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Cranial Morphometrics of a Stranded Common Bottlenose Dolphin *Tursiops truncatus* (Montagu, 1821) in Mersin Bay (Northeastern Mediterranean, Turkey)

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Abstract

On 10 November 2017, a young male common bottlenose dolphin *Tursiops truncatus* (Montagu, 1821), 185 cm in total length (TL), was found dead on the Mersin Marina (36°46'065"N, 34°34'212"E) in Northeastern Mediterranean coast of Turkey. Measurements of the sample performed and documented. The specimen buried to obtain the skeleton of the individual. At the end of this process, the sample was deposited in the Museum of the Systematic, Faculty of Fisheries, Mersin University, (Catalogue no: MEUMC-17- 11-001). The morphometric measurements can contribute to ongoing fisheries biology and taxonomic studies of *T. truncatus* from Mediterranean Sea waters. During routine fishing activities, common bottlenose dolphins can be caught in fishing nets and drowned. This issue leads to an extra population loss in addition to environmental factors that cause dolphin deaths. At the national level, measures should be implemented to protect dolphins and other marine species caught off -target.

Keywords: Common bottlenose dolphin, *Tursiops truncatus*, human effect, Mediterranean Sea, Turkey

1. Introduction

Common bottlenose dolphins *Tursiops truncatus* (Montagu, 1821) belonging to the Delphinidae family, are widely accepted in the Mediterranean Sea (Pilleri & Gihr, 1969; Cagnolaro et al., 1983; Notarbartolo di Sciara & Demma, 1994; Bearzi & Fortuna, 2006).

Tursiops truncatus is gray, and the abdomen is lighter in color. Its dark-colored sickle-shaped dorsal fin can quickly identify *T. truncatus*. No other bottle-nosed dolphin ecotype has been identified so far in the Mediterranean. Notarbartolo di Sciara & Demma (1994) stated that the Mediterranean population of *T. truncatus* is more related to the coastal ecotype due to the shallow water habits.

Tursiops truncatus prefer shallow waters as habitats. This preference may be related to the feeding habits of the species that feeding mostly on benthic and demersal fish (Voliani & Volpi, 1990; Orsi Relini et al., 1994; Silva & Sequeira, 1997; Mioković et al., 1999; Blanco et al., 2001; Santos et al., 2001).

There are different opinions among the researchers as to whether *T. truncatus* belonging to the genus *Tursiops* should be divided into a single species or several species. Some authors stated that it should be divided into Atlantic bottlenose (*T. truncatus*), Indopacific bottlenose (*T. aduncus*) and Pacific bottlenose (*T. gillii*). Recently, this distinction has not been generally accepted. Rice (1998) stated that *T. aduncus* is a separate species, but *T. gillii* is only a subspecies of *T. truncatus*.

Also, according to various researcher's studies', it is stated that the bottlenose dolphin found in the Black Sea is a subspecies of the bottlenose dolphin of the Atlantic and should be called *Tursiops truncatus ponticus* (Ridgway & Harrisson, 1999; Reynolds III et al., 2000; Reeves et al., 2002; Reynolds, III & Wells, 2003; Jefferson et al., 2008).

T. truncatus live in small groups, and each group has a mature male, the rest of the group consists of female and offspring. They communicate with each other with high-frequency sounds. Each dolphin has a unique voice (name) that identifies its identity and also uses it while hunting (Janik et al., 1994). Their total length varies between 190-400 cm, and they can reach weights up to 650 kg (Sergeant, 1969). The pregnancy period in dolphins is one year. At birth, their tails go out first, so they do not have the risk of suffocation at birth, which can last up to 2 hours. Immediately after birth, the mother pushes her offspring towards the water surface and allows it to breathe for the first time. Newborn babies are of 65 to 105 cm total length and 15-30 kg in weight. *T. truncatus* can live up to the age of 25, but some have reached the age of 35 under captivity (Shirihai et al., 2006).

In this study, morphometric measurements of *T. truncatus*, which were accidentally caught in the fishing net and stranded in Mersin Marina, were taken and compared with previous studies. The data obtained are aimed to contribute to the researchers engaged in fisheries biology and taxonomic studies. Information on the causes of deaths for this species and some recommendations for protection also has given.

2. Material and Methods

2.1 Study Site

In this study, a bottlenose dolphin was recorded near the Mersin Marina (Mersin Bay, Turkey), (Figure 1). Mersin coast is an enclosed system and has oligotrophic water; its biodiversity is continually changing with fish's migration. The Mersin Bay is an important fishing area of the Northeastern Mediterranean Sea due to the nutrient-rich freshwater inputs. The muddy, sandy seabed and the productive environment provide suitable living bio-habitats for all sea creatures.

