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SAMESEA

WP1 – Activity 1.2

DELIVERABLE 1.2.2

Transnational cooperation and monitoring model

Work Package	WP1: Joint development of the transnational strategy for the monitoring sentinel species	
Activity	Activity 1.2: Creation of the coordination model and monitoring protocols in the EUSAIR Region	
Name of deliverable	1.2.2 Transnational cooperation and monitoring model	
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ACRONYMS

ABMT: Area-Based Management Tools

ACCOBAMS: Agreement On the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area

ADRION: Adriatic-Ionian

ASI: Accobams Survey Initiative

CBD: Convention On Biological Diversity

CCL: Curve Carapace Length

CDS: Conventional Distance Sampling

CITES: Convention On International Trade of Endangered Species

CMS: Convention On Migratory Species

CREEM: Centre For Research into Ecological and Environmental Modelling

eDNA: Environmental DNA

EU: European Union

EUSAIR: EU Strategy for Adriatic and Ionian Region

IPA: Instrument For Pre-Accession Assistance

ISPRA: Italian Institute for Environmental Protection and Research

IUCN: International Union for Conservation of Nature

IWC: International Whaling Commission

IWDG: Irish Whale and Dolphin Group

MAP: Mediterranean Action Plan

MEDACES: Mediterranean Database on Cetacean Strandings

MPAS: Marine Protected Areas

MR: Mark-Recapture

MSFD: Marine Strategy Framework Directive

MSP: Maritime/Marine Spatial Planning

NETCET: Network For the Conservation of Cetaceans and Sea Turtles in the Adriatic

NGOs: Non-Governmental Organisations

NOAA: National Oceanic and Atmospheric Administration

PAM: Passive Acoustic Monitoring

PIT: Passive Integrated Transponder

PMI: Planning and Management Tools

PPs: Project Partners

PVA: Population Viability Analysis

RAC: Regional Activity Centre

SCL: Straight Carapace Length

SPA: Specially Protected Areas

UAV: Unmanned Aerial Vehicles

UME: Unusual Mortality Events

UNCLOS: United Nations Convention on the Law of the Sea

UNEP: United Nations Environment Programme

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1. INTRODUCTION

The EU Strategy for the Adriatic and Ionian Region (EUSAIR) is actively working towards conserving biodiversity, particularly in its marine and coastal areas. This aligns with the goals of EU Biodiversity Strategy for 2030 and other international frameworks. Despite a great ongoing effort to significantly expand the coverage and effectiveness of Marine Protected Areas (MPAs) in the macro-region, a large proportion of these still lack adequate and coordinated management measures, highlighting the urgent need to strengthen transnational, integrated, and efficient management planning for their protection and conservation. Currently, one of the main obstacles at the monitoring and conservation efforts is due to discrepancies in the legislative framework within and among EU Member States (Italy, Slovenia, Croatia, Greece in the case of SAMESEA project) and IPA countries (Bosnia and Herzegovina, Montenegro, Albania). Additionally, different levels of institutional engagement across these Countries results in a non-homogeneous monitoring protocols and methodologies, particularly for sentinel species difficult to monitor for peculiar life cycle, migratory patterns and long-distance movements across coastal and offshore marine areas, such as in the case of this project.

In this context, the SAMESEA project partnership, built according to the Quintuple Helix approach, aims to design and implement a coordination and cooperation model, to identify and harmonize best practices and standardized protocols for the monitoring of this target species across the macro-region, addressing the challenges of managing interactions between sentinel species and human activities. The application of the Quintuple Helix programme fosters the interconnectivity between academia, institutions of governance and industry, ensuring that both environmental awareness and social needs are integrated into planning and policymaking (Fig. 1.1.A). This activity is currently pursued in EU Countries through the Maritime Spatial Planning Directive (MSP, 2014/89/EU), a policy and planning instrument providing an integrated approach to the spatial and temporal management of the maritime space. The MSP offers a practical way of reconciling economic development with the protection of marine ecosystems and social objectives. It also underlines the importance of coordinated and integrated approach to manage different sectors, and of a transboundary cooperation among Countries to ensure the coherence of maritime spatial plans across marine regions. In this context, cross-border MSP is essential in ADRION region. Effective transnational and transboundary coordination of shared marine resources require close collaboration between stakeholders involved in different economic sectors (Hassler et al., 2018). Although, the recognition of transboundary MSP for achieving meaningful ecosystem-based management is growing, the cooperation and implementation process are often complicated by different challenges (Moodie et al., 2022). These include fragmented institutional frameworks, disparities in governance systems and policies, differences in stakeholder involvement and cultures, as well as lack of data and information sharing (Keijser et al., 2025). **Therefore, this document outlines the key principles and development process for a coordination model that can represent a concrete and functional solution to address the challenges described above.** This model serves not only as a guide to harmonize knowledge and skills but also as a tool for selecting and applying the most suitable monitoring practices in the macro-region. This will allow for an integrated and sustainable planning of human activities, with the consequent possibility of developing effective conservation and management strategies for sentinel species and potential impacts in the area, respectively. Moreover, the model promotes the development of short local networks and their integration with long transnational networks, allowing for effective coordination at different scales, facilitating the exchange of expertise between different local networks, to assemble and compare data collected through standardized protocols, and to support the implementation of locally applicable, effective and ecosystem-based MSP policies. Furthermore, the coordination model is designed to be scalable and transferable, adaptable to different spatial and temporal contexts and applicable beyond the current geographical and institutional boundaries of the SAMESEA project.

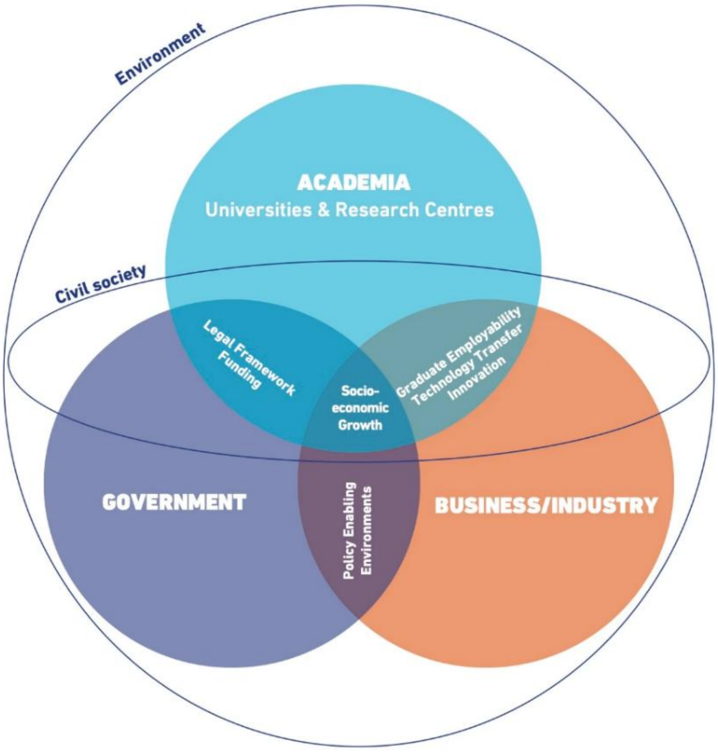

Fig.1.1.A - Graphical representation of Quintuple Helix process, in which the Triple Helix of academia-industry-government relationships with the integration of civil society (Quadruple Helix) and the effects of investment in education on sustainable development (Quintuple Helix) (Figure from Paradigms Education for Sustainable Development, paeradigms.org).

2. COORDINATION AND COOPERATION MODEL

Developing a coordination and cooperation model among EUSAIR countries that is sustainable, reliable, reproducible, and adaptable to other contexts requires knowledge and expertise. Therefore, for the SAMESEA project, the **first step** was to define the existing legal frameworks for the protection and conservation of sentinel species in each country, and the state of knowledge regarding the challenges associated with their monitoring and their interactions with human activities. The **second step** was to examine existing best practices for monitoring target species to provide technical guidelines to be tested in the next *Activity 1.3 - Implementation of the widespread transnational monitoring pilot action*. Finally, the **third step** consisted of creating/activating local networks, represented by individuals (belonging to different target groups) involved in the project, capable of integrating with existing transnational networks. Representatives of the local networks shared their expertise and experience in managing the monitoring of project-specific sentinel species and served as key points of contact for each country's institutions responsible for implementing legislative, conservation, and management tools for sentinel species and their habitats.

2.1 LEGAL FRAMEWORKS FOR THE PROTECTION AND CONSERVATION OF SENTINEL SPECIES IN THE EUSAIR REGION

The comparative analysis of the existing international and national legislative frameworks concerning the protection, conservation and management of sentinel species, highlighted commonalities and gaps among EUSAIR Countries. While non-EU Countries are signatories of numerous international conventions concerning the protection and safeguarding of species, their implementation differs from EU Member States due to jurisdictional frameworks variations. However, a certain degree of convergence with EU policies has been already achieved, particularly in Countries like Albania and Montenegro. Table 2.1.a reports the jurisdictional framework relevant to the protection and conservation of marine mammals and sea turtles, focusing on target species of the project, in each partner's Country. Each legal source is briefly described, highlighting its relevance for the target species and the corresponding area-based management tools (ABMT) and planning and management tools (PMI), whether legally binding or not. Finally, the table includes both the legal framework for EU and non-EU Countries, which need to comply with European regulations.

Table 2.1.a - International jurisdictional framework for the protection of marine mammals and sea turtles in EUSAIR region.

Legal source	Description	ABMTs and PMIs	EU Countries				Non-EU Countries		
			Italy	Slovenia	Croatia	Greece	Bosnia and Herzegovina	Montenegro	Albania
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; Washington, 1973)	International agreement which ensures that international trade in specimens of wild animals does not threaten their survival. *Caretta caretta* and *Monachus monachus* are listed on Appendix I while *Tursiops truncatus* is listed on Appendix II.		X	X	X	X	X	X	X
Convention on the Conservation of Migratory Species of Wild Animals (CMS/Bonn Convention, 1979)	Overseen by the United Nations Environment Programme (UNEP). It covers the conservation of all migratory animals. Migratory species in danger of extinction are listed on Appendix I of the Convention. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. *Tursiops truncatus, Caretta caretta* and *Monachus monachus* are listed in Appendix II.	Convention accomplished through ACCOBAMS.	X	X	X	X	X	X	X
Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979)	First international treaty aimed at protecting both habitats and species and promoting European cooperation on the issue of nature conservation (Council of Europe, 1979). It covers all national European marine waters up to Exclusive Economic Zone (EEZ) boundaries. 30 cetacean species are listed as *strictly protected* species (Annex II) and the remaining (those not mentioned in Annex II) as *protected* species (Annex III). To achieve the conservation targets of the Convention, a network of protected areas, named the Emerald Network, was set up, preceding the EU Natura 2000 network.	Accomplished through the Habitat Directive	X	X	X	X	X	X	X

United Nations Convention on the Law of the Sea (UNCLOS; Montego Bay, 1982)	UNCLOS splits the ocean into territorial waters (up to 12 nautical miles from the coastline), Exclusive Economic Zone (EEZ; 200 nautical miles from the coastline) and the high seas (beyond the EEZ), and attributes governance powers accordingly. Cetaceans found in territorial waters are governed directly by the coastal state. Cetaceans are addressed within Articles 65 and 120. Accordingly, coastal states should cooperate for the conservation, management and study of cetaceans.		X	X	X	X	X	X	X
United Nations Convention on Biological Diversity (CBD; Rio de Janeiro, 1992)	This convention establishes the criteria for the institution of MPAs even in ABNJ and to protect pelagic and migratory species, cetaceans and sea turtles included.	Ecologically and Biologically Significantly marine Areas (EBSAs) have been identified to orient MPA designation especially SPAMIs.	X	X	X	X	X	X	X
Habitats Directive (Council Directive 92/43/EEC)	The Directive protects important habitats and species through the establishment of protected areas, known as Natura 2000 sites, collectively forming the Natura 2000 network. *Tursiops truncatus, Caretta caretta,* and *Monachus monachus* are listed in Annex II and IV requiring, respectively, the designation of special areas of conservation and need of strict protection.	Natura 2000 network: Special Areas for Conservation (SACs)	X	X	X	X	X		X
Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean of 1995 – the Barcelona Convention (UNEP-MAP).	Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean entered into force in 2004. It includes the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol).	Specially Protected Areas of Mediterranean Importance (SPAMIs).	X	X	X	X	X	X	X

Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS, 2001)	It is a legal conservation tool based on cooperation. Its purpose is to reduce threats to cetaceans notably by improving current knowledge on these animals. It results from consultations between Secretariats of four Conventions: the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, the Bonn Convention on the Conservation of Migratory Species of Wild Animals, the Bern Convention on the Conservation of European Wildlife and Natural Habitats, the Bucharest Convention on the Protection of the Black Sea Against Pollution. Finally, given the migratory characteristics of these species, the Agreement was established under the auspices of the Bonn Convention (UNEP/CMS).	ACCOBAMS is working on the identification of Cetaceans Critical Habitats (CCHs) in the ACCOBAMS area, to identify MPA candidates and to propose appropriate threats management or spatial management measures. CCHs are tools to guide the designation of MPAs or the extension of an existing MPA, or the establishment of other ABMTs for conservation such as Fishery Restricted Areas (FRAs) and Particular Sensitive Sea Areas (PSSAs).	X	X	X	X		X	X
Marine Strategy Framework Directive (Directive 2008/56/EC)	Overall objective of the Directive is to achieve Good Environmental Status (GES) of EU marine waters. Some of the indicators identified from the Directive are relevant for the conservation and protection of marine mammals (D1, D4, D7, D8, D10, D11) and sea turtles (D1, D10).	Accomplished through the already existing legally binding jurisdictional instruments	X	X	X	X			
Law on nature protection. (Official Gazette of Montenegro, No. 054/16, No. 018/19, No. 084/24)	This Law governs the protection and conservation of nature (geosphere and biosphere unity, including natural resources, geomorphological and landscape diversity) on the territory of the Republic of Montenegro.							X	

Law on protection of the marine environment.	This law focuses on preserving marine ecosystems, including habitats of sentinel species, and aims to prevent and reduce pollution, to protect marine biodiversity, and establish marine protected areas (Chapter I, Article 3). A key aspect of the law is the Marine Environment Monitoring Program, which is developed based on an initial assessment of the marine environment's condition and objectives forachieving or maintaining Good Ecological Status (GES). This program also monitors human activities' impact on the marine environment, including pollution and noise (Article 11).							X	
Environmental Protection Law of Bosnia and Herzegovina ("Official Gazette of BiH," No. 15/21)	This Law serves as the foundation for nature protection, providing general guidelines for ecosystem preservation, pollution control, and sustainable management of natural resources. However, this law indirectly addresses the target species, but it is not specifically focused on marine species.						X		

Law on nature protection ("Official Gazette of FBiH," No. 66/13, 10/25) - Bosnia and Herzegovina.	This Law provides all necessary standards, measure and rules aimed to regulate the nature protection related tasks and actions, nature protection as primary environmental challenge on the territory of the Brčko District, and entity of the Federation of Bosnia and Herzegovina, autonomous self-governed region of the Bosnia and Herzegovina. This Law regulates the competences and measures for nature protection, including the conservation of biodiversity, habitats, and ecologically significant areas. It covers the protection of wild species, forest, karst, aquatic, marine, and coastal ecosystems, the establishment of the Natura 2000 network, the trade in protected species, and the protection of minerals and fossils. The Law also defines procedures for planning, monitoring, concessions, financing, and supervision, as well as public participation, education, promotion, awards, and penalty provisions. However, this law indirectly addresses the target species, but it is not specifically focused only on marine species.						X		

Biodiversity Law (No. 9587 dated 20.7.2006 “On biodiversity protection”, amended by No. 37/2013 dated 14.2.2013, No. 68/2014 dated 3.7.2014, No. 41/2020 dated 23.4.2020)	Law designed to ensure the protection of biodiversity, and to regulate the sustainable use of the components of biodiversity.								X
Wildlife Law (No. 10 006 dated 23.10.2008 “On protection of wild fauna”, amended by No. 10 137 dated 11.5.2009, No. 41/2013 dated 14.2.2013)									X

Law no. 15, dated 8 February 2024 on the Marine Environment Protection Strategy of the Republic of Albania.	This Law has the purpose to achieve and maintain the good environmental status of the marine waters of the Mediterranean Sea, which are under the sovereignty of the Republic of Albania. This law aims the preparation and enforcement of the Marine Protection Strategy in Albania for the marine environment protection and conservation; prevention of marine environment deterioration; marine ecosystem restoration and gradual pollution elimination. This Law is also partially aligned with the provisions prescribed in the Directive 2008/56/EC of the European Parliament and of the Council establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).								X

2.2 STATE OF KNOWLEDGE ABOUT THE CHALLENGES OF MONITORING OF INTERACTIONS BETWEEN SENTINEL SPECIES AND HUMAN ACTIVITIES

It is well known and well documented that, for marine conservation and strategic planning to be properly achieved, integrated and spatially explicit assessments of anthropogenic pressures and their effects on marine ecosystems are necessary (Halpern et al., 2008; Micheli et al., 2013; Giakoumi et al., 2015b; Katsanevakis et al., 2017; Korpinen and Andersen, 2017). For example, the United Nations Convention on the Law of the Sea (UNCLOS; Articles 204-206) outlines a clear responsibility for Member States to assess potential threats to the marine environment and to communicate the results of these assessments to other Parties.

In this context, a knowledge co-production framework was developed to explore cause-effect relationships, within a risk-based approach (Stelzenmüller et al., 2018, 2020), relating to human activities, related pressures, and impacted biota, with specific attention to the SAMESEA project's target species in the ADRION macro-region.

To guide the knowledge co-production, the official documents of the area-based management tools (ABMTs) and initiatives that promote or aim to protect marine mammals and sea turtles in the EUSAIR Region (Table 2.1.a) were screened to define: i) possible common criteria (e.g., ecological requirements, level of vulnerability) and ABMTs guiding the protection and conservation of marine mammals and sea turtles in the A-I region; ii) any information on the human-derived pressures and impacts that these conservation instruments aim to manage; and iii) any reference to the sources of knowledge and information to inform management (e.g., empirical data, expert judgment).

The cause-effect relationships between the human activities in the ADRION region and the conservation status of target species were analysed using a risk-based approach, adapted from Stelzenmüller et al. (2018, 2020) and the related concepts and glossary (Stelzenmüller et al., 2018 and references therein). Thus, the main keywords are defined as follow:

- **human activities** are defined as activities that could alter marine ecosystems and affect their capacity to provide benefits now and in the future;
- **pressures** as event or agents (biological, chemical or physical) resulting from one or more human activities that can produce an effect (that may lead to harm or cause adverse impacts);
- **receptor species** refer to one or more target species that may be negatively affected by specific pressure.

Each human activity was examined individually to identify the derived pressures and their potential effects on target species. This analysis aimed to depict their spatial footprint. To characterize more precisely human activities, diverse pressure transfer agents were introduced, which serve to link each human activity to the derived pressures, highlighting specific features relevant to management. Since each activity can give rise to multiple pressures, which can translate into diverse effects on the environment (Elliott et al., 2020), pressure transfer agents were used to reflect this diversity. For instance, fishing activities were associated to several pressures depending on the transfer agents, namely trawling activity, longline technique, small-scale fishery, purse seine, ghost fishing due to loss of abandonment of fishing gears and so on. This is a common approach in cumulative impact assessment (e.g., Menegon et al., 2018; Farella et al., 2021). Receptor species considered were the *T. truncatus*, *C. caretta*, and *M. monachus.*

The analysis was based on the integration of several knowledge sources: i) empirical data produced through focalized research in the study area; ii) relevant information from both scientific and grey literature; iii) local experts (SAMESEA partnership) to corroborate the information collected in the desk analysis, and to add with new information based on their local ecological knowledge. Experts were scientists focusing on the bio-ecology of marine mammals and sea turtles, environmental non-governmental organizations (NGOs) engaged in monitoring activities of these species as well as in cultural and touristic activities, Public Authorities responsible for environmental protection. Expert elicitation activity was carried out through a questionnaire distributed among PPs. The results of this survey include the analysis of cause-effect relationships in the EUSAIR area (Table 2.2.a, questionnaires from each PP are showed in ANNEX I). To quantify the extent of pressures resulting from human activities, a rapid assessment approach (similar to those adopted in Carlucci et al., 2021) was adopted by scoring composite indicators of frequency (i.e., rare, occasionally, seasonally, monthly, daily and unknown), magnitude (i.e., acting at species or at population levels), and impact level ((i.e., no impact, minor, medium, devastating/medium, lethal impact). The final scores for each indicator related to pressure and species were defined by averaging the values corresponding to the specific responses (see Table 1 in ANNEX I), while the final score for each pressure was obtained by summing the scores of its indicators.

To account for uncertainty deriving from the multiple knowledge sources (Walker et al., 2003; Stelzenmüller et al., 2015; Gissi et al., 2017; Shabtay et al., 2019), we qualitatively defined a confidence level based on the empirical evidence available for each cause-effect chain. The confidence was “high” (score 3) when empirical evidence of pressures and potential impacts on target species was available for the investigated area; “medium” (score 2) when empirical evidence was available from scientific studies on target species carried out in other marine areas; “low” (score 1) for the cause-effect chains mentioned by the experts but for which empirical evidence in the area was not available.

Results derived from the integration of each PPs questionnaire results were used to produce a Sankey diagram that visually illustrates the chain of cause–effect relationships between human activities, the pressures they generate, and the project target species that can be affected. Regarding the structure, the diagram is structured into four levels. On the left, we have the macro-categories of human activities, connected to pressure transfer agents. The next column represents the pressures themselves such as underwater noise, bycatch, chemical pollution, or habitat degradation. On the right we find the receptors, the species that can be directly or indirectly impacted. The width of each flow is determined by the overall score which combines frequency, magnitude, and impact level from each PP's questionnaire. However, the confidence score, which tells us how reliable our assessment is based on available scientific literature, is not visualized in the diagram width. This means a wide flow doesn't always mean high certainty, and a thin flow might hide an emerging threat.

Table 2.2.a - Analysis of cause-effect relationships, based on the results of a dedicated questionnaire.

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season related	Potential effect	SCORE					Published literature
						Frequency	Magnitude	Impact	Confidence	Total score	
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	0.17	resources competition/opportunistic feeding for the species; prey depletion/population size decrease; low scale redistribution/ altered movement and behaviour; bycatch during depredation and entanglement	0.72	0.70	0.47	2.33	1.89	Bearzi et al., 2008; Bearzi et al., 2010; Maiorano et al., 2010; Carlucci et al., 2016; Kotnjek et al., 2017; Russo et al., 2017; Bonizzoni et al., 2020; Ricci et al., 2020; Tsagarakis et al., 2021; Rudd et al., 2022; Janssen et al., 2022
			Monachus monachus	0.00	resources competition/reduction of prey availability/opportunistic feeding for the species: population size decrease/ low scale redistribution	0.60	0.40	0.33	1.33	1.33	Karamanlidis, 2015
		bycatch	*Tursiops truncatus* (or other cetaceans)	0.00	entanglement/ dissabilitation/injures/death	0.33	0.40	0.67	2.33	1.40	Fortuna et al., 2010; Casale et al., 2011; Đuras et al., 2012; Casale et al., 2018
			Caretta caretta (or other sea turtles)	0.50	entanglement/ dissabilitation/injures/death	0.70	0.70	0.70	3.00	2.10	Casale et al., 2004; Fortuna et al., 2010; Luchetti et al., 2018
		overfishing	*Tursiops truncatus* (or	0.00	resources competition /prey depletion due to fishing catches/reduction prey	0.64	0.90	0.37	2.00	1.91	Tudela et al., 2004; Bearzi et al., 2008; Coll et al., 2009; Bearzi et al., 2010; Maiorano et al., 2010; Piroddi et al., 2010; Colloca et al., 2017; Milani et al.,

			other cetaceans)		density, size and age/population size decrease/ low scale redistribution						2017; Giannoulaki et al., 2017; Carlucci et al., 2020; Tsagarakis et al., 2021; Janssen et al., 2022
			Monachus monachus	0.00	resources competition /prey depletion due to fishing catches, population size decrease/ low scale redistribution; illegal practices of dynamite fishing can have an important tool near their nursing caves	0.60	0.80	0.60	1.67	2.00	https://www.monachus-guardian.org/factfiles/medit16.htm; Pierce et al., 2011
		Habitat degradation	*Tursiops truncatus* (or other cetaceans)	0.00	altered movements and behavioural patterns; opportunistic feeding; benthic habitat alteration/loss of epifauna in feeding habitat/lowering foraging success; prey depletion may lead to lowered survival rates and/or shift in distribution	0.85	0.76	0.56	2.00	2.17	Gonzàlez-Correa et al., 2005; Rako et al., 2012a, Rako et al., 2012b; Fortuna et al., 2015; Kotnjek et al., 2017; Bonizzoni et al., 2020; Haselmair et al., 2021; Tsagarakis et al., 2021; Janssen et al., 2022
			Caretta caretta (or other sea turtles)	0.00	impacts on the turtle's feeding habitat; opportunistic feeding; benthic habitat alteration/loss of epifauna in feeding habitat/lowering foraging success; prey depletion may lead to lowered survival rates	0.68	0.64	0.48	1.60	1.80	Gonzàlez-Correa et al., 2005; Casale et al., 2008; Haselmair et al., 2021; Baldi et al., 2023

					and/or shift in distribution						
			Monachus monachus	0.00	altered-limited movements and behavioural patterns/ resting locations destroyed; prey degradation	0.50	0.70	0.50	2.00	1.70	Gonzàlez-Correa et al., 2005; Karamanlidis et al., 2008
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0.00	bycatch and entanglement in lost nets/death/injuries on animals; ingestion of marine debris/death due to gut obstruction; dietary dilution and reduced energy intake	0.35	0.40	0.77	2.40	1.52	Pribanižć et al., 1999; Bearzi, 2002; Stelfox et al., 2016; Fusco et al., 2016; Vlachogianni et al., 2017; ACCOBAMS, 2019; Đuras et al., 2012; Alexiadou et al., 2019; Pleslić et al., 2020; Đuras et al., 2021; Pietroluongo et al., 2022; Bearzi et al., 2024; Perroca et al., 2024
			Caretta caretta (or other sea turtles)	0.00	bycatch and entanglement in lost nets/death/injuries on animals; ingestion of marine debris/death due to gut obstruction; dietary dilution and reduced energy intake	0.40	0.40	0.77	2.00	1.57	Casale P., 2008; Casale et al., 2010; Casale, 2011; Casale et al., 2011; Fusco et al., 2016; Vlachogianni et al., 2017; Casale et al., 2018; Alexiadou et al., 2019; Pietroluongo et al., 2022; Curri et al., 2024
			Monachus monachus	0.00	bycatch and entanglement in lost nets/death/injuries on animals; ingestion of marine debris/death due to gut obstruction; dietary dilution and reduced energy intake	0.40	0.40	0.90	2.25	1.70	Lazar & Gračan, 2011; Alexiadou et al., 2019; Action Plan fo the Management of MMS (2022); Pietroluongo et al., 2022; Baldi et al., 2023; Perroca et al., 2024
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)	0.20	like trawlers; resources competition /prey depletion due to fishing catches, population size	0.67	0.80	0.40	1.50	1.87	Coll et al., 2009; Bearzi et al., 2010; Carlucci et al., 2020c; Ricci et al., 2020b; Rudd et al., 2022

					decrease/ low scale redistribution; entanglement in lost nets, death/injuries on animals						
			Monachus monachus	0.33	change of predator behaviour/resources competition /prey depletion due to fishing catches; population size decrease/ low scale redistribution	0.30	0.70	0.20	2.00	1.20	Pierce et al., 2011; Notarbartolo di Sciara & Kotomatas, 2016; Ríos et al., 2017; Dendrinos et al., 2020; Ingrosso et al., 2023
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0.00	entanglement during fishing activities/bycatch/chronic lesions; death/injuries on animals due to entanglement	0.35	0.40	0.54	1.71	1.29	Bearzi, 2002; Gillman et al., 2006; Ancha, 2008; López et al., 2012; Đuras et al., 2012; Papageorgiou et al., 2022; ACCOBAMS/GFCM (2019/2024)
			Caretta caretta (or other sea turtles)	0.00	Injuries/entanglement/severe dissabilitation or immediate death of individuals	0.35	0.55	0.55	2.00	1.45	Casale P., 2008; Lazar et al., 2008; Cardona et al., 2009; Casale et al., 2010; Fortuna et al., 2010; Casale et al., 2018; Gvozdenović et al., 2021
			Monachus monachus	0.00	Injuries/entanglement/severe dissabilitation or immediate death of individuals	0.30	0.40	0.65	1.50	1.35	Casale et al., 2007; Ancha, 2008; Cambiè et al., 2010; Ríos et al., 2017
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)	0.00	entanglement leading to injuries (skin lesions, fishing gear in stomach, larynx strangulation)/chronic lesions/death	0.33	0.40	0.93	2.33	1.67	Casale et al., 2011; Đuras et al., 2012; Hace et al., 2015; Casale et al. 2018; Morigenos 2020; Đuras et al., 2021; Morigenos, 2023
			Caretta caretta (or	0.50	entanglement/chronic lesions/death due to forced apnoea	0.80	0.70	0.90	3.00	2.40	Lucchetti et al., 2017

			other sea turtles)								
		competition	*Tursiops truncatus* (or other cetaceans)	0.00	resources competition/prey depletion/decreasing fishing grounds/population size decrease/ low scale redistribution/ temporary area replacement; entanglement/injuries/severe dissabilitation or immediate death of individuals; death	0.77	0.49	0.37	2.43	1.63	Gomerčić et al., 2008; Coll et al., 2009; Bearzi, 2011; Bearzi et al., 2011; Đuras et al., 2012; Colloca et al., 2017; Pleslić et al., 2020; Janssen et al., 2022; Rudd et al., 2022; Li Veli et al., 2023.
			Caretta caretta (or other sea turtles)	0.20	not compete directly for resources, but the intensive presence of artisanal fishing in coastal areas can limit access to benthic prey; prey depletion due to overfishing; entanglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	0.60	0.64	0.16	1.60	1.40	Lazar et al., 2006; Casale et al., 2008; Colloca et al., 2017; Gvozdenović et al., 2016; Casale et al., 2018; Casale et al., 2018
			Monachus monachus	0.33	resources competition/prey depletion/habitat loss/ area avoidance; entanglement/disorientation/ deliberate killing; lack of international coordination	0.40	0.40	0.47	2.33	1.27	Karamanlidis et al., 2008, 2021

	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.17	disturbance, population size decrease/ displacement/ medium scale redistribution; communication masking, hearing loss and behavioural change (more frequent traveling and diving behaviour, avoiding vessels, decrease in feeding behaviour); short term-decline population health/area avoidance; long-term effects/ decreasing resting, feeding, lower fecundity for females	0.45	0.80	0.60	1.83	1.85	Marine Board – ESF, 2008; Castellote et al., 2012; Maglio et al., 2015; Podestà et al., 2016; Roth, 2025
	Sonar	underwater noise	*Caretta caretta* (or other sea turtles)	0.00	disturbance/population redistribution; behavioural change and displacement	0.35	0.85	0.33	1.50	1.53	Ceraulo et al., 2022
	Sonar	underwater noise	*Monachus monachus*	0.00	disturbance/population redistribution/avoidance behaviour; strandings, hearing damage, avoidance of noisy areas, decreasing socialising/ feeding/ resting, disturb of mother/ pubs bonding,	0.53	0.70	0.53	1.75	1.77	Popper et al., 2014; Watwood et al., 2016; Panou et al., 2017; UNEP/MAP – SPA/RAC, 2019; Charrier et al., 2023
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0.00	tied with rope, cutting of the fins, weapons, animals drowned/ severe dissabilitation or immediate death of individuals	0.28	0.40	0.71	2.29	1.39	Pleslić et al., 2020; Đuras et al., 2024; Morigenos, 2024; Archipelagos Institute of Marine Conservation. (o.J) "Violent dolphin killing", 3rd of september 2025, Archipelagos Website

