

## REPORT ON THE CONSERVATION STATUS OF CETACEANS AND RELEVANT ACTIVITIES IN CENTRAL MEDITERRANEAN

### Introduction

*The aim of this report is to give a global vision of what occurred in the Region, regarding cetacean conservation, since the previous report, and what is important to address for the next period/in a near future. So the regional representative will synthesize the main studies (species, topics) led in the region, concerning research, monitoring and conservation, also the main “hot” topics or threats that need to be addressed and what is awaited from the Scientific Committee (and ACCOBAMS) for the next triennium as recommendations.*

### Countries of Central Mediterranean region

Albania, Croatia, Greece (western coast), Italy (Adriatic coast), Libya, Malta, Montenegro, Slovenia, Tunisia (eastern coast).

### **Overview of activities in the Region since the previous report:**

<b>Albania:</b>	There are no known specific studies on cetaceans in the Albanian waters at present time.
<b>Croatia:</b>	<ul style="list-style-type: none"> <li>• Continuous monitoring and photo-ID study of common bottlenose dolphins is being carried out in all six N2K sites in Croatia dedicated to this species, where also biopsy samples are collected.</li> <li>• Aerial surveys were carried out in 2021 and 2022 on the whole Adriatic, in collaboration with Italy.</li> <li>• A year-round acoustic monitoring is being carried out in the south Adriatic.</li> <li>• Targeted surveys focusing on a possible re-colonization of central Adriatic by common dolphins, which was considered regionally extinct, are being carried out.</li> <li>• Studies on dolphin-fisheries interaction mitigation in northern Adriatic are carried out as part of LIFE Delfi project (<a href="https://lifedelfi.eu/">https://lifedelfi.eu/</a>).</li> <li>• A Citizen science programme via the Marine Ranger website (<a href="http://www.marine-ranger.org">www.marine-ranger.org</a>) and mobile app continues providing relevant data on Cetacean observations in the Adriatic and Mediterranean.</li> <li>• Data on stranded animals is being regularly collected.</li> </ul>
<b>Greece (Western coast):</b>	<ul style="list-style-type: none"> <li>• Ongoing studies are carried out in the Ionian Sea archipelago, the Gulf of Ambracia, the Gulf of Corinth and along the Hellenic Trench, via boat surveys, photo-identification, biopsy sampling, acoustic surveys and aerial photogrammetry, focusing primarily on common bottlenose dolphins, common dolphins, striped dolphins, sperm whales and Cuvier’s beaked whales.</li> <li>• Fixed-line ferry-based surveys are ongoing in the ferry lines connecting Italy and Greece.</li> </ul>
<b>Italy (Adriatic coast):</b>	<ul style="list-style-type: none"> <li>• Aerial surveys were carried out in 2021 and 2022 on the whole Adriatic, in collaboration with Croatia and in 2021 in the Sicily strait, Gulf of Taranto and Ionian sea.</li> <li>• Monitoring activities under the MSFD for criterion D1C1: Fishery On-board observations and interviews on bycatch of protected species and species of conservation concern: GSA 17, 18.</li> <li>• Continuous boat-based and photo-identification studies are ongoing in the Friuli Venezia Giulia, Veneto and the Gulf of Taranto, focusing primarily on common bottlenose dolphins and Risso’s dolphins, focusing on population abundance, behaviour, interaction with fisheries, distribution and habitat use.</li> <li>• Fixed-line ferry-based surveys are ongoing in the ferry lines connecting Italy and Greece. Collection and necropsies of stranded animals is carried out along the entire Italian coast of the Adriatic Sea.</li> </ul>
<b>Libya:</b>	No activities related to cetacean research and conservation are currently known to be carried out.
<b>Malta:</b>	Data on cetaceans is collected via examination of stranded animals and boat-based surveys.
<b>Montenegro:</b>	Photo-ID and land-based research is carried out in south Montenegro. Opportunistic information on sightings and strandings are also collected.
<b>Slovenia:</b>	<ul style="list-style-type: none"> <li>• Continuous year-round research and monitoring of common bottlenose dolphins is carried out in the Gulf of Trieste and surrounding waters of the northern Adriatic Sea, via land-based and boat-based surveys, photo-identification and mark-recapture, biopsy sampling, passive acoustic monitoring, underwater noise monitoring, and the use of unmanned aerial vehicles (UAVs), focusing on population dynamics, social structure, behaviour, habitat use, interactions with fisheries, foraging ecology, chemical pollutants and body condition.</li> <li>• Data on other cetacean species occurring in the area occasionally, such as common dolphins and fin whales, is also collected.</li> <li>• Necropsies are carried out on all reported stranded and bycaught animals.</li> </ul>
<b>Tunisia (Eastern coast):</b>	Boat-based surveys with photo-identification are carried out in various parts of Tunisian waters, with recent studies focusing also on dolphin-fishery interactions, using passive acoustic monitoring.

### **Major issue(s) or main threats or “hot” topics that have emerged during the said period for the Region:**

<b>Albania:</b>	NR: No major special problem for cetaceans during the last two years in the region. Incidental by-catch is reported occasionally by fishermen.
<b>Croatia:</b>	None given in the NR
<b>Greece (Western coast):</b>	None given in the NR

<b>Italy (Adriatic coast):</b>	None given in the NR
<b>Libya:</b>	NR: There has been no major special problem for cetaceans during the last two years in the region
<b>Malta:</b>	Noise, collision and marine litter.
<b>Montenegro:</b>	Strategy on the Conservation of Cetaceans in the Adriatic Sea for the period 2016 - 2025 - recognize threats and their impacts on cetaceans in the Adriatic Sea. To date when Strategy was developed (2015), eight types of threats have been identified, with bycatch and marine debris being assessed as the most significant ones in terms of severity of impacts and number of cetacean species they may affect. However, it should be stressed that assumptions were given based on scarce data about actual impact. For instance, existing stranding data indicates relevance of bycatch, but do not show the accurate state. The significance of climate change is least known, but due to geographical features of the Adriatic, it expected this is an important issue to tackle in the future.
<b>Slovenia:</b>	<ul style="list-style-type: none"> <li>Recent assessments suggests that bycatch levels of common bottlenose dolphins are higher than previously thought.</li> <li>Plans for a new hydroplane landing strip in Piran Bay, a known important feeding area for the local bottlenose dolphin population, is a cause for concern.</li> <li>Dredging and mud-depositing plans off Koper are also cause for concern.</li> </ul>
<b>Tunisia (Eastern coast):</b>	<ul style="list-style-type: none"> <li>The existing data on abundance and density are very old (INSTM-2005 campaign) and also geographically limited (ASI-2018).</li> <li>In Tunisia, like most countries in the Mediterranean, the threats to cetaceans are generally linked to the concentration of human activities and mainly to fishing activity.</li> <li>Dolphins are now considered by professional fishermen as real competitors for access to fishery resources, hence the problems of depredation, bycatch and stranding.</li> </ul>

