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AN UPDATE ON THE STATUS OF THE LESSER CRESTED TERN COLONIES IN LIBYA WITH FIELD RINGING TRAINING AND CAMPAIGN AT GARA ISLAND

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Abstract

The Mediterranean Lesser Crested Tern (Thalasseus bengalensis emigratus) is an endangered seabird taxon listed under the SPA species protocol. The most important breeding population is located on three coastal islands in Libya, namely Elba, Jeliana, and Gara, where adult terns arrive in groups to breed, between June and July. The status of Lesser Crested Tern breeding colonies was assessed throughout the breeding season (June-August) using a multi-stage monitoring protocol. Initial surveys in June and July were conducted to determine colony establishment and breeding initiation, revealing the complete desertion and breeding failure at the Elba and Jeliana sites. High levels of human disturbance, including illegal hunting and coastal development can cause such failures. Subsequent activities in August, coinciding with the nestling phase, focused on assessing productivity at successful colonies and conducting ringing operations at Gara colony on crèching chicks (≥10 days old). A total of 168 nestlings, between 10 and 14 days old, were successfully ringed using coded colour rings (Darvic

and metal rings. In previous seasons 1,354 fledglings were ringed, and 80 were resighted (5.91%) either in breeding areas or during migration to West Africa for wintering. In this campaign two local NGO volunteers were trained on the ringing campaign process, to allow them to have a larger role in the monitoring and conservation of the site in the future. The successful ringing campaign at Gara Island highlights the importance of collaborative conservation efforts. The situation of the colonies on Elba and Jeliana needs further investigation in the coming seasons, to determine the reasons for desertion, and a call to the local authorities to take action to protect these sites. The collected data will contribute to ongoing research and inform future management strategies for the Lesser Crested Tern population in Libya. This work was financially supported by UNEP-MAP-SPA/RAC through the French Voluntary contribution.

Introduction

The Mediterranean Lesser Crested Tern *Thalasseus bengalensis emigratus*, a migratory seabird species, holds significant ecological importance

within the coastal ecosystems of the Mediterranean region, particularly in Libya. The Mediterranean breeding population does not exceed 2,400 pairs based on repeated field censuses (Meininger et al., 1994; Azafzaf et al., 2006; Hamza et al., 2007). Over 99% of this population breeds exclusively in Libya, where colonies are concentrated on Gara Island, Elba Island, and Jeliana Islet (Fig.1).

Despite its adaptability, the Lesser Crested Tern faces growing threats from habitat loss, climate change, and human activity, making the monitoring of its breeding colonies essential for effective conservation (Azafzaf et al., 2006; Hamza et al., 2017; Hamza et al., 2012; Hamza, 2014). It was listed as Endangered at the Mediterranean level, based on limited breeding range

and human disturbance and marine pollution (UNEP/ MAP RAC/SPA, 2003). In response, a long-term monitoring programme has been established by the Libyan Ministry of Environment with support from SPA/RAC. This programme was initiated in 2006, to provide a baseline for conservation management strategies for this unique Mediterranean population.

This study focuses on the status of the Lesser Crested Tern colony on Gara Island, Libya, a crucial breeding site in the Mediterranean. Gara Island, situated in the Gulf of Sirte, has long been recognized as a pivotal breeding ground for the species (Meininger et al., 1994; Azafzaf et al., 2006; Hamza, 2014). It also builds upon earlier research and proposes adaptations to the monitoring protocol to improve its effectiveness

