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CORRELATION OF CETACEAN STRANDING EVENTS BETWEEN 2010-2014 AT THE ROMANIAN COAST

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ABSTRACT

The current study presents data from research conducted at the Romanian coast, for the period May 2010 - December 2014. Stranding data were obtained mainly through the national stranding network established by the "Mare Nostrum" NGO in collaboration with the Water Administration authorities. The database of "Mare Nostrum" NGO contains 451 records. Stranding data refer to number of animals stranded and not to multiple stranding events.

It reveals an analysis of cetacean stranding along the entire shore and puts in front the correlations between natural and unnatural mortality, on gender and age stages. In the Black Sea, cetaceans are represented by three species, *Phocoena phocoena relicta*, *Tursiops truncatus ponticus* and *Delphinus delphis ponticus*. The main threat and cause of decline for the Black Sea dolphins are the fishing nets, the so-called by-catches.

For the protection and conservation of the dolphin populations from the Romanian Black Sea area in conformity with the objectives of the "National Action Plan for Conservation of Dolphins" and the "Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area", NGO "Mare Nostrum" developed a Monitoring program called "Monitoring and conservation of Black Sea dolphins" in partenership with the National Institute for Marine Research and Development "Grigore Antipa" Constanta, the Danube Delta Biosphere Reserve Authority, the National Agency for Fisheries and Aquaculture, the Natural Science Museum Complex "Dolphinarium" Constanta, the Border Police Inspectorate of Constanta County, ACCOBAMS and international partners.

Key words: *Black Sea, cetaceans, strandings 2010-2014, new data, Romanian coast*

AIMS AND BACKGROUND

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 (Asseburg et al., 2006; Boyd et al., 2006; Mace and Baillie, 2007; Sergio et al., 2008, Thomas, 1996; Wanless et al., 2007). An optimum monitoring method would be based on three fundamental principles: its ecological significance, its statistical credibility and its costeffectiveness (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 and Oakley, 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 and Baillie, 2007; Muller and Lenz, 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 in nature. Yet, it is admitted that stranded animals represent a minimum measure of at-sea mortality. Strandings are underused resources (Pikesley et al., 2011) and the collection of stranding data for decades in Europe 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 mostly in seabirds (Bibby and Lloyd, 1997; Hlady and Burge, 1993), sea otters (Garshelis, 1997), sea turtles (Koch et al., 2013) and, more recently, cetaceans (Maldini et al., 2005; Peltier et al., 2013, 2012, Pyenson, 2011, 2010; Williams et al., 2011).

The present study focuses on the three species of cetaceans from the Black Sea, namely the common dolphin (*Delphinus delphis ponticus*), bottlenose dolphin (*Tursiops truncates ponticus*) and harbour porpoise (*Phocoena phocoena relicta*), at the Romanian coast (Anton et al., 2012).

The first goal of this study was to analyze the stranding time series at the Romanian coast for the three species. Secondly, we aimed at inferring the distribution of dead cetaceans by age and sex.

MATERIAL AND METHOD

Records of marine mammals stranded on beaches in the study area were collected with the help of the "Mare Nostrum" NGO field team, comprised by volunteers and specialists. The data were collected on predefined monitoring expeditions (2-4 expeditions/month) and emergency interventions as result of monitoring network and nonstop signal phone number. The data of this study were recorded from 2010 to 2014 (the work is undergoing) (Paiu, 2013; 2014). The volunteer network is distributed along the coast, forming a marine mammals stranding network, and allowing the performance of an effective stranding time-response in the whole area (Fig. 1). The stranding network consist of public institutions: School Inspectorate, schools/highschools, 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 fuards, marinas, pleasure boats etc. Beside the network, every month were made 2-4 land expeditions in order to monitor the remote areas of the coast.

So, the stranding network receives alerts from diverse sources such as state agencies like the Police corps and coast guards, an emergency phone number, and also from local residents and tourists who may encounter a dead or injured marine mammal. In case of a 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, body 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 cetaceans. Our interest is mainly in determining 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 (Obis-Seamap) (Fig. 1).

