

## NON TECHNICAL SUMMARY

### 1. INTRODUCTION

In this report the findings of the Strategic Environmental Assessment (SEA) of the hydrocarbon activities for prospecting, research and exploitation within the license area to the south and west of Crete island are presented. The under study area is within marine areas belonging to the Greek Republic (according to law v.4001/2011).

The scope of the Ministry of Environment, Energy and Climate Change with this SEA is to ensure environmental protection and sustainable development of the area of Western Patraikos Gulf. The SEA was conducted in accordance with Directive 2001/42/EC of the European Parliament and of the Council on 27<sup>th</sup> July 2001, regarding the assessment of impact on the environment from certain plans and/or programs and the relevant Greek laws, in the frame of the Ministry's initiative for prospecting and exploitation of hydrocarbons according to the "open door" procedure. This initiative is referring to marine areas of the Ionian Sea and south of Crete island, which will be granted by Greek authorities for the hydrocarbon activities purpose (ΦΕΚ Β 2186-2014, ΥΑ Δ1-Α-12892\_31-07-2014, Εφημερίδα Ευρωπαϊκής Ένωσης 2014/С 400/03-13.11.2014).

The Directive 2001/42/EC was incorporated within Greek law system by KYA 107017/28.8.2006 "Assessment of environmental impacts of certain plans and programs in accordance to Directive 2001/42/EC".

The SEA was prepared by the Hellenic Center for Marine Research (HCMR), in collaboration with the University of Thessaly and the consultant company "Arcenviro".



Fig. 1. Location of 9 marine areas to the south and west of Crete Island considered for hydrocarbon licensing, belonging to the Greek Republic.

The license areas under study is part of a marine area of Greece and consists of the 9 blocks presented in Figure 1.

In Table I the surface area of each block is presented.

**Table I.** Surface area of each marine block.

Block number	Area (square klm)	Block number	Area (square klm)
1	1801,7	11	6572,9
2	2422,1	12	7092,2
3	3394,2	13	6069,7
4	3032,6	14	5954,2
5	3157,2	15	6175,3
6	4036,9	16	6764,0
7	3146,5	17	5422,3
8	4615,7	18	9543,8
9	5127,8	19	6143,9
10	3420,6	20	7197,7

According to Directive 2001/42/EC, the purpose of an SEA is to identify, describe, and evaluate the “likely significant environmental effects of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme.” This SEA focuses broadly on those activities most likely to result from the licensing programme, including prospecting, exploration, and exploitation. It is expected that detailed, specific Environmental Impact Assessments (EIAs) will be prepared for individual projects.

The main objective of this SEA is the study of the block areas 12 to 20 in the marine waters to the south and west of Crete Island (Fig. 1) and their geographical coordinates are given to the next Annex

The specific objectives of the SEA include:

- Description of the hydrocarbon activities that may reasonably be expected to occur in the licensing area;
- Presentaton of the existing environmental and socio-economic information;
- Identification of potential environmental effects of hydrocarbon activities and evaluate those likely to be significant;
- Recommendations of additional management and monitoring measures where necessary to ensure environmental protection and sustainable use of resources; and
- Identification of data gaps and shortcomings in the existing information that could be remedied by further study.

The SEA process included a review of the legal and regulatory context for offshore hydrocarbon activities in the Greek licence area south to Crete.

## 2. LICENSING PROGRAM AND REGULATORY CONTEXT

Greece has incorporated in its legislation a major part of Directive 94/22/EC of the European Parliament and of the Council of 30 May 1994 on conditions for granting and using authorizations for the prospecting, exploration, and production of hydrocarbons by Law 2289/1995, whereas the new Law 4001/2011 updates and clarifies the already existing legislation regarding hydrocarbon activities and licensing granted by the Greek state (art. 156 paragraph 17).

Greece has also incorporated in its national legislation Directive 2001/42 regarding the assessment of impacts on environment of certain plans and programs. The scope of the Directive is to ensure high level protection of the environment and the incorporation of environmental aspects during preparation and adoption of plans and programs, in order to promote sustainable development, ensuring that according to the directive an assessment of environmental effects will be performed for certain plans and programs which may have significant effects to the environment.

Harmonization of Directive 2001/42 in national legislation was done by KYA 107017/2006. KYA 107017/2006 (FEK 1225/B/5.9.2006) concerns the assessment of environmental impacts of certain plans and programs, in accordance to Directive 2001/42/EC.

Greece is also party to a number of international conventions and protocols, including MARPOL and the Barcelona Convention. Under the Barcelona Convention, there is an offshore protocol specifying control measures for hydrocarbon exploration and exploitation.

For the present SEA 3 main phases of hydrocarbon activities, which are based on existing legislation (Law 2289/1995) and the licensing practice by the Ministry of Environment, Energy and Climate Change: prospecting, and exploitation.

## 3. GENERAL DESCRIPTION OF STUDY AREA

This SEA Report includes a description of the current state of knowledge of the region covered by the hydrocarbon licensing program. The affected environment is divided into the physical, geological biological, and socioeconomic environments of the marine areas to the south and west of Crete Island.

The physical environment consists of the meteorological and oceanographic conditions in the lease areas, the characteristics of the sea floor, and the existing acoustic environment.

The biological environment within the license areas includes the following living elements:

- Marine plankton, including both phytoplankton (flora), which form the base of the food chain, and zooplankton (fauna), which link phytoplankton to fish production;
- Benthos, which refers to the animals (benthic fauna) and plants (benthic flora) that are found on, in or near the seabed;
- Nekton, which includes all the animals, but primarily fish species, found in the waters of the study area;
- Marine birds or sea birds, with particular attention to those species specifically noted in the Barcelona Convention Action Plan for Sea Birds;
- Marine mammals, sea turtles, and other protected or endangered species; and
- Areas of special concern such as Marine Protected Areas (MPAs)

Key marine environmental characteristics of the region include high salinity in sea waters, low concentration of nutrients, and low productivity and high seismicity.

The socioeconomic environment discussions provide an overview of the main socioeconomic features relevant to the coastal area of Crete Island, which may be affected by hydrocarbon activities.

Economic resources reviewed are as follows:

- Commercial and recreational fisheries;
- Aquaculture;
- Shipping and marine operations including ports and oil terminals;
- Telecommunications, specifically submarine cable systems;
- Recreation and tourism; and
- Archaeological resources, antiquities, and cultural heritage.

#### 4 ENVIRONMENTAL IMPACT ASSESSMENT

During the assessment of possible environmental impacts in the report, three phases of offshore hydrocarbon activities are recognised:

- **Prospecting:** activities to locate hydrocarbons and/or evaluate hydrocarbon potential by methods other than drilling. Prospecting includes seismic surveys, geological and geochemical sampling, electromagnetic surveys, and remote sensing.
- **Exploration:** the process of drilling one or more exploratory wells in a block to determine whether commercially exploitable hydrocarbons are present.
- **Exploitation (development and production):** the process of exploiting commercial quantities of hydrocarbons. Key activities include drilling of development wells, installation of production facilities, installation of export facilities such as pipelines, routine operation of these systems, and eventual decommissioning.

Potential effects were evaluated by considering the “impact factors” (causes or sources) involved in each phase of hydrocarbon activities as presented in Table II.

Examples of important impact factors include airgun noise during seismic surveys, drilling fluids and cuttings discharges during exploration and exploitation, and placement of production facilities on the sea floor.

Table II. Impact factors for phases of offshore hydrocarbon activities.

Prospecting	Exploration	Exploitation
<ul style="list-style-type: none"> <li>• Airgun noise</li> <li>• Vessel traffic and towed streamers</li> <li>• Effluent discharges</li> <li>• Air pollutant emissions</li> <li>• Sea floor disturbance</li> </ul>	<ul style="list-style-type: none"> <li>• Drilling rig installation and removal</li> <li>• Drilling rig presence</li> <li>• Drilling discharges</li> <li>• Other effluent discharges</li> <li>• Marine debris</li> <li>• Air pollutant emissions</li> <li>• Well testing</li> <li>• Support activities</li> </ul>	<ul style="list-style-type: none"> <li>• Facility installation</li> <li>• Presence of structures</li> <li>• Drilling discharges</li> <li>• Operational discharges</li> <li>• Marine debris</li> <li>• Air pollutant emissions</li> <li>• Support activities</li> <li>• Structure removal</li> </ul>

The following Table III summarises potential effects of offshore hydrocarbon activities in the licence areas to the south and west of Crete. The effects are grouped by phase (prospecting, exploration, and exploitation), followed by a separate listing for accidents. Within each phase, effects are organised by the impact factors identified for that phase. The table lists existing control measures and, for potentially significant effects, any additional mitigation measures recommended.