			Caretta caretta (or other sea turtles)	0.00	general deliberate injuries/head injuries/ flipper injuries and amputations; severe dissabilitation or immediate death of individuals	0.40	0.40	0.60	1.75	1.40	Casale, 2008; Gvozdenović et al., 2016; Archelon-Sea turtle protection Society of Greece, 3rd of september, website Archelon
			Monachus monachus	0.00	found killed by weapon (gun, spear gun, dynamite) or animals drowned suffered serious injuries/ severe dissabilitation or immediate death of individuals	0.25	0.40	0.80	2.17	1.45	Casale et al., 2018; Rapa Vlora Reports/round table; Action Plan fo the Management of MMS (2022); Đuras et al., 2024; Solanou et al., 2024
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0.00	loss of habitat and foraging areas/displacement; changes on vocalizations and social structure/injuries/hearing damage from pingers/ death	0.64	0.49	0.43	2.29	1.55	Díaz López, 2006; Đuras et al., 2012; Bonizzoni et al., 2020; ACCOBAMS (2021); Pleslić 2022; LEK, Archipelagos Observations
			Caretta caretta (or other sea turtles)	0.00	Injuries or ingestion of fishing gears; displacement, loss of foraging areas	0.45	0.50	0.17	1.60	1.12	UNEP/MAP (2015); ISPRA (2020); Mazaris et al., 2023
			Monachus monachus	0.00	Exclusion from coastal areas/displacement; loss of foraging areas/ injury or ingestion of fishing gear	0.40	0.40	0.40	1.33	1.20	Güçlüsoy et al., 2003; ISPRA, 2023
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.00	disorientation/moving away from the distribution area; physical trauma/area avoidance/mortality/	0.33	0.64	0.68	1.40	1.65	Marine Board – ESF, 2008; Ciminello et al., 2012; Maglio et al., 2015; ACCOBAMS 2021; OceanCare 2021; Rako et al. 2022; ISPRA 2024

					hearing loss/ behavioural change/ interferes with communication between individuals and foraging efforts.						
			Caretta caretta (or other sea turtles)	0.00	confounding orientation cues and disorientation/ moving away from the distribution area/avoidance behaviour; increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates; lethal or sub-lethal injury (lung/ear damage)/ plus behavioural effects from high-level noise	0.40	0.64	0.40	1.20	1.44	Samuel et al., 2005; Casale et al., 2010; Maglio et al., 2015; Lucchetti et al. 2017; Casale and Margaritoulis, 2010; ACCOBAMS 2021
			Monachus monachus	0.00	disorientation, moving away from the distribution area; death; vocalisations masked by shooting range noise/interfering with crucial breeding and pup interactions.	0.33	0.55	0.55	1.25	1.43	Casale et al., 2018; OceanCare 2021; RAC-SPA 2023; Charrier et al., 2023
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)	0.00	less prey, less chance of feeding; stress response/ hearing loss/increase in vocalization rate/startle response/deep diving/changes in group cohesion/ reduced foraging performance/	0.40	0.64	0.48	1.60	1.52	Fortuna et al., 2006; Rako-Gospić & Picciulin, 2019; ACCOBAMS, 2021; Jenkins et al., 2022; ISPRA, 2024; Fan et al., 2024

					changes in antipredator responses/modifications of foraging habits /severe injury or mortality to fish prey species; explosions may directly destroy structural habitats for fish species.						
			Caretta caretta (or other sea turtles)	0.00	less prey, less chance of feeding; reduced embryos development, increased larval mortality, injury to statocysts, alarm responses, changes in swimming patterns in mollusc; stress response, increased metabolism, latency to predator threat in crustacean	0.40	0.70	0.45	1.25	1.55	Casale et al., 2010; Rako-Gospić & Picciulin, 2019; ISPRA, 2023
			Monachus monachus	0.00	Severe injury or mortality to fish prey species/rupture swim bladders in fish/ destroy structural habitats for fish species; less prey, less chance of feeding; death	0.33	0.55	0.45	1.75	1.33	MOFI project; Johnson et al. 2006; Casale et al., 2018; Jenkins et al., 2022; RAC-SPA 2023; Fan et al., 2024
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.00	disorientation and behavioural change, moving away from the distribution area; communication masking, hearing loss; stress leading to symptoms like	0.33	0.76	0.76	1.40	1.85	Marine Board – ESF, 2008; Parsons et al., 2008; Maglio et al., 2015; ACCOBAMS, 2021; OceanCare 2021; Rako et al. 2022; Bearzi et al., 2024

					decompression sickness and mass strandings						
			Caretta caretta (or other sea turtles)	0.00	disorientation, moving away from the distribution area; disturbance, avoidance behaviour	0.40	0.70	0.50	1.25	1.60	Casale et al. 2010; Popper et al., 2014; Maglio et al., 2015; Watwood et al., 2016; ACCOBAMS 2021
			Monachus monachus	0.00	disorientation, moving away from the distribution area; mask or smother sounds from the seal; death	0.30	0.60	0.40	1.33	1.30	Wright et al., 2007; Casale et al., 2018; MOFI project; OceanCare, 2021; RAC-SPA 2023
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.00	disturbance, population size decrease/ medium scale redistribution/ habitat avoidance and displacement; behavioural alterations/cuts feeding, resting and socialising; disruption to communication structures/masking of communication/changes in vocalization and shifts in vocal behaviour	0.90	0.80	0.67	2.60	2.37	Jensen et al., 2009; Marine Board - ESF, 2008;; Papale et al., 2011; Rako et al., 2012a, Rako et al., 2012b; Campana et al., 2015; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić and Picciulin, 2016; Awbery et al., 2019; Rako-Gospić & Picciulin, 2019; Tenan et al., 2020; Roth, 2025
			Caretta caretta (or other sea turtles)	0.00	Spatial overlap; physical trauma and acoustic stress; habitat degradation and avoidance behaviour/altered behaviour patterns/ increased stress and aggression levels/ physiological damage to ears/ altered movement	0.85	0.80	0.57	1.50	2.22	Samuel et al., 2005; Martin et al., 2012; Luschi and Casale, 2013; Casale et al., 2017; Casale et al. 2018; ISPRA, 2023; Diaz et al., 2024

					and diving and surfacing rates/confounding orientation cues/cuts foraging/ predator avoidance/ increased vigilance.						
			Monachus monachus	0.00	physiological stress: mask or smother sounds from the seal; physical trauma and acoustic stress; death; area avoidance	1.00	0.55	0.55	1.25	2.10	Wright et al., 2007; Casale et al., 2018
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0.29	vessel collisions/injuries/animal death; behavioural disturbances/ less efficient foraging due to damage to their body and limbs/more likely to become prey for predators, can't swim to keep up with pod; displacement	0.44	0.40	0.71	2.00	1.55	Rapa Vlora Reports/round table; La Manna et al., 2019; Frantzis et al., 2019; ISPRA, 2020; ACCOBAMS (2021); Bearzi et al., 2024
			Caretta caretta (or other sea turtles)	0.43	vessel collisions/injuries from sharp collisions when coming up to breath /animal death; behavioural disturbance (avoidance of coastal areas and migratory routes); chronic noise stress	0.30	0.40	0.74	1.71	1.44	Rapa Vlora Reports/round table; Casale et al. 2017; Casale et al., 2018; Frantzis et al., 2019; ISPRA, 2023; Mihaljević et al., 2024
			Monachus monachus	0.20	vessel collisions/injuries/animal death; behavioural disturbance, displacement	0.40	0.40	0.64	1.75	1.44	Rapa Vlora Reports/round table; Panou et al., 2013; Casale et al., 2018

	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0.00	accumulation of heavy metals, possibly resulting in toxic effects for the organism; exposure to pollution may lead to lowered fitness of individuals; death/injuries on animals	0.45	0.64	0.60	1.80	1.69	Cardellicchio et al., 2000; Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Formigaro et al., 2017; ISPRA, 2020; Đokić et al., 2025
			Caretta caretta (or other sea turtles)	0.00	accumulation of heavy metals, possibly resulting in toxic effects for the organism; exposure to pollution may lead to lowered fitness of individuals; death/injuries on animals	0.53	0.64	0.44	1.75	1.61	Franzellitti et al., 2004; Lazar et al., 2008; Casale et al., 2017; Savoca et al., 2022; ISPRA, 2023
			Monachus monachus	0.00	accumulation of heavy metals, possibly resulting in toxic effects for the organism; exposure to pollution may lead to lowered fitness of individuals; death/injuries on animals	0.40	0.40	0.47	1.33	1.27	Casale et al., 2018
		marine litter	*Tursiops truncatus* (or other cetaceans)	0.00	pollution/accumulation of metals likely harm the health of the organism and represents a risk factor; ingestion of marine debris/ death due to gut obstruction/dietary dilution and reduced energy intake; entanglements in	0.23	0.40	0.54	1.71	1.18	Rapa Vlora Reports/round table; Pribanižć et al., 1999; Bearzi, 2002; Šuran et al., 2015; Bilandžić et al., 2015; Sedak et al., 2015; Bilandžić et al., 2016; Fossi et al., 2016; Sedak et al., 2016; Alomar and Deudero, 2017; Digka et al., 2018; Đokić et al., 2018; ACCOBAMS, 2019; UNEP/MAP, 2020; Đuras et al., 2021; Sedak et al., 2022; Đokić et al., 2025; Sedak et al., 2025;

					marine litter/injuries/severe dissabilitation or immediate death of individuals; reduced prey availability						
			Caretta caretta (or other sea turtles)	0.00	pollution/accumulation of metals likely harm the health of the organism and represents a risk factor; ingestion of marine debris/ death due to gut obstruction/dietary dilution and reduced energy intake; entanglements in marine litter/injuries/severe dissabilitation or immediate death of individuals	0.29	0.40	0.54	1.71	1.23	Rapa Vlora Reports/r; Casale et al., 2017; Matiddi et al., 2017; Lazar et al., 2018; UNEP/MAP, 2020; ISPRA, 2023; Baldi et al., 2023;
			Monachus monachus	0.00	pollution/accumulation of metals likely harm the health of the organism and represents a risk factor; ingestion of marine debris/ death due to gut obstruction/dietary dilution and reduced energy intake; entanglements in marine litter/injuries/severe dissabilitation or immediate death of	0.33	0.40	0.50	1.25	1.23	Rapa Vlora Reports/round table; Casale et al., 2018; Fossi et al., 2018; Digka et al., 2018; Karamanlidis et al., 2024; MOm reports.

					individuals; reduced prey availability						
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.25	short-term habitat degradation/disturbances on preys' localization and feeding; altered movement and behaviour patterns; habitat displacement/ medium scale redistribution; communication masking, physical trauma, hearing loss; injuries or even death if exposed at close range.	0.25	0.70	0.65	1.50	1.60	McCauley et al., 2000; Engås & Løkkeborg, 2002; Gordon et al., 2003; Marine Board – ESF, 2008; Maglio et al., 2015; Popper & Hawkins, 2016; Kavanagh et al., 2019; Rako-Gospić & Picciulin, 2019; Širović & Holcer, 2020
			Caretta caretta (or other sea turtles)	0.25	short-term habitat degradation/disturbances on preys' localization and feeding; altered movement and behaviour patterns/ medium scale redistribution; hearing damage, reduced ability to avoid natural and anthropogenic threats; stress; exclusion from key habitats; interruption of behaviour necessary for breeding, foraging or thermoregulation; injuries or even death if exposed at close range	0.33	0.80	0.47	1.00	1.60	Weir, 2007; Deruiter, 2010; Maglio et al., 2015; Nelms et al., 2016; Štrbenac, 2017; Rako-Gospić & Picciulin, 2019
			Monachus monachus	0.00	short-term habitat degradation/disturbance	0.40	0.40	0.40	1.00	1.20	Casale et al., 2018

					s on preys' localization and feeding; altered movement and behaviour patterns/ medium scale redistribution; death						
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0.00	Bioaccumulation of hydrocarbons, heavy metals or toxic substances; lowered fitness of individuals	0.40	1.00	0.40	1.50	1.80	Fossi et al., 2003; Marsili et al., 2004; UNEP/MAP, 2012
			Caretta caretta (or other sea turtles)	0.00	Bioaccumulation of hydrocarbons, heavy metals or toxic substances; lowered fitness of individuals	0.40	1.00	0.40	1.50	1.80	Lazar et al., 2011; UNEP/MAP, 2012; Camacho et al., 2013; NOAA, 2024
			Monachus monachus	0.00	Bioaccumulation of hydrocarbons, heavy metals or toxic substances; lowered fitness of individuals	0.40	1.00	0.60	1.00	2.00	Borrell et al., 1997; Aguilar et al., 2007; UNEP/MAP 2012
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.25	stress/physical trauma/hearing loss; disturbance/ habitat displacement; population size decrease/ medium scale redistribution/ habitat avoidance and displacement; behavioural alterations/vocalization changes; masking of communication/changes in vocalization/difficulty in communication between	0.33	0.80	0.60	1.33	1.73	Marine Board – ESF, 2008; La Manna et al., 2013; Buckstaff et al., 2013; Notarbartolo di Sciara et al., 2016; Erbe et al., 2019; Piwetz et al., 2021; Weaver, 2021

					individuals/shifts in vocal behaviour						
			Caretta caretta (or other sea turtles)	0.25	stress/behavioural disturbance; disturbance and habitat displacement	0.33	0.60	0.33	1.33	1.27	Hazel et al., 2009; Popper et al., 2014
			Monachus monachus	0.00	stress/behavioural disturbance; disturbance and habitat displacement	0.40	0.70	0.40	1.50	1.50	Karamanlidis et al., 2008; Casale et al., 2018
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0.00	stress/behavioural disturbance; disturbance and habitat displacement; masking of communication/behavioural change	0.53	1.00	0.47	1.67	2.00	Marine Board - ESF, 2008; Jensen et al., 2009; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić & Picciulin, 2016; Arcangeli et al., 2017; ACCOBAMS, 2018; Rako-Gospić & Picciulin, 2019
			Caretta caretta (or other sea turtles)	0.00	behavioural alteration/avoidance behaviour/altering diving and surfacing rates and confounding orientation cues/; stress and increasing aggression levels/physiological damage to ears; collisions/injuries/death; avoidance of areas	0.53	1.00	0.33	1.33	1.87	Samuel et al., 2005; Casale et al., 2010
			Monachus monachus	0.00	collisions; behavioural disturbance/stress from noise exposure; displacement from usual areas; death	0.40	0.40	0.40	1.50	1.20	UNEP/MAP, 2012; Casale et al., 2018

	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)	0.00	Bioaccumulation of PCBs, metals and other contaminants/ reduced fertility/lowered fitness of individuals/mortality; accumulation of hydrocarbons resulting in immunosuppression, cancer, skin lesions, secondary infections and diseases, sporadic die offs, reduced reproductive success	0.70	1.00	0.55	1.25	2.25	Marsili et al., 2001; Fossi et al., 2003; Fossi & Marsili, 2009; UNEP/MAP, 2012; UNEP/MAP-SPA/RAC, 2021; Bearzi et al., 2024
			Caretta caretta (or other sea turtles)	0.00	Bioaccumulation of contaminants (heavy metals, PCBs, hydrocarbons)/damage to the immune and reproductive systems/ developmental alteration/lowered fitness of individuals; accumulation of hydrocarbons resulting in carcinogenic effects, immunosuppression, liver damage, endocrine disruption, anaemia, kidney and salt glands damage, adverse metabolic effects	0.70	1.00	0.50	1.75	2.20	Lazar et al., 2011; Camacho et al., 2013; Bucchia et al., 2015; Cocci et al., 2018; UNEP/MAP-SPA/RAC, 2021; Arienzo et al., 2023
			Monachus monachus	0.00	bioaccumulation of contaminants with consequent reproductive risks; death	0.40	0.60	0.53	1.33	1.53	UNEP-MAP, 2012; Casale et al., 2018; UNEP/MAP-SPA/RAC, 2021
		underwater noise	*Tursiops truncatus* (or	0.00	stress/area displacements/ mortality and/or injuries/	0.53	0.80	0.53	1.67	1.87	La Manna et al., 2013; Notarbartolo di Sciara et al., 2016; Erbe et al., 2019

			other cetaceans)		behavioural and vocalization changes; masking of acoustic communication/potential hearing damage						
			Caretta caretta (or other sea turtles)	0.00	displacement; disorientation/ changes in behaviour/avoidance of noisy areas	0.70	1.00	0.40	1.50	2.10	McCauley et al., 2000; Hazel et al., 2009; Popper et al., 2014
			Monachus monachus	0.00	stress/avoidance of noisy areas/ loss of habitat	0.40	0.40	0.80	2.00	1.60	Karamanlidis et al., 2008
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0.00	chronic stress/avoidance of certain areas/habitat displacement; disturbance/masking of communication/collision; changes in vocal behaviour/ behavioural change	0.73	1.00	0.47	1.67	2.20	Marine Board - ESF, 2008; Jensen et al., 2009; Maglio et al., 2015; Pirotta et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić & Picciulin, 2016; Arcangeli et al., 2017; ACCOBAMS, 2018; Rako-Gospić & Picciulin, 2019
			Caretta caretta (or other sea turtles)	0.00	chronic noise stress/avoidance of coastal areas and migratory routes; collisions/ injuries/death/physiological damage to ears; behavioural disturbance/ increased aggression levels/altering diving and surfacing rates and confounding orientation cues	0.73	1.00	0.33	1.33	2.07	Samuel et al., 2005; Casale et al., 2010
			Monachus monachus	0.00	stress; habitat loss; collisions/death	0.40	0.40	0.40	1.50	1.20	Karamanlidis et al., 2008; Casale et al., 2018

Offshore renewable energy	Wind farm construction	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.00	disturbance/avoidance of certain areas/social disintegration; physical trauma/hearing loss/ increased cortisol; behavioural change	0.40	0.70	0.40	1.50	1.50	Marine Board – ESF, 2008; Tougaard et al., 2009; Dähne et al., 2013; Erbe et al., 2019; Bearzi et al., 2024
			Caretta caretta (or other sea turtles)	0.00	disturbance/disorientation/avoidance of noisy areas/habitat displacement; social disintegration; increased cortisol;	0.40	0.70	0.30	1.50	1.40	Hazel et al., 2009; Popper & Hastings, 2009; Bailey et al., 2010; Popper et al., 2014
			Monachus monachus	0.00	avoidance of noisy areas; death	0.40	0.40	0.50	1.50	1.30	Karamanlidis et al., 2008; Notarbartolo di Sciara et al., 2009; Brandt et al., 2011; Casale et al., 2018
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0.00	disturbance/chronic noise stress/alteration of hunting behavior/ habitat displacement; masking of communication, changes in vocalization; collisions	0.40	0.70	0.40	1.50	1.50	Pirotta et al., 2015; ACCOBAMS, 2018
			Caretta caretta (or other sea turtles)	0.00	collisions; habitat displacement; chronic noise stress	0.40	0.70	0.40	1.50	1.50	Duncan et al., 2006; Casale et al., 2010
			Monachus monachus	0.00	habitat loss; behavioural disturbance; death	0.40	0.40	0.40	1.50	1.20	UNEP/MAP, 2012; Casale et al., 2018; Gonzalvo et al., 2021
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	0.88	ingestion of marine debris/death due to gut obstruction/dietary dilution and reduced energy intake/ contamination of gastro-intestinal tract; entanglements/injuries/	0.40	0.40	0.69	1.86	1.49	Pribanižć et al., 1999; Fossi et al., 2014; de Stephanis et al., 2013; Fusco et al., 2016; Vlachogianni et al., 2017; Lusher et al., 2018; Casale et al., 2020; Pietroluongo et al., 2022; Đuras et al., 2021; Bearzi et al., 2024

					dissabilitation or immediate death of individuals						
			Caretta caretta (or other sea turtles)	0.88	ingestion of marine debris/death due to gut obstruction/dietary dilution and reduced energy intake; entanglements/injuries/ dissabilitation or immediate death of individuals; contamination of gastrointestinal tract	0.50	0.40	0.77	1.57	1.67	Lazar & Gračan, 2011; Fusco et al., 2016; Vlachogianni et al., 2017; Casale et al., 2020; Pietroluongo et al., 2022;; Baldi et al., 2023
			Monachus monachus	0.60	ingestion of marine debris/death due to gut obstruction/dietary dilution and reduced energy intake; entanglements/injuries/ dissabilitation or immediate death of individuals; contamination of gastrointestinal tract	0.50	0.40	0.65	1.75	1.55	Casale P., 2008; Casale P., 2011; Casale et al., 2018; Bundone et al., 2021; Pietroluongo et al., 2022
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0.67	displacements/habitat degradation; altered movement/behavioural changes/stress behaviour/ vocalization changes/behavioural budget alteration; consequences on the health, reproductivity, physical fitness	0.72	0.90	0.63	2.00	2.25	Rako et al., 2012a; Rako et al., 2012b; Rako et al., 2013; Rako et al., 2017; Clarkson, 2020; Pleslić et al., 2020; Roth, 2025
			Caretta caretta (or	0.83	degradation of nests/nets	0.70	0.80	0.60	1.83	2.10	Rapa Vlora Reports/round table /PPNEA-Monk seal project; Casale,

			other sea turtles)		damages/displacements; behavioural changes;					2008; Katselidis et al., 2013; Casale et al., 2020
			Monachus monachus	0.50	loss of habitat/ habitat degradation/ disturbance/ population redistribution/population decline; short-term habitat degradation/altered movement and behaviour patterns	0.73	0.85	0.70	2.00	2.28	Rapa Vlora Reports/round table /PPNEA-Monk seal project; Johnson et al., 1999; Karamanlidis et al., 2008;
		underwater noise	*Tursiops truncatus* (or other cetaceans)	0.83	disturbance/habitat degradation/displacement; altered movement and behaviour patterns; masking of communication/changes in vocalization/behavioural budget alteration	0.73	0.80	0.50	2.33	2.03	Marine Board - ESF, 2008; Jensen et al., 2009; Rako et al., 2012a; Rako et al., 2012b; Rako et al., 2013; Gonzalvo et al., 2014; Rako-Gospić & Picciulin, 2016; Rako-Gospić & Picciulin, 2019; Clarkson et al., 2020; Picciulin et al., 2022; Falkner et al., 2023; Archipelagos observations, INSETE Intelligence (Ikkos, 2024)
			Caretta caretta (or other sea turtles)	0.67	disturbance/habitat degradation/displacement; altered movement and behaviour patterns; masking of communication/changes in vocalization/behavioural budget alteration; increased stress and aggression levels/ physiological damage to ears/altering diving and surfacing rates and confounding orientation cues	0.80	0.80	0.37	1.83	1.97	Samuel et al., 2005; Franzellitti et al., 2019; Pini et al., 2023; NOAA; Samuel et al., 2004

			Monachus monachus	0.75	stress/disturbance of breeding/resting areas/area avoidance; behavioural budget alteration	0.73	0.80	0.67	2.67	2.20	Accobams (2016; NOAA website; INSETE Intelligence (Ikkos, 2024); ISPRA, 2024
		cave tourism	*Monachus monachus*	0.80	water cave pollution/disturbance/population redistribution; stress/collisions/behavioural budget alteration/harassment	0.60	0.76	0.76	2.60	2.12	Rapa Vlora Reports/round table /PPNEA-Monk seal project; Karamanlidis et al., 2008; Gomerčić et al., 2011; Panou et al., 2017
		light pollution	*Caretta caretta* (or other sea turtles)	1.00	confusion/attraction towards the coast; nesting problems/ hatchlings loss/ deterring females from going on the beach to lay eggs, disorienting hatchlings that won't reach the sea	0.60	0.88	0.52	2.25	2.00	Casale et al., 2018; Archelon, the sea turtle protection society of Greece
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0.29	stress/behavioural disturbance; habitat displacement /habitat degradation; altered movement and behaviour patterns/masking of communication/changes in vocalization/behavioural budget alteration	0.90	0.91	0.46	1.86	2.27	Marine Board - ESF, 2008; Jensen et al., 2009; Bearzi et al., 2012; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić & Picciulin, 2016; Accobams, 2016; Erbe et al., 2018; Rako-Gospić & Picciulin, 2019
			Caretta caretta (or other sea turtles)	0.29	stress/behavioural disturbance; habitat displacement /habitat degradation (especially nesting sites); altered movement and	0.90	0.91	0.40	1.57	2.21	Samuel et al., 2005; Maglio et al., 2015; Rako-Gospić & Picciulin, 2019;

					behaviour patterns/behavioural budget alteration; behaviour disruptions/ increased aggression levels/physiological damage to ears/altering diving and surfacing rates and confounding orientation cues						
			Monachus monachus	0.25	stress/behavioural disturbance; habitat displacement /habitat degradation; altered movement and behaviour patterns/behavioural budget alteration; immune system impairment	NA	0.85	0.65	2.25	1.50	Rapa Vlora Reports/round table /PPNEA-Monk seal project
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0.00	bioaccumulation of heavy metals/toxic effects/injuries on animals/ lowered fitness of individuals/death	0.70	0.64	0.28	2.00	1.62	Cardellicchio et al., 2000; Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Squadrone et al., 2015; Jepson et al., 2016; Casale et al., 2020; UNEP/MAP-SPA/RAC, 2021; Đokić et al., 2025
			Caretta caretta (or other sea turtles)	0.00	bioaccumulation of heavy metals/toxic effects/injuries on animals/ lowered fitness of individuals/death	0.80	0.64	0.20	1.60	1.64	Franzellitti et al., 2004; Lazar et al., 2008; Casale et al., 2020; Savoca et al., 2022; UNEP/MAP-SPA/RAC, 2021
			Monachus monachus	0.00	bioaccumulation of heavy metals/toxic effects/injuries on animals/ lowered fitness of individuals/death	0.40	0.40	0.20	1.00	1.00	UNEP/MAP-SPA/RAC, 2021

		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0.00	habitat degradation/ disturbance; bioaccumulation of organochlorine contaminants causing immunosuppression/increased susceptibility to disease/high lung and gastric macro-parasite burdens and generalised bacterial infections; lowered fitness of individuals	0.40	0.80	0.53	1.67	1.73	Genov et al., 2019; UNEP/MAP-SPA/RAC, 2021
			Caretta caretta (or other sea turtles)	0.00	bioaccumulation of organochlorine contaminants affecting endocrine, developmental and immune systems; lowered fitness of individuals	0.40	1.00	0.40	2.00	1.80	Lazar et al., 2011
		marine litter	*Tursiops truncatus* (or other cetaceans)	0.20	entanglements/ingestion/injuries on animals/death due to gut obstruction; dietary dilution and reduced energy intake; habitat degradation	0.30	0.52	0.44	1.80	1.26	Pribanižć et al., 1999; Simmonds & Nunny, 2002; Azzolin et al., 2016; Fusco et al., 2016; Vlachogianni et al., 2017; Poeta et al., 2018; Đuras et al., 2021; Mandić et al., 2021; Mandić et al., 2022
			Caretta caretta (or other sea turtles)	0.17	entanglements/ingestion/injuries on animals/death due to gut obstruction; dietary dilution and reduced energy intake; habitat degradation	0.40	0.50	0.67	1.83	1.57	Lazar & Gračan, 2011; Fusco et al., 2016; Vlachogianni et al., 2017; Casale et al., 2017; UNEP/MAP-SPA/RAC, 2021; Baldi et al., 2023

			Monachus monachus	0.33	entanglements/ingestion/injuries on animals/death due to gut obstruction; dietary dilution and reduced energy intake; habitat degradation	0.40	0.60	0.60	1.67	1.60	Simmonds & Nunny, 2002; Azzolin et al., 2016; Poeta et al., 2018; UNEP/MAP-SPA/RAC, 2021
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0.00	disturbance/habitat degradation; ingestion/injuries; accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals/disruption of immune system	0.53	0.60	0.33	1.50	1.47	Krishna et al. 2003; Scaravelli et al., 2009; Zaccaroni et al., 2009; Currey et al., 2009; Papastergios et al. 2010; Bilandžić et al., 2012; UNEP/MAP-SPA/RAC, 2021; Đokić et al., 2025,
			Caretta caretta (or other sea turtles)	0.00	disturbance/habitat degradation; ingestion/injuries; accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals/disruption of immune system	0.53	0.60	0.20	1.50	1.33	Franzellitti et al., 2004; Lazar et al., 2008; UNEP/MAP, 2015; Casale et al., 2017; UNEP/MAP-SPA/RAC, 2021; Savoca et al., 2022; ISPRA, 2023; Soubasakou et al., 2023
			Monachus monachus	0.00	disturbance/habitat degradation; ingestion/injuries; accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals/disruption of immune system	0.20	0.40	0.20	1.00	0.80	UNEP/MAP-SPA/RAC, 2021
		introduction of non-synthetic	*Tursiops truncatus* (or	0.00	disturbance/habitat degradation; ingestion/injuries;	0.47	0.60	0.27	1.33	1.33	Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012;

		substances and compounds	other cetaceans)		accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals; disruption of immune system						UNEP/MAP-SPA/RAC, 2021; Đokić et al., 2025
			Caretta caretta (or other sea turtles)	0.00	disturbance/habitat degradation; ingestion/injuries; accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals; disruption of immune system	0.60	0.60	0.20	1.50	1.40	Franzellitti et al., 2004; Lazar et al., 2008; UNEP/MAP, 2015; Casale et al., 2017; UNEP/MAP-SPA/RAC, 2021; Savoca et al., 2022; ISPRA, 2023
	Urban and agricultural runoff		*Monachus monachus*	0.00	disturbance/habitat degradation; ingestion/injuries; accumulation of heavy metals/toxic effects for the organism/lowered fitness of individuals; disruption of immune system	0.30	0.40	0.20	1.33	0.90	UNEP/MAP-SPA/RAC, 2021; Capanni et al., 2024
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0.00	area avoidance/habitat erosion/regression; bioaccumulation of organochlorine contaminants causing immunosuppression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections/fitness of individuals; altered	0.33	0.83	0.49	1.86	1.65	Marbà et al., 2014; Telesca et al., 2015; Genov et al., 2019; UNEP/MAP-SPA/RAC, 2021

					movement and behaviour patterns						
			Caretta caretta (or other sea turtles)	0.00	area avoidance/habitat erosion/regression; bioaccumulation of organochlorine contaminants causing immunosuppression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections/fitness of individuals; altered movement and behaviour patterns	0.33	0.83	0.46	1.57	1.62	Lazar et al., 2011; UNEP/MAP-SPA/RAC, 2021
			Monachus monachus	0.00	area avoidance/habitat erosion and regression; disruption of immune system	0.30	0.70	0.55	1.75	1.55	UNEP/MAP-SPA/RAC, 2021; Capanni et al., 2024
		marine litter	*Tursiops truncatus* (or other cetaceans)	0.00	ingestion/injuries/death due to gut obstruction/dietary dilution and reduced energy intake; entanglements	0.30	0.40	0.58	1.63	1.28	Pribanižć et al., 1999; Pietroluongo et al., 2017; Vlachogianni et al., 2017; Đuras et al., 2021; Mandić et al., 2021; Đuras et al., 2021; Mandić et al., 2022; UNEP/MAP-SPA/RAC, 2021; Archipelagos observations
			Caretta caretta (or other sea turtles)	0.00	ingestion/injuries/death due to gut obstruction/dietary dilution and reduced energy intake; entanglements	0.37	0.40	0.78	1.75	1.54	Lazar & Gračan, 2011; Vlachogianni et al., 2017; Digka et al., 2020; UNEP/MAP-SPA/RAC, 2021; Baldi et al., 2023
			Monachus monachus	0.00	ingestion/injuries/death due to gut obstruction/dietary	0.40	0.40	0.60	2.00	1.40	Simmonds & Nunny, 2002; Azzolin et al., 2016; Pietroluongo et al., 2017;

					dilution and reduced energy intake; entanglements						Poeta et al., 2018; UNEP/MAP-SPA/RAC, 2021
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)	0.75	area avoidance/habitat degradation; altered movement and behaviour patterns; disruption of turtle clutches/lower reproductive output	0.60	0.85	0.65	2.00	2.10	Casale et al., 2018, 2020
		light pollution	*Caretta caretta* (or other sea turtles)	1.00	area avoidance/habitat degradation; altered movement and behaviour patterns; lower reproductive output; disrupt the sea finding orientation/ mortality/reduction of population	0.60	0.85	0.60	2.00	2.05	Casale et al., 2018; Dimitriadis et al., 2018
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)	1.00	shift of nesting season to earlier in year/ possible decrease in hatching success/change in sex ratio/lower reproductive output; changes in food availability/ increased physiological stress/increased risk of disease;	0.60	0.85	0.65	2.00	2.10	Casale et al., 2018; https://doi.org/10.1371/journal.pone.0157170
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	0.40	loss of seagrass beds/decrease in prey availability/ changes in distribution and survival rates/increased physiological stress, increased risk of	0.53	0.85	0.45	1.25	1.83	Casale et al., 2018; Doumas, 2024

					disease; inundation of nest/lower reproductive output/changes in nesting timing, incubation success, and sex ratio						
			Monachus monachus	0.33	habitat (caves) loss: heat waves causing mortality of ecologically important species such as reef building corals and seagrass beds, damaging the seal's habitat/intense storms damaging and flooding caves and representing a direct risk to hauled put seals	NA	0.70	0.20	2.50	0.90	NOAA, Garrabou et al., 2022; Ranasinghe et al., 2021; Panou et al.,2023
		sea-level raise	*Caretta caretta* (or other sea turtles)	0.40	changes in coastal habitat structure/increased turbidity and reduced habitat quality; impact on movement patterns/lower reproductive output; inundation of nest/decrease in nesting beach area	0.60	0.85	0.55	1.50	2.00	Casale et al., 2018; https://doi.org/10.1007/s10113-022-01922-2; https://doi.org/10.1016/j.jembe.2013.10.017; https://doi.org/10.5194/nhess-17-449-2017
			Monachus monachus	0.25	Decrease in access to caves used for pupping, nesting and resting	0.80	1.00	0.80	1.67	2.60	MOFI Project; IPCC; ISPRA; https://doi.org/10.3390/ani14091309
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)	0.00	alteration or shifts in prey availability (abundance or distribution); exposure to novel diseases;	NA	1.00	0.20	2.00	1.20	Bearzi et al., 2024

					alteration of distribution and survival rates						
			Caretta caretta (or other sea turtles)	0.00	shifts in prey availability for adults and juveniles; more difficult migration between seasonal habitat/inefficient or different dispersal of juveniles; alteration of distribution and survival rate	NA	1.00	0.60	1.00	1.60	Hawkes et al., 2009
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0.00	alteration of ecosystem functioning; alteration of prey community structure, availability; alteration in distribution and survival rates	NA	1.00	0.28	1.40	1.28	D'Amen et al., 2024; https://doi.org/10.3390/biology12070933 https://archipelago.gr/fields-of-action/marine-biodiversity/invasive-species/
			Caretta caretta (or other sea turtles)	0.00	alteration of ecosystem functioning/changes in benthic food web/ degradation of turtle habitats/alteration of prey availability and distribution and survival rates	1.00	1.00	0.36	1.40	2.36	Fortic et al., 2023; https://doi.org/10.3390/biology12070933 https://archipelago.gr/fields-of-action/marine-biodiversity/invasive-species/
			Monachus monachus	0.00	alteration of ecosystem functioning; changes in prey community structure/abundance	NA	1.00	0.20	2.00	1.20	Panou et al.,2023; https://doi.org/10.3390/biology12070933 https://archipelago.gr/fields-of-action/marine-biodiversity/invasive-species/

Results of cause-effect relationships analysis

The results of cause-effect relationships analysis allow to identify the most hazardous activities and the key pressures that should be monitored. They highlight those pressures that are considered critical and are well supported by scientific evidence within the ADRION region, while also identifying those that may be significant but remain still poorly investigated at macro-regional scale. In cases where knowledge of cause-effect dynamics is still limited, the analysis provides a structured framework to prioritize and coordinate monitoring efforts.

