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## D.1.1 Conservation plan on Loggerhead sea turtle (Caretta caretta)

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## Contents

# 1. Introduction

The Adriatic Sea is a semi-enclosed basin of the Mediterranean Sea that, due to its morphological characteristics, can be divided into three sub-basins: Northern, Central, and Southern. These sub-basins differ in oceanographic features such as seabed topography, salinity, composition of benthic communities, and temperature regimes. It extends between Italy and the Balkans with a surface area of around 138000 km², connected to the Mediterranean through the narrow (72 km wide) but deep (780 m) Strait of Otranto (Cushman-Rosin et al., 2001). The bathymetry of the Adriatic Sea is characterized by strong latitudinal and longitudinal asymmetries. It is divided into three portions that reach increasingly greater depths from north to south: shallow depths in the northern portion with an average of -50 m, peaks of -200 m in the central Adriatic, up to exceeding a thousand meters in the southernmost portion.

The Adriatic has been recognized as an important habitat for many protected species. While there is no Adriatic agreement on protection of biodiversity in the basin there are multiple initiatives, such as the Adriatic-Ionian (established in May 2000) as a platform for cross-border/international between Albania, Croatia, Greece, Italy, Montenegro, and Slovenia. Within the European Union strategy, the Adriatic Sea is a sub-region of the Marine Strategy Framework Directive (MSFD) (Directive 2008/56/EC) underlining its importance as a region for conservation and management of sea use. There are over 30 Marine Protected Areas (MAPs) registered in the region, the majority being located on the Italian coast, however there are increasing numbers of initiatives being promoted (Mackelworth et al., 2013a, 2013b).

The Northern Adriatic, the focus of this document, has distinctive characteristics suitable for the life of sea turtles. This sub-basin is shallow, the sandy seabed reaches a maximum depth of about 100 m, with an average depth of 35 m and is strongly influenced by the Po river plumes, with low salinity, low water temperature and high productivity. The 100 m bathymetric contour line roughly separates the northern basin from the central Adriatic (Artegiani et al., 1997). The seabed, predominantly in the western portion of the basin, is defined as “mobile”, consisting of unconsolidated sandy sediments, except for some rocky outcrops such as in the case of the “Tegnue”. The small water volume created by its large surface area and limited depth define its low thermal capacity. Furthermore, the shallow depth results in minimal thermal variation between the surface and the seabed. In winter, the average temperature is 10°C, with minimums reaching 8°C, whereas in summer, the

average ranges between 21-24°C (Artegiani et al., 1997). These seasonal variations allow the survival and development of numerous benthic communities, including mollusks (gastropods and bivalves), crustaceans, jellyfish, sponges, and small fish (Casale et al., 2018), which serve as natural prey for *C. caretta*. The Northern Adriatic represents an important foraging and growth area (Casale et al., 2012), particularly for juveniles, adult females and turtles that nest in Greece (Lazar et al., 1998).

Winter temperatures, causing the cold-stunning phenomenon, lead to migration towards warmer southern waters for overwintering (Lazar et al., 2003). However, studies have reported the presence of juvenile individuals in the basin even during the coldest months (Casale et al., 2012). Turtles can exhibit a residential behavior, remaining in the northern sector throughout the year, or they can migrate seasonally to other areas. In spring, they may take advantage of the current flowing along the Albanian-Croatian coasts to move northward, while in autumn, they may migrate southward into the Mediterranean Sea, following the current generated along the Italian coast (Orlić et al., 1992; Casale et al., 2012). Nonetheless, it is not excluded that sea turtle migrations may also occur against the current (Lazar et al., 1998).

Another important aspect is the large number of rivers that flow into the Adriatic Sea, particularly in the Northern and Central basins. The annual average river discharge is approximately 4000 $m^3/s$, with the Po River being the primary freshwater source. The Po River alone has an average annual outflow of about 1700 $m^3/s$, with higher levels associated with spring snowmelt and heavy autumn precipitation (Orlić et al., 1992). Due to this significant freshwater influx and other rivers inputs, the salinity of the Northern Adriatic Sea is lower (34 PSU, Practical Salinity Units) compared to the southern part (38 PSU) (Artegiani et al., 1997). Additionally, rivers are the main contributors to the introduction of chemical pollutants into the Adriatic, as they pass through highly anthropized and contaminated areas during their course. The Northern Adriatic has the highest oxygen consumption rate in the basin due to biochemical processes, with peak activity occurring offshore of the Po River delta (Artegiani et al., 1997; Lipizer et al., 2014).

Furthermore, the high seasonality of temperatures and currents create “corridors” within which animals move within the basin itself. These peculiar characteristics, both in terms of morphology and physical and chemical environment, make this sea a hotspot of biodiversity. The very high productivity indeed supports an equally high richness of fish species at the Mediterranean level exploited from a fishing perspective.

Data on distribution and demographic, available from literature and by several project carried out (e.g Project BY-CATCH I-VIII, NETCET), indicate the Northern Adriatic as the most important feeding and overwintering area in the Mediterranean Sea, due to the neritic behavior of the species, as evidenced by the previous images and satellite tracks of 7 specimens of *C. caretta*. This area is an important development site for juvenile: incidental captures (Casale et al., 2004, Vallini et al., 2003,) and strandings highlight a massive use of this area (Vallini et al., 2011, Marisaldi et al., 2022, 2023). These have allowed for the determination of an initial distribution model of specimens in the Northern Adriatic on a seasonal basis (Lucchetti et al., 2016). The different aerial surveys (2010-2013) have shown that the density increases from the coast towards the open sea, with maximum values towards the center of the northern Adriatic (Fortuna et al., 2018) with 69% of the turtles are found in this area, with an estimated abundance and density of approximately 27000 turtles at 0.405 individuals/km$^2$, 53% of which populate the northern part of the basin. Fortuna et al. (2018) emphasize that 90% of these individuals are within territorial waters. As already mentioned, this area represents a hotspot for turtles, particularly during the spring and summer months for all age classes, thanks to the high seasonal presence of prey and due to the special conditions of the basin suitable to spend the winter time by juveniles (Vallini et al., 2011).

## 2. Situation analyses of targeted species and habitat types: *Caretta caretta*

Given the region's well-defined geographical boundaries, a combination of aerial surveys and coordinated boat-based assessments conducted across different seasons could generate crucial data to accurately determine the conservation status of these species. Given the Adriatic Sea's complexity in terms of oceanography, biodiversity, and economic activities, identifying biodiversity hotspots would likely benefit from the approach of defining Vulnerable Marine Areas (VMAs), as outlined by Zacharias and Gregr (2005). This method involves first identifying Valued Ecological Features (VEFs)—biological or physical characteristics and processes considered environmentally, socially, culturally, or economically significant (Zacharias and Gregr, 2005). VMAs can then be delineated and prioritized using predictive modeling. In this context, *C. caretta* represents a key biological indicator that should serve as the foundation for identifying and prioritizing VMAs.

In order to identify and coordinate a unified conservation strategy for sea turtles and to draft the National Action Plan for the Conservation of Sea Turtles (PATMA), in compliance with obligations derived from adherence to national, European and international legislations, and as required by Article 30 of the Action Plan for the Conservation of Mediterranean Marine Turtles, the Italian Ministry of the Environment in 2007 invited the 15 Italian coastal regions, 7 national park authorities, the Port Authority Corps, the State Forestry Corps, and ICRAM (now ISPRA) to join the Memorandum of Understanding (MoU) for the drafting of the National Action Plan for the Conservation of Sea Turtles (PATMA). The aim was to outline the implementation methods of the ISPRA Guidelines and establish coordination among all involved entities to facilitate participatory processes for monitoring, conservation, and management of sea turtles. Additionally, the Protocol was open for accession by research institutions, scientific societies, and environmental organizations.

The signatories of the MoU, under Article 8, committed to adopting and implementing the ISPRA Guidelines, providing the required data to the Ministry, and collaborating according to the operational protocols outlined in the agreement. They also committed to reporting the rescue centers they manage, their locations, their intervention capacity, and the personnel involved. The Ministry invited the Regions to coordinate these facilities to optimize resources and enhance their effectiveness; many Regions have established specific regional coordination bodies for this purpose. The Ministry is responsible for defining the territorial competence of the centers and for any necessary strengthening of existing structures.

According to the Memorandum of Understanding, the PATMA was developed by the MATTM with the technical and scientific support of ICRAM (now ISPRA). Once ratified by the parties, it will be formally adopted by the Ministry of the Environment, which retains full responsibility for overseeing and coordinating the Plan, following consultation with ISPRA and the Ministry of Agricultural, Food, and Forestry Policies (MIPAAF, now the Ministry of Agriculture, Food Sovereignty, and Forests – MASAF) and upon agreement from the Unified Conference. Upon approval of the Plan, each signatory entity commits to incorporating it into its own legislation, territorial planning, and programming.

While awaiting its final draft and approval, the signatory entities commit to coordinating and collaborating according to the directives issued by the Ministry of the Environment. Additionally, any action involving handling, capture, rescue, rehabilitation, monitoring, safeguarding, and surveillance of sea turtles must be reported and pre-authorized by the MATTM (now MASE), with the opinion of INFS (now incorporated in ISPRA), as required by Presidential Decree 357/1997 and its subsequent amendments. The Ministry of the

Environment grants exemptions from legal prohibitions for protection purposes, for preventing specific damages, for public health and safety reasons (including socio-economic reasons), and for educational, research, restocking, and reintroduction purposes. A list of granted exemptions is submitted biennially to the European Commission (Presidential Decree 357/1997 and subsequent amendments, Article 11).
The Plan will serve as a reference document for institutional entities to coordinate management aspects, including:

- Collection and archiving of all available knowledge;
- Criteria and procedures for intervention in critical and emergency situations;
- Identification of critical areas for species protection and related cartography;
- Coordination of rescue centers;
- Training of operators;
- Communication initiatives;
- Connection with national initiatives and actions as a prerequisite for implementing the National Action Plan for the species;
- Specific intervention and conservation projects, including institutional responsibilities and budget forecasts;
- International relations and access to European Union funding instruments;
- Urgent actions to be undertaken.

