




**EDISON S.P.A.**

**Exploration Permit Application for  
Liquid and Gaseous Hydrocarbons  
“d 84F.R-EL”**

*Environmental Impact Study*  
**NON-TECHNICAL SUMMARY**

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# 1. Introduction

This document is a non-technical summary of the Environmental Impact Study (EIS) for Liquid and Gaseous Hydrocarbon Exploration Project “d 84F.R-EL” (Project). The Environmental Impact Study was conducted by Golder Associates s.r.l. on request of Petroceltic Italia S.r.l. and Edison S.p.A. (Proponent). Golder Associates s.r.l. (Golder) collaborated with experts from Istituto Tethys Onlus in Milan to acquire deeper knowledge of marine mammals.

This non-technical summary divulges the content of the Environmental Impact Study (EIS) drawn up pursuant to Legislative Decree 104/2017, whose purpose is to make the Environmental Impact Assessment (EIA) process more understandable to laypeople.

For a more detailed analysis of the subjects described below, please refer to the Environmental Impact Study.

## 1.1. Location of the Project Area

The Exploration Permit Application Region is located in the Ionian Sea, over 14 nautical miles away from Santa Maria di Leuca (LE), and covers a total surface of approximately 729 km<sup>2</sup>. The Project Area covered by the seismic survey extends over a surface of approximately 300 km<sup>2</sup> in the south-eastern part of the Exploration Permit Application Region (Figure 1.1).

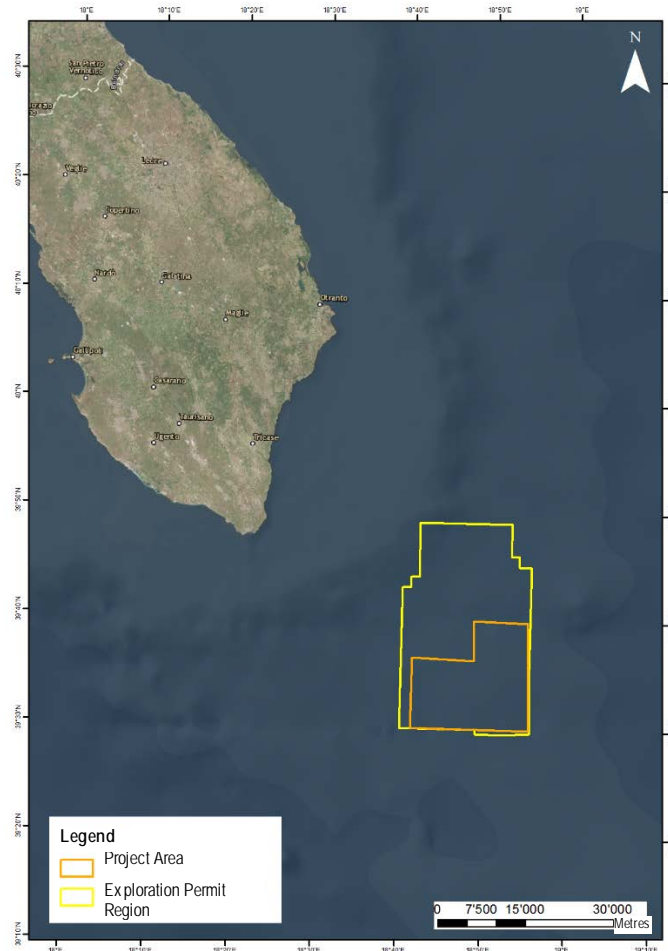


FIGURE 1.1: LOCATION OF THE PROJECT AREA

## 1.2. Environmental Impact Assessment procedure

The Project falls within the category of works subject to State Environmental Impact Assessment (EIA) procedure, pursuant to point 7) of Annex II to Part II of Legislative Decree 152/2006, as amended and supplemented, implementing the provisions of Article 6, paragraph 5, and Article 7, paragraph 3, of Legislative Decree 152/2006.

Therefore, the Environmental Impact Study (EIS) and this Non-Technical Summary (NTS) were prepared for this Project in addition to the documents to submit for the Environmental Impact Assessment Application to the Ministry for Environment and Territory and Sea Protection (Ministero dell'Ambiente e della Tutela del Territorio e del Mare, MATTM).

The EIS describes the size and the technical characteristics of the Project, describes the Project with respect to any constraints existing in the area, and assesses the impacts of the implementation of the Project.

Therefore, the EIS covers the following subjects:

- consistency of the Project with regional and sectoral planning and programming;
- technological characteristics and size of the Exploration Project;
- assessment of any potential impact on the environment of the seismic survey Project, with reference to the current quality of potentially impacted environmental components, considering any planned measures to prevent and/or reduce these impacts;
- proposed monitoring measures to verify consistency with identified environmental impact estimates and the effectiveness of adopted mitigation measures.

The Proponent chose to use the option given by the Scoping phase, which enabled the Proponent to start a preliminary dialogue with the Authority and determine the content of the Environmental Impact Study beforehand. At the end of this phase, the Proponent received a list of prescriptions, as included in VIA/VAS (Strategic Environmental Assessment) Commission Opinion No. 2199 of 14/10/2016. The guidance received after this phase were transposed in the EIS.

## 2. Proposed Project

The proposed Project aims to conduct an offshore survey campaign to record seismic data used in hydrocarbon exploration. The method consists in recording the propagation times of seismic waves in the various types of rocks characterised by different acoustic impedance. More specifically, waves generated by a surface energy source are transmitted to the subsoil as an elastic (seismic) pulse, whose frequency, amplitude and polarity are modified as a function of the density and velocity (acoustic impedance) of the geological layers crossed. Part of the transmitted energy is reflected from the geological layers to the surface, where dedicated sensors (hydrophones) capture the reflected signals and send them to a recording unit.

The Project survey method is of a towed streamer type, based on the use of an emission system (source) and a detection system (receiver), which is composed of hydrophones (streamers) towed by a special vessel. Therefore, this system is composed of:

- an emission system consisting of a set of seismic pulse generators or sources (air gun);
- a detection system composed of floating cables (streamers), which house sensors (or "hydrophones") to receive the reflected wave;

- a vessel to tow the equipment, where equipment control and data acquisition and processing systems are located.

The seismic surveys that will be performed will be 3D surveys, which are more detailed than 2D surveys. This means that a higher number of parallel streamer cables will be used and, therefore, the surface occupied by the recording systems in the water will be denser.

The energy source includes a compressed air device (air gun), which, once activated, generates a shock wave propagating across the sea. The air gun is currently the most widely used energy source in the field of offshore seismic surveys, and allows to generate moderate energy to protect the conditions of the marine environment affected by the operation. This technology produces a compressed air bubble, and resulting expansion and compression cycles. This generates pressure waves, which propagate first in the water and then in the subsoil and then are reflected differently according to the geological layers crossed.

The essential part of the system receiving the seismic waves generated by the air guns and reflected by the geological layers of subsoil is the seismic cable, also known as streamer. The streamer is a see-through neoprene tube, with 5-8 cm diameter, containing a set of receivers (hydrophones) and electrical connection circuits. For this Project, 8 km-long seismic cables are planned to be used. The streamer is connected to the vessel by means of a towing cable, which is composed of one steel shaft with wrapped around the wires that connect the hydrophones to the on-board recording system.

