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CETACEAN STRANDINGS BETWEEN 2010-2016 AT THE COAST OF ROMANIA

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ABSTRACT

Stranded cetaceans have long intrigued naturalists because their causation has escaped singular explanations. Regardless of cause, strandings also represent a sample of the living community, although their fidelity has rarely been quantified. The present study, conducted over a period of 6 years, between May 2010 and December 2016, in the frame of Mare Nostrum NGO program Monitoring and Conservation of Black Sea Cetaceans. Program that developed a Stranding Monitoring Network and conducted an active pathological examination activity in order to assess the cause of death shows the irregular trend of stranding events at the Romanian coast (245 Km). The highest pick was registered in 2012 when 177 cases were recorded, more than double of the average events/year. The paper presents a summary of the 585 cetacean strandings involving all the 3 species from the Black Sea (*Delphinus delphis ponticus*, *Tursiops truncatus ponticus* and *Phocoena phocoena relicta*), as well as 134 strandings not included in the previous correlation by Paiu (2016). Average number of events per year was 83.57 and the most common species was the harbor porpoise (*Phocoena phocoena relicta*) with 80%. Stranding events occurred throughout the year, with the lowest frequency occurring in the winter (December–February).

Key-Words: Romanian Black Sea shore; Harbour porpoise; Bottlenose dolphin; Common dolphin; cetacean stranding; distribution; monitoring network.

AIMS AND BACKGROUND

The present study focuses on the stranding events of the three species of cetaceans from Black Sea, common dolphin (*Delphinus delphis ponticus*), bottlenose dolphin (*Tursiops truncatus ponticus*) and harbour porpoise (*Phocoena*

phocoena relicta), at the Romanian coast (Anton *et al*., 2012) for the period 2010-2016. It represents an update of the cetacean stranding situation (Paiu *et al.*, 2016) with data from 2015 and 2016 and merging together for a complete analysis of the seven year period inferring distribution of dead cetaceans by time, age and sex.

Data of this study were recorded from 2010 to 2016 (the work is undergoing) (Paiu, 2013; 2014; 2015; 2016). Environmental monitoring is "the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress towards meeting a management objective" (Elzinga *et al*., 2001). Monitoring top predators is a major concern in the context of biological conservation (Boyd *et al.*, 2006; Mace *et al*., 2010; Sergio *et al*., 2008; Wanless *et al*., 2007). An optimum monitoring method would be based on the fundamental principle of effectiveness (Hinds, 1984). The ecological significance implies that monitoring data must be simple and well-defined measurements, and ensures that measured ecological process responds to changes in the population being considered. However monitoring wild species in their habitat remains very expensive (Elzinga *et al.*, 2001) and high cost of monitoring techniques is hindrance to efficiency (Caughlan et *al*., 2001). This is particularly true for marine mega fauna because of the very high costs of dedicated cruises at sea, if large oceanic areas consistent with the size of conservation units for such mobile animals are to be covered on a regular basis. The use of indicators is therefore needed. Indicators are defined as "measures established from verifiable data that include more information that data themselves do" (Bubb *et al*., 2005). They are often developed by scientists (Schiller *et al*., 2001) and constitute communication tools between scientists and policy-makers or stake-holders (Mace *et al*., 2007; Muller *et al.*, 2006; Turnhout *et al.*, 2007). Additionally, even the best population estimates are associated to uncertainties that limit our ability to detect small changes in abundance. Therefore, assessing the current status of most populations of small cetacean on the basis of abundance estimates only remains difficult. Consequently other sources of information are necessary to fully depict cetacean population status. Relative densities, frequency of occurrence, health and body condition, key demographic parameters, cause of death, and the risk and gravity of interaction with anthropogenic pressures are valuable parameters to be considered jointly in a monitoring strategy.

Many of these features can be collected from stranded cetaceans. Their use as a source of ecological indicators is still limited because of the reported lack of sampling strategy (Siebert *et al.*, 2006). The ecological relevance of stranding data is poorly understood, mostly because the geographical origin of a sample is unknown, their statistical credibility is disputed, because a sampling is mostly opportunistic nature. Yet, it is admitted that stranded animals represent a minimum measure of at-sea mortality. Stranding are underused resources (Pikesley *et al*., 2011) and the collection of stranding data for decades in Europe and Romania constitutes an underexploited monitoring dataset at large spatial and temporal scale. Attempts for using stranding data to elaborate indicators of at-sea mortality were made more recently for cetaceans (Maldini *et al*., 2005; Peltier *et al*., 2012; Pyenson, 2010; Pyenson, 2011; Williams *et al*., 2011).

