

Survey of the Status of Important Fauna Species in the Kyparissiakos Lease Area

Interim Progress Report

June 2025

[This page intentionally left blank]

Contents

Project Team

Name	Company	Expertise	Role
Tasos Dimalexis	NCC Ltd.	PhD Biologist, Ornithologist	Coordinator, field & drone surveys
Thanos Kastritis	NCC Ltd.	PhD Oceanographer, Ornithologist	Field surveys, Reporting
Jonathan Gordon	NCC Ltd.	PhD Zoologist, University of St Andrews, Sea Mammal Research Unit, Research Fellow	Cetaceans Expert, field surveys
Angeliki Maravelia	NCC Ltd.	Msc Biologist	Marine Mammal Observer, PAM Operator, Reporting
Eirini Antoniadi	NCC Ltd.	MSc Biologist	Marine Mammal Observer, PAM Operator, Data management, Reporting
Alan Rees	NCC Ltd	PhD Biologist/Sea Turtle Expert	Sea Turtle Expert, Analysis, Reporting
Vassilis Goritsas	NCC Ltd.	Environmentalist MSc	GIS & Data management
Odysseas Theodorou	NCC Ltd.	Biologist	GIS & Data management
Panagiotis Dendrinos	MOm/BIOTOPIA	PhD Marine Biologist	Coordinator, Marine and Aerial Surveys Expert
Kimon Koemtzopoulos	MOm	MSc Marine Biologist, Certified Marine Mammal Observer	Marine Mammal Expert/ Certified MMO, Field research & Data compilation
Odysseus Paxinos	MOm	MSc Oceanographer	Sea Turtle Satellite Tagging, Monk Seal Filed research & Data compilation
Panagiotis Mpatzios	MOm	System Engineer/Field Technician	Field Research and technical coordination
Styliani Adamantopoulou	MOm/BIOTOPIA	Biologist/Marine Mammal Expert	Data analysis, Reporting
Nikos Pipinis	NCC Ltd.	Skipper/Marine Mammal Expert	Boat skipper
Kostas Papakonstantinou	NCC Ltd.		Boat skipper

Abbreviations and scientific names

Calonectris diomedea	Scopoli's Shearwater
Caretta caretta	Loggerhead Turtle
Chelonia mydas	Green Turtle
Delphinus delphis	Short-beaked Common Dolphin
Grampus griseus	Risso's Dolphin
Hydrobates pelagicus	European Storm-Petrel
ESAS	European Seabirds at Sea (survey method)
Larus audouinii	Audouin's Gull
Larus michahellis	Yellow-legged Gull
Monachus monachus	Mediterranean Monk Seal
n.m.	nautical mile
Phalacrocorax aristotelis desmarestii	Mediterranean Shag
Physeter macrocephalus	Sperm Whale
Puffinus yelkouan	Yelkouan Shearwater
Stenella coeruleoalba	Striped Dolphin
SAC	Special Area of Conservation (Natura 2000 network)
SPA	Special Protection Area (Natura 2000 network)
SDF	Standard Data Form (Natura 2000 datasheet)
Tursiops truncatus	Common Bottlenose Dolphin
WP	Work Package
Ziphius cavirostris	*Cuvier's Beaked Whale*

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 Kyparissiakos Lease area" (Block 10).

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. Colony surveys at the Strofades islets SPA and the surrounding project area, using GSM nest cameras and GPS/GSM transmitters, as well as analysis of the transmitters' data fitted on Loggerhead turtles in the previous years.

The present document constitutes the Interim Report for Work Packages WP I–III. It presents the field surveys carried out during the first semester of 2025 and the results in each Work Package.

The present project represents the 2025 continuation of the ongoing project entitled "Survey of the Status of Important Fauna Species in the Kyparissiakos Lease Area", which has been implemented during the period 2020–2025.

2 Description of the Project Area

The **Project Area** is in the Ionian Sea, southeast of Zakynthos Island and west of the Peloponnese, approximately from the northern town of Zacharo and the southern town of Methoni. It extends between latitudes of 36°50'N in the south and 37°30'N in the north and between longitudes of 20°55'E in the west and 21°30'E in the east. Its total surface area is 3,422.5 km^2 (Figure 2-1).

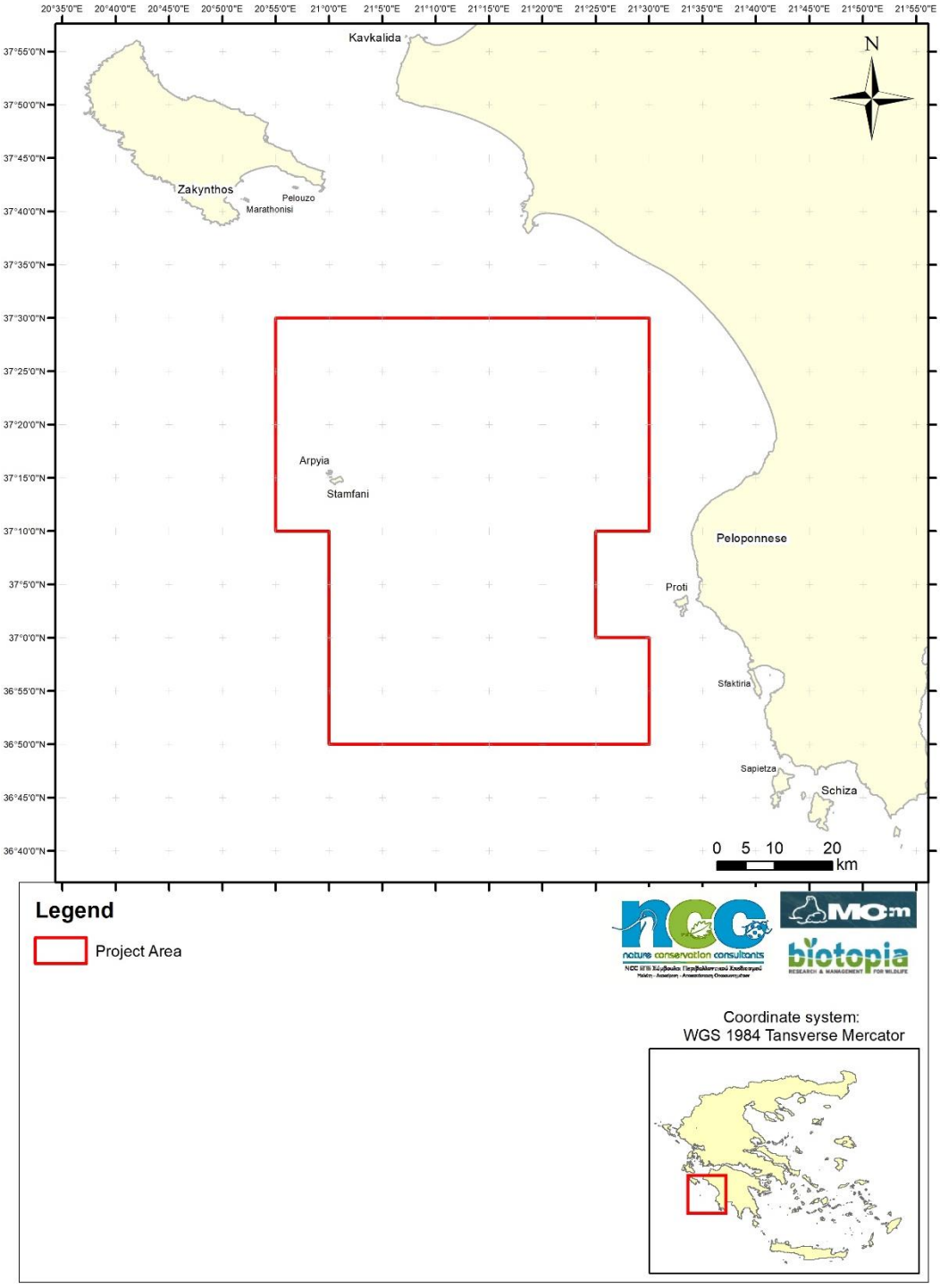

Figure 2-1. Project Area

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 neighbouring islets (Figure 2-2). The **Pelagic Survey Area**, where pelagic surveys are carried out, includes primarily the Project Area together with neighbouring waters to the east.

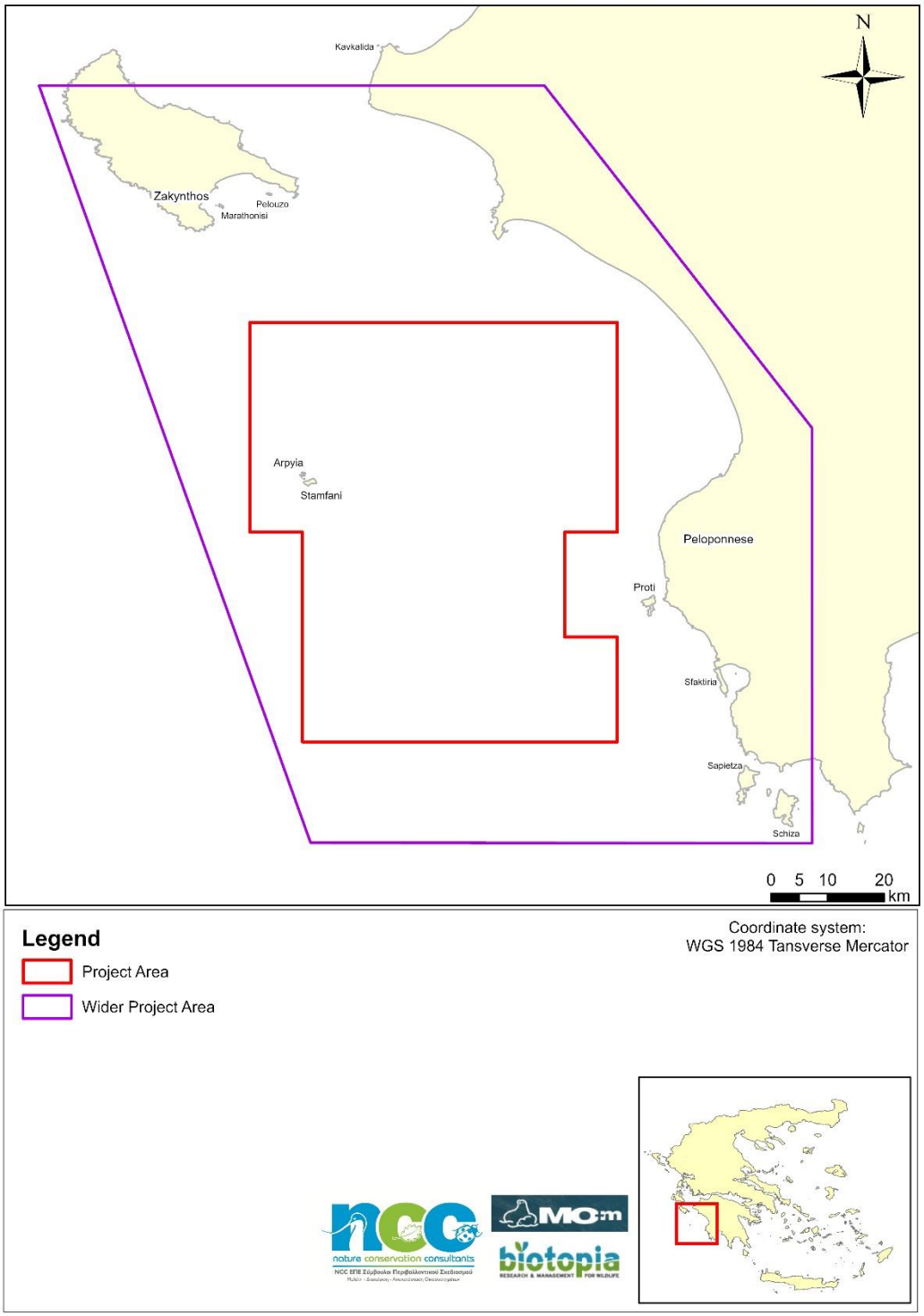

Figure 2-2. Wider Project Area

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 is the Strofades islets in the west, which are surrounded by a narrow belt of coastal waters (Figure 2-3).

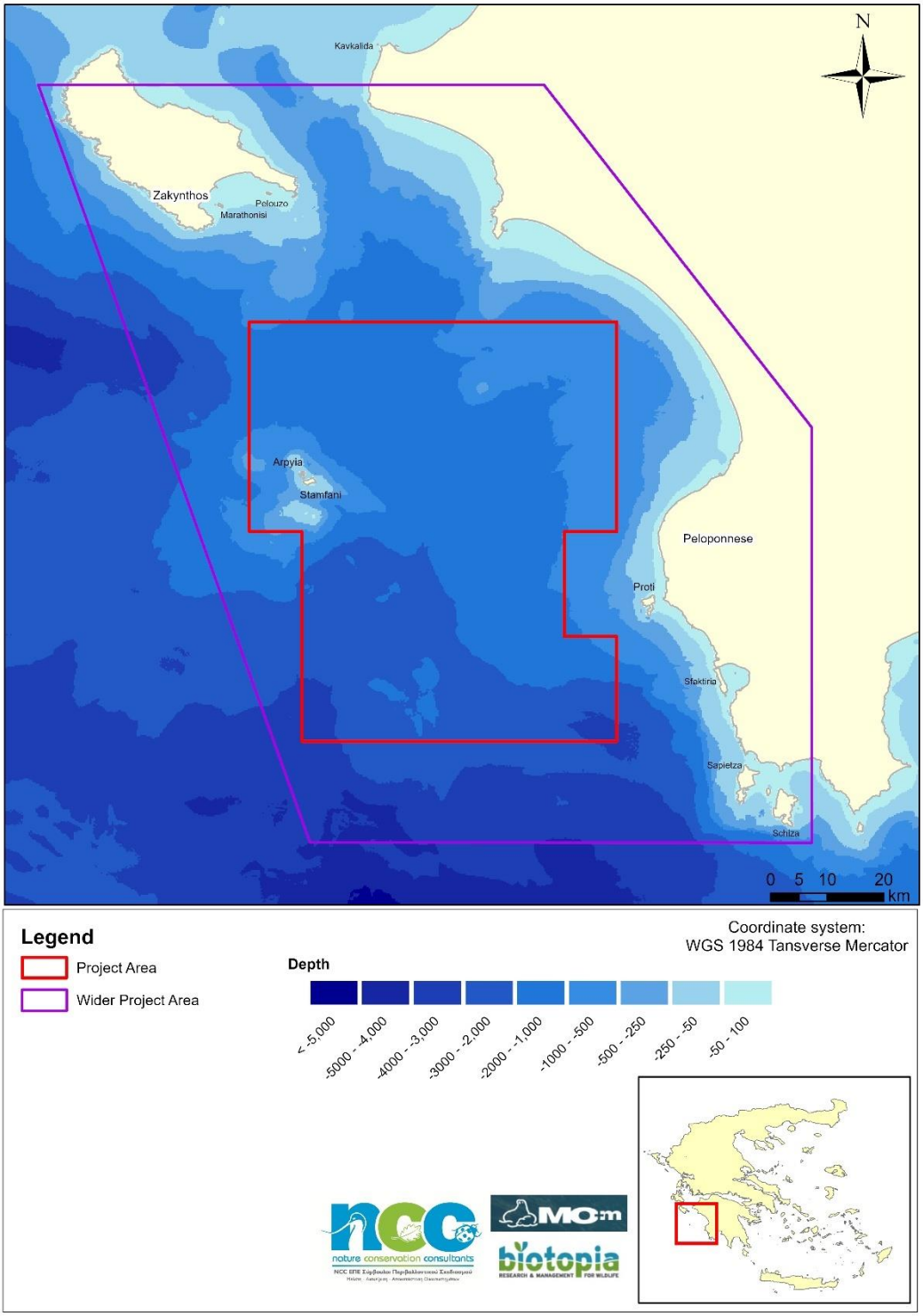

Figure 2-3. Bathymetry in the Project Area

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 53^{o} (Figure 2-4).