2.2 Sampling

On 10 November 2017, a young male bottlenose dolphin *T. truncatus*, 185 cm in total length (TL), was found dead on the Mersin Marina (36°46'065"N, 34°34'212"E) in Northeastern Mediterranean coast of Turkey (Figure 1). The specimen of the bottlenose dolphin buried to obtain the skeleton of the individual. Once the skeleton is obtained, the sample was deposited in the Museum of the Systematic, Faculty of Fisheries, Mersin University, (Catalogue No: MEUMC-17-11-001). The sampling location of the species in the Mediterranean Sea presented in Figure 1. Photographs of the caught sample shown in Figure 2 and the skeleton specimen of *T. truncatus* given in Figure 3.

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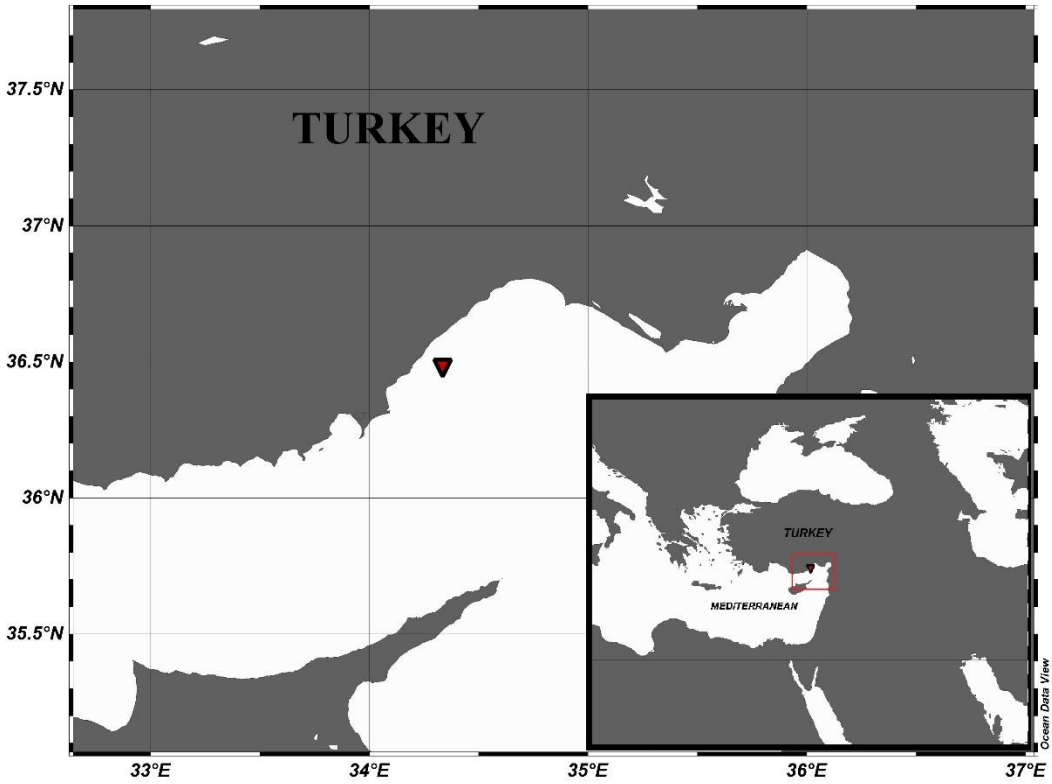

Figure 1. The red mark indicates the location where the specimen found

Figure 2. The specimen of *T. truncatus* from Mersin Bay

Figure 3. The skeleton of *T. truncatus*

3. Results

The *T. truncatus* individual, identified as male, is gray, and the abdomen is lighter in color. The dorsal fin is dark-colored and sickle-shaped. The sample had a 185 cm total length. The fins and front extremities had some hemorrhage and injuries. Also, there were some deep rope incisions on the body. In the study, cranial morphological data of the head of *T. truncatus* specimen were examined comparatively with the stranded samples on the shores of China Sea (Wang et al., 2000) and South Africa (Ross, 1977, 1984) (Table 1). Some morphometrics measured in this study are the following: Mandibular height (MH) is 63.2 mm, the upper teeth row length (UTRL) value is 157.4 mm, and the mandibular length (ML) value is 286.5 mm. Preorbital width (PRQ) and postorbital width (POW) values are 116.3 mm and 112.9 mm. Condylobasal length (CBL) and inter-supraorbital width (SOW) values measured as 385.5 and 142.4, respectively (Table 1).