EXPERIMENTAL

The information were collected by the stranding surveys on the Romanian Black Sea coast (1-4 expeditions/month)(Fig 1), Mare Nostrum Cetacean Stranding Monitoring Network, media (newspaper, TV, online news), social media, environmental authorities and 112 emergency service, as well as the emergency nonstop telephone line 0763255731 followed by interventions of the Emergency Task Force.

All the volunteer observers involved in the monitoring activity were previously trained for assuring a high quality data collection and were collecting the data according to "Volunteer guide for cetacean monitoring" (Cândea *et al*., 2011) (in accordance with ACCOBAMS and MEDACES protocols), including species identification, general measurements, body state and body condition. If the body was in a fresh state, the authorised team personnel proceed to do a necropsy and collect the samples (tissues, teeth, etc).

Used materials: the expeditions were made by foot or by ATV (all terrain vehicles). Each team used photo cameras, binoculars, gloves, ruler, standard observation sheets and sampling kits.

The volunteer network is distributed along the coast, forming a marine mammals stranding network, and allowing performance of an effective stranding time-response in the whole area (Fig. 1). The stranding network consist of public institutions: School Inspectorate, Schools/high schools, Water Administration, Danube delta Biosphere Reserve Administration, National Institute for Marine Research and Development "Grigore Antipa", Natural Science Museum, Coastal Guard, Port Administrations, and private sector: Divers, Safe Guards, Marinas, pleasure boats owners etc. Beside the network, every month were made 1-4 land expeditions in order to monitor the remote areas of the coast.

So, the Mare Nostrum responsible receives alerts on the emergency telephone number or by email, WhatsApp, Facebook etc. from different sources such as state agencies like the police corps and coast guards, and also from local residents and tourists who may encounter a dead or injured marine mammal. In case of stranding event, the network immediately sends the closest volunteer (team) out to confirm the report, investigate the animal, collect data about location, weather conditions, sea conditions and physical condition of the animal (alive or dead), to decide the suitable response.

If the animal is still alive, qualified personnel such as veterinarians and staff members go to the site to assist the animal with medical care. Some of the work teams do not have qualified personnel at all times, but all the volunteers are trained in marine mammal health assessment and supportive care, so they are able to proceed with keeping the animal in situ, checking vital signs, inform general public about the situation and waiting for authorised personnel to arrive.

When the stranded animal is dead on the beach, data are collected according to established protocols (Cândea *et al*., 2011) species identification, general measurements, and state and body condition. If the body is still in a fresh state, the authorised team personnel proceed to do a necropsy and collect the samples (tissues, teeth, etc). These are stored and/or delivered to university research groups who are

carrying out studies on cetacean. Our interest is mainly in determination the cause of death (natural/unnatural).

Study area: The Romanian Black Sea coast was split in three sectors. The **north sector** is bordered to the north by Musura Golf (Sulina City) and to the south by Cape Midia. The **central sector** between Cape Midia (North) and Constanta City (South) and the last sector, the **south sector** between Constanta City (North) and Vama Veche village (South), border with Republic of Bulgaria according to Mare Nostrum Black Sea Cetacean Monitoring and Conservation Program (http://seamap.env.duke.edu/) (Fig.1).

Fig. 1. Area under observation with colored spots for cetacean stranding events (2010-2016) OBIS-Seamap online database.

RESULTS AND DISCUSSION

1. Cetacean stranding data

A total of 585 cetacean strandings (Table 1) were collected by the Mare Nostrum monitoring network. Very few of them were reported from the north part mainly in Summer. Annual stranding numbers varied between 2010 and 2016 (Fig. 3), with a pick in 2012 of 177 stranded cetaceans. The stranding event presents a seasonal pattern with abundance in spring-summer and low abundance in autumn and winter (Fig. 2).

Table 1. Cetacean stranding events at the Romanian coast between 2010-2016.

Year	*Delphinus delphis*	*Tursiops truncatus*	*Phocoena phocoena*	Total no.
2010	2	5	38	45
2011	3	5	81	89
2012	10	7	160	177
2013	3	23	39	65
2014	6	27	42	75
2015	2	11	58	71
2016	2	8	53	63
Total/specie	28	86	471	**585**

Fig. 2. Seasonal cetacean stranding events for the 7 year period recorded.

Analyzing the events for each specie shows different pattern, but not for harbour porpoise, which is not always in close relation with the total number of strandings for that year (Fig. 3). If for the common dolphin the pick it coincide with the 2012 event, recording the highest abundance in stranding (10 individuals) for bottlenose dolphin the situation was totally different, the event from 2012 being outran by the next year: 2013 with 23 stranded individuals, 2014 with 27 individuals and even 2015 and 2016 with 11 individuals and 8 individuals.

