Collecting Scientific Data to Fill Existing Data Gaps on Cetacean Conservation in Turkey

Five Years of Dedicated Research Effort on Coastal and Deep-Diving Cetacean Species

DMAD
Marine Mammals Research Association
Annual Report 2021

Aylin Akkaya, Selina Brouwer, Tim Awbery, Patrick Lyne, Derya Özciğer Senalp, Duru Güneş Yalçın, Kerim Akkaya

dmadfornature
DMADforNATURE
www.dmad.org.tr

Contents

Foreword

Almost every cetacean species shows a worrying population decline in the entire Mediterranean Sea, which has resulted in their classification as either endangered, or vulnerable on the IUCN Red List. Currently, not only the coastal species but also the pelagic species of cetaceans show patchy and scarce distributions in locations where they were once widely distributed and abundant. Common dolphins (*Delphinus delphis*) are absent from the habitats where they were once the most common species. Bottlenose dolphins (*Tursiops truncatus*), known as the cosmopolitan coastal species, show signs of starvation. Sperm whales (*Physeter macrocephalus*), the giants of the deep-sea, are scattered with less than 2,500 mature individuals in the entire Mediterranean. Cuvier's beaked whales (*Ziphius cavirostris*), the marine mammals which hold the record as the deepest divers, are still one of the least known species in the Mediterranean. Cetacean species fill an important role from their pelagic to deep-sea habitats and their role for our planet extends beyond the boundaries of the marine realm to benefit the terrestrial one; they store thousands of tonnes of carbon throughout their lifetime as well as trapping this in the sea after their death, thus counteracting climate change. They are also known as ecosystem engineers due to their role in the nutrient cycle with their sole presence indicating habitats which are rich in diversity. Nevertheless, these marine top predators are under a wide range of threats, from habitat destruction, to overfishing, bycatch, marine traffic, pollution, loud and impulsive noise from seismic and sonar operations and climate change. Each and all of the above threats exist, often in combination with multiple other threats, and pile pressure on the territorial waters of Turkey. Despite being aware of the present threats, we do not know the range of impacts that these unregulated human activities are having and an assessment of their cumulative effect is a long way away with even less knowledge present within the Eastern Mediterranean Sea, including Turkey. Cetaceans live between 10s and 100s of years, they reach their maturity almost half-way through their lifespan, and have long interbreeding intervals. Therefore, any short-term threat we introduce to their environment is going to have long term consequences to the species with little hope of restoration. That being the case, we must live and learn from these magnificent creatures, assess the threats and choose our approach to minimise our negative footprint.

DMAD-Marine Mammals Research Association was established in 2015 to understand the current situation of cetacean species, to gather baseline knowledge which is an essential tool for their effective conservation and to assess human pressures within the territorial waters of Turkey. The projects of DMAD stretch from one of the busiest waterways in the entire world, the Istanbul Strait, to the protected waters of the Dilek Peninsula, while conducting dedicated effort in one of the tourist hotspots, the Gulf of Antalya and more recently the entire Eastern Mediterranean Sea of Turkey, covering the coastal and deep sea habitats between Gocek and Hatay. While taking a scientific approach to the assessment of species and the existing threats, DMAD values the importance of public engagement for the successful implementation of project results and in-situ conservation actions and therefore have developed public awareness projects and capacity enrichment both for early career researchers, students and anyone interested in learning. Our research efforts have identified critical habitats for both coastal and deep-sea species within the territorial waters of Turkey, contributing to the selection of Istanbul Strait and its adjacent waters as an "Important Marine Mammal Areas (IMMA)" and the Gulf of Antalya selected as an "Area of Interest" by the Marine Mammal Task Force. The research in partnership with WWF-Turkey and TUDAV led to the acceptance of Istanbul Strait and its adjacent waters as an IMMA. Furthermore, the first ever dedicated research effort, covering the entire waters of the Eastern Mediterranean Sea of Turkey, has now been started by DMAD. Rather than restricting survey efforts to the summer months like many research projects, DMAD also considers the spatial-temporal distribution of these important species within our waters. urkey is a country that holds critical habitats for cetaceans such as foraging, nursing, and socialising grounds for coastal and deep-diving species, throughout its waters in the Turkish Strait System, Aegean Sea and the Eastern Mediterranean. Our research effort highlights the invaluable importance of these waters for top predators that are known as climate warriors. Yet, our effort has also revealed sharp declines in the sighting rates of species since 2015 and an ever increasing uncontrolled human presence within the same waters. With the current pandemic our world is facing, this is a year to question our actions and understand how fragile we actually are if we do not work hand in hand with nature. This self-awareness will create the CHANGE we need for our survival that completely relies on decreasing our footprint on the only planet we know we can live on!

DMAD TEAM

Introduction

Cetaceans are often considered important keystone, indicator, and umbrella species (Parsons *et al*., 2015; Sergio *et al*., 2008). Despite their key roles in marine ecosystems, baseline information on both coastal and deep-sea cetacean species in the Mediterranean is highly fragmented with western and central basin housing comparably more research effort than the eastern and southern Mediterranean (Bearzi *et al*., 2008a; Boisseau *et al*., 2010; Dede *et al*., 2012; Notarbartolo di Sciara & Birkun, 2010; Santostasi *et al*., 2016). Knowing that knowledge gaps are one of the main obstacles to the effective protection of a species, the population decline that each Mediterranean subpopulation of cetaceans is facing today can have irreversible consequences not only for the species but also at an ecosystem level (Akkaya *et al*., 2020; Ballance, 2018; Braulik *et al*., 2018; Katona & Whitehead, 1988; Matear *et al*., 2019; Romero & Keith, 2012). Studies in the Eastern Mediterranean Sea have mainly been centred around opportunistic sightings, stranding reports and occasional surveys (Kerem *et al*., 2012; Frantzis *et al*., 1999, 2003; Giannoulaki *et al*., 2017; Kinzelbach, 1986; Marchessaux, 1980; Öztürk *et al*., 2011, 2013), with a steady increase of interest in cetacean research since the 1990s (Goffman *et al*., 2000; Kerem *et al*., 2012; Notarbartolo di Sciara & Birkun, 2010). Turkish, Israeli and Lebanese waters stand out as the main locations where cetaceans research has been targeted (Bas *et al.,* 2016a; Boisseau *et al.,* 2010; Dede *et al*., 2012; Goffman *et al.,* 2000; Kerem *et al*., 2012), while a few basin wide survey efforts have taken place in the Eastern Basin, the most recent of which was the ACCOBAMS Survey Initiative in 2018 (ACCOBAMS, 2018; Boisseau *et al*., 2010; Dede *et al*., 2012; Ryan *et al*., 2014). Regarding systematic studies conducted in the Eastern Mediterranean Sea of Turkey, a single survey in the summer seasons formed the only survey effort before 2015, when a dedicated photo-identification study was conducted (Bas *et al*., 2016b). Bottlenose dolphins were the main reported species (Goffman *et al.* 2000; Kerem *et al*., 2012; Notarbartolo di Sciara & Birkun, 2010), yet several delphinid species as well as Sperm Whales and Cuvier's beaked whales were also reported from the region (Bas *et al*. 2016c; Boisseau *et al* 2010; Dede *et al*., 2012; Drouot, 2004; Frantzis *et al*., 2011, 2014; Gannier & Epinat, 2008). Despite the increased survey effort, no further baseline information such as encounter rates, habitat preferences, or population sizes exist in the area. The Aegean Sea, the northernmost section of the Eastern Mediterranean, holds a relatively higher research effort compared to the Levantine Region. Systematic surveys and stranding reports in the region began in the early 1990s, documenting the distribution of delphinid species from north to south (Aytemiz *et al*., 2003; Carpentieri *et al*.1999; Frantzis *et al*., 2003; Öztürk & Öztürk, 1998; Öztürk *et al*., 2001). While the majority of the studies were localised targeting encounter rates, group size, seasonal variations and population size estimates (Alan *et al.,* 2017, 2018; Altug *et al*., 2011; Giannoulaki *et al*., 2017; Milani *et al*., 2017; Ryan *et al*., 2014), regionwide surveys were rare, resulting in an absence of population size estimates for the entire Aegean Sea.