The Project surveys will use a vessel designed and fitted both to tow the energy sources (air guns) and the recording cables (streamers), and to carry on-board equipment to support seismic acquisition operations, such as:

- compressor systems to activate the sources;
- systems to process seismic signals from the recording cables;
- control system to manage any equipment needed for the surveys;
- instrumentation for the continuous positioning of the vessel.

The vessels commonly used for these operations are known as Seismic Vessels. They are designed to operate autonomously for 30-40 days and are equipped with low-noise propellers, providing continuous low-speed navigation (4-7 knots) in order not to affect recording operations.

Five phases have been determined for the Project covered by this Study. In stable weather-sea conditions, therefore with no interruptions of operations, the geophysical survey campaign is expected to last between 15 and 25 days, including energisation and other phases. The vessels will navigate 24 hours a day.

These phases are detailed below:

- PHASE 1: the vessels arrive at the survey area (1 day);
- PHASE 2: the equipment and supporting instruments to use are prepared on board and laid down in the sea (4 days);
- PHASE 3: energisation and 3D recording (16 days);
- PHASE 4: the equipment and instruments used for the survey are collected (2 days);
- PHASE 5: departure from the surveyed area (1 day).

The “least impacting” configuration (array<sup>1</sup>) has been chosen for the Project, as required by the Scoping Procedure. This configuration requires 33 active air guns and 3 standby air guns.

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<sup>1</sup> The energisation system is composed of a set of air guns with a certain geometry (which is the quantity of air guns and how they are arranged in the space), known as array.

The planned navigation direction is N-S, with a distance of 500 m between shipping lines. The navigation must consider a buffer area, both north and south, of at least 8.5 km from the Project Area, in order to enable the vessel to turn.

### 3. Project options considered

#### 3.1. Option Zero

Option Zero consists in considering the non-implementation of the Project.

The Project aims to provide a better understanding of subsoil as part of the Exploration Permit. Therefore, Option Zero would not be consistent with Italy's current Energy Policy. The non-implementation of the survey would not allow to determine whether hydrocarbon resources of economic interest are located in the subsoil of the Exploration Permit Application Region.

#### 3.2. Location and Technological Options

Two Project Area location options, Option A and Option B, were considered within the Exploration Permit Region. However, these two options were rejected for environmental reasons (see Chapter 5):

- Option A does not interact directly with the most environmentally sensitive areas for benthos<sup>2</sup> (white corals) and fish fauna, but it is close to these areas and mostly covers a seabed area where, according to some experts, there could be colonies of white corals which have not yet been identified and mapped. Therefore, Option A was excluded in accordance with the precaution principle.
- Option B is very similar to the designated site, but it includes some sections that are part of the seabed sector where, according to some experts, there could be white corals that have not yet been identified and mapped. As in Option A, Option B was excluded in accordance with the precaution principle.

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<sup>2</sup> Benthos is formed by any aquatic organisms living in close contact with the seabed, where they fulfil their main vital functions (such as feeding or reproduction).

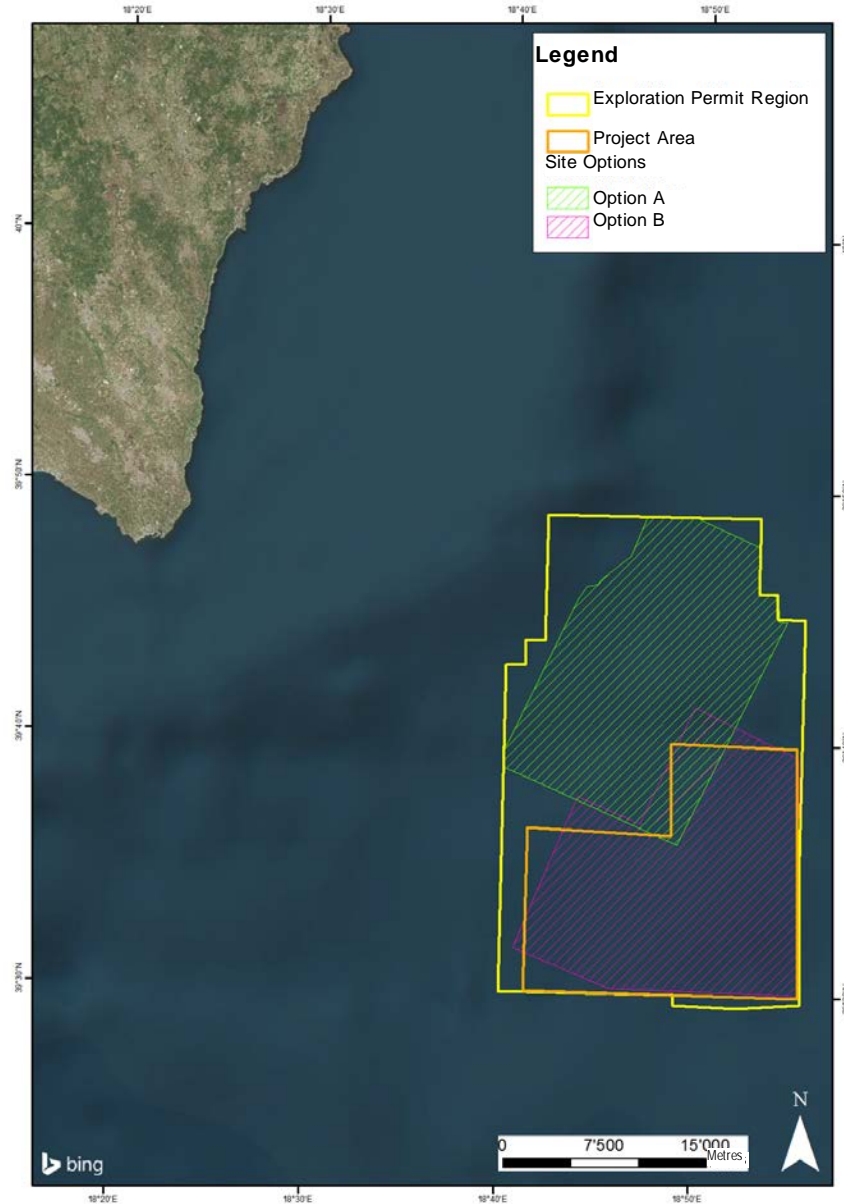


FIGURE 3.1: PROJECT AREA OPTIONS CONSIDERED WITHIN THE EXPLORATION PERMIT REGION

Therefore, the Project Area, extending over 300 km<sup>2</sup>, was positioned in the south-eastern sector, which, based on available data (especially for the benthic component and nursery areas), was found to be less sensitive in terms of biodiversity.

As for technological options, two options were considered to identify the best operating configuration, which allowed to achieve the best technical result with minimum disturbance for marine fauna, especially marine mammals. The analysis of these options covered two variables: the positioning of energisation and recording equipment, and the use of different air gun arrays.

For the positioning of energisation and recording equipment, 4 depth options for the air guns (3 to 7 m depth) and the streamers (4 to 8 m depth) were assessed in addition to the chosen solution, in order to optimise the emission and, above all, the reception of the acoustic signal, as this aspect does not have significant environmental impacts.

As for the choice of the best array, in terms of acoustic signal quality and reduced environmental impacts, the solution with the air guns positioned at a depth of 7 m and the streamers positioned at 8 m was found to be the best option among those considered.

