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## New records of Cuvier's beaked whales (*Ziphius cavirostris*) from the Turkish Levantine Sea

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**Abstract:** Cuvier's beaked whales were sighted once on each of three different surveys over Antalya Canyon, in June and September 2015. Sightings took place in waters between 600 and 1000 m in depth and at 8 km from the closest shore. While the first sighting was positively identified as Cuvier's beaked whale (*Ziphius cavirostris* (G. Cuvier, 1823)), latter sightings could not be identified to the species level. Nevertheless, noting that latter sightings had a similar spatial and temporal distribution to the first one and that there is an overwhelming difference between the probabilities of sighting Cuvier's beaked whales versus *Mesoplodon* sp. in the Mediterranean Sea, all three sightings were assumed to be Cuvier's beaked whales. Group size was recorded as two for the first two sightings and one for the last sighting. We hereby report the most recent Cuvier's beaked whale sightings from the Levantine Basin and the first ones from Antalya Bay, as well as compile the previous sighting and stranding information on beaked whales in the eastern Mediterranean Sea. The current study supports previous modeling results showing the northern region of the Levantine Sea to be of importance to the species distribution in the Mediterranean Sea and we propose that the species is indeed regularly present in the area. However, consistent regional surveys are needed in order to validate these conclusions.

**Key words:** Cuvier's beaked whales, sightings, Levantine Basin

Beaked whales' distribution in the Mediterranean is mostly known through stranding records (Podestà et al., 2006). While Cuvier's beaked whales are the only beaked whales commonly found in the Mediterranean Sea (Podestà et al., 2006), *Mesoplodon* specimens have been reported stranded only in five occasions in the Mediterranean Sea (Podestà et al., 2006; Notarbartolo di Sciara, 2009) and are considered as vagrant species (Taylor et al., 2008). Due to the paucity of data on Cuvier's beaked whales in the Mediterranean Sea, especially in the eastern basin, the status of this subpopulation has been noted as impossible to assess with the current level of knowledge (Cañadas, 2012) and, as such, it is listed as "Data Deficient" by the IUCN Red List. A recent proposal by the EU, however, resulted in the placement of the Cuvier's beaked whale subpopulation in Appendix 1 of the Convention for Migratory Species.

Cuvier's beaked whales' life history is also poorly known (Heyning and Mead, 2009). They are deep-diving pelagic cetaceans that inhabit offshore waters of all oceans (Reeves et al., 2002), currently holding the mammalian dive depth and duration records of 2992 m and 137.5 min, respectively (Schorr et al., 2014). In the Mediterranean Sea they are mostly observed in waters between 200 to 2000 m in depth,

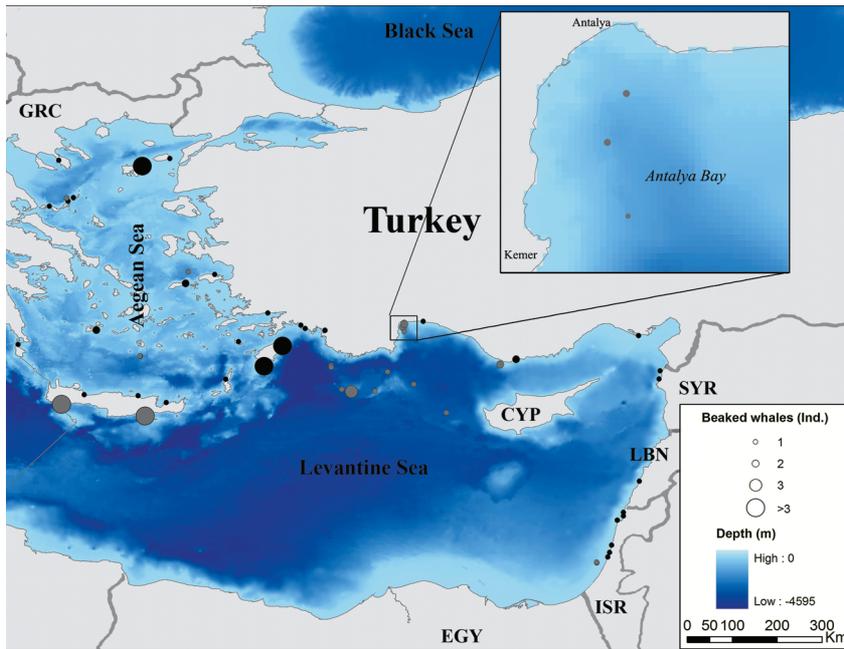
with a distinctive preference for depths of 1000 m (Boisseau et al., 2010). They are found mostly in small groups of 2 to 7, but are not uncommonly seen alone. While Turkey has a long coastline of 1577 km along the Levantine Sea and 2805 km along the Aegean Sea, live sightings of Cuvier's beaked whales in Turkish waters are extremely rare with only one record in the Ikaria Basin through acoustic detection in 2013 (Ryan et al., 2014) and two visual and seven acoustic reports from the northern Levantine Sea (Table 1; Figure 1) (Boisseau et al., 2010; Ryan et al., 2014). Visual sightings of beaked whales, assumed as Cuvier's beaked whales, were reported in 2007 (Boisseau et al., 2010); the first, with a group size of three, was recorded over the Anaximander Seamounts, and the second, with a group size of two, was recorded over the Adana Trough. Of the remainder of the records, seven beaked whales were acoustically detected over the Anaximander Seamounts in 2013 (Ryan et al., 2014). Apart from Turkish waters, a visual sighting was only reported once by a trawler off Ashdod, Israel, in 2003 (Kerem et al., 2012).