**Table 1.2.** Potential effects from offshore hydrocarbon activities in marine areas to the south and west of Crete Island (according to SEA Cyprus, 2008)

<b>Impact Factor</b>	<b>Potentially Significant Effects</b>	<b>Minor or Negligible Effects</b>	<b>Existing Control Measures Identified</b>	<b>Additional Mitigation Recommended</b>
<b>Prospecting</b>				
Air gun noise	<ul style="list-style-type: none"> <li>• Auditory trauma to marine mammals and sea turtles (including endangered, and critically endangered, and vulnerable species)</li> </ul>	<ul style="list-style-type: none"> <li>• Disturbance of fishes, plankton, other organisms</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Require licensees to implement a protocol to reduce the risk of auditory trauma to marine mammals and sea turtles. The protocol should include at a minimum, provisions for soft start, visual monitoring, and shutdown of the array</li> </ul>
Vessel traffic and towed streamers	<ul style="list-style-type: none"> <li>• Potential conflicts with fishing or shipping activities (e.g., temporary exclusion from certain areas, gear damage or entanglement)</li> </ul>	<ul style="list-style-type: none"> <li>• Small risk of vessels striking a marine mammal or sea turtle</li> </ul>	<ul style="list-style-type: none"> <li>• Licensees must conduct operations in an environmentally acceptable and safe manner. It is assumed that licensees would notify maritime authorities of survey location and schedule. Also, it is assumed that survey vessels would use appropriate signals in accordance with International Maritime Law</li> </ul>	<ul style="list-style-type: none"> <li>• Require licensees to consult with stakeholders prior to conducting streamer surveys to ensure that conflicts with fishing and shipping activities are minimized</li> </ul>
Effluent discharges	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on water quality similar to existing vessels in region</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Air pollutant emissions	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on air quality similar to existing vessel and aircraft traffic in region</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Sea floor disturbance	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor sea floor disturbance due to placement of cables or receiver boxes</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>

Exploration	Drilling rig installation and removal	Physical damage to possibly existing deepwater corals and chemosynthetic communities, or historic shipwrecks due to placement of structures and/or anchors	Physical damage to soft bottom benthos	None	Licenses must evaluate project area for deepwater corals and chemosynthetic communities Licenses must maintain a separation distance of 100 m between any potential deepwater corals or chemosynthetic communities and any sea floor disturbances (including anchoring) within the activity footprint Licenses must conduct a remote sensing survey to evaluate project area for shipwrecks and submit an archaeological assessment report by a qualified marine archaeologist, including recommendations for avoidance or further study None
Drilling rig presence (including noise and illumination)	None	Drilling rigs are likely to attract pelagic fish and plankton; noise may cause marine mammals or sea turtles to avoid the area	None	None	Licenses must evaluate project area for potential presence of deepwater corals and chemosynthetic communities, and maintain a separation distance of at least 500 m from any drilling discharges
Drilling discharges	Burial and anoxia effects on deepwater corals, or chemosynthetic communities if present within 500m	Burial and anoxia effects on soft bottom benthos	None	None	Licenses must evaluate project area for potential presence of deepwater corals and chemosynthetic communities, and maintain a separation distance of at least 500 m from any drilling discharges
Other effluent discharges	None	Minor impacts on water quality near drilling rigs, similar to existing ship traffic in region	MARPOL compliance	None	Licenses must evaluate project area for potential presence of deepwater corals and chemosynthetic communities, and maintain a separation distance of at least 500 m from any drilling discharges
Marine debris	Risk of death or injury to marine mammals, sea turtles, or birds due to ingestion of or entanglement with accidentally discarded debris	Water quality impacts cluttering of sea floor, shorelines	MARPOL compliance Licenses should perform site restoration activities in accordance with good international petroleum	None	None (existing measures assumed to be effective in avoiding significant effects)

Air pollutant emissions	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on air quality, similar to other vessel and aircraft traffic in region</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Well testing	<ul style="list-style-type: none"> <li>• Fallout of oil droplets due to incomplete combustion could produce a sheen on sea surface</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on air quality</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> </ul>	<ul style="list-style-type: none"> <li>• Require licensees to use a high-efficiency burner to minimise fallout of oil droplets and monitor for sheen on sea surface</li> </ul>
Support activities	<ul style="list-style-type: none"> <li>• Helicopters flying over Important Bird Areas (IBAs) could disturb coastal birds</li> </ul>	<ul style="list-style-type: none"> <li>• Small risk of vessel striking a marine mammal or sea turtle</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Advise licensees to avoid flying over IBAs</li> </ul>
<b>Exploitation</b>				
Facility installation	<ul style="list-style-type: none"> <li>• Physical damage to deep water corals, chemosynthetic communities, or historic shipwrecks due to placement of structures and/or anchors</li> </ul>	<ul style="list-style-type: none"> <li>• Physical damage to soft bottom benthos</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Require licensees to evaluate project area for deepwater corals and chemosynthetic communities</li> <li>• Require licensees to maintain a separation distance of 100 m between any potential deepwater corals or chemosynthetic communities and any sea floor disturbances (including anchoring, sea floor template installation, and pipeline construction)</li> <li>• Require licensees to conduct a remote sensing survey to evaluate project area for shipwrecks and submit an archaeological assessment report by a qualified marine archaeologist, including recommendations for avoidance or further study</li> </ul>
Presence of structures	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Platforms are likely to attract pelagic fish and plankton; underwater noise may affect behaviour of marine mammals or turtles</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Drilling discharges	<ul style="list-style-type: none"> <li>• Burial and anoxia effects on</li> </ul>	<ul style="list-style-type: none"> <li>• Burial and smothering of</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Licensees must evaluate project area</li> </ul>

	deepwater corals or chemosynthetic communities if present within 500 m	soft bottom benthos	for potential presence of deepwater corals and chemosynthetic communities, and maintain a separation distance of at least 500 m from any drilling discharges
Operational discharges	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on water quality near offshore facilities, similar to existing ship traffic in region</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> <li>• None</li> </ul>
Marine debris	<ul style="list-style-type: none"> <li>• Risk of death or injury to marine mammals, turtles, or birds due to ingestion of or entanglement with accidentally or improperly discarded debris</li> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Water quality impacts, cluttering of sea floor, shorelines.</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> <li>• Licensees must perform site restoration activities in accordance with good international petroleum industry practice</li> <li>• None (existing measures assumed to be effective in avoiding significant effects)</li> </ul>
Air pollutant emissions	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Minor impacts on air quality, similar to other vessel and aircraft traffic in region</li> </ul>	<ul style="list-style-type: none"> <li>• MARPOL compliance</li> <li>• None</li> </ul>
Support activities	<ul style="list-style-type: none"> <li>• Helicopters flying over IBAs could disturb coastal birds</li> </ul>	<ul style="list-style-type: none"> <li>• Small risk of vessel striking a marine mammal or sea turtle</li> </ul>	<ul style="list-style-type: none"> <li>• Advise licensees to avoid flying over IBAs</li> </ul>
Structure removal	<ul style="list-style-type: none"> <li>• Potential death or injury of a marine mammal or turtle (including endangered, critically endangered, or vulnerable species) if explosives are used</li> </ul>	<ul style="list-style-type: none"> <li>• Death or injury of fishes and other marine life near structures</li> </ul>	<ul style="list-style-type: none"> <li>• Require protocol for protecting marine mammals and turtles during structure removal in accordance with international best practice.</li> </ul>

#### Accidents

Oil spills including crude oil spill from a blowout	<ul style="list-style-type: none"> <li>• Depending on size and nature of spill, effects could include violation of water quality standards; contamination of sediments; death or injury of marine mammals, turtles, and birds; contamination of coa-</li> </ul>	<ul style="list-style-type: none"> <li>• Localized effects on air quality due to volatilization of hydrocarbons</li> <li>• Effects on soft bottom benthos around wellsites in the event of a subsea</li> </ul>	<ul style="list-style-type: none"> <li>• Oil spill trajectory modelling should be conducted to aid in understanding the fate of an oil spill at various locations in the licence area, the potentially affected environmental resources, and minimum response times</li> </ul>
Diesel fuel spill			
Drilling fluid base oil spill			



- |  |  |  |
|--|--|--|
| <ul style="list-style-type: none"> <li>• Streamer cable fluid leak or spill</li> </ul> | <p>stal habitats including beaches; and interference with fishing, shipping, recreation, and tourism during response and cleanup operations</p>                                  | <p>blowout or a drilling fluid base oil spill sinking to the sea floor</p>   |
| <p>Hydrogen sulfide (H<sub>2</sub>S) release</p>                                       | <p>Violation of air quality standards; potential death or injury of humans on offshore facilities and adjacent waters; potential death or injury of wildlife including birds</p> | <ul style="list-style-type: none"> <li>• None</li> </ul>   |
|  |  | <ul style="list-style-type: none"> <li>• The authority which give the license can require by licensees to submit a well location report including geological and geophysical information and safety measures to be used in the drilling of the well</li> </ul>   |
|  |  | <ul style="list-style-type: none"> <li>• Licenses should be required to submit information on expected H<sub>2</sub>S levels for prospective drill sites as part of the approval process for drilling activities.</li> <li>• Where there is a significant risk of encountering H<sub>2</sub>S during operations, licenses should be required to submit an H<sub>2</sub>S contingency plan</li> </ul> |

MARPOL = International Convention for the Prevention of Pollution from Ships.

