Project funded by
EUROPEAN UNION

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Black Sea
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Citizen Science - a tool to assess cetacean population status

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EDITURA CD PRESS
www.cdpress.ro

BUCUREȘTI, 2021

Descrierea CIP a Bibliotecii Naţionale a României
Citizen Science - a tool to assess cetacean population status / Marian Paiu, Arda M. Tonay, Costin Timofte, ... - Bucureşti : CD Press, 2021
ISBN 978-606-528-562-0

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This document is based on the activities of the ANEMONE project (Assessing the vulnerability of the Black Sea marine ecosystem to human pressures) with the financial support from the Joint Operational Programme Black Sea Basin 2014-2020.

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For bibliographic purposes, this document should be cited as:
ANEMONE Deliverable 4.3, 2021. “Citizen Science - a tool to assess cetacean population status”, Paiu M. [Ed], Ed. CD PRESS, 43 pp.

ISBN 978-606-528-562-0

Cover page design by Vector_Corp / Freepik. Cover page photo by Mare Nostrum NGO.

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Acronyms

ACCOBAMS	The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
AIC	The Akaike's Information Criterion
ANEMONE	Assessing the vulnerability of the Black Sea marine ecosystem to human pressures
ATV	all-terrain vehicles
BSB	Joint Operational Programme Black Sea Basin 2014-2020
CI	Confidence interval
CV	Coefficient of Variation
EEZ	Economic Exclusive Zone
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
MEDACES	Mediterranean Database of Cetacean Strandings
NGO	Non-Governmental Organization
R	The R Project for Statistical Computing
SE	Standard Error
TSS	Turkish Straits System
TUDAV	Turkish Marine Research Foundation
UNCLOS	United Nations Convention on the Law of the Sea

Executive summary

This deliverable integrates the results of the citizen science study on both cetacean strandings along the coasts and cetacean sightings during the five surveys performed in Romania and Turkey within the ANEMONE project, in 2019 and 2020.

This will serve as a working model for all the partners encouraging citizens involvement in scientific data collection. Also, the deliverable includes a chapter that analyse the citizen science added value, their feedback and recommendation for further collaboration.

The main aim of the ANEMONE project was to develop a joint Black Sea monitoring strategy using the most appropriate assessment criteria and indicators to evaluate the status of the Black Sea as a basis for future action. The project offered numerous opportunities for citizens to be involved in the research actions (stranding monitoring, vessel surveys) and be trained to assure a high quality of the data collected. Cetacean surveys require trained individuals supervised by a highly qualified expert or researchers, like the case of the presented study.

The involvement of citizens (yacht captains and/or students) in scientific surveys is a good way of capacity building for them. Such occasions are rare but should be realized whenever possible. The ANEMONE project provided such rare opportunities which will contribute to the overall research effort for dolphins and porpoises in the Black Sea. In order to implement the cetacean studies with help of citizens, people were trained during the public engagement workshops addressed to cetaceans, and strengthen the knowledge by in situ training.

The case studies provide scientific data that are uploaded in European and international databases for scientific purposes. The results of these studies, implemented with the help of citizens, represent the ground of the awareness-raising campaigns focusing on real data collected from the field, analyzed, and transposed for public acknowledge.

Citizen Science is a very important aspect and useful resource these days. The added value brought by citizens for science, research and policy, will represent an essential step made to contributed at the results obtained and how they can be involved in the future in different activities.

This report is part of the ANEMONE project (“Assessing the vulnerability of the Black Sea marine ecosystem to human pressures “), BSB-319, funded by the Joint Operational Programme Black Sea Basin 2014-2020. The actions were implemented by two of the project partners Mare Nostrum NGO (Romania) and Turkish Marine Research Foundation (TUDAV).

1 Black Sea cetacean species

The Black Sea is home to three species of cetaceans: bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), and harbour porpoise (*Phocoena phocoena*)(Çelikkale, 1989). All three species are present in the Black Sea and Atlantic Ocean, and two of them (the bottlenose dolphin and the common dolphin) are also present in the Aegean Sea, Mediterranean Basin. Although, the harbour porpoise is occasionally found in the Mediterranean Basin in small groups, it does not appear to form stable populations there. The Black Sea populations of these species have smaller bodies and show some other morphological differences from the conspecific Atlantic and Mediterranean populations (Goldin, 2004). Harbour porpoise common dolphin and bottlenose dolphin are genetically distinct, considering their maternal lineages (Viaud-Martinez et al. 2007, 2008; Tonay et al. 2017). On the other hand, differentiation was not observed between the Mediterranean and the Black Sea populations of common dolphin (Tonay et al. 2020).

1.1 The bottlenose dolphin

Tursiops truncatus ssp. *ponticus,* Barabasch – Nikiforov, 1940

Class: Mammalia

Order: Cetacea

Suborder: Odontoceti

Family: Delphinidae

Genus: Tursiops

Species: *Tursiops truncatus* ssp. *ponticus* (Figure 1.1)

Figure 1.1 - Tursiops truncatus ssp. ponticus (Barabasch-Nikiforov, 1940) (@Mare Nostrum NGO)

1.1.1 Habitat

The bottlenose dolphins are widely spread over the entire Black Sea basin, occurring in the shallow coastal waters, form the littoral zone of western-central coast of Turkey, to the continental shelf in the north-northwestern of the Black Sea, predominantly below depths of 250 m and in warmers waters ranging between 18 and 24°C (Sanchez-Cabanes et al. 2017). This is related to the feeding preference for predominantly benthic and nearshore pelagic fish (Birkun, 2012; Gladilina and Gol'din, 2014). It is considered that bottlenose dolphins from the Black Sea are likely to have fidelity to some regions (local populations), and also it is considered to co-exist with the offshore populations, mainly in summer where is high concentration of dolphins in pelagic waters (Gladilina and Gol'din, 2014). Bottlenose dolphins typically aggregate during autumn, winter and spring in a relatively small area off southern Crimea between Cape Sarych and Cape Khersones. Groups of hundreds of animals migrate every autumn to this area from the eastern and, probably, other parts of the Black Sea. In the Turkish Black Sea, western areas seem to be the most important areas for bottlenose dolphins whereas they are rare off the eastern coast of Turkey. They are also common in the Turkish Straits System (TSS) consisting of the Istanbul Strait (Bosphorus), Marmara Sea and the Çanakkale Strait (Dardanelles) (Dede et al. 2016). Bottlenose dolphins migrate to Bulgarian waters annually from the southeast and northeast in spring.

1.1.2 Distribution and abundance

In the monitoring study made by Birkun in 2013 (Table 1.1 and Table 1.2), the bottlenose dolphins were recorded in coastal waters of Ukraine, Romania and Bulgaria, from Gulf of Burgas, between Cape Maslen and Cape Emine) and near Cape Kaliakra in Bulgaria; to Danube Delta in Romania; opposite Danube-to-Dniester interfluve, and nearby Tarkhankut Peninsula in Ukraine (Birkun et al. 2014).

Table 1.1 - Density and abundance of bottlenose dolphins in the inshore area

Surveyed areas	Density of groups		Density of animals		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.192	0.106 – 0.346	0.343	0.188 – 0.628	6515	3563 – 11913
RO	0.158	0.098 – 0.255	0.217	0.131 – 0.359	1265	766 – 2089
BG	0.337	0.197 – 0.578	0.696	0.396 – 1.221	4861	2769 – 8533
Total area	0.219	0.155 – 0.309	0.392	0.274 – 0.560	12453	8719 - 17786

Also, bottlenose dolphins were recorded in different parts of the surveyed EEZs of Bulgaria, Romania and Ukraine. The sightings were rather scattered in the study area than concentrated somewhere in the form of clear gatherings. Nevertheless, some clusters of *T. t. ponticus* sightings have been recorded in the southern and central Bulgarian EEZ, in the central and northern Romanian EEZ, and in the northern and southern Ukrainian EEZ.

Table 1.2 - Density and abundance of bottlenose dolphins in the offshore area

Surveyed areas	Density of groups		Density of animals		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.159	0.099 – 0.256	0.297	0.182 – 0.487	10860	6629 - 17791
RO	0.147	0.054 – 0.400	0.295	0.106 – 0.824	6863	2459 - 19154
BG	0.174	0.080 – 0.376	0.360	0.164 – 0.789	10162	4633 - 22289
Total area	0.145	0.099 – 0.212	0.282	0.190 – 0.419	24820	16699 - 36892

1.1.3 Threats

There is little information on the influence of cetaceans on commercial fisheries in the Black Sea. No special estimates have been made, except for certain erroneous estimations of the annual amount of fish consumed by dolphins, hence the conclusion that dolphins are the main threat for fisheries, being responsible for the depletion of fishery resources. Fisheries may cause a series of effects on cetaceans, among which the following:

- modification (reduction or enhancement) of feeding possibilities;
- behavioural changes;
- alteration of distribution, migration and breeding capacity.

Pelagic and coastal fishing may affect cetacean populations by the overfishing of the fish species which are food sources for the dolphins. The fishery activity may alter dolphins' behaviour and fishing strategy, cetaceans being often sighted close to fishing vessels, active trawl, near or inside passive fishing gear (trap nets, gillnets, longlines). The deterioration of dolphin habitats by fisheries can occur in several ways:

- the large number of fixed tools - trap nets, gillnets etc. - significantly reduces the living area of dolphins, increasing highly the possibility of entanglement herein;
- bottom trawling, aside from being a direct hazard for cetaceans, also destroys benthic fauna, eliminating important links in the food chain;
- pelagic trawling is also a direct hazard, as there is the likelihood of dolphins being trapped in the net, however it manly influences food resources, as they are little selective, affecting both adults and spawn.

However, according to field observations, the greatest hazard for the Black Sea dolphins is represented by turbot gillnets, with one net wall and especially three wall gillnets (trammel nets), as they have a high catchment capacity and increased tear resistance, which results in the reduction of dolphins' escape chances after entanglement (Radu et al. 2013).

Population trend

Currently, the actual size of the total cetacean population in the Black Sea is unknown, however the research carried-out suggested that the size of the current population of bottlenose dolphins is estimated in the western Black Sea is approximately 26.000 ± 4.000. It is known that, among the three cetacean species in the Black Sea, *Tursiops truncatus ponticus* has had the lowest abundance (Birkun et al., 2014; Radu et al., 2013).

1.2 The common dolphin

Delphinus delphis ssp. *ponticus,* Barabasch-Nikiforov, 1935

Class: Mammalia

Order: Cetacea

Suborder: Odontoceti

Family: Delphinidae

Genus: Delphinus

Species: *Delphinus delphis* ssp. *ponticus* (Figure 1.2)

Figure 1.2 - Delphinus delphis ssp. ponticus (Barabasch-Nikiforov, 1935) (@Marian PAIU, Mare Nostrum NGO)

1.2.1 Habitat

The range of common dolphins encompasses almost the entire Black Sea, including territorial waters and exclusive economic zones of Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine, and internal waters of Ukraine in Karkinitsky Bay and more likely to be associated with greater depths (range 50 to 2250 m). Temperature appeared to be another important predictor, with a higher preference towards cooler waters (5-18°C) of the basin (Sanchez-Cabanes et al. 2017). Common dolphins are well known also in the TSS (Dede et al. 2016). They do not occur in the Azov Sea, normally avoid the Kerch Strait but can be seen in the southwestern part of the Kerch Strait (Birkun et al., 2014; Gol'din et al. 2013). As a secondary habitat, they inhabiting the circumlittoral area over the continental shelf (usually more than 6 m but less than 200 m deep) (Birkun et al., 2014).

1.2.2 Distribution and abundance

For the northwester part of the Black Sea, the same research showed a greater number of common dolphins in offshore waters of Bulgaria, Romania and Ukraine, whereas a smaller number was sighted for the inshore waters. It is well known that common dolphins are inhabiting offshore waters and visit the continental shelf when during seasonal aggregation and regular migrations of their prey (mainly small pelagic fishes) (Table 1.3 and Table 1.4), (Birkun et al., 2014).