Based on the results of the dedicated questionnaires, several patterns emerge for each species (Table 2.2.a, Fig.2.2. A). For the common bottlenose dolphin, underwater noise emerged as the most relevant pressure, achieving the highest overall scores, ranging from 1.50 to 2.37, with lower values linked to offshore wind farms and the highest value associated with marine transport. This was followed by chemical pollution and habitat degradation, both with a 2.25 score, the latter mainly related with coastal tourism and fisheries, with medium level of confidence (2.00). Marine litter showed consistently lower values (1.18-1.52), with the highest of these recorded from ghost fishing, supported by a high level of confidence (2.40). Additional relevant fishery-related pressures included longlines bycatch, with a score of 1.29, and intentional killing, with a score of 1.39, both with medium confidence (2.29). Among all these pressures, the only ones with a clear seasonal pattern were those related to recreational activities linked to coastal tourism.

In the case of the loggerhead sea turtle, the lowest scores were observed for competition from aquaculture (1.12), marine litter from naval discharges (1.23), underwater noise from oil and gas exploration (1.27), and industrial dumping deriving from coastal development (1.33). All were associated with relatively low confidence levels, ranging from 1.33 to 1.71. Conversely, the highest scores were linked to bycatch from small-scale fisheries (though considered potentially biased), underwater noise associated with marine transport (2.22), coastal development (2.21), and chemical pollution from oil and gas extraction (2.20). Confidence levels for all these pressures were generally low, with the exception of bycatch in small-scale fisheries.

For the Mediterranean monk seal, the lowest impacts were associated with coastal development, specifically the introduction of non-synthetic substances and compounds, with values ranging from 0.80 to 1.00 and very low levels of confidence. The most critical pressures were associated with coastal tourism, particularly habitat degradation and underwater noise, which scored 2.28 and 2.20 respectively, both with medium-to-high confidence. Sea level rise emerged as the single highest-scoring pressure overall (2.60), although the associated confidence level was only medium-to-low (1.67). In the Sankey diagram, the thin flow associated with cave tourism, although visually it appears small, it represents a highly focused threat to the species especially during pupping and resting activities.

Overall, the analysis indicates that underwater noise represents a dominant pressure for all three species and originates from multiple sources: marine transport, oil and gas exploration, offshore wind farms, navy exercises, and coastal activities. Marine litter, chemical pollution and introduction of non-synthetic substances, competition as well as habitat degradation, similarly originates from multiple sectors, such as marine transport, coastal development and fishery. Thus, these pressures, representing not a single issue, requires coordinated action to understand and manage cumulative potential impact. The offshore renewable energy sector shows some of the thinnest flows in the Sankey diagram, reflecting an emerging sector where both impacts and our understanding are still developing.

However, most of these pressures, and the effect they exert on target species, are difficult to monitor and to manage effectively at large scales. For example, fishery-related pressures, such as competition or habitat degradation, require multi-level monitoring approaches. Currently, most evaluations are based on species distribution models combined with the spatial overlap of human activities. While this indirect approach provides useful insights, it is not sufficient to fully understand the dynamics of effective interaction and consequences. Possible solutions to advance knowledge are based on scientific multi-disciplinary surveys (ACCOBAMS-MOP8/2022/Inf24). For example, dedicated studies on diet and trophic interactions through analysis of stranded individuals, analysis of fatty acids from free-ranging individuals (invasive, through biopsy skin samples), or analysis of faecal samples (non-invasive approach) can help to effectively address the effect of such pressures on species.

By interpretating the overall results, it is possible to distinguish between immediate management priorities, where evidence is robust such as bycatch and underwater noise, and research priorities, such as climate change and offshore energy effects, where potential threats are critical, but their understanding remains limited. An integrated approach ensures that well-documented threats are addressed, while building the knowledge needed to tackle emerging pressures.

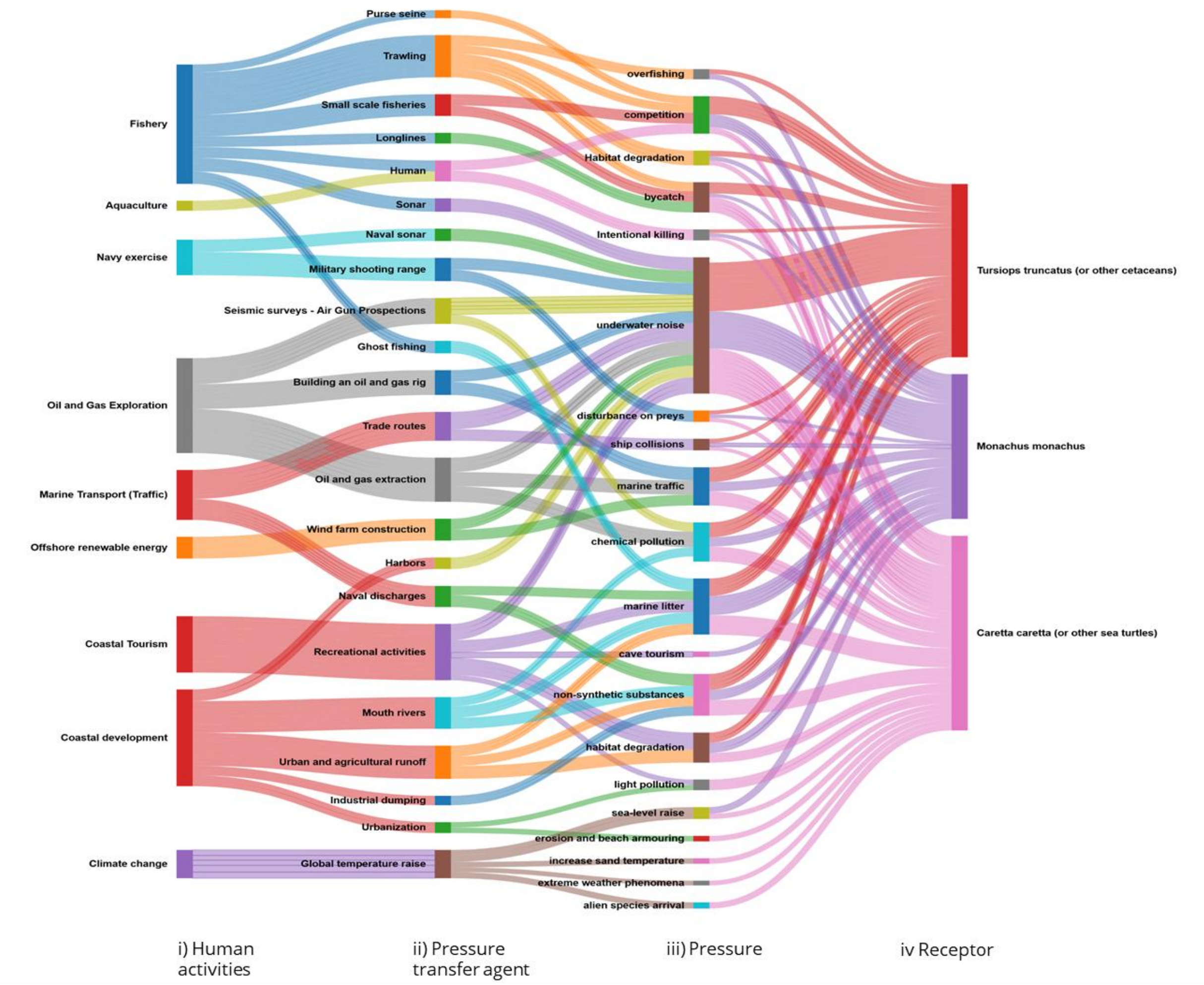

Fig. 2.2.A - Sankey diagram describing the relationships between i) human activities, ii) pressure transfer agents, iii) pressure, and iv) receptors, each corresponding to one node of the diagrams. The width of each band is proportional to the total pressure score derived by each cause-effect relationship chain "human activities - pressure transfer agent - pressure - receptor" (Diagram made with http://sankeymatic.com/).

2.3 MONITORING GUIDELINES

Currently, the degree of monitoring and conservation of marine mammals and sea turtles varies significantly across the EUSAIR region. While some Countries have well-established national networks and legal frameworks, others rely primarily on project-based funding and monitoring programs led by academic institutions and/or NGOs. Although several studies are conducted in the ADRION region on cetaceans and sea turtles (with fewer focusing on monk seals), it remains difficult to infer robust data for conservation purposes, mainly due to inconsistencies in methods between the different research programs. Thus, developing a shared model for both intra- and inter-country coordination requires the adoption of standardized data collection protocols for monitoring of strandings, free-ranging sightings and nesting events of sentinel species. Harmonized monitoring strategies across all Countries, coupled with the integration of existing research and monitoring initiatives, as well as the promotion of international information sharing, are essential to enhance both monitoring efforts, management and conservation outcomes. This coordinated process will allow the collection of robust and comparable data, enabling more accurate assessment of population parameters and trends across both spatial and temporal scales. These data are essential for joint MSP and for supporting the development of effective management and conservation strategies throughout the ADRION region.

The monitoring protocols that should be adopted among the EUSAIR Countries will be detailed in the following sections. The monitoring techniques selected are those scientifically validated and considered most appropriate for the investigation areas and the target species. Furthermore, the model allows to define a set of basic information to be systematically collected in case of sightings, strandings and nesting events, along with additional data which could be gathered as a function of the logistic and technical possibilities of each Country. A well-designed and standardized monitoring protocol will lead to a better understanding of species presence, distribution, abundance, habitat use, and interaction with anthropic activities in the macro-region. In this context, this Deliverable provides a set of guidelines summarizing monitoring methodologies and protocols developed based on scientific evidence and proposed by international organizations and agreement (e.g., IUCN, ACCOBAMS), national institutions (e.g., ISPRA) or within the framework of inter-regional projects (e.g., Interreg, LIFE). As these tools have already been validated in other contexts, either within the same macro-region or in comparable geographic areas, they provide a solid reference for the development and implementation of the activities foreseen under Activity 1.3. In that framework, the protocols and guidelines presented in the present Deliverable will be tested, according to the specific needs of different territories and the available technical capacities and resources of each PP in each Country, then validated and adapted for further improvement.

Specifically, the following sections will provide methodologies and protocols for:

- **Monitoring of stranding events** involving both live and dead animals, as a tool to collect data on species presence and distribution (based on the stranding location and drifting predictive models), assess the health status of target species and their habitat (e.g., emerging diseases, marine litter, toxicology, evidence of human interaction), and identify hotspots of potential human interaction;
- **Monitoring of free-ranging sentinel species** to collect information about occurrence, distribution, abundance, as well as interaction with human socio-economic activities;
- **Monitoring of suitable areas for sea turtles nesting**, to identify and protect strategic sites for conservation purposes.

2.3.1 STRANDING MONITORING PROTOCOLS AND ASSESSMENT OF HUMAN ACTIVITY INTERACTION

Strandings of marine mammals and sea turtles represent one of the most significant sources of scientific information on these protected species. Monitoring protocols are crucial to ensure the collection of harmonized and comparable data across the ADRION region, as well as to guarantee that interventions are effective, ethically sound and aligned with international standards (ACCOBAMS Res. 4.16, 6.22, 7.14; IWC Guidelines). The following sections summarize the main procedures for marine mammals and sea *turtles*, distinguishing between dead and live strandings.

Dead marine mammals stranding monitoring protocol

Regarding cetaceans, the joint ACCOBAMS and ASCOBANS protocol published in 2019, *Best practice on cetacean post-mortem investigation and tissue sampling,* was adopted. The full version is available at this link: https://accobams.org/wp-content/uploads/2021/07/Best-practices-on-cetacean-post-mortem-investigation.pdf

Scientific requirements, political drivers, resources, infrastructure, skills and experience vary between stranding networks of different Countries and sub-areas. For this reason, not always the same approach and the same amount of data collected is guaranteed: the carcass triage is conducted at different levels, depending on the resources, facilities or experience of the stranding network. The gold standard should be the implementation of a structured post-mortem investigation protocol, which includes external and internal examination conducted by well-resourced and experienced veterinary pathologists; but this is often the exception rather than the rule. Despite this, basic or less detailed examination of the carcass can give very important and useful information. For these reasons, the protocol was structured with a 3 Tiers approach:

1. Tier 1: External examination and stranding data collection

This is the first level of intervention, which can be applied by a wide range of personnel who have basic training, also in the field. External examination includes species identification, sex determination, morphometrics (total length, girth, blubber thickness), body condition scoring, and classification of decomposition status (Geraci & Lounsbury, 2005; NETCET, 2015a; LIFE DELFI, 2021). Special attention is given to external signs of anthropogenic interaction, such as net marks, propeller injuries, or evidence of plastic/fishing gear entanglement.

2. Tier 2: Basic post-mortem examination and tissue sampling

This tier can be applied by trained responders with expertise in animal dissections and awareness of potential hazards e.g. zoonotic infections. The difference with tier 1 is the visualization and gross inspection and sampling of all organ systems, beyond diet, contaminants, microbiological, genetic and other types of samples. The internal examination follows a stepwise approach: opening of thoracic and abdominal cavities, inspection of respiratory, digestive and reproductive systems, and systematic sampling of organs (liver, kidney, lungs, lymph nodes, brain, etc.). Samples are preserved for histopathology, microbiology, virology, toxicology, and genetic analyses (NETCET, 2015a; ACCOBAMS, 2019). In the absence of professional experience, findings should however be considered informative, but not conclusive.

3. Tier 3: Post-mortem examination with diagnostic aims

The aim of a post-mortem examination at this level is to establish the cause(s) of death and to assess the health status of the individual(s) investigated. This allows to detect causes of death ranging from viral epidemics and parasitic infestations to ship strikes, acoustic trauma and chemical pollution (ACCOBAMS Res. 4.16; Van Bressem et al., 2009). Only well-resourced and experienced veterinary pathologists can reach this level.

Carcass disposal must follow biosecurity standards, avoiding risks of zoonotic disease transmission and environmental contamination. Methods include burial, incineration, rendering, composting or controlled towing to sea, depending on local conditions and legislation (NOAA, 2017 – Marine Mammal Carcass Disposal Best Practices). Large whale strandings may require exceptional logistical measures and coordination with civil protection agencies.

Dead strandings not only provide diagnostic information but also supply tissues to international biobanks, enabling long-term ecological and toxicological research (ACCOBAMS Res. 7.14; MEDACES database).

The protocol adopted for cetaceans, can be adapted to monk seals, according to their anatomical differences.

Dead sea turtle stranding monitoring protocol

Regarding dead sea turtle stranding, the Adriatic IPA NetCet project protocol was adopted. The full version is available at this link: https://www.blue-world.org/bw/wp-content/uploads/2017/05/NETCET_Standard-protocols-for-post-mortem-examination-of-sea-turtles.pdf

Originally this protocol was not structured in levels, but **the 3 Tiers approach can be adopted also in this case.**

Sea turtle dead strandings are addressed through similar principles but adapted to reptilian anatomy and conservation priorities.

External examination includes the collection of morphometric data, such as curved carapace length (CCL), straight carapace length (SCL), weight, species identification via scutes (or scale) patterns, and photographic documentation of injuries. Evidence of anthropogenic threats (entanglement scars, boat strikes, ingestion of plastic bags or hooks) is systematically recorded.

Internal examination involves removal of the plastron and examination of organs in the celomatic cavity. Samples are collected for histology, microbiology, parasitology (e.g., spirorchiid trematodes), and contaminant analyses (NETCET, 2015b).

Dead turtles are managed in compliance with sanitary protocols, with carcass disposal coordinated by veterinary and environmental authorities. Data are reported to national and regional databases, contributing to the evaluation of long-term trends in population health and anthropogenic mortality.

Assessment of human activity interaction

The assessment of human activity interaction is conducted during the carcass external and internal examination and through specific laboratory analysis. The interpretation of signs and findings associated with human activities and their role in the death of the specimen, can be assessed only with Tier 3 of post-mortem examination.

- Fishery interaction: for the individuation and record of findings associated with fishing activities interaction, the framework created during the LIFE Delfi project (LIFE18 NAT/IT/000942) was adopted. The framework presents a multi-tiered structure, according to the joint ACCOBAMS and ASCOBANS document for post-mortem examination. The full version can be downloaded at this link: https://lifedelfi.eu/wp-content/uploads/2021/04/A3_Framework_Fishery_interaction-1.pdf .
  This framework can be adapted to pinnipeds and sea turtles.
- Vessels interaction: can cause various forms of injury: sharp, intermediate, blunt, and a combination of these three; see the NOAA *Handbook for recognizing, evaluating, and documenting human interaction in stranded cetaceans and pinnipeds* for further details (https://repository.library.noaa.gov/view/noaa/4429). This protocol can be adapted to sea turtles.
- Noise-induced lesions: difficult to assess (possible only from Tier 2) (see Fernandez et al., 2005; Morell et al., 2017);
- Chemical pollution: identifying the effects of chemical pollution on the health status of sentinel species is a difficult challenge, considering the different factors

that can affect their health. Despite this, scientific literature associates chemical pollution toxic effects to reproductive and immunology dysfunctions.

Cetacean Live Stranding Protocol

Live cetacean strandings are critical emergencies that require rapid, coordinated and welfare-oriented responses. According to ACCOBAMS Resolutions 6.22 and 4.16, as well as IWC and NOAA best practices, interventions must be based on triage principles led by veterinarians or other trained experts (ACCOBAMS Res. 6.22; IWC Workshop 2016; NOAA, 2018).

Briefly, first-aid measures include:

- Approaching animals calmly, minimizing noise and human presence (NETCET, 2015a; IWDG Guidelines, 2017);
- Keeping the animal upright, digging pits under pectoral fins for support, or using inflatable mattresses;
- Protecting blowhole and eyes, and avoiding manipulation of fins, tail, or genital areas;
- Preventing overheating with wet towels and shade, or hypothermia with insulating materials in winter.

Triage decisions are central: veterinarians assess whether an animal can be immediately released, rehabilitated, or must undergo euthanasia to prevent suffering or natural death (ACCOBAMS Res. 6.22; IWC Workshop on Euthanasia, 2013). The decision-making process considers clinical status, behaviour, ongoing epidemics, ethical concerns, and feasibility of rehabilitation.

Mass strandings and Unusual Mortality Events (UMEs) require specific contingency plans. International experience highlights the importance of early mobilization of expert task forces, large-scale coordination, public safety management, and transparent communication with authorities and media (ACCOBAMS Res. 4.16; IWC Workshop 2016).

Sea turtle live stranding protocol

Sea turtle live strandings and bycatch events are frequent in the Mediterranean. The NETCET protocols provide clear first-aid and handling procedures (NETCET, 2015b). Animals must be placed in appropriate containers with soft surfaces, always kept in ventral position, and never lifted by flippers.

Seasonal management is essential: in summer, turtles should be kept moist with wet cloths and shaded, while in winter they must be covered with dry towels and kept in a warm environment. Stress reduction is critical: covering the head and eyes with a damp cloth, keeping nares free, and limiting human contact.

Specific scenarios include:

- Comatose or bycaught turtles: place in slope position (hindquarters elevated 20–30 cm) to stimulate breathing and recovery;
- Hooked turtles or turtles with lines coming out from mouth and cloaca: cut the line as close as possible to the mouth (when the hook is well visible and all the line is out, without attempting hook removal); if the hook is not visible, try to fix the line to the body in order to avoid the ingestion of the line (fix it very softly, in order to avoid internal lesion caused by the hook) ; transfer to rescue centres for veterinary intervention (NETCET, 2015b).
- Wounded turtles: apply clean bandages to minimize infection risk during transport.

Transport must ensure continuous monitoring of respiration and hydration. On arrival, clinical assessment at rescue centres determines rehabilitation or release. Live strandings thus represent not only rescue opportunities but also sources of valuable data on threats such as fisheries interactions, plastic ingestion and vessel collisions, but also parasitic/microbiological analysis.

Monk seal dead and live management

The management of strandings of the Mediterranean monk seal (*Monachus monachus*) must reconcile the species' conservation status with the logistical and ethical complexities that arise in coastal and cave-dominated habitats. A transnational, standardized approach, anchored in the Barcelona Convention's SPA/RAC instruments and the newest IUCN technical guidance, ensures that data and decisions are comparable across the ADRION region and that interventions meet consistent welfare and biosecurity standards.

In the case of **dead animals**, response begins with controlled site management and thorough documentation (location, date and time, sea state, decomposition code, sex/age class, full morphometrics, high-quality photographic records), followed by a necropsy pathway adapted from pinniped best practice and tailored to *M. monachus* (external examination; blubber/fascia; thoracic and abdominal cavities; head and central nervous system). Systematic sampling (skin/blubber, lung, heart, liver, spleen, kidney, adrenals, stomach and intestines with contents, lymph nodes, reproductive organs, skeletal muscle, brain, etc.) supports histopathology, microbiology/virology/parasitology, toxicology and genetics, enabling evidence-based diagnoses that differentiate fisheries interactions, vessel strike, intentional killing, disease, malnutrition and pup losses. Teeth, whiskers and selected tissues should be archived for age determination and stable-isotope or contaminant work, and all chain-of-custody steps recorded. Carcass disposition (e.g., burial, rendering, incineration, controlled composting or return to sea) must comply with public-health and environmental safeguards, with choices driven by carcass size, location, accessibility, legal constraints and any chemical-euthanasia considerations. Data and samples should feed national repositories and regional frameworks to inform spatial planning and threat mitigation. This approach aligns with SPA/RAC's Action Plan and Regional Strategy for monk seal conservation, the IUCN's consolidated methods for monitoring and research, and globally used marine-mammal necropsy and carcass-disposal manuals.

For **live animals in distress**, rapid, welfare-centred response led by experienced veterinarians is essential, with human safety and stress minimization as the primary constraints. On scene, responders should secure a quiet perimeter and reduce disturbance from people, dogs and vessels; visual and acoustic shielding is particularly important around cave entrances used by females and pups. First aid focuses on thermoregulation (shade and gentle wetting to prevent hyperthermia in warm months; wind-breaks and dry insulating layers to prevent hypothermia in colder conditions), ocular protection and minimal handling; transportation relies on soft stretchers and padded crates that allow sternal recumbency and continuous monitoring of respiration and temperature. Triage then weighs clinical condition, behaviour, season (autumn–winter pupping), cave occupancy and feasibility of re-uniting dependent pups with mothers. Orphaned or injured pups require specialized stabilization (fluids, staged nutrition, biosecurity) and rehabilitation designed to prevent imprinting and prepare for post-release survival; release should occur within the species' local ecological context, timed to favourable sea and weather conditions, and ideally accompanied by individual identification (Passive Integrated Transponder - PIT/flipper tag), telemetry and structured post-release monitoring (camera-traps and photo-ID at caves, standardized sighting forms). This continuum, from first contact to release and follow-up, draws on decades of rehabilitation experience and lessons learned in Greece and elsewhere, while the IUCN's recent guidance and SPA/RAC tools promote harmonized protocols, adaptive decision-trees and clear reporting lines across jurisdictions.

Finally, monk seal strandings, dead or alive, must be viewed not only as emergencies but also as structured opportunities for knowledge generation. Consistent necropsy and sample archiving improve the ability to attribute mortality to discrete threats; standardized live-response metadata (location, age class, condition, interventions, outcomes) enhance regional indicators of population status and pressure. Integrating these data into national systems and SPA/RAC reporting streams strengthens the feedback loop between evidence and management, supporting the siting and design of MPAs, the regulation of high-risk maritime uses near breeding caves, and the targeting of fisheries mitigation. A coherent, macro-regional practice, grounded in the SPA/RAC Action Plan and Regional Strategy, operationalized through IUCN methods and refined by rehabilitation and veterinary experience, offers the best prospect of turning critical incidents into durable conservation gains for *M. monachus*.

2.3.2 FREE-RANGING MONITORING PROTOCOLS

Several complementary approaches are available for monitoring sentinel species, depending on the research goals, geographical context, and available financial resources. Each methodology provides different types of information, tailored to address specific monitoring objectives. A scientific monitoring program generally follows a structured approach that includes:

1. Define the objectives and goals of the monitoring research
2. Identify the target species
3. Define the geographic area to be monitored and establish the appropriate temporal frequency (i.e., monthly, seasonally) for the monitoring activity according to historical information available on target species
4. Evaluate logistical aspects, including area size, geomorphological characteristics and available survey platforms
5. Conduct a cost-benefit analysis to ensure efficiency and feasibility of the monitoring activity
6. Select the most suitable applicable method to meet the defined objectives.

The choice of the most suitable monitoring approach should be guided by the specific research questions to be addressed, taking into account both spatial (e.g., regional or population level) and temporal (e.g., seasonal or inter-annual) scales of investigation of phenomenon. The estimation of each population parameter of interest requires the acquisition of specific data, which in turn determines the most appropriate methodological tools to collect them. Different methods yield different types of data, each contributing to a more complete understanding of different aspects about target species. In the case of project sentinel species, often, the combination of multiple methodologies enhances data reliability and provides a more comprehensive knowledge of ecology and status of them (Evans and Hammond, 2004) (Tab.2.3.2.a).
In this section, different approaches used to collect the necessary information to assess the ecological and health status of populations of the project target species are reported. To provide a more complete overview of the applied methods, references were made to

published scientific works and to guidelines produced by institutions responsible for the conservation of these species at different spatial scales (e.g., IUCN, UNEP/MAP-RAC/SPA, ACCOBAMS, ISPRA), while also capitalising on the results of other European projects, especially LIFE.

Tab.2.3.2.a - Two-step process to determine the appropriate survey method according to the research objectives. The first table outlines the type of data required to obtain the specific results; the second table indicates the most suitable survey method to obtain those data.

Results	**Data required**							
	Survey effort	**Location position**	**Group size**	**Individual sex**	**Presence of juveniles/calves**	**Behaviour**	**Photo-ID**	**Acoustic**
Occurrence		x	x	x	x			x
Population abundance	x	x	x		x		x	x
Demographic parameters	x	x	x	x	x		x	x
Distribution	x	x	x					x
Movement patterns		x	x		x	x	x	x
Habitat use		x	x		x	x		x
Anthropogenic impact	x	x	x		x	x		x

Data required	**Survey method**		
	Aerial surveys	**Vessel surveys**	**Land surveys**
Location position	x	x	x
Group size	x	x	x
Individual sex		x	
Presence of juveniles/calves		x	x
Behaviour		x	x
Photo-ID data		x	
Acoustic data		x	x

Cetacean occurrence, distribution and habitat use pattern

Understanding the geographical and temporal distribution of cetaceans population is essential to identify predictable areas and periods of special ecological importance, and this knowledge is fundamental for implementation of effective conservation measures. Different sampling approaches, methods and designs are available for detecting the presence of cetaceans during at-sea monitoring. As already reported, several factors should be considered before choosing the appropriate approach and methodology. *Ad hoc* protocols can be applied to adapt the investigations to the specific characteristics of the study area considering the occurrence of different topographic and oceanographic features, as well as economic availability to perform it.

One of the most commonly adopted approaches is based on visual inspection of cetacean and sea turtle species at sea surface. The most recommended approach follows the assumptions and rules of the Conventional Distance Sampling (CDS) (Buckland et al., 2001; Buckland et al., 2004; Buckland et al., 2015). This approach, first introduced by Buckland et al. (1993), includes a suite of methods, such as line and point transect sampling, designed to collect a list of information on species presence from which animal density or abundance can be estimated. Although the main goal of CDS methods is to estimate animal density and abundance from a sample of distances to detected individuals over a study period, they also allow for a standardized protocol to collect several data useful for inferring patterns of distribution and habitat use. Such data include sightings occurrence over time, GPS coordinates of sightings, depth range of species observation, and a series of other information relevant to improve the ecological knowledge of each species.

The most widely used technique in CDS, especially in case study on cetaceans and sea turtles, is the line-transect distance sampling, which involves recording sightings from a moving platform along line transects placed independently of animal locations. These linear transects could be placed according to different types of sampling design, such as random, systematic, parallel, zigzag, or a combination of these. For a complete guide on Distance Sampling and its application in real cases, please refer to the books by Buckland et al. (2001, 2004, 2015), Thomas (2010), and the website of Centre for Research into Ecological and Environmental Modelling (CREEM) https://www.creem.st-andrews.ac.uk/research/ecological-survey-methods/distance-sampling-methods-2/.

Line transect distance sampling can be conducted from both boats/ships and aircrafts. In general, at both Mediterranean and national scales, aerial surveys are carried out in the framework of the MSFD monitoring of target species, included in the *Descriptor 1-Biodiversity*. ACCOBAMS has been working on developing an exhaustive program to estimate cetacean abundance and assess distribution and habitat preferences in the Black Sea, Mediterranean Sea, and the adjacent waters of the Atlantic. This program was implemented during the "*ACCOBAMS Survey Initiatives*" (ASI) carried out in 2018- 2019 and programmed to become an ACCOBAMS embedded Long Term Monitoring Programme sustaining collaborative macro regional surveys every 6 years. More details can be found at the following links: https://accobams.org/wp-content/uploads/2019/04/MOP7.Inf33_ASI-Technical-Reports.pdfprocolo (for an overview of protocol adopted during ASI) and https://water.europa.eu/marine/policy-and-reporting/msfd-reports-and-assessments/ (for an overview of monitoring results in different EU Countries).