## 5 CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Key Findings and Recommendations

The following conclusions and recommendations are based on the potentially significant effects identified during the SEA process for the marine areas to the south and west of Crete Island. Each “issue” refers to an impact factor and the potentially affected resource(s).

#### Issue 1: Effects of Airgun Noise on Marine Mammals and Turtles

Greece and specifically the under study areas to the south and west of Crete for this SEA, support a diverse marine mammal fauna, including several species listed by the IUCN as endangered (e.g., fin whale) or vulnerable (e.g., sperm whale). Common species are likely to include the bottlenose dolphin, common dolphin, and striped dolphin. The rare, critically endangered Mediterranean monk seal may be present in nearshore or coastal waters of Greek Seas (Adamandopoulou *et al.* 1999a), but is unlikely to be found in offshore waters of the licence area due to the depth.

Three sea turtles species occur in the area; the green (*Chelonia mydas*) and Caretta (*Caretta caretta*) are endangered, and the leatherback turtle (*Dermochelys coriacea*) is critically endangered. In Greece only Caretta is laying eggs mostly in Ionian Sea coasts (Zakynthos, Kyparissiakos Gulf and Cephalonia), and in Crete.

A common feature of most marine seismic surveys is the use of “airguns” (a compressed air sound source that is usually towed behind a vessel) to generate sound waves to penetrate the earth’s crust. During these surveys, there is a risk of temporary or permanent auditory trauma to marine mammals and sea turtles within a range of a several hundred metres from a typical airgun array, particularly if they swim beneath the array.

Baleen whales (e.g., fin whales) and some deep-diving species (e.g., sperm whales and beaked whales) may be at even greater risk than small dolphins. Also behavioral changes also have been recorded, however their significance is not fully understood.

Relatively little is known of sea turtle hearing, but sounds produced by airguns overlap with the frequency range where turtle hearing is most sensitive. Sea turtles are also showing an alert behavior, when exposed in high levels of sounds from airguns.

Marine mammals and sea turtles may avoid seismic survey areas at ranges of several kilometres from an airgun array.

The SEA did not identify any legal regulations or guidelines specifically protecting marine mammals or sea turtles from auditory trauma during seismic surveys. Mitigation recommendations are proposed based on widely used protective measures that have been developed for the U.K. and the U.S. Gulf of Mexico.

**Recommendation:** During seismic surveys, licensees should be required to implement a protocol to reduce the risk of auditory trauma to marine mammals and sea turtles. The protocol should include, at a minimum, the following provisions:

- **Soft start:** Every time the use of the seismic array is initiated, “soft-start” procedures should be used to allow time for marine mammals and turtles to move away before the array reaches full power. The process should begin with the smallest source in an array and build up slowly over 20 to 40 minutes.
- **Visual monitoring:** Beginning at least 30 minutes before startup during daylight hours, visual observers should monitor a safety (exclusion) zone of 500-m radius around the source vessel.

Startup of the array cannot begin until the safety zone is clear of marine mammals and turtles for at least 20 minutes.

- **Acoustic monitoring:** beginning at the same time as the visual monitoring during daytime by experienced personnel, and to continue after the optical monitoring is stopped during night time as long as the airgun activity continues. Startup of the array cannot begin until the safety zone is clear of marine mammals and turtles for at least in a radius of 500 m.
- **Shutdown of the array:** Visual monitoring of the sea surface should continue while the seismic array is operating during daylight hours, and the array should be shut down if a whale, monk seal, or sea turtle enters the safety zone during visual monitoring. A whale is defined as a cetacean other than Family Delphinidae (i.e., including any baleen, sperm, or beaked whale).

#### **Issue 2: Effects of Sea Floor Disturbances and Drilling Discharges on Benthic communities**

The area south of Crete shows strong geomorphological characteristics, since there are a number of smaller basins and trenches with deep and steep slopes. Characteristic example is the basin of Ierapetra (4300 m), the termination of the undersea canyon Samaria (3600 m) and the trench of Plinios (4300 m).

The overall conclusion (see section 4.2.2) of the studies that have been conducted in the area in relation to benthic fauna is that, contrary to earlier views, the deep sea of the Mediterranean is a dynamic and fragile ecosystem, directly connected with the biogeochemical processes occurring in the euphotic zone, the operation of which is significantly affected by the presence of various special geo-morphological structures, such as for example the abyssal plains, the seamounts and canyons and various extreme environments (mud volcanoes, lakes saline lakes, etc.) (Tselepides *et al.* 2007). Moreover, the abundance and distribution of fauna in the deep Mediterranean appears to directly depend on the availability of food, which is produced mainly in the euphotic zone and has an "episodic" character (Danovaro *et al.* 1995; Lampadariou & Tselepides 2006; Tselepides & Lampadariou 2004; Tselepides *et al.* 2000a). With regard to the coastal areas of southern Crete there are some sporadic studies reporting biocoenosis of sandy substrates and moderate to high quality and diversity while seagrass meadows are reported in southern Crete, mainly along the coastline and limited to shallow waters (<45 m depth).

*However it must be noticed that the deepwater zone of Ionian Sea as far as the benthic communities are considered, remains up to day barely known.*

During offshore hydrocarbon activities, deepwater corals, if existing, would be susceptible to physical damage from anchoring, placement of production facilities on the sea floor, and installation of pipelines. Because they do not depend on sunlight, these corals are not likely to be significantly affected by light occlusion due to turbidity from drilling discharges. However, if present, they could be adversely affected or buried by drilling discharges (muds and cuttings) settling on them.

Most significant effects of hydrocarbon activities on deepwater benthic communities and corals could be avoided by requiring licensees to conduct site-specific mitigation for individual projects. This is the basis for the following recommendation.

**Recommendation:** Prior to conducting activities that involve drilling, anchoring, placement of drilling rigs or production facilities on the sea floor, or installation of pipelines, licensees should be required to use high-resolution seismic survey (i.e., geohazards) data, 3D seismic survey data, and any other pertinent information available to identify hard bottom areas that could support important benthic communities as deepwater coral communities. If any such areas are identified, licensees should be required to conduct muds and cuttings discharge modeling to establish a separation distance that will protect these hard bottom areas and associated biological communities. In other parts of the world (i.e., the Gulf of Mexico), licensees are required to maintain the following separation distances:

at least 500 m from each proposed drilling fluid and cuttings discharge location, and at least 100 m from the location of all other proposed sea floor disturbances (including those caused by anchors, anchor chains, wire ropes, sea floor template installation, and pipeline construction) (MMS, 2004).

### Issue 3: Effects of Sea Floor Disturbances and Drilling Discharges on Chemosynthetic Communities

It has been shown (as mentioned at subchapter 4.2.1.1.) that the sediments of the Eastern Mediterranean are characterized by a relatively stable "benthic microbial loop" which consists of multiple levels (Tselepidis *et al.* 2007). Although the information on benthic microbial populations in the region of interest is limited, the general conclusion that emerges from comparative studies is that the microbial populations of Eastern Mediterranean is completely different from those of other regions (Kouridaki *et al.* 2010), while in general the sediments of the deep Mediterranean Sea can be classified as "rich hotspots" in microbial activity and biodiversity (Boetius *et al.* 1996, Danovaro *et al.* 2010, Luna *et al.* 2004).

Chemosynthetic communities are rare and often can be found to high-density deepwater assemblages that exist independent of photosynthesis. They are based on symbiotic bacteria that oxidise simple compounds such as hydrogen sulfide and methane. At water depths beyond those supporting photosynthesis and where seepage of hydrocarbons, venting of hydrothermal fluids, or other geological processes occur, chemosynthesis can become the dominant ecosystem process.

The existence of chemosynthetic communities in the licence areas has not been documented, but the potential exists in the region.

During offshore hydrocarbon activities, chemosynthetic communities would be susceptible to physical damage from anchoring, placement of production facilities on the sea floor, and installation of pipelines. Because they do not depend on sunlight, chemosynthetic communities are not likely to be significantly affected by turbidity from drilling discharges. However, if present, they could be adversely affected or buried by discharged materials settling on them.

Chemosynthetic communities are considered environmentally sensitive resources and are recognized by the European Community as vulnerable habitats needing protection. The SEA did not identify any EU or national regulations or guidelines specifically protecting chemosynthetic communities during offshore hydrocarbon activities. In the absence of EU regulations, guidance is available from experience in another region where chemosynthetic communities have been discovered near intense offshore hydrocarbon activities – the Gulf of Mexico. Studies in that area have shown that high-density chemosynthetic sites are associated with recognizable geophysical features and can be effectively avoided.