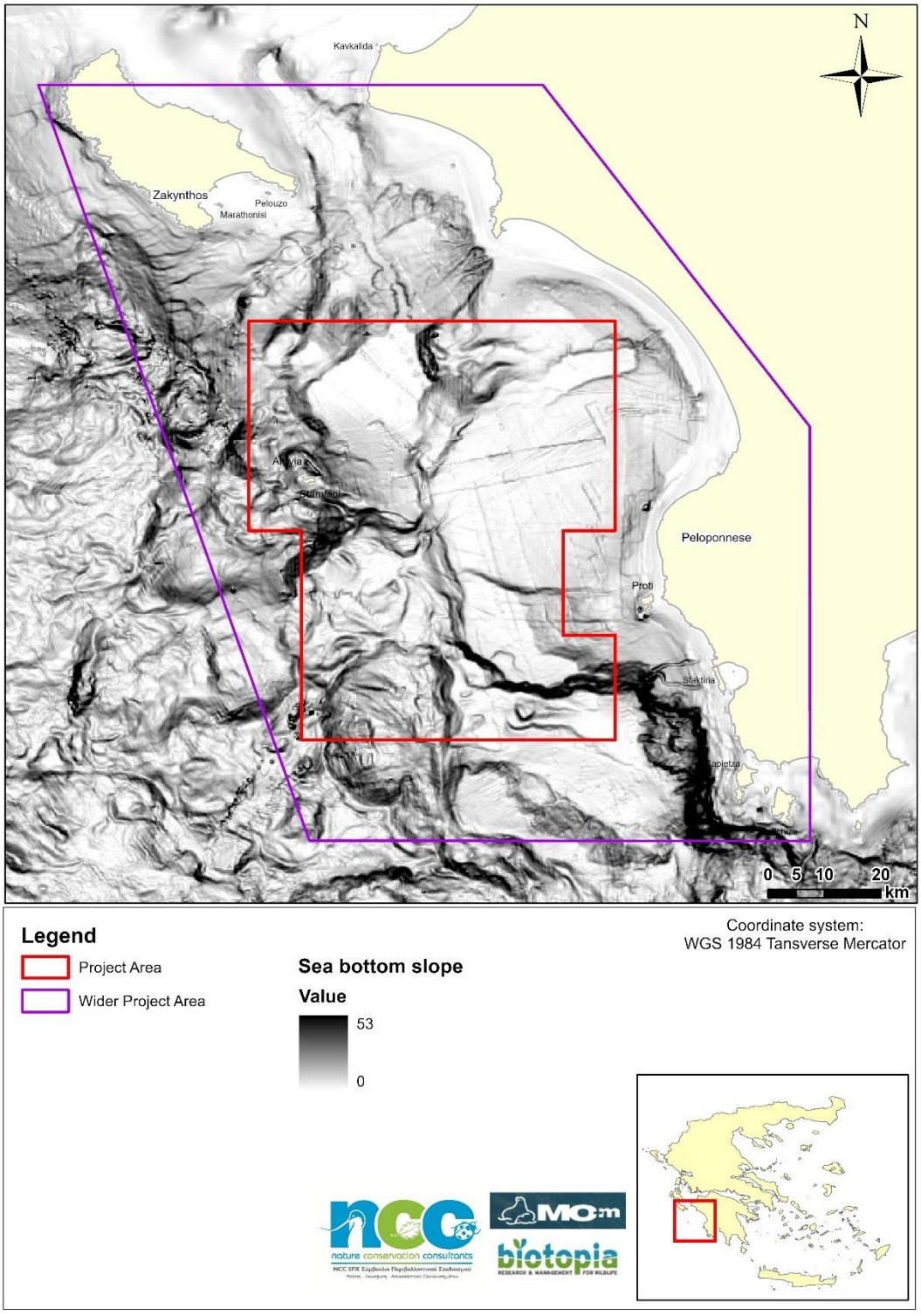

Figure 2-4. Slope of the sea floor in the Wider Project Area

2.2 General information about the main cetacean, seabird, and sea turtle species in the Project Area

2.2.1 Cetaceans

Hellenic seas host an unexpectedly high diversity of cetaceans with eight (8) species that are resident in the area, seven (7) of which belong to the Odondoceti suborder: Sperm Whale (*Physeter macrocephalus*), Cuvier's Beaked Whale (*Ziphius cavirostris*), Risso's Dolphin (*Grampus griseus*), Bottlenose Dolphin (*Tursiops truncatus*), Striped Dolphin (*Stenella coeruleoalba*), Short-beaked Common Dolphin (*Delphinus delphis*) and Harbour Porpoise (*Phocoena phocoena*) along with one representative of the Mysticeti suborder: Fin Whale (*Balaenoptera physalus*). The Harbour Porpoise is restricted to the Thracian Sea and North Aegean Sea, while the others are present in one or more seas in Greece (Frantzis et al. 2003).

It is important to note that due to the semi-enclosed nature of the Mediterranean basin, in combination with its very particular oceanographic features and oligotrophic waters especially moving towards the east of the basin, cetacean species populations of the Mediterranean (which occur elsewhere in the world also) are treated separately by the IUCN, when it comes to the designation of their threat status and population trends. In most cases, the Mediterranean subpopulation of cetacean species has at least one level higher in their designated threat status than the global population for the same species or is classified as Data Deficient.

The Wider Project Area is located along the Hellenic Trench, which is one of the most important areas for cetaceans in Greece. Except for the Harbour Porpoise (found only locally in the north-eastern Aegean) and the Fin Whale (observed mainly in the Ionian Sea, along the Hellenic Trench, north of Kefallonia), the remaining 6 commonly occurring species of cetaceans inhabiting Greek waters have been sighted or recorded as strandings in the Wider Project Area.

Table 2-1. General types of habitats, bathymetric characteristics, and distance from coast of recorded presence in Greek seas of common cetacean species that are present in the Wider Project Area (from Frantzis 2009).

Species	Common name	Habitat		
		Type	Depth	Distance from coast
Physeter macrocephalus	Sperm whale	Slope, secondarily pelagic	1235 m (510-2933 m)	8.1 km (1.6-25.2 km)
Ziphius cavirostris	Cuvier's beaked whale	Slope, probably pelagic as well	1066 m (491-2279 m)	8.6 km (2.1-26.5 km)
Grampus griseus	Risso's dolphin	Slope, probably over its shallower part	737 m (165-1717 m)	8.2 km (0.3-28.3 km)
Tursiops truncatus	Common bottlenose dolphin	Typically, coastal, also over shallow waters "offshore"	121 m (1-1504 m)	3.0 km (0.0-26.0 km)
Stenella coeruleoalba	Striped dolphin	Typically, pelagic and slope	1024 m (75-2920 m)	8.7 km (0.6-37.1 km)
Delphinus delphis	Short-beaked Common dolphin	Coastal and shallow, ("pelagic" and deep only in the Gulf of Corinth)	86 m (11-274 m) Gulf of Corinth: 713 m (275-935)	8.7 km (0.6-37.1 km)

The Wider Project Area includes coastal areas, continental shelf and slope, as well as pelagic areas. For the present study and based on the types of marine habitats typically used by the species present in the Wider Project Area, the focus of pelagic surveys is primarily on the species with regular presence in the Wider Project Area, namely the **Sperm Whale (*Physeter macrocephalus*), Cuvier's Beaked Whale (*Ziphius cavirostris*), Striped Dolphin (*Stenella coeruleoalba*)** and **Risso's dolphin (*Grampus griseus*)** in the pelagic and continental slope areas, and **Short-Beaked Common Dolphin (*Delphinus delphis*)** and **Bottlenose Dolphin (*Tursiops truncatus*)** in coastal areas. Accounts on the biology, ecology, as well as conservation and threat status of the cetacean species of interest are provided below. It should be noted that large data gaps are still present regarding the distribution and abundance of cetaceans in the eastern Mediterranean (Mannocci et al. 2018).

2.2.1.1 Sperm Whale (Physeter macrocephalus)

Figure 2-5. Sperm Whale (Physeter macrocephalus) (© Massimo Demma/ICRAM)

The second largest cetacean found in Greece and the largest Odondocetus found globally is the Sperm Whale (*Physeter macrocephalus*). The Sperm Whale prefers deep water habitats particularly deep continental slope water where they hunt their preferred prey, large mesopelagic cephalopods (Frantzis 2009, Notarbartolo di Sciara et al. 2012).

The Hellenic Trench is the species core habitat for the eastern Mediterranean sub-population (Frantzis et al. 2014). The total species population size in the Greeks Seas is estimated at 180 – 280 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/), the population size in the Hellenic Trench 200 – 250 individuals (Frantzis et al. 2014) and the estimated population size in the Ionian Sea, including international and Italian waters 62 individuals (95% CI: 24-165 individuals, in Lewis et al. 2003), however this is likely to be an underestimation (Frantzis 2009).

2.2.1.2 Cuvier's Beaked Whale (Ziphius cavirostris)

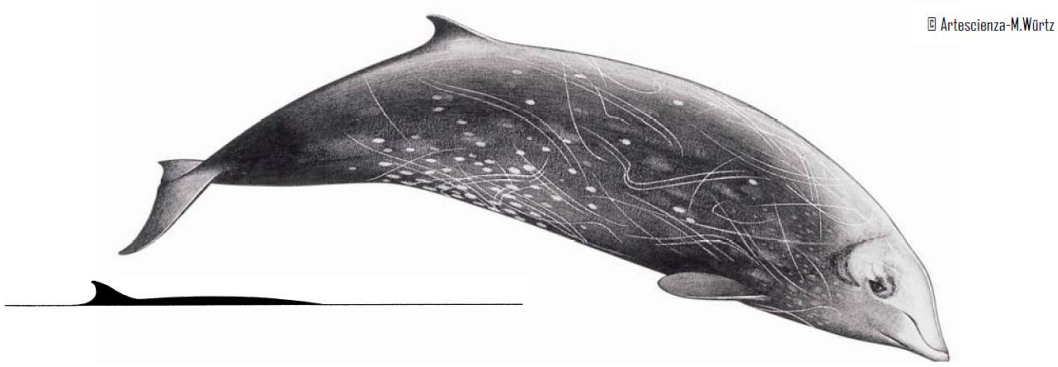

Figure 2-6. Cuvier's Beaked Whale (Ziphius cavirostris) (©Artescienza-M.Würtz)

Cuvier's Beaked Whale, a medium sized odondocetus, shares the same habitat and distribution as that described for the Sperm Whale, namely the continental slope. Almost all past species sightings occurred above depths of 500-1,500m (Frantzis et al. 2003). It is the only beaked whale common in the Mediterranean Sea. In Greece, most past sightings are associated with the Hellenic Trench, from eastern Rodos Island to northwest Corfu Island (Frantzis et al. 2003, Frantzis 2009) with the highest number of sightings south of Crete and west of Lefkada (Frantzis et al. 2003, Podestà et al. 2016). Along the Hellenic Trench the species feeds almost exclusively on mesopelagic and bathypelagic cephalopods (Frantzis

2009). Several sightings and numerous strandings have been recorded in the Wider Project Area (based on Frantzis 2009).

The Hellenic Trench is one of the species high-density areas in the Mediterranean. The total species population size in the Greeks Seas as well as in the Wider Project Area is unknown (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/). It is worth noting that Greek seas are considered to host quite a significant portion of the Mediterranean population (Frantzis 2009).

2.2.1.3 Risso's Dolphin (Grampus griseus)

Figure 2-7. Risso's dolphin (Grampus griseus) (© Massimo Demma)

Risso's dolphin is the largest dolphin that commonly occurs in the Greek Seas. The sightings and strandings records indicate that the species is present in all parts of the Greek Seas, however the only known area where the species is predictably present is the Myrtoon Sea extending south to the north-western Crete. The species is present in the Ionian Sea, as confirmed by strandings which have been recorded from north Corfu Island to south Peloponnese. No sighting records have been made in the Ionian Sea which indicates that either the species is present in low numbers, or it is present outside warm period when past surveys have been made. The strandings in the Ionian Sea have been recorded from the end of September until late April. The species is present primarily along the continental slope, preferably deep water and shelf break where the slope is the steepest, but also close to the coast, particularly when the shelf is narrow (Frantzis 2009). The species feeds mainly with squid and occasionally with fish.

The total species population size in the Greeks Seas is estimated to be 100 – 600 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/). The population size in the in the Wider Project Area is unknown.

2.2.1.4 Bottlenose dolphin (Tursiops truncatus)

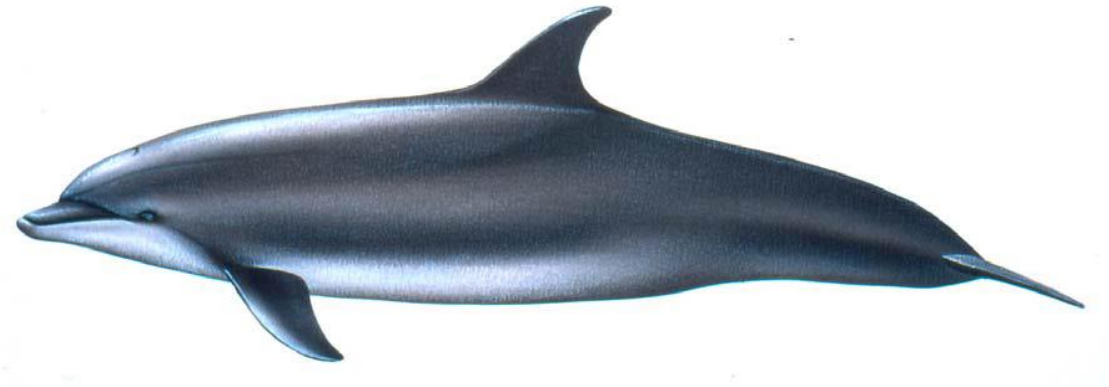

Figure 2-8. Common bottlenose dolphin (Tursiops truncatus) (© Artescienza-M.Würtz)

The bottlenose dolphin is the most common species of dolphin found in coastal shallow waters of the Mediterranean (Frantzis 2009). It is homogeneously distributed across all Greek Seas as it has been sighted in most coastal areas, straights and gulfs. (Frantzis 2009). The Bottlenose Dolphin in Greece, like Short-beaked Common Dolphin prefers the continental shelf usually staying within a depth of up to 200m (Frantzis 2009). It is known to consume a variety of prey items being quite adaptive.

The total species population size in the Greeks Seas is estimated to be 3,800 – 9,000 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/). The population size in the in the Wider Project Area is unknown.

2.2.1.5 Striped dolphin (Stenella coeruleoalba)

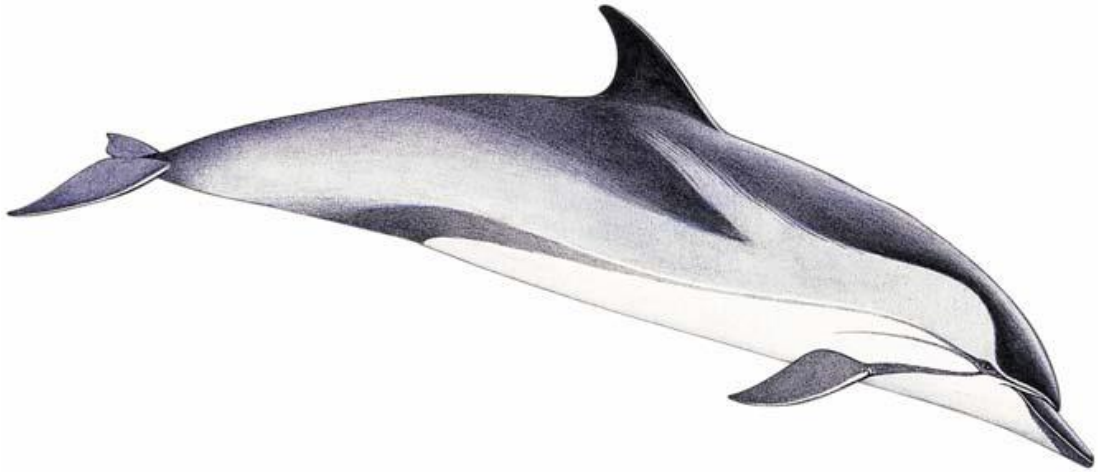

Figure 2-9. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM)

The Striped Dolphin, a small delphinid, has a year-round presence in Greek waters. It is the most abundant dolphin species in Greece and the Mediterranean overall (Frantzis 2009). Its distribution in Greece is widespread and it occurs in all deep (>500m), pelagic waters and the continental slope but it can also inhabit intermediate depths of 200-500m (Frantzis 2009). The Striped Dolphin is frequently sighted along the length of the Hellenic Trench. The species diet includes mainly cephalopods, as well as fish and crustaceans.