Table 1. Comparison of cranial data of *T. truncatus* specimen with previous studies

Character (mm)	Mersin This study	China (min/max) Wang et al. (2000)	South Africa (min/max) Ross (1977, 1984)
Number of sample (n)	1	2	2
MH	63.2	61.0-104.4	90.1-109.8
MFL	42.1	-	-
ML	286.5	340.8-480.8	425.8-498.2
RW	82.9	-	-
RL	192.5	203.5-319.6	183.2-334.6
ONW	51.8	-	-
UTRL	157.4	172.0-277-7	154.0-276.9
LTRL	156.0	-	-
ONRL	263.1	243.5-375.2	337.2-386.9
OL	42.7	-	-
RPW	66.3	-	-
TDMM	7.3	-	-
TDMR	7.1	-	-
TFW	158.3	-	-
POW	116.3	171.5-262.5	229.8-276.9
ZW	154.4	-	-
CBL	385.5	394.4-561.1	450.7-529.1
SOW	142.4	163.2-254.1	228.8-269.8
POW	112.9	187.2-286.6	253.9-301.1

MFL: Mandibular Fossa Length, ML: Mandibular Length. RW: Width of rostrum. RL: Rostrum length, ONW: Outer Nose Width, UTRL: Upper Tooth Row Length, LTRL: Lower Tooth Row Length, OL: Orbital Length, ONRL: Length from Outer Nostrils to Rostrum End, RPW: Rostrum Width in Rostrum Pre-maxillary, TDMM: Tooth Diameter in the Middle of Mandibul, TDMR: Tooth Diameter in the Middle of Rostrum, TFW: Posterior Boundary Width of Temporal Fossa, POW: Width between Pre-orbitals, PRW: Width Between Pre-orbitals, ZW: Skull Zigomatic Width, CBL: Condylobasal Length, SOW: Supraorbitals Width.

The ratio of skull measurements of *T. truncatus* specimens stranded in Gökçeada and Mersin Bay to condylobasal length is given in Table 2.

Table 2. Skull measurements ratios of *T. truncatus* to CBL (mm)

Character	Çanakkale/Gökçeada Doğangün (2018)	Mersin (Mediterranean) This study
CBL/CBL	1	1
MH/CBL	0.190	0.163
MFL/CBL	0.274	0.109
UTRL/CBL	0.500	0.408
RPW/CBL	0.245	0.301
POW/CBL	0.505	0.298
LTRL/CBL	0.463	0.404
DDRU/CBL	0.693	0.682
PRW/CBL	0.447	0.301
ZW/CBL	0.516	0.400
OL/CBL	0.151	0.110
RL/CBL	0.596	0.499
SOW/CBL	0.556	0.369
ML/CBL	0.858	0.743

The rostral measurement of *T. truncatus* specimens stranded in Gökçeada and Mersin Bay are given in Table 3 in detail. The ratio of rostral measurement data to zygomatic width (RL / ZW) was found to be 1.247 in Mersin sample (Table 3).

Table 3. Rostral measurement ratios of *T. truncatus* specimen (mm)

Character	Çanakkale/Gökçeada Doğangün (2018)	Mersin (Mediterranean) This study
RL/ZW	1.155	1.247
RL/CBL	0.598	0.499
RPW/ZW	0.475	0.431
RPW/RL	0.411	0.343

Mandibular measurement ratios (mm) of the *T. truncatus* specimens are given in Table 4 for Gökçeada and Mersin samples.

Table 4. Mandibular measurement ratios of *T. truncatus* specimen (mm)

Character	Çanakkale/Gökçeada Doğangün (2018)	Mersin (Mediterranean) This study
ML/CBL	0.914	0.743
LTRL/ML	0.516	0.544
MFL/ML	0.295	0.146
MH/ML	0.165	0.220

The postcranial numbers of *T. truncatus* specimens are given in Table 5. The first two vertebrae fused in the cervical region.