Unlike aerial surveys, boat/ship-based monitoring is more suitable for coastal surveys in smaller areas, often over continuous periods. These types of surveys can be carried out

using either platform of opportunity or dedicated research boat. Platforms of opportunity, such as ferries, fishery vessels, whale-watching boats offer a cost-effective method to collect valuable data over protracted periods than a dedicated platform, surely more suitable but also more expensive. The use of opportunity platforms presents limitations primarily related to the variability of survey effort, which is influenced by the fixed routes, timing, and operational logistics of this type of platform. Since 2007 the Italian Institute for Environmental Protection and Research (ISPRA) has been coordinated the international project called *Fixed Line Transect Mediterranean Monitoring Network (FLT-Med Network),* that provides specific protocols to monitor mega- and macrofauna (cetacean, sea turtles, seabirds, and other associated macrofauna) using ferries as observation platforms across the whole Med, overcoming possible limitations of this approach in terms of area coverage and long-term data collection. Lately, these protocols were updated and applied within the framework of the EU Life project *CONCEPTU MARIS.*
Complementary to visual inspections at sea, land-based monitoring surveys provide a useful source of information about species presence, especially in areas where the sea can be observed from a high vantage point of view. Although this approach requires specific conditions to be implemented (e.g., high point of observation), it is low cost, low risk, logistically simple, and capable of operating in a wider variety of sighting conditions. From land-based vantage points, marine mammals can be observed in the least intrusive and disruptive way possible, usually for long periods. Most land-based methods can detect relative trends in occupancy and predominant behaviours, providing the foundation for long-term population monitoring. For these reasons, land-based survey methodologies are used throughout the world, particularly in remote areas where long-term continuous surveys from any other platform type would be infeasible (Aragones et al., 1997, Keen et al., 2020). However, land-based survey methodologies present some limitations that constrain their range of application. Since the range of marine mammal populations is usually much larger than the viewshed from a single observation site, land-based findings are restricted in geographic scope. Another critical limitation is that only nearshore populations can be effectively surveyed, and our understanding of those populations will be biased by the densities, movements and behaviours of those individuals that occur closest to shore.
In recent years, in addition to monitoring carried out by expert marine mammal observers, Citizen Science has also been employed. It has emerged as a valuable research approach for enhancing knowledge of fine-scale cetacean distribution, particularly in sparsely populated regions and with limited research activity. Through immersive and targeted training, as well as passionate volunteers sensitive to conservation of protected species and environmental issues, citizen science enables the collection of data on species richness, group size, behaviour, seasonality, and conservation threats. The

growing accessibility of digital tools has opened new opportunities for public involvement in scientific activities, including data collection and information sharing (Tulloch et al., 2013; Theobald et al., 2015). Citizen science–based ecotourism has also proven effective in engaging the public in marine conservation efforts (Cigliano et al., 2015; Hyder et al., 2015; Turrini et al., 2018; Barbaccia et al., 2025). By actively involving non-scientists in data collection, analysis, and monitoring, these initiatives serve as a cost-effective means to advance scientific knowledge and promote environmental awareness (Ballard et al., 2024). Promoting citizen science programs in targeted, under-monitored areas can help fill knowledge gaps regarding species occurrence and distribution. Furthermore, the active involvement of citizens can support competent authorities in addressing environmental policy objectives (Alessi et al., 2019).

An alternative and complementary approach to visual monitoring is Passive Acoustic Monitoring (PAM). This technique has become increasingly used as it is considered coast-effective, non-invasive and capable of detecting cetaceans and providing critical information, especially in areas where data are lacking and where evaluations of threats for vulnerable populations are required at both high spatial and temporal resolutions (Caruso et al., 2020). Acoustic surveys can be performed using different technologies, depending on the target species and research goals. The main approaches to acoustic monitoring can be divided into fixed acoustic surveys, in which hydrophones are moored in a fixed location, and mobile acoustic surveys, in which hydrophones are towed behind a vessel (i.e. towed array) or attached to a mobile platform (i.e. glider). These systems range from dipping units with single or multiple hydrophones, to acoustic tags which can be deployed on individual animals, to array of hydrophones mounted on towed or bottom-moored structures, as well as autonomous platforms able to provide data across wide spatial scales (Mellinger et al., 2007; Van Parijs et al., 2009). A comprehensive overview of the different passive acoustic technologies is provided by the National Oceanic and Atmospheric Administration (NOAA): https://www.fisheries.noaa.gov/new-england-mid-atlantic/science-data/passive-acoustic-technologies.

Beyond acoustically documenting cetacean occurrence, PAM contributes to estimate population size and abundance, distribution and habitat use, residency pattern, behavioural patterns, spatio-temporal trends, interactions with anthropogenic marine activities and their potential impact (Boisseau et al., 2010; La Manna et al., 2014; Gibb et al., 2018; Frasier et al., 2021; Poupard et al., 2022; Di Nardo et al., 2023). Acoustic data can corroborate visual observation within an integrated and systematic monitoring framework conducted across seasons and years. The combined use of both monitoring techniques provides an effective long-term approach for monitoring and managing cetacean populations (e.g., Mellinger et al., 2007; Davis et al., 2017; La Manna et al., 2020; Dalpaz et al., 2021; Frasier et al., 2021; White et al., 2025). A non-exhaustive list of research studies carried out in ADRION region on this topic is provided: Caruso et al., 2017; Corrias et al., 2021; Awbery et al., 2022; Akkaya et al., 2023; Constaratas et al., 2025.

Satellite telemetry is another key technique which enables the tracking of individual cetaceans over long distances. The use of satellite transmitters has become increasingly common in behavioural ecology, offering insights into animal movement, distribution and habitat use. providing insights into behavioural states and home ranges of tracked individuals or wider populations.

Estimates of cetacean population density and abundance

As already mentioned in previous section, a ubiquitous and standardized method used to estimate the density and abundance of cetacean and sea turtles is the Line Transect Distance Sampling (e.g., Panigada et al., 2009, 2017, 2024; Lauriano et al., 2010; Carlucci et al., 2016, 2018a, b; Mannocci et al., 2018; Hammond et al., 2021). This method requires collecting data through reticle readings and bearing of the sighted animals to later calculate the perpendicular distances from each sighting to the track-line surveyed. The key principle is that the probability of detecting animals decreases with distance from the observer, so a detection function is modelled using the observed distances to estimate how many objects were missed and thereby, infer population size (Fig.2.3.2.A).

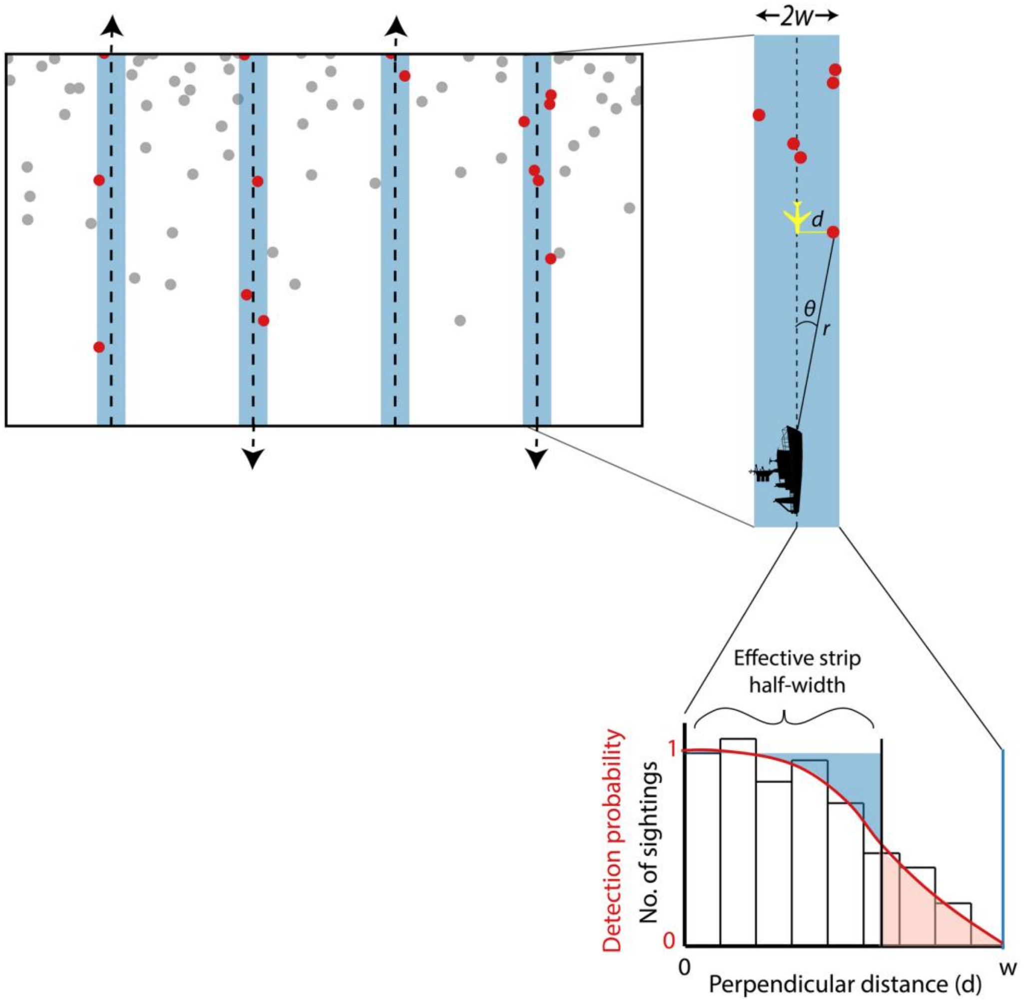

Fig.2.3.2.A - Schematic representation of the elements of a line transects survey (Hammond et al., 2021). w=Truncation distance, r=shortest distance to the focal group (can be calculated by reticules), Q=the bearing of the focal group to the transect line, d=perpendicular distance. Red points represent the encounters included in the analysis while the grey dots represent discarded sightings.

Common survey designs include a series of equally spaced parallel transects or an equally spaced zig-zag pattern (zig-zag line transect sampling), starting from a random point along one edge of the survey area. These designs aim to ensure the highest probability of investigation of the area, where every location within the area has the same chances of being sampled (equal coverage probability) (Thomas et al., 2010). This approach not only reduces bias but also helps to optimize the time and costs of the monitoring activity, while maintaining balanced spatial coverage of the study area. This approach does not require individual identification and is generally applied over large study areas, enabling the simultaneous monitoring of multiple species (Buckland et al., 2004; Daura-Jorge and Simões-Lopes, 2017). Dawson et al. (2008) provides a detailed description of designing and implementing line-transect surveys to obtain robust estimates of abundance. The method relies primarily on the visual detection made from a platform moving along predetermined transect lines. Observers record detection events including group size, radial distance of the event from the recorder and the angle between the vessel's bow and the animals. For each event, the perpendicular distance from the transect line is calculated. These data are used to estimate the probability of detection, the size of the covered region, density and abundance of the population and the effective strip width (Ollier et al., 2023). Recent advances integrate visual with acoustic methods. Acoustic monitoring has the advantage of detecting cetaceans even when they are not visible at the surface, thereby improving detection rates and the overall survey efficiency (Verfuss et al., 2018). PAM, using a towed hydrophones array, is a standard tool for localizing cetaceans during line-transect cetacean abundance surveys. Estimating the perpendicular distance between localized cetaceans and the track line is essential for deriving abundance estimates from acoustic data (Barkley et al., 2021).

Complementary to the Distance Sampling approach, another technique widely adopted for estimating cetacean population abundance is the Mark-Recapture (MR). This method is based on the assumption of Lincoln-Petersen index that the proportion of marked individuals recaptured in the second sample represents the proportion of marked individuals in the population as a whole (Ricker, 1975). Although this principle has been further extended over time by several ecologists such as Schnabel (1938), Cormack (1964), Jolly (1965), and Seber (1965) depending on whether the populations studied were assumed to be closed or open, the basic principle is the single unique recognition of each individual in the studied population.

Currently, MR methods can be implemented through different tools, including photo-identification (Photo-ID) (Genov et al., 2008; Hammond, 2018), acoustic detections (Marques et al., 2012) and genetic sampling (Mills et al., 2000). Photo-ID is the most used and non-invasive method, based on the protocol originally proposed by Würsig and Würsig (1977). It involves the identification of individuals based on unique natural markings of dorsal and caudal fins (e.g., notches, scars, pigmentation). Repeated sightings of these individuals allow to construct capture histories, which are then used to estimate the number of undetected animals and hence the overall population size (Hammond, 2018). This technique is particularly effective for small, coastal populations within limited geographic ranges. The recent development of Machine Learning-driven fin matching tools has proved to be an emerging useful tool to automate and increase the efficiency in Photo-ID analysis (Maglietta et al., 2018, 2022, 2023; Renò et al., 2022; Cipriano et al., 2022a, b).

Demographic Parameters

The demographic characteristics can be estimated from data directly collected with different methods, including visual surveys, mark-recapture (MR) approaches, as well as visual/acoustic surveys, photogrammetry, and remote skin biopsy sampling (Booth et al., 2020; SPA/RAC, 2021). In detail, visual surveys can provide relatively limited information, such as mother-calf ratio, useful to estimate birth rate (Booth et al., 2020). MR approaches involve the initial "capture" and "marking" of individual animals, usually by taking photographs that allow photo-ID of individuals (Hammond et al., 2009; Urian et al., 2015; Hammond et al., 2021). This method is considered highly feasible for most cetacean species and highly useful for assessing demographic characteristics. Specifically, long-term photo-ID is essential for reconstructing capture-recapture histories and for determining the sex and age classes of individuals (Hammond et al., 1990; Verborgh et al., 2021). The assessment of key population demographic parameters, such as survival probabilities, reproductive rates, recruitment, and rate of change of population size, can be carried out using MR models. MR estimates can be considered as a baseline for inferring future population dynamics trajectories and can be used in population viability analysis (PVA) framework. PVA models are powerful tools to evaluate population status, project growth rates, assess tolerance to threats, test resilience to catastrophic events, and quantify sustainable removals or habitat degradation (Lacy et al., 2021).

Photogrammetry provides a non-invasive method that enables the acquisition of detailed information on body shape, health status and nutritional condition of individuals (Durban et al., 2015). By deriving accurate measurements from the image analysis, it is possible to estimate key morphometric characteristics (e.g., length, girth etc.) and obtain insights into the age or stage class of an individual, as well as body condition, which can be reflects their energy reserves (Hanks, 1981). These data contribute to a better understanding of species life history, at both individual and population level. Moreover, this approach facilitates the collection of data on large sample sizes and supports long-term population monitoring (Burnett et al., 2019). Recent advancement in aerial photogrammetry protocols using drones or other unmanned aerial vehicles (UAVs) has proven highly efficient for monitoring free-ranging cetaceans. These applications have proven particularly effective for estimating morphometric traits and assessing variations in body condition, thus enabling the evaluation of population age structure and the early detection of demographic population changes (de Oliveira et al., 2023; Vivier et al., 2023). Skin biopsy sampling of free-ranging organisms provides help to define the health status of cetacean species with respect to multiple threats. Remote biopsy techniques enable researchers to gather a wide array of data with minimal disturbance, offering a comprehensive picture of individual and population health, as well as ecological and environmental exposure to pollutants and pathogens. ACCOBAMS provides protocol to collect skin biopsies from free-ranging dolphin: https://accobams.org/wp-content/uploads/2022/11/MOP8.Inf51_Guidelines-on-the-best-practices-to-assess-the-impact-of-chemical-pollution-on-cetaceans-to-measure-the-chemical-contamination-on-cetaceans.pdf

Behavioural budget, social structure and movement patterns

The study of cetacean behaviour commonly relies on focal follow technique, applied either at individual or group level (Altmann, 1974; Mann, 1999), and combined with different sampling protocols, such as *ad libitum*, point, or scan sampling, selected according to research objectives (Mann, 1999; Martin and Bateson, 2007). As a general rule, individual focal follow is considered optimal for obtaining detailed behavioural information, as they minimise sampling errors while observing the behavioural stream of a single animal (Altmann, 1974; Mann, 1999). Moreover, individual-level protocols reduce pseudoreplication (Hurlbert, 1984), allow the analysis of behavioural variation of the individual, and enable comparisons across age and sex classes. Since the individual is considered as the optimal unit of analysis in activity budget studies (Mann 1999), protocols focusing on individuals ensure consistency between unit data collection and analysis. However, the application of such follows requires rapid and accurate individual identification or, at least, the ability to identify the same animal throughout the track, which can be challenging in species that lack distinctive natural markings or that live in large groups. For this reason, individual-level protocols (e.g., focal follows) are not always feasible and remain less frequently used (Karniski et al., 2015). Nevertheless, they provide valuable information that supports in-depth analyses of social structures, based on measures of association (Cairns and Schwager, 1987; Bigg et al., 1990).
Since single individuals cannot be always reliably tracked, group follows tend to be a more appropriate approach, especially when the focus is on behaviours in stable groups. The focal group method, often applied with instantaneous scan sampling (Neumann, 2001), is commonly applied to record the predominant activity states (Table 2.3.2.b). These data provide useful information to identify critical habitats used by cetaceans for feeding, breeding, calving, nursing and socializing (Hastie et al., 2003; Nowacek et al., 2016; Torres et al., 2018). The behavioural data can facilitate the understanding of the dynamics of animal populations. The integration of behavioural data with Photo-ID are suitable tools for investigating movement patterns (e.g. site-fidelity and residency pattern), social structures and interactions in cetacean population (Day et al., 2001; Nowaceck et al., 2016; Santacesaria et al., 2019; Carlucci et al., 2020; Cipriano et al., 2022a, b; Pintore et al., 2025). In recent years, technological advances have greatly improved behavioural data

collection for cetaceans. A description of technological advanced methods developed to study cetaceans behaviour is reported in Nowacek et al. (2016).

Table 2.3.2.b. Ethogram with definition of behavioural state (Shane et al., 1986)

Behavioural state	Definition
Travelling	Dolphins involved in persistent directional movement at speeds greater than resting (<4 knots); may involve purposing at faster speeds.
Socialising	Dolphins leaping, chasing, and engaged in body contact with each other; involves aspects of play and mating with other dolphins; may serve a social and/or sexual role.
Milling	Dolphins showing frequent changes in direction that sometimes appear as a transitional behaviour between other behavioural states and is sometimes associated with foraging, socialising or play. Dolphins generally cluster in a location during the activity.
Feeding	Dolphins involved in any effort to capture and consume prey as evidenced by chasing fish on the surface, coordinated deep diving with loud exhalations but without contact between individuals, and rapid circle swimming; prey is sometimes observed in the mouth and frequently observed during the foraging bout.
Resting	Dolphins engaged in very slow movements as a tight group, occasionally stationary, and lacked the active components of the other behaviours described.

Cetacean interaction with anthropogenic activities

The assessment of cetacean-human interaction and related potential impacts can be conducted through the collection of data on physiology, presence, and behaviour, which allow the estimation of long-term abundance, distribution, behavioural budget, and movement patterns. These indicators are essential to detect possible changes associated with human activities. Fleishman et al. (2016) provide guidance for monitoring whether human activities affect the physiology or behaviour of marine mammals and, if so, whether those effects may lead to changes in survival and reproduction at the population level. Monitoring data can be used to develop population models, which can help infer individual- and population level-effects of human pressures. A variety of variables can be measured, directly or indirectly, to evaluate the mechanism by which cetaceans may respond to human activities:

- Visual observations to estimate population size and distribution;

- Passive acoustic monitoring (PAM) to assess behavioural responses to underwater noise, co-occurrence of cetaceans and vessels, and acoustic activity pattern (Cruz-Villagran et al., 2025);
- MR methods to obtain indirect measures on survival, reproduction, age structure, population size;
- Tags to obtain data on speed, travel distance, vocalizations, behaviour.

Direct measures and observations of individuals or groups could be the most accurate approach to address the responses and impacts of human activities. However, this approach is not straightforward as interactions are often difficult to observe in real time, as well as the understanding of their short- and long-term effects. For this reason, assessments are typically carried out *a posteriori*, for instance by applying species distribution models that relate cetacean occurrence to anthropic activities, such as fishing activity or marine traffic (e.g. Goetz et al., 2014; Carlucci et al., 2021). The same approach can be used to assess interaction with marine litter, assessing densities of macro-/micro-litter overlapping with species distribution (ACCOBAMS-SC15/2023/Doc13). Analytical tools can also be employed to quantify behavioural responses or changes related to human presence. For example, Markov chains can be used to investigate the effect of vessel presence on cetacean behavioural states and budget (Akkaya et al., 2017).

Citizen science and the involvement of stakeholders, such as fishers, is a powerful approach to obtain direct data about interaction. Fishers can be engaged through dedicated research programmes and structured interviews to gather information on several aspects, such as number of sighted dolphin species, cetacean interactions with fishing activities, and damage to fishing gears (the presence of holes in the nets and numbers of eaten fish from the net) or entanglement (Milani et al., 2019). Information provided by fishers, when combined with scientific data and opportunistic observations, enhance the understanding of overlap and potential competition. Generally, a combined approach may prove both effective and economical whereby causal pathways and cumulative assessments can also be more effectively addressed (Hawkins et al., 2017).

Whale-watching activities inevitably involve an interaction between cetaceans and human activities. Thus, to assess this kind of interaction different approaches can be followed. One of them consists of the use of land-based observations, as a non-invasive method to assess the environmental pressure of whale-watching vessels and acoustic behaviour analysis to determine the impact of this activity (Forli et al., 2024). Analysis of cetaceans behavioural activities, such as changes in the rate of surface behaviours, as well as measurement of group size can be powerful tools for assessing the impact of whale watching activities (Toro et al., 2021). Furthermore, ACCOBAMS provide guidelines for the management of cetacean-watching activities, where are indicated methods used to assess and monitor the potential impacts of whale watching activities on cetacean populations: https://accobams.org/wp-content/uploads/2023/08/GL_Management-of-cetacean-watching-activities-in-the-ACCOBAMS-area.pdf

In addition to these general approaches, the SAMESEA partnership has developed a dedicated monitoring protocol specifically designed to investigate the interaction between cetacean target species and two main anthropogenic pressures: fisheries and aquaculture activities, and maritime traffic.
For fisheries and aquaculture, systematic boat-based surveys are conducted following *ad libitum* survey design, while ensuring homogeneous coverage of the study area under standardized conditions of visibility, sea state, and vessel speed. When trawlers or purse seiners are encountered, the protocol requires maintaining a distance of 200 m, stopping and waiting for 5 minutes to detect species presence. If the animals are sighted, photo-identification and behavioural data are collected, and specific behavioural categories are assigned as follows:

- Active trawler follow (ATF): dolphins are performing long dives while maintaining a position, approximately where the trawl net is.
- Passive trawler follow (PTF): dolphins are following the trawling boat but not actively foraging, usually remaining near the trawling boat between haul and redeployment of the trawl net.
- Purse seiner feeding (PSF): dolphins are feeding around a purse seiner, clearly staying close to the fishing boat.

Fish farms are monitored by approaching up to approximately 50 m, reducing speed to around 8 knots, and driving along the cages to check for dolphin presence. If sighted, photo-identification and behavioural data are collected. Dolphins observed in proximity to aquaculture farms may display a wide range of behaviours, but in many cases, they are not actively foraging but rather socializing or milling within a few hundred meters of the farm. For this reason, the definition of "*fish farm sighting*" is left to the observer's discretion, based on the overall context of the observation.
Regarding maritime traffic, monitoring activities are carried out through land-based surveys, carried out with theodolite, in order to minimize disturbance from research vessels on the dolphin behaviour. Marine traffic data is collected both simultaneously during focal dolphin group encounters and independently of dolphin presence. Each time a vessel enters or leaves the sighting range of the observers, its position is recorded with the theodolite, gathering as many geographical points as possible. These are stored in the Phytagoras software, and each vessel is assigned to a predefined category (e.g., motorboats, sailing boats, ferries, cargo ships, fishing vessels) (Fig. 2.4.1). In cases of multiple simultaneous vessels, a recorder maintains a detailed list of vessels, including their group numbers and distinguishing features. Vessel positions will later be

transformed into tracklines, thus at least two points must be recorded per vessel. Finally, data is processed to assess three types of potential impacts:

- immediate directional reactions - only measured when vessels enter the 400 m zone and recorded for the nearest vessel to the dolphin group. In the case of more than a single boat, the reaction is not recorded due to the challenge of identifying the cause of the reaction. The distance of the nearest vessel is identified through the theodolite points between the vessel and the focal group. The response is measured in terms of changes in the swimming direction of dolphins, as positive (focal group approaches the vessel), negative (focal group moves away from the vessel), neutral (no clear directional reaction), and undetermined (the observers couldn't decide if directional changes took place).
- alterations in behavioural budget - assessed through post-analysis of recorded behavioural states recorded at 5 minutes intervals. The first behavioural record represents the preceding behaviour, the follow up activity is recorded as succeeding behaviour. Subsequently, control and impact chains are created, including only focal follows with a minimum of three behavioural transitions.
- spatial variation in habitat use - evaluated by recording the location, the number and type of vessels within different distances from the focal group (0–100 m; 101–400 m; 401–1000 m, >1000 m). Later the vessel densities are mapped and overlapped with the dolphin densities to assess potential spatial overlap and alterations of area use in response to the presence of high vessel density.

The implementation of this protocol across multiple sites ensures the collection of standardized and comparable datasets, which can be integrated with species distribution models and analytical frameworks to assess cumulative impacts.

- PEDDLER (**PED**) is a kayak, SUP or rowboat. It's any floatation device smaller than 12m that needs peddles so has no motor and is only recorded near the dolphins.
- JET SKIS (**JS**) Small (<12m) motorised watercraft with a flat hull and an upright centre, which a rider sits astride.
- MOTOR BOAT (**MB**) Motor boats are any boats with outboard engines with a size less than 12m.
- LUXURY BOAT (**LB**) It can have inboard or outboard engines but is generally good looking and luxurious.
- PASSENGER BOAT (**PB**) Passenger boats have outboard engines, generally carry tourists and are smaller than 12m with no second floor.
- RESEARCH BOAT (**RB**) Is a boat that is clearly doing research on probably the dolphins and needs to be under 12m (no picture).
- SAILING BOATS (**SB**) Belonging to this category are all the boats propelled partly or entirely by sails, sailboats should still be noted as so even if the sails are down.
- CRUISE SHIPS (**CR**) Cruise ships are passenger ships used for pleasure voyages, where the voyage itself and the ship's amenities are a part of the experience, as well as the different destinations along the way.
- FERRIES (**FE**) Ferries are merchant vessels used to carry passengers, and sometimes vehicles and cargo as well, across a body of water.
- FISHING VESSELS (**FV**) Is a fishing boat which is larger than 12m, often they have cranes or something on the back to pull in the nets.
- CARGO SHIPS (**CS**) Cargo ships are any sort of ship or vessel which carries cargo, goods, and materials from one port to another.
- RESEARCH VESSEL (**RV**) Are boats over 12m that are doing research, any research, they do not need to be biologists, but note down what research they are doing.

Fig. 4.2.1 - Marine vessel categories (from: Montenegro Dolphin Research)

Sea turtles occurrence, distribution and habitat use

Monitoring free-ranging sea turtles can follow the same general approaches described in the previous section for cetaceans, while accounting for their distinct bio-ecological characteristics. Specifically, sea turtles have a complex life cycle, involving seasonal shifts between nesting, feeding, and wintering areas, which vary depending on their life stages (e.g. juvenile or adult). Therefore, monitoring programmes should aim to accurately identify the current distribution of these areas, as well as detect spatial and temporal dynamics for both adult and juvenile sea turtles. Standardized monitoring of nesting, foraging and wintering sites is essential to ensure consistent and comprehensive data. Detailed guidelines describing standardized long-term monitoring methodologies and techniques for estimating population size in key nesting, feeding, and wintering areas are provided in the document: *"Guidelines for the long-term monitoring programmes for marine turtles nesting beaches and standardized monitoring methods for nesting beaches, feeding and wintering areas"* (UNEP(DEPI)/MED WG.431/Inf.4).

Aerial surveys are considered one of the most robust tools for estimating sea turtle density, abundance and distribution (Pierantonio et al., 2023). Globally, aerial line transect surveys are widely applied to assess population parameters for sea turtles, while in the Mediterranean Sea they have historically been used to monitor cetaceans, while recently aerial surveys has been dedicated to assessing abundance of loggerhead sea turtles at regional scale (e.g. DiMatteo et al., 2022). Boat-based surveys, although remain critical, allows to obtain data at local scales of all life stages of sea turtles and to conduct mark-recapture analysis. When combined, aerial and boat platforms within a Distance Sampling framework allow more robust estimates of abundance and density (Cardona et al., 2025). Unmanned aerial vehicles (UAV) represent a monitoring tool, which can double the rate of turtles sighted, per minute of survey effort, compared to boat surveys, and allows surveys in areas or times inaccessible (Yaney-Keller et al., 2021).

According to Pasanisi et al. (2024), most data for sea turtles derive from satellite tracking devices rather than visual surveys. Visual sightings from these surveys can be further integrated with satellite tracking data, providing a complementary approach to estimate at-sea distributions and relative densities (Pikesley et al., 2018). Satellite tracking provides detailed information about the movements of individuals within a population and about breeding area, nesting and clutch frequency of individuals (i.e. number of nests laid by specific individuals), inter-nesting period (duration between each nesting event), date of departure from breeding grounds, migration distance and time, identification of foraging and wintering sites, wintering/foraging site fidelity and/or the use of multiple sites, remigration intervals to breed (1-2 years in males and 1-3+ years for females, depending on foraging site and animal condition) and residency at breeding sites, prospecting of alternative (possibly future under climate change) nesting sites. Different recent studies provide information about species movement and dispersal pattern, identifying developmental areas, habitat suitability and habitat use for the different life stages (e.g. Hays & Hawkes, 2018; Abalo-Morla et al., 2022, 2023; Kot et al., 2022; Kim et al., 2024; Maglietta et al., 2024).

Sea turtles nesting monitoring protocols

Following the UNEP/MAP Guidelines, the monitoring methodology of sea turtles nesting sites employed must provide reliable data on female abundance, nest distribution, and hatching success. In areas characterized by regular and/or annual nesting events, monitoring should be carried out through nocturnal or diurnal beach patrols across sectors delineated based on homogeneous physiographic characteristics. This approach aims to detect nesting females during their emergence and ascent onto the beach (nocturnal) or tracks of nesting females and hatchlings (diurnal).

In the case of extensive coastal areas, daytime surveys may be conducted during the early morning hours to ensure the detection of nesting activity before tracks are potentially erased by human trampling. For even larger coastal stretches, aerial surveys using unmanned aerial vehicles (UAV) may be employed (UNEP/MAP, 2017).

The identification of emergence/nesting tracks enables confirmation of nest presence; the precise location must be georeferenced and physically marked to facilitate post-hatching data collection. When a nesting female is encountered, individual marking with metal flipper or satellite tags can be carried out post-oviposition, in accordance with established guidelines (ISPRA, 2013). It is advisable that at least four nesting females per nesting area be equipped with satellite transmitters per season. This activity enables the characterization of reproductive periodicity, individual annual nesting frequency, and interannual remigration intervals (UNEP/MAP, 2017).

The estimation of the nesting population at each site can be derived using various metrics (e.g., total number of eggs laid, number of emergence tracks, number of confirmed nests, number of individually identified females), combined with appropriate conversion factors. The individual identification of nesting females allows for the direct application of mark-recapture techniques, supporting robust estimates of nesting population abundance.

In terms of nesting success, the hatching success rate over the entire breeding season is a key indicator for assessing habitat quality. For this purpose, the following environmental parameters of the nesting sites should be recorded: beach width, nest distance from the shoreline, sand grain size and thermal profile at nest depth, presence of predators, artificial light sources, nocturnal anthropogenic disturbance, level of urbanization of the area, and use of mechanical beach cleaning practices.

Hatching success is assessed by calculating the proportion of hatched eggs relative to the total number of eggs laid, following standardized protocols reported in the relevant scientific literature (ISPRA, 2013). This metric not only reflects the reproductive fitness of the nesting females but also serves as an indicator of the habitat's overall suitability for nesting.

Mediterranean monk seal occurrence, distribution and habitat use

The guidelines "*Mediterranean monk seal. A comprehensive set of monitoring and research techniques for the study and conservation of* Monachus monachus *in the Mediterranean Sea*" (developed by Quintana Martín Montalvo and Muñoz Cañas (2025) outlines different monitoring and research methodologies to monitor this species, its habitat and threats. These guidelines start from the evidence of the lack of baseline estimates on monk seal abundance and distribution, so the need of collating baseline data as a necessary step to support the identification of priority monitoring sites.

The monitoring of monk seals needs to start from literature review, historical data check, social media, interviews with local communities, fishers and coastal residents. In fact, monitoring of monk seals starts from the identification of areas characterised by historical distribution and the location of critical habitats for the species, obtained through searches of national/regional archived data reporting available historical records of monk seal sightings, spanning from past occurrences to the present in each area, to support the creation knowledge on historical distribution patterns. Once this is done, field surveys can be carried out. Data can be collected through systematic surveys, opportunistic surveys, citizen science surveys, sighting reports, etc. Necessary data are the record date, location (with coordinates if possible), time, presence/absence of seals, number of animals, etc., and eventually information as individual identification, presence of marine litter entangling the specimen, presence of specific marks, presence of trauma, and so on. Non-invasive studies, such as the collection of faeces (e.g., for diet analyses, genetic studies, parasite detection, microplastics), fur or other remains, are strongly recommended.

The guidelines provide different factsheets for monitoring method description based on the research objective. Monitoring methods are proposed for cave monitoring, beach monitoring, photo-identification data acquisition, population dynamics, behaviour and seasonality, tracking movement and distribution, trophic ecology studies, marine pollution, genetic studies, emerging survey methods (e.g., eDNA), interaction with fisheries monitoring, habitat disturbance monitoring, and tourism interactions monitoring. Furthermore, it comprises some methods to engage locals in reporting monk seal sightings.