For the energisation power (a parameter that can have significant environmental impacts), that is to say the “charging” volume of the air guns, a volume of 3640 in<sup>3</sup> was chosen, which is the project option with the lowest (and, therefore, “least impacting”) operating volume compared to the other options (respectively 4100 in<sup>3</sup> and 4390 in<sup>3</sup>). After the assessment of sound dispersion in water, the 3640 in<sup>3</sup> array is expected to cause disturbance to cetaceans, in the area, as far as 1,700 m from the source. This distance is longer for the other arrays (3,900 m for the 4100 in<sup>3</sup> array and 5,800 m for the 4390 in<sup>3</sup> array).

## 4. Protections and constraints affecting the Project Area and its surroundings

For the purposes of properly assessing whether the Project complies with current regulations, various legislative and policy documents regarding environmental protections and constraints applicable to the Exploration Permit Application Region and its surroundings were analysed.

- Framework Law on protected areas (Law 394/1991, as amended and supplemented)
- Provisions for sea defence (Law 979/1982)
- Biological Protection Zones (ZTBs) (Decree by the President of the Republic 1369/1968, Article 98)
- Archeomar Project established with Law 264/2002
- Code of Cultural Heritage and Landscape (Legislative Decree 42/2004)
- Galasso’s Law (Law 431/1985)

Law 394/1991, “Framework law on protected areas”, as amended and supplemented, concerning the marine environment, distinguished between protected areas as defined in the Barcelona Convention for specially protected Mediterranean areas (SPA Protocol) and the areas defined pursuant to Law 979/1982, “Provisions for sea defence”. No protected marine area is within the Exploration Permit Region. Some protected areas are located near the Puglia coast, over 14 nautical miles away from the Exploration Permit Region (the full list is provided in the Environmental Impact Study). Among them, the nearest protected areas are the Regional Natural Park of “Costa Otranto-S. Maria di Leuca and Bosco di Tricase”, approximately 14.3 nautical miles (26.5 km) away, and the area of the Site of Community Importance at sea “Posidonieto Capo San Gregorio - Punta Ristola”, which is approximately 15.9 nautical miles (29.5 km) away. Hence, the Exploration Permit Application Region is located beyond the limit of 12 nautical miles set forth in Legislative Decree 152/2006, as amended and supplemented, for the safeguarding of natural areas protected by national and EU regulations, and international agreements and conventions.

The Italian legislation on fishing (Article 98 of Decree by the President of the Republic 1369/1968) either restricted or banned fishing in some marine zones that were recognised to be eligible for reproduction or growth of marine species of economic importance, or which would have been impoverished as a result of excessively intense exploitation. This law, providing the creation of Biological Protection Zones (ZTBs), is specific to fishing. The Northern Ionian Sea region covered by this Project does not include any of the currently existing ZTBs.

In 2004, the Ministry of Cultural Heritage started the “Archeomar Project” in accordance with the UNESCO Paris Convention, which established regulations and laws on the protection and development of the underwater cultural heritage. This Project was created with Law 264/2002, and it is mainly aimed at drawing up a register of underwater archaeological heritage in the Italian regions, in order to protect sites and



improve site management. The Index Map of the Project shows no archaeological sites, historical findings or known shipwrecks within the boundaries of the investigated region or in its immediate vicinity. However, historical and archaeological findings can be found in “Sheet 8”, but concentrating near Capo S. Maria di Leuca. They are located close to the coast at a distance of more than 12 nautical miles from the Exploration Permit Region.

Areas subject to landscape constraints mean portions of the Italian territory protected in accordance with Legislative Decree 42/2004 – Code of cultural and landscape heritage – which were declared to be of significant public or landscaping interest. According to Law 431/85 and Legislative Decree 42/2004, Article 142, as transposed by Law 431/1985, known as “Galasso’s Law”, a buffer zone of 300 metres from the shoreline was provided for the entire national territory, whereby all coastal areas within 300 metres from the shoreline, including land above the sea level, are subject to landscape constraints. The Exploration Permit Region does not include any area subject to constraints, as it is located offshore at over 14 nautical miles from the coast.

In addition, the Exploration Permit Region is located in a sea area where no restricted military marine areas exist.

Finally, the Exploration Permit Application Region falls within the D15 area, “hazardous airspace area from ground level up to 5,500 feet (approximately 1,650 m) due to intense military air activity notified by advanced Notice to Airmen (NOTAM). Therefore, the company that will perform the seismic surveys must operate carefully in the investigated area and pay the utmost attention to any NOTAM communications and notices to seafarers issued by competent authorities throughout the survey to warn about ongoing drills in the area. Near the area, more specifically next to the north-eastern top, an area is identified in the nautical chart with the wording “Unexploded remnants of war”.

## 5. Current environmental conditions

Physical, biological and socioeconomic components were analysed and described based on data available at the Public Administration (Region, Province, Municipality, Regional Agency for Environmental Protection and national entities), the findings of studies and surveys conducted by public and/or private parties on the investigated area or adjacent areas, relevant scientific literature and documentation collected from local experts (University of Lecce, University of Bari and COISPA).

For each component, a sufficiently broad area of study was established to determine a suitable framework for the analysed component, or proportionately to the potential impact of Project actions on the component. Therefore, the size of the area of study varies by component. The minimum size is the Exploration Permit Region (for instance for geology or sea birds), and the maximum size is the north-eastern Ionian Sea and southern Adriatic Sea basin (for instance for marine mammals).

### 5.1. Physical components

The following physical components were analysed in the EIS:

- atmosphere
- oceanography
- soil and subsoil (geology and morphology)
- noise climate at sea

Among those listed above, the most significant components for the purposes of assessing the impacts of the Project are noise climate at sea, sea currents and seabed morphology. The characteristics of these

components are briefly described below. For information on the status of the other components, please refer to the EIS document.

#### 5.1.1. Noise climate at sea

Being far from the coast, the investigated area is not affected by potential anthropic noise disturbance coming from the coast.

In a marine environment that is far from coasts, there are many natural physical and biological factors that constitute a noise source. Natural factors certainly include wind, weather phenomena, such as rainfall, and waves. When caused by the wind, waves are they key factor of noise disturbance.

Artificial factors lead to higher noise emissions in a marine environment. More specifically, in the low-frequency range (< 300 Hz) they mainly result from vessel traffic.

Apart from noise due to natural physical and biological factors, the investigated area can mainly be affected by low-frequency noise generated by fishing vessels, which potentially operate throughout the year, but especially in the summer months, and by pleasure craft, which can be found more often in the summer months. The Exploration Permit Application Region is not crossed by main trade routes, except for some minor crossings near its north-western boundaries.

#### 5.1.2. Sea currents

The investigated area is among the most complex regions in the entire Mediterranean Sea, especially from the hydrodynamic point of view, as it is the meeting and transit point of three important water masses:

- Adriatic Surface Water (ASW);
- Levantine Intermediate Water (LIW);
- Adriatic Dense or Deep Water (ADW).

The marine waters component is not potentially impacted by Project activities. However, some of the parameters described above are relevant and useful to understand potential impacts on the other physical and biological components involved.

