LOCAL ABUNDANCE AND DISTRIBUTION OF PHOCOENIDAE AND DELPHINIDAE FAMILIES IN THE BLACK SEA TERRITORIAL WATERS OF ROMANIA

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ABSTRACT

The vulnerability of the ecosystem, and mostly the Black Sea marine ecosystem, to human pressures is advisable to be assessed through indicators. Either we are speaking about human pressure or fauna and flora species, one of these indicators are filled by the marine mammal populations. Long-lived, slow-reproducing dolphins and porpoises are already recommended world-wide. During ANEMONE project we were able to perform several vessel surveys along the 12 NM area of Romanian Black Sea, between Sulina (northern border city) and Vama Veche (southern border village). The surveys were performed following distance sampling line transect methods and analyzed with Distance 7.3. software. The data were collected during spring 2019, summer 2019 and spring-summer 2020 and brings in discussion the status of the three cetacean species, abundance and distribution, in light of the latest research, and regional context, compared to the 2013 ("Adverse fisheries impacts on Cetacean population in the Black Sea" under the European Commission's "Studies for Carrying out the Common Fisheries Policy" research programme) and 2019 (CeNoBS: "Support MSFD implementation in the Black Sea through establishing a regional monitoring system of cetaceans (D1) and noise monitoring (D11) for achieving GES") survey results. The article reveals the results of these efforts and discusses the present situation of the two cetacean families present in the Romanian coastal waters.
Key-Words: dolphins, porpoises, abundance, distribution, seasons

AIMS AND BACKGROUND

The aim of the study is to report and discuss the data collected between 2010 and 2020, last decade. Emphasizing the efforts of implementing line transect distance sampling methods (Buckland *et al*, 2001; Zaharia *et al*., 2013) towards assessing the status of the two cetacean families in the

Romanian Black Sea area.

The data regarding the cetacean group in Romanian waters are scarce, as in most of the water bodies world-wide. Although the needs of data are there, in the frame of several Agreements (eg. ACCOBAMS) and Conventions (eg. CBD; CITES) together with the European Union Habitat and Water Framework Directives (92/43/CEE; 2008/56/CEE) (Palialexis et al., 2019) and național legislation (eg. GEO 374/2004) the financial allocation were very low. To overcome this the involvement of the research group within Mare Nostrum NGO, in cooperation with national and international partners developed projects to build the capacity and implemented scientific survey for data collection. Improving in this way the data available in respect to cetacean group for Romania.

The three species, Black Sea harbour porpoise, Black Sea bottlenose dolphin and Black Sea common dolphin (Anton, 2012; Antonescu, 1966; Birkun, 2008, 2014; Cândea *et al*., 2012; Călinescu, 1936; Ellis, 1989; Murariu, 2005, 2012; Nicolae *et al*., 2017; Paiu *et al*., 2011, 2015, 2017, 2018, 2019, 2021; Toza *et al*., 2001; Zaharia, 2013) are all listed in the IUCN Red List as Endangered (harbour porpoise and bottlenose dolphin) and Vulnerable (common dolphin) and in the Annex 3 and 4 of GEO 57/2007 which ratifies the Habitats Directive in Romania. In spring of 2020 the Ministry of Environment, Waters and Forests issued the order 488/2020[*] which approves the List of marine endangered species in the Romanian Black Sea area (position no. 62 *Delphinus delphis ponticus* Barabash-Nikiforov, 1935; 63 *Phocoena phocoena relicta* Abel, 1905; and 64 *Tursiops truncatus ponticus* Barabash-Nikiforov, 1940) with the purpose of protecting and conserving the species.

EXPERIMENTAL

The data set contains primary data from dedicated surveys following line transect methods and additional from photo-identification and vantage point applied methods. Ultimately some of the data were collected within the Mare Nostrum's Monitoring and Conservation of Black Sea cetacean Program under citizen science concept. Validating and accepting the sightings with solid proofs. Standard line transects methods assume the density of animals on the surveyed transects is equal to the density in the entire study area (Buckland *et al.*, 2001). To cover the assumption the transects were placed at random using a design where each part of the study area has an equal probability of being surveyed (uniform 'coverage probability'). Transects were designed using Distance software (Thomas *et al.*, 2010) as equal spacing zigzags to provide a compromise between practicality and almost uniform coverage probability. The transects were designed to start and terminate slightly outside the survey blocks ('plus sampling') to prevent 'edge effects' from compromising

uniformity of coverage.

