Total E&P Greece B.V.
Athens, Greece

Offshore Seismic Acquisition Block 2 - Ionian Sea

Environmental Action Plan

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ABBREVIATIONS AND ACRONYMS

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the Contiguous Atlantic Area
CMS	Conservation of Migratory Species of Wild Animals
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EAP	Environmental Action Plan
EBR	Environmental Baseline Report
EC	European Council
EEZ	Economic Exclusive Zone
EIA	Environmental Impact Assessment
EMFF	European Maritime and Fisheries Fund
ESBS	Environmental and Social Baseline Study
GG	Government Gazette
HC	Hydrocarbon
HCMR	Hellenic Centre of Marine Research
HHRM	Hellenic Hydrocarbon Resources Management
IBA	Important Bird Area
IIR	Ionian Islands Region
IUNC	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
JMD	Joint Ministerial Decision
KBA	Key Biodiversity Area
LD	Legislative Decree
MSFD	Marine Strategy Framework Directive
MD	Ministerial Decision
MPA	Marine Protected Area
M.S.	Meteorological Stations
NASPN	National Air Surveillance Pollution Network
NMS	National Meteorological Service
NOA	National Observatory of Athens
NSRF	National Strategic Reference Framework
OP	Operational Program
PACs	Project Affected Communities
PAPs	Project Affected Persons
PD	Presidential Decree
PGS	Petroleum Geo-Services
RES	Renewable Energy Sources
RU	Regional Unit
SEA	Strategic Environmental Assessment

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Total E&P Greece B.V., a subsidiary of Total S.A., and its partners Hellenic Petroleum and Edison International were selected in 2016 as preferred bidders to conduct Exploration and Production of Hydrocarbons in Offshore Block 2 in the Ionian Sea, Greece.

The Lease agreement was initiated in March 2017 by the Greek Ministry of Environment and Energy (MEE) and the Block 2 Joint Venture Partnership. The Agreement was reviewed by the Court of Audit and finally ratified by the Parliament on the 15th of March 2018 (GG 47A/2018).

Total E&P Greece B.V. is the Operator with 50% participating interest, Hellenic Petroleum with 25% and Edison International 25%, having exclusive rights to explore for and produce commercial quantities of hydrocarbons in Block 2.

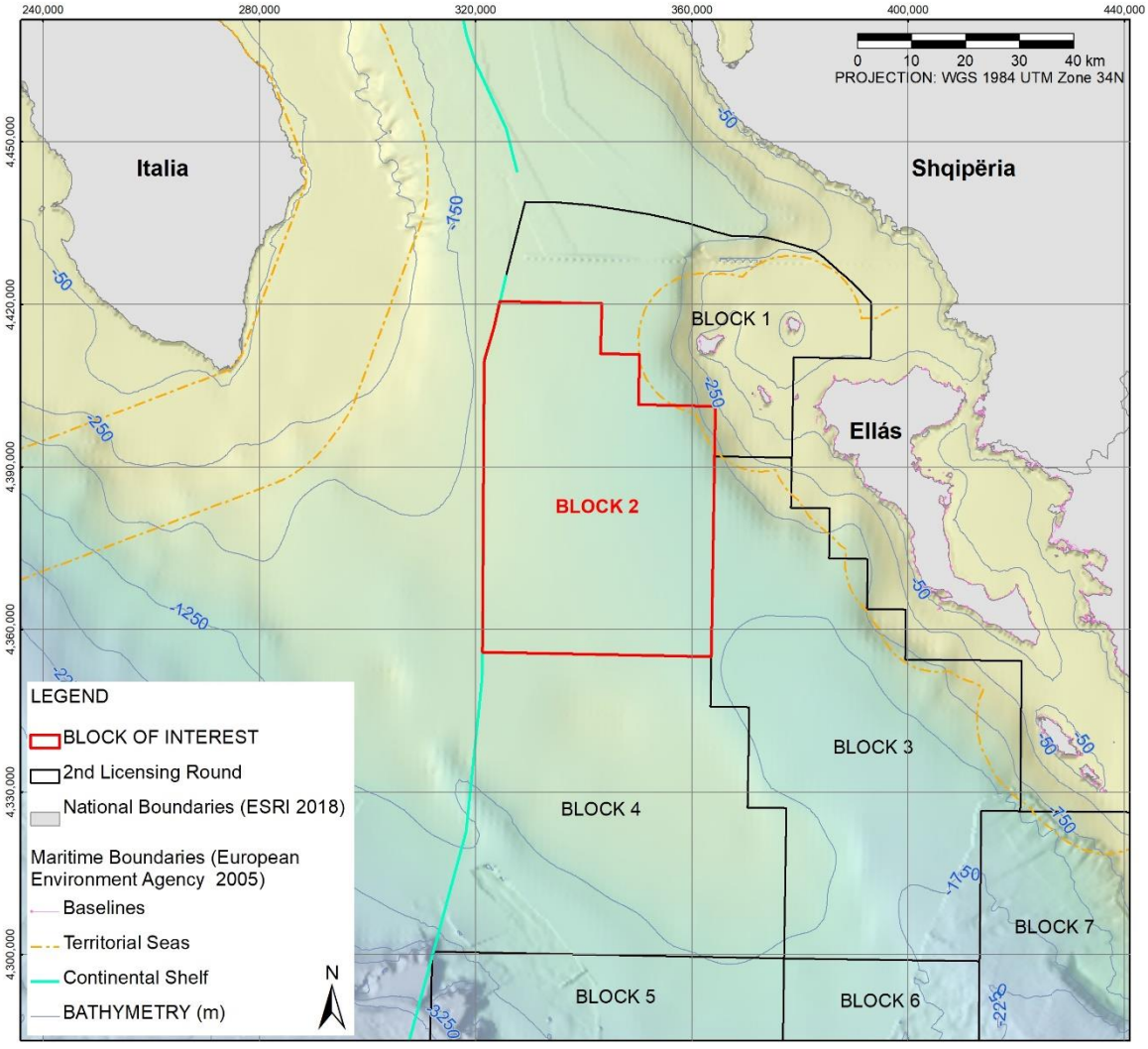

Figure 1.1: Block 2 Location - Ionian Sea (RINA Consulting, 2020)

Offshore area of Block 2 is located approximately 20 kilometres west of the Island of Corfu, in the Northern Ionian Sea, at water depth ranging approximately 750 to 1,200 m. On the administrative level, the Block 2 covers the area

located within the Regional Unit (RU) of Corfu of the Ionian Islands Region (IIR), while its Western limit follows the boundary line between the continental shelf areas of Italy and Greece according to the respective agreement of May 24, 1977, which establishes this boundary line in accordance with the principle of the median line.

Thus, the Block 2 area is almost entirely located in international waters, just outside the Greek territorial waters (6 nautical mile radius of the coast) but within the continental shelf area under the jurisdiction of the Republic of Greece, as shown in the following figure.

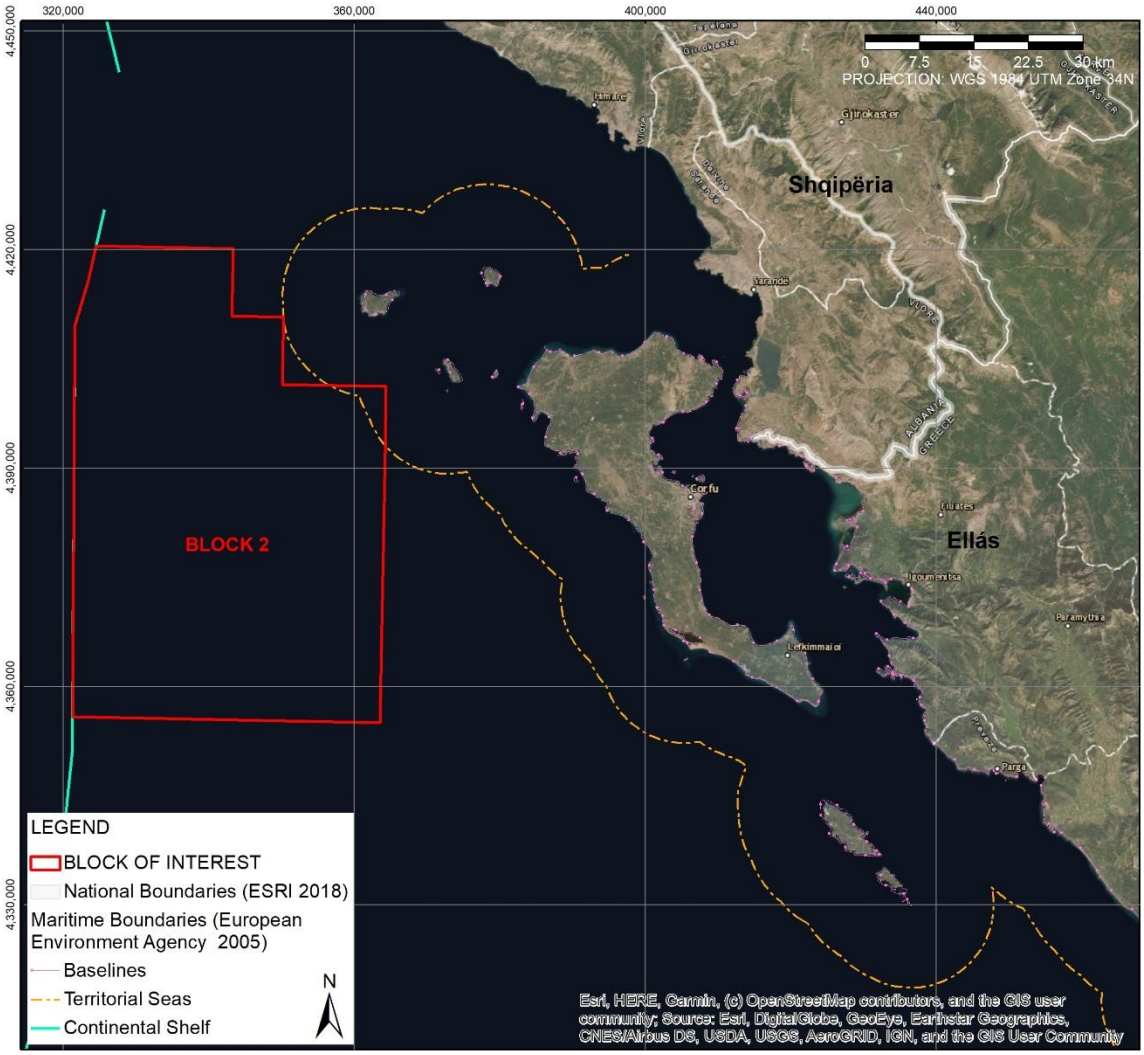

Figure 1.2: Block 2 Location and Greek Territorial Waters (RINA Consulting, 2020)

Western Greece area, where Block 2 area is located, is a largely sub-explored region, where the few exploration wells drilled in the past are located in the coastal areas and on the narrow continental shelf. The onshore area is characterized by a great number of natural surface oil seeps and several hydrocarbon indications were found for most of the drilled wells with one proven hydrocarbon accumulation (sub-commercial) identified at the West Katakolon field (offshore, close to the coast, at a distance of approximately 250 km South-East of Block 2).

The lack of extensive exploration together with the existence of a proven petroleum accumulation generates a clear interest in the region.

The exploration program to be implemented in Block 2 is divided into 3 phases and includes the actions described in the following table.

Table 1.1: Exploration Works in the Block 2

Minimum works	Phase 1			Phase 2		Phase 3		
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Firm Activities								
Seismic acquisition	Acquisition & Processing of 1800 km 2D seismic data			Re-evaluation of seismic data		Re-evaluation of seismic data		
Other Geophysical survey	Magnetic & Gravity survey (if possible during seismic acquisition)			-		-		
Drilling	-			one well		one well		
Contingent work								
Seismic acquisition	-			Acquisition of 3D seismic data (extent depending on 2D and well results)		-		

According to Article 2 of the Lease Agreement, the Exploration phase begins on the effective date of the Agreement and continues for the periods set out in the relevant article. At the present project phase (i.e. Phase 1), the Exploration Program includes the acquisition & Processing of 1,800 km of 2D seismic data and the elaboration of a Magnetic & Gravity Survey as provided in the Work schedule of the 1st Phase of exploration (see table above).

The proposed seismic survey for acquiring data is expected to be launched in last Quarter of year 2020, with the activity expected to start in November and to last approximately:

- ✓ 20 days in case of 2D survey;
- ✓ 45 days in case of 3D survey.

1.2 PRESENTATION OF THE PROJECT OWNER

In accordance to Law 4525/2018 (GG 47A/15.3.2018) ratifying the relevant lease agreement, project owners are the consortium of the following companies:

- ✓ Total E&P Greece B.V., a subsidiary of Total S.A;
- ✓ Hellenic Petroleum S.A.;
- ✓ Edison International S.p.A.;

The following paragraphs present a short description of the three Companies.

Total S.A. is a company founded in France in March 1924 and listed on the Paris, Brussels, London and New York stock exchanges. Total Group is the fourth largest international Oil and Gas Company in the world, with activities in more than 130 countries. The main activities of Total are the following[1]:

- ✓ Explore and Produce: Oil and Gas, Solar, Biomass;
- ✓ Transform and Develop: Specialty chemicals, Polymers, Refining and Petrochemicals;
- ✓ Ship and Market: Trading and Shipping, Marketing and Services.

Key facts and figures of Total are summarized in the following:

- ✓ more than 98.000 employees worldwide;
- ✓ it serves on a daily basis more than four (4) million customers;
- ✓ it produces more than 2.5 million barrels of oil equivalent per day;
- ✓ turnover of 149.7 billion USD;
- ✓ Adjusted Net Income of 8.3 billion USD;

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[1] Source: http://publications.total.com/total-major-energy-operator/

- ✓ R&D allocation of 1 billion USD.

Hellenic Petroleum S.A (HELPE) is active in the energy sector in Greece and Southeast Europe. The Group's wide range of activities includes:

- ✓ Refining, Supply & Trading of Petroleum Products, both in Greece and abroad;
- ✓ Fuels Marketing, both in Greece and abroad;
- ✓ Petrochemicals /Chemicals Production &Trading;
- ✓ Oil & Gas Exploration & Production;
- ✓ Power Generation & Trading;
- ✓ Renewable Energy Sources (RES);
- ✓ Engineering Services;
- ✓ Pipe line Networks - Sea Transportation.

HELPE Group is active in Southeast Europe, being one of the key marketing players, through its network of 279 fuel stations in Cyprus, Bulgaria, Serbia, Montenegro and FYROM. It also owns the sole refinery in Skopje (FYROM).

In the E&P Sector, Hellenic Petroleum has successfully conducted oil and gas exploration activities in a wide variety of technically challenging environments. Hellenic Petroleum, acting as Operator, has acquired seismic in environmentally sensitive terrain and offshore areas and has conducted drilling and production testing operations in 26 onshore and offshore Blocks granted by the State, covering an area of 55,000 Km^2. This effort led to the emergence of the prospective hydrocarbon basins in Greece. Hellenic Petroleum S.A. being successor of Public Petroleum Corporation of Greece S.A. (DEP S.A.) and Public Petroleum Corporation of Greece Exploration & Exploitation of Hydrocarbons S.A. (DEP-EKY S.A.) has been acting as Operator in the country for over 23 years during the period 1975-1998.

During the period 2007-2011 Hellenic Petroleum acted as Operator in Egypt Western desert. In addition, Hellenic has monitored all drilling and production operations in the Prinos Development area in North Greece, either as a Joint Venture partner or on behalf of the Greek State from production start-up in 1981 to 2009. In addition, it has acted as non-operator in various countries in the Adriatic, Albania, Libya, Egypt and the North Sea.

Edison International S.p.A. is an energy company in the field of electricity and natural gas headquartered in Milan, Italy. The company was established in 1884 while today Edison employs about 4,000 people in Europe, Africa and the Middle East.

Edison's primary activities are production and distribution of electricity and natural gas. Edison and its subsidiaries operate across Europe, Africa, and the Middle East. It is the second largest power producer in Italy (about 15% of national output) and in Greece (about 12% of national output). It operates in Greece through subsidiary Elpedison (38% interest, a joint venture between Edison, Hellenic Petroleum and Ellaktor). Together with DEPA, it develops the Greece–Italy pipeline project.

Hydrocarbons operations include exploration, production and distribution of natural gas and crude oil. As of 2010, Edison owned 80 hydrocarbons concessions and permits with hydrocarbons reserves of 52.8 billion cubic meters (1.86 trillion cubic feet).

1.3 PURPOSE OF THE EAP

1.3.1 Scope and Objectives

The Greek Environmental Legislation (Law 4014/2011 and MD 1958/2012) does not include any specific requirements for the preparation of Environmental Action Plan (EAP) for projects and activities.

In accordance with Law 4014/2011, projects and activities, the construction and operation of which may have impacts on the environment, are classified into two categories: A (subdivided into subcategories A1 and A2) and B and 12 groups common to all categories (Par. 1, Article 1 of L 4014/2011). Sub-class A1 includes projects and activities likely to have a significant impact on the environment, and sub-category A2 includes projects and activities likely to have a significant impact on the environment. Category B includes projects and activities characterized by local and non-significant environmental impacts. The categorization of each project or activities follows certain criteria included in Annex I of the Law, while in paragraph 4 of article 1, it is mentioned that a Ministerial Decision will be issued for the categorization of all projects and activities. This ministerial decision has been issued following

the issuance of the Law and has been updated a couple of times since then. The current version of the Ministerial Decision is the MD 37674/10-8-2016 – Modification of Ministerial Decision 1958/1912 for the environmental categorization of projects and activities.

Seismic Acquisition Surveys (offshore and onshore) are not included in the tables of Ministerial Decision 37674/10-8-2016 and as a result they can either be considered as activities with no impacts on the environment or they have to be included in a new update of the Ministerial Decision of the categorization (par. 6, art. 1).

During the last years, a number of seismic campaigns was carried out in Greece. In all cases, the Ministry of Environment requested an Environmental Action Plan ("E.A.P.") for the Seismic Acquisition Survey, through the relevant Ministerial Decision approving the Strategic Environmental Impact Assessment Study of the related Exploration Program.

In case of Block 2, the elaboration of an Environmental Action Plan for the proposed Marine Seismic Survey activities, has been requested through both the Lease Agreement signed between the Hellenic Republic and the Consortium that owns the project (Article 12– Environmental Protection) and the Ministerial Decision of the approval of the SEA study (MD 30373/3.7.2017).

Based on the above, the purpose of the Environmental Action Plan is to:

- ✓ meet the Requirements of the Decision of the Strategic Environmental Assessment for the Offshore Exploration Activities – Ionian Sea;
- ✓ present current National, European and International legislation;
- ✓ meet requirements of Total's standards concerning Environmental and Social Impact Assessment of Seismic Acquisition Surveys.

In accordance to the scope of work, the aim and objectives of the EAP are to:

- ✓ provide a description of the Environmental and Social conditions within the potential area of influence of the marine seismic survey activities, to a degree that is proportional and specific to the risk anticipated and significance of impacts;
- ✓ perform a detailed screening of potentially significant and adverse Environmental, Health, Social and Human Rights impacts associated with routine and accidental events (including a detailed noise assessment modelling);
- ✓ integrate Environmental and Social aspects into the seismic survey scope so that to avoid, minimize and compensate potential Environmental and Social impacts;
- ✓ provide the framework for an Environmental and Social Management Plan, and the Commitments' Register to be implemented by the Seismic Contractor and the Company.

1.3.2 Methodology Adopted for the Preparation of the Study

The elaboration of this Environmental Action Plan is based on the following:

- ✓ Requirements of Min. Decision 170225/2014 (GG 135/B/27.1.2014), which sets out the detailed contents of EIA studies for environmental permitting of projects and activities;
- ✓ the requirements of the Ministerial Decision approving the Strategic Environmental Assessment Study for the Exploration Program in the Ionian Sea concerning the environmental information that should be recorded at the scale of the wider study area;
- ✓ Provisions and requirements set in the following Total's Standards:
  - GS EP ENV 120 - Environmental impact assessment of E&P activities,
  - GS EP SDV 102 - Social Impact Assessment.

The Environmental Action Plan assesses and evaluates the potential impacts of the proposed marine seismic survey in Block 2 and proposes specific measures for the minimization of the residual impacts on the environmental and social characteristics of the study area

The main steps of the EAP include:

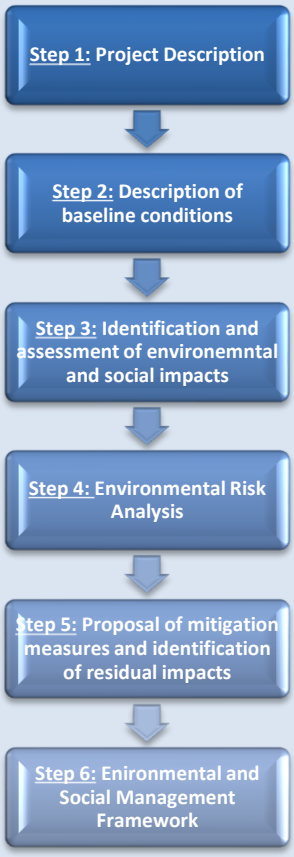

Figure 1.3: Main steps of the Environmental Action Plan preparation

Step 1 –Project description

The objective of this step is to provide a description of the project in sufficient detail, that together with the description of the existing environment, will allow understanding of the significant impacts likely to arise from the proposed activities. Project components and activities to be implemented in each phase of project life i.e. mobilization, operations and post-operations (demobilization) shall be described within the framework of this task. This part is meant to give a general idea of what the project will entail. The description of the proposed project includes the following information:

- geographic location of the project and its associated elements (in UTM coordinates) including photographs, maps, etc.;
- general description of the different phases of the project;
- technical description of the activities which could generate impacts;
- description of all equipment and facilities needed, temporary and permanent, as well as materials needed, including their origin;
- description of other plans and programs in the area which could be affected by this project.

Step 2 –Description of baseline conditions

The baseline conditions description will identify the main physical, biological, and social/cultural characteristics of the study areas (study area and wider study area) potentially exposed to the proposed project effects. In addition, an accurate description of the existing environmental baseline conditions is necessary to predict the likely significant impacts of the proposed activities. The relevant chapter of the EAP contains the following information based on the **Environmental and Social Baseline Study**:

- Climatic and bioclimatic characteristics ;
- Marine hydrography and oceanography;
- Morphology and bathymetry;
- Geology and tectonics;
- Natural environment;
- Air quality;
- Acoustic environment;
- Water quality;
- Anthropogenic sources of pressure on the environment;
- Social aspects;
- Socioeconomics.

Step 3- Identification and assessment of Environmental and Social impacts

In this step, the environmental and social impacts of the seismic acquisition survey will be identified, assessed and evaluated. The methodology which will be followed for the evaluation of the environmental and social impacts will be based on the **Leopold Matrix Method** which is a widely used method.
A matrix is used to identify potential impacts associated with the proposed project. .
The impact identification involves establishing the sources of impacts and the potential effects from the proposed operations based on the description of the project characteristics. The intensity of the potential effect is defined based on the following parameters:

- Type (relationship of the effect to the Project in terms of cause and effect);
- Duration **(**from generation of the effect to the restoration of the initial conditions);

- Extent (geographical or spatial);
- Magnitude (with regard to standards of acceptability toxicity or potential for bioaccumulation and its likely persistence in the environment).

The **severity** of the predicted impacts is evaluated by considering the intensity of the effect as well as the **sensitivity** and **vulnerability** of the identified **environmental** and **social receptors**. Once intensity of the effect, sensitivity and vulnerability of the environmental and social receptors have been defined, the severity can be assigned for each impact. Impact severity is designated using the following matrix.

Table 1.2: Matrix used to determine the severity of the impacts of the seismic survey

Severity= Intensity* Sensitivity/Vulnerability		Sensitivity/Vulnerability		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

The detailed methodology of the impact identification and assessment is presented in section 5.1.

Step 4 – Environmental Risk Analysis

The applied methodology for the risk analysis is the Analysis approach "ENVID" (Environmental risk Identification), a consolidated and widespread methodology, especially utilized in the Oil &Gas sector. The environmental risks associated with the proposed seismic operations are assessed by the following methodology:

- identification of the aspects/ sources of environmental risks associated with the seismic survey;
- identification of the receptors at risk within and adjacent to the survey area;
- definition of the potential environmental effect of the risk;
- identification of the likelihood of occurrence and potential consequences;
- determination of overall environmental risk levels using a likelihood and consequence matrix;
- identification of control measures associated with every aspect/source of risk and evaluation of residual risk level;
- identification of additional risk reducing measures if necessary, in the case of critical risks.

For this analysis, the range of occurrence frequency (or occurrence probability) and the range of severity of the possible environmental consequences are qualitatively evaluated. The risk is therefore established from the combination of these two factors.

The detailed methodology of the environmental risks identification is presented in section 8.

Step 5 –Proposal of mitigation measures and identification of residual impacts

The adoption of mitigation measures and compensation of impacts is one of the main objectives of the EAP. The containment of impacts through the adoption of mitigation measures and compensation requires identifying the actions to be undertaken at a project level to reduce (mitigate) any negative impact on each environmental component or to offset any imbalances induced on environment. Indeed, a choice made at a design stage, although being the best alternative in terms of general effects on the environment, may cause significant negative impacts on the individual variables of the anthropogenic system-environment.

Generally, the following mitigation measures and compensation can be envisaged:

- avoid the impact completely, i.e. by not carrying out the activity or part of it;
- minimize the impact limiting the magnitude or intensity of an activity;
- rectify an impact by intervening on damaged environment, e.g.: with requalification, reintegration, etc.;
- reduce or eliminate the impact through safeguard or maintenance during the project;
- compensate impacts by replacing resources.

Once mitigation and enhancement measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps described above, considering the assumed

implementation of the additional mitigation measures. The impact reduction measures enable its intensity and severity to be reduced.

The degree of significance attributed to residual impacts varies as follows:

- residual impacts of Major significance are considered to warrant substantial weight in the Project decision making process. Conditions should be imposed to ensure adverse impacts are strictly controlled and monitored;
- residual impacts of Moderate significance are considered to be of reducing importance to decision-making, however, still warrant careful attention to ensure best available techniques are used to keep adverse impacts to as low as is technically and financially feasible;
- residual impacts of Minor significance should be brought to the attention of the decision-maker but are identified as warranting little if any weight in the decision; and
- negligible residual impacts are those that, after assessment, are found not to be significant to the decision making about the Project.

Step 6 –Environmental and Social Management Plan Framework

The project's Environmental and Social Management Plan (ESMP) consists of the set of mitigation, monitoring, and regulatory measures to be taken during implementation and operation to eliminate adverse environmental. The role of the ESMP is to describe:

- the mitigation measures and environmental and social management procedures/plans
- the monitoring and reporting arrangements;
- the assignment of roles and responsibilities and schedules.

This EMSP is designed as an overriding document in a hierarchy of control plans, and sets out the overarching framework of environmental and social management principles that will be applied to the project. The EMSP contains guiding environmental principles and procedures for communication, reporting, training, monitoring and plan review to which all Total staff, Contractors and Subcontractors are required to comply with throughout all the phases of the seismic survey.

The EMSP should be also be considered as an overall framework document that establishes the terms of reference for all project environmental and social sub-plans that will completed including the following:

- Waste and Discharge Management Plan;
- Oil Spill Contingency and Emergency Plan;
- Environmental and Social Monitoring Plan;
- Stakeholder Engagement Plan.

1.3.3 Study Team

The Environmental Action Plan has been prepared by RINA Consulting S.p.A. (Italy), with the support of ENVECO S.A. (Greece). The study team of this Environmental Action Plan included the scientists of RINA Consulting and ENVECO S.A. presented in Appendix D to this document.

2 LEGAL FRAMEWORK

2.1 REGULATORY FRAMEWORK FOR THE PREPARATION OF THE EAP

The regulatory framework for the preparation of the EAP, includes the following:

- ✓ the Lease Agreement (Law 4525/2018 – G.G. 47A/15.03/2018) between the Hellenic Republic and the Lessee (Total E&P Greece B.V., Hellenic Petroleum and Edison International) for the granting of rights to explore and exploit hydrocarbons in the offshore area Block 2 of the Ionian Sea, and particular the Article 12 with regard to the environmental protection;
- ✓ the Decision of the Ministry of Environment and Energy No. 30373 of the 3rd of July 2017 "*Approval of the Strategic Environmental Assessment Study for the exploration and exploitation of hydrocarbons in eleven marine areas in the Ionian Sea*".

Article 12 of the Lease Agreement stipulates the reference terms and conditions concerning the environmental protection measures to be complied with during the execution of the exploration program.

12.1. All terms in this Article 12 will be considered according to the legislation in force, unless otherwise provided herein.

12.2. The Lessee shall:

(a) conduct all Petroleum Operations in a manner which will assure the protection of environment in accordance with Good Oilfield Practices;

(b) carry out all Petroleum Operations in full compliance with:

(i) the Environmental Laws;

(ii) the Law on Offshore Safety

(iii) the approved Strategic Environmental Assessment (SEA);

(iv) the Terms of Environment (ToE) resulting from the relevant Environmental Impact Assessment (EIA) procedure; and

(v) any additional Environmental Action Plan (EAP), pursuant to this Article and Good Oilfield Practices, while ensuring that such operations are properly monitored;

(c) employ modern and appropriate techniques in accordance with Good Oilfield Practices, for preventing any environmental damage that might be caused by the Petroleum Operations, and for minimizing the environmental impacts of the Petroleum Operations and works within the Contract Area and in adjoining or neighbouring or more distant areas;

(d) properly and timely implement any Laws in force regarding the safety of Hydrocarbons exploration and production activities during the period of Petroleum Operations;

(e) procure that the documentation on environmental compliance in conducting Petroleum Operations, such as SEA, ToE or EAPs and associated documents are made available to its employees and to its contractors and their subcontractors to develop adequate and proper awareness of the measures and methods of environmental protection to be used in conducting Petroleum Operations; and

(f) ensure that any agreement between the Lessee and its contractors and their sub-contractors relating to the Petroleum Operations shall include the terms as set out in this Article 12 and any established measures and methods for the implementation of the Lessee's obligations in relation to the environment under this Agreement.

12.3. The Lessee undertakes for the purposes of this Agreement to take all necessary and adequate steps:

(a) to fully and timely fulfil all requirements of applicable Environmental Laws; and

(b) to prevent environmental damage to the Contract Area and neighbouring or more distant areas being caused by Petroleum Operations.

12.4. If the Lessor has on reasonable grounds reason to believe that any works or installations erected by the Lessee or any operations carried out by the Lessee are endangering or may endanger persons or any property of any other person or are causing pollution or are harming wildlife or the environment to a degree which the Lessor deems unacceptable, the Lessee may take remedial measures within such period as may be determined by the Lessor and may repair any damage to the environment, the costs of such remedial action to be borne by the Lessee. If the Lessor deems it necessary, it may require the Lessee to discontinue Petroleum Operations in whole or in part until the Lessee has taken such remedial measures or has repaired any damage.

12.5. The measures and methods to be applied by the Lessee for purposes of complying with the terms of this Article 12 shall be determined in timely consultation and agreed with the Lessor prior to the commencement of the relevant Petroleum Operations, and whenever there is a significant change in the scope or method of carrying out Petroleum Operations, and the Lessee shall take into account Good Oilfield Practices as well as the relevant requirements of the ToE.

12.6. Pursuant to the above 12.2(a) provision, the Lessee shall prepare and submit to the competent governmental authority, an Environmental Impact Study (EIS) for the relevant Petroleum Operations in respect of which an EIA procedure is required. The EIS shall, as a minimum:

(a) fully comply with the requirements of the EIA legislation in force;

(b) meet the requirements and guidelines set out by SEA;

(c) be prepared by a third party with adequate expertise in the field of environmental studies, which will be appointed by the Lessee to work on its behalf.

12.7. Each project, work, activity or any other part of the Petroleum Operations that is subject to an EIA, shall commence only after the ToE have been approved.

12.8. Any modification, expansion, improvement or modernization of a project, work, activity or any other part of the Petroleum Operations with approved ToE, requires compliance with the relevant provisions of EIA legislation. The same applies for the renewal (time extension) of the ToE decision.

12.9. In case of activities for which an EIA is not mandatory but nevertheless it is reasonably expected that some minor environmental impacts may occur, as in particular for the case of seismic surveys, the ***Lessee shall prepare an EAP****,* ***to determine, assess and mitigate these impacts****, focusing on prevention and minimization thereof in accordance with Good Oilfield Practices.*

12.10. ***The EAP shall be submitted to the Lessor for review*** *and must be complied with by the Lessee.*

12.11. The Lessee shall include in each Annual Work Programme and Budget to be submitted to the Lessor, an environmental report on the work to be undertaken as provided in that document, as well as on the work undertaken in accordance with the preceding Annual Work Programme and Budget.

12.12. Before carrying out any drilling activities, the Lessee shall fully meet the requirements of the applicable legislation for safety, contingency (i.e. oil spill, fire, accident, emissions etc.) and major hazard management plans.

12.13. In the event of any emergency or accident arising from Petroleum Operations affecting the environment, the Lessee shall immediately notify the Lessor, giving details of the incident and immediately implement the relevant contingency plan. In dealing with any emergency or accident affecting the environment, the Lessee shall at all times take such action as is prudent and necessary in accordance with the Environmental Laws and Good Oilfield Practices in the circumstances.

12.14. The Lessee shall not be liable for any environmental condition or damage existing in the Contract Area prior to the commencement of the Lessee's operation therein and nothing in this Agreement shall

be construed to hold the Lessee liable in relation to any such pre-existing condition of damage. For this purpose, a baseline report shall be prepared by the Lessee, to detail the condition of the environmental parameters and resources at the time prior to operation commencement. ***The baseline report shall be submitted for review to the Lessor****. If no objections will rise by the latter within twenty (20) Business Days, the report is deemed accepted.*

In addition, the Approval of the Strategic Environmental Assessment Study for the exploration and exploitation of hydrocarbons in eleven marine areas in the Ionian Sea (including Block 2) provides requirements for the elaboration of an Environmental Action Plan for the proposed Marine Seismic Survey activities. More specifically, requirements relevant to the EAP have been set in chapter B of the Decision.

4. Airgun activities, known as "seismic surveys", which according to the existing legislation are not subject to an environmental licensing obligation, will be carried out under a detailed set of marine environmental protection measures, which will be described in an appropriate Environmental Action Plan (EAP), which should at least meet the requirements of the following paragraph.

The EAP approval which will be mandatory for its implementation and consequently for the initiation of the surveys, will be carried out by the Planning Authority or the Minister with the agreement of the Environmental Permitting Department of the Ministry of Environment and Energy.

5. The Environmental Action Plan of the proposed Marine Seismic Survey will include the following:

5.1. The detailed and documented compliance of the proposed Marine Seismic Survey with all the requirements of the legislation on the environment, including the provisions relating to the protection of species or areas and the avoidance of pollution.

5.2. To minimize the impact of the proposed Marine Seismic Survey to critical components of marine ecology, such as marine mammals (especially cetaceans and seals) and sea turtles (especially Caretta caretta)

5.3. The documentation concerning the prevention of any incident of pollution at sea, including at least the methods for managing solid and liquid waste, accidents and use of chemicals.

5.4. Limiting disruption to existing maritime activities such as fishing.

6. Especially with regard to prevent effects on cetaceans, the measures of the EAP of the Marine Seismic Survey should as a minimum include provisions for the following issues:

6.1. Complete response to commitments and guidance of international agreements which have been signed by Greece, as in particular the ACCOBAMS.

6.2. Gradual increase of acoustic power, in order to be given the opportunity and the time to any neighbouring sensitive to noise species to move temporarily in safe distance.

6.3. Option to use equipment of which the acoustic power is minimal for the purpose used, and in any event not exceed the levels cause injury or behavioural changes (such as those referred to in the relevant international scientific literature), even at short distances from the source of noise.

6.4. Sufficient number of appropriately trained marine mammal observers on board for the visual and passive acoustic observation of marine mammals and interruption of airguns, in case of their approach towards.

6.5. Marine Seismic Survey design in order:

(i) least passing of the seismic lines from areas where underwater ditches exist, thus minimizing the potential impact on deep submersibles cetaceans,

(ii) the density of the grid to be the minimum necessary (or in other words the distance between two adjacent lines to be the maximum possible), minimizing any repeating nuisance to marine mammals of the region,

(iii) to suffice a single passage from each line, making any potential nuisance to species in the area temporary and non-systematic and thus preventing the creation of any permanent changes in marine ecosystems.

6.6. For the selection of the time framework of the survey, it should be taken into account that the winter season is considered preferable because, there is less influence of the mammals during their reproduction activities.

Moreover, chapter C “System for monitoring the significant environmental impacts from the implementation of the program” provide requirements for monitoring.

1. To monitor the significant environmental impacts, an integrated system shall be developed on the basis of the following principles:

1.1. Monitoring shall concern both the condition of the environment in the wider area affected by the works of hydrocarbons exploration and areas of direct impact.

1.2. For the purposes of monitoring, wider area shall mean at least the entire applicable active exploration and exploitation concession area. In this area, physical and chemical properties of key environmental sectors shall be recorded, such as mainly

- *marine waters, including their physical and chemical properties as well as the dynamics of currents,*
- *local meteorology, particularly to the extent it affects water dynamics,*
- *the surface layer of the seabed, particularly regarding its role in the health of marine ecosystems.*

1.3. In the immediate area, monitoring should cover all the above and additionally include magnitude and indicators related to

- *the implementation of environmental conditions to be approved for each individual project,*
- *compliance with safety procedures related to the prevention of accidents with environmental impact.*

1.4. The spatial and temporal density of the recordings, and the means used to make them (e.g. permanent or mobile stations, suitable vessels etc.) must be selected according to the scale of the phenomena to be monitored, with appropriate variations between the immediate and wider area.

1.5. In the wider area, to understand and correlate the parameters, integrated computational simulations with analytical forecasting potential shall be developed, using existing initiatives such as the "Poseidon" system (www.poseidon.hcmr.gr). Measurements and recordings in the wider area should be designed and conducted in a manner that allows the validation of computational results.

1.6. The collection and processing of data for the monitoring of environmental impacts should be conducted annually. During each year, data shall be collected on a more regular basis, to allow trending with a shorter temporal development.

1.7. Environmental indicators will be used as key monitoring parameters which should represent, in a comprehensive way, important aspects of the developments with regards to the quality of the environment.

1.8. Once the production prospects have been finalized, a seismicity activity monitoring system should be established, using appropriate technology and the existing seismographic network. This system should actively contribute to the safety of the production facilities, by monitoring the temporal evolution of the local micro-seismicity and macro-seismicity, as well as of other data related to the deformation of the ground. The technical details of the above system and the way in which it will comply with the above guidelines and safety requirements pursuant to L. 4409/2016 will be a distinct part of the relevant Environmental Impact Assessment (EIA).

All the above-mentioned terms and requirements have been taken into account in order to establish the framework for the elaboration of the Environmental Action Plan.

2.2 REGULATORY FRAMEWORK FOR THE PROTECTION OF MARINE ENVIRONMENT AND CETACEANS

In the present Paragraph 2.2 is described the regulatory framework for the protection of marine environment and cetaceans, which has been summarized in table below.

Table 2.1: Regulatory Framework for the Protection of Marine Environment and Cetaceans

Name	Category	Geographical extent of application	Date of creation and last update
Marine Strategy Framework Directive (MSFD)	EU Directive	EU's marine environment	Validated in 2008 and updated in 2017
Barcelona Convention for the Protection of Marine Environment and Coastal Areas of the Mediterranean	International Agreement	Mediterranean Sea	Validated in 1976 and amended in 1995
Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP)	International Action Plan	Mediterranean Sea	Adopted in 1991
Convention on the Migratory Species of Wild Animals (CMS)	International Agreement	Worldwide	Signed in 1979
Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the Contiguous Atlantic Area (ACCOBAMS)	International Agreement	Black sea, Mediterranean Sea and contiguous Atlantic area	Signed in 1996
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	International Agreement	Worldwide	Signed in 1973
Convention of the Conservation of Wildlife and Natural Habitats of Europe (Bern Convention)	International Agreement	Europe and some African countries	Signed in 1979
Convention on Biological Diversity (CBD)	International Agreement	Worldwide	Signed in 1992
United Nations Convention on the Law of the Sea (UNCLOS)	International Agreement	World's oceans	Signed in 1982
Directive 92/43/EEC (Habitats Directive)	EU Directive	EU	Signed in 1992 and updated in 2013
Council Regulation No. 1967/2006 (Mediterranean Regulation)	EU Regulation	EU's Mediterranean Sea	Signed in 2006 and updated in 2015
Legislative Decree (LD) 420/70 (Fishing Code)	Greek legislation	Greek waters	Signed in 1970 and updated in 2019 (by Law 4646/2019)
Presidential Decree (PD) 55/1998 (Protection of marine environment)	Greek legislation	Greek marine environment	Signed in 1998 and updated (last) in 2019 (by PD 108/2019)
PD 67/1981 (Protection of native flora and fauna)	Greek legislation	Greece	Signed in 1981
Law 1335/14.03.1983 (Ratification of Bern Convention)	Greek legislation	Greece	Signed in 1983
Law 1337/14.03.1983 (Protection of national coastal zone)	Greek legislation	Greek's coastal zone	Signed in 1983 and updated (last) in 2001 (by Law 297/2001)
Laws 855/78 and 1634/18.07.1986 (Ratification of Barcelona Convention and all its Protocols)	Greek legislation	Greek's Mediterranean Sea	Signed in 1978 and 1986
Law 3022/2002 (Ratification of the amendments to the Barcelona Convention and to the Protocol for the Protection of the Mediterranean Sea against pollution)	Greek legislation	Greek's Mediterranean Sea	Signed in 2002

Name	Category	Geographical extent of application	Date of creation and last update
Law 1650/16.10.1986 (Protection of the environment)	Greek legislation	Greece	Signed in 1986 and updated (last) in 2019 (by Law 4610/2019)
Law 2055/30.06.1992 (Ratification of CITES Convention and issued decrees)	Greek legislation	Greece	Signed in 1992
Law 2204/15.04.1994 (Ratification of the CBD Convention)	Greek legislation	Greece	Signed in 1994
Joint Ministerial Decision (JMD) 33318/3028/98 (Incorporates Habitats Directive)	Greek legislation	Greece	Signed in 1998 and updated in 2008 (by JMD 14849/853/E103/4-4-2008)
Law 3937/2011 - GG 60/A/31.03.2011 (Conservation of Biodiversity)	Greek legislation	Greece	Signed in 2011 and updated in 2018
Laws 2742/1999 and 4109/2013 (Protected Areas and Endangered Species)	Greek legislation	Greece	Signed in 1999 and 2013 and updated respectively in 2018 (by Law 4519) and 2019 (by Law 4622)
Law 2719/1999 (Ratification of the CMS Convention)	Greek legislation	Greece	Signed in 1999
Ministerial Decision (MD) 336107 / 25.2.2000 (Wild Animals)	Greek legislation	Greece	Signed in 2000
Law 61/2006 (Offshore Ecological Protection Zones)	Italian legislation	Italian's Mediterranean Sea	Signed in 2006
Law 30/1979 and Law 175/1999 (Ratification and implementation of the Barcelona Convention and Protocols)	Italian legislation	Italian's Mediterranean Sea	Signed in 1979 and 1999
Law 27/2005 (Ratification and execution of ACCOBAMS)	Italian legislation	Italian's Mediterranean Sea	Signed in 2005
Legislative Decree 190/2010 (MSFD Directive)	Italian legislation	Italian's marine environment	Signed in 2010
Law 394/1991 (Protected areas)	Italian legislation	Italy	Signed in 1991
Law 979/1982 (Protection of the sea)	Italian legislation	Italian's Mediterranean Sea	Signed in 1982
Law 503/1981 (Ratification and execution of the Bern Convention)	Italian legislation	Italy	Signed in 1981
Law 42/1983 (Ratification and execution of the CMS Convention)	Italian legislation	Italy	Signed in 1983
Decrees of the President of the Republic 357/1997 and 120/2003 (Implementation of Habitats Directive)	Italian legislation	Italy	Signed in 1997 and 2003

2.2.1 Regulations and Conventions for the Protection of the Marine Environment

The main Regulations and Conventions of interest are:

- ✓ the Marine Strategy Framework Directive (MSFD), providing a framework for community actions in the field of marine environmental policies, which have been validated by the European Parliament Directive 2008-56/EC (Council of 17th of June 2008 and updated in May 2017) and ratified by Greece with the Law 3983/2011 (GG 144/A/17-6-2011);
- ✓ the Barcelona Convention for the Protection of the Marine Environment and Coastal Areas of the Mediterranean, which was originally validated in 1976 and then amended in 1995 by the following States: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, the European Community, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey. The Barcelona Convention has been ratified by Greece with Laws 855/78, 1634/18.07.1986 and Law 3022/2002.

The European Union and the countries surrounding the Mediterranean are the collaborating parties to the **Barcelona Convention**, which is implemented through the Mediterranean Action Plan and shapes policies and strategies for the protection of biodiversity and the marine and coastal environment.

Recognizing the importance of climate change for the Mediterranean region, the states of the Barcelona Convention signed in 2008 the Protocol on Integrated Coastal Zone Management in the Mediterranean, prioritizing adaptation to climate change. The Marrakesh Declaration, adopted by the Barcelona Convention in November 2009, highlights the need for immediate action to address the serious impacts of climate change on ecosystems and resources.

2.2.2 International Agreements For the Protection of the Cetaceans

The conservation of marine mammals is a priority for many international environmental agreements ratified by Greece. The most important include:

- ✓ the Mediterranean Action Plan of the United Nations Environment Programme (UNEP MAP).

The **UNEP MAP**, headquartered in Athens, which also operates as the Secretariat of the Barcelona Convention (the "Convention for the Protection of the Marine Environment and the Coastal areas of the Mediterranean", Barcelona, 1976 and 1995). The Barcelona Convention supplemented by a number of specific Protocols, also including the "Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean", which concerns the protection of cetaceans. the Contracting Parties to the Barcelona Convention adopted in 1991 an "Action Plan for the conservation of Mediterranean cetaceans" (UNEP/MAP 1991), highlighting priorities for protection of cetaceans, including prevention and elimination of pollution, protection of feeding, breeding and lactation areas, research and data collection and dissemination thereof on the biology, behaviour, territory and habitats of cetaceans and educational actions targeting the general public and fishermen.

- ✓ the Convention on the Conservation of Migratory Species of Wild Animals, also known as CMS or Bonn Convention (Bonn, 1979).

Annex I of the **CMS Convention** lists strictly protected migratory species classified as endangered throughout all or a significant part of their territory and includes fin whales, sperm whales and common dolphins. The same species as well as striped dolphins are also included in Annex II listing migratory species with a non-favourable conservation status, which require international agreements for their protection and management, and species with a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.

- ✓ the Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the Contiguous Atlantic Area, also known as ACCOBAMS (Monaco, 1996).

ACCOBAMS is a special agreement in the framework of the Bonn Convention, its "parent convention", in order to protect all cetaceans present in the Agreement area, including the recent resolutions of November 2019, one of which (Resolution 7.13 – Anthropogenic Noise) has updated, within the Annexe 2 of the Resolution, the "*Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area*".

- ✓ the Convention on International Trade in Endangered Species of Wild Fauna and Flora, known as CITES or Washington Convention (Washington, 1973).

CITES Convention prohibits the trade of endangered species, listed in Annex I (including, as regards cetaceans regularly present in Greek waters, fin and sperm whales) and regulates the trade of other species listed in Annex II (all other cetacean species).

- ✓ the Convention on the Conservation of Wildlife and Natural Habitats of Europe, also known as the Bern Convention (Bern, 1979).

Bern Convention in Annex I (strictly protected fauna species), includes all cetaceans regularly present in the Mediterranean.

- ✓ the Convention on Biological Diversity, known as CBD (Rio de Janeiro, 1992).

CBD Convention, although not specifically referring to cetaceans, urges Contracting Parties to develop national programs to preserve their natural heritage and biological diversity.

- ✓ the United Nations Convention on the Law of the Sea, known as UNCLOS (Montego Bay, 1982).

UNCLOS Convention foresees specific provisions for marine mammals (Art. 65: "States shall cooperate to conserve marine mammals...").

Furthermore, special reference is made to the international organization IUCN, as a provider of expertise in matters related to the conservation of natural habitats and species. The actions of the IUCN are related in various ways to the conservation of cetaceans in Greece as it maintains the authoritative Red List of species threatened with extinction, in which Mediterranean cetaceans are included in various risk categories.

2.2.3 European Legislation for the Protection of the Cetaceans

The following three important documents of the European Community legislation are related to the preservation of cetaceans:

- ✓ Council Directive 92/43/EEC of 21 May 1992 (updated in July 2013) on the conservation of natural habitats and of wild fauna and flora. Also known as the "Habitats Directive";

The **Habitats Directive** sets the protection of species and habitats, while the Marine Strategy Directive requires all Member States to adopt a strategy for marine protection, which shall include the protection of species and habitats. Furthermore, the MSFD contributes to the consistency between different political planning of the Member States, introducing an action plan with assessment of the present environmental condition and identification of environmental targets, establishment and implementation of a monitoring program, development of a series of measures and implementation, the latest by 2016.

- ✓ Council Regulation (EC) No 1967/2006 of 21 December 2006 (updated in May 2015) concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea. Also known as "Mediterranean Regulation";

The **Mediterranean Regulation** (2006) effectively adjusts the Common Fisheries Policy of the European Council (EC) to the Mediterranean circumstances, specifying necessary measures for the sustainable exploitation of fishery resources. It aims at the sustainability of fishing, setting out the specific species and habitats in need of

protection, specifying restrictions on fishing gear (technical measures, minimum distance from the coast and a minimum depth) and ensuring the definition of fisheries protected areas and the adoption of management plans in the territorial and community waters.

- ✓ Directive 2008/56/EC (updated in June 2017) of the European Parliament and of the Council of 17 June 2008, known as the "Framework Directive on Marine Strategy".

The **Marine Strategy Framework Directive** (MSFD) (2008) addresses the problem arising from the pressure exercised on natural marine resources and the demand for marine ecosystem services, which are admittedly often excessively increased in Europe, and the urgent need to reduce the impact of the Community on marine environment.

To achieve this, the Directive establishes a framework within which each Member State shall take the necessary measures to achieve or preserve a favourable conservation status of the marine environment, the latest by 2020. In particular, the Directive recognizes the importance of the establishment of Marine Protected Areas (MPAs) to achieve favourable conservation status, including areas that have already been designated or are to be designated as such, in the framework of the Habitats Directive, and of international or regional agreements to which European Community Member States are subject to. The Directive requires each Member State to develop a strategy on its marine environment, culminating in the execution of a series of measures designed to achieve or preserve favourable conservation status. The Directive sets out the procedure to be followed by each Member State for developing its own maritime strategy, which shall also include the preparation, the constitution of environmental targets, the establishment of monitoring programs and the implementation of a series of measures that will include both consistent and representative MPA networks, which should adequately cover the diversity of the ecosystems involved. In particular, the Directive specifies that the obligation of Member States to establish Natura 2000 areas will decisively contribute in the process.

The Marine Strategy Framework Directive (MSDF) is designed to complement the Habitats Directive.

2.2.4 Greek National Legislation

Overall, cetaceans in Greece are legally protected, both by the adoption of National legislation, and by ratification of International conventions, as summarized in the following table highlighting in bold the most significant (i.e. ratifications of international Conventions and European Directives).

Table 2.2: Greek National Legislation for the Protection of Marine Environment and Cetaceans

Legal reference	Title
Legislative Decree (LD) 420/70	Fishing Code: for fisheries, aiming at the conservation of fisheries by prohibiting illegal fishing activities (updated by Law 4646/2019 – G.G. 201/A/2019)
Presidential Decree (PD) 55/1998	Protection of the marine environment. This P.D. has been updated by: • P.D. 108/2019, (G.G.196/A` 9.12.2019) • Law 3497/2006, (G.G. 219/A/13.10.2006) • Law 3394/2005, (G.G. 243/A/4.10.2005) • Law 2881/2001, (G.G. 16/A/6.2.2001) • P.D. 163/2001, (G.G. 146/A/3.7.2001)
PD 67/1981	On the protection of native Flora and Fauna and determination of a coordination and Control process of the Research thereof (provides protection status to endangered species, including cetaceans, and prohibits their capture or killing)
Law 1335/14.03.1983	Ratification of the International Convention for the Conservation of European Wildlife and Natural Habitats (Bern Convention)
Law 1337/14.03.1983	Specific arrangements for the protection of the national coastal zone This Law has been updated by:

Legal reference	Title
	• Law 2971/2001 • P.D. 236/1984
Laws 855/78 and 1634/18.07.1986	Ratification of the Barcelona Convention and all its Protocols, for the protection of the Mediterranean Sea against pollution"
Law 3022/2002	Ratification of the amendments to the Barcelona Convention of 1976 and the amendments to the 1980 Protocol for the protection of the Mediterranean Sea against pollution from land-based sources
Law 1650/16.10.1986	Legal framework setting out the overall institutional and legal structure for the protection of the environment in Greece This Law has been updated by: • Law 4610/2019, (G.G. 70/A/7.5.2019) • Law 4492/2017, (G.G. 156/A/18.10.2017) • Law 4411/2016, (G.G. 142/A/3.8.2016) • Law 4409/2016, (G.G. 136/A/28.7.2016 • Law 4315/2014, (G.G. 269/A/29.12.2014) • Law 4042/2012, (G.G. 24/A/13.2.2012) • Law 4014/2011, (G.G. 209/A/21.9.2011) • Law 3536/2007, (G.G. 42/A/23.2.2007) • Law 3164/2003, (G.G. 176/A/2.7.2003) • Law 3010/2002, (G.G. 91/A/25.4.2002) • Law 2742/1999, (G.G. 207/A/7.10.1999)
Law 2055/30.06.1992	Ratification of the CITES Convention and the decrees issued for its implementation
Law 2204/15.04.1994	Ratification of the Convention on Biodiversity (CBD)
Joint Ministerial Decision (JMD) 33318/3028/98	Incorporates the Directive 92/43 of the European Council (EC) on Habitats Updated with JMD 14849/853/E103/4-4-2008 (G.G. 645/B/11.04.2008)
Law 3937/2011 - GG 60/A/31.03.2011	Conservation of Biodiversity and other provisions (updated by the Law 458/2018)
Laws 2742/1999 and 4109/2013	Regulates all matters relating to the establishment of management bodies for Protected Areas and/or endangered species Law 2742/1999 has been updated by: • Law 4519 (G.G. 25/A/20.2.2018) • Law 4030/2011, (G.G. 249/A/25.11.2011) Law 4109/2013 has been updated by Law 4622/2019, (G.G. 133/A/07.08.2019)
Law 2719/1999	Ratification of the International Convention for the Conservation of Migratory Species of wild animals" [Convention on Migratory Species (CMS) or Bonn Convention]
Ministerial Decision (MD) 336107 / 25.2.2000	Provides specific criteria, protocols and procedures for the establishment and operation of health care and rehabilitation facilities for wild animals

2.2.5 Italian National Legislation

Given the proximity to the Italian continental shelf a summary of main National legislation and ratification of international conventions and Directives is reported in the following table.

Table 2.3: Italian National Regulation for the Protection of Marine Environment and Cetaceans

Legal Reference	Title
Law 61/2006	"Establishment of Ecological Protection Zones beyond the external boundary of the territorial sea"

Legal Reference	Title
Law 30/1979 and Law 175/1999	"Ratification and implementation of the Final Act of the Plenipotentiary Conference on the Convention for the Protection of the Mediterranean Sea against Pollution, and relevant Protocols, held in Barcelona on 9 and 10 June 1995"
Law 27/2005	"Ratification and execution of the Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the adjacent Atlantic area, with Annexes and final act, done at Monaco on 24 November 1996"
Legislative Decree 190/2010	"Marine Environment – Community Action Framework" (MSFD – Directive 2008/56/CE)
Law 394/1991	"Framework Law on protected Areas"
Law 979/1982	"Provisions for protection of the sea"
Law 503/1981	Ratification and execution of the Convention for the Conservation of European Wildlife and Natural Habitats, and related annexes, that has been adopted in Bern on the 19th of September 1979"
Law 42/1983	Ratification and execution of Convention for the Conservation of Migratory Species of wild animals and related annexes, that has been adopted in Bonn on the 23rd of June 1979" [Convention on Migratory Species (CMS) or Bonn Convention]
Decrees of the President of the Republic 357/1997 and 120/2003	"Implementation of Directive 92/43 / EEC on the conservation of natural and semi natural habitats and of wild fauna and flora" and "Modifications and additions to D.P.R. 357/97 on the implementation of Directive 92/43 / EEC on the conservation of natural and semi natural habitats and of wild fauna and flora"

2.3 PROJECT OWNER POLICIES AND STANDARDS

The applicable Total Policies and Standards include:

- ✓ SAFETY HEALTH ENVIRONMENT QUALITY CHARTER;
- ✓ GS EP ENV 120 - Environmental impact assessment in E&P activities;
- ✓ GS EP SDV 102 - Social Impact Assessment in E&P activities.

3 PROJECT DESCRIPTION

3.1 AREA OF INTEREST AND PROPOSED SEISMIC ACQUISITION PROGRAM

The Block 2 has a surface of 2,422 km^2 and is located 20 km West of the Island of Corfu. The North-Eastern part of Block 2 lies close to the Diapontia Islands (approx. 7-10 km).

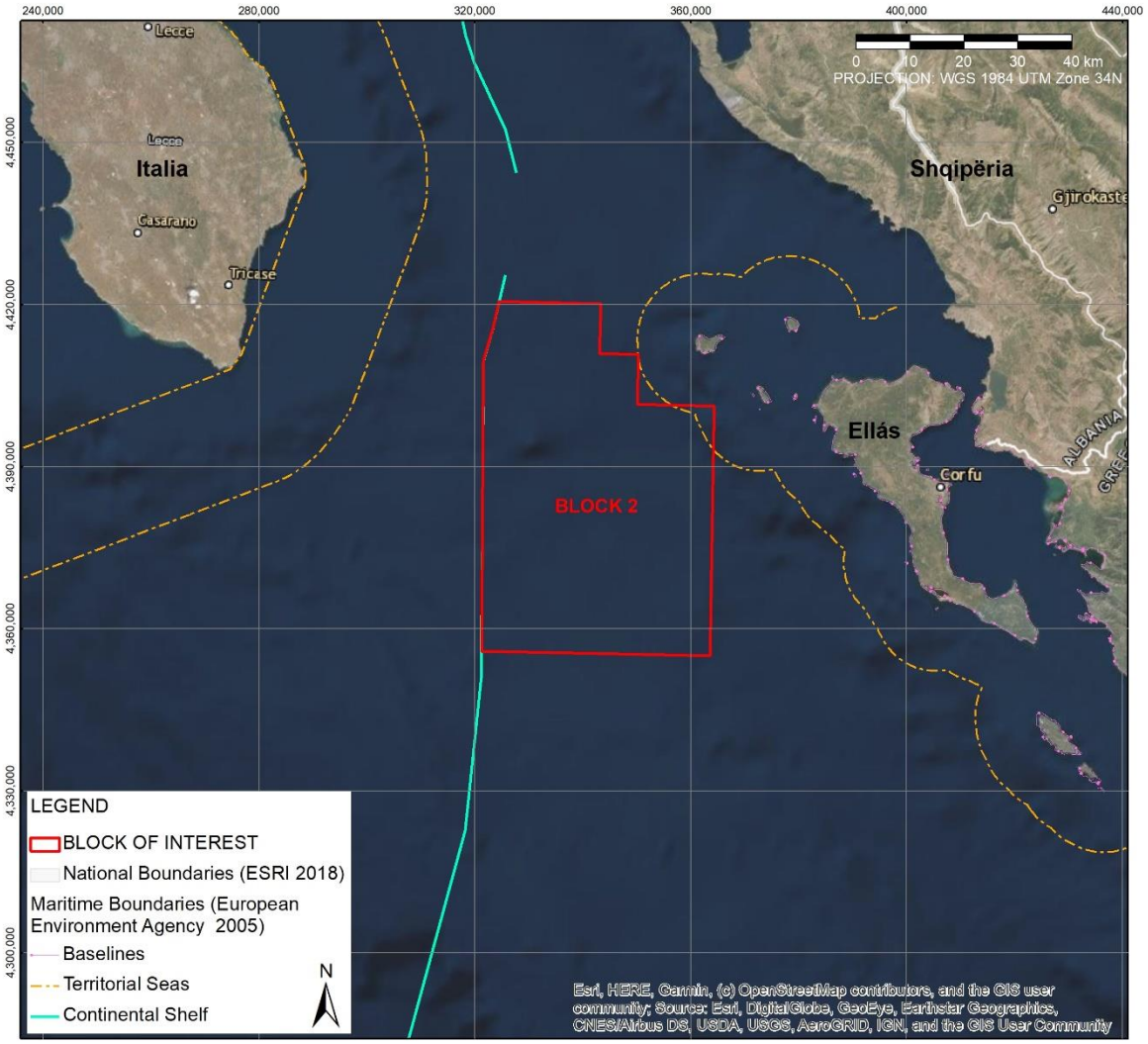

Figure 3.1: Block 2 (Full fold coverage area)

The Coordinates of the vertices of Block 2 are summarized in the following Table 3.1.

Table 3.1: Coordinates of Vertices of Block 2 (WGS 84)

Vertex	Longitude	Latitude
A	18° 55' 0" E	39° 55' 0" N

Vertex	Longitude	Latitude
B	19° 10' 0" E	39° 55' 0" N
C	19° 10' 0" E	39° 50' 0" N
D	19° 15' 0" E	39° 50' 0" N
E	19° 15' 0" E	39° 45' 0" N
F	19° 25' 0" E	39° 45' 0" N
G	19° 25' 0" E	39° 20' 0" N
H	18° 55' 0" E	39° 20" 0" N

As indicated in the "Notice from the Government of the Hellenic Republic concerning Directive 94/22/EC of the European Parliament and of the Council on the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons" (2014/C 400/03), the external boundaries of the Block 2 are delimited according to the existing bilateral agreements of delineation (i.e. the relevant median line agreed between the Hellenic Republic and the Italian Republic, with an Agreement signed in Athens on May 24, 1977).

The Project Owner intends to carry out a Seismic Acquisition Survey to accurately define the potential prospective hydrocarbon targets for exploration drilling over the entire surface of the Block 2 area ("fullfold" coverage area). This can be obtained by carrying out either 2D or 3D survey, or a combination of both 2D and 3D.

In case of 2D seismic survey, the anticipated overall length of acquisition lines is 1,810 km full fold design (2 km x 2 km grid); in case of 3D seismic survey, the anticipated overall acquisition area would be 1,820 km^2.

A detailed planning of the sail lines is expected prior to the carrying out of the activity. In this phase the actual typology (2D/3D) will be finalized. Specific acquisition parameters such as energy source effort and receiver station intervals, together with the data recording time are also defined during the planning stage.

3.2 AIMS AND OBJECTIVES OF THE PROPOSED SEISMIC ACQUISITION

The purpose of the seismic acquisition survey in Block 2 is to better define subsurface geology and more accurately define potential prospective petroleum targets for exploration drilling.

PGS -Petroleum Geo-Services acquired in 2013 a non-exclusive 2D survey, offshore western Greece. In particular, 3,800 km of 2D seismic lines were acquired in North Ionian Sea area, of which 486 km within the Block 2 area.

The North Ionian Sea area is dominated by the most external zones of the Hellenic fold-and- thrust belt and its foreland the Apulia platform. The Hellenides belong to the Alpine orogenic system, which comprises the Hellenides in Greece, the Dinarides – Albanides in the Eastern Adriatic and the Apennines in Italy. In the Adriatic area, the system consists of intensively deformed thrust sheets verging towards the stable Adriatic or Apulia foreland.