Table 1.3 - Density and abundance of common dolphins in the inshore area

Surveyed areas	Density of groups (groups/km^2)		Density of animals (ind./km^2)		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.249	0.090 – 0.684	0.523	0.189 – 1.445	9919	3589 – 27415
RO	0.192	0.079 – 0.470	0.279	0.113 – 0.685	1624	660 – 1993
BG	0.443	0.227 – 0.866	0.718	0.356 – 1.448	5019	2489 – 10118
Total area	0.258	0.138 – 0.483	0.486	0.258 – 0.915	15450	8211 – 29073

Table 1.4 - Density and abundance of common dolphins in the offshore area

Surveyed areas	Density of groups (groups/km^2)		Density of animals (ind./km^2)		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.278	0.142 – 0.548	0.503	0.253 – 1.003	18381	9228 – 36613
RO	0.100	0.045 – 0.225	0.217	0.089 – 0.532	5047	2058 – 12376
BG	0.383	0.179 – 0.822	0.835	0.383 – 1.810	23580	10874 – 51136
Total area	0.249	0.152 – 0.407	0.515	0.312 – 0.850	45337	27482 – 74794

In a vessel survey from December 2012 to February 2013 which was cruising from Taganrog (Azov Sea) to ports of Marmara Sea several sightings were made of the Common dolphins. The survey showed some wintering distribution, and also confirmed that Common dolphins inhabits the open waters of the Black Sea. 91% of the groups were recorded in areas where depth exceeded 1000m, but a group of 10 to 15 were recorded at depth of no more than 100m (Sinop region), showing that in winter they also inhabit the secondary habitat (Gladilina et al., 2013). This can be related to the pattern of fish aggregations, where it was found that the highest abundance of fish eggs and larvae during spawning season is in Turkish waters (temperature around 10°C in January) (Sanchez-Cabanes et al. 2017).

1.2.3 Threats

The main threats for the common dolphins are overfishing of the main prey (anchovies, sprats and horse mackerel), due to the fact of overlapping with the fishing grounds of the intense pelagic trawl fishery (Birkun et al., 2014; Bilgin et al. 2018).

1.2.4 Population trend

The population size of the Black Sea common dolphins in unknown. It is generally known that among all three species of cetaceans of the Black Sea, the common dolphins are the most abundant species. The results of the survey of 2013 suggested that the current total population size is at least several 10 000s, and possibly 100 000 or more (Birkun et al., 2014).

1.3 Black Sea harbour porpoise

Phocoena phocoena relicta, Abel, 1905

Class: Mammalia

Order: Cetacea

Suborder: Odontoceti

Family: Phocoenidae

Genus: Phocoena

Species: *Phocoena phocoena* ssp. *Relicta* (Figure 1.3)

Figure 1.3 - Phocoena phocoena ssp. relicta (Abel, 1905) (@Arda TONAY, TUDAV)

The Black Sea porpoise is recognized as endemic subspecies with morphological and genetics differences from other populations elsewhere in the world (Birkun et al., 2014), and is encountered in the whole Black Sea basin and its contiguous areas (Azov Sea, Kerch Strait) as well as in the TSS (Dede et al., 2016) and in the Aegean Sea. The population of harbour porpoise may consist of three or more subpopulations including those that are inhabiting much of the year in different geographically and ecologically areas (Birkun et al., 2014). Tonay et al. (2017) indicated that the Marmara Sea subpopulation was significantly genetically differentiated from all of the other subpopulations. Morphological differences between porpoises from the Black and Azov seas suggested that they may belong to differentiated subpopulations (Gol'din and Vishnyakova 2015, 2016) but there is not genetically differentiation (Chehida et al. 2020).

Occasionally, have been spotted in the Danube, Dnieper, Southern Bug situated in northwestern part of the continental shelf of the Black Sea, and in Don and Kuban rivers which drains in the Azov Sea (Birkun et al., 2014).

The Black Sea harbour porpoise inhabits mostly the waters over the continental shelf with depths ranging between 6 to 200m, but as a secondary habitat it can be encountered in open sea with depths more than 200 m (Birkun et al., 2014).

Annually begins migrations from the northwestern part of the Black Sea before winter, in autumn when they take routes to the southern parts of the Basin within the same ecological niche to the shore zone (Birkun et al., 2014). The primary wintering areas are in the south-eastern part of the Black Sea, including Georgian territorial waters and eastern Turkish territorial waters. During the cold season, there are subpopulations of the harbour porpoise wintering the Azov Sea, where is a well-known wintering grounds for the anchovy (Birkun et al., 2014).

1.3.1 Abundance

In the past decade there are no studies for the abundance of the Black Sea harbour porpoise, only for the northwester part of the basin. The same study, as mentioned before, included all three species of cetaceans (Table 1.5 and Table 1.6).

Table 1.5 - Density and abundance of harbour porpoises in the inshore area.

Surveyed areas	Density of groups (groups/km²)		Density of animals (ind./km²)		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.177	0.094 - 0.334	0.273	0.144 - 0.518	5178	2728 - 9827
RO	0.876	0.429 - 1.790	1.205	0.589 - 2.468	7023	3431 - 14378
BG	0.102	0.040 - 0.263	0.144	0.055 - 0.374	1003	385 - 2611
Total area	0.343	0.210 - 0.559	0.492	0.301 - 0.805	15635	9555 - 25583

The study was made in summer, showing a significantly higher number for Romania than other countries. A great number of individuals were spotted near Danube area, which confirms that in warm season, the species occur in low salinity and high turbidity waters.

Table 1.6 - Density and abundance of harbour porpoises in the offshore area

Surveyed areas	Density of groups (groups/km²)		Density of animals (ind./km²)		Number of animals	
	DS	95% CI	D	95% CI	N	95% CI
UA	0.114	0.071 - 0.182	0.146	0.090 - 0.237	5342	3303 - 8638
RO	0.032	0.014 - 0.073	0.034	0.015 - 0.079	799	346 - 1844
BG	0.282	0.145 - 0.546	0.353	0.181 - 0.686	9960	5116 - 19390
Total area	0.139	0.081 - 0.238	0.174	0.101 - 0.299	15307	8903 - 26318

The distribution of harbour porpoise shows the behaviour of this species, in general inhabit manly shallow waters of the continental shelf around the entire perimeter of the Black Sea, but it is also encountered in open waters, far from shore in depths over 1000m.

1.3.2 Threats

The main threats for the harbour porpoises are death by suffocation in the fishing gears, mostly in gillnets and depletion of the fishing stocks (Birkun et al., 2014). Also, in marine areas where maritime traffic or other activities are intense, it may cause a disturbance in the behaviour of the harbour porpoises. A potential negative impact could be represented by collision with boats and noise generated by different sources (Radu et al. 2013).

1.3.3 Population trend

The present total number is unknown for the harbour porpoise, mainly because the lack of a basin-wide survey. For the northwestern part of the Black Sea, it is estimated that the number of harbour porpoises is around 29,000 ±6,000 (Birkun et al. 2014).

2 Results of cetaceans strandings

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 chapter is presenting the results of the assessment performed within the ANEMONE project during 2019-2020 in both Romania and Turkey. The data were collected in the frame of Mare Nostrum NGO program Monitoring and Conservation of Black Sea Cetaceans and Turkish Marine Research Foundation (TUDAV).

Average number of events per year was 83.57 and the most common species was the harbour porpoise (*Phocoena phocoena relicta*) with 80%.

Stranding events occurred throughout the year, with the lowest frequency occurring in the winter (December–February).

2.1 Material and method

The cetacean stranding information were collected by foot or using vehicles, on the Romanian and Turkish Black Sea coast (1-2 expeditions/month) (Figure 2.1), Mare Nostrum and TUDAV Cetacean Stranding Monitoring Network, media (newspaper, TV, online news), social media, environmental authorities and 112 emergency service, as well as the emergency nonstop telephone lines of the two partners, 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; TUDAV, 2018) (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 authorized 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.

Mare Nostrum and TUDAV responsible receives alerts on the emergency telephone number or by email, WhatsApp, Facebook etc. from different sources such as state agencies like the police 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 authorized personnel to arrive.

When the stranded animal is dead on the beach, data are collected according to established protocols species identification, general measurements, and state and body condition. If the body is still in a fresh state, the authorized 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).

The activity involved more than 2000 persons from the two countries. From which 1065 students, 157 teachers, performed, between January 2019 and June 2020, 76 monitoring sessions along the Romania Black Sea coast. In Turkey 27 citizens were involved in training activities and acting as members of the monitoring network. They performed 14 monitoring sessions along the Turkish coastline.

In both Romania and Turkey, the members of the Stranding Monitoring Network, were trained on the same time during the Public Engagement workshop which was been held in October and December 2019. In Romania, after the training, the participants, mainly the teachers, held the same training for students at each school involved in the study. In total of 234 students and 34 teachers of 11 School Institutions, attended and been trained for the monitoring sessions. In Turkey, local fisheries officers along the Black Sea coast as well as some students and teachers attended the workshop, and they gave instruction to their colleagues at their offices and schools.

The involvement of citizens in data collection related to cetacean strandings it is a good opportunity to cover a larger area (since people are usually visiting coastal areas, especially when weather is favourable), to reduce costs (since, this alert can reduce the amount of monitoring expeditions) and to raise awareness between people (since all facing a stranding event become more intrigued and receptive to more scientific information).

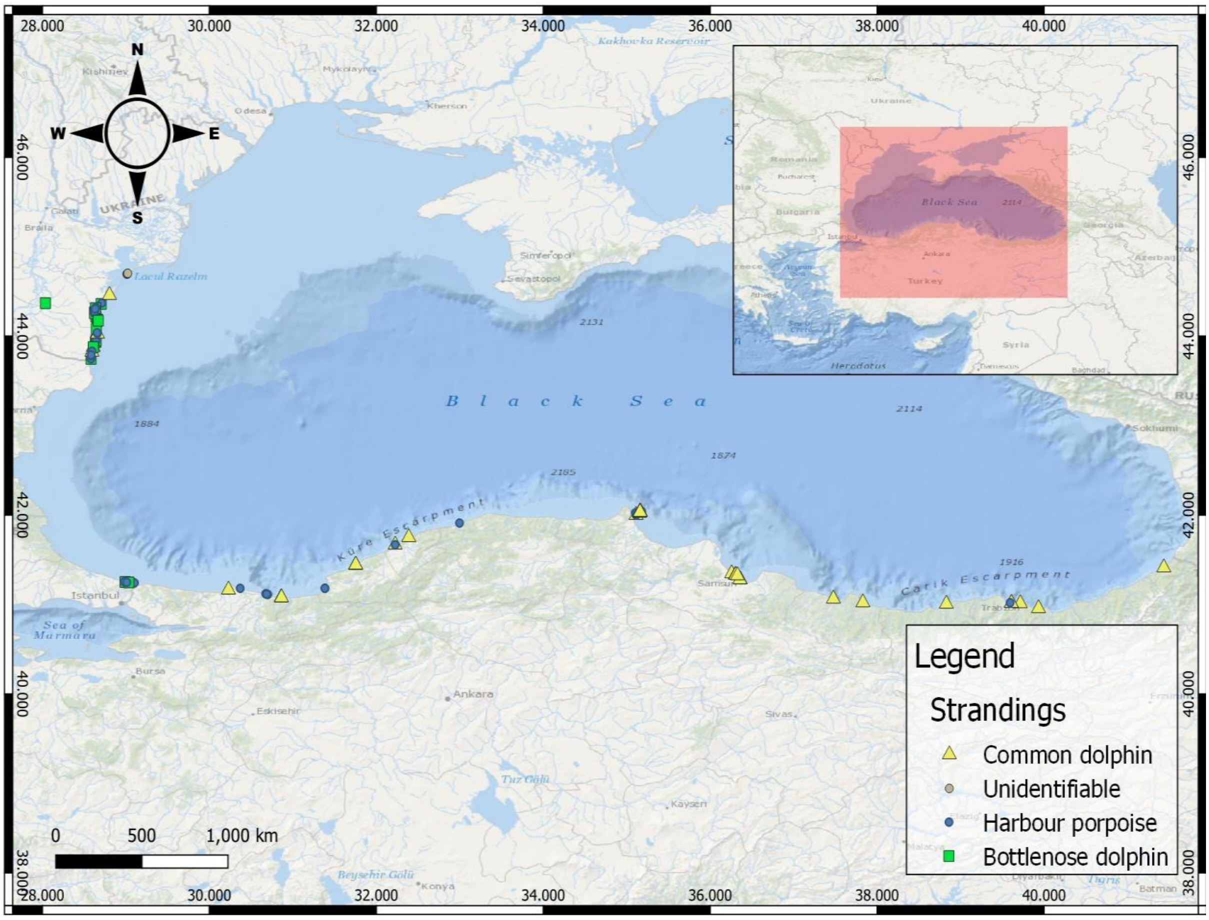

Figure 2.1 - Cetaceans stranding events recorded between January 2019 and May 2020 on both Romanian and Turkish coastlines

2.2 Results of the stranding monitoring program

The monitoring of cetacean strandings results, for the Romanian and Turkish coasts, are being presented below in two sections, one for each of the two countries.