The majority of the studies highlighted that the northern Aegean Sea is a habitat of high cetacean density particularly in the Thracian Sea, the Thermaic Gulf and the Northern Dodecanese (Bearzi *et al*., 2003; 2005, 2008b; Frantzis *et al*., 2003; Ryan *et al*., 2013). Öztürk & Öztürk, (1996) established the presence of 9 cetaceans inhabiting the northern and central regions of the Turkish Aegean waters. Studies targeting population sizes and photo-identification methods increased by the early 2010s (Vahit *et al*., 2014, 2017, 2018; Ryan *et al*. 2014). The Turkish straits systems (TSS) was probably one of the most studied locations in the Eastern Basin. TSS is a transition site between the Black Sea and Mediterranean, serving as an acclimatisation zone for migratory species (Öztürk & Öztürk, 1996). It hosts three cetacean species whose presence was first identified by Deveciyan (1926) and their regular occurrence was noted as a resident population in the Istanbul Strait in the early 1950s (Tezel 1958). The first seasonal line transect surveys of the TSS took place between 1997 and 1999 to estimate the population size of delphinids (Dede, 1999). A dedicated photo-identification study started in 2011 to understand the residency pattern and site fidelities of each species (Bas *et al.*, 2016b). In summary, despite the increased research effort within the regions of the Eastern Mediterranean Sea since the 2010s, data gaps are still the main barrier to marine protection. The Mediterranean Sea is listed as a Global Biodiversity Hotspot and a scarcity or lack of robust knowledge invariably undermines marine protection goals (Bearzi *et al*., 2008a), specifically considering the number of unregulated human pressures in these data deficient locations. The marine biodiversity of the Mediterranean Sea is under a wide range of human pressures and the Eastern Mediterranean is no exception. Whilst an understanding of the current threats to marine mammals exists, this understanding does not extend to the impact that these threats are missing at a species level and threat assessments for individual species are generally missing for the entire basin. The biggest threats to marine mammals in the Eastern Mediterranean and Black Seas are habitat destruction due to coastal infrastructure development, by-catch due to entanglement in driftnets (even though driftnets are banned by all Mediterranean countries) and the overexploitation of fish stocks that cause starvation of the cetaceans. Another threat is increasing marine pollution such as plastics and chemicals. In addition to this, particularly for deep diving species such as sperm whales and beaked whales, ever increasing underwater noise pollution produced by sonar during military exercises or for seismic surveying to find oil and gas and the noise from shipping lines, remains a threat as they interfere with marine mammals' echolocation system and causes physiological disruption such as stress or even death. (IUCN, 2012)

Methodology

Survey Area

DMAD has targeted four different survey locations; Istanbul Strait, Dilek Peninsula, Antalya and Eastern Mediterranean Sea of Turkey (Figure1). The studies in the Istanbul Strait have been undertaken since 2011, Antalya began in 2015, and the Eastern Mediterranean and Dilek Peninsula began being targeted in 2018 and 2019, respectively and since then each location has had a seasonal survey effort.

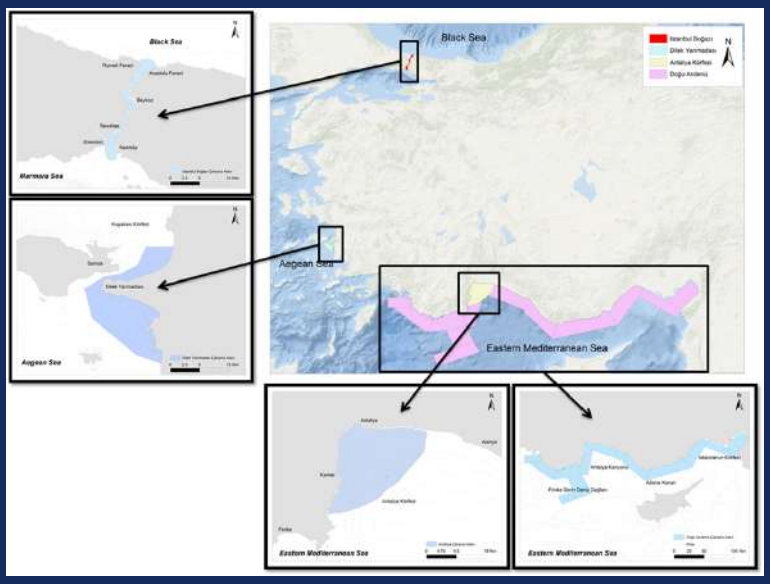


Figure 1. Survey Areas of DMAD in Turkey.

Survey Platforms

Land Survey

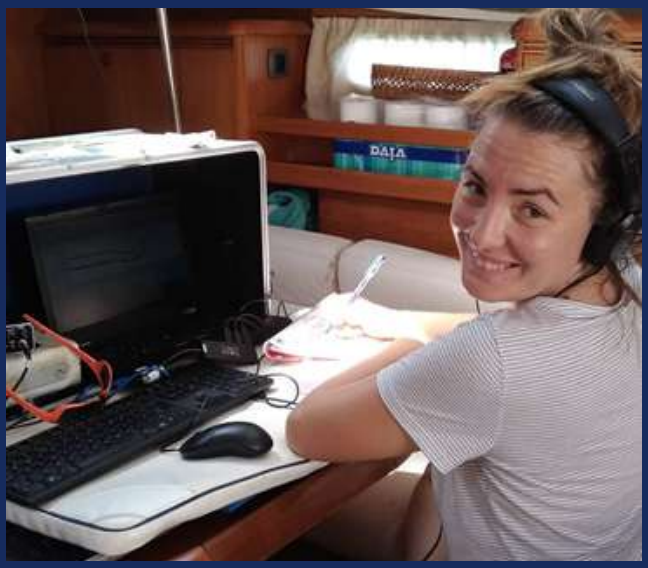
To get the geographical position of the cetaceans and the marine vessels in the area, a theodolite (SOKKIA DT5A) is used and simultaneously recorded in the software Pythagoras (version 1.2) to map their distribution, behaviour and group cohesion (Figures 2 & 3).

Figures 2 & 3:Land survey in Antalya in 2021.

Boat Surveys:

While stratified random routes are followed during the boat surveys in Istanbul, Dilek and Antalya, pre-determined transects are followed during the surveys in the Eastern Mediterranean Sea. The geographical coordinates of the boat were recorded every minute using Logger 2010 (Marine Conservation Research, 2019). In the case of a cetacean sighting, data is collected on behaviour, group cohesion, marine traffic density and photo-identification. While the boat surveys take a day in Istanbul, Dilek and Antalya, the Eastern Mediterranean Sea survey is continued for a minimum of 20 days with 24 hours/day effort, thus letting us collect data on the distribution of cetaceans during the night as well as during the day (figure 4 - 5).

Figures 4 & 5: Visual data collection during "Giant Guardians of the Deep Sea" in the Levantine Sea.



Figures 6 & 7: Acoustic data collection during "Giant Guardians of the Deep Sea" in the Levantine Sea.

Data Analysis

The current report analyses data that was collected between 2015 and 2021. The report firstly presents the variation in survey effort and sighting rate per year for each location. Photo-identification results are also presented with their sighting history for Istanbul, Dilek Peninsula and Antalya. Species distribution maps are created to delineate critical habitats for the species.

Results

DMAD bridges research and conservation activities to collect missing scientific knowledge within the Eastern Mediterranean Sea of Turkey while highlighting the importance of the involvement of public and stakeholders for the effective implementation of project results on the conservation of the species. Therefore DMAD started its scientific effort in 2015 in Antalya and since then has begun running four projects targeting cetaceans and the existing threats in the habitats that they live; “The Dolphins and Porpoises of the Istanbul Strait”, “Common dolphins of Common Seas - Dilek Peninsula”, “Dolphins in the Bay of Antalya” and “The Giant Guardians of the Deep Seas - Eastern Mediterranean Sea of Turkey.”

The dolphins and porpoises of the Istanbul Strait

The project builds on the PhD thesis of Dr Aylin Akkaya. The project has been an ongoing effort since 2011 with a three year research gap between 2014 and 2016 (Table 1 & 2). Land surveys comprised 81% of the total survey effort. Since 2017, however, the majority of the effort has been made up of boat surveys. Since the establishment of DMAD in 2015, there have only been 13 days of survey in the Istanbul Strait with an increased effort in 2021 (Table 1 & 2). Regarding the seasons, 2012 and 2013 represent the main years with a similar survey effort between seasons. Since 2017, the effort has shown considerable variation between seasons (Table 1 & 2) although this is in part due to COVID-19 pandemic.

Observation Type	Years							Total
	2011	2012	2013	2017	2019	2020	2021	
Boat	4	34	20	1	5	3	5	72
Land	36	139	133	0	0	0	3	311
Total	40	173	153	1	5	3	8	383

Years	Seasons				
	Spring	Summer	Winter	Autumn	Total
2011	0	3	28	9	40
2012	36	44	52	41	173
2013	47	53	15	38	153
2017	1	0	0	0	1
2019	0	0	4	1	5
2020	0	1	1	1	3
2021	3	4	0	1	8
Total	87	105	100	91	383

Table 1 & 2. The variation of survey effort between years and seasons.

Sighting rates also varied between years but the chance of sighting a dolphin in the Istanbul Strait was always more than 50% with an overall mean sighting rate of 73%. Another interesting fact was that since 2017,dolphins were reported in each survey. However as a result of a considerably low number of survey efforts, we cannot conclude that dolphins and porpoises are present every single day in the Strait. To reach an accurate conclusion, we must conduct dedicated survey effort both within and between seasons and years (Figure 8 & 9). Sighting rates of cetaceans remained relatively similar but autumn months had a lower sighting rate of 54%. Spring and summer, held the highest sighting rate of cetaceans in the Strait (Figure 8 & 9).