Natural occurring hydrocarbons, such as crude oil or natural gas, are trapped by overlying rock formations with lower permeability that act as a barrier to their migration upward and allow formation of an accumulation (reservoir).

The generation of an appropriate geological and tectonic model is essential, not only for the identification of the possible geological structure with low permeability ("trap") that act as a barrier to migration of Hydrocarbons upward and allow formation of an accumulation within an underlying geological formation ("reservoir") but it is quite important for understanding the expected areal extent of the source rock where hydrocarbons are originated, the quantity of the produced hydrocarbons and the maturity and the migration patterns to the reservoir.

The proposed acquisition activities will provide data to build a large scale, accurate, structural model integrating the surface geological elements of areas surrounding the Block 2, allowing for identification of geological structures to be possibly surveyed with the exploration drilling in a future phase.

3.3 DESCRIPTION OF THE OFFSHORE SEISMIC SURVEY

3.3.1 General Aspects

Reflection seismology (or seismic reflection) is a technique of exploration geophysics that uses the principles of seismology to investigate the properties of the earth's subsurface by means of reflected seismic waves (so called since they use frequencies similar to those originated from seismic events).

Marine seismic surveys carried out in the oil & gas offshore exploration sector, in particular, are finalized to characterize the geological structures of the subsoil under the seabed and to identify areas potentially containing deposits of naturally hydrocarbons (natural gas, oil). Other common applications of seismic surveys are in connection with the development of oil & gas reserves to map and monitor known hydrocarbon bearing formations.

In marine seismic surveys, sound waves are mechanically generated by energy sources towed by a ship and directed to earth's crust. These waves, travelling through the different geological formations of the subsoil are reflected back to the surface depending on the geological nature of each layer, and then acquired by a receiver system.

Data are recorded on board and sent to specialized laboratories for processing into visual images of the subsurface of the surveyed area through dedicated software. Interpretation of the images is therefore carried out by geologists in order to identify any potential reservoir.

The concept of the marine seismic survey is shown in the following Figure 3.2.

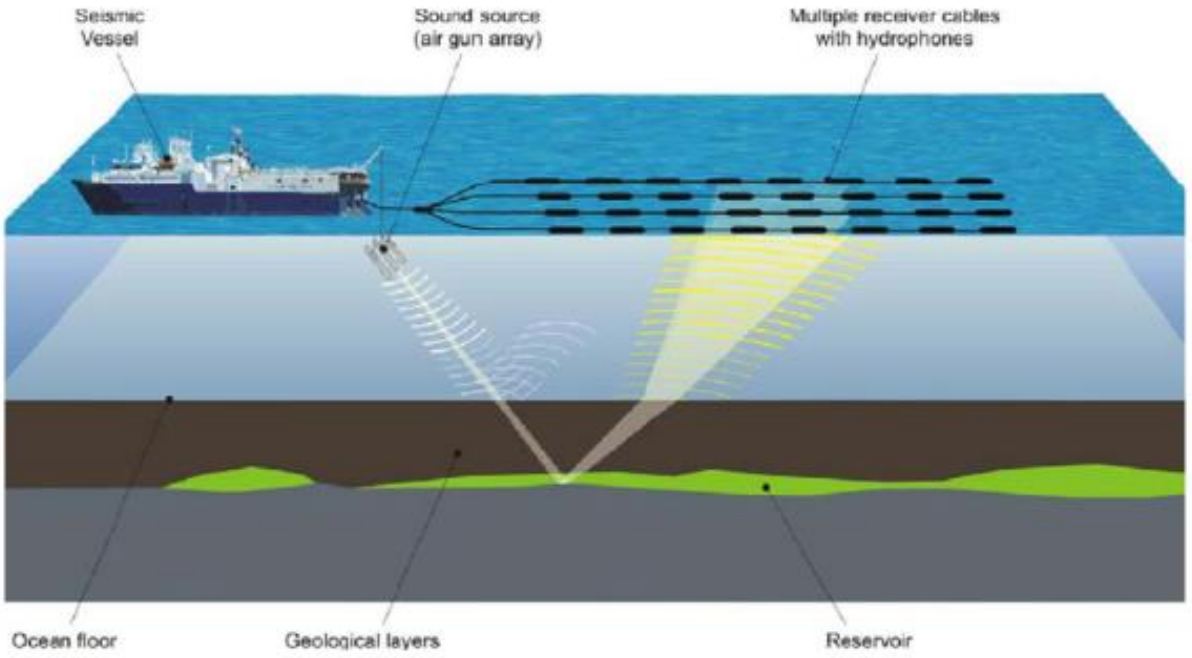

Figure 3.2: Concept of Marine Seismic Survey

Offshore seismic surveys are carried out through a configuration of energy sources and receiving sensors deployed over a given marine area, depending on the acquisition targets. Generally surveys may differ on the basis of:

- ✓ the type of source;
- ✓ the geometry of the receiver system;
- ✓ the density of measurement over the survey area;
- ✓ the type of sensor.

Sound waves can be generated by different artificial sources. The following source typologies are currently used in the oil & gas sector:

- ✓ water gun, which produces a seismic pulse by the implosion of a cavity created behind a jet of high pressure water expelled from the gun;
- ✓ airgun, which produces a seismic pulse by compressed air passing through a cavity of a piston connecting two chambers and instantly released into the water;
- ✓ marine vibroseis, which generates pre-set waves through vibrating metallic disks;
- ✓ sparker or boomer, which generates a high frequency acoustic signal through a copper coiled metallic plate activated by an electric pulse.

Airgun is however the most used technology worldwide and the most appropriate for the proposed Seismic Survey.

The receiver system is composed by a cable (commonly called streamer) containing a series of sensors. Depending on the target of the operations, the receiver system can be:

1. towed by a dedicated vessel;
2. placed on the seabed;
3. buried below the seabed;
4. placed in the well hole.

The following Figure 3.3 shows the abovementioned typical geometries of the receiver system.

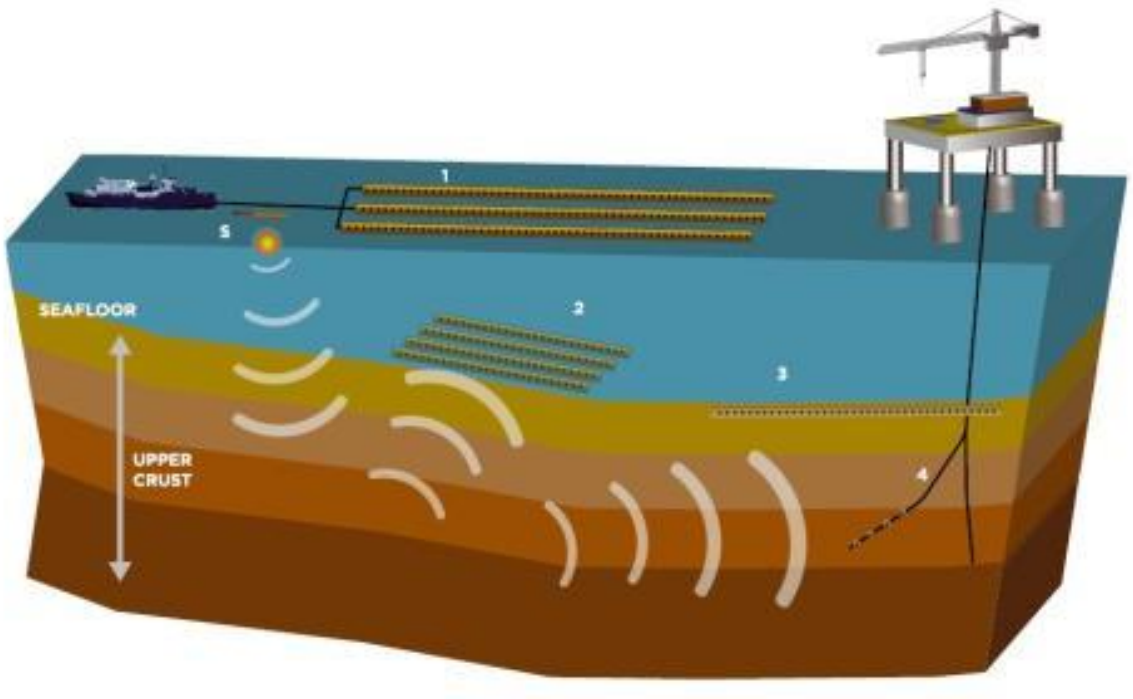

Figure 3.3: Geometry of the Receiver System (OGP, 2011)

Seismic surveys may also be differentiated by the density of the measurements (i.e. spacing of acquisition lines) over the survey area:

- ✓ 2D survey, to acquire a single profile of data;
- ✓ 3D survey, to obtain a three-dimensional picture of the subsoil by acquiring more than one 2D profile of data simultaneously;
- ✓ 4D survey (also called “time lapse” survey) with surveys repeatedly carried out over the same area.

Simplistically, 3D survey is the acquisition of many 2D lines closely spaced over the survey area. In general, 4D data density per unit area is higher than 3D, which in turn is higher than 2D.

Typical layout of 2D and 3D survey geometries is shown in following Figure 3.4.

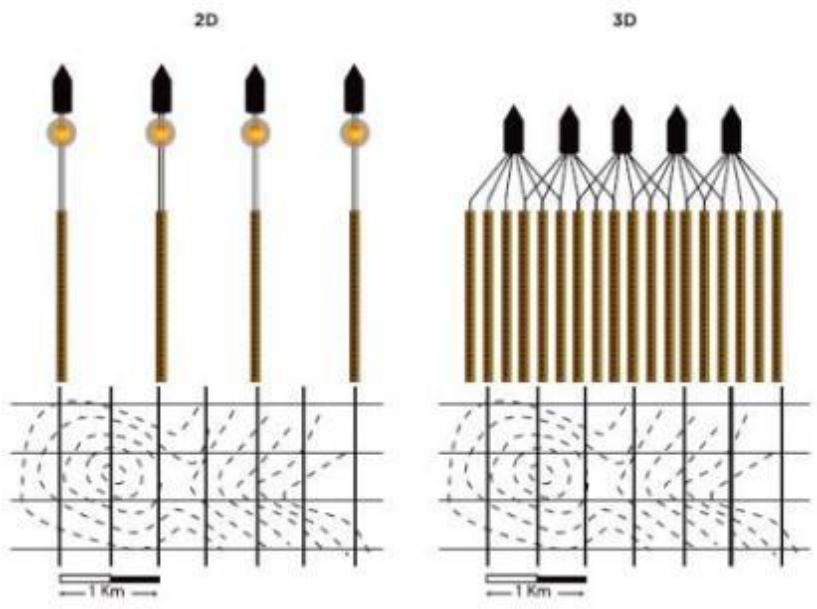

Figure 3.4: Typical 2D and 3D Survey Lines Spacing (OGP, 2011)

Regarding the type of sensor, marine surveys are usually carried out with hydrophones that detect the pressure fluctuation in the water caused by the reflected sound waves.

3.3.2 Proposed Technology and Equipment

3.3.2.1 Survey Technology

The survey will be carried out by means of towed energy source and receiver system.

The proposed equipment includes:

- ✓ arrays of airguns as energy sources;
- ✓ a system of streamers as receiving system;
- ✓ a seismic vessel.

A seismic survey aims to provide accurate data over a specific area (“fullfold” coverage area) to define the potential presence of geological targets.

Prior to the survey, careful planning is undertaken in order to ensure that the survey area is precisely defined and that the subsequent phases (acquisition, processing and interpretation of data) are correctly carried out.

The result of detailed planning is a map defining the survey boundaries and the direction of the survey lines together with the vessel manoeuvring routes. An example of marine seismic survey lines is shown in the Figure 3.5 below.

For 2D survey, one source and one streamer are typically used, with the vessel sailing along the planned lines, based on the expected data resolution. For 3D surveys, the sail line spacing depends on the number of streamers deployed and their cross-line separation. By using more than one source and more streamers with the same seismic vessel, the acquisition of many closely spaced 2D lines, typically 25-75 meters, can be achieved by a single sail line.

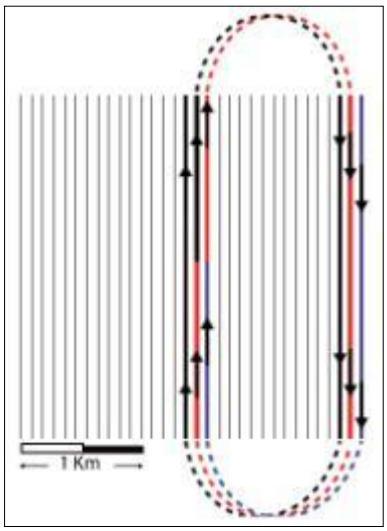

Figure 3.5: Example of Survey Lines design (OGP, 2011)

3.3.2.2 Energy Source (Airgun)

Airguns are the primary energy sources currently used in offshore seismic surveys.

The airgun is a cylindrical device which includes two high pressure air chambers sealed, in its “ready to operate” state, by a triggering piston and a firing piston, mounted on a common shank forming a shuttle.

High pressure air, typically at 2,000 – 2,500 psi, is supplied to the return chamber from the air compressor located on board the seismic vessel through a dedicated air hose. The air flows into the main chamber through a small orifice in the shank of the shuttle. The airgun is sealed because the area of the triggering piston is larger than the area of the firing piston, resulting in a net holding force.

The airgun is activated by sending an electrical pulse to the solenoid valve which opens, allowing high pressure air to flow to the left side of the triggering piston, into the triggering chamber. This forces the triggering piston to move away from its rest position and so the firing piston, physically connected to the triggering piston by the shuttle. The high-pressure air in the main chamber is rapidly (few milliseconds) discharged into the water through the ports, forming an air bubble.

The air bubble released by the airgun oscillates, causing elastic waves (soundwaves) to propagate through water. The period and characteristics of the oscillation depend on the operating pressure, the depth of operation, the temperature and the volume of air.

Once the bubble is released, the shuttle is forced back to its original position by the high-pressure air in the control chamber, so that once the main chamber is fully charged with high pressure air, the source can be reactivated.

The following Figure 3.6 represents the airgun operations in armed and fire states.

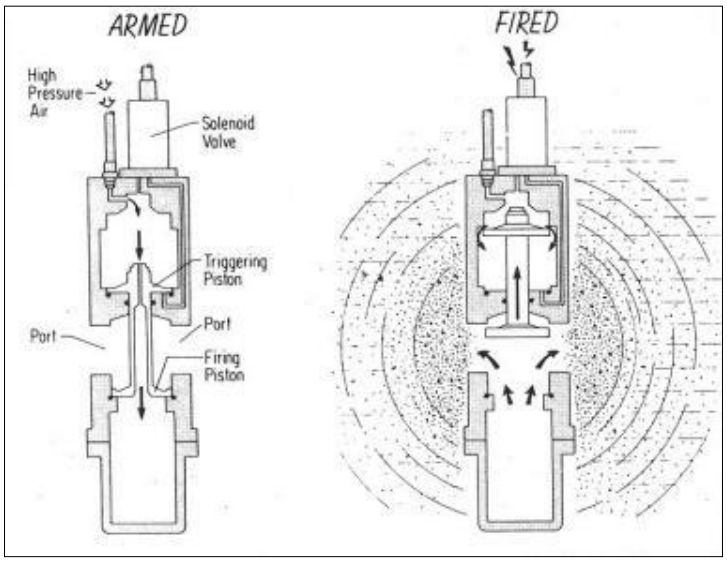

Figure 3.6: Airgun Operations (www.usgs.gov)

The following Figure 3.7 shows typical airgun used for seismic exploration activities (single and cluster).

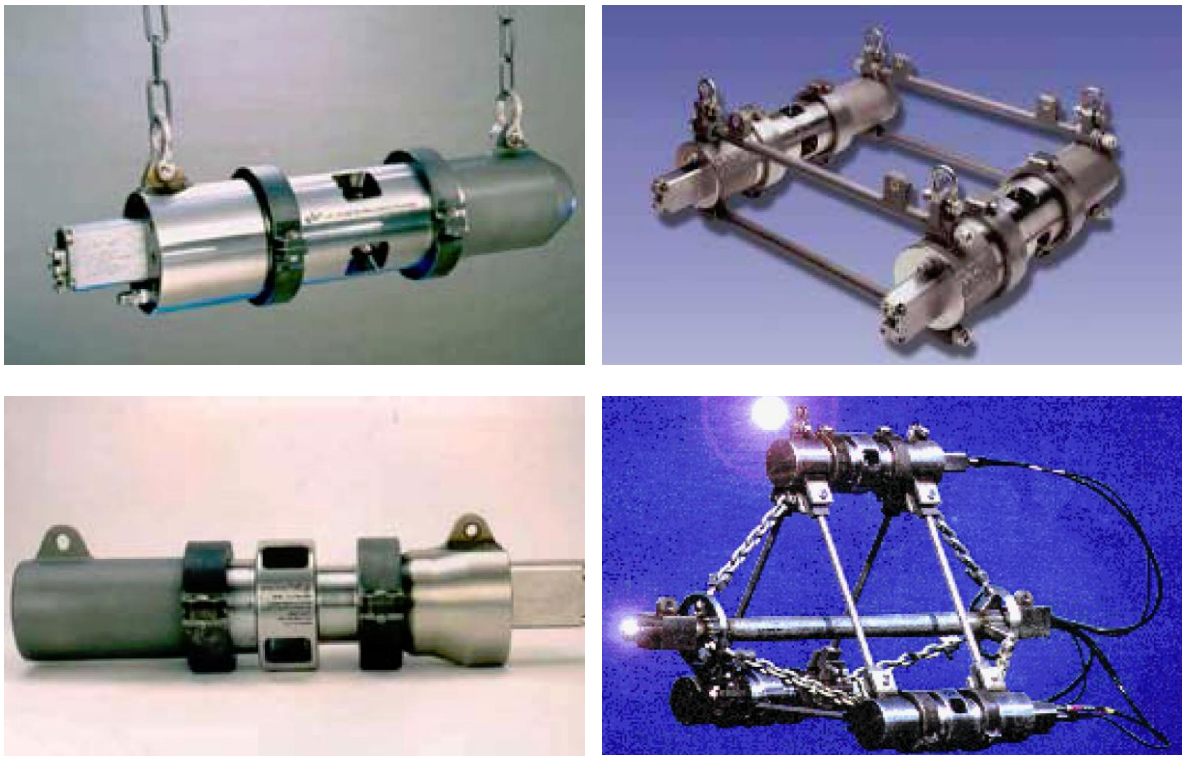

Figure 3.7: Example of Airgun (www.bolt-technology.com)

The operating volume of a single airgun in the offshore oil & gas industry is usually 30 – 800 in^3 (approx. 500 – 13,000 cm^3 or 0.5 – 13 litres). The total volume of a single array, given by the sum of each airgun volume, is usually 3,000 – 8,000 in^3 (0.05 – 0.13 m^3 or 50 – 130 litres). The total requested energy in terms of total volume is calculated depending on the objectives of the survey.

Based on the survey to be carried out and therefore on the sound wave to be generated in order to reach the identified geological target, airguns are arranged in series (arrays) and deployed on one or more lines following a planned geometry. Airguns can also be arranged in pairs/clusters within the same array. Each array can be composed of 10 or more airguns and subdivided into multiple rows of airgun (subarrays).

Airguns arrays are arranged with a tube on the top providing floatation, single airguns are hung below the sea level at the desired depth (typically 5 – 10 meters). Arrays are also provided with positioning system (GPS).

Example of typical airgun array and configuration are shown in the following Figure 3.8 and Figure 3.9.

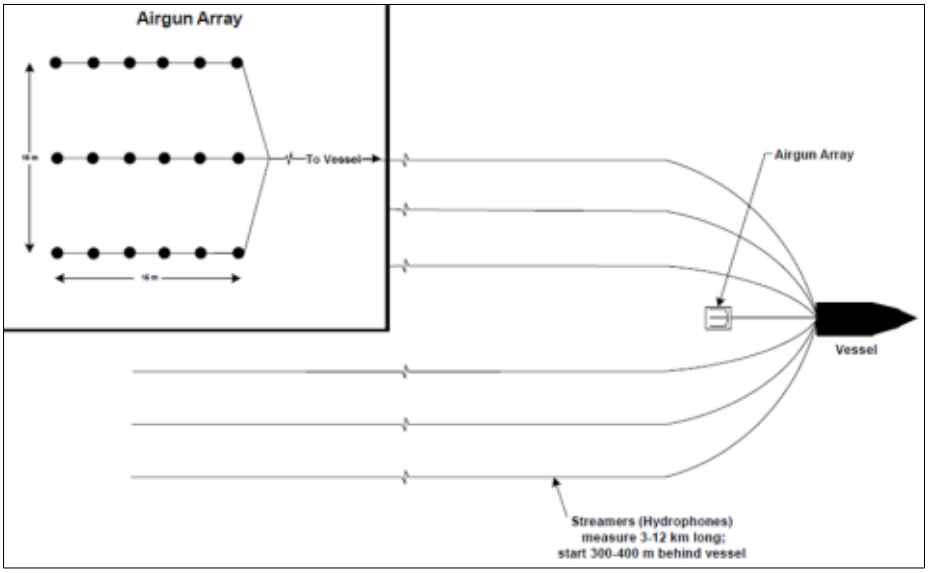

Figure 3.8: Example Airgun Configuration

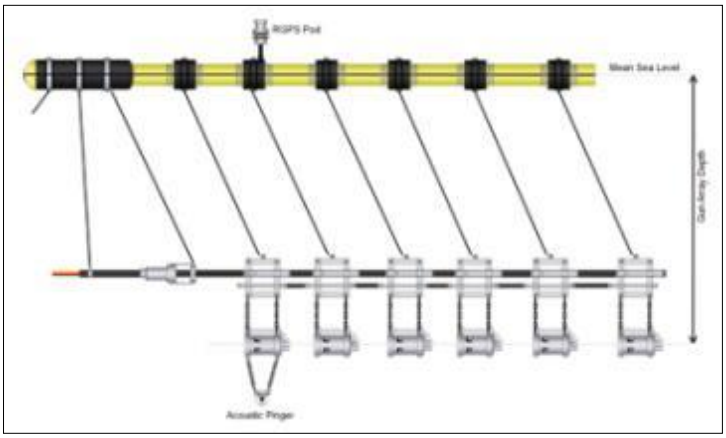

Figure 3.9: Example Airgun Array (OGP, 2011)

The anticipated characteristics of the airgun for the proposed 2D/3D seismic survey are reported in the following Table 3.2.

Table 3.2: Airgun Characteristics

Characteristic	Unit	3D/2DSurvey
Sources	-	1 to 2
Total Volume	in^3 (Litres)	4,100 -5,000 (67.2-82)
Operating Depth	m	7-8
Air pressure	psi	2,000
Firing Frequency	m	25
Peak to peak amplitude	bar m	110
Peak to bubble ratio	-	>25
Bandwidth	Hz	5–100,000
Major amplitude	Hz	10-120
Sound pressure level	dB re 1 µPa @ 1 m	220-262 (peak-to-peak)

Actual characteristics of the airgun source to be used for the project activities will be defined at the survey planning stage.

3.3.2.3 Receiver System (Streamer)

The receiver system is mainly composed by a seismic cable (streamer), consisting in a plastic tube (with 5-8 cm diameter) that contains pressure sensitive devices (hydrophones) which detect the reflected energy that travels from the seismic sources (airguns), through the water layer, down through the earth and back up to the surface.

The streamer is made of the following main components:

- ✓ hydrophones, which convert the reflected pressure into electrical signals;
- ✓ electronic modules, which digitize and transmit the seismic data;
- ✓ stress members (steel or Kevlar) that provide the physical strength required, allowing the streamer to be towed in the roughest weather;
- ✓ an electrical transmission system, for power to the streamer electronic modules and peripheral devices and for data telemetry;
- ✓ the skin of the streamer in which all the above is included.

The groups in the streamer are typically combined into sections, each 50 – 150 meters in length, to allow modular replacement in case of damaged sections. Each section is provided with a connector unit and in the past was typically filled with isolating fluid (oil), with a specific gravity less than water to make the streamer neutrally buoyant. Recent advances have led to the substitution of oil or other organic compound with synthetic (gel) or solid material.

The following Figure 3.10 shows a streamer when entering the water and stored on a reel.

Figure 3.10: Streamer (OGP, 2011)

Streamers number, length, depth and configuration depends on the geological target to be reached within the given survey area. Seismic surveys are carried out with one streamer (2D surveys) or several streamers (typically up to 12 in 3D surveys) towed by the seismic vessel. Streamer length can vary up to 12,000 meters or more (typically 8,000 to 12,000 meters), while the towing depth is typically down to 25 meters.

Distance between the streamers is typically 25–75 meters.

In addition to the internal components of the streamer, external devices are used to optimize the acquisition activity such as:

- ✓ diverters to help the spreading of the streamers array;
- ✓ depth and lateral control units (birds) to control the depth and the position of the streamer during the vessel cruising (typically each 300 m);
- ✓ tail buoy to house Differential Global Positioning System (DGPS) receivers used to constantly monitor the position of the hydrophone groups in the streamers (additionally head buoy is foreseen in case of 3D survey).

Example of diverter, bird and a tail buoy are shown in the following, from Figure 3.11 to Figure 3.13.

Figure 3.11: Example of Diverter

Figure 3.12: Example of Bird

Figure 3.13: Example of Tail Buoy

Anticipated characteristics of the streamers to be used for the proposed activities are reported in the following Table 3.3.

Table 3.3: Streamer Characteristics

Characteristic	Unit	2D Survey	3D Survey
Typology	-	Solid	
Number	-	1	10
Length	m	10,000	10,000
Towing Depth	m	up to 50	up to 50

Actual characteristics of the streamer to be used for the project activities will be defined at the survey planning stage.

3.3.2.4 Seismic Vessel and Support Units

The seismic vessel is a naval unit designed to perform seismic acquisition by towing both the energy sources (airguns) and the receiver system (streamers) along predetermined routes. The seismic vessels are provided with all the equipment requested for the conduction of the surveys.

The key elements of a typical seismic vessel are:

- ✓ instrument room;
- ✓ back deck;
- ✓ compressor room.

The instrument room is the area where the marine seismic instrumentation is located and operated. The room is usually located at the centre of the vessel, below the bridge and forward of the back deck. The room contains the main instrument for recording seismic data, controlling the streamer position and activating the energy source through the compressors. The navigation system (satellite, radio, compasses, etc.) is also housed in the instrument room, together with the computers for the seismic and positioning data quality checking and processing.

The back deck is used for the storage, deployment and retrieval of the towed seismic equipment. The back deck is also provided with a repair area in case of need.

The streamers are stored on large reels and prior to start of acquisition they are deployed from the back of the vessel for towing. The number of streamers available on board depends on the storage capacity of the vessel and its design. The wiring from the streamers is fed through watertight connections to the instrument room. The streamers are kept under control by the observer department of the seismic crew.

In the back deck is also stored the energy source equipment (which comprises a number of source elements linked together with special harnesses, air supply lines and electronic control cables). During the deployment, the equipment enters the sea through a slipway at the rear of the deck. The air feed from the vessel compressors to the airguns is monitored from a control panel located in a work area where repairing activities can also be carried out.

The towing equipment is designed to enable the streamers and airguns array to be accurately positioned behind the vessel and to allow the desired distances, as requested by the survey design. The towing equipment is capable to bear the pulling forces deriving from the towing even in variable weather conditions. The deployment or retrieval of the equipment may take several hours or days. The source and the towing system are taken under control by the mechanical department of the seismic crew.

Finally, the navigation or positioning hardware equipment is also stored on the back deck, including the tail buoys, usually attached to the end of each streamer and to the source array (if the case), containing the navigation instruments to constantly control and monitor the position of the towed equipment.

The compressor room includes the compressor engines and compressors, which supply high-pressure air to the airguns. The compressors are capable of reaching each source element rapidly and repeatedly, enabling the source array to be activated typically every 10 seconds during the survey. This room is under the control of the mechanics and is usually located near the back deck.

Characteristics of above components may vary depending on the architectural shape of the seismic vessel.

Seismic vessels sail at a speed of approximately 4 – 5 knots when in operation and are usually accompanied by naval units that assist in notifying other vessels about the seismic operations or provide any support in terms of material supply, crew change, etc.

Typical seismic vessels in operations are shown in the following Figure 3.14.

Figure 3.14: Typical Seismic Vessels in Operation

The anticipated vessels expected to be used for the proposed activities consist of:

- ✓ one seismic vessel (towing the energy sources and the receiver system along the planned acquisition lines);
- ✓ two chase vessels (warning other sea users of ongoing operations as well as to assist in emergency situations);
- ✓ one supply vessel (providing support to the survey activities for supplies, crew change, etc.).

The proposed seismic vessel will be a purpose-built naval unit provided with special features, including state-of-the-art navigation, communications, safety equipment, and accommodation for seismic crew.

Sophisticated positioning systems will be used to accurately navigate along the predetermined seismic lines and to determine the location of each component of the equipment at any point in time during the survey.

The anticipated characteristics of a seismic vessel are reported in the following Table 3.4.

Table 3.4: Typical Seismic Vessel Characteristics

Description	Unit	Specification
Length	m	80-110
Beam	m	15-40
Draft	m	7-8
Gross Tonnage	tonnes	10.000
Engine power	kW	10,000-20,000
Operating speed	knots	4.5
Cruising Speed	knots	10-15
Fuel capacity	m^3	3,000-3,500
Fresh water capacity	m^3	400-600
Accommodation	Pax	50-60

Actual seismic vessel to be used for the project activities will be identified at the survey planning stage.

The primary functions of the support vessel and chase vessels are to provide supplies, to warn other sea users of ongoing operations as well as to assist in emergencies (including any oil spills).

In areas where poor charting or the presence of other vessels may pose a potential problem to the survey operation, the support or chase vessels will ensure that other vessels do not cross over or otherwise interfere with the towed equipment. The support or chase vessels will also check that the way ahead of the survey vessel is clear of obstructions such as fishing equipment, which may need to be removed from the path of the vessel.

Typical support and chase vessels are shown in the following Figure 3.15 and Figure 3.16.

Figure 3.15: Typical Support Vessel

Figure 3.16: Typical Chase Vessel

The anticipated characteristics of typical support and chase vessels are reported in the following Table 3.5.

Table 3.5: Typical Support/Chase Vessels Characteristics

Description	Unit	Support Vessel	Chase Vessels
Length	m	70	35
Beam	m	15-20	9-10
Draft	m	7-10	3-4
Gross Tonnage	tons	3,000	300-500
Engine power	kW	4,000	1,500
Max Speed	knots	10-15	10-15
Accommodation	Pax	10-15	10-15

Actual chase/support vessel to be used for the project activities will be identified at the survey planning stage.

3.3.2.5 Data Processing

Time interval between the emission of energy from the source and the reception of the reflected energy (travel time) depends on the characteristics of each geological layer of the subsoil under the seabed. Based on the travel time, the depth of each layer is mapped along the acquisition profile.

Signals acquired by the receiving system during the seismic survey constitute raw data that need to be processed in order to be subsequently evaluated.

Raw data are temporary stored and filed on board and then sent to processing centres provided with data processing software in order to obtain accurate maps of the subsoil.

Maps together with available information on the survey area are subsequently analysed by geologist to identify the geological model closest to reality.

3.4 SURVEY DESIGN

3.4.1 2D Survey

The anticipated acquisition line survey for 2D is based on a regular grid on the Block 2 area (fullfold coverage area), with mesh 2.0 x 2.0 km. Average line length is 45 km and total length of the 2D acquisition lines is 1,810 km.

The anticipated 2D line design is shown in the following Figure 3.17.

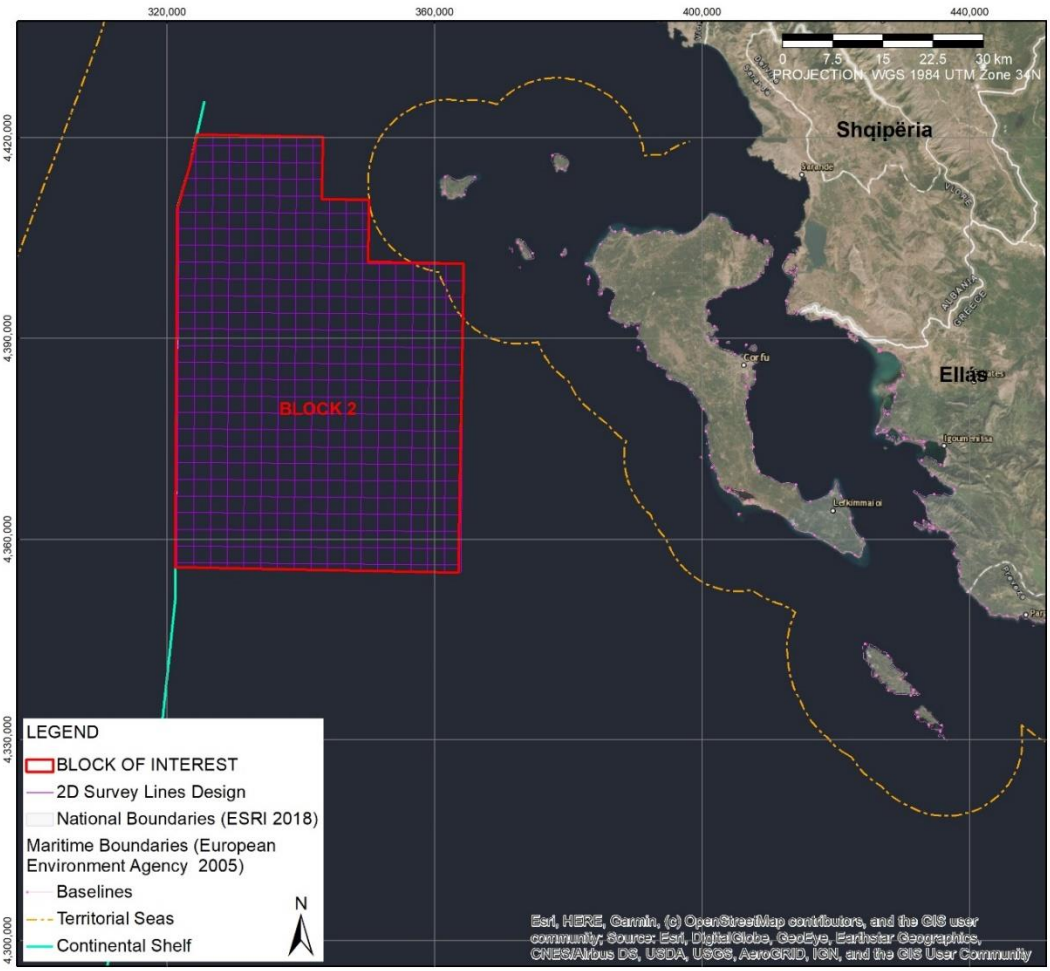

Figure 3.17: 2D Survey Lines Design

The anticipated 2D survey parameters are summarized in the following Table 3.6.

Table 3.6: 2D Survey Parameters

Description	Value
Airgun Source	1
Source Volume	5.000 in^3
Major amplitude	10-120 Hz
Sound pressure level	260 db $_{Peak}$ re 1 µPa @ 1 m
Source Depth	7.5 m
Shot Point Interval (SPI)	25 m
Streamer	1
Streamer Length	10,000 m
Streamer Depth	8-50m
Record Length	10 s

3.4.2 3D Survey

The anticipated acquisition survey area for 3D survey, which will be defined more accurately in a later stage, will cover 1,820 km^2 over the Block 2 area (fullfold coverage area), with line spacing approx. 600 m. Acquisition line length are assumed equal to those anticipated for the 2D survey.

The 3D survey parameters are summarized in the following table.

Table 3.7: 3D Survey Parameters

Description	Value
Airgun Sources	2
Source Volume (each)	3.500 in^3
Source Depth	7 m
Major amplitude	10-120 Hz
Sound pressure level	260 db $_{Peak}$ re 1 µPa @ 1 m
Shot Point Interval (SPI)	25 m
Streamers	10
Streamer Length	8,000 m
Streamer separation	120 m

Description	Value
Streamer Depth	8-50m
Record Length	10 s

3.4.3 Operational Aspects

The offshore seismic survey will be carried out, by a qualified seismic Contractor, utilizing a purpose-built seismic vessel that will sail along a series of predetermined seismic lines to acquire data for the survey area.

On arrival in the Country, an offshore mobilization without coming alongside into port is foreseen. On completion of vessel clearance, the vessel will start deploying the in-sea equipment within a deployment zone located in open waters (eventually outside of the survey area), away from the Greek Coast in order to avoid any obstructions and shallows.

The deployment zone will be defined at the planning phase and will be preliminary agreed with relevant Authorities.

Prior to commencement of the seismic acquisition, the Operator will issue a Notice to Mariners for the program, to notify vessels of the activity which may be operating in nearby waters.

While acquiring seismic data, the vessel will sail at a speed of approx. 4.5 knots (approx. 8.5 km/h). As the vessel travels along the survey lines, a series of acoustic pulses originated from the energy source (airgun) will be directed down through the water column into the seabed.

The streamers, towed at the design depth, will be equipped with tail buoy at their end (also head buoy in case of 3D survey). The cables towing the streamer may also be equipped with appropriate elements to increase the visibility of the part above water.

The 3D and 2D survey will be undertaken in water depths ranging approximately 750-1,200 meters.

In order to ensure the detection of the data for the entire acquisition line, the streamer must pass entirely above it and the survey shall be continued beyond a certain distance from the end of the line ("end point"). This distance is called the "run-out" and can be estimated approximately half the length of the streamer (i.e. approx. 5 km). Furthermore, in order to ensure accurate acquisition of data over the design survey area (i.e. the fullfold coverage area), the energy source shall operate beyond a certain distance from the vertical of the limit of the survey area (approx. 5 km). The ship then carries out a manoeuvre to align with the next line of acquisitions, with a turn radius that can be estimated in few kilometres (approximately 3.5 km). To ensure that the streamer is stretched as much as possible, the vessel must move on the route before the start point of the line ("start line"). This distance is called the "run-in" and can be estimated approximately equal to the length of the streamer (i.e. approx. 10 km).

The anticipated overall area of operations (where the vessel is expected to sail), has a surface of approx. 3,250 km^2 and is shown in the following figure. The area has been designed in order to avoid any direct interference with the boundary of any protected areas located in its proximity, with particular regard to the Natura 2000 site “Diapontia Islands”.

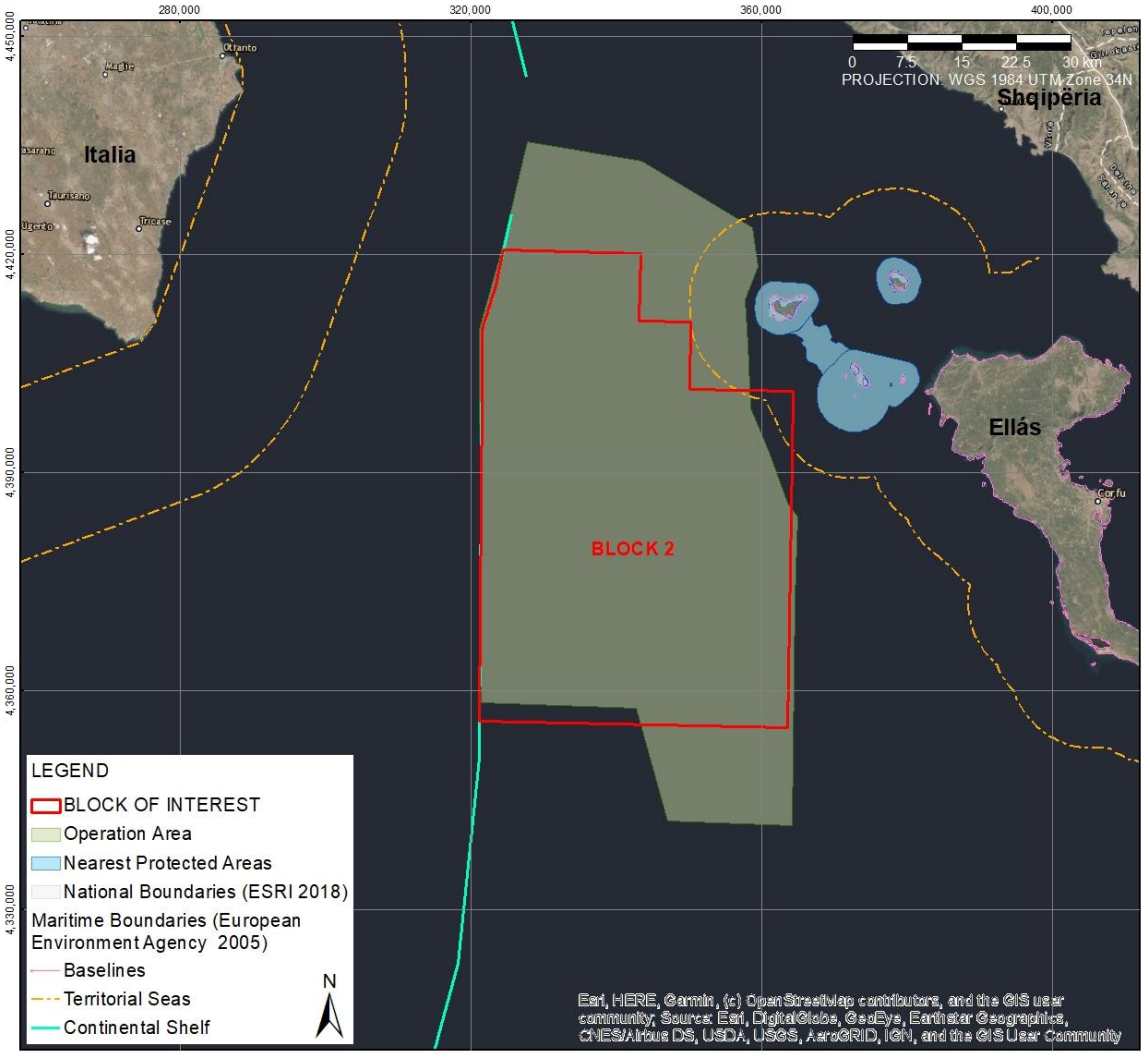

Figure 3.18: Operation Area and Nearest Protected Areas

During the acquisition the seismic vessel shall maintain a minimum speed of approx. 4.5 knots in order to control equipment at sea.

Seismic vessels are generally classified as "limited" in relation to the capacity to execute manoeuvres, thus such vessels during the course of the survey will take precedence over other ships that do not have this limitation.

In the case of 2D surveys, since the least number of sources and streamers are used, the vessel units have fewer restrictions than in the case of 3D surveys.

The seismic vessel will be accompanied, during the seismic activities, by two chase vessels, operating back and forth simultaneously, and a support vessel, for guarding purposes and to warn other sea users of ongoing operations. Additionally, the seismic vessel and streamers will display appropriate navigational safety measures such as day shapes, lights and reflective tail buoys to indicate that the vessel is in tow and restricted in its ability to manoeuvre.

A visual and radar watch will be maintained on the bridge at all times by trained and competent crew.

The support vessel duty will also be to transport equipment, material and supplies to/from the onshore support base, typically with a complete supply run every 10 to 14 days.

The support vessel may be used for crew change. Crew changes every 5-6 week full is anticipated. A helicopter may also be used in case of emergency or for crew transportation. Helicopter transfer, if required, is anticipated during daylight hours in acceptable wind and sea conditions. Night transfer may be required in the event of an operational emergency, medical evacuation or other non-routine circumstance (for example impending bad weather conditions). There will be no helicopter refuelling on board the seismic vessel.

The vessels, including the seismic vessel, will not anchor at sea unless required in an emergency. The local port expected to be used during the survey for re-supply, crew change and refuelling (if the case) will be defined at the planning phase.

As per standard operating procedure, all vessels will be topped off with fuel at start of activities. In order to reduce the likelihood of refuelling operations at sea during the survey, the seismic vessel is expected to arrive into Greece will a full tank of fuel, allowing for acquisition of the survey without the requirement for refuelling.

All vessels will be provided with safety, communication and emergency equipment, in line with international regulations, including:

- ✓ navigation systems (e.g.: radar, GPS, autopilot, depth sounder, etc.);
- ✓ radio communication systems (e.g.: radio station, portable VHF, transponder, etc.) and satellite (e.g.: INMARSAT, telex, fax, etc.);
- ✓ safety equipment (e.g.: life jacket, life rafts and rescue boats, boat support, mute insulation, etc.);
- ✓ fire protection equipment (e.g.: smoke detectors, sprinkler system fixed, portable fire extinguishers);
- ✓ auxiliary power supply systems (e.g.: generator emergency / parking, emergency batteries, etc.).

A helicopter will be used only in case of emergency and for transportation. Helicopter transfer, if required, is anticipated from a nearby airport during daylight hours in acceptable wind and sea conditions. Night transfer may be required in the event of an operational emergency, medical evacuation or other non-routine circumstance (for example impending bad weather conditions). There will be no helicopter refuelling on board the seismic vessel.

3.4.4 Magnetic and Gravity Survey

Magnetic and Gravity data will be acquired simultaneously to seismic data, in order to better define the seabed characteristics.

Magnetic and gravity data will be acquired by means of devices towed by the seismic vessel (magnetometer) or present onboard the vessel (gravimeter). Towing depth is expected same than that of the streamer.

3.5 EXPECTED SCHEDULE

The proposed seismic survey is expected to be launched in last quarter 2020. Tentative time-window for the survey is November-December 2020.

The anticipated duration of the seismic survey can be assumed as follows:

- ✓ 20 days in case of 2D survey;
- ✓ 45 days in case of 3D survey.

Expected duration of mobilization and mobilization activities is:

- ✓ approx. 2.5 days for 2D survey;
- ✓ approx. 4.5 days for 3D survey.

Anticipated average duration of changing between acquisition lines (nominal line change times) can be estimated approx. 200 minutes.

The campaigns to acquire geophysical data will be carried out continuously for the entire 24 h.

3.6 SUMMARY OF EXPECTED EMISSIONS TO THE ENVIRONMENT

All vessels will comply fully with international standards regulated under MARPOL 73/78 and relevant legislation.

The following processes are expected to be carried out during operations:

- ✓ sewage discharges will be treated and disinfected on board and may be discharged more than 3 nautical miles from the shoreline in accordance to MARPOL 73/78 Annex IV: Prevention of pollution by sewage from ships;
- ✓ oily water may be stored on the vessel until their delivery to appropriate Port facilities. If this is not feasible, oil/water separators should be in place to ensure that any drainage from machinery spaces and bilge water discharged from the ship complies with the legal limits of no more than 15 mg/l of oil for oil-in-water discharge according to IMO (International Maritime Regulations) guidelines (MEPC 2003).
- ✓ food wastes will be macerated to a diameter of less than 25 mm, prior to discharge. No food wastes will be directly discharged in sea;
- ✓ no plastics or garbage will be discharged to sea;
- ✓ waste will be segregated into recyclables and dangerous wastes (used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate management;
- ✓ hazardous waste must be labelled accordingly and disposed by specialist and registered waste disposal contractor.
- ✓ prior to entry into port, notify the Port Authorities of the types and quantities of waste being brought ashore for management;

All waste generated on board will be managed in accordance with international and national regulations.

The vessels will operate under an approved Oil Spill Contingency and Emergency Response Plan which will detail actions to be taken in the event of a shipboard emergency or oil spill in accordance with MARPOL 73/78 Annex I requirements.

Regarding air emissions, the following emission factors developed by Entec UK Limited (ENTEC, 2010) for the English Department for Environment, Food and Rural Affairs (DEFRA) can be typically assumed.

Table 3.8: Air Emissions Factors of Marine Vessels (ENTEC, 2010)

Engine/Use	NOx [g/kWh]	SO_2 [g/kWh]	CO [g/kWh]	Particulate [g/kWh]
ME - Main Engine (Propulsion)	10	0.8	1.1	0.4
AE – Auxiliary Engine (Power generation)	11.5	0.9	1.1	0.3

According to the *EMEP/EEA air pollutant emission inventory guidebook 2016* and the special volume 1.A.3.d on Navigation (shipping), the following emissions are expected:

Table 3.9: Emission Factors for NOx , NMVOC, PM and Specific Fuel Consumption for different Engine Types/Fuel Combinations and Vessel Trip Phases (Cruising, Hoteling, Manoeuvring) in g/kWh[2]

Engine	Phase	Engine type	Fuel Type	NOx EF 2000 [g/kWh]	NOx EF 2005 [g/kWh]	NOx EF 2010 [g/kWh]	NMVOC EF [g/kWh]	TSP PM10 PM2,5 EF [g/kWh]	Specific fuel consumption [g fuel/kWh]
Main	Cruise	Gas turbine	BFO	6.1	5.9	5.7	0.1	0.1	305.0
			MDO / MGO	5.7	5.5	5.3	0.1	0.0	290.0
		High-speed diesel	BFO	12.7	12.3	11.8	0.2	0.8	213.0
			MDO / MGO	12.0	11.6	11.2	0.2	0.3	203.0
			BFO	14.0	13.5	13.0	0.5	0.8	213.0

****

[2] Source: Entec (2002), Entec (2007), the emission factors for NMVOC was been derived as 98 % of the original HC emission factors value, based on reported CH4 factors from IPCC (1997).

Engine	Phase	Engine type	Fuel Type	NOx EF 2000 [g/kWh]	NOx EF 2005 [g/kWh]	NOx EF 2010 [g/kWh]	NMVOC EF [g/kWh]	TSP PM10 PM2,5 EF [g/kWh]	Specific fuel consumption [g fuel/kWh]
		Medium-speed diesel	MDO / MGO	13.2	12.8	12.3	0.5	0.3	203.0
		Slow-speed diesel	BFO	18.1	17.5	16.9	0.6	1.7	195.0
			MDO / MGO	17.0	16.4	15.8	0.6	0.3	185.0
		Steam turbine	BFO	2.1	2.0	2.0	0.1	0.8	305.0
			MDO / MGO	2.0	1.9	1.9	0.1	0.3	290.0
	Manoeuvring Hoteling	Gas turbine	BFO	3.1	3.0	2.9	0.5	1.5	336.0
			MDO / MGO	2.9	2.8	2.7	0.5	0.5	319.0
		High-speed diesel	BFO	10.2	9.9	9.5	0.6	2.4	234.0
			MDO / MGO	9.6	9.3	8.9	0.6	0.9	223.0
		Medium-speed diesel	BFO	11.2	10.8	10.4	1.5	2.4	234.0
			MDO / MGO	10.6	10.2	9.9	1.5	0.9	223.0
		Slow-speed diesel	BFO	14.5	14.0	13.5	1.8	2.4	215.0
			MDO / MGO	13.6	13.1	12.7	1.8	0.9	204.0
		Steam turbine	BFO	1.7	1.6	1.6	0.3	2.4	336.0
			MDO / MGO	1.6	1.6	1.5	0.3	0.9	319.0
Auxiliary	Cruise Manoeuvring Hoteling	High-speed diesel	BFO	11.6	11.2	10.8	0.4	0.8	227.0
			MDO / MGO	10.9	10.5	10.2	0.4	0.3	217.0
		Medium-speed diesel	BFO	14.7	14.2	13.7	0.4	0.8	227.0
			MDO / MGO	13.9	13.5	13.0	0.4	0.3	217.0

Regarding noise emissions during operations, the following are expected:

- ✓ airborne noise due to vessel engines, generators and machinery;
- ✓ underwater noise due to operation of the energy source (airgun), machinery noise/vibration through the hull and vessel propulsion.

4 BASELINE CONDITIONS

The following paragraphs present the main conclusions of the Environmental and Social Baseline Study (ESBS) that was prepared out for the Block 2 area in the framework of the relevant requirement of the Lease Agreement (RINA, 2017). The entire Environmental and Social Baseline Report study is reported in Appendix A to this document.

The characteristics of the Environmental and Social aspects are identified and analysed within the Study Area of the project, shown as “Extended Study Area” in figure below, which includes:

- ✓ the proposed hydrocarbon exploration and exploitation area, namely the Block 2;
- ✓ an additional buffer area up to 15 km, assuming that, based on similar projects, proposed activities may have some influence to the surrounding area of Block 2 (e.g. with regard to the vessel navigation and operation related to the seismic acquisition activities, under normal operating conditions);
- ✓ the coastal area and administrative limits of the closest onshore administrative unit to (Corfu Regional Unit).

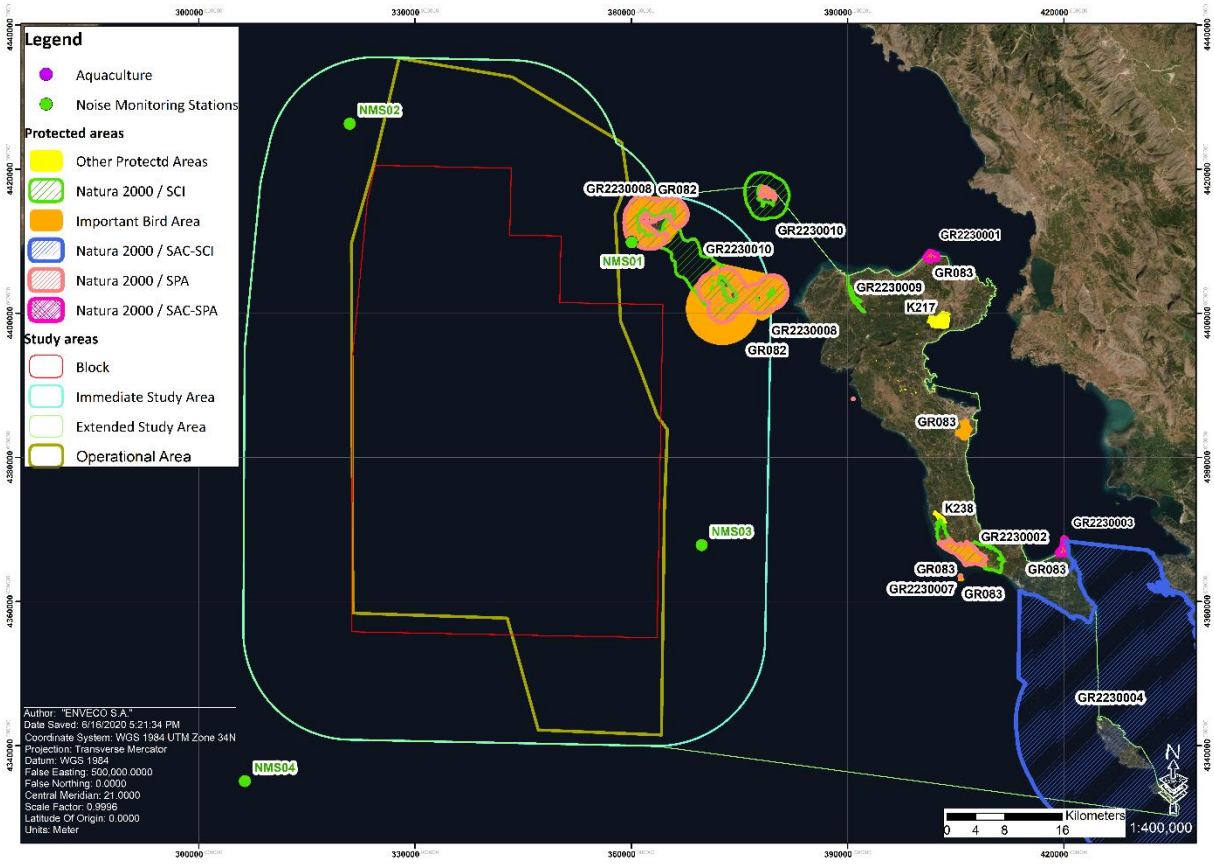

Figure 4.1: Study Area (ENVECO S.A., 2020)

4.1 CLIMATIC AND BIOCLIMATIC CHARACTERISTICS

The climate in the study area can be characterized as humid Mediterranean and can be divided into two main seasons, the cold season and the warm season, with the transition periods between them.

Based on data from six meteorological stations, namely: Aktio, Corfu_1, Othonoi (NMS) and Corfu_2, Igoumenitsa, Paxos and Parga (NOA), the prevailing winds in the study area are North-Eastern winds, but South-Eastern winds are prevailing during the first trimester of the year (Q1) especially for the stations CORFU_2 and PAXOS which are located closer to Block 2. Winds with greatest intensity mainly occur in the period from January to August. Generally, winds are characterised light to moderate (average of 3.64-5.63 km/h, meaning 1-2 Beaufort).

The average annual temperature in the study area is 17.7°C. The hottest months are July and August and coldest is January. Average temperatures during Q1 range from 6 to 17° C. Precipitation is quite significant in Corfu, reaching an average yearly amount of 1,079.3 mm. The rainiest months are November and October and the driest are August and July. On average, the monthly rainfall during the first quarter of is 102.34-137.77mm. The average relative humidity in the study area is 71%, with a maximum in November and a minimum in July. During Q1 it is almost stable at 74%. According to the Hellenic Network of Solar Energy[3], the average annual sum of solar radiation of the study area is expected to be around 1610-40 kWh/m^2.

Due to the lack of field data, the behaviour of the waves in the study area was derived by the "Atlas of the Wind and Waves of the Greek Seas" (source: SEA for offshore hydrocarbon E & E in the Ionian Sea, 2014)[4]. The expected characteristics of the waves in the study area (West of Corfu) on an annual average basis, are the following:

- ✓ average wave height 0.9 m-1.1 m (gradually decreasing towards the coast);
- ✓ average peak period of the waves is homogeneous around 5.6s;
- ✓ probability of >2.5 m wave height ranges between 3%-6% (decreasing nearer the coast);
- ✓ the predominant direction of the wave ripples is NW, with S following at a smaller frequency.

In conclusion, the wave status of the Ionian Sea is mild to moderate. Higher values of significant wave height occur in the winter and lower in the summer.

According to the study "The environmental, economic and social impacts of climate change in Greece"[5], over the past few years, rainfall has decreased by about 20% in Western Greece and 10% in Eastern Greece. Based on the models of human climate intervention under two extreme climatic change scenarios analysed (B2 and A2), it is expected that at the end of the 21st century, rainfall will decrease between 5% and 19%, respectively. It also appears that at the end of the 21st century the air temperature will rise between 3.0°C and 4.5°C, respectively. Generally, simulations predict significant changes in many climatic parameters, such as an increase in solar radiation (between 2.3W/m^2 and 4.5 W /m^2) across the country, increase of intensity of annual winds by 10%, changes in humidity, cloud cover and so on. The immediate danger of climate change in Greece relates to the rise in the average sea level which is estimated to range between 0.2 and 2 meters.

4.2 MARINE HYDROGRAPHY AND OCEANOGRAPHY

According to Theocharis *et al.* 1993 and Malanotte-Rizzoli *et al.* 1997, the main permanent structures in the circulation of the Ionian Sea is a cyclonic formation (Cretan Cyclone, CC) South-West of Crete, while to the North of the CC near the West coast of the Peloponnese, a powerful anticyclone is detected, known as “Pelops” (Pelops Anticyclone, PA). The CC has a depth limited between the upper thermocline and the intermediate layer without appearing below 400 m approximately. The Pelops is very barotropic below 100 m and quite intense up to 800 m. In its centre, it traps surface water from the Levantine Sea, which is warmer and saltier than the Levantine Intermediate Water (LIW) masses surrounding it.

Actual measurements of the Northern Ionian’s Temperature and Salinity have been performed by the Hellenic Centre of Marine Research (HCMR), in 2000 in the framework of the “Network for water management in the region of the Lower Adriatic-Ionian region (INTERREG-II Greece-Italy)”. Conductivity, temperature, depth (CTD) data were collected and showed that the deep waters have the highest values of Oxygen, are less salty (O_2 ~ 4.7 ml/l, S ~38.7 PSU) and hold less nutrient salts in comparison with the deep waters of the East Mediterranean Sea. In addition, it has been reported that the surface layer of the Ionian Sea (0-50 m) is characterised by low values of nutrient salts and therefore is considered as oligotrophic. The nutrients values tend to decrease even more during the warmer seasons (spring-summer).

Hellenic Centre for Marine Research (HCMR), in the framework of the POSEIDON program, has installed and operates a network of floating oceanographic measuring stations (buoys) recording in real-time (real-time) the

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[3] Hellenic Network of Solar Energy (http://www.helionet.gr/maps/clima_yearly_avg/total/Corfu). Data from 2002-2012.

[4] Strategic Environmental Impact Assessment for the marine areas of hydrocarbon exploration and exploitation in the Ionian Sea (HCMR – University of Thessaly – S. Dasaklis & G. Sigalos Partnership, December 2014)

[5] Climate Change Impact Assessment Study Committee, Bank of Greece, June 2011, "The environmental, economic and social impacts of climate change in Greece". Accessed via: http://www.bankofgreece.gr/BogEkdoseis/%CE%A0%CE%BB%CE%B7%CF%81%CE%B7%CF%82_%CE%95%CE%BA%CE%B8%CE%B5%CF%83%CE%B7.pdf

physical, biological and chemical parameters of the Greek seas. Available on-line data from the buoys and other program (www.poseidon.hcmr.gr) present a decrease of water temperature from October to March with the lowest temperature to occur in the region during March. The highest temperature seems to occur in July and August.

4.3 MORPHOLOGY AND BATHYMETRY

Bathymetry data for the study area have been collected through the Hellenic Navy Hydrographic Service as well as other sources (GEBCO, EMODnet, etc). Based on this data, the bathymetry of the Block 2 area is ranging from approx 250 m up to 1,200 m.

A fairly steep slope of the Eastern Ionian seafloor occurs at the North East side of the Block 2, reaching the shallower (250 m) and larger (1,200 m) depths. This slope is extensive in the Southern part of Corfu, creating instability and delivering sedimentary material from the shallow platform to the deep Ionian seafloor. The seafloor in the rest of the Block 2 lies at depth approx 800 to 1,200 m.

4.4 GEOLOGY, SESIMICITY AND GEOHAZARDS

The Geological structure of the study area consists of the Ionian Zone and the Paxos or Preapulian zone. The Ionian Zone is also known as Adriatic-Ionian Zone. It stretches along the West coast of mainland Greece with North-South direction and includes the largest part of Epirus, Acarnania, some parts of the Ionian Islands (including Corfu) and western Peloponnese. It is characterised as a continental basin with hemi-pelagic - pelagic sedimentation on the Apulian continental plate, consisting solely of sedimentary rocks such as evaporites.

The Paxos zone got its name the islands of Paxos in the Ionian Sea and the zone appears at the Islands of Paxos, Antipaxos, Lefkada, Cephalonia and Zakynthos, while its largest part is submerged under the sea. Continuous neritic carbonate sedimentation and lack of flysch are the characteristics of this zone.

The study of deep structures below the evaporites sequence is very important, as these structures could prove to have high hydrocarbons potential. Previous mappings conducted in the Ionian Sea area did not achieve penetration of limestone rocks and evaporites due to the limited length of the streamer (recorder) that was used. This can be overcome only by acquiring long seismic profiles to reliably determine geological formations, the lithology, sedimentary basins, the formations under the evaporites and the limits of the continental/marine context. This is essential for the development of geothermal models and tectonic interpretation of the basin (basin modelling) to assess the hydrocarbon generation potential and maturation of the source rocks.

Along the coasts of Western Greece, from Corfu to Western Crete, seismic activity can be divided into three geographical areas. The study area is located inside the first area, north of Lefkada, where the seismic activity is caused by compressive forces of approximately East - West direction (vertical to the direction of the coasts of Western Greece)[6]. Around these parts of Greece, the large number of small and medium-size earthquakes and the higher occurrence of strong (destructive) earthquakes is prevalent. Thus, despite the fact that in this area earthquake magnitudes are slightly smaller than in other regions of the Hellenic territory, the seismic risk is higher, because of the frequency of occurrence of earthquakes that can cause considerable damage. In particular, within the study area 24 earthquakes of higher magnitude (MW > 4.5) have occurred from 1965 to date (Athens Institute of Geodynamics).