2.2.1 Report on cetacean strandings on the Black Sea coast of Romania

All the information collected by the Mare Nostrum Cetacean Stranding Monitoring Network are presented below in Annex A, both the data collected within the project or Mare Nostrum NGO monitoring program. But for a clear view of the situation was decided to share the data beginning with January 2019 till May 2020. In total, 74 stranded cetaceans (harbour porpoises 70%, bottlenose dolphins 20%, common dolphins 6%, and Delphinid 4%) were recorded (Figure 2.2).

Strandings of harbour porpoises, the most negatively affected species by turbot fishery, were observed at high rate during spring and summer especially in June, which coincides with the illegal turbot fishing season (Figure 2.3). The stranding of bottlenose dolphins were high number in spring and relatively equal for summer early summer. These strandings may be related with turbot fisheries or other seines for small pelagic fish because bycatch evidence (such as net mark, missing parts) was found in five individuals. 10% of the strandings were attributed to common dolphin and unidentified stranded cetaceans.

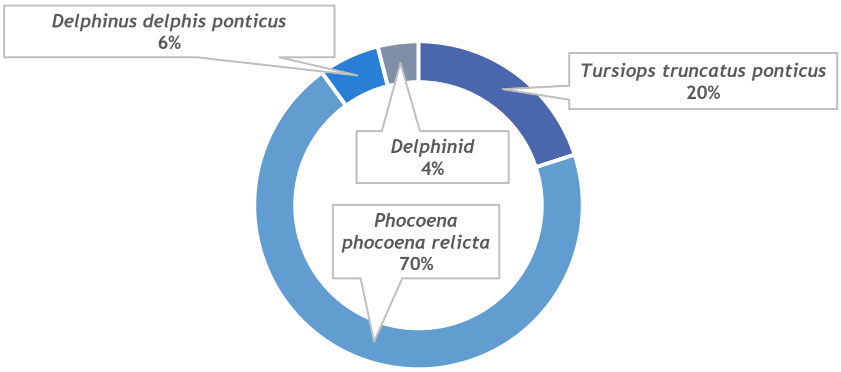

Figure 2.2 - Composition of stranded cetaceans by species at the Romanian coastline between January 2019 and May 2020

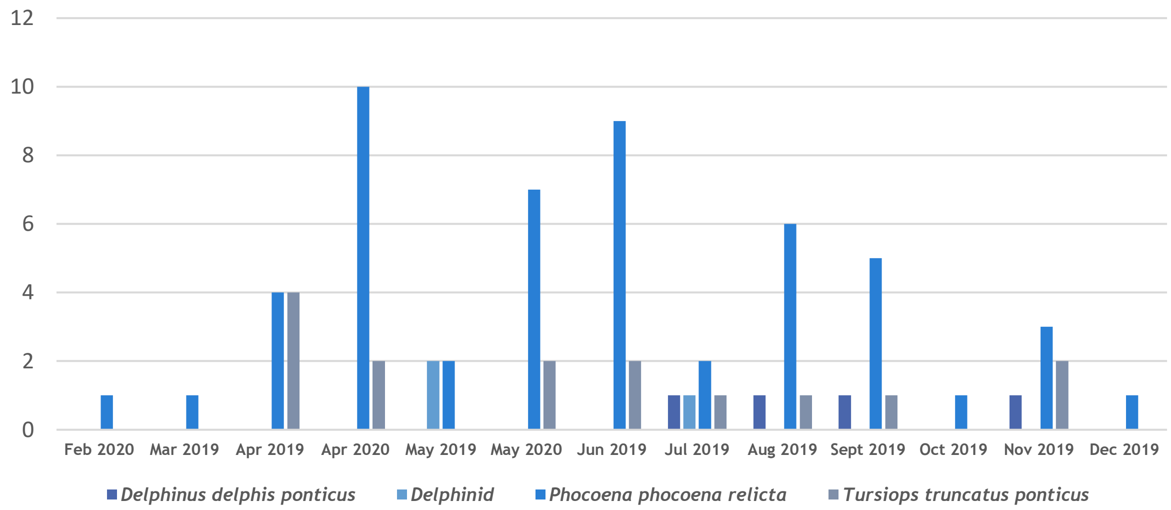

Figure 2.3 - Distribution of stranded cetacean by species and months at the Romanian coastline between January 2019 and May 2020

2.2.2 Report on cetacean strandings on the Black Sea coast of Turkey

All information collected by İÜ-TUDAV Cetacean Stranding Network and media during January 2019-May 2020 are shown in Annex B. In total, 50 stranded cetaceans (common dolphins 58%, harbour porpoises 36%, bottlenose dolphins 4%, and Delphinid 2%) were recorded (Figure 2.4). Strandings of harbour porpoises, the most negatively affected species by turbot fishery, were observed at high rate during spring and summer especially in June, which coincides with the illegal turbot fishing season

(Figure 2.5). The stranding of common dolphins was high number in winter and early spring. These strandings may be related with purse seine fisheries for small pelagic fish because bycatch evidence (such as net mark, missing parts) was found in six individuals. Half of the strandings were recorded in the western and the other half in the eastern Turkish Black Sea coast.

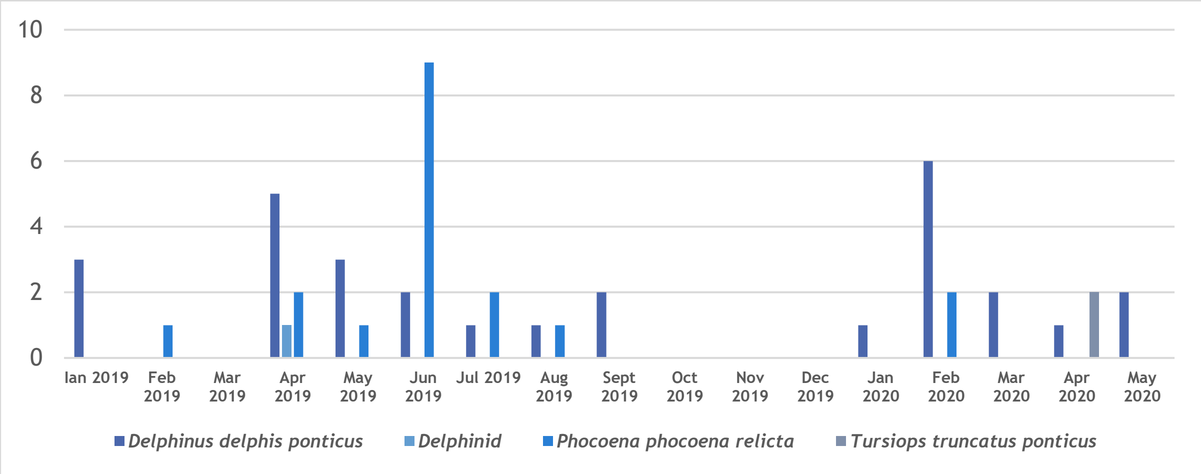

Figure 2.4 - Distribution of stranded cetacean by species and months at the Turkish coastline between January 2019 and May 2020

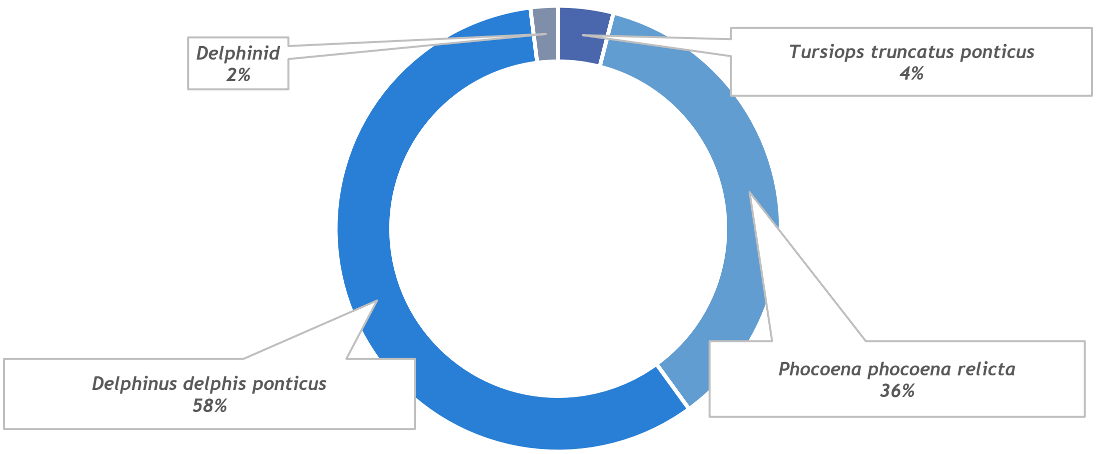

Figure 2.5 - Composition of stranded cetaceans by species at the Turkish coastline between January 2019 and May 2020

2.2.3 Visual report on the distribution of cetacean strandings on the Black Sea coasts of Romania and Turkey.

As could be seen in the Material and method chapter (3.1.) the stranding events appeared on most of the beaches under survey. Here below a representation by specie is presented (Figure 2.6, Figure 2.7 and Figure 2.8).

An interesting event took place in Romania, near Cernavodă city along the Danube where has been recorded a stranded bottlenose dolphin, by Mare Nostrum experts (Figure 2.7). The recorded data supports the scientific resources on low encounter rate of bottlenose dolphins along the Eastern part of Turkey (Paiu et al, 2021), and can be seen that the only cases were recorded in the western part, near the Istanbul Strait.

Strandings of harbour porpoises, the most negatively affected species by turbot fishery and other threats, were observed at all over the observed area (Figure 2.8). An exception in Turkey where the abundance of common dolphin overcome those of harbour porpoise but is normal since the hotspot for harbour porpoise is known to be in the western Black Sea (Birkun et al, 2014; Paiu et al., 2021).

