HELLENiQ UPSTREAM
KYPARISSIAKOS GULF

BLOCK 10

LEASE AREA

ENVIRONMENTAL REPORT 2024 - 2025

Contents

BLOCK 10 LEASE AGREEMENT AREA

ENVIRONMENTAL REPORT 2024 - 2025

HSE Policies & System, Environmental Studies and Implementation

Introduction

HELLENiQ UPSTREAM Kyparissiakos Gulf Single Member S.A. (HELLENiQ UPSTREAM Kyparissiakos Gulf), 100% subsidiary of HELLENiQ UPSTREAM S.A., owns all the rights to explore and produce hydrocarbons deriving from the Lease Agreement with the Greek State in the offshore area of Kyparissiakos Gulf (Block 10), total area 3.420,6 sq. km. HELLENiQ Upstream Kyparissiakos Gulf SA (100%, Operator) officially signed the Lease Agreement with the Minister of Environment & Energy on April 9, 2019 and on October 10, 2019, the Greek Parliament ratified (Law 4630/10.10.2019). HELLENiQ UPSTREAM Kyparissiakos Gulf, acting as Operator, is fulfilling its commitments and planning of the first phase of the exploration work program by implementing the most up-to-date, safe and environmentally friendly technological methods and practices with the outmost respect to local societies and socioeconomic activities. According to the Provisions of Article 12 for «Environmental Protection» «The Lessee shall include in each Annual Work Program 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 Program and Budget».

1. Environmental Monitoring and Recording of Critical Biodiversity Indicators 2024 final results

*Survey of the Status of Important Fauna Species in the **Block 10** Lease Area*

1.1. Introduction

In the context of Environmental Monitoring and Recording of Critical Environmental Indicators of Biodiversity, such as marine mammals (cetaceans and monk seals), sea turtles and seabirds, the Hellenic Petroleum Exploration & Production of Hydrocarbons Kyparissiakos Gulf Single Member S.A. company has assigned to Nature Conservation Consultants (NCC) Ltd a contract for conducting the present Project, namely the "Survey of the Status of Important Fauna Species in the Block 10 Lease area. The Project consists of 3 work packages (WP):

I. Pelagic Surveys for marine mammals, seabirds, sea turtles, nearshore and in the open sea, using an open water RIB vessel, a sailing boat and a single engine aircraft.
II. Coastal surveys for monk seals and Mediterranean shag breeding sites in the coastal zones of the adjacent Natura 2000 sites, using inflatable RIB boats.

III. Telemetry for seabirds and marine turtles using drone videography and stationary thermal cameras, as well as satellite transmitters.

The present project is the 2024 continuation of the ongoing project implemented in the period 2020- 2023.

1.2. Description of the Project Area

The Project Area is located in the Ionian Sea, southeast of Zakynthos Island and west of Peloponnese, approximately from the latitude town Zacharo in the north and town Methoni in the south. It extends between latitudes of 36º50'N in the south and 37º30'N in the north and between latitudes of 20º55'E in the west and 21º30'E in the east. Its total surface area is 3.422.5 km2.

The Wider Project Area envelops the project area and extends further north and east to additionally include the southwestern, south-eastern and eastern coast of Zakynthos, and the western coast of Peloponnese south of Kyllini, together with their neighboring islets. The Pelagic Survey Area, where pelagic surveys are carried out includes the primarily the Project Area together with neighboring waters to the east.

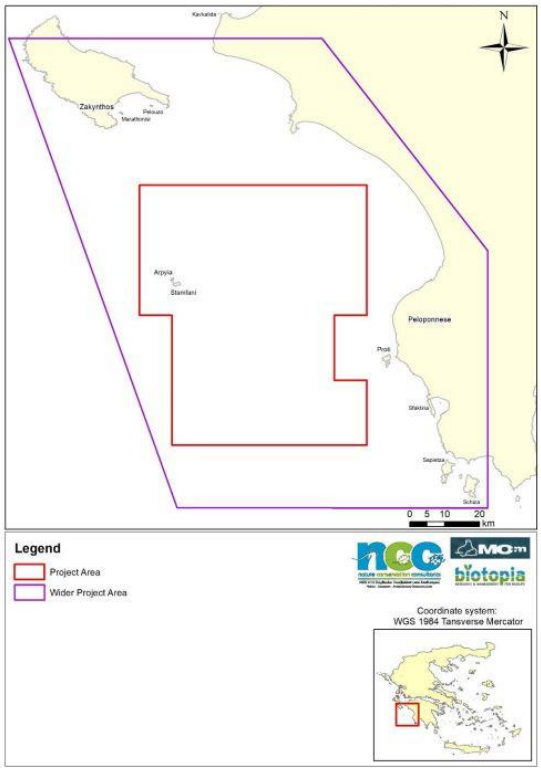

Fig.1: Wider Project Area

1.2.1. Oceanographic characteristics of the Project Area

The sea depth within the Project Area exceeds 500m and reaches more than 3.500m at its southwestern corner. The only exception are the Strofades islets in the west, which are surrounded by a narrow belt of coastal waters.

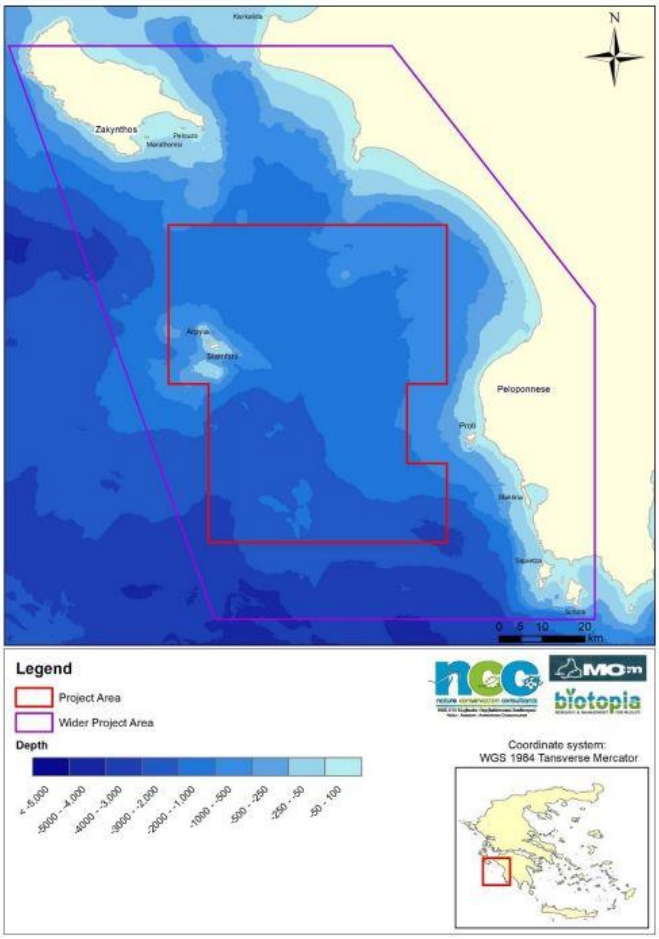

Fig.2: Bathymetry in the Project Area

In northern, north-eastern and eastern part of the Wider Project Area the slope of the sea floor descends gradually, without abrupt breaks towards southwest, however the southern and the western part exhibit numerous abrupt descends of the sea floor, accompanied by step slopes of the sea floor reaching up to 53º.

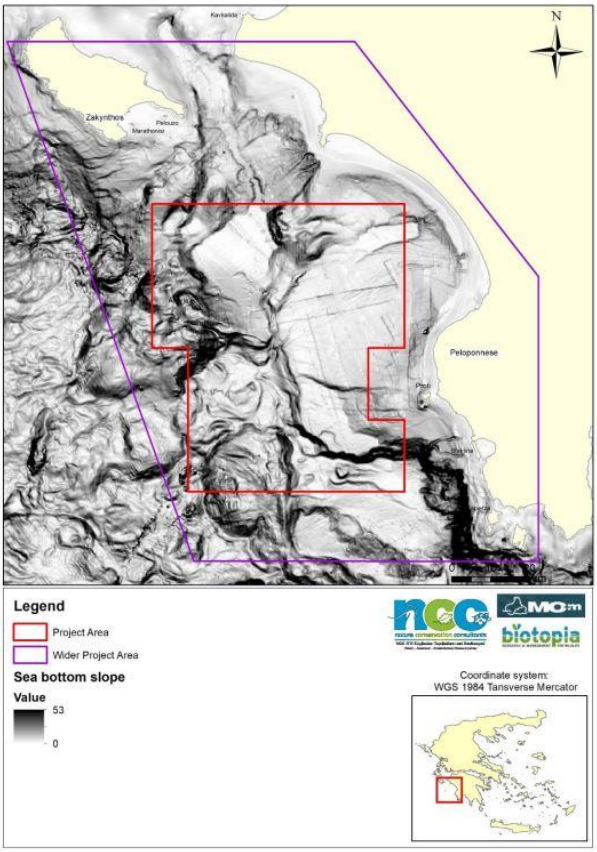

Fig.3: Slope of the sea floor in the Wider Project Area

1.3. Methodology

1.3.1. Pelagic surveys

Pelagic surveys for cetaceans, sea turtles and seabirds are carried out using i) a 15m sailing boat, ii) a 7,5m RIB boat and iii) a high wing, ultralight aircraft.