As for the geohazards that are expected in the study area, the most significant ones are pockmark fields (crater-like seabed structures, which are formed by the rapid expulsion of gases through the seabed). Gas-charged sediments were discovered in Corfu shelf/slope (open Ionian Sea), in the North-Western end of the Hellenic arc which extends to a water depth of 250 m. Gravitational mass movements have also been observed in the Ionian Sea area and the steep continental slope in the west of Corfu island can be a hazardous area for local submarine landslides.

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[6] Papazachos V., and Papazachou C.; 1997: The Earthquakes of Greece, Editions Ziti.

4.5 NATURAL HERITAGE

4.5.1 Natura 2000 Protected Areas, IBAs and EBSA

According to the Natura 2000 Network, there are eight (8) protected areas within the wider (extended) study area, of which four (4) are “Special Areas of Conservation” (SAC) or “Sites of Community Importance” (SCI), two (2) are “Special Protection Areas” (SPA) and two (2) are designated as both, SAC/SPA..

The following Table 4.1 presents, in alphabetical order, the closest Natura 2000 sites located in proximity of the study area and their distance from the Block 2 boundaries.

Table 4.1: Natura 2000 Network Sites in the Study Area

Name	Country	Site code	First Compilation date	Type of Protected Area	Area [ha]	Marine area [%]	Distance to Block 2
Alyki Lefkimmis (Corfu)	Greece	GR2230003	1995-01	SPA - SAC	212.7	24.3	55.3
Antinioti lagoon and Fonissa river (Corfu)	Greece	GR2230009	2016-12	SCI	81	-	25.8
Antiniotis' lagoon	Greece	GR2230001	1994-12	SPA – SAC	186.6	-	36.8
Diapontia Nisia (Othonoi, Ereikousa, Mathraki Vrachonisides)	Greece	GR2230008	2009-06	SPA	10117.5	88.5	5.3
Korission Lagoun	Greece	GR2230002	1994-12	SCI	2310.3	-	38.6
Limnothalassa Korission (Corfu) Kai Nisos Lagoudia	Greece	GR2230007	2001-10	SPA	1081.6	-	38.8
Marine area of Diapontia islands	Greece	GR2230010	2016-12	SCI	15327.2	100	4.4
Paxoi and Antipaxoi islands and wider marine area	Greece	GR2230004	1994-12	SCI – SAC	135189.2	98.2	50.2

Note

The Special Protected Areas (SPAs) are designated under the Birds Directive 79/409/CEE and they are strategic suitable areas for the protection of the most threatened bird species. The selected strategic areas are extremely important for the protection of birds, as they are specific areas connected to their reproduction, nutrition or migration.

A SAC is designated under the Habitats Directive 92/43/CEE and it is quite articulate as follows:

- ✓ Natura 2000 sites are selected based on national lists proposed by the Member States. For each biogeographical region the Commission adopts a list of Sites of Community Importance (SCI) which then become part of the network. Finally, the SCI are designated at the national level as Special Areas of Conservation (SAC).
- ✓ Special Areas of Conservation (SAC) aim to preserve natural and semi-natural habitats which are commonly interesting for their rarity and their primordial and ecological role.

Natura 2000 sites are reported in Figure 4.2 below.

Outside of the wider (extended) study area, five (5) more Natura 2000 sites facing Block 2, are present. These are listed in alphabetical order in the following Table 4.2.

Table 4.2: Natura 2000 Network Sites in proximity with Block 2 (Outside of the extended Study Area)

Name	Country	Site code	First Compilation date	Type of Protected Area	Area [ha]	Marine area [%]	Distance to Block 2
Coastal Marine Zone from Kanoni to Mesongi (Corfu)	Greece	GR2230005	1995-04	SAC	867.3	100	41.6
Alimini	Italy	IT9150011	1995-06	SCI	3711.3	62	44.4
Costa Otranto - Santa Maria di Leuca	Italy	IT9150002	1995-06	SCI	6085.3	67	41.2
Litorale di Ugento	Italy	IT9150009	1995-06	SCI	7237.6	83	59.3
Posidonieto Capo San Gregorio - Punta Ristola	Italy	IT9150034	1995-01	SCI	270.3	100	49.3

Beside the Natura 2000 areas, 2 proposed “Important Bird Areas” (IBA)[7] are located on the Diapontia Islands (IBA GR082) and Corfu (IBA GR083).

Furthermore, the following protected areas have been established in proximity of the study area under the National legislation:

- ✓ two (2) “Wildlife” refuges on Corfu island;
- ✓ thirty-three (33) “Small inland wetlands” on Corfu island.

Also, it is noted that the (1) “Ecologically or Biologically Significant Marine Area” (EBSA) “South Adriatic and Ionian straight” has been identified in the South Adriatic and Ionian Sea (partially overlapping with Block 2 area) and officially declared "Areas described as meeting EBSA criteria[8] that were considered by the Conference of the Parties" with COP Decision dated October 2014 .

It is also noted that no part of the study area (neither its proximity) has been proposed as “Regions of importance for the protection of cetaceans in Greece” in the “National Strategy and Action Plan for the conservation of cetaceans in Greece, 2010-2015. Initiative for the Conservation of Cetaceans in Greece”.

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[7] IBA are sites particularly important for bird conservation because they regularly hold significant population of one or more globally or regionally threatened, endemic or congregatory bird species or highly representative bird assemblages. It is noted that the BirdLife International project, called Important Bird Areas (IBA), was the scientific reference point to institute the SPAs

[8] In 2008, the ninth meeting of the Conference of the Parties (COP) to the Convention on Biological Diversity (COP 9) adopted the scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats.

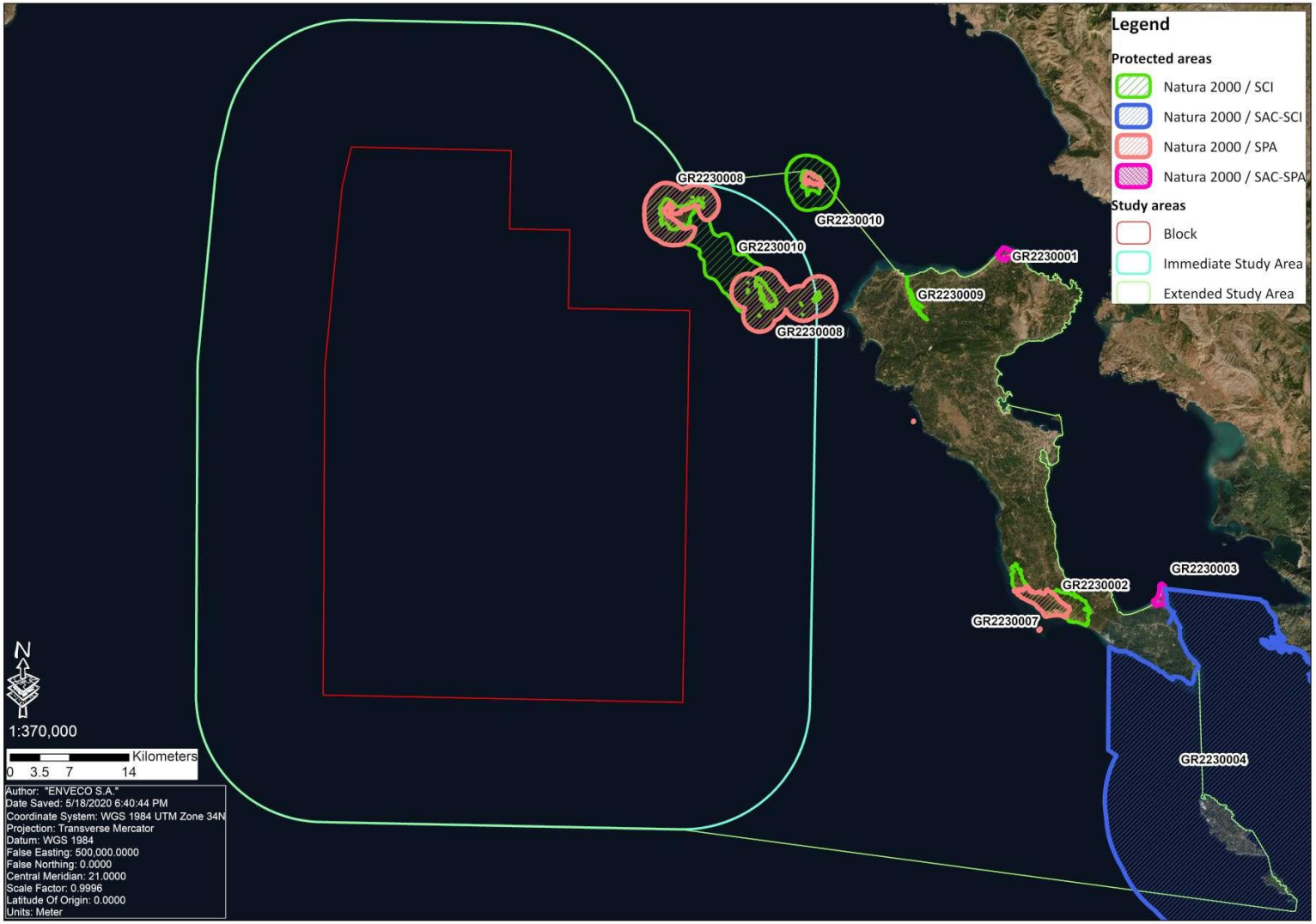

Figure 4.2: Map with the NATURA 2000 Areas in relation to the Study Area (ENVECO S.A., 2020)

4.5.2 Marine Flora

Marine flora in the study area has a relevant abundance. The most important species is Posidonia meadows (*Posidonia oceanica),* which in the wider study area it is expected to be found all along the coast of Corfu[9], Diapontia and Paxos islands, until 50 m of depth[10], but it is not expected to be found within the area of Block 2 due to the larger depth range (250-1200 m). As the "Posidonia meadow location, mapping & printing on nautical maps of the Greek Seas based on specific technical requirements for the needs of the General Directorate of Fisheries (Ministry of Agriculture)" project has shown[11], the species is mostly abundant on the North-Western coast of Corfu and around the islands Mathraki and Othonoi of the Diapontia complex, at the South-West coast of Corfu and at the South-East cape of the island.

Other Marine Flora kinds prevalent in the study area are Phytoplankton – even though the Northern Ionian area is characterized as oligotrophic[12,13] - and Macro algae (seaweed), with 70 different taxa recognized in the Ionian Sea[14].

4.5.3 Marine Fauna

4.5.3.1 Fishes/Invertebrates

Zooplankton[15]: dominant group are the small copepods (*Oithona, Clausocalanus, Calocalanus* and *Oncaea*) during all year, found from 200m depth up to the surface, reflective of the oligotrophic character of the Ionian Sea.

Zoobenthic Communities: available data mostly refer to coastal area, with recent sampling relevant to East of Corfu island. Most significant groups are represented by Polychaeta (89 species reported)[16], Molluscs (4 classes reported in the study area)[17], Crustaceans (most important for the study area is the decapod due to fishing)[18], Anthozoa (8-18 species expected in the study area, 3 of which are threatened according to the IUCN: *Cladocora caespitosa, Paranemonia vouliagmeniensis* and *Crassophyllum thessalonicae*)[19], Sponges (180 species reported in the Ionian

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9 Konstantinos Topouzelis, Despina Makri, Nikolaos Stoupas, Apostolos Papakonstantinou, Stelios Katsanevakis "Seagrass mapping in Greek territorial waters using Landsat-8 satellite images", 2018, Department of Marine Science, University of the Aegean, University Hill, 81100, Mytilene, Greece

10 "Monitoring and assessment of the conservation status of marine habitat types and species of Community interest in Greece", (Phase A: Preparatory work - Deliverable A4.2 "Explanatory Report of the Potential Spread of marine habitat types and species", Partnership of Consultants D. Argyropoulos - GAMMA 4 LLC-I. Sigalas, June 2014)

11 November 2015, conducted by the Hellenic Centre for Marine Research (HCMR), the Fisheries Research Institute (HAO-DEMETER) and the University of Patras - Laboratory of Marine Geology.

12 Casotti R., Landolfi, A. Brunet C, D'Ortenzio F, Mangoni O and Ribera d'Alcala M. Composition and dynamics of the phytoplankton of the Ionian Sea (eastern Mediterranean) 2003 Journal Of Geophysical Research, VOL. 108, NO. C9, 8116, doi:10.1029/2002JC001541, 2003

13 HCMR (by Poseidon team | Design and development by hcmrnet & E. Chatzikosti, 2008-2012

14 Orfanidis, 1992; Panayotidis et al. (2004), Diannelidis (1950), Gerloff & Geissler (1974) Athanasiadis (1987, for the Aegean Sea). Ribera et al. (1992), Gallardo et al. (1993) and Gómez Garreta et al. (2001a, Tsiamis et al in 2013 Directive 92/43/EK

15 Siokou-Frangou, I. *et al.* (2010), Dolan, J.R. *et al.* (2002), Nowaczyk, A. (2011), Scotto di Carlo, B. *et al.* (1991), Mazzocchi, M.G. *et al.* (2003), Mazzocchi, M.G. *et al.* (2014), Ramfos, A. *et al*. (2006), Gorsky & Palazzoli (1989), Kehayias, G. (2004), POSEIDON System, HCMR (2016).

16 The Polychaetes (Annelida, Polychaeta) of Greece, checklist, distribution and ecological characteristics, N. Simboura & A. Nicolaidou, 2001

17 http://www.emodnet-biology.eu/toolbox/en/download/occurrence/dataset/624

18 Kitsos, M.S., Anastasiadou, Ch., Tzomos, Th., Chatzopoulos, Ch., Koukoura, A. & Koukouras, A., 2006. The decapod (Crustacea, Malacostraka, Caridoida) fauna of the Aegean Sea and comparison with those of the neighbouring seas. 10th International Congress on the Zoogeoraphy and Ecology of Greece and Adjacent Regions, Patras, Greece, Abstract, p. 122

19 Marzia et al. (2017), Chintiroglou & den Hartog, (1995), Chintiroglou, Ch. *et al.* (1989), Bo, M. *et al.* (2011), Otero, M.M. *et al.* (2017), Heestand & France (2016)

Sea, 8 of which are threatened: *Aplysina aerophoba, Axinella polypoides, Calyx nicaeensis, Geodia cydonium, Petrosia ficiformis, Spongia agaricina, Spongia officinalis* and *Tethya aurantium*)[20].

Invertebrates[21].: *Pinna Nobilis* (coastal areas of 0.5-50m depth, vulnerable by the IUCN) *Lithophaga lithophaga* (30-50m, on reefs-1170 habitat type), *Centrostephanus longispinus* (urchin, 3-250m depth, on 1170 and 1110 type habitats) and the Scyllarides latus (mainly 3-50m, 1170 habitats).

Corals[22],[23]: Habitat type 1170 - Habitat Directive 92/43/EC priority habitat (30-50m and deeper type 50-200m). Also, cold water coral species reported in the area (120-1,400m depth), which might be found in the depth range of the Block 2 area (800-1200m).

Fish Fauna: 224 fish species identified in the Ionian Sea, of mostly commercial (fishing) value. 101 species of deep-water fish (300-1200m depth), which might be found in the depth range of the Block 2 area (800-1200m), have been identified in the Study Area (see ch.3.5.5.5 of the *ESBS of the Hydrocarbon Exploration Program - – Block 2, Ionian Sea*).

4.5.3.2 Bird Fauna-Sea Birds

Two IBAs exist in the wider study area, namely: GR082 - Diapontia islands (Othonoi, Ereikousa, Mathraki) and surrounding islets and GR083 - Lagoons of Kerkyra island are located within the study area. The most important bird species are European shag (*Phalacrocorax aristotelis*[24]-LC[25], Species of European Concern, resident) and Scopoli's shearwaters (*Calonectris diomedea*-LC, Species of European Concern, visitor). Other bird species present in the area are Eleonore's falcon (*Falco eleonorae*-LC, IBA trigger species, breeding), Audouin's gull (*Ichtyaetus audouinii*-LC) and European herring gull (*Larus argentatus*-LC).

4.5.3.3 Marine Mammals

According to the available literature[26], the marine mammal species, which are likely to be present in the area of the Inner Ionian Sea are the following:

- ✓ Bottlenose dolphin (*Tursiops truncatus*);
- ✓ Striped dolphin (*Stenella coeruleoalba*);
- ✓ Common dolphin (*Delphinus delphis*);
- ✓ Risso's dolphin (*Grampus griseus*);
- ✓ Cuvier's beaked whales (*Ziphius cavirostris*);
- ✓ Sperm whales (*Physeter macrocephalus*);
- ✓ Fin whale (*Balaenoptera physalus*); and
- ✓ Monk seal (*Monachus monachus*).

The overall conclusions of presence marine mammals in the wider project areas are the following

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[20] Tsoukatou, M. *et al.* (2003), Vacelet, J. *et al.* (2008), Voultsiadou, E. (2009), Dasaklis & Sigalos (2014), Pansini M. & Longo K. (2003), Neumann AC (1966), Bell, J. J. *et al.* (2015)

[21] *Monitoring and assessment of the conservation status of marine habitat types and species of Community interest in Greece", (Phase A: Preparatory work - Deliverable A4.2 "Explanatory Report of the Potential Spread of marine habitat types and species", Partnership of Consultants D. Argyropoulos - GAMMA 4 LLC-I. Sigalas, June 2014,)*

[22] *Monitoring and assessment of the conservation status of marine habitat types and species of Community interest in Greece", (Phase A: Preparatory work - Deliverable A4.2 "Explanatory Report of the Potential Spread of marine habitat types and species", Partnership of Consultants D. Argyropoulos - GAMMA 4 LLC-I. Sigalas, June 2014,)*

[23] New Mediterranean Biodiversity Records 2016. Mediterranean Marine Science Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS The journal is available on line at http://www.medit-mar-sc.net DOI: 10.12681/mms.1976

[24] Also known as *Gulosus aristotelis*

[25] IUCN assessment: LC - Least Concern, VU – Vulnerable, EN – Endangered

[26] Frantzis, A. *et al.* (2003), Frantzis et al., (2009), Giannoulaki, M. *et al.* (2017)

Bottlenose dolphins (*Tursiops truncatus*), as proven by many sightings, are found in the coastal areas of the Inner Ionian Sea. In the study area, many sightings of the species have been registered around all coasts of Corfu and Diapontia Islands, at the coast of Paxos and the coast of the mainland of Epirus[27]. It is expected that they will be regularly encountered around the coastal waters of the study area at a depth of 1-1,500 m and at a 0-26 km distance from the coast, during all year long, which can coincide with the Block 2 study area (800-1200m depths). Their reproduction period is between April - September[28].

The North inner Ionian Sea is important for Common Dolphins (*Delphinus delphis*) as proven by the sightings. The common dolphin is expected to be regularly encountered around the coastal waters of the study area along the continental slope in waters 200-2,000 m deep. They are present in the wider study area during all year and their reproduction period is between May - October[29]. It should be noted that the study area is not included in any of the 8 proposed Areas of Conservation Importance recommended by the ACCOBAMS scientific committee as part of the Mediterranean Common Dolphin Conservation Plan[30].

In the study area, the Striped Dolphins (*Stenella coeruleoalba*) have been usually observed mainly in the Eastern coast of Corfu and around the Diapontia Islands. In general, it is a mainly pelagic or deep water species (more than 200 m depth) and it is rare to be found close to the coast and in shallow waters (more than 1.5 km from the coastline). They are present during all year and their reproduction period is in autumn.[31]

Strandings of Risso's dolphins (*Grampus griseus*) in the North- West and in the East of Corfu are an indication of the presence of the species in the wider area. However, it is believed that the possibilities of finding it in the area are very low.[32]

Cuvier's beaked whales (*Ziphius cavirostris*) have been sighted in the offshore waters around the Diapontia Islands and the West of the Corfu Island, and some stranding events recorded in the study area. Therefore, there are considerable chances to be encountered in the deep waters of the study area, with a presence all year long and reproduction period during early -mid-summer.[33]

Fin whales (*Balaenoptera physalus*) have been observed during the summer months in the Northern Ionian Sea. However, even though the study area has the characteristics of the marine areas where Fin whales can be found, the possibilities of finding them in the area in November and December needs to be confirmed. Their reproduction period in the Mediterranean is expected to be between September to January[34].

Sperm Whales *(Physeter macrocephalus)* are not commonly observed in the study area. Stranding events have been reported in the past in the Adriatic, being the result of their erroneous entrance in that sea, which is known to be a trap for sperm whales. Thus, the possibilities of finding them in the area are very low. Their reproduction period in Mediterranean is expected to be Late Winter-until end of August[35].

Monk seals (*Monachus monachus*) few individuals were observed in the coastal areas of the Diapontia islands, the West and East of Corfu and the region between Paxoi and Corfu and the West coast of Corfu Island is one of the areas where breeding has been reported. Vagrant individuals moving to the Adriatic Sea (Italian coasts) are rare, but may be found within the Project area, even if the species prefer coastal habitats, which can be also interested by the presence of the seismic fleet during their trips from or to the harbour. The reproduction period is mainly in spring[36].

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27 Frantzis & Alexiadou., (2003), Giannoulaki et Al., (2016)

28 Frantzis & Alexiadou., (2003), Giannoulaki et Al., (2016)

29 Markoglou, E. *et al.* (2015), Giannoulaki et Al., (2016)

30 Conservation Plan for short-beaked common dolphins in the Mediterranean Sea, ACCOBAMS, 2004.

31 Frantzis & Alexiadou (2003), Frantzis et al. (2003)

32 Frantzis & Alexiadou (2003), Frantzis (2003),

33 Frantzis, 2003, Frantzis et al. (2003), Frantzis, A. (1998), Frantzis, (2014), Cañadas et al. 2011, Frantzis & Alexiadou (2003)

34 Frantzis (2003), Frantzis (2009), Frantzis & Alexiadou (2003), Frantzis et al. (2003), Panigada et al., 2017

35 Frantzis et al. (2003), Frantzis & Alexiadou (2003), Bearzi, G. *et al.* (2011), UNEP-MAP-RAC/SPA. (2014), Mazzariol, S. *et al.* (2011)

36 Adamantopoulou et al. (1999), Dendrinos et al. (2008), MOm (2005),

4.5.3.4 Sea Turtles - *Caretta caretta*

The Mediterranean Sea is a significant habitat for Loggerhead turtles (*Caretta caretta*) where they nest, feed, mate and grow. In Greece the main nesting assemblages, hosting approximately the half of the Mediterranean nests, are located in the Ionian Sea and the Cretan coast.

Within the study area, closest nesting beaches are located in the west-south coast of Corfu, however, it is believed that the possibilities of finding it in the area are relatively low. Their nesting period is considered to be between April to September. Furthermore, the Strait of Otranto seems to constitute an important migration passage towards the feeding ground of the North Adriatic, one of the most important feeding habitats of the species in the Mediterranean Sea[37].

4.5.3.5 Presence and Seasonality of Marine Mammals and Sea Turtles

It is noted that more details about the marine fauna of the study area are presented in the Appendix A of this study.

Presence and relevant seasonality of marine mammals and turtles in the study are is summarized in the following table.

Table 4.3: Presence and Seasonality of Marine Mammals and Turtles in the Study Area

Species	Presence	Seasonality	Breeding / Calving	IUCN Status Mediterranean[38]	Greek Red Book Status[39]
Bottlenose dolphin (*Tursiops truncatus*)	Expected	All year	April-September / April-September	VU	VU
Striped dolphin (*Stenella coeruleoalba*)	Expected	All year	July-August / July-August	VU	VU
Common dolphin (*Delphinus delphis*)	Expected	All year	May-October / March-September	EN	EN
Cuvier's beaked whale (*Ziphius cavirostris*)	Possible	All year	Early-Mid Summer / Early–Mid Summer	DD	DD
Risso's dolphin (*Grampus griseus*)	Very Low chance	All year	Unknown / unknown	DD	VU
Fin whale (*Balaenoptera physalus*)	Low Chance	Spring and Summer (winter presence to be confirmed.	September-January / August-December	VU	DD
Sperm whales (*Physeter macrocephalus*)	Very Low chance	All year	Late Winter-End of August / Late Summer-Early Autumn	EN	EN
Monk seal (*Monachus monachus*)	Expected	All year	All Year Mainly Spring / all year mainly Spring	CR	CR
Loggerhead turtle (*Caretta caretta*)	Low Chance	All year (Nesting)	May-October / June-November (Hatchling)	LC	EN

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[37] Margaritoulis, D. (1988), Margaritoulis & Teneketzis (2003), UNEP (2014), Lucchetti & Sala (2009), Lazar, B. *et al.* (2011), Casale et al., (2012), Teneketzis et al. (2006),

[38] IUCN assessment: LC - Least Concern, VU – Vulnerable, EN – Endangered, CR – Critically Endangered, DD – Data Deficient

[39] Greek Red Book assessment: VU – Vulnerable, EN – Endangered, CR – Critically Endangered, DD – Data Deficient

4.6 AIR QUALITY

An assessment of the air quality for the whole country was carried out within the project "*Updating the mapping of atmospheric pollution by recording the atmospheric emissions of the sources and development of an appropriate computational tool*", based on the existing monitoring station of the National Air Pollution Monitoring Network (NAPMN), established by the Ministry of Environment, Energy and Climate Change and indicative measurements at selected additional locations (one of which was set on Corfu island) and extending the assessment to the rest of the country using simulation techniques. The measurements took place within the period 2014-2015 and showed that the limits of the pollutants (as set in the Air Quality Directive 2008/50/EC) were only exceeded 3 days for the 50 μg/m^3 daily limit of Particulates PM_{10} (below the allowed 35 days of exceeding the limit) and for Benzo[a]pyrene (BaP), of which the mean yearly measurements at Corfu station was 1.2 ng/m^3 (threshold of 1 ng/m^3). Also, due to the marine character of the study area, the mapping project showed that a big percentage (5-15%) of the PM_{10} are caused by the natural evaporation of the sea, lowering the actual quantities of the pollution-derived particulates.

The data confirms that as there are no big cities or industries in the direct neighbourhood of the study area, it is obvious that the quality of the atmosphere is at a very good state, even for pollutants which are usually found in relatively increased concentrations in ports (i.e. SO_2, PM_{10} and $PM_{2.5}$, carbonyl compounds) related to the ships' flow and the operation of the port. Of course, in the summer there is an increased flow of both passenger/ferry boats and recreation crafts and perhaps the air quality might be locally degraded, as ship emissions can have considerable impact on atmospheric concentrations of several pollutants, especially in coastal areas (Matthias *et al.,* 2010).

4.7 ACOUSTIC ENVIRONMENT

The noise has two different sources:

- ✓ natural sound sources in the atmosphere and water (impulse noise, bubble noise, turbulence, seismic noise, air – sea noise, precipitation noise, Surfing noise and sediment motion, Biological noise- from cetaceans, fishes and invertebrate – thermal noise); and
- ✓ anthropogenic sources of air- and water-borne sounds/ noises (explosives, Industrial activities, Seismic research, sonar, Ships and smaller vessels, aircrafts).

In the wider offshore area, the prevailing source of noise, in conditions of calm and absence of precipitation, mostly originate from the marine traffic of cargo ships and ferry boats, recreational boats and coastal fishing. The traffic of ferry boats and recreational boats is especially increased in summer and, therefore contribute more to the levels of environmental noise.

In 2016 ACCOBAMS published a study of the noise hotspots in the Mediterranean Sea. Efforts in data collection were focused on activities using noise sources like coastal and offshore activities, geophysical surveys, naval exercises, marine traffic. In conclusion, from the data presented in the ACCOBAMS report and the above figures, it is expected that the study area is burdened with significant noise from several of the aforementioned activities and it is mentioned that the area of the northern part of the Hellenic Trench (where the study area is located) is identified as an area where potential conflicts between human activities and cetacean conservation might occur, in the framework of noise pollution (see more in ch. 3.7.2 of the *ESBS of the Hydrocarbon Exploration Program - – Block 2, Ionian Sea*).

4.8 WATER QUALITY

The coastal areas included in the study area belongs to the Corfu-Paxos River Basin (GR34) of the Water District of Epirus (WD 05).

According to their quality classification set in the Management Plan of the Water District of Epirus [40], the water bodies of the River Basin in the study area have an ecological status ranging from high to good, while their chemical status is recorded as unknown.[41]

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[40] Ministry of Environment, Urban Planning and Public Works, Management Plan of the Water District of Epirus

[41] According to the Special Secretariat for Water (Ministry of Environment and Energy, Greece), the methodologies followed for the classification of the water bodies are developed based upon the corresponding EU Guidance Documents, the EU observations following the assessment of the approved Management Plans, the available data from the operation of the

Also, according to the "Monitoring program of the quality of bathing waters at Greek coasts" there are fifty-seven (57) bathing beaches in the study area with good or excellent water quality, based on the latest sampling measurements (Bathing Water Quality in Greece, Reference year 2016)[42]. These are considered as protected recreational water areas, according to the Water Management Plan of District of Epirus.

Finally, the marine region of Corfu has also been studied within the framework of the "State of the Hellenic Marine Environment" report of the Hellenic Centre for Marine Research[43]. During the analysis of the Chemical state of the Marine Waters in Greece[44], the Sea of Corfu, as well as the coastline of the Ionian Sea (Kalamitsi – Preveza) are both described as typical oligotrophic marine environments, which are characterized as undisturbed to slightly disturbed areas, either due to the limited pressures to the water environment or due to the water circulation and dilution processes which control the nutrient distribution. The measurements carried out present a rather unpolluted area, with low nutrient measurements during the whole year long.

4.9 ANTHROPOGENIC SOURCES OF PRESSURE ON THE ENVIRONMENT

Urban wastewater

There are four (4) active wastewater treatment facilities in the study area, two (2) of which are discharging the processed water to the sea. From the wastewater treatment activities, it is estimated that approximately 148.5 tonnes/year BOD, 184.4 tonnes/year Suspended Solids (SS), 70.1 tonnes/year Nitrates (N) and 45.0 tonnes/year Phosphates (P) are discharged in the study area.

Industry

The main industrial activities in the study area are found in Central and Northern Corfu as there is no organized industrial zone. The biggest industrial units of Corfu are twelve (12)[45] and it is estimated that they contribute to the pollution of the area with 2,172.5 tonnes/year BOD, 9,576.4 tonnes/year Suspended Solids, 2,0 tonnes/year Nitrogen, 0,4 tonnes/year Phosphorous and 3.4 Oil waste.

Fish farms

There is only one fish farm within the study area, however this is located on the North-Eastern coast of Corfu contributing to the pollution of the area with 199.4 tonnes/year BOD, 36.4 tonnes/year Nitrogen and 8.3 tonnes/year Phosphorous.

Urban solid waste

Based on the current Water Management Plan of the Ionian Islands Region, there are two (2) sanitary landfills in the study area, with only one of them being operational. In addition, there are eleven (11) uncontrolled landfills, 7 of which in Corfu, one on Paxos, one on Mathraki, one on Othonoi and one on Ereikoussa Island.

Diffuse sources of pollution

Surface runoffs from urban areas, cultivated areas and livestock breeding can significantly contribute to pollution loads. The biggest impact can be related to urban areas as the organic and nitrogen loads are estimated to contribute more than 78%, and 41% respectively on the total load. Agriculture is responsible for the highest phosphorus loads though (at 88%).

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National Monitoring Network, and taking into account the particular circumstances prevailing in Greece. After the examination of the physicochemical elements, the biological parameters, the specific national pollutants and the hydrological elements, the ecological quality of surface water bodies is assessed and presented with the following qualitative five-point scale: High, Good, Moderate, Poor, Bad.

42 Bathing Water Quality In Greece - Reference year 2016, (June 2017), Ministry of Environment and Energy, Special Secretariat for Water

43 *S tate of the Hellenic Marine Environment*, Institute of Oceanography, Hellenic Centre for Marine Research, Athens 2005.

44 Pavlidou, A., Psyllidou-Giouranovits R. & Sylaios, G.K. *Nutrients and dissolved oxygen in Hellenic coastal waters*, *State of the Hellenic Marine Environment*, Institute of Oceanography, Hellenic Centre for Marine Research, Athens 2005.

45 According to the Chamber of Corfu, most industrial units concern food processing (alcohol production, meat & fish process, sweets and dairy products). Other types of industrial units include: chemicals production & commerce, concrete production, aroma & cosmetics and wood processing.

Marine litter

According to the available data of HELMEPA[46], the quantity of coastal litter in the Ionian-Adriatic region is not so high compared to other areas, with an average value of 136 kg/km^2. The west coasts of the Peloponnese have the highest values, 500 kg/km^2, possibly due to prevailing winds.

At any case, according to the requirements for waste management and disposal at sea of Annex V of MARPOL 73/78, for the Mediterranean Sea, the disposal of the following into the sea is prohibited:

- ✓ (i). all plastics, including but not limited to synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products which may contain toxic or heavy metal residues; and
- ✓ (ii). all other garbage, including paper products, rags, glass, metal, bottles, crockery, dunnage, lining and packing materials;
- ✓ (iii). disposal into the sea of food wastes shall be made as far as practicable from land, but in any case, not less than 12 nautical miles from the nearest land.

4.10 SOCIAL ASPECTS

4.10.1 Local Social Context

The Corfu Regional Unit (RU) is an area of island character, which includes Corfu, the second largest island in the Ionian Sea, the Diapontia Islands complex (nine islands with the bigger ones being Othonoi, Mathraki and Ereikoussa) and the Paxos islands complex (Paxos and Antipaxos islands).

The population of the area is almost half of the total population of the entire Ionian Islands Region (207,855 inhabitants), where the Corfu RU belongs to.

The population is considered to be fairly educated, with 12.3% having university degrees and postgraduate studies, 21.4% have finished secondary education, 14.7% have finished high school, 29% have at least finished primary school and only a mere 13.7% have abandoned school or are illiterate.

To protect the vulnerable groups in the Region during the economic crisis, the Ionian Islands have adopted a Strategic Framework Plan for the Elimination of Poverty and Social Inclusion which aims to facilitate sustainable development by strengthening competitiveness and attractiveness, through the exploitation of its knowledge economy and of its rich cultural and environmental heritage. Furthermore, an Action plan has been set into motion which is against all forms of social discrimination: racial, gender or lib discrimination (Women, Rom Communities and People with disabilities). As for the presence of minority communities, the main one in the study area is Rom population, of about 364 persons, the majority of which inhabit in the areas of Parelion and Achilleion in Corfu in three (3) known sedentary type camps at the settlements Livadi Ropa, Vassilika and Lefkimmi, far from the coastal areas of interest to the project.

The COVID-19 pandemic has resulted in over millions confirmed cases and many deaths globally. It has also sparked fears of an impending economic crisis and recession. Social distancing, self-isolation and travel restrictions forced a decrease in the workforce across all economic sectors and caused many jobs to be lost. Schools have closed down, and the need of commodities and manufactured products has decreased.

Although, Greece has avoided the worst of the global pandemic so far, with only 2,632 confirmed cases and 146 deaths as of May 4th 2020, one of the lowest counts in the European Union, and also Corfu RU has only 2 confirmed cases and 1 death (May 4th 2020), it is considered certain that the Region is going to be impacted in the social and economic environment since tourism is the key economic activity.

The Regional Unit of Corfu mainly has an agricultural character comparing to the total of Greece: area under cultivation or fallow land is 73 % versus 38.4% for the country's total. There are also significant urban areas (5.41 % vs. 2.0 % in Greece), due to the extent of the many settlements in Corfu (89 settlements in total) and great development due to its tourist activities.

The islandic character of the study area provides also a great potential for the development of aquacultures. The "Special Framework of Spatial Planning and Sustainable Development (SFSPSD) for fish-farming" of 2011 has set

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[46] Hellenic Marine Environment Protection Association, http://www.helmepa.gr/en/

one main aquaculture development area and additional spatial zones where aquacultures could also be installed. However, currently only one Fish farm exists in the study area off the North-Eastern coast of Corfu, near Kassiopi.

Fishing is very important for all the Ionian Islands and the study area. According to the Fishing Department of the Corfu Regional Unit, there are 520 registered fishing boats in Corfu, 11 of which are middle-size fishing vessels, while the rest is small sized. It is estimated that around 1560 people are working in the fishing sector in the area. According to the available yearly fishing catch data of Eurostat, during the period 2011-2015, catches for the Corfu RU are estimated around 2,000-2,200tn per year. Most common fishing areas are limited near the coast of Corfu, Paxos and Diapontia islands and within the 6 nautical miles of the Greek terrestrial waters. The Block 2 area is considered to be international waters and it might be a fishing region for large kinds of fish of the open sea such as swordfish and tuna but it is considered to be rarely used and mainly by Italian fishing vessels.

Administratively, the study area includes the Corfu Regional Unit, part of the Ionian Islands Region. It includes four Municipalities[47] (Central Corfu and Diapontia Islands Municipality, North Corfu Municipality, South Corfu Municipality and Paxos Municipality). The Region of the Ionian Islands is part of the Decentralized Administration of Peloponnese, Western Greece and the Ionian. Corfu has a big urban centre, with departments of all-important authorities such as the Police, Fire department, County Court, etc. Also, the Central Coast Guard of Corfu and the Coast Guard department of Paxos are protecting the marine regions of the study area.

The rich historical background and cultural heritage of the Ionian Islands and Corfu is one of its main strengths. Being on the border between mainland Greece and Italy, the area has been influenced by many different backgrounds. It is because of this, the study area has numerous ancient ruins, Byzantine and modern monuments. The eight (8) most important archaeological sites include prehistoric, ancient Greek and Roman settlements. The Ministry of Culture has declared an underwater archaeological site, an ancient Roman wreck, just off the South coast of the island, at shallow water area. Based on information received by the Department of Marine Antiquities of the Ministry of Culture, two more Roman shipwrecks have been discovered in the wider study area at a great depth (1,300m). Other important cultural elements of the study area are its Byzantine monuments, its museums, its traditional agglomerations, its numerous historic listed monuments, buildings and works of art and its mixture of religious beliefs.

As for migration flows, according to the police data there is a decline in the flows directed to foreign countries and use the Ionian Islands as intermediary stations.

4.10.2 Human Development

According to the Human Development Report of the United Nations (2019), Greece's Human Development Index (HDI) value for 2018 is 0.872 — i.e. in the range of "very high human development" category — positioning the country at 32 out of 189 countries and territories. Since 1990, the country's HDI has increased 13.7%.

Human rights are respected and protected by NGOs and volunteer bodies in the study area. Key values identified by the Network of Volunteers of Corfu are: Human Rights, Children Rights, Women Rights, People with Disabilities Rights, Rom People rights, Social solidarity to vulnerable social groups, Youth, education and Lifelong learning, Health and welfare, Protection of the environment, Protection from natural disasters, Culture and Sports and Quality of Life.

Community health and relevant infrastructure are covered by complete services on the island of Corfu. It has one General Hospital, one Medical Centre, 20 Regional Health Clinics, 1 health centre and numerous regional health clinics.

Corfu represents a cultural, fine arts and education centre in the Ionian Islands, home to the Ionian University, many schools and colleges thus there is a high level of education among the population. Primary education consists of 71 Kindergartens, 54 Primary Schools, 1 Special Education School for Deaf Children. Secondary Education includes 24 Junior High schools, 1 Music Junior High school, 1 Evening High school, 1 Vocational Jr High school, 1 School of Special Professional training, 12 Senior High schools, 4 Vocational Senior High schools (EPAL), 1 Professional Training School, 1 Second Chance School. Higher education level is represented by the aforementioned Ionian University which has 3 Schools.

Numerous community services are provided to the inhabitants of the study area with both centralized services pertaining to the municipality of Corfu and decentralized services (Local administration bureaus, etc.). Other

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[47] From 2019, after the local administration elections the former Municipality of Corfu divided into three smaller municipalities.

provided services relevant to social welfare include retirement homes, centres for children with disabilities, special education schools and a community network of mental health services.

4.11 SOCIOECONOMICS

4.11.1 Resources and Activities

Historically, the contribution of both agriculture and livestock breeding in the financial development of the Region of the Ionian Islands benefited both from the morphology of the land and the climate conditions, which are the appropriate ones for the development of this sector. To date, the primary sector in the study area is very strong, with a highly developed farming and livestock breeding.

The fishing activity in the Region of Ionian Islands is exercised extensively at a professional level using coastal fishing boats mainly and less middle-distance fishing, whose catches depend on seasonal fluctuation. At a smaller extent, amateur fishing boats are also active but there are no data for their fishing effort and production. Their catches are almost exclusively sold at the local market and professional fishing significantly contributes to the local and, generally, national economy. Fish-farming is also very promising for the study area but currently only one aquaculture is operating at the North-East coast of the island, in the area of Kassiopi (sea bass and bream breeding). The secondary sector is dependent on the primary one, including mostly farm related businesses (mainly oil mills, wineries, cheese factories, cottage industries, etc.).

The tertiary sector is the most dynamic growth area in the Region of Ionian Islands and this region shows strong growth. The distribution of employment by sector at the regional level during the period 2000-2010 characterized by a general shift towards the tertiary sector. Tourism, a key economic activity in the third sector, is particularly developed in Corfu, strongly supporting the local economy.

The Ionian Islands Region is steadily the richest region of Western Greece – Peloponnese – Ionian Islands.

Employment in the Ionian Islands Region per sector (expressed as a percentage on the total of the country) shows an increase in the primary sector from 2.34% in 2001, to 2.85% in 2011 and 2.55% in 2014. In the secondary sector it follows an opposite development in relation to absolute figures and, specifically, it increased from 1.26% in 2001 to 1.84% in 2011, to decrease again to 1.66% in 2014. In the tertiary sector, despite the exponential increase in absolute figures, the corresponding percentage decreased from 0.80% in 2001, increased by 0.82% in 2011 and 0.89% in 2014. Unemployment has spiked the latest years due to the economic crisis (reaching up to 28.9% in Q1 of 2015), but the percentages are constantly held quite lower than the country's average, mostly due to the intense tourist activities of the study area. The last three years overall unemployment in Greece is decreasing, reaching an average of 17.2% for 2019. Those levels are certain to be increased within 2020, since the COVID-19 outbreak.

4.11.2 Infrastructure Services

In the study area 46 ports are located in Corfu, 6 in Paxos, 1 in Antipaxos, 3 in Mathraki, 3 in Ereikoussa and 2 in Othonoi. Most passenger and vehicle traffic takes place during the second and the third trimester of the year for all the main ferry routes of Corfu – Igoumenitsa and there is an increase in passenger and vehicle traffic from 2014 to 2016, at almost all periods of the year. According to the Port Authority of Corfu, some passenger and cargo traffic routes however seem to cross the Block 2 area but are not relevant to Corfu Island (coming from other parts of the Ionian Sea travelling to Italy and vice versa).

The road network of Corfu is extremely dense and covers all settlements of the island. Public transportation is available. Air transportation is possible through the international airport of Corfu and the heliports on Othonoi, Ereikoussa and Paxos islands.

According to the national telecommunications network directorate, there are fully operational telecommunications (broadband connections, optical networks, etc.) covering the whole study area, connecting it with mainland Greece with submarine cables. Also, there are underwater telecommunication cable connections of Corfu with Italy, and Albania, which pass through the marine part of the study area.

4.11.3 Marine Traffic

The study area is directly concerned by one of the main shipping route entering in the Adriatic Sea (the Adriatic Motorway of the Sea). Figure below, extracted from the web portal Marinetraffic.com, shows the density map of marine traffic in the project area, based on the AIS data sent by each vessel provided with an AIS system, during 2017.

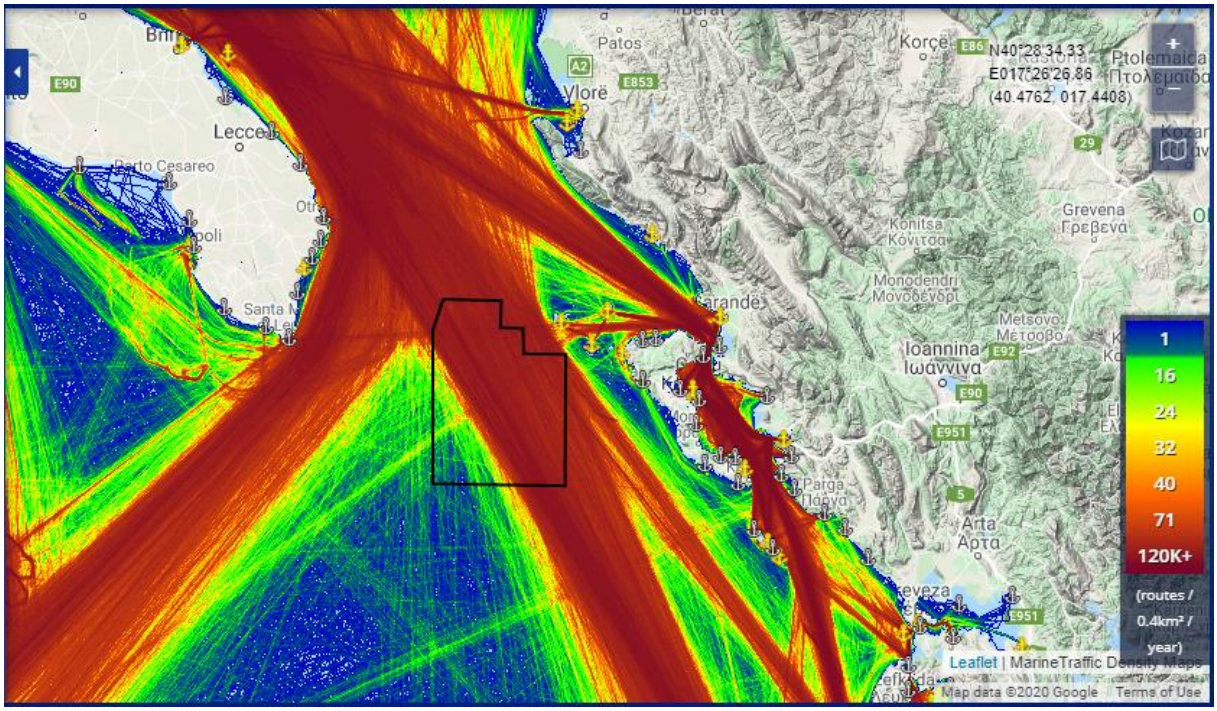

Figure 4.3: Density Map of 2017 Marine Traffic in the Project Area (www.marintraffic.com)

However, based on information provided by the Coast Guard, there are no specific sea routes and marine Traffic Separation Schemes (TSS[48]), thus, ships may anchor or move outside the commonly used area.

A dedicated Automatic Identification System (AIS[49]) data analysis was carried out for the project area in order to provide detailed information about the actual traffic.

Data were acquired from a specialized provider for an extent including Block 2 and the survey operational area (overall area 7.845 km^2) for the period January 2015 to December 2017.

Following table shows the overall maximum peak vessel transits per month registered in the entire extent and in the analysed period.

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[48] Traffic Separation Scheme or TSS is a traffic-management route-system ruled by the International Maritime Organization or IMO. The traffic-lanes (or clearways) indicate the general direction of the ships in that zone; ships navigating within a TSS all sail in the same direction or they cross the lane in an angle as close to 90 degrees as possible. The TSS rules are incorporated in the International Regulations for Preventing Collisions at Sea (Under Part B, Section I, Rule 10- Traffic Separation Schemes).

[49] The International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea requires AIS to be fitted aboard international voyaging ships with 300 or more gross tonnage (GT), and all passenger ships, regardless of their size

Table 4.4: AIS Data - Maximum Peak Vessel Transits per Month (January 2015 – December 2017)

Vessel Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo Ships	181	72	142	576	632	543	437	510	284	268	89	96
Fishing Boats	1			14	10	15	6	5	1	2	1	2
Passenger ships	14	8	7	74	103	85	95	113	63	63	12	8
Pleasure Crafts				12	32	57	30	62	30	2	1	
Sailing vessels				16	42	89	16	58	10	2		
Tankships	96	41	60	224	253	217	203	235	105	108	39	46
All vessels type *	298	123	205	944	1105	1033	789	1030	497	459	134	152

Note:
* Reported values are relevant to maximum monthly transit registered in the entire period and include other vessels type (tugboat, dredgers, etc.) not reported in the table.

Data reported in the table above show that November and December (the period in which the seismic activities are foreseen), are characterized by the lowest values of transit during the year, together with the month of February.

Moreover, an offshore boat detection has been performed in the project area by TOTAL using Radar imagery for years 2017 (176 radar images), 2018 (309 radar images) and 2019 (361 radar images). Such system can provide more accurate data on marine traffic, allowing to detect also vessels that are not provided with an AIS system.

The results of this study confirm the presence inside Block 2 of a main traffic corridor, oriented NW-SE (toward Adriatic Sea), consistent with the 2017 Marine traffic density map, as shown in figure below, with the south-west corner appearing to be less impacted by maritime traffic, if compared to the rest of the Block.

One fixed installation is detected in the South of the AOI (WGS84, Lat: 39,360897; Lon: 19,107445; red circle in figure below).

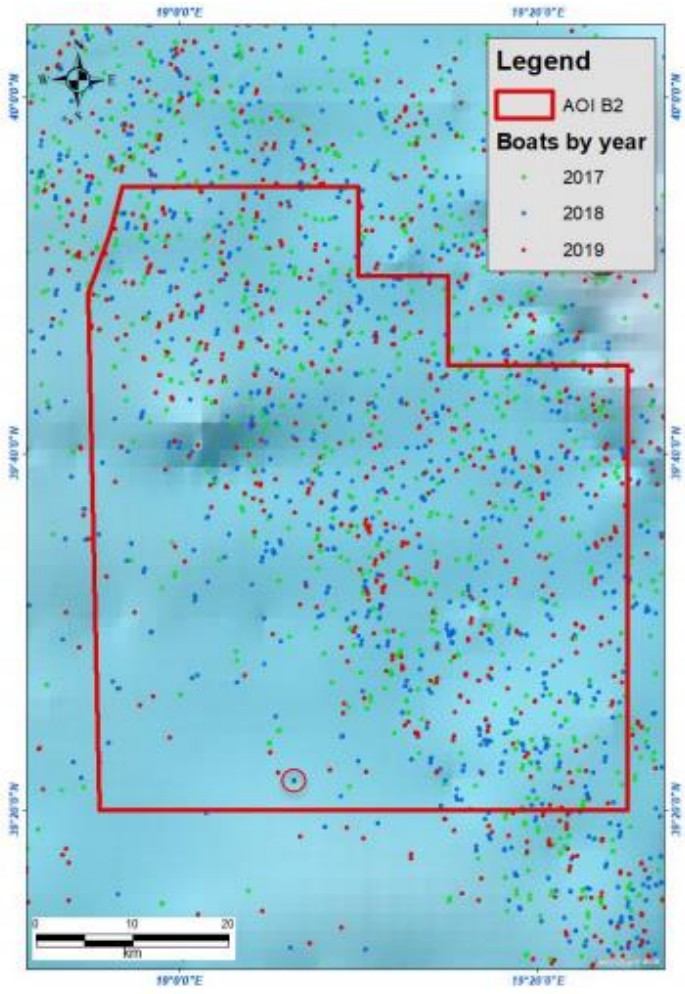

Figure 4.4: Distribution of Detected Boats per Year from January 2017 to December 2019 (TOTAL, 2020)

In particular:

- ✓ 597 boats were detected in 2017;
- ✓ 1.029 boats were detected in 2018; and
- ✓ 1.082 boats were detected in 2019.

In 2017 the number of detected boats is lower, partly due to the lower number of available images.

The monthly average of boats over 3 years shows that maritime traffic is higher for the period between June to November, while between January and March, traffic appears to be quieter.

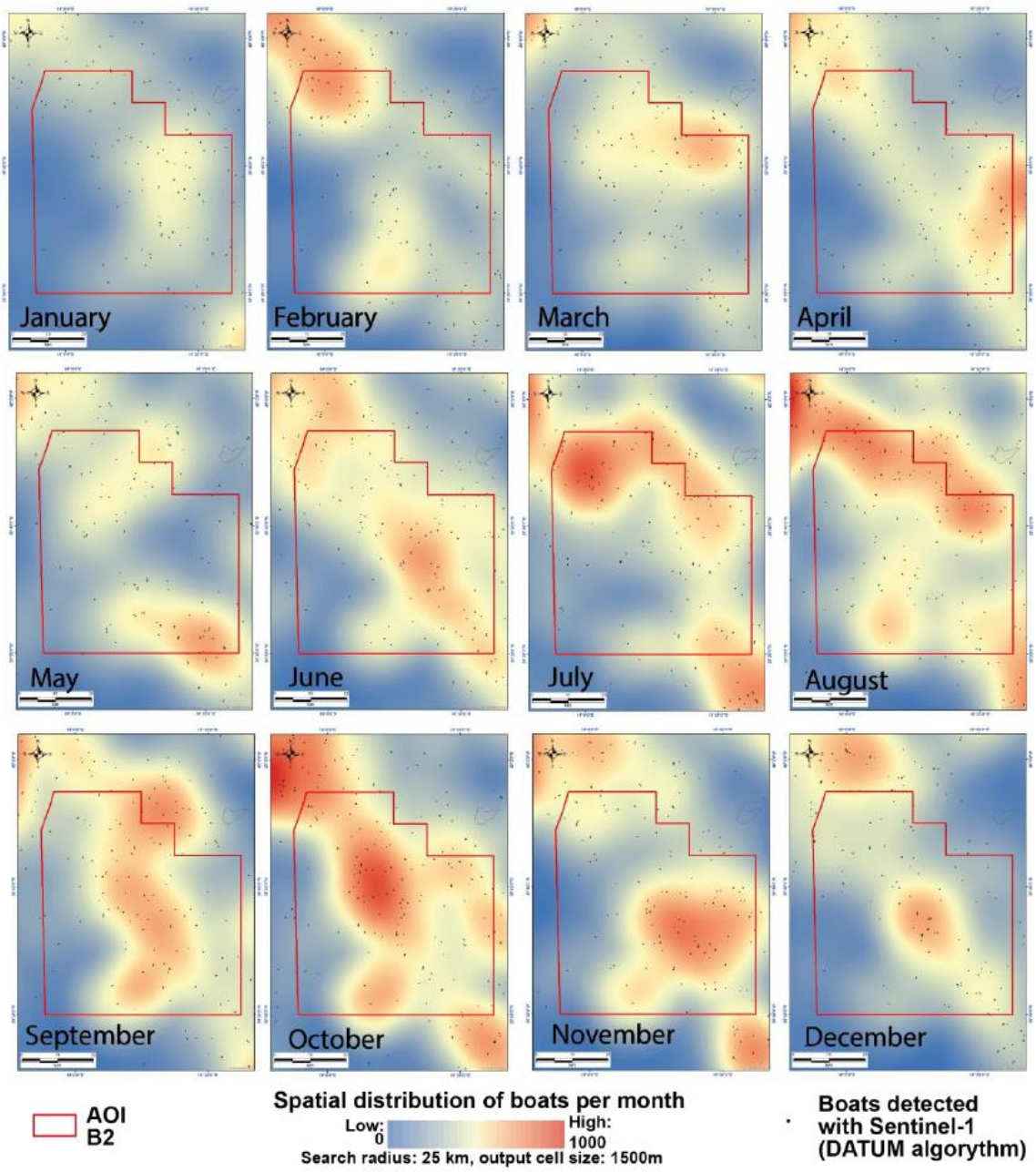

Figure 4.5: Spatial Distribution of Detected Boats per Month over 3 Years (2017, 2018, 2019) (TOTAL, 2020)

With regard to boat size, the study highlighted (see the following Figure 4.7) a size of detected boats ranging from 30 m to 260 m in length with a strong peak for boats at 230 m, which is the typical size of large tankers and a significant portion of boats with smaller sizes (from 30 to 70 m).

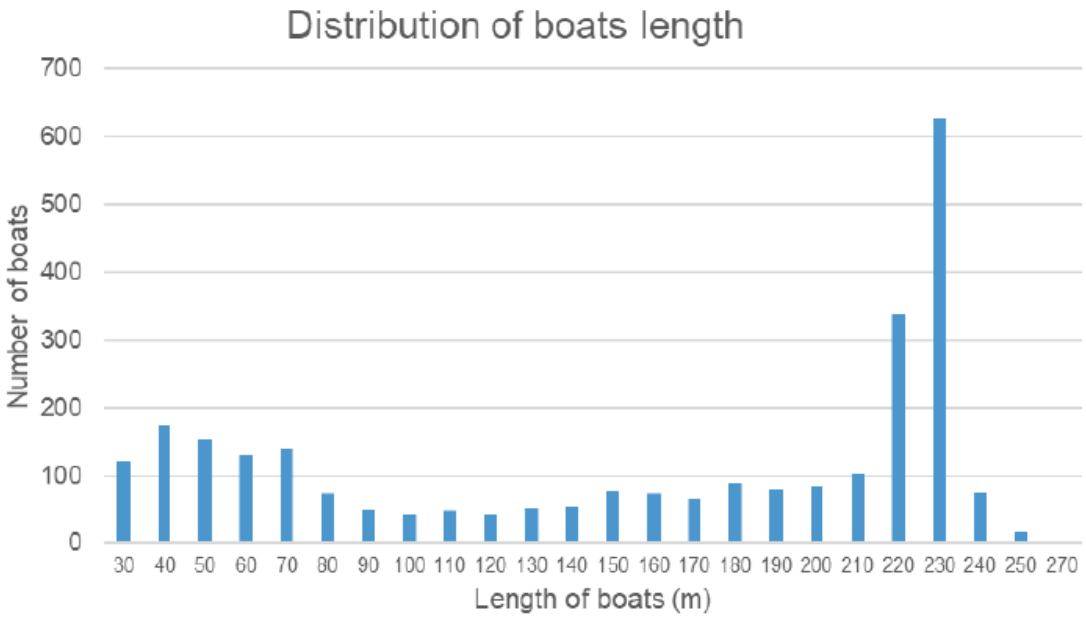

Figure 4.6: Graph Showing the Distribution of the Size of the Boats in Length (TOTAL, 2020)

Figure below illustrates the monthly repartition of boats classified by size.

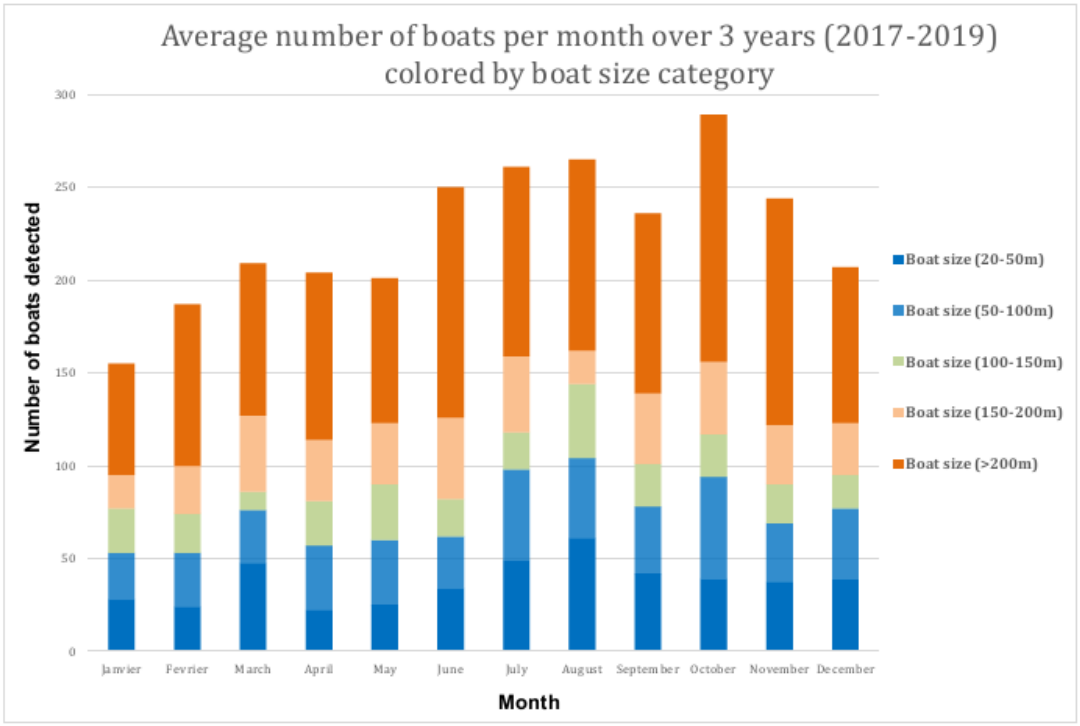

Figure 4.7: Histograms of Boats Average per Month (over 3 Years) and sorted into 5 Classes of Size (TOTAL, 2020)

These smaller boats (from 30 to 70 m), which are not always provided with an AIS system, were also detected mainly along the main NW-SE corridor previously highlighted.

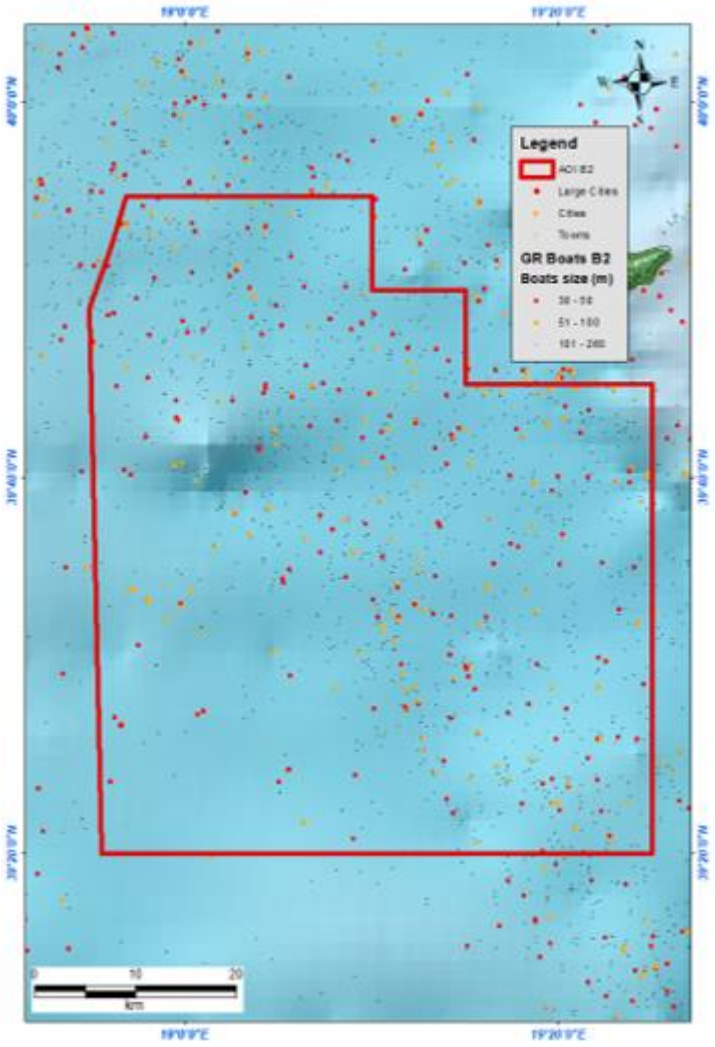

Figure 4.8: Spatial Distribution of Small Boats (30 to 50 m in Red and 50 to 100 m in Orange) detected over the 3 Years 2017-2019 (TOTAL, 2020)

Finally, the VIIRS Nighttime Imagery (Visible Infrared Imaging Radiometer Suite) that has been considered in the study of TOTAL, with an imagery resolution of 500 m, has confirmed this same corridor as mainly used during night-time navigation with no additional abnormal activity at night.