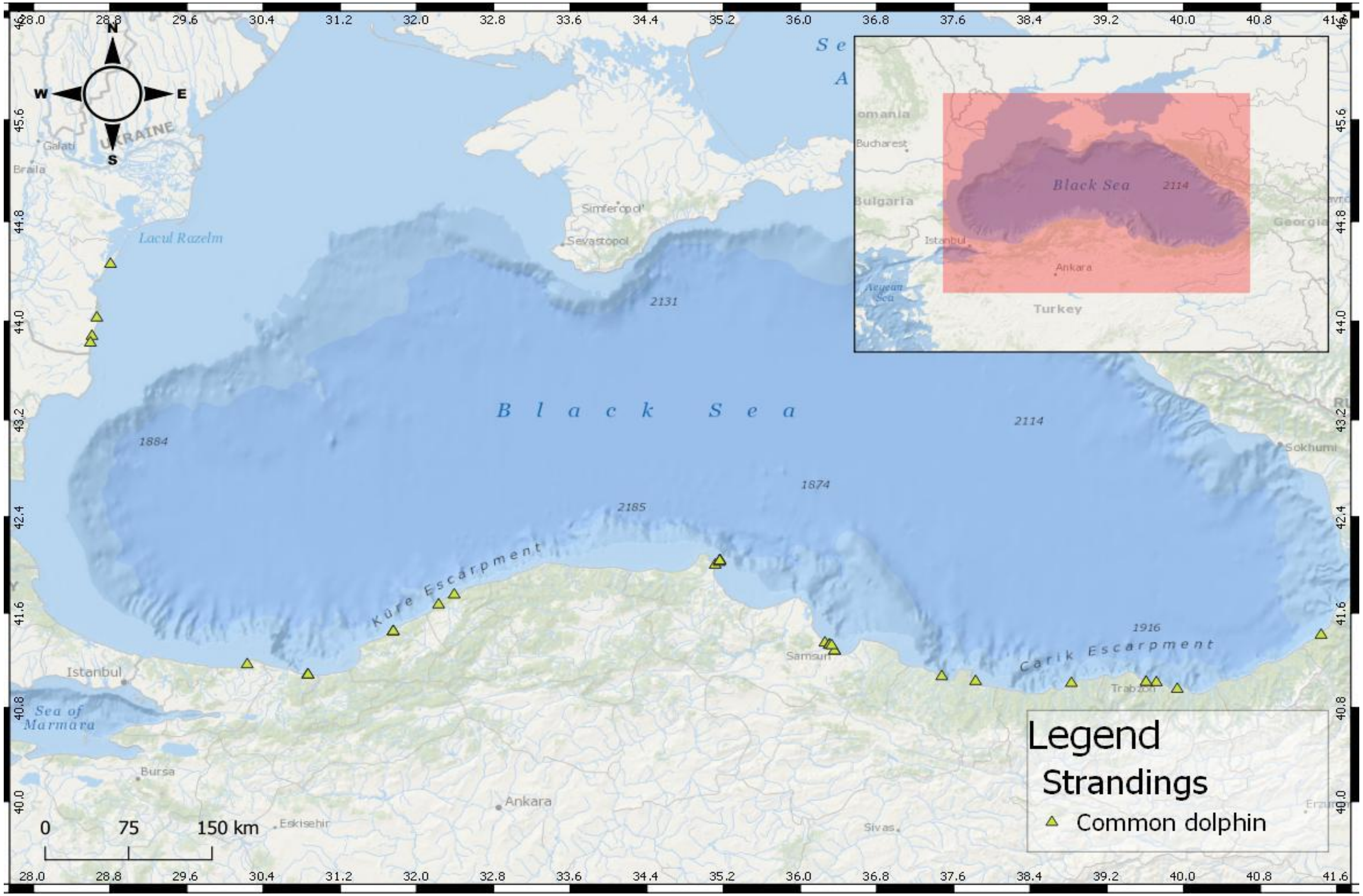

Figure 2.6 - Black Sea common dolphin stranding events recorded between January 2019 and May 2020 along the coasts of Romania and Turkey

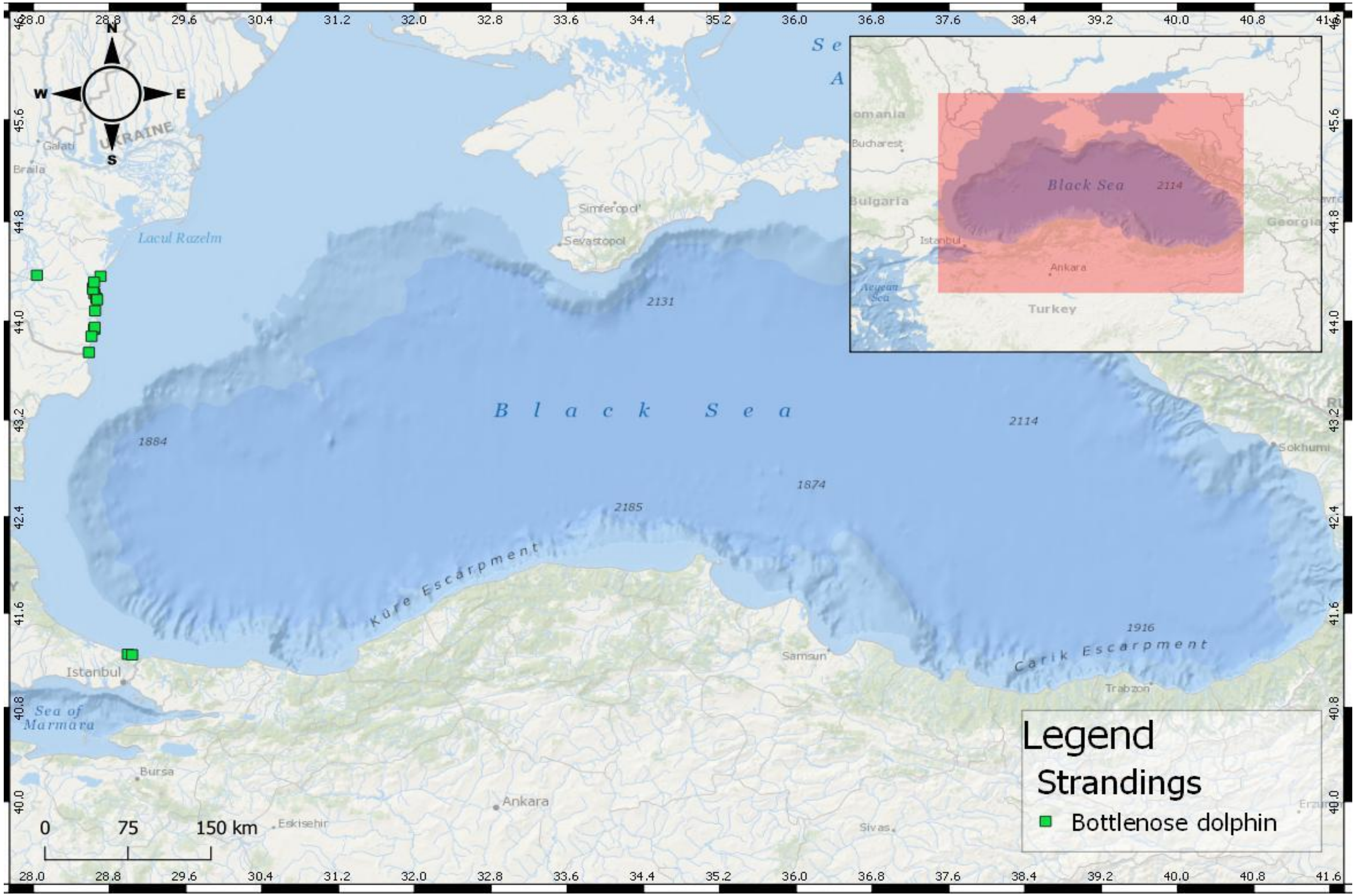

Figure 2.7 - Black Sea bottlenose dolphin stranding events recorded between January 2019 and May 2020 along the coasts of Romania and Turkey

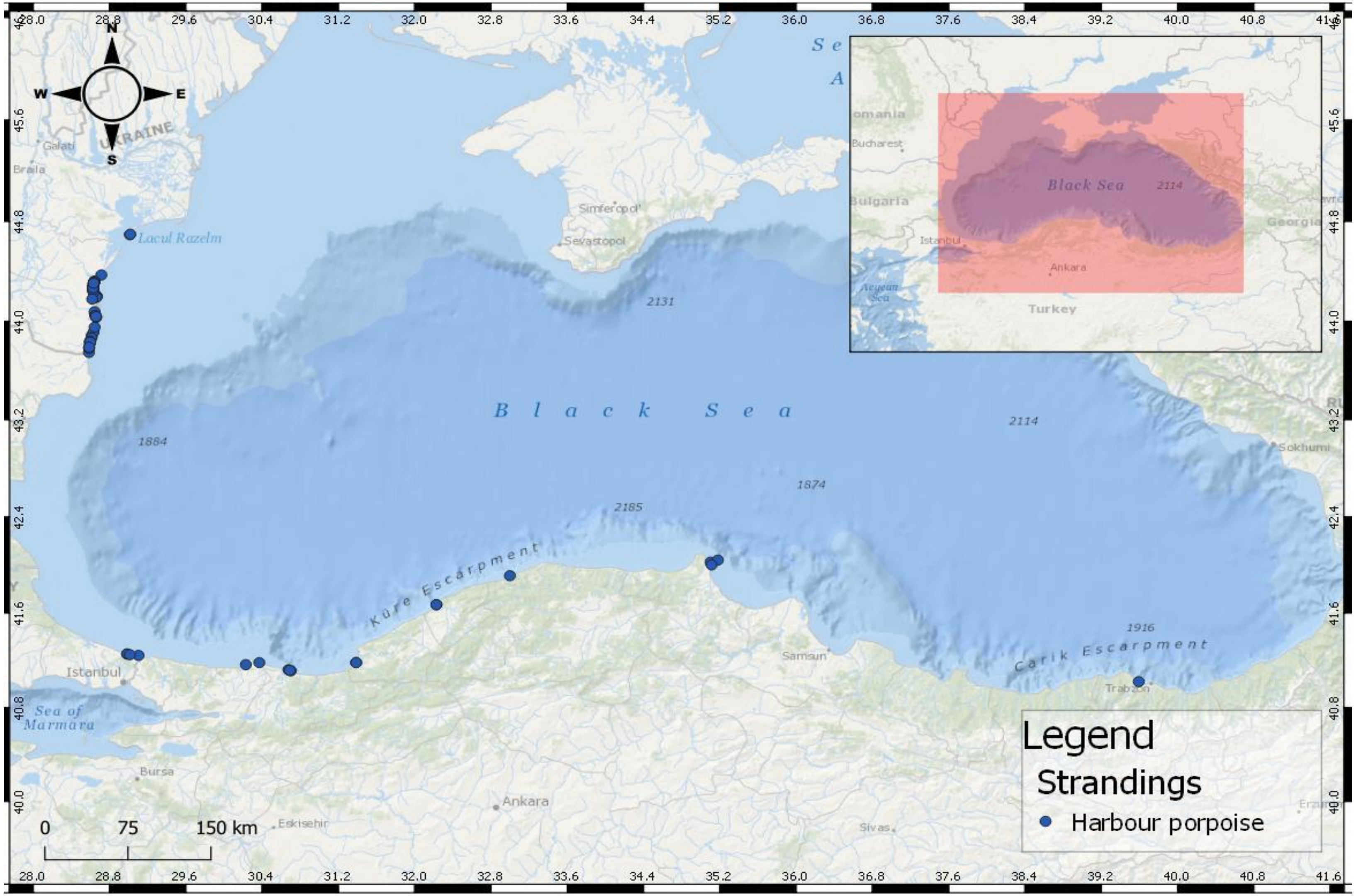

Figure 2.8 - Black Sea harbour porpoise stranding events recorded between January 2019 and May 2020 along the coasts of Romania and Turkey

3 Results of cetacean sightings survey

Within the project, five vessel surveys were performed, three in the territorial waters of Romania and two in Turkey. The two teams performed the surveys following distance sampling methods using sailing yachts. In the following chapters the method and results are presented.

3.1 Material and method

3.1.1 Monitoring area and sampling unit

The survey based on the advanced research methodology and international co-operation will be conducted for all three cetacean species. The surveys were designed in accordance with principles of distance/line transect sampling (Buckland et al. 1993; Thomas et al. 2010). Designed using Distance 7.2. software package, following the single platform method determined by the overall conditions and restraints. The baseline used for mapping the boat survey stratum was plotted in accordance with the guidelines of the United Nations Convention on the Law of the Sea (UNCLOS) both for Romania (Table 3.1) and Turkey (Table 3.2).