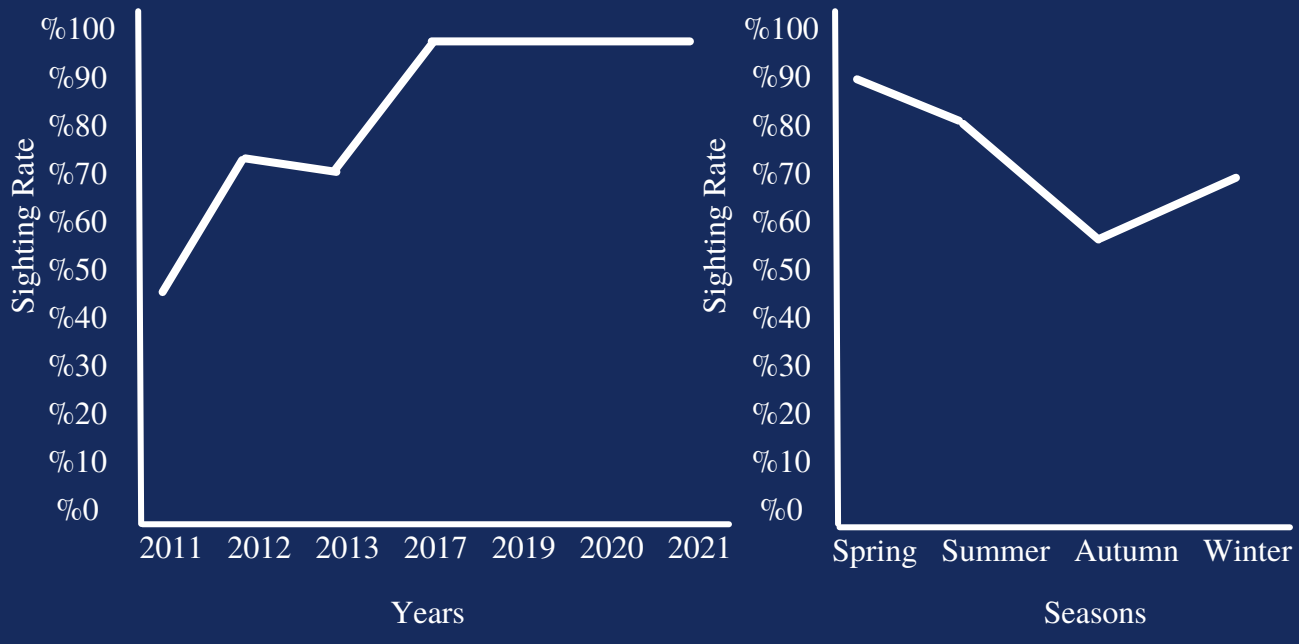


Figure 8 & 9. The variation on the sighting rate of cetaceans per year within the Strait.

Overall, 489 sightings of cetaceans took place in the Strait. Bottlenose dolphins were the most frequently sighted species followed by harbour porpoises and then common dolphins (Figure 10).

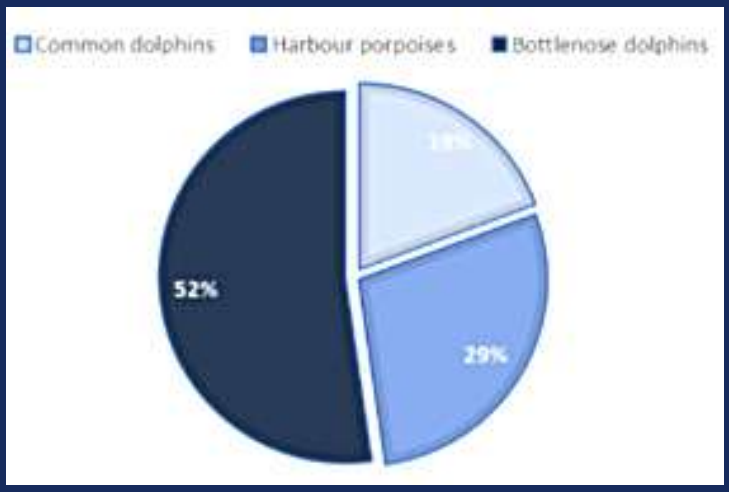


Figure 10. Species sighting in the Istanbul Strait

The survey effort revealed the year-round presence of bottlenose dolphins, common dolphins and harbour porpoises within the Istanbul Strait and its adjacent waters (Figure 11). While bottlenose dolphins and common dolphins were sighted mostly in spring and summer, harbour porpoises were encountered the most in summer and winter. Autumn had the least recorded sightings for each species (Figure12).

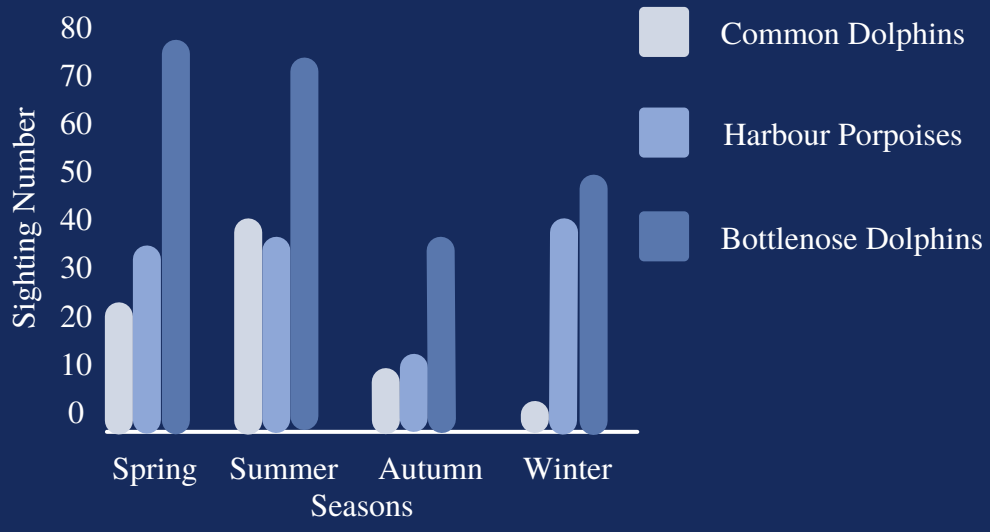


Figure 11. Sighting variation of species per season in the Istanbul Strait.

The distribution map of cetaceans revealed that the northern followed by the southern entries of the Strait hold the highest densities for each species, while the middle section was comparably less preferred by each species. Bottlenose dolphins had the highest densities within the Strait compared to the other two species while porpoises had the lowest density despite being the second highest sighted species of the Strait, due to their lower group sizes (Figure 12).

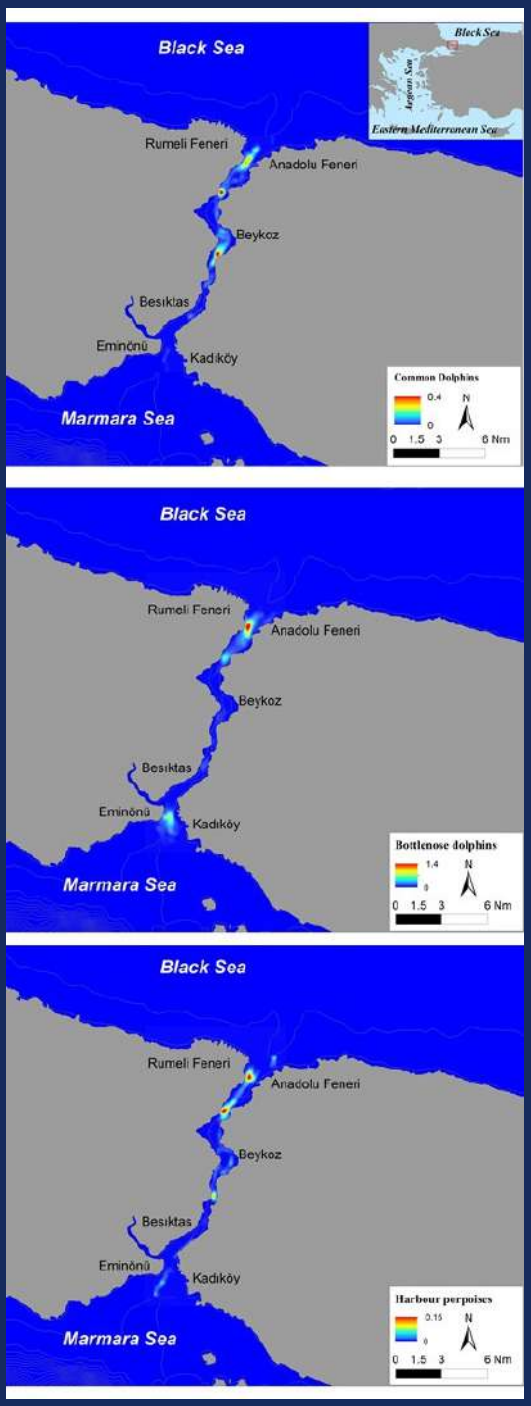


Figure 12: Spatial distribution of the cetaceans in the Istanbul Strait (displayed densities are dolphin groups/m2).