Fig. 3. Number of strandings by specie between 2010-2016 at the Romanian coast.

Harbour porpoise (*Phocoena phocoena relicta*), the most common by-catch recorded an average of 80% from the total cetacean by-catch for the period, followed by bottlenose dolphin (*Tursiops truncatus ponticus*) 15% and common dolphin (*Delphinus delphinus ponticus*) with 5% (Fig. 4). Trend which is found over each year with slight changes just in percentage not in the hierarchy, for harbour porpoise between 56% – 90 %, bottlenose dolphin between 5% - 36% and for common dolphin between 3% and 8%.

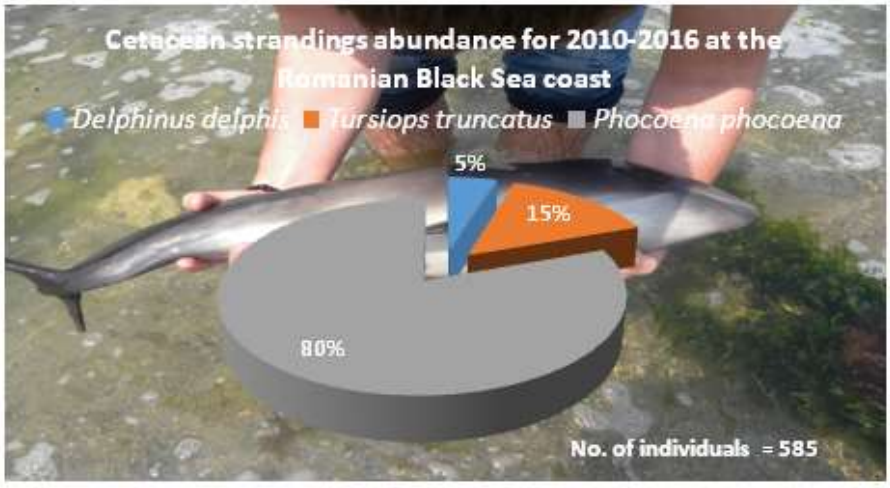

Fig. 4. Cetacean stranding abundance for 2010-2016 at the Romanian Black Sea coast.

2. Cetacean stranding by gender

The study revealed that the incidence of death is greater for males than females but with just 7% difference. From 585 cetacean analyzed 282 individual

were males and 239 females. 11% of the cetaceans stranded were not identified for gender because of state of decomposition or lack of information (Fig.5).

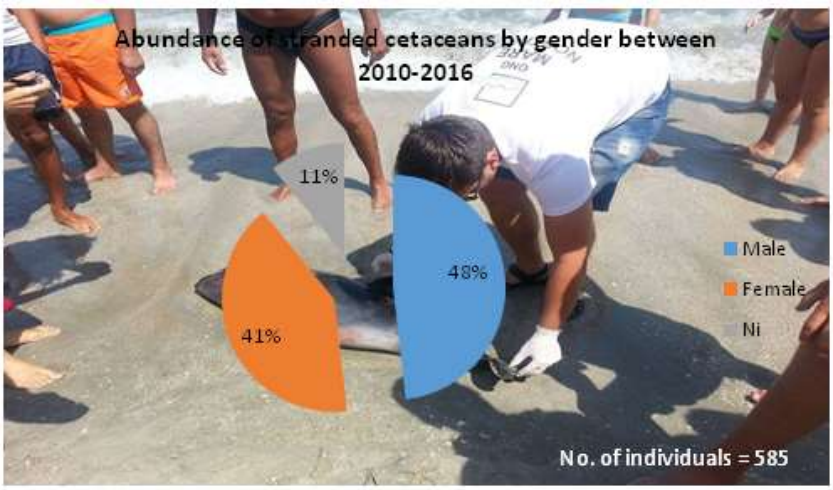

Fig. 5. Abundance of stranded cetaceans by gender between 2010-2016.

The trend is the same also by specie, for the study period, just in the case of *Phocoena phocoena relicta*, the balance is almost even (Fig. 6). Is true those if the data are taken separate by years the situation changes and will register dominance in female (for harbour porpoise in 2011, 2012 and 2013) in the sense of registering a greater number of dead females than males, for the others two species, the trend remains for more males than females.