Sampling units in case of vessel survey was determined using the line transect method (Buckland et al., 1993) and where appropriate using the latest version of Distance Software v7.3. (Thomas et al., 2010), on the territorial waters area (entire area if possible). Forward the actual design map of the survey can be observed for the Romanian territorial waters (12 NM) between Vama Veche (Southern border) and Sulina (Northern border) (Table 3.1) and for the Turkish Black Sea coast between İğneada (Bulgarian border) in the west and Karadeniz Ereğli in the east (Table 3.2). The design follows the equal spaced zigzag design class. The overall proportion of the stratum sampled is 7% of the study areas, 5871,423 Km^2 for the Romanian zone and 6611km2 for the Turkish area. The survey was conducted using a sailing yacht with motor, equipped with single platform. The observers acted both as observers and data recorder, changing the position at each new transect or every hour. Survey speed was between 6-8 kts (11.12 – 14.82 km/hr). Collecting 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. Data collection was based on the protocol used for the vessel survey Distance 7.3 software (Thomas et al., 2010). 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 the 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. For quality assessment, digital pictures of the whole group and individuals were taken; animals were counted and school size were estimated. Analysis was performed using Distance package (Miller et al., 2019) in R (R Development Core Team, 2020) and Distance Software v7.3 (Thomas et al., 2010).

Table 3.1 - The details of the transects used during the cetacean vessel surveys in Romanian waters

Number of transect	Start coordinates		End coordinates		Distance (km)
	Latitude	Longitude	Latitude	Longitude	
1	43.75319°N	28.86913°E	43.72269°N	28.77715°E	8.067
2	43.77524°N	28.8771°E	43.89404°N	28.61265°E	29.773
3	43.9164°N	28.6314°E	43.98198°N	28.94691°E	27.046
4	44.07698 °N	28.96775°E	44.16127 °N	28.65895°E	31.739
5	44.18056°N	28.65707°E	44.23393°N	29.0369°E	32.46
6	44.36026°N	29.09294°E	44.43374°N	28.77288°E	31.223

Number of transect	Start coordinates		End coordinates		Distance (km)
	Latitude	Longitude	Latitude	Longitude	
7	44.44223°N	28.78136°E	44.48856°N	29.17184°E	33.342
8	44.57917°N	29.53631°E	44.69975°N	29.01612°E	50.732
9	44.69977°N	29.01615 °E	44.80952°N	29.89623°E	74.664
10	44.80952°N	29.89623°E	44.88182°N	29.62238°E	27.212
11	45.01015°N	29.64039°E	45.0738°N	30.03477°E	33.198
12	45.0738°N	30.03477°E	45.19241°N	29.6349°E	40.467

Figure 3.1 - Study area and transects designed for Romanian waters

Table 3.2 - The details of the transects used during the cetacean vessel surveys in Turkish waters

Number of transect	Start coordinates		End coordinates		Distance (km)
	Latitude	Longitude	Latitude	Longitude	
1	41.764168°N	28.038126°E	41.86629°N	28.009291°E	12.623
2	41.735409°N	28.056196°E	41.90742°N	28.291719°E	25.754
3	41.816253°N	28.312646°E	41.52259°N	28.274995°E	33.356
4	41.52259°N	28.274995°E	41.680756°N	28.436155°E	20.75
5	41.612164°N	28.587712°E	41.409367°N	28.55167°E	22.95
6	41.409367°N	28.55167°E	41.567554°N	28.70288°E	20.305
7	41.510883°N	28.876798°E	41.307819°N	28.834092°E	22.946
8	41.307819°N	28.834092°E	41.477677°N	28.990041°E	21.527
9	41.439172°N	29.179004°E	41.247118°N	29.137696°E	21.706
10	41.246958°N	29.138544°E	41.422543°N	29.299751°E	22.243

Number of transect	Start coordinates		End coordinates		Distance (km)
	Latitude	Longitude	Latitude	Longitude	
11	41.395792°N	29.490448°E	41.210719°N	29.451789°E	20.932
12	41.209704°N	29.458057°E	41.378355°N	29.615432°E	21.458
13	41.356511°N	29.802643°E	41.159665°N	29.763085°E	22.282
14	41.159405°N	29.764643°E	41.341797°N	29.937972°E	23.326
15	41.331649°N	30.120433°E	41.144054°N	30.086765°E	21.275
16	41.144783°N	30.098705°E	41.32305°N	30.274618°E	23.063
17	41.32482°N	30.441278°E	41.169175°N	30.418249°E	17.709
18	41.158735°N	30.460355°E	41.328037°N	30.636262°E	22.282
19	41.330072°N	30.760772°E	41.102887°N	30.7361°E	25.974
20	41.098474°N	30.744961°E	41.334013°N	31.004477°E	31.685
21	41.335186°N	31.077714°E	41.08924°N	31.071322°E	28.481
22	41.08924°N	31.071322°E	41.339982°N	31.380472°E	35.401
23	41.340033°N	31.383708°E	41.302023°N	31.387824°E	4.531

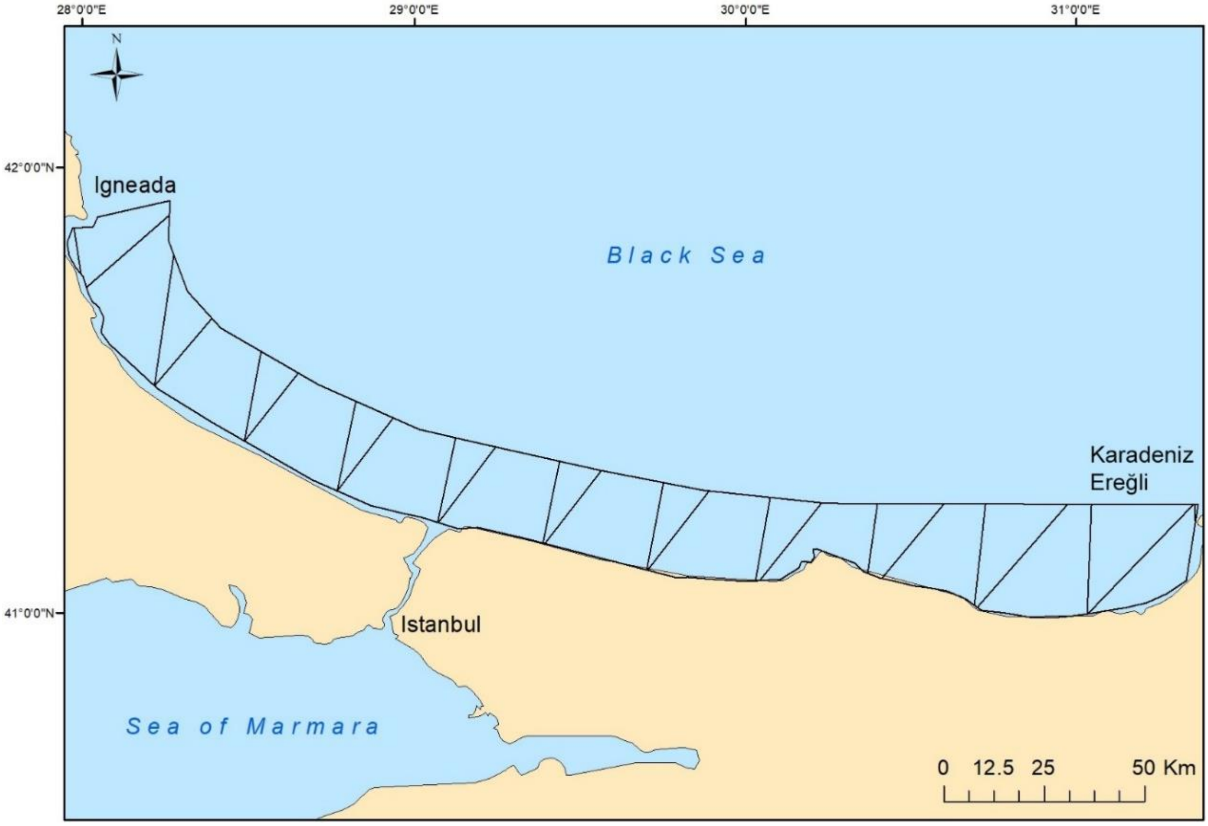

Figure 3.2 - Study area and transects designed for Turkish waters

Previous surveys using the same protocol in the area were the Adverse Fisheries Impacts on Cetacean Populations in the Black Sea project (Birkun et al., 2014) and Paiu et al. (2019).

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

Data Analysis

All the analysis was performed with the help of Distance software Thomas et al. (2010). Abundance was estimated using both conventional distance sampling or CDS and multiple covariate distance sampling or MCDS. The latter incorporates covariates, in addition to perpendicular distance, in the estimation of a detection function.

Transects – including GPS coordinates and total surface covered are presented in Table 3.1 for Romanian and Table 3.2 for Turkey.

The observations were collected over the distance of 419.923 km in Romanian waters and 522km in Turkey of line transects in each survey, a total of over 2000 km of transects on effort. Some part of the designed transect lines could not be completed due to logistical issues, unfavorable weather and sea conditions. Therefore, incomplete parts were not considered in the abundance analysis.

Analyses were performed only with the data collected during "on effort" mode.

3.2 Results of the five vessel surveys

Along the five vessel surveys implemented a total of 318 sightings were observed and recorded (on effort) and are presented below for each species.

3.2.1 Bottlenose dolphin

In Romania

During the study, three surveys were performed, and a total of 96 bottlenose dolphin sightings were made, with a total of 204 individuals, on-effort and 3 additional sightings with 18 individuals off-effort within the second survey. Group size for bottlenose dolphin varied from 1 to 25 individuals depending of the season. 1 – 5 in spring 2019 (first survey), 1-10 in summer 2019 (second survey) and 1 to 25 in spring-summer 2020 (third survey). With average mean of 1.05; 3.98 respective 13.93. The best model was chosen as Hazard rate+Half normal (1st survey), uniform model (2nd and 3rd survey), no truncation with group size covariate according to AIC values and goodness of fit tests. All sightings were pooled to fit detection function, but only on-effort sightings were used to estimate density and abundance. The abundance estimate for bottlenose dolphins can be read in the table Table 3.3.

Table 3.3 - Black Sea bottlenose dolphin estimates during the three surveys

Subspecies	Density of groups (groups/km^2)		Density of animals (ind./km^2)		Number of animals			Survey No.
	DS	95% CI	D	95% CI	N	95% CI	CV%	
T. t. ponticus	0.135	0.055-0.333	0.293	0.116-0.738	1719	682-4335	59.92	1
T. t. ponticus	0.320	0.131-0.781	0.837	0.339-2.063	2705	1097-6670	38.72	2
T. t. ponticus	0.195	0.100-0.381	0.337	0.161-0.708	1980	944-4156	37.2	3

In Turkey

During the study, a total of 76 bottlenose dolphin sightings were made, 56 on-effort and 20 off-effort. Group size for bottlenose dolphin varied from 1 to 15 individuals with average mean of 4.15 (SE ± 0.71) in 2019 and 5.21 (SE ± 0.92) in 2021. The best models were chosen as hazard-rate (no adjustment terms) truncated at 350m with group size covariate for the Fall 2019 survey and half-normal (cosine adjustment term) with no truncation for the Spring 2021 survey according to AIC values and goodness of fit tests. All sightings in each survey were pooled to fit detection function, but only on-effort sightings were used to estimate density and abundance. The on-effort encounter rate after truncation was 6.45 sightings per 100 km (CV = 34%) in 2019 and 9.49 sightings per 100 km (CV = 14.08%) in 2021. The abundance estimate for bottlenose dolphins is shown in the Table 3.4.

Table 3.4 - Black Sea bottlenose dolphin estimates during the two surveys in Turkish water

Subspecies	Density of groups (groups/km²)		Density of animals (ind./km²)		Number of animals			Survey Name
	DS	95% CI	D	95% CI	N	95% CI	CV%	
T. t. ponticus	0.185	0.085-0.404	0.593	0.265-1.327	3919	1751-8775	41.2	Fall 2019
T. t. ponticus	0.205	0.136-0.310	1.069	0.630-1.816	4290	2526-7284	26.84	Spring 2021

3.2.2 Common dolphin

In Romania

During the study, three surveys were performed, and a total of 35 common dolphin sightings were made, with a total of 63 individuals. From these 5 sightings with 17 individuals were off-effort and included in a further analysis for the second survey. This will not be presented in the present report. Group size for common dolphin varied from 1 to 6 individuals depending of the season: 1 – 8 in spring 2019 (first survey), 2-6 in summer 2019 (second survey, off-effort) and 1 to 2 in spring-summer 2020 (third survey). The best model was chosen as Hazard rate+Half normal (1st survey), uniform model (2nd and 3rd survey), no truncation with group size covariate according to AIC values and goodness of fit tests. All sightings were pooled to fit detection function, but only on-effort sightings were used to estimate density and abundance. The abundance estimate for common dolphins can be read in the Table 3.5.

