

SHORT COMMUNICATION

The acoustic detection of small cetaceans in Saros Bay in the northern Aegean Sea

Ayhan Dede^{1,2*}, Arda M. Tonay^{1,2}, Ayaka Amaha Öztürk^{1,2}

ORCID IDs: AD: 0000-0002-7712-615X; A.M.T. 0000-0003-2718-9328; AAÖ: 0000-0003-2281-7372

¹ Faculty of Aquatic Sciences, Istanbul University, Onaltı Mart Şehitleri Cad. No: 2, 34470, Fatih, Istanbul, TÜRKİYE

² Turkish Marine Research Foundation (TUDAV), P.O. Box: 10, Beykoz, Istanbul, TÜRKİYE

*Corresponding author: aydede@istanbul.edu.tr

Abstract

A passive acoustic monitoring study using F-POD was conducted for the first time in Saros Bay in the northern Aegean Sea. Between November 2022 and January 2023, harbour porpoise (*Phocoena phocoena relicta*) and delphinids were detected acoustically during both day and nighttime. However, diel patterns of delphinids and porpoises did not overlap. In general, the hours of high delphinid detection coincided with lower porpoise detection, implying the temporal difference in habitat use of these taxa. A year-long or longer study should be carried out to determine whether the presence of harbour porpoise in the region is continuous or seasonal.

Keywords: *Phocoena phocoena relicta*, harbour porpoise, passive acoustic monitoring, F-POD, Saros Bay SEPA

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Harbour porpoises (*Phocoena phocoena* Linnaeus 1758) are distributed widely throughout continental shelf waters of the Northern Hemisphere and are present in the North Atlantic, North Pacific, Black Sea, Turkish Straits System (namely, Marmara Sea, İstanbul and Çanakkale Straits), and northern Aegean Sea (Jefferson *et al.* 2015; Notarbartolo di Sciara and Tonay 2021). Endangered Black Sea harbour porpoise is recognized as a subspecies (*Phocoena phocoena relicta*) with morphological and genetic differences (Viaud-Martinez *et al.* 2007; Tonay *et al.* 2017). At least 5,500 years ago, this population split off from the closest conspecifics, which lived close to the Atlantic shores of Iberia and northwest Africa (Fontaine *et al.* 2010; Fontaine 2016). The historical presence

of harbour porpoises in the Aegean Sea has been debated in the past (Frantzis *et al.* 2001, 2003; Rosel *et al.* 2003), however, considering the genetic evidence showing that northern Aegean specimens are closely related to the Black Sea specimens (Viaud-Martinez *et al.* 2007; Tonay *et al.* 2017), the northern Aegean is included in the geographical distribution range of this subspecies.

There have been reports of sightings and strandings of harbour porpoises from the Aegean Sea coasts of Greece and Türkiye (Tonay and Dede 2013; Cucknell *et al.* 2016; Foskolos *et al.* 2020). Specifically, during a vessel-based survey in the summer of 2013 in the northern Aegean Sea, Cucknell *et al.* (2016) reported that Black Sea harbour porpoises were detected acoustically and observed visually in Saros Bay. Also harbour porpoise stranding event has been recorded in the Bay (Tonay and Dede 2013). It is obvious that the northern Aegean Sea is the eastern and southern limit of their distribution. It is crucial to collect more data on the presence of this species in the above area especially in Saros Bay (Special Environmental Protection Area) which is nationally a SEPA and internationally a part of IMMA (Northern Coast and Islands of the Thracian Sea IMMA) all year round to understand their temporal and spatial distribution, ultimately to facilitate conservation actions.

F-PODs (Full waveform capture Porpoise Detector) are passive acoustic monitoring devices whose main function is to identify the ultrasonic signals (clicks) generated by odontocetes (Tregenza *et al.* 2016). F-PODs' records summarize data on the time-domain characteristics of specific cetacean clicks using an omnidirectional hydrophone that works in the frequency range of 20 to 160 kHz.

To understand the presence of cetaceans, including harbour porpoises, in the interior of Saros Bay, an F-POD was deployed in Güneyli village (40.509143N, 26.673489E) for total of 80 days (02.11.2022-22.01.2023) at 20m depth, 200m off the coastline (Figure 1).

