

Using Opportunistic Sightings to Assess the Distribution of Small Cetaceans in Bulgarian Waters of the Black Sea in 2012

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Abstract: Opportunistic sightings from various surveys were used as an alternative to produce an overall recent estimation picture of the cetacean occurrence and distribution owing to the lack of specialised large scale survey on the cetacean populations in the Bulgarian Black Sea. Cetacean sightings data were gathered during seven research cruises in the Bulgarian waters of the Black Sea in 2012. Over 2,251 nautical miles and 50 days of survey effort, 437 animals were recorded in 106 sightings. All the three species occurring in the sea were observed: the bottlenose dolphin (*Tursiops truncatus*), the short-beaked common dolphin (*Delphinus delphis*) and the harbour porpoise (*Phocoena phocoena*). The most abundant species was the common dolphin, with 247 individuals recorded in 49 sightings, followed by the bottlenose dolphin (112 animals in 24 sightings), the harbour porpoise (62 individuals in 25 sightings) and unidentified animals (16 individuals in 8 sightings). The cetaceans were analysed according to their distribution in the coastal, shelf and offshore areas, in relation to their habitat and prey preferences. While dedicated surveys provide more accurate abundance data, the synthesis of opportunistic sightings offers an opportunity for large scale screening of the cetacean distribution.

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

Introduction

Three cetacean species are listed in the Black Sea fauna, being also resident in the Bulgarian marine waters: the harbour porpoise (*Phocoena phocoena relicta* Abel, 1905), the short-beaked common dolphin (*Delphinus delphis ponticus* Barabash, 1935) and the common bottlenose dolphin (*Tursiops truncatus ponticus* Barabash-Nikiforov, 1940) (TZALKIN 1940, KLEINENBERG 1956, BIRKUN 2008). The information about the distribution, abundance and population structure of the cetacean species off the Bulgarian coast is rather scarce. Most of the available data stem from stranding and opportunistic sightings during research cruises with other purposes or from catches from dolphin fisheries (NIKOLOV 1963, STANEV 1996, RAYKOV, PANAYOTOVA 2012). Although dedicated large scale surveys provide more accurate information, the assembling of opportunistic sightings data from various cruises has the potential to depict the cetacean distribution and infer their abundance.

The populations of all the three species were severely affected by the commercial dolphin fisheries and hunting conducted in all Black Sea coastal states since the 1950s till the 1980s (NIKOLOV 1963, TONAY, OZTURK 2012, RADU *et al.* 2013). Direct captures, together with indirect anthropogenic impacts such as alterations in the habitat conditions and reduced food availability, resulted into increased mortality and sharp decline in the cetacean abundance.

The current study aims at updating the information on the recent occurrence, abundance, distribution and habitat use of the small cetaceans in the Black Sea off Bulgarian coast using opportunistic observations made in 2012.

Material and Methods

Study area

The data presented here were collected opportunistically during seven shipboard surveys carried

out in May – November 2012, with a total effort of 50 days. Overall trackline of 2,251 nautical miles (NM) was covered in the coastal marine waters as well as along a transect crossing the national exclusive economic zone off the cape Galata along the depths between 5 m and 2,000 m. The survey period was selected in concurrence with the period of cetacean occurrence in the Western Black Sea, while the period November – April, when the cetaceans are distributed predominately in the Eastern area of the sea (STANEV 1996), was avoided. The research area was divided into three zones according to depth and seabed morphology (Fig. 1): coastal zone (up to 20 m depth), shelf zone (between 20 and 100 m depth) and offshore zone (depths over 100 m;).

The sightings data of marine mammals were collected onboard two vessels: medium-size research vessel “Akademik” (55 m long, height of observation platform 6.50 m) and small fishing vessel “Elis” (15.50 m long, height of observation platform 2.50 m) during seven surveys, whose primary goal was to monitor the marine environment and biota. The sightings were carried out by a team of two observers (one on each deck side) during the daylight hours with unarmaged eye. When the cetaceans were spotted, 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 behaviour. The data about the hydrological conditions were also collected, where available.

