Annuaire de l'Université de Sofia "St. Kliment Ohridski"
Faculte de Biologie
2017, volume 102, livre 4, pp. 62-69
Youth Scientific Conference "Kliment's Days", Sofia 2016

DATA ON CETACEAN MORTALITY ALONG BULGARIAN BLACK SEA COAST DURING SPRING-AUTUMN 2016

VIOLETA EVTIMOVA[1], KRASTIO DIMITROV[2]*, VENCESLAV DELOV[1], YANA VELINA[3],STOYAN IORDANOV[1]

1 – Department of Zoology and anthropology, Faculty of Biology, Sofia University "St. Kliment Ohridski", Sofia, Bulgaria
2 – Department of Ecology and EP, Faculty of Biology, Sofia University "St. Kliment Ohridski", Sofia, Bulgaria
3-Ministry of Environment and Water, Sofia, Bulgaria
** Corresponding author: krastiodimitrov@gmail.com*

Keywords: *Phocoena phocoena, Tursiops truncatus, Delphinus delphis*, the Black Sea, Cetacean mortality

Abstract: The aim of the present study was to gather data on mortality of harbor porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), and common dolphin (*Delphinus delphis*), the three representatives of Order Cetacea in the Black Sea, using noninvasive approaches. 27 sample areas were monitored using transects 1 to 10 km long. Samplings have been done from March to October 2016. Transects were passed along two to seven times. 55 full or partial carcasses of the three Cetacean species were registered. 280 stranding cases were analyzed in total, 150 of which were identified simultaneously at species and relative age level. The prevailing species *was Phocoena phocoena* (49,3%). *Tursiops truncatus* was identified in 9,3% and *Delphinus delphis* – 6,1% of the cases, and 35,3% remained unidentified at species level. In general 37% of the registered corpses belong to the age class up to 1 year. This high proportion was shown to be due to the newborns of the harbor porpoise. The mortality among *Ph. phocoena* of age class up to 1 year was significantly higher than those of the age classes above 1 year. The most significant number of strandings was observed in July (123 cases).

INTRODUCTION

Order Cetacea is presented in the Black Sea by three species - 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). As the Black Sea populations are considered as 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, data on their mortality rates can be regarded as especially valuable. Governmental bodies (Ministry of Environment and Water - MOEW) regularly report to ACCOBAMS (Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area) data on registered strandings, based on signals from citizens, mainly tourists. In addition to this approach the transect method was applied along the Bulgarian Black Sea coast line in accordance with the recently approved National monitoring methodology for Cetaceans (MOEW, 2015). Original and governmental data gathered by the two approaches were combined after critical evaluation and a static demographic analysis was performed in order to evaluate the death rates of the three species, based on strandings along the Bulgarian Black Sea coast line in 2016.

MATERIALS AND METHODS

27 transects with a total length of 84km along the Bulgarian Black Sea coast line were covered 2 to 7 times in the period March-October 2016. They have been selected under the criteria to be in relatively wild, hardly accessible areas, representing rocky and sandy beaches. This was done in order to avoid overlaps with data on strandings, managed by public authorities. The whole coast was observed, including beach length and width. The data used is original as well as public, provided by Varna and Burgas Regional Inspectorates of Environment and Water (RIEW). Large portion of the signals there were provided by citizens, mainly tourists. In some cases, the information is limited and the species has been not determined.

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

The present research method for monitoring of stranded marine mammals is used in Bulgaria (Goffman at al., 2015) and approved by ACCOBAMS.

External and bone morphometric characteristics of the stranded cetaceans were measured, recorded, and individuals were classified in age classes - neonates, calves and older within *Ph. phocoena* strandings, and calves and older for all three Black Sea cetaceans as no neonates were found within *D. delphis* and *T. truncatus*

strandings (Gol'din, 2004; Murphy and Rogan, 2006; Mazzariol and Centelleghe, 2015). The registered dead cases were treated as representative within each of the three populations in terms of mortality rates. Demographic analysis based on static demographic tables for the three species was performed. Survival rates (l_x) of the age classes were calculated as the ratio of the number of individuals alive at the beginning of the age class (n_x) to the number of individuals alive at the beginning of the first age class (n_0) ($l_x=n_x/n_0$), where survival of the youngest age class equals one. Mortality rates (d_x) were calculated as the difference between the survival rates at the beginning of the age class (l_x) and the survival rates at the beginning of the next age class (l_{x+1}) ($d_x=l_x-l_{x+1}$), where the sum of the mortality rates of all age classes equals one.

