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RESEARCH ARTICLE

Preliminary study on ornithofauna of Finike (Anaximander) Seamounts region and adjacent waters in the eastern Mediterranean Sea

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Abstract

This is the first study regarding offshore seabird sightings in Turkish waters. The survey was carried out in Finike Seamounts (Anaximander) region and adjacent waters for 10 days in spring and seven days in autumn of 2021. Bird distributions were determined by visual observations that were carried out onboard R/V YUNUS-S with the standard line transect method. In total, 19 bird species belonging to seven Ordos and 11 Families were recorded. The first three dominant groups of species were Scopoli's shearwater (*Calonectris diomedea*, n: 92, 47%), and common tern (*Sterna hirundo*, n: 22, 11%), and common swift (*Apus apus*, n: 15, 8%). In the Turkish coastal and offshore region of the Mediterranean, migratory movements and distribution of bird species, mainly Ardeidae (Ciconiiformes) and Laridae, Sternidae, and Scolopacidae (Charadriiformes), were observed in spring and autumn. In this paper, the observed and anticipated migration routes were described for those species. Detailed and long-term studies over larger areas are recommended at offshore regions in Türkiye.

Keywords: Seabirds, pelagic birds, eastern Mediterranean Sea, offshore observations, Ornitofauna, bird migration

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Introduction

Seabirds, sometimes named pelagic or marine birds, are birds adapted to life in marine environment. Seabirds vary largely in their lifestyles, behaviour, and physiology. They often, however, exhibit striking convergent evolution, as the same environmental problems and feeding niches result in similar adaptations (Brown 1980). Many studies have shown that seabirds are susceptible to changes in the food supply and marine environment changes and are therefore considered very good indicators of the health of fish stocks and marine ecosystems (Cairns 1988; Furness and Kees 1997). However, many seabirds are endangered and therefore research and monitoring are essential (Dias *et al.* 2019).

Research and monitoring on seabirds in the world date back to the beginning of the 1990s. Unfortunately, seabirds are among the least studied bird groups in Türkiye. Not only the existing literature but also offshore observations are scarce and based on opportunistic incidents, therefore do not represent the actual importance or its diversity in these offshore regions.

Eken (1997) studied the importance of Turkish coastal islands for marine birds, especially on the Aegean coast. This study described only the birds breeding on some of the islands. Sahin *et al.* (2012) conducted a census on Yelkouan shearwater (*Puffinus yelkouan*) in the Istanbul Strait (Bosporus). Onmuş (2015) studied the birds in the Aegean Sea, which can be considered a general compilation based on long-term personal field observations and existing literature.

Marine birds breeding in the southeastern Mediterranean coasts of Anatolia were studied (Yapan 2018). Onmuş and Gonulal (2019) studied the breeding status and the distribution of the Audouin's gull (*Larus audouinii*) in Türkiye. Though these studies are crucial, they were not attempting to describe pelagic seabirds and provided offshore bird observations. The first semi-professional study that described pelagic seabirds in offshore regions was about the population status of the Mediterranean subspecies of the European storm petrels *Hydrobates pelagicus melitensis* in the offshore region of Türkiye in the central-south Aegean Sea (Onmuş *et al*. 2022). Foreign-sourced open sea bird censuses are also present in our region. ACCOBAMS (2021) provided an estimate of the abundance and distribution of cetaceans and other marine megafauna, such as birds, as well as floating marine litter in the Mediterranean Sea based on the basin-wide aerial surveys in 2018.

However, there is no comprehensive and systematic study of open sea birds originating from Türkiye. Existing information is based on rare, random, and local observations that were not systematically collected. The aim of this study is therefore to identify the ornithofauna of the Finike Seamounts (Anaximander) region and adjacent waters located in the eastern Mediterranean coast of Türkiye.