Table 3.5 - Black Sea common dolphin estimates during the three surveys

Subspecies	Density of groups (groups/km²)		Density of animals (ind./km²)		Number of animals			Survey No.
	DS	95% CI	D	95% CI	N	95% CI	CV%	
D. d. ponticus	0.103	0.032-0.332	0.176	0.050-0.672	1032	336-3626	67.2	1
D. d. ponticus	0.119	0.053-0.269	0.149	0.064-0.343	873	378-2015	37.8	3

In Turkey

There were 55 common dolphin sightings, of which 44 were on-effort and 11 off-effort during the two surveys. The mean group size was 4.11 (SE ± 0.64) ranged from 1 to 40 in 2019 and 5.49 (SE ± 1.42, corrected for size-bias) ranged from 2 to 45 in 2021. The detection function was fitted using half-normal key function (no adjustment terms) truncated at 275m with no other covariates in 2019 and with half-normal (cosine adjustment term) with no truncation in 2021. All sightings in each survey were pooled to fit detection function, but only on-effort sightings were used to estimate density and abundance. The on-effort encounter rate for common dolphin was 6.45 sightings/100 km (CV = 32%) in 2019 and 4.74 sightings/100 km (CV = 7.81%) in 2021. The abundance estimates for common dolphins are presented in the Table 3.6.

Table 3.6 - Black Sea common dolphin estimates during the two surveys in Turkish water

Subspecies	Density of groups (groups/km²)		Density of animals (ind./km²)		Number of animals			Survey Name
	DS	95% CI	D	95% CI	N	95% CI	CV%	
D. d. ponticus	0.185	0.093-0.369	0.763	0.326-1.788	5047	2154-11823	43.4	Fall 2019
D. d. ponticus	0.103	0.074-0.142	0.563	0.303-1.049	2260	1214-4208	30.72	Spring 2021

3.2.3 Harbour porpoise

In Romania

During the study, three surveys were performed, and a total of 65 harbour porpoise sightings were made, with a total of 96 individuals. From this 1 sighting with 1 individual was off-effort and is not included in the results of the second survey. Group size for harbour porpoise varied from 1 to 5 individuals depending of the season: 1 – 5 in spring 2019 (first survey), 1-3 in summer 2019 (second survey, off-effort) and 1 to 4 in spring-summer 2020 (third survey). The best model was chosen as Hazard rate+Half normal (1st survey), uniform model (2nd and 3rd survey), no truncation with group size covariate according to AIC values and goodness of fit tests. All sightings were pooled to fit detection function, but only on-effort sightings were used to estimate density and abundance. The abundance estimate for harbour porpoise can be read in the Table 3.7.

Table 3.7 - Black Sea harbour porpoise estimates during the three surveys

Subspecies	Density of groups (groups/km^2)		Density of animals (ind./km^2)		Number of animals			Survey No.
	DS	95% CI	D	95% CI	N	95% CI	CV%	
P. p. relicta	0.057	0.025-0.132	0.09	0.036-0.234	536	209-1375	47.9	1
P. p. relicta	0.069	0.011-0.425	0.103	0.016-0.642	333	53-2074	92.50	2
P. p. relicta	0.440	0.228-0.851	0.643	0.329-1.255	3775	1934-9475	32.10	3

In Turkey

The harbour porpoise was the least encountered species during the 2019 survey. Only two sightings, one consisting of one animal and the other consisting of 15 individuals, were made in the eastern part of the study area. Abundance estimation was not performed since there were not enough observations. Nevertheless, in spring 2021 a total of 48 sightings of harbour porpoises were made, among which three were made during off-effort, thus excluded from the analysis. The best model was uniform with cousine adjustment term. Group size for harbour porpoises varied from 1 to more than 70 individuals with the mean of 4.09 (SE ± 0.75, corrected for size-bias). The on-effort encounter rate was 14.23 sightings per 100 km (CV = 30.59%). The abundance estimate for harbour porpoises was 4620 individuals (CV: 36.44%; 95% CI: 2164-9863), while the density was 1.15 ind/km^2. The abundance estimate for harbour porpoise can be read in the Table 3.8.

Table 3.8 - Black Sea harbour porpoise estimates during the survey in Turkish water

Subspecies	Density of groups (groups/km^2)		Density of animals (ind./km^2)		Number of animals			Survey No.
	DS	95% CI	D	95% CI	N	95% CI	CV%	
P. p. relicta	0.281	0.138-0.573	1.151	0.539-2.458	4620	2164-9863	36.44	Spring 2021

4 Citizen science - added value for cetacean monitoring

Citizen science can be defined as the non-professional involvement of volunteers in the scientific process, commonly in data collection, but also in other phases of the scientific process, such as quality assurance, data analysis and interpretation, problem definition, or dissemination of results (Science Communication Unit, 2013). Other definitions exist and are under debate in the scientific community (Auerbach et al. 2019).

Citizen science is growing and attracting increasingly the attention of the scientific community, governments and the media, but it is not new. It is born out of a long history of public participation in scientific research enacted through many approaches. Volunteers in many local and national bird monitoring schemes and networks of weather collectors and ocean monitoring have been collecting data for decades (e.g., UK's Breeding Bird Survey[1], Vigie-Nature in France[2], Rainfall Observers[3] in Scotland, the US National Weather Service programme on storm spotters[4]).

Citizen science is mostly connected with the environmental domain, because provides an opportunity to expand the knowledge base, through local involvement, and at the same time provides an increase in citizens' awareness and engagement. Citizen science plays a critical role in advancing knowledge about biodiversity, e.g., in relation to monitoring trends in occurrence, distribution, or status of species. The vast data volume that can be collected in a cost-efficient manner by a large number of volunteers dwarfs any professional capacity for monitoring.

This is better applicable for biodiversity monitoring spanning large spatial (e.g., Europe) and temporal extents (e.g., decades).

The new technologies, such as mobile internet and apps for mobile devices, has broadened the scope and the number of citizens' contributions. There are many different types of citizen science projects in the environmental area. According to a recently published study (Bio Innovation Service, 2018), the majority are 'contributory' projects, designed by scientists, but enlisting the help of volunteers to collect monitoring data.

The value of citizen science is being more and more recognised in the literature and practices, having an important effect on policies, science and society. It should be noted that the value in most citizen science projects is not easy to categorise and may emerge from broad aims, or as projects develop beyond their original scope. It is common for projects fitting the public participation in research model to have both scientific and educational goals. However, social and policy benefits may also emerge, for example, when projects are based around local people motivated by solving local environmental problems.

Policy value. Citizen Science can contribute to various phases of the policy-making cycle, including:

- Identify problems or issues, by making valuable, systematic observations and voicing public concerns with supporting scientific evidence to decision makers.
- Help formulate public policy, for instance by contributing to the development of policy options and assessing their potential impacts. Here, citizen science can particularly facilitate the inclusion of diverse societal perspectives in decision-making processes.

Scientific value. Policy decisions increasingly rely on the best available scientific evidence, but this does not necessarily come from the best peer-reviewed publications from the academic sector alone. Citizen science can complement or provide advantages over conventional science in multiple ways. One of its primary benefits is the collection of data that would otherwise be unavailable (e.g., because of its temporal or local granularity and detail, long time scales of observations, amount of data submitted etc.). Key aspects are however fit-for-purpose, data quality, long-term access and re-

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[1] https://www.bto.org/our-science/projects/bbs

[2] http://www.vigienature.fr/fr

[3] https://envscot-csportal.org.uk/rainfallobs/

[4] https://www.weather.gov/skywarn/

usability. The access and inclusion of tacit knowledge proves equally important.

Societal value. Citizen science projects empower citizens to draw public attention to local issues and provide them the evidence base to ask for, propose or collaborate towards solutions (e.g., noise pollution). Promotion of citizen science projects and their outcomes can also help to raise broader awareness for environmental issues, supports life-long learning and potentially stimulate behavioural change – here, especially related to issues that are not immediately visible (e.g., air pollution near schools, radiation from radon or longer-term health effects). Citizen science can bring a lot of benefits for the society, for science, policy and for the participants themselves (Figure 4.1 and Figure 4.2).

