

RESEARCH ARTICLE

Distribution of three cetacean species along the Bulgarian Black Sea coast in 2006-2013

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Abstract

Opportunistic observations of small cetacean species were made on board of fishing vessels and the 55-m research vessel "Akademik" during 20 surveys, carried out between April and November over the period 2006-2013 in the Bulgarian Black Sea territorial waters and exclusive economic zone. Over 10733 nautical miles and 1643 hours of survey effort, 289 sightings were recorded. Three cetacean species – bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and harbour porpoise (*Phocoena phocoena*) were observed. The most abundant species was the bottlenose dolphin - 618 individuals recorded in 120 sightings, followed by the common dolphin – 554 individuals in 101 sightings and 251 harbour porpoises in 68 sightings. The overall encounter rate was 3.18 sightings/100 nm. The distribution of cetaceans in the Bulgarian Black Sea area was associated with the ecological conditions such as prey dynamics, hydrology, ecosystem productivity, and also with some anthropogenic activities. Due to the absence of specialized surveys on cetaceans, the available sighting data help to elucidate the distribution of cetaceans, thus provide the scientific base for the designation of marine NATURA 2000 sites in the Bulgarian Black Sea for the conservation of marine mammals listed in Annex II of the Habitats Directive.

Keywords: Bulgarian Black Sea area, cetaceans, sightings, distribution

Introduction

The Black Sea is a deep semi-enclosed basin with high sensitivity to anthropogenic stress due to limited connection with the world oceans, vast drainage area, high productivity and permanent anoxic zone below 150-200 m (TDA 2007). As top predators in the Black Sea ecosystem, the marine mammals are vulnerable to human-driven alteration in the marine environment as a result of fisheries, shipping, tourism and other maritime and land-based activities. The abundance and distribution of cetaceans have been associated with the

ecological conditions such as prey dynamics, hydrological conditions, ecosystem productivity, as well as with ship traffic and fisheries. Cetaceans can modify their behavior and avoid human presence or approach fishing fleets to feed upon discarded fish (Bearzi 2002).

The Bulgarian Black Sea shoreline is 378 km long, representing 8.5 % of the total Black Sea coastline and the national exclusive economic zone (EEZ) is 29 000 km², constituting 6.8 % of the total Black Sea surface. Three cetacean species resident in the Bulgarian Black Sea area - the harbour porpoise (*Phocoena phocoena*), the short-beaked common dolphin (*Delphinus delphis*) and the common bottlenose dolphin (*Tursiops truncatus*). Generally, the cetaceans are observed frequently in the western Black Sea, including the Bulgarian waters with higher abundance from March to November (Stanev 1996; Birkun 2006, 2008). From November till April the cetaceans migrate for wintering and feeding to the southeastern part of the Black Sea, where their principal prey anchovy forms dense agglomerations (Birkun 2008). During winter, cetaceans are encountered along the Bulgarian coast, but in lower numbers (Stanev 1996). The period of high cetacean abundance along the Bulgarian coast coincides with the season of major fishing activities and tourism that generate various threats including accidental entanglement in fishing gears, reduction of prey resources, intensive noise and infections from wastewater pathogens.

The information about the distribution and abundance of the cetacean species off the Bulgarian Black Sea coast is scarce and most of the data were derived from stranding and opportunistic sightings during research cruises with other goals rather than cetacean sighting (Nikolov 1963; Stanev 1996; Raykov and Panayotova 2012). Some recent cetacean sightings in the western Black Sea, obtained during the round research cruise between Istanbul (Turkey) and Constanta (Romania), including Bulgarian waters, were reported by Dede and Tonay (2010). Although dedicated large scale surveys provide more accurate information, assembling of opportunistic sighting data from various cruises has the potential to depict the cetacean distribution and infer their relative abundance.

The aim of the present study is to analyze the distribution of the small cetacean species in the Bulgarian Black Sea area during 2006-2013 based on sighting data collected by opportunistic platforms.

Materials and Methods

The study area covers the entire Bulgarian coastal (up to 30 m) and shelf area (30-200 m) and partially northern offshore zone, including a transect across the EEZ in front of cape Galata to 2000 m depth. Observation data were collected during 20 shipboard surveys carried out between April and November during

the period 2006-2013, over an area of 14 465.55 km² with a total effort of 240 survey days (Figure 1). During the surveys, totally 10733 nautical miles (nm) were covered with total observation effort of 1643 hours. The average speed of the vessels during the cruises was 6.5 nautical miles per hour.