Chi-square cross tabulation was used to test the association of the species with the survey zones and Kruskal – Wallis test was applied to assess the monthly encounter rates.

Results

Totally, 437 small cetaceans of all three species were recorded in 106 sightings over the 50 days and 2,251 NM of survey effort off the coast of Bulgaria during May – November 2012. The number of sightings by species were: short-beaked common dolphin (*D. delphis*) – 49 (247 animals), common bottlenose dolphin (*T. truncatus*) – 24 (112 animals), harbour porpoise (*P. phocoena*) – 25 (62 animals) and unidentified cetaceans – eight (16 individuals). During all surveys, 10 carcasses of dead animals floating in the sea were observed and recorded.

The distribution of sightings by species is represented in Fig. 2.

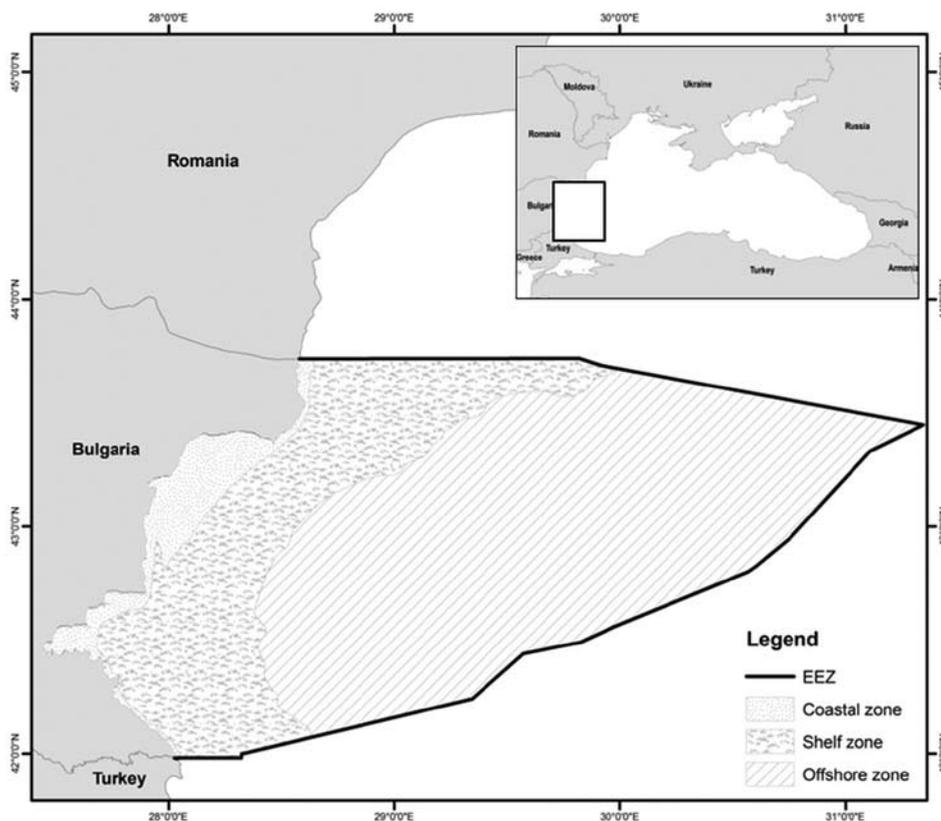


Fig. 1. Map of the study area

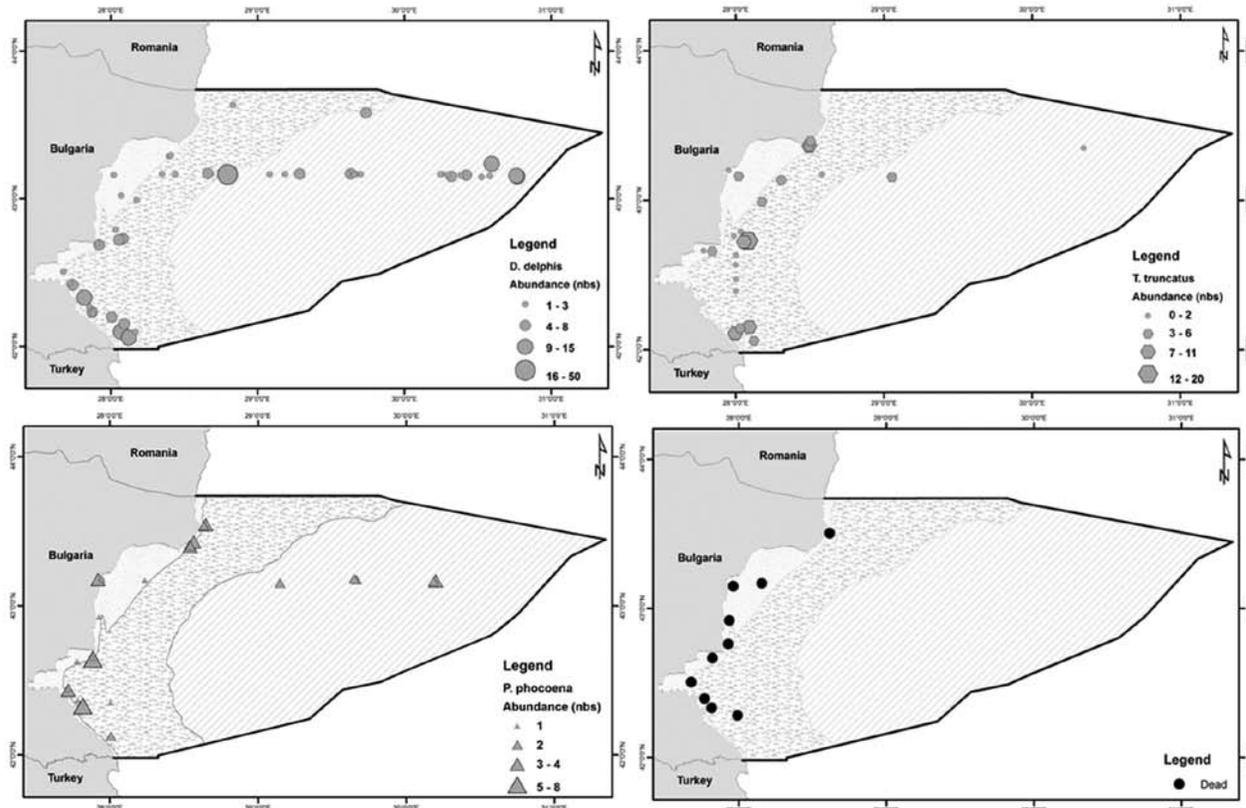


Fig. 2. Distribution of sightings (symbols proportional to group size) of cetacean species in Bulgarian Black Sea area in 2012

Discussion

Distribution range and pattern

The distribution range of the three cetacean species embraces the entire Black Sea (TZALKIN 1940, BIRKUN *et al.* 1997, SOKOLOV 1997) and the Turkish straits system (KLEINENBERG 1956, ÖZTÜRK, ÖZTÜRK, 1997), including the territorial waters and the exclusive economic zones of all riparian countries. The cetacean species occurring in the Black Sea are considered endemic and accepted as subspecies due to morphological differences from the Atlantic and Pacific populations (BARABASCH-NIKIFOROV 1960, BIRKUN 2008). Black Sea populations are also genetically different from other populations in the Eastern and Western parts of the Mediterranean and Northeast Atlantic (ROSEL *et al.* 1995, FONTAINE *et al.* 2005, NATOLI *et al.* 2005, BIRKUN 2008) and accepted as discrete populations or units.