**Recommendation:** Licensees proposing to conduct exploration or exploitation activities within the licence area that involve drilling, anchoring, placement of drilling rigs or production facilities on the sea floor, or installation of pipelines should be required to use high-resolution seismic survey (i.e., geohazards) data, 3D seismic data, and any other pertinent information available, to identify shallow geologic features that could support high-density chemosynthetic communities. If any such features are identified, licensees should be required to maintain the following separation distances: at least 500 m from each proposed drilling fluid and cuttings discharge location, and at least 100 m from the location of all other proposed sea floor disturbances (including those caused by anchors, anchor chains, wire ropes, sea floor template installation, and pipeline construction)

#### **Issue 4: Effects of Sea Floor Disturbances on Shipwrecks and Submerged Archaeological Resources**

The license area is in a region where submerged archaeological resources are likely to be present. These features are susceptible to physical damage from sea floor-disturbing activities such as anchoring, placement of production facilities on the sea floor, and installation of pipelines. In addition to the area submersible telecommunication cables exist.

Based on experience in the Gulf of Mexico, a region where shipwrecks have been discovered near offshore hydrocarbon activities, these resources can be protected by requiring remote sensing surveys and an archaeological assessment prior to conducting sea floor-disturbing activities. Typically, such archaeological surveys and assessments are conducted in conjunction with other surveys that an operator conducts prior to drilling or production (e.g., for shallow geohazards).

**Recommendation:** Prior to conducting exploration or exploitation activities that involve anchoring, placement of drilling rigs or production facilities on the sea floor, or installation of pipelines, licensees should be required to conduct a remote sensing survey of the sea floor to evaluate the potential for shipwrecks and other submerged archaeological resources. Licensees should be required to submit an archaeological assessment report by a qualified marine archaeologist to include any identified archaeological resources and recommendations for avoidance or further investigation. Based on the report, the Ministry could require avoidance or other protective measures.

#### **Issue 5: Effects of Seismic Survey Vessels and Towed Streamers on Fishing, aquacultures and Shipping**

All kinds of fish are likely to listen according to different degrees of sensitivity within the frequency spectrum of the sound generated by seismic airguns. The strong sound wave generated by seismic surveys can have different harmful effects on fish fauna, and even the different species have different degrees of sensitivity to certain sounds (Hawkins, 1973, Popper and Fay, 1973; Tavalga et al, 1981; Fay, 1988; Popper and Fay, 1993; Fay, 2000). The seismic vibrations can cause temporary or permanent hearing impairment in some species, but, as in the case of marine mammals, would be unlikely to cause serious injury, unless the distance is very short. Due to the large differences in the physiology and morphology between fish species, behavioral responses and sensitivity of fish to acoustic trauma vary greatly. The main effects are mainly concentrated in fish hearing system, the orientation system, the ability to find food, their reproductive success and to avoid predators (Popper and Clarke, 1976; Ha, 1985). The noise from seismic surveys can also cause concealment of sounds used by fish for their usual acoustic behaviors (Popper and Clarke, 1976; Ha, 1985). These effects in their behavior has not been shown directly connected with an increase in mortality (Dalen and Knutsen, 1986; Pearson et al., 1992; Engås et al., 1993; Løkkeberg and Soldal, 1993). According to the literature, lethal effects can occur if the seismic surveys are carried out nearby and affect in a large extent the larvae and fish eggs (Ifiok and Igboekwe, 2011).

Is a fact that studies of seismic surveys effects on fish have shown mixed results (Davis et al. 1998). There are studies which have shown little or no effect (Turnpenny et al., 1994). According to the literature, there have been documented cases of reduction of fish caught by trawlers and longliners, in areas close to conducting seismic surveys (Hirst and Rodhouse, 2000; Slotte et al., 2004), while direct observations showed that reef fish remained in their niches (Wardle et al., 2001). There are no indications of fish mortality from seismic surveys, and data are not available if the noise intensity would cause death or other pathological consequences.

During seismic surveys, a moving safety zone is maintained around the vessel and its towed streamers. The moving safety zone is necessary to prevent fishing vessels or other ships from damaging the survey

equipment. A typical example could be 20 km long and 12 km wide and, if moving at 4.5 knots (8.3 km/hr), could take 2 to 3 hours to pass a particular point. Fishing activities in the licence area, including bottom trawling and long-lining, may be temporarily interrupted due to the extent of the moving safety zone around the survey vessel. The safety zones could result in temporary exclusion of fishing boats and other ships from certain areas. Some vessels would need to detour around the area. There is also the possibility of entanglement with long-line sets.

The Ministry of Environment can require licensees to ensure that operations are conducted in an environmentally acceptable and safe manner, consistent with the applicable environmental legislation and good international industry practice. Also, it is assumed that survey vessels would use appropriate signals in accordance with International Maritime Law (including communications via radio, lights, and flags) to warn other vessels of the exclusion zone.

**Recommendation:** Implementation of voluntary measures as the soft start, in order to reduce impact on fish. Licensees should be required to consult with stakeholders prior to conducting streamer surveys to ensure that conflicts with fishing, aquaculture and shipping activities are minimized.

#### **Issue 6: Effects of Well Testing on Air and Water Quality**

If a hydrocarbon formation is discovered during exploratory drilling, well testing may be conducted, in order to determine the productive capacity, pressure, permeability, and/or extent of a hydrocarbon reservoir. If hydrocarbons are brought to the surface during the well test, they are disposed of by burning. This combustion will result in emissions to the atmosphere. Air pollutant emissions from well testing will have a localized effect on air quality near the well site during the test period. Due to the distance offshore, no effects on coastal or onshore air quality are expected. However, fallout of oil droplets from well testing can produce a sheen on the sea surface, which would represent a significant effect.

**Recommendation:** During well testing, licensees should be required to

- (1) use a high-efficiency burner to reduce the amount of hydrocarbon fallout and
- (2) monitor the sea surface to ensure that no visible sheen is produced.
- (3) compliance to MARPOL requirements in relation to all kind of wastes, effluents, emissions

#### **Issue 7: Effects of Helicopter Traffic on Important Bird Areas**

Vessel and helicopter traffic could periodically disturb individuals or groups of coastal birds. The effects would be similar to those of existing vessel and aircraft traffic. It is likely that individual birds would experience at most a short-term, behavioral disruption, and the effect is considered minor. However, significant effects could occur if helicopters traveled frequently over Special Protection Areas (SPAs) designated under the Birds Directive, or other Important Bird Areas (IBAs). There are currently 10 designated SPAs in the under study area (see Table 4.20).

**Recommendation:** Licensees should be advised that helicopters engaged in support operations should avoid flying over SPAs and IBAs when traveling to or from the drilling rig. A map of SPAs and IBAs should be provided for this purpose.

#### **Issue 8: Effects of Structure Removals on Marine Mammals and Sea Turtles**

If offshore production facilities are established in the license area, they would eventually be decommissioned at the end of their useful life. During decommissioning, offshore production facilities such as platforms would be removed. Typically, the platform legs are cut at the sea floor, sometimes using explosives. For offshore pipelines, the most common international practice is to clean the pipeline and abandon it in place. If explosive charges are used for platform removal, then there is the potential for effects on marine mammals and sea turtles, including endangered, critically endangered, and vulnerable species. The risk of deaths and injuries of marine mammals and turtles can be effectively avoided through monitoring during removal operations.

**Recommendation:** Licensees should be required to follow international best practice for safe structure removal during decommissioning. Prior to structure removals, a decommissioning plan should be prepared that includes monitoring for the presence of marine mammals and sea turtles to avoid effects of underwater detonations.

#### **Issue 9: Effects of Oil Spills and hydrogen sulphide on the Marine Environment**

Oil spills are rare events, but the environmental and socioeconomic effects can be significant. The effect could vary substantially depending on the size of the spill, its chemical characteristics, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures.

Spill prevention measures and contingency planning are key elements in reducing the risk of significant effects from oil spills.

The Ministry of Environment can require by the licensees to prepare and submit to the Minister for evaluation and approval a contingency plan for hydrocarbon leakage and fire. In the event of leakage or fire, the licensee immediately applies the relevant contingency plan. The licensee is required to take reasonable and necessary measures in accordance with generally accepted practices in the international petroleum industry (QSHE), which are based to OSPAR, MARPOL, ISO, etc.

Given the fact that the result of an accident during the course of research or production wells in the region, or at the operating time, will create an oil spill, it is necessary to create infrastructure that is able to reproduce at any time the progression and dispersion of pollutants. The majority of oil spills that have occurred in the past were mostly superficial, but the last major incident that took place in 2010 on the platform 'Deepwater Horizon' in the Gulf of Mexico produced subsurface spot.