Materials and Methods

Study Area

The Finike Seamounts (also known as Anaximander Sea Mountains) are morpho-tectonic elevations located between the Greek (to the west) and Cyprus arcs to the east (Öztürk *et al*. 2012; Şenöz 2015). This area was declared in the Official Gazette as the "Finike Seamounts Special Environmental Protection Area (SEPA)" in 2013 with the decision of the Council of Ministers, Republic of Türkiye. The area has been identified as a critical habitat by ACCOBAMS (2010), and the coastal area of Finike is included in the Hellenic Trench Important Marine Mammal Area (IUCN-MMPATF 2017).

Field Observations

The survey was carried out for 10 days between May 11 and 25, 2021, and seven days between September 18 and 30, 2021. Bird distributions were determined by visual observations that were carried out onboard R/V YUNUS-S with the standard line transect method. The survey was designed by linear section method applications with equally spaced zig-zag line arrangements (Buckland *et al*. 2001). Marine surveys were initiated at 07:00 in the morning and continued until sunset. During the survey, the cruise speed of the ship was kept constant at 8 knots. To prevent the encounter rate from being negatively affected, meteorological data were constantly monitored and no observation effort was made when the sea state was higher than 3 Beaufort. Survey design and applied transects are given in Figure 1.

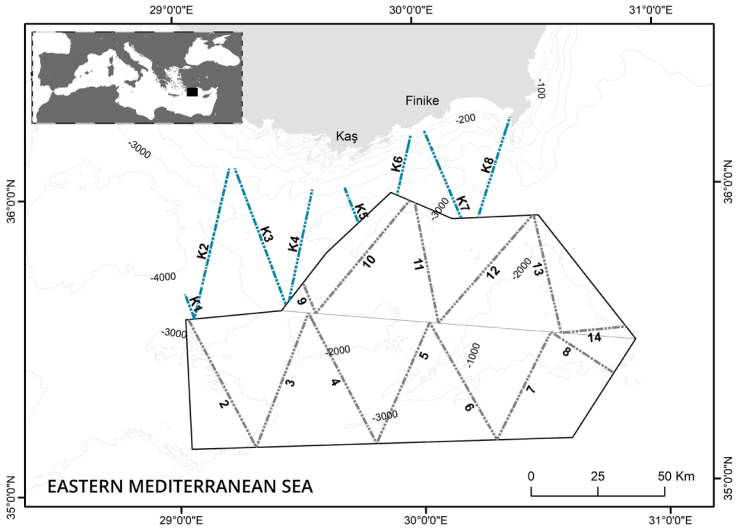

Figure 1. Survey design made in the Finike Seamounts region and adjacent waters. The area shown by solid black lines represents the Finike Seamounts Special Environmental Protection Area. Dashed lines are line transects and the numbers indicated each transect line.

The survey was carried out by an observation team of three people, two observers, and one recorder, on the port and starboard sides of the vessel. To prevent fatigue, rotation was made between three positions every hour. At the beginning of the line, the date, time, coordinates, observers, and sea conditions were recorded.

The port and starboard observers scanned an area of 100° in total, from 0° on the ship's bow to 10° on the opposite side, with binoculars and the naked eye, thus providing more observation effort for the 20° angle on the line. The species, numbers of birds, time, and coordinates were recorded not only during transects but also trying to record off effort (out of transects).

Besides this study, personal observation records (O.O.) collected over a long period spanning about 20 years in the Aegean and Mediterranean Seas are used. These records are used to describe observed and anticipated migration routes over the Aegean and the Mediterranean Seas intersecting the Finike Seamounts (Anaximander) region.

Results

During the study, a total of 19 different bird species belonging to seven Ordos and 11 Families were recorded in the Finike Seamounts SEPA and adjacent region. Some of the bird species recorded during the survey are given in Figure 2. A list of bird species observed during these sea observations and their IUCN Red List status are given in Table 1 and the distribution of these bird sightings is given in Figure 3. The first three dominant groups of species during these observations were Scopoli's shearwater (*Calonectris diomedea*, n: 92, 47%), and common tern (*Sterna hirundo*, n: 22, 11%), and common swift (*Apus apus*, n: 18, 8%).