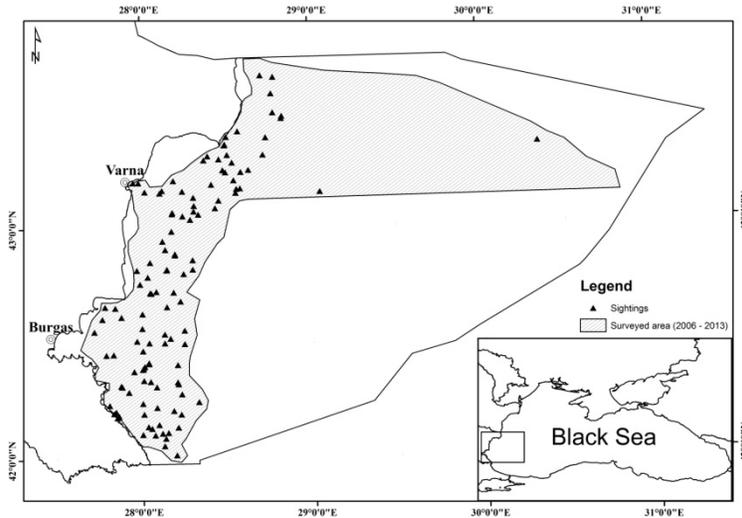


Figure 1. Surveyed area and sighting locations along Bulgarian Black Sea coast during the period 2006 – 2013

The sighting data were collected on board of two different types of vessels: a medium-size research vessel RV “Akademik” (55 m long, height of observation platform-6.50 m) and small fishing vessels (15.50-25.0 m long, height of the observation platform - 2.50-3.00 m) during 20 surveys, carried out between April and November during the period 2006 - 2013, whose primary goals were to monitor the marine environment and biota. The observation was carried out by a team of two observers (one on each deck side) during the daylight hours with naked eyes. When cetaceans were spotted, the binoculars were used for accurate species identification. All survey work was completed in sea states of Beaufort 3 or less. For each sighting, the recorded information included date, time, GPS location, species, minimum and maximum number of individuals seen at the surface at the same time, number of groups of animals and their behavior.

Results and Discussion

Overall 289 sightings (1423 individuals) of cetaceans were recorded during all surveys in the period 2006 – 2013 with total survey effort of 10733 nm. The number of sightings by species was: *T. truncatus* – 120 (41.52%, 618 animals), *D. delphis* – 101 (34.95%, 554 animals) and *P. phocoena* – 68 (23.53%, 251 animals). The overall encounter rate was estimated as 3.18 sightings/100 nm,

but the annual values varied from 0.97 to 8.33 sightings/100 nm (Table 1). Similar sighting rate (3.83 sightings/100 nm) was reported by Dede and Tonay (2010) for the western Black Sea area in 2007. In the same year, the sightings rate for the Bulgarian coast was 2.75 sightings/100 nm.

Table 1. Survey effort and number of cetacean sightings along the Bulgarian Black Sea coast during the period 2006 – 2013

Year	Survey effort		Number of sightings	Encounter rate
	(nm)	(hours)		(sightings/100 nm)
2006	1185	182	20	1.69
2007	1671	257	46	2.75
2008	975	150	31	3.18
2009	1430	220	33	2.31
2010	1370	211	33	2.41
2011	1340	198	13	0.97
2012	2582	397	98	3.80
2013	180	28	15	8.33
TOTAL	10733	1643	289	

The distribution of the small cetaceans in the Bulgarian Black Sea area revealed higher density in the shelf zone to 80 m depth and distance 30 nm from the coast, which is in agreement with the previously established pattern by Stanev (1996) and Raykov and Panayotova (2012). Individuals of all three species were sighted over the offshore areas at a distance of 125 nm off the coast almost to the limit of the Bulgarian EEZ, which confirms the results, obtained by Nikolov (1963) during the period 1956 – 1961 by aerial surveys for dolphin fishery and hunting. The majority of the sightings were located in the main fishing grounds along the Bulgarian coast and the distribution and behavior of the cetaceans could have been affected by the fishing activities. Zones with low, moderate and high fishing intensity in the Bulgarian shelf were reconstructed from Vessel Monitoring System (VMS) data for the fishing vessels (Todorova *et al.* 2013). The areas under high fishing pressure represented 23.4% of the shelf, moderate fishing activities encompassed 27.3 % of the shelf and low fishing intensity was observed over the remaining 49.3% (Todorova *et al.* 2013).

