

A CONTRIBUTION TO THE STUDY ON THE  
THREE CETACEAN SPECIES STRANDED ALONG THE  
BULGARIAN BLACK SEA COAST

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**Abstract:** The study was conducted by examining stranded cetaceans while explicitly searching for dead marine mammals. Observations were made through covering transects along the Bulgarian Black Sea coast. The data collection was in compliance with the standard form of the Mediterranean Data Base of Cetacean Strandings (MEDACES). The data gathered in this study encompass the three common cetacean species met in the Black Sea and covers the period January – September 2015.

As a result of the research, it was found that the most abundant species strandings were of *Phocoena phocoena* (46%), followed by *Tursiops truncatus* (14%) and *Delphinus delphis* (7%). The most significant number of strandings was observed in August (19 cases). The "hot points" with the highest number of strandings were the beaches of Varna (14% of all strandings), Shabla (10%), Zlatni Piasatsi and Krapets (9%). The number of reported incidents was higher in comparison with the available data from the last few years. The actual information for cetacean strandings along the Bulgarian Black Sea provided could be used for improving of the conservation measures taken for these vulnerable species.

## INTRODUCTION

Three cetacean species are distributed in the Bulgarian part of the Black sea - the harbor porpoise (*Phocoena phocoena relicta*, Abel, 1905), the short-beaked common dolphin (*Delphinus delphis ponticus*, Barabash, 1935) and the bottlenose

dolphin (*Tursiops truncatus ponticus*, Barabash-Nikiforov, 1940). The Black Sea populations are genetically different from the populations in the Mediterranean Sea and the Northeast Atlantic Ocean (Rosel *et al.*, 1995; Fontaine *et al.*, 2005; Natoli *et al.*, 2005; Birkun, 2008) and are defined as discrete populations. Two of the cetacean species are listed as vulnerable (VU) in the Red Book of the Republic of Bulgaria: *Tursiops truncatus ponticus* and *Phocoena phocoena relicta* (Spasov, 2015). *Delphinus delphis ponticus* is listed as data deficient (DD).

The existing data about the distribution, number and structure of cetacean populations along the Bulgarian coast are quite scant. Occasional studies on the correlation among the three species, their food and reproduction have been made by Klainenberg and Nikolov (Klainenberg, 1956; Nikolov, 1963). Information about the current status of cetaceans, including the stranded marine mammals along the Bulgarian coast can be found in the regular reports of the Ministry of Environment and Water of Bulgaria to ACCOBAMS (Slavcheva, 2013). There is a research on stranded cetaceans for the period 2002 along the northern Bulgarian Black Sea coast and an analysis of the likely reasons for their death (Peshev, 2005).

The present information can be used to find the cause of death, as well as to contribute to studies on accumulation of heavy metals and toxic substances, genetic studies on species and populations, negative impacts of anthropogenic factors on cetaceans, etc.

## MATERIALS AND METHODS

The study was conducted by examining dead bodies of cetaceans found on the sea shore during the covering of transects. The selected places were located along the whole Bulgarian coastline (the focus was mainly on relatively wild, uninhabited sandy and rocky beaches). The whole coast was observed, including beach length and width.

The present research method for monitoring of stranded marine mammals is used in Bulgaria and approved by ACCOBAMS. The data gathered in this study encompasses the three common cetacean species met in the Black Sea and covers the period January – September 2015. The data used is personal as well as public, taken from the Varna Regional Inspectorate of Environment and Water (RIEW) and RIEW Burgas.

The condition of the marine mammals was determined by using a five point classification scale: 1) alive 2) fresh corpse 3) decayed, but the organs are mostly preserved 4) the organs could not be identified and 5) mummified animal parts/ a skeleton and its parts (ACCOBAMS, 2004).

The relative frequency of stranded cetaceans is measured on an annual basis by determining the number of stranded marine mammals per 100 km coastline and turning the result in percent.

## RESULTS AND DISCUSSION

The locations of the stranded cetaceans, their coordinates and stages of decomposition are presented in Table 1.