#### 5.1.3. Seabed morphology and bathymetry

The depth of the seabed in the Exploration Permit Application Region ranges between 300 m and 1000 m. Its maximum slope is towards the east, in the north-western sector, and ranges between 300 and 500 m at the continental slope, whose average inclination is slightly above 5%. The slope decreases in the central sector (average 1%), where a large bathyal zone is located, at a depth of approximately 700 m. In the southern sector of the area, the seabed gradually goes down to a depth of approximately 1000 m, in the south-western area.

## 5.2. Biological components

The EIS analysed and described the status of the following biological components:

- marine mammals
- sea birds
- marine reptiles
- fish and fisheries
- benthos
- zooplankton and phytoplankton
- biocoenoses<sup>3</sup>

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<sup>3</sup> Community of the species of an ecosystem living in an environment with constant chemical-physical characteristics.

- protected areas and areas subject to constraints

Of all these components, the most significant components for the purpose of assessing the impacts of the Project are described below in this Non-Technical Summary. However, the components that are not described below, as less significant for the Project, are included in the EIS document, to which reference is made for more details.

### 5.2.1. Marine mammals

The work was based on approximately 170 bibliographic references. Four of the eight species of cetaceans that permanently live in the Mediterranean Sea could be found in the Exploration Permit Application Region and its surroundings:

- the striped dolphin, the most numerous and frequent species;
- the fin whale, which can be found less frequently than other areas of the Mediterranean Sea, and is more likely to be found with a higher concentration in the winter months;
- the sperm whale, which can be found in the area, although with limited density. According to available data, 62 specimens live in the entire Ionian Sea;
- Cuvier's beaked whale, whose presence has been proven in the area.

The following anthropic activities pose the main threats to these species:

- colliding with large vessels (sperm whale and fin whale);
- being trapped in nets (sperm whale);
- direct and indirect interaction with fishing, including being accidentally caught in fishing nets (bottlenose dolphin, striped dolphin, common dolphin and Risso's dolphin);
- widespread noise pollution caused by military sonars and seismic surveys (mainly Cuvier's beaked whale, sperm whale, fin whale and potentially Risso's dolphin);
- chemical pollution (all species);
- habitat degradation, fragmentation and loss (all species);
- vessel traffic (mainly fin whale and sperm whale for collision, and all species for noise pollution).

Many studies have confirmed that seismic surveying is a potential threat to marine mammals, as their hearing range can often overlap the low frequencies emitted by air guns.

### 5.2.2. Sea birds

The investigated area is mainly populated by pelagic birds throughout the year and, occasionally, by coastal birds that venture far from the coast for their trophic activities.

The presence of an Important Bird Area (IBA) along the coastline (IT147 - "Coast between Capo d'Otranto and Capo Santa Maria di Leuca") also confirms that the investigated area can be an important point of transit for many migratory birds. The investigated area is included in the Mediterranean Sea - Black Sea migratory route. Migrations occur both during the day and at night near the Puglia coasts, a stopover site for the birds. The most critical periods for migrations are February-April and late August-October.

The main threats to birdlife (especially migratory species) are summarised below:

- habitat destruction and degradation;
- presence of impacting infrastructure (such as wind farms and electricity transmission lines);
- poaching and hunting;
- climate change.

Offshore seismology is not among the typical threats to birdlife.

### 5.2.3. Marine reptiles

The Mediterranean Sea is home to mainly three species of sea turtles: *Caretta caretta* (loggerhead sea turtle), *Chelonia mydas* (green sea turtle) and *Dermochelys coriacea* (leatherback sea turtle). These three species could be found in the Ionian Sea, although the leatherback sea turtle and the green sea turtle can be found only occasionally in the Ionian Sea. Therefore, the study focussed on the loggerhead sea turtle.

In general, seismic surveying is not reported to be among the main threats to sea turtles. However, the ISPRA guidelines on noise impact report, based on scientific studies, “alert or escape attitudes as immediate response to the noise pulses emitted by air guns, while the findings of monitoring performed during seismic surveying showed controversial results.

The following key elements were found in the study:

- the investigated area could be populated especially by specimens of loggerhead sea turtle, migrating from the Greek coasts to the foraging areas in the Northern Adriatic Sea (in autumn), and then moving from the Northern Adriatic Sea (in spring) to Greek reproduction areas;
- migrating specimens tend to be solitary;
- migrating specimens swim at constant speed, both during the day and at night, and near the surface;
- the Ionian Sea (therefore, the Exploration Permit Region) could be a site populated by young turtles in their pelagic phase, especially those that were born on the Ionian islands of Greece and in the Ionian part of southern Calabria.

### 5.2.4. Benthos

The investigated area has different morphological characteristics and benthic associations, and it can be divided at least into three different areas:

- **Area around the western border of the Exploration Permit Region**  
In this area, outside and at the border with the Exploration Permit Application Region, there are colonies of white corals. These species are deemed to be very important in terms of biodiversity, as they can promote the development of a rich benthic fauna. They create a 3D environment, where many spatial niches can be found. The colonies form small hills with a diameter of approximately 5-7 m and a height below 10 m.
- **Slope area at the north-western corner of the Exploration Permit Region**  
This area is characterised by a slight slope of the seabed, and it was not covered by specific studies. However, given the bathymetric lines and the seabed morphology, we cannot exclude the presence of relatively structured rare colonies of corals and benthic communities.
- **The remaining area**  
The seabed is mainly flat, and the bathymetric lines are included between 500 and 800-1,000 m. It was not covered by specific research, thus any remarks on the presence of benthic fauna are based on the morphological and bathymetric characteristics of the area. This fauna is attributable to the biocoenosis of bathyal muds. The Project Area is fully located in this zone.

Main threats to benthos are posed by trawling. Secondary threats are posed by pollution (chemical pollution and waste), and sediment dumping.

In general, seismic surveying is not among the main threats to deep-sea benthic communities.