5 IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

5.1 METHODOLOGY OF IMPACTS IDENTIFICATION AND ASSESSMENT

The proposed methodology to assess the environmental and social impacts is based on Total E&P's specification GS EP ENV 120 'Environmental impact assessment of E&P activities" and GS EP SDV 102 "Social Impact Assessment". This embodies a systematic approach derived from Guidelines of the World Bank and Standard ISO 14001.

The main steps of the proposed methodology are summarized in Figure 5.1 and are comprised of the following:

- ✓ **First stage-Impact prediction:** to determine what could potentially happen to receptors as a consequence of the Project and its associated activities. The first stage involves establishing the sources of impacts and the potential effects from the proposed operations based on the project description.
- ✓ **Second stage- Impact evaluation:** to evaluate the severity of the predicted impacts by considering their intensity and the sensitivity/vulnerability of the receptor. The second stage involves estimating the environmental sensitivity of the environmental receptors from the description of the baseline state, evaluating the level of vulnerability of Project Affected Communities (PACs) and Project Affected Persons (PAPs) with regard to the potential impacts and evaluating the potential impact of each potential effect on each environmental receptor, including transboundary and cumulative impacts
- ✓ **Third stage- Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- ✓ **Fourth stage-Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures. The same methodology as that applied to the second stage is implemented; the impact reduction measures enable its intensity to be modified.

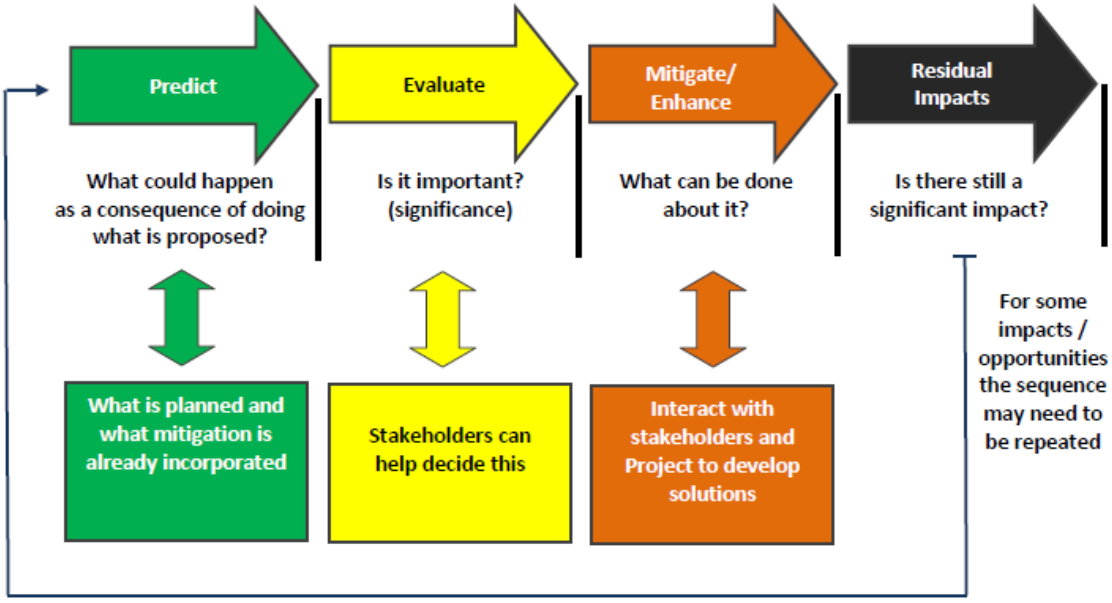

Figure 5.1: Impact Assessment Process

5.1.1 Sources of Impacts and Potential Effects

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the Project and its associated activities. The possible interactions between the

Project and the current state of the environment are identified. From these interactions, the potential impacts to the various resources/receptors are identified and are elaborated to the extent possible.

Sources of impacts

The project is subdivided into main operational phases regarding their potential environmental and social impacts.

Potential effects

All physical, chemical and socioeconomics effects of the projects that may generate environmental impacts are considered. On the basis of the interaction with the environment, the intensity of the potential effect is evaluated. The effects not affecting any specific environmental or social receptor are excluded.

Environmental/Social receptors

The environment is subdivided into single physical (i.e. fauna, flora, air, noise) and socioeconomics (i.e. tourism, historical and cultural elements) aspects.

5.1.2 Method for Determining Intensity of the Effect

The intensity of the potential effect is defined based on the following parameters, which are equally weighted and are each assigned a score of 1, 2 or 3. The only exception in this approach is the parameter “status”, which determines the positive, negative or zero value of the intensity.

Status (Nature)

The status (nature) of the effect is used to describe whether there is positive, negative or neutral effect on the relevant receptor. The effect may therefore be:

- ✓ Positive;
- ✓ Neutral;
- ✓ Negative.

Type

Indicates the relationship between the effect and the Project (cause - effect relationship). The effect can be:

- ✓ **Direct:** the effect occurs through direct interaction between the project and the environmental receptor;
- ✓ **Indirect:** the effect that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment;
- ✓ **Induced:** the effect that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

Duration

The duration of the effect is considered from its generation to the restoration of the initial conditions and is defined as follows:

- ✓ **Temporary:** effects that are predicted to be temporary and last for a short period of time;
- ✓ **Short-term:** effects that last only for the duration of the project;
- ✓ **Long-term/Permanent**: effects that cause a long-term or permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the project lifetime.

Extent

The extent defines the geographical extent or spatial space of the effect. The effect may therefore be:

- ✓ **Local:** affects an area in and near (about a few km) the Block 2 area;
- ✓ **Regional:** affects regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem;
- ✓ **National and/or transboundary:** affects nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences and/or affects the environment of neighbouring countries.

Magnitude

The magnitude can be defined by the concentration of an emission or discharge with respect to standards of acceptability that include applicable legislation and international guidance, its toxicity or potential for bioaccumulation and its likely persistence in the environment. It can be the degree/permanence of disturbance or physical impact. The effect ranges from:

- ✓ a **low magnitude** effect;
- ✓ a **medium magnitude** effect;
- ✓ a **high magnitude** effect.

Table 5.1: Score assigned to Parameters used to Determine the Intensity of the Potential Effect

Parameter	Type	Score
Type	Induced	1
	Indirect	2
	Direct	3
Duration	Temporary	1
	Short-term	2
	Long-term/Permanent	3
Extent	Local	1
	Regional	2
	National and/or transboundary	3
Magnitude	Low	1
	Medium	2
	High	3

Overall, the intensity score is assigned by adding the individual parameter scores and can therefore vary from “Low” (total score 4 to 6) to “High” (total score 10 to 12), as shown in following.

Table 5.2: Intensity Ranking based on Summed Parameters Scores

Intensity	Summed Parameter Scores
High	10-12
Medium	7-9
Low	4-6

5.1.3 Method for Determining Sensitivity and Vulnerability of Environmental and Social Receptors

Sensitivity and vulnerability of environmental and social receptors for each type of receptor (biological/ecological, human/social and physical/economical receptor/feature) are estimated based on the following parameters, which are equally weighted and are each assigned a rating of 1, 2, or 3:

- ✓ Presence;
- ✓ Resilience.

Overall, receptor sensitivity and vulnerability score are assigned by adding the individual parameter scores and can therefore vary from “Low” (total score 2) to “High” (total score 5 to 6).

Table 5.3: Sensitivity/Vulnerability Ranking Based on Summed Parameters Scores

Sensitivity/Vulnerability	Summed parameter Scores
High	5-6
Medium	3-4
Low	2

The criteria used for rating the parameters are further developed in the next Paragraphs based on the following receptors typology:

- ✓ biological and ecological receptors;
- ✓ physical receptors/features;
- ✓ human and social receptors;
- ✓ economical receptors/features.

5.1.3.1 Biological/Ecological Receptors

Presence

- ✓ score = 3: internationally threatened species/protected area within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and during routine or reliably predictable peak presence;
- ✓ score = 2: internationally threatened species/protected area within the area impacted by the project activities outside of period of high sensitivity or during routine or reliably predictable peak presence. Internationally near threatened species within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and/or during routine or reliably predictable peak presence. Nationally protected species and/or species which are of importance to the local and regional ecosystem within the area impacted by the project activities;
- ✓ score = 1: presence of species which is none of the above.

Resilience

- ✓ score = 3: species and/or population which has little or no capacity to absorb or adapt to change (i.e. little or no capacity to move away from or adapt to the project impact), leading to potential for substantial change of character and/or loss of ecological functionality;
- ✓ score = 2: species and/or population which has moderate capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact), leading to potential temporary but sustainable effect which does not substantially alter character or result in significant loss of ecological functionality;
- ✓ score = 1: species and/or population has high capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact) and is potentially unaffected or marginally affected.

5.1.3.2 Physical Receptors/Features

Presence

- ✓ score = 3: presence of feature which has, in reverse order, national or international value (e.g. state protected monument);
- ✓ score = 2: feature with local or regional value and is sensitive to disturbance;
- ✓ score = 1: feature which is none of the above.

Resilience

- ✓ score = 3: highly vulnerable (i.e. potential for substantial damage or loss of physical integrity);
- ✓ score = 2: undergoes moderate but sustainable change which stabilises under constant presence of impact source, with physical integrity maintained;
- ✓ score = 1: feature/receptor is unaffected or marginally affected (i.e. resilient to change);

5.1.3.3 Human and Social Receptors

Presence

- ✓ score = 3: people being permanently present in the geographical area of anticipated impact;
- ✓ score = 2: people being present some of the time in the geographical area of anticipated impact;
- ✓ score = 1: people being rarely present in the geographical area of anticipated impact.

Resilience

- ✓ score = 3: most vulnerable groups. Receptor vulnerability is considered high in the case of vulnerable receptors, who have little capacity and means to adapt to a given change and maintain / improve quality of life (e.g. homeless people, Internally Displaced Persons community in temporary accommodation, people with low access to recourse (e.g. no land titles), people with no or low representation (e.g. migrants, seasonal herders with no permanent assets in the area). Receptors of high vulnerability may include:
  - Individuals with a marginal livelihood, low socio-economic income or poor living conditions,
  - Individuals who are vulnerable due to their age, disability or other reason and who may require special assistance during engagement activities associated with the seismic survey,
  - Businesses with a marginal economic existence which are not able to easily adapt to change;
- ✓ score = 2: people being vulnerable to change or disturbance. Receptor vulnerability is considered medium when there is limited capacity and means to adapt to a given change and maintain / improve quality of life. Receptors of medium vulnerability may include:
  - Individuals who rely heavily on their livelihood to maintain their socio-economic status and have a limited ability to adapt to change,
  - Businesses that have a limited ability to adapt to change and are sensitive to any reduction in economic revenue or reputation;
- ✓ score = 1: people being least vulnerable to change or disturbance. Receptor vulnerability is considered low when there is a moderate to high capacity and means to adapt to a given change and maintain / improve quality of life. Receptors of low vulnerability may include:
  - Individuals who are able to quickly adapt to temporary disruption in their living conditions, livelihood status or a change in the status of public infrastructure (such as a road closure),
  - Businesses with a robust economic model that are able to adapt easily to any restrictions placed upon their activities, or who are able to gain economically from such changes.

5.1.3.4 Economical Receptors/Features

Presence

- ✓ 3 - Presence of feature with significant economic value;
- ✓ 2 – Presence of feature with moderate economic value;
- ✓ 1 - Presence of feature with ordinary economic value.

Resilience

- ✓ score = 3; businesses with a marginal economic existence which are not able to easily adapt to change;
- ✓ score = 2: businesses that have a limited ability to adapt to change and are sensitive to any reduction in economic revenue or reputation;
- ✓ score = 1: businesses with a robust economic model that are able to adapt easily to any restrictions placed upon their activities, or who are able to gain economically from such changes.

5.1.4 Method for Determining Impact Severity

For both Environmental and Socio-economic Impacts, impact severity is defined as a function of intensity and sensitivity/vulnerability. Once the effect intensity and resource/receptor sensitivity have been defined, the severity can be assigned for each impact. Impact severity is designated using the matrix shown in following table.

Table 5.4: Impact Severity Assessment

		Sensitivity/Vulnerability		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Impact severity is qualified according to a scale from negligible to major, based on the Word's bank definitions that are presented in the following Table 5.5.

Any impact classified as Major or Moderate is considered to be significant and, where the impact is negative, requires mitigation. Impacts of Negligible or Minor severity are considered as being mitigated as far as practicable and necessary, and therefore, do not require further mitigation.

An impact of negligible significance is one where a resource/receptor will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of minor significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance.

An impact of moderate significance has an impact severity that is within applicable standards but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable. This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of impact assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Table 5.5 provides the definition of environmental impact severity according to World Bank Methodology as presented in Total E&P's specification GS EP ENV 120 'Environmental impact assessment of E&P activities".

Table 5.5: Definition of Environmental Impact Severity according to World Bank Methodology

Criteria	Severity
Substantial adverse changes in an ecosystem. Changes are well outside the range of natural variation and assisted rehabilitation is required.	Major
Moderate adverse changes in an ecosystem. Changes may exceed the range of natural variation. Potential for natural recovery in the medium term is good. However, it is recognised that a low level of impact may remain.	Moderate
Minor adverse changes in an ecosystem.	Minor

Criteria	Severity
Changes might be noticeable but fall within the range of normal variation. Effects are short-lived and natural recovery takes place in the short term, however, it is recognised that a low level of localised impact may remain	
Changes in ecosystems that are unlikely to be noticeable (i.e. well within the scope of natural variation)	Negligible

Table 5.6 provides the definition of social impact severity according as presented on Total E&P's specification GS EP SDV 102 "Social Impact Assessment".

Table 5.6: Definition of Social Impact Severity

Criteria	Severity
Negative impacts on the social context and/or people are severe, permanent or otherwise irremediable. They require mandatory and specific correction, mitigation and remediation measures. Corrective measures on the project design are to be considered	Major
Negative impacts on the social context and/or people are substantial. Changes cannot be mitigated without special intervention. The residual impacts are very likely to extend throughout the project duration and thereafter.	Moderate
Impacts on the social context and/or people are moderate. Without intervention impacts are likely to persist throughout the project duration. Residual impacts may extend beyond the duration of the project unless mitigation actions are undertaken	Minor
Impacts on social context and/or people are minor Negative impacts are of short duration and with no significant or lasting impact on the social context or people, no impact at all on vulnerable individuals	Negligible

The results of the evaluation of the impacts will be presented in a Leopold type matrix which gives an overview of potential impacts of the seismic survey in Block 2 before implementing the necessary mitigation measures. The environmental receptors will be shown in the matrix rows and the impact factors in the columns.

5.1.5 Transboundary and Cumulative Impacts

In addition to impacts associated with seismic survey activities the following will also be assessed:

- ✓ **Transboundary Impacts:** defined as impacts that occur outside the jurisdictional borders of a project's host country;
- ✓ **Cumulative Impacts:** while an impact may be relatively small when considering the project or activity on its own, it may be magnified in combination with impacts from other projects and activities; these combined effects are known as cumulative' impacts.

Cumulative impacts may arise from the following:

- ✓ interactions between separate project-related residual impacts this could include the effect of multiple project environmental interactions (e.g. underwater noise, discharges, physical disturbance from vessel movements) on a single receptor or habitat with the resultant effect being greater than each individual impact;

- ✓ interactions between project-related residual impacts in combination with impacts from other projects and their associated activities within the same area of influence. This effect can occur as a result of the combined impacts of a number of projects, which individually might not be significant, but when considered together could create a significant cumulative effect on a single receptor or habitat.

The steps taken to undertake the cumulative impact assessment comprise the following:

- ✓ identify other known projects and activities within the vicinity of seismic survey area where there is potential for cumulative impacts;
- ✓ define the spatial (i.e. impacts are so close in space that their effects overlap) and temporal (i.e. impacts are so close in time that the effect of one is not dissipated before the next one occurs) scope of the assessment;
- ✓ assess potential cumulative impacts to the environmental and social receptors potentially affected by the seismic survey and the cumulative projects identified; and
- ✓ where required, define measures to avoid, reduce, or mitigate any potentially significant cumulative impacts to the extent possible.

The significance of transboundary and cumulative impacts is assessed using a qualitative analysis of impacts.

5.1.6 Identification of Mitigation Measures

The adoption of mitigation measures and compensation of impacts is one of the main objectives of the present study. The containment of impacts through the adoption of mitigation measures and compensation requires identifying the actions to be undertaken at project level to reduce (mitigate) any negative impact on each environmental and social component or to offset any imbalances induced on the environment, both natural and human. Indeed, a choice made at a design stage, although being the best alternative in terms of general effects on the environment, may cause significant negative impacts on the individual variables of the manmade system-environment.

At a general level, the following mitigation measures and compensation can be envisaged:

- ✓ avoid the impact completely, i.e. by not carrying out the activity or part of it;
- ✓ minimize the impact limiting the magnitude or intensity of an activity;
- ✓ rectify an impact by intervening on damaged environment, e.g.: with requalification, reintegration, etc.;
- ✓ reduce or eliminate the impact through safeguard or maintenance during the project;
- ✓ compensate impacts by replacing resources.

The proposed measures will be selected based on the Best Available Technologies concept, according to the OSPAR, Convention 1992 definition.

5.1.7 Residual Impacts

Once mitigation and enhancement measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures. The impact mitigation measures enable its intensity and severity to be reduced.

In some cases, it may only be possible to reduce the impact to a certain degree, without being able to be completely avoided.

The degree of significance attributed to residual impacts is related to the weight that should be given to them in reaching a decision on the Project, as follows:

- ✓ residual impacts of Major significance are considered to warrant substantial weight in the Project decision making process. Conditions should be imposed to ensure adverse impacts are strictly controlled and monitored;
- ✓ residual impacts of Moderate significance are considered to be of reducing importance to decision-making, however, still warrant careful attention to ensure best available techniques are used to keep adverse impacts to as low as is technically and financially feasible;
- ✓ residual impacts of Minor significance should be brought to the attention of the decision-maker but are identified as warranting little if any weight in the decision; and

- ✓ negligible residual impacts are those that, after assessment, are found not to be significant to the decision making about the Project.

5.2 IMPACT IDENTIFICATION AND ASSESSMENT

5.2.1 Implementation of the Cause-Effect Matrix

For the proposed Project, potential impacts are identified through the implementation of the systematic approach based on the methodology described in previous Section 5.1. All the sources of potential impacts associated with the Project have been considered with respect to their interactions with environmental and social receptors and features and related impacts assessed. The results from this process are summarized in the Leopold Type Matrix in section 5.5 “Summary of Environmental and Social Impacts”.

5.2.1.1 Sources of Impact

According to the project description, the main sources of impacts of the seismic survey are the following operational activities:

- ✓ Offshore operation (sailing of seismic vessel, chase vessel and support vessel);
- ✓ Acquisition of seismic data (airgun activation);
- ✓ Supporting activities (supplies procurement, onshore activities, port calls).

5.2.1.2 Potential Effects

The potential effects of a seismic acquisition survey project are the following:

- ✓ air emissions;
- ✓ noise emissions;
- ✓ light emissions;
- ✓ discharges (effluent and solid waste);
- ✓ collisions and entanglements of marine fauna;
- ✓ interference with seabed;
- ✓ use of resources;
- ✓ navigation restrictions;
- ✓ presence of foreign workers;
- ✓ operational expenses.

5.2.1.3 Environmental and Social Receptors/Features

Based on the ESBS data, the Environmental and Social receptors that are taken into consideration are presented below:

Biological/Ecological receptors:

- ✓ Fauna and Flora:
  - Plankton,
  - Zoobenthic Communities,
  - Invertebrates,
  - Corals,
  - Fish Fauna,
  - Marine Mammals,
  - Sea Turtles,
  - Seabirds,
  - Posidonia Meadows;

- ✓ Marine protected areas.

Physical Receptors/Features:

- ✓ Air quality;
- ✓ Sea water quality.

Human and Social Receptors:

- ✓ Fishing activities;
- ✓ Port and marine traffic;
- ✓ Tourist activities;
- ✓ Historical and cultural elements;
- ✓ Social context and human development.

Economical receptors/Features:

- ✓ Local and macro economy.

5.2.1.4 Scoping Matrix

The following Scoping Matrix finally displays potential effects against identified environmental and social receptors/features and supports the methodological identification of the related potential impacts of project activities.

Table 5.7: Potential Effects of Project Activities on Environmental and Social Receptor/Features

		Potential Effects									
		Air Emissions	Noise Emissions	Light Emissions	Discharges (Effluent and Solid Waste)	Collisions and Entanglement of Marine Fauna	Interference with Seabed	Use of Resources	Navigation Restrictions	Presence of Foreign Workers	Operational Expenses
Sources of impacts		***Offshore Operation***	***Acquisition of seismic data***	***Offshore Operation***	***Offshore Operation*** ***Supporting Activities***	***Offshore Operation***	***Supporting Activities***	***Offshore Operation*** ***Supporting activities***	***Offshore Operation***	***Offshore Operation*** ***Supporting activities***	***All Project phases***
Biological/Ecological Receptors											
Fauna Flora	Plankton		X	X	X						
	Zoobenthic Communities						X				
	Invertebrates		X	X	X						
	Corals				X		X				
	Fish Fauna		X		X						
	Marine Mammals		X		X	X					
	Sea Turtles		X		X	X					
	Seabirds			X	X						
	Posidonia Meadows				X		X				
Marine protected areas			X		X						
Physical Receptors/Features											
Air quality		X									
Sea water quality					X						
Human and Social Receptors											
Fishing activities									X		

	Potential Effects									
	Air Emissions	Noise Emissions	Light Emissions	Discharges (Effluent and Solid Waste)	Collisions and Entanglement of Marine Fauna	Interference with Seabed	Use of Resources	Navigation Restrictions	Presence of Foreign Workers	Operational Expenses
Sources of impacts	*Offshore Operation*	*Acquisition of seismic data*	*Offshore Operation*	*Offshore Operation* *Supporting Activities*	*Offshore Operation*	*Supporting Activities*	*Offshore Operation* *Supporting activities*	*Offshore Operation*	*Offshore Operation* *Supporting activities*	*All Project phases*
Port and Marine traffic								X		
Tourist activities								X		
Social context and human development							X		X	
Economical receptors/Features										
Local and macro economy							X			X

5.2.2 Evaluation of Intensity of Project Effects

The intensity score of the identified potential project effects is reported in detail in following Paragraphs (for each impact) and summarized in following table.

Table 5.8: Intensity Score of Potential Effects

Parameter	Air emissions		Noise emissions		Light emissions		Discharges (effluent and solid waste)		Collisions and entanglements of Marine Fauna		Interference with Seabed		Use of resources		Navigation restrictions		Presence of foreign workers		Operational expenses	
Type	Direct	3	Direct	3	Direct	3	Direct	3	Direct	3	Direct	3	Induced	1	Direct	3	Induced	1	Indirect	2
Duration	Short-Term	2	Short-Term	2	Temporary	1	Temporary	1	Temporary	1	Temporary	1	Short-Term	2	Short-Term	2	Temporary	1	Temporary	1
Extent	Local	1	Transboundary	3	Local	1	Local	1	Local	1	Local	1	Local	1	Regional	2	Local	1	Regional	2
Magnitude	Low	1	High	3	Medium	2	Low	1	Medium	2	Low	1	Low	1	High	3	Low	1	Low	1
Total Intensity score	**Medium**	**7**	**High**	**11**	**Medium**	**7**	**Low**	**6**	**Medium**	**7**	**Low**	**6**	**Low**	**5**	**High**	**10**	**Low**	**4**	**Low**	**6**

5.2.3 Sensitivity/Vulnerability Assessment

Air Quality

The project area is characterized by the absence of air polluting activities in the direct neighbourhood (big cities, airports, industries-factories), as Block 2 is located approximately 20 km west of Corfu island **(PRESENCE: 1)** Considering the location of the operational area in the open ocean, the air quality is not influenced because potential pollutants disperse quickly. **(RESILIENCE: 1).**

Sea Water Quality

The sea water in the project area is unpolluted, with low nutrient concentration. **(PRESENCE: 1)**. The highly dispersive nature of the marine environment of the offshore location ensures the rapid dilution of any permitted discharges. **(RESILIENCE: 1).**

Plankton

Even though significant meso-zooplankton taxa are found in the wider region of the Ionian Sea; accounting for the oligotrophic nature of the study area that exhibits low and relatively stable concentrations of plankton throughout the year, we consider low presence of protected plankton species **(PRESENCE=1)** in the study area. Due to the temporal nature and inherently high mortality rates of plankton their sensitivity to the Project activities is considered low **(RESILIENCE=1)**.

Zoobenthic Communities

The presence of Vulnerable and Protected zoobenthic species (Anthozoa, Polychaeta, Mollusca, Crustacea, and Echinoderms) is largely reported in the Ionian Sea far away from the project area, or at shallower depths **(PRESENCE=1)**. Low intensity or no impact of the project activities to zoobenthic organisms sets their sensitivity to be low ranking **(RESILIENCE=1)**.

Invertebrates

The presence of endangered and protected marine invertebrates of the water column is of low probability at the project area **(PRESENCE=1)**. Also, the ability of these organisms to move and avoid disturbed areas, sets the sensitivity of invertebrate organisms to low **(RESILIENCE=1).**

Corals

The presence of protected coral species is expected in some parts of the project area **(PRESENCE=2)**. Corals are of high sensitivity organisms and in combination to their inability to move and avoid disturbed areas, decreases their resilience to anthropogenic disturbance **(RESILIENCE=2)**.

Fish Fauna

The presence of endangered or sensitive fish species is not expected in the project area **(PRESENCE=1)**. Fishes are highly mobile and can flee to avoid noise impacts such as physical damage (close range), or behavioural responses, masking of biologically important sounds, increased stress levels **(RESILIENCE=1).**

Marine Mammals

The presence of seven species of marine mammals is expected in the project area, including sensitive and threatened species likely encountered there year-round **(PRESENCE=3)**. These species are highly vulnerable to the project activities, particularly to high levels of noise that may cause them auditory damage (permanent or temporary) or/and significant behavioural responses **(RESILIENCE=3).**

Sea Turtles

The presence of the loggerhead sea turtle, endangered and protected under National and European law, is expected in the project area, both during the summer nesting season and in fall-winter during migration **(PRESENCE=3**). The loggerhead, even though mobile is slow moving, is vulnerable to the Project activities, particularly to high levels of noise that may cause them auditory damage (permanent or temporary) or/and behavioural responses or increase stress and aggression levels **(RESILIENCE=2).**

Seabirds

Important bird species protected by National and European legislation are expected to be present in the wider project area **(PRESENCE=2)**. Their sensitivity to the Project activities is assessed to be Medium due to their ability to be highly mobile and avoid potential impacts **(RESILIENCE=2).**

Posidonia Meadows

Sensitive and protected Posidonia habitats are probably absent from the project area, since they are situated in coastal shallow water where no activity is expected **(PRESENCE=1)**. However, this important flora species is highly vulnerable to anthropogenic disturbance due to its immobility and ecology **(RESILIENCE=3)**.

Marine Protected Areas

The proposed survey area (Block 2) is located 5 km from Diapontia Islands site (Natura 2000 Protected areas) and includes part of a Biologically Significant Marine Area (EBSA) (**PRESENCE=3)**. All vulnerable and endangered bird, marine mammal, and sea turtle communities present in these Marine Protected Areas can potentially be threatened by the project activities during airgun operations **(RESILIENCE=3).**

Fishing Activities

The survey operational area overlaps part of existing fishing areas. **(PRESENCE: 3).** The total area of exclusion is very small compared with the area available for fishing**. (RESILIENCE: 1)**.

Ports and Marine Traffic

There is permanent presence of marine traffic in the project area, especially cargo ships. **(PRESENCE: 3)**. The total area of exclusion is limited to the immediate vicinity of the seismic vessel. The extra distance that may need to be travelled to avoid the zones is also small compared with total routing. **(RESILIENCE: 1).**

Tourist Activities

The proposed project will take place on the sea approximately 20 kilometres west from the Island of Corfu. Limited traffic of cruise vessels is present in the area. The expected dates of the proposed survey do not overlap with significant tourist season on the island. **(PRESENCE: 1).** The area of exclusion is small in the immediate vicinity of the seismic vessel and will not affect the cruise vessels. **(RESILIENCE: 1)**

Historical and Cultural Elements

There are no mapped shipwrecks within the Exploration Area. **(PRESENCE: 1).** The depths of the area of Block 2 are quite high and as a result any potential impact is related to the area where the vessel may turn close to the area of Diapontia Islands (**RESILIENCE: 1)**

Social Context and Human Development

People are not living in the area of the operations. (**PRESENCE: 1).** The closest residential areas are at 5-6 kilometres distance from the project area and the population can adapt to the temporary disruption. **(RESILIENCE: 1)**

Local and Macro Economy

The local and macro economy has an ordinary economic value. **(PRESENCE: 1)**. Businesses that are affected by the project are able to adapt easily to any restrictions placed upon their activities and are likely to gain economically from such projects. **(RESILIENCE: 1)**

Summary of the sensitivity/vulnerability ranking of the environmental and social receptors/features is reported in the following table.

Table 5.9: Sensitivity/Vulnerability Ranking of the Environmental and Social Receptors and Features

Environmental and Social Receptor and Features		Presence	Resilience	Sensitivity Vulnerability Score	Sensitivity Vulnerability Ranking
Physical Features	Air quality	1	1	2	Low
	Sea water quality	1	1	2	Low
Biological and Ecological Receptors	Plankton	1	1	2	Low
	Zoo benthic Communities	1	1	2	Low
	Invertebrates	1	1	2	Low
	Corals	2	2	4	Medium
	Fish Fauna	1	1	2	Low
	Marine Mammals	3	3	6	High
	Sea Turtles	3	2	5	High
	Seabirds	2	2	4	Medium
	Posidonia Meadows	1	3	4	Medium
	Marine protected areas	3	3	6	High
Human and Social Receptors	Fishing activities	3	1	4	Medium
	Port and Marine traffic	3	1	4	Medium
	Tourist activities	1	1	2	Low
	Historical and cultural elements	1	1	2	Low
	Social context and human development	1	1	2	Low
Economical Features	Local and macro economy	1	1	2	Low

5.2.4 Impacts on Air Quality due to Air Emissions

Based on the project description, the main impacts on air quality will be caused by the emission of pollutants from the vessels involved in the seismic activities (exhaust from engines).

Diesel exhaust comprises mainly Carbon dioxide (CO_2) as well as several air pollutants such as Nitrogen oxides (NO_X), Sulphur oxides (SO_X) and Carbon monoxide (CO). In addition, diesel combustion can produce Hydrocarbons (Total Hydrocarbons and Volatile Organic Compounds). Particulate matter is also produced during diesel combustion.

The seismic activities will involve four (4) vessels (the seismic vessel, a support vessel and 2 chase vessels) for an expected duration of approximately 45 days. The atmospheric emissions from the vessels are expected to be similar to those from typical diesel-powered vessels of comparable tonnage. The project area is area characterized by absence of pollution sources in the direct neighbourhood (big cities, airports, industries-factories), as Block 2 is located approx. 20 km west of Corfu Island. However, the area of interest is the main shipping route entering in the Adriatic Sea (the Adriatic Motorway of the Sea) with an intense traffic of ships.

The **sensitivity** of the air quality is evaluated **Low**.

Table 5.10: Air Quality – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Air quality	1	1	2	**Low**

Regarding air emissions, assuming typical emission factors (see Paragraph 3.6) and considering that the vessels are operating continuously 24 hours for 45 days (22 hours the main engine and 2 hours the auxiliary engine) and the engine power is 15000 kW, 4000 kW and 1500 kW for the seismic, support and chase vessel respectively (see Paragraph 3.3.2.4), the estimated volumes of air emissions are presented in the following table.

Table 5.11: Estimated Air Emission during the Seismic Survey

NOx [tonnes]	SO_2 [tonnes]	CO [tonnes]	Particulate [tonnes]
273	21	26	10

The relatively small mass of emissions is not expected to contribute to a significant or noticeable increase in air pollutant concentrations at receptors and will rapidly be dispersed in the atmosphere.

Considering the location of the operational area in the open sea, which is quite far from the coast, natural areas and residential area or sensitive populations, it is considered highly unlikely that atmospheric emissions will result in significant impacts

In any case, all vessels used during the seismic survey should comply with Annex VI MARPOL[50] emission standards with regards to air emissions, in particular with limits set for Nitrogen Oxides by Regulation 13 with reference to the year of the engine (Tier I, II or III) and rated engine speed, and Regulation 14 for the Sulphur Oxides, with reference to the Sulphur content of fuel which shall not exceed 0.50% m/m from the 1st January 2020.

No discernible emissions due to helicopter jet-fuel combustion is expected as the helicopter will be used only in case of emergency.

Based on the above, the **Intensity** of air emissions is evaluated **Medium**.

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[50] MARPOL: International Convention for the prevention od pollution from ships-Annex IV: Regualtions for the prevention of air pollution from ships

Table 5.12: Air Emissions – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the emission of air pollutants from the vessels involved in the seismic activities
Type	Induced Indirect **Direct**	3	There is direct emission of air pollutants to atmosphere due to exhaust from engines
Duration	Temporary **Short-term** Long term/Permanent	2	The impact will be short-term and will last 45 days at maximum
Extent	**Local** Regional National and/or transboundary	1	The emissions will be localised affecting only the air quality near the vessels
Magnitude	**Low** Medium High	1	The emissions are not expected to contribute to a noticeable increase in air pollutant concentrations at receptors
Intensity Score		**7**	**Medium**

The combination of a **Low sensitivity** receptor and **Medium intensity** effect results in an overall **Minor severity** impact**.**

Table 5.13: Impact on Air Quality due to Air Emissions

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	**Minor**	Moderate	Major
	High	Moderate	Major	Major

5.2.5 Impacts on Water Quality due to Discharges

Potential discharges from the seismic and support/chase vessels to the marine environment include:

- ✓ decks drainage;
- ✓ machinery space drainage;
- ✓ sewage;
- ✓ galley waste;
- ✓ solid waste.

Deck Drainage

Drainage of deck areas may result in small volumes of oils, solvents or cleaners being accidentally introduced into the marine environment.

The oils, solvents and cleaners that are expected to be introduced into the marine environment through drainage of deck areas are of small volumes and can't affect therefore significantly the water quality.

Machinery space drainage

Small volumes of oily substances (e.g. diesel fuel, lubricants) present in the machinery space of the vessels could be discharged to the marine environment.

The concentrations of oil reaching the marine environment through drainage of machinery spaces are expected to be low as long as the vessels fully comply with international agreed standards regulated under MARPOL 73/78.

All machinery space drainage may be discharged provided that they are treated to ensure that it does not contain more than 15 mg/l of oil, in accordance with MARPOL 73/78 requirements. At this concentration, any impact will be temporary and localized, with no visible sheen and quick dilution in the marine environment.

Sewage

Sewage poses an organic and bacterial loading on the natural degradation processes of the sea, resulting in an increased biological oxygen demand (BOD). This could result in anaerobic conditions.

Although treated sewage would also increase BOD, it does not pose a bacterial load. Sewage production will be similar to any vessels of same crew compliment (seismic vessel 50-60 people, chase/support vessel 10/20). Assuming that vessels will accommodate 70 to 100 people, and an average daily water consumption of 150-200 litres per person and a daily sewage production of 80% over water consumption, the sewage production can be evaluated 8.4 to 16 m^3/day that corresponds to a 0.34 – 0.64 kg Total Nitrogen, 0.0588-0.112 kg Total Phosphorous load and 1.596-3.04 kg Total BOD.

These quantities could not contribute to the pollution of the sea in the area of seismic surveys. For comparison purposes it is noted that to produce 100 kg of fish, an average daily load of approx. 9 kg Total Nitrogen, 1kg Total Phosphorous and 57kg BOD is directly discharged into the water as fish faeces and excretions[51]. A medium size aquaculture unit could have a yearly capacity of 200 tones.

Even though the pollution waste-water load produced by the seismic vessels is very low, in no case it will be directly discharged to the sea. All waste generated on board will be treated in accordance with international regulations and with respect to MARPOL (73/78) Annex IV: "Prevention of pollution by sewage from ships" provisions. More specifically, sewage discharges will be treated and disinfected by means of on board the treatment plant and may be discharged more than 3 nautical miles from shore, in accordance with MARPOL 73/78 requirements.

Galley Waste

Galley wastes, comprising mostly of biodegradable food waste, would place a small organic and bacterial loading on the marine environment. The volume of galley waste from a seismic and support vessel would be small and comparable to wastes from any vessel of a similar crew compliment as mentioned above. Discharges of galley wastes would be triturated and may be discharged offshore, more than 12 nautical miles from the shore.

Solid Waste

The disposal of solid waste comprising non-biodegradable domestic waste, packaging and operational industrial waste into the sea could pose a hazard to marine fauna, may contain contaminant chemicals and could end up as visual pollution at sea, on the seashore or on the seabed. Regarding the solid waste production during the ship's operation it can be estimated that an average of 1Kg of waste will be produced per person per day. Taking into account a crew of 100 people, the total daily solid waste production will be approximately 100 kg. The typical composition of solid waste includes 47% of organics.

All solid waste will be sorted and stored according to type and disposal destination, transported ashore for treatment or disposal in authorized plant or licensed landfill and consequently would have no impact on the marine environment. Waste will be segregated into recyclables and dangerous wastes (used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate disposal by certified waste disposal contractors. However, accidental release may result in a small amount of waste entering the marine environment (e.g. blown by wind, release during transfer to support vessel, etc.).

The **Intensity** of discharges (effluent and solid waste) is evaluated **Low.**

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[51] T.V.R.Pillay, Aquaculture and the Environment, Blackwell Publishing, p.65

Table 5.14: Discharges (effluent and solid waste) – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the deck drainage, machinery space drainage, sewage, galley wastes and solid waste from all vessels involved in the seismic operations
Type	Induced Indirect **Direct**	3	There is direct discharge from the seismic and support/chase vessels to the marine environment
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will take place occasionally during the seismic survey (max 45 days)
Extent	**Local** Regional National and/or transboundary	1	The discharges will be localised affecting only the water mass around the vessels
Magnitude	**Low** Medium High	1	Low volume of discharges and waste is expected. The relatively small volume of discharges is not expected to contribute to a significant or noticeable increase in water pollutant concentrations at receptors
Intensity Score		**6**	**Low**

The sea water in the project area is unpolluted, with low nutrient concentration. The highly dispersive nature of the marine environment of the offshore location ensures the reversibility of the impact and the rapid dilution of the discharges.

Thus, the **sensitivity of the sea water quality** is evaluated **Low (**see Paragraph 5.2.1.3).

Table 5.15: Water Quality – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Sea water quality	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **Low intensity** effect result in an overall **Negligible severity** impact**.**

Table 5.16: Impacts on Water Quality due to Discharges – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Considering the above , as well as the low volumes of the expected wastes, the location of the activities (offshore, in an area of the Northern Ionian Sea, West of the Island of Corfu, at a water depth ranging approximately 750 to 1,200 m), the mobile nature of the activities and the relatively short duration of the seismic survey (45 days maximum), the potential impact is evaluated as negligible assuming discharges and waste are treated in compliance with the MARPOL 73/78 standards and the international and national regulations.

5.2.6 Impacts on Marine Fauna due to Noise Emissions

5.2.6.1 Effects of Noise

The importance of sound in vital functions of marine organisms, makes noise an important nuisance for marine ecosystems. Several marine animals use sound to communicate, navigate, forage and identify threats and predators. Underwater, vision is less valuable, especially in deeper parts of the ocean, not reached by the light, while sound propagates faster and in longer distances than through air. Thus, sound is an essential sensory medium for a lot of marine organisms. Even though marine mammals, and particularly cetaceans are best known to produce elaborate vocalizations and depend on acoustic signals for the majority of their life functions, sound is crucial for other marine taxa as well. However, less is known and understood on the use of sound from marine invertebrates.

This dependence of marine organisms on sound may be problematic when non biological sounds that carry no functional purpose are introduced in their habitat. Sound produced by anthropogenic activities is considered noise when compared to soundscapes of natural ecosystems and may negatively interfere with marine wildlife and its functions in a variety of ways. Depending on the hearing sensitivity of the organism to certain frequencies, the frequency and amplitude of the noise source (Simmonds et al., 2004), there can be permanent, temporarily or no effects on the animals hearing ability. Higher amplitude noise can be more impactful on organisms affecting their physiology and/or behaviour.

Known effects include (see Section **Error! Reference source not found.** for details):

- ✓ behavioural changes manifested in avoidance of the noisy area causing habitat displacement;
- ✓ masking of vital acoustic cues for animals, interrupting their communication, their feeding or reproductive behaviours;
- ✓ stress;
- ✓ physiological injuries and tissue/organ damage of permanent or temporal nature, and at some cases death.

Besides the high sensitivity of marine mammals to noise, concerns also exists for the immobile organisms, incapable of exhibiting avoidance behaviour from the noise source. These may be exposed to high noise levels that could affect them with discomfort, stress, temporary or permanent loss of hearing (CIBRA, 2010).

Seismic exploration produces acute and impulsive type of sounds, while shipping noise tends to be broadband and continuous. The variety of acoustic characteristics of noise can affect marine organisms differently. The potential impacts of seismic on different organisms as described in the following are all considered negative and have been evaluated considering the criteria described above.

Furthermore, aerial noise from helicopters in case of its use for crew transportation may disturb seabirds, with particular regard to the presence of sensitive species in areas belonging within Natura 2000 network and Important Bird Areas (IBAs).

The effects of noise emissions from seismic acquisition can be considered as direct, short-term, regional and of high magnitude, which concludes the **intensity** of this parameter to be ranked **High**.

Table 5.17: Noise Emissions – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the emission of noise from the airguns involved in the seismic operations
Type	Induced Indirect **Direct**	3	There is direct emission of sound/noise to the water column from the seismic airguns
Duration	Temporary **Short-term** Long term/Permanent	2	The impact will be short-term and will last 45 days at maximum
Extent	Local Regional **National and/or transboundary**	3	The noise emissions will be regional and transboundary affecting a region where the sound propagates until it attenuates from the sound source
Magnitude	Low Medium **High**	3	The high sound amplitude of the airgun discharges is expected to contribute a major increase to the sound levels of the sea soundscape where receptors activate
Intensity score		**11**	**High**

5.2.6.2 Impacts on Marine Mammals due to Noise Emissions

Potential impacts from seismic surveys on marine mammals have been extensively reviewed (Richardson et al. 1995; Davis et al. 1998, Gordon et al. 1998; Stone 2003; Continental Shelf Associates, Inc., 2004) but no studies have been conducted in the Mediterranean Sea. Main conclusions include the following:

- ✓ there is a risk of temporary or permanent acoustic trauma in a radius of hundreds of meters from a typical airgun. The range depends on a variety of factors such as the array size and structure, water column depth and density;
- ✓ behavioural changes have been often observed such as flee, avoidance, without the biological significance of these behavioural changes to be well defined (Ocean Studies Board, 2003).

Risk of injury depends on the distance from the airgun (and the exposure period), but behavioural changes can take place in long distances from the sound source. These behavioural changes depend on the animal's age and health status, activity, and social background (McCauley et al., 2000).

Mysticetes, such as fin whales, are known to have good hearing in low frequencies (typically produced by airgun sources), while Odontocetes, such as dolphins and sperm whales, are known to have higher sensitivity to higher frequency sounds. Nonetheless, behavioural responses to underwater noise have been observed to both groups. Certain Odontocetes (Beaked and Sperm whales) may be more threatened by underwater noise due to their deep diving behaviour and the difficulty to visual detect them during monitoring at the exploration phase.

There is limited scientific knowledge about the Threshold Shifts of marine mammals hearing ability. Finneran et al. (2002) found a Temporary Threshold Shift (TTS) in a whale exposed to sounds of 224 dB re 1 μPa maximum

pressure. The animal's hearing returned to normal 4 minutes after its exposure. No threshold shifts were observed in a dolphin which was exposed to 226 dB re 1 µPa sound pressure.

According to the studies, the minimum exposition criterion relevant to damage is that for which a single exposure may cause a permanent auditory loss (Permanent Threshold Shift – PTS). Typical reference values can be found in:

- ✓ Southall et al., 2007: Threshold values are defined for permanent loss (PTS) and temporary loss (TTS) of auditory sensitivity;
- ✓ National Marine Fisheries Service, 2018: Threshold values are defined for permanent loss of auditory sensitivity, based conservatively on the temporary loss levels.

In accordance to the noise model that has been set up for the proposed activities in Block 2 (see Section **Error! R eference source not found.**), at a distance of 500-800 m from the source (depending upon the selected propagation scenario) the thresholds values for marine mammals proposed by Southall and the National Marine Fisheries Service will not be exceeded.

Mysticetes (e.g. fin whales) are likely to be more at risk of acoustic injury than Odontocetes due to their higher hearing sensitivity to lower frequencies where the majority of acoustic energy from airguns occurs (Goold, 1996). In the case of seismic surveys, Davis et al. (1998) considered the underwater seismic noise of low impact to masking, due to the low duty cycle of the nature of seismic pulses.

Even though there is a number of studies on behavioural responses of marine mammals to seismic surveys (Malme et al. 1984; Richardson et al. 1995; MacCauley et al. 2000; Stone 2003; Holst et al. 2006; Miller et al. 2006), it remains unclear how these changes may impact the long term health and welfare of these individuals and their populations (Ocean Studies Board , 2003). Different cetacean species exhibit different strategies dealing with acoustic disturbance from seismic surveys (Stone, 2003).

During seismic operations in UK several dolphin species were less observed when the airguns were emitting (Stone, 2003), with Mysticetes and small-sized dolphins exhibiting avoidance behaviour. Smaller Odontocetes (dolphins) exhibited higher sensitivity to seismic noise, while Mysticetes showed a more localized avoidance behaviour and Sperm whales didn't show any impact. However, Sperm whales are expected to be more sensitive to lower frequency sounds (such as airguns) than dolphins.

Mysticetes' sensitivity to lower frequencies is likely affecting their response to airguns by increasing their physical distance from the sound source, alter their direction and often remain closer to the surface.

Other behavioural responses documented (McCauley et al., 2000) include tail slapping, often displayed by males during breeding. It is likely that males interpret the loud airgun sounds as sounds from other competitive males.

Mother/calf activities are likely more vulnerable to noise disturbance. McCauley et al. (2000) reported 7-12 km avoidance behaviour by nursing animals, with these distances probably depending on the conditions of sound propagation.

Marine mammals in all Mediterranean countries are protected under ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the Contiguous Atlantic Area; Monaco, 1996). In the Project region, the presence of Bottlenose dolphin (*Tursiops truncatus*), Short-beaked common dolphin (*Delphinus delphis*), Striped dolphin (*Stenella coeruleoalba*) as well as Mediterranean monk seal (*Monachus monachus*) is expected. Other species such as Cuvier's beaked whale (*Ziphius cavirostris*), Fin whale (*Balaenoptera physalus*), Sperm whales (*Physeter macrocephalus*), and Risso's dolphin (*Grampus griseus*) present decreasing possibilities (in the order mentioned) to be encountered in the study area. Even though precise knowledge on the seasonality of most of these species is lacking, their year-round presence is expected in the region, with the exception of Fin whales, for which uncertainty exists about the annual movements during the winter period.

It has to be highlighted that Monk seals (IUCN Critically endangered) are expected to be present within or in the vicinity of the Project area, most likely closer to coastal habitats. Monk seals are less common to be encountered in the open sea, at great depths, and large distances from the shore, besides during their long distance movements.

Sensitive reproductive periods for marine mammals seem to take place mainly out of the project period (November-December), with the possible exception of the Fin whale (*Balaenoptera physalus*) that is known to reproduce between September and January and the Mediterranaean monk seal (*Monachus monachus*), potentially reproducing in any period of the year, even if mainly in spring. However, the presence of Fin whales in the study area still has to be confirmed in late fall, early winter, while it is well known that reproduction activities for the monk seal occur on land (caves or beaches).

Table 5.18: Reproductive Period of Sensitive Species

Species	Reproductive Period
Common dolphin	May-October
Striped dolphin	July-August
Bottlenose dolphin	April-September
Beaked whale	Largely unknown, perhaps early-mid summer
Fin whale	September-January
Sperm whale	Late Winter-end of August
Mediterranean Monk seal	All the year. Mainly in Spring

Given the expected presence of a variety of sensitive and endangered marine mammal species in the study area, although considering their relative ability to flee from operating seismic activities, the **Sensitivity** of this receptor is evaluated **High**.

Table 5.19: Marine Mammals – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Marine Mammals	3	3	6	**High**

The combination of a **High sensitivity** receptor and **High intensity** potential effect result in a **Major severity** impact and thus, mitigation measures are required to be implemented.

Table 5.20: Impacts on Marine Mammals due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	**Major**

5.2.6.3 Sea Turtles

Knowledge on the hearing ability of sea turtles is scarce. Acoustic experiments and behaviour studies show that sea turtles can detect low frequency sounds and are more sensitive to frequencies ranging from 100 to 700 Hz. Thus, it is probable that sea turtles are able to perceive seismic airgun activity at significant distances from the sound sources.

All sea turtle species are expected to be at risk from acoustic injuries. Sea turtle hatchlings are expected to be the least impacted from noise, although more research is required. They tend to float on seagrass on the sea surface where the airgun sound levels are expected to be low. Sea turtles spend most of their time submerged diving, and thus subject to noise emitted from airgun. Even though the airgun sound levels are not deemed capable to cause mortality to sea turtles, even in short distances, can cause acoustic injuries. Sub lethal effects of airgun noise to

sea turtles were tested in a study (Moein at al., 1995) that looked at stress levels before and after the airgun exposure. Results showed a temporary shift in their blood chemistry, increase in stress levels, and tissue damage, offering evidence that the animals were impacted by their exposure to continuous noise. Nonetheless, no serious tissue damage was reported, and the blood chemistry levels returned to normal 2 weeks later, supporting the theory that exposure to noise can cause small but reversible changes in the sea turtle tissues (Moein et al., 1995).

Studies on behavioural responses of sea turtles to airguns showed that airguns were deterring at a distance of 30 m away (O'Hara and Wilcox, 1990). However, sound reflection was not accounted making the sound levels biased. Moein et al. (1995) showed that sea turtles exhibit avoidance behaviour to airguns during their first exposure but exhibited habituation to the noise after three exposures. McCauley et al. (2000) showed that sea turtles increased their swimming activity and unusual swimming patterns when their exposure sound levels increased, perhaps an indication of stress. An "alarm" condition was observed to animals 2 km away from the survey vessel, and displayed avoidance behaviour in 1km distance. According to Holst et al. (2006), sea turtles were approached by research vessels in shorter distances when the seismic airguns were not activated (139 m and 228 m correspondingly).

Long term effects of seismic disturbances to sea turtles are hard to assess (Samuel et al. 2005). However it is likely that long exposure to airgun noise can interfere with their health and ecology, causing avoidance behaviour, increasing stress and aggression levels (Lagardere, 1982), inducing physiological ear damage either due to Temporary Threshold Shift or Permanent Threshold Shift (Hastings et al. 1996; Scholik and Yan 2001; Erbe, 2002; McCauley et al. 2003), altering their diving or surfacing rates, and disorientating them. Sea turtles are loyal to certain migratory pathways, foraging grounds, and nesting sites.

The loggerhead sea turtle in Greece is protected under National and European regulations. This species out of the three that are encountered in the Mediterranean, is the only one nesting in Greece with the majority of its nests at coastal areas of the Eastern Ionian Sea. The closest nesting site to the Project area is at the West-South coast of Corfu, at a distance greater than 20 km. Additionally, the study area belongs to the loggerhead migration route during Autumn-Winter months when the sea turtles pass through the region. It is suggested a year-round presence of this species in the area.

There is possibility that airgun noise interferes with sea turtles' physiology when in proximity to the sound source. However, sea turtles have the ability to detect underwater sound and are expected to move away from loud noise that falls within their detection radius.

Sea turtles nesting occurs in early summer, thus no sea turtles are expected to be impacted at their nesting habitats. Moreover, nesting sites are in certain distance from the Project area. Potential impacts are associated with the migration movements of adults to and from foraging grounds in the Adriatic Sea through the Otranto passage. These corridors are thus used at the end of the breeding season, predominantly in July and August for females and in May and June for males (Casale et al., 2018). Young sea turtles may be possibly present in the study area during the survey period but there is a lack of detailed knowledge on their distribution during their early lives. Their tendency to remain on the sea surface also decreases the risk of serious interferences with airgun noise.

Sea turtle sensitivity is assessed **High** given their expected presence in the area and their ability of fleeing the slow moving seismic research vessel.

Table 5.21: Sea Turtles – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Sea Turtles	3	2	5	**High**

The combination of a **High sensitivity** receptor and **High intensity** potential effect result in an overall **Major severity** impact**.** Mitigation measures are required to protect the endangered sea turtles from seismic operations.

Table 5.22: Impact on Sea Turtles due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	**Major**

5.2.6.4 Impact on Fish Fauna due to Noise Emissions

Different fish species have different sensitivity in the range of noise frequency produced by airguns. Seismic pulses may cause temporary or permanent hearing problems to some fish species, but it is unlikely that they induce serious injuries unless the exposure occurs in very short distances. Due to great differences in morphology and physiology between fishes, behavioural responses and sensitivity to acoustic injuries varies greatly.

There is no evidence of fish mortality due to seismic surveys and available data is lacking on fatalities due to exposure to sound intensity. Besides very short distances, airgun impacts to fish is expected to be temporary and predominantly related to behavioural responses exhibited by avoidance. Habituation to noise by fish is displayed with interruption of avoidance behaviour during exposure often a few minutes after the beginning of the seismic surveys.

Direct physical damage from airguns has been studied on fish eggs and larvae in a number of reports (see also Section **Error! Reference source not found.**). It is confirmed that a level higher than 230 – 240 dB p-p re 1 μPa i s necessary for physical damage to occur (Weinhold and Weaver, 1973; Kostyvchenko, 1973; Dalen and Knutsen, 1987; Greene et. al, 1985; Holliday et al, 1987; Kosheleva 1992; Falk and Engel, 1992; Evans and Nice, 1996 etc).

Seismic noise may cause masking of biological acoustic signals utilized by fishes for certain acoustic functions (Popper and Clarke 1976; Ha, 1985). No mortality has been recorded due to these behavioural responses. Species with higher hearing ability have higher risk to exhibit behavioural responses in long distances from the noise source than fishes with low hearing ability (McCauley, 1994).

Fishes exposed to airguns displayed “alarming” behavioural responses that included rapid swimming, swim close to the sea bottom and with tighter group formations in distances 2-5 km from the seismic sources. Fishes exposed to short distance airgun pulses displayed damages of their hearing structures but without indications of increased stress levels. The same study concluded that exposure to seismic airguns may cause significant damage to the fishes’ ears (McCauley et al., 2003).

In the Ionian Sea, 224 fish species are identified, mostly of commercial (fishing) value. 101 species of deep-water fish (300-1,200m depth) have been identified in the Study Area. This number and abundance showed a clear decrease with depth. In the zone 700-900 m, Catshark (*Galeus melastomus)* and Grenadier (*Nezumia sclerorhynchus)* showed both the highest abundance and frequency of occurrence. These two species were also the most abundant at depths 900-1,200 m, whereas Lantern fish (*Lampanyctus crocodilus)* was the most frequently encountered. Tuna, swordfish and sharks are also common in this area.

No endangered or sensitive fish species are expected to be present in the Project region. In combination with their ability to move away from disturbed zones set the sensitivity of fish fauna is evaluated **Low.**

Table 5.23: Fish Fauna – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Fish	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **High intensity** potential effect result in a **Moderate severity** impact**.**

Table 5.24: Impacts on Fish Fauna due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	**Moderate**	Major	Major

Studies on the impact of seismic operations on fishing industry have shown that both no effect and significant effect may occur during and for a period after the operations. Lokkerberg (1991) and Engas et al. (1993) reported that cod landings were reduced by 50-80% during seismic surveys in North Sea. Sound levels were at 160 and 191 dB correspondingly. This decrease lasted at least for 5 days and 33 km away from the airgun operations. Davis et al. (1998) report that this contradicts many surveys that show a more localized and short term effect. Gausland (2003) highlights that most of the studies refer to 2 km as the maximum range of impacts to the behaviour of fish by airguns.

5.2.6.5 Impact on Plankton due to Noise Emissions

Marine planktonic organisms include phytoplankton (floral plankton) and zooplankton (faunal plankton). The latter is divided into meroplankton (planktonic stage of fish or other invertebrate larvae) and holoplankton (remains in planktonic form throughout its life cycle).

Potential impacts of seismic operations on these organisms include physiological injury and/or mortality. Since plankton is drifted by sea currents and waves, it does not have the ability to choose direction and travel, thus incapable of any avoidance behaviour. Its exposure to the seismic noise can be detrimental to its survival if it occurs in close vicinity to the airgun sound source. Besides the direct effect to the planktonic organisms, negative impacts may occur to organisms in higher trophic levels that forage on plankton (e.g. fishes, invertebrates etc.) or which early life stages include planktonic forms. Furthermore, masking of acoustic signals or cues may interfere with larval orientation that could have implications for recruitment in meroplankton.

Recent study on krill (Semmens et al., 2017) found evidence that suggests that the airgun noise may harm the highly sensitive hair-like receptors that the animals use to navigate, and it might not kill them directly, but it could disorientate them and affect their survival.

The proposed survey area is overall oligotrophic with low and relatively stable concentrations of both phytoplankton and zooplankton throughout the year. Even though, the biomass of meso-zooplankton (Mazzocchi *et al.* 2014) is the lowest in the whole Mediterranean Sea (Mazzocchi *et al.* 2014), a seasonal peak in phytoplankton and meso-zooplankton was recorded in March, with a relatively eutrophic state in late winter – early spring. The dominant zooplankton group is Copepods, found from the surface to 200 m depth. The meso-zooplankton taxa found in the wider region of the Ionian Sea are the most important species of the meso-zooplankton in the East Mediterranean Sea (Zervoudaki *et al.*2006, Moraitou Apostolopoulou *et al.* 2000, Siokou-Frangou *et al.* 1997, Mazzochi *et al.* 1997, Siokou *et al.* 2010). Mainly fish eggs and larvae would be significantly impacted by airgun activity when in less than 2 m proximity (McCauley 1994). However, very small amount of planktonic organisms is estimated to be directly affected and in localised scale. Even though the effects would be in short term, no cumulative effect is recognized.

Accounting for the oligotrophic nature of the study area, the temporal nature and inherently high mortality rates of plankton, the sensitivity of planktonic organisms is evaluated **Low**.

Table 5.25: Plankton – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Plankton	1	1	2	**Low**

According to the **High intensity** of effect and **Low sensitivity** of receptor, the impacts of seismic noise to plankton across the survey area is calculated to be of **Moderate Severity**.

Table 5.26: Impacts on Plankton Fauna due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	**Moderate**	Major	Major

5.2.6.6 Impacts on Marine Invertebrates due to Noise Emissions

This section refers to the invertebrates encountered in the water column. The majority of them are insensitive to sound since they lack hearing organs. Even though sound production and sound dependence are notoriously attributed to marine mammals, other marine taxa also rely on sound on a regular basis including decapod crustaceans. Marine invertebrates lack a gas-filled bladder and are thus unable to detect the pressure changes associated with sound waves. However, all cephalopods as well as some bivalves, echinoderms, and crustaceans have a sac-like structure called a statocyst which includes a mineralised mass (statolith) and associated sensory hairs (e.g. crustaceans in Edmonds et al., 2016). Statocysts develop during the larval stage (Young et al., 2006) and may allow an organism to detect the particle motion associated with sound waves in water to orient itself (Sekiguchi and Terazawa, 1997; Kaifu et al., 2008). In addition to statocysts, cephalopods have epidermal hair cells which help them to detect particle motion in their immediate vicinity (Kaifu et al., 2008), comparable to lateral lines in fish. Similarly, decapods have sensory setae on their body (Popper et al., 2001), including on their antennae which may be used to detect low-frequency vibrations (Montgomery et al., 2006). Whole body vibrations due to particle motion have been detected in cuttlefish and scallops, although species names and details of associated behavioural responses are not specified (André et al., 2016). Limited research on the effects of seismic noise to invertebrates shows that they could respond to airgun noise with physiological injuries and mortality or avoidance behaviour, when the organisms are close to the sound source. The potential effects of sound on invertebrates may be poorly understood but may be significant (de Soto et al., 2013).

Biotic communities of the deep waters in the Northern Ionian Sea present high diversity including 44 crustacean and 25 cephalopod species. Crustaceans form a large, diverse arthropod taxon that includes animals such as shrimp, krill, and woodlice. In the Project area, 18 decapod species are encountered in the zone 900-1200 m but showed low abundance, with *Sergia robusta* and *Polycheles typhlops* being predominant. Presence of the deep water rose shrimp (*Parapenaeus longirostris*) has been reported. At depths beyond 500 m, between 700-900 m, the red shrimp (*Aristaeomorpha foliacea*) is also fished and is abundant, a species of commercial importance for the North Mediterranean Sea. From the identified decapods, *Acanthephyra eximia, Philoceras echinulatus and Pontophilus norvegicus* were mentioned for the first time in the Eastern Ionian Sea. Some other species, such as *Acanthephyra pelagica, Geryon longipes, Munida tenuimana, Paromola cuvieri, Parthenope macrochelos, Pasiphaea multidentata, Plesionika narval, Polycheles typhlops, Sergestes arachnipodus and Sergestes arcticus* have been reported for the area. Studies on the catch rates of mantis shrimp showed no reduction after seismic operations (La Bella et al. 1996). Further studies on the physiology and behaviour of prawns exposed to airgun noise showed no significant impact (Andriguetto-Filho et al. 2005).

Among the most usually commercial species fished in the area, presence of Short finned squid (*Illex coindetii*) is reported, and other mollusc species have been reported on shallow waters close to the island of Corfu. The Short finned squid is one of the most common squid species in the Ionian and is known to spawn during spring. Squid and their larvae could be impacted by the airgun, unless the adult individuals exhibit avoidance behaviour of the surveyed area. Studies on the impact on the Short-finned squid have shown no changes in trawl catches before and after the implementation of seismic surveys (La Bella *et al.* 1996). For different squid species (*Sepioteuthis australis*) there have been observed changes in their behaviour due to seismic noise (McCauley et al. 2003). Anecdotal evidence shows pronounced statocyst and organ damage in seven stranded giant squid after nearby seismic surveys (Guerra et al., 2004). After two hours of continuous sound treatment, four cephalopod species exhibited acoustic trauma in their statocysts, including lesions, hair cell loss and damage, and neuron swelling (Andre et al., 2011; Sole et al., 2013). Reported stranding of Giant squids during seismic surveys raises concerns on the effects of noise to cephalopods and specifically to different squid suborders.

Concerning behavioural responses, jetting and inking in squid have been observed during airgun operations, with startle responses occurring more frequently as sound levels increase (Fewtrell and McCauley, 2012). Decapods exhibited alarm behaviour when they were < 10 cm away from the sound source (Goodall et al., 1990) and showed no such behaviour in response to seismic sound at distances of 1 m or more (Goodall et al., 1990; Christian et al., 2003). Overall, sound avoidance behaviours have a more lasting impact on populations than startle responses, particularly if animals migrate out of an area in which seismic surveys are conducted (Carroll et al., 2017). Shrimp displayed less agonistic behaviour during a broad range of sound frequencies (100–25,000 Hz) compared to control conditions (Celi et al., 2013). Additionally, the respiration rate of cephalopods may be affected by low-frequency sound, with Octopus (*Octopus ocellatus)* suppressing their respiration at frequencies 50–150Hz at 120dB RMS re 1μPa) (Kaifu et al., 2007).