**Recommendations/suggestions for Improvement of the conservation [freely based on National Reports and RRs view]:**

<b>Albania:</b>	<ul style="list-style-type: none"> <li>Training activities for the capacity building, in particular necropsy for veterinarians is a necessity. National stranding network to be established as soon as possible. So far only incidental cases of stranding are reported by fishermen.</li> <li>The national plan for cetaceans' conservation is elaborated in 2006 initially and has been implemented through some pilot actions after that. There is a need for its revision and updated since it is more than 10 years of its preparation. Centre for Fauna and Flora Research (under the Faculty of Natural Sciences) in the framework of the annual monitoring projects, coordinated by National Environment Agency of Albania, is involved in the monitoring of cetacean species. However, due to the limited funds the monitoring is not comprehensive, and it does not cover all cetaceans' species</li> </ul>
<b>Croatia:</b>	<ul style="list-style-type: none"> <li>Bycatch particularly in set nets and interactions with fisheries present main cause of concern as issues are steadily increasing but without being properly addressed. National monitoring in place fails to identify any bycatch although incidental reports in the media and necropsies reports it occurs possibly at worrying levels. Therefore, obtaining trustworthy data from collecting scheme and addressing the bycatch issue should be of priority.</li> <li>In addition, dolphin watching in many coastal areas is becoming main tourist attraction but there is no regulation and monitoring in place that could prevent or identify (long-term) effects on populations. Further actions addressing this issue are recommended.</li> </ul>
<b>Greece (Western coast):</b>	NA
<b>Italy (Adriatic coast):</b>	<ul style="list-style-type: none"> <li>Impact assessment of studies using potentially invasive techniques, including skin biopsy and satellite telemetry.</li> </ul>
<b>Libya:</b>	<ul style="list-style-type: none"> <li>To continue providing capacity building in terms of national stranding networks, including gathering equipment, necropsy training for veterinarians, setting up a tissue bank and evaluating the functioning of the stranding networks.</li> <li>To organise passive acoustic training and MMO-PAM training.</li> </ul>
<b>Malta:</b>	<ul style="list-style-type: none"> <li>Noting that impacts from marine litter, underwater noise and ship strikes are omnipresent throughout the Mediterranean, it is deemed pertinent to continue providing capacity building regarding common methodologies for assessment of such impacts.</li> <li>To continue providing capacity building in terms of national stranding networks, including gathering equipment, necropsy training for veterinarians, setting up a tissue bank and evaluating the functioning of the stranding networks.</li> <li>To organise passive acoustic training.</li> </ul>
<b>Montenegro:</b>	<ul style="list-style-type: none"> <li>To continue providing capacity building in terms of national stranding networks, including gathering equipment, necropsy training for veterinarians, setting up a tissue bank and evaluating the functioning of the stranding networks.</li> <li>Also support training on MMO-PAM is of high relevance.</li> <li>Support to the development of Management plan for Cetaceans would be also very welcome.</li> </ul>
<b>Slovenia:</b>	<ul style="list-style-type: none"> <li>Expansion of existing MPAs (process currently ongoing).</li> <li>Improved funding of cetacean research and conservation programmes.</li> </ul>
<b>Tunisia (Eastern coast):</b>	<ul style="list-style-type: none"> <li>The realization of monitoring campaigns all along the Tunisian coasts.</li> <li>Standardization of observation technique and data analysis.</li> <li>Identification of IMMA and CCH areas.</li> </ul>

**Published papers in 2022-2023 relevant to the Central Mediterranean**

**SPECIES CONSERVATION STATUS**

- ⇒ Bearzi, G., Bonizzoni, S. & Santostasi, N.L. 2022. *Stenella coeruleoalba* (Gulf of Corinth subpopulation). The IUCN Red List of Threatened Species 2022: e.T210188066A210188619. <https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T210188066A210188619.en>.
- ⇒ Bearzi, G., T. Genov, A. Natoli, J. Gonzalvo, & G. J. Pierce. 2021. *Delphinus delphis* (Inner Mediterranean subpopulation). The IUCN Red List of Threatened Species: e.T189865869A189865884. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T189865869A189865884.en>.

- ⇒ Cañadas, A. & Notarbartolo di Sciarra, G. 2018. *Ziphius cavirostris* (Mediterranean subpopulation) (errata version published in 2021). *The IUCN Red List of Threatened Species* 2018: e.T16381144A199549199. <https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T16381144A199549199.en>.
- ⇒ Gauffier, P. & Verborgh, P. 2021. *Globicephala melas* (Inner Mediterranean subpopulation). *The IUCN Red List of Threatened Species* 2021: e.T198785664A198787672. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T198785664A198787672.en>.
- ⇒ Gonzalvo, J. & Notarbartolo di Sciarra, G. 2021. *Tursiops truncatus* (Gulf of Ambracia subpopulation). *The IUCN Red List of Threatened Species* 2021: e.T181208820A181210985. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T181208820A181210985.en>.
- ⇒ Lanfredi, C., Arcangeli, A., David, L., Holcer, D., Rosso, M. & Natoli, A. 2022. *Grampus griseus* (Mediterranean subpopulation) (errata version published in 2022). *The IUCN Red List of Threatened Species* 2022: e.T16378423A210404051.
- ⇒ Lauriano, G. 2022. *Stenella coeruleoalba* (Mediterranean subpopulation) (errata version published in 2022). *The IUCN Red List of Threatened Species* 2022: e.T16674437A210833690.
- ⇒ Natoli, A., Genov, T., Kerem, D., Gonzalvo, J., Lauriano, G., Holcer, D., Labach, H., Marsili, L., Mazzariol, S., Moura, A.E., Öztürk, A.A., Pardalou, A., Tonay, A.M., Verborgh, P. & Fortuna, C. 2021. *Tursiops truncatus* (Mediterranean subpopulation) (errata version published in 2022). *The IUCN Red List of Threatened Species* 2021: e.T16369383A215248781.
- ⇒ Panigada, S., Gauffier, P. & Notarbartolo di Sciarra, G. 2021. *Balaenoptera physalus* (Mediterranean subpopulation). *The IUCN Red List of Threatened Species* 2021: e.T16208224A50387979. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T16208224A50387979.en>.
- ⇒ Pirotta, E., Carpinelli, E., Frantzis, A., Gauffier, P., Lanfredi, C., Pace, D.S. & Rendell, L.E. 2021. *Physeter macrocephalus* (Mediterranean subpopulation). *The IUCN Red List of Threatened Species* 2021: e.T16370739A50285671. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T16370739A50285671.en>.