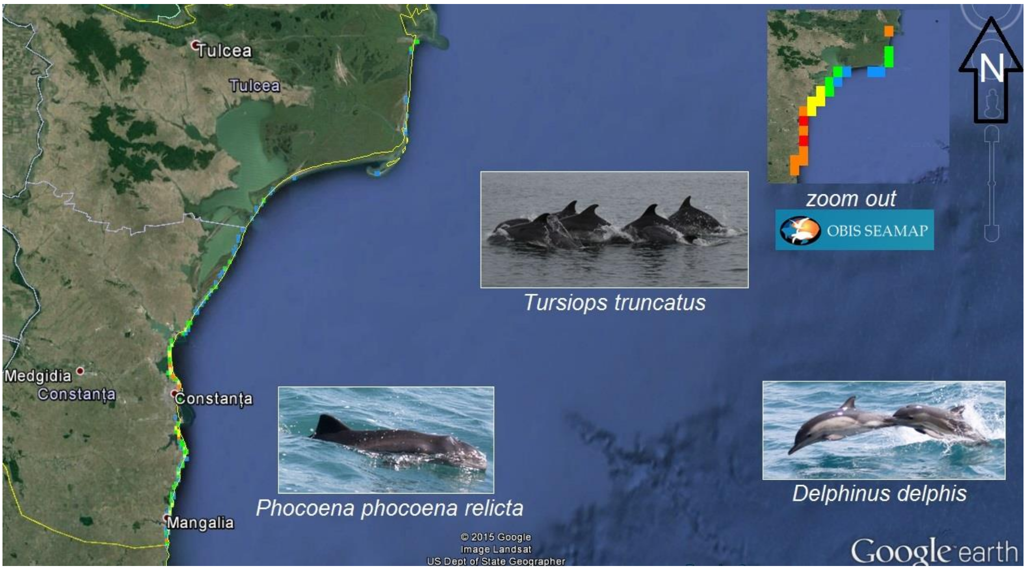

Fig. 1. Area under observation with colored pointed spots for strandings (2010-2014) OBIS-Seamap online database

Used materials: The expeditions were made by foot or by ATV (all terrain vehicle), with teams of at least two persons on each sector. Each team used photo cameras, binoculars, gloves, ruler, standard observation sheets and sampling kits.

Analysed data: Cetacean stranding from 2010-2014.

RESULTS AND DISCUSSION

Cetacean stranding data

A total of 451 cetacean strandings 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 2014 (Table 1), with a peak in 2012 of 177 stranded cetaceans. The stranding events present a seasonal pattern, with abundance in spring-summer and low abundance in autumn and winter (Fig. 2, 3, 4, 5).

Table 1. Strandings at the Romanian Coast between 2010-2014

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
Total/species	24	67	360	**451**

Regarding the seasonal strandings, the following were recorded:

- In **winter**, were identified just cases of bottlenose dolphins (*Tursiops truncatus ponticus*), one case in 2012 and 2 cases in 2014.

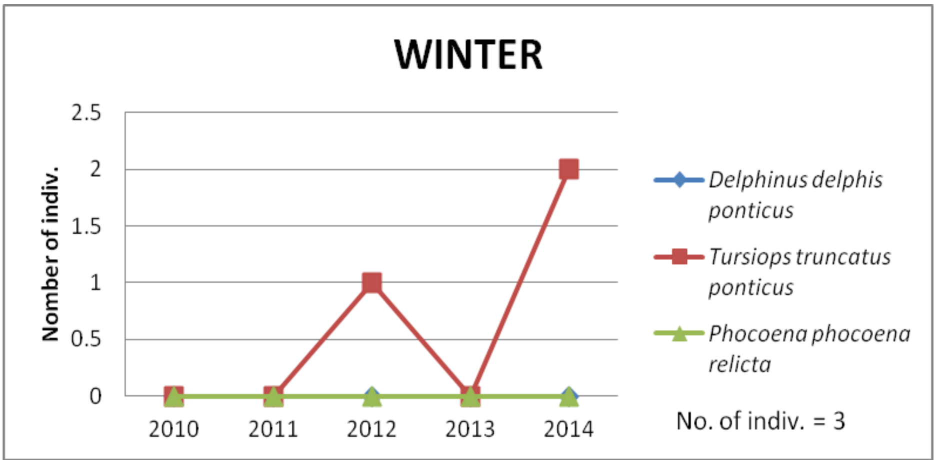

Fig. 2. Stranding distribution in the winter by species

- In **spring** were identified 122 cetaceans from all three species, with a peak in 2011 for harbour porpoise (50 cases).