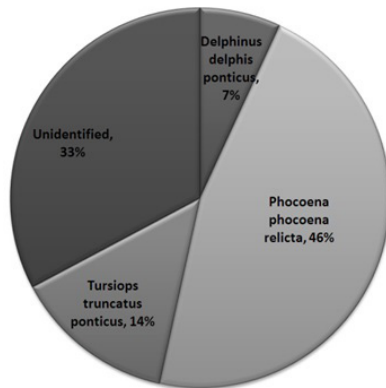
**Table 1.** Basic data on stranded cetaceans (Tt - *Tursiops truncatus ponticus*, Pp - *Phocoena phocoena relicta*, Dd - *Delphinus delphis ponticus*, UI – Unidentified)

Date	Place	N	E	Sp	Stages
20.01.2015	Primorsko	42.2822	27.7528	Tt	5
29.01.2015	Shabla	43.5730	28.5825	Tt	5
09.03.2015	Ahtopol	42.1026	27.9350	Dd	3
11.05.2015	Zl. Piasatsi	43.2864	28.0457	Pp	3
19.05.2015	Diuni	42.3644	27.7104	Pp	5
19.05.2015	Varna	43.1966	27.9211	Pp	2
20.05.2015	Sinemorets	42.0667	27.9729	Pp	5
20.05.2015	Albena	43.3689	28.0853	Pp	2
21.05.2015	Kranevo	43.3420	28.0704	Tt	3
22.05.2015	Zl. Piasatsi	43.2850	28.0453	Pp	5
24.05.2015	Varna	43.2050	27.9272	Dd	4
25.05.2015	Varna	43.1804	27.9109	Pp	5
25.05.2015	Varna	43.2110	27.9490	Pp	5
25.05.2015	Burgas	42.4990	27.4838	Pp	3
25.05.2015	Sozopol	42.4121	27.7020	Pp	3
26.05.2015	Kranevo	43.3446	28.0716	Dd	5
28.05.2015	Varna	43.2088	27.9376	Pp	4
08.06.2015	Pomorie	42.5626	27.6435	Tt	4
15.06.2015	Varna	43.1586	27.9439	UI	5
15.06.2015	Balchik	43.4053	28.1575	Tt	4
17.06.2015	Karadere	42.8958	28.8994	Tt	4
18.06.2015	Arkutino	42.3293	27.7373	UI	5
22.06.2015	Pomorie	42.5642	27.6414	UI	5
24.06.2015	Burgas	42.4902	27.4821	UI	5
26.06.2015	Kiten	42.2346	27.7800	Pp	3
03.07.2015	Koral	42.2171	27.7899	Pp	3
03.07.2015	Krapets	43.6259	28.5729	Pp	5
03.07.2015	Krapets	43.7290	28.5734	Pp	5
03.07.2015	Shabla	43.5582	28.5974	Pp	2
09.07.2015	Ahtopol	43.1022	27.9344	Pp	3
13.07.2015	Zl. Piasatsi	43.2884	28.0463	UI	5

15.07.2015	Balchik	43.4052	28.1578	UI	5
21.07.2015	Kavatsi	42.3950	27.7067	UI	5
23.07.2015	MMC-Primorsko	42.2472	27.7545	UI	5
23.07.2015	Zl. Piasatsi	43.2795	28.0437	UI	5
24.07.2015	Pomorie	42.5672	27.6394	Pp	4
24.07.2015	Gradina	42.4132	27.6559	UI	5
27.07.2015	Gradina	42.4117	27.6588	UI	5
31.07.2015	Varna	43.1974	27.9212	UI	5
31.07.2015	Varna	43.1985	27.9219	UI	5
31.07.2015	Kamchia	43.0380	27.8888	UI	5
31.07.2015	Tsarevo	42.1737	27.8503	Pp	3
31.07.2015	Tsarevo	42.1733	27.8507	Dd	3
31.07.2015	Koral	42.2160	27.7917	Pp	3
31.07.2015	Obzor	43.8099	27.8877	Tt	4
02.08.2015	Kamchia	43.0357	27.8883	UI	5
04.08.2015	Koral	42.2153	27.7929	UI	5
08.08.2015	Shabla	43.5702	28.5852	UI	5
08.08.2015	Kamchia	43.0321	27.8884	UI	5
08.08.2015	Kamchia	43.0329	27.8889	UI	5
08.08.2015	Koral	42.2167	27.7907	Pp	4
19.09.2015	Krapets	43.6286	28.5723	Pp	5
19.09.2015	Krapets	43.6293	28.5727	Pp	5
19.09.2015	Krapets	43.6463	28.5718	Pp	5
19.09.2015	Shabla	43.5509	28.6023	Pp	5
19.09.2015	Shabla	43.5499	28.6026	Pp	5
19.09.2015	Shabla	43.5443	28.6050	Tt	4
20.09.2015	Zl. Pisatsi	43.2768	28.0432	Pp	4