#### INTERACTIONS BETWEEN FISHERIES/AQUACULTURE AND DOLPHINS

- ⇒ Benmessaoud, R., Gharbi, M., Cherif, M., Koched, W., Ben Nakhla, L. 2023. Overview of Bottlenose dolphin depredation in Teboulba region (East of Tunisia). *INSTM Bull.* 48:23-36. <http://hdl.handle.net/1834/42575>  
**ABSTRACT:** This work was carried out in response to the numerous fishermen claims following to the interaction between dolphins and fishing gears along the coast of Teboulba. The aims of this work were: to establish an inventory of dolphins present in the study area and interacting with fisheries, to define the most affected fisheries by the depredation and to attempt to assess its economic consequences. For this purpose, field surveys as well as weekly monitoring of a sample of the fleet and sea trips were carried out in order to respond to the previously mentioned objectives. The findings of this study led to the conclusion that there are two dolphin species: the Bottlenose dolphin and the Striped dolphin. These two species have a different demographic and ecological distribution. They also interact in two different ways with the fishing boats and their nets. According to the surveys, the most depredated fisheries is the small scale fisheries. Set gillnet and trammel nets were the types of the fishing gear most vulnerable to dolphin depredation. The depredation rate and economical loss due to depredation vary slightly between gillnets and trammel nets. The depredation induces many holes with different size requiring mending operations that can be onerous. Likewise for landing, the resulting bites on the catch leave it unsealable. It is necessary to continue this study in order to identify the factors that can cause the depredation and propose mitigation measures to avoid any ecological and economic blunder.
- ⇒ Bonizzoni, S., Gramolini, R., Furey, N.B., Bearzi, G. 2023. Bottlenose dolphin distribution in a Mediterranean area exposed to intensive trawling. *Marine Environmental Research* 188:105993. <https://doi.org/10.1016/j.marenvres.2023.105993>  
**ABSTRACT:** The Adriatic Sea is one of the areas most exposed to trawling, worldwide. We used four years (2018–2021) and 19,887 km of survey data to investigate factors influencing daylight dolphin distribution in its north-western sector, where common bottlenose dolphins *Tursiops truncatus* routinely follow fishing trawlers. We validated Automatic Identification System information on the position, type and activity of three types of trawlers based on observations from boats, and incorporated this information in a GAM-GEE modelling framework, together with physiographic, biological and anthropogenic variables. Along with bottom depth, trawlers (particularly otter and midwater trawlers) appeared to be important drivers of dolphin distribution, with dolphins foraging and scavenging behind trawlers during 39.3% of total observation time in trawling days. The spatial dimension of dolphin adaptations to intensive trawling, including distribution shifts between days with and without trawling, sheds light on the magnitude of ecological change driven by the trawl fishery.
- ⇒ Bonizzoni, S., Hamilton, S., Reeves, R.R., Genov, T., Bearzi, G. 2022. Odontocete cetaceans foraging behind trawlers, worldwide. *Reviews in Fish Biology and Fisheries* 32:827-877. <https://doi.org/10.1007/s11160-022-09712-z>  
**ABSTRACT:** Several populations of odontocete cetaceans, including at least 19 species, have modified their behavior and adapted to foraging in association with trawlers. We review information on odontocete interactions with different types of trawlers across 13 Food and Agriculture Organization fishing areas around the world. We also review knowledge gaps, the effects on odontocete ecology, distribution, behavior and social organization, the main mitigation options, and some management avenues that could help reduce incidental mortality. Trawlers involved in the interactions varied greatly in gear and target species, implying odontocetes have developed behavioral specializations to forage under a variety of conditions. Specialized behavior included venturing into a moving trawl net to feed on the organisms trapped in the net, feeding on fish stirred up by the net, extracting fish from the outer mesh, feeding on catch lost during hauling, and scavenging on discarded catch. Foraging behind trawlers facilitates access to prey, and in some instances may compensate for scarcity of natural prey within areas exposed to intensive fishing or environmental degradation. This opportunistic foraging strategy, however, exposes the animals to potential harm and mortality in trawl gear. The combined effect of facilitated foraging and bycatch on the status and trends of odontocete populations is unknown. The economic damage caused by odontocetes, e.g. in terms of loss of marketable catch and gear damage, remains largely conjectural. Attempts to reduce depredation and/or bycatch in trawl gear have included acoustic deterrents and exclusion devices installed in nets, although neither technique has proven to be consistently effective.
- ⇒ Bonizzoni, S., Genov, T., Bearzi, G. 2023. Bottlenose dolphins share fish farm areas while maintaining sexual segregation: Investigating group memberships through spatially and temporally explicit parameters. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 33(1):70-88. <https://doi.org/10.1002/aqc.3908>  
**ABSTRACT:** Group membership is a key attribute of animal societies and central to the study of social structure in several taxa. However, social structure analyses are sensitive to the way data are collected and associations defined. In this study, a time–space method was used to investigate the social structure of common bottlenose dolphins *Tursiops truncatus* observed and photographed across 7 years in the semi-enclosed Gulf of Corinth, Greece. Instead of adopting traditional group definitions, individuals were considered as being members of the same group if photographed within a specific time and space window. This approach can be applied post hoc across studies and can offer advantages under challenging sampling conditions (e.g. when dealing with groups spread over vast areas or when group membership is otherwise hard to assess). Dolphins were mostly found around coastal cage aquaculture facilities farming European sea bass *Dicentrarchus labrax* and gilthead seabream *Sparus aurata*. Dolphins formed clusters largely or entirely composed of individuals of the same sex, suggestive of sex-based homophily. Habitat partitioning was not detected: there was substantial spatial overlap among dolphin clusters, with all individuals using a relatively small area in the northern portion of the Gulf, where most of the productive fish farms were located. Associations between females were stronger than those between males, and daughters tended to stay in the group of their mothers. Sex-based social clustering may allow females and calves to limit interactions with potentially aggressive males, while individuals of both sexes benefit from prey concentrated around fish farms. Adaptation to foraging around farms can result in trade-offs between the costs and benefits of nourishment and social interaction. This may have both positive or negative effects on the animals that should be considered in the context of ensuring their favourable conservation status.
- ⇒ Laspina, M., Terribile, K., Said, A. 2022. Interactions Between Cetaceans and Small-scale Fisheries Around the Central Mediterranean Maltese Islands. *MCAST Journal of Applied Research & Practice* 6(2):113-126.  
**ABSTRACT:** Cetacean depredation poses threats to both the socio-economic viability of fisheries as well as species conservation. This study is based in the Maltese islands where the fishing sector has always been of a small-scale nature, with 93% of vessels being under 12 metres in length. Maltese fishers engage in small-scale fishing utilizing a variety of artisanal fishing gear, including surface longlines, which are mainly used to target swordfish and tuna; bottom-longlines; trammel nets and entangling nets, which are used to target groupers, various species of bream, red snappers and red porgies; and pots and traps which are generally used to capture octopus and bogue. This study,

which aimed to analyse fishers' perception with respect to interaction occurrence between small-scale fisheries and cetaceans in Maltese waters, found that fishers claim that dolphin presence has increased in the past five years, particularly in the vicinity of bluefin tuna, seabream, and seabass fish farms locations. While the use of trammel nets remains by far the most popular gear type employed by Maltese fishers, this study showed that around 33% of the fishing gear deployed in the past year suffered damages. It is therefore essential that proper monitoring is carried out in order to assess the factors that drive the interactions and the impact of dolphin depredation on the fishing sector. New prevention and mitigation measures are proposed. This study provides first-hand insights which will aid in the execution of local fisheries management plans and, subsequently, ecosystem-based fisheries management.

- ⇒ Li Veli, D., Petetta, A., Barone, G., Ceciari, I., Franchi, E., Marsili, L., Pietroluongo, G., Mazzoldi, C., Holcer, D., D'Argenio, S., et al. 2023. Fishers' Perception on the Interaction between Dolphins and Fishing Activities in Italian and Croatian Waters. *Diversity*, 15:133. <https://doi.org/10.3390/d15020133>

**ABSTRACT:** Interactions between fishing and dolphins can be detrimental, since on one hand dolphins can be lethally entangled by nets and trawls, and on the other dolphins can predate fish caught by nets. For dolphins, this interaction can be dangerous as they can be wounded or accidentally killed; for fishers, the predation of their catch results in economic losses due to reduced quantity and/or quality of catches and damage to fishing gear. During July and November 2020, we surveyed the "dolphin-fisheries conflict" through compiling 209 fisher interviews from nine locations in Italy and Croatia. Fishers mentioned the common bottlenose dolphin (*Tursiops truncatus*) as the species primarily interacting with fishing, with the major issue being catch damage by predation. The interaction probability varied among gears and seasons, with some fishing activities (e.g., passive nets) more affected than others (e.g., bottom trawls), especially in terms of economic loss (1000–10,000 €/year on average). More than 70% of the fishers claimed that dolphin populations have increased over the last 10 years, in different degrees and based on different areas. Dolphin bycatch rates are generally low; however, 34.6% of respondents reported having captured at least one dolphin during their career. The fishers' attitude towards acoustic deterrents ("pingers") as a mitigation measure revealed that few of them were aware of these devices or were using them.