The initial studies on the cetacean abundance and distribution in the Bulgarian Black Sea started within the 1956-1961 aerial surveys for the purposes of the dolphin fisheries and covered the area up to 250–400 km from the shore. The onset of dolphin commercial exploitation was launched with the establishment of governmental fishing enterprises in 1948 and the introduction into practise of larger fishing vessels during

1950-1954 (NIKOLOV 1963). In the preceding years, the harvest of cetaceans did not exceed 2,000 – 3,000 animals annually, increasing sharply in the 1950s and peaking to 56,000 individuals in 1959 (NIKOLOV 1963). Owing to the acknowledged negative effect on the cetacean abundance, the commercial fishery on cetaceans was banned in 1966 in the former USSR, Bulgaria and Romania and much later in Turkey (1983). All riparian countries undertook conservation measures to protect the marine mammals in the Black Sea.

Sightings data collected by aerial and boat surveys during the period 1956-1996 were used to determine the distribution pattern of the small cetaceans in the Bulgarian Black Sea area due to lack of specially designed surveys. Visual aerial surveys during 1956-1961 documented that the cetaceans (mostly the short beaked common dolphin) were predominantly distributed in the shelf and offshore zones (NIKOLOV 1963; see Fig. 3).

During 1992–1995, STANEV (1997) carried out monitoring on the distribution, migrations and abundance of the cetaceans in the area enclosed between cape Galata and cape Emine up to 30 miles from the shore and found that *D. delphis* was distributed mainly in the area between 10–17 miles while *T. truncatus* was from 5 to 7 miles from the coast, and *P. phocoena* was near the coast (up to 2-4 miles).

Recent data from cetacean sightings in 2006–2010 showed that all three species occurred in the area up to 100 m depth along the Black Sea coast (RAYKOV, PANAYOTOVA 2012). The common bottlenose dolphin was the most abundant, followed by the short-beaked common dolphin and the least numerous was the harbour porpoise (RAYKOV, PANAYOTOVA 2012).

Spatial and temporal distribution of the cetaceans

During the observation period (May–November 2012), overall 106 sightings and 437 individuals of marine mammals were recorded in the coastal, shelf and offshore zones (Table 1). Accurate determination of the abundance was possible due to the small average group size. The common dolphin was the most abundant species with 56.5% of all sightings (average group size 5.06 ± 1.1 individuals), occurring mainly offshore, although significant numbers were observed also over the shelf. The bottlenose dolphin

was recorded in two times lower numbers and average group sizes of 4.67 ± 0.91 individuals, with the highest abundance recorded in the shelf zone. The least abundant species was the harbour porpoise, with only 14.2% of all sightings (average group size of 2.48 ± 0.44 animals), although the species was predominant in the coastal zone.

The seasonality in the cetacean distribution is presented on Fig. 4. In the coastal zone, the cetaceans were recorded every month during the survey period, except in September. In September, *D. delphis* was the only observed species and only in the offshore zone. The relative abundance peaked in June – July dominated by the harbour porpoise and the common bottlenose dolphin. The individuals were grouped in small shoals with group sizes ranging between one and ten animals. The behaviour and habitat use of the observed cetaceans included feeding and moving in pursuit of the prey fishes (mainly anchovy, horse mackerel etc.), who after the spring migration were distributed mostly