The upcoming installation of drilling worksite requires extensive study of marine currents in the area of research, especially in the region that mediates between the points of drilling and the adjacent coast. The only way that allows for high-frequency (every one or every half hour) recording the whole field of surface currents of an area of hundreds of square kilometers, is coastal high frequency radars (HF radars).

Oil spill trajectory modeling is a useful aid in contingency planning. The oil spill trajectory model of POSEIDON which is available by HCMR has been used in the region of Aegean Sea in the frame of programs and the needs of the Regional Marine Pollution Emergency Response Centre (REMPEC).

An example of the application of the POSEIDON oil spill model in the under study area to the south and west of Crete has been run in the frame of the present SEA, using meteorological and oceanographic data of the 10<sup>th</sup> November 2011. The results are presented in chapter 4.1.4 and in this Appendix. Additional modeling of trajectories over multiple seasons and spill sites would aid in predicting the fate of an oil spill in the licence area, identifying potentially affected environmental resources, and determining minimum response times for contingency planning.

Finally arbitrary leakage of hydrogen sulphide due to an accident can have a significant impacts on air quality and human health, but are limited to very short distances from the emission source. The extent of the impact depends on the concentrations of hydrogen sulphide and the meteorological conditions

prevailing at the time of the accident. The holder of a drilling permit for the drilling wells areas is required to have gathered information on expected levels of hydrogen sulfide and present them during the approval process of mining. Where high concentrations are expected in the course of extraction is also required to have an 'emergency plan' to address any accidental emission of H<sub>2</sub>S.

**Recommendation:** Elaboration by the license holders of a plan to assess the hydrocarbon leak probability and possible resulting fire and how to fight against them, but also in accordance with the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL), ships as rigs are required to have in place a contingency plan for dealing with oil pollution (Shipboard Oil Pollution and Emergency Plan, SOPEP), submitted in delegating Ministry for evaluation and approval.

Installation and operation of high-frequency coastal radar systems for many years to record currents.

Conduct additional spill trajectory model to identify likely spill trajectories from multiple launch points in the license areas, using seasonal meteorological and oceanographic data.

Use the combination of results from HF radars and models to determine the likely fate of spills in the license area, potentially affected environmental resources, and minimum times for a spill to reach shorelines of Crete..

The providing the license authority may require by contract for each well drilled the holder of the license to report the geological and geophysical information on expected levels of hydrogen sulfide, as well as on the safety regulations applicable at the stage of the opening of the well.

#### Issue 10: Transboundary Environmental Impact

Cross-border environmental impacts are referring in an area under the jurisdiction of a state, while the cause is in another state jurisdiction. The Environmental Impact Assessment in a Transboundary Context is necessary for legal reasons, as required by a number of provisions of the National, European or international law, but is also necessary for practical reasons, since the environment is not "recognizing" borders, since the forwarding or transmission processes of the cause of an effect, particularly in the marine environment is uniform, although parts of the affected areas may belong to the jurisdiction of different states

The main conventions, directives, laws governing provisions and obligations relating to the prevention and addressing transboundary impacts of exploration and exploitation activities of Hydrocarbons, are:

- European Directive on Environmental Impact Assessment (85/337)
- Barcelona Convention (1976 "Treaty on the Protection of the Mediterranean against pollution», Offshore Protocol)
- OPRC Convention (Oil Pollution Preparedness, Response and Cooperation, ratified by Law. 2252/1994)
- UNCLOS Convention (United Nations Convention on the Law of the Sea) of the United Nations. The contract was ratified in Greece in 1995 (Law. 2321/95 FEK136A / 23.6.1995).
- Directive 2001/42 and the CMD 107017/2006
- ESPOO Convention and its Protocol of Kiev.
- Directive 2013/30 / EU "For the safety of offshore oil operations and amending Directive 2004/35 / EC (Official Journal of the European Union L 178, 06.28.2013



Most of the impacts of offshore hydrocarbons activities are located in the immediate vicinity of the wells, pipelines, and other facilities and sites therefore are unlikely to affect neighboring countries. However, the licensing areas for exploration and exploitation of hydrocarbons in the marine area south and west to Crete Island are adjacent to the sea borders of several Mediterranean countries, including Albania, Italy, Malta and Libya.

Under normal conditions the direct and cumulative environmental effects of the activities of prospecting, exploration and exploitation of hydrocarbons is estimated that concern local impact and not likely to affect the environment of neighbouring countries. However, a major accident during or as a result of hydrocarbon activities, may result potentially to transboundary environmental effects.

The evaluation of potential transboundary effects (see Table I.III), based on impact factors for each phase of the hydrocarbons operations (prospecting, exploration and exploitation), as well as accidents, identifies two sources of potentially significant transboundary effects - a crude oil slick due to an explosion and diesel oil leakage. That relates to accidents only.

Every program to perform seismic, drilling and production activities must include measures to deal with potential emergencies that pose a threat to humans, the environment or assets.

However, even with the most careful planning, studying and applying correct procedures, best practices and proper training of personnel such casualties can occur, as (E & P Forum / UNEP, 1997):

- discharge of fuel, oil, gas, chemical and hazardous materials,
- boom in oil and gas drilling (blowout),
- fires (on site or in the surroundings)
- unplanned loss of facilities and shutdown events,
- natural disasters and their impact on operations, for example, floods, earthquakes, and
- war or sabotage.

The incidence of serious accidents (Table IV) is higher during the drilling stage of exploratory wells.

The exploration and exploitation of hydrocarbons in the Eastern Mediterranean could serve for a greater cooperation at regional level, through setting environmental standards for offshore hydrocarbon activities, methods for ensuring safety in offshore oil activities and strengthening institutional structures. At this point, reference should be made in the absence of accidents in the region, despite its long Italian activity in marine oil operations, which means that both the region not characterized by increased risk and secondly that there is accumulated knowledge and experience which could be exploited

In conclusion, during the process of hydrocarbon activities the relevant provisions of the Barcelona Convention should be taken into account, which regulates in detail such matters, the EU Directives (eg Directive 2013/30) and the Law of the Sea and other legislative frameworks. In addition, a detailed analysis of the provisions of the Barcelona Convention offshore Protocol and its Annexes must be undertaken, in order to confirm that all the research and exploitation activities of hydrocarbons in the license area are in line with the requirements of this protocol.

On ensuring cross-border availability and compatibility of intervention tools, it is noted that Greece is a member of the OPRC Convention (Oil Pollution Preparedness, Response and Cooperation, n. 2252/1994) which regulates in detail such issues, while poses the needed National Contingency Plan in order to address pollution from oil and other harmful substances (PD 11/2002).

Table IV. Potential transboundary impacts every phase of hydrocarbon activities (prospecting, exploration and exploitation), as well as accidents.

Impact factor	Possible transboundary effect	Possible significance of transboundary effect
<i>Prospecting</i>		
Airgun Noise	The noise can be detected many kilometers away, but the risk of significant effects (eg in marine mammals and turtles) is limited to a few hundred meters from the seismic survey vessels	No
Ships traffic and towed equipment.	A slight chance of minimal extension of the research lines and towed equipment in the marine area of another State.	No
Waste discharges	Dissolve rapidly near the ships	No
Air pollutants emissions	Dissolve rapidly near the ships	No
Seafloor disturbance	The effects are limited to areas that are wires or equipment on the seabed	No
<i>Exploration</i>		
Installation, presence and removal of the drill	The effects are limited close to the drilling and anchoring areas	No
Drilling waste	Turbidity plumes may extend a few kilometers from the rigs and thin films of drilling fluids can spread in several kilometers	No?
Other wastes	Dissolve quickly near the rigs	No
Marine debris	Floating debris can be dispersed in large areas, But the effects on the bottom are limited near the drilling	No
Air pollutants emissions	Spread quickly near the drilling rig	No
Drilling test	Emissions and oil droplets	No

	dispersed by precipitation near the drilling rig	
Support activities	The effects can appear between the well and the Crete Island coast, where perhaps there will be onshore facilities	No
<b>Exploitation (Development and Production)</b>		
Facilities	Effects mainly near the drilling and along the pipelines towards the mainland side of the Crete island	No
Infrastructure presence	Effects in the vicinity of the offshore infrastructures.	No
Drilling waste	Turbidity plumes may extend a few kilometers from the rigs and thin films of drilling fluids can spread in several kilometers	No
Operating waste	The wastes quickly dissolve near the offshore installations	No
Marine debris	Floating debris can be dispersed in large areas, limited effects on the bottom near the drilling site	No
Air pollutants emissions	Spread quickly near the drilling rig	No
Support activities	The effects can appear between the well and the Crete coast, where perhaps there will be onshore facilities	No
Infrastructure removal	Effects in the vicinity of the offshore infrastructures.	No
<b>Accidents</b>		
Crude oil slick due to explosion	The effects can be extended to neighboring territories, depending on the volume of the slick, chemical composition, oceanographic and meteorological conditions, and effectiveness	YES

	of the slick countermeasures	
Diesel oil slick	The effects can be extended to neighboring territories, depending on the volume of the slick, chemical composition, oceanographic and meteorological conditions, and effectiveness of the slick countermeasures	YES
Spot due to drilling fluids	The impact is limited near the rigs	No
Leak or slick due to liquids from streamer cables	Effects are limited near the ships operating seismic surveys	No
Release of Hydrogen Sulfide (H <sub>2</sub> S)	The impact is limited near the rigs and offshore production facilities	No

## 5.2 Recommendations for Additional Control, Management, and Monitoring

Greece has revised its legal framework to harmonize it with Directive 94/22/EC of the European Parliament on conditions for granting and using authorizations for the prospecting, exploration, and production of hydrocarbon according to KYA 107017/28.8.2006 "Assessment of environmental effects of certain plans and programs, in accordance to the provisions of Directive 92/44/EC".