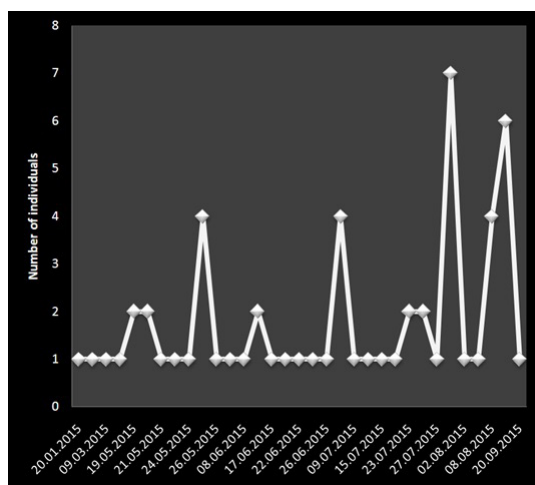


**Figure 1.** Distribution of recorded cetacean strandings along the Bulgarian coast (January - September 2015)



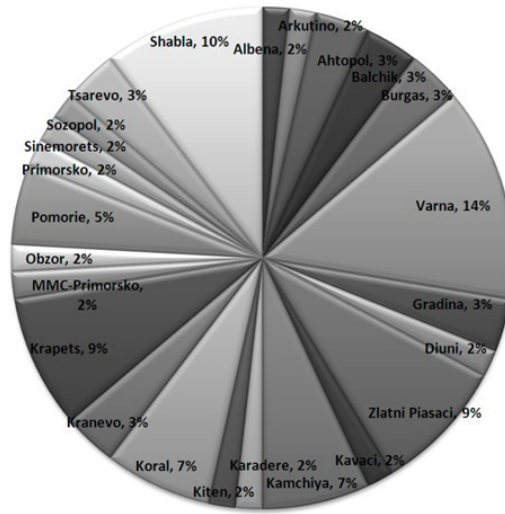
**Figure 2.** Percentage distribution of the stranded cetaceans

The results in Fig. 2 show a prevalence of strandings of *Phocoena phocoena* (almost 50%), followed by a considerably smaller percentage of strandings of *Tursiops truncatus* and the lowest percentage of strandings of *Delphinus delphis*. The previously published population data showed that the most numerous are *Delphinus delphis* with a national population of 8 207, followed by *Phocoena phocoena* - 4 886 and *Tursiops truncatus* - 1 057 (Mihaylov, 2015). This suggests that the size of the strandings is generally in reverse correlation to the size of the populations. It can be explained by the fact that the main part of *Delphinus delphis*'s population is located at open sea beyond the 12 mile zone of territorial waters and probably the dead bodies are found far from the Bulgarian Black Sea shoreline. We can assume that for the other two species - *Phocoena phocoena* and *Tursiops truncatus*, a significant part of the dead cetaceans is washed up on the beach and therefore, the data from these strandings correlate with the size of the populations.