2.4 CREATING/ACTIVATING LOCAL NETWORKS

The non-homogeneous situation of the regulatory framework in each country, synoptically described in Chapter 2.1, obviously implies a different administrative organization in terms of institutions responsible and procedures aimed at monitoring natural capital (habitats, species). Therefore, the third step of a coordination and cooperation model is to establish a multi-level network involving local, regional, national, and international institutions, in close dialogue with each other and with representatives of NGOs, the maritime economic sector (i.e., fisheries), the scientific community, and citizens in order to establish a flow of information useful to better define conservation strategies of biodiversity as well as of socio-economic development at national, macro-regional (EUSAIR) and Mediterranean scale. The possibility to establish and recognize a network of people-institutions as hubs for the systematic collection of data on sentinel species and anthropogenic pressures, enabling a transfer of validated information from a local to a national level ensures that knowledge is effectively disseminated and contributes to informed decision-making processes. So that, the SAMESEA partnership has decided to establish reference contact points, at least one in each country involved, which can act as a bridge between local and national authorities, scientific institutions, and citizens. By integrating knowledge related to target species monitoring and awareness of local conservation, these reference points support the development of a localised knowledge base and technical skills. As a result, when countries need to implement conservation measures, a solid base of know-how, expertise and trained personnel, and operational infrastructures are already in house. Within the SAMESEA project we want to test how the implemented coordination model can represent a positive example to be applied in other contexts and that can last over time. In detail, the Table 2.4.a lists the reference points of the local network, to be contacted in case of stranding, sighting or nesting events specifically for the common bottlenose dolphins and other cetacean species (in case), the loggerhead sea turtles and other sea turtles (in case) and the Mediterranean monk seal.

Table 2.4.a - Reference points contact for the activation of local networks based on the specific event (sighting, stranding, nesting).

Country	Institution	Reference contact	Event	Species
Croatia	Free emergency number	112	Sighting, stranding, nesting	All species of marine mammals and sea turtles

Italy	Coast Guard	1530	Sighting, stranding, nesting	All species of marine mammals and sea turtles
Albania	RAPA Vlora RAPA Lexha	+355688040880 Info@akzm.gov.al	Sighting, Stranding, nesting	All species of marine mammals and sea turtles
Slovenia	Morigenos	+386 59014067	Sighting, stranding	All species of marine mammals
	Free emergency number	112	Sighting, stranding, nesting	All species of sea turtles
Montenegro	Institute of Marine Biology, Morsko Dobro, Environmental Protection Agency, MDR		Sighting, stranding, nesting	All species of marine mammals and sea turtles
Greece	Archipelagos		Sighting, stranding, nesting	All species of marine mammals and sea turtles
Bosnia and Herzegovina	Port Authority	+387 36 880 020	Sighting, stranding	All species of marine mammals and sea turtles
	Coast Guard	+387 36 192		
	Civil Protection Office of the Municipality of Neum	+387 36 880 121		

Indeed, being part of a transnational network, these reference points foster communication among key actors in each Country, facilitating the harmonisation and coordination of conservation actions across the ADRION region. This ensures coherence and alignment of efforts at a macro-regional scale.

This network not only promotes cooperation among stakeholders but also facilitates the development of common and best monitoring practices, which are key components for strengthening future coordination and addressing the challenges associated with cross-border MSP. By facilitating the exchange of monitoring approaches and conservation strategies among Countries, the network promotes mutual learning and the co-development of best practices, leading to more effective and consistent monitoring protocols across the macro-region. Within this framework, the model supports shared monitoring activities related to strandings, sightings of free-ranging animals, and nesting events of sentinel species. The development of the coordination model involves not only data on the presence/absence, distribution and abundance of marine sentinel species, but also a qualitative and quantitative assessment of the potential presence and effects of anthropogenic pressures. To ensure the durability beyond the end of the project, the model includes awareness-raising activities and transfer of knowledge and technology through, for example, stakeholder engagement sessions, workshops, and dissemination initiatives. Indeed, training activities are fundamental in this contest, to learn the best technique used for monitoring species and threats, not only in a qualitative but also in a quantitative way. These activities will promote the adoption of homogeneous protocols by competent bodies, ensure knowledge continuity and creation of a historical series, and promote policy alignment and transnational collaboration.

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ANNEX I

Table 1. Description of scoring system to determine the pressure extent for each cause-effect relationship depicted in this study. Scores are expressed on a scale 0-1.

Attribute of the pressure	Level	Score
Frequency	Rare	0,2
	Occasionally	0,4
	Seasonally (more than twice a year)	0,6
	Monthly	0,8
	Daily	1
Magnitude/impact extent	individual	0,4
	population	1
Impact level	no impact	0
	minor disturbance	0,2
	medium disturbance	0,6
	devastating - medium	0,8
	lethal	1
Season-related	Yes	1
	No	0
Confidence	Low	1
	Medium	2
	High	3

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season-related (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	Specify which season (Open answer)	Potential effect (Please, specify the potential effects on target species - open answer)	SCORE					Sources (Published literature specific to the study area)	Notes
							Frequency (Among the option, please specify the frequency of interaction)	score	Magnitude (Among the option, please specify the magnitude of the interaction)	Impact level (Please, specify the impact on the sentinel species)	Confidence (Please, specify the level of confidence with which the information is given)		
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	resources competition/opportunistic feeding for the species, population size decrease/ low scale redistribution	Monthly	0.8	individual	minor disturbance	High	Carlucci et al., 2016; Maiorano et al., 2010; Russo et al., 2017; Ricci et al., 2020	
			Monachus monachus	0	Year-round	resources competition/opportunistic feeding for the species, population size decrease/ low scale redistribution	Unknown*		individual	minor disturbance	Low		
		bycatch	*Tursiops truncatus* (or other cetaceans)										
			Caretta caretta (or other sea turtles)										
		overfishing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	resources competition /prey depletion due to fishing catches, population size decrease/ low scale redistribution	Occasionally	0.4	population	minor disturbance	Medium	Maiorano et al., 2010; Carlucci et al., 2020; Tudela et al., 2004; Piroddi et al., 2010; Giannoulaki et al., 2017.	
			Monachus monachus	0	Year-round	resources competition /prey depletion due to fishing catches, population size decrease/ low scale redistribution	Unknown*		population	medium disturbance	Low	https://www.monachus-guardian.org/factfiles/medit16.htm	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	altered movements and behavioral patterns	Daily	1	population	medium disturbance	Medium	Fortuna et al., 2015	
			Caretta caretta (or other sea turtles)	0	Year-round	impacts on the turtle's feeding habitat	Daily	1	population	medium disturbance	Low		
			Monachus monachus	0	Year-round	altered-limited movements and behavioral patterns	Occasionally	0.4	population	minor disturbance	Medium	Karamanlidis et al., 2008	
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	entanglement in lost nets, death/injuries on animals	Unknown*		individual	devastating/lethal	Medium	Bearzi, 2002; Stelfox et al., 2016; ACCOBAMS, 2019	
			Caretta caretta (or other sea turtles)	0	Year-round	entanglement in lost nets, death/injuries on animals	Unknown*		individual	devastating/lethal	Medium	Casale et al. (2010); Casale P. (2008)	
			Monachus monachus	0	Year-round	entanglement in lost nets, death/injuries on animals	Unknown*		individual	devastating/lethal	Medium	Action Plan fo the Management of MMS (2022)	
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	resources competition /prey depletion due to fishing catches, population size decrease/ low scale redistribution	Occasionally	0.4	population	minor disturbance	Low	Carlucci et al., 2020c; Ricci et al., 2020b; Bearzi et al., 2010	
			Monachus monachus	0	Year-round	resources competition /prey depletion due to fishing catches, population size decrease/ low scale redistribution	Occasionally	0.4	individual	minor disturbance	Medium	Dendrinos et al., 2020; Notarbartolo di Sciara & Kotomatas, 2016	
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year-round	entanglement during fishing activities, death/injuries on animals	Occasionally	0.4	individual	devastating - medium	Medium	Bearzi, 2002; Gillman et al., 2006	
			Caretta caretta (or other sea turtles)	0	Year-round	Injury, mortality due to entanglement due to attraction by light	Occasionally	0.4	individual	devastating/lethal	Medium	Casale et al. (2010); Casale P. (2008)	
			Monachus monachus	0	Year-round	entanglement during fishing activities, death/injuries on animals	Rare	0.2	individual	devastating/lethal	Low		
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)										
			Caretta caretta (or other sea turtles)										
			Monachus monachus										
		competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	resources competition, population size decrease/ low scale redistribution	Monthly	0.8	individual	minor disturbance	High	Bearzi, 2011; Bearzi et al., 2011;	
			Caretta caretta (or other sea turtles)	0	Year-round	not compete directly for resources, but the intensive presence of artisanal fishing in coastal areas can limit access to benthic prey	Seasonally	0.6	individual	minor disturbance	Medium	Casale et al., 2018	
			Monachus monachus	1	Spring-summer	resources competition	Seasonally	0.6	individual	medium disturbance	Medium	Karamanlidis et al., 2008	
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Year-round	disturbance, population size decrease/ medium scale redistribution	Seasonally	0.6	population	medium disturbance	Medium	Podestà et al., 2016; Castellote et al., 2012; Maglio et al., 2015	
			Caretta caretta (or other sea turtles)	0	Year-round	disturbance, population redistribution	Occasionally	0.4	population	medium disturbance	Medium	Ceraulo et al., 2022	
			Monachus monachus	0	Year-round	disturbance, population redistribution	Rare	0.2	individual	medium disturbance	Medium	UNEP/MAP – SPA/RAC, 2019	
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	resources competition/opportunistic feeding for the species	Unknown*		individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	death for use of meat or carapace	Unknown*		individual	minor disturbance	Medium	Casale P. (2008)	
			Monachus monachus	0	Year-round	death due to competition for fishing and poaching for skins	Unknown*		individual	devastating - medium	Medium	Action Plan fo the Management of MMS (2022)	
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Displacement, hearing damage from pingers, loss of foraging areas	Monthly	0.8	individual	medium disturbance	Medium	ACCOBAMS (2021); Díaz López (2006)	
			Caretta caretta (or other sea turtles)	0	Year-round	Injury or ingestion of fishing gears	Occasionally	0.4	individual	minor disturbance	Medium	ISPRA (2020); UNEP/MAP (2015)	
			Monachus monachus	0	Year-round	Exclusion from coastal areas	Occasionally	0.4	individual	medium disturbance	Medium	ISPRA (2023)	
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disorientation, moving away from the distribution area	Occasionally	0.4	population	medium disturbance	Medium	ACCOBAMS 2021; OceanCare 2021; Rako et al. 2022; ISPRA 2024	
			Caretta caretta (or other sea turtles)	0	Year-round	disorientation, moving away from the distribution area	Occasionally	0.4	population	minor disturbance	Medium	Lucchetti et al. 2017; Casale et al. 2010; ACCOBAMS 2021	
			Monachus monachus	0	Year-round	disorientation, moving away from the distribution area	Rare	0.2	population	medium disturbance	Medium	RAC-SPA 2023; OceanCare 2021	
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)	0	Year-round	less prey, less chance of feeding	Occasionally	0.4	population	minor disturbance	Medium	Fortuna et al. 2006; ACCOBAMS 2021; ISPRA 2024	
			Caretta caretta (or other sea turtles)	0	Year-round	less prey, less chance of feeding	Occasionally	0.4	population	minor disturbance	Medium	Casale et al. 2010; ISPRA 2023	
			Monachus monachus	0	Year-round	less prey, less chance of feeding	Rare	0.2	population	minor disturbance	Medium	MOFI project; Johnson et al. 2006; RAC-SPA 2023	
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disorientation, moving away from the distribution area	Occasionally	0.4	population	medium disturbance	Medium	ACCOBAMS 2021; OceanCare 2021; Rako et al. 2022	
			Caretta caretta (or other sea turtles)	0	Year-round	disorientation, moving away from the distribution area	Occasionally	0.4	population	minor disturbance	Medium	Casale et al. 2010; ACCOBAMS 2021	
			Monachus monachus	0	Year-round	disorientation, moving away from the distribution area	Rare	0.2	population	minor disturbance	Medium	MOFI project; OceanCare 2021; RAC-SPA 2023	
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disturbance, population size decrease/ medium scale redistribution	Daily	1	population	devastating - medium	Medium	Campana et al., 2015	
			Caretta caretta (or other sea turtles)	0	Year-round	Physical trauma and acoustic stress	Unknown*		population	devastating - medium	Medium	Casale et al. (2017); ISPRA (2023)	
			Monachus monachus	0	Year-round	Physical trauma and acoustic stress	Daily	1	individual	medium disturbance	Low		
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Behavioral disturbance, displacement, collisions	Daily	1	individual	medium disturbance	High	ACCOBAMS (2021); La Manna et al. (2019); ISPRA (2020)	
			Caretta caretta (or other sea turtles)	0	Year-round	Behavioral disturbance, displacement, collisions	Unknown*		individual	devastating/lethal	Medium	Casale et al. 2017; ISPRA (2023)	
			Monachus monachus	0	Year-round	Behavioral disturbance, displacement, collisions	Occasionally	0.4	individual	devastating/lethal	Medium	Panou et al., 2013	
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	0.2	individual	medium disturbance	Medium	ISPRA (2020); Cardellicchio et al., 2000	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*		individual	medium disturbance	Medium	ISPRA (2023); Casale et al., 2017	
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*		individual	medium disturbance	Low		
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	0.2	individual	medium disturbance	Medium	Bearzi, 2002; ACCOBAMS, 2019	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	0.2	individual	medium disturbance	Medium	ISPRA (2023); Casale et al., 2017	
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Occasionally	0.4	individual	medium disturbance	Low		
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	short-term habitat degradation/disturbances on preys localization and feeding, altered movement and behaviour patterns/ medium scale redistribution	Rare	0.2	population	medium disturbance	Low	Kavanagh et al., 2019; Gordon et al., 2003; Engås and Løkkeborg, 2002; Popper and Hawkins 2016.	
			Caretta caretta (or other sea turtles)	0	Year-round	short-term habitat degradation/disturbances on preys localization and feeding, altered movement and behaviour patterns/ medium scale redistribution	Occasionally	0.4	population	medium disturbance	Low		
			Monachus monachus	0	Year-round	short-term habitat degradation/disturbances on preys localization and feeding, altered movement and behaviour patterns/ medium scale redistribution	Occasionally	0.4	individual	medium disturbance	Low		
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Bioaccumulation of hydrocarbons, heavy metals or toxic substances	Occasionally	0.4	population	medium disturbance	Medium	Fossi et al., 2003; Marsili et al., 2004; UNEP/MAP 2012	
			Caretta caretta (or other sea turtles)	0	Year-round	Bioaccumulation of hydrocarbons, heavy metals or toxic substances	Occasionally	0.4	population	medium disturbance	Medium	Camacho et al., 2013; Lazar et al., 2011; UNEP/MAP 2012, NOAA, 2024	
			Monachus monachus	0	Year-round	Bioaccumulation of hydrocarbons, heavy metals or toxic substances	Occasionally	0.4	population	medium disturbance	Low	Aguilar et al., 2007; Borrell et al., 1997; UNEP/MAP 2012	
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Difficulty in communication between individuals, stress, loss of habitat, avoidance of certain areas	Occasionally	0.4	population	medium disturbance	Medium	La Manna et al., 2013; Erbe et al., 2019; Notarbartolo di Sciara et al., 2016	
			Caretta caretta (or other sea turtles)	0	Year-round	Possible collisions, behavioral disturbance, stress from noise exposure, moving from usual areas	Occasionally	0.4	individual	medium disturbance	Medium	Hazel et al., 2009; Popper et al., 2014;	
			Monachus monachus	0	Year-round	Behavioral changes, stress, loss of habitat, avoidance of certain areas	Occasionally	0.4	population	medium disturbance	Medium	Karamanlidis et al., 2008; Mom	
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Possible collisions, behavioral disturbance, stress from noise exposure, displacement from usual areas	Occasionally	0.4	population	medium disturbance	Medium	ACCOBAMS, 2018; Arcangeli et al., 2017	
			Caretta caretta (or other sea turtles)	0	Year-round	Increased risk of collisions, avoidance of areas, behavioral alteration	Occasionally	0.4	population	medium disturbance	Medium	Casale et al., 2010	
			Monachus monachus	0	Year-round	Possible collisions, behavioral disturbance, stress from noise exposure, displacement from usual areas	Occasionally	0.4	individual	medium disturbance	Medium	UNEP/MAP, 2012	
			Tursiops truncatus (or other cetaceans)	0	Year-round	Bioaccumulation of PCBs, metals and other contaminants, reduced fertility, mortality	Occasionally	0.4	population	devastating - medium	Medium	Fossi et al., 2003; UNEP/MAP, 2012	

		chemical pollution	*Caretta caretta* (or other sea turtles)	0	Year-round	Bioaccumulation of contaminants (heavy metals, PCBs, hydrocarbons), damage to the immune system, reproductive system, developmental alteration	Occasionally	0.4	population	medium disturbance	Medium	Camacho et al., 2013; Lazar et al., 2011
			Monachus monachus	0	Year-round	Bioaccumulation of contaminants with consequent reproductive risks	Occasionally	0.4	individual	devastating - medium	Medium	UNEP-MAP, 2012
	Oil and gas extraction	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Masking of acoustic communication, avoidance of noisy areas, stress, potential hearing damage	Occasionally	0.4	population	medium disturbance	Medium	La Manna et al., 2013; Notarbartolo di Sciara et al., 2016; Erbe et al., 2019
			Caretta caretta (or other sea turtles)	0	Year-round	Disorientation, changes in behavior, avoidance of noisy areas	Occasionally	0.4	population	medium disturbance	Medium	McCauley et al., 2000; Popper et al., 2014; Hazel et al., 2009
			Monachus monachus	0	Year-round	Avoidance of noisy areas, loss of habitat, increased stress	Occasionally	0.4	individual	devastating - medium	Medium	Karamanlidis et al., 2008; Mom
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Collisions, chronic stress, avoidance of certain areas	Occasionally	0.4	population	medium disturbance	Medium	ACCOBAMS, 2018; Pirotta et al., 2015; Arcangeli et al., 2017
			Caretta caretta (or other sea turtles)	0	Year-round	collisions, behavioral disturbance (avoidance of coastal areas and migratory routes), chronic noise stress	Occasionally	0.4	population	medium disturbance	Medium	Casale et al., 2010;
			Monachus monachus	0	Year-round	Risk of collisions, habitat loss and stress	Occasionally	0.4	individual	medium disturbance	Medium	Karamanlidis et al., 2008; Mom
Offshore renewable energy	Wind farm construction	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	High disturbance especially in the pile driving phase with consequent avoidance of certain areas, social disintegration, increased cortisol	Occasionally	0.4	population	devastating - medium	Medium	Tougaard et al., 2009; Erbe et al., 2019; Dähne et al., 2013
			Caretta caretta (or other sea turtles)	0	Year-round	Disturbance during migration and in foraging areas; disorientation; avoidance of noisy areas avoidance of certain areas, social disintegration, increased cortisol	Occasionally	0.4	population	medium disturbance	Medium	Hazel et al., 2009; Popper & Hastings, 2009; Bailey et al., 2010
			Monachus monachus	0	Year-round	Avoidance of noisy areas, noise disturbance	Occasionally	0.4	individual	devastating - medium	Medium	Karamanlidis et al., 2008; Brandt et al., 2011; Notarbartolo di Sciara et al., 2009
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Collisions, movements from usual areas, alteration of hunting behavior, chronic noise stress from construction or maintenance vessels	Occasionally	0.4	population	devastating - medium	Medium	Pirotta et al., 2015; ACCOBAMS, 2018
			Caretta caretta (or other sea turtles)	0	Year-round	Collisions, displacement from coastal areas, continuous noise stress and vibrations related to construction/maintenance vessels	Occasionally	0.4	population	devastating - medium	Medium	Duncan et al., 2006; Casale et al., 2010
			Monachus monachus	0	Year-round	Behavioral disturbance; habitat loss; prolonged avoidance of construction site areas or associated routes	Occasionally	0.4	individual	medium disturbance	Medium	Gonzalvo et al., 2021; MOm; UNEP/MAP, 2012
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Summer	ingestion of litter (plastic), death/injuries on animals	Occasionally	0.4	individual	devastating - medium	Medium	Fossi et al., 2014; de Stephanis et al., 2013; Lusher et al., 2018
			Caretta caretta (or other sea turtles)	1	Summer	ingestion of litter (plastic), death/injuries on animals	Occasionally	0.4	individual	devastating - medium	Low	
			Monachus monachus	1	Summer	ingestion of litter (plastic), death/injuries on animals	Occasionally	0.4	individual	devastating/lethal	Medium	Casale P. (2008); Casale P. (2011)
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	1	Summer	short-term habitat degradation, altered movement and behaviour patterns	Seasonally	0.6	population	medium disturbance	Low	
			Caretta caretta (or other sea turtles)	1	Summer	impacts even at nest level	Seasonally	0.6	population	medium disturbance	Medium	Casale P. (2008)
			Monachus monachus	1	Summer	short-term habitat degradation, altered movement and behaviour patterns	Seasonally	0.6	individual	medium disturbance	Medium	Karamanlidis et al., 2008
		underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Summer	short-term habitat degradation, altered movement and behaviour patterns/ small-scale redistribution	Seasonally	0.6	individual	minor disturbance	Medium	Jensen et al., 2009; Gonzalvo et al., 2014
			Caretta caretta (or other sea turtles)	1	Summer	short-term habitat degradation, altered movement and behaviour patterns/ small-scale redistribution	Seasonally	0.6	individual	minor disturbance	Medium	Franzellitti et al., 2019; Pini et al., 2023
			Monachus monachus	1	Summer	Disturbance of breeding/resting areas	Seasonally	0.6	individual	medium disturbance	Medium	ISPRA (2024)
		cave tourism	*Monachus monachus*	1	Summer	Disturbance of breeding/resting areas	Seasonally	0.6	individual	medium disturbance	Medium	Karamanlidis et al., 2008
		light pollution	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Confusion and attraction towards the coast	Seasonally	0.6	population	devastating - medium	Medium	Casale et al., 2018
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	short-term habitat degradation, altered movement and behaviour patterns/ small-scale redistribution	Unknown*		population	minor disturbance	Medium	Bearzi et al., 2012
			Caretta caretta (or other sea turtles)	0	Year-round	short-term habitat degradation, altered movement and behaviour patterns/ small-scale redistribution	Unknown*		population	minor disturbance	Low	
			Monachus monachus	0	Year-round	short-term habitat degradation, altered movement and behaviour patterns/ small-scale redistribution	Unknown*		individual	medium disturbance	Low	
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*		individual	minor disturbance	High	Cardellicchio et al., 2000; Jepson et al., 2016; Squadrone et al., 2015
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Daily	1	individual	minor disturbance	Low	
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Occasionally	0.4	individual	minor disturbance	Low	
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of litter, death/injuries on animals	Unknown*		population	minor disturbance	Medium	Simmonds and Nunny, 2002; Azzolin et al., 2016; Poeta et al., 2018
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of litter, death/injuries on animals	Unknown*		population	medium disturbance	Medium	Casale et al., 2017
			Monachus monachus	0	Year-round	ingestion of litter, death/injuries on animals	Occasionally	0.4	population	minor disturbance	Medium	Poeta et al., 2018; Azzolin et al., 2016; Simmonds & Nunny, 2002
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Occasionally	0.4	individual	minor disturbance	Low	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Occasionally	0.4	individual	minor disturbance	Medium	UNEP/MAP (2015); Casale et al., 2017; ISPRA (2023)
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	0.2	individual	minor disturbance	Low	
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	0.2	individual	minor disturbance	Low	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*		individual	minor disturbance	Medium	UNEP/MAP (2015); Casale et al., 2017; ISPRA (2023)
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Occasionally	0.4	individual	minor disturbance	Low	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habitat erosion/regression	Occasionally	0.4	population	devastating - medium	High	Telesca et al., 2015; Marbà et al., 2014
			Caretta caretta (or other sea turtles)	0	Year-round	habitat erosion/regression	Occasionally	0.4	population	medium disturbance	Low	
			Monachus monachus	0	Year-round	habitat erosion/regression	Occasionally	0.4	individual	medium disturbance	Low	
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of litter, death/injuries on animals	Rare	0.2	individual	minor disturbance	Low	
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of litter, death/injuries on animals	Occasionally	0.4	individual	devastating - medium	Low	
			Monachus monachus	0	Year-round	ingestion of litter, death/injuries on animals	Occasionally	0.4	individual	minor disturbance	Medium	Poeta et al., 2018; Azzolin et al., 2016; Simmonds & Nunny, 2002
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)	1	Spring-summer	lower reproducrive output	Seasonally	0.6	population	medium disturbance	Low	
		light pollution	*Caretta caretta* (or other sea turtles)	1	Spring-summer	lower reproducrive output	Seasonally	0.6	population	devastating - medium	Medium	Casale et al., 2018
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)	1	Spring-summer	lower reproductive output, increase of female	Seasonally	0.6	population	devastating - medium	Medium	Casale et al., 2018
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	1	Spring-summer	lower reproductive output, inundation of nest	Seasonally	0.6	population	minor disturbance	Medium	Casale et al., 2018
			Monachus monachus	0	Year-round	loss of caves	Unknown*		population	minor disturbance	Medium	Panou et al.,2023
		sea-level raise	*Caretta caretta* (or other sea turtles)	1	Spring-summer	lower reproductive output, inundation of nest	Seasonally	0.6	population	medium disturbance	Medium	Casale et al., 2018
			Monachus monachus	1	Winter-Spring	loss of nursery caves	Seasonally	0.6	population	devastating/lethal	Medium	MOFI Project; IPCC; ISPRA
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0	Year-round	alteration of ecosystem functioning	Unknown*		population	minor disturbance	Low	
			Caretta caretta (or other sea turtles)	0	Year-round	alteration of ecosystem functioning	Daily	1	population	minor disturbance	Low	
			Monachus monachus	0	Year-round	alteration of ecosystem functioning	Unknown*		population	minor disturbance	Medium	Panou et al.,2023

PP2 - BWI

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	**Season-related** (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	**Specify which season** (Open answer)	**Potential effect** (Please, specify the potential effects on target species - open answer)	SCORE **Frequency** (Among the option, please specify the frequency of interaction)	**Magnitude** (Among the option, please specify the magnitude of the interaction)	**Impact level** (Please, specify the impact on the sentinel species)	**Confidence** (Please, specify the level of confidence with which the information is given)	**Sources** (Published literature specific to the study area)	Notes
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	0	Year round	Prey depletion and bycatch during depredation	Monthly	population	medium disturbance	Medium	Bearzi et al., 2008; Bearzi et al., 2010	
			Monachus monachus									
		bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Rare	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	0	Year round, more often in cold months	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Monthly	individual	devastating - medium	High	Casale 2011; Casale et al., 2011; Casale et al. 2018	
		overfishing	*Tursiops truncatus* (or other cetaceans)	0	Year round	Prey depletion may lead to lowered siurvival rates and/or shift in distribution	Daily	population	medium disturbance	Medium	Bearzi et al., 2008; Bearzi et al., 2010	
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year round	Prey depletion may lead to lowered siurvival rates and/or shift in distribution	Daily	population	medium disturbance	High	Rako et al., 2012a, Rako et al., 2012b	
			Caretta caretta (or other sea turtles)	0	Year round	Prey depletion may lead to lowered siurvival rates and/or shift in distribution	Daily	population	minor disturbance	Medium	Casale et al., 2008	
			Monachus monachus									
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Occasionally	individual	devastating - medium	High	Pleslić et al., 2020; Bearzi et al., 2024	
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Occasionally	individual	devastating - medium	Medium	Casale 2011; Casale et al., 2011; Casale et al. 2018	
			Monachus monachus									
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Monthly	population	minor disturbance	Low		
			Monachus monachus									
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Rare	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Occasionally	population	devastating - medium	Medium	Cardona et al., 2009; Fortuna et al., 2010; Lazar et al., 2008; Casale et al., 2018	
			Monachus monachus									
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Rare	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Monthly	individual	devastating - medium	High	Casale 2011; Casale et al., 2011; Casale et al. 2018	
		competition	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Daily	individual	minor disturbance	High	Gomerčić et al. 2008; Li Veli et al., 2023; Pleslić et al., 2020	
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in fishing gear may lead to severe dissabilitation or immediate death of individuals	Daily	population	no impact	Medium	Casale et al., 2008; Casale et al., 2018; Lazar et al., 2006	
			Monachus monachus									
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	In theory may lead to behavioural change and displacement, however no direct or indirect evidence of this in eastern Adriatic	Rare	population	medium disturbance	Medium		
			Caretta caretta (or other sea turtles)	0	Year round	In theory may lead to behavioural change and displacement, however no direct or indirect evidence of this in eastern Adriatic	Rare	population	minor disturbance	Medium		
			Monachus monachus									
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0	Year round	May lead to severe dissabilitation or immediate death of individuals	Rare	individual	lethal	High	Pleslić et al., 2020	
			Caretta caretta (or other sea turtles)	0	Year round	May lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	lethal			
			Monachus monachus									
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Year round	No direct or indirect evidence of negative impact in eastern Adriatic	Unknown*	population	no impact	High	Pleslić 2022	
			Caretta caretta (or other sea turtles)	0	Year round	No direct or indirect evidence of negative impact in eastern Adriatic	Unknown*	population	no impact			
			Monachus monachus									
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	population	devastating - medium	Low		
			Monachus monachus									
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	Shifts in vocal behaviour	Daily	population	medium disturbance	High	Rako et al., 2012a, Rako et al., 2012b	
			Caretta caretta (or other sea turtles)	0	Year round	Unknown	Daily	population	medium disturbance	Low	Casale et al. 2018	
			Monachus monachus									
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0	Year round	Basically, nothing is known about this in eastern Adriatic Sea	Unknown*	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	1	Spring, Summer	May lead to severe dissabilitation or immediate death of individuals	Occasionally	individual	lethal	Low	Casale et al. 2018	
			Monachus monachus									
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	medium disturbance	Low		
			Monachus monachus									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Occasionally	individual	devastating - medium	Low		
			Monachus monachus									
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)	1	No specific season, but when it happens it lasts for several weeks/months	May lead to displacements, behavioural changes; injuries or even death if exposed at close range	Rare	population	medium disturbance	Medium	Širović and Holcer 2020	
			Caretta caretta (or other sea turtles)	1	No specific season, but when it happens it lasts for several weeks/months	May lead to displacements, behavioural changes; injuries or even death if exposed at close range	Rare	population	minor disturbance	Low		
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)	1	No specific season, but during construction	May lead to displacements, behavioural changes; vocalization changes	Rare	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	1	No specific season, but during construction	May lead to displacement	Rare	population	minor disturbance	Low		
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year round	May cause changes in vocal behaviour, displacement, behavioural change	Rare	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	May cause collisions with injuries or death as a result	Rare	population	minor disturbance	Low		
			Monachus monachus									
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
		underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	May lead to displacements, behavioural changes; vocalization changes	Daily	population	minor disturbance	Low		

	Oil and gas extraction	underwater noise	*Caretta caretta* (or other sea turtles)	0	Year round	May lead to displacement	Daily	population	minor disturbance	Low		
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year round	May cause changes in vocal behaviour, displacement, behavioural change	Monthly	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	May cause collisions with injuries or death as a result	Monthly	population	minor disturbance	Low		
			Monachus monachus									
Offshore renewable energy	Wind farm	underwater noise	*Tursiops truncatus* (or other cetaceans)									Currently, this threat does not exist in the Croatian part of the Adriatic
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Summer	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	1	Summer	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Monthly	individual	devastating - medium	Low		
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	1	Summer	May lead to displacements, behavioural changes; vocalization changes	Daily	population	medium disturbance	High	Pleslić et al., 2020; Rako et al., 2012a; Rako et al., 2012b; Rako et al., 2013; Rako et al., 2017	
			Caretta caretta (or other sea turtles)	1	Summer	May lead to displacements, behavioural changes	Daily	population	minor disturbance	Low		
			Monachus monachus									
		underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Summer	May lead to displacements, behavioural changes; vocalization changes	Daily	population	medium disturbance	High	Falkner et al., 2023; Picciulin et al., 2022Rako et al., 2012a; Rako et al., 2012b; Rako et al., 2013; Rako et al., 2017	
			Caretta caretta (or other sea turtles)	1	Summer	May lead to displacements, behavioural changes	Daily	population	minor disturbance	Low		
			Monachus monachus									
		cave tourism	*Monachus monachus*									
		light pollution	*Caretta caretta* (or other sea turtles)				Unknown*	population	no impact			
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Year round	May lead to displacements, behavioural changes; vocalization changes	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	1	Year round	May lead to displacement	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	devastating - medium	Low		
			Monachus monachus									
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	medium disturbance	Low	Currey et al. 2009	
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Exposure to pollution may lead to lowered fitness of individuals	Unknown*	population	minor disturbance	Low		
			Monachus monachus									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	Entaglements in marine litter may lead to severe dissabilitation or immediate death of individuals	Unknown*	individual	devastating - medium	Low		
			Monachus monachus									
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)									No nesting of loggerhead turtles was recorded in Croatian part of Adriatic
		light pollution	*Caretta caretta* (or other sea turtles)									
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)									No nesting of loggerhead turtles was recorded in Croatian part of Adriatic
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	0	Year round	May lead to shifts in prey availability and indirectly to distribution and survival rates	Unknown*	population	medium disturbance	Low		
			Monachus monachus									
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)	0	Year round	May alter prey availability and indirectly distribution and survival rates	Unknown*	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year round	May alter prey availability and indirectly distribution and survival rates	Unknown*	population	medium disturbance	Low		
		sea-level raise	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0	Year round	May alter prey availability and indirectly distribution and survival rates	Unknown*	population	medium disturbance	Medium	D'Amen et al., 2024	Loss of suitable habitat predicted by modelling. However, primary factor would be sea temperature.
			Caretta caretta (or other sea turtles)	0	Year round	May alter prey availability and indirectly distribution and survival rates	Unknown*	population	medium disturbance	Low		
			Monachus monachus									