Distance software was used also for data analysis, estimating abundances of the three species (Paiu *et al*., 2019).

A single platform method was implemented, determined by the overall conditions and restraints. The area focused on was Romanian territorial waters (TW) boundaries. The design follows the equal spaced zigzag design class, within the 12 nautical miles area (territorial waters TW) of Romania, between Vama Veche (Southern border) and Sulina (Northern border) (Fig. 1.). Beside the ANEMONE surveys which were performed in all the above-mentioned area, there were two other surveys performed only in the southern part, between Constanta (North) and Vama Veche (South) following perpendicular on the shore transect design. The overall proportion of the stratum sampled was between 7% (2019-2020) and 39.6% (2017). This also influenced the area of the study, entire TW surface being estimated to 5871,423 Km^2 as for the southern part only 1063 Km^2. There were used two types of platforms for the expeditions, sailing yacht with motor, equipped with single platform and a motorboat. Both options with similar hights. The team on effort was comprised by two observers which surveyed the area between abeam and 90° angle to the right and left of the boat and a data recorder that was responsible to note all the data from the two observers. Each position was changed in a 30-minute sequence. Survey speed was between 5-9 kts (9.26 – 16.66 km/h). Angles were collected with the help of angle boards and Fujinon binoculars with compass following Birkun *et al*., 2014 and Heinemann, 1981 methods. To collect the distances Zeiss binocular with electronic range finder, Fujinon CMP binocular and distance ruler were used. To obtain the precise measurement of the perpendicular distance to the animal or group of animals Lerczak & Hobbs (1998) methods was used. Environmental conditions: sea state, glare, cloud cover, turbidity and a subjective assessment of overall conditions were recorded at the beginning of each transect and whenever a change occurred. Due to the limited time available for the survey and unfavourable hydrometeorological forecast, the observers remained active even in poor conditions with sea state of 4 on the Beaufort scale. Observers searched a 110° arc from abeam to ahead with naked eyes and binoculars for species identification. When a sighting was made, the following data were recorded: angle of the sighting to the transect line, radial distance, species, group size (min-max-best estimate), initial cue, estimated swim direction, behaviour, and name of the observer who made the sighting. Tracks and coordinates were recorded, using the GPS navigator Garmin Etrex 30. For quality assessment, digital pictures of the whole group and individuals were taken; animals were counted, and school size were recorded. Action was performed only "on effort" mode. Analysis was performed Distance 7.3. software package (Thomas *et al*. 2010).

Previous survey using the same protocol in the area were the "Adverse Fisheries Impacts on Cetacean Populations in the Black Sea" study (Birkun *et al*., 2014). Following it the line transect distance sampling surveys were designed and performed.

Angle to sightings was measured with fixed angle-boards that, together with the measured distance with the help of 7x50 WPC-CF Fujinon Mariner Binoculars, provided a precise measurement of the perpendicular distance to the animal or group of animals.

The overall effort for the dedicated surveys following distance sampling was of round 1000 NM, and 24 days. The total effort on the reported data is of 173 days in which cetacean were observed, not including the days without observations. When it comes to sightings from shore vantage point method (Nuuttila & Mendzil, 2014; Evans and Hammond, 2004; Diederichs *et al*., 2008; Boyd et al., 2010; Bas *et al*., 2014; Todd *et al*., 2015; Benedek, 2013; Geraci & Lounsbury, 1998) was applied and for photo-identification method the ACCOBAMS guidelines (2004; 200X) and of Wilson et al., 1999; Culloch & Robinson, 2008; Gol`din *et al*., 2017, Paiu *et al*., 2011, 2014; Benedek, 2013.

All the data were submitted to OBIS SEAMAP repository (Paiu *et al*., 2019b).

RESULTS AND DISCUSSION

This report is meant to provide background information on the abundance and distribution of the three cetacean species present in the Romanian territorial waters collected within Mare Nostrum's program and support the effort towards management and conservation of the species.

The area includes nine Natura 2000 marine protected areas: ROSPA0076 Black Sea, ROSCI0066 Danube Delta–Marine zone, ROSCI0413 Lobe of Zernov Phyllophora Field, ROSCI0197 Eforie North - Eforie South Submerged beach, ROSCI0273 Marine Area of Cape Tuzla, ROSCI0293 Costinesti - 23 August, ROSCI0281 Cape Aurora, ROSCI0094 Mangalia Sulphide Seeps, ROSCI0269 Vama Veche–2 Mai (https://natura2000.eea.europa.eu/Natura2000), whereas 2 species of cetaceans (*Tursiops truncatus ponticus* and *Phocoena phocoena relicta*) are referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC for all SCI areas (Fig. 1). (Natura 2000 Network view and Standard Data forms**).