The MoU provides for the establishment of an Institutional Committee (Article 5), composed of representatives from the Ministry, Regions, Protected Areas, State Forestry Corps, Port Authority Corps, the Forestry and Surveillance Corps of the Sardinia Region, and the Ministry's scientific support institutions. This committee is responsible for consultations with local populations and organizations involved in the matter, ensuring maximum engagement and overseeing the implementation and feasibility of urgent actions identified by the Technical-Scientific Committee (Article 6). The latter is tasked with gathering documentation and formulating project proposals for the Action Plan, relying on experts in the relevant fields, including fauna and territorial planning.
Article 7 of the MoU outlined the work phases and the timeline for drafting the PATMA. Specifically, the plan was expected to be adopted within 12 months from the signing of the Memorandum of Understanding by all involved parties. As of now, the PATMA is still in the adoption phase.

## 2.1 Characteristics of the Natura 2000 sites

Following the findings that emerged during the Marine Biogeographical Seminar with the European Commission (Malta, September 27-29, 2016), based on the scientific document prepared by ISPRA, which identifies the Northern Adriatic as a critical area for the bottlenose dolphin (*T. truncatus*) and the loggerhead sea turtle (*C. caretta*), transmitted to the relevant Regions with note no. 20402 dated 25/09/2017, and in light of the results of the Conference on Fisheries Management Measures in Natura 2000 sites (Zadar, October 6-12, 2017), the Italian Ministry of the Environment urged the Regions to designate the necessary marine Sites of Community Importance (SCIs) to protect the two species within Italian territorial waters (12 nautical miles).
The Veneto Region constructively engaged and involved various stakeholders in the fisheries sector and actively participated in the work of the Northern Adriatic Fisheries District, held in Mestre on October 15, 2018, and in Bologna on January 31, 2019. Through the District, a process of sharing and discussion on the delimitation of the marine SCIs and the proposed conservation measures was initiated with stakeholders and neighboring Regions, also utilizing specific measures from the European Maritime and Fisheries Fund (EMFF).
As part of this initiative, and in implementation of Regional Council Resolution D.G.R. no. 631 of May 8, 2018, a collaboration agreement was established to acquire scientific knowledge regarding the presence and protection of bottlenose dolphins and loggerhead sea turtles. This agreement, formalized on June 21, 2018, involved the University of Padova, – Department of Comparative Biomedicine and Food Science (BCA), and the Regional Natural Park of the Po Delta.
Thanks to collaboration with the University, a preliminary report on strandings in the Adriatic Sea was produced, containing an analysis of historical data and trends. The data analysis and assessments, together with the contents of the *Final Report - Monitoring of Marine Mammals in Veneto (June-September 2018)*, carried out by ARPAV and Dolphin Biology Conservation, enabled the Veneto Region to submit a proposal to MATTM. This proposal, submitted with joint note no. 87087 dated 01/03/2019 from the Regional Assessor for Agriculture, Hunting, and Fisheries and the Regional Assessor for Territory, Culture, and Security, outlined the possible boundaries of the SCI in Veneto's maritime waters and potential conservation measures. The note emphasized that the proposal had been developed in collaboration with institutions and stakeholders, including within the framework of the Northern Adriatic Fisheries District.

MATTM presented this proposal to the European Commission, which received it positively during the seminar held in Zagreb on March 6, 2019. Subsequently, with note no. 329461 dated 23/07/2019, in response to commitments made for closing the EU-Pilot case 8348/16/ENVI, MATTM invited the Veneto Region and other involved Italian Regions to submit their respective designations of new marine SCIs, complete with supporting documentation (an mdb-format database containing properly completed Standard Data Forms and shp-format cartography).

For the preparation of the designation decree requested by MATTM, it was crucial to obtain updated, objective, and comprehensive scientific knowledge on species distribution in the relevant area. This knowledge would allow the identification of protection measures, also in agreement with supra-regional authorities.

With Regional Council Resolution (D.G.R.) no. 1684 of November 19, 2019, following the submission of a project proposal by the Po Delta Park (note no. 456242 dated 23/10/2019), a new Collaboration Agreement was approved with the Po Delta Park and the University of Padova – Department of Comparative Biomedicine, finalized on November 26, 2019. The goal of this agreement, in continuation of the previous one, was to update and expand monitoring data on bottlenose dolphins and loggerhead sea turtles, process existing databases in the format required by MATTM (including the Standard Data Form), and verify, using shp-format cartography, the potential confirmation of the proposed SCIs boundary, which had been positively received by the European Commission.

With note no. 1835 dated May 7, 2020, the Po Delta Park transmitted the results of the work carried out in collaboration with the University. These results allow, within the framework of the responsibilities assigned to Regions and Autonomous Provinces concerning Natura 2000 by Presidential Decree 357/97 and its subsequent amendments, particularly Article 3, paragraph 1, the proposal of a new marine Site of Community Importance off the coast of the Po Delta.

The findings of these studies effectively confirm the initial proposal submitted to MATTM and accepted by the European Commission. These findings are included in the scientific report annexed as *Attachment A* to this resolution, which forms an integral and substantive part of it. The report outlines the proposed SCI boundary in Veneto's maritime waters and potential conservation measures. It also references the latest information on species monitoring, including the outcomes of the *TARTATUR* project (*Interaction between fisheries and protected species* Tursiops truncatus *and Caretta caretta. Assessment of impact and survey among professional fishery operators*), funded under the EMFF 2014-2020 program (Veneto Region,

Ministry of Agricultural, Food, and Forestry Policies, VeGal, Venetian FLAG, CAG, Emilia-Romagna Coast FLAG, FVG FLAG, UNIPD-BCA), published in January 2019.
During the project, which concluded in February 2020, data and information on the presence of bottlenose dolphins and loggerhead sea turtles were collected through collaboration with fishermen. Regarding monitoring, particularly of bottlenose dolphins, in addition to the data already published and those from *TARTATUR*, the report references the *Final Report - Monitoring of Marine Mammals in Veneto (June-September 2018)*, conducted by ARPAV and Dolphin Biology Conservation.

The proposed area for the marine SCI for the species *T. truncatus* and *C. caretta* is located between the Veneto Region and the Emilia-Romagna Region. The designated area, covering a surface of 225 km² within Veneto's territorial waters, extends between 6 and 12 nautical miles from the coast. It is contiguous with the Emilia-Romagna SCI and is designated as follows:
**Site of Community Importance (SCI) IT3270025 "Northern Adriatic Veneto - Po Delta".**
For this site, in accordance with Article 4 of Presidential Decree 357/97 and subsequent amendments, the application of the conservation measures outlined in *Annex C*, which forms an integral and substantial part of this resolution, is proposed. This annex specifies the obligations, prohibitions, and best practices to be implemented for the proper management of the area, as well as the conservation and protection of the species of interest.

## 2.2 Regulatory framework (International Conventions, European Directives, National Legislation, Local Regulations and any Management Plans)

The Mediterranean subpopulation of *Caretta caretta* is defined as LC (Least Concern) in the IUCN (World Conservation Union) Red List (Casale, 2015). Sea turtles are strictly protected under international legislation through various conventions. The European Union adheres to these conventions and issues Directives and Regulations aimed at protecting and conserving natural habitats and wildlife, including marine turtles. Each EU Member State, including Italy, ratifies these international conventions and implements the corresponding EU provisions through its own national laws.

There are four key international conventions relevant to the protection and conservation of marine turtles:

- The Washington Convention (CITES);
- The Bern Convention;
- The Bonn Convention;
- The Barcelona Convention.

All marine turtle species are protected under the **Washington Convention** (Convention on International Trade in Endangered Species of Wild Fauna and Flora-CITES, 1973) on international trade in endangered species of wild fauna and flora, which came into force on July 1, 1975, and was ratified by Italy with Law No. 874/75. Marine turtles are listed in Appendix I as "species critically endangered with extinction for which trade is strictly prohibited". The EU transposed CITES into its legislation with Regulation (EC) No. 3626/82, which included marine turtles in Annex A. This was later replaced by Regulation (EC) No. 338/97, implemented in Italy through Law No. 150/92, later amended by Legislative Decree No. 275/2001. The latest amendment to this regulation was Regulation (EC) No. 2023/966, following the 19th Conference of the Parties to the Convention.

Another key instrument at the international level is the **Bern Convention** (1979) on the Conservation of European Wildlife and Natural Habitats, which came into force on June 1, 1982, and was ratified by Italy with Law No. 503/81. Marine turtles are listed in Annex II as "strictly protected fauna species." Article 6 of the Convention states that "each Contracting Party shall adopt the necessary and appropriate legal and regulatory measures to ensure special protection for the species listed in Annex II." This includes a strict ban on:
Any form of intentional capture, possession, or killing;

- Intentional destruction or deterioration of breeding or resting sites;
- Disturbance, especially during reproduction, breeding, and hibernation periods;
- Intentional destruction or collection of eggs from the wild or their possession, even if empty;
- Possession and trade of these animals, whether alive, dead, taxidermied, or in part-derived products.

Italy has partially implemented the Bern Convention through **Framework Law No. 157/1992**, but this law applies only to homeothermic wildlife and does not include marine turtles.

The **Bonn Convention** (1979) on the Conservation of Migratory Species of Wild Animals (CMS) recognizes the importance of protecting migratory species, especially those at risk of extinction, including marine turtles. These species are listed in Annex I and II of the Convention. *C. caretta* is included in Annex I, along with other chelonian species (except *Natator depressus*) and *Dermochelys coriacea*, which require strict protection and conservation by participating states. It is also listed in Annex II, which covers migratory species with an unfavorable conservation status requiring international agreements for their protection and management. The European Economic Community (now European Union) adopted the Convention through Council Decision 82/461/EEC, and Italy ratified it with Law No. 42/1983.

The **Barcelona Convention** (1976) for the Protection of the Mediterranean Sea Against Pollution, later revised in 1995 as the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, was ratified by Italy with Law No. 175/1999. Under this convention, the Specially Protected Areas and Biodiversity Protocol (SPA/BD, 1995) was adopted to implement the Convention on Biological Diversity (1992) for the sustainable management of Mediterranean biodiversity. The European Community adhered to the SPA/BD Protocol through Decision 1999/800/EC, listing marine turtles in Annex II as endangered or threatened species. This protocol requires member states to:

- Prohibit killing, trade, and disturbance of these species during breeding, migration, overwintering, and other stress periods;
- Develop Regional Action Plans for conservation, including the Action Plan for the Conservation of Mediterranean Marine Turtles, first adopted in 1989 and revised in 1999, 2007, and 2013.

The EU **Habitats Directive** (92/43/EEC, 1992), in response to the 1992 Rio de Janeiro Conference, includes *C. caretta* and *C. mydas* in Annex II (species requiring special conservation areas) and in Annex IV (species requiring strict protection). Under the Habitats Directive, EU Member States hosting marine turtles must:

- Monitor the conservation status of populations (Article 11);
- Implement strict protection measures (Article 12);
- Promote research and information exchange (Article 18);
- Encourage cross-border cooperation in research (Article 18.2).