Table 5. Postcranial numbers of *T. truncatus*

Character	Çanakkale/Gökçeada Doğangün (2018)	Mersin (Mediterranean) This study
Cervical	7	7
Thoracic	13	13
Lumbar	15	15
Caudal	26	21
Total	61	56

4. Discussion

The Mandibular height (MH) value (63.2 mm) of the Mersin specimen of *T. truncatus* was closely similar to the Chinese sample, which was smaller than the other one (61.0 mm) (Wang et al., 2000). Rostrum length (RL) value (192.5 mm) is quite different from an individual of (smaller one) the South Africa sample (183.2 mm) (Ross, 1977). Table 1 shows that the UTRL value is similar to the South African samples (smaller one), and the ONRL value is similar to the smaller individual of Chinese samples. When the mandibular length (ML) value is examined, it is seen that this value is higher in China (340.8 - 480.8 mm) and South African samples (425.8 - 498.2 mm) in Mersin sample (286.5 mm). When the values between pre-orbitals width (PRW) and postorbital width (POW) were examined, it was found that these values in the Mersin sample were quite smaller (116.3 - 112.9 mm) than China (171.5 - 187.2 mm) and South Africa (229.8 - 253.9 mm). Also, condylobasal length (CBL) and inter-supraorbital width (SOW) values are slightly lower than the comparable samples.

The stranded of *T. truncatus* specimens of the skull measurements were compared with studies in Aegean (Gökçeada) and Mediterranean (Mersin) regions; RPW / CBL ratio was found to be greater in the sample in Mediterranean region, and other measurements were smaller (Table 2). In the rostral measurement values, it was found that the RL / ZW ratio was high, and the other data were low in the species belonging to the Mediterranean region (Table 3). Table 4 shows

that the LTRL / ML data are similar in both samples, and the MH / ML ratio is high in the Mediterranean region. In the postcranial data of *T. truncatus* specimens, there is no significant difference between the vertebrae of the skeleton (Table 5). The first two vertebrae are fused in the cervical region, which is a characteristic of dolphins. Thoracic and Lumbar regions are equal in spine numbers. However, an excess of spine detected in the Caudal region in the Çanakkale/Gökçeada sample. Rommel (1990), in his study on *T. truncatus*, the maximum and minimum values of the number of vertebrae were determined as 60-65. As a result, there may be various regional differences between individuals of the same species.

Reeves & Notarbartolo di Sciara (2006) evaluated the status of bottlenose dolphins in the Mediterranean within the scope of a regional Red List Workshop held in March 2006, and they have stated that this species had a bottleneck in the Mediterranean Sea and could be considered as a sub-population.

Bearzi & Fortuna (2006), under the IUCN red list the criteria that are the main reasons for the decrease in the number of *T. truncatus*. They stated that there are threats from overfishing of the populations, habitat degradation, chemical pollutants, and environmental pollution.

According to Perrin & Geraci (2009), a live Cetacean species can land again when returned to the sea. However, they may decide that they cannot survive or float at sea, but may also land on the sea to continue breathing. Valuable information about anatomy, life history, genetics, diseases, parasites, predators, and nutritional ecologies of marine mammals can be obtained from carcasses stranded. Each stranding event can be considered as a potential opportunity that cannot be learned otherwise.

Today, although the exact cause of mass stranding is not known, marine mammals are stranded by the effects of wave and wind as dead or fallen due to many natural or unnatural reasons (Wayne, 1984). Reasons for mass hitting; epidemics and parasites, biotoxins, acoustic dead zones, changes in world magnetism, significant climatic changes, seasonal changes in environmental conditions. Besides, due to the decrease in food resources, hunger, sun-bursting activities can be due to reasons such as human-caused reasons (Geraci & Lounsbury, 2005).

According to various researchers (Fernández et al., 2005; Perrin & Geraci, 2009), seismic investigations during oil exploration and extraction, organochlorine compounds, which cause increased viral outbreaks in marine mammals can lead to death by weakening the immune system. Besides, military sonars have also been shown to cause mass deaths of dolphins (Perrin & Geraci, 2009).

The specimen found in this study had a lot of injuries on the fins and the body. With a detailed examination of the body of the sample, it can be thought that an incidental catch was the cause of death. Although fishing activities do not target dolphins in the Mediterranean. In the present study, the bottlenose dolphin individual in the Mersin Marina found dead as incidentally in fishing nets. Thus, this situation should not be ignored in bottlenose dolphin deaths in the Eastern Mediterranean.

5. Conclusion

The bottlenose dolphin individual recovered from the eastern Mediterranean waters once again demonstrates the destructive effects of the fishing activity on the dolphins in this region. The bottlenose dolphin individual in the Mersin Bay drowned as a result of accidental fishing. This result is thought to be an essential factor in bottlenose dolphin deaths in the Eastern Mediterranean. Therefore, it is considered necessary to increase the local and national protection measures for these species in our country and the Mediterranean.

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