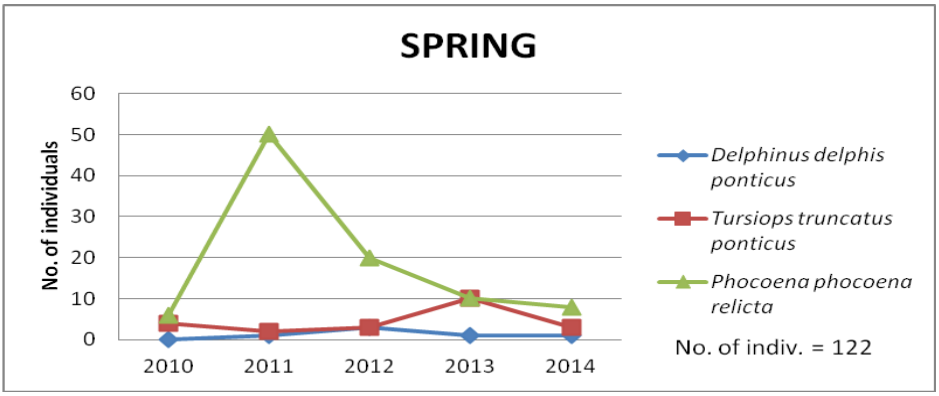

Fig. 3. Stranding distribution in spring by species

- In **summer**, the number of strandings increases every year. There were recorded 281 stranding events, with a majority from harbour porpoise. In 2012, were recorded 130 individuals - *Phocoena phocoena relicta*.

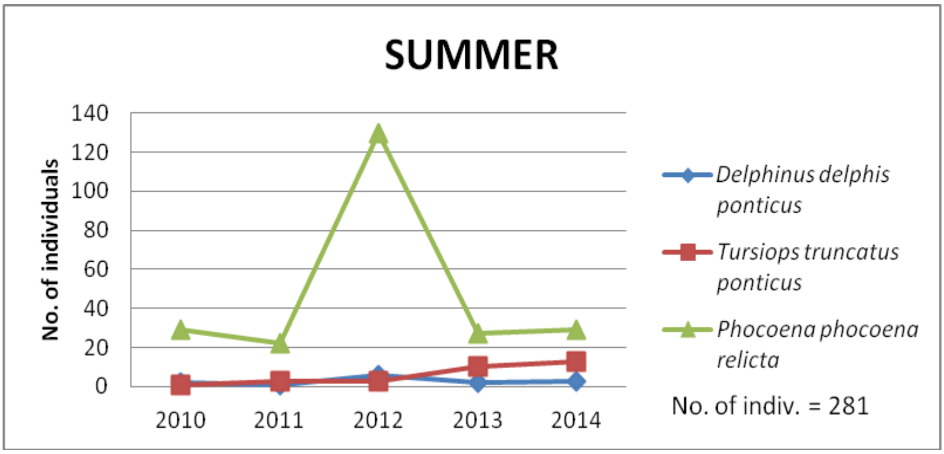

Fig. 4. Stranding distribution in summer by species

- **Autumn** represents the decline of strandings over the year. There were recorded 45 stranding events, with a majority from harbour porpoise and bottlenose dolphin, with 9 cases in 2011 and 2012 for porpoise and in 2014 (9 individuals) of bottlenose dolphin.

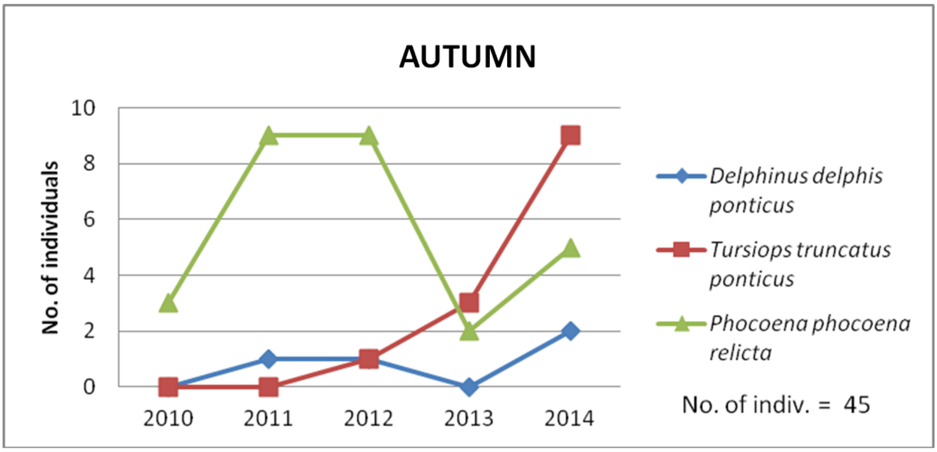

Fig. 5. Stranding distribution in autumn by species

It is a well known the fact that, in spring and summer, the number of stranding events raises, and the present study strengthens the studies, revealing that in spring and summer the number of events reached 403 cases, in comparison with autumn and winter, when only 48 cases were recorded.

