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Short Note

The First Photo-Identification Study on Bottlenose Dolphins (*Tursiops truncatus*) in the Foça Special Environmental Protection Area, Turkey

Vahit Alan,[1,2] Fethi Bengil,[3] Gökhan Kaboğlu,[1,2] and Harun Güçlüsoy[1,2]

[1]*Underwater Research Society, Marine Mammals Research Group, Akıncılar Sk. 10/1 Gazi Mustafa Kemal Boulevard, Maltepe, Ankara, Turkey*
E-mail: vahitalan@gmail.com
[2]*Dokuz Eylül University, Institute of Marine Sciences and Technology, Bakü Boulevard 100, Balçova, Izmir, Turkey*
[3]*Girne American University Marine School, University Drive P.K. 5, Karmi Campus, Girne, TRNC via Turkey*

The bottlenose dolphin (*Tursiops truncatus*, Montagu, 1821) is a cetacean species that is distributed from the tropics to cold temperate waters worldwide (Leatherwood & Reeves, 1989; Wells & Scott, 1999). Bottlenose dolphins live in schools with an average of 15 individuals but can vary from a pair to over a hundred individuals (Shirihai & Jarrett, 2006). They generally forage as a small group, even though the species members feed individually and foraging behaviour can differ by habitat type (Henderson & Würsig, 2007). Among their prey are eel, shrimp, and a wide variety of fish and squid (Wells & Scott, 2002). Although the global population of bottlenose dolphins is listed as "Least Concern," the Mediterranean population is listed as "Vulnerable" by the International Union for Conservation of Nature's (IUCN) *Red List of Threatened Species* (Hammond et al., 2012).

Twenty-eight species of cetaceans occur in various degrees of abundance in the Mediterranean and Black Seas, and 11 of them are regularly present in the Mediterranean (Notarbartolo di Sciara, 2016). Among these, 12 species of cetaceans have been reported in Turkish seas to date (Güçlüsoy et al., 2014).

Studies on cetaceans in Turkish seas were designed to address certain topics, including strandings (e.g., Güçlüsoy et al., 2004; Veryeri, 2012), bycatch (e.g., Öztürk et al., 2001), fisheries interactions (e.g., Enül et al., 2009), population estimates (e.g., Dede, 2000), and opportunistic records (e.g., Kinzelbach, 1991; Güçlüsoy, 2008). To date, two photo-identification studies are known from Turkish seas: one is from the Turkish coast of the Aegean Sea on short-beaked common dolphins (*Delphinus delphis,* L. 1758) by Akça & Sosyal (2013), and another is from the Istanbul Strait on *T. truncatus* by Akkaya Baş et al. (2015). Legal and illegal capturing of individuals for dolphinariums has also been reported for Turkish seas (Didrickson et al., 2009)

Dorsal fin features of most cetacean species, in particular bottlenose dolphins, are unique to each individual and can be used for distinctive identification. Researchers frequently employ photo-identification techniques in studies of populations, migration, and social interactions (e.g., Würsig & Jefferson, 1990).

In the present study, one of the first photo-identification efforts in the Turkish Aegean Sea, authors aim to identify *T. truncatus* individuals to establish a baseline for monitoring the species in the Foça Special Environmental Protection Area (SEPA). The study area, the coast of Foça, is a marine coastal protected area that is one of the 11 SEPAs on the Turkish coasts and has an area of 71,38 km^2. The site was declared as a protected area in 1990, primarily due to the presence of the endangered Mediterranean monk seal (*Monachus monachus*, Hermann, 1779), and its goal is to protect this species (Güçlüsoy, 2015).

For the present study, photo-identification surveys were conducted from 12 June to 28 September 2013 from a 4.20-m inflatable boat with a 25-hp outboard engine by the first two authors. During surveys, a single DSLR photo-camera with a 70- to 300-mm zoom lens was used. Survey routes were selected randomly and were governed according to weather conditions. Data were collected in good sea states (Beaufort sea state ≤ 3) when visibility was also high. Observations were performed by the naked eye and by using Nikon 10 × 40 binoculars.

During each survey, effort data were comprised of date, time, and sea state. Other data recorded were the route paths, location of dolphin sightings, group size, and image data. The positions of

the boat and dolphin groups were determined by a handheld GPS (Garmin 60c). The locations of bottlenose dolphin sightings were recorded at the beginning of each encounter. All effort tracks and a distribution map of the sightings were created by GIS software *MapInfo*, Version 10.0.

Photo-identification procedures suggested by Würsig & Jefferson (1990) were followed during the sightings. Natural marks (nicks) on dorsal fins were used to identify each individual. Other features, such as fin shape, scars, and other body marks, were used as auxiliary information to aid in identification. Photo-identification effort included taking photographs of both sides of the dorsal fins when possible.