The total species population size in the Greeks Seas is estimated to be 20,000 – 80,000 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/). The population size in the in the Wider Project Area is unknown.

2.2.1.6 Short-beaked common dolphin (Delphinus delphis)

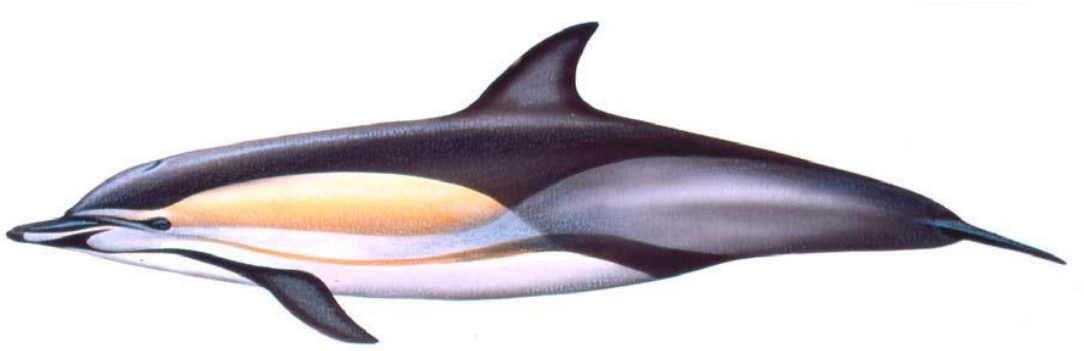

Figure 2-10. Short-beaked common dolphin (Delphinus delphis) (© Artescienza-M.Würtz)

The Short Beaked Common Dolphin (or simply Common Dolphin) is a small delphinid with a year-round presence in Greek waters. Its distribution in Greece is patchy and their presence seems to be mostly limited to the central and northern Greek Seas (Frantzis 2009). In general, it prefers shallow (<200m) and coastal waters, with exception of Gulf of Corinth where it exhibits preference to pelagic habitats (Frantzis 2009). It exhibits flexible feeding habits. The distribution of the Common Dolphin in the Ionian Sea the is limited to shallow waters between north Lefkada, Kefallonia and south Zakynthos and the mainland. In the Inner Ionian Sea, the main prey includes shoaling fish e.g., anchovies and sardines.

The total species population size in the Greeks Seas is estimated to be 750 – 4,200 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/).

The population of Common Dolphins of the Inner Ionian Sea has been the focus of regular surveys for years and has been well documented (Bearzi et al. 2008B). The local population counted 150 individuals until the mid-90s, and their range seemed to cover the entire Inner Ionian. Since then, the population has declined dramatically with only an estimated 15 individuals encountered over the past years mostly sighted in southern Lefkada (Bearzi et al. 2008B).

2.2.2 Seals

2.2.2.1 Mediterranean Monk Seal

Figure 2-11. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM)

The Mediterranean Monk Seal is the only pinniped (seal) living in the Mediterranean region, the rarest extant member of the Phocidae family and one of the rarest marine mammals in the world.

Mediterranean monk seals were once widely and continuously distributed in the Mediterranean and Black Seas, and in the North Atlantic waters from Morocco to Cap Blanc, including the Canary, Madeira and the Azores Islands. A few individuals have been recorded in Senegal, the Gambia and the Cape Verde Islands in the southern end, as well as in Portugal and Atlantic France in the northern end of the species' distribution. Today the distribution of the Mediterranean is highly fragmented and consists of three to four isolated subpopulations (Karamanlidis et al. 2016). In the Mediterranean Sea, the stronghold of the species has been on islands in the Ionian and Aegean Seas, and along the coasts of Greece and western and southern Turkey ((Güçlüsoy, Kiraç, Veryeri, & Savaş 2004, Gücü, Gücü, & Orek 2004, Anonymous, 2007). In the North Atlantic, two subpopulations exist: one at Cabo Blanco (also known as Cap Blanc) at the border of Mauritania and Western Sahara (González & Fernandez de Larrinoa 2012, Martínez-Jauregui et al. 2012), and one at the Archipelago of Madeira (Pires, Neves, & Karamanlidis, 2008). An unknown number of monk seals might still survive at the Mediterranean coasts of eastern Morocco (and perhaps Algeria) (Mo, Bazairi, Bayed, & Agnesi, 2011), but without on-going systematic conservation actions the fate of this subpopulation is unknown.

The total species population size in the Greece is estimated to be 300 – 400 individuals (2013-18 Habitats Directive Article 17 Reporting at https://nature-art17.eionet.europa.eu/article17/).

2.2.3 Sea turtles

There are three species of sea turtles that regularly occur in the Mediterranean: **Loggerhead Turtle (*Caretta caretta*)**, **Green Turtle (Chelonia mydas)** and **Leatherback Sea turtle (*Dermochelys coriacea*).** The sea turtles live almost exclusively in the marine environment with females returning to land for dig nests and lay eggs, while males almost never return to land. The range of all three species extends along the Wider Project Area (Legakis & Maragou

2009, 2013-18 Habitats Directive Article 17 Reporting: species range), however only Loggerhead Turtle and Green Turtle have been recorded in the area (2013-18 Habitats Directive Article 17 Reporting: species distribution). Among these two the Loggerhead Turtle is the species of interest due to its regular presence and nesting in the Wider Project Area of the Kyparissia Bay, while the Green Turtle is regular but rare visitor in the area. The Leatherback Sea turtle to is only considered in Greece to be a visitor from the Atlantic (Casale & Margaritoulis 2010).

2.2.3.1 Loggerhead turtle (Caretta caretta)

Figure 2-12. Loggerhead Turtle (Caretta caretta)

The Loggerhead turtle is an oceanic turtle with a global distribution. It is a migratory species and may travel thousands of kilometres to forage and to return to its breeding sites. After hatching, logger-head turtles adopt an oceanic lifestyle in major current systems (Bolten and Witherington 2003). After 4-19 years spent in the oceanic zone, they move to neritic areas where they forage and mature over 10-39 years (Avens and Snover 2013). After attaining sexual maturity, they migrate between neritic foraging grounds and nesting areas. The Mediterranean, where the species is nesting in the eastern basin (Legakis & Maragou 2009), the breeding population of the loggerhead turtle is spread over tens of rookeries which are estimated to produce over 7,200 nests annually (Casale & Margaritoulis 2010) with most nests being found in Greece. The country's two most important nesting beaches are in the Wider Project Area, namely on Zakynthos (Laganas Bay) and on Peloponnese (Kyparissia Bay), which host 43% and 19% of all nests in Greece, respectively (Legakis & Maragou 2009). The average number of nests per season for the period 1984-2007 at Laganas Bay and at Kyparissia Bay are 1,244 nests/season (range: 833-2,018 nests/season) and 621 nests/season (range: 286-927 nests/season) (Casale & Margaritoulis 2010). Currently, Kyparissia Bay hosts the largest Loggerhead turtle nesting aggregation in the Mediterranean Sea (Rees et al. 2020).

In Greece and in the Central Mediterranean, the turtles after hatching disperse mainly in the Ionian, south-central Mediterranean and Adriatic Seas (Casale & Mariani 2014). Loggerhead turtles, especially juveniles, forage in almost all oceanic areas in the Mediterranean. Water circulation system has the greatest effect on their distribution (Casale et al. 2018). The neritic foraging areas (i.e., those located above continental shelf) are more frequently used by larger turtles, including adults (Casale et al. 2018, Figure 2-13). Loggerhead turtles generally overwinter within or close to their foraging areas, however some may move from cold areas e.g., Adriatic Sea during winter (Casale et al. 2018).

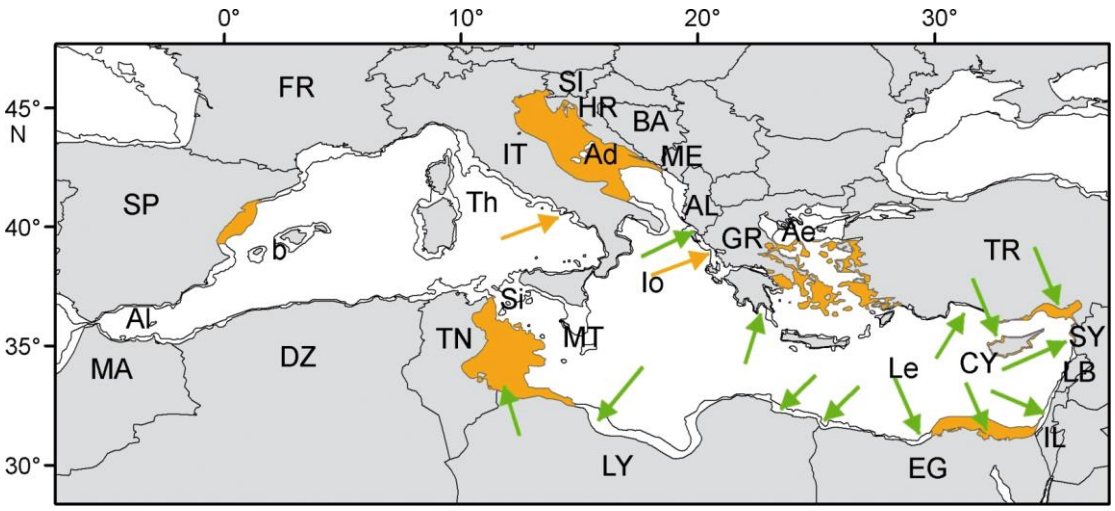

Figure 2-13. Neritic foraging and wintering sites for loggerhead turtles (orange areas and arrows) and green turtle (green arrows) (adopted from Casale et al. 2018).

Migration corridors are areas which are frequently used by migrating turtles, mainly for adult breeding migration and particularly for post-breeding migration from breeding areas to foraging grounds. Therefore, these migratory corridors are used at the end of the breeding season, in May and June by males, while in July and August, mostly by females (Casale et al. 2018). The main migration corridors are presented in Figure 2-14.

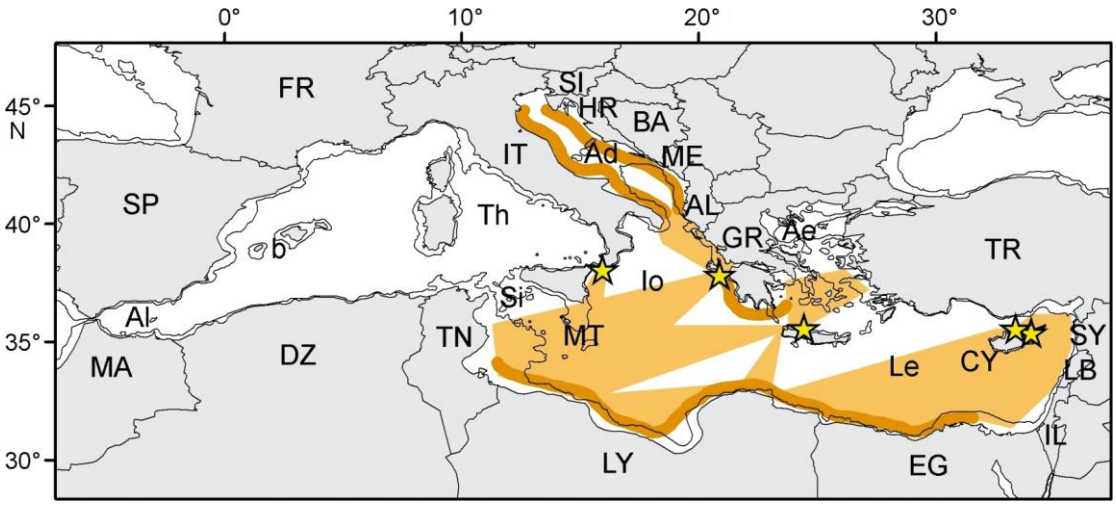

Figure 2-14. Main known migratory corridors for adult loggerhead turtles to and from breeding sites (stars). Light brown areas represent migratory funnels in the open sea while darker strips represent paths along the coasts, typically in shallow waters (adopted from Casale et al. 2018).

The movements of the Loggerhead turtles nesting in the Ionian Sea, particularly those from Zakynthos has been well studied by satellite or GPS telemetry (e.g., Zbinden et al. 2008, Schofield et al. 2010a-c, Schofield et al. 2013, Luschi & Casale 2014). The data from 75 tracked turtles breeding on Zakynthos showed after breeding the turtles migrate to neritic sites with waters shallower than 100m, with the majority of turtles migrate north to the Adriatic Sea and Amvrakikos Gulf (42%) or south-west to Libya and Tunisia (32%), while the remaining either

stay in the Ionian Sea or move to the eastern or western Mediterranean (Zbinden et al. 2008, Schofield et al. 2013). After leaving their foraging areas (in October – November) the tracked turtles move to their overwintering areas further south (Zbinden et al. 2008). The main foraging and overwintering areas are presented in the Map 11, below. The main foraging areas are located over the continental shelves and slopes (Ullmann & Stachowitsch 2015) in the Northern and Southern Adriatic Sea, Ionian Sea, the Strait of Sicily and the Tunisian shelf. A small proportion (~7%) were resident to Zakynthos. Significantly more males than females remain within 100km of Zakynthos (Schofield et al. 2013).

2.2.3.2 Green turtle (Chelonia mydas)

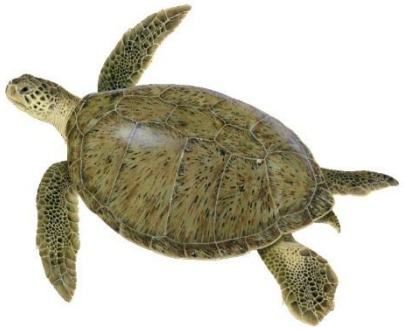

Figure 2-15. Green turtle (Chelonia mydas)

The green turtle (*Chelonia mydas*) is a migratory oceanic turtle with a global distribution. Their nesting sites in the Mediterranean are located mostly in Turkey, Cyprus and Syria (Figure 2-13) with an average of 1500 nests per year. No regular nesting areas are in Greece. They use mostly marine areas in the Levantine basin, but also forage in Greece and Libya, as well as occasionally in the Adriatic Sea and the western Mediterranean basin (Figure 2-16). In Greece local concentration have been found in Lakonikos Bay, southern Peloponnese. Stranding data indicate that there is a more frequent presence of adult green turtles in southern Aegean (Casale & Margaritoulis 2010). The species has been recorded in the Wider Project Area.

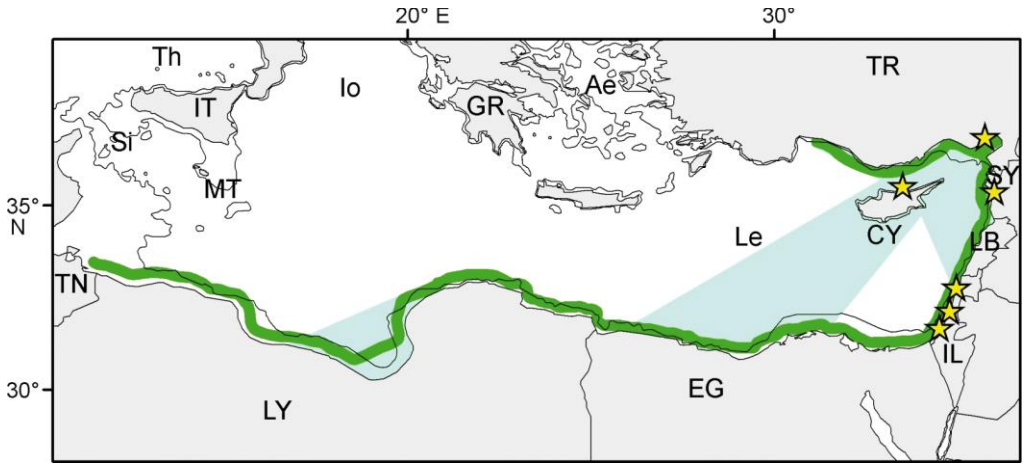

Figure 2-16. Main known migration corridors for adult female green turtles during reproductive migrations from the breeding sites (stars) (adopted from Casale et al. 2018).