- ⇒ Terranova, F., Raffa, A., Florida, S., Monaco, C., Favaro, L. Vocal Behaviour of a Bottlenose Dolphin Pod during a Deadly Bycatch Event in the Gulf of Catania, Ionian Sea. *J. Mar. Sci. Eng.* 2022, 10, 616. <https://doi.org/10.3390/jmse10050616>

**ABSTRACT:** Cetacean bycatch is increasing worldwide and poses a threat to the conservation of several dolphins. The bottlenose dolphin (*Tursiops truncatus*) is frequently involved in bycatch incidents, due to its coastal distribution and opportunistic behaviour. The acoustic behaviour of cetaceans during death-related events is a largely unexplored topic. During an acoustic monitoring survey of the bottlenose dolphin population inhabiting the Gulf of Catania (Ionian Sea), we documented the entangling and subsequent death of a sub-adult male in a fishing net. Here, we provide a detailed analysis of the vocal behaviour of the pod of bottlenose dolphins during the event. We identified a total of 720 vocalisations in a timespan of 138 min, including 436 signature whistles, 51 non-signature whistles, and 233 burst pulses. We recorded high vocal activity, with a peak characterised by emission rates of 36 signature whistles per minute and 70 burst pulses per minute. Although future studies are required, our results show massive vocal activity during net entangling, characterised by a significant emission of signature whistles and burst pulses, including bray series of gulps and squeaks. Therefore, we suggest that developing tools for automatically detecting the peaks of these sound types could be helpful in recognising bycatch events, in order to better quantify the impact of professional fishing on small cetaceans.

#### POPULATION STRUCTURE, UNIT-TO-CONSERVE

- ⇒ Akkaya, A., Awbery, T., Medcalf, K., Lyne, P., Cipriano, G., Alvarenga, M., I'srapilova, L., Atalan, Y., Eikelenboom, O., Ricci, P., Crugliano, R., Papale, E., Fanizza, C., Carlucci, R. 2023. Initial results on the variation of whistle characteristics of bottlenose dolphins from two neighbouring regions of the Mediterranean Sea: Northern Ionian and Southern Adriatic Sea. *Front. Mar. Sci.* 10:1099576. doi: 10.3389/fmars.2023.1099576.

**ABSTRACT:** Bottlenose dolphins have a complex vocal repertoire that varies depending on behavioral context, social structure, group composition, and anthropogenic pressures. This current study describes the whistle characteristics of bottlenose dolphins for the first time in the South Adriatic Sea while assessing the potential differences between whistle characteristics of geographically separated dolphins within neighbouring waters of the North Ionian Sea. The results show that whistle characteristics were similar between Taranto Gulf (Italy) and Boka Bay (Montenegro), despite their spatial differences. The mean peak frequency was 10kHz for each study location while the mean minimum and maximum frequency ranged from 7 to 14kHz. The average duration of whistles was 500 milliseconds. These results share similarities with previous literature, although several studies reported slightly different mean peak frequencies, ranging up to 15kHz in the neighbouring waters of Croatia and Italy. Further, harmonics were produced and formed in 40% of the whistles in Taranto Gulf and 30% of the whistles in Boka Bay. A high incidence of harmonics has previously been associated with behavioral states (i.e., travelling) and with certain types of marine traffic (i.e., fishing vessels). Therefore, it is important to collect simultaneous data on the visual behavior of the focal group as well as document the type and density of marine traffic within the proximity of the dolphins to have an in-depth understanding of vocal behavior. Despite the similarities of whistle characteristics of Taranto and Boka Bay, the whistle contours showed notable variations. Upsweep whistles were the most regularly produced whistle type in each location, which coincides with previous studies in the Mediterranean Sea. However, the least produced whistle had a concave contour in Taranto and was flat in Boka Bay. Previous studies have confirmed that flat whistles account for the least produced whistle contour in the Mediterranean Basin. Examining the whistle characteristics and the variation in whistle contours provides an in-depth understanding of the behavioral complexity as well as its plasticity in the presence of pressure. Therefore, future studies need to include behavior, group composition, noise levels, and human presence to enable an effective understanding of variation in whistle characteristics of bottlenose dolphins.

- ⇒ Antonacci, R., Linguiti, G., Paradiso, F., Scalone, C., Fanizza, C., Ciani, E., Cipriano, G., Ciccicarese, S., Carlucci, R. 2023. Mitochondrial DNA diversity and genetic structure of striped dolphin *Stenella coeruleoalba* in the Northern Ionian Sea. *Front. Mar. Sci.* 10:1088598. doi: 10.3389/fmars.2023.1088598

**ABSTRACT:** In the framework of global and EU policies focused on stopping the loss of biodiversity process, deepening the genetic variability, especially of populations species identified as threatened, is crucial for defining conservation units and developing appropriate conservation strategies. This is more urgent for cetacean species in the Mediterranean because they assume a key ecological role in the marine food web and are severely affected by numerous and different anthropogenic pressures. This study aims to increase information on the genetic variability of striped dolphin in the Northern Ionian Sea by investigating the population structure, phylogenetic relationships and phylogeographic patterns using two mtDNA markers. From October 2020 to August 2021, a total of 88 skin tissue samples were collected from free-ranging dolphins in the Gulf of Taranto by applying the non-invasive technique of skin swabbing. An acceptable amount of DNA was extracted from 86 samples and used for subsequent genetic analysis conducted on the partial sequences of 421 and 704 bp in length of the cytb gene and D-loop control region, respectively. In addition, the sequences of the two mtDNA markers were joined together to compose a mtDNA concatenated sequence of 1125 bp for each sampled dolphin in order to investigate the genetic variability of the species population in the study area. Genetic analysis highlighted a low nucleotide diversity and high haplotypic diversity of the striped dolphin of the Gulf of Taranto, suggesting a population in rapid expansion after a period of reduction in size and diversity of the initial population. The phylogenetic analyses revealed the presence of at least two different lineages of *Stenella coeruleoalba* in the Mediterranean Sea, one specific to the Northern Ionian Sea and one shared with the Mediterranean population, confirming results already obtained for the local unit in the Gulf of Taranto. The results point out a potential problem of hybridization between striped and common dolphins which needs to be further investigated. Therefore, increasing the analysis of several markers may increase understanding of the genetic diversity of the population in the Ionian Sea and represent a useful tool to support the implementation of future effective conservation measures.