1.3.1.1. Boat surveys

Visual-based surveys

The method applied for visual surveying seabirds, cetaceans and sea turtles in the Pelagic surveys area is the European Seabirds at Sea (ESAS), based on Tasker et.al 1984 and Champhuysen & Garthe 2004 and adopted to Greek/Mediterranean conditions through the LIFE-Nature project for the Identification of Marine Important Bird Areas (marine IBAs) in Greece, entitled "Concrete Conservation Actions for the Mediterranean Shag and Audouin's Gull in Greece, including the Inventory of Relevant Marine IBAs", LIFE07 NAT/GR/000285, (http://www.ornithologiki.gr/en/seabirds), as described in Fric & Gaganis 2009.

In summary, the method is aiming at systematically recording seabirds, cetaceans and sea turtles as well as human activities in the survey area, in transects by trained observers, from a boat which is moving at a constant low speed (300m, W = within 300m), but no distance recorded. For flying birds, coded with F, there is no distance indication. Boat position (poskey), namely geographical longitude and latitude, are

recorded every 5 min. The marine species are spotted by a naked eye or binoculars and are identified by binoculars.

A method described by Heinemann (1981) is used to determine the distances at sea and more particularly the distance of 300m from the observing platform which determines the width of the line transect by using a caliper or a ruler. During ESAS surveys data is recorded regarding (A) boat route, (B) marine species and (C) human activities in the survey area, which may have an effect on the presence and behavior of the marine species.

Survey boat data include: start and end location date, time and geographical location of each line transect, sea state, visibility and floating matter (including fishing vessels). Species data recorded include: species, number of individuals, age (if applicable), distance from the observation vessel, location within or outside 300m line transect, flight direction (for birds), behavior and association with human activities or other species.

Fig.4: Visual boat surveys using the ESAS survey method

The *survey design for cetaceans* is similar to the established methodology designs for such surveys, used over the past 4 decades (Buckland et al. 2001, Buckland et al. 2004) and used a grid of parallel line transects, that provided comprehensive coverage of the study area. The transect lines acted as the basis for the daily track line followed by the vessel providing a roughly uniform coverage of the study area. Attempts were made when selecting the orientation of the transect lines, to have them move across (at an angle to) the depth gradient in the area as opposed to moving along (parallel to) the depth gradient. This was done to allow for the coverage of different depth levels during navigation of each transect, in order to minimize detection bias on individual transect lines when mapping sighting data.

When a group of cetaceans is sighted (group defined 'dolphins observed in apparent association, moving in the same direction and often, but not always, engaged in the same activity' (Bearzi et al. 2005) by any of the on-effort observers, the systematic search effort is interrupted while the vessel diverted from the track line toward the sighted animals in order to achieve more accurate determinations of the species, the

group size, group age class composition and group activity of the group sighted. In addition to basic environmental data.

Beaufort sea state, visibility conditions etc.) collected at regular 1 hour intervals as well as at the start and at the end of each transect line, data collected for each sighting includes the time, GPS coordinates, initial bearing and radial distance to the cetacean group (used to calculate the perpendicular distance of the sighting to the track line), species identity, group size, group age class composition (3 age classes: Calf < 1/2 length of adult, Juvenile < 2/3 length of adult and adult) and the general activity in which the group is engaged in at the time of approach (e.g. foraging, travelling, milling).

For the purpose of the correct identification of the species as well as the correct recording of group size and group age class composition attempts are made to approach the animals to obtain photographs. Where possible the photographs taken are also used for the photo-identification of individuals. This is done to ensure the same group of animals was not counted twice during the same survey day.

Encounter Rates are calculated as the number of encounters / 100km of "on effort" navigation. The navigation schedule coincided with the Visual boat-based surveys.

In case a group of cetaceans or seabirds was spotted, a drone was used in order to more accurately identify the species and assess the number of the individuals, record their behavior and gather the relevant photographic evidence. The numbers of individuals of each species recorded by ESAS surveys were transformed into species densities per km2, considering the 2x300m=600m transect survey width and the distance travelled by the survey vessels per 5-minute time interval distance travelled = boat speed x 5 min. The locations of number of recorded individuals per species and the density of individuals per species were overlaid 4 geographical minutes (4'x4') reference grid in WGS84 projection coordinate system.

Considering that more than one may have crossed each 4'x4' reference grid cell, for each cell the following variables were calculated:

• The average over all survey trips of the total number of individuals per species recorded in a 4'x4' grid cell per trip

• The maximum over all survey trips of the total number of individuals per species recorded in a 4'x4' grid cell per trip

• The average over all survey trips of the average density of individuals per km2 per species in a 4'x4' grid cell per trip

• The average over all survey trips of the maximum density of individuals per km2 per species in a 4'x4' grid cell per trip

• The maximum over all survey trips of the average density of individuals per km2 per species in a 4'x4' grid cell per trip

• The maximum over all survey trips of the maximum density of individuals per km2 per species in a 4′x4′ grid cell per trip.

It should be noted that individuals recorded outside transect are excluded from density calculation. The densities of the species per reference grid cell are representative of the habitat suitability. The variable "average over all survey trips of the average density of individuals per km2 per species in a 4′x4′ grid cell per trip" was used as a measure of habitat suitability for each species. This variable was classified into 4 classes:

• Most suitable habitats – top 5% of positive (i.e., non-zero) densities in grid cells

• More suitable habitats – 25-5% top values of positive densities in grid cells

• Suitable habitats – 75-25% top values of positive densities in grid cells, and

• Presence – remaining grid cells with species presence (bottom 25% values).

To further analyze the patterns of seabird movements in the area for each grid cell the prevailing flight directions were calculated. Additionally, locations of interactions of seabirds with fisheries were identified in association with their abundance in absolute numbers.

Finally, for each grid cell the number of species of interest recorded in the grid cell was calculated to identify those areas where the species richness is the greatest.

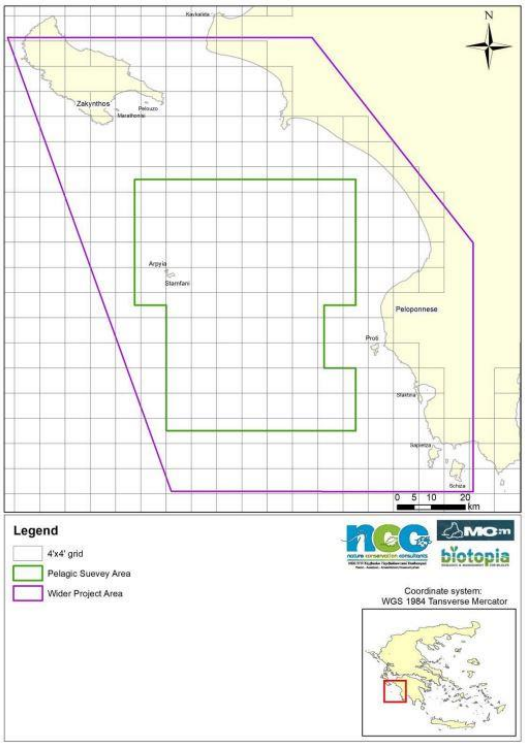

Fig.5: Four decimal minute (4′x4′) reference grid in WGS84 coordinate system

Acoustic surveys

The acoustics detection team worked in cooperation with the visual observers, detecting cetacean vocalizations by using a hydrophone array towed behind sailing boat. The hydrophone array system consisting of High Frequency Magrec HP03 hydrophone elements, comprising a HP03 preamp (Low cut filter set at 2kHz) with a nominal sensitivity of 1.5kHz – 150kHz along with a topside Magrec HP/27ST Amplifier along with a Lenovo Thinkpad Laptop using the PAMGUARD acoustic analysis software specifically developed for cetacean monitoring, covering the range of possible vocalizations for species likely to be encountered during our surveys. The towed hydrophone system was submerged and active, and a PAM operator was active on the equipment during all "On Effort" times during the survey.