The survey was conducted over 10 d, with one survey per day due to the limitations of the weather conditions (Table 1). A total effort in terms of track length was 130 nmi with an average of 13 ± 1.4 nmi for each survey day. The average cruise duration was 3.5 ± 0.9 h.

Bottlenose dolphins were observed on eight cruises, with one group encountered each cruise (Figure 1). The observations concentrated to the west of the Foça Islands. The cluster size varied from 1 to 45 individuals with an average of 17 ± 14 individuals. The common movement direction of seven out of eight groups was to the south of the SEPA border. It is worth noting that no other cetacean species were observed.

Although there were eight successful cruises with species sightings, photographs could only be taken on seven of them; in the final cruise, the encounter period was too brief to take any photos. A total of 1,434 photographs were taken, 175 (12%) of which were well-marked and could be used for photo-identification (Table 2). The most successful cruise was cruise #10 with an identification rate of 30% (6/20); while the third cruise was the least successful with a 4.4% (2/45) identification rate. Individuals were identified in five cruises out of ten (Table 2).

In this study, a total of 11 well-marked adult individuals were identified through the use of photo-identification. The photographs of these individuals became the basis of a photo-identification catalogue for further investigation (Figure 2). In addition to dorsal fin morphology (geometric characteristics), several marks were also used to identify each individual (Table 3). Individuals ID-2 and ID-8 were identified with a single mark type (pigment pattern and fin shape, respectively), while two or three mark types were used in combination to identify the rest of the individuals. Notches (n = 8) and scratches (n = 7) were more commonly used marks for identification rather than fin shape (n = 4) and pigment pattern (n = 4) (Table 3).

Groups of bottlenose dolphins in varying cluster sizes were observed to use the study area, and some of these groups included calves, although no usable photographs were obtained. The observation of juvenile individuals in some dolphin schools may indicate that Foça SEPA and adjacent waters could be a possible breeding area for bottlenose dolphins. The tendency of southern movement may be related to an increased probability of finding prey in the no-take military zone between the southern border of Foça SEPA and the mouth of the Gediz River about 5 nmi to the south. High encounter rates (80%) (Table 2) and recapture rates (46%) (Table 3) in the sampling period also suggest that bottlenose dolphins may be a resident cetacean species in the Foça SEPA; this area covers almost half of the home range size

Table 1. The survey effort data on *Tursiops truncatus* in the Foça SEPA in 2013; start and finish times are in military time.

Cruise #	Date	Start	Finish	Cruise duration (h)	Effort (nmi)	Beaufort sea state
1	12 June 2013	0800 h	1100 h	3.00	10.90	1-2
2	14 July 2013	1600 h	1900 h	3.00	12.42	1-2
3	17 July 2013	1400 h	1930 h	5.50	14.56	2-3
4	21 July 2013	0800 h	1200 h	3.00	13.50	2-3
5	15 Aug. 2013	1245 h	1700 h	4.25	13.85	1-2
6	13 Sept. 2013	1300 h	1530 h	3.50	15.40	1-2
7	20 Sept. 2013	0900 h	1300 h	4.00	11.61	2-3
8	24 Sept. 2013	0900 h	1200 h	3.00	11.70	1-2
9	25 Sept. 2013	0700 h	0930 h	2.50	12.40	1-2
10	28 Sept. 2013	1200 h	1700 h	5.00	13.66	1-2