- Italy transposed the Directive with Presidential Decree 357/1997, which prohibits:
- Capture or killing of turtles in the wild;
- Disturbance, especially during reproduction, hibernation, and migration;
- Destruction or collection of eggs and nests in the wild;
- Damage or destruction of breeding and resting areas.

Italy, with Presidential Decree 357/1997 and subsequent amendments and additions, has regulated the implementation of the Habitats Directive in our country and has included sea turtles in Annex D, letter a), as animal species requiring strict protection. As provided by Art. 12, paragraphs 1 and 2 of the Habitats Directive, it is prohibited to:

- Capture or kill specimens of these species in the natural environment;
- Disturb them, particularly during all phases of their reproductive cycle or during hibernation, wintering, and migration;
- Destroy or collect eggs and nests in the natural environment;
- Damage or destroy breeding sites and resting places.

Regions and Autonomous Provinces are responsible for safeguarding and monitoring species and habitats of community interest, particularly priority species. On February 21, 2023, the European Commission presented an Action Plan to protect and restore marine ecosystems for sustainable fisheries: **EU Action Plan for Marine Ecosystems**. This plan contributes to the EU Biodiversity Strategy for 2030 and aims to maintain marine environmental conditions by reducing climate change and ocean pollution impacts. The Plan requires Member States to:

- Implement marine protected area (MPA) conservation measures to safeguard breeding and nursery zones and restore essential habitats.
- Reduce bottom trawling in MPAs, with a complete ban by 2030 in newly established MPAs.
- Increase selectivity of fishing gear and reduce by-catch of threatened species, including marine turtles, by the end of 2024.

It builds on existing environmental and fisheries regulations, including Regulation (EU) 2019/1241, which sets rules on when, where, and how to fish to ensure sustainability.

To coordinate conservation strategies, Italy's Ministry of the Environment (MATTM now MASE) initiated the **National Action Plan for Marine Turtle Conservation** (PATMA, 2007).

It involves 15 coastal regions, seven national parks, the Coast Guard, the State Forestry Corps, and research institutes like ISPRA. The PATMA establishes:

- National data collection and archiving of turtle populations;
- Emergency response protocols;
- Identification of critical habitats and mapping;
- Recovery center coordination;
- Operator training and public awareness campaigns;
- Integration with EU conservation efforts.
- Although still pending adoption, PATMA will become the official national reference document for coordinating sea turtle conservation efforts.

## 2.3 Biology and status of the species

*C. caretta* belongs to the family *Cheloniidae*. It is a cosmopolitan species widely distributed in warm-temperate, subtropical, and occasionally tropical waters of seas and oceans (Pritchard, 1997; Wallace et al., 2010). It is also the only marine turtle that nests along the Italian coast. As sentinel species, their health reflects marine changes, signaling emerging diseases, pollution, and climate impacts (Aguirre and Tabor, 2004). Their ecological role as keystone species in maintaining the structure and function of marine ecosystems emphasizes their importance for marine biodiversity health. Conservation of these umbrella species indirectly protects many other species that make up the ecological community of the marine habitat. Additionally, as flagship species inspire public engagement, driving global conservation efforts. Protecting these species safeguards marine ecosystems, highlighting their importance not only as ecological pillars, but also as symbols of natural heritage for sustainable marine management (McArthur et al., 2004). Its conservation is not only crucial for maintaining the health of marine ecosystems but also for safeguarding biodiversity, promoting sustainable tourism, and addressing broader environmental challenges such as climate change and habitat degradation. Protecting this protected species and its habitats is a shared responsibility to ensure a healthy Mediterranean marine ecosystem for generations to come.

*C. caretta*, like other marine turtles, spends most of its life at sea, except for nesting, incubation, and hatching, which occur on land. Its life cycle is complex and consists of several stages, each taking place in a specific habitat. After hatching on the nesting beach, hatchlings enter a pelagic growth phase in the open ocean ("the lost years"), lasting several years (Miller,

1997). Subsequently, they migrate to neritic foraging zones in shallow coastal waters, where both immature and adult individuals feed. Upon reaching sexual maturity, turtles of both sexes migrate from foraging areas to breeding sites near the nesting beaches, where mating occurs. After mating, males return to foraging areas, while females proceed to nesting beaches to lay eggs (Miller et al., 2003). At the beginning of the breeding season, mature individuals migrate to reproduction sites near the natal beaches of females (Miller et al., 2003). Mating includes courtship behaviors, such as males biting the female's neck and shoulders before mounting. The male uses his long, curved claws to hold onto the female's shell while insemination takes place. The sperm is stored in the oviducts and used throughout the nesting season. Loggerhead turtles exhibit promiscuous mating behavior, with a single clutch potentially having up to five different fathers (Miller et al., 1997; Miller et al., 2003; Robinson and Paladino, 2013). After fertilization, the female returns to her natal beach due to strong nest-site fidelity, known as natal homing (Miller et al., 2003). The beach must have optimal characteristics, including accessibility, elevated location to avoid flooding, sandy substrate for gas exchange, appropriate humidity, low salinity, and suitable incubation temperature (Miller et al., 2003). Nesting usually occurs at night, where the female digs a 50 cm deep nest using her hind flippers, lays eggs, covers them with sand, and returns to the sea without further care (Miller et al., 1997; Miller et al., 2003). Loggerhead females do not nest annually but typically every 2–4 years. During a nesting season (May–August in the Mediterranean), they lay 2–3 clutches, each spaced 12–17 days apart, containing around 100 eggs. In recent years, in the Mediterranean Sea there has been an increase in the number of nests throughout the Italian peninsula, with an increase also in terms of latitude (Hochscheid et al., 2022). A recent study (Pietroluongo et al., 2023) concluded that the nests reported in Marche in 2019, in Liguria in 2021 and 2022, and in Veneto in 2021, along with the confirmed increase in sea temperature in the Adriatic basin, support the hypothesis of the expansion of nesting activity towards the northern coast of the western Mediterranean over the past decade. Hatching success ranges between 56% and 86%, and incubation lasts about 53–56 days, depending on temperature (Miller et al., 2003; Casale et al., 2018). The incubation temperature determines hatchling sex, with pivotal temperatures identified between 28.9°C and 29.3°C. Below this range, males develop, while higher temperatures produce females. Factors influencing nest temperature include sand color and grain size, shading from vegetation, weather conditions, and seasonal timing of nesting (Casale et al., 2018). In the eastern Mediterranean, female-biased sex ratios have been observed. Hatchlings use an "egg tooth" to break the shell and emerge from the nest, usually at night, to avoid predators.

They exhibit positive phototaxis, orienting towards the brightest horizon (typically the sea). Once in the water, they rely on wave cues (mechanotaxis) and the Earth's magnetic field for orientation (Miller et al., 1997). Males remain in the ocean for life, while females return only for nesting. Hatchlings survive initially on yolk sac reserves and migrate to pelagic "nursery habitats" where predation is lower. They drift with ocean currents while feeding on plankton. This oceanic juvenile stage, lasting 6.5–11.5 years, is poorly understood and referred to as "the lost years." Upon reaching approximately 50 cm in curved carapace length (CCL), juveniles transition to neritic feeding grounds, consuming benthic prey like mollusks and crustaceans until reaching sexual maturity (Bolten et al., 2003).

*C. caretta* is included in the IUCN Red List of Threatened Species and classified as "Vulnerable" (VU) at the global level, with decreasing population trend (Casale and Tucker, 2017). At the Mediterranean sub-population level, it is categorized as "Least Concern" (LC) (Casale, 2015), with an increasing population trend. However, at the local level, it has been listed as "Endangered" (EN) in the 2022 Red List of Italian Vertebrates (Rondinini et al., 2022) under criterion D1. The least concern (LC) assessment for the Mediterranean bioregion dates back to 2015 and was likely the result of decades of intensive monitoring and conservation programs for nesting sites. Recently, an increasing level of anthropogenic and climate-related threats has amplified the vulnerability of this population. In fact, the 4th report of EU Member States for the period 2013–2018 (pursuant to Article 17 of the Habitats Directive) assessed the overall conservation status of this species in the Mediterranean marine bioregion as "unfavorable-inadequate," with a high level of uncertainty regarding population trends and habitat usage (Zampollo et al., 2022). A residency index can support in estimate the number of days in which a satellite-tagged turtle is detected within MPA boundaries by the total number of days that the turtle is monitored (Mason and Lowe, 2010; Revuelta et al., 2015). On this matter, the abundance (total number of individuals) and density (individuals km2) assessment within limits of MPAs can be calculated (Fortuna et al., 2018). The estimated relative density, home ranges and core areas if mapped for each life stage and for the whole sample of tracked turtles can compute the percentage of overlapping between turtles locations and MPAs (Schofield et al., 2013; Revuelta et al., 2015; Fortuna et al., 2018).
Marine turtles face various threats in both marine and terrestrial environments. These threats may be anthropogenic or non-anthropogenic, though those caused by humans account for most of the fatalities. As a species considered at risk of extinction, it is protected by international and national regulations.

## 2.4 Carried out or in progress conservation measures

Current measures limiting fishing effort in the Northern Adriatic region can positively affect the possibilities of interaction with protected species as they reduce the risk of encounter. In particular, in Veneto's fishing communities, sea fishing activities are carried out with trawl nets (otter trawls, pelagic trawls, beam trawls), hydraulic dredges, fixed gear (pots, small pots, large fyke nets, nets), hooks and lines. Below is a summary of regulations and technical closures for maritime fishing activities in Veneto.

Fishing for bivalve mollusks with hydraulic dredges is regulated under EC Reg. 1967/2006, by National Laws and Decrees that indicate general guidelines and, in detail, by Ordinances of local Port Authorities. In summary, distinguishing between clam fishing and smooth clam fishing:

- Clam dredgers are subject to two months of mandatory technical closure to be carried out between April and October (the period is decided and indicated annually by the two Management Consortia). For several years, clam dredgers have been implementing an additional voluntary unpaid technical closure, the duration of which is planned year by year. Pursuant to Ministerial Decree 27.12.2016, the maximum catch quota for *Chamelea gallina* has been reduced to 400 kg/day for a maximum of 4 days/week, compared to the previous 600 kg/day for 5 days/week. It should be noted that the daily clam harvesting quota is decided based on market demands, so as not to fish excessive quantities.
- Smooth clam dredgers are subject to two months of mandatory technical closure to be carried out within the calendar year. Usually, a fortnightly closure is practiced to be repeated 4 times.