No EU directives or guidance were identified concerning regulation of discharges from offshore hydrocarbon activities.

However there is the European Directive 2013/30 / EU on the safety of offshore oil and gas operations as well as, three parallel sets of guidance have been used by other EU countries: the OSPAR Convention, the Barcelona Convention and the International MARPOL convention 73/78..

**Directive 2013/30 / EU on the safety of offshore oil and gas operations:** Directive 2013/30 / EU of the European Parliament and of the Council of 12 June 2013 is on the safety of offshore oil and gas operations and amending the Directive 2004/35/EC.

This Directive lays down minimum standards for the prevention of major accidents during offshore oil and gas operations and limiting the consequences of such accidents. It shall not prejudice Union law as regards the safety and health of workers at work, in particular Directives 89/391 / EEC and 92/91 / EEC and without prejudice to Directive 94/22 / EC, 2001/42 / EC, 2003/4 / EC (19), 2003/35 / EC, 2010/75 / EU (20) and 2011/92 / EU.

The directive without making stricter environmental conditions in the oil and gas exploration and production activities in marine areas, is introducing a more systematic follow-up of operations. Mainly provides a detailed examination of the capacity (financial and technical) of the contractors to cope with the environmental requirements of these activities. To monitor the work, provides for the establishment of an independent authority which should be separated from the corresponding attending issues related with the technical and economic research and production of hydrocarbons. It is worth noting that according to the new directive the independent authority to which are communicated any plans to carry out for the

research or exploitation, has the right if necessary, even to prohibit the start of work. Also, companies that operate in a Member State, and are simultaneously operate exploitation or research in another Member State of the EU, are obliged upon request, to submit a report about the circumstances of any serious accident in which they are involved.

The incorporation of the directive into Greek legislation is underway

**OSPAR Convention:** For most of the hydrocarbon-producing states of western Europe (contracting parties are Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom), the “Convention for the Protection of the Marine Environment of the North-East Atlantic” (OSPAR Convention) is the basis for national laws governing the discharge of offshore effluents.

Activities under the OSPAR Convention are organized into six strategies among which the fourth is about offshore oil and gas industry. The offshore oil and gas industry strategy includes decisions and recommendations concerning offshore chemicals, produced water, organic-phase drilling fluids, management of offshore cuttings piles, disposal of disused offshore installations, environmental management systems, toxicity testing, monitoring and reporting, and related topics. Member states commit to implementing OSPAR decisions and recommendations in their national regulatory system.

**Barcelona Convention:** In 1976, 16 Mediterranean countries adopted the “Convention for the Protection of the Mediterranean Sea Against Pollution” (Barcelona Convention). The Barcelona Convention includes an offshore protocol specifically developed to control pollution during offshore hydrocarbon activities and has the purpose to activate collaboration between all the Mediterranean countries for prevention, mitigation and fight the marine pollution and was amended in 1980. This protocol was adopted in 1994 and has been signed and ratified by Greece by Laws N. 855/1978 (ΦΕΚ 235/Α/23.12.1978), N. 1634/1986 (ΦΕΚ104/Α) and N.3022/2002 (ΦΕΚ 114/Α). The offshore protocol addresses control of harmful or noxious substances and materials; oil and oily mixtures; drilling fluids and cuttings; sewage; garbage; reception facilities, instructions, and sanctions; safety measures; contingency planning; monitoring; removal of installations; specially protected areas; and transboundary pollution.

The Barcelona Convention offshore protocol is the basis for produced water discharge standards in several Mediterranean EU countries and would be a logical starting point for Greece to develop discharge requirements for offshore hydrocarbon activities. In addition, the Barcelona Convention offshore protocol provides a comprehensive set of guidelines for various aspects of offshore activities in a single document, in contrast to the numerous decisions, recommendations, and amendments of the OSPAR Convention.

**International Convention MARPOL 73/78:** The International MARPOL Convention (Marine Pollution) 73/78 «about prevention of marine pollution by ships» was the result of 1973 Convention and 1978 meeting – MARPOL protocol. This convention was put into effect in 2 October 1983 for Appendix I concerning oil and for Appendix II concerning harmful liquid chemical substances.

- Appendix V, about discharges was put in effect in 31 December 1988.
- Appendix III, about harmful substances carried in package was put in effect in 1<sup>st</sup> July 1992.
- Appendix IV, about sewage wqs put in effect in 27 September 1997.
- Appendix VI, about atmospheric pollution, adopted in September 1997.

This convention put the legal frame prevention of pollution by ships, by determining pollution thresholds of shipborne minimal discharges and anyway in a specified distance from nearest coast. In addition, in “Special Areas” as is the Mediterranean Area almost any type of discharge from ships is forbidden. Specifically, the 1973 convention defined as special areas the Mediterranean, Black Sea, Baltic Sea, Red Sea, and the Persian Gulf, which are considered sensitive/vulnerable for oil pollution, thus any oil discharges are forbidden. Amendments in the technical appendices of MARPOL 73/78 convention began

in 1984, in order to continuously try to prevent and secure protection of the marine environment from shipborne pollution.

In Greece the International convention MARPOL 73/78 was ratified by Law 1269/1982 (ΦΕΚ 89/Α/21.7.1982).

**Recommendation:** Discharge requirements should be established for drilling fluid and cuttings, produced water, and other effluents from hydrocarbon activities in the license area. In developing the requirements, the Barcelona Convention offshore protocol and the OSPAR Convention offshore oil and gas industry strategy should be considered as sources of guidance., as well as MARPOL convention and the new directive 2013/30/EC. In addition, it is recommended that detailed requirements of the Barcelona Convention offshore protocol and its annexes should be reviewed to ensure that all hydrocarbon activities in the license area are consistent with the requirements of the protocol.

### 5.3 Data Gaps

This Strategic Environmental Assessment Report for the marine areas to the south and west of Crete Island includes a review of existing environmental and socioeconomic data for the region. While data gaps are noted for several individual topics, only those relevant to the offshore licensing program are listed here.

Although during drafting of this SEA the lack of data relating to a number of issues was evident, only those that are relevant to the licensing program are listed here and which should be the subject of individual specific Environmental Impact Assessments (EIA), which will follow.

Of great importance is the lack of knowledge concerning the ecology of the benthic communities, including the extent and biological characteristics of its Posidonia meadows, possible deepwater coral communities and chemosynthetic communities, understanding of how circulation and biogeochemistry of the Mediterranean interconnect with the biological activity and the distribution of populations at great depths. In order to fill this gap, a reconnaissance study of these communities would need to be conducted, including a combination of side-scan sonar surveys to map the extent of emergent hard bottom, visual observations (e.g., using a benthic camera) to document the presence of deepwater corals and other epifauna in relation to sea floor characteristics, and collection of benthic samples (e.g., dredges, trawls, box cores) to aid in identifying the fauna. Filling these data gaps will be useful in establishing a better baseline of the pre-existing environmental conditions, but this is not considered a prerequisite to continuing with the licensing activities.

In summary, the relevant data gaps identified in the Environmental Report, with recommendations for further study, are as follows:

- Assessment of the ecology and extend of important benthic communities, including deepwater corals if existing; In the light of a future mining activity and production facility on the seabed, the impact and assessment of pressure levels in macro- and minority benthic communities must be monitored using appropriate methodology and indicators. This impact monitoring after installation of the wells is proposed to follow a strategy of graded distance from the extraction point is usually followed that when the effects of a factor of disturbance or pressure decrease with distance from the point source. Indicative classified distances for selection of monitoring points can be a) near the extraction point b) 120 m from the point c) 1000 m from the extraction point. Such assessment systems of ecological and environmental status of benthic communities have recently developed (Simboura & Zenetos, 2002; Simboura et al., 2012; 2014; in press) in implementing EU

directives such as the WFD (EC, 2000/60), and the MSFD Directive (EC, 2008). In particular, for the bathyal zone have been proposed benchmarks (reference values) for diversity indices as well as and integration systems for biotic and diversity indices.