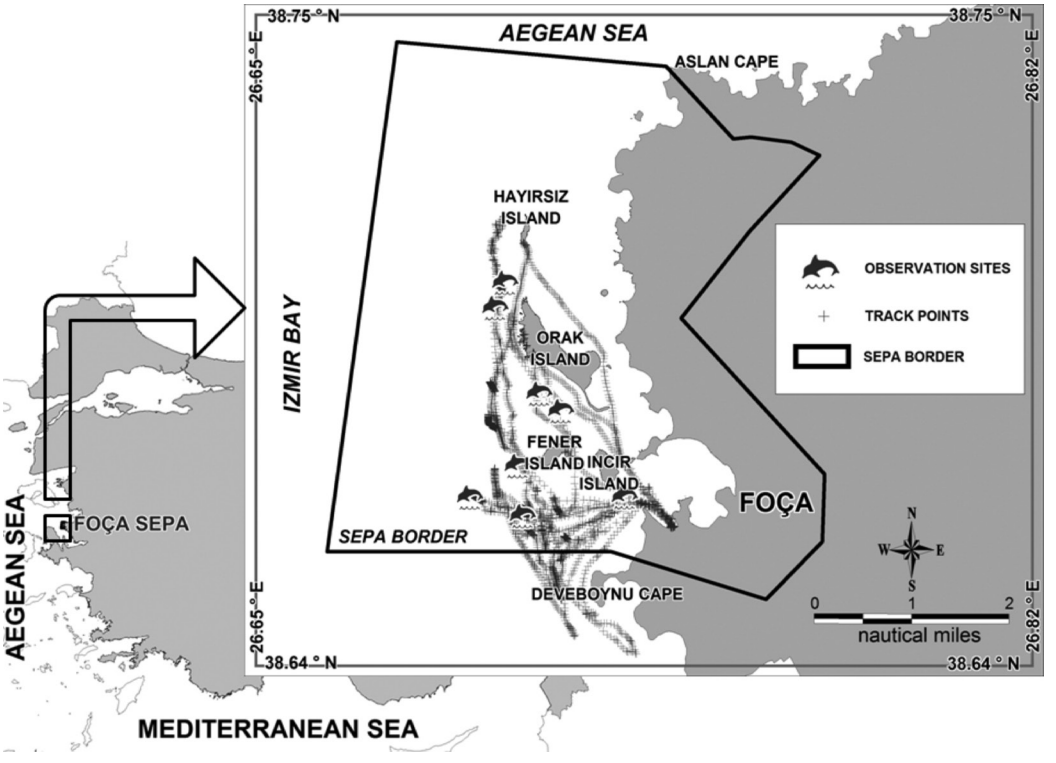

Figure 1. Total survey effort distribution (as tracks) and the first sighting location of *Tursiops truncatus* groups/individuals in the Foça SEPA (outgoing tracks beyond the SEPA borders are due to following *T. truncatus* groups)

Table 2. The survey results showing sighting and image data, and the number of individuals identified confined to each survey in the Foça SEPA

Cruise #*	Cluster size	Total photographs taken	# of well-marked photographs	# of identified individuals	Ratio of identified individuals in each cluster (%)
1	18	46	0	0	0
2	2	0	0	0	0
3	45	351	42	2	4.4
4	0	0	0	0	0
5	0	0	0	0	0
6	1	22	0	0	0
7	18	144	23	1	5.6
8	21	175	15	1	4.8
9	12	310	32	1	8.3
10	20	386	63	6	30

*One group was observed per cruise; thus, each row corresponds to a group.

of 100 to 150 km^2 for resident bottlenose dolphin populations found in other regions (Wells & Scott, 1999; Bearzi et al., 2010).

Though the study was carried out over a short period, the large group sizes encountered and the successful photo-identification of some individuals provides information on the abundance of the population of *T. truncatus* in the area. Genov et al. (2008) reported that occasional sightings of large groups in their study were a likely explanation for