The Istanbul strait holds foraging, nursing, and socialising grounds and possibly a migration corridor for each species. Despite the importance of this waterway for these top predators, the existing human threats continue in an uncontrolled fashion from habitat destruction to pollution, bycatch, overfishing and marine traffic. Not only is the main effect of each of these threats important to assess but also the cumulative effect of anthropogenic stressors on these already threatened populations. The current spatial distribution maps already indicate variation in area usage with a preference for the northern followed by the southern waters of the Istanbul Strait, which hold comparably less marine traffic. The waters in between Eminönü and Sarıyer are under pressure from intense marine traffic activity with over 2000 vessels being present in this narrow strait per day. It is not just the international maritime traffic but also the local traffic that creates wide ranging and unassessed threats to the marine ecosystem, including the dolphins and porpoises. It has already been documented that bottlenose dolphins showed avoidance of certain areas during the fishing seasons favouring the less crowded waters and altered their behaviours such as foraging and socialising in locations with high marine traffic density. With all the specific features it holds, Istanbul Strait is a "critical habitat" for cetaceans, and as a result it has recently been selected as an **"Important Marine Mammal Area"** by the Marine Mammal Task Force (Figure 13). Considering its vital importance both for Black Sea and Mediterranean populations of dolphins and porpoises, adjective with the ever increasing human presence in the area, the strait holds every feature which is considered to classify a ***"Particularly Sensitive Sea Area"*** and needs urgent actions in order to protect it.

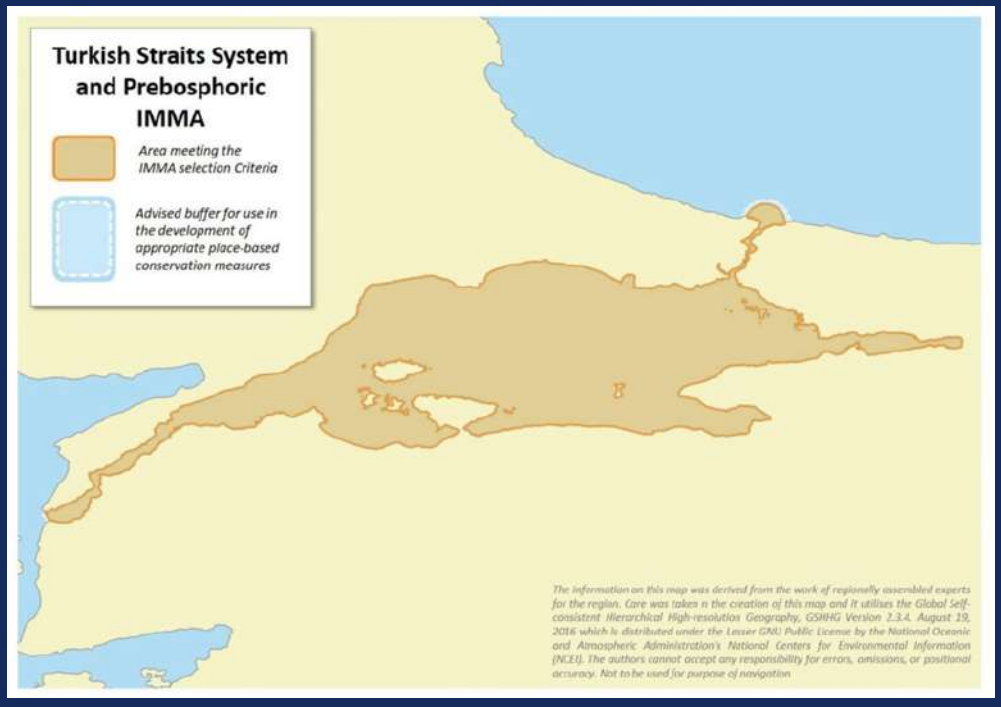


Figure 13: IMMA in the Turkish straits system (Marine Mammal Protected Area Task Force, 2021)

The Common Dolphins of Common Seas

The project was implemented in partnership with WWF-Turkey. Overall 10 boat surveys have been conducted in the Dilek Peninsula National Park since January 2019. While summer, autumn, winter seasons were covered in 2019 and 2020 surveys, survey effort was limited to a single summer survey in 2021 due to the restrictions of the COVID-19 pandemic. Common dolphins were the only sighted species, of which 23 groups were encountered during the surveys. Group size ranged from two to 12 individuals and subadults were always present within the group. Travelling was the most dominant activity of the sighted groups which may indicate that Dilek Peninsula is a biological corridor between foraging grounds for sardine hunting. A photo-identification study revealed 40 distinct common dolphins in the Dilek Peninsula (Figures 14 - 17).

Figures 14 - 17: Four different identified Short-beaked common dolphins at the Dilek Peninsula

Spatial distribution of common dolphins revealed the presence of this endangered species was not just confined to within the protected area boundary but also extending into Kusadası Bay with an increased density in the Dilek Strait (Figure 18).

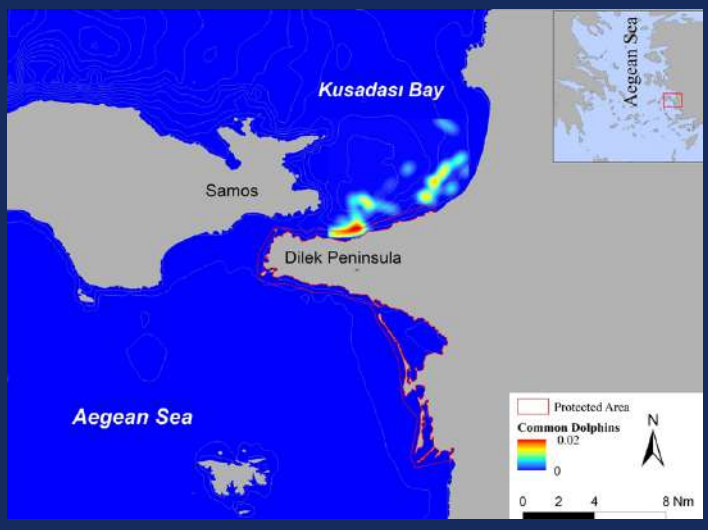


Figure 18: Spatial distribution of common dolphins in the Dilek Peninsula Protected Area and its neighbouring waters (displayed densities are common dolphin groups/ km2).

In summary, each survey revealed the importance of common dolphins within and beyond the boundaries of Dilek Peninsula Protected Area, where subadult presence was reported throughout the year, with additional sightings of newborns. Further, this is the first study in this region that has analysed the acoustic behaviour of this rare species. Common dolphins are one of the most endangered species within the Entire Mediterranean Sea. Dilek Peninsula falls under the National Park (NP) protection status and was the first declared protected area in Turkey in 1966, with the addition of the Great Menderes Delta in 1994 by the Ministry of Environment and Forestry (Çelik et al. 2004; Kılıçaslan et al. 2011). The national park mainly covers the terrestrial habitats with only the coastline and intertidal zones protected in the marine realm. Therefore, the sole presence of common dolphins highlights the importance of the Dilek Peninsula National Park and also underlines the importance of extending the boundaries of the protection status to the territorial waters of Turkey within the region. Last but not least, the peninsula holds one of the narrowest straits in the Aegean Sea that connects the Turkish and Greek waters, with a distance of 1.6km. The dolphins reported in Dilek Peninsula are also present in the waters of Samos Island, which emphasises the importance of transboundary research and conservation effort between the two neighbouring countries for effective conservation of the common dolphin population that is already showing worrying signs of decline.

Dolphins in the Bay of Antalya

The project started in Antalya in 2015 and since then has run seasonal land and boat surveys in Antalya with 204 days of survey effort thus far. While 2015 held the highest survey effort with 110 days of survey, 2020 had only three days of survey due to the Covid-19 pandemic. 2016 and 2017 had a similar effort of 22 days of survey in each year while 2021 was the second most surveyed year with 47 days of effort. There were no surveys in 2018 due to the limitation in resources available. Overall, 132 groups of bottlenose dolphins, four groups of Cuvier's beaked whales and two groups of striped dolphins were detected within the survey area. Regarding the sighting rate between seasons, cetaceans showed a high preference for warmer seasons with spring having the highest sighting rate while colder seasons had considerably less cetacean sightings (Figure 20 & 21). Sightings varied between years as well. It was highest in 2017 with sightings during 69% of surveys with a rapid decline to 13% in 2021 (Figure 19 & 20).