- ⇒ Gaspari, S., Dooley, C., Shreves, K., Silva, C.S.E., Chapman, N., Genov, T., Gonzalvo, J., Holcer, D., Moura, A.E. 2023. Connectivity patterns of bottlenose dolphins (*Tursiops truncatus*) in the north-east Mediterranean: implications for local conservation. *Research Square*, <https://doi.org/10.21203/rs.3.rs-2616749/v1>

**ABSTRACT:** Accurate description of population structure and genetic connectivity is essential for efficient conservation efforts. Along the European coastline, *Tursiops truncatus* typically shows high site fidelity to relatively small areas, often semi-enclosed waters, but patterns of genetic connectivity among such areas are often poorly understood. In this study, we investigate the patterns of genetic structure and connectivity of *Tursiops truncatus* in the Adriatic Sea and contiguous Mediterranean, where photo-ID studies suggest the occurrence of local 'resident communities', and a complex pattern of geographic population structure has previously been suggested. Our results are consistent with the occurrence of communities with high site fidelity to the Gulf of Ambracia, Croatian island systems and the Gulf of Trieste. Dolphins in this region do not fit a model of complete panmixia, but neither do they exhibit multiple discrete population units. Even for the community in the Gulf of Ambracia, which is well separated by several population genetic estimates, we can unambiguously identify individual dispersal to the most distant area in the Northern Adriatic Sea. We suggest that the population

structure patterns in these animals might be best described as a stable metapopulation and discuss the implications of such a model for regional conservation efforts. The critically endangered Ambracian sub-population is particularly well differentiated and is therefore at high risk of local extinction due to relatively small size, high degree of isolation and exposure to several anthropogenic pressures. The exact geographic boundaries of individual sub-populations cannot always be determined due to lack of sampling and low resolution of the methods used. Nevertheless, our results have important implications for effective conservation of local communities showing strong site fidelity.

- ⇒ Genov, T., Železnik, J., Bruno, C., Ascheri, D., Fontanesi, E., Blasi, M. F. 2022. The longest recorded movement of an inshore common bottlenose dolphin (*Tursiops truncatus*). *Mammalian Biology* 102:1469–1481 <https://doi.org/10.1007/s42991-022-00316-5>  
**ABSTRACT:** Information on movements and connectivity among populations of animals is important for the delineation of units to conserve, so that demographic parameters, such as abundance, fecundity and mortality, can be placed in an appropriate population and conservation context. Common bottlenose dolphins (*Tursiops truncatus*) are often considered relatively 'resident' and demonstrating strong site fidelity to specific areas. However, this perception may partly be an artefact of the distribution and 'habitat use' of cetacean researchers, rather than animals themselves, and bottlenose dolphins have been shown to be capable of substantial movements, often in relatively short periods of time. Here, we report on two long-distance movements of a common bottlenose dolphin within the Mediterranean Sea, across the Tyrrhenian, Ionian and Adriatic Seas, and subsequently back across all three seas to Ligurian Sea, making these the two longest recorded movements for this species in the Mediterranean Sea to date and some of the longest in the world. We also review published records of long-distance movements in this species worldwide. This study highlights the utility of photo-identification and the importance of regional data sharing. We argue that photo-identification comparisons are always worthwhile and the results are informative regardless of the presence or absence of matches, especially with the ongoing advances in automated matching software.
- ⇒ Gnone, G., Bellingeri, M., Molinari, Y., Dhermain, F., Labach, H., Díaz López, B., David, L., Di Meglio, N., Azzinari, G., Azzinari, C., et al. 2022. The Seabed Makes the Dolphins: Physiographic Features Shape the Size and Structure of the Bottlenose Dolphin Geographical Units. *J. Mar. Sci. Eng.*, 10:1036. <https://doi.org/10.3390/jmse10081036>  
**ABSTRACT:** The common bottlenose dolphin (*Tursiops truncatus*) is a cosmopolitan delphinid, regularly present in the Mediterranean Sea. According to previous studies, this dolphin tends to form resident geographical units scattered on the continental shelf. We investigated how the physiographic characteristics of the area of residence, with special reference to the size and shape of the continental shelf, affect the home range and the group size of the local units. We analysed and compared data collected between 2004–2016 by 15 research groups operating in different study areas of the Mediterranean Sea: the Alboran Sea, in the South-Western Mediterranean, the Gulf of Lion and the Pelagos Sanctuary for the marine mammals, in the North-Western Mediterranean, and the Gulf of Ambracia, in the North-Central Mediterranean Sea. We have found that in areas characterised by a wide continental platform, dolphins have wider home ranges and aggregate into larger groups. In areas characterized by a narrow continental platform, dolphins show much smaller home ranges and aggregate into smaller groups. The results obtained from this collective research effort highlight the importance of data sharing to improve our scientific knowledge in the field of cetaceans and beyond.
- ⇒ Maio, N., Fioravanti, T., Latini, L., Petraccioli, A., Mezzasalma, M., Cozzi, B., Mazzariol, S., Podestà, M., Insacco, G., Pollaro, F., et al. 2023. Life History Traits of Sperm Whales *Physeter macrocephalus* Linnaeus, 1758 Stranded along Italian Coasts (Cetartiodactyla: Physeteridae). *Animals*, 13, 79. <https://doi.org/10.3390/ani13010079>  
**ABSTRACT:** We investigated the relationship between age and body length, and age at sexual maturity of *Physeter macrocephalus* individuals stranded along the Italian coast. Our molecular analysis shows that all our samples belong to the C.001.002 haplotype, shared between Atlantic and Mediterranean populations. We show that males attain sexual maturity at 10 years, similar to those from other marine areas. However, considering the same body length class, Mediterranean males are older than Atlantic ones. Our finding of a Mediterranean pregnant female of only 6.5 m in length and an assessed age of 24–26 years is particularly noteworthy, considering that females reach sexual maturity at about 9 years and 9 m of total length in other regions. Comparing our results with the literature data, we highlight the positive correlation between lifespan, adult body length and weight of males from the Mediterranean and Atlantic Ocean. Regardless of whether the relatively small size of Mediterranean specimens is a consequence of an inbreeding depression or an adaptation to less favorable trophic conditions, we recommend to closely monitor this population from a conservation perspective. In fact, its low genetic diversity likely corresponds to a relatively limited ability to respond to environmental changes compared with other populations.
- ⇒ Violi, B., de Jong, M.J., Frantzis, A., Alexiadou, P., Tardy, C., Ody, D., de Stephanis, R., Giménez, J., Lucifora, G., Silva, M.A., Oliveira, C., Alves, F., Dinis, A., Tejedor, M., Fernández, A., Arregui, M., Arbelo, M. Lopez, a., Covelo, P., Hoelzel, A.R. 2023. Genomics reveals the role of admixture in the evolution of structure among sperm whale populations within the Mediterranean Sea. *Molecular Ecology* 00:1-17. DOI: 10.1111/mec.16898  
**ABSTRACT:** In oceanic ecosystems, the nature of barriers to gene flow and the processes by which populations may become isolated are different from the terrestrial environment, and less well understood. In this study we investigate a highly mobile species (the sperm whale, *Physeter macrocephalus*) that is genetically differentiated between an open North Atlantic population and the populations in the Mediterranean Sea. We apply high-resolution single nucleotide polymorphism (SNP) analysis to study the nature of barriers to gene flow in this system, assessing the putative boundary into the Mediterranean (Strait of Gibraltar and Alboran Sea region), and including novel analyses on structuring among sperm whale populations within the Mediterranean basin. Our data support a recent founding of the Mediterranean population, around the time of the last glacial maximum, and show concerted historical demographic profiles in both the Atlantic and the Mediterranean. In each region there is evidence for a population decline around the time of the founder event. The largest decline was seen within the Mediterranean Sea where effective population size is substantially lower (especially in the eastern basin). While differentiation is strongest at the Atlantic/Mediterranean boundary, there is also weaker but significant differentiation between the eastern and western basins of the Mediterranean Sea. We propose, however, that the mechanisms are different. While post-founding gene flow was reduced between the Mediterranean and Atlantic populations, within the Mediterranean an important factor differentiating the basins is probably a greater degree of admixture between the western basin and the North Atlantic and some level of isolation between the western and eastern Mediterranean basins. Subdivision within the Mediterranean Sea exacerbates conservation concerns and will require consideration of what distinct impacts may affect populations in the two basins.