Table 1. The observed bird species and the number of individuals recorded during the field survey of the Finike Seamounts SEPA and adjacent waters in spring and autumn 2021 and their IUCN Red List status.
(SP: Spring, AU: Autumn, LC: Least Concern, VU: Vulnerable)

Ordo	Familia	Species	SP	AU	Total number	IUCN
Procellariiformes	Procellariidae	*Calonectris diomedea*	70	22	92 (47%)	LC
		Puffinus yelkouan	6	4	10 (5%)	VU
Pelecaniformes	Phalacrocoracidae	*Phalacrocorax carbo*	2		2 (1%)	LC
		Gulosus aristotelis	2		1 (1%)	LC
Ciconiiformes	Ardeidae	*Nycticorax nycticorax*	8		8 (4%)	LC
		Ardeola ralloides	2		2 (1%)	LC
Falconiformes	Falconidae	*Falco tinnunculus*	1		1 (1%)	LC
Charadriiformes	Scolopacidae	*Calidris pugnax*	13		13 (7%)	LC
	Stercorariidae	*Stercorarius pomarinus*	1		1 (1%)	LC

Table 1. Continued

	Laridae	*Ichthyaetus melanocephalus*	1+	?	1+ (1%)	LC
		Larus michahellis	8+	?	8+ (4%)	LC
	Sternidae	*Sterna hirundo*	22		22 (11%)	LC
Apodiformes	Apopidae	*Apus apus*	15		15 (8%)	LC
		Tachymarptis melba	1	1	1 (1%)	LC
Passeriformes	Hirundinidae	Hirundinidae sp.	11	2	13 (7%)	-
	Sylviidae	*Sylvia borin*	1		1 (1%)	LC
		Phylloscopus trochilus	1		1 (1%)	LC
Unidentified Passeriformes species			3		3 (2%)	-
The total number of birds recorded			166+	29	195+(100%)	

Figure 2. Photographs of some bird species recorded during the field survey of the Finike Seamounts region; **A)** Scopoli's shearwater (*Calonectris diomedea*), **B)** Squacco heron (*Ardeola ralloides*), **C)** Willow warbler (*Phylloscopus trochilus*), **D)** Pomarine jaeger (*Stercorarius pomarinus*), **E)** Common tern (*Sterna hirundo*), **F)** Ruff (*Calidris pugnax*)

Bird migration over the eastern Mediterranean Sea

During the surveys, migrating Procellariiformes, Ciconiiformes, and Charadriiformes species were observed in the offshore regions and in the coastal regions of Finike, including especially Procellaridae, Ardeidae, Sternidae, Laridae, and Scolopacidae species.