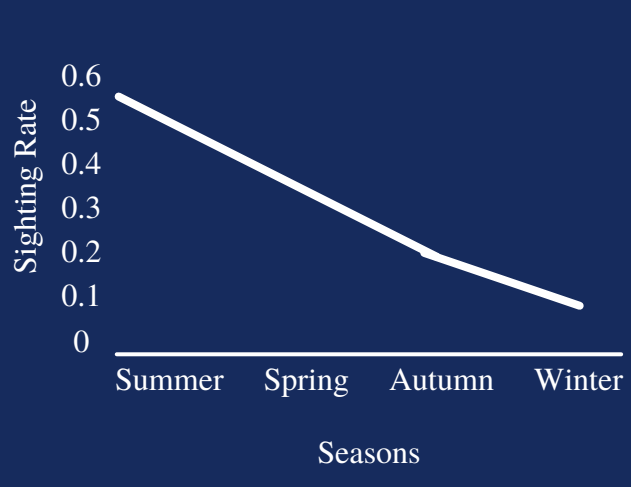


Figure 19 & 20: Sighting rate per season and year in Antalya bay.

While there was a worrying decline of cetacean sightings, mainly being bottlenose dolphins, a photo-identification study revealed the presence of 80 individuals in the Bay of Antalya of which certain individuals have been sighted since 2015, highlighting the high site fidelity of bottlenose dolphins (Figures 21 & 22).

Figure 21: Bottlenose Dolphin identified as number 0028 in Antalya

Figure 22 : Bottlenose Dolphin identified as number 0029 in Antalya

Additionally, Cuvier's beaked whales are one of the least studied cetacean species in the entire Mediterranean Sea. However, DMAD recorded solitary individuals and mother-calf pairs of this rare species between 2015 and 2017 (Figure 23). Since 2018, no individuals have been sighted in the Bay.

Figure 23: First and Second sighting of a Cuvier's Beaked whale individual, 4 and 18 June 2015, Antalya Bay.

Regarding the spatial distribution of cetaceans, bottlenose dolphins were found to be highly coastal with a distribution in waters shallower than 500m depth yet this might be just a reflection of survey effort, rather than representing their full home range. Striped dolphins were sighted on the 800m contour line and Cuvier's beaked whales were found between 500 and 1000m depth (Figure 24)

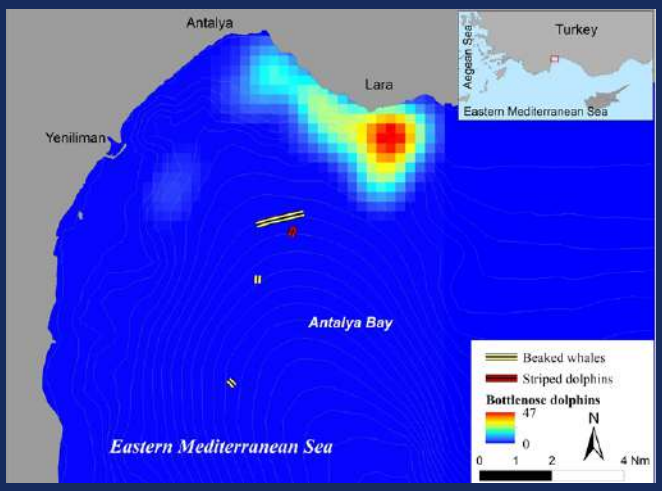


Figure 24: Bottlenose dolphin density distribution within Antalya Bay (displayed densities are bottlenose dolphin groups/ km2) and Cuvier's beaked whales and striped dolphins sightings.

Due to the dedicated research effort of DMAD, Antalya Bay has been selected as an "Area of Interest" by the Marine Mammal Protected Area Task Force. Yet, the same habitat is under the heavy pressure of uncontrolled tourism activities, loud and impulsive noise presence, pollution and habitat destruction and the negative impact of threats on these key species may already be showing. It is alarming to note the current decline in sighting rate for both bottlenose dolphins and Cuvier's beaked whales. While the recorded decline may be the result of variation in their natural habits, it is also likely to be influenced by the ever increasing human population and thus ever increasing pressure in these coastal waters. Despite Antalya being a year-round destination for tourism, the city has a steep increase in the number of tourists with 307% in warmer months (annual tourism news bulletins published by the Turkey Ministry of Tourism and Culture), which consequently increases the coastal marine traffic, marine debris and noise pollution in the locations where the bottlenose dolphin distribution simultaneously overlaps (REF). According to annual tourism news bulletins published by the Turkey Ministry of Tourism and Culture (T.C. Turizm ve Kültür Bakanlığı, turizm istatistikleri yıllık bülten), Antalya showed an increase on its international arrivals from around 12 million to 14,6 million between 2015 and 2019, yet with some fluctuations between years. Due to the Covid19, the number of international and national arrivals to Antalya decreased to around 3 million in 2020 or 2021. Bottlenose dolphins do also show variations on their sighting rate in Antalya and one of the reasons for this variation may be linked to tourism activities, yet this assumption has to be investigated first before drawing any conclusions. Further, Cuvier's beaked whales are known to be one of the most sensitive species to the loud and impulsive noise (Fernández, 2004; Frantzis, 1998; Heyning & Mead, 2009; Soto *et al.,* 2006). The territorial waters of Antalya showed a rapid increase in the presence of anthropogenic noise within the last decade which may explain the absence of the Cuvier's beaked whales sighting in these waters. According to the results of our study, despite the current decline, Antalya does hold important cetacean habitats, thus the value of this city cannot be underestimated. Therefore, it is vital to promote a sustainable blue economy for the benefit of all rather than any current destructive tourism activities.

Giant Guardians of the Deep Seas

The project evolved in 2018, first covering a relatively small range between Gocek and Antalya, later the project expanded covering the entire territorial waters of the Eastern Mediterranean Sea of Turkey from 2020. Overall, 99 days were surveyed across 11 seasons, including both warmer and colder months. 2020 comprised the lowest survey effort with only 6 days of survey due to the COVID19 pandemic restrictions, however 2021 had 41 days of survey, representing the highest surveyed year. 2018 and 2019 have the same survey effort with 25 survey days per each. The ongoing project effort resulted in 335 detection of cetaceans, of which 39 groups of sperm whales and 3 groups of Cuvier's beaked whales were encountered (Table 3). While sperm whales were mainly reported in warmer seasons with no detection in winter and only one in autumn, delphinids were present in the area for each season, with similar distribution both in warmer and colder seasons. The presence of bottlenose dolphins, striped dolphins and common dolphins were visually confirmed with the former being the most frequently sighted delphinids, both in coastal and deep waters (Table 3 and Figure 25) Additionally, marine turtles were recorded on 35 occasions in both warmer and colder seasons.

	2018			2019				2020	2021		Total
Species	Spring	Summer	Autumn	Spring	Summer	Autumn	Winter	Winter	Summer	Winter	
Sperm whales	3	11	1	5	3	0	0	0	16	0	39
Cuvier's beaked whales	0	1	0	0	0	1	0	1	0	0	3
Delphinids	17	13	3	17	24	31	24	21	38	55	243
Common dolphins	3	0	0	0	4	0	0	0	0	0	7
Striped dolphins	0	0	0	0	0	0	0	2	0	3	5
Bottlenose dolphins	5	6	2	3	1	1	0	1	8	11	38
Marine turtles	6	2	0	18	0	0	0	0	2	7	35
Total	34	33	6	43	32	33	24	25	64	76	370

Table 3: Species detections per season and per year.

The species distribution map revealed that delphinids were present throughout the study area. Bottlenose dolphins were recorded both in the coastal and deep waters, reaching depths of up to 3000m. Common dolphins and striped dolphins were concentrated between Rhodes and the Antalya canyon with no detections further east than Finike. Sperm whales showed a similar pattern with a distribution range between Rhodes Basin and Antalya Canyon, with a single detection in the Adana Canyon. Cuvier's beaked whales were detected off the coast of Gocek and Kas. Additionally marine turtles were reported to be mainly coastal but they were also found in the area of the Finike seamounts (Figure 25).

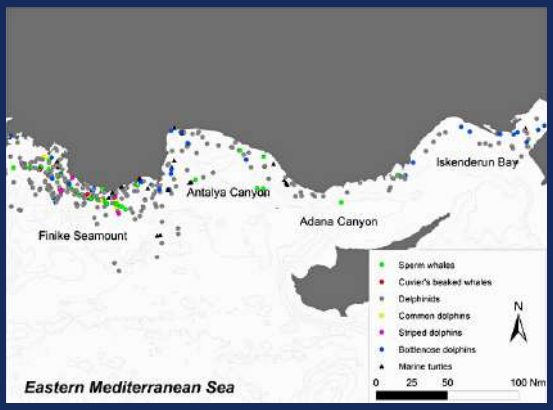


Figure 25: Species distribution within the Eastern Mediterranean Sea of Turkey.