In regards to the beaked whale stranding records of Turkey, eleven stranded individuals were reported to date (Table 2; Figure 1), the first being reported from Gökçeada

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**Table 1.** List of live Cuvier’s beaked whale sightings in the Levantine Sea and Aegean Sea (*Zc*, *Ziphius cavirostris*; Ind., Individuals).

Species	Ind., n	Date	Coordinates	Country	Sea	Reference
Zc	3	13.06.2007	35°25'45.48"N 29°37'51.60"E	Turkey	Levantine	Boisseau et al., 2010
Zc	2	16.06.2007	35°58'48.72"N 32°36'31.68"E	Turkey	Levantine	Boisseau et al., 2010
Zc	2	04.06.2015	36°43'49.36"N 30°39'54.21"E	Turkey	Levantine	Current study
Assumed Zc	2	18.06.2015	36°47'41.28"N 30°41'24.50"E	Turkey	Levantine	Current study
Assumed Zc	1	07.09.2015	36°38'01.00"N 30°41'31.00"E	Turkey	Levantine	Current study
Zc	1	02.12.2003	31°58'10.20"N 34°32'19.32"E	Israel	Levantine	Kerem et al., 2012
Zc	1	May–September 1993	36°8'30.24"N 25°24'4.42"E	Greece	Aegean	Carpentieri et al., 1994
Zc	1	1991–2002	39°20'24.72"N 23°56'1.00"E	Greece	Aegean	Frantzis et al., 2003
Zc	2–5	1991–2002	34°55'59.49"N 25°30'24.03"E	Greece	Levantine	Frantzis et al., 2003
Zc	10–15	1991–2002	35°10'1.18"N 23°49'48.35"E	Greece	Levantine	Frantzis et al., 2003



**Figure 1.** Sighting and stranding locations of beaked whales within the eastern Mediterranean Sea. The darker blue shade in the inset marks the course of Antalya Canyon. Gray dots represent sighting events; black dots represent stranding events. GRC – Greece; CYP – Cyprus; SYR – Syria; LBN – Lebanon; ISR – Israel; EGY – Egypt.

**Table 2.** List of beaked whale strandings in the Levantine Sea and Aegean Sea (Zc, *Ziphius cavirostris*; Ms, *Mesoplodon* sp.; Ind., Individuals; F, Female; M, Male; -, Undetermined).