PP3 - VEFUNIZG

Type of maritime use/driver/activities	**Pressure transfer agents**	**Pressure**	**Species**	**Season-related** (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	**Specify which season** (Open answer)	**Potential effect** (Please, specify the potential effects on target species - open answer)	**SCORE**				**Sources** (Published literature specific to the study area)	**Notes**
							Frequency (Among the option, please specify the frequency of interaction)	**Magnitude** (Among the option, please specify the magnitude of the interaction)	**Impact level** (Please, specify the impact on the sentinel species)	**Confidence** (Please, specify the level of confidence with which the information is given)		
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus									
		bycatch	*Tursiops truncatus* (or other cetaceans)	0	year round	chronic lesions due to entanglemen, death	occasionally	individual	lethal	high	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)									
		overfishing	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus									
		Habitat degradation	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	injuries due to interaction with fishing gear, death	Occasionally	individual	lethal	High	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)	0	Year-round	injuries due to interaction with fishing gear, death	Occasionally	individual	devastating - medium	Low	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Monachus monachus									
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus									
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year-round	chronic lesions due to entanglemen, death	Occasionally	individual	lethal	High	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)	0	year round	chronic lesions due to entanglemen, death	occasionally	individual	lethal	high	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	injuries due to interaction with fishing gear, death	Occasionally	individual	lethal	High	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	death due to the competition for fishing	Occasionally	individual	lethal	High	Đuras M, Kolenc M, Gomerčić T, Gudan Kurilj A, Galov A, Korpes K (2024): Intentional harm in marine mammals stranded dead in the Adriatic Sea, Croatia, 1990–2023. Dis Aquat Org., 160, 75 - 93.	
			Caretta caretta (or other sea turtles)									
			Monachus monachus	0	Year-round	death due to the competition for fishing	Rare	individual	lethal	High	Đuras M, Kolenc M, Gomerčić T, Gudan Kurilj A, Galov A, Korpes K (2024): Intentional harm in marine mammals stranded dead in the Adriatic Sea, Croatia, 1990–2023. Dis Aquat Org., 160, 75 - 93.	
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habitat loss, injuries due to interaction with fishing gear, death	Rare	individual	devastating - medium	Medium	Đuras M, Galov A, Korpes K, Kolenc M, Baburić M, Gudan Kurilj A, Gomerčić T (2012): Cetacean mortality due to interactions with fisheries and marine litter ingestion in the Croatian part of the Adriatic Sea from 1990 to 2019. Vet. arhiv 91, 189-206.	
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		ship collisions	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution,injuries, death, accumulation of essential and non-essential elements	Rare	individual	minor disturbance	Medium	Đokić, M et al. (2025); Sedak, M et al. (2025); Sedak, M et al. (2022); Đuras, M et al. (2021); Đokić, M et al (2018); Bilandžić, N et al. (2016); Sedak, M et al. (2016); Šuran, J et al. (2015); Sedak, M et al. (2015); Bilandžić, N et al. (2015)	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution,injuries, death, accumulation of essential and non-essential elements	Rare	individual	minor disturbance	Low	Đokić, M et al. (2025); Sedak, M et al. (2025); Sedak, M et al. (2022); Đuras, M et al. (2021); Đokić, M et al (2018); Bilandžić, N et al. (2016); Sedak, M et al. (2016); Šuran, J et al. (2015); Sedak, M et al. (2015); Bilandžić, N et al. (2015)	
			Monachus monachus									
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Offshore renewable energy	Wind farm construction	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Spring, summer	ingestion of litter, injuries, death	Occasionally	individual	devastating - medium	High	Đuras, M et al. (2021)	
			Caretta caretta (or other sea turtles)	1	Spring, summer	ingestion of litter, injuries, death	Occasionally	individual	devastating - medium	Low	Đuras, M et al. (2021)	
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
			Tursiops truncatus (or other cetaceans)									

Coastal tourism	Recreational activities	underwater noise	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		cave tourism	*Monachus monachus*	0	Year-round	harassment	Rare	individual	devastating - medium	High	Gomerčić, T., Đ. Huber, M. Đuras Gomerčić, H. Gomerčić (2011): Presence of the Mediterranean monk seal (*Monachus monachus*) in the Croatian part of the Adriatic Sea. Aquatic mammals 37, 243-247.	
		light pollution	*Caretta caretta* (or other sea turtles)									
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		marine litter	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of litter, injuries or death	Rare	individual	devastating - medium	Low	Đuras, M et al. (2021)	
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of litter, injuries or death	Rare	individual	devastating - medium	Low	Đuras, M et al. (2021)	
			Monachus monachus									
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)									
		light pollution	*Caretta caretta* (or other sea turtles)									
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)									
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		sea-level raise	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									

PP5 - CETEOR

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season-related (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	Specify which season (Open answer)	Potential effect (Please, specify the potential effects on target species - open answer)	SCORE				Sources (Published literature specific to the study area)	Notes
							Frequency (Among the option, please specify the frequency of interaction)	Magnitude (Among the option, please specify the magnitude of the interaction)	Impact level (Please, specify the impact on the sentinel species)	Confidence (Please, specify the level of confidence with which the information is given)		
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Resources competition/opportunistic feeding for the species, population size decrease/ low	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		overfishing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Resources competition/opportunistic feeding for the species, population size decrease/ low	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Altered movements and behavioral patterns	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Impacts on the turtle's feeding habitat	Occasionally	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Entanglement in lost nets, death/injuries on animals	Unknown*	individual	minor disturbance	Medium	Vlachogianni et al., 2017; Fusco et al., 2016	
			Caretta caretta (or other sea turtles)	0	Year-round	Entanglement in lost nets, death/injuries on animals	Unknown*	individual	minor disturbance	Medium	Vlachogianni et al., 2017; Fusco et al., 2016	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Resources competition /prey depletion due to fishing catches, population size decrease/ low	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Entanglement in lost nets, death/injuries on animals	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Injury, mortality due to entanglement due to attraction by light	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Resources competition /prey depletion due to fishing catches, population size decrease/ low	Monthly	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Not compete directly for resources, but the intensive presence of artisanal fishing in	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Disturbance	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Disturbance	Occasionally	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Death	Unknown*	individual	lethal	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Death for use of meat or carapace	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Displacement, hearing damage from pingers, loss of foraging areas	Rare	individual	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Injury or ingestion of fishing gears	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)									This type of maritime use/driver/activity has not been identified for Bosnia and Herzegovina; not applicable.
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Disturbance, population size decrease/ medium scale redistribution	Occasionally	individual	medium disturbance			
			Caretta caretta (or other sea turtles)	0	Year-round	Habitat degradation, altered movement and behaviour patterns	Unknown*	individual	medium disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Behavioral disturbance, displacement, collisions	Rare	individual	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Collisions, behavioral disturbance (avoidance of coastal areas and migratory routes), chronic	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Rare	individual	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Rare	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Rare	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)									This type of maritime use/driver/activity has not been identified for Bosnia and Herzegovina; not applicable.
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									

			Monachus monachus									
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Offshore renewable energy	Wind farm	underwater noise	*Tursiops truncatus* (or other cetaceans)									This type of maritime use/driver/activity has not been identified for Bosnia and Herzegovina; not applicable.
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Spring-summer	Ingestion of litter (plastic), death/injuries on animals	Occasionally	individual	devastating - medium	Medium	Casale et al., 2020; Vlachogianni et al., 2017; Fusco et al., 2016	
			Caretta caretta (or other sea turtles)	1	Spring-summer	Ingestion of litter (plastic), death/injuries on animals	Occasionally	individual	devastating - medium	Medium	Casale et al., 2020; Vlachogianni et al., 2017; Fusco et al., 2016	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	1	Summer	Altered movement and behaviour patterns	Occasionally	individual	medium disturbance	Medium	Casale et al., 2020;	
			Caretta caretta (or other sea turtles)	1	Summer	Disturbance of resting areas	Occasionally	individual	medium disturbance	Medium	Casale et al., 2020;	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Spring-summer	Altered movement and behaviour patterns	Seasonally	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	1	Spring-summer	Habitat degradation, altered movement and behaviour patterns	Seasonally	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		cave tourism	*Monachus monachus*									No recent records of this species exist for the Neum Bay.
		light pollution	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Confusion and attraction towards the coast	Seasonally	individual	minor disturbance	Low		
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Habitat degradation, altered movement and behaviour patterns	Unknown*	individual	minor disturbance	Low		The direct impact results from the operation of the small ports in Neum and the Mali Ston Bay
			Caretta caretta (or other sea turtles)	0	Year-round	Habitat degradation, altered movement and behaviour patterns	Unknown*	individual	minor disturbance	Low		The direct impact results from the operation of the small ports in Neum and the Mali Ston Bay
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Occasionally	individual	minor disturbance	Medium	Casale et al., 2020;	
			Caretta caretta (or other sea turtles)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Occasionally	individual	minor disturbance	Medium	Casale et al., 2020;	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Ingestion of litter, death/injuries on animals	Unknown*	individual	minor disturbance	Medium	Vlachogianni et al., 2017; Fusco et al., 2016	
			Caretta caretta (or other sea turtles)	0	Year-round	Ingestion of litter, death/injuries on animals	Unknown*	individual	minor disturbance	Medium	Vlachogianni et al., 2017; Fusco et al., 2016	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Pollution, accumulation of metals likely harm the health of the organism and represents a	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Habitat erosion/regression, habitat degradation, altered movement and behaviour	Unknown*	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Habitat erosion/regression, habitat degradation, altered movement and behaviour	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Ingestion of litter, death/injuries on animals	Occasionally	individual	medium disturbance	Medium	Vlachogianni et al., 2017	
			Caretta caretta (or other sea turtles)	0	Year-round	Ingestion of litter, death/injuries on animals	Occasionally	individual	medium disturbance	Medium	Vlachogianni et al., 2017	
			Monachus monachus									No recent records of this species exist for the Neum Bay.
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Habitat erosion/regression, habitat degradation, altered movement and behaviour	Seasonally	individual	medium disturbance	Medium	Casale et al., 2020;	
		light pollution	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Confusion and attraction towards the coast	Seasonally	individual	minor disturbance	Low		
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Changes in food availability, increased physiological stress, increased risk of disease	Seasonally	individual	minor disturbance	Low		
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Changes in food availability, increased physiological stress, increased risk of disease	Seasonally	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		sea-level raise	*Caretta caretta* (or other sea turtles)	0	Year-round	Change in coastal habitat structure, increased turbidity and reduced habitat quality, impact	Unknown*	individual	minor disturbance	Low		
			Monachus monachus									No recent records of this species exist for the Neum Bay.
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Alteration of ecosystem functioning	Unknown*	population	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round	Alteration of ecosystem functioning	Daily	population	minor disturbance	Medium	Fortic et al., 2023	
			Monachus monachus									No recent records of this species exist for the Neum Bay.

PP4 - UAMD

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season-related (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	Specify which season (Open answer)	Potential effect (Please, specify the potential effects on target species - open answer)	SCORE				Sources (Published literature specific to the study area)	Notes
							Frequency (Among the option, please specify the frequency of interaction)	Magnitude (Among the option, please specify the magnitude of the interaction)	Impact level (Please, specify the impact on the sentinel species)	Confidence (Please, specify the level of confidence with which the information is given)		
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus									
		bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		overfishing	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus									
		habitat degradation	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0								
			Caretta caretta (or other sea turtles)	0	Year-round	entanglement in lost nets, death/injuries on animals; Injury or ingestion of fishing gears	Occasionally	individual	devastating/lethal	Medium	Curri A., Kolitari J., Haxhiu I.; "Reducing the impact of ghost gear on sea turtles, in Drini Bay: Results of Life-MedTurtles project", 4th international conference of Agricultural and Life Sciences	
			Monachus monachus	0	Year-round	entanglement in lost nets, death/injuries on animals; Injury or ingestion of fishing gears	Unknown*	individual	devastating/lethal	Low		
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)		Year-round	entanglement in lost nets, death/injuries on animals; Injury or ingestion of fishing gears	Unknown*	individual	devastating/lethal	Low		
			Monachus monachus									
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		competition	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus	0	randomly	animal death	Rare	individual	devastating/lethal	Low	Rapa Vlora Reports/round table	
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		ship collisions	*Tursiops truncatus* (or other cetaceans)	1	Touristic season	animal death due to vessel collisions	Occasionally	individual	devastating/lethal	Medium	Rapa Vlora Reports/round table	
			Caretta caretta (or other sea turtles)	1	Touristic season	animal death due to vessel collisions	Occasionally	individual	devastating/lethal	Medium	Rapa Vlora Reports/round table	
			Monachus monachus	1	Touristic season	animal death due to vessel collisions	Occasionally	individual	devastating/lethal	Medium	Rapa Vlora Reports/round table	
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	individual	medium disturbance	Low	Rapa Vlora Reports/round table	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	individual	medium disturbance	Low	Rapa Vlora Reports/round table	
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Rare	individual	medium disturbance	Low	Rapa Vlora Reports/round table	
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Bioaccumulation of PCBs, metals and other contaminants, reduced fertility, mortality	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	The oil industry (extraction and processing) remains one of the main sources of pollution in inland and coastal waters,most notably for the Seman rivers (from its Gjanica branch) and the Vjosa (passing through oil and bitumen areas)
			Caretta caretta (or other sea turtles)	0	Year-round	Bioaccumulation of contaminants (heavy metals, PCBs, hydrocarbons), damage to the immune system, reproductive system, developmental alteration	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	Bioaccumulation of contaminants with consequent reproductive risks	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
		underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Offshore renewable energy	Wind farm	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Touristic season	ingestion of litter (plastic), death/injuries on animals	Seasonally	individual	devastating - medium	Low		
			Caretta caretta (or other sea turtles)	1	Touristic season	ingestion of litter (plastic), death/injuries on animals	Seasonally	individual	devastating - medium	Low		
			Monachus monachus	1	Touristic season	ingestion of litter (plastic), death/injuries on animals	Seasonally	individual	devastating - medium	Medium	Luigi Bundone, Gema Hernandez-Milian, Nexhip Hysolakoj, Rigers Bakiu, Tatjana Mehillaj, Lorela Lazaj; (2021); Mediterranean monk seal in albania:historical presence, sightings and habitat availability; AJNTS No 53 / 2021 (XXVI).	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	1	Touristic season	short-term habitat degradation, altered movement and behaviour patterns	Seasonally	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	1	Touristic season	Areas of bars close to the touristic zones - nets damages/The camping areas (camping cars pose a risk for the turtles' nests)	Seasonally	population	devastating - medium	Low	Rapa Vlora Reports/round table /PPNEA-Monk seal project	
			Monachus monachus	1	Touristic season	habiatat degradation/ disturbance, population redistribution	Seasonally	population	devastating - medium	Low	Rapa Vlora Reports/round table /PPNEA-Monk seal project	
		underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus	1	Touristic season	behavioral disturbance, stress from noise exposure, displacement from usual areas						
		cave tourism	*Monachus monachus*	1	Touristic season	human/tourists diesturbance of monk seals in the water cave; solid waste within the water caves/ water pollution due to vessel fuels/ disturbance, population redistribution; Possible collisions, behavioral disturbance, stress from noise exposure, displacement from usual areas	Seasonally	population	devastating - medium	Medium	Rapa Vlora Reports/round table /PPNEA-Monk seal project	
		light pollution	*Caretta caretta* (or other sea turtles)									
	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Touristic season	behavioral disturbance, stress from noise exposure, displacement from usual areas	Seasonally	population	medium disturbance	Low		
			Caretta caretta (or other sea turtles)	1	Touristic season	behavioral disturbance, stress from noise exposure, displacement from usual areas	Seasonally	population	medium disturbance	Low		
			Monachus monachus	1	Touristic season	behavioral disturbance, stress from noise exposure, displacement from usual areas	Seasonally	population	medium disturbance	Medium	Rapa Vlora Reports/round table /PPNEA-Monk seal project	
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Caretta caretta (or other sea turtles)	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	pollution, accumulation of metals likely harm the health of the organism and represents a risk factor, death/injuries on animals	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	devastating - medium	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Tursiops truncatus (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Caretta caretta (or other sea turtles)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	devastating - medium	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	

Coastal development			*Monachus monachus*	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	devastating - medium	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Caretta caretta (or other sea turtles)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Caretta caretta (or other sea turtles)	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	habiatat degradation/ disturbance, Injury or ingestion of marine litter	Unknown*	individual	minor disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	habitat erosion/regression	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Caretta caretta (or other sea turtles)	0	Year-round	habitat erosion/regression	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	habitat erosion/regression	Unknown*	population	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of litter, death/injuries on animals	Unknown*	individual	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of litter, death/injuries on animals	Unknown*	individual	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
			Monachus monachus	0	Year-round	ingestion of litter, death/injuries on animals	Unknown*	individual	medium disturbance	Low	UNEP/MAP-SPA/RAC, 2021. Albania Conservation of Mediterranean marine and coastal biodiversity by 2030 and beyond. By R. Kedani. Ed. SPA/RAC, Tunis: 74 pp. + Annexes.	
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)									
		light pollution	*Caretta caretta* (or other sea turtles)									
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)									
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		sea-level raise	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									

PP6 - MORIGENOS

Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season-related (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	Specify which season (Open answer)	Potential effect (Please, specify the potential effects on target species - open answer)	SCORE: Frequency (Among the option, please specify the frequency of interaction)	SCORE: Magnitude (Among the option, please specify the magnitude of the interaction)	SCORE: Impact level (Please, specify the impact on the contrast species)	SCORE: Confidence (Please, specify the level of confidence with which the information is given)	Sources (Published literature specific to the study area)	Notes
Fishery	Trawling	competition	Tursiops truncatus (or other cetaceans)	0	Year-round	opportunistic feeding, altered movement and behaviour	Monthly	individual	medium disturbance	High	Kotnjek et al., 2017; Bonizzoni et al., 2020	Trawlers appear to attract dolphins and alter their movements and behaviour, interaction with trawlers occured in 22 % of sightings over 10 years, most interactions involved the same individuals (Kotnjek et al., 2017). [illegible]
		bycatch	Tursiops truncatus (or other cetaceans)	0	Year-round	bycatch, entanglement leading to injuries	Occasionally	individual	minor disturbance	High	Fortuna et al., 2010	Bycatch events from Italian pelagic trawlers in Adriatic concentrated in northern Adriatic, however bycatch rates low [illegible] (Fortuna et al., 2010).
			Caretta caretta (or other sea turtles)	1	May-December	bycatch, entanglement leading to injuries	Seasonally	population	medium disturbance	High	Fortuna et al., 2010; Casale et al., 2004; Lucchetti et al., 2018	Loggerhead sea turtles showed high bycatch rate in Italian pelagic trawlers [illegible]
		overfishing	Tursiops truncatus (or other cetaceans)	0	Year-round	suspected prey depletion due to overfishing	Daily	population	minor disturbance	High	Colloca et al. 2017; Coll et al., 2009	Trawlers very abundant in Adriatic region, [illegible]
		habitat degradation	Tursiops truncatus (or other cetaceans)	0	Year-round	opportunistic feeding, altered movement and behaviour, loss of epifauna in feeding habitat	Monthly	individual	medium disturbance	Medium	Kotnjek et al., 2017; Bonizzoni et al., 2020; Hausmann et al., 2021	Trawlers appear to attract dolphins and alter their movements and behaviour, [illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	opportunistic feeding, loss of epifauna in feeding habitat	Occasionally	individual	medium disturbance	Medium	Baldi et al., 2023; Hausmann et al., 2021	[illegible]
	Loss/abandonment of nets and fishing gears and driftnets	marine litter	Tursiops truncatus (or other cetaceans)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake, bycatch	Rare	individual	devastating - medium	Medium	Đuras et al., 2021; Pribanić et al., 1999; Pavlova et al., 2024	Ingestion of litter (not associated with fisheries) very rare in Croatia despite abundant marine litter in Adriatic, [illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake, bycatch	Occasionally	individual	devastating - medium	High	Lazar & Gračan, 2011; Baldi et al., 2023; Pavlova et al., 2024	Marine debris found in 1/3 of sea turtles from stranded or incidentally captured dead loggerhead sea turtles from Croatia and Slovenia, [illegible]
	Purse seine	competition	Tursiops truncatus (or other cetaceans)	1	April-December	suspected prey depletion due to overfishing	Unknown*	population	minor disturbance	High	Coll et al., 2009	Decreased biomass of several commercial species (which are also dolphin prey) related to increased fishing [illegible]
	Longlines	bycatch	Tursiops truncatus (or other cetaceans)	0	Year-round	bycatch, entanglement leading to injuries	Unknown*	individual	minor disturbance	Low	López et al. 2012; Papageorgiou et al., 2022; Ansha, 2006	No data on dolphin bycatch in longlines from Northern Adriatic. Cetacean bycatch in longlines reported from other areas of Mediterranean (e.g. López et al. 2012; Papageorgiou et al., 2022; Ansha, 2006).
			Caretta caretta (or other sea turtles)	0	Year-round	bycatch, entanglement leading to injuries	Unknown*	individual	devastating - medium	Low	Cambiè et al., 2010; Casale et al., 2007; Ansha, 2006	No data on sea turtle bycatch in longlines from Northern Adriatic. [illegible]
	Small scale fisheries (nets)	bycatch	Tursiops truncatus (or other cetaceans)	0	Year-round	bycatch, entanglement leading to injuries (skin lesions), fishing gear in stomach, lesions [illegible]	Occasionally	individual	lethal	High	Morigenos 2024; Hace et al., 2015; Morigenos, 2023; Đuras et al., 2021	Interaction with fishing gear (set nets) cause of death [illegible]
			Caretta caretta (or other sea turtles)	1	Summer	bycatch, death due to forced apnoea	Monthly	population	lethal	High	Lucchetti et al., 2017	Estimated 5,400 sea turtles caught in north Adriatic [illegible] (Lucchetti et al., 2017).
		competition	Tursiops truncatus (or other cetaceans)	0	Year-round	suspected prey depletion due to overfishing	Daily	population	minor disturbance	Low	Colloca et al. 2017; Coll et al., 2009	No direct evidence of competition between bottlenose dolphins and small scale fisheries in northern Adriatic. [illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	suspected prey depletion due to overfishing	Daily	population	minor disturbance	Low	Colloca et al., 2017	No direct evidence of competition between loggerhead sea turtles and small scale fisheries in northern Adriatic. [illegible]
	Sonar	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	communication masking, hearing loss and behavioural change	Unknown*	individual	medium disturbance	Low	Marine Board – ESF, 2008	Effects of sonar on cetaceans may include communication masking, hearing loss and behavioural change (Marine Board – ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	disturbance, avoidance behaviour	Unknown*	individual	minor disturbance	Low	Popper et al., 2014; Weilgart et al., 2016?	[illegible]
	Human	intentional killing	Tursiops truncatus (or other cetaceans)	0	Year-round	death	Rare	individual	minor disturbance	High	Morigenos, 2024	[illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	death	Unknown*	individual	minor disturbance	Low	Casale et al., 2010	Intentional killing due to presumed damage of fishing gear or competition for fish is reported from several Mediterranean countries [illegible]
Aquaculture	Human	competition	Tursiops truncatus (or other cetaceans)	0	Year-round	displacement, loss of foraging areas	Unknown*	individual	minor disturbance	High	Bonizzoni et al., 2020	Bottlenose dolphin occurrence tended to be influenced by the activity of mussel farms in north Adriatic [illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	displacement, loss of foraging areas	Unknown*	individual	minor disturbance	Low		No data on interaction between sea turtles and aquaculture in Slovenia/Gulf of Trieste.
Naval exercise	Military shooting range	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	physical trauma, hearing loss, behavioural change	Rare	individual	devastating - medium	Low	Maglio et al., 2015; Marine Board – ESF, 2008	[illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Unknown*	individual	minor disturbance	Low	Maglio et al., 2015; Samuel et al., 2005 and references therein	[illegible]
		disturbance on prey	Tursiops truncatus (or other cetaceans)	0	Year-round	stress response, hearing loss, increase in vocalization rate, startle response, deep diving, changes in group cohesion, reduced foraging preformance, changes in antipredator responces, modifications of foraging habits in fish	Unknown*	individual	medium disturbance	Low	Rako-Gospić & Picciulin, 2019 and references therein	No information available on effect of military exercises on bottlenose dolphin prey in Northern Adriatic, [illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	reduced embryo development, increased larval mortality, injury to statocysts, alarm responses, changes in swimming patterns in mollusc; stress response, increased metabolism, latency to predator threat in crustaceans	Unknown*	individual	medium disturbance	Low	Rako-Gospić & Picciulin, 2019 and references therein	No information available on effect of military exercises on loggerhead sea turtle prey in Northern Adriatic, [illegible]
	Naval sonar	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	communication masking, hearing loss and behavioural change	Unknown*	individual	devastating - medium	Low	Maglio et al., 2015; Bearzi et al., 2024 and references therein; Marine Board – ESF, 2008	[illegible]
			Caretta caretta (or other sea turtles)	0	Year-round	disturbance, avoidance behaviour	Unknown*	individual	minor disturbance	Low	Maglio et al., 2015; Popper et al., 2014; Weilgart et al., 2016?	[illegible]
Marine Transport (Traffic)	Trade routes	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	disturbance, habitat displacement, masking of communication, changes in vocalization	Daily	population	medium disturbance	Medium	Rako-Gospić & Picciulin, 2019; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić and Picciulin, 2016; Jensen et al., 2009; Marine Board - ESF, 2008	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019), has a very high concentration of harbours (Maglio et al., 2015). Underwater monitoring programme in Gulf of Trieste showed high noise pressure without seasonal variation (cargo vessel traffic homogenous all over the year), whit main source of noise being large ships (Codarin & Picciulin, 2015). No direct evidence of how traffic noise affects dolphins in Gulf of Trieste is available, however noise caused by boat traffic is known to affect dolphin whistle frequencies in North Adriatic part of Croatia (Rako-Gospić and Picciulin, 2016). Study from Australia showed that noise from small vessels can significantly mask acoustically mediated communication in bottlenose dolphins (Jensen et al., 2009). Effects of noise from vessels include masking communication and habitat displacement in marine mammals (Marine Board - ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Daily	population	minor disturbance	Low	Samuel et al., 2005 and references therein	No information on the effect of underwater noise form marine traffic on sea turtles available for the Gulf of Trieste or Adriatic. Little is known about potential effects of exposure to marine traffic noise on behaviour and health of sea turtles, however in experiments sea turtles displayed agitated behaviour, abrupt body movements, startle responses and prolonged inactivity at bottom of tank in response to low-frequency sound, prolonged exposure could lead to avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues (Samuel et al., 2005 and references therein).
		ship collisions	Tursiops truncatus (or other cetaceans)	1	Summer	mortality or injury from contact with a vessel, particularly the hull or propeller	Rare	individual	lethal	Medium	Bearzi et al., 2024	Danger of vessel collisions with vessels considered low in Adriatic sea (Bearzi et al., 2024).
			Caretta caretta (or other sea turtles)	1	Summer	mortality or injury from contact with a vessel, particularly the hull or propeller	Rare	individual	lethal	Medium	Mihajlović et al., 2024?; Casale et al., 2010 and references therein	Collision with vessels is the second major threat to loggerhead turtles in Adriatic [illegible]
	Vessel discharges	introduction of non-synthetic substances and compounds	Tursiops truncatus (or other cetaceans)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	medium disturbance	High	Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Đokić et al., 2025	Heavy metals in tissues of stranded bottlenose dolphins from Northern Adriatic [illegible] from Croatia exceeding the limit at which toxic effects appear in marine mammals (Bilandžić et al., 2012). Elevated levels of copper and zinc in tissues of stranded dolphins from Croatia indicating localized environmental contamination, however significant decreasing trend in copper and zinc concentration during two decades, likely due to improved pollution control or shifrs in dolphins' feeding habits (Đokić et al., 2025).
			Caretta caretta (or other sea turtles)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	minor disturbance	High	Franzellitti et al., 2004; Lazar et al., 2008; Savoca et al., 2022	Stranded loggerhead sea turtles along Italian north Adriatic coast exhibited Cd, Cu, Mn and Ni concentrations higher than in loggerhead sea turtles and other species living in other areas, however unknown if such high levels may have detrimental effects on health, speculated source of metals drom diet, specifically bivalves (Franzellitti et al., 2004). Loggerheads stranded in Croatia and Slovenia exhibited highest Hg concentrations for this species worldwide, concentration of Cd was twice of that found in other populations in Mediterranaean, concentrations still below levels proven to exhibit toxic effect in marine mammals, however possible synergistic effect of different pollutants (Lazar et al., 2008). High concentrations of As can lead to widespread liver degeneration in C. caretta, high concentrations of Cd can adversely affect the health of sea turtles such as C. caretta (Savoca et al., 2022 and references therein).
		marine litter	Tursiops truncatus (or other cetaceans)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Rare	individual	devastating - medium	Medium	Đuras et al., 2021; Pribanić et al., 1999	Ingestion of litter (not associated with fisheries) very rare in Croatia despite abundant marine litter in Adriatic, however fatal in 3/4 cases (Đuras et al., 2021).
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Occasionally	individual	devastating - medium	High	Lazar & Gračan, 2011; Baldi et al., 2023	Marine debris found in 1/3 of sea turtles from stranded or incidentally captured dead loggerhead sea turtles from Croatia and Slovenia, only one (of 54) died directly because of debris ingestion (Lazar & Gračan, 2011). Presence of marine litter in feces of loggerhead sea turtles from South Adriatic Sea demonstrates non-lethal effects of ingestion (mostly small fragments), however prolonged presence of debries in digestive tract may increase risk of internal injuries and reduction of stomach capacity, inappetence, increased buoyancy and chemical contamination leading to poor health and reduced fitness (Baldi et al., 2023).
Oil and Gas Exploration	Seismic surveys - Air Gun Perspections	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	communication masking, physical trauma, hearing loss, behavioural change, habitat displacement	Occasionally	individual	medium disturbance	Low	Maglio et al., 2015; Rako-Gospić & Picciulin, 2019; Marine Board – ESF, 2008; McCauley et al., 2000	Adriatic Sea area with most seismic exploration concentrated between 2005 and 2015, noise hotspot detected in Western part of North Adriatic (Italian coast) due to seismic surveys (Maglio et al., 2015). Increase in the size of area used for seismic surveys in Gulf of Trieste in the past 10 years (Rako-Gospić & Picciulin, 2019). Possible effects of air-guns on cetaceans include communication masking, physical trauma, hearing loss, behavioural change, habitat displacement (Marine Board – ESF, 2008). Humpback whales showed localised avoidance of the operating air-gun vessel during survey and startle responses (McCauley et al., 2000).
			Caretta caretta (or other sea turtles)	0	Year-round	hearing damage, reduced ability to avoid natural and anthropogenic threats, behavioural change, stress, entanglement in equipment, exclusion from key habitats, interruption of beahaviour necessary for breeding, foraging or thermoregulation	Occasionally	individual	medium disturbance	Low	Maglio et al., 2015; Rako-Gospić & Picciulin, 2019; Štrbenac, 2017 and references therein; Nelms et al., 2016; Deruiter, 2010; Weir, 2007	Adriatic Sea area with most seismic exploration concentrated between 2005 and 2015, noise hotspot detected in Western part of North Adriatic (Italian coast) due to seismic surveys (Maglio et al., 2015). Increase in the size of area used for seismic surveys in Gulf of Trieste in the past 10 years (Rako-Gospić & Picciulin, 2019). Sea turtles able to detect sounds of low frequencies (e.g. seismic airguns) which can potentially cause physical damage, hearing damage, behavioural change, chronic impacts, stress, entanglement in equipment, a typical airgun array at depth between 100 and 120 m could impact behaviour of sea turtles in 2 km radius and cause avoidance in 1 km radius (Štrbenac, 2017 and references therein). Hearing damage due to exposure to seismic air guns may lead to reduced ability to avoid natural and anthropogenic threats (e.g. bycatch and vessel collisions), acoustic disturbance coud leat to exclusion from key habitats, interruption of beahaviour necessary for breeding, foraging or thermoregulation, changes in foraging duration, swim speed, dive depth and duration, restricted access to surface to breathe, leading to reduction in individual fitness (Nelms et al., 2016). Visual observation of Caretta caretta during seismic survey in Algeria showed half of turtles displaying avoidance behaviour, 20 % of which showing startle response, possible negative consequences if it interferes with thermoregulation (basking) or results in additional energy expenditure (Deruiter, 2010). In addition, sea turtles may become fatally trapped in survey equipment (Weir, 2007). Weir (2007) observed fewer sea turtles near airguns as they were firing (as opposed to silent airguns), however the source of agitation could not be identified; the turtles may have reacted to the ship and towed equipment rather than specifically to the airgun (Weir 2007).
	Building an oil and gas rig	underwater noise	Tursiops truncatus (or other cetaceans)	0	Year-round	physical trauma, hearing loss, behavioural change, habitat displacement	Occasionally	individual	medium disturbance	Low	Buckstaff et al., 2013; Piwetz et al., 2021; Weaver, 2021; Marine Board – ESF, 2008	Bottlenose dolphin densities in vicinity of constriction site in Sarasota Bay, Florida significantly lower during construction, behavioural changes observed during underwater explosion: decreased nearest neighbor distance, increased group size, heading changes (Buckstaff et al., 2013). Lower occurence of humpback dolphins in historically importent areas near longerm low-intensity construction activity in Hong Kong, dolphin swimming speed was higher in response to vessel presence, temporal overlap in adjacent marine construciton areas may displace animals for extended periods (Piwetz et al., 2021). Significant decreases in numbers of feeding but no decrease in socializing bottlenose dolphins after construction in prime habitat in Gulf of Mexico, dolphins adapted to degraded habitat: establishing feeding locations beyond the disturbed construction zone and shifting temporal rythms of behaviours to later in the day when construciton activities were minimized (Weaver, 2021). Possible effects of pile driving and explosions during construction on cetaceans include (Marine Board – ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	disturbance from pile driving, habitat displacement	Occasionally	individual	minor disturbance	Low	Popper et al., 2014	Data on the effects of pile driving on sea turtles are lacking, because of their rigid external anatomy, it is possible that sea turtles are highly protected from impulsive sound effects, at least with regard to pile driving and seismic airguns (Popper et al., 2014).
		marine traffic	Tursiops truncatus (or other cetaceans)	0	Year-round	disturbance, habitat displacement, masking of communication, changes in vocalization	Daily	population	medium disturbance	Medium	Rako-Gospić & Picciulin, 2019; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić and Picciulin, 2016; Jensen et al., 2009; Marine Board - ESF, 2008	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019), has a very high concentration of harbours (Maglio et al., 2015). Underwater monitoring programme in Gulf of Trieste showed high noise pressure without seasonal variation (cargo vessel traffic homogenous all over the year), whit main source of noise being large ships (Codarin & Picciulin, 2015). No direct evidence of how traffic noise affects dolphins in Gulf of Trieste is available, however noise caused by boat traffic is known to affect dolphin whistle frequencies in North Adriatic part of Croatia (Rako-Gospić and Picciulin, 2016). Study from Australia showed that noise from small vessels can significantly mask acoustically mediated communication in bottlenose dolphins (Jensen et al., 2009). Effects of noise from vessels include masking communication and habitat displacement in marine mammals (Marine Board - ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Daily	population	minor disturbance	Low	Samuel et al., 2005 and references therein	No information on the effect of underwater noise form marine traffic on sea turtles available for the Gulf of Trieste or Adriatic. Little is known about potential effects of exposure to marine traffic noise on behaviour and health of sea turtles, however in experiments sea turtles displayed agitated behaviour, abrupt body movements, startle responses and prolonged inactivity at bottom of tank in response to low-frequency sound, prolonged exposure could lead to avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues (Samuel et al., 2005 and references therein).
		chemical pollution	Tursiops truncatus (or other cetaceans)	0	Year-round	accumulation of hydrocarbons resulting in immunosupression, cancer, skin lesions, secondary infections and diseases, sporedic dieoffs, reduced reproductive success	Daily	population	medium disturbance	Low	Marsili et al., 2001; Bearzi et al., 2024; Fossi & Marsili, 2009	Blubber samples from fin whales and striped dolphins from Ligurian and Ionian Seas showed exposure to polycyclic aromatic hydrocarbons, concentrations peaked in both species during crude oil spill in 1993, greater accumulation of carcinogenic hydrocarbons in dolphins, naphthaliene highest concentration in both species (Marsili et al., 2001). Mortality or health problems due to contamination, contact or ingestion of hydrocarbons from oil spills and oil derivates at sea considered of low importance for cetaceans in Adriatic (Bearzi et al., 2024). Effects of endocrine disruptors in cetaceans include immunosupression, cancer, skin lesions, secondary infections and diseases, sporedic die-offs, reduced reproductive success (Fossi & Marsili, 2009).
			Caretta caretta (or other sea turtles)	0	Year-round	accumulation of hydrocarbons resultin in carcinogenic effects, immunosuppression, liver damage, endocrine disruption, anemia, kidney and salt glands damage, adverse metabolic effects,	Daily	population	medium disturbance	High	Cocci et al., 2018; Bucchia et al., 2015; Arienzo et al., 2023; Camacho et al., 2013	Juvenile loggerhead sea turtles rescued along Italian coast of northern and central Adriatic exhibited detecable levels of polycyclic aromatic hydrocarbons found in all plasma samples, effects of PAHs and PCBs on wildlife include carcinogenic effects, immunosuppression, liver damage, endocrine disruption, in turtles bioaccumulation of PAHs and PCBs results in hematological changes, possibly causing anemea (Cocci et al., 2018). Current levels of organic conamination considerably higher in Adriatic loggerhead sea turtles than in Atlantic, Adriatic turtles appar to have higher levels of mercury, one of the most toxic elements, PCBs, OCPs and PAHs associated with carcinogenic, neurodevelopmental, reproducive and endocrine effects in several species (Bucchia et al., 2015). Stranded loggerhead sea turtles along coast of south Tyrrhenian Sea showed exceptionally high levels of PAHs in liver, up to 100-times greater than from literature, naphthalene predominant contributor, potential risk of neoplastic disease development (Arienzo et al., 2023). Effects of persistent organic pollutants (OCPs, PCBs and PAHs) on loggerhead sea turtles from Cape Verde showed that PCB exposure could result in anemia in sea turtles, negative association between OCP and white blood cells and thrombocytes, exposure to DDT could affect kidneys and salt glands, OCPs and PAHS could induce adverse metabolic effects in sea turtles (Camacho et al., 2013).
	Oil and gas extraction											