The current project is one of the highlights of DMAD's research effort and forms the only dedicated research on cetaceans within the entire Eastern Mediterranean Sea with a seasonal survey effort that employs both traditional visual and advanced acoustic survey techniques. Despite the encounters of these important key species, the entire Eastern Mediterranean Sea shows negative signs of the human footprint ranging from habitat destruction to marine traffic, marine debris and the continuous presence of loud and impulsive noise. Prior to the dedicated efforts of DMAD, the Eastern Mediterranean Sea was regarded as holding one of the least favourable habitats for cetaceans. However, our research effort revealed that the basin does hold important cetacean habitats and the lack of sightings were only reflecting the lack of research effort within the basin, rather than the absence of the species. DMAD's ongoing research effort has filled an important gap in knowledge and will continue its activities in the upcoming years to shed light on the scientific knowledge that is critical for the effective management and conservation of cetaceans that are considered indicators of ecosystem health.

Public Outreach

From a conservation perspective, DMAD considers its role as one that enhances the scientific knowledge of local researchers as well as one that encourages the importance of citizens not only for conservation actions but also for research itself. Therefore, DMAD released their "Remote Internship" opportunities to local students where anyone can sign up and gain key skills on data interpretation, while broadcasting tutorials on Geographic Information Systems on youtube which have been viewed more than 60,000 (Figure 26).

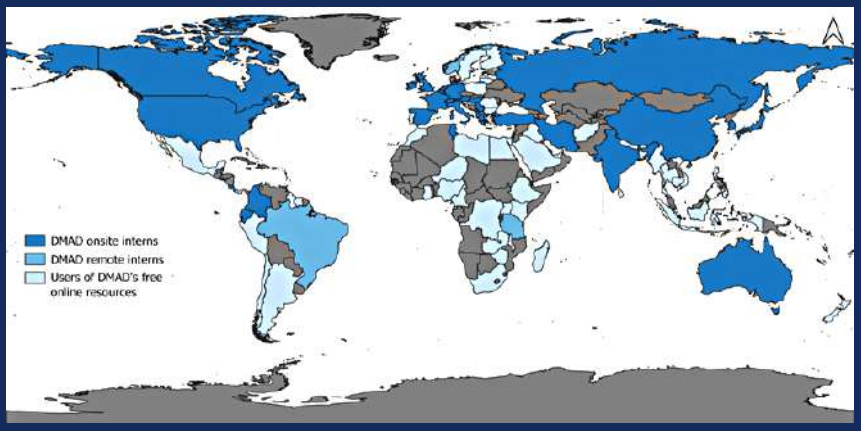


Figure 26. DMAD's Reach: Where our interns (onsite and remote) are from and countries that our free online GIS courses have been viewed.

In addition to the online learning skills, prior to each survey, five workshops were organised on visual and acoustic survey techniques that have been attended by over 100 local students (Figure 27).

Figure 27: Practical training of local students during a land survey.

Subsequently, each student was invited to participate in the "Giant Guardians of the Deep Seas" project to gain practical skills, with 50 local students participating. Also, in the last five years there has been a more and more demand for people with a Marine Mammal Observer and Passive Acoustic Monitoring qualification. Therefore in July 2019, DMAD the "ACCOBAMS High Quality Marine Mammal Observer and Passive Acoustic Monitoring" certification workshop, which reached 16 local students and early career researchers (Figure 28).

Figure 28: ACCOBAMS Highly Qualified MMO/PAM course

In addition to the capacity building activities, five different dolphin watching tours have been organised for disadvantaged students and children of Turkey since 2018. In addition to this DMAD organised an Art Exhibition in IC Cesme Marina in September 2021 and reached over 200 people through the artwork "Cetaceans of Turkey" in 2021 (Figure 29).

Figure 29: Exhibition in Cesme Marina

Alongside this, information posters were created with cetaceans of Turkey and the blue-economy as their subject heading. The posters were distributed to schools, public halls, fishery cooperatives and governmental bodies. DMAD published and distributed a bilingual report with the title "It is too Loud Now!". The report summarises the evidence of noise pollution on different species of cetaceans, proposes solutions and ACCOBAMS Resolutions to be used as a mitigation guide. On top of this, the Istanbul Municipality prepared a short documentary in October 2021 about Istanbul Strait dolphins to draw attention to the marine biodiversity of this cosmopolitan city and asked DMAD to contribute to this. The videos can be found on YouTube and can also be seen aboard every ferry in Istanbul. Since DMAD's conception, Yeniliman Fishery cooperative has been frequently visited to develop mutually beneficial and respectful relationships with one of the most important stakeholders of the project where DMAD placed a GPS on 20 different small scale fishery to map the fishing density as well as interviewed the fishers to understand the magnitude of fishery-cetacean interaction .

In 2016, DMAD started a preliminary sighting network in Turkey to get the local people such as fishers, sailors and observers more involved in the project. Overall, 67 sightings were reported, of which 37% had location references or coordinates to be mapped. The 25 sightings which were able to be mapped were composed of eight different cetacean species (Figure 30). While the majority of the sightings were bottlenose dolphins, Risso's dolphins were the second most reported species. The majority of the sightings were reported from Gokceada in the North Aegean Sea (an area where DMAD does not currently have active operations) as a result of our strong relationship with the island's fishing community. This data helps increase our understanding of the overall distribution of marine mammals in Turkish waters and emphasises the importance of the established mutually respectful connections between the stakeholders.

Figure 30: Reported cetacean sightings in Turkey

Last but not least, a collaboration was made with Setur Marinas in September 2021. Setur Marinas is a corporation that has the most established and widespread marinas in Turkey, with a total of 10 marinas along the coastline of Turkey and one in Greece. Pursuant to company policies, they aim to be a pioneer in nature conservation, successfully following nature conservation trends, and develop groups for this purpose, with the objective of disseminating such information into the wider society. DMAD has partnered with Setur Marinas to bring greater attention to the cetaceans of Turkey and the threats they are facing. Currently, the marinas display DMAD stickers and posters emphasising the presence of whales in Turkey and the heavy human pressures they are under. With a well-established, but ever developing bridge between research and conservation actions, DMAD has already achieved important milestones in the understanding and protection of cetaceans within Turkey. Yet, the unknowns surrounding species' baseline information still outweighs the knowledge we currently have. Therefore, the continuous systematic research design together with the active involvement of the public are the key steps of the evolution in the protection of the marine environment of Turkey.

DMAD IN THE COMMUNITY

WORKSHOPS

5 workshops on field techniques, photo-identification were provided to the local students of Turkey with reaching up to 100 local students/ early career researchers.

BOAT EXPEDITION

Participation of 50 local students/ early career researchers in Giant Guardians of the Deep Sea project to gain practical skills.

MMO/PAM CERTIFICATION

ACCOBAMS Highly Qualified MMO/PAM certification workshop with reaching up to 30 local students/ early career researchers.

DOLPHIN WATCH TOURS

Organised for the disadvantaged children and youth of Turkey.

ART EXHIBITION

Called "Cetaceans of Turkey" that reached up to 200 local people in Cesme.

GPS LOGGERS

20 GPS loggers were placed to the fishers' boat to document their movement in the Antalya Bay.

MEDIA CHANNELS

Were used to spread the cetacean knowledge of Turkey, with as achieved a contribution to a short documentary from the Istanbul Municipality and a contribution to a book of NGO The Dolphin's Voice.

COLLABORATIONS

A collaboration in 2019 with MedPan & Cyan Planet and in 2021 with Setur Marinas in Turkey.

TURKEY DOLPHIN SIGHTING NETWORK

Development of Turkey Dolphin Sighting Network.

ONLINE TRAINING

Remote internship and online GIS lessons with reaching up to 3500 local and international students/ early career researchers.

PUBLICATION & CONFERENCE

2014

Publication: Selection of critical habitats for bottlenose dolphins (Tursiops truncatus) based on behavioral data, in relation to marine traffic in the Istanbul Strait, Turkey

2015

Publication: Annual Report of Turkey

2016

Publication: Seasonal encounter rates and residency patterns of an unstudied population of bottlenose dolphin (Tursiops truncatus) in the northwestern Levantine Sea, Turkey
Publication: New Records of Cuviers beaked whales from the Turkish Levantine Sea
Publication: The effects of marine traffic on the behaviour of Black Sea harbour porpoises in the Istanbul Strait
Publication: Interactions between marine mammals and fisheries case studies from the Eastern Aegean and the Levantine Sea

2017

Publication: Annual Report of North-Levantine Sea
Publication: Selection of critical habitats for bottlenose dolphins (Tursiops truncatus) based on behavioral data, in relation to marine traffic in the Istanbul Strait, Turkey
Publication: Seasonal Encounter Rates and Residency Patterns of an Unstudied Population of Bottlenose Dolphin in the North western Levatine Sea, Turkey
Publication: New Mediterranean Biodiversity Records
Conference: Bottlenose dolphins in the Turkish Levantine Sea Encounter Rates, Distribution and Residency patterns

2018

Publication: Encounter rate, residency pattern and site fidelity of bottlenose dolphins (Tursiops truncatus) within the Istanbul Strait, Turkey