The short-beaked common dolphins were observed mainly in shelf and offshore, although occasionally they were sighted inshore as well (Figure 2) with total number of 101 sightings (554 individuals). High concentrations were recorded in front of Varna, cape Kaliakra and also close to the border with Turkey, confirming results of Dede and Tonay (2010). *D. delphis* showed higher abundance offshore compared to the other two species, related to the predation on pelagic fish species (Birkun 2006). The common dolphins visit also the shallow coastal waters in pursue of their preferred prey, small pelagic fishes such as anchovy (*Engraulis encrasicolus*) and sprat (*Sprattus sprattus*) during

their seasonal migrations and summer concentrations in the northwestern and northeastern Black Sea (Birkun 2008). The observed spatial pattern of *D. delphis* sightings in the period 2006 – 2013 did not show correlation with the fishing activities intensity (Figure 2), the species was distributed rather evenly over the shelf at encounter rate of 0.67, 0.77 and 0.96 sightings/100 nm in areas of low, moderate and intensive fishing pressure, respectively.

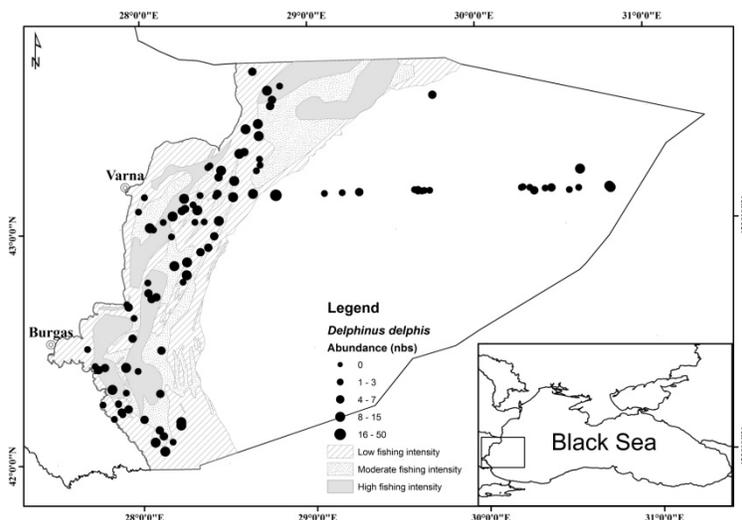


Figure 2. Distribution of *D.delphis* sightings in Bulgarian Black Sea area during 2006 – 2013. Circles show the sighting locations and their size corresponds to the number of the observed individuals.

The distribution range of the bottlenose dolphins encompasses the shelf and offshore areas. In front of the Bulgarian coast during the period 2006-2013, the species was the most abundant (120 sightings, 618 individuals) and was sighted frequently in the central parts of the shelf zone, although some individuals were observed in the offshore areas (Figure 3). High abundance was observed in the shelf waters in front of Kamchia river mouth and cape Emine. The bottlenose dolphins feed on both benthic and pelagic fishes, which are more abundant in the shelf area. Analysis of *T. truncatus* observations in relation to the intensity of fishing activities shows clear preference to the areas characterized with moderate and intensive fishing activities. The encounter rate in the areas with moderate and intensive fishing impact was 1.31 and 1.51 sightings/100 nm, respectively, compared to the areas with low fishing intensity, where the sightings rate decreased to 0.88 sightings/100 nm.