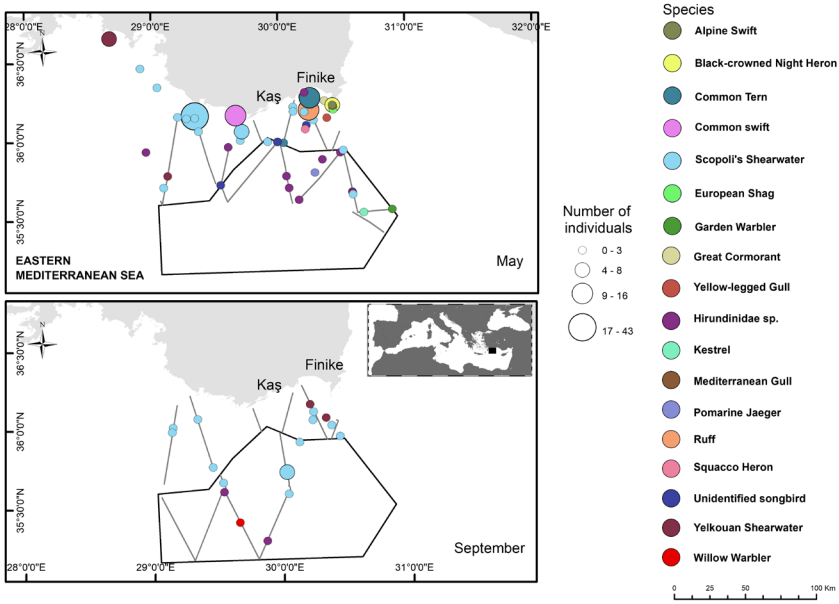

Figure 3. The distribution and the number of birds recorded during the field survey of the Finike Seamounts region and adjacent waters in spring and autumn of 2021

Discussion

This research was designed specifically for cetaceans and therefore bird records were collected based on semi-opportunistic events especially for sea gulls. During off effort (outside of transects), gulls observations were not recorded. Therefore, records do not represent actual numbers.

The study area is devoid of ornithological studies, the only relevant source of information is the checklist of birds from the Greek island of Kastelorizo located near the Kaş region (iNaturalist 2002). This checklist contains only 18 species besides these species that have most probably been observed on or close to the island. Among the listed species, great cormorant (*Phalacrocorax carbo*), Audouin's gull (*Ichthyaetus audouinii*), and great white pelican (*Pelecanus onocrotalus*) are the species that are most relevant to our observations.

Our findings indicate that Finike Seamounts region is hosting a diverse ornithofauna. ACCOBAMS (2021) indicated intense Scopoli's shearwater presence in the western adjacent waters of the Finike Seamounts region as in our findings. In our study, we found out that the regions do not only host pelagic seabirds such as Scopoli's shearwater or yelkouan shearwater but also other water birds such as terns, waders, herons, egrets, and even songbirds. Zotier *et al*. (1999) indicated by using the existing literature on breeding birds that the eastern Mediterranean with lower primary productivity is expected to host much fewer marine bird taxa than the more productive western part. However, this information might have been misleading, since open sea bird observations in the eastern Mediterranean are lacking. The eastern Mediterranean may host a lower number of breeding pelagic birds, but that does not prove to us that eastern Mediterranean hosts migratory, non-breeding, and foraging birds because the eastern Mediterranean basin holds fertile river ecosystems that may provide important feeding opportunities for those pelagic birds.

Yelkouan shearwater (*P. yelkouan*), endemic to the Mediterranean Basin has recently been up-listed as Vulnerable (VU) by the IUCN and is one of the most important species recorded in the Finike Seamounts SEPA and adjacent region in terms of species conservation perspective (BirdLife International 2018). Significant gaps exist in our knowledge of the life history of the yelkouan shearwaters and the main threats including light and sound pollution, predation of eggs and chicks by rats, and other human-related impacts (BIOSNIPPET 2019). Therefore, it is expected that our observations will partially contribute to filling a gap in the knowledge of the species' distribution in the region.

During the field study, bird migration was also observed over the sea including Procellariiformes, Ciconiidae, and Charadriiformes. Similar migrating Ciconiidae and Charadriiformes species have also been frequently observed in the sea coast and offshore regions of the Aegean Sea (Onmus 2015). Those species seem to avoid terrestrial and inland regions and prefer to migrate over the sea. The migration route of these birds probably starts at the north of the Aegean Sea around the Meriç (Evros) Delta, located between the Greek and Turkish borders. From there these birds pass through both the Turkish side and over the Greek islands of the Aegean Sea (Magioris 1985).

A schematic path of the observed and the anticipated migration route of those birds is given in Figure 4. As a result of the observations of the birds' movements during the surveys, we made assumptions for some possible migration routes. These envisaged routes are; the migration route to Crete Island, the migration route to Northeast Africa towards the Nile Delta, the migration route to Cyprus Island, and the migration route to Syria and Israel in the eastern Mediterranean. The accuracy of these assumptions is recommended to be investigated in more detailed studies in the future.