2.2.4 Seabirds

To the present study, only those seabird species which are exclusively associated with the marine environment and the pelagic area, that have been recorded in the Ionian Sea in the past and their presence in the wider Project area has been either confirmed. These species include pelagic seabird species**: Scopoli's Shearwater (*Calonectris diomedea*), Yelkouan Shearwater (*Puffinus yelkouan*)** and **European Storm-petrel (*Hydrobates pelagicus*)**, as well as, coastal seabird species which could be present in the pelagic areas due to shallow waters in the Project area or due to human activities, i.e. **Yellow-legged Gull (*Larus michahellis*) and the Mediterranean Shag (*Phalacrocorax aristotelis desmarestii*).**

2.2.4.1 Scopoli's's Shearwater (Calonectris diomedea)

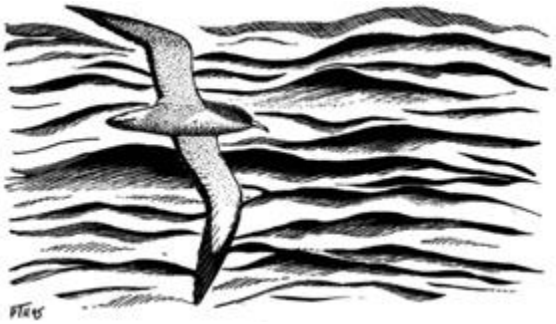

Figure 2-17. Scopoli's Shearwater (Calonectris diomedea) (© Paul Hirst)

Scopoli's Shearwater (C*alonectris diomedea*) breeds across Mediterranean with most of the population spending the non-breeding season in the Atlantic. In the past it was considered conspecific with the Cory's Shearwater (C*alonectris borealis*) which breeds in the Atlantic. In Greece the species breeding in the Aegean and Ionian Sea with the largest known colony being located at Strofades Islets (within the Project Area), south of the Zakynthos Island in the Ionian Sea, with an estimated breeding population of 5,550 pairs (Karris et al. 2017). Other large colonies occur mainly in the southern, central and eastern Aegean Sea although breeding has also been confirmed in the northern Aegean Sea (Fric et al. 2012). The only other known breeding area in the Ionian Sea s at Diapontia islands at Kerkyra with much smaller breeding population of 60-100 pairs (Fric et al. 2012).

2.2.4.2 Yelkouan Shearwater (Puffinus yelkouan)

Figure 2-18. Yelkouan Shearwater (Puffinus yelkouan) (© Paul Hirst)

Yelkouan Shearwater is an endemic species to the Mediterranean and the Black Sea. The known species colonies in Greece are in the Aegean Sea, while no colonies have been found so far in the Ionian Sea. The main known colonies are located the North, East and Central Aegean Sea (Fric et al. 2012), with the largest being on Gyaros island in the Northern Cyclades (Fric & Portolou 2016). During the non-breeding season Yelkouan Shearwaters disperse widely within the Mediterranean Sea (mainly Adriatic and Aegean Seas) and the Black Sea. Additionally, 4,000-6,000 individuals are estimated to overwinter in the Aegean Sea The main foraging areas of the Yelkouan Shearwaters are rich coastal and pelagic fishing grounds in the North, Central and East Aegean Sea, while the species is less common in the South Aegean and Ionian Seas (Fric et la. 2012).

The global species population is estimated at 15,337-30,519 pairs with a decreasing population trend (30% in the next 54 year i.e., three generations). Ten colonies in the Mediterranean Sea have disappeared during the last 60 years (Derhe 2012B, BirdLife International 2015, Birdlife International 2018B). The national population is estimated at 4,000-7,000 pairs (without the inclusion of the Gyaros colony which is estimated at 3,090-7,450 pairs), equivalent to 22% percent of the global population (more than 38% with the inclusion of the Gyaros population). The national population trend is estimated to be stable.

2.2.4.3 European Storm-petrel (Hydrobates pelagicus)

Figure 2-19. European Storm-petrel (Hydrobates pelagicus) (© Paul Hirst)

European Storm-petrel is the smallest seabird species in the Western Palaearctic. Its distribution is limited mainly to the Northeast Atlantic Ocean and the West Mediterranean Sea, while the Aegean Sea comprises the easternmost part of its range. The Mediterranean subspecies *Hydrobates pelagicus melitensis* comprises less than 5% of the overall global population (i.e., 12,000-17,500 breeding pairs) with the main colonies located in Malta, Sicily and the Balearic Islands. The species occurs in all Greek seas mainly in spring and summer during the breeding period. Up to date only two colonies have been located, one in the Central Aegean Sea and another in the Cyclades. Storm-petrels, usually individual birds, or very small groups, are regularly observed in the Cyclades, Dodecanese, Central and southwest Aegean Sea and the Karpathian Sea suggesting potential existence of other breeding colonies (Fric et al. 2012).

2.2.4.4 Mediterranean Shag (Phalacrocorax aristotelis desmarestii)

Figure 2-20. Mediterranean Shag (Phalacrocorax aristotelis desmarestii) (© Jens Overgaard Christensen)

Mediterranean Shag is a cormorant species, resident and widely spread in Greece which usually occurs in coastal waters. Shags breed colonially, forming small, loose (rarely dense) colonies, on cliff ledges or small caves or even under thick vegetation. Nesting sites are re-used in successive years by the same birds. They often roost in large groups (Fric et al. 2012). It is a good swimmer and a foot-propelled diver which feed on benthic and pelagic fish in waters with depths up to 80 m which are usually located in coastal zones within a 20 km radius around their colony or roosting sites (Wanless *et al.* 1991; Velando and Friere 1999).

The Greek national population size is 1,300 -1,450 pairs (Fric et al. 2012), equivalent to 2% of the species European population (BirdLife International 2015, BirdLife International 2018D). The population in Greece is stable (Fric et al. 2012). The island of Zakynthos hosts an important population of the Mediterranean Shag (i.e., 44-46 adult and juvenile individuals) (Portolou et al. 2009, Fric et al.2012). The species breeds along the western coast of the Zakynthos and forages in coastal waters along the western and eastern coast, including the Bay of Laganas. Therefore, the major breeding and foraging areas of the Mediterranean Shag around Zakynthos Island are located outside the Project Area and within the Wider Project Area.

2.2.4.5 Yellow-legged Gull (Larus michahellis)

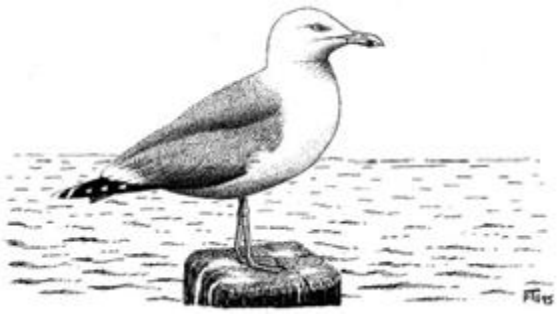

Figure 2-21. Yellow-legged Gull (Larus michahellis) (© Paul Hirst)

The Yellow-legged Gull is the most common gull species in Greece. It is widely distributed around the southern regions of the Palaearctic, from the western part of the Black Sea across to the Mediterranean, Iberian Peninsula, and reaching the Macaronesian region. Breeding grounds are centred mainly around the Mediterranean but reach also the Black Sea, Caspian

Sea, and eastern Atlantic. In Greece, the species is resident and widespread all along the coastline of mainland Greece and of the islands of the Aegean and Ionian Seas.

In Greece, the largest breeding colonies are located on uninhabited islets of the Evvoikos and Saronikos Gulfs that surround Attica, the most urbanised area in the country, although colonies occur on most Greek islets (Fric et al. 2012). Wintering grounds include the coast of southwest Asia, most of the European coast up to Denmark and the coast of Africa from Western Sahara through the eastern Mediterranean (del Hoyo *et al.* 1996).

3 Methodology

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.

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 (<15 knots). Swimming seabirds, cetacean, fish and sea turtles are being recorded continuously in a 300m wide strip transect in **5-minute intervals**, while flying birds are recorded with **1-min snapshot**. Scanning angle is 180° (*i.e. in front of the survey vessel*). The perpendicular distance of swimming fauna is recorded relative to the transect line ahead of the ship: **A = 0-50m, B = 50-100m, C = 100-200m, D = 200-300m, E = >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 300*m* from the observing platform which determines the width of the line transect by using a calliper 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 influence the presence and behaviour 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), behaviour and association with human activities or other species. Datasheets for observation vessel data and species data are provided in Annex I.

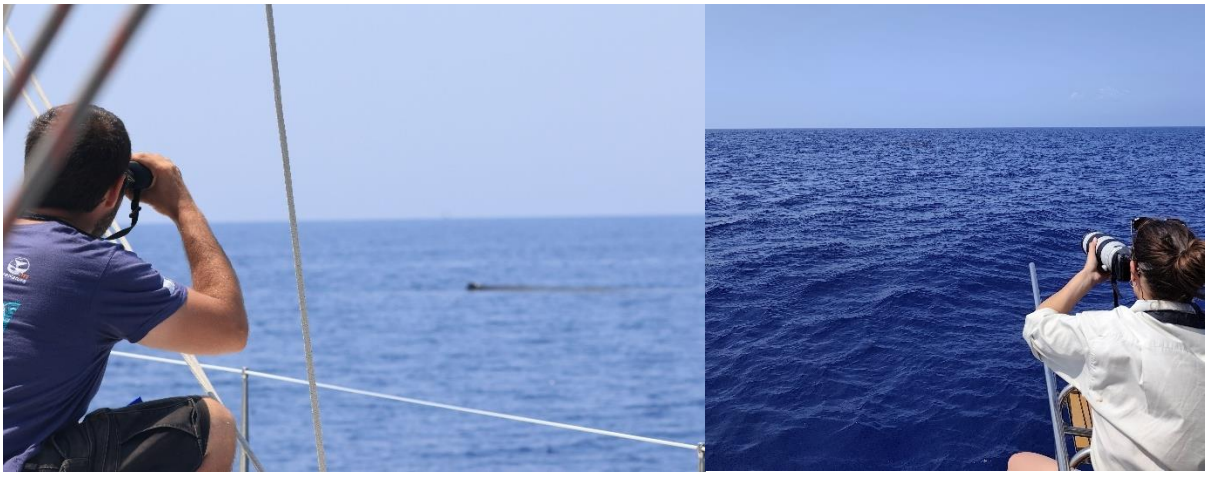

Figure 3-1. Visual boat surveys

The **survey design for cetaceans** is like 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, which 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, 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 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 (e.g., Beaufort sea state, visibility conditions etc.) collected at regular 1 hour intervals as well as at the start and 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 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.

The navigation schedule coincided with the Visual boat-based surveys.

In case a group of cetaceans or seabirds was spotted, a drone was used to more accurately identify the species and assess the number of the individuals, record their behaviour and gather the relevant photographic evidence.

Acoustic surveys

The acoustics detection team works in cooperation with the visual observers, detecting cetacean vocalizations by using a hydrophone array towed behind a 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 is submerged and active, and a Passive Acoustic Monitoring (PAM) operator is active on the equipment during all "On Effort" times during the survey. The hydrophone system consists of 2 hydrophones, which record on 2 different channels. The visual observers and PAM operator rotate every 1.5 hours to minimize fatigue.

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

The hydrophone recordings are analysed by PAMGUARD software using the "*whistle and moan detector"* module.

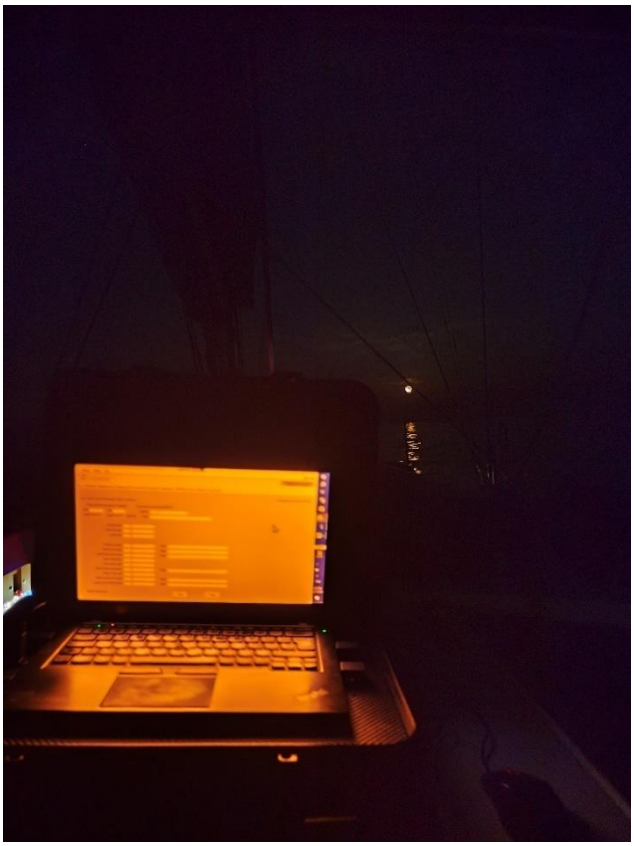

Figure 3-2. Night PAM boat survey.

Figure 3-3. Deployment of the towed hydrophone array behind the sailing boat

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 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.

Figure 3-4. The aircraft used for the aerial surveys spotting a group of Sperm whales

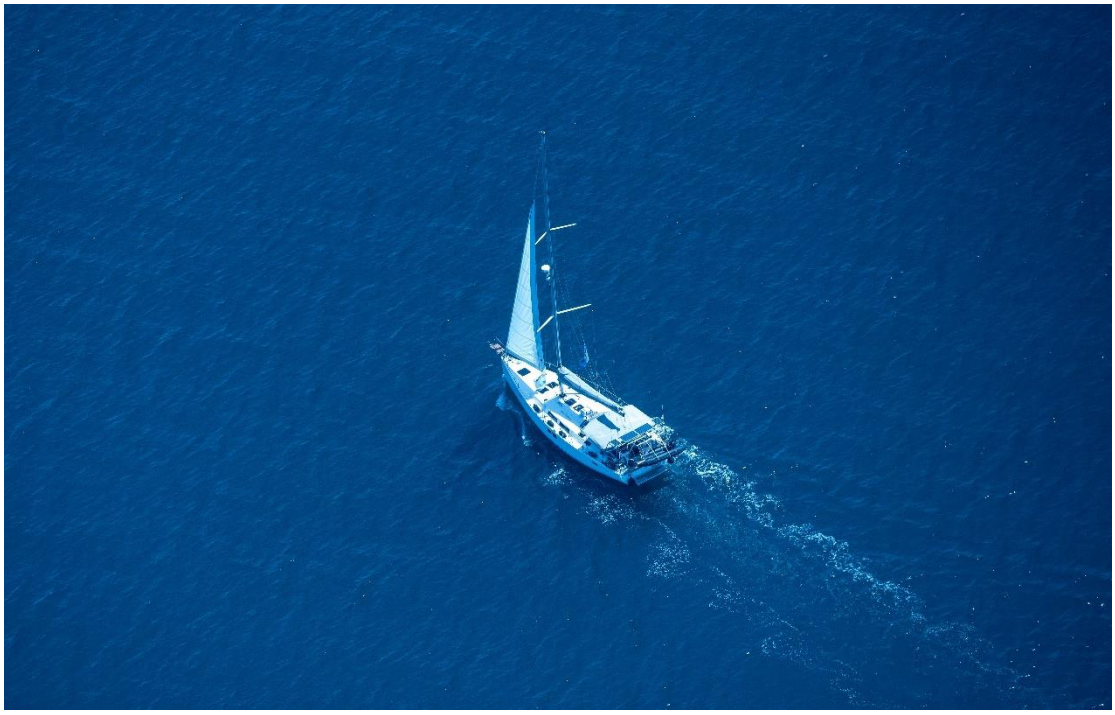

Figure 3-5. NCC Sailboat from the aircraft's cockpit

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

Figure 3-6. A: Recording an "object of interest", B: Approaching, C: Identifying

3.2 Coastal surveys

3.2.1 Coastal surveys and cave monitoring for the Mediterranean Monk Seal

Coastline surveys will be conducted across southwest Zakynthos Island, the Strofades Islands, the Kyparissiakos Gulf, and the southwestern Peloponnese to identify and monitor marine caves that may serve as suitable pupping sites for the Mediterranean monk seal (*Monachus monachus*). Surveys will be carried out using a Rigid Inflatable Boat (RIB), enabling efficient coverage of extensive and complex coastal areas to ensure that no potential pupping site is overlooked.