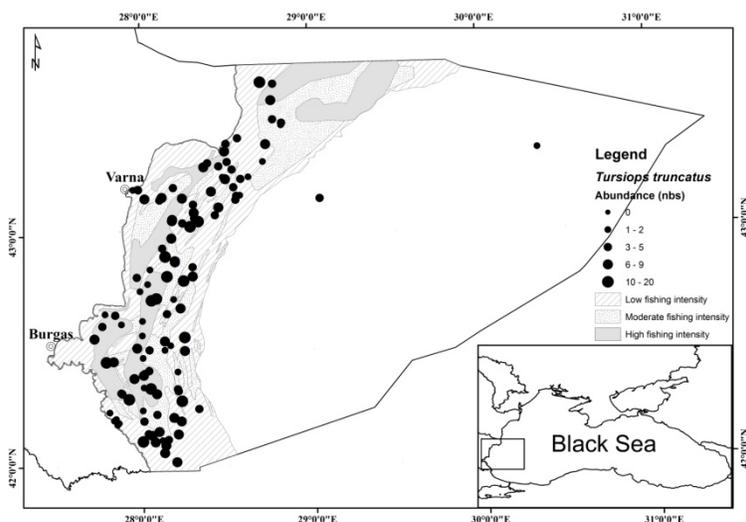


Figure 3. Distribution of *T. truncatus* sightings in Bulgarian Black Sea area during 2006-2013. Circles show the sightings locations and their size corresponds to the number of the observed individuals.

During the surveys, small groups of bottlenose dolphins were frequently observed to escort the fishing vessels and approach them closely during the trawl hauling operations, feeding on fish that escaped from the net (Figure 4). Such feeding behavior was reported also in the Ukrainian and Georgian Black Sea waters (Birkun 2002). Similar behavior was also observed of the common dolphins, but very rare.

The harbour porpoises inhabit mainly the coastal and shelf waters (0 - 200 m), although they may also occur far offshore in deep water area (Birkun 2008). In front of the Bulgarian coast, *P. phocoena* was observed throughout the coastal, shelf and offshore waters, but in the lowest abundance of all three cetacean species (68 sightings, 251 animals). The higher number of individuals was observed in front of Varna and in the southern region – in front of cape Emine and cape Maslen nos near Burgas (Figure 5) during the summer period (May – July). The harbor porpoise distribution did not show relationship with the fishing intensity and the species was observed with encounter rate of 0.60, 0.39 and 0.82 sightings/100 nm in the areas of low, moderate and intensive fishing intensity, respectively.



Figure 4. Bottlenose dolphins feeding around trawl nets

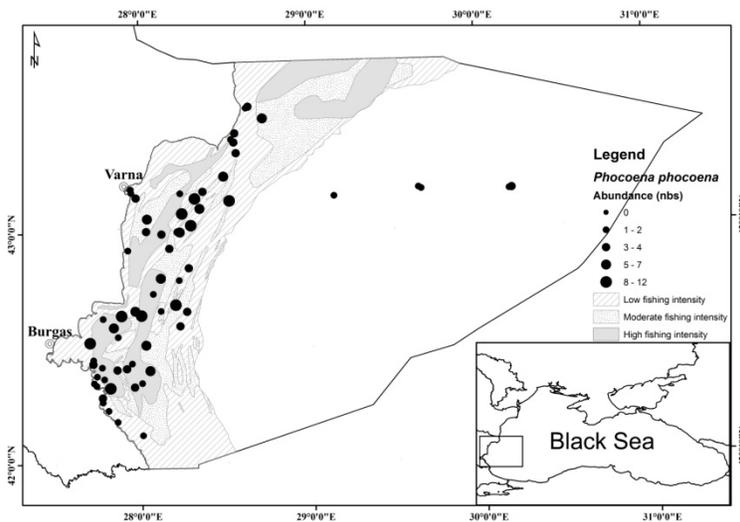


Figure 5. Distribution of *P. phocoena* sightings in Bulgarian Black Sea area during 2006-2013. Circles show the sightings locations and their size corresponds to the number of the observed individuals

Both of these small seas (as well as the northwestern Black Sea shelf zone) may represent geographical disjunct breeding-calving-feeding areas while the straits (Kerch and Bosphorus) connecting the seas serve as migration corridors (Reeves

and Notarbartolo di Sciara 2006; Birkun 2008). On the other hand the Bulgarian coastal water holds activities that pose threat to the cetaceans being an important multi-species fishing ground, tourist destination and area with intensive shipping. Several types of fisheries activities represent direct or indirect threat to the cetacean populations through mortality due to accidental catch, habitat deterioration or reduction of prey resources. The bottom-set gillnets for turbot fisheries are the major source of cetacean mortality (Birkun 2008). For the Bulgarian coast, the by-catch index of *P. phocoena* was estimated at 22 animals per 100 km net set and for *T. truncatus*-2 per 100 km net set or overall 24 cetaceans per 100 km net (Mihailov 2011). The pelagic trawl fishery decreases the pelagic fish stocks, disturbs physically the seabed and the benthic communities, and thus reduces the food availability (Boltachev 2006). The tourism and shipping are sources of disturbance to the cetaceans through pollution (sewage, oil) and noise that can induce behavioral and distribution modifications.