Trawl net fishing, including otter trawls, beam trawls (“rapido”), and twin otter trawls, is managed at the ministerial level.
Regarding fishing provisions:

- Paid biological fishing closure of 30 days during the summer period (August-October)
- Fishing is prohibited on Saturdays, Sundays, and holidays.
- In the weeks of technical closure following the biological closure, fishing is also prohibited on Fridays; at the shipowner's choice, another day is prohibited or the fishing vessel must not exceed 60 hours of weekly activity.

- In the remaining months, fishing activity must not exceed 72 hours per week and be distributed over 5 days or 4 days at the shipowner's choice.
- From July 30 to the end of October (and for pelagic trawlers until the end of December), trawling and pelagic trawling are prohibited within a distance from the coast of less than 6 miles or with a water depth of less than 60 meters. In derogation to what is indicated, vessels registered in IV category authorized for local coastal fishing within 6 miles from the coast and vessels with an overall length of up to 15 meters are authorized to fish beyond 4 miles from the coast.
- Additional mandatory 30-day closure for pelagic trawlers from the end of April (GFCM Recommendation 42/2018/8).

Fishing with fixed gear, such as pots, small pots, large fyke nets or "reoni", and nets refer to local regulations issued by the Port Authority, with the exception of nets regulated by EU Regulation. In detail:

- Fishing with large fyke nets or "reoni" for cuttlefish (*Sepia officinalis*) takes place between March and mid-May, and operators position the gear in predefined locations. This type of fishing is regulated by Port Authority Ordinance.
- Fishing with pots for cuttlefish (*Sepia officinalis*) is carried out from April to July, with operators in Venice declaring the fishing area in their application, and in Chioggia, fishing areas are drawn by lot and spatially delimited. This type of fishing is regulated by Port Authority Ordinance.
- Fishing with small pots concerns the species of dog whelk (*Nassarius mutabilis*) and mantis shrimp (*Squilla mantis*).
- Fishing with nets is generally practiced near the coast and sporadically offshore and is regulated by EC Reg. 1967/2006 and not by local regulations. No technical closures are planned.

**Obligations**

**Conservation scope for *Caretta caretta* and *Tursiops truncatus*:**

a) Avoid voluntarily approaching the species in question, unless they approach the vessels themselves.

b) Report the discovery of dead and/or stranded specimens to the territorially competent Port Authorities.

c) Maintain a straight course when trawl and drag nets are in operation.

d) Mark fixed nets and other fixed gear with TAGs.
e) Apply to currently used fishing gear any mitigation measures that will be provided, if effective, in order to reduce by-catch for turtles as part of the application of good practices.
b) Prohibition of constructing new wind farms, according to Article 5, paragraph l) of the Decree of October 17, 2007.
c) Prohibition of practicing windsurfing, kitesurfing, water skiing, jet skiing, motorized towing of flight equipment (kites, parasailing, and similar devices), and motorboat events.
d) Prohibition of close interaction with animals, including voluntary approach, capture, feeding, and swimming in the presence of animals.
Good practices
a) Involve representatives from the professional fishing industry in the management body of the SCI area and in any modification and redefinition of mitigation measures.
b) Conduct studies for the application of selection and mitigation tools.
c) Transfer non-releasable animals and/or carcasses to the appropriate authorities after agreement with the Port Authorities to ascertain the causes of injuries or deaths. In case of live animals, ensure adequate welfare conditions by providing for their release and/or transfer to a recovery center, reporting both events to the competent authorities.
d) Prepare structures for the safe storage of live-caught turtles and for transfer to recovery centers, without compromising, slowing down, or hindering fishermen's activities. Define and apply a protocol for turtle recovery.
e) Provide economic support to fishing companies that use selection tools and potential deterrents.
f) Continue and implement training through theoretical-practical informative courses and updates for fishermen and other stakeholders for monitoring animals at sea, for interaction with other institutional and non-institutional actors, for animal management, and the use of mitigation tools to reduce possible mortality. These activities should be extended to other actors such as recreational boaters, sport fishermen, and transport operators. Training activities will also include a return of data processed by research and monitoring bodies that allow for informed participation in the critical review of conservation and management measures for these species. These will be manifested through public meetings with direct stakeholders and with different fishing sectors.
Implement public training and information activities by integrating fishing tourism activities with dolphin-watching through adequate training and compliance with international rules governing such activities.

g) Maintain and support scientific research activities, monitoring on land (strandings) and at sea (free-ranging and accidental captures) with the direct participation of fishing enterprises. These activities should be made continuous and systematic in order to identify density, abundance, and distribution of animal populations. Furthermore, the Monitoring Programs referred to in Article 11 of Legislative Decree 190/2010 must be ensured, as defined by Italy in the Ministerial Decree of February 11, 2015 (Framework Agreement between the Ministry of Environment and the 15 Italian coastal Regions). The coordination and definition of monitoring and research activities will be carried out by the Veneto Region, directly involving fishing enterprises. Fishermen will actively participate by providing information using quick and effective tools (dedicated apps, websites, etc.) and being an active part in this activity. The Interregional Stranding Network, Veneto and Emilia Romagna, should be supported, making it institutional, coordinated, and able to intervene with unique and harmonized protocols and procedures to provide the necessary information for management and to ensure adequate monitoring for all causes (anthropogenic and non-anthropogenic) that determine strandings.

g) Define accidental catch indices through constant monitoring on land and at sea, analyzing data for individual gear and mortality data.

h) Promote and involve all stakeholders in demonstration activities and research projects concerning the various factors that threaten the conservation status of bottlenose dolphins and sea turtles. In particular, continue with good practices regarding the collection of marine litter and ghost nets, which represent an imminent, concrete, and impactful danger. These actions should involve all stakeholders, not just fishermen who already actively participate in "fishing for litter" campaigns and have been involved in projects to reduce the presence of plastics. In this sense, it is important that waste collected at sea was classified as urban (Salvamare law, nr 60. 2022/05/17) and not special, and its management does not entail additional costs for fishermen who, instead, take on an irreplaceable service for the benefit of the entire marine ecosystem.

i) Support and promote sustainable fishing, including through objective sustainability certifications, according to accredited standards such as MSC or "Friends of the Sea". It is possible to further implement this effort by trying to extend it to other gear and expanding it with certification systems with specific references to the respect and protection of bottlenose dolphins and sea turtles. This is also possible thanks to EMFF funding that allows for adequate economic returns through direct contact with the consumer and appropriate product valorization.

## 2.5 Analysis of threats and limiting factors for restocking and conservation

A cumulative model incorporating 22 anthropogenic drivers, classified into four categories - climate-related factors (including the combined effects of rising temperatures, increased UV exposure, and acidification), fishing, sea-based factors (such as commercial shipping, invasive species, oil spills, and oil rigs), and land-based factors (including nutrient input, organic pollution, urban runoff, hypoxia risk, and coastal population density) - indicates that the Adriatic Sea ranks among the most heavily impacted regions (Micheli et al., 2013). When climate-related factors, which are beyond direct management or control, are excluded, the primary contributors to significant cumulative impacts in the Adriatic are demersal fishing, hypoxia, and pollution stemming from land-based activities (Micheli et al., 2013). Additionally, within the Adriatic Sea, a stark contrast in overall impact is observed between the eastern and western coasts, with the latter experiencing significantly greater anthropogenic pressures.

Among the natural threats, turtle eggs and hatchlings face predation from various wild animals, including mammals (e.g., red foxes, golden jackals, badgers, martens, and rats), crustaceans (e.g., ghost crabs Ocypode cursor), and birds (e.g., gulls and crows). In some nesting sites, eggs are also affected by invertebrate infestations (e.g., crickets). These predators significantly reduce hatching success rates and the number of hatchlings reaching the sea, with predation rates on unprotected nests ranging between 38% and 80%. Nest protection efforts have successfully reduced predation to 5% (Casale et al., 2018; Butler et al., 2020). At sea, juveniles and adults are preyed upon by large fish, orcas, and large sharks, including great whites (*Carcharodon carcharias*) (Casale et al., 2018). Human activities have exacerbated this issue, introducing feral dogs that prey on nests and hatchlings. In some Greek beaches, feral dogs have also been documented preying on nesting females. Mediterranean monk seals (*Monachus monachus*) have also been observed preying on adult turtles, likely due to declining prey availability caused by overfishing (Casale et al., 2018). Another risk akin to predation arises from plant roots encroaching on nests, reducing oxygen availability or releasing toxic substances, thereby harming embryos. In Zakynthos, Greece, human-planted tamarisks (*Tamarix* spp.) have led to nest dehydration (Mavropoulou and Zanetti, 2001; Casale et al., 2018).

Among other natural threats, marine turtles are susceptible to bacterial, viral, parasitic, and fungal infections, which can be fatal either directly or by weakening them, making them more vulnerable to predators (Ebani, 2023). Bacterial infections not only pose a threat to turtle health but also present a zoonotic risk to humans through contaminated sand, eggs, or turtle exudates. Individuals working in turtle rescue centers are particularly at risk (Ebani, 2023). Temperature fluctuations and environmental pollutants influence turtle immune system efficiency, making them more susceptible to infections. Rising antibiotic resistance among pathogenic bacteria further complicates treatment (Ebani, 2023). While bacterial infections are rare in wild turtles due to their protective integument and robust immune system, injuries sustained from mating, fishing gear, or boat collisions can allow bacterial entry, potentially leading to septicemia (George, 1997). In human-controlled environment, bacterial infections are more common due to poor water quality and overcrowding (George, 1997). Virally, fibropapillomatosis, caused by a herpesvirus variant, is a severe disease characterized by cutaneous tumors that impair movement, feeding, and vision. In severe cases, tumors spread to internal organs, leading to death (Herbst, 1994; Flint, 2013; Reséndiz et al., 2016). The disease is prevalent in coastal areas with high human activity, suggesting environmental contaminants contribute to immunosuppression (Herbst, 1994; Flint, 2013).
Parasites, such as digenean trematodes, nematodes (*Angiostoma carettae*, *Sulcaris sulcata*), and epibionts like barnacles (*Chelonibia testudinaria*), can affect turtle health by increasing hydrodynamic drag, impairing mobility, and causing tissue damage (George, 1997; Flint, 2013; Santoro et al., 2019; Frick and Pfaller, 2013). Emerging fungal infections, notably *Fusarium solani* complex species, threaten sea turtle eggs, significantly reducing hatching success (Gleason et al., 2020; Pietroluongo et al., 2023).
Finally, another natural cause of sea turtle mortality is the “cold-stunning”, which refers to a state of severe hypothermia, sometimes fatal, that occurs following prolonged exposure to water temperatures dropping below 10°C (Schwartz, 1978). This condition results in lethargy, floating, difficulty or inability to dive, and respiratory distress characterized by sudden head jerks to reach the surface for air (Schwartz, 1978; Bentivegna et al., 2002). Cold-stunning events occur when cold air temperatures and strong winds cause a rapid drop in sea surface temperature, particularly in shallow coastal areas (Bentivegna et al., 2002). Interestingly, compared to small juvenile turtles, larger *C. caretta* individuals can withstand colder temperatures for longer periods due to their enhanced thermoregulation abilities (Still et al., 2005). In the Mediterranean Sea, only one recorded case of mass stranding attributed to

cold-stunning occurred between December 2001 and January 2002 in the southern Adriatic (Bentivegna et al., 2002).