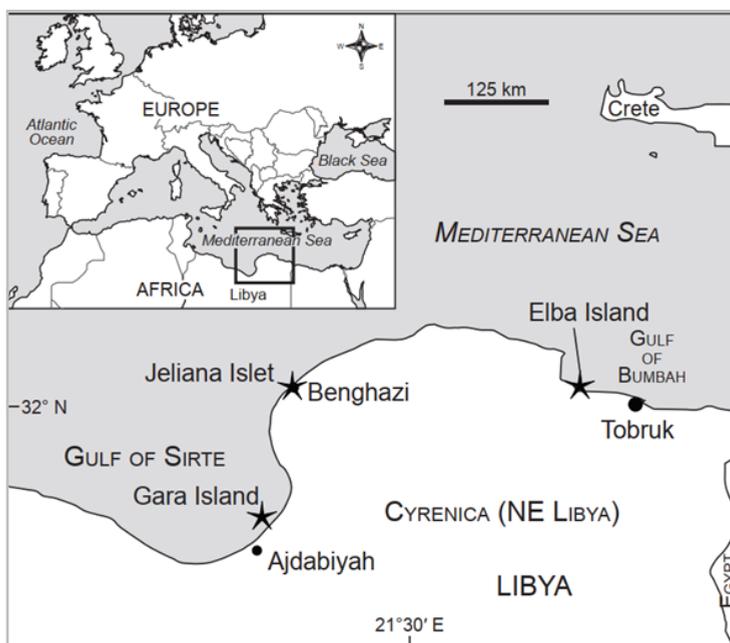


Figure 1. Map showing the three breeding sites off the Libyan coast (Source: Hamza et al., 2017).

in light of emerging challenges. The 2023 monitoring season aimed to conduct theory and field-based training on colony monitoring and ringing of nestlings for both conservation staff from the Ministry of Environment and members of local CSOs near the Gara site. Ringing technique provides valuable insights into post-breeding dispersal and survival, which are crucial for assessing the overall health of the population (Hamza *et al.*, 2017). Finally, the study assessed population size, breeding success, and ongoing threats at the key breeding sites during the 2023 season and proposed adaptations to the current SPA/RAC protocol of monitoring these colonies (RAC/SPA- UNEP/MAP, 2012).

Methods

Colony Monitoring

Monitoring was carried out across three sites: Gara Island, Jeliana Islet, and Elba Island. These sites were surveyed at regular intervals from June to August 2023. The methodology followed established SPA/RAC protocols, which included:

- Boat Surveys: Used to document colony size and distribution at coastal sites like Gara and Elba.
- Ground Surveys: Employed to assess breeding pairs and clutch size, with careful attention to minimizing disturbance to nesting birds.
- Data Recording: Colony positions, chick numbers, and any signs of

disturbance were meticulously documented. Standardized forms were used to ensure data consistency across sites and seasons/years.

Training Sessions

A comprehensive training session was conducted in August 2023 in Ajdabiyah, the nearest city to the main nesting colony of Gara Island. The training targeted local conservationists, civil society organization (CSOs) members, and staff from the Ministry of Environment. To recruit qualified participants, two CSOs Alhayat organisation and Green footprint, located in Ajdabiyah and Benghazi within the Gara Island region were formally contacted. These CSOs were invited to nominate candidates based on specific selection criteria, requiring a higher education degree in biology or a related field and a demonstrated interest in ornithology. Staff of the Ministry of Environment belong to Nature Conservation Department. The training focused on theoretical fundamentals of marine ornithology with special emphasis on terns and their colonies, and a set of practical skills was presented for effective seabird colony monitoring. The SPA/RAC-issued LCT protocol (RAC/SPA - UNEP/MAP, 2012) formed the foundation of the curriculum. Both the theoretical and practical modules were delivered by Abdulmaula Hamza.

Ringing Campaign

The ringing campaign was conducted only at Gara Island. Up on approaching

the colony at Gara, the team agreed on the method of building a corral using plastic mesh. Tern chicks were then carefully herded towards the corral (Fig.3). A total of 168 Lesser Crested Tern nestlings were ringed using white coded Darvic rings (registered at ISPRA, Italy) and metal rings provided by the Maltese ringing scheme run by BirdLife Malta. The aim was to enable long-term tracking of individual birds to study their movements, such as post-fledging and later post-breeding dispersal, migration routes, but also survival rates.

The ringing process involved capturing nestlings, carefully placing identification rings and releasing them back into the colony. The use of both durable Darvic rings and metal rings ensures that birds can be identified at a distance without the need for recapture, reducing stress on the individuals and the colony.

Results

Colony monitoring:

Jeliana Islet: No breeding activity was recorded at Jeliana Islet during the 2023 monitoring season. While approximately 50 adult birds were observed along the lake's edge, no evidence of nesting or fledgling was found. The likely cause of this failure to breed is the ongoing urban development near the site, which has resulted in increased levels of disturbance and habitat degradation.

Elba Island: Similarly, Elba Island showed no evidence of breeding activity in 2023. Disturbance from illegal hunting activities, particularly

during the falconry season, is believed to have played a significant role in the colony's abandonment. Local fishermen and hunters were reported to frequent the area, and the lack of enforcement of existing protection measures has exacerbated the issue.