In addition, infrared (IR) trap cameras will be installed in selected caves to collect data that will support further assessment of monk seal breeding activity. Depending on the monitoring objective, cameras will either operate in timelapse mode capturing images at regular intervals (e.g., every 1 or 2.5 hours) for continuous observation of known breeding sites, or in motion-triggered mode to record presence-absence data of the species.

Figure 3-7. Installation of infrared camera systems in a monk seal shelter

3.3 Telemetry activities

3.3.1 Colony surveys of Scopoli's Shearwater at the Strofades islets SPA with nest cameras

The internationally significant colony of Scopoli's Shearwater (*Calonectris diomedea*) at the Strofades Islets SPA, and the surrounding project area, will be monitored using GSM-enabled stationary nest cameras and audio recordings. These systems will document the breeding activity, assess the presence and behavior of ground predators, and detect potential anthropogenic disturbances to the colony.

Cameras will be deployed throughout the breeding season. All visual and acoustic data collected will undergo systematic analysis. The cameras are equipped with PTZ (pan-tilt-zoom) capabilities, allowing for adjustable fields of view and enhanced monitoring coverage compared to fixed-angle systems. Furthermore, their integrated audio recording functionality enables the dual use of data for both visual and acoustic analysis, providing a comprehensive assessment of the colony's status and threats.

3.3.2 Telemetry of Scopoli's Shearwater at the Strofades islets SPA with satellite transmitters

10 GPS/GSM tags will be deployed to Scopoli's shearwater fledglings on September-early October 2025, 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 "Kyparissiakos block" lease area will be further explored.

4 Results

4.1 Pelagic surveys

4.1.1 Boat surveys

A total of **483 nautical miles** of boat-based visual and acoustic surveys were carried out from 10/6/2025 to 16/6/2025 in the Pelagic Survey Area, as well as in the Wider Project Area and the surrounding areas, to assess the presence, abundance and distribution of the cetacean, sea turtle and seabird species of interest.

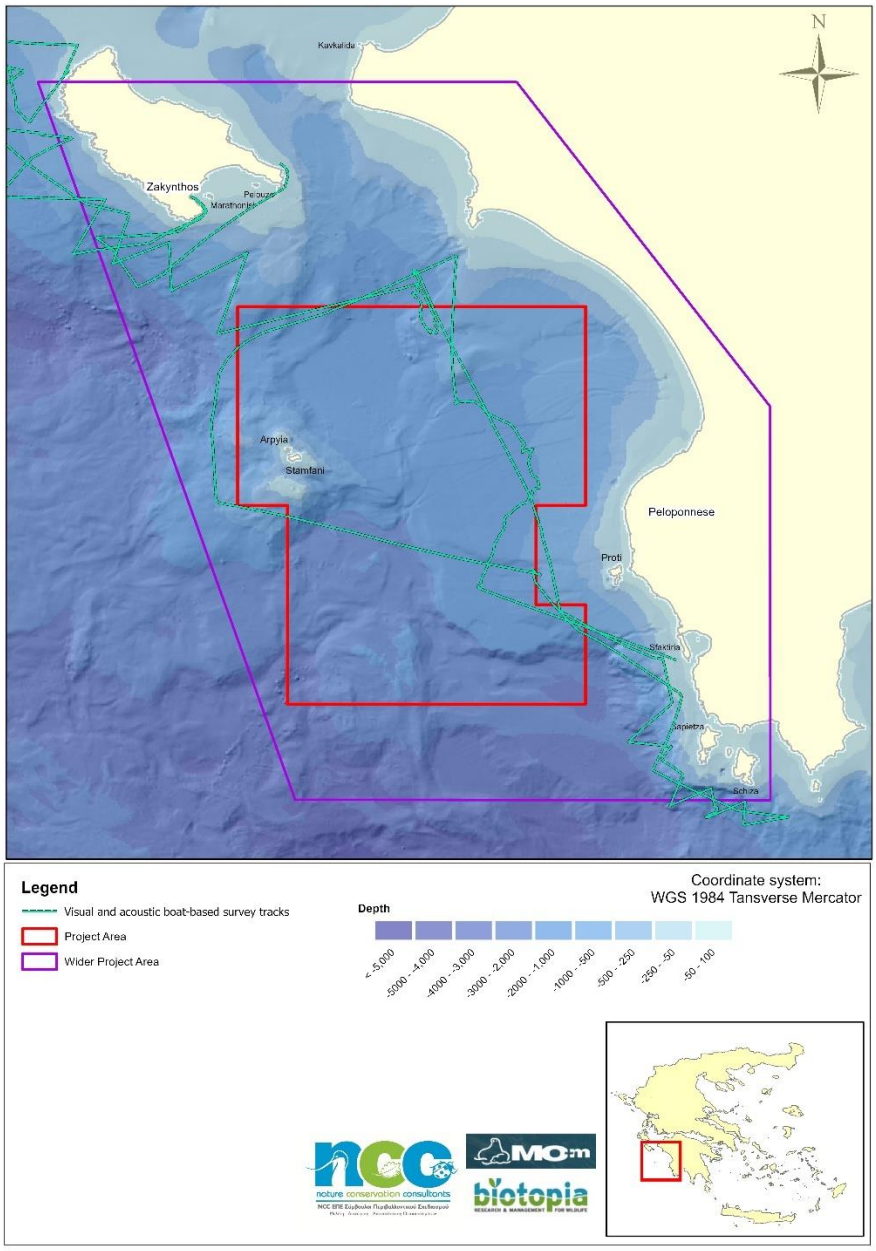

Figure 4-1. Visual and acoustic boat-based survey tracks

During the visual surveys the following species were recorded visually:

- 3 cetacean species: **sperm whale** (*Physeter macrocephalus*), **Cuvier's beaked whale** (*Ziphius cavirostris)*, and **striped dolphin** (*Stenella coeruleoalba*),
- 1 seabird species: **Scopoli's Shearwater** (*Calonectris diomedea*)

Table 4-1. Species visually recorded in the Wider Project Area

Species	Common name	Number of individuals
Physeter macrocephalus	sperm whale	15
Ziphius cavirostris	Cuvier's beaked whale	8
Stenella coeruleoalba	striped dolphin	90
Calonectris diomedea	Scopoli's Shearwater	32

Moreover, during the visual surveys, the following target species were observed outside the Wider Project Area:

- **2 loggerhead turtles**,
- **7 sperm whales** NW of Zakynthos Island,
- **60 striped dolphins**, S of the SE border of the wider project area.

During the **acoustic surveys with the towed hydrophone**, covering 483 nautical miles, 5 detections of Cuvier's beaked whale, 3 **independent detections of sperm whales** were recorded, as well as **11 detections of dolphins** (species identification is not possible for dolphin species with the acoustic data) in the Wider Project Area.

Additionally, another **12 acoustic detections of sperm whales**, 1 detection of Cuvier's beaked whale and 2 detections of dolphins were recorded outside the Wider Project Area (NW of Zakynthos and S of the SW border of the Wider Project Area).

It is noteworthy that during the visual and acoustic surveys conducted in June 2025, a total of **20 to 21 sperm whales** (*Physeter macrocephalus*) were recorded within the wider project area and its surroundings. This represents an exceptionally high number of individuals, considering the estimated population in Greek waters is between 180 and 280 animals. Among those encountered, two social groups of females accompanied by calves were identified, as well as an undetermined number of males—with at least one confirmed.

Additionally, an encounter involving 14 individuals, also documented via aerial survey imagery, presents a particularly intriguing case. The animals remained at the surface for several hours, displaying close social interactions, without diving behaviour which is typically observed (e.g., no fluking). The NCC vessel remained with the group from midday until dusk, yet no foraging activity or deep dives were recorded.

To interpret this unusual congregation, a comprehensive analysis will be conducted and presented in the final report. The analysis will focus on understanding the behaviour of the

group of the 14 individuals, utilizing photographic and video documentation of the encounter, as well as the acoustic recordings of social sounds produced during the interaction.

The results of the boat visual and acoustic surveys are presented in the following figures.

Cetaceans

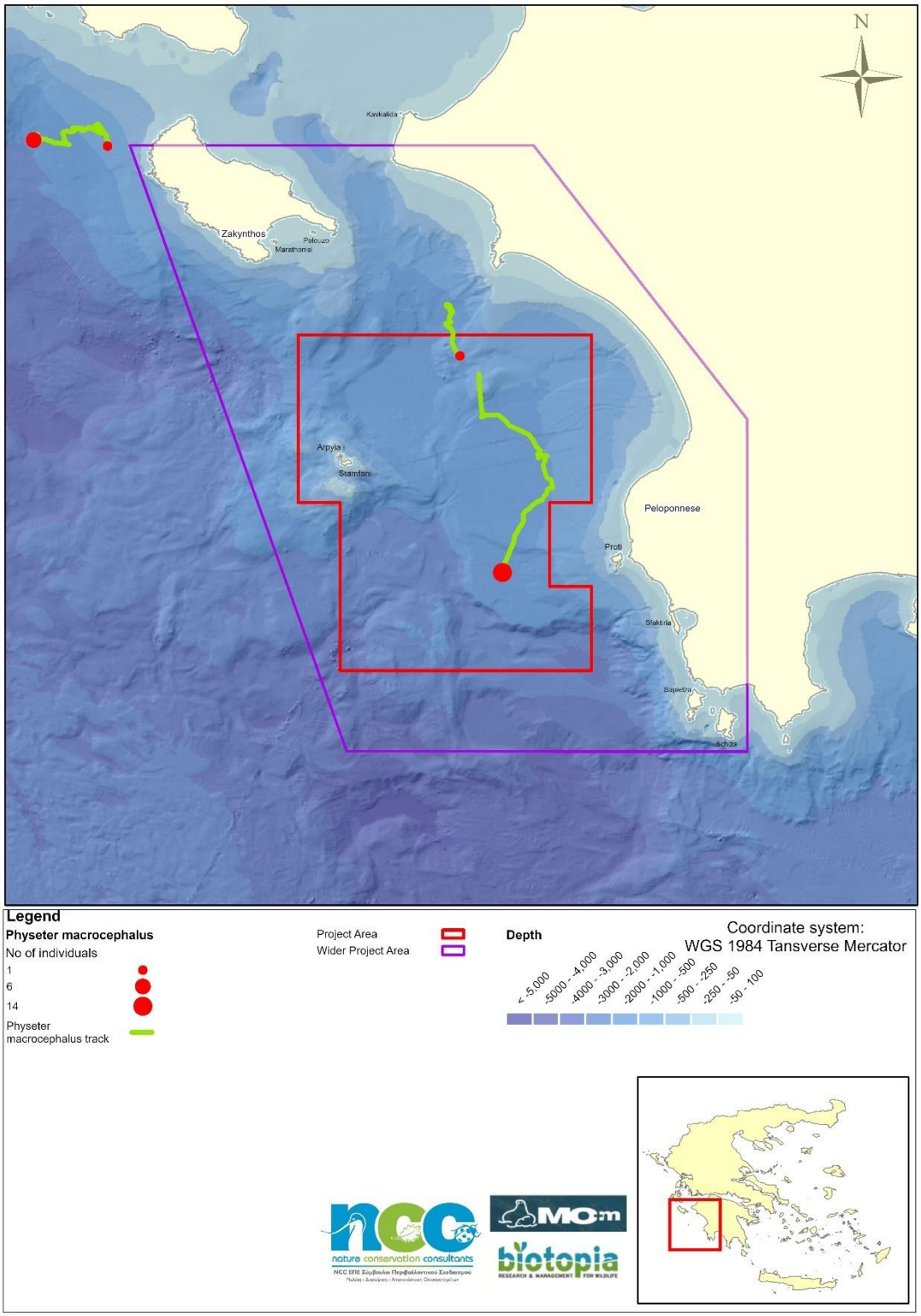

Figure 4-2. Locations of first encounter and tracks following sperm whales.

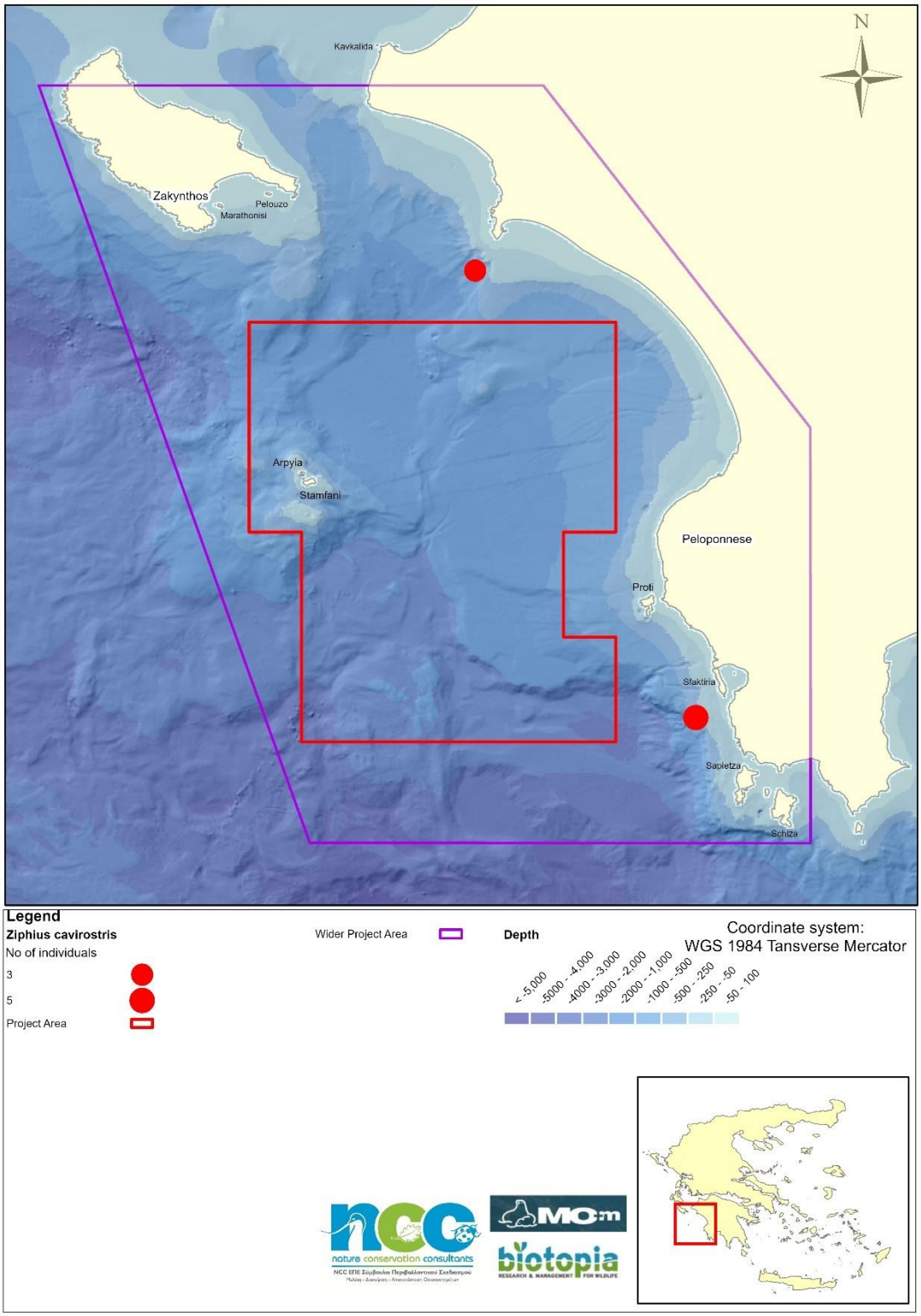

Figure 4-3. Locations of Cuvier's beaked whale visual records.