The recordings were analysed using F-POD specialized software, and cetacean click trains were extracted with the KERNO-F v1.0 classifier. This classifier can discriminate 'NBHF-Narrow Band High Frequency clicks' (here considered as Phocoenidae) and 'other cetacean' (here considered as delphinids). Standard click train filters for cetacean monitoring were used throughout; Train filters: high sp confidence only, Q; High+Moderate (the subset of the KERNO-F output that is typically used in monitoring studies, Species NBHF and Dolphins; other cetacea (Ivanchikova and Tregenza 2023). Train data exported as Detection Positive Minutes (DPM), then hourly, daily totals created in MS excel. For delphinids, at least four species of Delphinidae are commonly observed in the bay: bottlenose (*Tursiops truncatus*), common (*Delphinus delphis*), Risso's (*Grampus griseus*), and striped (*Stenella coeruleoalba*) dolphins (Altuğ *et al.* 2011).

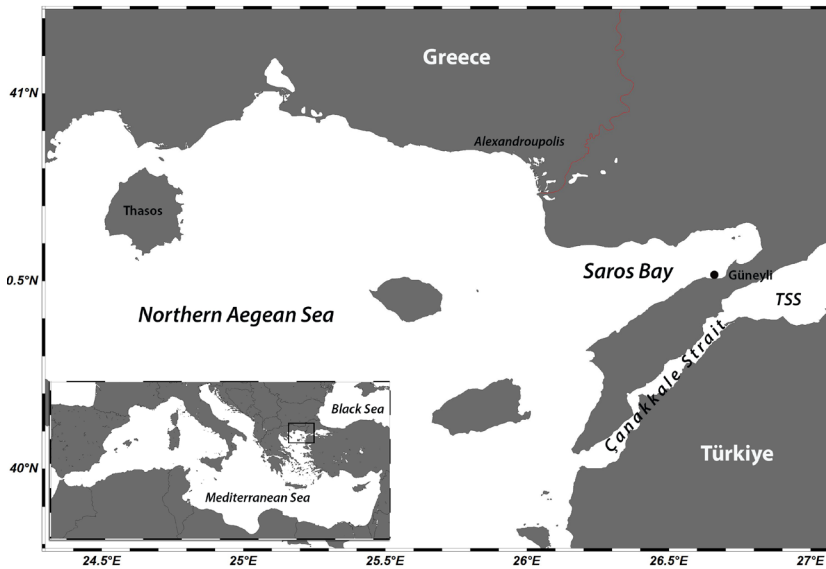


Figure 1. Study area. The black dot shows the location of F-POD.

During the monitoring period of 80 days, totally 9527 (7302 delphinid, 2225 phocoenid) click trains were detected. The number of days when acoustic detection is made is called “cetacean presence day”. In this regard, delphinids (72 presence days) were more dominant than porpoises (45 presence days). Both were absent for four days (Figure 2). Duration of their presence around the PAM station varied between 1-673, avg. 73 minutes for delphinids and 1-258, avg. 35 minutes for porpoises (Figure 3.)

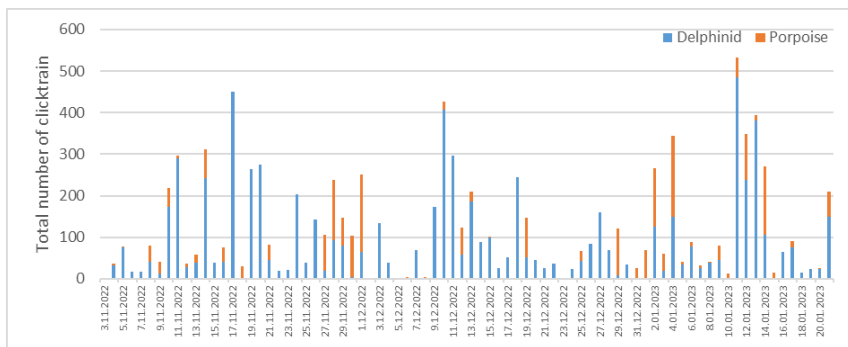


Figure 2. The daily total number of click trains recorded by F-POD during the monitoring period

Interclick intervals (ICIs) were extracted from F-POD data (Figure 4). Short ICIs observed indicated mostly feeding and foraging activities (Akamatsu *et al.* 2005; Verfus *et al.* 2009; Wahlberg *et al.* 2011; Tellechea 2020).