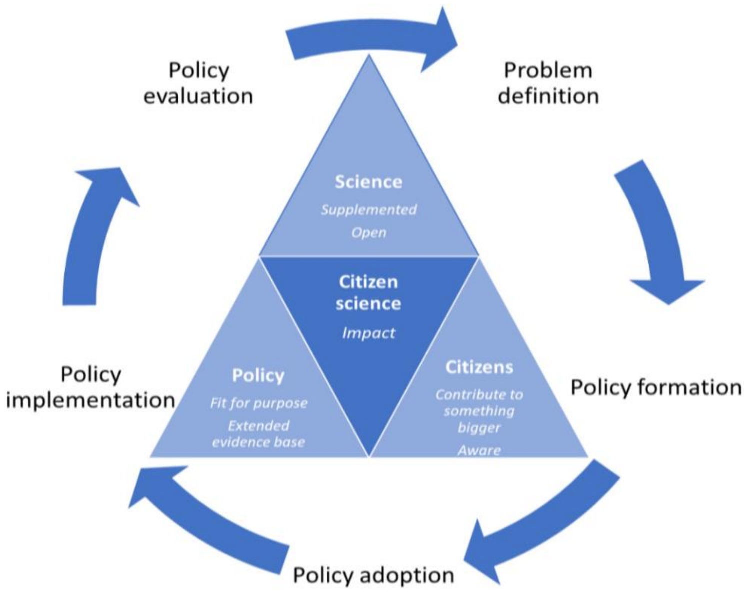

Figure 4.1 - Interaction between policy, science, society and citizen science

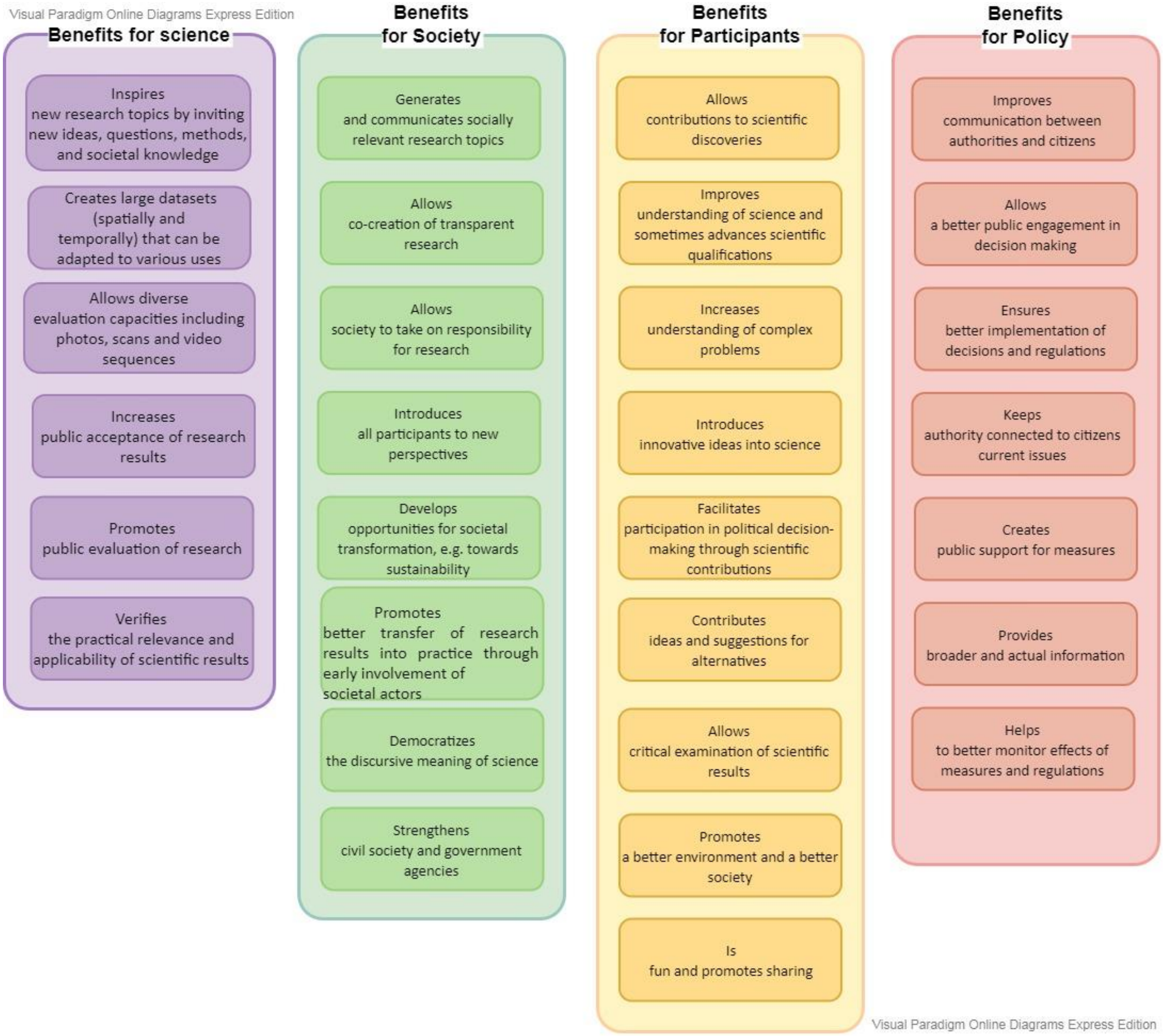

Figure 4.2 - Classified benefits of citizen science

4.1 Citizen science in cetacean monitoring

Having in mind the previous experience of the partners involved in the Citizen Science activity, Anemone project offered a very good framework to implement Citizen Science at Black Sea basin level. The purpose was to prove that citizens can provide real, useful and accurate data for scientists to use. For cetacean monitoring this approach is used since a very long time in the Black Sea. The main challenge is to transform this citizen involvement in an added value work for science.

Research results can be easily tampered if contributors are using different scale of measures or have little experience is proving information. This makes citizen science a restricted domain to the ones trained to do it. Since for stranded cetacean, for example, an telephone line is used, it happened for a high number of times to get incomplete or wrong information from citizens, just because they had few information on the case (ex: small dolphins of 2m long, stranded cetacean when in reality is was a picked dogfish, wrong location reporting with an error of 200-300 m). It is recommended to check all this kind of provided information by phone and to ask for extra confirmation in order to make an accurate data collection. Using of technology at hand and available very cheap for people can make these sightings more useful for science and research. The sense of usefulness that common citizens get when having contributed to research activities can be valued by asking for detailed information.

Several aspects have to be established and mandatory used:

- Clear photos, with good light and a standard object that can give information related to dimensions (a plastic bottle of 0.5 l);

- Share location on Smartphone apps – even if the location is not 100% accurate, it is the closest option to the real positioning;
- Extra details related to time, weather, colour of the animal or marks.

Just by looking at the numbers resulted, it is clear that it would have been impossible to reach such an extensive extent by only involving researchers.

The figure below (Figure 4.3) shows the dimensions of the citizen involvement in cetacean monitoring. Although the training was performed in all 4 partner countries, only in Romania and Turkey it was applied the citizen science methodology for cetacean monitoring.

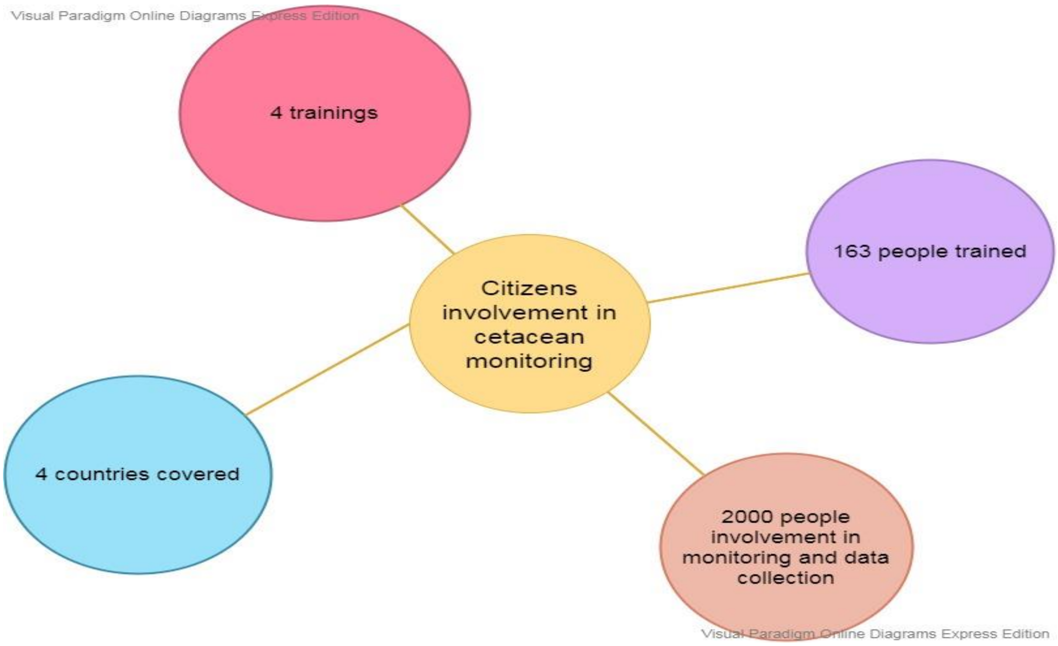

Figure 4.3 - Citizen's involvement in cetacean monitoring within the ANEMONE project

The most fast and easy to apply is the cetacean stranded monitoring. Media and social media has a multiplier effect, making the opportunity available for more people, even for tourists that visit for a short time the area.

Mare Nostrum NGO extended the involvement in citizens in data collection related to cetacean, to the boat and sailing boats owners. Having in mind, that during summer, they perform quite a number of expeditions at sea, they are more likely to encounter groups of dolphins and for sure they make photos or videos. The only "scientific" addition is to ask for a GPS location of the encounter, date and time. This added to a share of the media recorded, can make a nice map of sightings, that further on can provide data on migration patterns, distribution and resident populations. For this purpose, a Facebook group was created and all potential contributors were included. They have in this way an easy way to share all data, to communicate with other people with the same interest and dedication and to have their activity promoted for the greater public. The group gathered 109 members and already shared more than 30 media files and sightings.

The success of the activity was assured through a complex process of public engagement and continuous communication. In order to have a useful citizen science project and to maximize the results for all the stakeholders and beneficiaries, it is very important to have a clear and agreed process and to communicate all details to all participants. The 4 workshops organized within the same project, in autumn 2019, in each partners country (Bulgaria, Romania, Turkey and Ukraine) made an introduction of the cetacean topic. Also, it provided the participants with knowledge about the methodology, the possible biases and the tools to be used in the field.

Further efforts were made by Mare Nostrum and TUDAV to train and accept citizens (NASEM, 2018), with low to high qualification, into the cetacean monitoring programs as was presented in the previous chapters. Citizens together with specialists participating in data collection expedition both within the project limits but also after in the so-called Cetacean Monitoring Networks.

5 Conclusions

- Citizen science concept and projects investigate a range of phenomena using scientific practices. It allows people with diverse motivation and intention to participate in science as in the particular case of Cetacean Stranding Networks where the input from citizens it covers more than scientist which are restricted due to the low budget allocation, reduced staff, large area to be covered etc.
- Because citizen science supports the scope of contributing to science, or who can contribute, it can introduce new processes, observations, data to science and in the same time be a trigger towards protecting the environment and awareness rise in the coastal communities, and even outside through tourists.
- Participants learning through citizen science, within the activities, have benefit not only for their own development but also interact with scientists for further development of the communities and science.
- The concept is underdeveloped, and the data are not yet existing in many other science branches due to bias and lack of validation body and this should be worked on. With careful planning, intentional design, and learning support, citizen science can amplify the efforts in science, provide an opportunity for participants to learn about data, data analysis, and interpretation of data.
- Citizen science projects that welcome and respond to participants motivation and interests are more likely to maximize their skills and the quality of data collected in the future.
- Overall, the project offered numerous opportunities for citizens to both be involved in the research actions (stranding monitoring, vessel surveys) and be trained to assure a high quality of the data collected.
- The seasonal distribution of the surveys performed within the project and with the help of citizen and expert observers revealed the seasonal variation in the abundance and distribution of cetaceans in the Black Sea, at least for Romania and western Turkey.
- Cetacean surveys require trained individuals such as researchers in this study. The involvement of citizens (yacht captains and/or students) to scientific surveys is a good way of capacity building for them. Such occasions are rare but should be realized whenever possible. The ANEMONE project provided such rare opportunities which will contribute to the overall research effort for cetacean observation in the Black Sea.
- Based on the preliminary results, the Sakarya Canyon (Turkey) and coastal waters (Romania) were proposed as a candidate Important Marine Mammal Area of IUCN in February 2021. The areas should be monitored carefully on a regular basis to elaborate conservation measures for these vulnerable animals.

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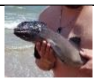
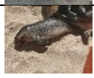
ANNEX A List of cetacean stranding records between January 2019 and May 2020 along the Romanian Black Sea coast

No	Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
		-	14.03.2019	Navodari	*Phocoena phocoena relicta*	F	146	2	Bycatch
		-	20.03.2019	Mamaia	*Phocoena phocoena relicta*	-		4	-
		-	06.04.2019	Costinesti	*Tursiops truncatus ponticus*	-	130	3	-
		-	10.04.2019	Mamaia	*Tursiops truncatus ponticus*	-	-	3	-
		762	13.04.2019	Eforie Nord	*Phocoena phocoena relicta*	M	114	2	Bycatch
		-	25.04.2019	Navodari	*Phocoena phocoena relicta*	M	101	3	-
		-	25.04.2019	Saturn	*Phocoena phocoena relicta*	F	124	4	-
			30.04.2019	23 August	*Tursiops truncatus ponticus*	-	180	4	Bycatch
		-	30.04.2019	Corbu	*Tursiops truncatus ponticus*	F	173	2	Bycatch
		-	30.04.2019	Eforie Nord	*Phocoena phocoena relicta*	F	130	4	-
		-	18.05.2019	Gura Portitei	*Phocoena phocoena relicta*	F	110	4	Bycatch
		-	18.05.2019	Gura Portitei	*Phocoena phocoena relicta*	F	100	4	Bycatch
	-	-	18.05.2020	Gura Portitei	*Delphinid*	-	-	-	Bycatch
	-	-	18.05.2020	Gura Portitei	*Delphinid*	-	-	-	Bycatch
		-	06.06.2019	Costinesti	*Tursiops truncatus ponticus*	M	110	4	Bycatch
		773	08.06.2019	Constanta	*Phocoena phocoena relicta*	F	70	2	-
		-	09.06.2019	Constanta	*Phocoena phocoena relicta*	F	133	4	-
		775	11.06.2019	Mamaia	*Phocoena phocoena relicta*	M	66	2	-
	-	-	12.06.2020	Corbu	*Phocoena phocoena relicta*	-	-	-	-
		-	14.06.2019	Constanta	*Phocoena phocoena relicta*	-	-	2	-