#### PATHOGENS AND PARASITES

- ⇒ Audino, T., Berrone, E., Grattarola, C., Giorda, F., Mattioda, V., Martelli, W., Pintore, A., Terracciano, G., Cocumelli, C., Lucifora, G., et al. 2022. Potential SARS-CoV-2 Susceptibility of Cetaceans Stranded along the Italian Coastline. *Pathogens* 11:1096. <https://doi.org/10.3390/pathogens11101096>  
**ABSTRACT:** Due to marine mammals' demonstrated susceptibility to SARS-CoV-2, based upon the homology level of their angiotensin-converting enzyme 2 (ACE2) viral receptor with the human one, alongside the global SARS-CoV-2 occurrence and fecal contamination of the river and marine ecosystems, SARS-CoV-2 infection may be plausibly expected to occur also in cetaceans, with special emphasis on inshore species like bottlenose dolphins (*Tursiops truncatus*). Moreover, based on immune and inflammatory responses to SARS-CoV-2 infection in humans, macrophages could also play an important role in antiviral defense mechanisms. In order to provide a more in-depth insight into SARS-CoV-2 susceptibility in marine mammals, we evaluated the presence of SARS-CoV-2 and the expression of ACE2 and the pan-macrophage marker CD68. Aliquots of tissue samples, belonging to cetaceans stranded along the Italian coastline during 2020–2021, were collected for SARS-CoV-2 analysis by real-time PCR (RT-PCR) (N = 43) and Immunohistochemistry (IHC) (N = 59); thirty-two aliquots of pulmonary tissue sample (N = 17 *Tursiops truncatus*, N = 15 *Stenella coeruleoalba*) available at the Mediterranean Marine Mammal Tissue Bank (MMMTB) of the University of Padua (Legnaro, Padua, Italy) were analyzed to investigate ACE2 expression by IHC. In addition, ACE2 and CD68 were also investigated by Double-Labeling Immunofluorescence (IF) Confocal Laser Microscopy. No SARS-CoV-2 positivity was found in samples analyzed for the survey while ACE2 protein was detected in the lower respiratory tract albeit heterogeneously for age, gender/sex, and species, suggesting that ACE2 expression can vary between different lung regions and among individuals. Finally, double IF analysis showed elevated colocalization of ACE2 and CD68 in macrophages only when an evident inflammatory reaction was present, such as in human SARS-CoV-2 infection.
- ⇒ Cipriani, P., Palomba, M., Giulietti, L., Marcer, F., Mazzariol, S., Santoro, M., Aco Alburquerque, R., Covelo, P., López, A., Santos, M.B., Pierce, G.J., Brownlow, A., Davison, N.J., McGovern, B., Frantzis, A., Alexiadou, P., Højgaard, D.P., Mikkelsen, B., Paoletti, M., Nascetti, G., Levens, A., Mattiucci, S. 2022. Distribution and genetic diversity of *Anisakis* spp. in cetaceans from the Northeast Atlantic Ocean and the Mediterranean Sea. *Scientific Reports* 12:13664 <https://doi.org/10.1038/s41598-022-17710-1>

**ABSTRACT:** Parasite biodiversity in cetaceans represents a neglected component of the marine ecosystem. This study aimed to investigate the distribution and genetic diversity of anisakid nematodes of the genus *Anisakis* sampled in cetaceans from the Northeast Atlantic Ocean and the Mediterranean Sea. A total of 478 adults and pre-adults of *Anisakis* spp. was identified by a multilocus genetic approach (mtDNA *cox2*, *EF1 $\alpha$*  – 1 nDNA and *nas* 10 nDNA gene loci) from 11 cetacean species. A clear pattern of host preference was observed for *Anisakis* spp. at cetacean family level: *A. simplex* (s.s.) and *A. pegreffii* infected mainly delphinids; *A. physeteris* and *A. brevispiculata* were present only in physeterids, and *A. ziphidarum* occurred in ziphiids. The role of cetacean host populations from different waters in shaping the population genetic structure of *A. simplex* (s.s.), *A. pegreffii* and *A. physeteris* was investigated for the first time. Significant genetic sub-structuring was found in *A. simplex* (s.s.) populations of the Norwegian Sea and the North Sea compared to those of the Iberian Atlantic, as well as in *A. pegreffii* populations of the Adriatic and the Tyrrhenian Seas compared to those of the Iberian Atlantic waters. Substantial genetic homogeneity was detected in the Mediterranean Sea population of *A. physeteris*. This study highlights a strong preference by some *Anisakis* spp. for certain cetacean species or families. Information about anisakid biodiversity in their cetacean definitive hosts, which are apex predators of marine ecosystems, acquires particular importance for conservation measures in the context of global climate change phenomena.

- ⇒ Fernández-Escobar, M., Giorda, F., Mattioda, V., Audino, T., Di Nocera, F., Lucifora, G., Varello, K., Grattarola, C., Ortega-Mora, L.M., Casalone, C., et al. 2022. *Toxoplasma gondii* Genetic Diversity in Mediterranean Dolphins. *Pathogens* 11:909. <https://doi.org/10.3390/pathogens11080909>

**ABSTRACT:** *Toxoplasma gondii* constitutes a major zoonotic agent but also has been frequently identified as an important cause of clinical disease (e.g., abortion, pneumonia, encephalitis) in wildlife; specifically, *T. gondii* has been associated with neurological disease in cetaceans. This study investigated the genetic diversity of *T. gondii* strains involved in infections in dolphins found stranded in the Mediterranean coastlines of Italy. Tissue samples from 16 dolphins (*Stenella coeruleoalba* and *Tursiops truncatus* species) positive for *T. gondii*-DNA presence by PCR were examined by histology and subjected to further genetic characterization of strains detected by PCR-RFLP and multilocus PCR-sequencing assays. According to fully genotyped samples, the genotypes ToxoDB#3 (67%) and #2 (22%) were detected, the latter being reported for the first time in cetaceans, along with a mixed infection (11%). Subtyping by PCR-seq procedures provided evidence of common point mutations in strains from southwestern Europe. Despite evidence of *T. gondii* as a cause of neurological disease in dolphins, sources of infections are difficult to identify since they are long-living animals and some species have vast migration areas with multiple chances of infection. Finally, the genetic diversity of *T. gondii* found in the dolphins studied in the Mediterranean coastlines of Italy reflects the main genotypes circulating inland in the European continent.