Among anthropic threats, coastal erosion, sea-level rise, and human activities contribute to habitat loss, impacting nesting and foraging grounds (Margaritoulis et al., 2003; Casale et al., 2010; Lucchetti et al., 2017). Extreme weather events, temperature fluctuations, and nest flooding reduce hatching success and increase hatchling mortality (Mavropoulou and Zanetti, 2001).
Interaction with fishing activities is one of the main threats for sea turtles worldwide (Casale, et al., 2010; 2011) and the Adriatic is not an exception (Lazar and Tvrtković, 1995; Casale et al., 2004; Casale, 2011). Over 132000 turtles are estimated to be caught annually in the Mediterranean, with approximately 44000 fatalities (Casale et al., 2010; 2011; et al., 2018). In Italy alone, over 52000 captures and 10000 deaths were estimated in 2014, with the Adriatic Sea being a hotspot for turtle by-catch (Lucchetti et al., 2017; Almpanidou et al., 2022). Trawling and longline fisheries account for most captures. In the Adriatic basin, the higher number of by-catch events was recorded in bottom trawlers (Lazar and Tvrtković, 1995; Casale et al., 2004; Casale, 2011), followed by mid-water/pelagic trawlers (Casale et al., 2004; Fortuna et al., 2010). There are not reliable data for gillnet or longlines, however experts believe that mortality in these fishing gears is also high (Casale et al., 2004; Casale, 2011). Modifications such as By-catch Reduction Devices (BRDs), circle hooks, and Turtle Excluder Devices (TEDs) have reduced by-catch rates but are not universally applicable (Casale et al., 2004; Lucchetti et al., 2019). Ghost fishing (abandoned fishing gear) poses another significant threat (Casale et al., 2018).
Collisions with boats, particularly during peak tourist seasons, are a leading cause of turtle mortality after by-catch or during basking to optimize body temperature (Panigada et al., 2008, Casale et al., 2010).
Other significant threats are chemical and litter pollution. Mediterranean turtles have higher levels of contaminants than their Atlantic counterparts (Casale et al., 2018). Oil spills and litter ingestion further endanger turtles (Almpanidou et al., 2022).
Intentional killing remains prevalent in some Mediterranean regions where some fishermen kill turtles to reduce competition for fish stocks or out of cruelty (Casale et al., 2010). Recent cases in Italy and Tunisia highlight this ongoing issue (www.tartapedia.it).
Climate change affects all turtle life stages, altering migratory routes, food availability, and nesting habitats. Rising sand temperatures skew sex ratios towards females and may reduce

hatching success (Casale et al., 2018; Almpanidou et al., 2022; Hochscheid et al., 2022; Pietroluongo et al., 2023). Rising sea levels and increased storm frequency further threaten nesting beaches (Casale et al., 2018; Mancino et al., 2022; Mazaris et al., 2023). Human development and tourism exacerbate these impacts by discouraging nesting, introducing artificial light pollution, and physically disturbing nests (Mavropoulou and Zanetti, 2001; Mo et al., 2013; Ceolotto et al., in press).

## 2.6 Identification of Decision Makers and Stakeholders directly involved in the management of the species and SWOT analysis

The conservation of *C. caretta* within the SCI IT3270025 "Northern Adriatic Veneto - Po Delta" requires a collaborative approach involving multiple decision-makers and stakeholders at different levels. These actors include governmental institutions, local authorities, scientific organizations, conservation groups, economic sectors, and the local community.

**Institutional and Governmental Bodies**

- European Union (EU) provides directives such as the Habitats Directive (92/43/EEC) and supports conservation through funding programs (e.g., LIFE Program, Interreg).
- Italian Government (Ministry for the Environment and Energy Security - MASE) is responsible for national biodiversity strategies and marine protection policies.
- Veneto Regional Authority implements national and EU policies at the regional level, regulates protected areas, and provides funding for conservation projects.
- Po Delta Park Authority oversees conservation activities within the SCI, monitors biodiversity, and enforces habitat protection measures.
- Port Authorities regulates maritime traffic, enforces environmental standards, and collaborates on measures to reduce interactions between sea turtles and fishing activities.
- ARPAV (Agenzia Regionale per la Protezione Ambientale del Veneto) conducts environmental monitoring, assesses pollution levels, and provides scientific data to support conservation policies and habitat protection.

**Research and Conservation Organizations**

- ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) conducts scientific research on marine biodiversity, monitors *C. caretta* populations, and provides conservation guidelin es.
- University of Padova is engage in scientific research, population studies, stranding monitoring, and conservation management.
- Non-Governmental Organizations (NGOs) (WWF, Legambiente) play a crucial role in awareness and education campaigns and marine rescue programs.
- Sea Turtle Rescue Centers: in Veneto (Natural History Museum of Venice - Centro di primo soccorso "Morosini") and in other adjacent regions (CESTHA, Fondazione Cetacea) are responsible for rehabilitating sea turtles and educating the public.

**Economic Sectors**

- Fishing Industry and Cooperatives, Aquaculture and Fisheries Management Organizations (VeGal, Flag veneziano, CAG, GAC), given that by-catch is considered a major threat, collaboration with fishermen is essential for sustainable practices and the adoption of mitigation strategies. Moreover, they ensure sustainable resource use and habitat protection.
- Tourism and Recreational Activities (beach resorts, diving centers, ecotourism operators): stakeholders involved in coastal and marine-based tourism have a significant impact on turtle nesting sites and foraging areas.
- Maritime Transport Sector: collaboration is needed to mitigate ship strikes and reduce marine pollution.

**Local Community and Public Involvement**

- Local Municipalities engage in public awareness, land-use planning, and conservation measures.
- Residents and Coastal Users play a role in reporting turtle strandings and nesting, reducing litter, and participating in citizen science initiatives.
- Educational Institutions and Schools: Participate in environmental education programs, promoting conservation awareness among younger generations.

A **SWOT** (Strengths, Weaknesses, Opportunities, Threats) analysis evaluates internal and external factors affecting conservation efforts. The conservation of *C. caretta* requires a multi-stakeholder approach integrating regulatory frameworks, scientific research,

sustainable resource management, and active community participation. Addressing weaknesses and threats while leveraging strengths and opportunities is crucial for ensuring long-term species protection and habitat preservation. Collaborative efforts between decision-makers and stakeholders must be reinforced through policy development, financial support, and education. The following SWOT analysis considers the strategic position of stakeholders in achieving conservation goals.

**Internal Factors (Strengths and Weaknesses)**

***Strengths (Favorable Internal Factors)***

- Strong Legal Protection Framework: the Habitats Directive, Marine Strategy Framework Directive, and National Action Plan for Sea Turtles provide a strong legal foundation for conservation.
- Scientific Expertise and Ongoing Research: universities, research institutions, and ARPAV contribute valuable scientific knowledge to conservation efforts.
- Existing Conservation Initiatives: sea turtle rescue centers, active NGO involvement, and regional conservation programs support conservation.
- Community Awareness and Engagement: increasing public interest and participation from local municipalities, schools, and citizen science programs fosters conservation efforts.

***Weaknesses (Unfavorable Internal Factors)***

- Fishery Interactions: high mortality due to accidental capture in fishing gear, with limited implementation of mitigation measures.
- Coastal Habitat Degradation: urbanization, beach erosion, and pollution negatively impact turtle nesting and foraging habitats.
- Funding Constraints: limited financial resources restrict long-term, large-scale conservation projects, research, and habitat restoration efforts.
- Fragmented Stakeholder Coordination: improved integration and communication between government bodies, conservation groups, and economic sectors are needed to optimize conservation efforts.

**External Factors (Opportunities and Threats)**

***Opportunities (Favorable External Factors)***

- Implementation of Sustainable Fishing Practices: expanding fishery interaction mitigation measures and by-catch mitigation strategies could significantly reduce turtle mortality.
- Ecotourism Development: potential for sustainable tourism initiatives that promote conservation while supporting local economies.
- Technological Advancements: satellite tracking, AI for monitoring populations, eDNA, and data-driven conservation measures can improve management strategies.
- Climate Adaptation Strategies: addressing climate change impacts on turtle populations by developing adaptive conservation actions.
-

***Threats (Unfavorable External Factors)***

- Climate Change: rising temperatures affect hatchling sex ratios and nesting site viability.
- Marine Pollution: marine litter, microplastics, and chemical contaminants pose severe health risks to turtles.
- Human Disturbance: coastal development, boat traffic, and unregulated tourism disrupt nesting and feeding grounds.
- Invasive Species: predation by non-native species on eggs and hatchlings threatens population recovery.

| | **Helpful** | **Harmful** |
|---|---|---|
| **Internal Factors** | **Strengths (S)** | **Weaknesses (W)** |
| | Strong EU and national legal protection | Fishery iteraction |
| | Scientific expertise, ongoing research and monitoring | Coastal habitat degradation |
| | Existing conservation initiatives | Funding constraints |
| | Community awareness and engagement | Fragmented stakeholders coordination |
| **External Factors** | **Opportunities (O)** | **Threats (T)** |
| | Implementation of sustainable fishing practices | Climate change |
| | Ecotourism development | Marine Pollution |
| | Technological advancements | Human disturbance |

| | Climate adaptation strategies | Invasive species |
|---|---|---|

## 3. Management and conservation objectives for the targeted species

To enhance the conservation status of *C. caretta* in the SCI, the following objectives are established:

- **Protection of key habitats:** ensure the preservation and restoration of critical habitats, including nesting beaches, foraging and resting areas, and migration corridors.
- **Reduction of anthropogenic threats:** implement measures to minimize threats such as by-catch, marine pollution, coastal development, and boat traffic.
- **Enhancement of population monitoring:** develop systematic monitoring programs to assess population trends, habitat use, and health status of *C. caretta*.
- **Improvement of rescue and rehabilitation efforts:** strengthen the response to stranded, by-caught or injured individuals through coordinated rescue operations and rehabilitation centers.
- **Community engagement and awareness:** promote education and awareness campaigns targeting local communities, fishers, and tourists to foster coexistence and active participation in conservation efforts.
- **Scientific research and data sharing:** encourage research initiatives to better understand the species' ecology, genetic diversity, climate change and other impacts while ensuring data sharing among stakeholders.
-

To achieve **management objectives**, a combination of legal protection, stakeholder collaboration, and adaptive management approaches need to be employed. **The key management objectives include:**

- Strengthen enforcement of existing regulations and integrate additional protective measures where necessary.
- Promote collaborative initiatives among governmental agencies, NGOs, scientific institutions, and local communities.
- Foster sustainable economic activities, such as eco-tourism and responsible fisheries, that align with conservation goals.