The mountains in the Aegean region are located perpendicular to the sea on the West-East axis, creating deep valleys and high mountain ranges. In addition, there are important river deltas along the coastal Aegean from north to south, and both the presence of wetlands and the regions where these rivers open to the sea lead to relatively richer fish stocks. These two factors may have caused waterbirds to move along the coastline in the Aegean region. It has been documented that air movements in the north-south or vice versa in the Aegean Sea cause migratory birds to migrate faster and in a shorter time by taking tailwinds in this region (Panuccio *et al.* 2016).

Non-reproductive factors in migratory birds also affect breeding populations through their effects on survival and reproduction. These factors include threats and environmental conditions during migration routes and wintering areas (Newton 2008; Trierweiler *et al.* 2014). For this reason, we emphasize that it is very important to take into account the migration routes as well as the breeding and wintering areas for the protection of these vulnerable species. The potential migration routes defined by this study, therefore, is very important and it is necessary to investigate them further.

Figure 4. A schematic figure of the observed and the anticipated migration routes of Ardeidae, Sternidae, Laridae, and Scolopacidae species in the Aegean and the eastern Mediterranean region: A) the observed main route, B) the anticipated migration route to Crete Island, C) the anticipated migration route to Northeast Africa through the Nile Delta, D) the anticipated migration route to Cyprus Island, and E) the anticipated migration route to further eastern Mediterranean.

Plastic wastes are often ingested by marine predators and can cause significant health problems and even death. Shearwaters are the most vulnerable species among other bird species in the Mediterranean region (Codina-García *et al.* 2013), and unfortunately, each year more plastic waste are observed at the sea. The eastern adjacent waters of the study area, the Cilician Sea that connects Cyprus

and the Mediterranean coast of Türkiye have been identified as a regional marine plastic hotspot (Liubartseva *et al.* 2018). Therefore marine plastic litter pollution is probably the most dangerous threatening factor for those species in this region. We recommend detailed and long-term studies over larger areas in offshore regions like the Finike Seamounts SEPA.

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Doğu Akdeniz Finike (Anaximander) Denizaltı Dağları bölgesi ve komşu denizlerinde ornithofaunasına ait ön araştırma sonuçları

Öz

Bu, Türkiye denizlerinde yapılan açık deniz kuşları gözlemleri ile ilgili ilk çalışmadır. Çalışma, Özel Çevre Koruma Bölgesi olan Finike Denizaltı Dağları (Anaximander) bölgesinde ve komşu denizlerinde 2021 yılı ilkbahar döneminde 10 gün ve sonbahar döneminde yedi gün süre ile yapıldı. Açık denizde bulunan kuş dağılımları, R/V YUNUS-S gemisinde standart doğrusal kesit yöntemiyle yapılan gözlemlerle belirlendi. Çalışma boyunca toplam yedi Ordo ve 11 Familya'ya mensup 19 farklı kuş türünden kaydedildi. Bu gözlemler sırasındaki ilk üç baskın tür grubu, boz yelkovan (*Calonectris diomedea*, n: 92, %47), sumru (*Sterna hirundo*, n: 22, %11) ve ebabil (*Apus apus*, n:15, %8). Türkiye'nin Akdeniz kıyı şeridi ve açık deniz bölgeleride, ilkbahar ve sonbaharda ağırlıklı olarak Ardeidae (Ciconiiformes) ve Laridae, Sternidae ve Scolopacidae (Charadriiformes)'lerin kullandığı göç hareketleri gözlemlendi ve bu türler için Ege ve Akdeniz kıyılarını içeren gözlemlenen ve tahmin edilen göç rotaları tanımlandı. Türkiye karasuları ve çevresindeki kuş türlerinin daha detaylı olarak araştırılması önerilmektedir.

Anahtar kelimeler: Deniz kuşları, pelajik kuşlar, doğu Akdeniz, açık deniz gözlemleri, Ornitofauna, kuş göçü, Türkiye

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