2019

Publication: Interactions between small-scale fisheries and marine mammals in the Eastern Mediterranean
Publication: Interactions Between Marine Mammals and Fisheries Case Studies from the Eastern Aegean and Levantine Sea
Publication: Annual report about Critical Habitats, Population, Threats and Conservation Measures of Sperm and Curvier Beaked Whales in the Eastern Mediterranean
Conference: Presentation of From Small Cetaceans to the Great Whales of the East at the World Marine Mammal Conference
Conference: Presentation of The Delineation of Critical Habitats for the Conservation of Cetaceans in Three Understudied Areas of the Mediterranean at the 7th meeting of the parties to ACCOBAMS

2020

Publication: Annual report of Cetaceans of the Dilek Peninsula
Publication: MAVA report about From Small Cetaceans to the Great Whales of the East
Publication: Comparison of Acoustic Patterns Recorded for the Sperm Whales
Publication: Preliminary Results of Cetacean Sightings in the Eastern Mediterranean Sea of Turkey
Publication: It is too loud now!! a Bilingual report on "noise pollution" in Turkish waters
Conference: Award for Best Paper Presented by a Young Researcher" for our paper, "Comparisons of Acoustic Patterns of the Sperm Whale in the Ionian Sea (Central Mediterranean Sea) and the North-Western (Eastern Mediterranean Sea)" at IMEKO TC-19 International Workshop on Meteorology for the Sea

2021

Publication: Mitigating cetacean decline in the Med for IMarEST Magazine by Patrick Lyne
Publication: MAVA report about From Small Cetaceans to the Great Whales of the East
Publication: A preliminary study on marine top predators inhabiting Gökçeada Island the North Aegean Sea
Publication: Sightings and stranding reports of fin whales (Balaenoptera physalus) in the Levantine Sea
Conference: Presentation of Expeditions in the Eastern Mediterranean at the 5th ANZSCSMM Conference
Conference: Presentation of Combining Data Sources to Understand the Fine- Scale Distribution and Encounter Rates of Common Dolphins Delphius delphis in one of the busiest waterways in the world, the Istanbul Strait at The 2021 IEEE International workshop on Metrology for the Sea
Conference: Presentation of Giant Guardians of the Deep Sea at ACCOBAMS' 5th Conference
Conference: Presentation of Biodiversity of the Proposed IMMA of the Turkish Straits System at ICYMARE conference
Conference: Participation at European Cetacean Society Webinar
Conference: Participation at 5th Conference on Cetacean Conservation in South Mediterraean Countries

Acknowledgements

As DMAD-Marine Mammals Research Association, we would like to thank our volunteers who have played an important role in the growth of our association since our establishment, and all our donors for their financial support. We would like to thank the T.C. General Directorate of Nature Conservation and National Parks of the Ministry of Agriculture and Forestry for approving our work to become ture, the Setur Marinas for hosting us with their hospitality during our voyages, and the Coast Guard Group Commands in the Aegean and the entire Mediterranean region for their accessibility at any time so that we can continue our operations safely.

We owe a debt of gratitude to our esteemed teacher Prof. Dr.Bayram Öztürk for his irreplaceable guidance in the works of our association, to Assoc. Prof. Onur Gönülal and Assoc. Prof. Cem Dalyan the two esteemed scientists and most importantly our friends for their supports and contributions.

We are also grateful to WWF-Turkey and WWF-Turkey Marine and Wildlife Programme Manager Ms. Ayşe Oruç for their contribution to our association with their wise experience.

We are grateful to have many new local students forging new collaborations and helping us keep the projects going and the Turkish captains who have accepted us on their boats in recent years.

Finally, we would like to thank everyone who sent us information and photos/videos when they saw cetacean species on the Turkish coastline. This has really helped us a lot when we were unable to collect data due to COVID-19.,

Together we are DMAD

References

ACCOBAMS., 2018. ACCOBAMS Survey Initiative. http://medpan.org/accobams-survey-initiative/

Akkaya, A., Lyne, P., Schulz, X., Awbery, T., Capitain, S., Rosell, B. F., ... & Gordon, J., 2020. Preliminary results of cetacean sightings in the eastern Mediterranean Sea of Turkey. Journal of the Black Sea/Mediterranean Environment, 26(1).

Altuğ, G., Aktan, Y., Oral, M., Topaloğlu, B., Dede, A., Keskin, Ç., ... & Çiftçi, P. S., 2011. Biodiversity of the northern Aegean Sea and southern part of the Sea of Marmara, Turkey. Marine Biodiversity Records, 4.

Alan, V., Bengil, F., Kaboglu, G., & Güçlüsoy, H., 2017. The First Photo-Identification Study on Bottlenose Dolphins (Tursiops truncatus) in the Foça Special Environmental Protection Area, Turkey. Aquatic Mammals, 43(3), 302.

Alan, V., Kaboğlu, G., Akçalı, B., Bengil, F., Ubay, B., & Güçlüsoy, H., 2018. Sightings of small delphinids in the southern Çandarlı Bay (Aegean Sea) between 2015 and 2018. 24. 224-232.

Aytemiz, I., Dede, A., Danyer, E., & Tonay, A. M., 2012. Morphological identification of parasites found in the stomach contents of bycaught striped dolphins (Stenella coeruleoalba) from Turkish Eastern Mediterranean Sea coast. J. Black Sea/Mediterr, 18, 238-245.

Ballance, L. T., 2018. Cetacean ecology. In Encyclopedia of marine mammals (pp. 172-180). Academic Press.

Baş, A.A., Erdoğan, M., Ulusoy, E., Aslan, B., Kurt, M., Poot, J., Basmaci, M., Bas, E., 2018a. Marine Mammals of the North Levantine Sea. Annual Report 2016-2017, Marine Mammal Research Association (DMAD), Antalya, Turkey.

Baş, A.A., Erdoğan, M.A., Morris, N.R.C., Yeoman, K., Humphrey, O., Gaggioli, E., Roland, C., 2016b. Seasonal encounter rates and residency patterns of an unstudied population of bottlenose dolphin (Tursiops truncatus) in the northwestern Levantine Sea, Turkey. Hyla: Herpetological bulletin 2016(1): 1-13.39

Baş, A.A., Lagoa, J.C., Atchoi, E., 2016c. New records of Cuvier's beaked whales (Ziphius cavirostris) from the Turkish Levantine Sea. Turkish Journal of Zoology 40(3): 454-460.

Bearzi, G., Reeves, R. R., NOTARBARTOLO-DI-SCIARA, G. I. U. S. E. P. P. E., Politi, E., Canadas, A. N. A., Frantzis, A., & Mussi, B., 2003. Ecology, status and conservation of short-beaked common dolphins Delphinus delphis in the Mediterranean Sea. Mammal Review, 33(3-4), 224-252.

Bearzi, G., Politi, E., Agazzi, S., Bruno, S., Costa, M., & Bonizzoni, S., 2005. Occurrence and present status of coastal dolphins (Delphinus delphis and Tursiops truncatus) in the eastern Ionian Sea. Aquatic conservation: marine and Freshwater Ecosystems, 15(3), 243-257.

Bearzi, G., Fortuna, C.M. and Reeves, R.R., 2008a. Ecology and conservation of common bottlenose dolphins Tursiops truncatus in the Mediterranean Sea. *Mammal Review*, *39*(2), pp.92-123.

Bearzi, G., Agazzi, S., Bonizzoni, S., Costa, M., and Azzellino, A., 2008b. Dolphins in a bottle: abundance, residency patterns and conservation of bottlenose dolphins Tursiops truncatus in the semi-closed eutrophic Amvrakikos Gulf, Greece. Aquatic Conservation: Marine and Freshwater Ecosystems, 18(2), pp.130-146.

Boisseau, O., Lacey, C., Lewis, T., Moscrop, A., Danbolt, M., McLanaghan, R., 2010. Encounter rates of cetaceans in the Mediterranean Sea and contiguous Atlantic area. Journal of the Marine Biology Association of the United Kingdom 90(8): 1589-1599.

Braulik, G. T., Kasuga, M., Wittich, A., Kiszka, J. J., MacCaulay, J., Gillespie, D., ... & Hammond, P. S., 2018. Cetacean rapid assessment: An approach to fill knowledge gaps and target conservation across large data deficient areas. Aquatic Conservation: Marine and Freshwater Ecosystems, 28(1), 216-230.

Carpentieri, P., Corsini, M., Marini, L., 1999. Contribute to the knowledge of the presence and distribution of cetaceans in the Aegean Sea. Atti della Società italiana di scienze naturali e del museo civico di storia naturale di Milano 140(1): 65-75.

Çelik, A., Baslar, S., Guvensen, A. Y. K. U. T., & Ozturk, M., 2004. Role of national parks in Turkey-A case study from Dilek peninsula-great Menderes Delta National Park. Pakistan Journal of Botany, 35(5; SPI), 641-658.

Dede, A., 1999. Studies on the marine mammal populations in the Turkish Straits System, Thesis (PhD), Istanbul University, 62pp (Turkish).