- Establish regular impact assessments to evaluate the effectiveness of conservation actions and adapt strategies accordingly.
-

The key **conservation objectives** include:

**Marine and Coastal Ecosystems:**

- Ensure the conservation of seagrass meadows (*Posidonia oceanica* and *Cymodocea nodosa*), which serve as important foraging grounds.
- Maintain water quality by reducing pollution sources, including marine litter and chemical contaminants.

**Open Sea Areas and Migration Corridors:**

- Establish and enforce other marine protected areas (MPAs) or adjacent to the existing SCI to reduce the impact of fishing activities and vessel traffic.
- Develop sustainable fisheries management strategies to mitigate by-catch risks, including the use of mitigation measures (turtle excluder devices - TEDs) and modified fishing gear.

**Nesting Beaches and Coastal Zones** can also be included in the conservation objectives:

- Assessing habitat suitability for nesting sites, protect and restore potential nesting beaches by minimizing human disturbances.
- Implement regulations to prevent beach erosion and the degradation of coastal dunes.

## 3.1 Definition of general and specific objectives ensuring conservation of the species

The guiding legislative framework is the European Union's Habitats Directive, under which this species is included in Annex II. Although it does not explicitly mandate the formulation of conservation objectives, it operates on the premise that each Natura 2000 site will possess such goals. The Habitats Directive establishes three overarching statutory aims:

1. To preserve biodiversity (Article 2.1);
2. To ensure the maintenance or restoration of a favorable conservation status for habitats and species listed in Annexes I and II (Article 2.2);
3. To develop the Natura 2000 network in a way that supports the attainment of favorable conservation status (Article 3.1).

According to the "Guidelines for Developing Conservation Objectives for Marine Special Areas of Conservation (SACs)" (EN et al., 2001), conservation objectives within Natura 2000 sites should reflect each site's role in achieving favorable conservation status and promoting biodiversity. These objectives must be tailored to the site's qualifying features. In accordance to this, the primary relevant aim is maintaining or restoring favorable conservation status, as outlined in Article 2.2.
Article 1(i) of the Directive defines the conservation status of a species as the cumulative influence of factors affecting its long-term natural distribution and abundance within EU member states. A species is considered to be in "favorable conservation status" when the following conditions are met:

1. Population trends suggest long-term viability within its natural habitats;
2. Its natural distribution is stable or increasing, with no foreseeable declines;
3. Adequate habitat is, and will continue to be, available to support long-term population sustainability.

Based on these criteria, two overarching goals for this Conservation Plan can be identified:

1. To ensure that the population size of the loggerhead turtle within the area covered by the Plan is maintained or increased;
2. To sustain or enhance the species' distribution and habitat usage across the region.

These goals must be anchored in a baseline, which, due to insufficient historical data, typically corresponds to the current state of the population and its distribution. Therefore, the minimum ambition is to preserve present conditions, with the additional aim of achieving improvements where possible.

To ensure effectiveness, specific objectives should be prioritized according to how practical they are to monitor and how useful they are in assessing conservation progress. The following Specific Conservation Objectives should be considered:

1. **Abundance**
   - Objective 3: Ensure that the species' population in the region is sustained or increased over the long term.

2. **Distribution and Habitat Use**

- Objective 4: Prevent long-term spatial or temporal reductions in the use of areas that provide essential conditions and corridors for the species' activities and survival.

3. **Health Status**
   - Objective 5: Safeguard the health of individuals within the population, avoiding any decline.

4. **Prey Availability**
   - Objective 6: Support or improve the availability of food resources necessary for the species' survival.

5. **Threats monitoring and mitigation**
   - Objective 7: Implement the monitoring of human activity impact and species interaction;
   - Objective 8: Implement mitigation measures to be adopted at local and regional level.

6. **Genetic Population Structure**
- Objective 1: Preserve the genetic diversity within the population(s).
- Objective 2: Prevent population fragmentation and the genetic isolation of subgroups by maintaining or enhancing gene flow among population centers.

# 4. Action plan

The Action Plan outlines the essential measures required to achieve the defined Conservation Objectives. These actions are strategically developed to reduce or mitigate the pressures facing the species and its habitat. As such, the Action Plan emerges from a thorough assessment of existing threats, their potential impact on the population(s), and the identification of practical and effective preventive or remedial interventions.

An initial assessment of the state of the art of *C. caretta* population in the intervention area is pivotal to evaluate the current framework of knowledge and population status (numerical

consistency, distribution, sex ratio). Following this, the objectives of this plan are expressed through a series of actions.

## 4.1 Identification of a Plan of integrated actions for the correct protection and management of the species

**Monitoring Actions**

These actions focus on research related to specific elements of the species, their habitats, or associated human activities and their potential effects. Their primary aim is to close key scientific knowledge gaps that are critical for guiding effective conservation strategies. Monitoring actions also involve the systematic collection of data on essential indicators, identified as key to evaluating trends in species and habitat conservation status, as well as the influence of threats and human pressures. Through this, they help determine whether conservation objectives are being achieved.

Actions:

- At sea monitoring and beach patroling for population dynamic and threats;
- Stranding monitoring for demographic assessment.

**Research Actions**

These are targeted actions initiated when there is an immediate need for scientific information to resolve a particular issue—such as evaluating the effectiveness of by-catch reduction techniques—or to gather foundational data essential for informed decision-making.

Actions:

- Evaluation of animal hot-spot areas through e-DNA techniques or drone monitoring;
- Stranding monitoring and post-mortem investigations to assess the impact of human activities and natural threats, to identify specific threats (fishing gears, emerging diseases, etc.), and establish mortality indexes;
- Establish a central database maintained by a central body.

**Management Actions**

These actions are intended to regulate and oversee human activities that may impact the species or its environment, such as fishing, tourism, or pollution.

Actions:

- Standardized digital reporting method to support presence, stranding, and nest monitoring networks and authorities for streamlined coordination and effective data sharing;
- Empower and standardize the logistics to collect and deliver stranded animals to veterinary laboratories equipped to perform post-mortem examinations or to rehabilitation centers;
- Stranding networks connections per species at regional level;
- Implementation of marine litter reduction.

**Legislative Actions**

This category includes initiatives to draft, revise, or enhance laws, regulations, and policy guidelines. It also encompasses activities related to endorsing or implementing regional and transboundary agreements or conventions. Additionally, it covers efforts to improve the enforcement and application of existing legal frameworks.

Actions:

- Establishment and recognition of monitoring networks at national level involving all the relevant stakeholders;
- Establish regular monitoring program (MPA);
- Identify risk hotspots of particular protection/monitoring supporting targeted regulations and joint policy enforcement;
- Enforce regional cooperation in emergency response and addressing human interaction;
- Increase national dedicated budget for the marine sentinel species monitoring;
- Review existing monitoring and management plans (national, MPA).

**Capacity-Building Actions**

These actions aim to strengthen both institutional and individual capacity to support conservation efforts. At the institutional level, this includes equipping relevant organizations—whether governmental, educational, or non-governmental—with the tools, knowledge, and mechanisms needed to advance the Plan's objectives. At the individual level, the focus is on educating and training key stakeholders—such as educators, journalists, managers, and researchers—so they are empowered to contribute meaningfully to conservation outcomes.

Actions:

- Develop periodic training program at individuals, organizations, public scientific institution and policy level to define, update and adopt standardize protocols;
- Increase collaboration with the fishery sector and other stakeholders (Coast Guard, tourism, sea enthusiasts) to train on rescue, handling and basic data collection.

**Public Awareness Actions**

These initiatives serve to connect the goals of the Conservation Plan—and broader biodiversity strategies at the regional, national, or international level—with the general public. Through engaging and educational outreach, they aim to inform and involve diverse audiences including students, fishers, managers, and the broader community.

Actions:

- Launch a local awareness campaign on issues related to sea turtles;
- Launch an awareness campaign to reduce deaths caused by impacts with boats;
- Preparation of educational material (also containing correct methodologies for approaching animals in case of sighting).

## 4.2 Information and awareness measures for stakeholder and the local population

Information and awareness initiatives are essential to foster a conservation culture, promote responsible behaviors, and build support across all levels of society, from key stakeholders to the general public.

This chapter outlines the strategy for developing and implementing targeted awareness and education campaigns aimed at increasing stakeholder accountability and strengthening the relationship between local communities and the marine environment.

**Objectives of Awareness and Information Measures**

The principal aims of the information and awareness component are to:

- Improve understanding of *C. caretta* ecology, threats, and conservation status;
- Encourage sustainable behavior and active involvement in conservation by local users of the coastal and marine environment;
- Reduce human-induced threats such as by-catch, marine litter, vessel collisions, and disturbance of nesting or foraging areas;

- Promote scientific literacy and knowledge exchange among fishers, tourism operators, schools, and institutions;
- Strengthen the sense of stewardship and co-responsibility among coastal residents and visitors.

