos *et al.*, 1999). A total of 160 bird species have been recorded within the Reserve, with 50 confirmed as breeding (Utmar *et al.*, 2024).

The first indication of breeding by Mediterranean shag in the Duino Cliffs Nature Reserve was recorded on 29th April 2024, when an individual was observed carrying nest material (i.e., branches from broadleaved shrubs) and landing at various locations along the cliff. On the 6th May 2024, a nest was located, along with a second nest approximately 200 meters away. The first nest was situated about 8 meters above ground level on the cliff face known as "Torre Syntesis" where the pair was repeatedly observed at the nest site, displaying behaviors consistent with brooding. The second nest was situated near a cliff wall known as the "Muraglione" where a pair was seen near a rudimentary nest positioned roughly 6 meters above sea level. By 15th May 2024, the first nest remained occupied, while the second had already been abandoned (Fig. 2). The pair at the first nest continued to be observed during all four subsequent visits, up until 17th June 2024. After that date, this nest was also deserted. In total, the site was used for breeding activity for at least 50 days. Although no clear

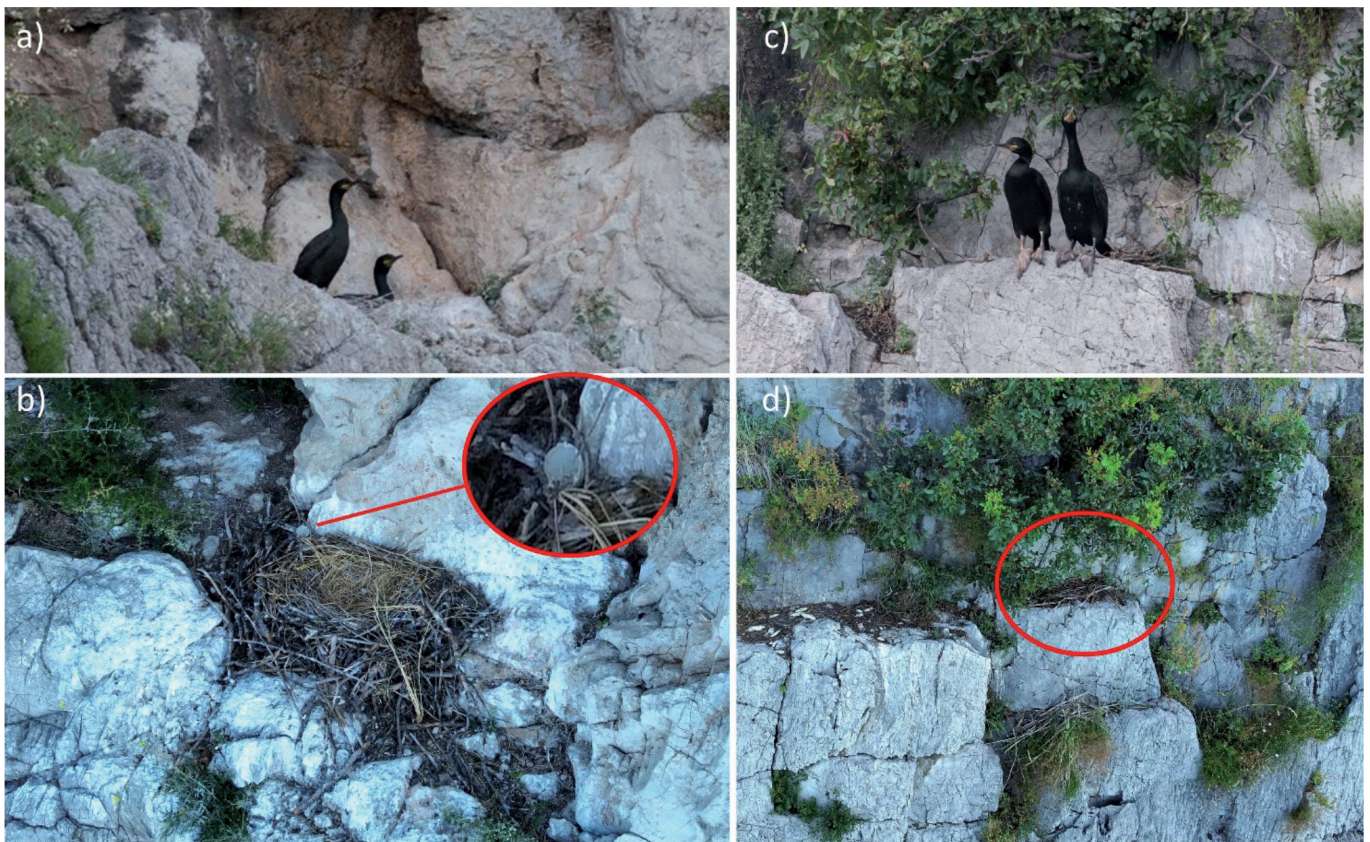


Fig. 2 – Images of the two pairs of breeding Mediterranean shags (a,c) in the Duino Cliffs Regional Nature Reserve and their respective nests (b,d). In panel b, the red circles highlight the presence of a broken shag egg. / Immagini delle due coppie di marangoni dal ciuffo (a, c) nella Riserva Naturale Regionale delle Falesie di Duino e dei rispettivi nidi (b, d). Nel pannello b, i cerchi rossi evidenziano la presenza di un uovo rotto di marangone dal ciuffo.

cause of nest failure was identified, several contributing factors may be hypothesized. Notably, the unusually late timing of the breeding attempts, between late April and May 2024, falls well beyond the species' typical breeding period (i.e., December to early May). It is therefore plausible that these observations represent re-nesting attempts following breeding failures at the Croatian colony, where the majority of the Adriatic population is concentrated. In addition, a certain degree of anthropogenic disturbance, such as the incursion of boats and canoeists into restricted areas, may have played a role in the reproductive failure observed. Similar impacts have been documented for other species, such as the Common Eider, in previous surveys (Utmar *et al.*, 2024). However, the unusually late timing of the breeding attempts, combined with a certain degree of anthropogenic disturbance, such as the incursion of boats and canoeists into restricted areas, may have contributed to the reproductive failure observed, as reported occasionally for other species (e.g., common eider) in previous surveys (Utmar *et al.*, 2024). On 5th July 2024, after the nests had been abandoned for some time, we used a camera mounted on a 10-meter endoscopic pole to capture images of the contents of a nest deserted by one of the birds (Fig. 2), revealing that at least an abandoned egg was present in the first nest (where an individual was observed brooding).

These observations represent the first documented breeding attempts of the Mediterranean shag in the Duino Cliffs Nature Reserve and, more broadly, in the northernmost sector of the Mediterranean Sea (Fig. 1). Although both nesting attempts ultimately failed, the extended presence of breeding pairs, active nest-building, brooding behavior, and the confirmed presence of an egg indicate that the area holds potential as a future breeding site for the species. Continued monitoring will be essential to determine whether this represents a sporadic event or the beginning of a northward range expansion, potentially driven by population pressures or shifting environmental conditions. Moreover, these findings underline the importance of minimizing disturbance during the breeding season, especially in protected areas, to support successful colonization by sensitive coastal species.

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