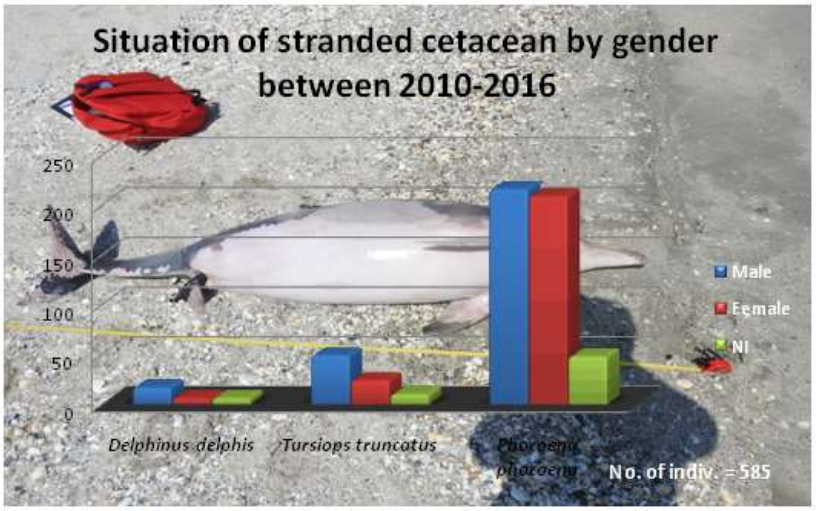

Fig. 6. Situation of stranded cetacean by gender.

3. Cetacean stranding on age stages

For the entire period the assessment showed a high number of deaths in

adult category and smaller for calves (Fig. 7), 75% respective 25%. Assessing each year the situation was similar with higher percentage of adults stranded, just the year 2015 it distinguish with higher number of juveniles and neonates stranded (41 % adults and 59 % juveniles and neonates) and with 57% adults and 43 % juveniles and neonates in 2016. In 2016 at the West and South Western Black Sea coast (Bulgaria and Turkey) were recorded according to Ayaka et al., 2017 (31 st Conference of the European Cetacean Society Meeting) (Omaha Ozturk *et al.*, 2017) 677 strandings, from which 96% harbour porpoises, mainly neonates in advanced state of decomposition.

Fig. 7. Situation of stranded cetaceans by age for the study period (2010-2016).

CONCLUSIONS

1. As in the previous article the conclusion related to the main threat at Romanian coastline, as in other areas of World Ocean, when each year tens and even hundreds of cetaceans are stranded due of to by-catch in commercial fishing gear (Nicolaev *et al*., 2011). On the study period were identified and registered 585 stranded cetaceans from all three species along the Romanian coast.

2. The article is updating with new data regarding cetacean stranding events at Romanian coastline, the abundance, distribution and also makes an analysis over structure (gender and age), adding data for 2015 and 2016 and analyzing them together.

3. The character of migratory species is well reflected in the abundance of stranding along the year with picks in spring and summer (88%) and low abundance in autumn and winter (12%). The stranding of cetaceans have been reported, particularly in the breeding period of turbot, mainly when they are caught illegally by fishermen with turbot gillnets.

4. By gender, dolphins follow the same trend with high number of males and small number of females. In the case of *Delphinus delphis* the ratio is 3/1 (m/f) and for *Tursiops truncatus* 2/1.

5. By age resulted higher abundances of adults in comparison with calf, different percentage for each species with high abundance for porpoise and smaller for dolphins exept 2015 when for harbour porpoise the calfs/juveniles overcome the adults in strandings.

6. The high abundance in stranded calfs from 2015 it happened in the following year in the south and south western part of the Black Sea. Some of the cases could be putted on the presence of morbillivirus in porpoises discovered in samples from Romania and Bulgaria (unpublished data).

7. To conclude with, this kind of programme should be on going, not just for limited periods, and should be financially supported by the government.

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REFERENCES

ANTON E., PAIU R.-M., CÂNDEA M. (2012), Observation on dolphin sightings at the Romanian coast and measures to reduce accidental cathes in fishing nets. *Researches Marines*. Incdm. ISSN:..... , **42**: 149-158;

BOYD I.L., WANLESS S., CAMPHUYSEN J. (2006), Introduction. *Top Predation in Marine Ecosystems*, 1-11;

BUBB P., JENKINS M., KAPOS V. (2005). Biodiversity Indicators for National Use;

CAUGHLAN L., OAKLEY K.L. (2001). Cost considerations for long-term ecological monitoring. *Ecological Indicators* **1**: 123-140;

CÂNDEA M., FABIAN R., PAIU R.-M. (2011). Ghidul voluntarului pentru monitorizarea delfinilor. *Mare Nostrum NGO*, 29 pp.;

ELZINGA C.L., SALZER D.W., WILLOUGHBY J.W., GIBBS J.O. (2001), Monitoring Plant and Animal Populations. *Blackwell Science*;