The entire database analyzed includes 720 sightings of 1782 individuals from the three species (Table 1). From these 144 sightings are registered in the north part and the rest, 576, in the southern part of the area.

The Figure 1 reiterates the species are using the area, offering an overall picture in time and space overlapping the 10 years data collection effort. At

the same time the presented distribution is tributary to the effort imposed in data collection, being directly affected by the number of surveys. With most sightings recorded in spring and summer seasons (Fig. 2).

Table 1. Distribution in time of the recorded sightings between 2010-2020, in Romanian 12 NM area

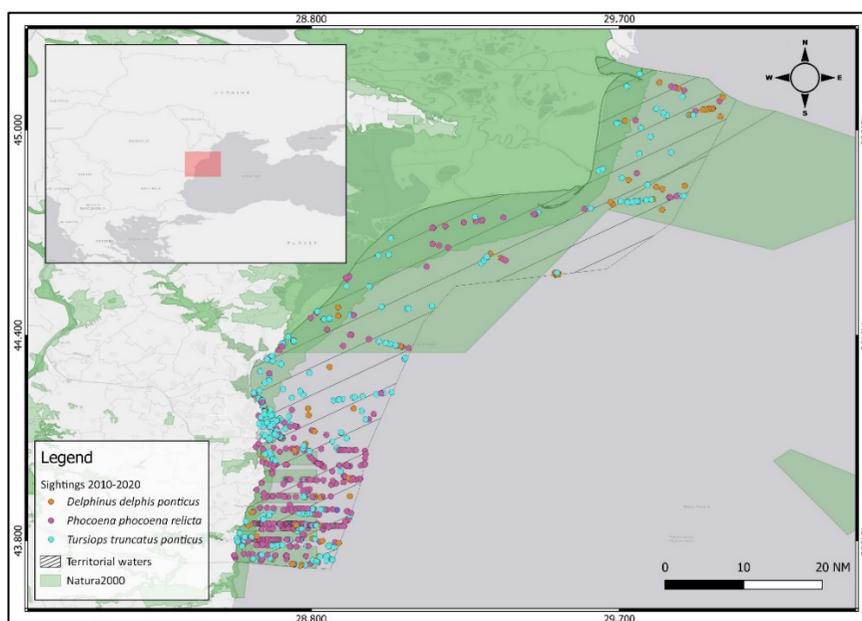| Year	Cetacea	*Delphinus delphis ponticus*	*Phocoena phocoena relicta*	*Tursiops truncatus ponticus*	Grand Total
2010	-	3	1	2	6
2011	-	3	10	5	18
2012	-	-	14	7	21
2013	-	8	11	21	40
2014	-	5	3	11	19
2015	-	1	3	12	16
2016	-	2	3	21	26
2017	2	10	234	58	304
2018	-	1	13	18	32
2019	-	20	20	68	108
2020	-	18	69	43	130
Grand Total	**2**	**71**	**381**	**266**	**720**

Fig. 1. Sighting of the three cetacean species, between 2010 and 2020, within the 12 NM Romanian area. Highlighting the marine protected areas found in the perimeter

Higher density of sightings in southern part can be explained also through the greater effort applied in the area despite the rough conditions and accessibility, whereas in the north part is required more effort for surveys. Several limiting factors for surveying in the northern part of the Romanian coastline are the difficult accessibility in the Danube Delta Protected area and the lack of harbors mainly because the infrastructure is poorly developed. These two factors make almost impossible to apply the citizen science concept due to the fact that there are strictly protected areas where the access is prohibited for citizen. Moreover, the lack of harbors, funds and the instability of the Black Sea are making the surveys to imply more effort and difficulty towards completing them.
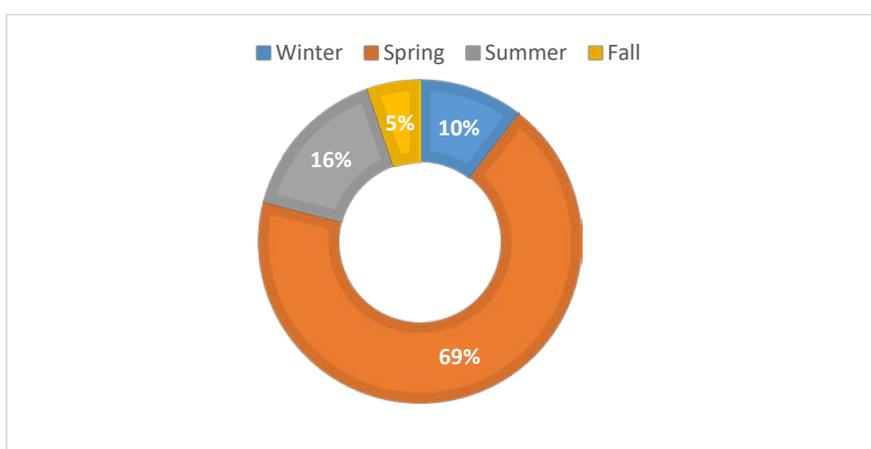