Species	Ind., n	Sex	Date	Coordinates	Location	Country	Sea	Reference
Zc	1	-	08.03.1964	40°8'29.18"N 26°0'7.65"E	Gökçeada	Turkey	Aegean	Marchessaux, 1980
Zc	1	-	13.09.1982	36°33'28.00"N 35°22'47.56"E	Karataş	Turkey	Levantine	Kinzelbach, 1985
Zc	1	-	July 1994	36°50'39.57"N 31°4'15.14"E	Serik	Turkey	Levantine	Öztürk and Öztürk, 1998
Zc	1	F	19.03.1995	37°1'3.17"N 27°57'38.11"E	Ören	Turkey	Aegean	Öztürk and Öztürk, 1998
Zc	1	M	April 1997	36°46'9.95"N 28°37'31.35"E	Dalyan	Turkey	Aegean	Öztürk and Öztürk, 1998
Zc	2	-	19.04.2001	36°4'52.25"N 32°55'42.71"E	Bozyazı	Turkey	Levantine	Podestà et al., 2006
Zc	1	F	27.01.2002	36°40'1.94"N 29°6'18.66"E	Fethiye	Turkey	Levantine	Öztürk, 2002
Ms	1	F	09.01.2009	36°39'45.68"N 29°6'29.70"E	Fethiye	Turkey	Levantine	Notarbartolo di Sciarra, 2009
Zc	1	M	07.02.2009	36°42'12.53"N 28°42'40.63"E	Sarıgerme	Turkey	Levantine	Öztürk et al., 2011
Zc	1	-	12.04.2012	-	-	Turkey	-	Bachara and Norman, 2013
Zc	1	M	18.03.1999	32°58'54.83"N 35°4'48.91"E	Shavei Tzion	Israel	Levantine	Goffman et al., 2000
Zc	1	M	23.06.2001	32°54'44.75"N 35°4'49.34"E	Acko	Israel	Levantine	Kerem et al., 2012
Zc	1	M	17.07.2002	32°10'23.64"N 34°47'59.44"E	Shefayim	Israel	Levantine	Kerem et al., 2012
Zc	1	M	20.04.2004	32°19'7.82"N 34°50'42.20"E	Netanya	Israel	Levantine	Kerem et al., 2012
Zc	1	M	30.04.2004	32°49'17.41"N 34°57'15.20"E	Haifa	Israel	Levantine	Kerem et al., 2012
Zc	1	M	06.04.2006	32°4'44.62"N 34°45'50.68"E	Tel Aviv	Israel	Levantine	Kerem et al., 2012
Zc	1	M	09.04.2008	32°49'17.41"N 34°57'15.20"E	Haifa	Israel	Levantine	Kerem et al., 2012
Zc	1	-	11.03.2005	35°50'41.36"N 35°48'38.99"E	Ras al Basit	Syria	Levantine	Gonzalvo and Bearzi, 2008
Zc	1	-	April–May 2005	35°40'58.71"N 35°47'38.30"E	Borj Islam	Syria	Levantine	Gonzalvo and Bearzi, 2008
Zc	1	F	03.03.2008	33°36'41.15"N 35°23'50.90"E	Rmielah	Lebanon	Levantine	Gonzalvo and Bearzi, 2008
Zc	1	-	1991–2002	35°40'35.76"N 27°7'19.56"E	Karpathos	Greece	Aegean	Frantzis et al., 2003
Zc	4	-	1991–2002	34°57'45.54"N 25°31'32.67"E	Crete	Greece	Levantine	Frantzis et al., 2003
Zc	5–10	-	1991–2002	35°56'24.44"N 27°53'8.41"E	Rhodos	Greece	Levantine	Frantzis et al., 2003

Table 2. (Continued).

Species	Ind., n	Sex	Date	Coordinates	Location	Country	Sea	Reference
Zc	5–10	-	1991–2002	36°20'59.07"N 28°15'19.43"E	Rhodos	Greece	Levantine	Frantzis et al., 2003
Zc	1	-	1991–2002	36°25'59.25"N 27°22'36.85"E	Tilos	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	37°47'40.84"N 26°53'56.27"E	Samos	Greece	Aegean	Frantzis et al., 2003
Zc	2	-	1991–2002	37°36'58.32"N 26°18'52.22"E	Ikaria	Greece	Aegean	Frantzis et al., 2003
Zc	5–10	-	1991–2002	39°59'15.55"N 25°26'58.60"E	Limnos	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	40°6'7.45"N 23°46'42.37"E	Neos Marmaras	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	40°8'30.00"N 22°33'55.33"E	Katerini	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	39°10'40.23"N 23°35'19.14"E	Skopelos	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	39°16'42.87"N 23°58'1.21"E	Alonnisos	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	39°20'51.45"N 24°4'17.28"E	Kyra Panagia	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	36°22'40.60"N 22°57'44.95"E	Cythera	Greece	Aegean	Frantzis et al., 2003
Zc	2	-	1991–2002	36°40'8.10"N 24°31'43.67"E	Milos	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	35°12'5.37"N 25°55'42.79"E	Crete	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	35°20'30.87"N 25°22'5.54"E	Crete	Greece	Aegean	Frantzis et al., 2003
Zc	1	-	1991–2002	35°21'42.38"N 24°17'9.12"E	Crete	Greece	Aegean	Frantzis et al., 2003

in March 1964 by Marchessaux (1980). The majority of the strandings were reported from the Levantine coasts, followed by the Aegean coasts (Marchessaux, 1980; Kinzelbach, 1985; Öztürk and Öztürk, 1998; Podestà et al., 2006; Notarbartolo di Sciara, 2009; Öztürk et al., 2011, 2014; Bachara and Norman, 2013). There are no records of beaked whales, stranded or sighted, in the Turkish Black Sea. All stranded individuals were identified as Cuvier's beaked whale except the live stranding at Fethiye, which was identified as *Mesoplodon* sp.