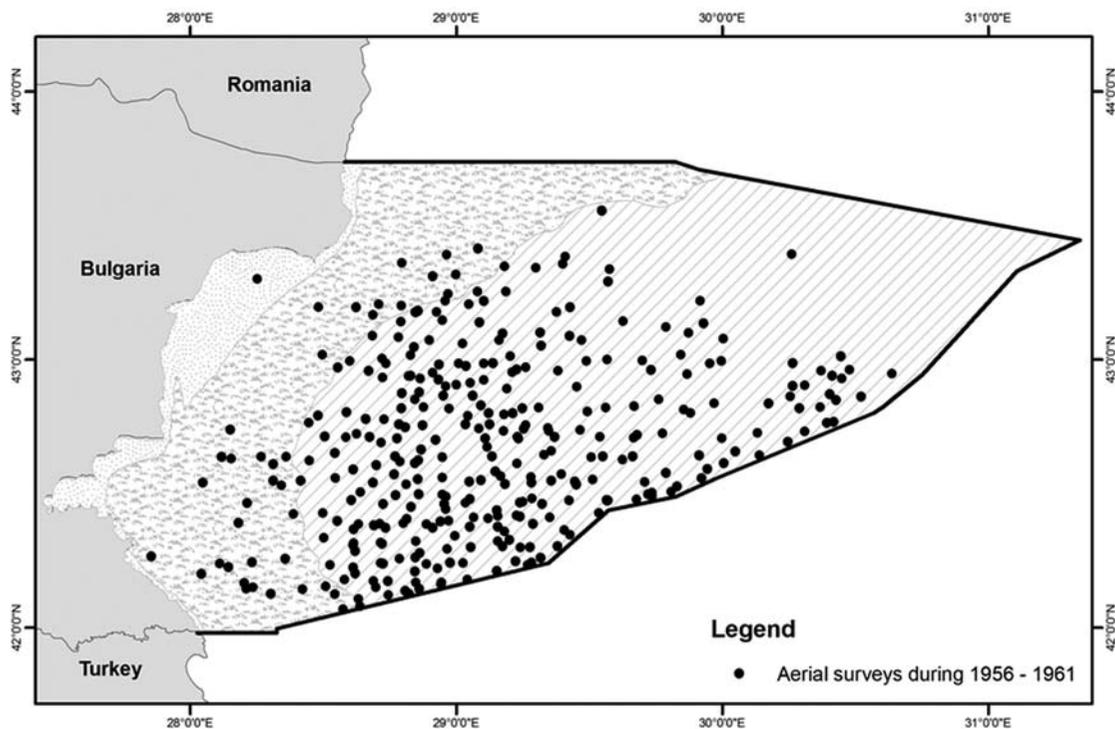


Fig. 3. Distribution of sightings, obtained by aerial surveys during the period 1956-1961 (according to NIKOLOV, 1963)

Table 1. Distribution of the observed cetaceans by species and zones

Zone	Abundance/Sightings				Total
	<i>T. truncatus</i>	<i>D. delphis</i>	<i>P. phocoena</i>	Unidentified	
Coastal	27/7	14/7	29/12	3/3	73/29
Shelf	79/15	101/22	22/8	13/5	215/50
Offshore	6/2	132/20	11/5	0	149/27
Total	112/24	247/49	62/25	16/8	437/106

in the North-Western shelf (STOYANOV *et al.* 1963, SVETOVIDOV 1964, STECF 2013).

The shelf zone was inhabited by all the three species and was characterised by the highest number of sightings. The short-beaked common dolphin (*D. delphis*) had the major share in the records – approximately 47%. The peak in the abundance of *T. truncatus* and *D. delphis* was recorded in August, and of *P. phocoena* in November. Large groups of feeding bottlenose dolphins (up to 20 animals) were observed in front of the cape Emine, Tsarevo and Ahtopol in the Southern Black Sea area in August (Figs. 2 and 4). In that period, pelagic trawling surveys carried out in these areas indicated large schools of sprat and whiting. The bottlenose dolphins were often attracted by the trawling activities and approached the fishing vessels to feed on fish that seeped out of the trawls. The short-beaked common dolphins formed less abundant groups (up to 15 animals), distributed over the shelf. The harbour porpoise was the least abundant species in the shelf area with a contribution of 10.23 % to the total cetacean abundance, and occurred in small groups of 2-4 animals.

The offshore area was inhabited by the highest number of *D. delphis* with 88.6% from the total cetacean sightings during the period May – November with a peak in July. These observations demonstrate a possible relationship with data from pelagic trawling hauls that indicated migration of horse mackerel, anchovy, bluefish and red mullet in July. The other two species were rare in the offshore zone, occurring in small groups of up to five animals.