Gara Island: Gara Island hosted approximately 2,000 breeding pairs during the 2023 season, confirming its status as the most important breeding site for the Mediterranean population of the Lesser Crested Tern. The colony was first detected on 20 June 2023, and monitoring continued through late August 2023. The breeding pairs formed a distinct belt-shaped colony (120m x 2-3m) along the northern side of the island.

Clutch success was high, with 90% of nests producing fledglings. However, during the monitoring period, a specific mortality event affecting approximately 100 nestlings was observed, with many individuals displaying clinical signs such as wing deformities and paralysis. While these symptoms have been speculated to be consistent with diseases like avian flu, no definitive diagnosis was confirmed, and similar symptoms are also commonly associated with other pathogens or environmental factors, such as avian botulism. Unlike certain highly pathogenic avian influenza strains which are known to cause high morbidity in adult birds, no concurrent large-scale mortality or evidence of numerous dead or dying adult terns were recorded during or immediately following this specific nestling loss event.

Training session

A training session (theory) was held in Ajdabiya, included six participants and covered species identification, colony monitoring, and field data collection (Fig.2). Trainees were introduced to best practices in estimating colony location, size, breeding success, and reporting environmental variables such as prey availability and predation pressure. Key monitoring techniques included recording the presence/absence of colonies, accurately estimating the number of breeding pairs, and collecting data on clutch size and breeding success. Special attention was given to minimizing disturbance to the colonies during field visits, as the sensitivity of seabird colonies to human interference is well documented (RAC/SPA - UNEP/MAP, 2012).

Ringin g campaign

During the ringing campaign at Gara Island 168 nestlings were successfully tagged. White Darvic rings with black engraved alpha-numeric code were used, the code consisting of a letter followed by two numbers (Fig. 3, 4). As a key practical outcome of this initiative, a new colour-ringing scheme for the Libyan population of Lesser Crested Tern *Thalasseus bengalensis* was established to facilitate long-term studies on dispersal, site fidelity, and survival. The unique combination of colour rings has been formally registered and is publicly detailed on the European colour-ring birding platform (CR-Birding, 2023; <https://cr-birding.org/node/1046>).

To aid in the success of this monitoring program, we strongly encourage researchers, birdwatchers, and members of the public to carefully check Lesser Crested Terns for the presence of colour rings and report any sightings directly through the CR-Birding website. The data collected from these birds will be invaluable in tracking their migration patterns, particularly as previous studies have suggested that this population migrates along the West African coastline (Hamza 2014; Hamza *et al.*, 2017). The collaboration with BirdLife Malta and ISPRA Italy has provided a robust foundation for continued monitoring of migration movements of this population, with initial reports indicating post-breeding dispersal towards West Africa. In previous seasons (2006-2012), 1,354 fledglings were ringed, and 80 were resighted (5.91%) either in breeding areas or during migration to West Africa for wintering. The campaign was documented by a short documentary in Arabic with English subtitles, that can be watched at <https://www.youtube.com/watch?v=oIF8QqHEKzw>.



Figure 2. Theory training session for Government and CSO participants.



Figure 3. Herding tern nestlings towards the corral, prior to ringing.

Discussion

The 2023 monitoring programme has revealed both positive and concerning trends in the conservation of the Lesser Crested Tern *Thalasseus bengalensis emigrata* in Libya. On a positive note, Gara Island continues to be a critical stronghold for the species, hosting a population estimated at approximately 2,000 pairs in 2023. This finding is consistent with historical data, which indicates a remarkable long-term stability of this colony. The first estimate in 1937 recorded over 2,000 individuals (Moltoni, 1938), and subsequent surveys have consistently documented stable breeding numbers, including ~1,700 pairs in 1993 (Meininger et al., 1994) and counts between 1,500 and 2,100 pairs from 2006 to 2010 (Azafzaf et al., 2006; Hamza et al., 2007; Hamza et al., 2012; Hamza, 2014).

While this long-term data suggests overall stability in population size, we acknowledge that ongoing monitoring is critical for accurately assessing reproductive success rates over time. In stark contrast to the resilience of the Gara colony, the absence of breeding at Jeliana and Elba is alarming and highlights the vulnerability of other sites to human activities. The impact of disturbance from unregulated waterbird hunting, urban development, and environmental pollution cannot be overstated. Jeliana, in particular, faces significant pressures from ongoing development, which, without appropriate mitigation, could lead to the permanent abandonment of this once-vital breeding site. Similar pressures are true at Elba. Although all sites have been declared protected areas since



Figure 4. The tern nestling after putting PVC white ring.