HINDS W.T. (1984). Towards monitoring of long-term trends in terrestrial ecosystems. *Environment Conservation* **11**: 11-18;

MACE G.M., BAILLIE J.E.M. (2007), The 2010 biodiversity indicators: challenges for science and policy. *Conservation Biology* **21**: 1406 – 1413;

MALDINI D., MAZZUCA L., ATKINSON S. (2005). Odontocete strandings patterns in the main Hawaiian Islands (1937-2002): how do they compare with live animals surveys?. *Pacific Science* **59**: 55-67;

MULLER F., LENZ R. (2006). Ecological indicators: theoretical fundamentals of consistent applications in environmental management. *Ecological indicators* **6**: 1-5;

NICOLAEV S., ANTON E., CANDEA M., FABIAN R., PAIU R.-M. (2011). Recomandari privind diminuarea impactului negative al uneltelor de pescuit asupra populatiilor de delfini din Marea Neagra. *Mare Nostrum NGO*, 24 pp.;

OMAHA OZTURK A., TONAY A.M., DEDE A., DANYER E., DANYER, B. OZTURK I.A., POPOV D. (2017). Unusual Mass Mortality of Harbour Porpoises on the Coast of the

Western Black Sea (Bulgaria and Turkey) in Summer 2016. *31st Conference of European Cetacean Society Meeting* – poster;

PAIU R.-M., MIREA CÂNDEA M. (2016), Correlation of cetacean stranding events between 2010-2014 at the Romanian coast. *Researches Marines*, **46**: 144-155;

PAIU R.-M. (2013), Annual report in the frame of Monitoring and Conservation of Black Sea Dolphins Program. *Mare Nostrum*;

PAIU R.-M. (2014), Annual report in the frame of Monitoring and Conservation of Black Sea Dolphins Program. *Mare Nostrum*;

PAIU R.-M. (2015), Annual report in the frame of Monitoring and Conservation of Black Sea Dolphins Program. *Mare Nostrum*;

PAIU R.-M. (2016), Annual report in the frame of Monitoring and Conservation of Black Sea Dolphins Program. *Mare Nostrum*;

PELTIER H., DABIN W., DNIEL P., VAN CANNEYT O., DOREMUS G., HUON M., RIDOUX V. (2012). The significance of stranding data as indicators of cetacean population at sea: modeliling drift of cetacean carcasses. *Ecological Indicators* **18**: 278-290;

PIKESLEY S.K., WITT M.J., HARDY T., LOVERIDGE J., WILLIAMS R., GODLEY B.J. (2011). Cetacean sightings and strandings: evidence for spatial and temporal trends. *Journal of Marine Biological Association of the United Kingdom*;

PYENSON N.D. (2010). Carcasses on the coastline: measuring the ecological fidelity of the cetacean stranding record in the eastern Nord Pacific Ocean. *Paleobiology **36***: 453-480;

PYENSON N.D. (2011). The high fidelity of cetacean stranding record: insights into measuring diversity by integrating taphonomy and macroecology. *Proceedings of the Royal Society **B***;

SCHILLER A., HUNSAKER C.T., KANE M.A., WOLFE A.K., DALE V.H., SUTER G.W., RUSSELL C.S., PION G., JENSEN M.H., KONAR V.C. (2001). Communicating ecological indicators to decision makers and the public. *Conservation Ecology* **5**: 19;

SERGIO F., CARO T., BROWN D., CLUCAS B., HUNTER J., KETCHUM J., MCHUGH K., HIRALDO F. (2008), Top predators as conservation tools: ecological rationale, assumption and efficacy. *Annual Review of Ecology. Evolution, and Systematics* **39**: 1-19;

SIEBERT U., GILLES A., LUCKE K., LUDWIG M., BENKE H., KOCK K.-H., SCHEIDAT M. (2006). A decade of harbour porpoise occurrence in German waters – analyses of aerial survey, incidental sightings and strandings. *Journal of Sea Research* **56**: 65-80;

TURNHOUT E., HISSCHEMOLLER M., EIJSACKERS H. (2007). Ecological indicators: between the two fires of science and policy. *Ecological Indicators* **7**: 215-228;

WANLESS S., FREDERIKSEN M., DAUNT F., SCOTT B.E., HARRIS M.P., (2007). Black-legged kittiwakes as indicators of environmental change in the North Sea: evidence from, long-term studies. *Progress in Oceanography* **72**: 30-38;

WILLIAMS R., GERO S., BEJDER L., CALAMBOKIDIS J., KRAUS S.D., LUSSEAU D., READ A.J., ROBBINS J. (2011). Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. *Conservation Letters* **4**: 228-233;

http://seamap.env.duke.edu/.