- Because the high seismicity of the area is a potential risk for exploitation of possible undersea hydrocarbon deposits, since it is a main factor causing geo-hazards such as underwater gravitational movements sediments (slips, mass-scare flows turbidite currents), bottom drilling, or massive leaks of fluid from the bottom and the possible induction of tsunamis, in conclusion, before starting mining potential hydrocarbon resources a special study is needed on the assessment of geo-hazards in the wider area south and west of Crete and in order to avoid them by appropriate siting, design and implementation and operation of the plant and mining measures. Obviously, this study should be developed after having progressed sufficiently the research on probable reserves and the maturation of planning to exploit them in order to make known the points on which to focus the hydrocarbon activities in the total concession area. Also, is recommended the systematic recording of mikroseismic activity in the region, by placing local amphibian networks of seismographs and preparing special geo-hazard analysis study with emphasis on slope stability-landslides in existence craters, escape of hydrocarbon gases, mud volcanoes and hydrates.
- Measurements of sediment quality (surface and deeper layers), the suspended material and the rate of sedimentation. Information relating to the overall geochemical composition and distribution of major and trace elements in sediments of the Eastern Mediterranean is very limited and requires systematic work to record the contemporary situation and evaluation of potential anthropogenic pressures as recorded in marine sediments. Measurements of hydrocarbon and trace metal concentrations in sea floor sediments from the license area, particulate matter and sedimentation rates, to provide a useful baseline for detecting future changes due to offshore hydrocarbon activities;
- Measurements of pollutants such as heavy metals and PAHs to be done in the water column as well, since there are virtually no information to permit an assessment of any changes due to the hydrocarbon activities.
- Measurements of pollutants (hydrocarbons, heavy metals) is proposed to be done before the start of activities in indicators-organisms (bivalves, fish) of the region, to complement the few existing data, which are sporadic and insufficient, and thus to be used as basis for future environmental monitoring of the area
- The chemical characteristics of materials of drilling that will reach the marine environment should be within the tolerance limits of the ecosystem in which are directed. It is therefore necessary a qualitative study of excavated materials, and environmental monitoring of the marine area where the excavated material will be rejected, before, during and after the rejection, as explicitly mentioned by the Application Instructions issued by the United Nations Environment program for management of excavation in the Mediterranean Sea (UNEP / MED POL 2000) and required by national legislation and international treaties (London 1972 and Barcelona 1976 together with the accompanying Protocols) concerning the protection of the marine environment.
- Since research work performed is dated back to 2005-6, in relation to the water circulation in the region, it is estimated that there is a need for repetition of the field research in the area of interest. Additionally, immerse headphone proposed (preferably) current meters (ADCP) in a few selected areas of the region of interest for a period of at least one year, as this will significantly contribute to a better understanding of water circulation in the area

- Extension or increase of resolution of the existing ocean flow models, in order to improve the accuracy and reliability of oil spill fate and trajectory modeling; It should in this EIS also develop contingency plans, informing the stakeholders, action planning, staff training, in constant readiness to tackle emergencies
- In connection with the above, it could be foreseen to provide installation of telemetric monitoring stations, radar, and create a database that will be linked to early warning system for preventing and treating oil spills and assist decision making. Also to emphasize areas NATURA 2000. Additional information on areas NATURA, SACs, SPAs in relation to imprint ecological corridors, determination of reproductive activities, immigration etc.
- Collection of additional subsurface current, meteorological data, temperature, and salinity data, atmospheric pollutants in the licence area at sufficiently high temporal and/or spatial resolution to constrain ocean flow forecasting models and circulation hypotheses because existing data is old or missing. Also in the absence of recent measurements relating to distributions of oxygen, suspended material and nutrients highlighted is the necessity of depicting and monitoring of the current situation.
- Mapping of shipwrecks, telecommunication cables and submerged archaeological resources.
- To develop proposals for resolving potential problems and restore the landscape in connection with possible visual impairment from the permanent facilities on the landscape, if any, and following possible impact on tourism will be done as part of specialized EIA per position per drilling and production position, as provided by the environmental licensing laws (n. 4014/2011, 1958/2011 UNHCR etc.). In the same EIA and the respective decisions approving environmental conditions should be investigated, whenever the need, the type and the specific characteristics of countervailing measures, especially in areas of the network Natura 2000 (n. 4014/2011, art. 2 Fri the 7th and arts . 10 Fri the 4th and UNHCR oik.48963 / 2012, para. 7.8) or as regards the prevention and remedying of environmental damage (PD 148/2009). Finally, the same EIA should examine the methods and environmental rehabilitation safeguards against the withdrawal or uninstallation steps.
- A study will further explore the necessary measures to avoid, minimize or mitigate for the possible negative impact of hydrocarbon activities in the financial, etc. activities in these areas, especially in tourism, but also more detailed examination of alternative scenarios to create an area of protection in the coastline and the activities that take place in it. Also the refinery installation issue or sea transport of crude oil should be considered on an assessment of damage and benefits.
- A proposal for specifications for the establishment of an independent technical advisers committee to assist the local community within the involved regions as universities, etc., to control environmental conditions and technical control standards in all work of exploration and exploitation-production of hydrocarbons and the establishing of a Control and Coordination Agency for facing emergent high-risk incidents in connection with the incremental technical advisors.



## **ΠΑΡΑΡΤΗΜΑ ΣΤ**

The available Blocks are delimited by  
the following geographical coordinates

Block No	Longitude	Latitude
	18° 55' 0" E	39° 55' 0" N
	19° 10' 0" E	39° 55' 0" N
	19° 10' 0" E	39° 50' 0" N
	19° 15' 0" E	39° 50' 0" N
Block 1*	19° 15' 0" E	39° 45' 0" N
	19° 25' 0" E	39° 45' 0" N
	19° 25' 0" E	39° 40' 0" N
	19° 35' 0" E	39° 40' 0" N
	19° 35' 0" E	39° 50' 0" N
	19° 45' 0" E	39° 50' 0" N
	19° 45' 0" E	40° 0' 0" N
	18° 55' 0" E	39° 55' 0" N
	19° 10' 0" E	39° 55' 0" N
	19° 10' 0" E	39° 50' 0" N
Block 2*	19° 15' 0" E	39° 50' 0" N
	19° 15' 0" E	39° 45' 0" N
	19° 25' 0" E	39° 45' 0" N
	19° 25' 0" E	39° 20' 0" N
	18° 55' 0" E	39° 20' 0" N
	19° 25' 0" E	39° 40' 0" N
	19° 35' 0" E	39° 40' 0" N
	19° 35' 0" E	39° 35' 0" N
	19° 40' 0" E	39° 35' 0" N
	19° 40' 0" E	39° 30' 0" N
	19° 45' 0" E	39° 30' 0" N
	19° 45' 0" E	39° 25' 0" N
	19° 50' 0" E	39° 25' 0" N
	19° 50' 0" E	39° 20' 0" N
Block 3	20° 5' 0" E	39° 20' 0" N
	20° 5' 0" E	39° 5' 0" N
	20° 0' 0" E	39° 5' 0" N

ΣΤΡΑΤΗΓΙΚΗ ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ ΓΙΑ ΤΗ ΠΕΡΙΟΧΗ ΕΡΕΥΝΑΣ &  
ΕΚΜΕΤΑΛΛΕΥΣΗΣ ΥΔΡΟΓΟΝΑΝΘΡΑΚΩΝ ΝΟΤΙΩΣ ΤΗΣ ΚΡΗΤΗΣ

	20° 0' 0" E	38° 50' 0" N
	19° 35' 0" E	38° 50' 0" N
	19° 35' 0" E	39° 5' 0" N
	19° 30' 0" E	39° 5' 0" N
	19° 30' 0" E	39° 15' 0" N
	19° 25' 0" E	39° 15' 0" N
	18° 55' 0" E	39° 20' 0" N
	19° 25' 0" E	39° 20' 0" N
	19° 25' 0" E	39° 15' 0" N
	19° 30' 0" E	39° 15' 0" N
Block 4*	19° 30' 0" E	39° 5' 0" N
	19° 35' 0" E	39° 5' 0" N
	19° 35' 0" E	38° 50' 0" N
	18° 50' 0" E	38° 50' 0" N
	18° 50' 0" E	38° 50' 0" N
	19° 35' 0" E	38° 50' 0" N
	19° 35' 0" E	38° 15' 0" N
	19° 20' 0" E	38° 15' 0" N
Block 5*	19° 20' 0" E	38° 25' 0" N
	19° 0' 0" E	38° 25' 0" N
	19° 0' 0" E	38° 35' 0" N
	18° 50' 0" E	38° 35' 0" N
	18° 50' 0" E	38° 50' 0" N
	19° 35' 0" E	38° 50' 0" N
	20° 0' 0" E	38° 50' 0" N
	20° 0' 0" E	38° 30' 0" N
Block 6	20° 15' 0" E	38° 30' 0" N
	20° 15' 0" E	38° 5' 0" N
	19° 35' 0" E	38° 5' 0" N
	20° 0' 0" E	39° 5' 0" N
	20° 30' 0" E	39° 5' 0" N
	20° 30' 0" E	39° 0' 0" N
	20° 35' 0" E	39° 0' 0" N
	20° 35' 0" E	38° 50' 0" N
Block 7	20° 30' 0" E	38° 50' 0" N
	20° 30' 0" E	38° 25' 0" N
	20° 15' 0" E	38° 25' 0" N
	20° 15' 0" E	38° 30' 0" N
	20° 0' 0" E	38° 30' 0" N
	19° 50' 0" E	38° 5' 0" N