The hydrophone system consists of 2 hydrophones which record in 2 different channels. The visual observers and PAM operator rotated every 1.5 hour to minimize fatigue.

The PAM operator immediately informed the visual observer team of any acoustic detection.

The hydrophone recordings were analyzed by PAMGUARD software using "whistle and moan detector" module.

Fig.6: Part of the hydrophone array towed behind a sailing boat

1.3.1.2.Aerial surveys

For the aerial surveys, a high wing, light aircraft Cessna C172R Skyhawk was used, powered with a Lycoming IO-360-L2A, 160 Hp. This four-seater aircraft offers an excellent view from its cockpit and is considered suitable, reliable and cost-effective for such a mission. Messolonghi Airport (ICAO designator GR-0008) was used as a base for the aerial expeditions to the Northern Ionian Project Area. The flight was performed along the Project Area at an altitude of 1000 ft MSL and an average Speed Over Ground of 85 knots. The flights were performed under ideal weather conditions (wind speed less than 10 knots, clear sky and visibility more than 8 km). In every case where an "object/s of interest" was spotted, the airplane left its track and performed one or more

circles over the object/s in order to visually identify it. Furthermore, the object was photographed so that a proper record of its observation and identification is kept.

The photographic operation was performed using a full frame DSLR (Nikon D750) with a 70-200mm F/2.8 Tamron SP lens. All photographs were georeferenced since the camera was equipped with a GPS Unit (Nikon GP-1A). The flights were monitored and recorded with the use of two specialized applications namely the GARMIN-Pilot and the Fore-Flight.

Fig.7: The aircraft used for the aerial survey

In the following example, the staged photographic identification process of an initially "object of interest" located on the shore is clearly shown.

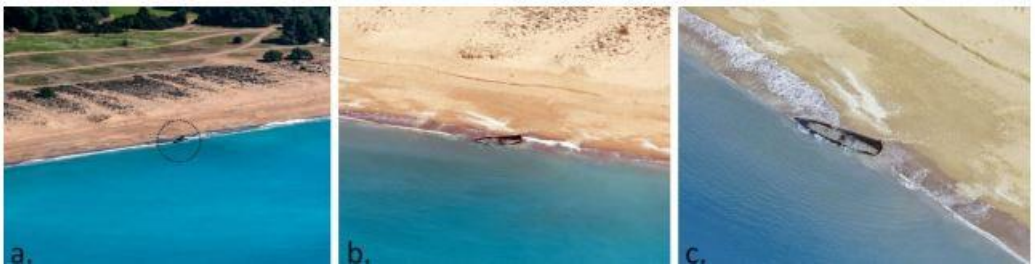

Fig.8: Recording an "object of interest", B: Approaching, C: Identifying

1.3.2. Coastal surveys

1.3.2.1. Coastal surveys for the Scopoli's Shearwater

At species' breeding colony in Strofadia islands, an adaptation of the existing raft counting method has been developed, with the RIB boat following the birds gathering in front of the colony before sunset, to create the raft. When a raft is spotted, the number of birds is counted using binoculars and ZOOM cameras. The DJI Mini 2 drone is then deployed flying at 30m above sea level to take photos and 4k video of the raft, in order to provide more accurate estimations.

At a second stage, after sunset, the raft is further monitored using a 640x480 thermal camera, to assess the movements of birds from the rafts to the colonies, as well as the timeline of the birds' entrance and flights to the colony sites. In this respect, breeding birds are distinguished from prospectors to provide more precise estimates of the colony size.

1.3.2.2. Coastal surveys for the Mediterranean Shag

Coastal surveys for the Mediterranean Shag involve the recording of the species individuals, age and activity while the survey vessel travels at a low speed along the survey coastline at a distance of 50-100m from the shore. The species are identified by binoculars, data is recorded on field maps and their locations are recorded by a portable GPS unit. Simultaneously, apparently active or suspected nesting sites are recorded. The data recorded during field surveys included:

- Date / time of the observation
- Location of the observation (GPS waypoint name, latitude, longitude) • Seabird species
- Number of individuals
- Number of adult and juvenile individuals (for the Mediterranean Shag)
- Identification of colony/nest sites, number of nests, suitable nesting habitat, roosting sites
- Potential localized threats
- Comments

1.3.2.3. Coastal surveys for the Mediterranean Monk Seal

Cave monitoring with the use of Automated Infrared Cameras

During the previous phase of the project, 4 Infrared Camera Traps were placed in 2 caves in the wider project area: ZAK6 and ZAK7. Three camera systems were installed in cave ZAK6 and 1 was installed in cave ZAK7. These were placed on rocky walls of the caves and were positioned to maximize the coverage of the terrestrial component of the cave (internal beach). Three of the camera systems were set to take time lapse photos (every 1 and 2.5 hours) of the cave beach to record the presence or absence of animals while one camera system set on motion detection operation.

1.3.3.Sea turtle Telemetry

The two main goals of the Fieldwork:

1) Retrieve transmitters from male turtles tracked from 2023 to access stored data. 2)Deploy transmitters on a further two male turtles To identify if the turtles from 2023 had returned to Kyparissia in 2024 we deployed a drone (DJI Phantom 3) to systematically search the field site for evidence of turtles with transmitters. This was undertaken throughout the field period, whilst the other work was being carried out. We acquired the two male turtles to receive transmitters using turtle rodeo technique as used in the previous fieldwork, namely a small RIB was used to approach the turtles and then they were caught by hand, secured in a net and taken ashore to receive the transmitters. Should we have seen a male turtle with a transmitter in place, we would have used the same rodeo technique to catch it to retrieve the transmitter.

1.3.4. Telemetry of Scopoli's Shearwater

The bird flights at the species breeding colony at Strofades islands will be recorded by a drone and stationary thermal cameras and will be stored to a geodatabase. The birds movements will be monitored in the vicinity of island colonies and foraging aggregations of seabirds and marine mammals will be spotted and mapped within the project area. An array of trail cameras and bio-acoustic microphones will be deployed at the Strofades colony to record the colony activities, threats and social interactions among breeding and non-breeding individuals.

Ten (10) GPS/GSM tags will be deployed to Scopoli's shearwater fledglings on September-early October 2024, to record the maiden journeys of the fledged birds and identify possible threats and mortality factors during this high-risk period. By processing the data through Artificial Intelligence and machine learning software, the bird populations, movements, patterns of space use by the species for foraging in the "Block 10" lease area will be further explored.

1.4. Results

1.4.1. Pelagic surveys

1.4.1.1. Boat surveys

A total of 964 nautical miles of boat-based visual surveys were carried out on 4-7/7/2024, 13- 19/7/2024 and 7-11/10/2024 in the Pelagic Survey Area, as well as in the surrounding areas in the Wider Project Area, to assess the presence, abundance and distribution of the cetacean, sea turtle and seabird species of interest.

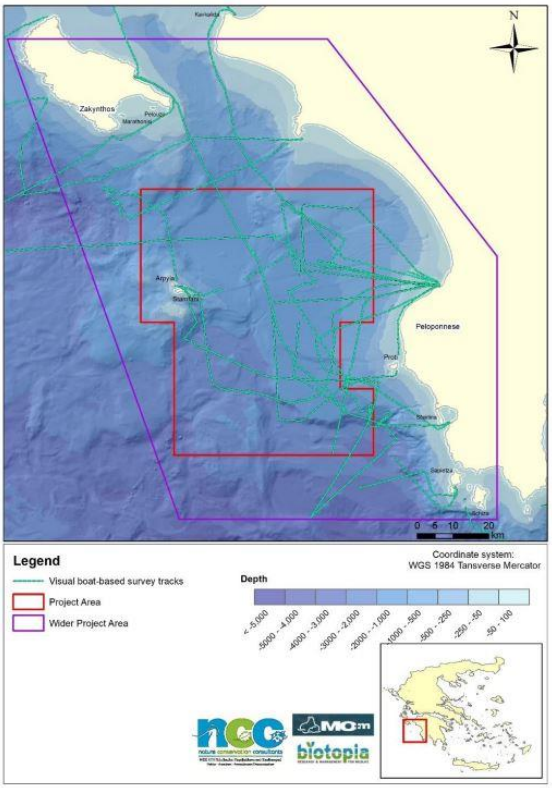

Fig.9: Visual boat-based survey tracks

During the visual surveys the following species were recorded:

- 3 cetacean species: Sperm whale (Physeter macrocephalus), Cuvier's beaked whale (Ziphius cavirostris), and stripped dolphin (Stenella coeruleoalba),
- 6 seabird species: Scopoli's Shearwater (Calonectris diomedea), Yelkouan Shearwater (Puffinus yelkouan), Yellow-legged Gull (Larus michahellis), Mediterranean Shag (Phalacrocorax aristotelis), European Storm Petrel (Hydrobates pelagicus) and Common Tern (Sterna hirundo),
- 1 wetland bird species: Shelduck (Tadorna tadorna),
- 1 raptor species: Marsh Harrier (Circus aeruginosus),
- 1 sea turtle species: Loggerhead turtle (Caretta caretta).