Dede, A., Saad, A., Fakhri, M., & Öztürk, B., 2012. Cetacean sightings in the Eastern Mediterranean Sea during the cruise in summer 2008. J. Black Sea/Mediterr. Environ, 18(1), 49-57.

Drouot, V., Gannier, A., Goold, J.C., 2004. Summer social distribution of sperm whales (Physeter macrocephalus) in the Mediterranean Sea. Journal of the Marine Biological Association of the United Kingdom 84(3): 675-680.

Fernández, A., 2004. Pathological findings in stranded beaked whales during the naval military manoeuvers near the Canary Islands. ECS Newsletter, 42, 37-40.

Frantzis, A., 1998. Does acoustic testing strand whales?. Nature, 392(6671), 29-29.

Frantzis, A., Swift, R., Gillespie, D., Menhennett, C., Gordon, J., & Gialinakis, S., 1999. Sperm whale presence off southwest Crete, Greece, eastern Mediterranean. Eur Res Cet, 13, 214-217.

Frantzis, A., Alexiadou, P., Paximadis, G., Politi, E., Gannier, A. and Corsini-Foka, M., 2003. Current knowledge of the cetacean fauna of the Greek Seas. Journal of Cetacean Research and Management, 5(3), pp.219-232.

Frantzis, A., Airoldi, S., Notarbartolo di Sciara, G., Johnson, C., Mazzariol, S., 2011. Inter-basin movements of Mediterranean sperm whales provide insight into their population structure and conservation. Deep-Sea Research Part I: Oceanographic Research Papers 58(4): 454-459.

Frantzis, A., Alexiadou, P., Gkikopoulou, K. C. , 2014. Sperm whale occurrence, site fidelity and population structure along the Hellenic Trench (Greece, Mediterranean Sea). Aquatic Conservation: Marine and Freshwater Ecosystems 24(1): 83-102.

Gannier, A., & Epinat, J., 2008. Cuvier's beaked whale distribution in the Mediterranean Sea: results from small boat surveys 1996–2007. Journal of the Marine Biological Association of the United Kingdom, 88(6), 1245-1251.Giannoulaki, M., Markoglou, E., Valavanis, V. D., Alexiadou, P., Cucknell, A., & Frantzis, A., 2017. Linking small pelagic fish and cetacean distribution to model suitable habitat for coastal dolphin species, Delphinus delphis and Tursiops truncatus, in the Greek Seas (Eastern Mediterranean). Aquatic Conservation: Marine and Freshwater Ecosystems, 27(2), 436-451.

Giannoulaki, M., Markoglou, E., Valavanis, V. D., Alexiadou, P., Cucknell, A., & Frantzis, A., 2017. Linking small pelagic fish and cetacean distribution to model suitable habitat for coastal dolphin species, Delphinus delphis and Tursiops truncatus, in the Greek Seas (Eastern Mediterranean). Aquatic Conservation: Marine and Freshwater Ecosystems, 27(2), 436-451.

Goffman, O., Roditi, M., Spanierm, E., Kerem, D., Shariv, T. (2000) Mediterranean Sea. Israel Journal of Zoology 46(2): 143-147.

Heyning, J. E., & Mead, J. G., 2009. Cuvier's Beaked Whale: Ziphius cavirostris. In Encyclopedia of marine mammals (pp. 294-295). Academic Press.

IUCN, 2012. Marine mammals and sea turtles of the Mediterranean and Black Seas.

Katona, S., & Whitehead, H., 1988. Are cetacea ecologically important. Oceanogr Mar Biol Annu Rev, 26, 553-568.

Kerem, D., Hadar, N., Goffman, O., Scheinin, A., Kent, R., Boisseau, O., Schattner, U., 2012. Update on the Cetacean fauna of the Mediterranean Levantine Basin. The Open Marine Biology Journal 6(1): 9-30.

Kılıçaslan, Ç., Deniz, B., Göktug, T. H., Kara, B., & Kutsal, E., 2011. Evaluation of tourism alternatives in the national park of Dilek Peninsula Büyük Menderes delta. Procedia-Social and Behavioral Sciences, 19, 270-279.

Kinzelbach, R., 1986. The Sperm whale, Physeter macrocephalus, in the Eastern Mediterranean Sea. Zoology in the Middle East 1(1): 15-17.

Marchessaux, D., 1980. A review of the current knowledge of the cetaceans in the eastern Mediterranean Sea. Vie Marine 2(2): 59-66.

Marine Mammal Protected Area Task Force. (2021). https://www.marinemammalhabitat.org/portfolio-item/turkish-straits-system-and-prebosphoric-imma/

Matear, L., Robbins, J. R., Hale, M., & Potts, J., 2019. Cetacean biodiversity in the Bay of Biscay: suggestions for environmental protection derived from citizen science data. Marine Policy, 109, 103672.
Milani, C. B., Vella, A., Vidoris, P., Christidis, A., Koutrakis, E., Sylaios, G., ... & Özdilek, Ş. Y., 2017. Encounter rate and relative abundance of bottlenose dolphins and distribution modelling of main cetacean species in the North Aegean Sea (Greece). Encounter, 23(2).
Notarbartolo di Sciara, G. and Birkun, A., 2010. Conserving whales, dolphins and porpoises in the Mediterranean and Black Seas. *An ACCOBAMS status report-ACCOBAMS, Monaco*.
Ozturk, B., & Ozturk, A. A., 1996. On the biology of the Turkish straits system. Bull Inst Oceanogr, 17, 205-21.
Öztürk, B., Öztürk, A.A., 1998. Cetacean strandings in the Aegean and Mediterranean coasts of Turkey. Rapp Comm int Mer Medit 35: 476-477.
Öztürk, B., Öztürk, A.A., Dede, A., 2001. Dolphin bycatch in the swordfish driftnet fishery in the Aegean Sea. Rapp Comm int Mer Medit 36: 308.
Öztürk, A.A., Tonay, A., Dede, A., 2011. Strandings of beaked whales, Risso's dolphins, and a minke whale on the Turkish Coast of the Eastern Mediterranean Sea. Journal of Black Sea/Mediterranean Environment 17(3): 269-274. 45
Öztürk, A.A., Tonay, A.M., Dede, A., 2013. Sperm whale (Physeter macrocephalus) sightings in the Aegean and Mediterranean part of Turkish waters. Journal of the Black Sea/Mediterranean Environment 19: 169-177.
Parsons, E. C. M., Baulch, S., Bechshoft, T., Bellazzi, G., Bouchet, P., Cosentino, A. M., ... & Sutherland, W. J., 2015. Key research questions of global importance for cetacean conservation. Endangered Species Research, 27(2), 113-118.
Romero, A., & Keith, E. O. (Eds.)., 2012. New approaches to the study of marine mammals. BoD–Books on Demand.
Ryan, C., Romagosa, M., Boisseau, O., Cucknell, A. C., Frantzis, A., Moscrop, A., McLanaghan. R., 2013. Cruise report for a visual and acoustic survey for marine mammals of the Aegean Sea and Levantine Sea, Eastern Mediterranean conducted from R/V song of the whale July to September 2013. Report to the International Fund for Animal Welfare, September, pp. 53.
Ryan, C., Cucknell, A.C., Romagosa, M., Boisseau, O., Moscrop, A., Frantzis, A., McLanaghan, R., 2014. A visual and acoustic survey for marine mammals in the eastern Mediterranean Sea during summer 2013. Unpublished report to the International Fund for Animal Welfare, Marine Conservation Research International, Kelvedon, UK.
Santostasi, N. L., Bonizzoni, S., Bearzi, G., Eddy, L., & Gimenez, O., 2016. A robust design capture-recapture analysis of abundance, survival and temporary emigration of three Odontocete species in the Gulf of Corinth, Greece. PloS one, 11(12), e0166650.

Sergio, F., Caro, T., Brown, D., Clucas, B., Hunter, J., Ketchum, J., ... & Hiraldo, F., 2008. Top predators as conservation tools: ecological rationale, assumptions, and efficacy. Annual review of ecology, evolution, and systematics, 39, 1-19.

Soto, N. A., Johnson, M., Madsen, P. T., Tyack, P. L., Bocconcelli, A., & Borsani, J. F., 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (Ziphius cavirostris)?. Marine Mammal Science, 22(3), 690-699.

TC Kültür ve Turizm bakanlığı Yatırım ve İşletmeler Genel Müdürlüğü, istatistik bültenleri 2015-2020. https://yigm.ktb.gov.tr/TR-249709/yillik-bultenler.html

Tezel, R., 1958. About the dolphins which we don't see anymore in the Bosphorus. Balık ve Balıkçılık, 6(3), 12-14.

Vahit, A. L. A. N., Bengil, F., Kaboglu, G., & Güçlüsoy, H., 2014. Preliminary results on the status of bottlenose dolphin (Tursiops truncatus Montagu, 1821) in the Izmir Bay, Turkey.

Annual Report

2021

dmadfornature

DMADforNATURE

www.dmad.org.tr

DMAD

Marine Mammals Research Association