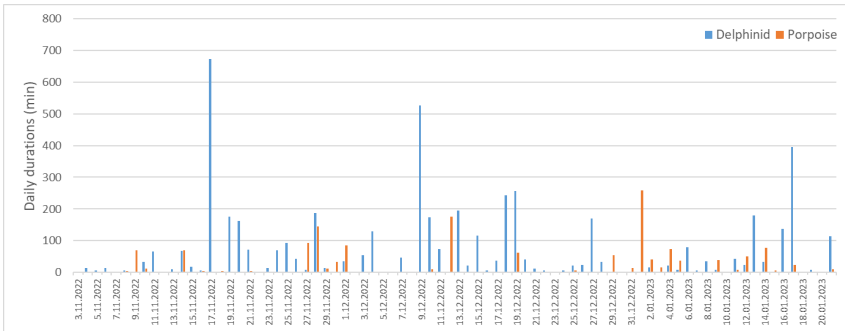


Figure 3. Daily distribution of presence durations (minutes)

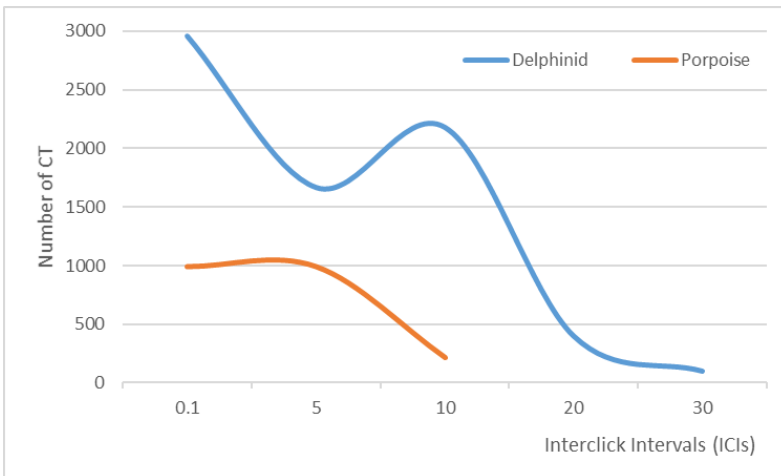


Figure 4. Distribution of interclick intervals (ICIs) of click trains recorded by F-POD

Delphinids were detected more at night, compared to the porpoises (Figure 5). The diel pattern of these two taxa did not overlap each other. Porpoise detections always appeared (9min-11h, avg. 9h) after delphinid presence, then disappeared (11min-22h, avg. 5.5h) before delphinid detections appeared. Similar presence pattern was indicated previously by Cosentino *et al.* (2024). In general, the hours of high delphinid presence coincided with lower porpoise presence.

The northern Aegean Sea, as a part of the eastern Mediterranean, has high productivity due to the influence of Black Sea waters (Ignatiades *et al.* 2002). For the majority of the year, northerly winds influence Saros Bay. The northern coastal region of the Gelibolu Peninsula is impacted by northeast winds, and upwelling activities in the region result in cold, dense water (Tokat and Sayin 2007). It is known that there is a three-layered water mass in Saros Bay: Black Sea Water at the surface, 20-40 m thick, which undergoes change as it passes

through Turkish Straits System; in the middle and at the bottom saline water (Pazi 2008). Therefore, conditions similar to those of the cold Black Sea, where harbour porpoises originate from, can be found in Saros Bay.