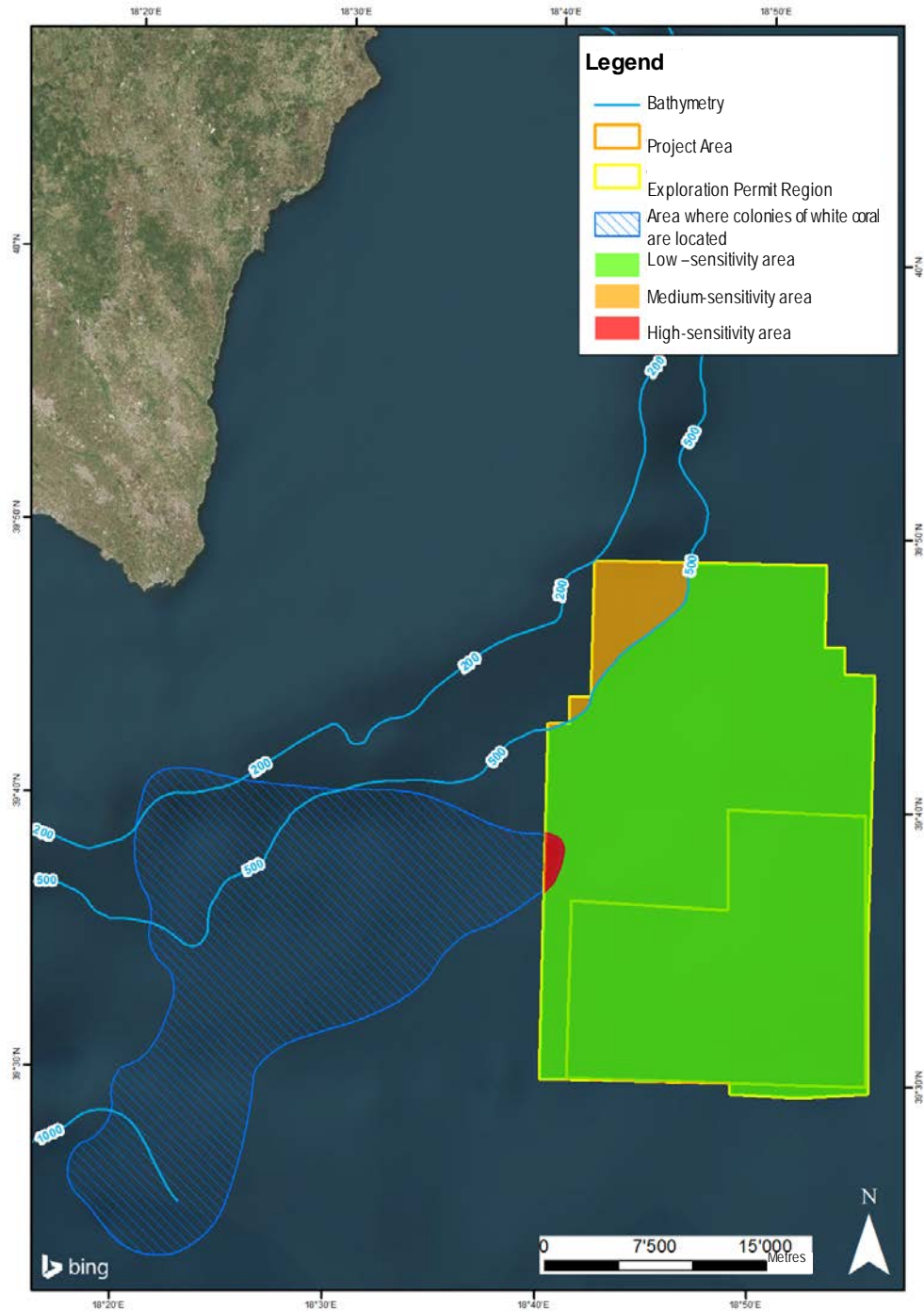


FIGURE 5.1: AREAS WITH DIFFERENT SENSITIVITY IN TERMS OF BENTHIC AND FISH COMPONENT, BASED ON AVAILABLE DATA AND THE INFORMATION SUMMARISED IN THE PREVIOUS FIGURE

### 5.2.5. Fish and invertebrate fisheries

The fish and invertebrate fauna that qualifies as fisheries (i.e. caught during fishing) in the investigated area mostly includes deep-sea species (such as forkbeard, blue whiting, European hake, European conger, common mora, piper gurnard, blackspot seabream, wreckfish, and Squaliformes, such as black-mouth catshark, velvet belly, sandy skate, bluntnose sixgill shark, gulper shark and sharpnose skate), but transits of large migratory pelagic fish were reported, such as Atlantic bluefin tuna, albacore and swordfish.

Crustacean and molluscan fisheries that could be found in the area, especially in the far-northern sector of the investigated area, include the blue shrimp, the red shrimp, the Norway lobster, the short-finned squid and the common bobtail squid.

A higher concentration of species is likely to be found in the central part of the western border of the Exploration Permit Region, where some colonies of white corals can be found. Excluding this small portion, almost the entire seabed of the investigated area is characterised by the biocoenosis of bathyal muds, with low environmental heterogeneity, where trawling is reported, especially in the south-eastern sector. Finally, a small slope area, with only a slight slope, contributes to increasing the seabed heterogeneity (therefore, potentially increasing the number of fish species found) in the north-western part of the investigated area.

Main threats to fish and molluscan and crustacean fisheries are posed by fishing, pollution and anthropic development along the coast. Although seismic surveying is not generally reported among the main threats to fisheries, it can have a negative impact on fish communities and other fisheries.

Given the potential difference among populations of fish and invertebrate fisheries in the three areas, it was deemed appropriate to assign a different degree of spatial sensitivity to the three areas. The area characterised by the presence of white corals and the slope area are reported as potential nursery areas<sup>4</sup> in literature. Therefore, the white corals area was assigned a high degree of sensitivity (given the potential role of spawning area<sup>5</sup>, and of nursery area, of the white corals biocoenosis area), and the slope area was assigned a medium degree of sensitivity. The fish fauna of the remaining mobile seabed area was assigned a low degree of sensitivity.

As reported in the Project Options chapter (section 3.2), the Project Area will only cover mobile and flat seabeds where fish species are deemed to have a low degree of sensitivity.

### 5.3. Socioeconomic components

Of the four socioeconomic components considered when the EIS was prepared, this document only describes fishing and vessel traffic, as landscape and built heritage and tourism are not subject to any disturbance caused by the Project, as the Project will be implemented offshore. For more details, please refer to the EIS.

#### 5.3.1. Fishing

Given the distance from ports and the characteristics of the fishing fleet operating in the area, the number of local vessels that can fish in the area is rather low. Trawling is performed in the south-eastern sector, while in the remaining area fishing with surface longlines is performed in the summer months, and bottom fishing is performed especially in the slope area. Overall, the area is deemed to be affected by moderate fishing activities.

#### 5.3.2. Vessel traffic

The northern Ionian Sea and southern Adriatic Sea basin is crossed by “motorways of the sea”, thus it is characterised by heavy vessel traffic (over 2,000,000 cruise passengers and over 217 million tons of goods every year).

Vessel traffic can be classified in the following main categories:

- freight;
- passenger transport;
- leisure;
- fishing.

<sup>4</sup> Areas, with high environmental heterogeneity, where young specimens can find shelter from predators.

<sup>5</sup> Reproduction areas where sexually mature specimens produce gametes (reproductive cells - sperms and eggs).



Despite the heavy traffic in the area, the Exploration Permit Region is not crossed by main freight and passenger transport routes. Therefore, in the Exploration Permit Region vessel traffic mainly consists of fishing vessels (however, those operating in the area are only a small number) and pleasure craft, which in the summer months can sail across the Ionian Sea to and from Greece, and therefore go through the Exploration Permit Application Region.