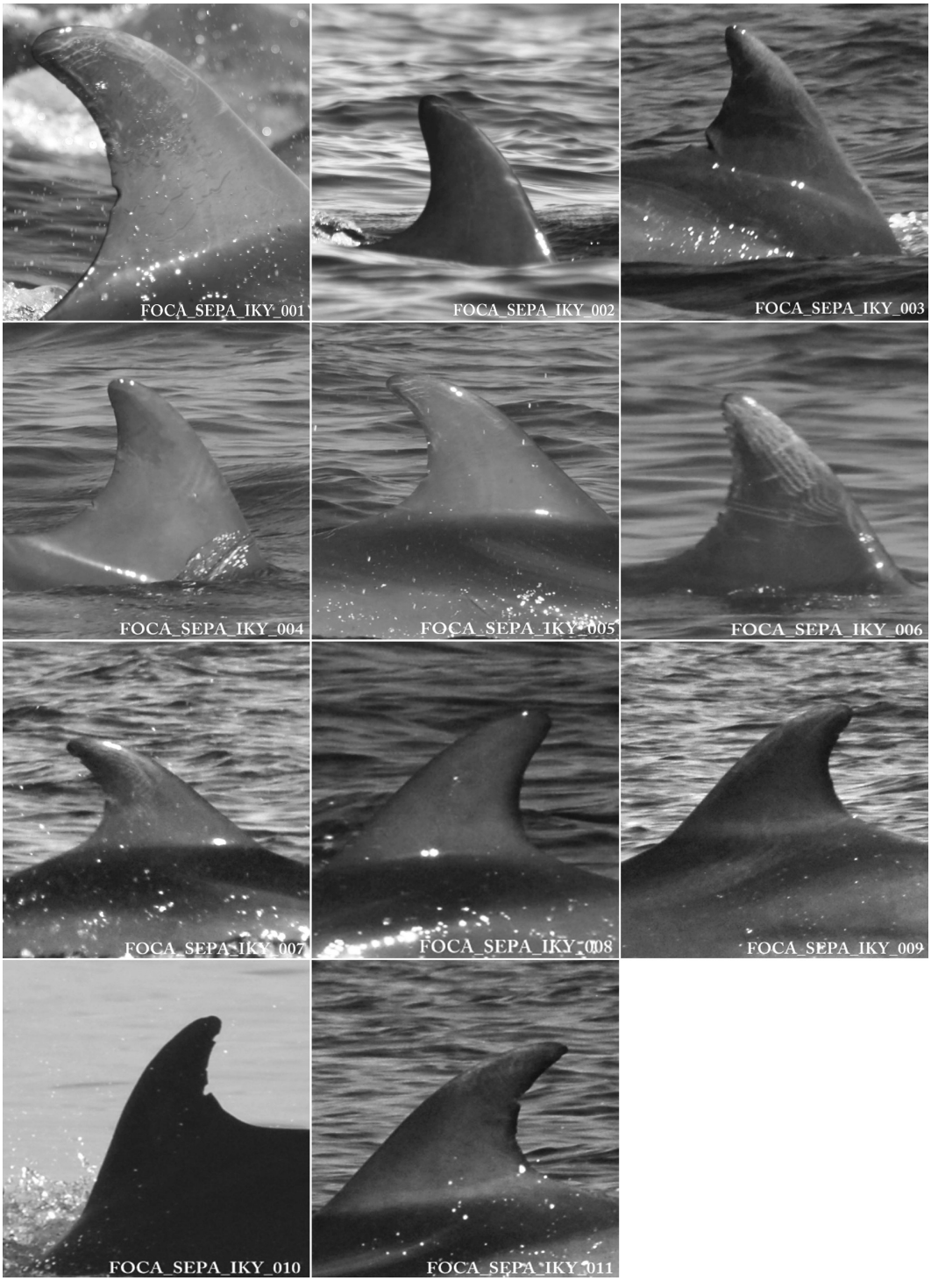

Figure 2. The dorsal fins of identified bottlenose dolphins in the Foça SEPA; each photograph shows the identified individual in the study.

Table 3. Photo-identification marks used for identification of each individual and number of recaptures confined to each individual

Individual code	Distinct scratches	Distinct notches	Fin shape	Pigment pattern	Recaptures
ID-1	+	+			--
ID-2				+	--
ID-3		+	+	+	3
ID-4	+	+			--
ID-5	+	+			--
ID-6	+	+	+		3
ID-7	+	+			2
ID-8			+		--
ID-9	+			+	1
ID-10		+	+		1
ID-11	+	+		+	--

sudden increases in their cumulative identification process. In contrast, encounters with large groups were not rare and occurred in almost half of all sampling days in this study. These results indicate that the area might have a relatively high abundance of the species and that the population in the area prefers to travel in large groups. This behaviour would be advantageous for conducting systematic monitoring studies in the future to evaluate the social structure of the population.

In this study, 11 well-marked individual bottlenose dolphins, of which seven were recaptured and suggest residency, were identified through the use of 175 photographs. Photo-identification success was found to be related to sea state and relative locations of the sun, the animals, and the observer, and also to observer experience and the camera used. In this study, notches and scratches were used more than fin shape and pigment patterns in identifying individuals (e.g., Würsig & Jefferson, 1990) because these mark types are more distinct. Two or three mark types were generally needed to identify the catalogued individuals in nine out of the 11 cases.

Photo-identification surveys in this study were performed from inflatable boats with high speed and manoeuvring capabilities. For this reason, the success of this type of survey is strongly dependent on the weather conditions present at the time of the study. Strong and continuous winds limited the number of survey efforts during this study period, resulting in a concentration of survey effort in this region. This created a spatial disparity in sampling and reduced the ability to identify a high number of individuals.

Foça SEPA is located in the outer part of the Izmir Bay (Turkish Aegean Coast). Izmir Bay was a known legal capture area of dolphins for a short period 8 y ago. Fishermen report that illegal captures still sometimes occur in the area. The photo catalogue of the İzmir Bay individuals that was produced in this study may help governmental officials in identifying illegally captured individuals if they were to be recognized in the existing dolphinariums operating in Turkey (Bengil et al., 2012). Such a practical use of this catalogue as an identification tool for illegal capturing also supports the need for a larger database.

This study was one of the first ones of its type in Turkey, but understanding cetacean populations requires long-term studies. A well-designed study with more photo-identification effort could provide vital population parameters, such as abundance, through closed mark-recapture models. Information gained via photo-identification will be valuable for understanding the distribution, home range, and social relationships among the individual bottlenose dolphins throughout the lifespan of this population.

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