RESULTS AND DISCUSSION

Spatial, species and age class specific distribution of strandings.

280 stranding cases were analyzed in 2016. In 150 of them we were able to identify simultaneously the species and age class (calf and older). The locations of the stranded cetaceans are presented in Fig. 1a and 1b. The results show prevalence of strandings of *Ph. phocoena* (almost 50%), followed by a considerably smaller percentage of strandings of *T. truncatus* and the lowest percentage of *D. delphis* (Fig.2). This general pattern can be explained by the fact that the main part of *D. delphis* population is located in open sea beyond the 12 mile zone of territorial waters and probably the dead bodies are found far from the Bulgarian Black Sea shoreline. It indicates and corresponds well to the fact that common dolphins are observed less frequently near shore, followed by the bottlenose dolphins and the harbor porpoises. We can assume that for *Ph. phocoena* and *T. truncatus* a significant part of the dead cetaceans is washed upon the beach and therefore, the data from these strandings correlate with the size of the populations.

The most abundant species in this study was *Phocoena phocoena* (49,3%), followed by *Tursiops truncatus* (9,3%). These data are fully consistent with the biological characteristics of both species that inhabit the coast near the shelf zone. As could be expected, upon the occurrence of death the bodies of these species are more likely to be washed up ashore. The smallest relative share belongs to *Delphinus delphis* (6%). This is largely determined by the biological characteristics of the species, since it generally inhabits the open water and rarely approaches the shore. Therefore, in the event of death it is much more unlikely that the body reaches shore as opposed to the other two species.

Fig.1a. Distribution of recorded cetacean strandings along the North Bulgarian coast - Obzor - Durankulak (March - October 2016)

Fig.1b. Distribution of recorded cetacean strandings along the South Bulgarian coast - Obzor - Rezovo (March - October 2016)

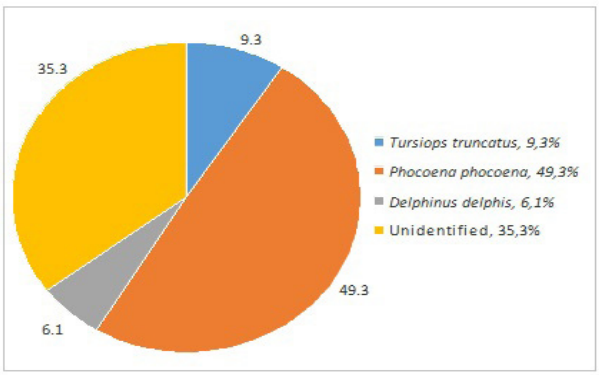

Fig.2. Distribution of the stranded cetaceans (%) along the Bulgarian Black Sea coast line in 2016.

The highest mortality rates among individuals up to 1 year was recorded in the harbor porpoise (0.93) being two to three times higher than in the common dolphin and the bottlenose dolphin (Table 1). As only in the harbor porpoise neonates were recorded, being prevailing, neonates were further separately analyzed from calves in *Ph. phocoena.*

Table 1. Survival and mortality rates in the three Cetaceans in 2016, based on species and age identified stranding cases along the Bulgarian Black Sea coastal line.

Ph.phocoena	l_x	d_x
calves	1,00	0,93
older	0,07	0,07
T.truncatus	l_x	d_x
calves	1,00	0,27
older	0,73	0,73
D.delphis	l_x	d_x
calves	1,00	0,62
older	0,38	0,38

When analyzed separately mortality rates in neonates of the harbor porpoise explain these values (Table 2), as they were characterized by a mortality rate of 0.67. The mortality among calves (without neonates of the harbor porpoise) of the three Cetacean species was comparable (0.25-0.62).

Table 2. Survival and mortality of three age classes in the harbor porpoise in 2016, based on species and age identified stranding cases along the Bulgarian Black Sea coastal line.