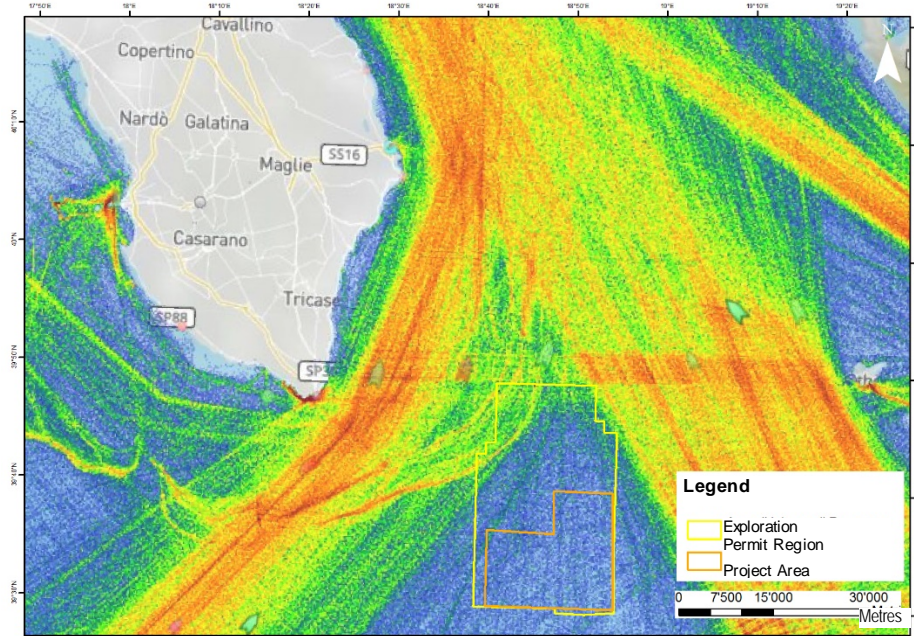


FIGURE 5.2: MAP SHOWING VESSEL TRAFFIC DENSITY IN 2015 AND 2016 (SOURCE: [WWW.MARINETRAFFIC.COM](http://WWW.MARINETRAFFIC.COM))

## 6. Environmental impact analysis method

The conceptual methodology adopted by Golder to analyse the impacts of the Project is based on a semi-quantitative approach of impacts.

Compared to the standard division in three different phases (construction phase; operation phase; disposal phase), this survey Project does not include construction or disposal activities, but only the operation phase. Therefore, the EIS only considered the operation phase, which includes any necessary action to prepare (or set up) the survey activities, perform the survey, and finally complete (or finish) the survey activities.

The impact assessment method applied covers the following activities:

- Preliminary verification of potential impacts:
  - identification of Project actions to perform the survey;
  - identification of any environmental component that could be impacted by the Project (with the Leopold matrix provided in the EIS document).
- Impact assessment:
  - characterisation of environmental components *ante operam*, consisting in determining the current status of potentially impacted environmental components;
  - identification of impact factors that can potentially act on environmental components;
  - definition and assessment of the environmental impact acting on every considered component after the adoption of mitigation measures.

The status of every potentially impacted environmental component was determined with the identification and description of the key characteristics of those components. Every component was assigned a parameter to define its sensitivity (S) to the impact of Project actions. This parameter can have 4 different levels of intensity:

- negligible sensitivity - the component has no sensitive elements;
- low sensitivity - the component has limited and minor sensitive elements;
- medium sensitivity - the component has many minor sensitive elements;
- high sensitivity - the component has major sensitive elements.

The impact on every affected component was assessed with specially-designed impact matrices, which cross the status of the component, which is expressed in terms of sensitivity to the impact, with the considered impact factors, which are quantified based on a set of descriptive parameters, as shown in the table.

TABLE 6.1: POSSIBLE CHARACTERISTICS OF IMPACT FACTORS

Impact factor	Value	Description
<b>Duration over time (D):</b> it defines the time range of the impact	short	Time range < 1 day
	medium-long	1 day < time range < 2 months
	medium	2 months < time range < 6 months
	medium-long	6 months < time range < 1 year
	long	Time range > 1 year
<b>Time distribution (Di):</b> it defines the frequency of occurrence of the potential impact	concentrated	short and one occurrence
	non-continuous	occurrence repeated periodically or randomly over time
	continuous	evenly distributed over time
<b>Area of influence (A):</b> area where the potential impact exercises its influence	limited	the impact falls within an area whose extension varies and is not defined <i>a priori</i>
	extended	the impact falls within an area whose extension varies and is not defined <i>a priori</i>
	global	the impact has an area of influence on a global scale
<b>Significance (Ri):</b> the extent of changes and/or alterations to the environmental component caused by the potential impact	very low	the extent of the alterations/changes causes a variation that cannot be detected by instruments or perceived by the senses
	low	the extent of the alterations/changes causes a variation that can be detected by instruments or perceived by the senses, but it is limited
	medium	the extent of the alterations/changes causes a variation that can be detected on the directly affected component
	high	significant changes leading to alterations that result in a reduced environmental value of the component
<b>Reversibility (R):</b> possible restoration of the qualitative status of the component after the changes through human intervention and/or the autonomous abilities of the component	reversible in the short term	the environmental component restores its original conditions within a short time range
	reversible in the medium/long term	the time needed to restore the original conditions corresponds to a generation cycle



Impact factor	Value	Description
	irreversible	the original qualitative status of the impacted component cannot be restored
<b>Probability of occurrence (P):</b> probability that the potential impact occurs	low	low probability of occurrence
	medium	medium probability of occurrence
	high	high probability of occurrence
	certain	situations that cannot be avoided
<b>Mitigation (M):</b> possible reduction of the potential impact with appropriate design and/or management actions	high	the potential impact can be mitigated with good effectiveness
	medium	the potential impact can be mitigated with sufficient effectiveness
	low	the potential impact can be mitigated with poor effectiveness
	null	the potential impact cannot be mitigated in any way

The extent of the impact was assessed for each impact factor based on the following scale:

- level 1 - very low overall impact;
- level 2 - low overall impact;
- level 3 - medium-low overall impact;
- level 4 - medium overall impact;
- level 5 - medium-high overall impact;
- level 6 - high overall impact.

## 7. Assessment of expected impacts

The possible impacts of the Project were estimated based on the methodology described in Chapter 6. After the analysis of the Project actions and the resulting impact factors, multiple-pulse noise emission (air guns) was identified as the potentially most impacting factor, especially for biological components. The detailed list of the Project actions and identified impact factors is available in the EIS document.

Each physical, biological and socioeconomic component was compared with the impact factors that are potentially harmful to the component.

The tables below provide a brief description of the specific impacts on the components. They also show the mitigation measures planned for each component, and the estimated residual impact value. The extent of the impacts shown in the tables results from specific calculations made with the support of the impact matrices, as specified in Chapter 6.

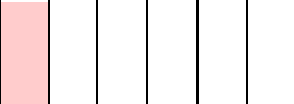
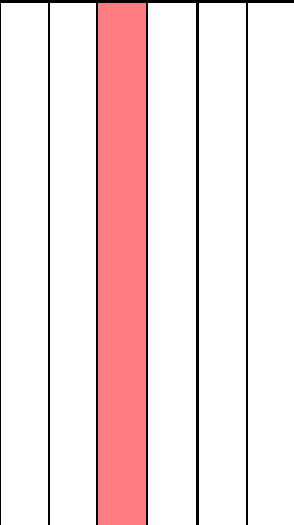
For a more detailed description of the analysis of potential impacts, and an overview of the impact matrices, please refer to Chapter 7 in the EIS document.