Species	Common name	Number of individuals
Physeter macrocephalus	Sperm whale	3
Ziphius cavirostris	Cuvier's beaked whale	9
Stenella coeruleoalba	Bottlenose dolphin	2
Dolphin (unidentified species)		3
Calonectris diomedea	Scopoli's Shearwater	335
Puffinus yelkouan	Yelkouan Shearwater	100
Hydrobates pelagicus	European Storm Petrel	1
Larus michahellis	Yellow-legged Gull	35
Sterna hirundo	Common Tern	1
Phalacrocorax aristotelis	Mediterranean Shag	3
Tadorna tadorna	Shelduck	12
Circus aeruginosus	Marsh Harrier	1
Caretta caretta	Loggerhead turtle	1

Fig.10: Species recorded in the Project Area

Moreover, during the visual surveys, the following cetacean species were observed outside the Wider Project Area: - 3 sperm whales NW of Zakynthos Island, - 1 sperm whale in the deep waters of South Messiniakos Gulf, - 4 Cuvier's beaked whales, W of Zakynthos Island, - 28 striped dolphins, W of Kefalonia Island. During the acoustic surveys with the towed hydrophone, covering 827 nautical miles, 36 detections of sperm whales were recorded, as well as 16 detections of dolphins (species identification is not possible with the towed hydrophone survey) in the Wider Project Area.

Additionally, another 21 acoustic detections of sperm whales were recorded outside the Wider Project Area (NW of Zakynthos and W of Kefalonia Islands).

1.4.1.2. Aerial surveys

The aerial survey was conducted on the 7 April 2024. A total of 644 km of coastline were inspected, covering the project area, as well as the western coast of Zakynthos Island and the northwestern coast of Peloponnese.

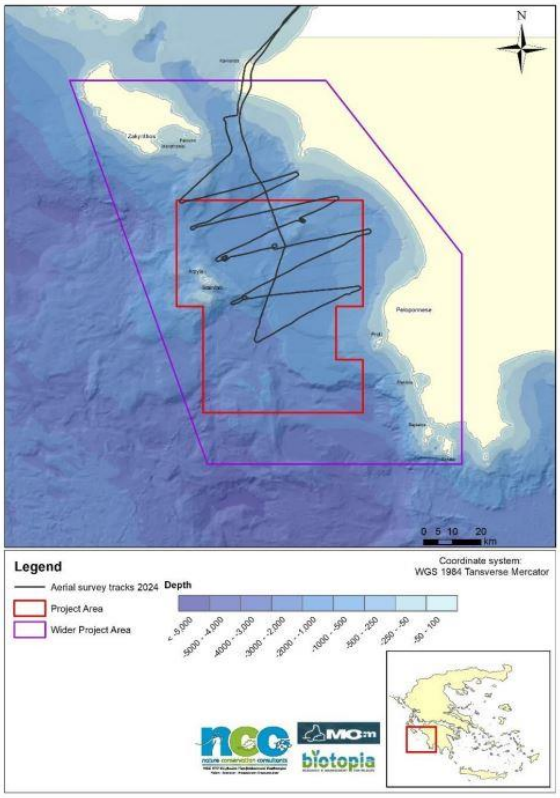

Fig.11: Aerial surveys track

Fig.12: Sperm whales during the boat surveys

Fig.13: Sperm whales during the boat surveys

Fig.14: Sperm whale with ferry and sailing boats(above)

Fig.15: A trawler operating in the project area during the aerial surveys

1.4.2. Coastal surveys

1.4.2.1. Coastal surveys for the Scopoli's shearwater

Coastal surveys for Scopoli's shearwater were conducted in July and September 2024 using a RIB boat. The coastal surveys focused on Strofades islands, where the largest breeding colony of Scopoli's Shearwater in Greece is located. Both drone surveys and thermal camera monitoring took place, as well as a visit to the colony on the islet of Stamfani to locate accessible nests for tagging birds.

1.4.2.2. Coastal surveys for the Mediterranean Shag

Coastal surveys for the Mediterranean shag at the Kyparissia coastline and the Strofades islets revealed no birds. This is attributed to the very low densities of the species in the project area, due to the unsuitable habitat (Kyparissia) or the offshore character of the project sites.

1.4.2.3. Coastal surveys for the Mediterranean Monk Seal

During the previous stages of the project, the coastline within the Wider Project Area was surveyed for the presence of suitable monk seal pupping habitat (marine caves). Monitoring efforts of the monk seal population during the previous reporting period focused on the island of Zakynthos. Three automatic infrared camera systems were placed in 2 pupping caves selected in the island of Zakynthos: ZAK6 and ZAK7. As Zakynthos island's caves and the monk seal population using them are the most vulnerable in relation to any future drilling activities and potential spills in the B10 lease area, monitoring of these caves was considered essential. The results of the infrared cameras in combination with data collected through the operation of the Rescue and Information Network (RINT) of MOm in the area are summarized up as follows:

- 21 monk seal observations collected through RINT
- 261 days of cave camera monitoring conducted
- 13329 photographs collected
- 17 different individuals identified through the analysis of the photos captured:
    - 7 Adult females
    - 2 Adult males
    - 2 Sub-adults
    - 1 Female pup
    - 3 Male pups
    - 2 pups of unknown sex

Based on the above-mentioned information, the number of monk seals inhabiting the area of Zakynthos Island is estimated to be at least 20 individuals. These results documented for the first time the importance of Zakynthos Island as a monk seal pupping site in the Ionian region.

Fig.16: Animals of all age classes photographed in ZAK6

1.4.3. Sea turtle Telemetry

Despite multiple hours of searching with the drone, with many turtles observed, none was recognized as having a transmitter in place. We therefore concluded that the two previously tracked turtles had not returned to Kyparissia in 2024.

Our survey methods were validated as the drone observed one of the 2024 turtles in the field area after it had received its transmitter. On the deployment side, we were able to successfully catch the planned two adult male turtles and equip them with transmitters. Both turtles' transmitters continue to transmit locations and data and they were recorded making their post-breeding migrations to widely disparate foraging locations.

Fig.17: Left: Three turtles observed in close proximity to each other during drone surveys. None have a transmitter in place. Right: The first turtle to receive a transmitter in 2024 observed during the drone surveys after his release.

Fig.18: The two adult males that were successfully equipped with satellite transmitters during the April 2024 field mission

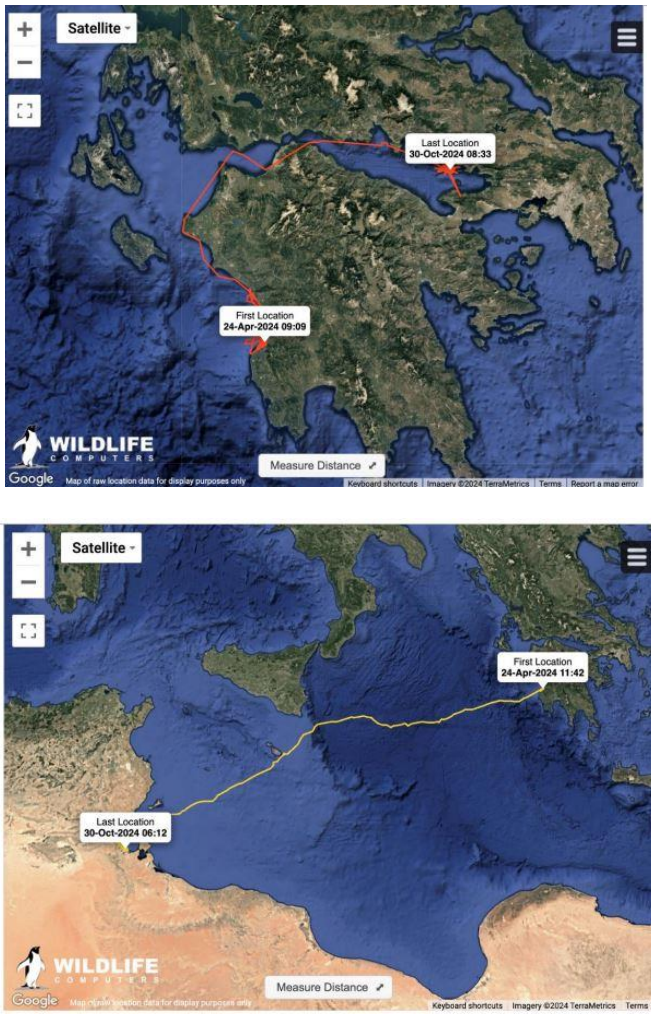

Fig.19: Post migration tracks of the two adult males tagged in Kyparissia Bay in May 2024