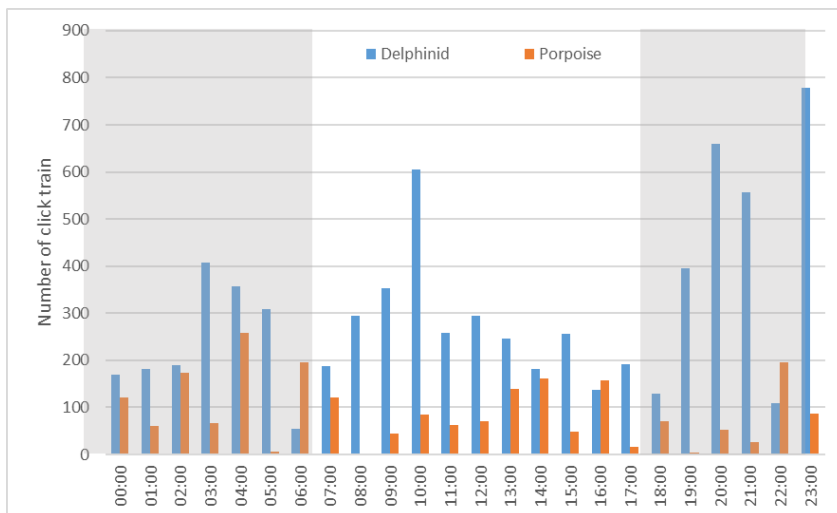


Figure 5. Accumulated data of diel pattern of the click train detections by F-POD

The North Aegean Sea is characterized by high primary production and, as a result, is one of the major fishing grounds in Greece (Milani *et al.* 2019). However, since fishing in Türkiye is concentrated mainly in the Black Sea, this is not the case for Türkiye. Therefore, while harbour porpoise bycatch, especially in trammel and gillnets, is reported in Greece (Milani *et al.* 2019), there is a lack of comparable systemic bycatch data on the Turkish coast of the Saros Bay. Fisheries in Saros Bay consist of small-scale fisheries, such as gillnet, trammel net, longline and hand line fisheries, while large-scale industrial fisheries are very limited (Çoker and Akyol 2018). Both the sea conditions similar to the Black Sea and high productivity can be the reasons why porpoises extend their distribution to the northern Aegean Sea, including Saros Bay.

This study, conducted in late autumn and winter, has confirmed for the first time the presence of harbour porpoises in Saros Bay in this season. The south-eastern region of Saros Bay was declared as the Special Environmental Protection Area (SEPA) in the Official Gazette with Decision No. 27793 on 22.12.2010 and also Saros Bay is a part of Northern Coast and Islands of the Thracian Sea IMMA (IUCN-MMPATF 2017). A year-long or longer study in the Saros Bay SEPA and IMMA will be important in determining whether the presence of harbour porpoises in the region is continuous or seasonal, highlighting the importance of SEPA for cetaceans.

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Author contributions: AD, AAÖ, AMT planned the study. AD made the analyses, the authors wrote the initial manuscript draft together. All authors approved the submitted version.

Türkiye'nin Kuzey Ege Denizi'nde Saros Körfezi'nde küçük setaselerin akustik tespiti

Öz

Kuzey Ege Denizi'nde Saros Körfezi'nde F-POD kullanılarak yapılan ilk pasif akustik izleme çalışması gerçekleştirildi. Kasım 2022 ve Ocak 2023 tarihleri arasında hem gündüz hem gece muturların ve Delphinidlerin varlığı tespit edilmiştir. Ancak, Delphinidlerin ve muturların günlük hareket düzenleri birbiriyle örtüşmemektedir. Delphinidler, muturlardan ziyade çoğunlukla gece vakti tespit edilmiştir. Genel olarak, Delphinidlerin yoğun olarak tespit edildiği saatler, muturların daha az tespit edildiği saatlerle çakışmaktadır, bu da bu türlerin habitat kullanımında zamansal bir fark olduğunu göstermektedir. Bir yıl veya daha uzun süreli bir çalışma, bölgedeki muturların varlığının daimi mi yoksa mevsimsel mi olduğunu belirlemek açısından önemli olacaktır.

Anahtar kelimeler: *Phocoena phocoena relicta*, mutur, pasif akustik izleme F-POD, Akdeniz, Saros Körfezi ÖÇKB

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