**Key Target Groups and Stakeholders**

To maximize outreach impact, information and awareness efforts will be tailored to the following priority groups:

a) Professional and Recreational Fishers
Role: Critical for reducing by-catch and adopting mitigation tools.
Messaging Focus: Safe handling of by-caught turtles, gear modification benefits, reporting protocols, participation in data collection.

b) Tourism Operators (Beach Resorts, Boating, Diving Centers)
Role: Gatekeepers of high-impact coastal and marine activities.
Messaging Focus: Interaction protocols, light pollution, protection of nesting zones, eco-certification benefits.

c) Local Communities and Coastal Residents
Role: Custodians of terrestrial turtle habitats and first responders in strandings.
Messaging Focus: Beach cleanups, responsible coastal use, emergency reporting.

d) Schools and Educational Institutions
Role: Future ambassadors of marine conservation.
Messaging Focus: Turtle biology, conservation ethics, citizen science participation.

e) Maritime and Port Authorities
Role: Enforcement, surveillance, and coordination.
Messaging Focus: Enforcement of approach distances, stranding response, reporting systems.

f) Tourists and Recreational Users (Boaters, Swimmers, Sport Fishers)
Role: Seasonal impact on nesting and foraging areas.

Messaging Focus: Best practices for sea interaction, noise and light reduction, plastic use minimization.

**Strategic Tools and Communication Channels**

The following tools will be employed to implement targeted awareness and information campaigns:

a) Educational Materials and Visual Communication

- Development of brochures, posters, infographics, and QR-coded signs at beaches and ports with clear instructions on what to do in the case of by-catch, sightings, or strandings.
- Illustrated guides for fishermen on species identification and safe handling.

b) Digital Media and Mobile Tools

- Launch of a dedicated multilingual webpage and social media presence for the Conservation Plan, featuring interactive maps, nesting season updates, and educational content.
- Integration with mobile apps (existing or developed) for fast reporting of turtle encounters and data entry (e.g., stranding, by-catch, sightings).

c) On-Site Outreach and Signage

- Installation of permanent informational panels in high-traffic areas (ports, fishing docks, beaches, tourist centers), including species facts, photos, threats, and behavioral guidelines.
- Signage to indicate nesting areas or turtle-sensitive zones during the active season (May–October).

d) Public Events and Engagement Activities

- Organization of public open days, community turtle release events, and "Turtle Week" campaigns in collaboration with NGOs, schools, and municipalities.
- Volunteer beach patrol programs during peak nesting and stranding seasons.

e) Training and Workshops for Professionals

- Periodic capacity-building courses for fishers, port authority staff, tourism professionals, and Coast Guard personnel focusing on:
- Rescue protocols,
- Handling and reporting procedures,
- Legal framework and regulatory updates,
- Use of mitigation tools (e.g., TEDs, circle hooks).

f) School Programs and Citizen Science Initiatives

- Design of age-specific educational kits and lesson plans for schools.
- Promotion of student-led marine litter surveys, turtle monitoring campaigns, and art/essay contests to foster local pride and commitment.

**Collaborative Network for Communication**

An intersectoral Communication Working Group will be established under the coordination of the Po Delta Park Authority and the Veneto Region. This group will include:

- Communication officers from regional institutions and Port Authorities;
- NGO outreach coordinators;
- Education sector representatives;
- Media partners (local newspapers, radio, TV);
- Social media managers from project partners.

The working group will ensure the consistency, scientific accuracy, and timely dissemination of all awareness material and will coordinate seasonal campaigns with peak nesting and migration periods.

**Indicators for Impact Evaluation**

The effectiveness of awareness and information measures will be monitored through both qualitative and quantitative indicators.

| Indicator | Description |
|---|---|
| Number of awareness materials distributed | Flyers, brochures, posters, digital downloads |
| Public engagement | Attendance at events, school program participation, social media interaction |
| Stakeholder involvement | Number of trained fishers, tourism operators engaged |

| Indicator | Description |
|---|---|
| Behavioral change indicators | Increased reports of sightings/strandings, adoption of best practices |
| Media coverage | Articles, interviews, social campaigns related to *C. caretta* |
| Website/App analytics | Visits, interactions, user-generated content, submitted reports |

Regular impact assessments will inform the adjustment of campaign content and formats, ensuring continued relevance and effectiveness.

**Integration with Broader Marine Education Programs**
Awareness measures under this Plan will be designed to complement and reinforce regional and national environmental education strategies, including:

- The National Environmental Education Strategy for Sustainable Development (SNAES);
- EU Ocean Literacy Initiatives;
- Regional marine science education programs;
- LIFE or Interreg project campaigns with overlapping geographic or thematic focus.

Collaborative planning and co-branding will maximize outreach, avoid duplication, and leverage shared resources.

## 4.3 Evaluation of impact of the Action Plan for the correct protection and management of the species

The success of the Action Plan for the protection and management of *C. caretta* hinges not only on the implementation of the outlined measures but also on a rigorous, systematic evaluation of their effectiveness. The Evaluation Plan serves to assess whether the actions undertaken are producing the intended conservation outcomes, ensuring that adaptive management can be applied where necessary to optimize results.

**Objectives of the Evaluation Plan**
The primary objectives of the Evaluation Plan are to:

1. Measure the direct and indirect impacts of the Action Plan on *C. caretta* populations and their habitats;
2. Monitor the implementation progress of individual actions and assess their contribution to the overall conservation objectives;
3. Identify barriers, gaps, or inefficiencies in the implementation process;
4. Ensure accountability and transparency for stakeholders, policymakers, and the public;
5. Provide data-driven guidance for adaptive management and long-term conservation planning.

**Evaluation Framework**

The evaluation framework is structured around the main action categories of the Action Plan: Monitoring, Research, Management, Legislative, Capacity-Building, and Public Awareness. Each category will be evaluated through specific indicators, methods of data collection, and performance metrics, described below.

**Monitoring and Research Actions**

**Key Evaluation Indicators:**

- Increase in data availability on population dynamics (e.g., nesting frequency, distribution, sex ratio);
- Identification and documentation of threat patterns (e.g., by-catch rates, stranding causes);
- Frequency and consistency of monitoring activities across target areas.

**Evaluation Methods:**

- Yearly analysis of collected field data (from at-sea monitoring and strandings);
- Comparison of temporal trends in key population parameters;
- Quality and completeness assessments of centralized databases.

**Performance Metrics:**

- Annual population trend reports;
- Number of monitored hotspots validated through e-DNA and drone surveys;
- Number of strandings logged and post-mortem reports completed.

**Management Actions**

**Key Evaluation Indicators:**

- Degree of adoption of standardized digital reporting tools;
- Efficiency of stranding response and transport systems;
- Level of integration among regional stranding networks;
- Reduction in marine litter indicators in turtle habitats.

**Evaluation Methods:**

- System audits of reporting and response platforms;
- Feedback from veterinary and rehabilitation centers on logistics;
- Periodic surveys of marine litter presence in nesting and feeding zones.

**Performance Metrics:**

- Response time to reported strandings;
- Number of connected regional networks;
- Tons of marine litter removed annually from key areas.

**Legislative Actions**

**Key Evaluation Indicators:**

- Number and scope of new or revised legal instruments;
- Establishment and functionality of national monitoring networks;
- Budget allocation trends for sentinel species conservation;
- Instances of successful enforcement of regulations.

**Evaluation Methods:**

- Policy analysis and legal reviews;
- Budget tracking and allocation reports;
- Case studies of regulation enforcement outcomes.

**Performance Metrics:**

- Legislation enacted or amended;

- Frequency of monitoring activities in newly established MPAs;
- Percentage increase in funding dedicated to *C. caretta* conservation.

**<u>Capacity-Building Actions</u>**

**Key Evaluation Indicators:**
- Number of individuals and institutions trained;
- Uptake and use of standardized protocols in the field;
- Stakeholder satisfaction and engagement levels.

**Evaluation Methods:**
- Pre- and post-training assessments;
- Surveys and interviews with stakeholders (fishers, Coast Guard, NGOs);
- Evaluation of training content and delivery.

**Performance Metrics:**
- Annual training reports;
- Percent of stakeholders using standardized protocols;
- Stakeholder engagement indices.

1. **<u>Public Awareness Actions</u>**

**Key Evaluation Indicators:**
- Reach and engagement of awareness campaigns;
- Increase in public knowledge and behavioral change indicators;
- Feedback from educational events and materials.

**Evaluation Methods:**
- Media analytics (reach, engagement);
- Questionnaires before and after public campaigns;
- Event attendance records and participant surveys.

**Performance Metrics:**
- Number of people reached through campaigns;

- Reduction in harmful human-turtle interactions;
- Volume of educational material distributed.

**Data Collection and Reporting**

All data will be collected using standardized protocols and fed into a centralized database managed by the lead coordinating body. Annual progress reports will be published to:

- Review the status of implementation of each action;
- Compare progress against baselines and predefined targets;
- Identify actions requiring modification or enhancement.

Every five years, a comprehensive impact assessment will be conducted to evaluate the overall effectiveness of the Action Plan, feeding into the development of subsequent conservation strategies.

**Adaptive Management and Feedback Loop**

The evaluation process is not an endpoint but a dynamic component of adaptive management. Based on the findings of the evaluation, corrective actions will be proposed and implemented to address emerging challenges or underperforming strategies. The feedback loop ensures that the Plan evolves in response to ecological, social, or institutional changes, maintaining its relevance and effectiveness over time.

## 4.4 Identification of human and financial resources which will be included into the project through partnerships with public and private authorities

The effective implementation of conservation measures for *C. caretta* within the SCI IT3270025 "Northern Adriatic Veneto – Po Delta" requires a robust and sustained allocation of both human and financial resources. To ensure the longevity and scalability of the conservation efforts outlined in this Plan, it is essential to establish and formalize strategic partnerships with public institutions and private stakeholders. This chapter outlines the framework for identifying, mobilizing, and integrating these resources through cross-sector collaboration and funding mechanisms.

**Public Sector Partnerships**

**National and Regional Government Authorities**

The Ministry of the Environment and Energy Security (MASE), in collaboration with the Ministry of Agriculture, Food Sovereignty and Forests (MASAF), will serve as the central institutional bodies coordinating conservation efforts. These Ministries are key sources of both policy support and public financing. Through the implementation of the National Action Plan for Marine Turtles (PATMA), funds allocated under the national biodiversity strategy and the National Recovery and Resilience Plan (NRRP) can be directed towards the protection of *C. caretta*.

The Veneto Region, as the principal administrative authority for the designated SCI, will play a crucial role in channeling regional funds, managing Natura 2000 site budgets, and coordinating sector-specific contributions through programs such as the Regional Operational Program (ROP) and the European Maritime and Fisheries Fund (EMFF), now succeeded by the European Maritime, Fisheries and Aquaculture Fund (EMFAF) 2021–2027.