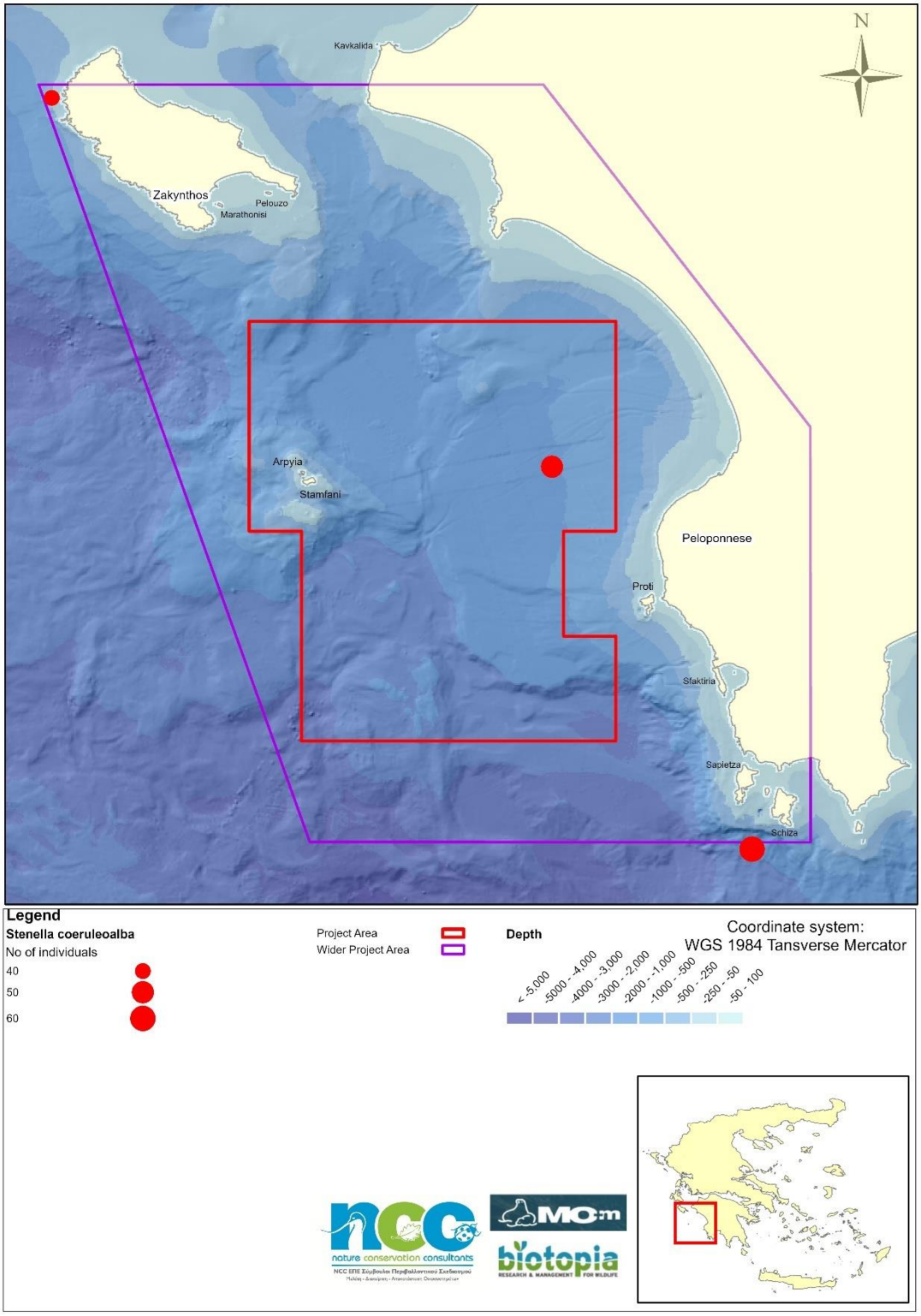

Figure 4-4. Locations of striped dolphin visual records.

Seabirds

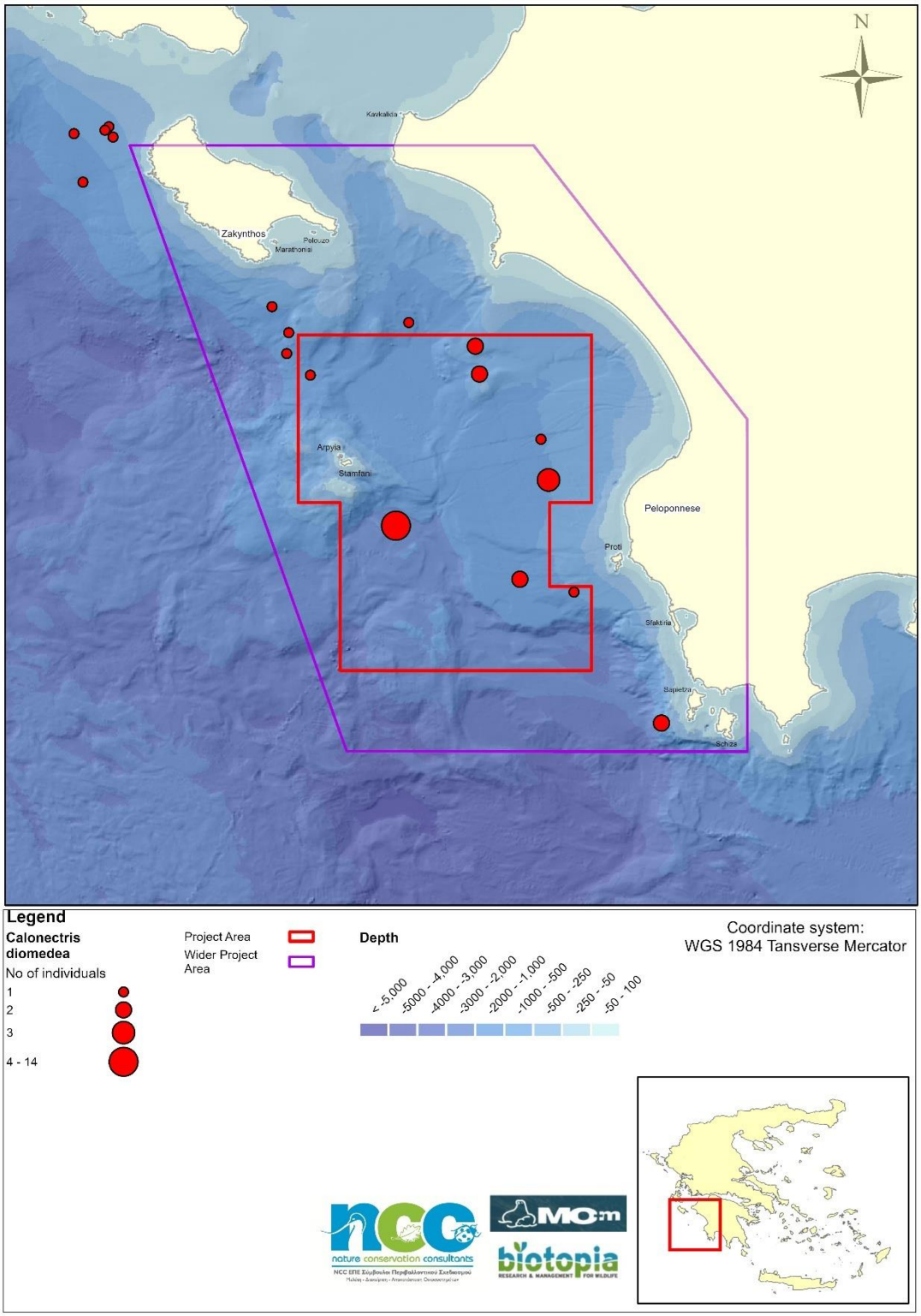

Figure 4-5. Locations of Scopoli's Shearwater visual records.

Figure 4-6. Sperm whales during the boat surveys.

Figure 4-7. Cuvier's Beaked whales during the boat surveys

Figure 4-8. Group of Sperm whales with a sailing boat (above) and Scopoli's Shearwater (below).

Figure 4-9. Big group of Striped Dolphins porppoising

Figure 4-10 Striped Dolphins travelling

4.1.2 Aerial surveys

The aerial survey was conducted on the 16th and 17th of June 2025. A total of **990 km** have been inspected, covering the Wider Project Area.

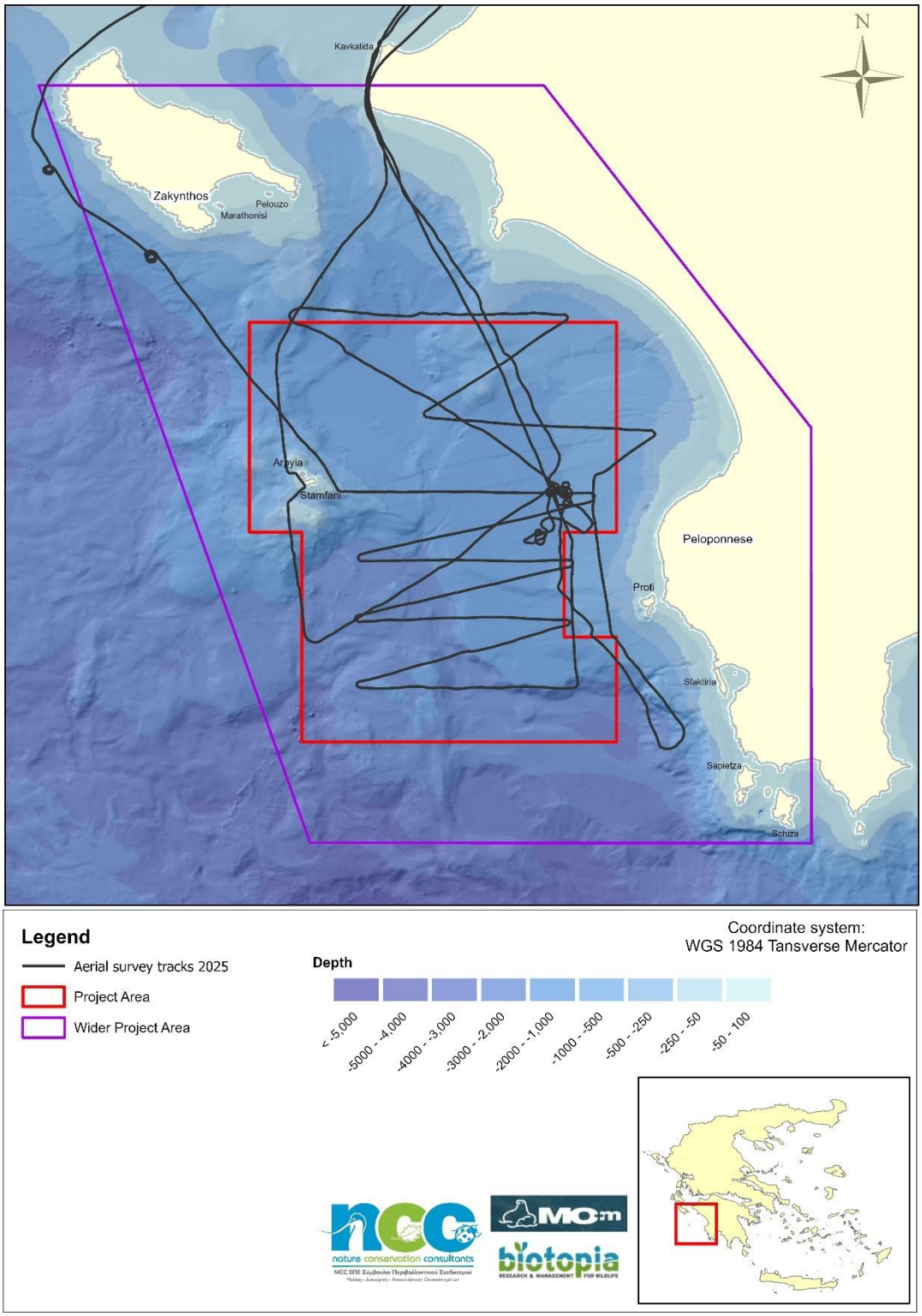

Figure 4-11. Aerial surveys track.

Figure 4-12. Sperm whales observed during the aerial surveys

4.2 Coastal surveys

4.2.1 Coastal surveys and cave monitoring for the Mediterranean Monk Seal

During the 2024–2025 monitoring period, systematic monitoring of the Mediterranean monk seal population continued within the framework of the National Rescue and Information Network (RINT), with a particular focus on the southwestern coast of Zakynthos—an area already identified as critically important for the species' reproduction in the Ionian Sea.

A total of 21 monk seal sightings were recorded between 1 July 2024 and 30 June 2025, including 20 live animals and 1 dead adult male. Age classification of the observed individuals comprised 9 adults, 2 subadults, 4 pups, and 6 of unknown age. Sex classification indicated 3 males, 6 females, and 12 individuals of undetermined sex.

The updated data confirms the species' consistently high presence and reproductive activity in the wider Zakynthos area, where an estimate of six pups are born annually. In contrast, the species appears to be only sporadically present in the Kyparissiakos Gulf. Most sightings were concentrated along the southwestern coast of Zakynthos, with their spatial distribution presented in Figure 4-13. The specific locations of pup sightings are depicted separately in Figure 4-14, highlighting the core pupping zone.

A significant negative incident has been also documented: the deliberate killing of an adult male monk seal, found washed ashore within the boundaries of the National Marine Park of Zakynthos in February 2025.

These findings reinforce the ecological significance of Zakynthos as a key reproductive hotspot for the Mediterranean monk seal in the southern Ionian Sea. In the upcoming study period, the planned installation of infrared camera systems in marine caves of southwestern Zakynthos will further support documentation of the area's importance for the species' reproduction.

Table 4-1 Sightings from 1/6/2024 to 30/6/2025 within the wider project area classified by age classes and sex.

Age Class	No of Inds	Sex Class	No of Inds
Adult	9	Male	3
Subadult	2	Female	6
Pup	4	Unknown	12
Unknown	6	Total	21
Total	21		

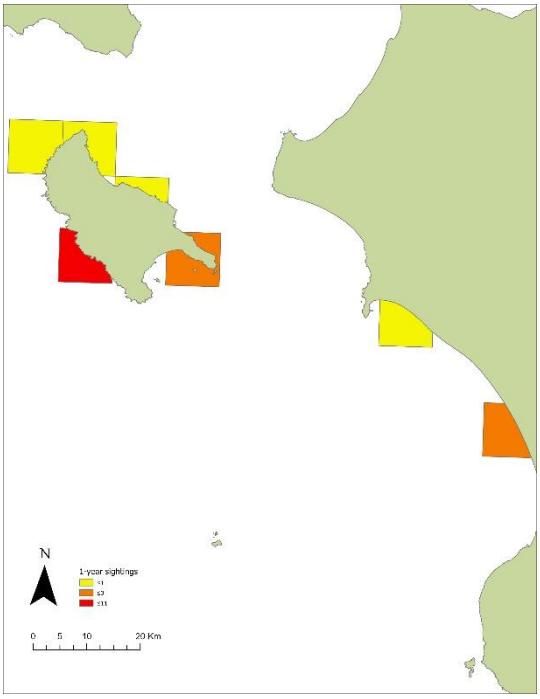

Figure 4-13. Geographic distribution of sightings during the period 1/6/2024-30/6/2025 within the wider project area.