Ph.phocoena	l_x	d_x
neonates	1,00	0,67
calves	0,33	0,25
older	0,07	0,07

The elevated mortality rates in early development of the harbor porpoise could be explained by three groups of factors at least. Firstly the total sample size is much higher than of the two other species (Fig. 2 and 3). Second, the frequent near shore visits, which characterize the species behavior, elevate the chances of dead neonates to be washed up ashore. Not at last, the spread of viral, bacterial and fungal diseases among harbor porpoise neonates is quite common (Datta et al., 2009; Ross and Wilson, 1996; Siebert et al., 2006; Zagzebski et al., 2006). Aggressive behavior of adult bottlenose dolphins also contributes to higher mortality on neonate and young harbor porpoises (Ross and Wilson, 1996; personal communications of present authors).

Seasonal dynamics of the stranded Cetaceans

During the whole research period strandings were recorded every month (March until October) (Fig.3). Most cases were registered in the months of June (31), July (123) and August (85). During these three months were recorded 85,4% of all cases, and 74,3% of stranded cetaceans were registered in the months of July and August.

Only one of the three species is present throughout the entire eight-month period of the study – *Ph. phocoena*. Respectively it is also the most abundant species in each month of the study. Representatives of another species inhabiting mainly the shelf zone – *T. truncatus* were registered in seven out of the eight months, during which time there were recordings of stranded cetaceans. All three species were present during the following six months - May, June, July, August, September and October.

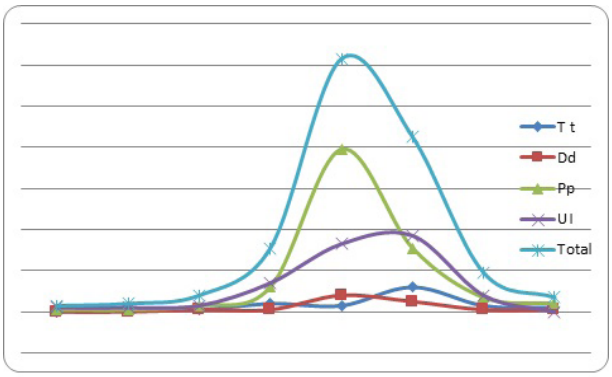

Fig. 3. Dynamics of stranded Cetaceans along the Bulgarian Black Sea coast line (March-October 2016). Tt - *Tursiops truncatus ponticus*, Pp - *Phocoena phocoena relicta*, Dd - *Delphinus delphis ponticus*, UI – Unidentified cetacean species.

June, July and August are marked as most significant in terms of the number of stranded cetaceans. In comparison, data from a similar study conducted for a longer period (January – September 2015) along a shorter coast line (Bulgarian Northern Black Sea) showed also highest percentage allocation in July and August - nearly 50% (Evtimova et al., 2015). The reasons for the large number of registered cases in this period could include the large number of tourists in the months from June until August, which could definitely account for the increased number of incoming signals.

Also interaction with turbot fishery - based on the research of incidental catches of cetaceans in fishing nets it was established that out of all three species most often caught in fishing nets was the porpoise (Blasdol, 1999). The greatest effect was determined in fixed nets for turbot. The high mortality rates among neonates of harbor porpoise should also be considered as a cause for this substantial elevation of cetacean stranding findings in this period.

CONCLUSIONS

The very high mortality among neonates of the harbor porpoise, combined with the long period of their strandings (June-August) point that most probable explanation of dead events is not due to direct negative human-animal interactions, neither single negative anthropogenic factor. The frequent use of near shore habitats of the species contributes to the higher frequencies of strandings. The spread of diseases among neonates of the harbor porpoise has to be investigated in detail as their higher susceptibility compared to the two other Cetacean species in the Black Sea has been shown worldwide.

Acknowledgments. The field works were partly supported by grant contract 101/04.2016 of Sofia University "St. Kliment Ohridski". The authors also thanks RIEW Burgas and Varna for providing detailed information on cetacean stranding cases in 2016.