1.4.4. *Telemetry of Scopoli's Shearwater*

The movements and flight patterns of Scopoli's Shearwater were monitored by telemetry. The birds were tagged at the breeding colony of the species on Strofades Islands. It is worth mentioning that for the first time in Greece, both adults and young birds were tagged, giving us the opportunity to study not only the movements of the parents during the breeding season, but also the dispersal patterns of the young birds after leaving their nests. The results revealed that the tagged adult birds used the south and central Ionian Sea and Adriatic Sea, as well as the Gulf of Taranto and the eastern coast of Sicily, for foraging during their breeding season. Additionally, an individual regularly visited Gulf of Corinth for foraging. After the end of the breeding season, both adults and young birds left the colony on Strofades and headed towards the Western Mediterranean to reach their wintering grounds in the Atlantic.

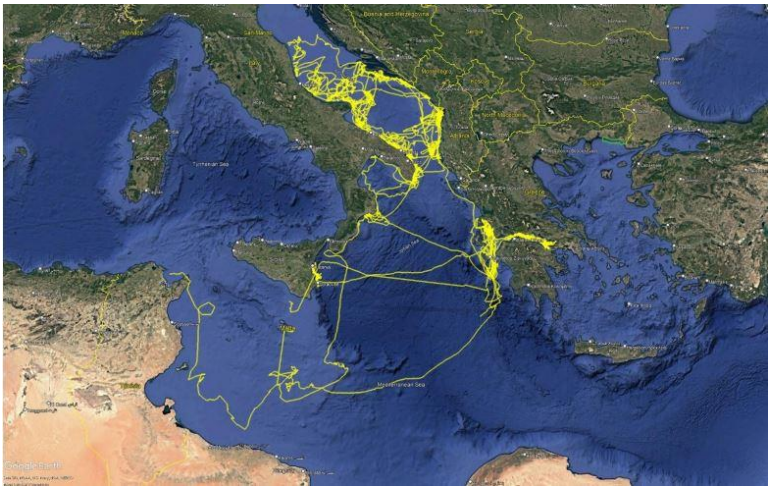

Fig.20: Flight movements of the tagged Scopoli's Shearwaters

1.5. Conclusions

During 2024, all the scheduled tasks have been performed successfully. Both boat surveys (visual-based and acoustic) and aerial surveys were carried out in the project area in spring, summer and autumn 2024. In total 3 species of cetaceans (sperm whale, Cuvier's beaked whale and striped dolphin) were spotted, all typical cetacean species of the deep waters of the Project Area. The record of 9 Cuvier's beaked whales was significant, but the most important observation was the groups of sperm whales, both within and outside the Project Area.

It is worth mentioning that this year a dedicated effort to locate sperm whales was carried out under the guidance of Dr. Jonathan Gordon, an international expert of the species, who supported the overall fieldwork project planning this year and participated in the surveys in July. These observations confirm that the Hellenic Trench in Ionian Sea, at depths >1000m, is the most suitable marine habitat for the large cetaceans of Greece. Additionally, 6 species of seabirds and one species of sea turtle were recorded during the surveys.

Scopoli's Shearwater was the most abundant seabird species, as it holds the largest breeding colony of Greece within the Project Area, on Strofades islands, and regularly uses the surrounding marine area as a foraging ground. Telemetry of Scopoli's Shearwater revealed that the tagged birds used the wider area of North Ionian – South Adriatic Sea as foraging grounds during their breeding period. During the first weeks of October, both adults and young birds left the colony and started moving towards the Western Mediterranean in order to arrive at their wintering grounds in Atlantic.

Regarding sea turtle telemetry, transmitters were deployed on two adult male Loggerhead turtles in Kyparissia. Telemetry of adult males is providing novel data on their behaviour and movements, helping fill a gap in the understanding of sea turtle biology, not only in Greece but globally. By the end of October 2024, one male has been moved to the eastern part of Gulf of Corinth, while the other headed southwest towards the Gulf of Gabes.

Regarding the Mediterranean Monk Seal, the results of the current Monitoring Survey for the species population of Zakynthos Island provide an updated (and for the first time well documented) assessment of the status of this rare species in the area. The evidence collected during the project verify Zakynthos Island as indeed being a highly important hub for the Mediterranean monk, not only in the Kyparissiakos Gulf wider area but in the Ionian Sea in general. Specifically cave ZAK6 shows an intense use by monk seals to give birth and raise their pups.

The up-to-date findings confirm the necessity to establish prevention and response measures and contingency plans for the protection of the pupping habitat of the monk seals on the island in the event of an oil spill accident during drilling operations in the region.

The above described surveys carried out during 2024 and the results in each Work Package of the project "Survey of the Status of Important Fauna Species in the Kyparissiakos Lease area" are being presented in detail in the Final Progress Report that could be found in the relevant website of the Environmental Unit of HELLENiQ UPSTREAM Kyparissiakos:

Environmental Monitoring Program for Critical Habitats - Biodiversity (helpe-kyparissiakos.gr)

Πρόγραμμα Περιβαλλοντικής Παρακολούθησης Κρίσιμων Ενδιαιτημάτων - Βιοποικιλότητας (helpe-kyparissiakos.gr)

2. Environmental Monitoring and Recording of Critical Biodiversity Indicators – 2025 onwards

In the context of Environmental Monitoring and Recording of Critical Environmental Indicators of Biodiversity such as marine mammals (cetaceans and monk seals), marine turtles and seabirds, it is proposed that the company, Nature Conservation

Consultants -NCC Ltd, in collaboration with the scientifically specialized NGO MOm and the highly experienced in the marine field research company BIOTOPIA, set up an expert's project team.

The present proposal refers to the further continuation in 2025, and integration, of the field surveys that have been carried out during the previous years, at the project area of "Block 10" (marine and coastal areas of adjacent Natura sites), using appropriate and state of the art field sampling techniques, in order to provide sufficient and well documented data on the status of monk seals, marine mammals, seabirds and sea turtles in the project area, as well as other sensitive elements and locations that should be prioritized by a future monitoring program.

The focus for the 2025 environmental monitoring will be in the update-improvement of the detail level of the baseline data gathered during the previous period and the expansion of monitoring parameters, to cover more effectively the hydro-acoustic environment, and further expand the work with automatic cameras at the seabirds breeding colonies and with boat thermal cameras for recording of marine mammals and seabirds at sea during night.

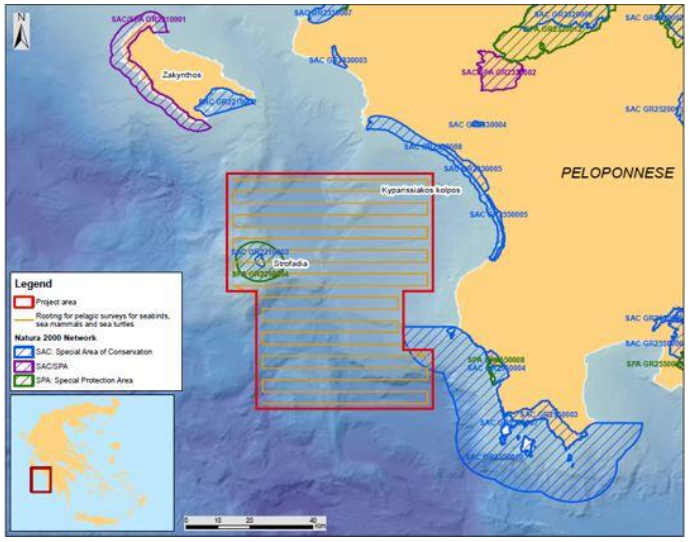

Fig.21: Project area and field survey zones for the proposed work packages

An innovation of the 2025 field surveys project will be the installation of a boat thermal camera to record marine mammals and seabirds during night boat surveys and the use of GSM video and acoustic equipment to record seabirds' nests on 24/7 basis. The deployment of the devices will be made during the foreseen pelagic boat surveys, which will follow an improved field protocol to gather more sufficient data on the population of marine mammals. GSM cameras will be deployed at Strofades islets at Scopoli's shearwater nests to record the breeding process of the species as well as the impact of ground predators (rats) on nestlings.