ΣΤΡΑΤΗΓΙΚΗ ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ ΓΙΑ ΤΗ ΠΕΡΙΟΧΗ ΕΡΕΥΝΑΣ & ΕΚΜΕΤΑΛΛΕΥΣΗΣ ΥΔΡΟΓΟΝΑΝΘΡΑΚΩΝ ΝΟΤΙΩΣ ΤΗΣ ΚΡΗΤΗΣ

	20° 25' 0" E	38° 5' 0" N
	20° 25' 0" E	38° 0' 0" N
	20° 35' 0" E	38° 0' 0" N
Block 8	20° 35' 0" E	37° 25' 0" N
	20° 0' 0" E	37° 25' 0" N
	20° 0' 0" E	37° 30' 0" N
	19° 50' 0" E	37° 30' 0" N
	20° 35' 0" E	37° 35' 0" N
	20° 55' 0" E	37° 35' 0" N
	20° 55' 0" E	37° 10' 0" N
	21° 0' 0" E	37° 10' 0" N
Block 9	21° 0' 0" E	36° 50' 0" N
	20° 10' 0" E	36° 50' 0" N
	20° 10' 0" E	37° 25' 0" N
	20° 35' 0" E	37° 25' 0" N
	20° 55' 0" E	37° 30' 0" N
	21° 30' 0" E	37° 30' 0" N
	21° 30' 0" E	37° 10' 0" N
	21° 25' 0" E	37° 10' 0" N
Block 10	21° 25' 0" E	37° 0' 0" N
	21° 30' 0" E	37° 0' 0" N
	21° 30' 0" E	36° 50' 0" N
	21° 0' 0" E	36° 50' 0" N
	21° 0' 0" E	37° 10' 0" N
	20° 55' 0" E	37° 10' 0" N
	21° 35' 0" E	36° 40' 0" N
	22° 0' 0" E	36° 40' 0" N
	22° 0' 0" E	36° 50' 0" N
	22° 10' 0" E	36° 50' 0" N
	22° 10' 0" E	36° 40' 0" N
	22° 15' 0" E	36° 40' 0" N
	22° 15' 0" E	36° 20' 0" N
	22° 35' 0" E	36° 20' 0" N
	22° 35' 0" E	36° 35' 0" N
	22° 50' 0" E	36° 35' 0" N
	22° 50' 0" E	36° 5' 0" N
Block 11	23° 0' 0" E	36° 5' 0" N
	23° 0' 0" E	35° 55' 0" N
	22° 50' 0" E	35° 55' 0" N
	22° 50' 0" E	35° 50' 0" N
	22° 20' 0" E	35° 50' 0" N

ΣΤΡΑΤΗΓΙΚΗ ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ ΓΙΑ ΤΗ ΠΕΡΙΟΧΗ ΕΡΕΥΝΑΣ & ΕΚΜΕΤΑΛΛΕΥΣΗΣ ΥΔΡΟΓΟΝΑΝΘΡΑΚΩΝ ΝΟΤΙΩΣ ΤΗΣ ΚΡΗΤΗΣ

	22° 20' 0" E	36° 0' 0" N
	22° 10' 0" E	36° 0' 0" N
	22° 10' 0" E	36° 10' 0" N
	22° 0' 0" E	36° 10' 0" N
	22° 0' 0" E	36° 20' 0" N
	21° 45' 0" E	36° 20' 0" N
	21° 45' 0" E	36° 25' 0" N
	21° 35' 0" E	36° 25' 0" N
	22° 55' 0" E	35° 40' 0" N
	23° 25' 0" E	35° 40' 0" N
	23° 25' 0" E	35° 10' 0" N
Block 12	23° 40' 0" E	35° 10' 0" N
	23° 40' 0" E	34° 40' 0" N
	22° 50' 0" E	34° 40' 0" N
	22° 50' 0" E	35° 35' 0" N
	22° 55' 0" E	35° 35' 0" N
	23° 40' 0" E	35° 10' 0" N
	23° 55' 0" E	35° 10' 0" N
	23° 55' 0" E	35° 5' 0" N
Block 13	24° 30' 0" E	35° 5' 0" N
	24° 30' 0" E	35° 0' 0" N
	24° 35' 0" E	35° 0' 0" N
	24° 35' 0" E	34° 25' 0" N
	23° 40' 0" E	34° 25' 0" N
	24° 0' 0" E	34° 55' 0" N
Excluded inner part of block		
	24° 10' 0" E	34° 55' 0" N
	24° 10' 0" E	34° 45' 0" N
	24° 0' 0" E	34° 45' 0" N
	24° 35' 0" E	35° 0' 0" N
	24° 40' 0" E	35° 0' 0" N
	24° 40' 0" E	34° 50' 0" N
Block 14	25° 15' 0" E	34° 50' 0" N
	25° 15' 0" E	34° 55' 0" N
	25° 25' 0" E	34° 55' 0" N
	25° 25' 0" E	34° 10' 0" N
	24° 35' 0" E	34° 10' 0" N
	25° 25' 0" E	34° 55' 0" N

**ΣΤΡΑΤΗΓΙΚΗ ΜΕΛΕΤΗ ΠΕΡΙΒΑΛΛΟΝΤΙΚΩΝ ΕΠΙΠΤΩΣΕΩΝ ΓΙΑ ΤΗ ΠΕΡΙΟΧΗ ΕΡΕΥΝΑΣ & ΕΚΜΕΤΑΛΛΕΥΣΗΣ ΥΔΡΟΓΟΝΑΝΘΡΑΚΩΝ ΝΟΤΙΩΣ ΤΗΣ ΚΡΗΤΗΣ**

	25° 35' 0" E	34° 55' 0" N
	25° 35' 0" E	34° 50' 0" N
Block 15	25° 50' 0" E	34° 50' 0" N
	25° 50' 0" E	34° 55' 0" N
	26° 15' 0" E	34° 55' 0" N
	26° 15' 0" E	34° 10' 0" N
	25° 25' 0" E	34° 10' 0" N
	21° 20' 0" E	34° 45' 0" N
	22° 10' 0" E	34° 45' 0" N
Block 16*	22° 10' 0" E	35° 0' 0" N
	22° 50' 0" E	35° 0' 0" N
	22° 50' 0" E	34° 0' 0" N
	22° 50' 0" E	34° 0' 0" N
	22° 50' 0" E	34° 40' 0" N
	23° 40' 0" E	34° 40' 0" N
	23° 40' 0" E	34° 15' 0" N
Block 17*	23° 30' 0" E	34° 15' 0" N
	23° 30' 0" E	34° 5' 0" N
	23° 20' 0" E	34° 5' 0" N
	23° 20' 0" E	33° 45' 0" N
	23° 20' 0" E	33° 45' 0" N
	23° 20' 0" E	34° 5' 0" N
	23° 30' 0" E	34° 5' 0" N
	23° 30' 0" E	34° 15' 0" N
Block 18*	23° 40' 0" E	34° 15' 0" N
	23° 40' 0" E	34° 25' 0" N
	24° 35' 0" E	34° 25' 0" N
	24° 35' 0" E	33° 25' 0" N
	24° 35' 0" E	33° 25' 0" N
Block 19*	24° 35' 0" E	34° 10' 0" N
	25° 25' 0" E	34° 10' 0" N
	25° 25' 0" E	33° 20' 0" N
	25° 25' 0" E	33° 20' 0" N
Block 20*	25° 25' 0" E	34° 10' 0" N
	26° 15' 0" E	34° 10' 0" N
	26° 15' 0" E	33° 15' 0" N

The external boundaries of the block's labelled with asterisk \* are delimited according to the existing bilateral agreements of delineation and in the case of absence of such agreements, by the median line as is described in article 2, §1 of law 2289/1995, as amended with article 156, §2 of law 4001/2011 (FEK A' 179/22.08.201



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Δρ Καλλιόπη Πάγκου  
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ΓΕΩΡΓΙΟΣ ΔΙΟΝ. ΣΙΓΑΛΟΣ

ΔΙΑΧΕΙΡΙΣΤΗΣ ARCEVNIRO

ΚΑΤΟΧΟΣ ΠΤΥΧΙΟΥ ΜΕΛΕΤΗΤΗ 27Γ

ΑΡ. ΜΗΤΡΩΟΥ 12134

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