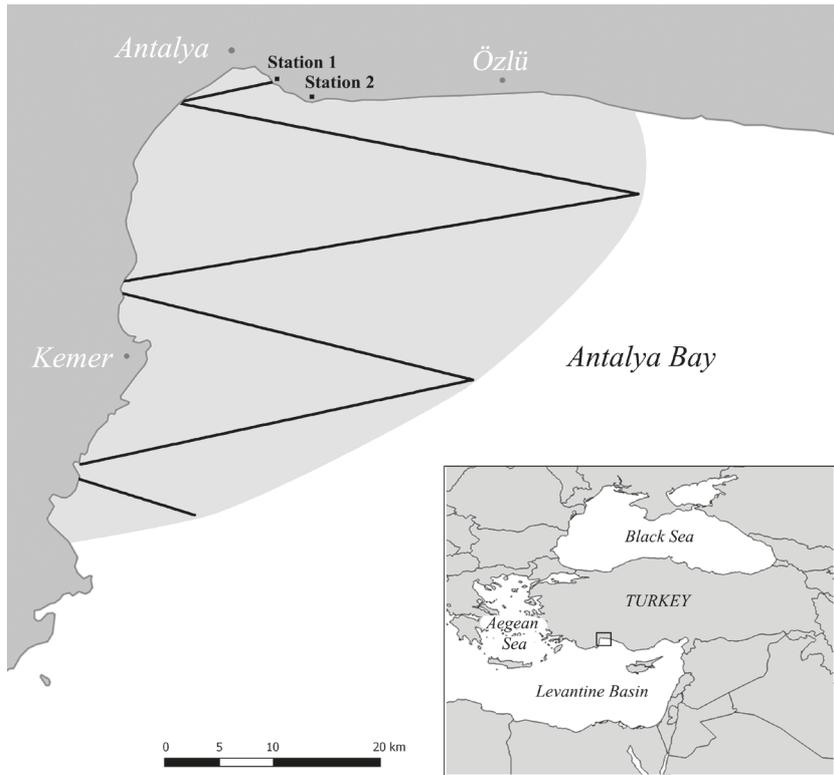
Aside from the Turkish waters, within the Levantine Sea, seven strandings from Israel's coast between 1999 and 2008, two strandings from Syria in 2005, and one stranding from Lebanon in 2008 were reported, all being *Z. cavirostris* (Table 2; Figure 1) (Goffman et al., 2000; Gonzalvo and Bearzi, 2008; Kerem et al., 2012). Additionally, six specimens from the years between 1960

and 1980 are stored in the Tel Aviv University Museum collection, 5 stranded on the Israeli coast and one, from 1968, from Egypt (Kerem et al., 2012).

In order to collect baseline data on cetaceans, systematic land and boat surveys were carried out in Antalya Bay between 1 March 2015 and 1 November 2015. While the area covered by land stations was of approximately 300 km<sup>2</sup>, boat surveys covered 1875 km<sup>2</sup> (Figure 2).

Land surveys were conducted twice a week from two independent stations (Station 1: 36°52'5.9"N, 30°43'6.3"E; Station 2: 36°50'49.4"N, 30°45'52.5"E) and covered waters between 0 to 350 m in depth. The land station team was composed of a theodolite spotter, a computer operator, a behavioral data collector, and two spotters using binoculars.

Boat surveys were carried out both by following predetermined transects and by random routes within



**Figure 2.** Survey area showing both the predetermined transect lines for boat surveys and land stations in Antalya Bay. Area coverages of surveys are shown in gray.

the survey area. Predetermined transects were followed seasonally and random routes were followed once a month. Predetermined transects were designed in accordance with the principles of distance/line transect sampling. Equally spaced zigzag lines were generated and the best survey design was chosen according to our logistical constraints. Six transect lines were selected for our survey design, with 10 km of spacing in between and a total length of 205 km. Transects were uploaded into the vessel's navigation system beforehand. During the surveys, the boat sailed along the transect lines with a speed of 4 knots. A double platform technique (lower and upper platform with a height of 2.93 m and 4.83 m, respectively) was used to collect data. On each platform, there were two observers who rotated through starboard and port on an hourly basis, and two photographers on the bow. Observers located on the lower platform scanned predominately with the naked eye up to 500 m in distance while upper platform observers used reticle binoculars to scan the area beyond 500 m. During the surveys, both on-effort and off-effort sightings were recorded. Focal cetacean groups were approached from the side or rear with an idle speed whenever possible and followed from a minimum distance of 50 m to a maximum of 400 m. The data logging software 'Logger 2000' (developed by IFAW; <http://www.ifaw.org>) was run continuously on a PC. All sightings, effort data, and

environmental and survey conditions were recorded on preprepared data sheets. In addition to the current study, published articles were reviewed for previous sighting and stranding data in the eastern Mediterranean Sea.