The project team will use appropriate research vessels for open sea surveys, including two inflatable RIB boats, a 15m sailing boat, drones and related equipment for offshore and coastal surveys, in order to identify breeding sites -and congregation sites of seals,

cetaceans and seabirds. Concerning the coastal surveys, they will be focused within the adjacent to the lease zone Natura 2000 sites.

Fig.22: The 7,5 YDROVATIS II RIB and the 6,5 NAUTILUS boats proposed to be used for pelagic and coastal surveys.

The following Work Packages will involve survey reports combined with the existing literature information on the presence of marine turtles, cetaceans, seals, and seabirds in the wider project area, and identification and mapping of the most sensitive areas, including also the adjacent protected Natura 2000 sites.

WPI. Pelagic survey for marine turtles- seals - cetaceans and seabirds with extended offshore expeditions.

- Visual surveys will be conducted.

  The pelagic survey will be made by 2 open water RIB vessels, and a 15m sailing boat. The sailing boat will operate, on a continuous basis, for a period of 14 days per field expedition, to cover the whole lease area plot, emphasizing in the offshore part.

- Passive Acoustic Monitoring surveys (PAM) surveys will take place day and night.

- The improved 2024 survey protocol will be followed, to enable the identification of animal groups and possibly of individual animals. This will mainly focus on Cuvier's Beaked whales (Ziphius) and Sperm whales (Physiter).

Period of field surveys (April-June and September-November 2025)

WPII. Coastal Surveys for monk seal's pupping sites and seabirds in the coastal zones of the adjacent Natura 2000 sites:

- Detailed surveys of the coastline of the Natura 2000 sites of SW Zakynthos island, Strofades islands, Kyparissiakos and South western Peloponnese will be conducted in order to:

- Assess the conservation status of breeding seabirds at the vicinity of the Block10 Lease area and identify existing and potential threats.

- Assess the breeding sites and populations of seabirds such as the Cory's shearwater.

- Monitor marine caves – suitable Mediterranean monk seal pupping sites with the use of automatic infrared camera systems.
- Assess demographic parameters of the local monk seal population.

Period of field surveys (February-May 2025 and June-October 2025)

WP III: Telemetry exercise, using tags, drones, microphones, thermal cameras and GSM stationary nest cameras.

- An array of 10 GSM nest cameras and 10 bio-acoustic microphones will be deployed at the Strofades colony to record the colony activities, threats and social interactions
- Data processing through Artificial Intelligence and machine learning software, the bird populations, movements, patterns of space use by the species for foraging
- The satellite tagged loggerhead turtles tracks of the previous years will continuously be followed and data from their trips, habitat use, environmental conditions in the neritic and coastal foraging areas will be analyzed.

Period of Field Surveys (May-October 2025)

Work Package deliverables will be included in an Interim and a Final project report as follows:

I. **Pelagic Survey Report (Boat and aerial surveys)**: Report of seasonal presence - spatial distribution of marine turtles, seals, cetaceans, seabirds in the study area, based on transect lines. Thematic maps.

II. **Report of the Coastal survey for seabird breeding sites**: Reporting and identification of breeding sites in the wider study area. Thematic maps-sensitivity map.

III. **Report on the Status of the Monk Seal population in the wider project area,** including demographic parameters and distribution of important pupping sites.

IV. **Report of the marine telemetry survey:** Reports including maps of the tracks and distribution of Cory's shearwaters in the area. Identification of sensitive areas during the different seasons.

3. Seismicity Monitoring - Results 2024

Given the high seismic activity in the broader area of Western Greece, and especially in the Kyparissiakos Gulf, and aim at the safety of the future planned research, HELLENiQ UPSTREAM KYPARISSIAKOS GULF SINGLE MEMBER S.A. cooperated with the

Geodynamic Institute of the National Observatory of Athens (CONTRACT AGREEMENT 2022013/06.05.2022) regarding the monitoring and analysis of the existing seismic activity and the seismic hazard assessment in the area of interest.

During 2nd Exploration Period in the Lease Area of Block 10 considering the Strategic Environmental Assessment (SEA) for the said lease area, the Joint Ministerial Decision (JMA) approving the above SEA and the reference of Article 12 (Environmental Protection), HELLENiQ UPSTREAM Kyparissiakos Gulf S.A. in collaboration with the "National Observatory of Athens (NOA) and its Geodynamic Institute, put the seismicity of the Kyparissiakos Gulf under scientific monitoring and study. The installation of a local network, which was decided, ensures the accurate and detailed monitoring of all seismic events up to and including the local microseismicity. The resulting data is also useful for identifying any potential active seismic zones in the area

The monitoring of seismicity, even at the level of microseismicity, was decided to be carried out in "real time" conditions by installing a local network of seismographs. The data, which will result at the end of the project, will also be particularly useful for identifying the active faults in the exploration area. The National Observatory of Athens (NOA), headed by the President of the research center, Prof. Emm. Plionis, and the Principal Investigator Vassilis Karastathis (Research Director IG/NOA) undertook the installation of a local network consisting of twenty-two (22) portable seismographs, as well as the operation of a local seismic array in the area of Pylos, in order to make denser the already existing national seismograph network, used by the Institute of Geodynamics of NOA for the continuous monitoring of the daily seismic activity of the Greek area. The 22 new stations are in continuous operation with simultaneous (real-time) data transmission to the Institute of Geodynamics.

The installation of the stations was performed in such a way as to achieve the maximum density of the network using, where possible, even the smallest islands of the Ionian (e.g. Strophades islets). Besides the geometry of the network, the selection of the station locations considered, both the soil conditions and the noise level of each location. He also considered the coverage of the mobile telephony, so that the direct transmission of the data is possible. For the completion of the installations, nine (9) visits by technical and scientific staff were made to the areas of interest, during the period June - September 2022. The objective was to ensure optimal azimuthal coverage of the area with the portable seismographs and to combine them with the array of seismographs installed in the Kynigos area of Pylos. It is expected that with the addition of the Microseismicity, which was identified after visual inspection of the waveforms, the magnitude of completeness will be greatly reduced. Since the microearthquakes have a limited number of recorded phases, they have not yet been implemented to the figures.

The coordinates of the local network positions are described in the fig. 23 shows how the stations complemented the existing network. The stations installed by the Institute of Geodynamics as part of the project are shown in yellow color. The portable stations will remain in operation throughout the duration of the project.

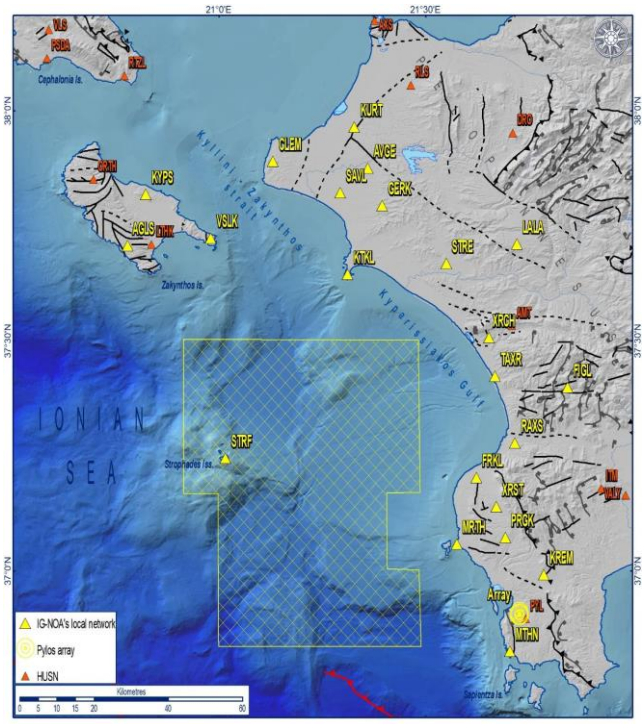

Fig.23: Schematic presentation of the locations where the 22 new portable seismographs were installed (yellow symbols). The locations of the permanent stations of the National Seismograph Network are shown with a red symbol. The seismic array of the Institute of Geodynamics, which will have a key role in the location and analysis of the remote offshore events is shown with the yellow concentric circles.