Some invertebrates may become habituated to sound, with Squid showing fewer alarm responses with subsequent exposure to noise from airguns (Fewtrell and McCauley, 2012), Cuttlefish habituating to repeated 200 Hz tone pips (Samson et al., 2014), and Squid showing decreased responses over sound exposure trials (Mooney et al., 2016). Cephalopods may also be able to adapt their behaviour to particular sounds types. In a series of caged trials in which turtles, fish, and squid were exposed to airguns, the squid were the only animals to shelter in the sound shadow at the ocean surface (McCauley et al., 2000).

Accounting for the probable absence of endangered and protected marine invertebrates of the water column at the Project area, and the ability of these organisms to move and avoid disturbed areas, the sensitivity of neritic invertebrate organisms is evaluated to be **Low**.

Table 5.27: Marine Invertebrates – Sensitivity ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Marine Invertebrates	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **High intensity** potential effect from seismic noise result in an overall **Moderate severity** impact**.**

Table 5.28: Impact on Marine Invertebrates due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	**Moderate**	Major	Major

5.2.6.6.1 *Impacts on Marine Protected Areas due to Noise Emissions*

According to Section 4 of the present document, there are 8 official Natura 2000 Protected areas, and a few more Wildlife Refuges, wetlands, and Important Bird Areas within the wider (extended) Project area, including:

- ✓ SCI - Marine area of Diapontia islands - GR2230010 (closest Natura 2000 site);
- ✓ SPA/SAC - Alyki Lefkimmis - GR2230003 ;
- ✓ SCI - Antinioti lagoon and Fonissa river - GR2230009;
- ✓ SPA/SAC - Antiniotis' lagoon - GR2230001;
- ✓ SPA - Diapontia Nisia (Othonoi, Ereikousa, Mathraki Vrachonisides) - GR2230008;
- ✓ SCI - Korission Lagoun - GR2230002;
- ✓ SPA - Limnothalassa Korission (Corfu) & Nisos Lagoudia - GR2230007;

- ✓ SCI/SAC - Marine area of Nisoi Paxoi Kai Antipaxoi - GR2230004.

The Diapontia Islands (GR2230008) are an important colony for protected bird species. The Corfu Lagoons are important sites for seabirds. The protected Monk seal and Bottlenose dolphin are present at the area of Nisoi Paxoi Kai Antipaxoi (GR2230004).

Outside of the wider (extended) study area but in proximity with Block 2, five (5) more Natura 2000 areas can be identified including:

- ✓ In Greece:
  - SAC - Coastal Marine Zone from Kanoni to Mesongi (Corfu) - GR2230005;
- ✓ In Italy:
  - SCI – Alimini - IT9150011,
  - SCI - Costa Otranto - Santa Maria di Leuca - IT9150002,
  - SCI - Litorale di Ugento - IT9150009,
  - SCI - Posidonieto Capo San Gregorio - Punta Ristola - IT9150034.

The Italian Natura sites: “Alimini” (SCI - IT915011), Posidonieto Capo San Gregorio - Punta Ristola (SCI - IT9150034), “Costa Otranto - Santa Maria di Leuca” (SCI - IT9150002), and “Litorale di Ugento” (SCI – IT9150009) are mostly significant for Posidonia beds, Algae, Coralligens and birds.

Posidonia meadows and Cystoseira communities are significant species at Coastal Marine Zone from Kanoni to Mesongi (GR2230005).

Of high concern is the inclusion of the Project area in the Ecologically or Biologically Significant Area (EBSA) of South Adriatic and Ionian Sea, where protected and sensitive marine mammals, sea turtles, corals, sponge aggregations, and other fish are present.

The presence of EBSA partially overlapping with the Block 2 area and its proximity to Diapontia Islands site (although the relevant marine areas has been excluded from any operational activity) increases the sensitivity of these ecosystems, with particular regard to the presence of marine mammals, and sea turtles and, the sensitivity of Marine protected areas is assessed to be **High.**

Table 5.29: Sensitivity ranking of Marine Protected Areas

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Marine Protected Areas	3	3	6	**High**

The combination of a **High sensitivity** receptor and **High intensity** potential effect result in a **Major severity** impact**.**

Table 5.30: Impact on Marine protected Areas due to Noise Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	**Major**

Further mitigation measures are required to be implemented to account for the protection of these areas and their ecosystems.

5.2.7 Impacts of Vessel Operation on Marine Fauna and Flora

5.2.7.1 General Aspects

The seismic surveys scheduled include four vessels operating continuously for the entire 24 h, during 20-45 days. Specifically, the marine spread expected to be mobilized for the execution of the survey includes (see also Paragraph 3.3.2.4):

- ✓ one seismic vessel, 80-110 m long, that accommodates 50-60 people, with 10-15 knots cruising speed and 4.5 knots operational speed;
- ✓ two chase vessels, 35 m long each, that accommodates 10-20 people each, with 10-15 knots cruising speed, and
- ✓ one supply vessel, 70 m long, that accommodates 10-20 people, with 10-15 knots cruising speed.

Operation of the seismic vessels and operation and supporting activities of other vessels associated with seismic surveys can harm marine fauna in different ways.

The analysis of potential impacts to marine organisms from vessel operation during the exploration stage is divided in impacts due to increased:

- ✓ discharges (effluent and solid waste);
- ✓ collisions and entanglements of marine fauna;
- ✓ light emissions; and
- ✓ interference with the seabed.

The assessment includes the potential effect to all types of marine organisms and ecosystems:

- ✓ Fauna and Flora:
  - Plankton,
  - Zoobenthic communities,
  - Marine invertebrates,
  - Corals,
  - Fish fauna,
  - Marine mammals,
  - Sea turtles,
  - Seabirds,
  - Posidonia meadows;
- ✓ Marine Protected Areas.

5.2.7.2 Impacts due to Discharges

5.2.7.2.1 *Effect Intensity*

Effluent discharges that result from the survey activities include sewage and domestic waters (sanitary and galley wastewater), and oily waters (drainage, bilge). Such discharges to the marine environment could potentially degrade the ecosystems and negatively affect the welfare of marine organisms.

Effluent discharges occurring from vessel use during the offshore operations and supporting activities are evaluated to be direct, temporary, local and of low magnitude, which concludes the intensity of this parameter to be ranked **Low**.

Table 5.31: Discharges – Intensity Ranking

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the by the deck drainage, machinery space drainage, sewage, galley wastes and solid waste from all vessels involved in the seismic operations
Type	Induced Indirect **Direct**	3	There is direct discharge from the seismic and support/chase vessels to the marine environment
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will take place occasionally during the seismic survey (max. 45 days)
Extent	**Local** Regional National and/or transboundary	1	The effluent discharges will be localised affecting only the water mass near the vessels
Magnitude	**Low** Medium High	1	Low volume of discharges and waste is expected. The relatively small volume of discharges is not expected to contribute to a significant or noticeable increase in water pollutant concentrations at receptors
Intensity score		**6**	**Low**

5.2.7.2.2 *Impacts Severity*

Effluent discharges and solid waste are expected to be of small volume and since the vessels would comply with the MARPOL 73/78 standards, will have low oil content. The loading of sewage and oily waters released during the activities is comparable to volumes produced by similar vessels and insignificant compared to the daily nutrient flux that should occur in the region. The short duration (up to 45 days) of the seismic survey represents a time-limited source of potential contamination to deep sea ecosystems. The reduction of the water quality is expected to be localized and temporary. It is expected that discharges will be quickly diluted in the open sea. Thus, the overall impact to the seawater quality and consequently the marine organisms is considered of low significance.

Multiple sensitive receptors are present in the area. Megafauna such as marine mammals, sea turtles and seabirds are expected to be encountered in the region year-round to forage, breed and rest. Water pollution may put at risk the health of these organisms. Additionally, endangered cold-water corals are expected to be distributed at parts of the study region. Depending on the coral species, they may exhibit a range of responses to oil contamination (reduced growth, tissue damage, and impaired settlement).

Posidonia meadows, which are highly sensitive to water pollution are coastal species situated away from the Project region, in habitats close to shore. However, the amount of waste and oil in the water column and the increase of nutrient concentrations are not expected to add significantly to the current baseline water quality status.

We conclude that, the sensitivity of these receptors may vary from Low to High, and in combination with the Low Intensity of the parameter, the resulted impacts on marine organisms from effluent discharges are evaluated to be of Negligible, Low, to Moderate (marine mammals, marine protected areas) severity.

In particular, the combination of a **Low intensity** potential effect and a **Low sensitivity** receptor for Plankton, Invertebrates and Fish Fauna results in a **Negligible severity** impact**.**

Table 5.32: Impact on Plankton, Invertebrates and Fish Fauna due to Discharge – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

The combination of a **Low intensity** potential effect and a **Medium sensitivity** receptor for Corals, Seabirds and Posidonia meadows result in a **Minor severity** impact**.**

Table 5.33: Impact on Corals, Seabirds and Posidonia Meadows due to Discharge – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	**Minor**	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

The combination of a **Low intensity** potential effect and a **High sensitivity** receptor for Marine Mammals, Sea Turtles and Marine protected areas result in a **Moderate severity** impact**.**

Table 5.34: Impact on Marine Mammals, Sea Turtles and Marine Protected Areas due to Discharges – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	**Moderate**
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.2.7.3 Impacts due to Collisions and Entanglement of Marine Fauna

5.2.7.3.1 *Effect Intensity*

A number of streamers (up to 10 in case of 3D surveys) with individual length of approximately 8-10 km are expected to be towed behind the seismic vessel during operations. The presence of survey vessels and the equipment towed represent a potential physical hazard that marine wildlife will possibly avoid. The seismic operation introduces however a risk of collision or entanglement of sea turtles and marine mammals. The impact due to potential interference may range from the minimal temporary behavioural changes, for disturbance, to detrimental impacts

such as injuries or mortality caused by vessel strikes. The potential risk of a collision also depends on the abundance of fauna in the study area and the vessel speed.

Potential collision/entanglement of megafauna, occurring from vessel and towed arrays used during the seismic operations, are evaluated to be direct, temporary, local and of moderate magnitude, which concludes the intensity of this parameter to be evaluated **Medium**.

Table 5.35: Collisions and Entanglements of Marine Fauna – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the occupation of the sea surface by the vessels and the towed equipment used in the operations
Type	Induced Indirect **Direct**	3	There is direct effect of potential collisions or entanglement of megafauna due to the occupation of sea surface of the vessels and the towed arrays
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will last 45 days at maximum
Extent	**Local** Regional National and/or transboundary	1	The occupation of sea surface will be localised affecting only the exact area that the vessels go through
Magnitude	Low **Medium** High	2	The relatively big surface area that the vessel and the streamers occupy, and the low operational vessel speed (4.5 knots) are expected to moderately increase the risk of collision or entanglement of megafauna by the equipment
Intensity score		**7**	**Medium**

5.2.7.3.2 *Impacts Severity*

Sea turtles

Sea turtles are relatively slow moving organisms with average swimming speeds under 1 km/h. They may spend up to 4-7 hours underwater and depending on their activity they regularly need to surface to breath. Throughout their day, they spend some prolonged periods on the sea surface to breath and rest.

The Loggerhead sea turtle in Greece is protected under National and European regulations. This species out of the three that are encountered in the Mediterranean, is the only one nesting in Greece with the majority of its nests at coastal areas of the Eastern Ionian Sea. The closest nesting site to the Project area is at the west-south coast of Corfu, at a distance above 20 km. Additionally, the study area belongs on the loggerhead migration route during Autumn-Winter months when the sea turtles pass through the region. It is suggested a year-round presence of this species in the area.

There is possibility that the research vessel collides with sea turtles during the seismic operations. Sea turtles have the ability to detect underwater sound and would be expected to move away from loud sound sources that fall within their detection radius. Even though the speed of the seismic vessel is relatively low (4.5 knots), it remains much higher than the average swimming speed of a sea turtle. Typically, sea turtles will avoid vessels by performing rapid dives. However, their response rate depends on the speed of the vessel and their behavioural status. Their avoidance behaviour of approaching vessels has been based on visual cues. With increasing vessel speed, the response rate of sea turtles decreases (Hazel et al., 2009) and increases the possibility of negative impacts to the

animals. If a collision occurs, the sea turtle carapace provides some protection to the animal but severe to fatal injuries depend on the force of the collision, the vessel type and whether the animal was struck by the hull or the propeller.

Furthermore, the towed equipment from the research vessel that includes the streamer tail buoys has the potential to cause sea turtle fatalities. Entanglement of individuals with the towed arrays and entrapments with the streamers have been an issue during marine seismic surveys in the past. Thus, the 8-10 km long towed equipment may be a risk for sea turtles.

Sea turtle sensitivity is assessed **High** accounting for their expected presence in the region and their possibility to flee the slow moving seismic research vessel.

Table 5.36: Sea Turtles - Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Sea Turtles	3	2	5	**High**

The combination of a **High sensitivity** receptor and **Medium intensity** potential effect result in a **Major severity** impact**.**

Table 5.37: Impact on Sea Turtles due to Collisions and Entanglements - Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	**Major**
	High	Moderate	Major	Major

Further mitigation measures are required to be implemented to account for the protection of sea turtles and their ecosystems.

Marine mammals

Marine mammals, and particularly cetaceans, spend most of their time performing shallow or deeper foraging dives, depending on the species and the habitat. Their need to breathe brings them regularly to the sea surface that dependent on the species and behaviour, they spend longer and less frequent or shorter and much more frequent periods interacting with the surface.

Marine mammals in all Mediterranean countries are protected under ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, the Mediterranean and the Contiguous Atlantic Area; Monaco, 1996). In the Project region, the presence of bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*), Mediterranean monk seal (Monachus monachus) is expected. Other species such as Cuvier's beaked whale (Ziphius cavirostris), fin whale (*Balaenoptera physalus*), sperm whales (*Physeter macrocephalus*), and Risso's dolphin (*Grampus griseus*) present decreasing in the order mentioned possibilities to be encountered in the study area. Even though precise knowledge on the seasonality of most of these species is lacking, their year-round presence is expected in the region, with the exception of fin whales, for which uncertainty exists about the annual movements during the winter period.

Mortality of marine mammals due to collisions with vessels has been documented, usually including fast moving vessels. Studies suggest that vessels travelling with speed above 14 knots pose the highest risk to marine megafauna (Laist et al, 2001). The chance of a lethal vessel-whale strike to occur has been calculated to be less than 10% at a vessel speed of 4 knots (Vanderlaan & Taggart, 2007). Thus, such collisions appear to be largely uncommon, as reported by the US National Ocean and Atmospheric Administration (NOOA). Among the cetaceans that are potentially present in the Project region, Sperm whales have been particularly vulnerable to ship strikes

within the Mediterranean basin. Fin whales are also often victims of ship strikes. However, these species are less common in the study area.

Given the expected presence of a variety of sensitive and endangered marine mammal species in the Project region, and their relative ability to flee from operating seismic activities, the sensitivity of this receptor is assessed to be **High**.

Table 5.38: Marine Mammals – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Marine Mammals	3	3	6	**High**

The combination of a **High sensitivity** receptor and **Medium intensity** potential effect result in an overall **Major severity** impact**.**

Table 5.39: Impact on Marine Mammals due to Collisions and Entanglements - Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	**Major**
	High	Moderate	Major	Major

Further mitigation measures are required to be implemented to account for the protection of marine mammals and their ecosystems.

5.2.7.4 Impact due to Light Emissions

5.2.7.4.1 *Effect Intensity*

Light pollution has become a significant issue over the last 50-80 years. It is defined as the 'degradation of the photic habitat by artificial light' (Verheijhen, 1985). Lighting during the seismic surveys is integral part of safe navigation and work practices. Since the survey activities are scheduled to be undertaken on a 24 hours basis, throughout the week, during the whole operation period (max. 45 days), lights are required on vessels during the night hours. Both Seismic and Support Vessels will be equipped with suitable artificial lighting for safety purposes. Thus, it is introduced a light source that alters the natural light.

Certain marine organisms in the vicinity of the operation area and the higher part of the water column, close to the sea surface, may be affected negatively. Disturbance occurs when organisms are exposed to light in the wrong place, at the wrong time or intensity. The concern of light pollution penetrating the ocean is associated with the fact that in this habitat, very little natural light is available which makes its inhabitants highly sensitive even to very small amounts of it. Often in the ocean, sleeping cycles, breeding cycles, migration cycles, feeding cycles are controlled by cues from the moon and the sun with animals following life patterns by visual cues. Artificial light can interrupt and disturb those patterns.

Even though artificial light at night alters the behaviour of planktonic forms and can disrupt the development of ecological communities in the marine environment, the source of light will consist of seismic vessel back deck and project related vessels sailing along predetermined routes

Nocturnal artificial light occurring from vessel use during the seismic operations, as described in Table 5.40, is evaluated to have a direct, temporary, local and of medium magnitude effect, which concludes the intensity of this parameter to be evaluated **Medium**.

Table 5.40: Light Emissions – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the emission of artificial lighting from all 4 vessels involved in the seismic operations
Type	Induced Indirect **Direct**	3	There is direct emission of artificial light due to typical vessel operation at night
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will last 45 days at maximum, only during night hours
Extent	**Local** Regional National and/or transboundary	1	The emissions will be local affecting the area around the vessels in a radius that the lights are visible
Magnitude	Low **Medium** High	2	The 4 vessels are expected to moderately increase the light pollution at receptors
Intensity score		**7**	**Medium**

5.2.7.4.2 *Impact Severity*

Plankton

Most types of plankton exhibit some type of vertical migration. The diel vertical migration in the ocean is a pattern of movement which occurs when organisms move during the night from the mesopelagic to the epipelagic zone. Main exogenous factor that affects this function is typically the light. Organisms, commonly Copepods, look for an optimum light intensity and the organism will travel to where it is most comfortable. During a full moon, organisms don't appear to migrate up as far high on the water column and during an eclipse they start to migrate. Important reason for zooplankton to perform this daily migration is predator avoidance (Gliwicz, 1986). The sea surface may be risky to reside in during the day than deep water, and often zooplankton migrates to deep waters during the day to avoid predation from fish and come up to the surface at night to feed. Artificial changes in light may interrupt those movements with ecosystemic consequences.

Seismic operations may introduce artificial light that can potentially impact upper ocean processes, such as the diel vertical migration of plankton (Moore et al., 2000). The presence of artificial light at night may alter the biorhythms of zooplankton. In the long term, the disturbance could become a factor of stress for the organisms and decrease the biological production of plankton. On the contrary, a main effect of light may be the slight increase of photosynthetic activity of phytoplankton in the surface water layers, likely increasing water productivity in localized regions.

Artificial light at night may also affect meso-zooplankton and consequently the settlement of marine invertebrates into new habitats. Light is an important cue which guides the larvae of marine invertebrates as they search for suitable habitats to settle, grow and reproduce.

The proposed survey area is overall oligotrophic with low and relatively stable concentrations of both phytoplankton and zooplankton throughout the year. Even though, the biomass of meso-zooplankton (Mazzocchi et al. 2014) is the lowest in the whole Mediterranean Sea (Mazzocchi et al. 2014) there has been recorded a seasonal peak in phytoplankton and meso-zooplankton in March, with a relatively eutrophic state in late winter – early spring. The dominant zooplankton group is Copepods and are found from the surface to 200 m depth. The meso-zooplankton taxa found in the wider region of the Ionian Sea are the most important species of the mesozooplankton in the East Mediterranean Sea (Zervoudaki et al.2006, Moraitou Apostolopoulou et al. 2000, Siokou-Frangou et al. 1997, Mazzochi et al. 1997, Siokou et al. 2010) increasing the sensitivity of the organisms.

Given the oligotrophic nature of the study region, the sensitivity of Plankton is evaluated **Low**.

Table 5.41: Plankton – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Plankton	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **Medium intensity** potential effect result in an overall **Minor severity** impact**.**

Table 5.42: Impact on Plankton due to Light Emissions – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	**Minor**	Moderate	Major
	High	Moderate	Major	Major

Marine Invertebrates

Light is known to affect different invertebrates and settlement (see above section 5.2.7.4.1) in different ways. Impacts of artificial light in invertebrates include unwanted fouling and altering the abundance of the species in the wider marine environment. Light from oil rigs, passing ships and harbors may be preventing some species from settling. At the same time, the light may draw other species, like Barnacles, that can disrupt balances and certain marine ecosystemic functions. Specifically, research has shown that the more light an area was exposed to, the fewer settling of filter feeders there was. Filter feeders, such as Polychaete, Decapods, Sponges and Corals, feed on plankton and nutrients from the water and increase the ecosystem health. On the other hand, species such as Sea worms and Barnacles are attracted to light. What is more, artificial night light is known to attract Squid (Longcore and Rich, 2004). Result of this disorientation may increase risk of predation.

Biotic communities of the deep waters in the North Ionian Sea present high diversity including 44 crustacean and 25 cephalopod species. Crustaceans form a large, diverse arthropod taxon which includes such familiar animals as Shrimp, Krill, and Woodlice. 18 Decapod species are encountered in the zone 900-1,200 m but showed low abundance, with Shrimp (*Sergia robusta)* and decapod *Polycheles typhlops* being predominant. Presence of the deep water rose shrimp (*Parapenaeus longirostris*) has been reported. At depths beyond 500 m, in the zone 700-900 m, the red shrimp (*Aristaeomorpha foliacea*) is also fished and is abundant, a species of commercial importance for the North Mediterranean Sea. From the identified decapods, *Acanthephyra eximia*, *Philoceras echinulatus* and *Pontophilus norvegicus* were mentioned for the first time in the East Ionian Sea. Some other species, such as *Acanthephyra pelagica*, *Geryon longipes*, *Munida tenuimana*, *Paromola cuvieri*, *Parthenope macrochelos*, *Pasiphaea multidentata*, *Plesionika narval*, *Polycheles typhlops*, *Sergestes arachnipodus* and *Sergestes arcticus* have been reported for the area. Furthermore, the Short finned squid (*Illex coindetti*) is one of the most common squid species in the Ionian and is known to spawn during spring.

Accounting for the probable absence of endangered and protected marine invertebrates of the water column at the Project area, and the ability of these organisms to move and avoid disturbed areas, the sensitivity of neritic invertebrate organisms is evaluated **Low**.

Table 5.43: Marine Invertebrates – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Marine Invertebrates	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **Medium intensity** potential effect from light emission result in an overall **Minor severity** impact**.**

Table 5.44: Impact on Marine Invertebrates due to Light Emission

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	**Minor**	Moderate	Major
	High	Moderate	Major	Major

Seabirds

Many seabirds are active at night. This allows them to avoid predation, which is important during the breeding season (Montevecchi 2006). Nocturnal seabirds often exploit vertically migrating prey and may also use the night sky to navigate (Imber 1975, Reed *et al*. 1985). Other nocturnal bird species use the moon and stars for navigation during migrations. Bird migration takes place, in fact, according to specific air routes that may be subject to "deviations" caused by the presence of strong light sources. Nocturnal seabird species are sensitive to the disorientating influences of artificial light (Montevecchi 2006) and light pollution. In some circumstances enormous numbers can be drawn to the lights of boats, often with fatal consequences.

The birds of Greece are protected by a Natura 2000 network, which includes Special Protection Areas (SPAs) for bird fauna. The Diapontia Islands (code IBA GR082 - Life International, Fric et al., 2012) is an important area in the North Ionian for the avian fauna. There, important population of Shag (*Phalacrocorax aristotelis)* is present year-round and Scopoli's shearwaters (*Calonectris diomedea*) visit from March to September to form colonies, reproduce, rest and feed. The population of the *Calonestris diomedea* at the island of Traheia is considered to be very important because it seems to connect the population of Greece with the population of the Adriatic and Central Mediterranean Sea (Papakonstantinou, 2009). Together with endangered species (like Eleonore's falcon *Falco Eleonora*) and other seabirds, like gull (*Icthyaetus audouinii*, *Larus argentatus)*, the region makes an important habitat for avifauna. Both *Phalacrocorax aristotelis* and *Ichthyaetus audouinii* are endemic species well expected in the project area due to its close proximity to their habitat. Similarly, the Lagoons of Kerkira, important location for birds, is located approximately 20 km from the Project area. All species mentioned besides *P. aristotelis* are known to exhibit nocturnal foraging behaviour. Light pollution may also impact Petrels and Shearwaters.

The scale at which seabirds are attracted to illuminated vessels can be immense with detrimental effect on some globally threatened bird populations (Reed *et al.* 1985). Lighting on board the survey vessel can cause stranding of pelagic seabirds on the survey vessel at night. On one occasion, an estimated 6,000 Crested Auklet *Aethia cristatella*, with a combined weight of around 1.5 metric tons, nearly capsized a fishing fleet after they became grounded in bad weather (Dick and Davidson 1978). In another incident, a research vessel passing through waters to the west of South Georgia and the South Sandwich Islands reported being struck by almost 900 seabirds during one night after the birds were attracted to the vessel's powerful lights (Black 2005). Migrating birds can become confused by artificial light and bright areas without the stars to help them navigate. They get attracted to lights and will fly in circles around them until they die from exhaustion or predators. Vulnerability to artificial lighting varies between different species and age classes and according to the influence of season, lunar phase and weather conditions. But overall, young birds are more likely to become disorientated by man-made light sources. Most collisions occur in poor weather, when the moon is new or during periods of peak migration (Montevecchi 2006).

Endangered seabirds may fly over the survey area since important bird areas are in proximity to the Project region. The sensitivity of the Seabirds in the Project region is evaluated to be **Medium**.

Table 5.45: Seabirds – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Seabirds	2	2	4	**Medium**

The combination of a **Medium sensitivity** receptor and **Medium intensity** potential effect result in an overall **Moderate severity** impact**.**

Table 5.46: Impact on Seabirds due to Light Emission – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	**Moderate**	Major
	High	Moderate	Major	Major

5.2.7.5 Impacts due to Interference with Seabed

5.2.7.5.1 *Effect Intensity*

The designed survey includes the use of a towed array of up to 10 streamers, 8-10 km long each. Towing depth, based on the actual configuration of the streamer, may be up to 50 m.

Accidental dragging of the streamers, although limited to a very small part of the operational area located in a close distance from the coast with shallower seabed (in case the streamer is not correctly deployed), may result in localized physical disturbance to organisms that dwell on the seabed, such as benthic communities, corals and Posidonia meadows.

Given the water depth range across the Block 2 area (750-1,200m) and the depth of the operational area where seismic vessel is expected to sail, which are generally greater than 50 m, the potential interferences with seabed would be mainly limited to incidents.

It has to be highlighted that no mooring and/or anchor deployment at sea is expected for the marine spread (seismic vessel, chase vessels, supply vessel).

Overall, interferences with seabed are evaluated to have a direct, temporary, local and of low magnitude effect, which concludes the intensity of this parameter to be ranked **Low**.

Table 5.47: Interference with Seabed – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the dragging of the streamer along the seabed during the seismic operations
Type	Induced Indirect **Direct**	3	There is direct effect of streamers dragging on the benthic communities, corals and Posidonia meadows
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will occur only during the turns of the seismic vessel
Extent	**Local** Regional National and/or transboundary	1	The effect will be limited to the seabed affected by the streamers dragging
Magnitude	**Low** Medium High	1	The effect will be of low magnitude due to the water depth in the area of the survey and the project technical specifications
Intensity score		**6**	**Low**

5.2.7.5.2 *Impact Severity*

Evaluation of the impact severity is reported with regard to the identified sensitivities (see detailed information reported in Paragraphs above).

Zoobenthic communities

The presence of Vulnerable and Protected zoobenthic species is expected mostly in regions further away from the Project area, and thus their sensitivity is evaluated to be **Low**.

Table 5.48: Zoobenthic Communities – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Zoobenthic Communities	1	1	2	**Low**

The combination of a **Low sensitivity** receptor and **Low intensity** potential effect from interference with seabed result in an overall **Negligible severity** impact**.**

Table 5.49: Impact on Zoobenthic Communities due to Interferences with Seabed – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Corals

Corals are of high sensitivity organisms, and the presence of protected coral species is expected in some parts of the Project region. Their inability to move and avoid disturbed areas, decreases their resilience to anthropogenic disturbance. The sensitivity of corals in the study area is evaluated to be **Medium.**

Table 5.50: Corals – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Corals	2	2	4	**Medium**

The combination of a **Medium sensitivity** receptor and **Low intensity** potential effect result in a **Minor severity** impact.

Table 5.51: Impact on Corals due to Interferences with Seabed – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	**Minor**	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Posidonia Meadows

Marine flora is not expected to be abundant in the study area. The great depths of the Project region do not allow sunlight to penetrate the sea water column and reach the sea bottom to support typical plant or algal vegetation. The Mediterranean endemic marine angiosperm *Posidonia oceanica* is an important species (Habitat Directive 92/43/EC priority habitat) present in coastal habitats and shallow areas at maximum 30-42 m depth. Posidonia meadows are characterized as one of the most important marine habitats with vital role in enhancing the biodiversity in coastal zones. Posidonia makes for a sensitive biosensor, with low tolerance to anthropogenic disturbance. Such habitats are encountered in proximity to the Diapontia Islands coast, at an estimated distance about 5 km North-East of the Project region.

It has to be highlighted that sensitive Posidonia habitats are situated out of the navigation area at depths where impacts from interferences with sea bottom are not expected. No distraction of any benthic habitat is expected to occur by the seismic survey equipment. The seismic operations will be conducted over areas with depths greater than 700 m and the risk of the towed streamers sinking and reaching the seabed would occur in unlikely occasions during the turns of the ships from one acquisition line to the next.

According to the probable absence of Posidonia meadows in the Project zone and the small possibility the seismic equipment to disturb the sea bottom, set the sensitivity of these important flora species to **Medium**.

Table 5.52: Posidonia Meadows – Sensitivity Ranking

Receptor	Presence	Resilience	Sensitivity Score	Sensitivity Ranking
Posidonia Meadows	1	3	4	**Medium**

The combination of a **Medium sensitivity** receptor and **Low intensity potential** effect result in a **Minor severity** impact.

Table 5.53: Impact on Posidonia Meadows due to Interferences with Seabed – Severity Assessment

		Sensitivity		
		Low	Medium	High
Intensity	Low	Negligible	**Minor**	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.2.8 Impacts due to Navigation Restrictions

5.2.8.1 Effect Intensity

The anticipated overall operational area where the vessel is expected to sail has a surface of approx. 3,250 km^2.

The offshore seismic survey will be carried out, by a qualified seismic Contractor, utilizing a purpose-built seismic vessel that will sail along a series of predetermined seismic lines to acquire data for the survey area. The seismic vessel will be accompanied, during the seismic activities, by two chase vessels, operating back and forth simultaneously for guarding purposes and to warn other sea users of ongoing operations, and a support vessel.

The area of Block 2 is crossed by a significant sea-highway, with most traffic consisting of cargo ships and tankers.

Assessing the intensity of navigation restrictions is evaluated to be direct, short-term, regional and of high magnitude, which concludes the intensity of this parameter to be evaluated **High**.

Table 5.54: Navigation Restrictions – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative caused by the implementation of a safety zone
Type	Induced Indirect **Direct**	3	There is direct impact since the vessels would be required to give way to the seismic vessel
Duration	Temporary **Short-term** Long term/Permanent	2	The impact will be short-term and will last 45 days at maximum
Extent	Local **Regional** National and/or transboundary	2	The navigation restrictions affect fisheries and marine traffic activities of the wider regional area of Block 2 area
Magnitude	Low Medium **High**	3	The navigation restrictions will be implemented in an area of approx. 3,250 km^2,
Intensity score		**10**	**High**

5.2.8.2 Impacts on Fishing Activities due to Navigation Restrictions

The proposed seismic surveys could potentially impact the commercial fishing due to the navigation restrictions and the temporary cessation or displacement of fishing activities within the area of operations.

In particular, disruption to commercial fisheries from marine seismic surveys can result from:

- ✓ restriction of access to fishing grounds due to vessel movements and operations;
- ✓ loss of fishing gear e.g. buoyed fish traps.

Based on information provided by the Port Authority of Corfu (letter of 25/07/2017, attached in Appendix A) the most common routes and fishing areas of commercial fishing vessels are located within an area parallel to Corfu West coast, as shown in the figure below (based on coordinates provided by the Port Authority), which partially overlaps the Block 2 area.

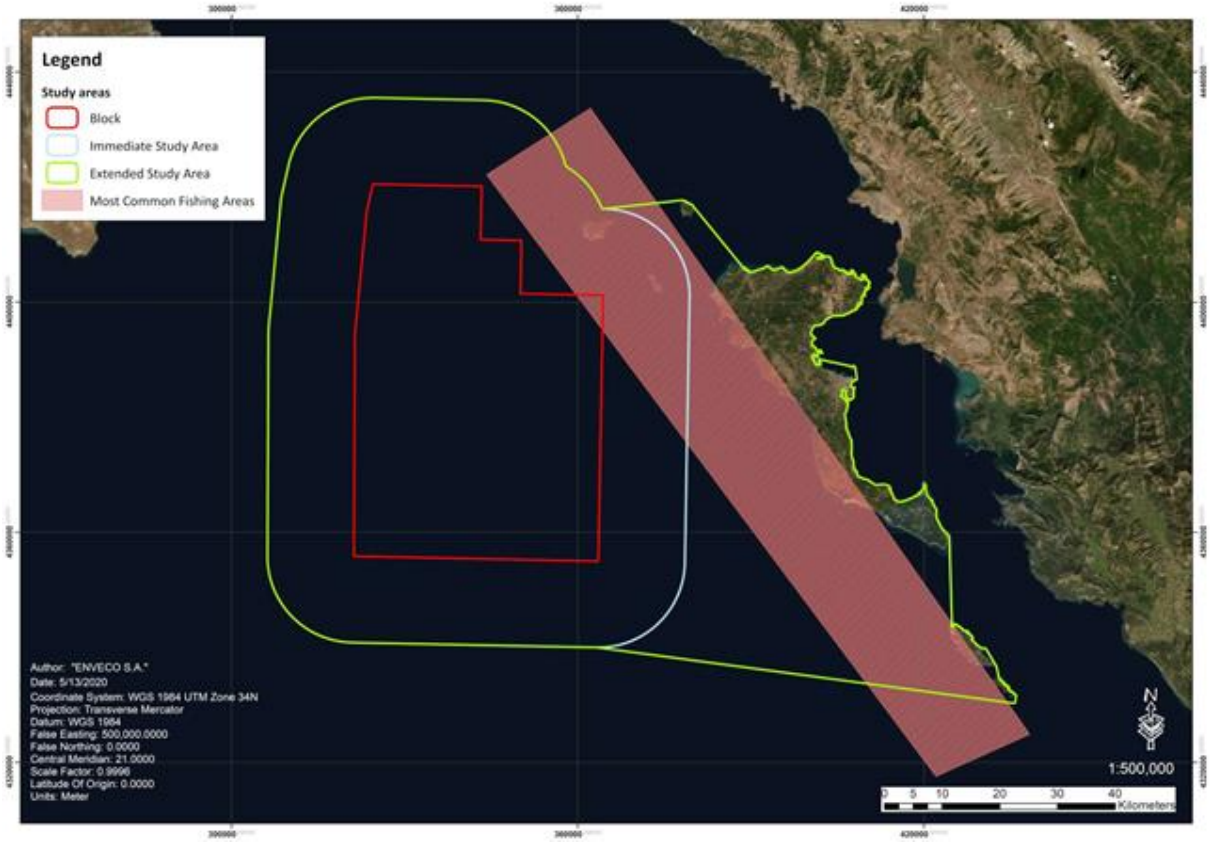

Figure 5.2: Most Common Fishing Area in Corfu (ENVECO S.A., 2020)

According to the project “Oikoskopio.gr” by WWF, the extent of the fishing area at regional level is shown in the Figure 5.3. The Block 2 is considered as a fishing area for large pelagic fishes (e.g. swordfish and tuna).

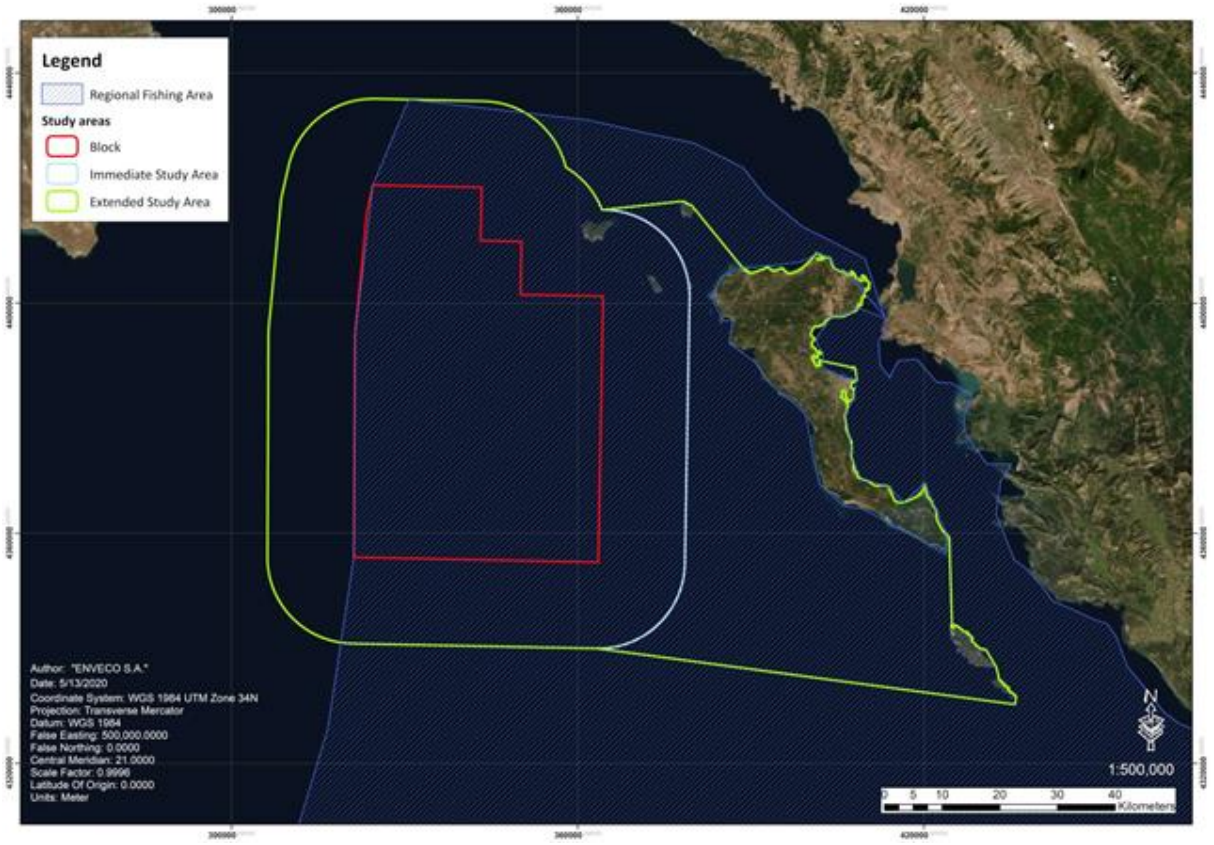

Figure 5.3: Regional Fishing area (source: *Oikoskopio.gr, 2020*) (ENVECO S.A., 2020)

Apart from the Greek territorial waters (which are included in the 6 nm radius from the Greek coasts) the Corfu fishing zone also includes a large area of international waters where fishing vessels from neighbouring countries are also expected to be found among Greek ones. Based on anecdotal Information provided by the Port Authority of Corfu and the analysis of AIS data, Block 2 area is often used by large Italian fishing vessels (mainly from the Apulia region). These vessels tend to have larger fishing ground with highly developed navigational and communication systems which will be able to easily avoid the mobile safety exclusion zone around the seismic vessel and the equipment.

The above figures show that the operational area overlaps the fishing areas. However, the total area of exclusion is very small compared with the area available for fishing. The impact will be temporary and will not exclude fishing in the whole area but rather cause temporary displacement of any potential fishing activities in the immediate vicinity of the seismic vessel. A chase vessel will be present around the seismic vessel in order to liaise with fishermen and inform them on the movements of the seismic vessel.

The potential impacts on fishing activities are mainly related to the duration of the activities and the control measures incorporated in the project design. The proposed activities are planned to have duration up to 45 days in a period where the weather conditions are not so favourable. In addition, in November-December the non-commercial fishing activities are limited compared to summer, also because the fish consumption related to tourist activities is smaller.

Given the permanent presence of fishing activities in the Project region and the resilience of the fishermen to any restrictions placed upon their activities, the **vulnerability** of this receptor is assessed to be **Medium** and it can be assumed that the project activities in the study area and the navigation restrictions will displace fishing activities, thus potentially affecting the livelihood of the fishing industry in the area of Block 2.

Table 5.55: Fishing activities – Vulnerability Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Fishing Activities	3	1	4	**Medium**

The combination of a **Medium vulnerability** receptor and **High intensity** potential effect result in a **Major severity** impact**.**

Table 5.56: Impact on Fishing activities due to Navigation Restrictions – Severity Assessment

		Vulnerability		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	**Major**	Major

Further mitigation measures are required to be implemented to account for the possible impacts on fishing activities.

5.2.8.3 Impacts on Port and Marine Traffic due to Navigation Restrictions

The seismic vessel and towed array represent a potential navigational hazard and other vessels will need to avoid the seismic vessel to prevent vessel collisions, entanglement of/damage to the streamers and other components of the towed array and other incidents.

The highest potential risk will be during slow speed turning of the seismic vessel during line changes, or when it is moving perpendicular to the normal passage of commercial shipping. There will be a need to be active and maintain clear and effective communication with all shipping within the vicinity of the seismic vessel whilst the towed array is deployed, and normal seismic acquisition operations are underway. There may be a considerable speed difference between commercial shipping and the seismic vessel whilst the latter is conducting operations. Any avoiding or diversionary action that may have to be taken by a non-survey related commercial vessel will have to be taken without compromising navigational safety, and as such, the seismic vessel will have to establish communications early with any potential vessel that may be approaching.

The main facts for marine traffic in the area of interest, according to the Environmental and Social Baseline Study, are the following:

- ✓ *Passenger ships/Cargo ships:* according to the preliminary information provided by the Corfu Coast Guard Authority, no passenger ships connecting Greece with Italy travel through the Block 2 area. Only cargo ships travel through that region, although most of them use different routes[52];
- ✓ *Maritime routes to Diapontia Islands:* during the summer months daily routes take place from Corfu port (Alexandros) and Agios Stefanos Port (Pigassos) in Corfu to Diapontia islands. During the rest of the year the routes become less frequent.

In addition, based on analysis of Automatic Identification System (AIS) data for marine traffic in the area, during the period January 2015 to December 2017, and on data from the offshore boat detection that has been performed in the project area by TOTAL using Radar imagery for years 2017, 2018 and 2019, the overall monthly vessels transit registered higher values mainly for cargo ships and tankers (boat size greater than 200 m), even if a significant portion of boats transit were also represented by smaller sizes (from 30 to 70 m).

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[52] ESBS, p. 58.

Taking under consideration the above it is probable that the survey could have a significant impact on the marine traffic, with particular regard to cargo/tankers ships and the cruise vessels, which would be required give way to the seismic vessel.

However, the total area of exclusion is small in the immediate vicinity of the seismic vessel. The extra distance that may need to be travelled to avoid the zones is also small compared with total routing.

The navigation restrictions during the seismic survey will only alter the route of the marine traffic and will not affect the economic activities of the port of Corfu, which holds an important share in Ionian Sea commercial traffic.

Given the permanent presence of marine traffic in the Project region and the resilience of the cargo ships and cruise vessels to any restrictions placed upon their activities, the vulnerability of this receptor is assessed to be **Medium**.

Table 5.57: Port and Marine Traffic – Sensitivity Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Port and Marine traffic	3	1	4	**Medium**

The combination of a **Medium vulnerability** receptor and **High intensity** potential effect result in a **Major severity** impact**.**

Table 5.58: Impacts on Port and Marine Traffic due to Navigation Restrictions

		Vulnerability		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	**Major**	Major

Further mitigation measures are required to be implemented to account for the possible impacts on port and marine traffic.

5.2.8.4 Impacts of Navigation Restrictions on Tourist activities

The Ionian Islands Region has an outstanding position in the tourist development both in the country as well as in the Mediterranean and Europe. The tourist revenue of the Ionian Islands Region contributes significantly to the national economy. Corfu is a very popular tourist destination for foreign and Greek tourists offering a great variety of options in terms of recreation and holiday. The considerable increase in April airport arrivals is attributed to the beginning of the tourist season in Corfu, which extends from April to late October. Within this context late autumn-early winter in the area of the Ionian Islands and particularly in Corfu is considered to be outside the tourist season.

The tourist accommodations and facilities in Corfu will not be affected by the seismic survey as on one hand the proposed project will take place offshore in the Block 2, approximately 20 kilometres West from the Island of Corfu and on the other hand no accommodation is expected to be required from the crew of the vessels since those will stay in the ship at any circumstances. Therefore, it is not expected that the survey operation could have an impact on tourism in the area,.. Furthermore, according to preliminary information given by the Corfu Port authorities and the Coast Guard only cruise vessels travel through the survey area – no passengers ships travel through the survey area. Taking under consideration the above and also the description and the duration of proposed project and the proposed time for its implementation, navigation restrictions are expected to have a medium impact on Tourism.

Given the minor presence of cruise vessels in the Project region and the resilience of them to any restrictions placed upon their activities, the vulnerability of this receptor is evaluated to be **Low**.

Table 5.59: Tourist Activities – Severity Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Tourist activities	1	1	2	**Low**

The combination of a **Low vulnerability** receptor and **High intensity** potential effect result in a **Moderate severity** impact**.**

Table 5.60: Impact on Tourist Activities due to Navigation Restrictions – Severity Assessment

		Vulnerability		
		Low	Medium	High
Intensity	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	**Moderate**	Major	Major

5.2.9 Impacts due to Use of Resources

The main water consumption expected during the project activities is due to operating requirements of vessels (e.g.: cooling) and crew's uses.

Sea water will be used for the operating requirements of vessels and then immediately discarded without undergoing any kind of contamination and therefore no treatments are required. Thermal pollution is also not considering an important issue due to the low increase of the temperature as well as the limited quantities used for the operating activities of the vessels.

With regard to the fresh water for civil use of the on-board crew (sanitary use and on-board systems), this might be supplied by on-board tanks or desalinators.

Fuel will be used for the vessel propulsion and power needs. Given the endurance of the seismic vessel, no refuelling at sea is expected.

Assessing the intensity of use of resources that occur from the seismic operations they are evaluated to be induced, short-term, local and of low magnitude, which concludes the intensity of this parameter to be evaluated **Low**.

Table 5.61: Use of Resources – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative because sources of water and fuel will be used during the seismic survey
Type	**Induced** Indirect Direct	1	There is induced effect on water and fuel stocks
Duration	Temporary **Short-term** Long term/Permanent	2	The impact will be short-term and will last 45 days at maximum
Extent	**Local** Regional National and/or transboundary	1	The extent of the impact is local affecting only the local and macro economy of Corfu
Magnitude	**Low** Medium High	1	Low volumes of water will be used. No refuelling at sea is expected.
Intensity score		**5**	**Low**

5.2.9.1 Impacts on Local and Macro Economy due to Use of Resources

No important resources for the local and macro economy are expected to be over-used. The used resources will typically include use of fuel, water and food for medium size vessels with total crew number around 70-100 and a total period of operations of approximately max. 45 days.

Based on the above, the vulnerability of local and macro economy concerning use of resources is evaluated to be **Low**.

Table 5.62: Local and Macro Economy – Vulnerability Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Local and Macro economy	1	1	2	**Low**

The combination of a **Low vulnerability** receptor and **Low intensity** potential effect result in a **Negligible severity** impact**.**

Table 5.63: Impacts on Local and Macro Economy due to Use of Resources – Severity Assessment

		Vulnerability		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.2.9.2 Impacts on Social Context and Human Development due to use of Resources

Proposed activities will take place offshore in the Block 2, without any essential contact between the vessel's staff and the local population. Potential interference in terms of availability of resources and their costs can be assumed not significant, also considering the period of the year (not in the tourist season). This includes burdens on health services, sewage and waste management which can be estimated very limited.

The vulnerability of social context and human development concerning use of resources is evaluated to be **Low**.

Table 5.64: Social Context and Human Development

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Social context and human development	1	1	2	**Low**

The combination of a **Low vulnerability** receptor and **Low intensity** potential effect result in a **Negligible severity** impact**.**

Table 5.65: Vulnerability ranking of Social Context and Human Development

		Vulnerability		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.2.10 Impacts on Social Context and Human development due to Presence of Foreign Workers

The seismic surveys will involve four vessels operating continuously 24 h/7 days, for a duration up to 45 days. Specifically, the survey fleet includes:

- ✓ one seismic vessel, 80-110 m long, that accommodates 50-60 people;
- ✓ two chase vessels, 35 m long, that accommodates 10-20 people each;
- ✓ one supply vessel, 70 m long, that accommodates 10-20 people.

The vessels crew employees are considered as foreign workers as the seismic Contractor will probably not source any employee on the vessel from the local labour market (except for a limited number of figures such as CLOs and FLOs), due to the high expertise requirements for this type of activities. All the workers employed for the seismic survey will be accommodated on-board. It is not envisaged that any employees will bring family members with them.

The increase in workers from outside the local area may be perceived as a threat to resources used by locals. Moreover some foreign workers within the project workforce may perceive themselves as "protected", and therefore "immune" to local law, order and customs.

Moreover, in the case workers visit Corfu or Diapontia islands, the presence of a large number of single men may theoretically lead to problems of alcoholism, prostitution, drug abuse, conflict over competition for women and also to violence/crime. Tension could occur if behaviour in specific social contexts, for example in cafes/bars and during community social and cultural events provokes local antagonism due to norms being breached.

The periodic presence of foreign workers on the islands reduces the intensity of the potential effect: Corfu is a tourist destination with thousands of arrivals every year from other countries and the local population is accustomed to house foreign workers without causing significant negative social effect.

No ethnic tension and no impact on vulnerable individuals in the area is expected. The Roma settlement in the island, in the area Livadi Ropa, is situated in a distance from the shore and the city of Corfu, where workers may be accommodated.

It should however be noted that, due to COVID-19 outbreak in Europe during spring 2020, any visit from foreign workers will be avoided and their presence in Corfu will be limited to what is strictly necessary. Workers will be aware of and will respect any specific precaution, restriction and rule set by Greek Authorities and by the Operator, that will be in force at the time of operations.

Consequently, given the short duration of the proposed project and the type of activities, the seismic acquisition survey is expected to have a very limited impact on the social context and the human development of the Region and Corfu. Potential impacts are of short duration and with no significant or lasting impact on the social context or population of the island.

Based on the above, assessing the intensity of presence of foreign workers, as described in Table below, they are evaluated to be induced, temporary, local and of low magnitude, which concludes the intensity of this parameter to be ranked **Low**.

Table 5.66: Presence of Foreign Workers – Effect Intensity

Parameter		Score	Justification
Status	Positive Neutral **Negative**	-	The impact is negative because the interaction between foreign workers and local communities may affect negatively several social aspects
Type	**Induced** Indirect Direct	1	There is induced effect on social context and human development because of the interaction between foreign workers and local communities, specially assumed due to COVID-19
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary and will last 45 days at maximum
Extent	**Local** Regional National and/or transboundary	1	The extent of the impact is local affecting only the social context of Corfu
Magnitude	**Low** Medium High	1	The survey fleet includes about 100 foreign workers
Intensity score		**5**	**Low**

The vulnerability of social context and human development is evaluated to be **Low**.

Table 5.67: Social Context and Human Development – Vulnerability Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Social context and human development	1	1	2	**Low**

The combination of a **Low vulnerability** receptor and **Low intensity** potential effect result in a **Negligible severity** impact**.**

Table 5.68: Impact on Social Context and Human Development due to Presence of Foreign Workers – Severity Assessment

		Vulnerability		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.2.11 Impacts on Local and Macro Economy due to Operational Expenses

New job creation associated with the proposed project will be very limited, since the proposed exploration work activity will be of relatively short duration (approx. 45 days). In addition, the crew undertaking the proposed exploration activities will predominantly be made up of specialists trained to conduct such work aboard the specially designed and contracted vessels. These specialists may include foreign nationals that are engaged full time for similar exploration work around the world. Limited short-term employment will be created for the provision of environmental management support (MMO – Marine Mammals Observers, FLO - Fishing Liaison Officer and CLO - Community Liaison Officer).

Nevertheless, there may be some indirect benefits due to commercial operations that might be expected to benefit from increased business, such as for the supply of food and beverages and port services (fuel, waste management). These benefits are not significant, since the crew is not expected to live in local communities.

Based on the above, assessing the intensity of operational expenses, as described in Table below, they are evaluated to be positive, indirect, temporary, regional and of low magnitude, which concludes the intensity of this parameter to be evaluated **Low**.

Table 5.69: Operational expenses - Effect Intensity

Parameter		Score	Justification
Status	**Positive** Neutral Negative	-	There is positive impact of operational expenses to local and macro economy
Type	Induced **Indirect** Direct	2	Indirect impacts on local economy through small scale trading activities.
Duration	**Temporary** Short-term Long term/Permanent	1	The impact will be temporary
Extent	Local **Regional** National and/or transboundary	2	Regional benefits can be envisaged related to employment and commercial activities
Magnitude	**Low** Medium High	1	No significant regional and national benefits
Intensity score		**6**	**Low**

The vulnerability of social context and human development is evaluated to be **Low**.

Table 5.70: Local Macro Economy – Vulnerability Ranking

Receptor	Presence	Resilience	Vulnerability Score	Vulnerability Ranking
Local and Macro Economy	1	1	2	**Low**

The combination of a **Low vulnerability** receptor and **Low intensity** potential effect result in a **Negligible positive** impact**.**

Table 5.71: Impact on Local and Macro Economy due to Operational Expenses – Severity Assessment

		Vulnerability		
		Low	Medium	High
Intensity	Low	**Negligible**	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

5.3 CUMULATIVE IMPACTS

Cumulative impacts are the result of a series of activities, discharges and emissions that are combined or overlap, creating, potentially, a significant impact.

Potential cumulative impacts may occur as the result of impacts of seismic activities that interact or combine with those of other activities (e.g. other seismic acquisition activities, exploration drilling, marine scientific research, commercial fishing, shipping and military activities) taking place in the proximity of the project area.

Additional impacts may be generated by other hydrocarbon developments or activities in the vicinity of Block 2, which may be additive or synergistic with the relevant impacts of the proposed seismic acquisition activities within Block 2.

Such impacts may arise due to spatial overlap (e.g. overlap in spatial extent of water quality changes) or temporal overlap (e.g. underwater sound impacts caused by seismic activities at the same time from different sources).

Block 2 is surrounded by other offshore blocks located in the continental shelf area under the jurisdiction of the Republic of Greece, in particular Block 1 to the North-East and Blocks 3 and 4 to the South-East. Blocks 3 and 7 are considered as one Block, known as Ionian Block.

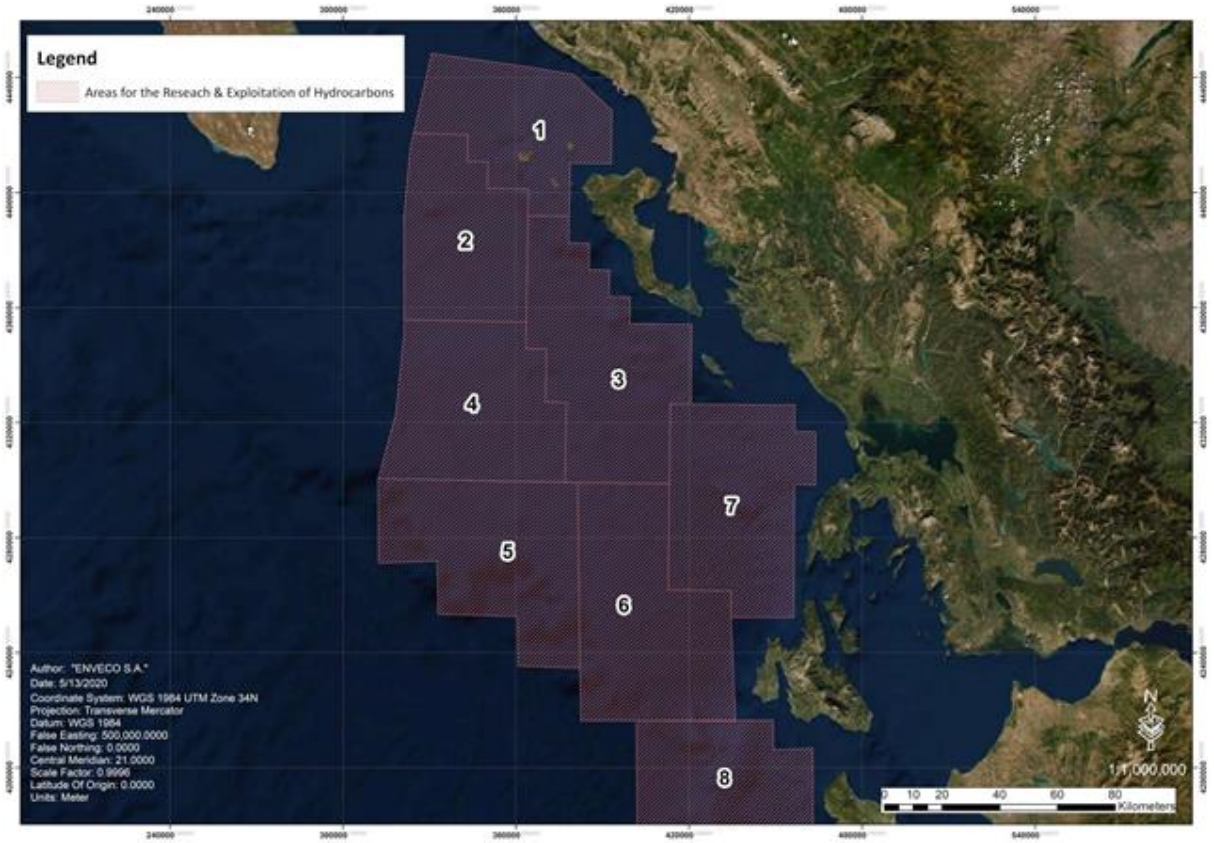

Figure 5.4: Ionian Sea Blocks for Exploration and Exploitation of Hydrocarbons (ENVECO S.A., 2020)

In the context of the 2nd International Licensing round offshore Western Greece and South of Crete, Hellenic Petroleum submitted an offer for Block 1. The evaluation procedure by the committee is ongoing.

Concerning the Ionian Block (Blocks 3 and 7), this has been leased to REPSOL (50%) and Hellenic Petroleum (50%) with the Lease Agreement Law 4629/2019.

The seismic survey for Ionian Block is expected to be launched between the last quarter of 2020 and the first quarter of 2021 (October 2020-March 2021). Based on that scenario it is very likely to have simultaneously offshore seismic acquisition surveys on two (2) adjacent Blocks (Block 2 and Ionian Block).

Moreover, Block 2 is adjacent to two other offshore blocks within the continental shelf area under the jurisdiction of the Republic of Italy. For these two blocks, two Environmental Impact Assessment (EIA) procedures for prospecting permit were positively granted in August 2017 by the Italian Ministry for the Environment:

- ✓ geophysical survey within the offshore exploration permit named “F.R 44.GM” (150 km 2D seismic survey and possible 3D acquisition);
- ✓ geophysical survey within the offshore exploration permit named “F.R 45.GM” (150 km 2D and possible 3D acquisition).

An EIA procedure for a geophysical survey to be carried out on a third exploration permit within the jurisdiction of the Republic of Italy (d 84 F.R-.EL), which was located immediately to the North of the two others, was presented in February 2018, but has been suspended at the end of 2018.

The location of the permit areas (each approx. 730-750 km^2) is shown in the figure below. It has to be highlighted that the EIA Decree require that no contemporary seismic acquisition shall take place at a distance lesser than 55 nautical miles or unless after a period of 12 months.

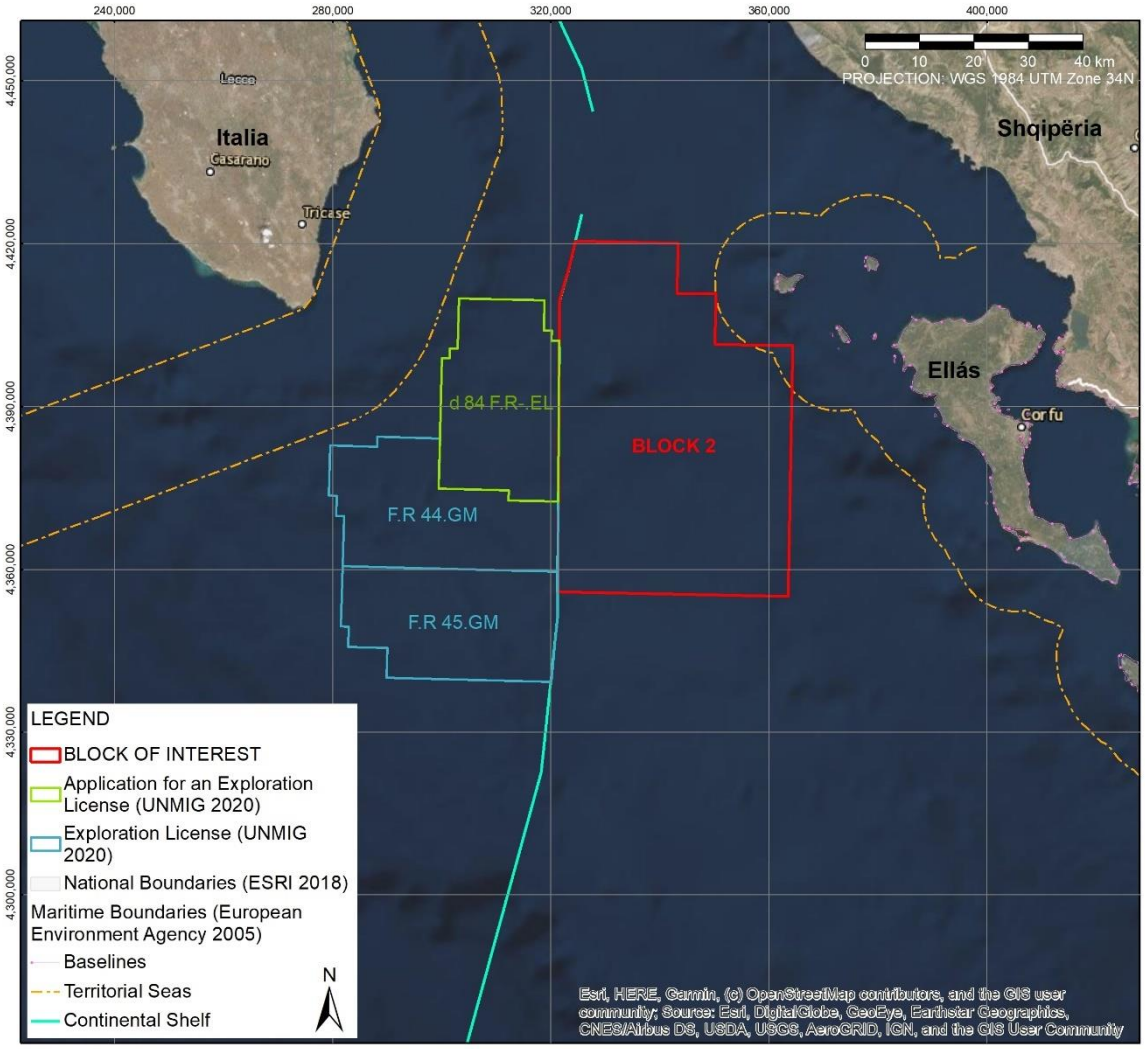

Figure 5.5: Offshore Exploration Blocks located in the Continental Shelf Area under the Jurisdiction of the Republic of Italy (RINA Consulting, 2020)

In the event of having simultaneously offshore seismic acquisition surveys, the effects for which cumulative impacts can be envisaged are those having regional extent:

- ✓ Noise emissions;

- ✓ Navigation restrictions.