During the surveys, carcasses of dead animals were observed floating on the sea surface mainly in the coastal zone, but also in the shallower parts of the shelf (Fig. 2). The highest number of dead cetaceans was observed in May, probably as a consequence of incidental capture in bottom-set gillnets during the season of turbot fishery in spring. Currently, the entanglement of cetaceans in different fishing gears is a significant threat and a major source of mortality, while direct capture affected seriously their populations in the past.

The review of the existing published information on the distribution and ecology of the cetaceans in the Bulgarian Black Sea updated with the synthesis of the recent sightings data leads to the conclusion that the three cetacean species utilise different marine habitats. The distribution of the observed cetacean species was significantly related to the survey zones (Chi square test, $\chi^2 = 139.138$, d.f. = 6, $P < 0.0001$). The harbour porpoise usually inhabits the shallow coastal and shelf areas (0 – 100 m), although it can occur in the offshore area depend-

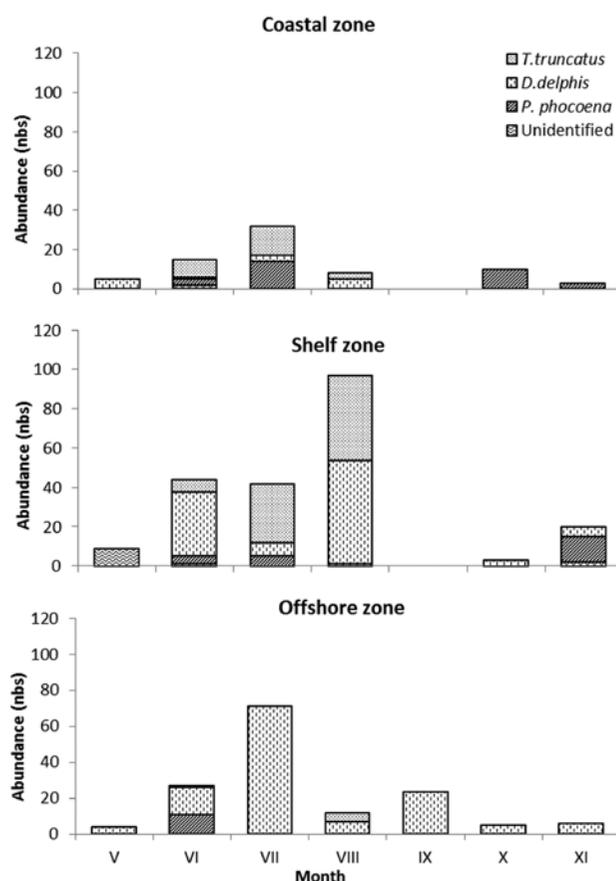


Fig. 4. Sightings of small cetaceans by zones and months during May – November 2012

ing on the food availability of pelagic and demersal fish. The short-beaked common dolphin occupies mainly the open sea; however it enters the coastal waters pursuing the pelagic fishes during their seasonal aggregation and migration. The common bottlenose dolphin occurs all over the offshore, shelf and coastal areas, however showing preference for the shelf. The three cetacean species have different diets: the harbour porpoise feeds mostly on small benthic (gobies), benthopelagic (whiting) and pelagic schooling fishes (anchovy, sprat); the diet of the bottlenose dolphin includes the small pelagic anchovy and the benthopelagic whiting and mullets, as well as the demersal turbot; the principal prey for the short-beaked common dolphin includes mainly pelagic and benthopelagic fishes as sprat, anchovy, whiting, pipefishes, mullets etc. (BIRKUN 2002). Different prey preferences may explain the different distributional pattern of the three cetacean species: the harbour porpoise – in the coastal area, the bottlenose dolphin – in the shelf area and the common dolphin – offshore. The highest abundance of cetaceans in 2012 was observed over the shelf and in the offshore area during June – August (Fig. 4) that was

Table 2. Encounter rate per 10 nautical miles (NM) by months and over the whole investigated period

Month	Sightings/10 nm				
	<i>T. truncatus</i>	<i>D. delphis</i>	<i>P. phocoena</i>	Unidentified	Total
May	0.10			0.06	0.16
June	0.28	0.28	0.28	0.09	0.93
July	0.33	0.15	0.23	0.03	0.74
August	0.25	0.14		0.02	0.40
September	0.16				0.16
October	0.16		0.05		0.21
November	0.12		0.23	0.04	0.38
Average	0.22	0.11	0.11	0.04	0.47

related to active feeding and rearing of juveniles in the summer season.