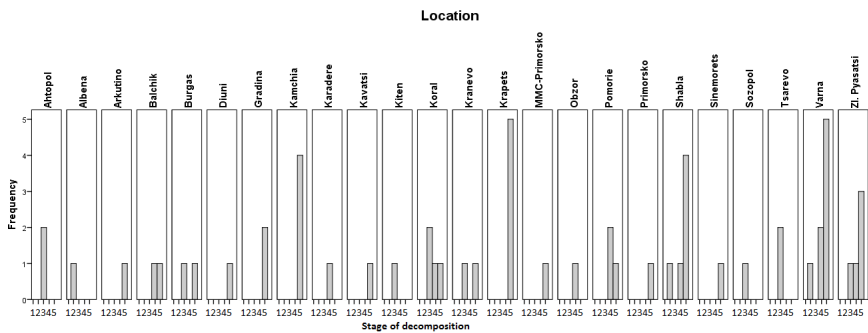
**Figure 3.** Timing of cetacean strandings along the Bulgarian coast

The analysis of the distribution of the stranded cetaceans according to the time of the year shows a significant increase in their number in August. The possible reasons could range from military exercises, incidental capture to natural factors such as different diseases. Their role could be determined by additional study.



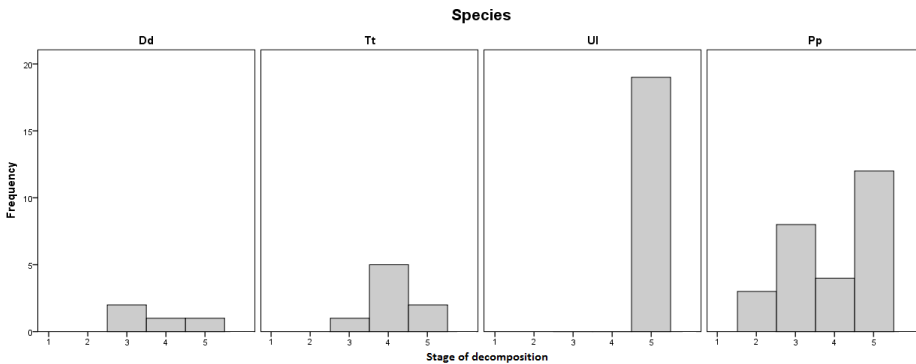
**Figure 4.** Location distribution of stranded cetaceans

The highest percentage of cetacean strandings is registered along the coast of Varna - 14%, followed by Shabla - 10%, Zlatni Piasatsi and Krapets - 9%, Koral and Kamchia - 7%, etc.



**Figure 5.** Distribution frequency of different stages of decomposition of the stranded cetaceans by location. Stage 1,00 – alive; stage 2 - fresh corpse; stage 3 - decayed, but the organs are mostly preserved; stage 4 - the organs could not be identified; stage 5 - mummified animal parts/a skeleton and its parts

From Fig.5 we can conclude that the decomposition of the cetaceans is mostly in the fifth stage. It can be also noted that the highest number of these individuals is found along the northern Bulgarian Black Sea coast. The amount of dead bodies of stages four and three is almost equal. The number of decayed stranded cetaceans of stage two is the lowest and marine mammals in the first stage are completely missing.



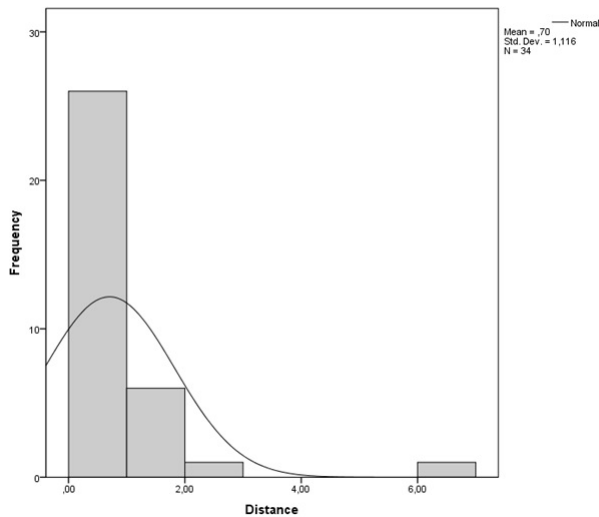
**Figure 6.** Distribution frequency of different stages of decomposition of the stranded cetaceans by species (Tt - *Tursiops truncatus ponticus*, Pp - *Phocoena phocoena relicta*, Dd - *Delphinus delphis ponticus*, UI – Unidentified). Stage 1,00 – alive; stage 2 - fresh corpse; stage 3 - decayed, but the organs are mostly preserved; stage 4 - the organs could not be identified; stage 5 - mummified animal parts/a skeleton and its parts