Considering that the environmental receptors possibly affected in case of existence of cumulative impacts are the following:

- ✓ Physical environmental receptors:
  - Fish Fauna,
  - Marine Mammals,
  - Sea Turtles,
  - Birds;
- ✓ Social environmental receptors:
  - Fishing activities,
  - Port and Marine traffic.

Given the effect intensity related to the potential impacts and the sensitivity of the identified receptors, it can be assumed that cumulative impacts in case of contemporary seismic survey may be of medium-high severity, thus requiring appropriate mitigation measures to be in place to minimize possible effects.

It is however to be noted that the seismic operator will voluntarily cooperate with seismic operators of adjacent exploration Blocks in order to mutually agree, as possible, on avoiding simultaneous execution of the seismic survey during the same period.

5.4 TRANSBOUNDARY IMPACTS

Block 2 is almost entirely located in international waters, just outside the Greek territorial waters (6 nautical mile radius off the coast) but within the continental shelf area under the jurisdiction of the Republic of Greece agreed with the Republic of Italy.

The following table presents an evaluation of the potential for transboundary impacts, of the proposed seismic survey.

Table 5.72: Potential Sources and Significance of Transboundary Impacts

Impact Factor	Potential Source of Transboundary Impact	Potentially Significant?
Noise Emissions	Noise detectable many kilometres away, but risk of significant impacts (e.g., to marine mammals and sea turtles) is limited to a few hundred meters from survey vessels in the Block 2 area	Some kind of behavioural impacts are expected on a transboundary level but no significant effects are expected. No effect expected on coastal areas of other countries.
Effluent discharges	Discharges rapidly diluted near survey vessels	No
Air emissions	Emissions rapidly dispersed near survey vessels	No
Navigation restrictions	Temporary exclusion of Italian fishing vessels from Block 2 area	Not significant considering the short duration of the seismic survey (max 45 days) and the continuous communication between an appointed Fisheries Liaison Officer and fishing industry bodies and fishing vessels
	Some survey lines and towed streamers will extend into adjacent areas under the jurisdictions of Italy	Possible interferences with safety of marine traffic and regulatory aspects

Most of the effects of seismic activities are localised within the immediate vicinity of the block and are unlikely to affect neighbouring areas.

5.5 SUMMARY OF ENVIRONMENTAL AND SOCIAL IMPACTS

The identified environmental and social impacts are summarized in the following table.

Table 5.73: Leopold Type Matrix-Assessment of the Environmental and Social Impacts of the Project [(1)]

		Potential Effects								
	Air Emissions	Noise Emissions	Light Emissions	Discharges (Effluent and Solid Waste)	Collisions and Entanglement of Marine Fauna	Interference with Seabed	Use of Resources	Navigation Restrictions	Presence of Foreign Workers	Operational Expenses
Sources of impacts	*Offshore Operation*	*Acquisition of seismic data*	*Offshore Operation*	*Offshore Operation* *Supporting Activities*	*Offshore Operation*	*Supporting Activities*	*Offshore Operation* *Supporting activities*	*Offshore Operation*	*Offshore Operation* *Supporting activities*	*All Project phases*
Physical Receptor/Features										
Air quality	Medium **Minor** Low									
Sea water quality				Low **Negligible** Low						
Biological/Ecological Receptors										
Fauna and Flora – **Plankton**		High **Moderate** Low	Medium **Minor** Low	Low **Negligible** Low						
Fauna and Flora – **Zoobenthic Communities**						Low **Negligible** Low				
Fauna and Flora – **Invertebrates**		High **Moderate** Low	Medium **Minor** Low	Low **Negligible** Low						
Fauna and Flora – **Corals**				Low **Minor** Medium		Low **Minor** Medium				
Fauna and Flora – **Fish Fauna**		High **Moderate** Low		Low **Negligible** Low						
Fauna and Flora – **Marine Mammals**		High **Major** High		Low **Moderate** High	Medium **Major** High					
Fauna and Flora – **Sea Turtles**		High **Major** High		Low **Moderate** High	Medium **Major** High					
Fauna and Flora – **Seabirds**			Medium **Moderate** Medium	Low **Minor** Medium						
Fauna and Flora – **Posidonia Meadows**				Low **Minor** Medium		Low **Minor** Medium				
Marine Protected Areas		High **Major** High		Low **Moderate** High						
Human and Social Receptors										
Fishing Activities								High **Major** Medium		
Port and Marine traffic								High **Major** Medium		

		Potential Effects								
	Air Emissions	Noise Emissions	Light Emissions	Discharges (Effluent and Solid Waste)	Collisions and Entanglement of Marine Fauna	Interference with Seabed	Use of Resources	Navigation Restrictions	Presence of Foreign Workers	Operational Expenses
Sources of impacts	*Offshore Operation*	*Acquisition of seismic data*	*Offshore Operation*	*Offshore Operation* *Supporting Activities*	*Offshore Operation*	*Supporting Activities*	*Offshore Operation* *Supporting activities*	*Offshore Operation*	*Offshore Operation* *Supporting activities*	*All Project phases*
Tourist activities								High **Moderate** Low		
Social context and human development							Low **Negligible** Low		Low **Negligible** Low	
Economical Receptors/Features										
Local and macro economy							Low **Negligible** Low			Low **Negligible** Low

Note

(1) Impacts are represented as the combination of receptor vulnerability and effect intensity ($_{\text{RECEPTOR VULNERABILITY}}$ - IMPACT - $^{\text{EFFECT INTENSITY}}$).

6 MARINE NOISE EVALUATION

In order to provide an assessment of the potential impact of marine noise on marine mammals and marine life in general, characteristics of underwater noise generated by project activities shall be defined.

Underwater noise propagation and attenuation are influenced by many factors, including variations or inhomogeneous conditions of temperature, salinity and depth. The noise can propagate through the water either directly, or through multiple reflections between the surface and the seabed at a certain distance from the source. Refraction and absorption also promote the deformation of the sound waves, causing a variation in extremely complex waveform during propagation.

The assessment of the impact of anthropogenic noise, with particular regard to marine mammals, has been evaluated based on the results of modelled noise propagation. The model has been implemented considering assumptions related to the characteristics and configuration of the proposed source (air-gun) and the characteristics of the project area. A summary of activities carried out for the assessment of impacts due to underwater noise is reported in this Section; more details are reported in the full noise modelling report, attached in Appendix B to this document.

6.1 GENERAL ASPECTS ON NOISE

Sound is a mechanical disturbance that travels through an elastic medium (e.g.: air or water). Particles in the medium start oscillating around their original position as the disturbance travels through the medium. This oscillation can be slow (producing what we call “low pitch” sounds), or fast (“high pitch” sounds). The frequency of oscillation per second is measured in Hertz (Hz) (UNEP-CBD, 2012).

The sound in the marine environment propagates at a speed of approximately 1,500 m/s, i.e. about 4 times greater than the speed of sound propagation in the atmosphere. Speed of sound in sea water is a function of density and hence its temperature, salinity and pressure (and therefore the depth) (Bradley and Stern, 2008).

The word “sound” is a general term for acoustic energy, while “noise” refers to an unwanted sound for the receiver (UNEP-CBD, 2012).

6.1.1 Physical Quantities

The sound level or Sound Pressure Level (SPL) is expressed in decibels (dB), which is a relative measure of sound pressure referred to the lower limit of audibility (corresponding to 0 dB in the air). Quantities expressed in dB are usually referred to as “levels”. The marine noise levels in dB are referred to a value of 1 µPa.

Noise amplitude and energy of the Sound Pressure Level can be described with different physical quantities (UNEP-CBD, 2012):

- ✓ peak pressure (also zero-to-peak pressure) is the maximum absolute value of the amplitude of a pressure wave with regard to reference pressure (typically used for noise showing peak values, e.g. impulsive noise with non-symmetric waveform);
- ✓ peak-to-peak (p-p) is the difference of pressure between the maximum positive pressure and the maximum negative pressure in a sound wave (generally used for short duration noise with high intensity);
- ✓ the root-mean-square-(RMS) value is calculated as the square-root of the mean-squared pressure of the waveform. RMS sound values change depending on the time duration of the analysis. The values of a continuous signal measured in RMS or in peak value usually differ by 10-12 dB;
- ✓ source level (SL) describe the level of sound pressure referred to the nominal distance of 1 meter from the source.

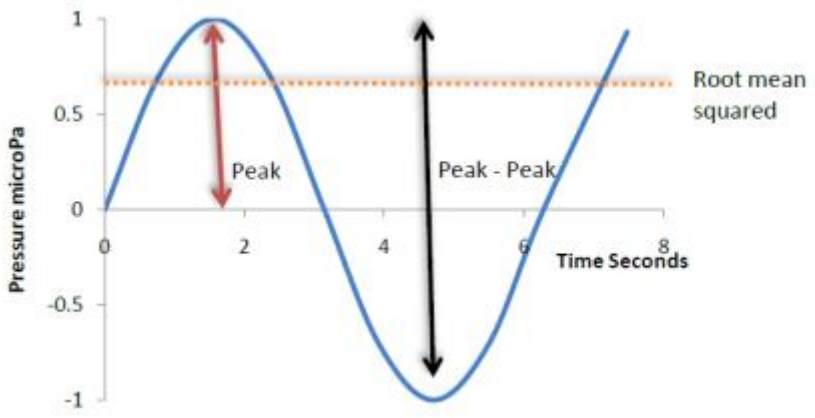

Figure 6.1: Physical Quantities Peak, Peak-to-Peak and RMS for a Sine Wave (DEEC-UK, 2011)

Other significant physical used for description of underwater noise are:

- ✓ Transmission Loss (TL) refers to the loss of acoustic power with increasing distance from the sound source. Sound pressure diminishes over distance due to the absorption and geometrical spreading of waves. In an ideal scenario, without reflections or obstacles, the sound pressure diminishes by a factor of 1 over the considered distance (1/r, where r = radius from the source). In realistic scenarios, due to differing layers of water, the propagation of sound and its attenuation may be very different. For example, the reduction of sound pressure could diminish if the sound is channelled due to seabed topography and/or water column stratification. The effects of topography and the characteristics of the water column can induce very complex situations, which should be taken into account when establishing correct measurements of sound impacts. Absorption losses are negligible for low frequencies (<1 kHz) but can be significant for high frequencies;
- ✓ the Sound Exposure Level (SEL) is a measure of the energy of a sound and depends on both amplitude and duration;
- ✓ the spectrum of a sound, provides information on the distribution of the energy contained in the signal or the 'frequency content' of a sound. The term "bandwidth" describes the frequency range of sound. A normalized bandwidth of 1 Hz is standard practice in mathematical analysis of sound, while 1/3 octave bandwidths are most common in physical analysis. Spectra therefore need some indication of the analysis bandwidth.

6.1.2 Propagation and Absorption

Propagation of sound through water is affected by spreading losses (due to distance) and attenuation losses (due to absorption) with sound energy decreasing with increasing distance from the source.

The decay of marine noise is closely related to the morphology of the seabed, the physical-chemical characteristics of the water mass, as well as by the characteristics of the source. Generally high frequency noise has limited propagation, while low frequency shows lower transmission loss and can maintain high intensity.

6.2 ANTHROPOGENIC NOISE SOURCES

Anthropogenic noise is considered an important stressor for marine life and is now acknowledged as a global issue that needs addressing. The impacts of sound on marine mammals have received particular attention, especially the military use of active sonar and industrial seismic surveys.

Extensive investigation mainly over the last decade by academia, industry, government agencies and international bodies has resulted in a number of reviews of the effects of sound on marine fauna.

Furthermore, according to the Marine Framework Strategy Directive 2008/56/CE:

- ✓ introduction of energy, including underwater noise, is included among the environmental quality indicators to be considered for the assessment of the good environmental status;
- ✓ sources of high intensity sound (low-medium-high frequency) exceeding thresholds that may have a significant adverse impact on marine fauna, measured as peak sound pressure level a range 10-10,000Hz are referred to as descriptors of anthropogenic noise.

Sound sources can be subdivide based on the characteristics of noise emissions:

- ✓ Pulse noise (e.g. pile driving, air-gun), characterized by a number of events of short duration (impulsive components);
- ✓ Continuous noise (e.g. marine traffic, drilling activities), eventually characterized by noise emission on specific bandwidths (tonal components).

Typical characteristics of noise emission from anthropogenic sources are reported in the following table (UNEP-CBD, 2012).

Table 6.1: Typical Noise Emissions from Anthropogenic Sources (UNEP-CBD, 2012)

Sound Source	Source Level (dB re 1 µPa-m)	Bandwidth (Hz)	Major amplitude (Hz)	Duration (ms)	Directionality
Ship shock trials (10000 lb explosive)	304	0.5 - 50	-	2,000	Omni
TNT	272 – 287 Peak	2 – 1,000	6 – 21	~ 1 - 10	Omni
Airgun array	260 – 262 Peak to Peak	10 – 100,000	10 – 120	30 - 60	Vertically focused
Military sonar mid-frequency	223 – 235 Peak	2,800 – 8,200	3,500	500 – 2,000	Horizontally focused
Pile driving	228 Peak/ 243 – 257 Peak to Peak	20 - >20,000	100 – 500	50	Omni
Military sonar low-frequency	235 Peak	100 - 500	-	600 – 1,000	Horizontally focused
Echosounders	235 Peak	Variable	Variable 1,500 – 36,000	5 - 10	Vertically focused
ADDs / AHDs	132 – 200 Peak	5,000 – 30,000	5,000 – 30,000	Variable 15 – 500	Omni
Large vessels	180 – 190 rms	6 - > 30,000	> 200	continuous	Omni
Small boats and ships	160 – 180 rms	20 - > 1,000	> 1,000	continuous	Omni
Dredging	168 – 186 rms	30 - > 20,000	100 – 500	continuous	Omni
Drilling	145 – 190 rms	10 – 10,000	< 100	continuous	Omni
Acoustic telemetry SIMRAD HTL 300	190	25,000 – 26,500	-	continuous	90 x 360°
Wind turbine	142 rms	16 – 20,000	30 – 200	continuous	Omni
Tidal and wave energy	165 – 175 rms	10 – 50,000	-	continuous	Omni

The airgun is presently the most employed technology for carrying out marine seismic exploration and typical values range as follows (ACCOBAMS, 2019):

- ✓ Source level: 220-262 re 1 µPa m peak-to-peak);
- ✓ Bandwidth: 5 Hz – 100 kHz;
- ✓ Major amplitude: 10 Hz – 120 Hz;
- ✓ Duration 10-100 ms;
- ✓ Directionality downward.

Underwater noise sources used for seismic survey may have different characteristics depending on the type of source. Most seismic surveys, today, are using airguns as sound source, towed behind the seismic vessel at a speed of about 4-6 knots, at a depth between 4 and 10 m and operated (“fired”) at intervals of about 6-20 s (McCauley, 1994; Gulland and Walker, 1998).

Compressed air is rapidly released from the airgun, creating oscillating bubbles in the water which originate an omni-directional propagating pressure wave. The typical waveform shows a primary peak (which is the signal used for geophysical profiling), followed by a series of decaying bubble pulses. Airguns can have double internal chamber to reduce the unwanted bubble pulse or be arranged in arrays tuned to focus the pulsed pressure on the vertical, reducing the horizontal propagation. Air-gun arrays have a frequency-dependent directivity in the horizontal, being omni-directional in the low frequencies and bi/multipolar (showing directivity pattern along two/more direction) with higher frequencies.

Generally, individual airguns produce broadband source levels (SL) between 215 and 230 dB re 1 µPa-m, with the higher energies, in a range of 10 to 330 Hz (McCauley, 1994; Green et al., 1995). Although most of the energy is produced at lower frequencies, a considerable energy, above the level of environmental noise can be produced at frequencies up to 22 kHz (Gordon and Moscrop, 1996). The broadband source levels "Peak to Peak", pointing down, show, for a set of airguns, peak frequencies covering the range 10-100 Hz (McCauley, 1994; Green et al., 1995).

Regarding the frequency content of the airgun signal, literature data are reported in the following table.

Table 6.2: Air-Gun Characteristics (Simmons et Al, 2004)

TRANSIENT NOISE SOURCES	SOURCE LEVELS, dB re 1µPa-m							HIGHEST LEVEL	
	Broad-band	1/3rd octave band centre frequencies [kHz]						1/3rd octave band	
	(0.045-7.07 kHz)	0.05	0.1	0.2	0.5	1	2	Freq. [Hz]	Level [dB]
SEISMIC SURVEYS									
Airgun	216	210	209	199	184	191	178	50	210

Regarding vessel traffic, the underwater noise produced is mainly associated to the cavitation of propellers, to the engines and related structures vibration and to the water displacement caused by hulls. In particular, the propellers cavitation is the noisiest aspect amongst the ones above mentioned and it depends on propellers rotation speed. The higher the speed, the greater will be the turbulence in the nearby of propellers, forming micro air bubbles, which increase the sound emission related.

6.3 NATURAL NOISE SOURCES

Sound is extremely important to many marine animal species and plays a key role in communication, navigation, orientation, feeding and the detection of predators. The distinctive properties of underwater noise in the marine environment, in terms of range and speed of signal transmission, and the limitations of other senses mean that sound is the preferential sensory medium for a large proportion of marine animals. Almost all marine vertebrates rely to some extent on sound for a wide range of biological functions (UNEP-CBD, 2012).

Marine mammals use sound as a primary means for underwater communication and sensing. They emit sound to communicate about the presence of danger, food, a conspecific or other animal, and also about their own position, identity, and reproductive or territorial status. Sounds range from the 10 Hz low-frequency calls of blue whales to the ultrasonic clicks of more than 200 kHz in certain offshore dolphins. Source levels of click sounds used by sperm whales in navigation and foraging can be as high as 235 dB re 1µPa peak-to-peak. Baleen whales use low frequency sound for long distance communication over hundreds of kilometres. Most toothed whales (Odontocetes) emit three main types of sounds: tonal whistles (i.e. short duration pulsed sounds used for echolocation) and less distinct pulsed sounds such as cries, grunts or barks. Odontocete echolocation clicks are highly directional forward-projecting pulsed sounds of high-intensity and frequency. Some species of seal produce strong underwater sounds that may propagate for great distances.

Many other marine taxa also rely on sound on a regular basis including teleost fish and invertebrates such as decapod crustaceans. Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection and communication. Impeding the ability of fish to hear biologically relevant sounds might interfere with these functions. Many marine fish species also produce sound for communication. The low frequency sounds created by fish can make a significant contribution to ambient noise. Fish can produce sounds as individuals, but also in choruses and the increase in low-frequency noise can be as much as 20-30 dB in the presence of chorusing fishes.

Although the study of invertebrate sound detection is still rather limited, based on the information available it is becoming clear that many marine invertebrates are sensitive to sounds and related stimuli. However, the importance of sound for many marine taxa is still rather poorly understood and in need of considerable further investigation.

There are also natural sound sources in the marine environment of physical or biological origin. In particular, natural physical phenomena contributing to underwater ambient noise include wind, waves, and swells; bubbles; currents and turbulence; earthquakes and precipitation. Wind-driven waves are the dominant natural physical noise source in the marine environment over an extremely broad frequency band from below 1 Hz to at least 100 kHz (UNEP-CBD, 2012).

6.4 EFFECTS OF MARINE NOISE

Marine noise generated by human activities can result in a number of effects on marine mammals. In general, a low level sound that can be heard by animals, can have no visible effects, but the higher the level is, the more the sound can cause disorder and can induce avoidance and other changes in the behaviour of the affected animal. A wide range of effects of increased levels of sound on marine fauna have been documented both in laboratory and field conditions. The effects can range from mild behavioural responses to complete avoidance of the affected area, masking of important acoustic cues, and in some cases serious physical injury or death. Low levels of sound can be inconsequential for many animals. However, as sound levels increase, the background noise can disrupt normal behaviour patterns (e.g. leading to less efficient feeding). Masking of important acoustic signals or cues can reduce communication between con-specifics and may interfere with larval orientation which could have implications for recruitment.

Some marine mammals have tried to compensate for the elevated background noise levels by making changes in their vocalisations. Intense levels of sound exposure can cause physical damage to tissues and organs of marine animals and can lead to mortality. Lower sound levels have been shown to cause permanent or temporary loss of hearing in marine mammals and fish. Behavioural responses such as strong avoidance of the sound source can lead to habitat displacement. Furthermore, some marine animals, such as beaked whales are particularly susceptible to anthropogenic sound, and some populations have experienced declines for years after a sonar-induced stranding event.

Animals that, for any reason, cannot avoid the noise source, may be exposed to acoustic conditions likely to produce negative effects that can range from discomfort and stress to give sound real with loss of hearing sensitivity, temporary or permanent (CIBRA, 2010).

As before mentioned, studies have shown that, depending on the suborder of belonging (baleen whales or Odontocetes), cetaceans use sound in different ways for different biological functions and react to anthropogenic noise with behavioural responses that vary according to intensity and frequency of the sounds perceived (Simmonds et al., 2004).

Generally, the bigger the animals are, the smaller the frequencies used will be. As an example, baleen whales (Mysticetes), produce dominant signals less than 1 kHz, while small toothed whales (Odontocetes) as *Stenella coeruleoalba* and *Delphinus delphis*, use signals even higher than 80 kHz. Medium-sized toothed whales (*Tursiops truncatus*), generate sound with frequencies between 40 and 80 kHz (Roussel, 2002).

Sound generation in marine mammals is an integral part of the species' ethology, that's why the interference with these communicative functions is considered highly negative.

Anthropogenic sound can be acute and impulsive (for example caused by a sonar test, a geophysical exploration or a pile driver), or widespread and continuous (for example caused by maritime traffic or by the sum of many sources which are constantly in movement) and can cause many different impacts on Cetaceans.

The following table summarizes the main types of these effects (Jasny et al., 2005 in ISPRA, 2012).

Table 6.3: Potential Effects of Noise in Marine Environment (Jasny et al., 2005 in ISPRA, 2012)

EFFECT	DAMAGE TYPE	
Physiological	**Non-auditory**	Damage to body tissue (internal haemorrhaging, rupture of lung tissue) Embolism (and other symptoms consistent with decompression sickness, or "the bends")
	Auditory	Gross damage to the auditory system (rupture of the oval or round window on the threshold of the inner ear, which can be lethal; rupture of the eardrum) Vestibular effects (resulting in vertigo, disequilibrium and disorientation) Permanent hearing loss (known as permanent threshold shift, or PTS) Temporary hearing loss (known as temporary threshold shift, or TTS)
	Stress-related	Compromised viability of individual Suppression of immune system and vulnerability to disease Decrease in reproductive rate
Behavioural	Stranding and beaching Interruption of normal behaviours such as feeding, breeding and nursing Loss in efficiency (feeding dives are less productive, mating calls are less effective) Antagonism toward other animals Displacement from area (short-term or long-term)	
Perceptual	Masking of communication with other members of the same species Masking of other biologically important sounds, such as the calls of predators Interference with the ability to acoustically interpret the environment Interference with food-finding	
Chronic	Cumulative and synergistic impacts Sensitization to noise, exacerbating other effects Habituation to noise, causing animals to remain near damaging levels of sound	
Indirect effects	Degradation of habitat quality and availability Reduced availability of prey	

6.4.1 Reference Values for Marine Mammals

To address the direct effects of noise threshold of permanent and temporal hearing loss were set by Southall et al in 2007. Recently the National Marine Fisheries Service, (2016) has updated the existed thresholds for each hearing Group of Marine mammals.

The hearing sensitivity of marine mammals has been measured from captive animals or has been assessed and theoretically speculated since for many species limited data are available. Low-frequency cetaceans consist of 13 species and subspecies of mysticete (baleen whales).

The following table summarizes the functional marine mammal hearing groups, auditory bandwidth, genera represented in each group, and group-specific (M) frequency-weightings as they have been presented by Southall et al. (2007).

Table 6.4: Functional marine mammal hearing groups (Southall et al., 2007)

Functional hearing group	Estimated auditory bandwidth	Genera represented (Number species/subspecies)	Frequency-weighting network
Low-frequency cetaceans	7 Hz to 22 kHz	*Balaena, Caperea, Eschrichtius, Megaptera, Balaenoptera* (13 species/subspecies)	M_{lf} (lf: low-frequency cetacean)
Mid-frequency cetaceans	150 Hz to 160 kHz	*Steno, Sousa, Sotalia, Tursiops, Stenella, Delphinus, Lagenodelphis, Lagenorhynchus, Lissodelphis, Grampus, Peponocephala, Feresa, Pseudorca, Orcinus, Globicephala, Orcaella, Physeter, Delphinapterus, Monodon, Ziphius, Berardius, Tasmacetus, Hyperoodon, Mesoplodon* (57 species/subspecies)	M_{mf} (mf: mid-frequency cetaceans)
High-frequency cetaceans	200 Hz to 180 kHz	*Phocoena, Neophocaena, Phocoenoides, Platanista, Inia, Kogia, Lipotes, Pontoporia, Cephalorhynchus* (20 species/subspecies)	M_{hf} (hf: high-frequency cetaceans)
Pinnipeds in water	75 Hz to 75 kHz	*Arctocephalus, Callorhinus, Zalophus, Eumetopias, Neophoca, Phocarctos, Otaria, Erignathus, Phoca, Pusa, Halichoerus, Histriophoca, Pagophilus, Cystophora, Monachus, Mirounga, Leptonychotes, Ommatophoca, Lobodon, Hydrurga,* and *Odobenus* (41 species/subspecies)	M_{pw} (pw: pinnipeds in water)
Pinnipeds in air	75 Hz to 30 kHz	Same species as pinnipeds in water (41 species/subspecies)	M_{pa} (pa: pinnipeds in air)

According to the studies, the minimum exposition criterion relevant to damage is that for which a single exposure may cause a permanent auditory loss (Permanent Threshold Shift – PTS).

Following table reports Threshold values defined for permanent loss (PTS) and temporary loss (TTS) of auditory sensitivity (Southall et al., 2007).

Table 6.5: Threshold Values for Marine Mammals – Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) (Southall et al., 2007; ISPRA, 2012)

		NOISE TYPOLOGY		
		Single Pulse	Multi Pulse	Non Impulsive
PTS	CETACEANS SENSITIVE TO LOW FREQUENCIES			
	SPL	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)
	SEL	198 dB re: 1 μPa^2-s	198 dB re: 1 μPa^2-s	215 dB re: 1 μPa^2-s
	CETACEANS SENSITIVE TO MEDIUM FREQUENCIES			
	SPL	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)
	SEL	198 dB re: 1 μPa^2-s	198 dB re: 1 μPa^2-s	215 dB re: 1 μPa^2-s
	CETACEANS SENSITIVE TO HIGH FREQUENCIES			
	SPL	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)

		NOISE TYPOLOGY		
		Single Pulse	Multi Pulse	Non Impulsive
	SEL	198 dB re: 1 µPa^2-s	198 dB re: 1 µPa^2-s	215 dB re: 1 µPa^2-s
	PINNIPEDS (in Water)			
	SPL	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)
	SEL	186 dB re: 1 µPa^2-s	186 dB re: 1 µPa^2-s	203 dB re: 1 µPa^2-s
TTS	**CETACEANS SENSITIVE TO LOW FREQUENCIES**			
	SPL	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)
	SEL	183 dB re: 1µPa^2-s	183 dB re: 1µPa^2-s	195 dB re: 1µPa^2-s
	CETACEANS SENSITIVE TO MEDIUM FREQUENCIES			
	SPL	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)
	SEL	183dB re: 1µPa^2-s	183 dB re: 1µPa^2-s	195 dB re: 1µPa^2-s
	CETACEANS SENSITIVE TO HIGH FREQUENCIES			
	SPL	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)	224 dB re: 1µPa (peak) (flat)
	SEL	183 dB re: 1µPa^2-s	183 dB re: 1µPa^2-s	195 dB re: 1µPa^2-s
	PINNIPEDS (in Water)			
	SPL	212 dB re: 1 µPa (peak) (flat)	212 dB re: 1 µPa (peak) (flat)	212 dB re: 1 µPa (peak) (flat)
	SEL	171 dB re: 1 µPa^2-s	171 dB re: 1 µPa^2-s	183 dB re: 1 µPa^2-s

Furthermore, table below lists the marine mammal injury thresholds defined by the latest National Oceanic and Atmospheric Administration (NOAA) criteria (NMFS, 2018) and its earlier iterations (MPAA 2013, 2015, NMFS 2016).

Table 6.6: Unweighted per-Pulse SPL, SEL_{24H} and PK Thresholds for Acoustic Effects on Marine Mammals (National Marine Fisheries Service, 2018)

Hearing group	NMFS (2014)	NMFS (2018)*			
	Behaviour	Injury (PTS)		(TTS)	
	SPL (dB re 1 µPa)	Weighted SEL_{24H} (dB re 1 µPa^2·s)	PK (dB re 1 µPa)	Weighted SEL_{24H} (dB re 1 µPa^2·s)	PK (dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196
Phocid pinnipeds in water		185	218	170	212

* NMFS (2018) applies dual metric acoustic thresholds for impulsive sounds. Whichever results in the largest isopleth should be used for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

The following Table (modified from Southall et al., 2007) reports levels for multi-pulse noise that induce behavioural changes, expressed as Sound Pressure Level (SPL), intensity measured at the receiver (Receiver Level – RL).

Table 6.7: Threshold Values - First Significant Behavioural Response in Marine Mammals (Southall et al., 2007; ISPRA, 2012)

Threshold values for multi pulse noise
Cetaceans sensitive to low frequencies: 120 dB re: 1 µPa RL (RMS/pulse duration)
Cetaceans sensitive to low frequencies: 90-180 dB re: 1 µPa RL (RMS/pulse duration)
Cetaceans sensitive to high frequencies: not applicable
Pinnipeds in Water: 190 dB re: 1 µPa RL (RMS/pulse duration)

6.4.2 Reference Values for Other Marine Organisms

Other marine organisms sensitive to marine noise include:

- ✓ marine turtles;
- ✓ fishes;
- ✓ marine invertebrates.

6.4.2.1 Marine Turtles

Marine turtles, in particular, are sensitive to low frequency sounds in the range 100-1,000 Hz (maximum sensitivity between 200 and 400 Hz). Available literature studies for these organisms refer to exposure to air gun sources in the short term. Most of these studies showed a strong initial avoidance response to airgun arrays at a strength of 175 dB re 1µPa RMS or greater, while specimens in confined environments have shown lesser response to subsequent stresses which may be caused by a reduction of their sensitivity (TTS). For example, one turtle experienced a TTS and recovered two weeks later. It was estimated in one study that a typical air-gun array operating in 100–120 m water depth, could cause behavioural changes at a distance of approximately 2 km and avoidance at around 1 km for marine turtles. A recent monitoring assessment recorded that 51% of turtles dived at or before their closest point of approach to the air-gun array.

The exposure in the long term to high levels of anthropogenic noise at low frequencies in coastal areas that constitute their habitat could affect the behaviour and ecology of these animals. For lower noise levels, turtles that remain in areas affected by activities may show abnormal behaviours that reduce their ability to feed. In any case, there are no studies on the long-term effects of these abnormal behaviours (UNEP-CBD, 2012).

6.4.2.2 Fishes

Regarding fishes, research on the effects of anthropogenic noise, particularly for fish in the natural state, are not developed at all if compared to those on marine mammals. In general, marine fishes are sensitive to the same range of noise that may cause effects on cetaceans, although the mechanisms of perception of noise are substantially different.

The impact of noise of high intensity in short periods has been studied in terms of resulting physical trauma and behavioural changes. It has to be considered that, in the case of fishes, also effects of noise on the eggs and larvae shall be taken into consideration.

Overall, the responses to the stresses caused by underwater noise in fish may consist of (UNEP-CBD, 2012):

- ✓ injury and physical effects;
- ✓ behavioural disturbance;
- ✓ masking.

The physical effects may be related to reduction of acoustic sensitivity (inner ear and lateral line), damage to the bladder and embolism due to exposure to noise at high intensity. Temporary hearing disturbances are reported, for example, as a result of prolonged exposure to noise from ferry or small boats; the loss in sensitivity seems related to the intensity of the noise in relation to the sensitivity threshold at that frequency. At frequencies which fish have higher sensitivity, greater disturbance is caused by constant broadband noises.

Permanent hearing damage is reported in case of exposure to airgun sources. In particular, a field study in which were used caged fish exposed to air gun, showed how some sensory hair cells of the inner ear have been seriously damaged and have not shown signs of recovery after two months.

The behavioural response of fish to sounds can range from no change, to mild "awareness" of the sound or a startle response (but otherwise no change in behaviour), to small temporary movements for the duration of the sound, to larger movements that might displace fish from their normal locations for short or long periods of time. Depending on the level of behavioural change, there may be no real impact on individuals or populations or substantial changes (e.g., displacement from a feeding or breeding site or disruption of critical functions) that affect the survival of individuals or populations. For some species (cod and haddock), a significant decline in catches has been observed up to 25 nautical miles from the airgun source (maximum distance examined) and catch rates did not recover until five days after the seismic survey ceased (maximum time observed). For other species, changes in the depth of swimming and in the aggregation behaviours have been observed.

The majority of fish species detect sounds from below 50 Hz up to 500–1500 Hz with most communication signals in fish falling within a frequency band between 100 Hz and 1 kHz, which overlaps with low frequency shipping noise. Fish are also known to produce sounds (during territorial fighting, when competing for food, when being attacked by a predator, for courtship interactions and in spawning aggregations). Masking of the sounds produced by fish for mate detection and recognition, or for aggregating reproductive groups may therefore have significant fitness consequences for populations. Some fish communities, which are located in busy shipping lanes or noisy coastal areas are likely to be restricted in their ability to detect and respond to acoustic signals.

Anthropogenic noise may also interfere with prey or predator detection in marine fish. Predator avoidance by fish may depend on species hearing or localizing specific sounds. It has been suggested that predators that use sound for hunting can be restricted by noisy conditions through lower availability of suitable foraging areas (habitat displacement) and a lower catching efficiency. The latter has also recently been shown for predatory fish that rely on vision to catch prey and was attributed to the sound interfering with the attention span of the fish, distracting it from feeding.

Elasmobranchs do not have a swim bladder or any other air-filled cavity, meaning that they are incapable of detecting sound pressure. Therefore, particle motion (induced from noise propagation) is assumed to be the only sound stimulus that can be detected. The hearing bandwidth for elasmobranchs has been measured as between 20 Hz and 1 kHz, with similar thresholds in all species above 100 Hz. Elasmobranchs do not appear to be as sensitive to sound as teleost fish when measured in comparable ways. However, the current knowledge of elasmobranch hearing is based on data from only a few of the hundreds of species, and so one must be cautious in making generalizations about an entire subclass of fishes based on these data. Anthropogenic noise sources that have the potential to affect elasmobranchs are thought to be pile driving, wind turbines and boat noise

6.4.2.3 Marine Invertebrates

For other marine invertebrates the few studies available regarding the use of air guns do not allow to draw clear conclusions. High levels of background noise tend to alter the acoustic environment of marine invertebrates. Anthropogenic noise at low frequencies can mask the communication of shellfish, for example. The masking of important acoustic signals used by invertebrates during orientation and larval settlement may also be a factor in coastal areas and can lead to maladaptive behaviours that reduce the success of recruitment. More subtle physiological changes may occur in noisy environments (increased stress).

6.5 NOISE MODELLING

6.5.1 Selected Model

RAMGeo model was selected – upon available acknowledged underwater noise propagation models – for modelling of low frequency propagation in fully range-dependent environment. RAMGeo model is included in the underwater acoustic software AcTUP Toolbox v.2.2l, distributed by the Centre for Marine Science and Technology - Curtin University of Technology.

The model has been implemented taking into consideration the source characteristics and configuration (e.g.: typical frequency, towing depth, source directionality), propagation patterns (e.g.: seabed depth, water column velocity profiles, seabed attenuation and density of the seabed layer) and the data available from the Environmental Baseline Report of the project.

6.5.2 Modelling Scenarios

The aim of the Seismic Acquisition Survey will be to accurately define the potential prospective hydrocarbon targets for exploration drilling over the entire surface of the Block 2 area ("fullfold" coverage area). This can be obtained by carrying out either 2D or 3D survey, or a combination of both 2D and 3D. In order to ensure accurate acquisition of data over the design survey area (i.e. the fullfold coverage area), the energy source shall operate beyond a certain distance from the vertical of the limit of the survey area (approx. 5 km).

The project area is a complex marine ecosystem that supports natural and human activities. Some of the environmental features of the area are more sensitive than others in relations to the project activities (such as the presence of natural protected areas, the potential presence of marine mammals, sea turtles, etc.) and shall be given particular consideration as environmental sensitivities.

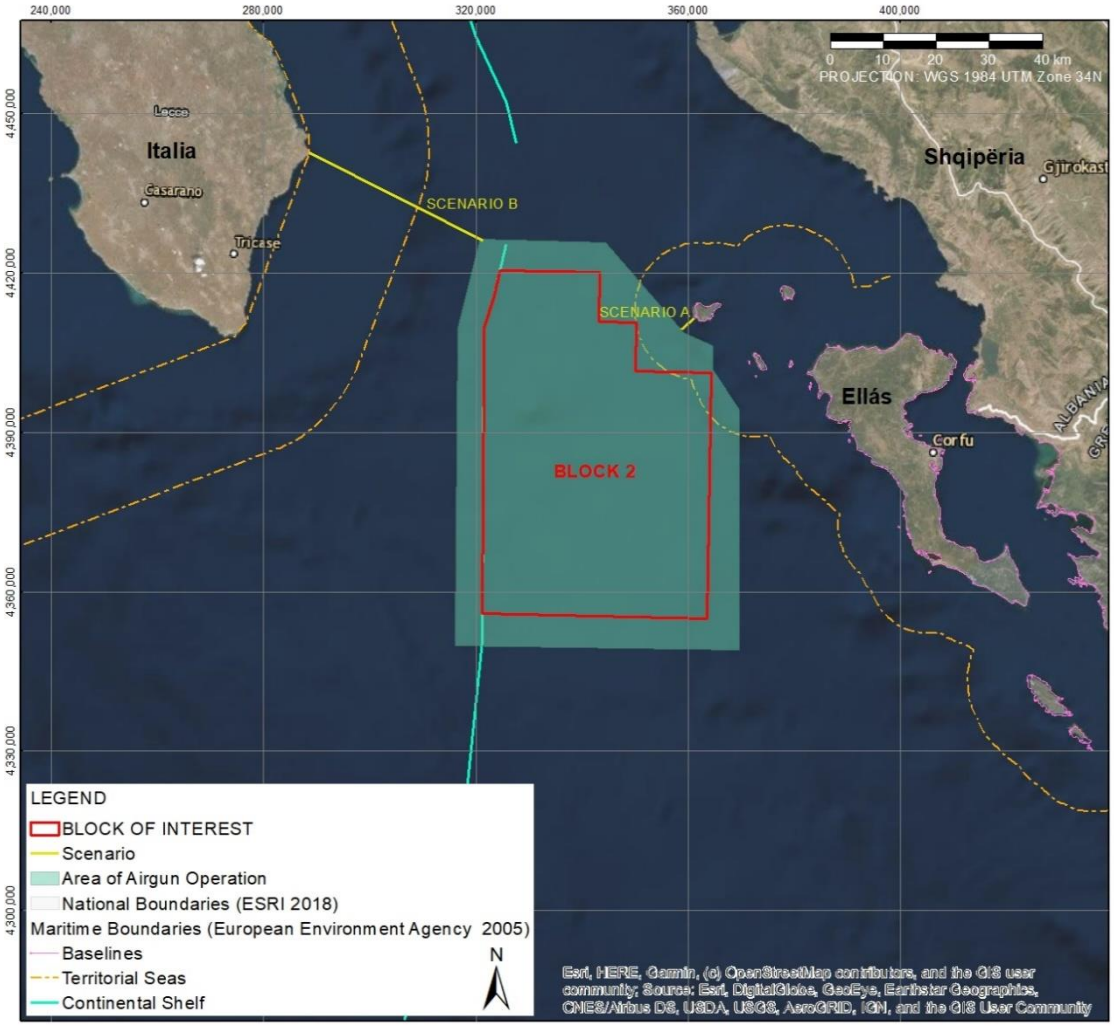

Figure 6.2: Noise Modelling Scenarios (RINA Consulting, 2020)

Based on the environmental analysis carried out in the ESBS, the following scenarios were selected:

- ✓ Scenario A – Proximity to the Natura 2000 site has been defined in order to provide a description of short-range noise propagation in coastal water, based on the proximity to the Coast (i.e. the Diapontia Islands, in particular Othonoi island) ant the marine protected area of the Natura 2000 site "Diapontia Islands" and taking

into consideration the possible presence of sensitive marine species such as cetaceans (Cuvier's beaked whale) and pinnipeds (Monk seal);

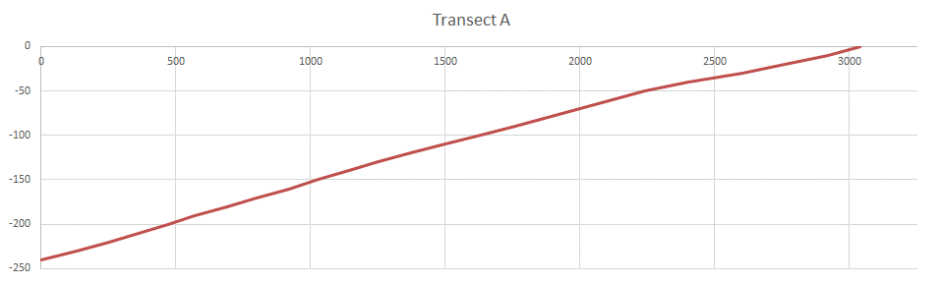

Figure 6.3: Transect A –Seabed Morphology

- ✓ Scenario B – Propagation in Open Water has been defined in order to provide a description of long-range noise propagation in offshore deep water and potential transboundary effects, based on the proximity of the continental shelf under the jurisdiction of the Italian Republic.

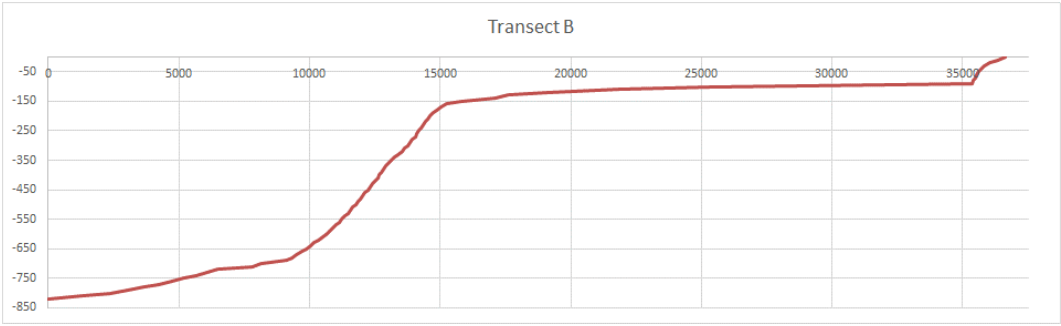

Figure 6.4: Transect B –Seabed Morphology

It has to be highlighted that the actual configuration of the seismic survey foresees that, in case of a 3D survey, the airgun volume will be reduced from 5.000 to 3.500 in^3.

According to such conservative approach, the results of noise modeling should therefore be considered as precautionary.

6.5.3 Environmental Data

The following environmental characteristics have been also considered based on the surveyed area:

- ✓ temperature and salinity of the water column (World Ocean Atlas 2013 version 2" WOA13 V2, published NOAA);
- ✓ presence of sandy sediments (Scenario A) and muddy sediments (Scenario B).

The following project data have been considered based on the project data:

- ✓ source depth;
- ✓ typical airgun highest level frequency.

6.6 MODEL RESULTS

The results of the modelled noise propagation for the scenarios are reported in the following figures showing, in particular, the noise Transmission Loss (decrease of sound intensity, in dB re 1 µPa) relevant to the frequency 75 Hz, with indication of the morphology of the seabed (brown line). The data are calculated as function of water depth (metres, vertical axis) and radial distance from the source ("range", in metres, horizontal axis).

Broadband source level 260 dB re 1 µPa has been conservatively considered to estimate the Propagation Loss.

6.6.1 Scenario A

The analysis of the results for Scenario A shows that:

- ✓ Transmission Loss (TL) rapidly increase from few tens on meters from the source, with values ranging 30-40 dB re 1 µPa from few hundred meters. At a distance 1,000-1,200 m from the source, values range 50-60 dB re 1 µPa and in correspondence of the coast (approx. 3 km from the source), values range 70-80 dB re 1 µPa;
- ✓ Transmission Loss at the various depth along the water column (10 m, 50 m and 100 m) can be estimated higher than 40 dB re 1 µPa at distance of few hundred meters from the source;
- ✓ at a distance of 800 m from the source, TL can be estimated higher than 50 dB re 1 µPa along the entire water column.

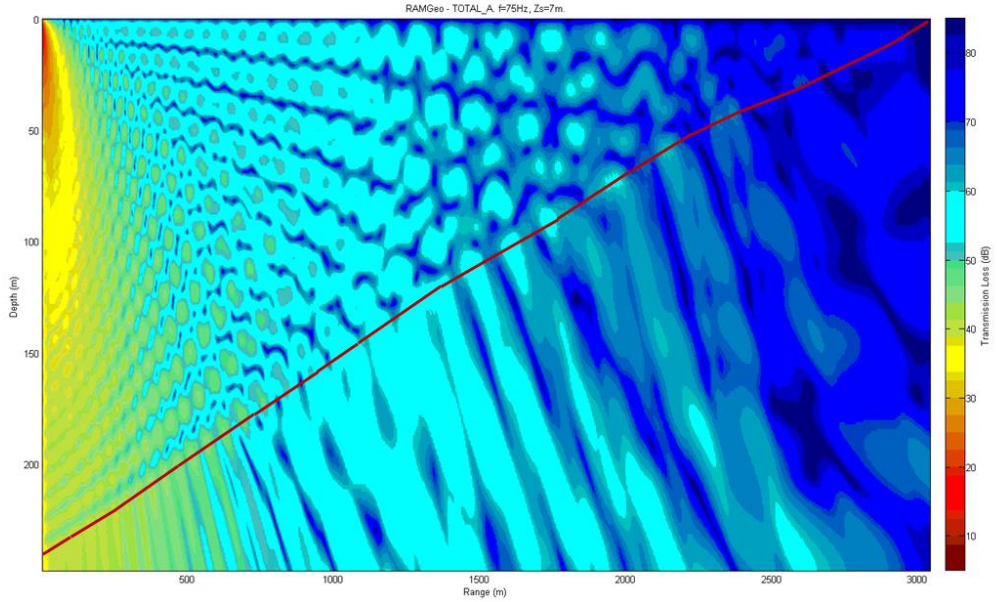

Figure 6.5: Transmission Loss – Scenario A

6.6.2 Scenario B

The analysis of the results for Scenario B shows that:

- ✓ Transmission Loss (TL) rapidly increase from few kilometres from the source, with values ranging 40-50 dB re 1 µPa at approx. 1 km and 50-60 at 2 km. At a distance 7-8 km m from the source, values range 70-80 dB re 1 µPa and in correspondence of the coast (approx. 36.5 km from the source), values are above 80 dB re 1 µPa;
- ✓ Transmission Loss at the various depth along the water column (10 m, 50 m, 100 m and 500 m) can be estimated higher than 40 dB re 1 µPa at distance of few hundred meters from the source;
- ✓ at a distance of 500 m from the source, TL can be estimated higher than 50 dB re 1 µPa up to a depth of approx. 250 m.

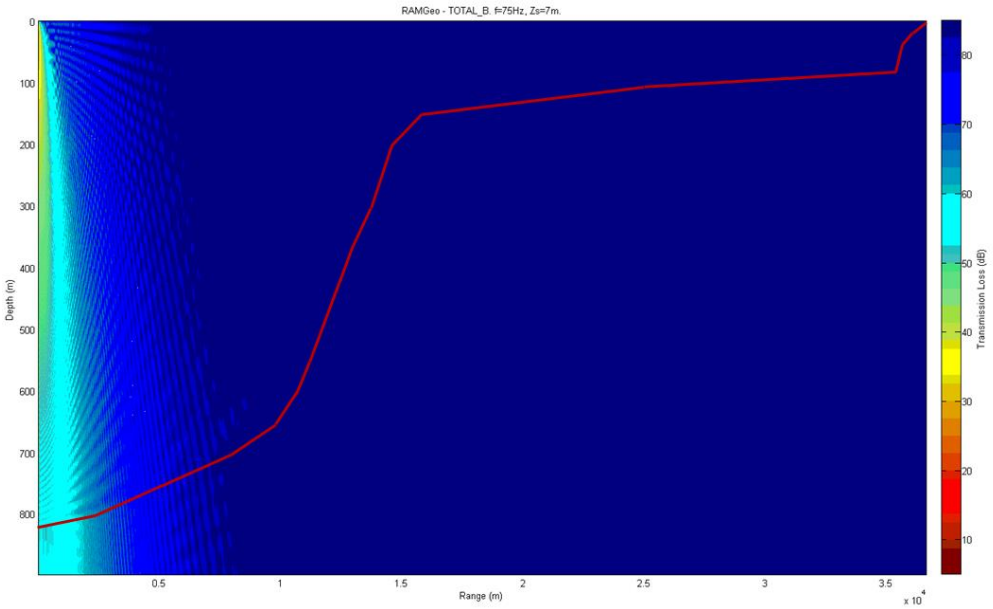

Figure 6.6: Transmission Loss – Scenario B

6.7 EVALUATION OF IMPACTS

6.7.1 Impacts of Anthropogenic Noise on Marine Mammals (Multiple Sources)

The marine mammal species that are likely to be present in the study area are:

- ✓ Bottlenose dolphin (*Tursiops truncatus*);
- ✓ Striped dolphin (*Stenella coeruleoalba*);
- ✓ Common dolphin (*Delphinus delphis*);
- ✓ Risso's dolphin (*Grampus griseus*);
- ✓ Cuvier's beaked whale (*Ziphius cavirostris*);
- ✓ Fin whale (*Balaenoptera physalus*);
- ✓ Sperm whales (*Physeter macrocephalus*); and
- ✓ the pinniped Mediterranean monk seal (*Monachus monachus*).

On the basis of literature values reported in Table 6.5, auditory damage (temporary or permanent-TTS/PTS) may occur in the case of SPL values greater than the threshold values of 212 dB re 1µPa (for pinnipeds) and of 224 dB re 1µPa (for cetaceans) as regards to the TTS and 218 dB re 1µPa (for pinnipeds) and 230 dB re 1µPa (for cetaceans) for PTS are exceeded. According to the results of the modelling, it should be highlighted that:

- ✓ at a distance of 800 m from the source (Scenario A) and 500 m from the source (Scenario B) the following thresholds value for marine mammals proposed by Southall and the National Marine Fisheries Service will not be exceeded:
  - Low Frequency Cetaceans: 224 dB re 1µPa (TTS, Southall) – 219 dB 1µPa (PTS Onset Threshold, NMFS);
  - Medium Frequency Cetaceans: 224 dB re 1µPa (TTS, Southall) – 230 dB 1µPa (PTS Onset Threshold, NMFS);
  - Pinnipeds, in water: 212 dB re 1µPa (TTS, Southall) – 218 dB 1µPa (PTS Onset Threshold, NMFS);
- ✓ near the coastal areas (preferred habitat for the Mediterranean monk seal), levels of marine noise will be significantly further reduced;

- ✓ continuous visual and acoustic monitoring shall be carried out inside the Mitigation Zone around the seismic vessel to ensure the absence of marine mammals inside this area. In case of sightings in the Mitigation Zone, the appropriate measures will be undertaken according to ACCOBAMS and JNCC Guidelines (see following Paragraphs).

Furthermore, the comparison between the noise levels in accordance with the results of the propagation modelling and the reference levels (RL) for multi pulse source proposed by Southall et Al. (2007), reported in Table 6.7 shows that behavioural response of any mammal may take place at a certain distance from the source.

The realization of the project activities could, therefore, lead to some behavioural response like an increasing probability of avoidance and other behavioural effects to the specimens eventually present in the surrounding areas, outside the Mitigation Zone around the seismic vessel. However, the following shall be considered:

- ✓ the actual configuration of seismic operations is foreseen to be less invasive from an acoustic point of view (in case of 3D survey, lower airgun volume);
- ✓ mitigation measures will be implemented in accordance with ACCOBAMS and JNCC Guidelines;
- ✓ the survey is expected to have a limited duration (approx. 20 days for 2D operations and approx. 45 more days in case of performance of the 3D survey);
- ✓ the potentially affected species, due to their mobility and capability, may adopt avoidance mechanism limiting their actual exposure to the disturbance.

6.7.2 Impacts of Anthropogenic Noise on Marine Mammals (Continuous Sources)

The project activities will also determine emissions of underwater noise generated by the engines of the vessels involved (Seismic vessels, support vessel and No. 2 chase vessels). However, in that case, noise will be continuous and not impulsive (as it is for the air gun).

For the output level of the source, for vessels expected to be involved, it can be assumed the characteristic values that do not reach the 190 dB re 1µPa @ 1m RMS (see Table 6.1)

These values are well below the threshold of damage (TTS and PTS) for sources not impulsive proposed by Southall et al. (2007), while there could be behavioural responses.

6.7.3 Impacts of Anthropogenic Noise on Marine Reptiles and Demersal/Halieutic Resources

The effects of noise-related activities of greatest impact (use of the air gun) in the open sea can be considered as less relevant than in confined conditions (bays, estuaries), where no escapes routes are present. In the open sea marine reptiles and demersal fishery resources should be able to easily move away in case of disturbance.

In case of seismic survey, this can occur even before the start of the activities: as early as the support/chase vessels will reach the area, noise produced by engines and propellers may induce the avoidance of the area by some species.

As before mentioned, marine turtles are sensitive to low-frequency sounds within the range of 100-1,000 Hz (in particular maximum sensitivity between 200 and 400 Hz) and, according to literature, generally a strong initial avoidance response has been associated to prospection activities characterized by airgun arrays at a strength of 175 dB re: 1 µPa RMS or greater, while successive airgun shots have been associated to the reduction of hearing sensitivity (TTS).

It should be noted that the most common marine turtle in the area of intervention (*Caretta caretta*) is known to overwinter on the Ionian Islands. However, it should be noted that marine turtles are considered to be less sensitive to noise than marine mammals.

With regard to fishes and other marine invertebrates, the little studies that have been done on the effects of airgun noise, have shown a wide range of results which can vary (according to the species, to the species phase of life - larvae, adults - to the environmental features, to the distance from the source, etc.), from the absence of effects, to pathological damages to the hearing system.

Generally, among the main effects that can be detected, there is the avoidance of the area and some behavioural changes due to an increase of stress in species (“alarm” behaviour, startle, C-turn behaviour, etc.).

Significant impacts on fish from seismic activities noise could, then, result just at very little distance from the source.

7 PROPOSED MITIGATION MEASURES AND RESIDUAL IMPACTS

The adoption of mitigation measures for impact containment consists in the definition of the actions to be undertaken, at the project level, to reduce (mitigate) any negative impact of the project on each environmental and social component, or to balance any disorder eventually induced on the natural and human environment (compensation).

Generally, the following categories of mitigation measures can be foreseen:

- ✓ avoid impact, not performing a specific task or part of it;
- ✓ minimize the impact, limiting the magnitude or intensity of an activity;
- ✓ rectify the impact, by intervening on the damaged environment through requalification and reintegration measures;
- ✓ reduce or eliminate the impact, through safeguard and maintenance works during the execution of the project activities;
- ✓ compensate the impact, procuring or introducing replacement resources.

The mitigation measures proposed for the project are reported in the following Paragraphs.

7.1 MITIGATIONS MEASURES – ENVIRONMENTAL ASPECTS

7.1.1 Air Quality

The following mitigation measures are foreseen:

- ✓ Seismic vessels and supply/chase vessels will comply with MARPOL 73/78 Annex IV Regulations for the prevention of air pollutants from ships;
- ✓ No ozone depleting substances will be used in accordance to regulation 12 of Annex VI MARPOL;
- ✓ The seismic and support vessels will have a valid International Air Pollution Prevention (IAPP) Certificate (as appropriate to vessel class) in accordance to Regulation 5 of Annex VI of MARPOL 73/78;
- ✓ Low Sulphur content fuel oil will be used in accordance to the current global limit for Sulphur contents in maritime which is 0.50% m/m (mass by mass);
- ✓ All survey vessels and equipment will have to present to the Operator before commencement of any activities, evidences of appropriate maintenance in accordance with written procedures based on the manufacturer's guidelines, applicable industry code or engineering standards to ensure efficient and reliable operation;
- ✓ Prior to the start of the seismic survey the ship shall be subject to an initial inspection by the Operator in order to ensure that all equipment, systems and material fully comply with applicable industry code or engineering standards and MARPOL requirements;
- ✓ The seismic Contractor shall prepare a plan for optimization of fuel use to increase efficiency and minimize emissions, which should be included in the ESMP;
- ✓ The seismic contractor shall record and monitor all fuel consumption in order to prevent excessive consumptions. The volume of fuel used by the vessels/equipment will be recorded and reported in the Ministry of Environment at the end of the seismic survey along with the results of the monitoring program.

7.1.2 Sea Water Quality

The following mitigation measures are foreseen:

- ✓ Sewage will be treated on-board and managed in compliance with MARPOL 73/78 Annex IV "Prevention of pollution by sewage from ships"; oily waters will be managed in compliance with Annex I "Regulations for the Prevention of Pollution from oil" and all waste managed in compliance with Annex V "Prevention of pollution by garbage from ships" and in accordance with international and national regulations. More specifically, the following measures should be implemented:
  - sewage discharges will be treated and disinfected by means of on board treatment plant and may be discharged more than 3 nautical miles from shore. Sewage shall be safely stored on-board when the ship is less than 3 nautical miles from the nearest land,

- oily water may be stored on the vessel until their delivery to appropriate Port facilities. If this is not feasible, oil/water separators should be in place to ensure that any drainage from machinery spaces and bilge water discharged from the ship complies with the legal limits of no more than 15 mg/l of oil for oil-in-water discharge according to IMO (International Maritime Regulations) guidelines (MEPC 2003).
- food wastes will be macerated to a diameter of less than 25 mm, prior to disposal. No food wastes will be directly discharged in the sea,
- no plastics or garbage will be discharged to sea,
- waste will be segregated into recyclables and dangerous wastes (including used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate disposal.
- hazardous waste must be labelled accordingly, and disposed by specialist and registered waste disposal contractor,
- prior to entry into port, Seismic Vessel Contractor will notify the Port Authorities of the types and quantities of waste being brought ashore for disposal;

✓ The seismic and chase/support vessels shall have a valid International Oil Pollution Prevention Certificate (IOPPC) and a valid International Sewage Pollution Prevention Certificate (ISPPC) applicable to vessel class in accordance to the requirements of Annex I and Annex IV of MARPOL 73/78;

✓ All vessels shall operate under an approved Oil Spill Contingency and Emergency Response Plan which details actions to be taken in the event of a shipboard emergency or oil spill in accordance with MARPOL 73/78 Annex I requirements (see Section 9.3.2);

✓ Seismic Vessel Contractor will be responsible for preparing and executing a Waste and Discharge Management Plan, in the framework of the Environmental and Social Management Plan (see Section 9.3.1), which will include among other provisions the following:

- ensure that solid and hazardous waste disposal is carried out in accordance with the appropriate laws and ordinances and in close cooperation with the local authorities,
- All types of discharges and waste will be collected, sorted and disposed in accordance with the Waste and Discharge Management Plan,
- Low-toxicity biodegradable detergents should be used in cleaning of all deck spillage,
- Maintain a waste log including waste type, quantity and disposal method which will be reported in the Ministry of Environment at the end of the seismic survey along with the results of the monitoring program,
- Ensure that on-board solid waste storage is secured,
- Personnel will be trained in waste sorting and collection (adapted to position and generated waste types),
- Waste will be reused and recycled where safe and practicable to do so;

✓ Any accidental release of waste to the marine environment that does not meet MARPOL discharge standards will be reported to relevant local authorities within a time framework of less than 12 hours;

✓ Safe Work procedures will be developed and followed to prevent objects to being dropped;

✓ Personnel will be trained with regard to the prevention of dropped objects during relevant meetings and the appropriate inductions;

✓ Lost equipment will be relocated and recovered where safe and practicable to do so;

✓ Ballast Water Exchange will occur prior to arrival, at an appropriate location;

✓ The seismic vessel must comply with Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and will be prepared in accordance with the IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53);

✓ Standard fuel supply procedures (safety valves) will be followed during refuelling of support vessels in Port or in case of emergency refuelling at sea is needed;

✓ Pre-bunkering checklist will be developed and implemented prior to refuelling of support vessels in Port or in case of emergency refuelling at sea is needed;

✓ Bunkering will commence during daylight hours and during acceptable sea and wind conditions in case of emergency refuelling at sea is needed;

✓ Spill response kits will be located in proximity to hydrocarbons bunkering areas and appropriately stocked/replenished as required;

- ✓ Crew induction will include spill prevention, reporting and use of spill response equipment;
- ✓ Any significant fuel losses to the marine environment will be reported to the relevant government agencies;
- ✓ All hydraulic systems will be adequately maintained, and all hydraulic hoses will be frequently inspected;
- ✓ Preventive maintenance, leak detection and repair programs for on-board equipment that may originate unwanted spill will be implemented.

7.1.3 Marine Fauna and Flora

Specific mitigation measures will contribute to minimize the impact of the seismic acquisition activities on biotic environment. Below are described the measures required to be implemented to mitigate identified impacts to biological and ecological receptors due to noise emissions, collision/entanglement and light emissions.

7.1.3.1 Noise Emissions

In order to protect the marine fauna from their exposure to high levels of noise, with particular regard to the marine mammals, mitigation measures will be implemented in accordance to ACCOBAMS and JNCC Guidelines during seismic surveys and airgun use (attached in Annex C to this document). Mitigation guidelines will be adopted and acknowledged by the Operator /Contractor of the seismic vessel.

The mitigation procedures will be practical in that they will use data that can be readily collected by observers and passive acoustic monitoring devices, considering seismic operations conditions and constraints, and, as far as possible, minimize disruption of operations while maximizing environmental protection. Measures will be based on a conservative approach that reflects levels of uncertainty, with a precautionary approach taken when uncertainties emerge.

Survey Area & Period

- ✓ Seismic contract will be informed about the existing information for sensitive marine species (whales, dolphins, monk seals, sea turtles) in the area, derived from ESBS and EAP, so that activities are properly planned and conducted with potential impacts to be As Low As Reasonably Practicable (ALARP);
- ✓ Operator shall voluntarily cooperate with seismic operators of adjacent exploration Blocks in order to mutually agree, as possible, on avoiding simultaneous execution of the seismic survey during the same period in order to avoid cumulative noise impacts;
- ✓ Operator shall make any possible effort to avoid execution of survey during the reproduction periods for marine mammals and sea turtles to minimize interferences.