The monitoring revealed that the most stranded species is represented by the harbour porpoise, which was registered in 80% of the cases, followed by bottlenose dolphin with 15% and common dolphin with 5% (Fig. 6).

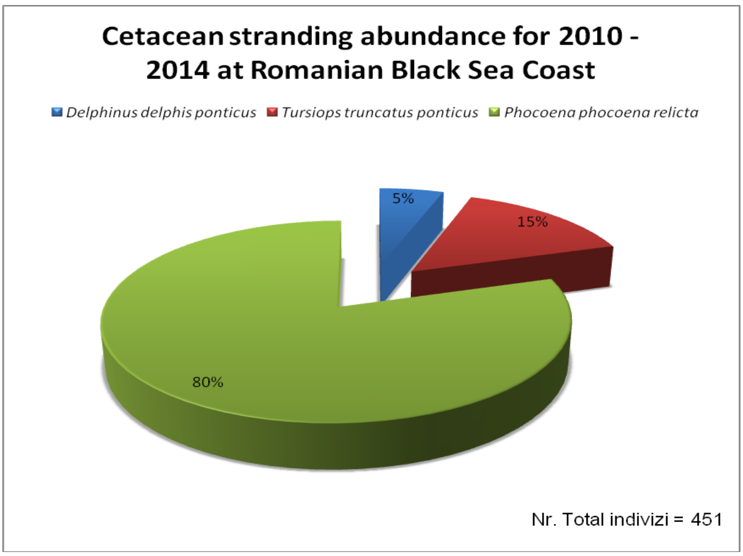

Fig. 6. Cetacean stranding abundance for 2010-2014 at the Romanian Black Sea coast

Cetacean stranding data on sex

The five year period study revealed that the incidence of death came in a greater number for males than females. From 451 cetacean analysed, 209 individuals were males and 186 females. 15.30% of the stranded cetaceans were not identified for gender, being observed in state 5 (skeleton) (Fig. 7).

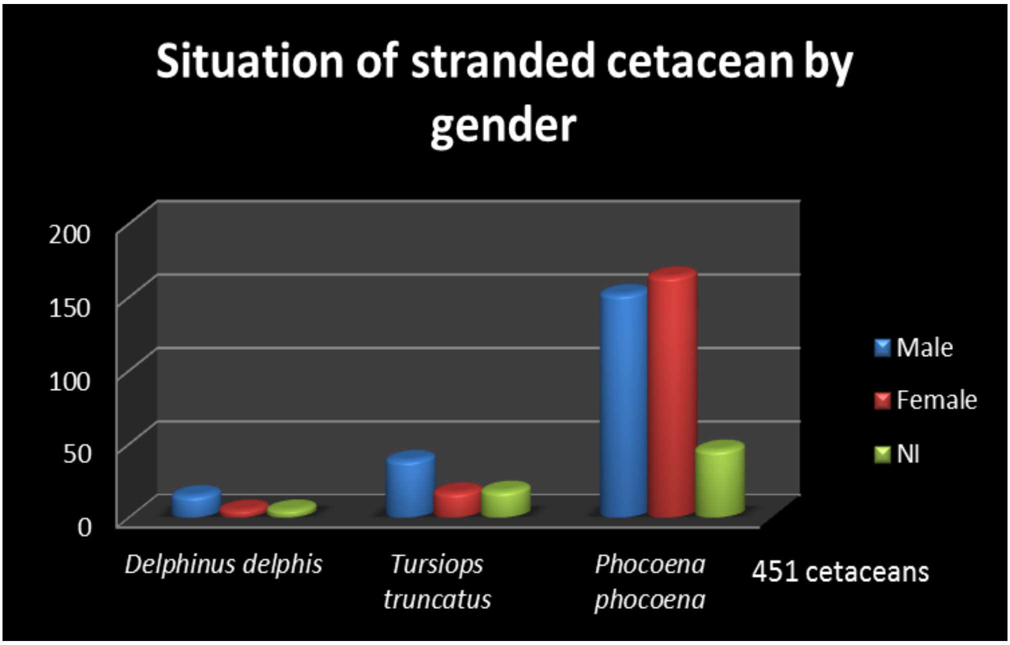

Fig. 7. Situation of stranded cetaceans by gender

On species, just in *Phocoena phocoena relicta* the situation changed, in the sense of registering a greater number of dead females than males, for the other two species, the trend remains of more males than females, the difference registered being more than 50%.