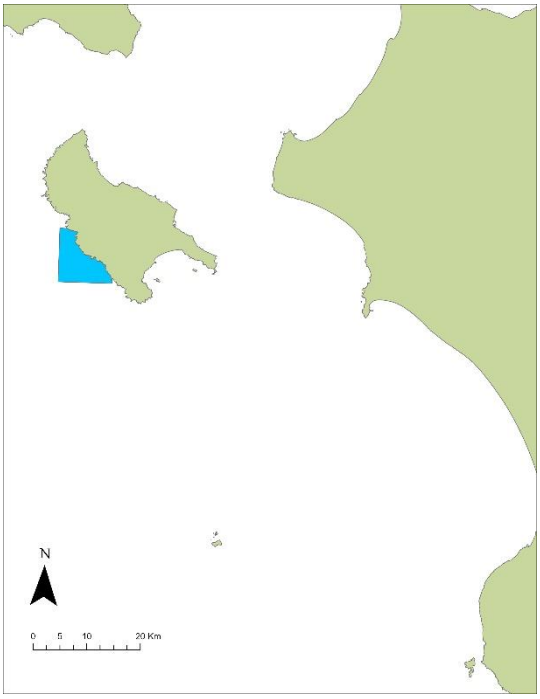

Figure 4-14. Geographic distribution of pup sightings(N=2) during the period 1/6/2024-30/6/2025 within the wider project area.

Figure 4-15. A monk seal pup resting on the beach in marine cave at the SW coast of Zakynthos (27/9/2024).

Figure 4-16. A deliberately killed adult male monk seal that was found washed ashore within the National Marine Park of Zakynthos in February 2025.

4.3 Telemetry activities

4.3.1 Colony surveys of Scopoli's Shearwater at the Strofades islets SPA

Two GSM-enabled stationary nest cameras were deployed on June 26, 2024, and retrieved on October 3, 2024, at two Scopoli's Shearwater (*Calonectris diomedea*) nests located on the Strofades islets. These cameras operated continuously throughout the entire breeding season, providing a comprehensive dataset that includes high-resolution images, video recordings, and ambient audio. This dataset offers valuable insights into key aspects of the species' breeding behavior, chick development, and potential disturbances from natural predators or human activity.

The cameras' GSM functionality allowed remote data retrieval and monitoring, enhancing efficiency and minimizing disturbance at the nesting site. Data processing and analysis are currently in progress and involve reviewing visual and acoustic material to extract detailed behavioral and ecological information. The final outcomes of this monitoring effort, including assessments of breeding success and potential threats to the colony, will be presented in the forthcoming final report.

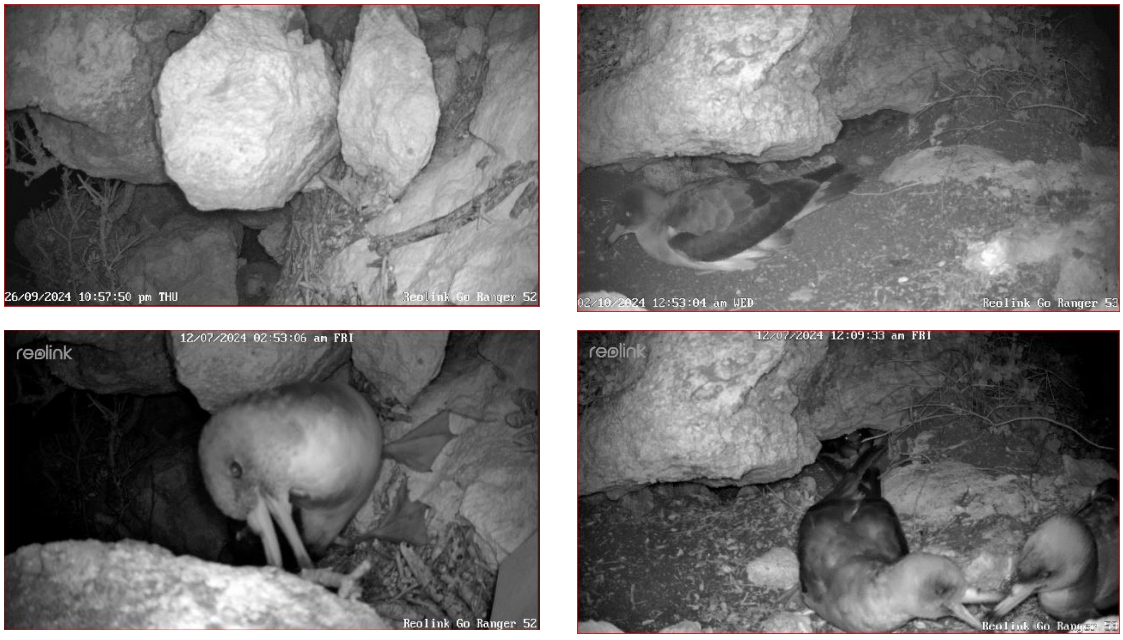

Figure 4-17. Footage from Scopoli's Shearwater nests from the GSM cameras

4.3.2 Sea turtle telemetry data analysis

Following the loggerhead turtle (*Caretta caretta*) satellite and GSM telemetry tagging efforts that have taken place over previous years (from 2019 to 2024), data analysis has led to the publication of one peer-reviewed article (Rees et al., 2025), with an additional manuscript under review and another in preparation.

The study focused on Kyparissia Bay, which hosts the largest loggerhead nesting aggregation in the Mediterranean. Using satellite and GSM telemetry in combination with drone surveys, researchers tracked the internesting movements of female turtles during the breeding season, which spans from late May to August.

From the data analyzed till the present date the turtles **predominantly remained nearshore, within the 50 m isobath**, and within proximity to their nesting sites in the southern section of the bay (from Elaia to Kalo Nero). A notable hotspot was also identified within the sheltered waters of Kyparissia harbor.

The studies further updated the estimated clutch frequency for this population, indicating an average of **3.3 to 3.5 clutches per turtle per season**, slightly lower than earlier estimates but still among the highest reported in the Mediterranean.

The full article is presented in Annex I.

5 Conclusions

During the first semester of 2025, all planned activities were successfully completed. Both boat-based (visual and acoustic) and aerial surveys were conducted within the project area in June 2025. Three cetacean species were recorded: the sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*), and striped dolphin (*Stenella coeruleoalba*), all characteristic of the deep waters in the Project Area.

The most notable finding was the observation of sperm whale groups, both inside and outside the Project Area. Particularly significant was the encounter with a group of 14 individuals. This group not only represented an unusually large aggregation but also exhibited atypical behavior, which remains insufficiently understood and warrants further investigation.

As in 2024, targeted efforts to locate sperm whales were guided by Dr. Jonathan Gordon, an internationally recognized expert on the species. Dr. Gordon contributed to the planning of fieldwork and actively participated in the June surveys.

Additionally, Scopoli's Shearwaters (*Calonectris diomedea*) were sighted during the boat surveys. The species breeds on the Strofades Islands—home to the largest colony in Greece—and utilizes the broader project area as a feeding habitat.

Coastal surveys focused on the Mediterranean monk seal (*Monachus monachus*) reaffirmed the importance of the southwestern region of Zakynthos Island as a key reproductive site for the species in the South Ionian Sea. It is estimated that approximately six pups are born annually in the wider Zakynthos area.

The installation of GSM cameras at Scopoli's Shearwater nesting sites in July 2024 enabled continuous monitoring of the species' entire breeding season. The collected footage yielded valuable insights into the species' breeding ecology and the threats it faces. Further analysis of the photo and video data is expected to enhance our understanding of this ecologically significant colony at the Mediterranean scale.

Finally, telemetry studies on loggerhead turtles (*Caretta caretta*), conducted during previous phases of the project, have generated significant findings. These results have contributed to peer-reviewed publications, enhancing our knowledge of the species' ecological requirements within the region.

Bibliography

Adamantopoulou, S., Androukaki, E. & Kotomatas, S. (1999). The distribution of the Mediterranean monk seal in Greece based on an information network. *Contributions to the Zoogeography and Ecology of the Eastern Mediterranean Region*, 1, 399-404

Aguilar, A. & Gaspari, S. 2012. *Stenella coeruleoalba*. The IUCN Red List of Threatened Species 2012: e.T20731A2773889.

Aguilar, A. & Lowry, L. (IUCN SSC Pinniped Specialist Group). 2010. *Monachus monachus*. The IUCN Red List of Threatened Species 2010: e.T13653A4305567.

Anonymous (2007). Status of the population of the Mediterranean monk seal (*Monachus monachus*) in Greece. pp. 1-42. MOm/Hellenic Society for the Study and Protection of the Monk seal, Athens, Greece.

Avens, L. and M.L. Snover (2013) Age and age estimation in sea turtles. In: J. Wyneken, K.J. Lohmann & J.A. Musick (ed.), *The biology of sea turtles. Volume III.*, pp. 97-133. CRC Press, Boca Raton, FL, USA.

Bearzi, G. 2003. *Delphinus delphis* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2003: e.T41762A10557372.

Bearzi, G., Reeves, R.R., Notarbartolo di Sciara, G., Politi, E., Cañadas, A., Frantzis, A. and Mussi, B. 2003. Ecology, status and conservation of Short-beaked Common Dolphins (*Delphinus delphis*) in the Mediterranean Sea. *Mammal Review*. 33(34): 224-252.

Bearzi, G., Politi, E., Agazzi, S., Bruno, S., Costa, M. and S. Bonizzoni (2005) Occurrence and present status of coastal dolphins (Delphinus delphis and Tursiops truncatus) in the eastern Ionian Sea. *Aquatic Conserv: Mar. Freshw. Ecosyst*. 15: 243–257

Bearzi, G., Fortuna, C. M. and R. R. Reeves (2008A) Ecology and conservation of common bottlenose dolphins *Tursiops truncatus* in the Mediterranean Sea. *Mammal Rev*. 39(2): 92-123.

Bearzi, G., Agazzi, S., Gonzalvo, J., Costa, M., Bonizzoni, S., Politi, E., Pirroddi, C. and R.R. Reeves (2008B) Overfishing and the disappearance of short-beaked common dolphins from western Greece. *Endang. Species. Res*. 5: 1-12

Bearzi, G., Fortuna, C. & Reeves, R. 2012. *Tursiops truncatus*. The IUCN Red List of Threatened Species 2012: e.T22563A2782611.

BirdLife International (2015) European Red List of Birds. Luxembourg: Office for Official Publications of the European Communities

BirdLife International (2018A) *Calonectris diomedea*. *The IUCN Red List of Threatened Species* 2018: e.T45061132A132667885. Downloaded on 15 November 2018.

BirdLife International (2018B) *Puffinus yelkouan*. *The IUCN Red List of Threatened Species* 2018: e.T22698230A132637221. Downloaded on 15 November 2018.

BirdLife International (2018C) *Hydrobates pelagicus*. *The IUCN Red List of Threatened Species* 2018: e.T22698477A132650209. Downloaded on 15 November 2018.

BirdLife International (2018D) *Gulosus aristotelis*. *The IUCN Red List of Threatened Species* 2018: e.T22696894A133538524. Downloaded on 15 November 2018.

BirdLife International (2018E) *Larus audouinii*. *The IUCN Red List of Threatened Species* 2018: e.T22694313A132541241. Downloaded on 15 November 2018.

BirdLife International (2018F) *Larus michahellis*. *The IUCN Red List of Threatened Species* 2018: e.T62030970A132234755. Downloaded on 15 November 2018.

Bolten, A.B. and B.E. Witherington (2003) *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C., USA.

Bourgeois, K. & E. Vidal (2008) The endemic Mediterranean yelkouan shearwater Puffinus yelkouan: distribution, threats and a plea for more data. *Oryx* 42(2): 187-194.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and L. Thomas (2001) Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford, UK.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and L. Thomas (2004) Advanced Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, Oxford, UK.

Cañadas, A. & Notarbartolo di Sciara, G. 2018. *Ziphius cavirostris* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2018: e.T16381144A50286386.

Carboneras, C., Derhé, M. & I. Ramirez (2013) Update on the population status and distribution of Mediterranean shearwaters. Report to Seventh Meeting of the ACAP Advisory Committee, La Rochelle, France, 6-10 May 2013.

Casale, P. & D. Margaritoulis (Eds.). (2010). Sea turtles in the Mediterranean: distribution, threats and conservation priorities. IUCN.

Casale, P. & P. Mariani (2014) The first 'lost year' of Mediterranean sea turtles: dispersal patterns indicate subregional management units for conservation. *Mar Ecol Prog Ser* 498: 263–274

Casale, P. (2015) *Caretta caretta Mediterranean subpopulation*. *The IUCN Red List of Threatened Species*2015: e.T83644804A83646294.

Casale, P. & A.D. Tucker (2017) *Caretta caretta* (amended version of 2015 assessment). *The IUCN Red List of Threatened Species* 2017: e.T3897A119333622.

Casale, P., Broderick, A. C., Camiñas, J. A., Cardona, L., Carreras, C., Demetropoulos, A., Fuller, W. J., Brendan, J. G., Hochscheid, S., Kaska, Y., Lazar, B., Margaritoulis , D., Panagopoulou , A., Rees , A.F., Tomás , J. & Türkozan, O. (2018). Mediterranean sea turtles: current knowledge and priorities for conservation and research. *Endangered species research*, 36, 229-267.

Champhuysen, C. J. & S. Garthe (2004) Recording foraging seabirds at sea: Standardized recording and coding of foraging behaviour. *Atlantic Seabirds 5(si)*

Dendrinos, P., Karamanlidis, A.A., Kotomatas, S., Legakis, A., Tounta, E. & Matthiopoulos, J. (2007). Pupping habitat use in the Mediterranean monk seal: a long-term study. *Marine Mammal Science*, 23, 615-628.

Dendrinos, P., Kotomatas, S. & Tounta, E. (1999). Monk seal pup production in the National Marine Park of Alonissos-N.Sporades. *Contributions to the Zoogeography and Ecology of the Eastern Mediterranean Region*, 1, 413-419.

Derhé, M. A. (2012A) Developing a Population Assessment for Scopoli's and Cory's Shearwaters *Calonectris diomedea/Calonectris borealis*. In: Yésou, P.; Baccetti, N.; Sultana, J. (ed.), *Ecology and Conservation of Mediterranean Seabirds and other bird species under the Barcelona Convention – Proceedings of the 13th Medmaravis Pan- Mediterranean Symposium. Alghero (Sardinia) 14-17 Oct. 2011*, pp. 29–38. Medmaravis, Alghero

Derhé, M. A. (2012B) Population assessment for the Yelkouan Shearwater *Puffinus yelkouan*. In: BirdLife International (ed.), Methodology for Bird Species Recovery Planning in the European Union. Final Report to the European Commission. BirdLife International for the European Commission, Cambridge, UK.

Dimalexis, T., Kastritis, Th., Grivas, K., Manolopoulos, A., Kardakari, N., Kakalis, L., Xirouchakis, S., Tsaitouridis, S., Papazoglou, C. and B. Barov (2009) Definition of compatible activities with respect to the species for the designation of the Special Protection Areas for birds. [In Greek]

del Hoyo, J., Elliott, A. and J. Sargatal (1996) Handbook of the Birds of the World, vol. 3: Hoatzin to Auks. Lynx Edicions, Barcelona, Spain.

Diogou, N., Klinck, H., Frantzis, A., Nystuen, J. A., Papathanassiou, E., & Katsanevakis, S. (2019). Year-round acoustic presence of sperm whales (Physeter macrocephalus) and baseline ambient ocean sound levels in the Greek Seas. Mediterranean Marine Science, 20(1), 208-221.

Frantzis A., (1998) Does acoustic testing strand whales? *Nature* 392:29

Frantzis A., Alexiadou P., Paximadis G., Politi E., Gannier A., Corsini-Foka M., 2003. Current knowledge of the cetacean fauna of the Greek Seas. *The Journal of Cetacean Research Management* 5(3): 219-232.

Frantzis A. (2009) *Cetaceans in Greece: Present status of knowledge*. Initiative for the Conservation of Cetaceans in Greece, Athens, Greece, 94 pp.

Frantzis, A., Alexiadou, P., & Gkikopoulou, K. C. (2014). Sperm whale occurrence, site fidelity and population structure along the Hellenic Trench (Greece, Mediterranean Sea). Aquatic Conservation: Marine and Freshwater Ecosystems, 24(S1), 83-102.

Frantzis, A., Leaper, R., Alexiadou, P., Prospathopoulos, A., & Lekkas, D. (2019). Shipping routes through core habitat of endangered sperm whales along the Hellenic Trench, Greece: Can we reduce collision risks?. *PloS one*, *14*(2), e0212016.