REFERENCES

1. ACCOBAMS, 2004, Guidelines for the development of National Networks of Cetacean Strandings Monitoring, p.19.
2. 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, 365-395 p.
3. BLASDOL. 1999. Estimation of human impact on small cetaceans of the Black Sea and elaboration of appropriate conservation measures: Final report for EC Inco-Copernicus (contract No.ERBIC15CT960 104). C.R. Joiris (Coord.), Free University of Brussels, Belgium; BREMA Laboratory,Ukraine; Justus Liebig University of Giessen, Germany; Institute of Fisheries, Bulgaria; and Institute of Marine Ecology and Fisheries, Georgia.Brussels, 113 p.

4. Datta, K., Bartlett, K. H., Barr, R., Byrnes, E., Galanis, E., Heitmna, J., Marr, K. A. 2009. Spread of *Cryptococcus gatti* into Pacific Northwest region of the United States. *Emerging Infectious Diseases*, *15*, 1185-1191.
5. Evtimova V., Delov V., Velina Y., Grozdanov A. 2015. Contribution study on the strandings of the three cetacean species in Bulgarian black sea coast**.** Annuaire de l'Université de Sofia ″St. Kliment Ohridski″, volume 101, livre 4, 99: 33 - 43.
6. Fontaine M.C., K.A. Tolley, V. Ridoux, T. Jauniaux, M. Sequeira,M. Addink, C.Smeenk, U. Siebert, A. Birkun,A. López, J.M. Bouquegneau and J.R. Michaux 2005. Phylogeography of harbour porpoise (*Phocoena phocoena*)in the southeastern North Atlantic and in the Black Sea exploredby the analyses of nuclear andmitochondrial DNA.In: Abstracts of 19th Annual Conference of the EuropeanCetacean Society, 130 p.
7. [Goffman O., Kerem D., Michailov K., Dimitrov K., Delov V., Terziiski G., Paiu M., Klisarova D., 2015. Monitoring methodology for Cetaceans - *Tursiops truncatus, Phocoena phocoena and Delphinus delphis*. Approved by MOEW, 2016 (in Bulgarian)], http://eea.government.bg/bg/bio/nsmbr/prakticheskо-rakovodstvo-metodiki-za-monitoring-i-otsenka/Delphinusdelphis_Phocoena phocoena _ Tursiopstruncatus_MetodikaMonitoring.pdf.
8. Gol'din P. 2004. Growth and body size of the harbor porpoise, *Phocoena phocoena* (Cetacea, Phocenidae) in the Sea of Azov and the Black Sea. Vestnik zoologii, 38(4), 59-73.
9. Mazzariol S., Cozzi B. 2015. Necroscopy protocol for small odontocetes. In: Hadbook for small Cetaceans' strandings. Eds: Mazzariol D., Cozzi B, Centelleghe C., Massimo Valdina the coffee house art&adv, Milano, 61-97.
10. Murphy S., Rogan E. 2006. External morphology of the short-beaked common dolphin, *Delphinus delphis*: growth, allometric relationships and sexual dimorphism. Acta Zoologica (Stockholm), 87, 315-329.
11. Natoli A., Birkun A., Aguilar A., Lopez A., Hoezel A.R. 2005.Habitat structure and dispersal of male and female bottlenosedolphins (*Tursiops truncatus*). – *Procedings of RoyalSociety B*, 272: 1217-1226.
12. Ross, H. M., Wilson, B. (1996). Violent interactions between bottlenose dolphins and harbour porpoises. *Proceedings of the Royal Society of London B*, *263*, 283-286.
13. Rosel P.E., A.E. Dizon and M.G. Haygood 1995. Variabilityof the mitochondrial control region in populations of theharbour porpoise, Phocoena phocoena, on interoceanicand regional scales. – *Canadian Journal of Fisheries andAquatic Sciences*, 52 (6): 1210-1219.
14. Siebert, U., Wünschmann, A., Weiss, R., Frank, H., Benke, H., Frese, K. 2006. Post-mortem findings in harbour porpoises (*Phocoena phocoena*) from the German North and Baltic Seas. *Journal of Comparative Pathology*, *124*, 102-114
15. Zagzebski, K. A., Gulland, F. M. D., Haulena, M., Lander, M. E., Greig, D. J., Gage, L. J., Stewart, B. S. (2006). Twenty-five years of rehabilitation of odontocetes stranded in central and northern California, 1977 to 2002. *Aquatic Mammals*, *32*(3), 334-345.