Marine Mammals Observers and PAM

- ✓ Operator will secure continuous presence on board of qualified, trained, ACCOBAMS certified, dedicated and experienced Marine Mammals Observers (MMO) and Passive Acoustic Monitoring (PAM) operators (ACCOBAMS Highly Qualified MMO/PAM operators, according to ACCOBAMS Resolution 6.18 "*Implementation of an ACCOBAMS certification for highly qualified marine mammals observers*" adopted in November 2016 and according to the "Progress report on the implementation of an ACCOBAMS certification for highly qualified MMOs/PAM", presented during the MOP7 in November 2019. The operator shall prove if they couldn't find certified personnel. In that case, JNCC's approved personnel is required) to ensure that marine mammals or sea turtles are not present within the Mitigation Zone (MZ) to be established around the seismic vessel, before turning on the acoustic sources and while sources are active.
- ✓ At least two dedicated MMOs will be surveying at all times during daylight. Shifts will be organized to allow enough rotation and resting periods to observers. Each hour an MMO, at turn, will shift with the one at rest, in order to ensure max. a 2 consecutively hours watch per operator;
- ✓ PAM operators will be on duty throughout the operations to allow for detection of certain marine mammals by the vocalizations they produce underwater and ensure that monitoring of marine mammals is provided 24/24h within the Mitigation Zone;
- ✓ Operator shall ensure that PAM system can achieve as much as possible of the following:
  - An appropriate acoustic software for elaboration of noise recordings is available and used on the vessel,
  - Detect the range of frequencies of marine mammal vocalisations expected to be present in the survey area,

- Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time,
- Immediately communicate relevant information to the PAM operators (real time) so appropriate and timely mitigation measures can be undertaken (e.g. delay soft start),
- Able to be repaired on board or replaced in case of breakdown (e.g. appropriate repair tools and backup equipment);

✓ Operators shall ensure that MMOs will be suitably equipped for an optimal visual monitoring within the Mitigation Zone, with appropriate 7x50 distance measuring binoculars, also provided with a compass, in order to be able to verify distance and direction from the noise source, big eyes, HD cameras, video camera, etc.;

✓ MMOs and PAMs will be responsible for monitoring and reporting any observation of marine fauna using a standardized protocol as per ACCOBAMS Guidelines and overseeing implemented mitigation rules. There will be use of certain protocols in case of sighting/presence of mammals within the survey area;

✓ MMOs and PAMs operatives will be equipped with an up-to-date copy of the ACCOBAMS and JNCC guidelines and recording forms;

✓ MMOs shall be able to advise the crew on the procedures set out in the guidelines and to provide advice to ensure that the survey is undertaken in accordance with the guidelines (pre-mobilization meeting, etc.);

✓ Reports with information on the implemented procedures, their effectiveness, and obtained datasets will be submitted by the Operator to the Ministry of Environment within a period of one (1) month from the completion of the seismic acquisition campaign. In addition, all environmental information reported by MMOs will be forwarded, by the MMO/PAM team responsible, to the National Focal Point, that applies ACCOBAMS, the responsible national Authority for the dissemination of this information.

Sensitive Areas

✓ Operations shall be designed in order to minimize as far as possible impacts on the identified sensitive area within and in proximity to the survey area, namely the Natura 2000 site “Diapontia Islands”.

Exclusion/Mitigation Zones

As per ACCOBAMS and JNCC Guidelines, in which distance from sensitive areas and the definition of a protection area surrounding the noise source is suggested, here below are presented the mitigation measures proposed related to these aspects.

ACCOBAMS Resolution 7.13 – Anthropogenic Noise - in particular encourages Parties to “*avoid or minimize producing noise in marine protected areas, as well as in particular in areas containing critical habitat of cetaceans likely to be affected by man-made noise*”, and to “*Avoid cetaceans’ key habitats and marine protected areas, define appropriate buffer zones around them; consider the possible impact of long-range propagation*”, while the “*JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys - August 2017*”, suggests to consider the “*distance to sensitive areas and coastline to reduce any potential for entrapment (i.e. prevent animals from possibly being trapped between the vessel and shoreline)*”.

With particular reference to the Mitigation Zone proposed in the following, this has been determined according to the results of the noise modeling as the distance to which animals are not expected to receive harmful noise levels (see Appendix B for further details), as suggested by ACCOBAMS guidelines (the area “*should be dynamically modelled based on the characteristic of the source (power and directionality), on the expected species, and on the local propagation features (cylindrical vs spherical spreading, depth and type of sea bottom, local propagation paths related to thermal stratification)”*).

✓ Exclusion Zones (EZ) with restrictions on navigation of seismic vessel and operation of airguns will be determined around the proposed sensitive area and shall be included in the planning of the seismic acquisition survey. The anticipated extents of the proposed Exclusion Zones are the following:

- Seismic Vessel Navigation Exclusion Zone of 800 m from the limit of the sensitive area,
- Airgun operation Exclusion Zone of 1600 m (i.e. two times the Mitigation Zone) from the limit of the sensitive area;

✓ The anticipated extents of the proposed Exclusion Zones (as well as for the proposed Mitigation Zone as described later) will be evaluated during the initial phase of the seismic survey in conjunction with the relevant results of the monitoring program and shall be adjusted accordingly in order to avoid any impacts on the identified sensitive area. Notification to the Ministry of Environment and Energy must be sent for any adjustment

of the limits of the Exclusions Zones (as well as for the proposed Mitigation Zone as described later), followed by the relevant supporting documentation;

- ✓ In order to better assess the noise contribution of the project activities, a base noise monitoring is also foreseen before the start and after the completion of the activities;
- ✓ A Mitigation Zone (MZ) shall be implemented around the seismic vessel where visual and acoustic monitoring of marine mammals will be continuously implemented by MMOs and PAMs. The role of a MMO/PAM operator is to detect marine mammals as part of the mitigation procedures and to advise a delay in the commencement of activity, or an interruption of the ongoing activity, should any marine mammals be detected within the mitigation zone;
- ✓ Mitigation Zone shall not be less than 800 m from the vessel estimated from the centre of the airgun array or noise source location.

Airgun use

- ✓ Standard Airgun Mitigation Procedures as proposed in ACCOBAMS Resolution 7.13 – Annex 2 "Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area" (November 2019) and in "JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys - August 2017" shall be implemented (see annex C to this document).
- ✓ Use of the lowest practicable source power (active airgun) determined by depth of investigation and quality of data shall be implemented;
- ✓ Seismic acquisition shall be designed aiming at the minimization of the horizontal propagation of acoustic waves by adopting suitable array configurations and pulse synchronization and eliminating unnecessary high amplitudes;
- ✓ Adoption of the soft-start technique will be implemented: slow increase of acoustic power (ramp-up or soft start) to allow marine mammals the opportunity to leave the area. To minimize noise emissions, soft-starts shall not be longer than 20 minutes;
- ✓ Before beginning any emission there will be a dedicated visual and acoustic survey for about 60 minutes to ensure no animals are within and in the vicinity of the MZ around the seismic vessel. If deep diving species, such as beaked and/or sperm whales, or other sensitive species, are seen or acoustically detected near the vessel, the monitoring period will be extended to 120 minutes and the emissions will be delayed. Ramp-up may not begin until 30 minutes (or 120 in case of deep diving species) after the animals are seen to leave the MZ, or 30 minutes (or 120 in case of deep diving species) after they are last seen;
- ✓ Shut-down of source(s) will be performed whenever a marine mammals is seen to enter the MZ, when aggregations of vulnerable species (such as beaked/sperm whales) are detected anywhere within the monitoring area, and when abnormal behaviours are observed in animals. Focused monitoring of the affected animals should follow;
- ✓ High power airgun configurations will be avoided as far as possible at night and during unfavourable sea state conditions. Since low visibility doesn't allow for accurate visual detection and localization of marine mammals. The use of PAMs should be emphasized under these conditions and airgun emissions will be restricted as possible;
- ✓ Interruption of source energization at each acquisition line end when expected to be greater than 20 minutes. Airgun firing will be terminated at the end of the line and a full 20 minutes soft-start will be undertaken before next line. A pre-shooting search will also be undertaken during the scheduled line change;
- ✓ A system of automated logging of acoustic source use will be developed to document the amount of acoustic energy produced, and this information will be reported to the Ministry of Environment and Energy following the completion of the seismic acquisition campaign.

Strandings

- ✓ During operations, existing stranding networks in the area will be alerted. The Port Authorities and relevant environmental organizations will be informed for recording potential stranding.
- ✓ In case of mass stranding or increased rate of individual stranding in the wider area, any acoustic emission should be stopped and the causes of the event, relationship with the seismic operations, and potential changes in marine mammals encounter rates as indication of their population density, identified and investigated.

7.1.3.2 Entanglement/Collision

Due to the potential presence of sea turtles in the project area, in order to avoid possible entanglement, a Turtle Guard system (as shown in following figures) will be installed on tail buoys on the streamers. This device effectively reduces the risk of sea turtle entanglement in the seismic equipment.

Moreover, in case of entanglement, immediate intervention by appropriately trained personnel should be implemented.

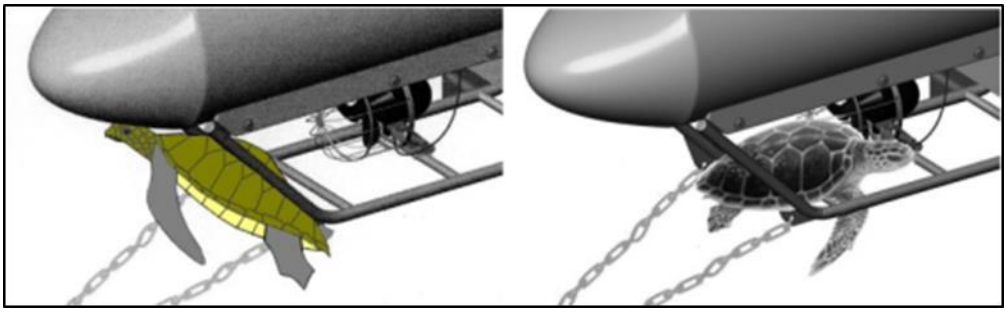

Figure 7.1: Entanglement Scheme (Ketos Ecology, 2009)

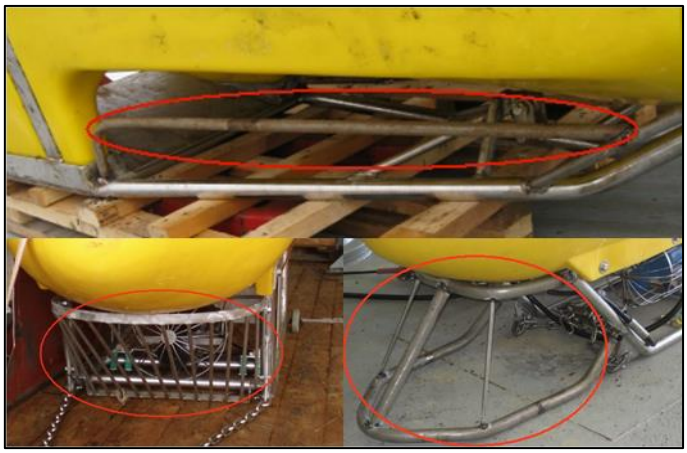

Figure 7.2: "Turtle Guards" Examples (Web Site: www.ketosecology.co.uk)

7.1.3.3 Light Emissions

To mitigate potential major negative impacts of artificial lights to marine life (particularly seabirds), external lighting will be minimised to that required for navigation, vessel safety and safety of deck operations, except in the case of an emergency.

Any stranded seabirds must be retrieved and released according to appropriate guidelines.

7.1.4 Additional Measures

In order to minimize any disturbance on seabird, in case of use of helicopter, flying over natural protected areas shall be avoided.

In order to minimize any disturbance to the benthic communities, the following additional measures shall be taken into account as an example of best practice and common sense:

- ✓ Ensure that streamer is stretched as much as possible;
- ✓ Vessel should move on the route before the start point and after the endpoint of the acquisition line;
- ✓ Routine monitoring of the streamers;
- ✓ Streamers will be equipped with depth control devices (birds).

7.2 MITIGATIONS MEASURES – SOCIAL ASPECTS

7.2.1 General Measures

- ✓ A Stakeholder Briefing (plan for engagement) will be developed to ensure timely sharing of information on the details of the seismic survey;
- ✓ Seismic Contractor will recruit a Community Liaison Officer (CLO), based in Corfu, who will engage prior and during the seismic survey with the different local stakeholders (authorities, actors related to the maritime activities, fishing, tourism, etc.) in order to keep them informed about the coming and on-going activities and their timeframe and be able to gather their questions and concerns and respond to them;
- ✓ A grievance mechanism procedure will be developed and implemented to ensure that all stakeholders get the opportunity to raise a grievance related to the Project activities and provide a process for timely resolution of grievances; the CLO will inform local stakeholders about the existence of the grievance mechanism;
- ✓ The Community Liaison Officer (CLO) will be in-charge of the management of the grievances, in coordination with the Fishing Liaison Officer (FLO).

7.2.2 Fishing Activities

In order to ensure minimization of impacts from the seismic survey on the fisheries and the fishing community, the following mitigation measures have been identified:

- ✓ Seismic Contractor will appoint No. 1 Fishing Liaison Officer (FLO), which will be based on a support vessel, to communicate with and meet with the various stakeholders linked to fishing activity to inform them of the seismic plan and associated timeframes. The FLO shall liaise with all affected fishing vessels, particularly pelagic long-line fishing activities in the region to plan the placing of fishing gear, if possible, or provide additional notice of the areas of operations. Clear information will be provided to ensure that fishermen are aware that the Project will not exclude people from their fishing grounds but rather will cause only a temporary disturbance to fishing activities, if any;
- ✓ Appointed FLOs on-board must speak Greek, Italian and English in order to facilitate potential interaction with fishermen at the project area;
- ✓ Seismic Contractor shall be responsible for the following:
  - Collaborate with the competent Authorities for issuance of NAVAREA warnings for the area where seismic acquisition survey will take place as well as for the deployment area of the survey, before commencement of operations,
  - Prepare a 72-hours acquisition plan of operations which must be notified on a daily basis (until 10 a.m.) to the Corfu Port Authority and to the Central Coast Guard of Corfu presenting the area of operations within that time framework,
  - Collaborate with the competent Authorities for issuance of NAVTEX – Notice to Mariners on a daily basis, in accordance to the 72-hours acquisition plan of operations;
- ✓ Seismic Contractor shall use chase vessels in order to:
  - liaise with fishermen in the vicinity of the seismic vessel in the daytime and at night;
  - ensure navigational safety and appropriate management of interactions between the survey vessel and fishing vessels, and
  - ensure that no vessels or fishing gear remain in the path of the seismic survey vessel;
- ✓ Operator and Seismic Contractor will ensure that:
  - Procedures are in place for dealing with grievances in the event of damaged fishing gear, managed through the grievance process;
  - The FLO liaises with the CLO for any concern and grievance related to fishing activity;
- ✓ All vessels will be equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.

7.2.3 Port and Marine Traffic

In order to ensure potential impacts from the seismic survey on port and marine traffic are avoided or reduced as much as possible, the following mitigation measures are planned, which are complementary to those proposed for the fishing activities:

- ✓ A mobile safety exclusion zone shall be maintained around seismic survey vessel in order to avoid collision with other vessels in the area. All vessels would be required to give way to the seismic vessel. The safety exclusion zone will depend on the planned seismic vessel route, defined by a 72-hours acquisition plan which must be notified on a daily basis to the Corfu Port Authority and to the Central Coast Guard of Corfu. The perimeter of this zone is expected at least 2 nm in front, 3 nm at left and right of the ship and 6 nm on the back because of the presence of the airgun arrays/towed streamers. The communication of timely information will help to raise awareness of seismic activity and potential disturbance to fishing and marine traffic activities, to help marine users to avoid the vessel, seismic equipment and the mobile safety zone.
- ✓ Complete fulfilment of the International Marine Traffic Regulation shall be ensured;
- ✓ Seismic and support vessels must comply with all applicable standard maritime safety procedures, including 24-hr visual, radio and radar watch for vessels within and in the vicinity of the operational area, and display of appropriate navigational beacons and lights;
- ✓ All procedures and practices of Seismic and support vessels must be in accordance with the requirements of IMO's International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Total Standards;
- ✓ Seismic and support vessels must be equipped with Automatic Identification System (AIS) and approved electronic navigation systems and radar on seismic vessel;
- ✓ The Community Liaison Officer (CLO) will communicate and meet, at least one month before the start of the activities, with the various stakeholders that are related with navigation activities and inform them of the seismic acquisition operation plan and associated timeframes.

7.2.4 Tourism Activities

In order to ensure minimization of impacts from the seismic survey on tourist activities, Operator should ensure that Seismic Acquisition Survey will be commenced as early as practicable within the operational window of November to December 2020, in order to avoid as far as possible coincidence with period of tourist activities, which for the project area starts at April and ends in October.

7.2.5 Local and Macro Economy

No mitigation measures are required since the impact of the seismic survey on local and macro economy is positive. Local provisions and supplies and any recruitment (e.g. CLOs, FLOs) must be enhanced in order to increase the benefits of the project on local economy.

7.2.6 Social Context and Human Development

HSE: the seismic survey will comply with requirements in terms of safety, waste management and oil spill response:

- ✓ The seismic and support vessels will comply with all applicable standard maritime safety procedures, including display of appropriate navigational beacons and lights in accordance with the requirements of Marine Order 30 Prevention of Collision (as appropriate to vessel class);
- ✓ Implementation of an approved Waste and Discharge Management Plan;
- ✓ Implementation of an approved Oil Spill Contingency and Emergency Response Plan which details actions to be taken in the event of a shipboard emergency or oil spill in accordance with MARPOL 73/78 Annex I requirements.

Human Rights: The seismic survey will be conducted in a manner that respects the human rights and the dignity of all people, complying with all legal requirements. In particular:

- ✓ All internationally recognized human rights, as set out in the International Bill of Human Rights and the International Labour Organization's declaration on Fundamental Principles and Rights at Work will be respected as well as the relevant requirement of Greek Legislation;
- ✓ All human and labour rights will be respected, as stated in the United Nations Guiding Principles (UNGP) on Business and Human Rights;

- ✓ All workers, employees and suppliers will be treated fairly and without discrimination and will be entitled to work in an environment and under conditions that respect their rights and dignity;
- ✓ The rights of people in any Communities potentially impacted by the seismic acquisition activities will be respected;
- ✓ Operator and Seismic Contractor will ensure that contractual commitments will guarantee that all subcontractors and suppliers adhere to the aforementioned principles.

7.2.7 Additional Measures

In order to minimize any disturbance to the seabed, the following additional measures shall be taken into account:

- ✓ In case of identification of any marine archaeological site/wreck during the seismic acquisition survey, then operator shall immediately inform the competent archaeological authority of marine antiquities;
- ✓ Ensure that streamer is stretched as much as possible;
- ✓ Vessel should move on the route before the start point and after the endpoint of the acquisition line;
- ✓ Routine monitoring of the streamers;
- ✓ Streamers will be equipped with depth control devices (birds).

7.3 SUMMARY OF PROPOSED MITIGATION MEASURES AND RESIDUALS IMPACTS

Implementation of mitigation measures can minimize a potential impact by reducing the sensitivity and vulnerability of a receptor/feature or the potential intensity of an effect.

Following table summarises identified environmental and social impacts, proposed mitigation measures and assessment of residual impacts assuming that all proposed mitigation measures are implemented.

Table 7.1: Summary of Environmental Impacts and Mitigation Measures

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
Air emissions	Air quality	Medium **Minor** Low	Minor	Seismic vessels and supply/chase vessels: ✓ Compliant with MARPOL 73/78 Annex IV Regulations for the prevention of air pollutants from ships; ✓ No ozone depleting substances will be used in accordance to regulation 12 of Annex VI MARPOL; ✓ Valid International Air Pollution Prevention (IAPP) Certificate (as appropriate to vessel class) in accordance to Regulation 5 of Annex VI of MARPOL 73/78; ✓ Low Sulphur content fuel oil will be used in accordance to the current global limit for Sulphur contents in maritime which is 0.50% m/m (mass by mass); ✓ All survey vessels and equipment will have to present to the Operator before commencement of any activities, evidences of appropriate maintenance in accordance with written procedures based on the manufacturer's guidelines, applicable industry code or engineering standards to ensure efficient and reliable operation. ✓ Prior to the start of the seismic survey the ship shall be subject to an initial inspection by the Operator in order to ensure that all equipment, systems and material fully comply with applicable industry code or engineering standards and MARPOL requirements. Seismic Contractor: ✓ Prepare a plan for optimization of fuel use to increase efficiency and minimize emissions, which should be included in the ESMP; ✓ Record and monitor all fuel consumption in order to prevent excessive consumptions. The volume of fuel used by the vessels/equipment will be recorded and reported in the Ministry of Environment at the end of the seismic survey along with the results of the monitoring program.
Noise Emissions	Plankton	High **Moderate** Low	**Moderate**	Survey area & period: ✓ Operator shall voluntarily cooperate with seismic operators of adjacent exploration Blocks in order to mutually agree, as possible, on avoiding simultaneous execution of the seismic survey during the same period in order to avoid cumulative noise impacts; Airgun use: ✓ Use of the lowest practicable source power (active airgun) determined by depth of investigation and quality of data shall be implemented; ✓ Seismic acquisition shall be designed aiming at the minimization of the horizontal propagation of acoustic waves by adopting suitable array configurations and pulse synchronization and eliminating unnecessary high amplitudes; ✓ Adoption of the soft-start technique will be implemented: slow increase of acoustic power (ramp-up or soft start) to allow mobile marine species the opportunity to leave the area. To minimize noise emissions, soft-starts shall not be longer than 20 minutes; ✓ Interruption of source energization at each acquisition line end when expected to be greater than 20 minutes. Airgun firing will be terminated at the end of the line and a full 20 minutes soft-start will be undertaken before next line. A pre-shooting search will also be undertaken during the scheduled line change; ✓ A system of automated logging of acoustic source use will be developed to document the amount of acoustic energy produced, and this information will be reported to the Ministry of Environment and Energy following the completion of the seismic acquisition campaign.
	Invertebrates	High **Moderate** Low	**Moderate**	
	Fish Fauna	High **Moderate** Low	**Moderate**	

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
	Marine Mammals	High **Major** High	**Moderate**	Survey area & period: ✓ Seismic contractor will be informed about the existing information for sensitive marine species (whales, dolphins, monk seals, sea turtles) in the area, derived from ESBS and EAP, so that activities are properly planned and conducted with potential impacts to be As Low As Reasonably Practicable (ALARP); ✓ Operator shall voluntarily cooperate with seismic operators of adjacent exploration Blocks in order to mutually agree, as possible, on avoiding simultaneous execution of the seismic survey during the same period in order to avoid cumulative noise impacts; ✓ Operator shall make any possible effort to avoid execution of survey during the reproduction periods for marine mammals and sea turtles to minimize interferences. Marine Mammals Observers and PAM: ✓ Operator will secure continuous presence on board of qualified, trained, ACCOBAMS certified, dedicated and experienced Marine Mammals Observers (MMO) and Passive Acoustic Monitoring (PAM) operators (ACCOBAMS Highly Qualified MMO/PAM operators. The operator shall prove if they couldn't find certified personnel. In that case, JNCC's approved personnel is required), to ensure that marine mammals or sea turtles are not present within the Mitigation Zone (MZ) to be established around the seismic vessel, before turning on the acoustic sources and while sources are active. ✓ At least two dedicated MMOs will be surveying at all times during daylight. Each hour an MMO, at turn, will shift with the one at rest, in order to ensure max. a 2 consecutively hours watch per operator; ✓ PAM operators will be on duty throughout the operations to allow for detection of marine mammals vocalizations and ensure that monitoring of marine mammals is provided 24/24h within the Mitigation Zone; ✓ Operator shall ensure that PAM system can achieve: • An appropriate acoustic software for elaboration of noise recordings is available and used on the vessel, • Detect the range of frequencies of marine mammal vocalisations expected to be present in the survey area, • Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time, • Immediately communicate relevant information to the PAM operators (real time) so appropriate and timely mitigation measures can be undertaken (e.g. delay soft start), • Able to be repaired on board or replaced in case of breakdown (e.g. appropriate repair tools and backup equipment); ✓ Operators shall ensure that MMOs will be suitably equipped for visual monitoring within the Mitigation Zone with appropriate 7x50 distance measuring binoculars, also provided with a compass, in order to be able to verify distance and direction from the noise source, big eyes, HD cameras, video cameras, etc.; ✓ MMOs and PAMs will be responsible for monitoring and reporting any observation of marine fauna using a standardized protocol as per ACCOBAMS Guidelines, and overseeing implemented mitigation rules. There will be use of certain protocols in case of sighting/presence of mammals within the survey area; ✓ MMOs and PAMs operatives will be equipped with an up-to-date copy of the ACCOBAMS and JNCC guidelines and recording forms; ✓ MMOs shall be able to advise the crew on the procedures set out in the guidelines and to provide advice to ensure that the survey is undertaken in accordance with the guidelines (pre-mobilization meeting, etc.); ✓ Reports with information on the implemented procedures, their effectiveness, and obtained datasets will be submitted to the Ministry of Environment within a period of one (1) month from the completion of the seismic acquisition campaign. In addition, all environmental information reported by MMOs will be forwarded by the MMO/PAM team responsible, to the National Focal Point, that applies ACCOBAMS, the responsible national Authority for the dissemination of this information. Mitigation zones: The Mitigation Zone proposed in the following has been determined according to the results of the noise modeling as the distance to which animals are not expected to receive harmful noise levels (see Appendix B for further details), as suggested by ACCOBAMS Resolution 7.13 (the area "*should be dynamically modelled based on the characteristic of the source (power and directionality), on the expected species, and on the local propagation features (cylindrical vs spherical spreading, depth and type of sea bottom, local propagation paths related to thermal stratification)"*). ✓ A Mitigation Zone (MZ) shall be implemented around the seismic vessel where visual and acoustic monitoring of marine mammals will be continuously implemented by MMOs and PAMs. The role of a MMO/PAM operator is to detect marine mammals as part of the mitigation procedures and to advise a delay in the commencement of activity, or an interruption of the ongoing activity, should any marine mammals be detected within the mitigation zone; ✓ Mitigation Zone shall not be less than 800 m from the vessel estimated from the centre of the airgun array or noise source location; ✓ The anticipated extents of the proposed Mitigation Zone will be evaluated during the initial phase of the seismic survey in conjunction with the relevant results of the monitoring program and shall be adjusted accordingly in order to avoid any impacts on the identified sensitive area. Notification to the Ministry of Environment and Energy must be sent for any adjustment of the limits of the Mitigation Zone, followed by the relevant supporting documentation; ✓ In order to better assess the noise contribution of the project activities, a base noise monitoring will be performed before the start and after the completion of the activities. Airgun use: ✓ Standard Airgun Mitigation Procedures as proposed in ACCOBAMS Resolution 7.13 – Annex 2 and in JNCC guidelines (August 2017) shall be implemented. ✓ Use of the lowest practicable source power (active airgun) determined by depth of investigation and quality of data shall be implemented;
	Sea Turtles	High **Major** High	**Moderate**	

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
				✓ Seismic acquisition shall be designed aiming at the minimization of the horizontal propagation of acoustic waves by adopting suitable array configurations and pulse synchronization and eliminating unnecessary high amplitudes; ✓ Adoption of the soft-start technique will be implemented: slow increase of acoustic power (ramp-up or soft start) to allow marine mammals the opportunity to leave the area. To minimize noise emissions, soft starts shall not be longer than 20 minutes; ✓ Before beginning any emission there will be a dedicated visual and acoustic monitoring for about 60 minutes to ensure no animals are within and in the vicinity of the MZ around the seismic vessel. If deep diving species, such as beaked and/or sperm whales, or other sensitive species, are seen or acoustically detected near the vessel, the monitoring period will be extended to 120 minutes and the emissions will be delayed. Ramp-up may not begin until 30 minutes (or 120 in case of deep diving species) after the animals are seen to leave the MZ, or 30 minutes (or 120 in case of deep diving species) after they are last seen; ✓ Shut down of source(s) will be performed whenever a marine mammals is seen to enter the MZ, when aggregations of vulnerable species (such as beaked/sperm whales) are detected anywhere within the monitoring area, and when abnormal behaviours are observed in animals. Focused monitoring of the affected animals should follow; ✓ High power airgun configurations will be avoided as far as possible at night and during unfavourable sea state conditions. Since low visibility doesn't allow for accurate visual detection and localization of marine mammals. The use of PAMs should be emphasized under these conditions and airgun emissions will be restricted as possible; ✓ Interruption of source energization at each acquisition line end when expected to be greater than 20 minutes. Airgun firing will be terminated at the end of the line and a full 20 minutes soft start will be undertaken before next line. A pre-shooting search will also be undertaken during the scheduled line change; ✓ A system of automated logging of acoustic source use will be developed to document the amount of acoustic energy produced, and this information will be reported to the Ministry of Environment and Energy following the completion of the seismic acquisition campaign. Stranding: ✓ During operations, existing stranding networks in the area will be alerted. The Port Authorities and relevant environmental organizations will be informed for recording potential stranding. ✓ In case of mass stranding or increased rate of individual stranding in the wider area, any acoustic emission should be stopped and the causes of the event, relationship with the seismic operations, and potential changes in marine mammals encounter rates as indication of their population density identified and investigated.
	Marine Protected Areas	High **Major** High	**Moderate**	Sensitive areas: ✓ Operations shall be designed in order to minimize as far as possible impacts on the identified sensitive area within and in proximity to the survey area, namely the Natura 2000 site "Diapontia Islands" Exclusion zones: ACCOBAMS Resolution 7.13 – Anthropogenic Noise - encourages Parties to "*avoid or minimize producing noise in marine protected areas, as well as in particular in areas containing critical habitat of cetaceans likely to be affected by man-made noise*", and to "*Avoid cetaceans' key habitats and marine protected areas, define appropriate buffer zones around them; consider the possible impact of long-range propagation*", while the "*JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys - August 2017*", suggests to consider the "*distance to sensitive areas and coastline to reduce any potential for entrapment (i.e. prevent animals from possibly being trapped between the vessel and shoreline)*". The Exclusion Zone proposed in the following has been determined according to the results of the noise modeling, considering a conservative distance from sensitive area as two times the distance to which animals are not expected to receive harmful noise levels (see Appendix B for further details). ✓ Exclusion Zones (EZ) with restrictions on navigation of seismic vessel and operation of airguns will be determined around the proposed sensitive area and shall be included in the planning of the seismic acquisition survey. The anticipated extents of the proposed Exclusion Zones are the following • Seismic Vessel Navigation Exclusion Zone of 800 m from the limit of the sensitive area, • Airgun operation Exclusion Zone of 1600 m from the limit of the sensitive area; ✓ The anticipated extents of the proposed Exclusion Zones will be evaluated during the initial phase of the seismic survey in conjunction with the relevant results of the monitoring program and shall be adjusted accordingly in order to avoid any impacts on the identified sensitive area. Notification to the Ministry of Environment and Energy must be sent for any adjustment of the limits of the Exclusions Zones, followed by the relevant supporting documentation; ✓ In order to better assess the noise contribution of the project activities, a base noise monitoring will be performed before the start and after the completion of the activities; ✓ In case of use of helicopter, flying over natural protected areas is avoided.
Light Emissions	Plankton	Medium **Minor** Low	**Minor**	✓ External lighting will be minimised to that required for navigation, vessel safety and safety of deck operations, except in the case of an emergency. ✓ Any stranded seabirds must be retrieved and released according to appropriate guidelines.
	Invertebrates	Medium **Minor**	**Minor**	

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
		Low		
	Seabirds	Medium **Moderate** Medium	**Moderate**	
Discharges (effluent and solid waste	Sea Water Quality	Low **Negligible** Low	**Negligible**	✓ Sewage will be treated on-board and managed in compliance with MARPOL 73/78 Annex IV "Prevention of pollution by sewage from ships"; oily waters will be managed in compliance with Annex I "Regulations for the Prevention of Pollution from oil" and all waste managed in compliance with Annex V "Prevention of pollution by garbage from ships" and in accordance with international and national regulations. More specifically, the following measures should be implemented: • sewage discharges will be treated and disinfected by means of on-board treatment plant and may be discharged more than 3 nautical miles from shore. Sewage shall be safely stored onboard when the ship is less than 3 nautical miles from the nearest land, • oily water may be stored on the vessel until their delivery to appropriate Port facilities. If this is not feasible, oil/water separators should be in place to ensure that any drainage from machinery spaces and bilge water discharged from the ship complies with the legal limits of no more than 15 mg/l of oil for oil-in-water discharge according to IMO (International Maritime Regulations) guidelines (MEPC 2003). • food wastes will be macerated to a diameter of less than 25 mm, prior to disposal. No food wastes will be directly discharged in the sea, • no plastics or garbage will be discharged to sea, • waste will be segregated into recyclables and dangerous wastes (including used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate disposal. • hazardous waste must be labelled accordingly, and disposed by specialist and registered waste disposal contractor, • prior to entry into port, Seismic Vessel Contractor will notify the Port Authorities of the types and quantities of waste being brought ashore for disposal; ✓ The seismic and chase/support vessels shall have a valid International Oil Pollution Prevention Certificate (IOPPC) and a valid International Sewage Pollution Prevention Certificate (ISPPC) applicable to vessel class in accordance to the requirements of Annex I and Annex IV of MARPOL 73/78; ✓ All vessels shall operate under an approved Oil Spill Contingency and Emergency Response Plan which details actions to be taken in the event of a shipboard emergency or oil spill in accordance with MARPOL 73/78 Annex I requirements; ✓ Seismic Vessel Contractor will be responsible for preparing and executing a Waste and Discharge Management Plan, in the framework of the Environmental and Social Management Plan, which will include among other provisions the following: ✓ ensure that solid and hazardous waste disposal is carried out in accordance with the appropriate laws and ordinances and in close cooperation with the local authorities, • All types of discharges and waste will be collected, sorted and disposed in accordance with the Waste and Discharge Management Plan, • Low-toxicity biodegradable detergents should be used in cleaning of all deck spillage, • Maintain a waste log including waste type, quantity and disposal method which will be reported in the Ministry of Environment at the end of the seismic survey along with the results of the monitoring program, • Ensure that on-board solid waste storage is secured, • Personnel will be trained in waste sorting and collection (adapted to position and generated waste types), • Waste will be reused and recycled where safe and practicable to do so; ✓ Any accidental release of waste to the marine environment that does not meet MARPOL discharge standards will be reported to relevant local authorities within a time framework of less than 12 hours; ✓ Safe Work procedures shall be developed and followed to prevent objects to being dropped; ✓ Personnel shall be trained with regard to the prevention of dropped objects during relevant meetings and the appropriate inductions; ✓ Lost equipment shall be relocated and recovered where safe and practicable to do so; ✓ Ballast Water Exchange shall occur prior to arrival, at an appropriate location; ✓ The seismic vessel shall comply with Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and should have been prepared in accordance with the IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53); ✓ Standard fuel supply procedures (safety valves) shall be followed during refuelling of support vessels in Port or in case of emergency refuelling at sea is needed; ✓ Pre-bunkering checklist shall be developed and implemented prior to refuelling of support vessels in Port or in case of emergency refuelling at sea is needed;
	Invertebrates	Low **Negligible** Low	**Negligible**	
	Corals	Low **Minor** Medium	**Minor**	
	Fish Fauna	Low **Negligible** Low	**Negligible**	
	Marine Mammals	Low **Moderate** High	**Minor**	
	Sea Turtles	Low **Moderate** High	**Minor**	
	Seabirds	Low **Minor** Medium	**Minor**	
	Posidonia Meadows	Low **Minor**	**Minor**	

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
		Medium		✓ Bunkering should commence during daylight hours and during acceptable sea and wind conditions in case of emergency refuelling at sea is needed; ✓ Spill response kits should be located in proximity to hydrocarbons bunkering areas and appropriately stocked/replenished as required; ✓ Crew induction should include spill prevention, reporting and use of spill response equipment ✓ Any significant fuel losses to the marine environment shall be reported to the relevant government agencies; ✓ All hydraulic systems should be adequately maintained, and all hydraulic hoses should be frequently inspected; ✓ Preventive maintenance, leak detection and repair programs for on-board equipment that may originate unwanted spill shall be implemented.
	Marine Protected Areas	Low **Moderate** High	**Minor**	✓ See the mitigation measures foreseen for other environmental receptors ✓ See the mitigation measures for Exclusion Zones reported for Noise Emissions;
Collisions and Entanglements of Marine Fauna	Marine Mammals	Medium **Major** High	**Moderate**	✓ See the mitigation measures for MMOs and PAM, Sensitive Areas, Exclusion/Mitigation Zones reported for Noise Emissions.
	Sea Turtles	Medium **Major** High	**Moderate**	✓ A Turtle Guard system will be installed on tail buoys on the streamers. This device effectively reduces the risk of sea turtle entanglement in the seismic equipment. ✓ Moreover, in case of entanglement, immediate intervention by appropriately trained personnel should be implemented. ✓ See also mitigation measures for MMOs and PAM, Sensitive Areas, Exclusion/Mitigation Zones reported for Noise Emissions.
Interference with Seabed	Zoobenthic Communities	Low **Negligible** Low	**Negligible**	✓ Ensure that the streamer is stretched as much as possible; ✓ Vessel should move on the route before the start point and after the endpoint of the acquisition line; ✓ Routine monitoring of the streamers; ✓ Streamers will be equipped with depth control devices (birds): ✓ See also mitigation measures for Sensitive Areas and Exclusion/Mitigation Zones reported for Noise Emissions and Measures.
	Corals	Low **Minor** Medium	**Negligible**	
	Posidonia Meadows	Low **Minor** Medium	**Negligible**	
Use of resources	Social context and human development	Low **Negligible** Low	**Negligible**	✓ Prepare a plan for optimization of fuel use to increase efficiency and minimize emissions, which should be included in the ESMP; ✓ A Stakeholder Briefing (plan for engagement) will be developed to ensure timely sharing of information on the details of the seismic survey; ✓ Seismic Contractor will recruit a Community Liaison Officer (CLO), based in Corfu, who will engage prior and during the seismic survey with the different local stakeholders (authorities, actors related to the maritime activities, fishing, tourism, etc.) in order to keep them informed about the coming and on-going activities and their timeframe and be able to gather their questions and concerns and respond to them; ✓ A grievance mechanism procedure will be developed and implemented to ensure that all stakeholders get the opportunity to raise a grievance related to the Project activities and provide a process for timely resolution of grievances; the CLO will inform local stakeholders about the existence of the grievance mechanism; ✓ The Community Liaison Officer (CLO) will be in-charge of the management of the grievances, in coordination with the Fishing Liaison Officer (FLO)
	Local and macro economy	Low **Negligible** Low	**Negligible**	
Navigation restrictions	Fishing activities	High **Major**	**Moderate**	✓ A Stakeholder Briefing (plan for engagement) will be developed to ensure timely sharing of information on the details of the seismic survey;

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
		Medium		✓ Operator will recruit a Community Liaison Officer (CLO), based in Corfu, who will engage prior and during the seismic survey with the different local stakeholders (authorities, actors related to the maritime activities, fishing, tourism, etc.) in order to keep them informed about the coming and on-going activities and their timeframe and be able to gather their questions and concerns and respond to them; ✓ Seismic Contractor will appoint No. 1 FLO, which will be based on a support vessel, to communicate with and meet with the various stakeholders linked to fishing activity to inform them of the seismic plan and associated timeframes. The FLO should liaise with all affected fishing vessels, particularly pelagic long-line fishing activities in the region to plan the placing of fishing gear, if possible, or provide additional notice of the areas of operations; Clear information will be provided to ensure that fishermen are aware that the Project will not exclude people from their fishing grounds but rather will cause only a temporary disturbance to fishing activities, if any. ✓ Appointed FLOs on-board must speak Greek, Italian and English in order to facilitate potential interaction with fishermen at the project area. ✓ Seismic Contractor must be responsible for the following: • Collaborate with the competent authorities for issuance of NAVAREA warnings for the area where seismic acquisition survey will take place as well as for the deployment area of the survey, before commencement of operations, • Prepare a 72-hours acquisition plan of operations which must be notified on a daily basis (until 10 a.m.) to the Corfu Port Authority and to the Central Coast Guard of Corfu presenting the area of operations within that time framework, • Collaborate with the competent authorities for issuance of NAVTEX – Notice to Mariners on a daily basis, in accordance to the 72-hours acquisition plan of operations, ✓ Seismic Contractor will use chase vessels in order to: • liaise with fishermen in the vicinity of the seismic vessel in the daytime and at night, • ensure navigational safety and appropriate management of interactions between the survey vessel and fishing vessels, • ensure that no vessels or fishing gear remain in the path of the seismic survey vessel; ✓ Operator and Seismic Contractor will ensure that: • Procedures are in place for dealing with grievances in the event of damaged fishing gear, managed through the grievance process; • The FLO liaises with the CLO for any concern and grievance related to fishing activity; ✓ All vessels will be equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.
	Port and Marine Traffic	High **Major** Medium	**Moderate**	✓ A Stakeholder Briefing (plan for engagement) will be developed to ensure timely sharing of information on the details of the seismic survey; ✓ A grievance mechanism procedure will be developed and implemented to ensure that all stakeholders get the opportunity to raise a grievance related to the Project activities and provide a process for timely resolution of grievances; the CLO will inform local stakeholders about the existence of the grievance mechanism; ✓ The Community Liaison Officer (CLO) will be in-charge of the management of the grievances, in coordination with the Fishing Liaison Officer (FLO); ✓ Mobile safety exclusion zone around the seismic vessel in order to avoid collision with other vessels. The safety zone will depend on the planned seismic vessel route, defined by a 72-hours acquisition plan which will be notified on a daily basis to the Corfu Port Authority and to the Central Coast Guard of Corfu. The perimeter is expected at least 2 nm in front, 3 nm at left and right and 6 nm on the back. The communication of timely information will help to raise awareness of seismic activity and potential disturbance to fishing and marine traffic activities, to help marine users to avoid the vessel, seismic equipment and the mobile safety zone; ✓ Complete fulfilment of the International Marine Traffic Regulation should be ensured. ✓ Seismic and support vessels must comply with all applicable standard maritime safety procedures, including 24-hr visual, radio and radar watch for vessels within and in the vicinity of the operational area, and display of appropriate navigational beacons and lights. ✓ All procedures and practices of Seismic and support vessels must be in accordance with the requirements of IMO's International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and Totals Standards ✓ Seismic and support vessels must be equipped with Automatic Identification System (AIS) and approved electronic navigation systems and radar on seismic vessel. ✓ The Community Liaison Officer (CLO) will communicate and meet, at least one month before the start of the activities, with the various stakeholders that are related with navigation activities and inform them of the seismic acquisition operation plan and associated timeframes.
	Tourist activities	High **Moderate** Low	**Minor**	✓ A Stakeholder Briefing (plan for engagement) will be developed to ensure timely sharing of information on the details of the seismic survey; ✓ Seismic Contractor will recruit a Community Liaison Officer (CLO), based in Corfu, who will engage prior and during the seismic survey with the different local stakeholders (authorities, actors related to the maritime activities, fishing, tourism, etc.) in order to keep them informed about the coming and on-going activities and their timeframe and be able to gather their questions and concerns and respond to them; ✓ A grievance mechanism procedure will be developed and implemented to ensure that all stakeholders get the opportunity to raise a grievance related to the Project activities and provide a process for timely resolution of grievances; the CLO will inform local stakeholders about the existence of the grievance mechanism; ✓ The Community Liaison Officer (CLO) will be in-charge of the management of the grievances, in coordination with the Fishing Liaison Officer (FLO);

Potential Impact	Environmental and Social Receptor/Feature	Unmitigated Effect Intensity **Impact Severity** Vulnerability Sensitivity	Mitigated **Impact Severity**	Mitigation Measures
				✓ Operator should ensure that Seismic Acquisition Survey will be commenced as early as practicable within the operational window of November to December 2020, in order to avoid as far as possible coincidence with period of tourist activities, which for the project area starts at April and ends in October.
Presence of Foreign Workers	Social context and human development	Low **Negligible** Low	**Negligible**	The seismic survey will be conducted in a manner that respects the human rights and the dignity of all people, complying with all legal requirements. In particular: ✓ All internationally recognized human rights, as set out in the International Bill of Human Rights and the International Labour Organization's declaration on Fundamental Principles and Rights at Work will be respected as well as the relevant requirement of Greek Legislation. ✓ All human and labour rights will be respected, as stated in the United Nations Guiding Principles (UNGP)on Business and Human Rights. ✓ All workers, employees and suppliers will be treated fairly and without discrimination and will be entitled to work in an environment and under conditions that respect their rights and dignity. ✓ The rights of people in communities potentially impacted by the seismic acquisition activities will be respected. ✓ Operator and Seismic Contractor will ensure that contractual commitments will guarantee that all subcontractors and suppliers adhere to the aforementioned principles.
Operational expenses	Local and macro economy	Low **Negligible** Low	**Negligible**	✓ Local provisions and supplies and any recruitment (e.g. CLOs, FLOs) must be enhanced in order to increase the benefits of the project on local economy.

8 ENVIRONMENTAL RISK ANALYSIS

This section contains the results of the identification and the qualitative evaluation of the environmental risks associated to the seismic survey activities.

The risk analysis is based on the information provided for the specific activity as described in the project description (Section 3) and, where applicable, on the basis of other similar projects.

8.1 METHODOLOGY

The applied methodology for the risk analysis is the Analysis approach “ENVID” (Environmental risk Identification), a consolidated and widespread methodology, especially utilized in the Oil &Gas sector. The environmental risks associated with the proposed seismic operations have been assessed by the following methodology:

- ✓ Identification of the aspects/ sources of environmental risks associated with the seismic survey;
- ✓ Identification of the receptors at risk within and adjacent to the survey area;
- ✓ Definition of the potential environmental effect of the risk;
- ✓ Identification of the likelihood of occurrence and potential consequences;
- ✓ Determination of overall environmental risk levels using a likelihood and consequence matrix;
- ✓ Identification of control measures associated with every aspect/source of risk and evaluation of residual risk level;
- ✓ Identification of additional risk reducing measures if necessary, in the case of critical risks.

The aspects/sources of risk identification involved a preparatory phase, which defined the limits of the analysis and was conducted according to the systematic application of a checklist in order to identify the environmental risks associated with the different phases of the project. The identification of environmental risks has been conducted only for those activities related to accidental events potentially concerning the environment (i.e. accidental release of hazardous waste).

Once identification of the activities and risks was complete, the potential impacts of each were identified. Each environmental risk was considered in turn against each sensitive receptor in the surrounding environment for a potential interaction.

The environmental risk analysis required each activity/source of risk that have an associated impact to be qualitatively ranked by risk categories, ranging from “high” through “medium” to “low”. This method involved the identification of the likelihood and the consequence for each potential impact and based on this, the determination of the level of risk through the application of an environmental risk matrix.

For each aspect/source of risk, the mitigation measures (column "control measures") and the environmental or social management plans scheduled for the implementation of these measures (column “Reference docs”) were documented and the residual risk level was evaluated.

When critical risks where identified, these were addressed either by avoiding the activity or by adopting an alternative process with a lower associated risk to the environment or by proposing additional risk reducing measures.

8.2 IMPLEMENTATION OF ENVIRONMENTAL RISK ANALYSIS

The calculated risk is divided into three main categories of values: Low Risk (acceptable), Medium Risk (ALARP - As Low As Reasonably Practicable - Both low as pragmatically as possible), and High Risk (Unacceptable):

- ✓ **Low Risk:** it is a typically acceptable risk, without further implementation or improvement measures. Within this category fall the risks for which are not expected significant impacts regardless of the frequency of occurrence or, on the contrary, the risks for which the frequency of occurrence is not probable. With Low Risk, operations can be carried out without additional measures;
- ✓ **Medium Risk:** it is a risk which is not negligible, against which must be put in place all possible measures for prevention and mitigation measures to make it acceptable. When a risk is ALARP is mandatory to try to decrease it as much as possible, by acting on the prevention (i.e. lowering the frequency of occurrence) or mitigation (i.e. reducing the impact of the possible consequences) in a pragmatic way that is without the disproportionate increase of costs instead the achieved benefits. When everything possible is done to reduce

the risk, it can be assumed that the risk is "controlled" (ALARP) and operations may continue;

- ✓ **High Risk (unacceptable)**: it is a risk where, without a significant improvement, the condition is not acceptable. In this case, solid measures must be put in place to prevent or mitigate the risk by ensuring that the expected frequency, the expected consequences, or both, are reduced significantly (i.e. to controlled or acceptable risk).

The Probability and Qualitative Classes of Consequence used are shown in the following Tables 8.1 and 8.2.

Table 8.1: Probability Class

Value	Probability class	Description
A	NEGLIGIBLE PROBABILITY	Not expected that the event happens during the activity
B	LOW PROBABILITY	Exists the possibility that the event happens during the activity
C	MEDIUM PROBABILITY	Reasonable to expect that the event happens during the activity
D	HIGH PROBABILITY	Very probable that the event happens during the activity

Table 8.2: Consequence Class

Value	Consequence class	Description
0	NO DAMAGE EXPECTED	No significant environmental damage is expected
1	MINOR DAMAGE	The environmental damage is expected to be minor and recoverable
2	MEDIUM DAMAGE RECOVERABLE	The environmental damage is expected to be medium and recoverable
3	SIGNIFICANT DAMAGE	The expected environmental damage is significant and it is considered difficult to be recovered
4	EXTENDED DAMAGE	The expected environmental damage is extensive and probably irrecoverable

The Risk Matrix used for risks identification is reported in the following figure.

PROBABILY CLASS							
	HIGH PROBABILITY	D	D0	D1	D2	D3	D4
	MEDIUM PROBABILITY	C	C0	C1	C2	C3	C4
	LOW PROBABILITY	B	B0	B1	B2	B3	B4
	NEGLIGIBLE PROBABILITY	A	A0	A1	A2	A3	A4
			0	1	2	3	4
			NO DAMAGE EXPECTED	MINOR DAMAGE	MEDIUM DAMAGE RECOVERABLE	SIGNIFICANT DAMAGE	EXTENDED DAMAGE
			ENVIRONMENTAL DAMAGE				

	Low Risk (acceptable)
	Medium Risk: everything possible is done to reduce the risk
	High Risk (inacceptable): measures must be put in place to prevent or mitigate the risk

Figure 8.1: Generic Environmental Risk Assessment Matrix

Table 8.3 presents the interaction matrix between the aspects/sources of risks and the environmental and social receptors.

The matrix with the overall environmental risk analysis is reported in the following Table 8.4, with identification of:

- ✓ Activities/sources of risks;
- ✓ Affected receptors;
- ✓ Potential effects;
- ✓ Risk evaluation from the combination of probability and consequence;
- ✓ Any identified/suggested control measure aiming to reduce the level of risk;
- ✓ Residual risk evaluation after the implementation of the control measures.

Table 8.3: Aspects/Sources of Risks and Receptor Interaction Matrix

ASPECT/SOURCE OF RISK	AIR QUALITY	SEA WATER QULITY	PLANKTON	ZOOBENTHIC COMMUNITIES	INVERTEBRATES	CORALF	FISH FAUNA	MARINE MAMMALS	SEA TURTLES	SEABIRDS	POSIDONIA MEADOWS	MARINE PROTECTED AREAS	FISHING ACTIVITIES	PORT AND MARINE TRAFFIC	TOURISM ACTIVITIES	HISTORICAL AND CULTURAL ELEMENTS	LOCAL AND MACROECONOMY	SOCIAL CONTEXT AND HUMEN DEVELOPMENT
Dropping or loss of a streamer and associated equipment				X		X												
Introduction of invasive marine species (IMS) from vessel ballast water discharge and biofouling							X					X						
Accidental release of hazardous waste from the seismic and support/chase vessels		X	X	X	X	X	X	X	X	X		X						
Accidental release of non-hazardous waste from the seismic and support/chase vessels		X	X	X	X	X	X	X	X	X		X						
Accidental release of hydrocarbons to the marine environment during sea emergency refuelling (bunkering) of the seismic vessel		X	X	X	X	X	X	X	X	X	X	X						
Accidental oil leakage		X	X	X	X	X	X	X	X	X	X	X						
Release of hydrocarbons due to a vessel collision		X	X	X	X	X	X	X	X	X	X	X	X					
Accidents involving fishing activities													X					
Accidents involving other marine vessels													X	X	X			
Accidental off-specification airgun operations			X	X	X	X	X	X	X	X								
Helicopter accident																		X

Table 8.4: Environmental Risk Analysis Matrix

ASPECT/ SOURCE OF RISK	ENVIRONMENTAL/SOCIAL RECEPTOR	POTENTIAL IMPACT	PROBABILITY	CONSEQUENCE	RISK	CONTROL MEASURE	REFERENCE DOCS	RESIDUAL RISK
Dropping or loss of a streamer and associated equipment	Zoobenthic communities Corals	Physical damage to benthic habitats and communities Physical damage to corals	B	2	B2	Safe Work procedures developed and followed to prevent objects being dropped Routine monitoring of the streamers Use of solid streamers rather than fluid (oil) filled streamers The streamers are fitted with pressure-activated, self-inflating buoys (SRDs) Streamers will be equipped with depth control devices (birds) Personnel will be trained with regard to the prevention of dropped objects during relevant meetings and the appropriate inductions Lost equipment will be relocated and recovered where safe and practicable to do so		A2
Introduction of invasive marine species (IMS) from vessel ballast water discharge and biofouling on the seismic and support vessels	Marine protected areas Fishes	Displacement of native marine species, Reduction in species biodiversity and decline in ecosystem integrity of the surrounding marine environment	B	3	B3	Ballast Water Exchange will occur prior to arrival at an appropriate location The seismic vessel must comply with Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and should have been prepared in accordance with the IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53).	Environmental and Social Monitoring	A3
Accidental release of hazardous waste from the seismic and support/chase vessels	Sea water quality, Marine fauna, Marine protected areas	1. Pollution or contamination of the marine environment 2. Localised and temporary reduction in water quality resulting in toxic effects on marine fauna 3. Injury or mortality of marine fauna through ingestion	B	3	B3	Procedures comply with MARPOL 73/78 requirements for waste management Correct segregation and disposal of hazardous waste Maintain a waste log including waste type, quantity and disposal method Any accidental release of hazardous waste to the marine environment will be reported immediately to relevant government agencies. Hazardous waste must be labelled accordingly, and disposed by specialist and registered waste disposal contractor.	Waste and Discharge Management Plan	A2
Accidental release of non-hazardous waste from the seismic and support/chase vessels	Sea water quality, Marine fauna, Marine protected areas	1. Pollution or contamination of the marine environment 2. Localised and temporary reduction in water quality resulting in toxic effects on marine fauna 3. Injury or mortality of marine fauna through ingestion	B	2	B2	Procedures comply with MARPOL 73/78 requirements for waste management Correct segregation and disposal of non-hazardous waste Maintain a waste log including waste type, quantity and disposal method Waste will be relocated and recovered where safe and practicable to do so Any accidental release of non-hazardous waste to the marine environment that does not meet MARPOL discharge standards will be reported immediately to relevant government agencies.	Waste and Discharge Management Plan	A2

ASPECT/ SOURCE OF RISK	ENVIRONMENTAL/SOCIAL RECEPTOR	POTENTIAL IMPACT	PROBABILITY	CONSEQUENCE	RISK	CONTROL MEASURE	REFERENCE DOCS	RESIDUAL RISK
Accidental release of hydrocarbons to the marine environment during emergency refuelling (bunkering) of the seismic vessel at sea	Sea water quality, Marine fauna, Marine flora Marine protected areas	1. Temporary and localised reduction in water quality leading to toxic effects on marine biota 2. Direct toxic or physiological effects on marine biota, particularly mammals, sea turtles, seabirds and fish fauna	B	2	B2	Procedures comply with MARPOL 73/78 requirements Standard fuel supply procedures (safety valves) Pre-bunkering checklist developed and implemented Bunkering to commence during daylight hours and during acceptable sea and wind conditions Spill response kits located in proximity to hydrocarbons bunkering areas and appropriately stocked/replenished as required Crew induction to include spill prevention, reporting and use of spill response equipment Any significant fuel losses to the marine environment will be reported to the relevant government agencies	Oil spill contingency and emergency response plan	A2
Accidental oil leakage	Sea water quality, Marine fauna, Marine flora Marine protected areas	1. Temporary and localised reduction in water quality leading to toxic effects on marine biota 2. Direct toxic or physiological effects on marine biota, particularly mammals, sea turtles, seabirds and fish	B	2	B2	Procedures comply with MARPOL 73/78 requirements All hydraulic systems should be adequately maintained and all hydraulic hoses should be frequently inspected. Preventive maintenance, leak detection and repair programs for on-board equipment that may originate unwanted spill will be implemented. Solid streamer will be used (no oil release ills in case of unlikely accidental breakage). Spill response kits located in proximity to hydrocarbons storage areas and appropriately stocked/replenished as required Crew induction to include spill prevention, reporting and use of spill response equipment	Oil spill contingency and emergency response plan	A2
Release of hydrocarbons due to collision of vessels	Sea water quality, Marine fauna, Marine flora Marine protected areas Fishing Activities	1. Reduction in water quality leading to toxic effects on marine biota 2. Direct toxic or physiological effects on marine biota, particularly mammals, sea turtles, seabirds and fish 3. Socio-economic impacts on commercial fishing	A	3	A3	Vessels comply with safety navigation requirements Procedures comply with MARPOL 73/78 requirements Spill response kits located in proximity to hydrocarbons storage areas and appropriately stocked/replenished as required Crew induction to include spill prevention, reporting and use of spill response equipment Fishermen and other mariners will be alerted of survey vessels' presence and extent of towed array.	Oil spill contingency and emergency response plan	A2
Accidents involving fishing activities	Fishing Activities	Damage to fishing gear (e.g. nets/lines swept away or entangled in the airgun arrays/towed streamers or the seismic vessel)	B	2	B2	A Stakeholder Briefing will be developed to ensure timely sharing of information on the movement of survey vessels. Support vessels on standby to respond to implementation of exclusion zones if required and to manage interactions between survey vessel and fishing vessels. An updated 72-hours acquisition plan must be notified in daily basis (until 10 a.m.) to the Corfu Port Authority and to the Central Coast Guard of Corfu Navigation instruments to constantly control and monitor the position of the towed equipment	Stakeholder Briefing	A2
Accidents involving	Fishing Activities	Damage to vessels	B	2	B2	The seismic and support/chase vessels will comply with all applicable standard maritime safety procedures including 24-hr	Stakeholder Briefing	A2

ASPECT/ SOURCE OF RISK	ENVIRONMENTAL/SOCIAL RECEPTOR	POTENTIAL IMPACT	PROBABILITY	CONSEQUENCE	RISK	CONTROL MEASURE	REFERENCE DOCS	RESIDUAL RISK
marine vessels	Port and Marine traffic Tourism Activities					visual, radio and radar watch for vessels within and in vicinity of the navigation area and display of appropriate navigational beacons and lights A Stakeholder Briefing will be developed to ensure timely sharing of information on the movement of survey vessels. An updated 72-hours acquisition plan must be notified in daily basis (until 10 a.m.) to the Corfu Port Authority and to the Central Coast Guard of Corfu Support vessels on standby to respond to implementation of exclusion zones if required and to manage interactions between the survey vessel and ships Navigation instruments to constantly control and monitor the position of the towed equipment		
Accidental off-specification airgun operations	Marine fauna Marine Mammals Sea Turtles Marine protected areas	Disruption and/or Injury of marine fauna Behavioural disturbance to marine mammals and sea turtles	A	3	A3	Optimum airgun configurations to ensure that the lowest possible sound level of airguns is selected for the required activity	Environmental and Social Monitoring	A2
Helicopter accident	Social context and human development	Injury and/or mortality of crew	B	4	B4	Comply with safety flying procedures Helicopter use during daylight hours and acceptable wind and sea conditions		A4

8.3 RESIDUAL RISK ASSESSMENT AND PRIORITIZATION OF INTERVENTION

The environmental risk analysis has identified 11 environmental risks.

- ✓ 8 environmental risks have been evaluated as acceptable (Low Risk);
- ✓ 3 environmental risks have been evaluated as ALARP (Medium Risk). These risks concern the following:
  - the introduction of invasive marine species (IMS) from vessel ballast water discharge and biofouling on the seismic and support vessels,
  - the accidental release of hazardous waste from the seismic and support/chase vessels, and
  - a helicopter accident.

The best practicable and reasonable effort shall be exercised to reduce these environmental risks.

The mitigation measures plan proposed to be carried out during the seismic survey reduce their risk value, turning them all, to acceptable levels or risk (Low risk).

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FRAMEWORK

9.1 SCOPE AND OBJECTIVES OF ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) will be developed and implemented by the Operator and will form the framework for managing social and environmental impacts throughout project execution (which includes the pre-survey, the survey and post survey stages).

The ESMP will include the following:

- ✓ a commitment register in which the Operator will list all the commitments within this Environmental Action Plan that are to be implemented throughout project execution;
- ✓ a legal register of legislation applicable to the project;
- ✓ the Environmental and Social Management Plans that should be implemented through project execution;
- ✓ a schedule of monitoring, inspections and audits of environmental and social performance that includes checking that the Block 2 Seismic Survey Contractor is meeting the expectations set out in the Environmental Action Plan; and
- ✓ implementation of an action tracking system to monitor the findings of inspections and audits that do not conform to the Environmental Action Plan and the implementation of corrective actions.

The ESMP will be used to deliver the environmental and social commitments (as set out within the commitments register) and to coordinate and review the environmental and social performance of the project throughout its execution.

Special consideration will be given to the following:

- ✓ practical training and raising the environmental and social awareness of personnel;
- ✓ supervision and monitoring of environmental and social issues in the field; and
- ✓ continuous improvement of environmental and social performance throughout the project.

As part of its commitment in environmental and social performance, Operator will ensure the following:

- ✓ fulfil all environmental and social conditions associated with project approvals;
- ✓ develop, promote and foster a shared sense of responsibility for environmental and social performance of the project;
- ✓ promote environmental awareness and understanding among employees and Contractors through training, identification of roles and responsibilities towards environmental and social management and linking project performance to overall environmental and social performance;
- ✓ encourage an understanding of social and cultural sensitivities in local communities and the importance of minimizing project impacts on local lifestyles and culture;
- ✓ monitor environmental and social performance throughout the project and implement an adaptive management approach to continuous improvement;
- ✓ work with local communities and project affected stakeholders to ensure that they benefit as a result of project development; and
- ✓ maintain an ongoing commitment to informing, engaging and involving local stakeholders throughout all phases of the project.

This ESMP should be designed as an overriding document in a hierarchy of control plans, and sets out the overarching framework of environmental and social management principles that will be applied to the project. The ESMP will contain guiding environmental principles and procedures for communication, reporting, training, monitoring and plan review to which all Operator's staff, Contractors and sub-Contractors are required to comply with throughout all the phases of the seismic survey.

The ESMP should be also considered as an overall framework document that establishes the terms of reference for all project environmental and social sub-plans that will be completed including the following:

- ✓ Waste and Discharge Management Plan;
- ✓ Biodiversity Management Plan;
- ✓ Oil Spill Contingency and Emergency Plan;
- ✓ Environmental and Social Monitoring Plan;
- ✓ A Stakeholder Briefing.

9.2 ROLES AND RESPONSIBILITIES

The Operator will have the overall responsibility for managing the Block 2 Seismic Acquisition Survey as well as monitoring and auditing of the technical, safety, environmental and socio-economic performance of the Seismic Contractor, through the implementation of the ESMP. The Seismic Contractor will be required to cooperate with the Operator for the development and implementation of the ESMP and ensure conformance against this system.

The Operator and the Seismic Contractor are committed to providing resources essential to the implementation and control of the ESMP. Resources include the appropriate human resources and specialised skills.

The structure for the organisation responsible for the implementation of the ESMP is outlined in the next paragraphs and is shown in the following chart.