In total, we conducted surveys for 90 days (451.20 h), of which 73 days were land and 17 days were boat surveys, with 6 of them covering depths of 1000 m. The total effort at sea was 102.21 h with an average boat speed of 4 knots. While beaked whale presence was never recorded during the land surveys, the species was encountered on three different dates during boat surveys (Figure 1). All the sightings were recorded on-effort with the exception of the first one. Individuals were sighted only when the distance from the research boat was less than 400 m. Beaked whales showed area avoidance after the approach of the research vessel and changed their behavior from resting to diving. During the encounters, no other marine vessel was recorded in the area.

The first sighting took place on 4 June 2015. A group of two beaked whales was followed for 10 min over 800 m in depth. Only one individual was photographed (Figure 3) and positively identified as Cuvier's beaked whale. Following Rosso et al. (2011), the photographed individual was identified as female due to the coloration and scarring characteristics, which appeared predominately on the upper body. The second sighting, with a group size of two,



**Figure 3.** First sighted Cuvier's beaked whale individual, 4 June 2015, Antalya Bay.

was recorded on 18 June 2015. The sighting took place when the individuals were traveling over waters of 600 m in depth, and they were followed for 20 min. One of the individuals was photographed; however, individuals could not be identified to the species level (Figure 4). Lastly, one individual was sighted for 5 min on 7 September 2015. The individual was resting on the surface and dove with our approach. The sighting depth was recorded as 1000 m. Due to the limited observation time, this individual could not be photographed. The second and third sightings of this study were assumed to be Cuvier's beaked whales not only because Cuvier's beaked whales are by far the most common beaked whale species in the Mediterranean (Notarbartolo di Sciarra and Birkun, 2010) but also because the spatial and temporal distributions of those sightings closely matched the former sighting.

The presence of Cuvier's beaked whale and one *Mesoplodon* sp. in the Turkish Levantine Sea has been confirmed both through stranding and sighting data. However, due to the lack of consistent survey efforts in the area, their abundance, distribution, and population statuses are mostly unknown. While the western and central Mediterranean Sea are highly studied in regards



**Figure 4.** Second sighted Cuvier's Beaked whale individual, 18 June 2015, Antalya Bay.

to cetacean abundance and distribution, studies in the eastern basin are scarce (Frantzis et al., 2003; Kerem et al., 2012). Beaked whale sighting/stranding reports follow the same pattern, with records more numerous in the western and central Mediterranean Sea than in the eastern Mediterranean Sea; however, we postulate that this difference is most likely a result of differences in survey efforts between the two basins rather than differences in abundance.

For the eastern Mediterranean Basin, the vast majority of at-sea cetacean studies originate from Greek waters, resulting in a bigger concentration of knowledge in the same area. The Ionian Sea, Hellenic Trench, and steep depressions of the Aegean Plateau are marked as important grounds for Cuvier's beaked whales due to the regularity of sightings (Frantzis et al., 2003). Kerem et al. (2012) also highlighted the fact that the mean stranding frequency of Cuvier's beaked whales per 100 km of coastline in Israel is twice as high as that from the well-monitored Spanish Mediterranean coastline, bordering waters known as the "hotspot" of the species (Cañadas, 2012). Therefore Kerem et al. (2012) proposed that Cuvier's beaked whale within the Levantine Sea might be as regular as in the western Mediterranean Sea. Indeed, a modeling exercise that projected habitat preference attributes from well-studied regions to the entire Mediterranean basin (Cañadas, unpublished) predicted the northeastern corner to be part of the species' critical habitat.

In conclusion, despite the fact that there are comparably fewer studies in the Levantine Sea, none long-term, Cuvier's beaked whales have been detected through visual and acoustic surveys in this region. The current Cuvier's beaked whale sightings were recorded during the first offshore surveys of our continuous ongoing research in Antalya Canyon. It is important to note that all the previous sightings and our current sightings were clustered in a close range. Therefore, it is feasible to suggest that the northern Levantine Sea, and specifically between the Anaximander Seamounts, Antalya Canyon, and Adana Trough, is an area of importance for the distribution of Cuvier's beaked whales and that the species is regular in the area. Therefore, there is a crucial demand for long-term dedicated surveys to fill the knowledge gap on the species' abundance and distribution pattern, which will clarify the species' regional status, guiding future conservation efforts.

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