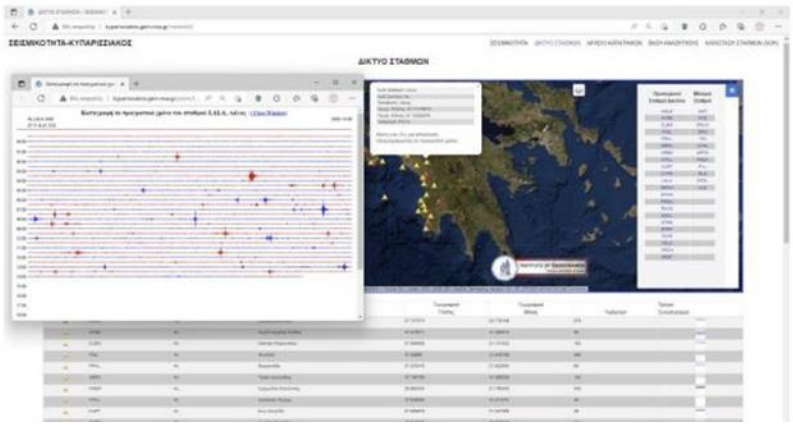

Fig.24: Current state of the network. Real time monitoring of the recordings

3.1. Current Results - Discussion

Seismicity monitoring was continued for the period between June 2003 - May 2024. In the previous recording period, an active zone was imaged and described in the northern part of the area of interest with considerably increased event depths. The focal mechanism of the major M4.2 event on September 16, 2022, had a NW-SE trend. However, given the fact that the aftershock sequence was particularly short and localized, the fault that was activated was not precisely identified. In particular, the sequence had a short duration from September 15 to 19 with a number of earthquakes that amounted to 85.

It should be noted that the sequence of increased depth earthquakes (15-19/9/22), in the region south of Katakolo, continued with relatively shallower earthquakes.

On March 29, 2024, as previously mentioned, the M5.7 magnitude earthquake occurred in the offshore area between Strofades and Messinia and its aftershock sequence which included about 180 aftershocks, of which the largest had a M4.2 magnitude. In general, the earthquake sequence had a small number of aftershocks, but the magnitudes were also quite limited. The depths of the events in this sequence are much shallower compared to those of the September sequence. The largest concentration of hypocenters is found at depths between 18 and 35 km.

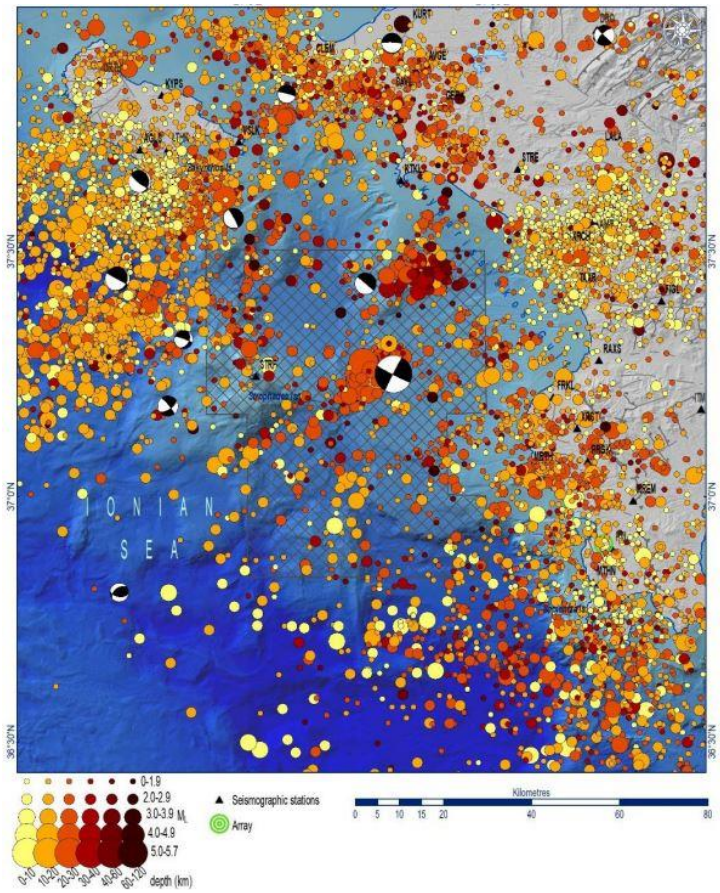

Fig.25: Focal mechanisms that were calculated by NOA's Institute of Geodynamics. for the recording period (2022-2024) in combination with the relevant seismicity

The proposed focal mechanisms suggest two possible strike slip fault planes (Figure): one NE-SW striking sinistral and one NW-SE striking dextral. From the horizontal distribution of the epicenters and its observed linear arrangement the NE-SW orientation appears to be more prominent. Therefore, the suggested fault of the 29th March 2024 earthquake is sinistral with a NE-SW strike, which caused the main faulting at depths between 18 and 35 km.

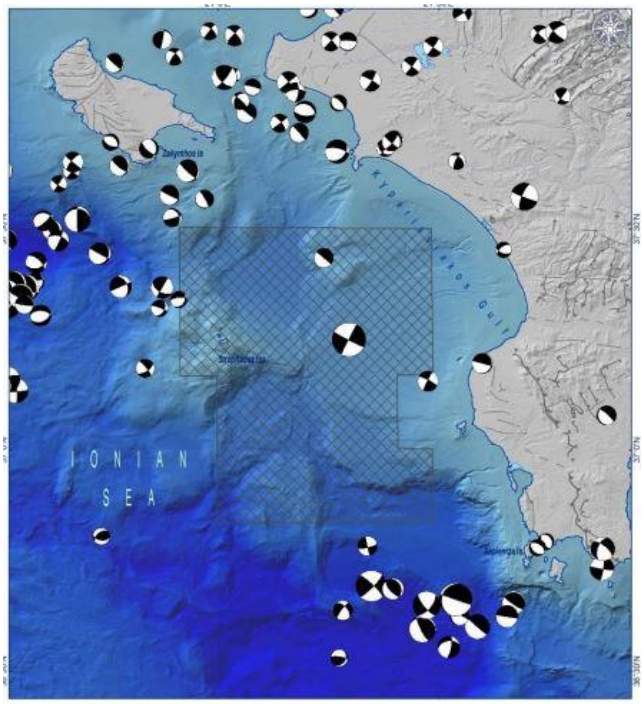

Fig.26: All focal mechanisms from NOA's Institute of Geodynamics from 2012 up to the present day for the broader region of interest.

Fig.27: Proposed focal mechanisms (including those of NOA's Institute of Geodynamics) for the main event of 29th March 2024.

The location and the geometry of the faulting is in accordance with the following structure that is proposed by Sachpazi et al. (2016) and mainly with the SW extension of fault F4 (Figure): The NE subducting plate of the Greek Subduction Zone is intersected by parallel towards the plate dip (NE-SW) strike slip faults, which do not just

intersect the plate, but also cause differential dip of its individual segments. Segmentation, however, of the subducting plate is attributed to dextral NE-SW striking faults, a fact that is in contrast with the kinematics of the recent earthquake of the 29th of March 2024. Some of the faults of the above model proposed by Sachpazi et al. (2016) may not follow the same kinematic. From their work, the faults that are related to specific seismic events and their related focal mechanisms are few in number and therefore fault F4 may not follow the same kinematic.