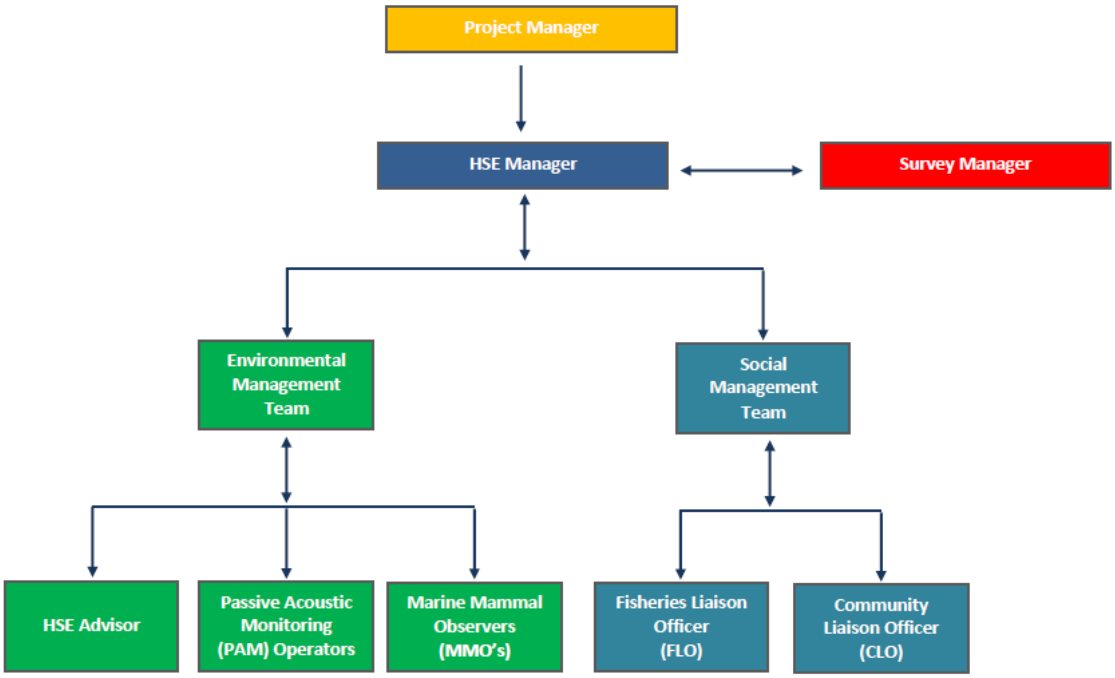

Figure 9.1: Environmental and Social Management Plan Flowchart

The organization and structure of the seismic Contractor team, including roles and responsibilities for all key personnel on-board the survey vessel, are reported in the following.

All staff and contractors taking part in the survey will be advised of their responsibilities prior to commencement of survey activities. A dedicated induction meeting will ensure all key personnel understand their roles. If contractor's personnel do not have appropriate skills to undertake the identified responsibilities training will be provided or will be replaced with competent personnel.

Key responsibility with regard to the implementation and management of the ESMP, are reported in the following.

Project Manager

- ✓ the Project Manager will have overall responsibility for the execution of the Project;
- ✓ the Project Manager will be directly responsible for the management of Operator's staff and of Contractors;
- ✓ the Project Manager will ensure that contractors are informed and understand environmental and social requirements before the commencement of the activities;
- ✓ the Project Manager will have responsibility for environmental and social matters and for seeing that activities are carried out safely and in accordance with the requirements of the ESMP;
- ✓ the Project Manager will verify that environmental and social requirements are implemented in full, both by Operator and Contractors;
- ✓ the Project Manager will seek for support from the Operator Environmental and Social coordinators when necessary, upon request of the HSE Manager;
- ✓ the Project Manager will verify that there are adequate planning and sufficient resources in place for the implementation of the ESMP;
- ✓ the Project Manager will be responsible for ensuring that all operations permissions (including relevant clearances, permits, licenses and necessary approvals from the relevant authorities) exist and are valid prior to commencing the survey;
- ✓ the Project Manager will be responsible for ensuring that final details of the survey (including coordinates of seismic lines, schedule and seismic survey vessel specifications) are communicated to the relevant authority prior to commencing the survey.

Survey Manager

- ✓ the survey will be carried out under the management of the Survey Manager who will have overall authority and responsibility for vessel operation and navigation, and safety of the vessel and the crew in accordance with applicable laws and regulations;
- ✓ the Survey Manager will train, or verify that the crew receives the necessary training with regard to on-board safety and environmental control requirements;
- ✓ the Survey Manager is Responsible for immediately notifying the Project Manager of any incidents/activities arising from vessel operations that are likely to have a negative impact on the performance objectives detailed in the ESMP.

Health, Safety and Environmental Manager (HSE Manager)

- ✓ the HSE Manager will ensure the implementation of commitments as defined in the Environmental Action Plan (EAP) and the proper implementation of the ESMP;
- ✓ the HSE Manager will be responsible for the development of all project environmental and social sub-plans, such as the following:
  - Waste and Discharge Management Plan,
  - Oil Spill Contingency and Emergency Plan,
  - Environmental and Social Monitoring Plan,
  - Stakeholder Briefing;
- ✓ the HSE Manager will have the overall responsibility for the health, safety and environmental management on-board the vessel, and for ensuring that appropriate control and mitigation measures are implemented to minimise potential environmental effects resulting from vessel operations (e.g. waste management/disposal, and fuel/oil spill response);
- ✓ the HSE Manager will verify that the crew receives the necessary training with regard to on-board health and safety and environmental control requirements;
- ✓ the HSE Manager will verify that the crew receives the necessary training with regard to social conduct with local stakeholders, in order to ensure that all workers will have a proper and respectful behaviour;
- ✓ the HSE Manager will report to the Project Manager for providing information about the status of implementation of the ESMP;
- ✓ the HSE Manager will report to the Project Manager of any emergency situations;

- ✓ the HSE Manager will review Environmental and Social Reporting to the environmental authorities in accordance to the requirements of the EAP and the ESMP;
- ✓ the HSE Manager will review the outcome of implementation of the ESMP and propose in accordance with the rest of the team the required correction actions;
- ✓ the HSE Manager will be on the survey vessel during the survey and present in the port before and after the survey;
- ✓ where required the HSE Manager will act as intermediary between the Project Manager and MMOs and PAMs Operators to resolve issues that may arise related to the implementation of environmental mitigation or monitoring requirements;
- ✓ where required the HSE Manager will act as intermediary between the Project Manager and the FLO and the CLO, to resolve issues that may arise related to the implementation of social mitigation or monitoring requirements.

Fishing Liaison Officer (FLO)

- ✓ a FLO will conduct pre-survey consultation with fishing operators and organisations, and will assist with fishing issues before, during, and after survey activities. The FLO is central to the process of mitigating potential impacts on fishing activities;
- ✓ appointment of the FLO by the Seismic Contractor will be undertaken taking into consideration that sufficient time is required for establishing a working relationship with the fishing industry and fisheries regulators;
- ✓ the role of the FLO will include:
  - coordinating on a daily basis with the CLO and the HSE Manager, to ensure they are both on the same page regarding engagements, management of concerns, questions and grievances related to fishing activity,
  - reporting to the HSE Manager on a daily basis;
  - establishing a system of communication with local fishing enterprises, government fisheries agencies, and Port Authorities in advance of surveys,
  - communicating details of the surveys to fishing operators, including the survey plan and schedule, in advance of commencing activities,
  - communicating updates (including changes) to fishing operators during the course of survey activities,
  - liaising with fishing operators with regard to grievances,
  - coordinating with chase vessels during surveys with regards to communicating with fishing operators in the area,
  - coordinating with the MMOs if necessary;
- ✓ the FLO will be required to acknowledge and act according to the authority of the Survey Master, while on-board the seismic survey fleet.

Community Liaison Officer (CLO)

- ✓ appointment of the CLO by the Seismic Contractor will be undertaken taking into consideration that sufficient time is required for establishing a working relationship with the different local stakeholders;
- ✓ the CLO will implement the Stakeholder Briefing part of the ESMP;
- ✓ the CLO will report to the HSE Manager on a daily basis;
- ✓ the CLO will liaise with the FLO on a regular basis (ideally daily), to ensure a good coordination regarding stakeholders related to the fishing activity;
- ✓ the CLO will communicate to all key project stakeholders, information of the project, goals and objectives as well as environmental protections actions;
- ✓ the CLO will cooperate with local authorities for issue related to project implementation;
- ✓ the CLO will ensure support on conducting any required meetings with stakeholders;
- ✓ the CLO will maintain a Grievance Mechanism register, and will investigate and resolve complaints received from stakeholders in coordination with the FLO and the HSE Manager; in particular, all solutions proposed to resolve a grievance which cannot be resolved immediately, shall be first submitted to the approval of the HSE Manager or the Operator Social Performance Coordinator;

- ✓ the CLO will organize answers to stakeholder queries and will address any socioeconomic issues affecting local communities;
- ✓ the CLO will produce Minutes of Meetings and will assure the recording of them in accordance with the requirements of the ESMP;
- ✓ the CLO will train staff on social context and conduct, workers' rights, and how to apply the relevant procedures of the Project's ESMP.

HSE Advisor

- ✓ the HSE advisor will provide support and guidance in legislative compliance to the relevant HSE Manager;
- ✓ will provide guidance and oversight for all offshore operational activities;
- ✓ will support the review and revision of HSE procedures and work practice;
- ✓ will participate in incident investigation and risk management;
- ✓ will provide support to the FLO, the CLO, MMOs and PAM operators;
- ✓ will provide audit were necessary in operational activities.

Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) Operators

Monitoring of marine fauna will be led by the vessel-based monitoring team, which will consist of at least 2 Marine Mammal Observers (MMOs) on watch at a time and a Passive Acoustic Monitoring (PAM) Operator. Considering that visual monitoring is requested for the entire daylight period and in order to ensure that all operators may operate in the best working conditions, at least 3 MMO's will be needed: 2 on watch and 1 at rest, with max. 2 hours operating shifts and a shift change each hour. Experienced and dedicated PAM operators will also be present in order to cover the 24/24h monitoring. The vessel-based monitoring team will be responsible for implementing the requirements of the Environmental and Social Monitoring Plan specified in the EAP and the ESMP.

Marine Mammal Observers (MMOs)

The Marine Mammal Observers (MMOs) will be experienced marine biologists and certified ACCOBAMS Highly Qualified MMOs (as per ACCOBAMS Resolution 6.18 "*Implementation of an ACCOBAMS certification for highly qualified marine mammals observers*" adopted in November 2016 and according to the "Progress report on the implementation of an ACCOBAMS certification for highly qualified MMOs/PAM", presented during the MOP7 in November 2019) or, in case the Seismic Contractor can prove that ACCOBAMS HQ MMOs are not available, JNCC or BOEM approved, with previous marine mammal observation experience in the wider project area. The MMO will also be qualified in the identification and observation of other marine fauna that might be included in the monitoring program.

The MMOs will be watching for marine mammals from the best available vantage point on the survey vessels, typically the bridge.

The MMOS will be on board for the entire duration of the seismic survey so that they are able to provide input to operational decisions and implement mitigation procedures whenever necessary.

For the proposed survey activities, at least three MMOs will be needed to ensure that daylight hour monitoring requirements are fully covered (two on watch and one at rest). Moreover, experienced and dedicated PAM operators will ensure the 24/24h coverage of monitoring activities within the Mitigation Zone.

MMOs will have the independence and authority to recommend stopping the survey activities (including seismic shooting) to the Survey Manager in response to circumstances that may harm marine fauna as described in the EAP and ESMP.

The MMO's duties will include the following:

- ✓ prior to the commencement of a soft start, monitoring the mitigation zone for a prescribed period during daylight hours to determine if the area is clear of certain marine fauna; and
- ✓ during and after the firing of the airgun array, monitoring the mitigation zone and area around the mitigation zone during daylight hours for the presence and behaviour of certain marine fauna.

Where there is a clear risk to marine mammals, the MMO has the authority to intervene and notify the vessels' crew so that operations shall be suspended immediately.

It is duty of the MMOs to report incidents with marine mammals to the HSE Manager and to document findings in a daily monitoring report filling the standard "Cetacean Sighting Report" available by ACCOBAMS and also update

the International Noise Register developed by ACCOBAMS (as recently introduced by the ACCOBAMS Resolution 7.13 – Annex 2 "Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area" of November 2019).

It is also duty of the MMOs to prepare a detailed report of real-time mitigations, within one month after the completion of the operations, following the ACCOBAMS standard form (as presented in October 2019 during MOP7 within the "*Methodological Guide: Guidance on Underwater Noise Mitigation Measures*" – ACCOBAMS-MOP7/2019/Doc 31Rev1).

Passive Acoustic Monitoring (PAM) Operators

The PAM system will be controlled by qualified PAM operators (possibly Highly Qualified PAM operators according to ACCOBAMS Resolution 6.18 "*Implementation of an ACCOBAMS certification for highly qualified marine mammals observers*" adopted in November 2016 and according to the "Progress report on the implementation of an ACCOBAMS certification for highly qualified MMOs/PAM", presented during the MOP7 in November 2019), in order to ensure the continuous acoustic monitoring 24/24 h per day. The PAM operators will be specially trained in the operation of and maintenance of the PAM system and in the interpretation of the PAM detection signals.

The PAM operators will be on board for the entire duration of the seismic survey so that they are able to provide input to operational decisions when necessary.

The PAM system will be in constant 24-hour operation for the duration of the survey. The PAM system will be used to supplement visual monitoring and also to ensure monitoring at all times since adverse sea and climatic conditions may preclude optimal monitoring by MMOs.

The PAM operator's duties will include the following:

- ✓ prior to the commencement of a soft start, monitoring for a prescribed to detect the presence of marine mammals; and
- ✓ during and after the firing of the airgun array, monitoring for the presence of marine mammals.

The primary responsibilities of the PAM operator are to detect marine mammal sounds and document findings in a daily report.

It is duty of PAM operators to integrate the final report of real-time mitigations previously mentioned.

9.3 KEY PARTS OF THE ESMP

9.3.1 Waste and Discharge Management Plan

The objectives of the Waste and Discharge Management Plan (WDMP) are to provide a framework to ensure that produced waste and discharges are managed under conditions that prevent significant impacts on the environment. The Waste and Discharge Management Plan (WDMP) will include the list of produced waste, their classification, segregation procedures and recording system until final disposal in compliance with local and international regulation. The main objectives of the WMP are to:

- ✓ Minimize the generation of waste material by judicious use of materials and reuse or recycling of materials, when feasible;
- ✓ Treat or dispose waste with a minimum impact on the surrounding environment, and;
- ✓ Enhance awareness of the staff on-site about proper waste management procedures.

The Waste and Discharge Management Plan (WDMP) will fully comply with international standards regulated under MARPOL 73/78 and relevant legislation.

The key points of the Waste and Discharge Management Plan are summarized below.

Waste classification

Waste is classified into two main groups according to danger criteria: hazardous waste and non-hazardous waste. Non-hazardous waste is household waste and similar from industrial activity. Hazardous waste is waste creating nuisance due to flammability, reactivity, corrosiveness, toxicity to humans and the environment, and requiring careful and controlled disposal.

Generated waste (hazardous and non-hazardous) is expected to be like those of a vessel of similar size

Waste identification, quantification and monitoring

An inventory of generated waste shall be kept updated. In order to obtain an effective waste monitoring. In that framework the following actions shall be carried out:

- ✓ Label waste containers;
- ✓ Estimate the tonnage of each waste collected into each type of containers;
- ✓ Control sub-Contractor in charge of waste handling, transport and disposal.

Registers will be used to record and track all waste generated by the vessel. Waste transfer and treatment will be monitored until final disposal. As per MARPOL Convention, the vessel will maintain a garbage record book on-board.

Waste collection and disposal

Solid waste will be regulated by MARPOL 73/78 Annex V "Prevention of pollution by garbage from ships"[53]. All waste must be collected and disposed of in appropriate bins/skips/containers. The waste collection principles include:

- ✓ Incompatible / inter-reacting substances shall not be mixed (e.g. spent oils and waste paints) under any circumstances.
- ✓ Personnel will be trained in waste sorting and collection (adapted to position and to waste generated).

No solid waste discharge from the support vessel and the chase/support vessels is permitted (with the exception of food waste under certain circumstances) and crew members should also be aware that garbage and debris should not be discharged into the sea. All waste including plastics, metals and oils will be segregated and re-used or recycled where possible.

The following operating practices should be observed:

- ✓ All waste generated on board will be managed in accordance with international and national regulations.
- ✓ Food wastes will be triturated and may be discharged offshore, more than 12 nautical miles from the shore;
- ✓ No plastics or garbage will be discharged to sea;
- ✓ waste will be segregated into recyclables and dangerous wastes (used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate treatment/disposal;
- ✓ Hazardous waste must be labelled accordingly and disposed by specialist and registered waste disposal Contractor.
- ✓ Prior to entry into port, notify the Port Authorities of the types and quantities of waste being brought ashore for disposal;

Discharges

Sewage will be treated on-board and managed in accordance to MARPOL 73/78 Annex IV "Prevention of pollution by sewage from ships" and oily waters in accordance to MARPOL 73/79 Annex I "Regulation for preventing oil pollution from ships".

- ✓ sewage discharges will be treated and disinfected by means of on-board treatment plant and may be discharged more than 3 nautical miles from shore;
- ✓ Oil/water separators should be in place to ensure that any drainage from machinery spaces and bilge water discharged from the ship complies with the legal limits of no more than 15 mg/l of oil for oil-in-water discharge according to IMO (International Maritime Regulations) guidelines (MEPC 107(49) – 2003 as amended by MEPC 285(70) - 2016).
- ✓ Treated effluents should have the following characteristics in accordance to resolution MEPC.159(55).

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[53] Revised MARPOL Annex V which entered into force on 1 March 2018

Table 9.1: Effluent Characteristics of treated sewage (MEPC 159(55))

Parameter in treated effluent	Value
Thermotolerant coliforms/100 ml	<100 cfu
Total Suspended Solids (TSS)	<35 mg/l
5-day Biochemical Oxygen Demand (BOD5)	<25 mg/l
Chemical Oxygen Demand (COD)	<125 mg/l.
pH	6 to 8.5

9.3.2 Oil Spill Contingency and Emergency Response Plan

The survey vessels will operate under an approved Oil Spill Contingency and Emergency Response Plan. The Oil Spill Contingency and Emergency Response Plan will be developed in accordance with the requirements of Regulation 37 of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 relating there to, and in line with applicable Greek regulation.

The purpose of the Plan will be to provide guidance to the Crew on board the ship with respect to the steps to be taken when an oil pollution incident has occurred or is likely to occur. The primary objectives of the Plan should be to:

- ✓ prevent oil pollution;
- ✓ stop or minimize any oil outflow when a damage to the ship occurs;
- ✓ stop or minimize any oil outflow when an operational spill occurs in excess of the quantity or instantaneous rate permitted under the present Convention.

Further, the purpose of the Plan should be to provide crew members with a practical guide to the prevention of oil spills and in carrying out the responsibilities associated with Regulation 37 of Annex I to MARPOL 73/ 78:

- ✓ procedures to report an oil pollution incident;
- ✓ Coastal State contacts (Focal Points) and Port Contact Lists to be contacted in the event of an oil pollution incident;
- ✓ response actions to reduce or control the discharge of oil following an incident co-ordination with national and local Authorities in combating oil pollution.

The plan should be followed by appendices containing communication data of all contacts referenced in the Plan, as well as other reference material. The Plan should contain all information and operational instructions as required by the "Guidelines for the development of the Shipboard Oil Pollution Emergency Plan" as developed by the Organization (IMO), published under MEPC.54 (32) and amended by MEPC.86 (44). An example of the summary flowchart of the SOPEP is given in the following figure.

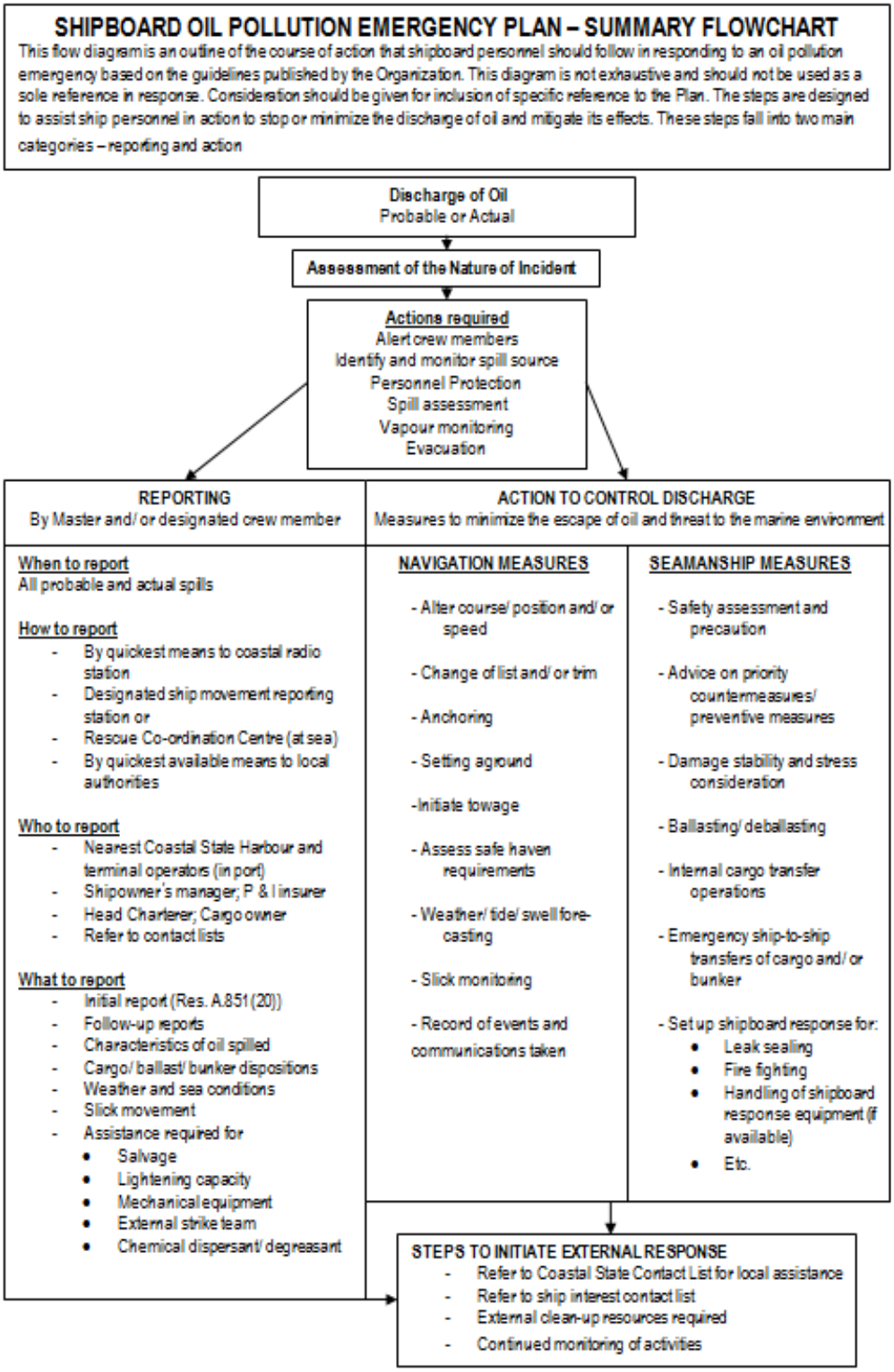

Figure 9.2: Example of Summary Flowchart of Oil Spill Contingency and Emergency Response Plan (Res. MEPC.54(32), 1992)

The objective of the plan is to ensure the safety of project personnel and to protect the marine environment. The plan should incorporate the appropriate guidelines from Government Agencies and other operating Companies. This should be addressed, not only in planning, but also in co-coordinated exercises. The goal will always be to reduce impact from any emergency situation through the rapid and appropriate response of available resources, knowledge and experience.

The Seismic Contractor should take consideration of the following as minimum:

- ✓ any relevant national safety regulations of the Greek legislation;
- ✓ relevant marine safety regulations from the International Maritime Organisation (IMO), including the 1992 Shipboard Oil Pollution Emergency Plans Guidance;
- ✓ requirements from the International Convention on Oil Pollution Preparedness, Response and Co-operation 1990 (OPRC), and the Protocol on Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol);
- ✓ safety procedures from the International Convention for Safety at Life at Sea (SOLAS);
- ✓ requirements from the Convention on the International Regulations for Preventing Collisions at Sea (COLREG);
- ✓ requirements from the MARPOL 73/78 Convention;
- ✓ guidance from the Marine Geophysical Safety Manual from the International Association of Geophysical Contractors (IAGC 2004);
- ✓ procedures from the International Management Code for the Safe Operation of Ships and for Pollution Prevention or the International Safety Management Code;
- ✓ Flag State requirements;
- ✓ procedures from the International Ships and Port Security Code (ISPS);
- ✓ requirements from the International Standard Occupational Health and Safety Assessment Series 18001: 2007- OHSAS 18001;
- ✓ procedures from the Health, Safety and Environmental Schedules for Marine Geophysical Operations, from the E&P Forum; and
- ✓ procedures from Guidelines for the Development and Application of Health, Safety and Environmental Management Systems (E&P Forum 1994).

Emergency Response procedures should be coordinated with the Port Authorities and the Coast Guard. A copy of the Oil Spill Contingency and Emergency Response Plan and a list of emergency contact number should be available in all the vessels.

9.3.3 Environmental and Social Monitoring Plan

The proposed Environmental and Social Monitoring Plan is designed to:

- ✓ assess the magnitude of protection that the proposed mitigation measures offer;
- ✓ propose, if necessary, enhanced protection measures;
- ✓ fulfil the reporting requirements of ACCOBAMS for the country.

The proposed Monitoring Plan (MP) includes actions that fall into two categories in terms of time:

- ✓ real-time (or near real-time) monitoring required to trigger appropriate action where sound levels approach or exceed defined thresholds (i.e. essential for mitigation);
- ✓ monitoring of data that do not need to be analysed in real time, aiming to gather information related to the impacts of the seismic survey on the above mentioned sensitive environmental elements, both before the commencement of activities as well as, during and after them.

Monitoring Plan consist of Vessel Based Monitoring actions which mainly cover active observing of the presence of marine mammals in the mitigation area around the vessel and passive acoustic monitoring;

In the following paragraphs the proposed monitoring plan is described in detail.

9.3.3.1 Vessel-Based Monitoring

Vessels based monitoring activities will be implemented during the project activities both by the HQMMO/PAM team (based on the seismic vessel), and by the FLO (based on the support vessel).

Visual and acoustic monitoring of marine fauna will be implemented in accordance with ACCOBAMS and JNCC Guidelines, including the establishment of a Mitigation Zone (MZ) around the seismic vessel where visual and acoustic monitoring of the presence of marine mammals will be continuously carried out.

The survey vessel-based monitoring team will consist of a team of MMO/PAM operators onboard during the whole survey period. The most experienced will be the leader for the Vessel based monitoring team and he/she will act as the supervisor on-board the survey vessel.

The support vessel-based monitoring team will be constituted by a FLO, that will be able to handle any issue that may arise with fisherman in the area, and that will operate in coordination with the CLO, the HSE Manager and, if necessary, the MMO's leader (see also next Paragraph 9.3.3.4 for further details).

Visual Monitoring

Vessel-based visual monitoring for marine mammals will be done by trained MMOs throughout the period of marine survey activities. MMOs will monitor the occurrence and behaviour of marine mammals in the interested area during all daylight periods during operation.

MMOs duties will include watching for and identifying marine mammals, recording their numbers, distances, and reactions to the survey operations.

The MMOs will be required on-board the survey vessel in order to meet the following criteria:

- ✓ 100% monitoring coverage during all periods of survey operations in daylight;
- ✓ maximum of 2 consecutive hours on watch per MMO;
- ✓ maximum of 8 hours of watch time per day per MMO.

The MMOs will be experienced marine biologists which will be preferably ACCOBAMS HQMMOs or, in case of proved unavailability, JNCC or BOEM approved, with previous marine mammal observation experience in the wider project area.

The observers will watch for marine mammals from the best available vantage point on the survey vessels, typically the bridge. The observer(s) will scan systematically with the unaided eye and 7×50 reticule binoculars, supplemented during good visibility conditions (e.g.: with Fujinon 25x150 "Big-eye" binoculars mounted on a bride wing or flying bridge (seismic vessel only). Available personnel on the bridge, adequately formed for the purpose, will assist the Marine Mammal Observers in watching for marine mammals.

The MMOs should be equipped with a standard "Cetacean Sighting Form" made available by ACCOBAMS. When a mammal is sighted, the following information about the sighting will be recorded:

- ✓ species, group size, age/size/sex categories (if determinable), behaviour when first sighted and after initial sighting, heading (if determinable), bearing and distance from observer, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and pace;
- ✓ time, location, speed, and activity of the vessel, sea state, visibility, and sun glare;
- ✓ the positions of other vessel(s) in the vicinity of the observer location;
- ✓ the ship's position, speed of the vessel, water depth, sea state, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

A close out "Marine fauna visual and acoustic observation" report will be also provided to the Operator after the completion of the activity, in which all the data collected during the seismic survey will be summarized.

Passive Acoustic Monitoring (PAM)

Monitoring during night or periods of poor visibility is one of the main challenges of the proposed plan.

Towed passive acoustic monitoring system (PAM) is proposed to be implemented for the duration of seismic acquisition. PAM system provides an opportunity to detect and indicate the location of marine mammal vocalizations at sea relative to a towed hydrophone streamer. Marine mammal species are identified by the specific characteristics of the detected click and whistle sounds, the interpretation of which requires a specialized operator.

Whilst it is recognized that PAM may be particularly useful for monitoring at night or during periods of poor visibility, current towed PAM technology requires further field testing in order to provide a consistent and reliable real-time monitoring tool at sea.

The presence and characteristics of ambient acoustic noise relative to animal vocalizations, availability of experienced PAM operators and levels of 3rd party technical support are contributing factors to determining the overall operational performance of PAM systems. The flexibility of the PAM towing arrangement and ease of deployment/recovery methods must be considered in relation to existing in-sea equipment in order to ensure that the PAM system can be used without additional risk to vessel personnel and equipment either during seismic data acquisition or equipment maintenance schedules during typical line changes or periods of poor weather.

In any case, as foreseen by the ACCOBAMS, a PAM system will be in use, with a dedicated PAM operator, for the entire duration of the noise emission. Such acoustic monitoring should alert the visual observers (MMO) to the presence of cetaceans. If activities are carried out at night or during bad weather conditions, acoustic monitoring becomes the main monitoring tool.

PAM equipment should be able at least to detect and localize cetaceans. The following software tools are suggested[54].

Table 9.2: Suggested Software for Passive Acoustic Monitoring

SOFTWARE	MORE INFOS AND/OR DOWNLOAD
PAMGUARD	http://www.pamguard.org/
SEAPRO & PAM WorkStation	http://www-3.unipv.it/cibra/seapro.html
ISHMAEL	(Mellinger 2001)
RAINBOWCLICK	http://www.marineconservationresearch.co.uk/
WHISTLE	www.ifaw.org

Figure 9.3: Passive Acoustic Monitoring[55]

PAM operators should be experienced bio-acousticians, familiar with the vocalizations of cetaceans in a determined area.

MMO Handbook

In order to maximize the successful operation of the MMOs, a Marine Mammal Observers' Handbook is proposed to be prepared in the framework of the monitoring program, by the HQMMO/PAM team. Handbook contains maps, illustrations, and photographs, as well as text, which are intended to provide guidance and reference information to

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[54] Methodological Guide: Guidance on underwater noise mitigation measures, ACCOBAMS-MOP7/2019/Doc 31Rev1
[55] http://www.marinemammalmitigation.org/

trained individuals who will participate as MMOs/PAM operators. The following topics are proposed to be covered in the MMO Handbook:

- ✓ summary overview descriptions of the project, marine mammals and underwater noise, the marine mammal monitoring program;
- ✓ monitoring and mitigation objectives and procedures, initial safety radius;
- ✓ responsibilities of staff and crew regarding the marine mammal monitoring plan;
- ✓ instructions for ship crew regarding the marine mammal monitoring plan;
- ✓ data recording procedures: codes and coding instructions, common coding mistakes, electronic database; navigational, marine physical, field data sheet;
- ✓ list of species that might be encountered: identification cues, natural history information;
- ✓ use of specialized field equipment (reticule binoculars, NVDs, laser rangefinders);
- ✓ reticule binocular distance scale;
- ✓ table of wind speed, Beaufort wind force, and sea state codes;
- ✓ data storage and backup procedures;
- ✓ safety precautions while on-board;
- ✓ crew and/or personnel discord; conflict resolution among MMOs and crew;
- ✓ drug and alcohol policy and testing;
- ✓ scheduling of cruises and watches;
- ✓ communication availability and procedures;
- ✓ list of field gear that will be provided;
- ✓ suggested list of personal items to pack;
- ✓ suggested literature, or literature cited.

It is advisable the MMO handbook to be distributed to the MMOs at least 15 days before the commencement of the activities in order to have enough time to go through it.

Reporting

After each watch, or at the end of the day, MMOs enter the data from the Data Recording Forms into a Database. A weekly report is then prepared and sent to the Client in which are summarized the marine mammal species observed, their number and distance relative to the vessel, time, location, and the vessel speed including any mitigation measures that were applied.

After completion of the activity, all paper data forms, electronic database, and a close out "Marine fauna visual and acoustic observation" report will be provided to the Operator.

Within one month after the completion of the operations, a close out report prepared following ACCOBAMS standard form (as presented in October 2019 during MOP7 within the "*Methodological Guide: Guidance on Underwater Noise Mitigation Measures*" – ACCOBAMS-MOP7/2019/Doc 31Rev1), will also be provided from the HQMMO/PAM team, to the ACCOBAMS Secretariat and to the relevant Authorities.

IAGC Guidance for Marine Life Observers and towed PAM.

IAGC guidelines and policies for Marine Life observers and towed passive acoustic monitoring will be taken into consideration.

Figure 9.4: Marine Fauna Monitoring Procedures

9.3.3.2 Verification of the Exclusion/Mitigation Zone in the Field

The mitigation measures to be implemented for the protection of marine mammals from the effects of marine noise during the carrying out of the activities, in accordance with ACCOBAMS and JNCC Guidelines, will include a verification of the Mitigation Zone set for the project activities (800 m) in order to verify actual level of underwater noise.

Such verification will also allow to evaluate the validity of the proposed Exclusion Zone.

Notifications to the Ministry of Environment and Energy will be sent for any adjustment of the limits of the Mitigation or of the Exclusion Zone, followed by the relevant supporting documentation.

9.3.3.3 Background Noise and Pre and Post Survey Acoustic Monitoring

In order to better assess the noise contribution and the population density in the project area of marine mammals, an acoustic monitoring will be performed before the start and after the completion of the activities (as per

ACCOBAMS Resolution 7.13 – Annex 2 "Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area" of November 2019).

In particular, a monitoring system of the background acoustic levels and of the acoustic signals from marine mammals shall be undertaken:

- ✓ at the minimum one week prior to the commencement of seismic activities;
- ✓ just after the completion of seismic activities.

9.3.3.4 Monitoring for Fishing and Marine Transport Activities

Disruption of fishing and marine transport activities can be minimized by continuous communication and coordination with other marine users, including:

- ✓ prior notification to port authorities, fisheries communities and marine users of the survey schedule and location;
- ✓ proactive communication with vessels at sea during the survey, in order to ensure navigational safety and appropriate management of interactions, if any;
- ✓ monitoring the survey area to alert vessels in the vicinity (day and night);
- ✓ interacting with the operators of fishing vessels to find out whether there is fishing gear within or close to the survey area and ensure that no vessels or fishing gear remain in the path of the seismic survey vessel.

For this purpose, a FLO, which will be appointed by the Seismic Contractor and will be able to speak fluently Greek, Italian and English, will ensure the implementation of the above-mentioned measures.

The FLO will inform, prior to operations, the various stakeholders related to fishing and other maritime activities, about the seismic plan and associated timeframes, in coordination with the CLO.

Moreover, during the operations, the FLO, based on the support vessel, will liaise with all affected fishing vessels, particularly pelagic long-line fishing activities in the region to plan the placing of fishing gear, if possible, or provide additional notice of the areas of operation.

The FLO, operating in an area surrounding the seismic vessel will also be able to alert in advance the MMO team in case of any direct marine mammal sighting within the monitored area or any sighting eventually communicated by fishermen in the area.

With regard, more in general, to all the marine transport activities, the Seismic Contractor will inform on a daily basis, competent Authorities and prepare a 72-hours acquisition plan of operations, which is going to be reported through NAVTEX – Notice to Mariners by local authorities to all vessels using this area.

To ensure that any potential impact from the seismic survey on port and marine traffic are avoided or reduced as much as possible, a mobile safety exclusion zone will be monitored around the seismic survey vessel in order to avoid collision with other vessels in the area. All vessels will be required to give way to the seismic vessel. The safety exclusion zone will depend on the planned seismic vessel route, defined and communicated as previously described, to the Corfu Port Authority and to the Central Coast Guard of Corfu.

9.3.4 Stakeholder Briefing

Operator will provide to the Seismic Contractor a Stakeholder Briefing to be implemented by the Contractor. The purpose of this document is to plan an open and transparent dialogue and minimize any adverse impact of the project to stakeholders. The objectives of this briefing include:

- ✓ Establish appropriate communication channels with authorities and other stakeholders relevant to the Project (interested in the project and potentially affected by the project) prior to the beginning of the operation;
- ✓ Maintain a positive relationship based on dialogue and transparency with all stakeholders and therefore ensure the social license to operate;
- ✓ Prior to the beginning of the seismic campaign, inform them about the exact seismic location, schedule and duration through e-mails, phone calls or personal meetings;
- ✓ Inform stakeholders, during the seismic campaign and once completed, about major socio-economic issues encountered, if any;
- ✓ Develop an external grievance mechanism (to be approved by the Operator);

- ✓ Ensure a consistent and appropriate messaging and respond to all questions and concerns expressed by stakeholders;
- ✓ Record, report and solve grievances submitted by stakeholders related to the project;
- ✓ Offer to share valuable information acquired during the seismic survey with stakeholders who might have an interest in knowing them (NGOs involved in marine ecosystem protection, fishermen, government agency etc.);

For the purpose of guaranteeing smooth operations and minimizing issues that could rise from encounters with fishermen or commercial ships at the Project location, additional measures are recommended to be implemented by the Operator and the Contractor:

- ✓ A grievance procedure will be part of the Stakeholder Briefing, describing a simple process and providing templates for the CLO to be able to receive grievances and respond to them with an appropriate response and solution;
- ✓ Leaflets in Greek, Italian and English language shall be prepared explaining the purpose of Project activities and its main hazards to fishermen. These leaflets shall be distributed to all fishermen encountered in the area during Project implementation;
- ✓ A Fishing Liaison Officer (FLO) speaking Greek, Italian and English shall stay on board a support vessel during operation in order to handle any issue that may arise with fishermen in the area;
- ✓ A Community Liaison Officer (CLO), speaking Greek and English based in Corfu will be in charge of engagement with local stakeholders and handle any issue that may arise from the different stakeholders including grievances.

9.4 TRAINING REQUIREMENTS

Operator will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions. It is important that employees at each relevant function and level are aware of the Project's environmental and social policy; potential impacts of their activities; and roles and responsibilities in achieving conformance with the policy and procedures.

This will be achieved through a formal training process. Employee training will include awareness and competency with respect to:

- ✓ environmental and social impacts that could potentially arise from their activities;
- ✓ necessity of conforming to the requirements of the Environmental Action Plan (EAP) and Environmental and Social Management Plan (ESMP), in order to avoid or reduce those impacts; and
- ✓ roles and responsibilities to achieve that conformity, including with regard to change management and emergency response.

The HSE Manager is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. The HSE Manager will also periodically verify that staff is performing competently through discussion and observation.

Employees responsible for performing inspections will receive the appropriate training prior to Project's implementation. Upon completion of training and once deemed competent by management, staff will be ready to train other people.

Similarly, the Project will require that each Contractors institute training programs for its personnel. Each Contractor is responsible for an awareness training on ESMP for personnel working on the job sites. The Contractors are also responsible for identification of any additional training requirements to maintain required competency levels.

The Contractor training program will be subject to approval by the Operator and it will be audited to ensure that:

- ✓ Training programs are adequate;
- ✓ All personnel requiring training have been trained; and
- ✓ Competency is being verified.

The training sessions will broach the following topics:

- ✓ Environmental policy;
- ✓ Waste management procedures;

- ✓ Discharges (air and liquids) management;
- ✓ Dangerous chemicals management, including Oil Spill Contingency and Emergency Response Plan implementation in case of accidental spillage;
- ✓ Regulatory and socio-economic aspect management;
- ✓ Identification and treatment of non-compliance, etc.

9.5 AUDITING AND REPORTING

An Environmental audit program will be written in compliance with Operator's procedures and will include:

- ✓ Identification of deviations from regulatory standards and contractual requirements identified;
- ✓ Evaluation of the various plans' implementation efficiency, devices and mitigation measures identified in this study;

The Project Manager, with the HSE manager, will be responsible for the implementation of internal environmental audits on environmental good practices. He will be responsible for preparing environmental and social reports to the authorities.

Audits will be carried out:

- ✓ before starting operation, an HSE marine seismic operation specialist mandated by Operator will carry out an audit on the contracted vessels. This audit enables the specialist to review environmental procedure at the beginning of the project. The HSE specialist will be accompanied by the Project Manager, the HSE manager and the survey manager.
- ✓ during operation, an audit will be conducted by the HSE manager to ensure that the monitoring, control and intervention on board are compliant with the requirements of the Environmental Action Plan (EAP) and of the Environmental and Social Management Plan (ESMP). The audit will include, at minimum, the following:
  - completeness of documentation, including planning documents and inspection records,
  - conformance with monitoring requirements,
  - efficacy of activities to address any non-conformance with monitoring requirements, and
  - training activities and record keeping.

Two kinds of reports are envisaged during the course of the project, as follows:

A) Weekly Reports

B) Incidental Reports

The weekly Report will cover at least the following:

- ✓ summary of activities;
- ✓ amount of acoustic energy produced;
- ✓ daily reports of the MMOs and PAMs;
- ✓ daily updates of the International Noise Register developed by ACCOBAMS from the MMOs and PAMs;
- ✓ any behavioural changes identified either in the mitigation zone or the exclusion zones;
- ✓ records derived from the implementation of the Waste and Discharge Management Plan;
- ✓ stakeholder engagement activities;
- ✓ grievances and concerns identified, analysed and mitigated.

The Incidental Report will be prepared whenever an incident happens, and it will include at least the following:

- ✓ detailed description of the incident;
- ✓ potential environmental and social impacts from the incident;
- ✓ proposed mitigation measurements.

Finally, a completion Environmental and Social Monitoring report will be submitted to Operator following the completion of the project activities, presenting all the monitoring activities and results during the period of execution of the project.

9.6 COMMITMENT REGISTER

No.	Commitment	Responsibility
	General	
1	All survey vessels and equipment shall present to the Operator before commencement of any activities, proves of maintenance in accordance with written procedures based on the manufacturer's guidelines, applicable industry code or engineering standards to ensure efficient and reliable operation	Seismic Contractor
2	Prior to the start of the seismic survey the ship shall be subject to an initial inspection by the Operator in order to ensure that all equipment, systems and material fully comply with applicable industry code or engineering standards and MARPOL requirements	Operator
3	Operator shall ensure that Seismic Acquisition Survey will be commenced as early as practicable within the operational window of November to December 2020, in order to avoid as far as possible coincidence with period of tourist activities, which for the project area starts at April and ends in October.	Operator
4	Operator shall voluntarily cooperate with seismic operators of adjacent exploration block in order to mutually agree if possible on simultaneous execution of the seismic survey during the same period in order to avoid cumulative seismic noise effects	Operator
	Atmospheric Emissions	
5	Seismic vessels and supply/chase vessels will comply with MARPOL 73/78 Annex IV Regulations for the prevention of air pollutants from ships	Seismic Contractor
6	No ozone depleting substances shall be used in accordance to regulation 12 of Annex VI MARPOL	Seismic Contractor
7	The seismic and support vessels will have a valid International Air Pollution Prevention (IAPP) Certificate (as appropriate to vessel class) in accordance to Regulation 5 of Annex VI of MARPOL 73/78	Seismic Contractor
8	Low Sulphur content fuel oil will be used in accordance to the current global limit for Sulphur contents in maritime which is 0.50% m/m (mass by mass)	Seismic Contractor
9	Prepare a plan for optimization of fuel use to increase efficiency and minimize emissions, which should be included in the ESMP	Seismic Contractor
10	Record and monitor fuel consumption in order to prevent excessive consumptions. The volume of fuel used by the vessels and the helicopter will be recorded and reported to the	Seismic Contractor

No.	Commitment	Responsibility
	Ministry of Environment at the end of the seismic survey along with the results of the monitoring program	
Marine Pollution and Waste Management		
11	Sewage will be treated on-board and managed in accordance to MARPOL 73/78 Annex IV: Prevention of pollution by sewage from ships, oily water will be treated and managed in accordance to MARPOL 73/78 Annex I Prevention of Pollution from oil and all waste will be regulated by MARPOL 73/78 Annex V: Prevention of pollution by garbage from ships and managed in accordance with international and national regulations. More specifically, the following measures should be implemented: ✓ sewage discharges will be treated and disinfected by means of on board treatment plant and may be discharged more than 3 nautical miles from shore. Sewage shall be safely stored on-board when the ship is less than 3 nm from the nearest land; ✓ oily water may be stored on the vessel until their delivery to appropriate Port facilities. If this is not feasible oil/water separators should be in place to ensure that any drainage from machinery spaces and bilge water discharged from the ship complies with the legal limits of no more than 15 mg/l of oil for oil-in-water discharge according to IMO (International Maritime Regulations) guidelines (MEPC 2003). ✓ food wastes will be macerated to a diameter of less than 25 mm, prior to disposal. No food wastes will be directly discharged in the sea. ✓ no plastics or garbage will be discharged to sea; ✓ waste will be segregated into recyclables and dangerous wastes (used lubricating oil, filters, batteries etc.) and taken to shore by the support vessel for appropriate disposal. ✓ hazardous waste must be labelled accordingly, and disposed by specialist and registered waste disposal Contractor. ✓ prior to entry into port, Seismic Vessel Contractor will notify the Port Authorities of the types and quantities of waste being brought ashore for disposal	Seismic Contractor
12	The seismic and support vessels must have a valid International Oil Pollution Prevention Certificate (IOPPC) and a valid International Sewage Pollution Prevention Certificate (ISPPC) applicable to vessel class in accordance to the requirements of Annex I and Annex IV of MARPOL 73/78.	Seismic Contractor
13	All vessels will operate under an approved Oil Spill Contingency and Emergency Response Plan which details actions to be taken in the event of a shipboard emergency or oil spill in accordance with MARPOL 73/78 Annex I requirements (Section 9.3.2).	Seismic Contractor

No.	Commitment	Responsibility
14	Any accidental release of waste to the marine environment that does not meet MARPOL discharge standards will be reported to relevant local authorities within a time framework of less than 12 hours.	Seismic Contractor / Operator
15	Safe Work procedures developed and followed to prevent objects being dropped	Seismic Contractor
16	Personnel will be trained with regard to the prevention of dropped objects during relevant meetings and the appropriate inductions	Seismic Contractor
17	Lost equipment will be relocated and recovered where safe and practicable to do so	Seismic Contractor
18	Ballast Water Exchange will occur prior to arrival, at an appropriate location	Seismic Contractor
19	The seismic vessel must comply with Regulation B-1 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and should have been prepared in accordance with the IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53).	Seismic Contractor
20	Standard fuel supply procedures (safety valves) during refuelling of support vessels in Port or in case of emergency refuelling at sea is needed	Seismic Contractor
21	Pre-bunkering checklist developed and implemented prior to refuelling of support vessels in Port or in case of emergency refuelling at sea is needed	Seismic Contractor
22	Bunkering to commence during daylight hours and during acceptable sea and wind conditions in case of emergency refuelling at sea is needed	Seismic Contractor
23	Spill response kits located in proximity to hydrocarbons bunkering areas and appropriately stocked/replenished as required	Seismic Contractor
24	Crew induction to include spill prevention, reporting and use of spill response equipment	Seismic Contractor
25	Any significant fuel losses to the marine environment will be reported to the relevant government agencies	Seismic Contractor / Operator
26	All hydraulic systems should be adequately maintained and all hydraulic hoses should be frequently inspected.	Seismic Contractor
27	Preventive maintenance, leak detection and repair programs for on-board equipment that may originate unwanted spill will be implemented.	Seismic Contractor

No.	Commitment	Responsibility
28	Seismic Vessel Contractor will be responsible for preparing and executing a Waste and Discharge Management Plan, in the framework of the ESPM (Section 9.3.1), which will include among other provisions the following: ✓ ensure that solid and hazardous waste are managed in accordance with the appropriate laws and ordinances and in close cooperation with the local authorities; ✓ all types of discharges waste will be collected, sorted and disposed in accordance with the Waste and Discharge Management Plan; ✓ low-toxicity biodegradable detergents should be used in cleaning of all deck spillage; ✓ maintain a waste log including waste type, quantity and disposal method which will be reported in the Ministry of Environment at the end of the seismic survey along with the results of the monitoring program; ✓ ensure that on-board solid waste storage is secured; ✓ personnel will be trained in waste sorting and collection (adapted to position and to waste generated); ✓ waste will be reused and recovered where safe and practicable to do so.	Seismic Contractor
Marine Fauna Monitoring		
29	Seismic Contractor shall be informed about the existing information for sensitive marine species (whales, dolphins, monk seals, sea turtles) in the area, derived from ESBS and EAP, so that activities are properly planned and conducted with potential impacts to be As Low As Reasonably Practicable (ALARP)	MMO and PAM Team Responsible / Operator / Seismic Contractor
30	Operator shall make any possible effort to avoid execution of the seismic survey during the reproduction periods for marine mammals (April-October for Bottlenose dolphin, Striped dolphin, Common dolphin and Cuvier's beaked whale, unknown for Risso's dolphin, September-January for the Fin whale, late winter-end of August for the Sperm whale and all the year, but mainly in spring for the Monk seal) and sea turtles (May-October) to minimize interferences	Operator
31	Operator shall secure continuous presence on board of qualified, trained, approved, dedicated and experienced Marine Mammals Observers (MMO) and Passive Acoustic Monitoring (PAM) operators to ensure that marine mammals or sea turtles are not present within the Mitigation Zone (MZ) around the seismic vessel before turning on the acoustic sources and while sources are active	Operator
32	MMOs and PAMs will be responsible for monitoring and reporting using a standardized protocol as per ACCOBAMS Guidelines and overseeing implemented mitigation rules. There will be use of certain protocols in case of sighting/presence of mammals within the survey area.	MMO and PAM Team Responsible
33	At least two dedicated MMOs will be surveying at all times during daylight. Shifts will be organized to allow enough rotation and resting periods to observers. Each hour an MMO,	MMO and PAM Team Responsible / Operator

No.	Commitment	Responsibility
	at turn, will shift with the one at rest, in order to ensure max. a 2 consecutively hours watch per operator.	
34	PAM operators will be on duty throughout the operations and 24h to allow for detection and monitoring of certain marine mammals by the vocalizations they produce underwater.	MMO and PAM Team Responsible / Operator
35	Operations shall be designed in order to minimize as far as possible impacts on the sensitive area that has been identified within and in proximity to the survey area, namely the Natura 2000 site “Diapontia Islands”.	Operator / Seismic Contractor
36	Exclusion Zones (EZ) with restrictions on navigation and operation of airguns must be determined around the proposed sensitive area and must be included in the planning of the seismic acquisition survey. The anticipated extents of the proposed Exclusion Zones are the following ✓ Seismic Vessel Navigation Exclusion Zone of 800 m from the limit of the sensitive area ✓ Airgun Exclusion Zone of 1600 m from the limit of the sensitive area	Operator / Seismic Contractor
37	The anticipated extents of the proposed Exclusion Zones will be evaluated during the initial phase of the seismic survey in conjunction with the relevant results of the monitoring program and will be adjusted accordingly in order to avoid any impacts on the identified sensitive area. Notification to the Ministry of Environment and Energy will be sent for any adjustment of the limits of the exclusion zones, followed by the relevant supporting documentation.	MMO and PAM Team Responsible / Operator
38	In order to minimize any disturbance on seabird, in case of use of helicopter, flying over natural protected areas shall be avoided	Helicopter pilot / Seismic Contractor / Operator
39	A Mitigation Zone (MZ) will be implemented around the seismic vessel where visual and acoustic monitoring of marine mammals will be continuously implemented by MMOs and PAMs. The role of a MMO/PAM operator is to detect marine mammals as part of the mitigation procedures and to advise a delay in the commencement of activity, or an interruption of the ongoing activity, should any marine mammals be detected within the mitigation zone. Mitigation Zone will not be less than 800 m from the vessel estimated from the center of the airgun array or noise source location	Operator
40	Operators shall ensure that MMOs will be suitably equipped for an optimal visual monitoring within the Mitigation Zone, with appropriate 7x50 distance measuring binoculars, also provided with a compass, in order to be able to verify distance and direction from the noise source, big eyes, HD cameras, video camera, etc.	MMO and PAM Team Responsible / Operator
41	Operator shall ensure that PAM system can achieve as much as possible of the following: ✓ An appropriate acoustic software exists on the vessel	MMO and PAM Team Responsible / Operator

No.	Commitment	Responsibility
	✓ Detect the range of frequencies of marine mammal vocalisations expected to be present in the survey area; ✓ Detect and identify vocalising marine mammals and establish bearing and range in a reasonable period of time; ✓ Immediately communicate relevant information to the PAM operators (real time) so appropriate and timely mitigation measures can be undertaken (e.g. delay soft start); ✓ Able to be repaired on board or replaced in case of breakdown (e.g. appropriate repair tools and backup equipment).	
42	MMOs and PAMs operatives should be equipped with an up-to-date copy of ACCOBAMS/JNCC guidelines and recording forms.	MMO and PAM Team Responsible / Operator
43	MMOs shall be able to advise the crew on the procedures set out in the guidelines and to provide advice to ensure that the survey is undertaken in accordance with the guidelines (pre-mobilization meeting, etc.).	MMO and PAM Team Responsible / Seismic Contractor / Operator
44	Reports with information on the implemented procedures, their effectiveness, and obtained datasets must be submitted by the Operator to the Ministry of Environment within a period of one (1) month from the completion of the seismic acquisition campaign. In addition, all environmental information reported by MMOs will be forwarded by the MMO/PAM team responsible to the National Focal Point, that applies ACCOBAMS, the responsible national authority for the dissemination of this information.	MMO and PAM Team Responsible / Operator
45	Standard Airgun Mitigation Procedures as proposed in ACCOBAMS (2019) and JNCC (2017) guidelines for minimising the risk of injury to marine mammals from geophysical surveys must be implemented.	Seismic Contractor
46	Use of the lowest practicable source power (active airgun) determined by depth of investigation and quality of data should be implemented	Seismic Contractor
47	Seismic acquisition should be designed aiming at the minimization of the horizontal propagation of acoustic waves by adopting suitable array configurations and pulse synchronization and eliminating unnecessary high amplitudes	Seismic Contractor
48	Adoption of the soft-start technique should be implemented: slow increase of acoustic power (ramp-up or soft start) to allow marine mammals the opportunity to leave the ensonified area. To minimize noise emissions, soft-starts shall not be longer than 20 minutes	Seismic Contractor
49	Before beginning any emission there will be a dedicated visual and acoustic survey for about 60 minutes to ensure no animals are within and in the vicinity of the MZ around the seismic vessel. If deep diving species, such as beaked and/or sperm	MMO and PAM Team Responsible / Seismic Contractor

No.	Commitment	Responsibility
	whales, or other sensitive species, are seen or acoustically detected near the vessel, the monitoring period will be extended to 120 minutes and the emissions will be delayed. Ramp-up may not begin until 30 minutes (or 120 in case of deep diving species) after the animals are seen to leave the MZ, or 30 minutes (or 120 in case of deep diving species) after they are last seen.	
50	Shut-down of source(s) will be performed whenever a marine mammals is seen to enter the MZ, when aggregations of vulnerable species (such as beaked/sperm whales) are detected anywhere within the monitoring area, and when abnormal behaviors are observed in animals. Focused monitoring of the affected animals should follow	Seismic Contractor
51	High power airgun configurations will be avoided as far as possible at night and during unfavorable sea state conditions. Since low visibility doesn't allow for accurate visual detection and localization of marine mammals. The use of PAMs should be emphasized under these conditions and airgun emissions will be restricted as possible.	Seismic Contractor
52	Interruption of source energization at each acquisition line end when expected to be greater than 20 minutes. Airgun firing will be terminated at the end of the line and a full 20 minutes soft-start will be undertaken before next line. A pre-shooting search will also be undertaken during the scheduled line change.	MMO and PAM Team Responsible / Seismic Contractor
53	A system of automated logging of acoustic source use will be developed to document the amount of acoustic energy produced, and this information will be reported to the Ministry of Environment and Energy following the completion of the seismic acquisition campaign	Seismic Contractor / Operator
54	During operations, existing stranding networks in the area will be alerted. The Port Authorities and relevant environmental organizations will be informed for recording potential stranding	Operator
55	In case of mass stranding or increased rate of individual stranding in the wider area, any acoustic emission should be stopped and research cruises will be arrange to identify the causes of the event, relationship with the seismic operations, and potential changes in marine mammals encounter rates as indication of their population density	Operator
Light Emissions		
56	To mitigate potential major negative impacts of artificial lights to marine life (particularly seabirds), external lighting will be minimised to that required for navigation, vessel safety and safety of deck operations, except in the case of an emergency.	Seismic Contractor
57	All stranded seabirds shall be retrieved and released according to appropriate guidelines	MMO and PAM Team Responsible / Seismic Contractor / Operator

No.	Commitment	Responsibility
Collision/Entanglement with Marine Fauna		
58	Due to the potential presence of sea turtles in the project area, in order to avoid accidents of entanglement, a Turtle Guard system will be installed on seismic survey tail buoys on the streamers. This device effectively reduces the risk of sea turtle entanglement in the seismic equipment.	Seismic Contractor
59	In case of entanglement, immediate intervention by appropriately trained personnel should be implemented.	MMO and PAM Team Responsible / Seismic Contractor
Flying Safety		
60	Comply with safety flying procedures in case of helicopter use	Helicopter pilot / Seismic Contractor
61	Helicopter use during daylight hours and acceptable wind and sea conditions	Helicopter pilot
Stakeholder Engagement and Grievance Management		
62	A Stakeholder Briefing will be developed to ensure timely sharing of information on the details of the seismic survey.	Operator
63	A simple grievance procedure shall be developed to make sure that any stakeholder gets the opportunity to complain and obtain a solution to their grievance	Operator
64	Seismic Contractor will appoint an CLO to communicate and meet with the various stakeholders, Authorities and especially those that are related with maritime activities and inform them about the seismic acquisition operation plan and associated timeframes. CLO shall start to engage at least one month before the start of the activities	Community Liaison Officer / Seismic Contractor
65	Concerns and grievances shall be managed by the CLO in coordination with the HSE Manager. The CLO shall respond to all questions and concerns and receive and resolve any grievance according to the grievance procedure.	Community Liaison Officer / Seismic Contractor
Marine Traffic and Fishing Activities		
66	Inform prior to operations: Seismic Contractor will appoint 1 FLO, which will meet with the various stakeholders related to fishing and other maritime activities to inform them of the seismic plan and associated timeframes, in coordination with the CLO.	Fishing Liaison Officer / Seismic Contractor
67	Inform during operations: The FLO, on board of a chase vessel during all the seismic survey, will liaise with all affected fishing vessels, particularly pelagic long-line fishing activities in the region to plan the placing of fishing gear, if possible, or provide additional notice of the areas of operations; Clear information will be provided to ensure that fishermen are aware that the Project will not exclude people from their fishing	Fishing Liaison Officer / Seismic Contractor

No.	Commitment	Responsibility
	grounds but rather will cause only a temporary disturbance to fishing activities, if any.	
68	The FLOs on-board must speak Greek, Italian and English in order to facilitate potential interaction with fishermen at the project area.	Fishing Liaison Officer / Operator
69	Seismic Contractor must be responsible for the following: ✓ Collaborate with the competent authorities for issuance of NAVAREA warnings for the area where seismic acquisition survey will take place as well as for the deployment area of the survey, before commencement of operations ✓ Prepare a 72-hours acquisition plan of operations which must be notified on a daily basis (until 10 a.m.) to the Corfu Port Authority and to the Central Coast Guard of Corfu presenting the area of operations within that time framework ✓ Collaborate with the competent authorities for issuance of NAVTEX – Notice to Mariners on a daily basis, in accordance to the 72-hours acquisition plan of operations	Seismic Contractor / Operator
70	Seismic Contractor will use of chase vessels in order to: ✓ liaise with fishermen in the vicinity of the seismic vessel in the daytime and at night; ✓ ensure navigational safety and appropriate management of interactions between the survey vessel and fishing vessels; ✓ ensure that no vessels or fishing gear remain in the path of the seismic survey vessel.	Seismic Contractor / Operator
71	Operator will ensure that: ✓ Procedures are in place for dealing with grievances in the event of damaged fishing gear, managed through the grievance process; ✓ The FLO liaises with the CLO for any concern and grievance related to fishing activity; ✓ All vessels will be equipped with collision risk reducing devices i.e. navigational lights and beacons, marker buoys, etc.	Seismic Contractor / Fishing Liaison Officer / Operator
72	Complete fulfilment of the International Marine Traffic Regulation should be ensured.	Seismic Contractor / Operator
73	Seismic and support vessels must comply with all applicable standard maritime safety procedures, including 24-hr visual, radio and radar watch for vessels within and in the vicinity of the operational area, and display of appropriate navigational beacons and lights.	Seismic Contractor / Operator
74	All procedures and practices of Seismic and support vessels must be in accordance with the requirements of IMO's	Seismic Contractor / Operator

No.	Commitment	Responsibility
	International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and TOTAL' Standards	
75	Seismic and support vessels must be equipped with Automatic Identification System (AIS) and approved electronic navigation systems and radar on seismic vessel.	Seismic Contractor / Operator
76	Local provisions and supplies and any recruitment (e.g. CLOs, FLOs) must be enhanced in order to increase the benefits of the project on local economy.	Seismic Contractor / Operator
Human Rights		
77	All the activities will be conducted in a manner that respects the human rights and the dignity of all people, complying with all legal requirements. In particular: ✓ All internationally recognized human rights, as set out in the International Bill of Human Rights and the International Labour Organization's declaration on Fundamental Principles and Rights at Work will be respected as well as the relevant requirement of Greek Legislation ✓ All human and labour rights will be respected, as stated in the UN Guiding Principles on Business and Human Rights. ✓ All workers, employees and suppliers will be treated fairly and without discrimination and will be entitled to work in an environment and under conditions that respect their rights and dignity. ✓ The rights of people in communities potentially impacted by the seismic acquisition surveys activities will be respected.	Seismic Contractor / Operator
78	Operator and Seismic Contractor will ensure that contractual commitments will guarantee that all sub-Contractors and suppliers adhere to the aforementioned principles	Seismic Contractor / Operator
Cultural Heritage and Archaeological Sites		
79	Any identified marine archaeological sites should be excluded from the seismic acquisition survey in case that proposed operations may influence their integrity.	Operator
80	In case of identification of any marine archaeological site during the seismic acquisition survey, then operator should immediately inform the competent archaeological authority of marine antiquities.	Operator
81	Contractor should follow the international best practice for the documentation and protection of the cultural heritage in case of chance finds.	Seismic Contractor / Operator
82	Routine monitoring of the streamers	Seismic Contractor / Operator

No.	Commitment	Responsibility
83	Streamers will be equipped with depth control devices (birds)	Seismic Contractor / Operator

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