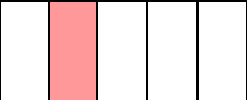
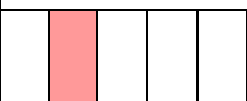
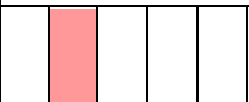

TABLE 7.1: CHARACTERISTICS OF IMPACT FACTORS, MITIGATION MEASURES AND RESIDUAL IMPACT VALUES WITH RESPECT TO PHYSICAL COMPONENTS

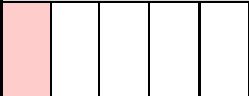
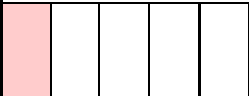

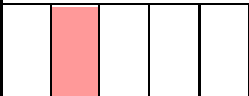
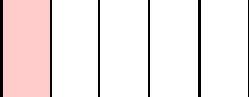
Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description	
Physical components	Atmosphere	Emission of air pollutants	<ul style="list-style-type: none"> <li>Use of combustion engine ships in excellent state of maintenance.</li> <li>Use of vessels provided with the necessary certificates of conformity with emissions.</li> </ul>	Negligible	A low number of ships will be used, for a limited number of days (20 days), thus significantly reducing emissions, which will be similar to the emissions of boats and fishing vessels normally sailing across the investigated area.	
		Greenhouse gas emissions		Negligible		
	Marine Soil and Subsoil	Generation of compressional waves	No measures planned.	Negligible		The bubbles generated by the air guns will stop at approximately 20-30 m of depth, thus they will not cause interference in the marine soil and subsoil.
	Noise climate at sea	There is no noise classification in the marine environment. Therefore, the direct impact of the Project on noise climate at sea was not assessed. Noise climate was considered and thoroughly analysed with respect to the other biological and social components that are potentially impacted, either directly or indirectly, by the emission of non-impulsive noise and especially by the multiple-pulse noise produced by the air gun.				

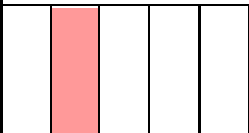
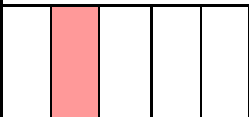
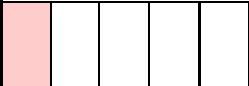
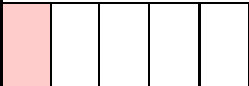

TABLE 7.2: CHARACTERISTICS OF IMPACT FACTORS, MITIGATION MEASURES AND RESIDUAL IMPACT VALUES WITH RESPECT TO BIOLOGICAL COMPONENTS

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
Biological components	Marine mammals	Physical presence of moving vessels	<ul style="list-style-type: none"> <li>Low -noise vessels will be used.</li> <li>Lower-impact air guns will be chosen.</li> <li>The Project activities will not be performed in the winter, when it is more</li> </ul>	Negligible	The sailing speed of seismic vessels is 4-7 knots. Therefore, this specific impact factor is unlikely to be significant for marine mammals in the area.

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
		Emission of non-impulsive noise (by vessel engines)	<ul style="list-style-type: none"> <li>likely to find fin whales in the area.</li> <li>Continuous visual monitoring (MVO operators) of the presence of marine mammals.</li> <li>Continuous Passive Acoustic Monitoring (PAM) by means of hydrophones to locate cetaceans in depths and with limited visibility.</li> </ul>	<p>Negligible</p> 	Given the low number of vessels and their noise level, the impact is deemed to be very low.
		Emission of multiple-pulse noise (air guns)	<ul style="list-style-type: none"> <li>Establishment of an Exclusion Zone (EZ), with a 600-m radius, where the presence of cetaceans will disable the air guns.</li> <li>Before the air guns are activated, the absence of marine mammals will be checked for at least 120 minutes.</li> <li>The activation and/or reactivation of the air guns will be performed gradually (Ramp Up or Soft Start), in order to enable any cetaceans in the EZ to leave the area.</li> <li>Planning of <i>ante-operam</i> and <i>post-operam</i> monitoring, (see Chapter 8).</li> </ul>	<p>Medium-low</p> 	
	Sea birds	Emission of non-impulsive noise	<ul style="list-style-type: none"> <li>Low-noise vessels will be used.</li> </ul>	<p>Negligible</p>	Given the low number of vessels and their noise level, the impact is deemed to be very low.

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description	
		(by vessel engines)	<ul style="list-style-type: none"> <li>Gradual increase in the level of noise emissions at the beginning of the seismic survey.</li> <li>Do not leave food leftovers on the ship during the seismic survey.</li> <li>Reduce light intensity where high light intensity is not required, or use "bird-friendly" lighting.</li> </ul>			
		Emission of multiple-pulse noise (air guns)		Low		Unlike cetaceans, sea birds are only slightly sensitive to the impacts of operating air guns. These birds could be potentially impacted by the seismic survey only when they are fishing or diving to escape. Studies have shown that, for these birds to be seriously harmed, they should be near operating air guns. As described for cetaceans, the gradual start of the seismic survey performed with the slow-moving vessel should enable the birds to perceive any disturbance in advance and stay away also during regular operations.
		Physical presence of moving vessels		Low		The reduced speed of the vessels and the reduced light intensity of the beacons placed on the vessels allow to mitigate the impacts of any collisions with ships.
		Night lighting		Low		Birds are attracted to lights and, being disoriented due to the high light intensity, they could collide with the ship. The short duration and the limited area of influence result in a low impact of lighting.
	Marine reptiles	Physical presence of moving vessels	<ul style="list-style-type: none"> <li>Gradual start of the seismic survey.</li> <li>The continuous visual monitoring by MMO operators will allow to identify any turtles in the exclusion zone, as already established for cetaceans. The MMO Manager will assess whether the power should be reduced or the</li> </ul>	Negligible		Collisions between vessels during the seismic survey and sea turtles seem to be unlikely, both because during the survey speed will be limited (4-7 knots), at least on the seismic vessel (main vessel), and because it has been proven that noise emissions from air guns make <i>C. caretta</i> turtles move away from the area, thus they are unlikely to collide with a vessel.
		Emission of non-impulsive noise		Very low		

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
		(by vessel engines)	survey should be suspended. • Use of “Turtle guards” placed on the submerged parts of the tail buoys of the streamers.		Vessels with low-noise propellers will be used to avoid any interference with the seismic survey. Therefore, the impact of the noise generated by vessel engines is deemed to be very low .
		Emission of multiple-pulse noise (air guns)		Negligible 	Air guns are not among major threats to sea turtles. In any case, the 600-m exclusion zone, as established for cetaceans and also applied to turtles, is assumed to mitigate any possible damage to <i>C. caretta</i> turtles.
		Physical presence of towed streamers		Negligible 	There is a risk that reptiles are trapped in the submerged parts of tail buoys. These buoys are placed at the end of streamers to signal their presence and continuously monitor the streamers. “Turtle guards” placed on the submerged parts of the buoys can prevent these incidents. This means that metal bars will need to be added to the buoy structure, which will prevent turtles from being trapped.
	Fish and molluscan and crustacean fisheries	Emission of multiple-pulse noise (air guns) - White corals area	• Lower-impact air guns will be chosen. • The activation and/or reactivation of the air guns will be performed with Ramp Up to enable any pelagic fish to move away from the emission source. • Compatibly with other constraints, the seismic survey will not be performed in the winter and during biological rest periods for fishing, where possible.	Low 	Many species of bony fish and invertebrate fisheries are associated with the presence of biocoenosis of white corals, together with a higher concentration of sharks compared to the other areas. This area is also a nursery area. However, as reported in the Project options (Section 3.2), the white corals area will not be affected at all by the exploration, thus there will be no impact on the fish and invertebrates living in the area.
				Emission of multiple-pulse noise (air guns) - Slope area	Negligible 