Fig. 2. Seasonal distribution of sightings, between 2010 and 2020, within the 12 NM Romanian area. Highlighting the warm season availability of data

If the distribution data are more achievable to be collected and disseminated (Nicolae *et al*., 2017; Radu *et al*., 2013), abundance data are hard to obtain, either because of lack of funds or simply because of lack of expertise. During the studied period we collected and assessed data to determine abundances of the three species in 5 expeditions, 3 in the frame of ANEMONE) project (ANEMONE Deliverable 4.3., 2021) covering all the area and 2 in the frame of an ACCOBAMS financed project (Paiu *et al*., 2017), just for the southern part of the study area. Beside these, two large scale surveys were performed and also covered the interest area, one in 2013 by Birkun and colleagues and one in 2019 under CeNoBS project by Paiu and colleagues (2021b). These are the only abundance data available so far and which are compiled below for the waters of Romania (Table 2).

Table 2. The abundance estimates of the three cetacean species by means of distance sampling analysis performed within the report period

Species	Project/Season	Density of animals, indv./km2		Number of animals	
		D	95% CI	N	95% CI
Harbour porpoises	MEP/summer	1.205	0.589 – 2.468	7023	3431 – 14378
	ACCOBAMS/ spring	0.337	0.119-0.955	359	127-1015
	ACCOBAMS/ summer	5.359	2.821-10.183	5697	2999-10824
	ANEMONE/ spring	0.09	0.036-0.234	536	209-1375
	ANEMONE/ summer	0.103	0.016-0.642	333	53-2074
	ANEMONE/ summer	0.643	0.329-1.255	3775	1934-9475
	CeNoBS/ summer	0.426	0.217-0.834	10887	8414 - 14489
Common dolphin	MEP/summer	0.279	0.113–0.685	1624	660 – 1993
	ACCOBAMS/ summer	0.153	0.0491-0.480	163	52-510
	ANEMONE/ summer	0.176	0.050-0.672	1032	336-3626
	ANEMONE/ summer	0.149	0.064-0.343	873	378-2015
	CeNoBS/ summer	0.143		3661	2772 - 4966
	MEP/summer	0.217	0.131 – 0.359	1265	766 – 2089
Bottlenose dolphin	ACCOBAMS/ spring	0.627	0.201-1.957	667	214-2080
	ACCOBAMS/ summer	0.424	0.194-0.927	451	207-986
	ANEMONE/ spring	0.293	0.116-0.738	1719	682-4335
	ANEMONE/ summer	0.837	0.339-2.063	2705	1097-6670
	ANEMONE/ summer	0.337	0.161-0.708	1980	944-4156
	CeNoBS/ summer	0.243	0.129-0.372	6208	3968 -10325

*The CeNoBS figures are for the TW+EEZ of Romania.

CONCLUSIONS

The research presented by the authors is providing a report of the available data on cetaceans within the 12 NM area for the period 2010-2020. It also compares the results of several standard surveys following line transect distance sampling.

Distribution and the presence of species in different quarters of the year, less winter, not covered by the surveys, it supports to certain extent the general conclusion that most probably dolphins and porpoises are migrating in these waters for feeding and breeding. The question that arises is whether cetaceans are leaving the territorial waters in late autumn following the migration of fish towards southeastern Black Sea, because there are recordings in winter season as well. Even though the recordings are low in number this can indicate the possibility of resident or semi-resident populations using the territorial waters or the western part of the basin all year round.

This question underlines the need of a dedicated and standardized monitoring program with the objective of determining the trends in the cetacean population using the Romanian territorial waters and resident populations.

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