The marine areas are the focus of multipurpose usage and therefore require adequate management of human activities to achieve complex environmental and socio-economic targets. Profound knowledge of the spatial and temporal distribution of the marine natural resources is fundamental for the implementation of effective conservation measures. In this sense, the information collected by sightings of cetaceans during the shipboard surveys along the Bulgarian Black Sea coast was used as part of the information base for the extension of the marine NATURA 2000 network in the Bulgarian Black Sea in 2013, aiming at maintenance of the favorable conservation status of *T. truncatus* and *P. phocoena*, species listed in Annex II of the Habitats Directive. Currently, the NATURA 2000 network in Bulgaria includes 14 marine sites with a total marine area of 245 227 ha, in which *T. truncatus* and *P. phocoena* are subject of conservation.

References

- Bearzi, G. (2002) Interactions between cetaceans and fisheries Mediterranean Sea. In: Cetaceans in the Mediterranean and Black Seas: State of Knowledge and Conservation Strategies (ed. G. Notarbartolo di Sciara), ACCOBAMS Secretariat, Monaco, pp. 78–97.
- Birkun A. (2002) Interactions between cetaceans and fisheries in the Black Sea. In: Cetaceans of the Mediterranean and Black Seas: State of Knowledge and Conservation Strategies, (ed. G. Notarbartolo di Sciara), ACCOBAMS Secretariat, Monaco 10, 11 pp.
- Birkun, A. (2006) Cetaceans (Cetacea). In: The North-Western Black Sea: Biology and Ecology, (ed. Y.P. Zaitsev), Naukova Dumka, Kiev, 703 pp. (in Russian).

Birkun, A. (2008) The state of cetacean populations. In: State of Environment Report 2001-2006/7, 2008-3 (ed. T. Oguz), Publication of the Commission on the Protection of the Black Sea against Pollution, Istanbul, pp. 365-395.

Boltachev, A.R. (2006) Trawl fishery and its effect on the bottom biocenoses in the Black Sea. *Mar. Ecol. J.* 3: 45-56 (in Russian).

Dede, A., Tonay, A.M. (2010) Cetacean sightings in the Western Black Sea in Autumn 2007. *JEPE* 11(4): 1491-1494.

Mihaylov, K. (2011) Cetacean bycatches in turbot fisheries on the central coast of the Bulgarian Black Sea. Report of the 2nd Transversal Working Group on by-catch, Antalya, Turkey, 7-9 December 2011. General Fisheries Commission for the Mediterranean, Scientific Advisory Committee, 39 pp.

Nikolov, D. (1963) Catch and distribution of dolphin's shoals in front of Bulgarian coast. Proc. of Central Res. Inst. of Aqua. Fish. -BAS III: 183-197 (in Bulgarian).

Raykov, V., Panayotova, M. (2012) Cetacean sightings off the Bulgarian Black Sea coast over the period 2006-2010. *JEPE* 13(3A): 1824-1835.

Reeves, R., Notarbartolo di Sciara, G. (2006) The Status and Distribution of Cetaceans in the Black Sea and Mediterranean Sea. IUCN Centre for Mediterranean Cooperation, Malaga, Spain. 137 pp.

Stanev, C. (1996) Distribution and abundance of dolphins in Bulgarian marine area of the Black Sea. Proc. Inst. Fish. Varna XXIV: pp. 177-182 (in Bulgarian).

TDA (2007) Black Sea Transboundary Diagnostic Analysis. GEF Black Sea Environmental Programme Publication, Istanbul, 269 pp.

Todorova, V., Panayotova, M., Prodanov, B., Keremedchiev, S., Kotsev, I. (2013) Physical disturbance (8B02). In: National Report: Initial Assessment of State of Marine Environment Regarding Art.8 of MSFD 2008/56/EC and NOOSMV, (eds., S. Moncheva, V. Todorova), vol.1. MOEW, pp. 245-258 (in Bulgarian).

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