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
		Emission of multiple-pulse noise (air guns) - Semi-flat mobile seabed		Low 	This area in the Exploration Permit Region has semi-flat mobile seabed, which are home to the typical fauna of the deep waters of the Ionian Sea and in part, especially in its eastern sector, it is known to be a trawling area. In this area, the fish fauna is deemed to have a low degree of sensitivity. Given the nature, intensity and limited duration of the impact factor, and the adoption of appropriate mitigation measures, the impact is deemed to be low.
	Benthos	Emission of multiple-pulse noise (air guns) - White corals area	<ul style="list-style-type: none"> <li>The Project Area will be selected to avoid any area indicated as high and medium-sensitivity area for the benthic component.</li> <li>Lower-impact air guns will be chosen.</li> </ul>	Low 	Given the unique nature of the white corals biocoenosis identified near the north-western borders of the Exploration Permit Region, and the hypothesis formulated by some researchers that white coral formations could also be found in the northern sector of the Exploration Permit Region, the seismic survey area (Project Area) was positioned in the south-eastern sector of the Exploration Permit Region, in order to fully avoid being even near a mapped or assumed white coral seabed. In this south-eastern sector, the potential impact was found to be very low.
		Emission of multiple-pulse noise (air guns) - Slope area		Negligible 	
		Emission of multiple-pulse noise (air guns) - Semi-flat mobile seabed		Negligible 	
	Phytoplankton and Zooplankton	Emission of multiple-pulse noise (air guns)	No measures planned.	Low 	Impacts on phytoplankton and zooplankton are generally observed at a distance of 5 m from the seismic source, causing the death of these organisms, which are an important trophic resource for whales, fish and birds. Dead or harmed fish larvae have also been observed at distances below 5 m from the noise emission source. Plankton larvae disperse very quickly, and the potential damage caused by the sound waves of air guns


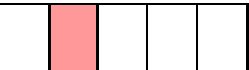
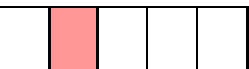
Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description																																																								
				<table border="1"> <tr> <td style="background-color: #f08080;"> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>									is highly localised. Therefore, the mortality rate due to noise is not deemed significant if compared with the natural mortality rate.																																																
	Biocoenoses	In order to assess the impact with respect to biocoenoses, the impact remarks and assessments for the various environmental components, especially marine soil and subsoil, fish, benthos, phytoplankton and zooplankton, sea turtles and cetaceans should be considered as a whole.																																																											
	Protected Areas	Emission of non-impulsive noise (by vessel engines)  Emission of multiple-pulse noise (air guns)  Physical presence of vessels  Night lighting	No measures planned.	<table border="1"> <tr> <td colspan="8">Null</td> </tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td> </tr> <tr> <td colspan="8">Null</td> </tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td> </tr> <tr> <td colspan="8">Null</td> </tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td> </tr> <tr> <td colspan="8">Null</td> </tr> </table>	Null																Null																Null																Null								<p>Considering the distance between the Project Area and the examined protected coastal and land areas (above 12 nautical miles), the impact on these areas is deemed to be null.</p> <p>However, adopting a precautionary approach, the EIS document also calculates the impact of the Project on these protected areas with respect to the future marine area (<i>Penisola salentina</i> Protected Coastal Area), as it is closer to the Project Area. However, in this case the potential impact is deemed to be low.</p>
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Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description

TABLE 7.3: CHARACTERISTICS OF IMPACT FACTORS, MITIGATION MEASURES AND RESIDUAL IMPACT VALUES WITH RESPECT TO SOCIOECONOMIC COMPONENTS

Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
Socioeconomic components	Fishing	Emission of multiple-pulse noise (air guns)	<ul style="list-style-type: none"> <li>Communication of the Project Area to the competent Harbour Office.</li> </ul>	Low	As for any indirect impact on fish species due to the air gun technique, experts and institutions do not have a recognised shared opinion on the magnitude of actual effects. The potential impact is deemed to be low, based on a precautionary approach.
		Physical presence of vessels		Low	
		Physical presence of towed streamers		Low	
	Landscape and archaeological assets	Physical presence of vessels	No measures planned.	Negligible	No archaeological assets have been reported to be within the Exploration Permit region.



Group	Component	Impact factors	Mitigation measures	Residual impact after mitigation measures	Brief description
					presence of these vessels will have the same impact as any vessel sailing across that sea area, thus a low impact.
	Vessel traffic	Physical presence of moving vessels	<ul style="list-style-type: none"> <li>Communication of the Project Area to the competent Harbour Office.</li> </ul>	Negligible	The investigated area is not crossed by main freight and passenger transport routes, thus it will not impact on a high number of vessels. In addition, the location of the Project Area only in the south-eastern sector of the Exploration Permit Region fully excludes the risk of interference with sea lanes.
		Physical presence of towed streamers		Low	
					
	Tourism and use of the coastal strip	Physical presence of moving vessels	<ul style="list-style-type: none"> <li>The Project activities will not be performed in July and August.</li> </ul>	Low	Along the coast, tourism is mainly seaside tourism, thus it mostly develops in the summer months. Therefore, avoiding any Project activities in July and August will further reduce any interference of the Project with pleasure navigation.
		Physical presence of towed streamers		Low	
					

## 8. Proposed monitoring

Environmental monitoring is planned to be *ante-operam*, ongoing and *post-operam*. It will focus on:

- cetaceans as *ante-operam* monitoring;
- cetaceans, large pelagic fish and turtles as ongoing monitoring;
- cetaceans and turtles as *post-operam* monitoring.

The proposed monitoring measures are consistent with main national and international guidelines and protocols. Throughout the monitoring period (*ante-operam*, ongoing and *post-operam* monitoring), deep-sea acoustic monitoring will be performed with sonobuoy<sup>6</sup> to acquire accurate information on the presence and distribution of marine mammals in the area.

The ***ante-operam* monitoring** will be performed for 60 days. In addition to acoustic monitoring with sonobuoy, the investigated area will be covered with a suitable platform, which will refer to a set of defined routes. This monitoring will be surface visual and acoustic monitoring performed by qualified MMO and PAM staff, and will consist in distance sampling.

The main purpose of the **ongoing monitoring** is to verify the presence of marine mammals in the exclusion zone or detect any approaching marine mammals. Therefore, the main purpose is to implement a specific protocol to suspend the seismic survey whenever necessary. In addition to the continuous use of the sonobuoy, the monitoring will include continuous visual observation with MMOs (Marine Mammal Observers) during the day, and 24 h PAM (Passive Acoustic Monitoring). If cetaceans are identified in the exclusion zone, or cetaceans approaching this zone are detected, the protocol prescribes that the seismic survey must be suspended, and it can only resume after a certain period of time, to allow the animals to leave the area.

And end-of-survey report will be drawn up, available to competent authorities, to specify: the seismic survey date and location, characteristics of the air guns, vessels used, marine mammals sightings, procedures implemented in case of sighting, and any issues found in general and in case of sighting.

Finally, a ***post-operam* monitoring** will be performed to detect any stranded cetaceans and turtles after the survey. This monitoring will be performed for 60 days, and will cover the coastal area between Lecce and Taranto, which is approximately 200 km. The detection of any stranded animals will be combined with acoustic monitoring with sonobuoy, in order to analyse the area involved in the seismic survey.

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<sup>6</sup> A sonobuoy is a passive recording system anchored to the seabed and kept suspended at a certain distance from the seabed, which is used to record all natural and anthropic acoustic pulses.

**GOLDER ASSOCIATES S.R.L.**



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