- ⇒ Marangi, M., Carlucci, R., Carlino, P., Fanizza, C., Cirelli, G., Maglietta, R., Beneduce, L. 2022. Dolphins and sea turtles may host zoonotic parasites and pathogenic bacteria as indicators of anthropic pressure in the Gulf of Taranto (Northern Ionian Sea, Central-Eastern Mediterranean Sea). *Veterinary Research Communications* 46:1157-1166. <https://doi.org/10.1007/s11259-022-10011-y>

**ABSTRACT:** The occurrence of protozoan parasites *Giardia duodenalis* and *Cryptosporidium* spp. such as the pathogenic bacteria *Salmonella* spp. and *Escherichia coli* was molecularly investigated in the following free ranging species of striped dolphins (*Stenella coeruleoalba*), Risso's dolphins (*Grampus griseus*) as well as loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles living in the Gulf of Taranto (Mediterranean Sea). Out of forty-one investigated individuals belonging to the 4 species, 13 (31.7%) were positive to one or more pathogens and zoonotic *G. duodenalis* assemblage A, *Cryptosporidium parvum* and *S. enterica* were identified in striped dolphins, loggerhead and green sea turtles. In this work, the presence of these opportunistic pathogens has been investigated in fecal samples of free ranging dolphin and sea turtle species for the first time. Moreover, this is the first record of *C. parvum* in loggerhead sea turtles. These results may provide baseline data for the potential role of cetaceans and sea turtles as potential sentinel species for zoonotic and terrestrial pathogens in the marine environment.

#### NOISE IN PROTECTED AREAS/ NATURA 2000 SITES

- ⇒ Picciulin, M., Armelloni, E., Falkner, R., Rako-Gospić, N., Radulović, M., Pleslić, G., Muslim, S., Mihanović, H. and Gaggero, T., 2022. Characterization of the underwater noise produced by recreational and small fishing boats (< 14 m) in the shallow-water of the Cres-Lošinj Natura 2000 SCI. *Marine Pollution Bulletin*, 183, p.114050. [\[link\]](#)

**ABSTRACT:** Recreational boats are a dominant source of underwater noise in coastal areas, but reliable boat noise assessment is generally lacking. Here the Underwater Radiated Noise (URN) of seven recreational and small fishing boats moving at two different speeds was measured in the shallow waters of the Cres-Lošinj Natura 2000 SCI (Croatia). Measurements were undertaken considering the internationally recognized standards and published guidelines for shallow waters. URN was provided in 1/3 octave band spectra and in narrow band spectra, to highlight the tonal components. Engine power and type rather than the boat length and design result to be more predictive of URN. Highest speeds induce highest noise levels only in a very limited frequency range and different boats with similar speed but different engines show a shift in the spectra. Relevance of the achieved results for the tested area is further discussed.

- ⇒ Picciulin, M., Bolgan, M., Rako-Gospić, N., Petrizzo, A., Radulović, M. and Falkner, R., 2022. A Fish and Dolphin Biophony in the Boat Noise-Dominated Soundscape of the Cres-Lošinj Archipelago (Croatia). *Journal of Marine Science and Engineering*, 10(2), p.300. [\[link\]](#)

**ABSTRACT:** Spatio-temporal variability of marine soundscapes reflects environmental dynamics and local habitat health. This study characterizes the coastal soundscape of the Cres-Lošinj Natura 2000 Site of Community Importance, encompassing the non-tourist (11–15 March 2020) and the tourist (26–30 July 2020) season. A total of 240 h of continuous recordings was manually analyzed and the abundance of animal vocalizations and boat noise was obtained; sound pressure levels were calculated for the low (63–2000 Hz) and high (2000–20,000 Hz) frequency range. Two fish sound types were drivers of both seasonal and diel variability of the low-frequency soundscape. The first is emitted by the cryptic Roche's snake blenny (*Ophidion rochei*), while the second, whose emitter remains unknown, was previously only described in canyons and coralligenous habitats of the Western Mediterranean Sea. The high-frequency bands were characterized by bottlenose dolphin (*Tursiops truncatus*) vocalizations, indicating dolphins' use of area for various purposes. Boat noise, however, dominated the local soundscape along the whole considered periods and higher sound pressure levels were found during the Tourist season. Human-generated noise pollution, which has been previously found 10 years ago, is still present in the area and this urges management actions.

#### INTERNATIONAL FRAMEWORKS

- ⇒ Fortuna, C.M., David, L. 2021. Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMA Common Indicators 3, 4 and 5 related to Marine Mammals. Agenda item 4.1: Monitoring and Assessment Elements for the IMA Common Indicators 3, 4 and 5 related to marine mammals. Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) Biodiversity and Fisheries, Videoconference, 10-11 June 2021, UNEP-MAP SPA/RAC. 47 pages.

**ABSTRACT:** This report proposes the refinement to the monitoring and assessment scale and to reference and threshold values for the marine mammals IMA Common Indicator (CI) 3 (Species distributional range), CI 4 (Population abundance of selected species abundance) and CI 5 (Population demographic characteristics) for marine mammal. It provides a list of recommendations on future work to be carried out within the EcAp/IMAP implementation and revision. It also considers the CI 12 (Bycatch of vulnerable and non-target species) because of its strong connection to CI 3, CI 4 and CI 5. This proposal was prepared with the support of the Biodiversity Online Working Group (OWG) on marine mammals and is submitted to this CORMON meeting on biodiversity and fisheries for consideration.

- ⇒ Manea, E., Bergami C., Pugnetti, A., Gianni, F., Oggioni, A., Bandelj, V., Cataletto, B., Pleslic, G., Bongiorno, L. 2022. An ecosystem-based system of variables to enhance marine species and habitat monitoring and conservation: The Adriatic Natura 2000 case study. *Front. Mar. Sci.* 9:920366. doi: 10.3389/fmars.2022.920366

**ABSTRACT:** Implementing effective marine monitoring to detect and track ecosystem shifts, biodiversity alteration, and habitat loss is one of the most crucial challenges to meet the objectives set out by the Post-2020 Biodiversity Framework and by the United Nations Sustainable Development Goals. The lack of coordinated and harmonized monitoring frameworks at different spatial scales and their weakness in accounting for ecological processes, due to incomplete sets of monitoring variables, strongly hinder the achievement of conservation objectives. Here, we propose an approach to build a coherent ecosystem-based system of monitoring variables for target marine species and habitats. The approach is designed to integrate the existing monitoring frameworks set up by the Water and the Marine Strategy Framework directives, and the Essential

Ocean and Biodiversity Variables, with the aim to contribute to their harmonization and implementation. Furthermore, by embracing a holistic vision, it aims to incorporate ecological processes and socio-ecological aspects, considering the benefits of public engagement through citizen science, and of the ecosystem services approach for policies' implementation. The study stems from the Ecological Observing System of the Adriatic Sea (ECOAdS), which was developed in the framework of the Interreg Italy-Croatia project ECOS, using as exemplary monitoring test cases two relevant conservation targets for Natura 2000 sites of the Adriatic Sea, the common bottlenose dolphin and seagrass meadows. We test the potential of this approach in guiding the prioritization of monitoring variables under ecosystem-based criteria, and provide insights into the benefits delivered by an integrated system of observatories' networks and monitoring frameworks to support marine conservation at both local and regional scales. The proposed approach can be transferred to other contexts and scales to help build a common knowledge and monitoring framework for conservation and management strategies, saving costs by relying on available resources and on consolidated and long-lasting approaches that might converge towards global initiatives.