Cetacean strandings on age stages

For all three species the abundance by age was the same, registering a high number of deaths in adult category and smaller for calves (<100 cm). For *Delphinus delphis* (common dolphin*)* and *Tursiops truncatus* (bottlenose dolphin) were registered two cases each, 8% and 3.28%, respectively, of the total individuals stranded from the same species. The situation changes for *Phocoena phocoena relicta (harbour porpoise)*, where the calf stage of stranding reached 28.75% of the total stranded individuals (Fig. 8).

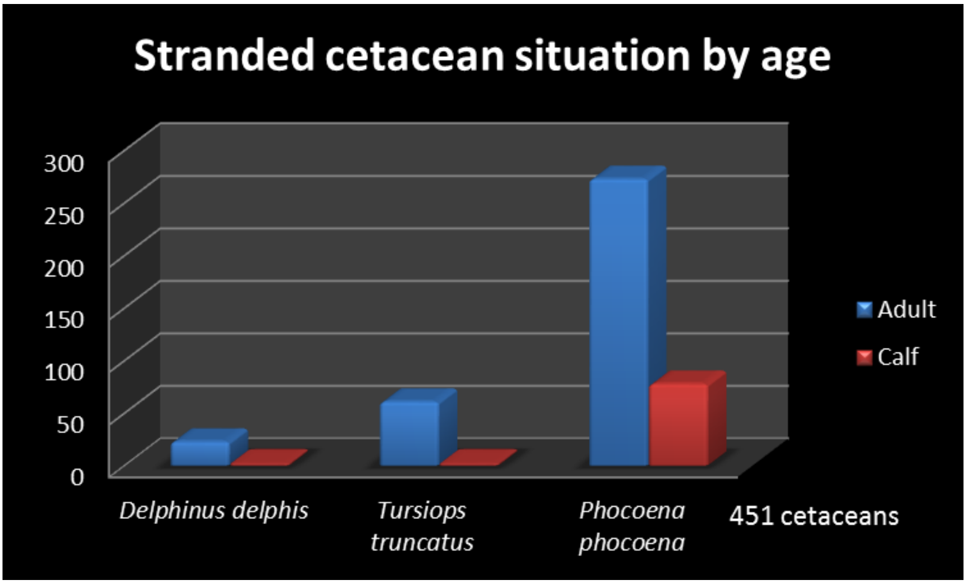

Fig. 8. Situation of stranded cetaceans by age

CONCLUSIONS

At the Romanian coastline, as in other areas of thevWorld Ocean, each year tens and even hundreds of cetaceans are stranded due to bycatch in commercial fishing gears (Nicolaev et al., 2011). During the study period were identified and registered 451 stranded cetaceans, from all three species inhabiting in Black Sea.

The study brings new data regarding cetacean stranding events at the Romanian coastline, their abundance, distribution, and also makes an analysis over structure (sex and age).

The character of migratory species is also reflected in the abundance of strandings along the year, with peaks in spring and summer (89.36%) and low abundance in autumn and winter (10.64%). The stranding of cetaceans has been reported particularly during the breeding period of turbot, mainly when they are caught illegally by fishermen with turbot gilnets, which are not complying with national legislation (smaller mesh size and use of large diameter wires).

By gender, dolphins follow the same trend, with a 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* 2.8/1.

By age, higher abundances of adults resulted in comparison with calves, in different percentages for each species, with high abundance for porpoise and smaller for dolphins.

These situations are favoured by sea currents, wind etc. and lead directly to results which are not consistent with the existing reality in order to correlate the data with the fishing effort. Specimens of dead cetaceans brought by currents from the neighbouring countries and stranded at the Romanian shore will generate errors of calculation between by-catches, stranding and fishing effort. However, for assessing the cause of death, abundance etc., the data are of great value.

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

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