		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disturbance, habitat displacement, masking of communication, changes in vocalization	Daily	population	medium disturbance	Medium	Rako-Gospić & Picciulin, 2019; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić and Picciulin, 2016; Jensen et al., 2009; Marine Board - ESF, 2008	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019), has a very high concentration of harbours (Maglio et al., 2015). Underwater monitoring programme in Gulf of Trieste showed high noise pressure without seasonal variation (cargo vessel traffic homogenous all over the year), whit main source of noise being large ships (Codarin & Picciulin, 2015). No direct evidence of how traffic noise affects dolphins in Gulf of Trieste is available, however noise caused by boat traffic is known to affect dolphin whistle frequencies in North Adriatic part of Croatia (Rako-Gospić and Picciulin, 2016). Study from Australia showed that noise from small vessels can significantly mask acoustically mediated communication in bottlenose dolphins (Jensen et al., 2009). Effects of noise from vessels include masking communication and habitat displacement in marine mammals (Marine Board - ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Daily	population	minor disturbance	Low	Samuel et al., 2005 and references therein	No information on the effect of underwater noise form marine traffic on sea turtles available for the Gulf of Trieste or Adriatic. Little is known about potential effects of exposure to marine traffic noise on behaviour and health of sea turtles, however in experiments sea turtles displayed agitated behaviour, abrupt body movements, startle responses and prolonged inactivity at bottom of tank in response to low-frequency sound, prolonged exposure could lead to avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues (Samuel et al., 2005 and references therein).
Offshore renewable energy	Wind farm	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disturbance from pile driving, physical trauma, hearing loss, behavioural change	Unknown*	individual	no impact	Low	Bearzi et al., 2024 and references therein; Marine Board – ESF, 2008	No offshore windfarms present in Adriatic yet, however many are being planned for construction in the near future, especially in Italy and Croatia. Disturbance may be caused by pile driving required to instal wind turbines, once the wind turbines are in place, impacts may be lower, results drom acoustic monitoring in Scotland suggested no dramatic longterm changes in use of area around turbines by harbour porpoises. No information avaiable about possible impact of pile driving on cetaceans in Mediterranean (Bearzi et al., 2024 and references therein). Effects of pile driving may include physical trauma, hearing loss and behavioural change (Marine Board – ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	disturbance from pile driving, habitat displacement	Unknown*	individual	no impact	Low	Popper et al., 2014	No offshore windfarms present in Adriatic yet, however many are being planned for construction in the near future, especially in Italy and Croatia. Data on the effects of pile driving on sea turtles are lacking, because of their rigid external anatomy, it is possible that sea turtles are highly protected from impulsive sound effects, at least with regard to pile driving and seismic airguns (Popper et al., 2014).
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disturbance due to underwater noise, habitat displacement, masking of communication, changes in vocalization, collisions	Unknown*	individual	no impact	Low		No offshore windfarms present in Slovenia/Gulf of Trieste.
			Caretta caretta (or other sea turtles)	0	Year-round	habitat displacement, collisions	Unknown*	individual	no impact	Low		No offshore windfarms present in Slovenia/Gulf of Trieste.
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	Summer	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Rare	individual	devastating - medium	Medium	Đuras et al., 2021; Pribanić et al., 1999; Bearzi et al., 2024	Ingestion of litter (not associated with fisheries) very rare in Croatia despite abundant marine litter in Adriatic, however fatal in 3/4 cases (Đuras et al., 2021). Impact of marine litter on cetaceans in Adriatic sea is considerd low (Bearzi et al., 2024).
			Caretta caretta (or other sea turtles)	1	Summer	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Occasionally	individual	devastating - medium	High	Lazar & Gračan, 2011; Baldi et al., 2023	Marine debris found in 1/3 of sea turtles from stranded or incidentally captured dead loggerhead sea turtles from Croatia and Slovenia, only one (of 54) died directly because of debris ingestion (Lazar & Gračan, 2011). Presence of marine litter in feces of loggerhead sea turtles from South Adriatic Sea demonstrates non-lethal effects of ingestion (mostly small fragments), however prolonged presence of debries in digestive tract may increase risk of internal injuries and reduction of stomach capacity, inappetence, increased buoyancy and chemical contamination leading to poor health and reduced fitness (Baldi et al., 2023).
		underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Summer	disturbance, habitat displacement, masking of communication, changes in vocalization	Seasonally	population	medium disturbance	Medium	Rako-Gospić & Picciulin, 2019; Rako-Gospić and Picciulin, 2016; Jensen et al., 2009; Marine Board - ESF, 2008	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019). No direct evidence of how traffic noise affects dolphins in Gulf of Trieste is available, however noise caused by boat traffic is known to affect dolphin whistle frequencies in North Adriatic part of Croatia (Rako-Gospić and Picciulin, 2016). Study from Australia showed that noise from small vessels can significantly mask acoustically mediated communication in bottlenose dolphins (Jensen et al., 2009). Effects of noise from vessels include masking communication and habitat displacement in marine mammals (Marine Board - ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Daily	population	minor disturbance	Low	Samuel et al., 2005 and references therein	No information on the effect of underwater noise form marine traffic on sea turtles available for the Gulf of Trieste or Adriatic. Little is known about potential effects of exposure to marine traffic noise on behaviour and health of sea turtles, however in experiments sea turtles displayed agitated behaviour, abrupt body movements, startle responses and prolonged inactivity at bottom of tank in response to low-frequency sound, prolonged exposure could lead to avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues (Samuel et al., 2005 and references therein).
		light pollution	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	disturbance, habitat displacement, masking of communication, changes in vocalization	Daily	population	medium disturbance	Medium	Rako-Gospić & Picciulin, 2019; Maglio et al., 2015; Codarin & Picciulin, 2015; Rako-Gospić and Picciulin, 2016; Jensen et al., 2009; Marine Board - ESF, 2008	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019), has a very high concentration of harbours (Maglio et al., 2015). Underwater monitoring programme in Gulf of Trieste showed high noise pressure without seasonal variation (cargo vessel traffic homogenous all over the year), whit main source of noise being large ships (Codarin & Picciulin, 2015). No direct evidence of how traffic noise affects dolphins in Gulf of Trieste is available, however noise caused by boat traffic is known to affect dolphin whistle frequencies in Croatia (Rako-Gospić and Picciulin, 2016). Study from Australia showed that noise from small vessels can significantly mask acoustically mediated communication in bottlenose dolphins (Jensen et al., 2009). Effects of noise from vessels include masking communication and habitat displacement in marine mammals (Marine Board - ESF, 2008).
			Caretta caretta (or other sea turtles)	0	Year-round	avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues	Daily	population	minor disturbance	Low	Rako-Gospić & Picciulin, 2019; Maglio et al., 2015; Samuel et al., 2005 and references therein	Gulf of Trieste noise hotspot in Mediterranean (Rako-Gospić & Picciulin, 2019), has a very high concentration of harbours (Maglio et al., 2015). No information on the effect of underwater noise form marine traffic on sea turtles available for the Gulf of Trieste or Adriatic. Little is known about potential effects of exposure to marine traffic noise on behaviour and health of sea turtles, however in experiments sea turtles displayed agitated behaviour, abrupt body movements, startle responses and prolonged inactivity at bottom of tank in response to low-frequency sound, prolonged exposure could lead to avoidance behaviour, increased stress and aggression levels, physiological damage to ears, altering diving and surfacing rates and confounding orientation cues (Samuel et al., 2005 and references therein).
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	medium disturbance	High	Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Đokić et al., 2025	Heavy metals in tissues of stranded bottlenose dolphins from Northern Adriatic Sea in low concentrations, but high enough to exert potential immunotoxic effects, lymph node swelling observed during necropsies (Zaccaroni et al., 2009). Heavy metals present in bottlenose dolphin prey in same area as well (Scaravelli et al., 2009). Concentrations of cadmium, arsenic, mercury and lead measured in tissues of stranded cetaceans from Croatia exceeding the limit at which toxic effects appear in marine mammals (Bilandžić et al., 2012). Elevated levels of copper and zinc in tissues of stranded dolphins from Croatia indicating localized environmental contamination, however significant decreasing trend in copper and zinc concentration during two decades, likely due to improved pollution control or shifrs in dolphins' feeding habits (Đokić et al., 2025).
			Caretta caretta (or other sea turtles)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	minor disturbance	High	Franzellitti et al., 2004; Lazar et al., 2008; Savoca et al., 2022	Stranded loggerhead sea turtles along Italian north Adriatic coast exhibited Cd, Cu, Mn and Ni concentrations higher than in loggerhead sea turtles and other species living in other areas, however unknown if such high levels may have detrimental effects on health, speculated source of metals drom diet, specifically bivalves (Franzellitti et al., 2004). Loggerheads stranded in Croatia and Slovenia exhibited highest Hg concentrations for this species worldwide, concentration of Cd was twice of that found in other populations in Mediterrnaean, concentrations still below levels proven to exhibit toxic effect in marine mammals, however possible synergistic effect of different pollutants (Lazar et al., 2008). High concentrations of As can lead to widespread liver degeneration in C. caretta, high concentrations of Cd can adversely affect the health of sea turtles such as C. caretta (Savoca et al., 2022 and references therein).
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	Year-round	bioaccumulation of organochlorine contaminants causing immunosupression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections	Occasionally	population	medium disturbance	High	Genov et al., 2019	Relatively high levels of PCBs detected in northern Adriatic dolphins, enough to potentially cause population level effects, majority of animals in study exceeded lower toxicity threshold with 50% exceeding high threshold, high PCB levels in previous studies linked to immunosupression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections (Genov et al., 2019).
			Caretta caretta (or other sea turtles)	0	Year-round	bioaccumulation of organochlorine contaminants effecting endocrine, developmental and immune systems	Occasionally	population	medium disturbance	High	Lazar et al., 2011	Accumulation of organochlorene contaminants detected in loggerhead sea turtles from eastern Adriatic Sea (Slovenia and Croatia), sea turtles in this study exhibited high OC levels compared to other populations, contamination occurs primarily through the food web (biomagnification). Chronic exposure to OCs affects endocrine, developmental and immune systems (Lazar et al., 2011).
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Rare	individual	devastating - medium	Medium	Đuras et al., 2021; Pribanić et al., 1999	Ingestion of litter (not associated with fisheries) very rare in Croatia despite abundant marine litter in Adriatic, however fatal in 3/4 cases (Đuras et al., 2021).
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Occasionally	individual	devastating - medium	High	Lazar & Gračan, 2011; Baldi et al., 2023	Marine debris found in 1/3 of sea turtles from stranded or incidentally captured dead loggerhead sea turtles from Croatia and Slovenia, only one (of 54) died directly because of debris ingestion (Lazar & Gračan, 2011). Presence of marine litter in feces of loggerhead sea turtles from South Adriatic Sea demonstrates non-lethal effects of ingestion (mostly small fragments), however prolonged presence of debries in digestive tract may increase risk of internal injuries and reduction of stomach capacity, inappetence, increased buoyancy and chemical contamination leading to poor health and reduced fitness (Baldi et al., 2023).
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	medium disturbance	High	Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Đokić et al., 2025	Heavy metals in tissues of stranded bottlenose dolphins from Northern Adriatic Sea in low concentrations, but high enough to exert potential immunotoxic effects, lymph node swelling observed during necropsies (Zaccaroni et al., 2009). Heavy metals present in bottlenose dolphin prey in same area as well (Scaravelli et al., 2009). Concentrations of cadmium, arsenic, mercury and lead measured in tissues of stranded cetaceans from Croatia exceeding the limit at which toxic effects appear in marine mammals (Bilandžić et al., 2012). Elevated levels of copper and zinc in tissues of stranded dolphins from Croatia indicating localized environmental contamination, however significant decreasing trend in copper and zinc concentration during two decades, likely due to improved pollution control or shifrs in dolphins' feeding habits (Đokić et al., 2025).
			Caretta caretta (or other sea turtles)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	minor disturbance	High	Franzellitti et al., 2004; Lazar et al., 2008; Savoca et al., 2022	Stranded loggerhead sea turtles along Italian north Adriatic coast exhibited Cd, Cu, Mn and Ni concentrations higher than in loggerhead sea turtles and other species living in other areas, however unknown if such high levels may have detrimental effects on health, speculated source of metals drom diet, specifically bivalves (Franzellitti et al., 2004). Loggerheads stranded in Croatia and Slovenia exhibited highest Hg concentrations for this species worldwide, concentration of Cd was twice of that found in other populations in Mediterrnaean, concentrations still below levels proven to exhibit toxic effect in marine mammals, however possible synergistic effect of different pollutants (Lazar et al., 2008). High concentrations of As can lead to widespread liver degeneration in C. caretta, high concentrations of Cd can adversely affect the health of sea turtles such as C. caretta (Savoca et al., 2022 and references therein).
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	medium disturbance	High	Scaravelli et al., 2009; Zaccaroni et al., 2009; Bilandžić et al., 2012; Đokić et al., 2025	Heavy metals in tissues of stranded bottlenose dolphins from Northern Adriatic Sea in low concentrations, but high enough to exert potential immunotoxic effects, lymph node swelling observed during necropsies (Zaccaroni et al., 2009). Heavy metals present in bottlenose dolphin prey in same area as well (Scaravelli et al., 2009). Concentrations of cadmium, arsenic, mercury and lead measured in tissues of stranded cetaceans from Croatia exceeding the limit at which toxic effects appear in marine mammals (Bilandžić et al., 2012). Elevated levels of copper and zinc in tissues of stranded dolphins from Croatia indicating localized environmental contamination, however significant decreasing trend in copper and zinc concentration during two decades, likely due to improved pollution control or shifrs in dolphins' feeding habits (Đokić et al., 2025).
			Caretta caretta (or other sea turtles)	0	Year-round	accumulation of heavy metals, possibly resulting in toxic effects for the organism	Daily	population	minor disturbance	High	Franzellitti et al., 2004; Lazar et al., 2008; Savoca et al., 2022	Stranded loggerhead sea turtles along Italian north Adriatic coast exhibited Cd, Cu, Mn and Ni concentrations higher than in loggerhead sea turtles and other species living in other areas, however unknown if such high levels may have detrimental effects on health, speculated source of metals drom diet, specifically bivalves (Franzellitti et al., 2004). Loggerheads stranded in Croatia and Slovenia exhibited highest Hg concentrations for this species worldwide, concentration of Cd was twice of that found in other populations in Mediterrnaean, concentrations still below levels proven to exhibit toxic effect in marine mammals, however possible synergistic effect of different pollutants (Lazar et al., 2008). High concentrations of As can lead to widespread liver degeneration in C. caretta, high concentrations of Cd can adversely affect the health of sea turtles such as C. caretta (Savoca et al., 2022 and references therein).
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	bioaccumulation of organochlorine contaminants causing immunosupression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections	Occasionally	population	medium disturbance	High	Genov et al., 2019	Relatively high levels of PCBs detected in northern Adriatic dolphins, enough to potentially cause population level effects, majority of animals in study exceeded lower toxicity threshold with 50% exceeding high threshold, high PCB levels in previous studies linked to immunosupression, increased susceptibility to disease, high lung and gastric macro-parasite burdens and generalised bacterial infections (Genov et al., 2019).
			Caretta caretta (or other sea turtles)	0	Year-round	bioaccumulation of organochlorine contaminants effecting endocrine, developmental and immune systems	Occasionally	population	medium disturbance	High	Lazar et al., 2011	Accumulation of organochlorene contaminants detected in loggerhead sea turtles from eastern Adriatic Sea (Slovenia and Croatia), sea turtles in this study exhibited high OC levels compared to other populations, contamination occurs primarily through the food web (biomagnification). Chronic exposure to OCs affects endocrine, developmental and immune systems (Lazar et al., 2011).
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Rare	individual	devastating - medium	Medium	Đuras et al., 2021; Pribanić et al., 1999	Ingestion of litter (not associated with fisheries) very rare in Croatia despite abundant marine litter in Adriatic, however fatal in 3/4 cases (Đuras et al., 2021).
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion of marine debris, death due to gut obstruction, dietary dilution and reduced energy intake	Occasionally	individual	devastating - medium	High	Lazar & Gračan, 2011; Baldi et al., 2023	Marine debris found in 1/3 of sea turtles from stranded or incidentally captured dead loggerhead sea turtles from Croatia and Slovenia, only one (of 54) died directly because of debris ingestion (Lazar & Gračan, 2011). Presence of marine litter in feces of loggerhead sea turtles from South Adriatic Sea demonstrates non-lethal effects of ingestion (mostly small fragments), however prolonged presence of debries in digestive tract may increase risk of internal injuries and reduction of stomach capacity, inappetence, increased buoyancy and chemical contamination leading to poor health and reduced fitness (Baldi et al., 2023).
	Urbanization	[illegible]	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
		[illegible]	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
Climate change	Global temperature raise	[illegible]	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
		[illegible]	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
		[illegible]	*Caretta caretta* (or other sea turtles)									No sea turtle nesting in Slovenia/Gulf of Trieste
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)	0	Year-round	shifts in prey availability (abundance or distribution), exposure to novel diseases	Unknown*	population	minor disturbance	Medium	Bearzi et al., 2024	Human-induced changes in climate resulting in water heating and acidification, ecosystem change, shifts in prey availability (abundance or distribution), shifts in distribution of competitors or predators, altered trophic webs, ecology or productivity, exposure to novel diseases etc., considered highly relevant source of impact on cetaceans from Adriatic (Bearzi et al., 2024).
			Caretta caretta (or other sea turtles)	0	Year-round	shifts in prey availability for adults and juveniles, more difficult migration between seasonal habitats, inefficient/different dispersal of juveniles	Unknown*	population	minor disturbance	Low	Hawkes et al., 2009	Warmer climate conditions induce profound changes to benthic communities where loggerhead sea turtles feed, lower numbers of nesting loggerhead sea turtles observed in northwestern Pacific when annual sea surface temperatures in core foraging ground in the preceding year were higher; decreased predictability of seasonal habitats in time and space and more difficult migration between them, juvenile sea turtles may not disperse as efficiently or to the same areas as at present due to changes in thermohaline circulation patterns, altered prey availability for juvenile sea turtles due to changes in pelagic communities with climate change (Hawkes et al., 2009).
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0	Year-round	[illegible]	Unknown*	population	minor disturbance	Low		No data on interactions with alien species in Slovenia/Gulf of Trieste
			Caretta caretta (or other sea turtles)	0	Year-round	[illegible]	Unknown*	population	minor disturbance	Low		No data on interactions with alien species in Slovenia/Gulf of Trieste

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Type of maritime use/driver/activities	Pressure transfer agents	Pressure	Species	Season-related (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	Specify which season (Open answer)	Potential effect (Please, specify the potential effects on target species - open answer)	SCORE Frequency (Among the option, please specify the frequency of interaction)	score	Magnitude (Among the option, please specify the magnitude of the interaction)	score	Impact level (Please, specify the impact on the sentinel species)	score	Confidence (Please, specify the level of confidence with which the information is given)		Sources (Published literature specific to the study area)	Notes
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	1	Spring and Summer mainly	We have closely encountered bottlenose dolphins following trawlers for oppurtunistic feeding in multiple occasions. Entanglement and negative change of behaviour from fishers might be potential effect	Monthly	0.8	population	1	medium disturbance	0.6	High	3	Rudd LE, Awbery T, Waller R, Crowe M, Bauer J, Jacquemart A, ... & Akkaya A. (2022). The effect of commercial and artisanal fishing practices on the behavioral budget of bottlenose dolphins off the coast of Montenegro, South	We have observed the behaviour during our own research.
			Monachus monachus	0	Not season related	No documented interaction in Montenegro	Unknown*	0.6			minor disturbance	0.2	Low	1	The interaction is unknown and unlikely with trawlers	The interaction is unknown and unlikely with trawlers
		bycatch	*Tursiops truncatus* (or other cetaceans)													
			Caretta caretta (or other sea turtles)													
		overfishing	*Tursiops truncatus* (or other cetaceans)	0	Not season related	The fishing fleet in Montenegro is very small with majority of it being small-scale	Rare	0.2	population	1	minor disturbance	0.2	Medium	2	The fleet is only in 300s, including the small scale fishery	
			Monachus monachus	0	Not season related	The fishing fleet in Montenegro is very small with majority of it being small-scale fishery, however the illegal practices of dynamite fishing can have an important tool near their nursing caves.	Unknown*	0.6	population	1	medium disturbance	0.6	Medium	2	-	Although it is illegal, dynamite fishing is a practice that can take place especially within the south coast of Montenegro whcih overlaps with the monk seal sightings. Therefore there is a potential threat. Small scale fishery can also have a definite impact on overfishing, although lesser in dimension compare to the rest of the Adriatic Sea countries.
		Habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
			Caretta caretta (or other sea turtles)	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
			Monachus monachus	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
			Caretta caretta (or other sea turtles)	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
			Monachus monachus	0	Not season related	Unknown threat in Montenegro	Unknown*	0.6							-	Unknown threat
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)	0	Spring and Summer mainly	Similar to trawlers	Monthly	0.8	population	1	medium disturbance	0.6	Medium	2	Rudd LE, Awbery T, Waller R, Crowe M, Bauer J, Jacquemart A, ... & Akkaya A. (2022). The effect of commercial and artisanal fishing practices on the behavioral budget of bottlenose dolphins off the coast of Montenegro, South	We have observed the behaviour during our own research.
			Monachus monachus	0	Not season related	No documented interaction in	Unknown*	0.6								Unknown threat
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Not season related	No documented interaction in Montenegro but has a potential	Unknown*	0.6	individual	0.4	minor disturbance	0.2	Medium	2		Unknown threat
			Caretta caretta (or other sea turtles)	0	Not season related	Several dead sea turtles were recorded in Montegro and half of them were recorded with the signs of bycatch (hooks, lines)	Occasionally	0.4	individual	0.4	minor disturbance	0.2	High	3	Gvozdenović, S., Đurović, M., & Ikica, Z. (2021). Contribution to the sea turtle findings in Montenegro (southeast Adriatic Sea). Studia Marina, 34(1), 21-34.	Studies from 2020 documented 31 turtle sightings; among those, 18 were found dead, though the causes were largely incidental (e.g., bycatch, hooks)
			Monachus monachus	0	Not season related	No documented interaction in Montenegro but has a potential	Unknown*	0.6	individual	0.4	minor disturbance	0.2	Medium	2		Unknown threat
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)													
			Caretta caretta (or other sea turtles)													
			Monachus monachus													
		competition	*Tursiops truncatus* (or other cetaceans)	0	Not season related	The small scale fishery is highly coastal in Montenegro, overlaps with the distribution of bottlenose dolphins. The potential effect is mainly temporary area replacement, although there is no direct interaction has been documented at the current knowledge	Daily	1	individual	0.4	minor disturbance	0.2	High	3	Rudd LE, Awbery T, Waller R, Crowe M, Bauer J, Jacquemart A, ... & Akkaya A. (2022). The effect of commercial and artisanal fishing practices on the behavioral budget of bottlenose dolphins off the coast of Montenegro, South	
			Caretta caretta (or other sea turtles)	1	During warmer seasons, their encounter increase	Almost half of the reported strandings holds bycatch signs in Montenegro	Rare	0.2	individual	0.4	minor disturbance	0.2	Medium	2	Gvozdenović, S., Đurović, M., & Ikica, Z. (2016). Distribution records of sea turtles in the Montenegrin waters. Studia Marina,	
			Monachus monachus	0	Not season related	The distribution range does overlap, other than the prey depletion and area avoidance, there is no proved impact	Rare	0.2	individual	0.4	minor disturbance	0.2	Medium	2	-	
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Not season related	No documented impact of eco-sounders or fish finders in Montenegro at the moment. However sonar impact in the offshore species as in sperm whales and beaked whales in the Adriatic Pit is known and also this type of impact is documented wordwide. Area avoidance might be the reason for the fin whale sightings within the Boka Bay after the potential navy practices in Bar in summer	Occasionally	0.4	population	1	devastating - medium	0.8	High	3	-	
			Caretta caretta (or other sea turtles)	0	Not season related	Unknown threat in Montenegro	Occasionally	0.4	population	1			Low	1	-	
			Monachus monachus	0	Not season related	Unknown threat in Montenegro	Occasionally	0.4	population	1			Low	1	Panou, A., Varda, D., & Bundone, L. (2017). The Mediterranean monk seal, Monachus monachus, in Montenegro. In 7th International Symposium of Ecologists, Sutomore, Montenegro (pp. 94-101). Sutomore, Montenegro: ISEM7.	The Montenegrin marine caves, are now known to be essential habitats for monk seals, are specifically flagged as being vulnerable to noise disturbance. Although it was not specifically underlines, noise was pointed out as one of the threat for these caves
	Human	intentional killing	*Tursiops truncatus* (or other cetaceans)	0	NA	Intentional killing is not reported in Montenegro	Rare	0.2	individual	0.4	lethal	1	High	3		
			Caretta caretta (or other sea turtles)	0	NA	During the last decade, the intentional killing reported only in few occasion, mainly by the tourist	Occasionally	0.4	individual	0.4	lethal	1	High	3	Gvozdenović, S., Đurović, M., & Ikica, Z. (2016). Distribution records of sea turtles in the Montenegrin waters. Studia Marina,	Intentional killing was identified as the least possible cause
			Monachus monachus	0	NA	The last intentional killing took place in 1967, although it was not intentional and again by tourist	Rare	0.2	individual	0.4	lethal	1	High	3		
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Not season related	There are increase sightings in close proximity of mussel and oyster farms in Boka Kotorska Bay	Daily	1	individual	0.4	minor disturbance	0.2	High	3		Our surveys records close proximity to the areas, as well as our acoustic devices within the farms
			Caretta caretta (or other sea turtles)	0	Not season related	Mussel and oyster farmers reports frequent visits of sea turtles in the farms	Monthly	0.8	individual	0.4	minor disturbance	0.2	High	3		Local community reports
			Monachus monachus	0	Not season related	No known report	Unknown*	0.6					Low	1		Unknown threat
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
			Caretta caretta (or other sea turtles)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
			Monachus monachus	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
			Caretta caretta (or other sea turtles)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
			Monachus monachus	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1	-	No reports
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1		
			Caretta caretta (or other sea turtles)	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1		
			Monachus monachus	0	Not season related	The impact is not documented in Montenegro, although there are wide range of impact reports globally	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Low	1		
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	Habitat avoidance and behavioural alterations. Although the traffic we focus here is not just the trade route but local traffic as well as the cruise ships noise	Daily	1	individual	0.4	medium disturbance	0.6	High	3	Awbery T, Nikpaljevic N, Clarkson J, Abbiss L, Pouw Kraan D, Liebig P, Todorović S, Akkaya A. (2019). Bottlenose and striped dolphins of Montenegro: An insight into sighting variations, behavioral patterns, photo-identification, core habitats, marine traffic, and conservation initiatives 2017-2018. Annual Report of Montenegro	
			Caretta caretta (or other sea turtles)	0	Year round	Area avoidance	Occasionally	0.4	individual	0.4	medium disturbance	0.6	Low	1		Unknown
			Monachus monachus	0	Year round	Area avoidance	Daily	1	individual	0.4	devastating - medium	0.8	Low	1		Due to the known effort of underwater noise on the caves for the seals
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0	Not season related	Not documented in Montenegro	Unknown*	0.6	individual	0.4	minor disturbance	0.2	High	3		The dimension of this current impact is unknown
			Caretta caretta (or other sea turtles)	0	Not season related	Few occasions were thought to be related to the ship collision	Rare	0.2	individual	0.4	minor disturbance	0.2	Medium	2		The dimension of this current impact is unknown
			Monachus monachus	0	Not season related	Not documented in Montenegro	Unknown*	0.6	individual	0.4	minor disturbance	0.2	Medium	2		The dimension of this current impact is unknown
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0		Not documented in Montenegro	Unknown*	0.6								Unknown
			Caretta caretta (or other sea turtles)	0		Not documented in Montenegro	Unknown*	0.6								Unknown
			Monachus monachus	0		Not documented in Montenegro	Unknown*	0.6								Unknown
		marine litter	*Tursiops truncatus* (or other cetaceans)	0		Not documented in Montenegro	Unknown*	0.6								Unknown
			Caretta caretta (or other sea turtles)	0		Not documented in Montenegro	Unknown*	0.6								Unknown
			Monachus monachus	0		Not documented in Montenegro	Unknown*	0.6								Unknown
Oil and Gas Exploration	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)	0		The decline on the sighings in 2019 and 2020 might be link to the coastal seismic practices off Bar	Rare	0.2	individual	0.4	devastating - medium	0.8	Medium	2	Sirovic, A., & Holcer, D. (2020). Ambient noise from seismic surveys in the Southern Adriatic Sea. In The Montenegrin Adriatic Coast: Marine	There was a seismic survey in 2018 and 2019 and a decline on bottlenose dolphins were recorded but there is no proof of direct link
			Caretta caretta (or other sea turtles)	0		Unknown										Unknown
			Monachus monachus	0		Unknown										Unknown
		chemical pollution	*Tursiops truncatus* (or other cetaceans)	0		Unknown										Unknown
			Caretta caretta (or other sea turtles)	0		Unknown										Unknown
			Monachus monachus	0		Unknown										Unknown
	Building an oil and gas rig	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	NA	Not applicable										
			Caretta caretta (or other sea turtles)	0	NA	Not applicable										
			Monachus monachus	0	NA	Not applicable										
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	NA	Unknown										
			Caretta caretta (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)	0	NA	Unknown										
			Caretta caretta (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
		underwater noise	*Tursiops truncatus* (or other cetaceans)	0	NA	The decline on the sighings in 2019 and 2020 might be link to the coastal seismic practices off Bar	Rare	0.2	individual	0.4	devastating - medium	0.8	Medium	2		
			Caretta caretta (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	NA	Unknown										
			Caretta caretta (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
		underwater noise	*Tursiops truncatus* (or other cetaceans)	0	NA	Unknown										Montenegro is currently in the early stages of exploring offshore wind energy potential, with no operational marine wind farms yet established.