**Local Authorities and Public Agencies**

Municipalities within the SCI boundaries and the Po Delta Park Authority will be engaged as co-funders and implementing partners for local conservation actions, including education, monitoring, and beach management. ARPAV, as the environmental monitoring agency, will contribute skilled personnel and logistical support for systematic data collection, pollution assessments, and water quality testing.

In addition, the Port Authorities and the Italian Coast Guard will provide operational support in surveillance, enforcement of no-interference zones, and emergency response during stranding events or high-risk periods.

**Private Sector Engagement**

**Fishing and Aquaculture Industry**

Recognizing the central role of fisheries in both the threats and solutions to C. caretta conservation, formalized agreements will be established with fishing cooperatives and producer organizations such as VeGAL, GAC, and CAG. These partnerships will focus on:

- Voluntary adoption of by-catch mitigation tools (TEDs, circle hooks, BRDs);
- Participation in co-managed data collection programs;
- Access to EMFAF funding for transitioning to sustainable practices;

- Compensation schemes or financial incentives for vessels demonstrating reduced by-catch rates.

A portion of EMFAF funding will be earmarked for training, observer programs, and gear modification grants, specifically for cooperatives committing to conservation agreements.

**Tourism and Recreational Sectors**

Beach resorts, diving operators, maritime transport companies, and eco-tourism providers will be approached for voluntary contributions to a *C. caretta* Conservation Fund. This fund, administered jointly by the Veneto Region and an appointed NGO, will support public awareness campaigns, beach monitoring activities, and the development of low-impact tourism models.

Private sector contributions may be monetized through green certification programs (e.g., Blue Flag criteria, "Turtle Safe Beaches"), environmental tax deductions, or co-branding with conservation campaigns. Dedicated training programs will be delivered to tourism operators to ensure compliance with best practices and interaction protocols.

**Scientific and Educational Institutions**

The University of Padova and other collaborating research institutions will contribute human resources in the form of research fellows, graduate students, and technical staff. Their participation in field monitoring, post-mortem investigations, and stranding response will be formalized through Memoranda of Understanding (MoUs) that detail data-sharing protocols and joint scientific publications.

Furthermore, academic and institutional partners will co-apply for competitive funding under European programs such as Horizon Europe, LIFE+, and Interreg ADRION, enabling transnational collaboration and knowledge exchange.

Educational institutions (high schools, marine science academies, Po Delta Park) will also be engaged through environmental education projects supported by national education funds and private sponsors.

**NGO Participation and Philanthropic Funding**

Environmental NGOs (e.g., WWF Italy, Legambiente, Marevivo) will be involved in the design and implementation of outreach campaigns, capacity-building workshops, and turtle rescue

programs. These organizations can mobilize volunteers and raise private donations to complement public investments. They will also serve as key applicants for European and international conservation grants. Partnerships with private foundations or corporate CSR programs (especially in the marine, tourism, and logistics sectors) will be explored for co-financing large-scale actions such as satellite tracking, habitat restoration, or community-based nest surveillance.

**Mechanisms for Coordination and Accountability**

To ensure alignment and maximize efficiency in resource deployment, the following structures and mechanisms will be implemented:

- Resource Coordination Platform (RCP) under the Institutional Committee: This will act as a financial and technical coordination body involving all major funders and partners.
- Annual Resource Mobilization Review: A report will be compiled annually to assess available resources, expenditures, funding gaps, and reallocation needs.
- Integrated Project Dashboard: A centralized digital tool, accessible to all partners, will track action implementation status, budgetary inputs, and measurable outputs.
- Multi-Stakeholder Agreements (MSAs): Legal frameworks formalizing partnerships and defining roles, funding commitments, and performance expectations.

**Summary Table – Indicative Resource Matrix**

| Sector/Partner | Type of Resource | Use | Funding Source |
|---|---|---|---|
| Veneto Region | Financial (regional and EU co-funding) | Habitat management, staff, equipment | EMFAF, ROP |
| Ministry of Environment (MASE) | Regulatory oversight and co-financing | PATMA coordination, national monitoring programs | National Budget, EU Cohesion Funds |
| Fishing Cooperatives | Human (crew), technical (gear) | By-catch reduction, data collection | EMFAF, cooperative contributions |

| Sector/Partner | Type of Resource | Use | Funding Source |
|---|---|---|---|
| Po Delta Park | Human (staff), infrastructure | Monitoring, networking, education and awareness, fundraising, policy | National Budget, Regional Budget, EU Funds |
| University of Padova | Human (researchers), scientific infrastructure | Monitoring, post-mortem, data analysis | University funds, Horizon Europe |
| NGOs (e.g., WWF, Legambiente) | Volunteers, advocacy, small grants | Awareness, community outreach, citizen science | Donations, international foundations |
| Tourism Operators | Financial (CSR), logistical | Eco-labeling, public campaigns | Private sector, CSR programs |
| ARPAV and Po Delta Park Authority | Technical staff, monitoring stations | Water quality monitoring, habitat condition | Regional funds |
| Port Authorities, Coast Guard | Patrol boats, enforcement personnel | Marine surveillance, emergency response | National maritime budget |

## 4.5 Monitoring Plan for checking the effectiveness of actions

A Monitoring Plan plays a crucial role by establishing a mechanism that provides ongoing feedback, ensuring that the Conservation Plan remains responsive and effective over time. Through consistent monitoring, insights can be gained that allow for timely adjustments to the planned actions, enabling them to respond to evolving conditions or new challenges.
Baseline data is required on two primary fronts: the status of the target population and the extent and nature of human activities. In all instances, it is essential to prioritize monitoring efforts based on their relevance and practical feasibility.
Key components of the Monitoring Plan should include a clearly defined conservation goal, the selection of an appropriate indicator, the choice of monitoring methodology (covering

data collection and analysis techniques), and the final interpretation of results, which should feed back into the ongoing refinement of the Conservation Plan.

The table that follows outlines a schematic version of the Monitoring Plan specifically for the population, along with the necessary baseline information.

Just like the process of gathering baseline data, it is important to recognize and leverage potential synergies among various monitoring methods. Many techniques used for data collection and analysis are compatible across different Conservation Objective indicators. Recognizing these overlaps can significantly enhance the efficiency and effectiveness of monitoring activities. For instance, sampling methods can generally be grouped into four main categories, each capable of generating data suitable for diverse analyses, especially for population monitoring purposes.

Sampling approaches include:

**Fishery-based sampling (via observer programs):**

- Modeling habitat preferences;
- Estimating population abundance;
- Assessing human impacts;
- Collecting by-catch data;
- Tagging and tissue sampling (used in genetic, toxicological, and stable isotope studies).

**Systematic line transect surveys:**

- Habitat preference modeling;
- Population abundance estimates;
- Monitoring human activities.

**Non-systematic line transect surveys:**

- Habitat preference modeling;
- Population abundance estimates;
- Monitoring human activities.

**Strandings and incidental captures (by-catch):**

- Pathological analysis;
- Genetic studies;
- Identifying causes of mortality and mortality index;
- Stable isotope analysis;
- Toxicological analysis.

| ACTION | OBJECTIVES | INDICATORS | TARGET | PRIORITY |
|---|---|---|---|---|
| Habitat Deterioration | Maintenance | Area used | Protection of hot spots and seasonal migratory corridors | Medium |
| Marine Litter | Reduction | Stomach contents/tissues | Reduction | Medium |
| By-catch | TED Implementation and deterrent for aquaculture and set-net | Number of catches, fishing effort | Reduction | High |
| Aquaculture | TED implementation | Row for aquaculture deterioration | Lowering interaction | High |
| Collisions | Frequency reduction | Post-mortem evidence | Reduction | High |
| Health status | Pathogens prevalence and mortality | Post-mortem evidence | Reduction | High |
| Site fidelity | Migration to area of interest | Sightings | Hot spot recognizability | Medium |
| Fishermen collaborations | Improvement of the relationship | Capture reports | Improvement on turtle manipulation | High |

| | | | | |
|---|---|---|---|---|
| Stakeholders | Involvement increasing | Local law increasing | Increase information spreading | Low |
| Citizen Science | Improvement of animal interactions | Collaborations | Collaboration, data gathering, App | Medium |

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## 6. Appendix: stakeholders list

| Category | Stakeholders | Role |
|---|---|---|
| **Government Agencies** | Ministry of Environment / Wildlife Department | Policy-making, regulation, enforcement |
| | Marine and Coastal Management Authorities | Habitat protection, marine zoning |
| | Fisheries Department | By-catch regulation, sustainable fisheries |
| | Local Municipal and Regional Governments | Beach regulations, lighting ordinances |
| | Po Delta Park | Monitoring biodiversity, habitat protection measures, education and awareness |
| **Non-Governmental Organizations (NGOs)** | Local Conservation NGOs | Nest protection, public education, monitoring |
| | International Wildlife Organizations (e.g., WWF, IUCN) | Funding, expertise, advocacy |
| **Local Communities** | Coastal Residents | Local support, community-based conservation |

| Category | Stakeholders | Role |
|---|---|---|
| | Local Groups | Cultural knowledge, traditional stewardship |
| **Fishing and Marine Industry** | Commercial Fishermen | By-catch reduction, gear modification |
| | Artisanal Fishers | Sustainable practices, local livelihoods |
| | Fishing Cooperatives / Associations | Engagement, policy negotiation |
| **Tourism Sector** | Eco-tourism Operators | Turtle watching, public education |
| | Hotels and beach resorts | Light management, beach access control |
| | Tourism Boards | Promotion of eco-friendly practices |
| **Scientific and Academic Institutions** | Universities / Research Centers | Long-term studies, conservation science |
| **Media and Public Awareness** | Environmental Journalists / Media | Awareness, public engagement |
| | Social Media | Advocacy, outreach to youth |
| **Funding Bodies and Donors** | International Conservation Funds | Financial support |
| | Philanthropic Foundations | Investment in conservation programs |
| | Corporate Sponsors | Support through funding, outreach |
| **Legal and Policy Experts** | Environmental Lawyers / Policy Advisors | Legal frameworks, enforcement tools |
| | International Agreements (e.g., CITES, CMS, Barcelona Convention) | Compliance, transnational cooperation |
| **Collaborative Platforms** | Regional Conservation Networks | Data sharing, coordination |

| Category | Stakeholders | Role |
|---|---|---|
| | Transboundary Working Groups | Joint conservation of migratory populations |

## Editing instructions:

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