No	Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
		-	17.06.2019	Costinesti	*Tursiops truncatus ponticus*	M	256	2	Bycatch
		-	17.06.2019	Mamaia	*Phocoena phocoena relicta*	M	72	3	-
		-	26.06.2019	Mamaia	*Phocoena phocoena relicta*	-	70	2	-
		-	26.06.2019	Constanta	*Phocoena phocoena relicta*	M	115	3	-
		-	26.06.2019	Olimp	*Phocoena phocoena relicta*	-	70	2	-
		-	05.07.2019	23 August	*Phocoena phocoena relicta*	-	115	3	-
		-	14.07.2019	2 Mai	*Phocoena phocoena relicta*	F	69	3	-
	-	-	-	Navodari	*Delphinid*	-	-	-	-
		-	29.07.2019	Olimp	*Delphinus delphis ponticus*	F	157	4	-
		-	29.07.2019	Vama Veche	*Tursiops truncatus ponticus*	F	80	3	-
		-	05.08.2019	Costinesti	*Phocoena phocoena relicta*	-	130	2	Bycatch
		-	08.08.2019	Vadu	*Delphinus delphis ponticus*	F	167	2	Bycatch
		-	20.08.2019	Eforie Nord	*Phocoena phocoena relicta*	M	131	2	-
		-	21.08.2019	Mamaia	*Tursiops truncatus ponticus*	-	-	-	-
		-	25.08.2019	Eforie Nord	*Phocoena phocoena relicta*	-	68	3	-
		-	25.08.2019	Mamaia	*Phocoena phocoena relicta*	M	100	3	Bycatch
		-	26.08.2019	Mamaia	*Phocoena phocoena relicta*	M	132	4	-
		-	30.08.2019	Neptun	*Phocoena phocoena relicta*	M	133	3	Bycatch
		-	08.09.2019	2 Mai	*Phocoena phocoena relicta*	-	-	-	-
		-	11.09.2019	Mamaia	*Phocoena phocoena relicta*	F	70	4	-
		-	11.09.2019	Mamaia	*Phocoena phocoena relicta*	M	87	4	-

No	Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
		-	12.09.2019	Eforie Sud	*Delphinus delphis ponticus*	-	68	4	-
		-	15.09.2019	Saturn	*Phocoena phocoena relicta*	F	138	4	Bycatch
		-	20.09.2019	Constanta	*Tursiops truncatus ponticus*	F	198	4	-
		-	29.09.2019	Saturn	*Phocoena phocoena relicta*	-	120	4	-
		804	16.11.2019	Agigea	*Tursiops truncatus ponticus*	F	150	2	-
		-	16.11.2019	Navodari	*Phocoena phocoena relicta*	M	105	4	-
		-	19.11.2019	Constanta	*Phocoena phocoena relicta*	M	68	4	-
		-	19.11.2019	Mamaia	*Phocoena phocoena relicta*	M	126	3	-
		808	27.11.2019	Mamaia	*Tursiops truncatus ponticus*	F	153	3	-
		-	27.11.2019	Saturn	*Delphinus delphis ponticus*	M	160	4	-
		-	02.12.2019	Mamaia	*Phocoena phocoena relicta*	M	78	4	-
		-	09.02.2020	Saturn	*Phocoena phocoena relicta*	M	101	4	-
		-	07.04.2020	Olimp	*Tursiops truncatus ponticus*	F	163	3	Bycatch
		813	17.04.2020	Mamaia	*Phocoena phocoena relicta*	M	94	2	-
		814	21.04.2020	Eforie Sud	*Phocoena phocoena relicta*	F	85	2	-
		-	21.04.2020	Eforie Sud	*Phocoena phocoena relicta*	-	84	4	-
		-	23.04.2020	Saturn	*Phocoena phocoena relicta*	F	83	4	-
		817	25.04.2020	Navodari	*Phocoena phocoena relicta*	M	86	2	-
		-	25.04.2020	Navodari	*Tursiops truncatus ponticus*	F	137	4	-
		822	28.04.2020	Corbu	*Phocoena phocoena relicta*	M	94	2	Bycatch
		-	28.04.2020	Navodari	*Phocoena phocoena*	M	71	3	Bycatch

No	Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
					relicta				
		-	28.04.2020	Navodari	*Phocoena phocoena relicta*	F	79	3	-
		-	28.04.2020	Navodari	*Phocoena phocoena relicta*	F	88	4	-
		-	29.04.2020	Mamaia	*Phocoena phocoena relicta*	-	100	3	-
		-	01.05.2020	Navodari	*Phocoena phocoena relicta*	M	84	3	-
		825	02.05.2020	Navodari	*Phocoena phocoena relicta*	F	128	3	-
		-	02.05.2020	Navodari	*Phocoena phocoena relicta*	M	59	2	-
		-	10.05.2020	Cernavoda	*Tursiops truncatus ponticus*	M	190	4	-
		-	13.05.2020	2 Mai	*Phocoena phocoena relicta*	F	113	4	-
		-	14.05.2020	Mamaia	*Phocoena phocoena relicta*	F	80	3	-
		-	22.05.2020	Navodari	*Phocoena phocoena relicta*	F	83	4	-
		-	23.05.2020	Eforie Sud	*Phocoena phocoena relicta*	F	136	4	-
		-	24.05.2020	Constanta	*Tursiops truncatus ponticus*	-	-	-	-

ANNEX B List of stranding records between Jan 2019-May 2020 in the Turkish Black Sea coast.

Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
	-	17.2.2019	Trabzon	*Delphinus delphis ponticus*	--	App. 150	2	-
	-	17.2.2019	Karasu	*Phocoena phocoena relicta*	-	App. 100	2	-
	-	25.2.2019	Trabzon Akçabat	*Delphinus delphis ponticus*	-	-	2	-
	-	25.2.2019	Trabzon Akçabat	*Delphinus delphis ponticus*	-	-	2	-
	-	7.4.2019	Ketendere R.Feneri	*Phocoena phocoena relicta*	-	-	5	-
	-	7.4.2019	Gümüşdere	*Tursiops truncatus ponticus*	-	-	4	-
	-	9.4.2019	Artvin	*Delphinus delphis ponticus*	-	-	4	-
	-	9.4.2019	Trabzon Arsin	*Delphinus delphis ponticus*	-	-	2	-
	19008	12.4.2019	Sinop, Kiraztepe	*Delphinus delphis ponticus*	F	152	4	Bycatch
	-	14.4.2019	Tirebolu	*Delphinus delphis ponticus*	-	-	4	-
	-	15.4.2019	Sinop	*Delphinus delphis ponticus*	-	-	2	-
	19009	17.4.2019	Sinop	*Phocoena phocoena relicta*	-	-	3	-
	-	26.4.2019	Kilyos	*Tursiops truncatus ponticus*	-	-	5	-
	-	26.4.2019	Kozlu Zonguldak	*Delphinid*	-	-	4	-
	-	9.5.2019	Samsun atakum	*Delphinus delphis ponticus*	-	-	2	-
	-	17.5.2019	Sinop bahçeler	*Delphinus delphis ponticus*	-	-	2	-

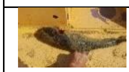
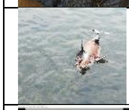
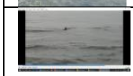
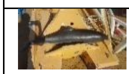
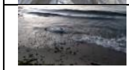
Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
	-	18.5.2019	Samsun	*Delphinus delphis ponticus*	-	-	1	-
	19010	18.5.2019	Sinop Denizler	*Phocoena phocoena relicta*	M	124	4	-
	-	5.6.2019	Alaplı Zonguldak İncivezaltı	*Phocoena phocoena relicta*	-	-	3	-
	-	5.6.2019	Alaplı Zonguldak İncivezaltı	*Phocoena phocoena relicta*	-	-	4	-
	-	8.6.2019	Karasu	*Phocoena phocoena relicta*	-	-	2	-
	-	13.6.2019	Samsun, Atakum	*Delphinus delphis ponticus*	-	-	2	-
	-	14.6.2019	Bartın, inkum	*Phocoena phocoena relicta*	-	-	3	-
	-	15.6.2019	Kandıra Kumcağız	*Phocoena phocoena relicta*	-	-	2	neonate
	19013	18.6.2019	Kilyos Kısırkaya	*Phocoena phocoena relicta*	-	-	3	neonate
	-	22.6.2019	Kilyos Kısırkaya	*Phocoena phocoena relicta*	-	-	4	neonate
	-	25.6.2019	Trabzon Akçaabat	*Phocoena phocoena relicta*	-	-	4	-
	-	25.6.2019	Ordu	*Delphinus delphis ponticus*	-	-	1	-
	-	30.6.2019	Kilyos Gümüşdere	*Phocoena phocoena relicta*	-	-	2	-
	-	7.7.2019	Samsun	*Delphinus delphis ponticus*	-	-	5	-
	-	22.7.2019	Kocaali, Kandıra, Babalı	*Phocoena phocoena relicta*	-	-	3	-
	-	30.7.2019	Kastamonu, Cide Ovaaltı Köyü	*Phocoena phocoena relicta*	-	-	4	-
	19016	9.8.2019	Kiraztepe, Sinop	*Phocoena phocoena relicta*	F	76	4	neonate

Photo	Sample No	Date	Locations	Species	Sex	Length (cm)	Stage*	Notes
	-	27.8.2019	Samsun Demirsahası	*Delphinus delphis ponticus*	-	-	3	-
	-	17.9.2019	Bartın, Amasra	*Delphinus delphis ponticus*	-	-	2	-
	19018	19.9.2019	Sinop	*D.d*	M	184	4	-
	20002	23.1.2020	Bartın İnkumu Tatil Beldesi	*Delphinus delphis ponticus*	M	170	3	
	20003	8.2.2020	Bartın İnkumu Sahili	*Phocoena phocoena relicta*	F	125	2	pregnant, bycatch
	-	14.2.2020	Zonguldak, Kozlu	*Delphinus delphis ponticus*	-	-	3	bycatch
	-	14.2.2020	Zonguldak, Kozlu	*Delphinus delphis ponticus*	-	-	3	bycatch
	-	16.2.2020	Kandıra, Kefken	*Delphinus delphis ponticus*	-	-	2	
	-	22.2.2020	Karasu	*Phocoena phocoena relicta*	-	-	2	
	-	23.2.2020	Sakarya, Kocaali	*Delphinus delphis ponticus*	-	-	2	bycatch
	-	23.2.2020	Sakarya, Kocaali	*Delphinus delphis ponticus*	-	-	2	bycatch
	-	23.2.2020	Sakarya, Kocaali	*Delphinus delphis ponticus*	-	-	2	bycatch
	-	9.3.2020	Samsun Atakum	*Delphinus delphis ponticus*	-	-	3	
	20005	12.3.2020	Sinop Karakum	*Delphinus delphis ponticus*	M	188	4	
	20006	29.4.2020	Sinop	*Delphinus delphis ponticus*	-	-	4	
	20007	1.5.2020	Sinop	*Delphinus delphis ponticus*	M	101.5	4	
	-	5.5.2020	Ordu Fatsa	*Delphinus delphis ponticus*	-	-	1	

Partners:

Coordinator - National Institute for Marine Research and Development “Grigore Antipa” (NIMRD) (Romania)
Project partner 2 - Mare Nostrum Non-Governmental Organization (Romania)
Project partner 3 - Institute of Oceanology - Bulgarian Academy of Sciences (IO-BAS) (Bulgaria)
Project partner 4 - Ukrainian Scientific Center of Ecology of Sea (UkrSCES) (Ukraine)
Project partner 5 - Scientific and Technological Research Council of Turkey/Marmara Research Center (TUBITAK-MAM) (Turkey)
Project partner 6 - Turkish Marine Research Foundation (TUDAV) (Turkey)

Project funded by EUROPEAN UNION

Joint Operational Programme Black Sea Basin 2014-2020
National Institute for Marine Research and Development “Grigore Antipa” (NIMRD) Constanta, Romania 2021
Joint Operational Programme Black Sea Basin 2014-2020 is co-financed by the European Union through the European Neighbourhood Instrument and by the participating countries: Armenia, Bulgaria, Georgia, Greece, Republic of Moldova, Romania, Turkey and Ukraine.
This publication has been produced with the financial assistance of the European Union.
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