Offshore renewable energy	Wind farm construction		*Caretta caretta* (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
		marine traffic	*Tursiops truncatus* (or other cetaceans)	0	NA	Unknown										
			Caretta caretta (or other sea turtles)	0	NA	Unknown										
			Monachus monachus	0	NA	Unknown										
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	1	All year with an increase in summer	Injury and possibly fatality										
			Caretta caretta (or other sea turtles)	1	All year with an increase in summer	Injury and possibly fatality										
			Monachus monachus	1	All year with an increase in summer	Injury and possibly fatality										
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	All year round, although summer it increase notably	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3	Clarkson J, Christiansen F, Awbery T, Abbiss L, Nikpaljevic N, & Akkaya A. (2020). Non-targeted tourism affects the behavioral budgets of bottlenose dolphins Tursiops truncatus in the South	This threat is the biggest threat on the sentinel species in Montenegro due to its mass development.
			Caretta caretta (or other sea turtles)	0	All year round, although summer it increase notably	Temporary or permanent area avoidance	Daily	1	population	1	devastating - medium	0.8	High	3		Boat collisions are common with turtkes with a recent fatal injurt in Bat from a propeller strike.
			Monachus monachus	0	All year round, although summer it increase notably	Temporary or permanent area avoidance	Daily	1	population	1	devastating - medium	0.8	High	3		Tourist boat entries to the caves pose a concerning threat for the population
		underwater noise	*Tursiops truncatus* (or other cetaceans)	0	All year round, although summer it increase notably	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3	Clarkson J, Christiansen F, Awbery T, Abbiss L, Nikpaljevic N, & Akkaya A. (2020). Non-targeted tourism affects the behavioral budgets of bottlenose dolphins Tursiops truncatus in the South	Intense number of jet-skies, motor boats, luxury boats, cruise ships, especially in summer months, pose a significant threat for the sentinel species in Montenegro
			Caretta caretta (or other sea turtles)	0	All year round, although summer it increase notably	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3		
			Monachus monachus	0	All year round, although summer it increase notably	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3		
		cave tourism	*Monachus monachus*	1	Summer	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3	Panou, A., Varda, D., & Bundone, L. (2017). The Mediterranean monk seal, Monachus monachus, in Montenegro. In 7th International Symposium of Ecologist, Sutomore, Montenegro (pp. 94-101).	Although not linked to the tourism in caves, it underlines the imprtance of caves for seals in Montenegro
		light pollution	*Caretta caretta* (or other sea turtles)	1	Summer	Hatchlings get lost, nesting problems	Seasonally	0.6	population	1	devastating - medium	0.8	High	3		The newly identified nesting beach of loggerhead turtles in Ulcinj long beach is under the heavy pressure of summer tourism
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year round	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3		Harbor and pier construction, along with urban development, has significantly degraded marine habitats and an active source of concern, specifically in Ulcinj, Bar, Sutomore, Budva and Boka Kotorska
			Caretta caretta (or other sea turtles)	0	Year round	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3		Though no study targets sea turtles or seals directly, the broader ecosystem degradation poses indirect but real threats, effecting nursery and feeding
			Monachus monachus	0	Year round	Temporary or permanent area avoidance, behavioural budget alteration	Daily	1	population	1	devastating - medium	0.8	High	3		
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year round	Unstudied threat in Montenegro										Unknown
			Caretta caretta (or other sea turtles)	0	Year round	Unstudied threat in Montenegro										Unknown
			Monachus monachus	0	Year round	Unstudied threat in Montenegro										Unknown
		chemical pollution	*Tursiops truncatus* (or other cetaceans)													
			Caretta caretta (or other sea turtles)													
		marine litter	*Tursiops truncatus* (or other cetaceans)	1	Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2	Mandić, M., Gvozdenović, S., De Vito, D., Alfonso, G., Daja, S., Ago, B., ... & Piraino, S. (2022). Setting thresholds is not enough: Beach litter as indicator of poor environmental status in the southern Adriatic Sea. Marine pollution bulletin, 177, 113551. Mandić, M., Gvozdenović, S., Peraš, I., Ivanović, A., & Malovrazić, N. (2021). Quantification and classification of beach litter in Montenegro (South-East Adriatic Sea). In The Montenegrin Adriatic Coast: Marine Chemistry Pollution (pp. 257-274). Cham: Springer International Publishing. https://slidetodoc.com/marine-litter-and-sea-turtles-results-of-	Seafloor litter, especially in feeding grounds like Boka Kotorska, adds risks of entanglement or ingestion. During our photo-id study, dolphins were frequently reported entangled on litter. Overall debris density in areas critical for foraging and social behaviors could disrupt dolphin populations already
			Caretta caretta (or other sea turtles)	1	Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2		Plastic litter on beaches and coasts threatens nesting sites and hatchling survival, risking ingestion and entanglement, specifically in between Ulcinj and Ada Bojana
			Monachus monachus	1	Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2		Litter, especially in coastal caves deters habitation or pose physical hazard
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Unknown	Unknown										Unknown
			Caretta caretta (or other sea turtles)	0	Unknown	Unknown										Unknown
			Monachus monachus	0	Unknown	Unknown										Unknown
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Unknown	Unknown										Unknown
			Caretta caretta (or other sea turtles)	0	Unknown	Unknown										Unknown
			Monachus monachus	0	Unknown	Unknown										Unknown
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	All year round	Area avoidance			population	1	devastating - medium	0.8	High	3		Details are already provided above under habitat destruction
			Caretta caretta (or other sea turtles)	0	All year round	Area avoidance			population	1	devastating - medium	0.8	High	3		
			Monachus monachus	0	All year round	Area avoidance			population	1	devastating - medium	0.8	High	3		
		marine litter	*Tursiops truncatus* (or other cetaceans)		Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2	Mandić, M., Gvozdenović, S., De Vito, D., Alfonso, G., Daja, S., Ago, B., ... & Piraino, S. (2022). Setting thresholds is not enough: Beach litter as indicator of poor environmental status in the southern Adriatic Sea. Marine pollution bulletin, 177, 113551. Mandić, M., Gvozdenović, S., Peraš, I., Ivanović, A., & Malovrazić, N. (2021). Quantification and classification of beach litter in Montenegro (South-East Adriatic Sea). In The Montenegrin Adriatic Coast: Marine Chemistry Pollution (pp. 257-274). Cham: Springer International Publishing. https://slidetodoc.com/marine-litter-and-sea-turtles-results-of-	Seafloor litter, especially in feeding grounds like Boka Kotorska, adds risks of entanglement or ingestion. During our photo-id study, dolphins were frequently reported entangled on litter. Overall debris density in areas critical for foraging and social behaviors could disrupt dolphin populations already
			Caretta caretta (or other sea turtles)		Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2		Plastic litter on beaches and coasts threatens nesting sites and hatchling survival, risking ingestion and entanglement, specifically in between Ulcinj and Ada Bojana
			Monachus monachus		Year round, increase in Summer	Injury and possibly fatality	Occasionally	0.4	individual	0.4	devastating - medium	0.8	Medium	2		Litter, especially in coastal caves deters habitation or pose physical hazard
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)	0	Year round	Area avoidance			population	1	devastating - medium	0.8	High	3		Specifically south of Montenegro between Ulcinj and Ada Bojana is under the current threat for sea turtle populations, where a nesting beach is identified
		light pollution	*Caretta caretta* (or other sea turtles)	1	Year round, increase in Summer	Area avoidance, alteration of nesting habitat			population	1	devastating - medium	0.8	High	3		Specifically south of Montenegro between Ulcinj and Ada Bojana is under the current threat for sea turtle populations, where a nesting beach is identified
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)	1		Sex ratio			population	1	devastating - medium	0.8	High	3		There are no peer-reviewed or local studies that explore how climate-related changes, such as warming seas, altered nesting conditions, or shifting species behavior, affect these sentinel species in Montenegro. Other than having the global knowledge on the subject, there is no specific case we can mention, thus left empty as the situation does not change for Montenegro
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	0		nesting timing, incubation success, and sex ratio										
			Monachus monachus	0												
		sea-level raise	*Caretta caretta* (or other sea turtles)	0												
			Monachus monachus	0												
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)													
			Caretta caretta (or other sea turtles)													
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0												
			Caretta caretta (or other sea turtles)	0												
			Monachus monachus	0												

PP9 - ARCHIPELAGOS

							SCORE					
Type of maritime use/driver/activities	**Pressure transfer agents**	**Pressure**	**Species**	**Season-related** (Please, specify if the pressure depends on the season: 0 = no, 1 = yes)	**Specify which season** (Open answer)	**Potential effect** (Please, specify the potential effects on target species - open answer)	**Frequency** (Among the option, please specify the frequency of interaction)	**Magnitude** (Among the option, please specify the magnitude of the interaction)	**Impact level** (Please, specify the impact on the sentinel species)	**Confidence** (Please, specify the level of confidence with which the information is given)	**Sources** (Published literature specific to the study area)	**Notes**
Fishery	Trawling	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	direct resource competition / demersal prey depletion	Occasionally	population	medium disturbance	Medium	Janssen et al. (2022), Tsagarakis et al. (2021)	the impact level depends on the region
			Monachus monachus	0	Year-round	reduced prey avalability	Seasonally	individual	medium disturbance	Medium	Karamanlidis (2015)	peak activity in spring-summer-autmn
		bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		overfishing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	prey depletion which causes reduced prey density, size and age	Seasonally	population	devastating - medium	Medium	Janssen et al. (2022), Tsagarakis et al. (2021), Milani et al. (2017)	peak activity in spring-summer-autmn
			Monachus monachus	0	Year-round	prey depletion	Seasonally	individual	medium disturbance	Medium	Pierce et al. (2011)	peak activity in spring-summer-autmn
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round	benthic habitat alteration --> indirectly lowering foraging success	Seasonally	population	devastating - medium	Medium	Janssen et al. (2022), Tsagarakis et al. (2021), González-Correa et al. (2005)	peak activity in spring-summer-autmn
			Caretta caretta (or other sea turtles)	0	Year-round	benthic habitat alteration --> indirectly lowering foraging success	Seasonally	individual	devastating - medium	Medium	González-Correa et al. (2005)	peak activity in spring-summer-autmn
			Monachus monachus	0	Year-round	resting locations are destroyed / prey degradation	Seasonally	individual	devastating - medium	Medium	González-Correa et al. (2005)	
	Loss/abandonment of nets and fishing gears and old driftnets	marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	entanglement / ingestion / lethal consequences	Occasionally	individual	devastating - medium		Pietroluongo et al. (2022), Alexiadou et al. (2019)	
			Caretta caretta (or other sea turtles)	0	Year-round	entanglement / ingestion / lethal consequences	Occasionally	individual	devastating - medium	High	Pietroluongo et al. (2022), Alexiadou et al. (2019)	
			Monachus monachus	0	Year-round	entanglement / inestion -> lethal consequences	Occasionally	individual	devastating - medium	High	Pietroluongo et al. (2022), Alexiadou et al. (2019)	
	Purse seine	competition	*Tursiops truncatus* (or other cetaceans)									
			Monachus monachus	1	small-pelagic fish season	change of predator behaviour / prey depletion	Rare	population	minor disturbance	Medium	Ingrosso et al. (2023), Pierce et al. (2011), Rios et al. (2017)	lower niche overlap than with bottom trawlers
	Longlines	bycatch	*Tursiops truncatus* (or other cetaceans)	0	Year-round	drowning, injuries from tangeling and the long lines,	Occasionally	individual	medium disturbance	Medium	ACCOBAMS/GFCM (2019/2024) Revies of cetacean bycatch rates in the Mediteeranean & black sea; mitigation measures and hotspots. technical document	
			Caretta caretta (or other sea turtles)									
			Monachus monachus	0	Year-round	Etanglement	Occasionally	individual	medium disturbance	Medium	Rios, N., et al. (2017) Occurrence and impact of interactions between smal-scale fisheries and marine mammals in the Mediterranean Sea. Fisheries Research, 187,56-68	
	Small scale fisheries (nets)	bycatch	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Etanglement, culling by fishers, decreasing fishing grounds	Occasionally	individual	medium disturbance	High	Janssen, S. E., Le Coz, J., Macrina, L., Grandjean, T., Miliou, A. (2022) "Conflict analysis between commercial fisheries and common bottlenose dolphin (Tt) in the Dodecanese region, Greece (2013-2019) Fisheries Managment and Ecology	
			Caretta caretta (or other sea turtles)									
			Monachus monachus	0	Year-round	Etanglement, habitat loss, deorientation, deliberate killing, lack of international coordination	Occasionally	individual	medium disturbance	High	Karamanlidis, A. A.; Dendrinos, P.; Kotomatas, S.; Paravas,V.; & Adamantopoulou, S. (2021). Mediterranean monk seal (Monachus monachus) and fisheries: Conserving biodiversity and mitigating a conflict in Hellenic Seas. Research-Gate	
	Sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	more frequent traveling and diving behaviour, avoiding vessels, stress response, decrease in feeding behaviour --> short term, decline population health, area avoidance, decreasing resting, feeding, lower fecundity for females --> long term effects	Seasonally	population	devastating - medium	Medium	Roth, D.A.- "Short term impacts of Marine traffic on the behaviour of Delphinius delphis und Tursiops truncatus in the Aegean Sea" (2025, report, study) Essex Student Journal, 16 (1)	
			Caretta caretta (or other sea turtles)									
			Monachus monachus	0	Year-round	strandings, hearing damage, avoidance of noisy areas, decreasing socialsising/ feeding/ resting, disturb of mother/ pubs bonding,	Daily	population	devastating - medium	High	Charrier, I.; Huetz, C., Prevost, L.; Dendrinos, P., & Karamanlidis, A. A.; (2023) "First description of the underwater souds in the Mediterranean monk seals Monachus monachus in Greece: towards establishing a vocal repertoire. Animals, 13(6), 1048.	
	Human	Intentional killing	*Tursiops truncatus* (or other cetaceans)	0	Year-round	tied with rope, cutting of the fins, weapons, animals drowned	Occasionally	individual	medium disturbance	Medium	Archipelagos Institute of Marine Conservation. (o.J) "Violent dolphin killing", 3th of september 2025, Archipelagos Website	
			Caretta caretta (or other sea turtles)	0	Year-round	general deliberate injuries, head injuries, flipper injuries and amputations	Occasionally	individual	medium disturbance	Low	Archelon-Sea turtle protection Society of Greece, 3th of september, website Archelon	
			Monachus monachus	0	Year-round	found killed by weapon (gun, spear gun, dynamite) or animals drowned suffered seroius injuries caused directly by humans	Occasionally	individual	devastating - medium	High	Solanou, M.; Panou, A.; Maina, I.; Kavadas, S.; Giannoulaki, M. (2024). "Ten years of of Mediterranean Mon seal stranding records in Greece under the Microscope: What do the data suggests? Animals, 14(9), 1309. https://doi.org/10.3390/ani14091309	
Aquaculture	Human	competition	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Displacement, loss of foraging areas, changes on vocalizations and social structure	Daily	individual	medium disturbance	Medium	LEK, Archipelagos Observations	
			Caretta caretta (or other sea turtles)	0	Year-round	Displacement, loss of foraging areas, injury or ingestion of fishing gear	Occasionally	individual	minor disturbance	Low	Mazaris, A.D. et al., 2023	
			Monachus monachus	0	Year-round	Displacement, loss of foraging areas, injury or ingestion of fishing gear	Occasionally	individual	minor disturbance	Low	Güçlüsoy, H. Y. et al., (2003)	
Navy exercise	Military shooting range	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Acute risk zones for mortality or serious injury to dolphin species. Underwater noise caused by this interferes with communication between individuals and foraging efforts.	Unknown*	individual	medium disturbance	Medium	Ciminello et al., 2012	
			Caretta caretta (or other sea turtles)	0	Year-round	Underwater explosions/shooting ranges find plausible pathways to lethal or sub-lethal injury (lung/ear damage), plus behavioral effects from high-level noise	Occasionally	individual	medium disturbance	Low	Casale and Margaritoulis, 2010	
			Monachus monachus	0	Year-round	Monk seal vocalisations could be masked by shooting range noise, interfering with crucial breeding and pup interactions.	Occasionally	individual	medium disturbance	Low	Charrier et al., 2023	
		disturbance on preys	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Noise from underwater explosions or military shooting ranges may cause severe injury or mortality to fish prey species. shockwaves from miliary activity have been seen to rupture swimbladders in fish up to several hundred metres. Explosions may directly destroy structural habitats for fish species.	Occasionally	individual	medium disturbance	High	Fan et al., 2024; Jenkins et al., 2022	
			Caretta caretta (or other sea turtles)	0	Year-round	na						
			Monachus monachus	0	Year-round	Severe injury or mortality to fish prey species. shockwaves from military activity have been seen to rupture swimbladders in fish. Explosions may directly destroy structural habitats for fish species.	Occasionally	individual	medium disturbance	High	Fan et al., 2024; Jenkins et al., 2022	
	Naval sonar	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Sonars can cause stress leading to symptoms similar to decompression sickness and mass strandings	Rare	population	devastating - medium	Medium	Parsons et al., 2008 https://www.sciencedirect.com/science/article/abs/pii/S0025326X08002221#:~:text=rights%20and%20content-,Abstract,Introduction	
			Caretta caretta (or other sea turtles)	0	Year-round	N/A	Unknown*					No information available looking into the impacts of sonar on sea turtles
			Monachus monachus	0	Year-round	mask or smother sounds from the seal	Unknown*				Wright et al., 2007	
Marine Transport (Traffic)	Trade routes	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Underwater noise from boats cuts feeding, resting and socialising. Disruption to communication structures. Decreased abundance	Daily	population	devastating - medium	High	Roth, 2025; Tenan et al., 2020; Papale et al., 2011	
			Caretta caretta (or other sea turtles)	0	Year-round	Cuts foraging, predator avoidance, increased vigilance. High co occurance between shipping lanes and turtle distribution. Spatial overlap.	Daily	population	medium disturbance	High	Diaz et al., 2024; Martin et al., 2012; Luschi and Casale, 2013	
			Monachus monachus	0	Year-round	can cause physiological stress, mask or smother sounds from the seal	Daily	population	medium disturbance	Medium	Wright et al., 2007	
		ship collisions	*Tursiops truncatus* (or other cetaceans)	0	Year-round	High mortality risk, less efficient foraging due to damage to their body and limbs, more likely to become prey for predators, can't swim to keep up with pod	Occasionally	individual	devastating - medium	Medium	(Frantzis et al., 2019)	
			Caretta caretta (or other sea turtles)	0	Year-round	Mortality more likely, injuries from sharp collisions when coming up to breath	Occasionally	individual	devastating - medium	Medium	(Frantzis et al., 2019)	
			Monachus monachus	0	Year-round	death and injury	Occasionally	individual	devastating - medium			
	Naval discharges	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Toxicological risk, habitat degredation	Occasionally	individual	medium disturbance	Medium	Formigaro et al., 2017	
			Caretta caretta (or other sea turtles)	0	Year-round	Toxicological risk, habitat degredation	Occasionally	individual	medium disturbance			
			Monachus monachus	0	Year-round	Toxicological risk, habitat degredation	Occasionally	individual	medium disturbance	Medium		
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round	ingestion, entanglement, toxicological risk from marine litter. Indirect effects: can reduce prey availability	Occasionally	individual	medium disturbance	High	Fossi et al., 2016; Digka et al., 2018; UNEP/MAP, 2020; Alomar and Deudero, 2017	
			Caretta caretta (or other sea turtles)	0	Year-round	ingestion, entanglement, toxicological risk from marine litter.	Occasionally	individual	medium disturbance	High	Matiddi et al., 2017; Lazar et al., 2018; UNEP/MAP, 2020.	
			Monachus monachus	0	Year-round	ingestion, entanglement, toxicological risk from marine litter. Indirect effects: can reduce prey availability	Occasionally	individual	medium disturbance	Medium	Karamanlidis et al., 2024; Fossi et al., 2018; Digka et al., 2018; MOm reports.	
	Seismic surveys - Air Gun Prospections	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
			Tursiops truncatus (or other cetaceans)									

Oil and Gas Exploration	Building an oil and gas rig	underwater noise	*Caretta caretta* (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Oil and gas extraction	chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Offshore renewable energy	Wind farm	underwater noise	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		marine traffic	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
Coastal Tourism	Recreational activities	marine litter	*Tursiops truncatus* (or other cetaceans)	0		marine litter contamination, contamination of the gastrointestinal tract	Unknown*	individual	medium disturbance	Medium	Pietroluongo, G. Martin-Montalvo, B.Q. Antichi, S. Miliou,A. Costa,V.(2022), "First Assessment of Micro-Litter Ingested by Dolphins, Sea Turtles and Monk Seals Found Stranded along the coasts of Samos Island, Greece", *MDPI*, 12.	
			Caretta caretta (or other sea turtles)	0		marine litter contamination, contamination of the gastrointestinal tract	Unknown*	individual	medium disturbance	Medium	Pietroluongo, G. Martin-Montalvo, B.Q. Antichi, S. Miliou,A. Costa,V.(2022), "First Assessment of Micro-Litter Ingested by Dolphins, Sea Turtles and Monk Seals Found Stranded along the coasts of Samos Island, Greece", MDPI , 12.	
			Monachus monachus	0		marine litter contamination, contamination of the gastrointestinal tract	Unknown*	individual	medium disturbance	Medium	Pietroluongo, G. Martin-Montalvo, B.Q. Antichi, S. Miliou,A. Costa,V.(2022), "First Assessment of Micro-Litter Ingested by Dolphins, Sea Turtles and Monk Seals Found Stranded along the coasts of Samos Island, Greece", MDPI , 12.	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0		stress behaviour —>	Unknown*	population	medium disturbance	Medium	Roth, D.A. (2025)"Short-term impacts of Marine Traffic on the Behaviour of Doplhins in the Aegean Sea", *Essex Student Journal* 16(1).	
			Caretta caretta (or other sea turtles)	1	summer	degradation of nests	Seasonally	individual	medium disturbance	Medium	Katselidis, K.A. Schofield, G. Stamou, G. DImopoulos, P. Pantis, J.D. (2013) " Evidence-based management to regulate the impact of tourism at a key marine turtle rookery on Zakynthos Island, Greece", *Fauna & Flora International*, 47(4), p584-594.	
			Monachus monachus	0		loss of habitat —> decline of *Monachus monachus*	Unknown*	population	medium disturbance	Medium	Johnson, W.M. Lavigne, D.M. (1999), " Mass Tourism and the mediterranean monk seal", *The monachus guardian.*	
		underwater noise	*Tursiops truncatus* (or other cetaceans)	1	Summer	Habitat degradation, behavioural alterations, masking of acoustic cues, stress	Seasonally	population	medium disturbance	High	Archipelagos observations, INSETE Intelligence (Ikkos, 2024)	
			Caretta caretta (or other sea turtles)	1	Summer	Stress, changes in behaviour and habitat use, changes in migratory patterns, hearing loss	Seasonally	population	medium disturbance	High	NOAA, Samuel et al. (2004)	
			Monachus monachus	1	Summer	Stress leading to immune system impairment, habitat degradation, masking	Seasonally	population	medium disturbance	High	Accobams (2016), NOAA website, INSETE Intelligence (Ikkos, 2024)	
		cave tourism	*Monachus monachus*	1	Summer	Disturbance of resting and breeding habitats, possible abandonment	Seasonally	population	devastating - medium	High	NOAA	
		light pollution	*Caretta caretta* (or other sea turtles)	1	Summer	Deterring females from going on the beach to lay eggs, disorienting hatchlings that won't reach the sea	Seasonally	population	devastating - medium	High	Archelon, the sea turtle protection society of Greece	
Coastal development	Harbors	underwater noise	*Tursiops truncatus* (or other cetaceans)	0	Year-round but higher in summer	Habitat degradation, behavioural alterations, masking of acoustic cues, stress	Daily	population	medium disturbance	High	Accobams (2016), Erbe, Dunlop & Dolman (2018)	
			Caretta caretta (or other sea turtles)	0	Year-round but higher in summer	Habitat degradation (especially nesting sites), change of migratory paths, behaviour disruptance, stress, hearing loss	Daily	population	medium disturbance	High	Accobams (2016) NOAA website	
			Monachus monachus	0	Year-round but higher in summer	Stress leading to immune system impairment, habitat degradation, masking	Occasionally	population	medium disturbance	High	Accobams (2016) NOAA website	
	Mouth rivers	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
		chemical pollution	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		marine litter	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
			Monachus monachus									
	Industrial dumping	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Disruption of immune system	Rare	individual	minor disturbance	Medium	Papastergios et al. (2010), Krishna et al. (2003)	
			Caretta caretta (or other sea turtles)	0	Year-round	Disruption of immune system	Rare	individual	minor disturbance	Low	Soubasakou, Evrenoglou & Cavoura (2023)	
			Monachus monachus	0	Year-round	Disruption of immune system	Rare	individual	minor disturbance	Low	NOAA website	
	Urban and agricultural runoff	introduction of non-synthetic substances and compounds	*Tursiops truncatus* (or other cetaceans)	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Low		
			Monachus monachus	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Medium	Capanni et al. (2024)	
		habitat degradation	*Tursiops truncatus* (or other cetaceans)	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Low		
			Caretta caretta (or other sea turtles)	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Low		
			Monachus monachus	0	Year-round (higher in spring-summer)	Disruption of immune system, eutrophy	Rare	individual	minor disturbance	Medium	Capanni et al. (2024)	
		marine litter	*Tursiops truncatus* (or other cetaceans)	0	Year-round (higher in summer)	Ingestion of litter or accummulation from prey, death, entanglement	Occasionally	individual	medium disturbance	High	Archipelagos observations, Pietroluongo et al. (2017)	
			Caretta caretta (or other sea turtles)	0	Year-round (higher in summer)	Voluntary or involuntary ingestion, entanglement, death	Occasionally	individual	lethal	High	Digka et al. (2020)	
			Monachus monachus	0	Year-round	Ingestion of litter or accummulation from prey, death, entanglement	Occasionally	individual	devastating - medium	High	Pietroluongo et al. (2017)	
	Urbanization	erosion and beach armouring	*Caretta caretta* (or other sea turtles)	1	summer	disruption of turtle clutches	Seasonally	population	medium disturbance	Medium	Casale, P. Broderick, A.C. Caminas, J.A. Cardona, L. Carreras, C. Demetropoulos, A. Fuller, W.J. Godley, B.J. Hochscheid,S. Kaska, Y. Lazar, B. Margaritoulis, D. Panagopoulou, A. Rees, A.F. Tomas, J. Turkozan O. (2018), "Mediterranean sea turtles: current knowledge and priorities for conservation and research", *Inter-Research*, 36, p229-267.	
		light pollution	*Caretta caretta* (or other sea turtles)	1	during summer	disrupt the sea finding orientation —> mortality —> reduction of population	Seasonally	population	medium disturbance	Medium	Dimitriadis, C. Konstantinidou,I.F. Sourbès, L.Koutsoubas, D. Mazaris, A.D.(2018) "Reduction of sea turtle population recruitment caused by nightlight: Evidence from the Mediterranean region", *Elsevier*, 153, p108-115.	
Climate change	Global temperature raise	increase sand temperature	*Caretta caretta* (or other sea turtles)	1	spring-summer	Female bias, shift of nesting season to earlier in year, possible decrease in hatching success	Seasonally	population	devastating - medium	Medium	https://doi.org/10.1371/journal.pone.0157170	
		extreme weather phenomena	*Caretta caretta* (or other sea turtles)	0	Year-round (higher in summer)	Loss of seagrass beds as a result of extreme temperatures during marine heatwaves —> decrease in prey availability	Occasionally	population	devastating - medium	Low	Doumas (2024) - Phytobenthic Communities of Aegean Sea Under the Impact of Climatic Warming	
			Monachus monachus	1	Spring-summer	Heat waves causing mortality of ecologically important species such as reef building corals and seagrass beds, damaging the seal's habitat. Intense storms damaging and flooding caves and representing a direct risk to hauled put seals	Rare	individual	minor disturbance	High	NOAA, Garrabou et al. (2022), Ranasinghe et al. (2021)	
		sea-level raise	*Caretta caretta* (or other sea turtles)	1	Spring-summer	Decrease in nesting beach area, as a result of inundation as well as beach erosion, due to sea level rise	Seasonally	population	devastating - medium	Medium	https://doi.org/10.1007/s10113-022-01922-2 https://doi.org/10.1016/j.jembe.2013.10.017 https://doi.org/10.5194/nhess-17-449-2017	
			Monachus monachus	0	Year-round (higher during autumn-winter)	Decrease in access to caves used for pupping, nesting and resting	Daily	population	devastating - medium	Medium	https://doi.org/10.3390/ani14091309	
		increased sea temperature and ocean acidification	*Tursiops truncatus* (or other cetaceans)									
			Caretta caretta (or other sea turtles)									
		alien species arrival	*Tursiops truncatus* (or other cetaceans)	0	Year-round	Changes in prey community structure/abundance	Unknown*	population	minor disturbance	Medium	https://doi.org/10.3390/biology12070933 https://archipelago.gr/fields-of-action/marine-biodiversity/invasive-species/	
			Caretta caretta (or other sea turtles)	0	Year-round	Changes in benthic food webs, degradation of turtle habitats	Unknown*	population	medium disturbance	Medium		
			Monachus monachus	0	Year-round	Changes in prey community structure/abundance	Unknown*	population	minor disturbance	Medium		