Overall encounter rate calculated per 10 NM trackline was 0.47 for the whole investigated period. A Kruskal-Wallis test showed that there was a statistically significant difference in the monthly encounter rates of the total sightings of all three species ($H = 105.0$, d.f. = 6, $p < 0.0001$) with peaks in the observations registered in June and July – 0.93 and 0.74 (Table 2).

Conservation measures

The three cetacean species are subjects to conservation in the Bulgarian marine waters and also at regional (Black Sea) and international level. At national level, the legal framework for the cetaceans conservation is provided by the Biodiversity Act and the Fisheries and Aquaculture Act, prohibiting all forms of deliberate capture or killing; deliberate disturbance, particularly during the period of breeding, rearing, and migration; taking of dead animals; keeping, transport and sale or exchange of specimens taken from the wild.

The above listed national laws transpose the conservation requirements with regards to the cetaceans provided by various international conventions and agreements to which the Republic of Bulgaria is a signatory: the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Cartagena Protocol on Biodiversity, the EC Habitats Directive (Council Directive 92/43/EEC).

Fourteen special areas of conservation (SACs) designated in the Bulgarian Black Sea

as part of the European ecological network NATURA 2000 host *P. phocoena* and *T. truncatus*, who were identified as subjects of conservation listed in Annex II of the Habitats Directive (<http://natura2000.moew.government.bg/Home/Natura2000ProtectedSites>). These SACs protect overall 30% and 22% of the national coverage of the characteristic habitats, calculated as the marine area to the 100 m depth and 200 m depth for *P. phocoena* and *T. truncatus*, respectively. *Delphinus delphis* is also protected in the Bulgarian marine NATURA 2000 sites, listed under the category “other important species”. The recent sightings verify the occurrence of all cetacean species in the offshore area. Therefore, designation of additional offshore SACs is required in the Bulgarian Exclusive Economic Zone in order to maintain the favourable conservation status of the cetaceans throughout their natural range.

The three cetacean species have been included in the IUCN Red List at the regional Black Sea level as threatened with the following conservation status: the common bottlenose dolphin (*T. pontucus*) is endangered [EN A2cde] (BIRKUN, 2012); the harbour porpoise (*P. phocoena*) is endangered [EN A1d+4cde] (BIRKUN, 2008); and the short-beaked common dolphin (*D. delphis*) is vulnerable [VU A2cde] (BIRKUN, 2008).

At the national level two of the small cetaceans species are listed as threatened in the Red Book of Republic of Bulgaria: the common bottlenose dolphin (*T. pontucus*) is vulnerable VU [D1]; and the harbour porpoise is vulnerable [VU A1acde + 2ce] (SPASSOV 2011).

Conclusions

The recent sightings data collected in the Bulgarian Black Sea in 2012 verify the occurrence of the three small cetaceans throughout the coastal, shelf and offshore areas. In agreement with the available his-

torical information the new data manifested different habitat preferences of the three cetaceans: the coastal zone was occupied predominantly by the harbour porpoise and the common bottlenose dolphin, the shelf zone – by the common bottlenose dolphin and the short-beaked dolphin, the offshore zone – mainly by the short-beaked dolphins. The common dolphin was the most abundant species with 56.5% of all sightings; the bottlenose dolphin was recorded in twice lower numbers; and the least abundant species was the harbour porpoise with only 14.2% of

all sightings. The highest cetacean abundance was observed in June-July, related to the season of active feeding and juveniles rearing in the Bulgarian marine waters. Designation of offshore NATURA 2000 SACs is required to encompass the characteristic habitat of the cetaceans and ensure the maintenance of favourable conservation throughout their natural range of distribution.

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