From Fig. 6 could be seen that the highest amount of dead bodies was not identified cetaceans. They were on the fifth stage of decomposition, which explains the fact why their type is unidentified. Decayed individuals of *Phocoena phocoena* are found in all four stages (2, 3, 4, and 5) as those in the fifth one are mostly seen. The decayed *Tursiops truncatus* are in 3, 4 and 5, as those in the fourth stage are predominant. Individuals of *Delphinus delphis* are also found in stages 3, 4 and 5 of decomposition and the amount of cetacean stranding is almost equally distributed.

**Table 2.** Distance between individuals in the observed beaches in km.

<b>Place</b>	<b>Length of the observed fields/km</b>	<b>Number of individuals</b>	<b>Distance between individuals / km</b>
Krapets	6	5	2,8 – 0,2 – 0,1 – 0,3
Shabla	5	7	0,3 – 0,4 – 1,3 – 1,45 – 0,150 – 0,9
Balchik	1,5	2	0,050
Albena	5	1	
Kranevo	2,2	2	0,3
Zl. Piasatsi	3,5	5	0,250 – 0,150 – 0,7 – 0,350
Varna	4,5	8	1,1 – 1,350 – 1,2 – 0,150 – 0,1 -
Kamchia	4	4	0,260 – 0,4 – 0,9
Obzor	1,5	1	
Pomorie	5	3	0,350 – 0,5
Burgas	3,7	2	1
Gradina	2	2	0,3
Sozopol	1	1	
Kavatsi	1,1	1	
Diuni	4,5	1	
Arkutino	1,5	1	
Primorsko	10	2	6,1
Kiten	2	1	
Koral	1	4	0,1 – 0,150 – 0,130
Tsarevo	0,6	2	0,070
Ahtopol	2	2	0,070
Sinemorets	1	1	





**Figure 7.** Correlation between the number of stranded cetaceans (distribution frequency) and the distance in kilometers between them

The figure shows that the distance between most of the dead bodies is up to 1 km – 27 individuals in total, followed by 5 stranded species at a distance from 1 to 2 km and two bodies between 2 and 3 km. Cetaceans from the next category (3 to 6 km) were not found.

In this particular study, the result is 15 cetaceans stranded over a 100-kilometer beach (or 15%), calculated from the 58 reported during the research period stranded marine mammals over the entire Bulgarian coast, which is 378 km (Black Sea Basin Directorate Varna, 2012). In previous studies (Birkun et al., 1999, 2000, BLASDOL, 1999, Mikhailov, 2009, 2011), the relative frequency of stranded cetaceans in 2010-2011 varies between about 2-5% and about 11%.

The nearest neighbor method, or observing the distance between stranded cetaceans uses raw data. Thus, its meaning and importance is about to be further interpreted. A significant amount of samples and compiling a larger data collection over an extended period of time is needed for additional analysis of the information by drawing estimate models. This approach has not been applied yet in studies of stranded cetaceans in Bulgaria, which makes it original and allows for further developments in the methodology.

## CONCLUSIONS

The constantly increasing occurrence of strandings of cetaceans along the Bulgarian Black Sea coast is a sign of conservation problems of the three species. The number of reported incidents was higher in comparison with the available

data from the last few years. Additional studies and appropriate emergency measures should be taken such as additional management of fisheries and ship traffic in specific areas.

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