2021, the actual implementation is hindered by political and administrative constraints.

These findings are not only of national importance but also contribute directly to regional marine conservation assessments. Our monitoring approach, which tracks population size and breeding success, is in direct alignment with the methodological framework of the UN Environment Programme's Integrated Monitoring and Assessment Programme (IMAP) for the Mediterranean, where seabird populations serve as a key ecological indicator (Common Indicator 3) (UNEP/ MAP, 2016). Furthermore, the observed threats, particularly the abandonment of colonies due to coastal development and human disturbance, corroborate the

major pressures on marine biodiversity identified in the 2023 Mediterranean Quality Status Report (MED QSR), (UNEP/MAP, 2023). This study therefore provides crucial, up-to-date data that helps fill knowledge gaps identified in the MED QSR and contributes to the collective effort of assessing the Good Environmental Status (GES) of the Mediterranean Sea.

Further investigation is required into the causes of the nestling mortality observed at Gara Island. While avian flu and/or Botulism are suggested as potential causes, future monitoring and sampling of ill-looking nestlings for viral /bacterial infection screening are needed. Continued monitoring and collaboration with local stakeholders (fishers and local CSOs) will be crucial



Figure 5. The ringing team before releasing the nestlings.

to addressing these issues and ensuring the long-term survival of the species (Fig.5).

Adaptations to the Monitoring Protocol To improve future conservation efforts, several adaptations and new initiatives for the monitoring protocol are recommended:

1. Integrate advanced remote monitoring technologies: The use of remote monitoring technologies should be significantly expanded to minimize human disturbance while maximizing data collection. In addition to the deployment of Unmanned Aerial Vehicles (UAVs or drones) for colony-wide surveys, the installation of automatic camera traps at strategic locations within the colonies is highly recommended. These devices

are invaluable for the continuous, non-invasive monitoring of multiple factors, including disturbance events and predation rates. Furthermore, they provide a valuable tool for reading colour rings remotely. The use of modern surveillance systems capable of transmitting images in real time is particularly advantageous, as this functionality allows for immediate intervention in response to detected threats and may concurrently serve as a deterrent to human disturbers.

2. Establish a coordinated colour-ringing resighting programme: A formal programme should be established to train personnel and citizen scientists in colour-ring reading. This effort should focus on carrying out systematic observations from a safe distance using telescopes and digi-scoping at known roost sites and, where feasible without

causing disturbance, at the breeding colonies. A key objective should be to determine the ratio of colour-ringed to un-ringed individuals in observed flocks. To maximize data return, this national effort should be complemented by coordinated resighting campaigns at key stopover sites along the migratory flyways and within the West African wintering grounds.

3. Strengthen community engagement and awareness: Local communities, particularly fishermen and hunters, must be actively engaged in conservation efforts. This should involve targeted awareness campaigns highlighting the species' ecological importance and the benefits of sustainable practices.

4. Implement a disease surveillance protocol: A protocol for opportunistic sampling should be established. Blood samples and swabs should be taken from moribund or deceased nestlings and adults to screen for potential viral infestations, such as avian influenza.

5. Enhance enforcement of protected area regulations: Strengthening the on-the-ground enforcement of existing protected area regulations is critical. This is especially urgent at the vulnerable colonies of Elba and Jeliana to mitigate direct human pressures and prevent further degradation.

Conclusion

The 2023 monitoring of the Lesser Crested Tern in Libya underscores the importance of Gara Island to the species' survival, with around 2,000 pairs breeding successfully and a high 90% fledgling rate. However, the troubling signs of nestling mortality, possibly due to avian flu, raise concerns for the colony's health. Meanwhile, no breeding was observed at Jeliana Islet or Elba Island, where human activities like urban development and illegal hunting continue to disrupt these fragile colonies. The ringing of 168 nestlings at Gara Island was a positive step toward tracking their movements and understanding their migration, but it's clear that ongoing health checks, particularly for diseases like avian flu, are critical. To better protect these birds, future efforts should focus on reducing human disturbance with tools like drones, involving local communities in conservation, and ensuring stronger enforcement of protection measures, especially at Jeliana and Elba. These actions are essential to preserving the Lesser Crested Tern in the Mediterranean for years to come.

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