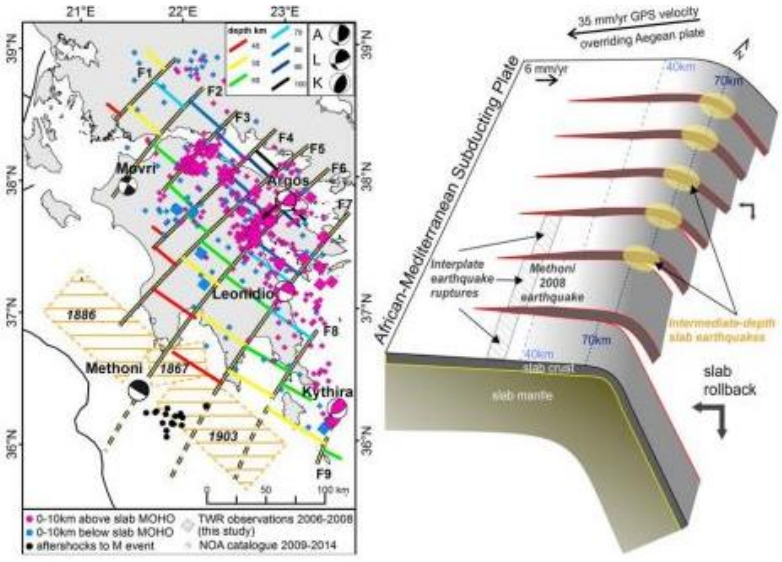

Fig.28: The geodynamic model of the subducting plate of the western Hellenic Arc by Sachpazi et al. (2016).

The two zones that were activated (September 2022 and March 2024 respectively) are very close to each other and the timing of their activation does not exclude the possibility of some tectonic connection between them. However, it must be taken into account that the focal mechanisms are significantly different from each other, implying that it is not the same tectonic structure but two different faults whose stress changes affect each other. The evidence, however, are expected to become more sufficient at a later stage, in order to draw safe conclusions about this assumption.

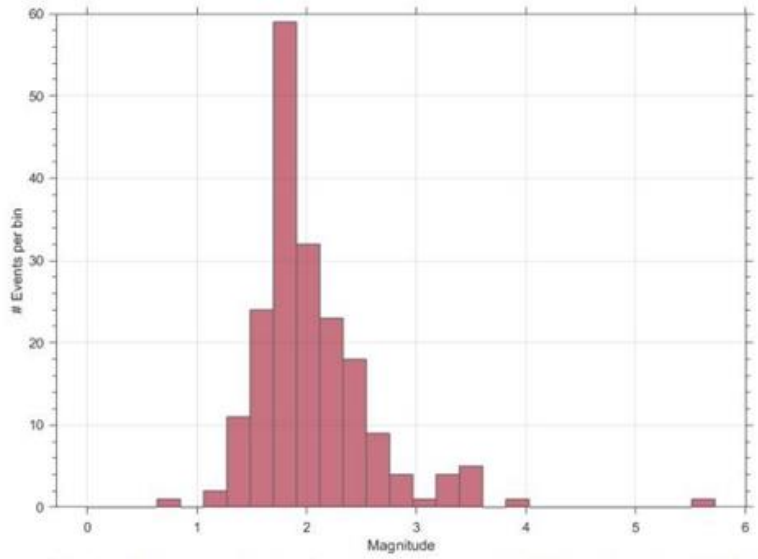

Fig.29: Magnitude histogram for the aftershock sequence of the M5.7 earthquake of 29 March 2024.

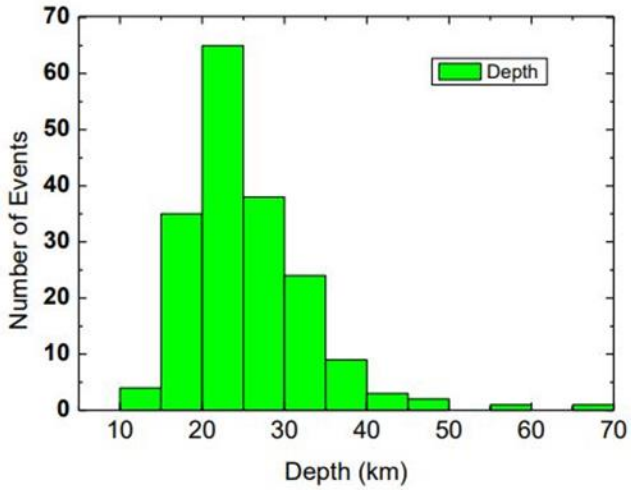

Fig.30: Depth histogram for the aftershock sequence of the M5.7 earthquake of 29 March 2024

In the onshore coastal area of Kyparissiakos, while there was a state of constant natural seismicity until January 20, 2023, there was an increase in the number of epicenters, mainly in the broader area of Zacharo, which was especially intensified after late April of 2024 and that is observed up to the present day. In total from 20/1/23 until the end of May, 1800 micro-earthquakes have been recorded in the region. This is microseismic activity, which mainly includes very shallow earthquakes, the vast majority of which are less than 10 km deep. The largest earthquakes of the sequence in the Zacharo region occurred on the 21st of February of 2023 with a magnitude of MW3.3 and on the 13th of May of 2024 with a magnitude of MW3.9. Although the earthquake magnitudes were not adequately large in order to calculate a reliable focal mechanism, the relevant analysis was performed and the calculated focal mechanisms does not appear to be related to the EW-trending faults that dominate the area, as for example the

earthquake of 2/21/ 23. In contrast, the May 13, 2024 earthquake appears to originate from a nearly NE-striking normal fault. However, there is intense micro-seismicity whose spatial distribution extends throughout the zone where these faults are located. The spatial distribution does not allow the identification of specific tectonic structures, since it appears to be sparse, without any specific trend.

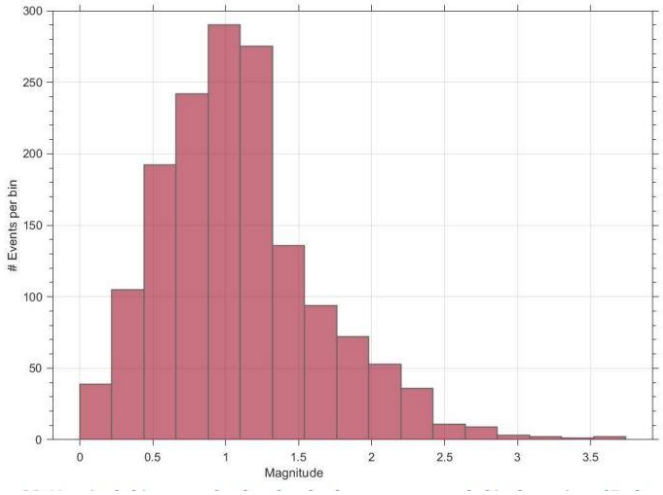

Fig.31: Magnitude histogram for the aftershock sequence recorded in the region of Zacharo, which started on 20/1/2022 and became more intense on May 2024

Papanikolaou et al., (2007) propose that in the same region, the transition faults with a general E-W trend that dominate the onshore region and that have shaped its topography with the formation of a parallel system of tectonic horns and trenches (horst and graben), continue towards the offshore area, intersecting and displacing previous tectonic structures. According to the authors, the estimated slip rates of the onshore faults are sometimes smaller and sometimes larger than their corresponding offshore extensions.

It is worth noting the existence of a clear active zone that follows the direction of the Kyllini straights (NW-SE) and which appears to approach the study region in its northern part. The linear pattern of its spatial distribution, as well as the focal mechanisms that have been at times suggested for this narrow area, indicate the existence of a sinistral, almost vertical tectonic structure with a NW-SE strike. Its NW extension matches the strike of the NW tectonically controlled slope of Enos Mountain in Cephalonia, suggesting a possible link between them. This structure is also conjugate to the Andravida fault that caused the associated earthquake in 2008 and perhaps marks its south-west end or shift. The active segments of the Hellenic arc are in direct contact to with the study area. The MW6.8 earthquake of 26th of October 2018 was recorded in the broader region and was followed by a long and intense aftershock sequence. In this particular region, as well as in the western limits of the study area there is intense seismic activity. In the next deliverable, a new, more detailed, seismic velocity model will be calculated and then used for the relocation of the hypocenters, in order to accurately define the locations of the active zones

4. Seismicity Monitoring & Seismic Hazard Assessment – 2025 onwards

The collaboration with the Institute of Geodynamics of NOA in the context of the Program "Seismicity Monitoring & Seismic Hazard Assessment in the Lease Area of Block 10" will continue in 2025 and the relevant tasks will include the following:

- Maintenance of 22 portable seismographs in addition to the permanent national network and a seismic array of 9 portable seismographs.
- Data transmission in real-time and a daily basis analysis.
- Development of a 3D tomographic model
- Automatic notifications SMS to "HELLENiQ UPSTREAM KYPARISSIAKOS" based on the automatic solutions for earthquakes in the area with size from (≥M4.0).
- Seismic Hazard assessment Study in the wider area of the "Block10".