- ⇒ Pugnetti, A., Manea, E., Vilibić, I., Sarretta, A., Capotondi, L., Cataletto, B., De Maio, E., Franzosini, C., Golec, I., Gottardi, M. and Kurtović Mrčelić, J., 2022. The Ecological Observing System of the Adriatic Sea (ECOAdS): structure and perspectives within the main European biodiversity and environmental strategies. [\[link\]](#)

**ABSTRACT:** This Policy Brief succinctly presents the Ecological Observing System of the Adriatic Sea (ECOAdS), aimed at integrating the ecological and oceanographic dimensions within the conservation strategy of the Natura 2000 network, and to propose a way to go for its future development and maintenance. After a definition of marine ecological observatories, we describe the current structure of ECOAdS, its key components and potential relevance in relation to the main European strategies for biodiversity and marine observation for the next decade. Finally, we suggest some actions that could be undertaken for the future development of ECOAdS, targeting possible perspectives in different regional, macro-regional, national and European strategic contexts. This Policy Brief is one of the outcomes of the Interreg Italy-Croatia Project ECOS (ECological Observing System in the Adriatic Sea: oceanographic observations for biodiversity; <https://www.italy-croatia.eu/web/ecoss>), which had the main purpose to design and carry out the first steps for the establishment of ECOAdS.

#### OTHER TOPICS

- ⇒ Gnone, G.; Bellingeri, M.; Airoidi, S.; Gonzalvo, J.; David, L.; Di-Méglio, N.; Cañadas, A.M.; Akkaya, A.; Awbery, T.; Mussi, B.; et al. 2023. Cetaceans in the Mediterranean Sea: Encounter Rate, Dominant Species, and Diversity Hotspots. *Diversity*, 15:321. <https://doi.org/10.3390/d15030321>

**ABSTRACT:** We investigated the presence and diversity of cetaceans in the Mediterranean Sea, analysing the data collected by 32 different research units, over a period of 15 years (2004–2018), and shared on the common web-GIS platform named Intercet. We used the encounter rate, the species prevalence, and the Shannon diversity index as parameters for data analysis. The results show that cetacean diversity, in the context of the Mediterranean basin, is generally quite low when compared with the eastern Atlantic, as few species, namely the striped dolphin, the bottlenose dolphin, the fin whale, and the sperm whale, dominate over all the others. However, some areas, such as the Alboran Sea or the north-western Mediterranean Sea, which includes the Pelagos Sanctuary (the Specially Protected Area of Mediterranean Interest located in the northern portion of the western basin), show higher levels of diversity and should be considered hotspots to be preserved. Primary production and seabed profile seem to be the two main drivers influencing the presence and distribution of cetaceans, with the highest levels of diversity observed in areas characterized by high levels of primary production and high bathymetric variability and gradient. This collective work underlines the importance of data sharing to deepen our knowledge on marine fauna at the scale of the whole Mediterranean Sea and encourages greater efforts in the networking process, also to accomplish the requirements of the Marine Strategy Framework Directive, with particular reference to Descriptor 1: biological diversity is maintained.

- ⇒ Maglietta, R., Saccotelli, L., Fanizza, C., Telesca, V., Dimauro, G., Causio, S., Lecci, R., Federico, I., Coppini, G., Cipriano, G., Carlucci, R. 2023. Environmental variables and machine learning models to predict cetacean abundance in the Central-eastern Mediterranean Sea. *Scientific Reports* 13:2600 <https://doi.org/10.1038/s41598-023-29681-y>

**ABSTRACT:** Although the Mediterranean Sea is a crucial hotspot in marine biodiversity, it has been threatened by numerous anthropogenic pressures. As flagship species, Cetaceans are exposed to those anthropogenic impacts and global changes. Assessing their conservation status becomes strategic to set effective management plans. The aim of this paper is to understand the habitat requirements of cetaceans, exploiting the advantages of a machine-learning framework. To this end, 28 physical and biogeochemical variables were identified as environmental predictors related to the abundance of three odontocete species in the Northern Ionian Sea (Central-eastern Mediterranean Sea). In fact, habitat models were built using sighting data collected for striped dolphins *Stenella coeruleoalba*, common bottlenose dolphins *Tursiops truncatus*, and Risso's dolphins *Grampus griseus* between July 2009 and October 2021. Random Forest was a suitable machine learning algorithm for the cetacean abundance estimation. Nitrate, phytoplankton carbon biomass, temperature, and salinity were the most common influential predictors, followed by latitude, 3D-chlorophyll and density. The habitat models proposed here were validated using sighting data acquired during 2022 in the study area, confirming the good performance of the strategy. This study provides valuable information to support management decisions and conservation measures in the EU marine spatial planning context.

- ⇒ Manfrini, V.; Pierantonio, N.; Giuliani, A.; De Pascalis, F.; Maio, N.; Mancina, A. 2022. Fin Whale (*Balaenoptera physalus*) Mortality along the Italian Coast between 1624 and 2021. *Animals* 12:3111. <https://doi.org/10.3390/ani12223111>

**ABSTRACT:** The Mediterranean Sea hosts a population of fin whale (*Balaenoptera physalus*), the only species of Mysticete regularly occurring in the basin. Observed and inferred mortality suggests that the population is likely declining. Accordingly, understanding the causes of mortality and assessing the health status is pivotal to the survival of this endangered population. While such studies are inherently difficult for a highly roaming species with a pelagic distribution, mortality events provide the opportunity to investigate biological and epidemiological traits linked to these events, and evaluate the footprint of human activity, especially when long-term data series exist. We present a comprehensive spatial-temporal overview of fin whale mortality events along the Italian coast encompassing four centuries (1624–2021). Time series analysis was used to highlight structural changes in the evolution of mortality through time, while spatial-temporal patterns in the distribution of mortality events were assessed through emerging hot spot analysis methods. Recent mortality events (1964–2021) were further explored to evaluate, where possible, the primary causes of mortality and to identify anthropogenic threats of conservation concerns. This long-term survey offers the basis for an understanding of the health status of this *B. physalus* population and provides much-needed information for developing an effective management and conservation plan for the species in the region.

- ⇒ Menniti, M.A., Vella, A. 2022. Sighting of Risso's dolphin (*Grampus griseus*) during scientific research of the Calabrian Southern Ionian Sea (Central Eastern Mediterranean). *NEsciences* 7(3):248-259, doi: 10.28978/nesciences.1206056

**ABSTRACT:** The presence of Risso's dolphins (*Grampus griseus*) in Southern Calabrian waters of the Ionian Sea is poorly known. During dedicated cetacean research started in the summer of 2019 in the stretch of Calabrian waters between Brancaleone and Botricello, a pod of Risso's dolphins was recorded for the first time. This observation occurred of Siderno and Locri at about 8.3 km from the shore where the sea depth is 720 m, a bathymetric feature that is in line with the known deeper water habitat preference of the species. This Risso's dolphin pod was composed of at least 14 individuals. The latter were photo-identified. One individual showed signs of a serious injury due to a probable vessel accident that severed partly into its back behind its dorsal fin. Most of the individuals observed were mature to old with their frontal area already light grey to white. This scientific report contributes new knowledge on the distribution of the species in the Central Mediterranean Sea which may better address effective conservation management efforts for the species. Further monitoring and management are needed for this endangered species, especially in a geographic area that was previously unstudied for an extended period, despite past stranding events and citizen sightings of cetaceans being recorded occasionally.

- ⇒ Miočić-Stošić, J., Frleta-Valić, M., Holcer, D. 2022. The camera does not lie: Superimposed dorsal fins introducing error in cetacean photo-identification. *Aquatic Mammals* 2022 Vol. 48 Issue 5 Pages 456-461. DOI: 10.1578/AM.48.5.2022.456

**ABSTRACT:** Herein, we look at the possible errors in the matching procedure stemming from images showing several individuals surfacing in tight formation, using the common bottlenose dolphin (*Tursiops truncatus*) as an example.