Fric J. & K. Gaganis 2009. European Seabirds at Sea Methodology. LIFE-Natura project LIFE07 NAT/GR/000285, Hellenic Ornithological Society. [In Greek]

Fric, J., Portolou, D., Manolopoulos, A. and T. Kastritis (2012). *Important Areas for Seabirds in Greece*. LIFE07 NAT/GR/000285 - Hellenic Ornithological Society (HOS / BirdLife Greece), Athens.

Fric, J. & D. Portolou (2016). Population study of the Yelkouan Shearwater (*Puffinus yelkouan)* in the area of Gyaros. 2015 annual report. Nature Conservation Consultants (NCC) Ε.Π.Ε. & Hellenic Ornithological Society [In Greek].

García-Barcelona, S., Ortiz de Urbina, J. M., de la Serna, J. M., Alot, E. & D. Macias (2010) Seabird bycatch in Spanish Mediterranean large pelagic longline fisheries, 2000-2008. *Aquatic Living Resources* 23: 363–371.

Gaspari, S. & Natoli, A. 2012. *Grampus griseus* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2012: e.T16378423A16378453.

González, L.M. & Fernandez de Larrinoa, P. (2012). Mediterranean monk seal *Monachus monachus* distribution and fisheries interactions in the Atlantic Sahara during the second half of the 20th century. *Mammalia*, 77, 41-49.

Granadeiro, J. P., Dias, M. P., Rebelo, R., Santos, C.D. & P. Catry (2006) Numbers and population trends of Cory's Shearwater *Calonectris diomedea* at Selvagem Grande, Northeast Atlantic. *Waterbirds* 29: 56-60.

Güçlüsoy, H., Kiraç, C.O., Veryeri, N.O. & Savaş, Y. (2004). Status of the Mediterranean monk seal, *Monachus monachus* (Hermann, 1779) in the coastal waters of Turkey. *E.U. Journal of Fisheries & Aquatic Sciences*, 21, 201-210.

Gücü, A.C., Gücü, G. & Orek, H. (2004). Habitat use and preliminary demographic evaluation of the critically endangered Mediterranean monk seal (*Monachus monachus*) in the Cilician Basin (Eastern Mediterranean). *Biological Conservation*, 116, 417-431.

Heinemann D. 1981. A range finder for pelagic bird censusing. J. Wildl. Manage. 45(2), pp. 489-493.

Haywood, JC, Fuller WJ, Godley BJ, Magaritoulis D, Shutler JD, Snape RTE, Widdicombe S, Zbinden JA, Broderick AC (2020) Spatial ecology of loggerhead turtles: Insights from stable isotope markers and satellite telemetry. Diversity and Distributions 26: 368-381.

IUCN (2012). Marine Mammals and Sea Turtles of the Mediterranean and Black Seas. Gland, Switzerland and Malaga, Spain: IUCN. 32 pages.

Karamanlidis, A.A., Dendrinos, P., Fernández de Larrinoa, P., Gücü, A.C., Johnson, W.M., Kiraç, C.O. & Pires, R. (2016). The Mediterranean monk seal Monachus monachus: status, biology, threats, and conservation priorities. Mammal Review, 46, 92-105.

Karamanlidis, A. & Dendrinos, P. 2015. Monachus monachus (errata version published in 2017). The IUCN Red List of Threatened Species 2015: e.T13653A117647375

Karamanlidis, A.A., Pires, R., Silva, N.C. & Neves, H.C. (2004). The availability of resting and pupping habitat for the critically endangered Mediterranean monk seal *Monachus monachus* in the archipelago of Madeira. *Oryx*, 38, 180-185.

Karris, G., Xirouchakis, S., Grivas, K., Fric, J., Dimalexis, T. and S. Sfenthourakis (2011) Migratory behaviour of Cory's Shearwaters, *Calonectris diomedea*, from an Ionian Sea colony: An

application of miniature geolocation technology. In: Fusani L., Coppack T. and M. Stradzs (eds.) *Programme and Abstracts of the 8th Conference of the European Ornithologists' Union*, 27-30 August 2011, Riga, Latvia. Latvian Ornithological Society, 432 pp.

Karris, G., Xirouchakis, S., Grivas, C., Voulgaris, M. D., Sfenthourakis, S., & S. Giokas (2017). Estimating the population size of Scopoli's Shearwaters (Calonectris diomedea) frequenting the Strofades islands (Ionian Sea, western Greece) by raft counts and surveys of breeding pairs. *North-Western Journal of Zoology*, *13*(1).

Karris, G., Xirouchakis, S., Maina, I., Grivas, K., & Kavadas, S. (2018). Home range and foraging habitat preference of Scopoli's shearwater *Calonectris diomedea* during the early chick-rearing phase in the eastern Mediterranean. *Wildlife Biology*, 2018(1).

Laneri, K., Louzao, M., Martínez-Abraín, A., Arcos, J.M., Belda, E., Guallart, J., Sánchez, A., Giménez, M., Maestre, R. & D. Oro (2010). Trawling moratoria influences longline seabird bycatch in the Mediterranean: new insights from a small scale fishery. *Marine Ecology Progress Series* 420: 241–252.

Legakis, A. and P. Maragou (2009) The Red Book of endangered animals of Greece. Athens, GR : Hellenic Zoological Society. 525pp

Lewis, T., Gillespie, D., Lacey, C., Matthews, J., Danbolt, M., Leaper, R., McLanaghan, R. & Moscrop, A. (2007). Sperm whale abundance estimates from acoustic surveys of the Ionian Sea and Straits of Sicily in 2003. Journal of the Marine Biological Association of the United Kingdom, 87(1), 353-357.

Luschi, P., & Casale, P. (2014). Movement patterns of marine turtles in the Mediterranean Sea: a review. *Italian Journal of Zoology*, *81*(4), 478-495.

Mannocci, L., Roberts, J. J., Halpin, P. N., Authier, M., Boisseau, O., Bradai, M. N., ... & Fortuna, C. M. (2018). Assessing cetacean surveys throughout the Mediterranean Sea: a gap analysis in environmental space. *Scientific Reports*, *8*(1), 1-14.

Margaritoulis, D. and A. Rees (2001) The Loggerhead Turtle, *Caretta* caretta, population nesting in Kyparissia Bay, Peloponnesus, Greece: results of beach surveys over seventeen seasons and determination of the core nesting habitat. *Zoology in the Middle East* 24: 75-90.

Margaritoulis, D. (2005) Nesting activity and reproductive output of loggerhead sea turtles, *Caretta caretta*, over 19 seasons (1984-2002) at Laganas Bay, Zakynthos, Greece: the largest rookery in the Mediterranean. *Chelonian Conservation and Biology*4: 916-929.

Martínez-Jauregui, M., Tavecchia, G., Cedenilla, M.A., Coulson, T., Fernández de Larrinoa, P., Muñoz, M. & González, L.M. (2012). Population resilience of the Mediterranean monk seal *Monachus monachus* at Cabo Blanco peninsula. *Marine Ecology Progress Series*, 461, 273-281.

Mo, G., Bazairi, H., Bayed, A. & Agnesi, S. (2011). Survey on Mediterranean monk seal (*Monachus monachus*) sightings in Mediterranean Morocco. *Aquatic Mammals*, 37, 248-255.

Notarbartolo di Sciara, G. and J. Gordon (1997) Bioacoustics: A tool for the conservation of cetaceans in the Mediterranean Sea. *Marine & Freshwater Behaviour & Phy.* 30: 125-146

Notarbartolo di Sciara, G., Frantzis, A., Bearzi, G. & Reeves, R. 2012. *Physeter macrocephalus* (Mediterranean subpopulation). The IUCN Red List of Threatened Species 2012: e.T16370739A16370477.

Oppel S., Raine A.F., Borg J.J., Raine H., Bonnaud E., Bourgeois K.& A.R. Breton (2011) Is the Yelkouan shearwater *Puffinus yelkouan* threatened by low adult survival probabilities? *Biological Conservation* 144(9): 2255-2263.

Pires, R., Neves, H.C. & Karamanlidis, A.A. (2008). The Critically Endangered Mediterranean monk seal *Monachus monachus* in the archipelago of Madeira: priorities for conservation. *Oryx*, 42, 278-285.

Podestà, M., Azzellino, A., Cañadas, A., Frantzis, A., Moulins, A., Rosso, M., Tepsich, P. & Lanfredi, C. (2016). Cuvier's Beaked Whale, Ziphius cavirostris, distribution and occurrence in the Mediterranean Sea: high-use areas and conservation threats. In *Advances in Marine Biology* (Vol. 75, pp. 103-140). Academic Press.

Portolou, D., Bourdakis, S., Vlachos, C., Kastritis, T. and T. Dimalexis (eds.) (2009). *Important Bird Areas of Greece: Priority sites for conservation*. Hellenic Ornithological Society, Athens. [In Greek].

Rees, A. F., Theodorou, P., & Margaritoulis, D. (2020). Clutch frequency for Loggerhead Turtles (*Caretta caretta*) nesting in Kyparissia Bay, Greece. *Herpetological Conservation and Biology*, *15*(1), 131-138.

Reeves, R. R., & Notarbartolo di Sciara, G. (2006). The status and distribution of cetaceans in the Black Sea and Mediterranean Sea.

Ristow, D., Berthold, P., Hashmi, D. and U. Querner (2000) Satellite tracking of Cory's shearwater migration. *Condor* 102: 696-699.

Santostasi, N. L., Bonizzoni, S., Gimenez, O., Eddy, L., & Bearzi, G. (2018). Common dolphins in the Gulf of Corinth are Critically Endangered. *Aquatic Conservation: Marine and Freshwater Ecosystems*.

Schofield, G., Hobson, V.J., Fossette, S., Lilley, M.K.S., Katselidis, K.A. & Hays, G.C. (2010a) Fidelity to foraging sites, consistency of migration routes and habitat modulation of home range by sea turtles. Diversity & Distributions, 16, 840–853.

Schofield, G., Hobson, V.J., Lilley, M.K.S., Katselidis, K.A., Bishop, C.M., Brown, P. & Hays, G.C. (2010b) Interannual variability in the home range of breeding turtles: implications for current and future conservation management. Biological Conservation, 143, 722–730.

Schofield G, Lilley MKS, Bishop CM, Brown P, Katselidis KA, Dimopoulos P, Pantis JD, Hays GC. (2010c). Conservation hotspots: Implications of intense spatial area use by breeding male and female loggerheads at the Mediterranean's largest rookery. Endangered Species Research 10:191–202.

Schofield G, Dimadi A, Fossette S, Katselidis KA, Koutsoubas D, Lilley MKS, Luckman A, Pantis JD, Karagouni AD, Hays GC. (2013). Satellite tracking large numbers of individuals to infer

population level dispersal and core areas for the protection of an endangered species. Diversity and Distributions 19:834– 844.

Seminoff, J.A. (Southwest Fisheries Science Center, U.S.). 2004. Chelonia mydas. The IUCN Red List of Threatened Species 2004: e.T4615A11037468.

Tasker, M.L., Jones, P.H., Dixon, T. & B.F. Blake (1984) Counting seabirds at sea from ships: A review of methods employed and suggestion for a standardized approach. *The Auk 101:567-57*

Ullmann, J., & M. Stachowitsch (2015) A critical review of the Mediterranean sea turtle rescue network: a web looking for a weaver.

Valeiras, J. & J. A. Caminas (2003) The incidental capture of seabirds by Spanish drifting longline fisheries in the western Mediterranean Sea. *Scientia Marina* 67: 65–68.

Velando, A. and J. Freire (1999) Inter-colony and seasonal differences in the breeding diet of European shags on the Galician coast (NW Spain). *Marine Ecology Progress Series* **188**: 225–236.

Wanless, S., Harris, M.P. and J.A. Morris (1991) Foraging range and feeding locations of Shags *Phalacrocorax aristotelis* during chick rearing. *Ibis* **133**: 30-36.

Temple, H.J. and Terry, A. (Compilers) (2007) *The Status and Distribution of European Mammals*. Luxembourg: Office for Official Publications of the European Communities. viii + 48pp, 210 x 297 mm.

Zbinden, J. A., Aebischer, A., Margaritoulis, D., & R. Arlettaz (2008) Important areas at sea for adult loggerhead sea turtles in the Mediterranean Sea: satellite tracking corroborates findings from potentially biased sources. *Marine Biology*, *153*(5), 899-906.

Annex I: Article on loggerhead turtle telemetry

Further Evidence Supporting Internesting Habitat Boundaries for Loggerhead Turtles Nesting in Kyparissia Bay, Greece

ALan F. Rees[1#], Tasos Dimalexis[2], George Mikoniatis[3], Yannis Vavassis[3]

[1]*Turtles from Above, Plymouth, UK (#alanfrees@gmail.com)*
[2]*Nature Conservation Consultants (NCC) Ltd, Athens, Greece*
[3]*HELLENiQ UPSTREAM S.A., HELLENiQ ENERGY Holdings S.A., Athens, Greece*

Kyparissia Bay in Greece hosts the largest loggerhead turtle (*Caretta caretta*) nesting aggregation in the Mediterranean (Casale et al 2018). The turtle nesting season runs from late May through to August, during which time individual turtles may deposit 1 to 5 clutches of eggs at approximately two-week intervals (Margaritoulis 1983, Omeyer et al. 2019). Turtles may remain in the breeding area for an approximately two-month internesting period – defined as the time in days after deposition of the individuals first clutch of the season until the day of departure, which is normally the day after the deposition of the individual's last clutch of the season (Dujon et al. 2017). The turtles then migrate away to their overwintering and foraging areas which may be up to 1,000km or more away (Margaritoulis et al. 2003; Zbinden et al. 2008; Schofield et al. 2013; Patel et al. 2015; Snape et al. 2016).

Due to the predictable presence, during the summer, of sea turtles in waters off known nesting areas, these sites are often declared protected areas and are subject to specific management measures. For example, the National Marine Park of Zakynthos, largely incorporates the marine habitats of Laganas Bay as protected internesting habitat (Dimopoulos 2001) and the nearshore waters of southern Kyparissia Bay, down to the 25 m isobath, are designated protected as an EU Natura 2000 site (GR2330008).

For these designations to be effective they need to encompass most of the turtles internesting area, over the period the turtles are there, and prohibit activities that might harm the turtles. In Kyparissia Bay a Presidential Decree (PD; Government Gazettes D 391/03-10-2018, D 414/12-10-2018) has stipulated the protection of the integrity of the designated area, including protected species occurring there, such as the loggerhead turtle. The PD provides some protective measures including speed limits for vessels within one nautical mile of the shore, with regulations in place during the breeding period. However, a specific Management Plan, which is legally required for the area, is still being drafted and additional conservation measures may be included therein.

In the context of hydrocarbon exploration in the Ionian Sea, HELLENiQ UPSTREAM S.A., a member of the HELLENiQ ENERGY Group, has undertaken five 2D/3D Marine Seismic Surveys in the Greek territorial waters of the Ionian Sea between 2016 -2023. Especially in Block 10 Lease Area (offshore Kyparissiakos Gulf). HELLENiQ UPSTREAM as the sole operator of the Block, put in place Environmental Monitoring Projects in aim to assess critical habitats of protected species in the wider area of Ionian Sea during the course of the hydrocarbon exploration activities. During the period 2018-2023, HELLENiQ UPSTREAM has established a state-of-the-art Biodiversity Monitoring and Critical Habitats Assessment project, for marine megafauna in the context of the hydrocarbons exploration programs in the Ionian Sea, (Greece). More particularly the project, implemented by the specialised consultancy Nature Conservation Consultants (NCC) Ltd, in collaboration with international biodiversity expert groups BIOTOPIA and MOm (the Hellenic Society for the study and protection of the Monk Seal; https://www.mom.gr/) has conducted extensive field surveys, to assess and map the spatiotemporal

distribution, abundance and conservation status of sea turtles, marine mammals (cetaceans and monk seals), and seabirds, in the wider area of Ionian Sea.

Recent studies carried out in southern Kyparissia Bay, using telemetry and drone surveys were able to identify at sea hot spot areas of high use by turtles during the summer months (Rees et al. 2023). Results suggested that the 25 m isobath boundary for the marine protected area may not sufficiently encompass the turtles internesting habitat.

This present study, which was contemporaneous with the published work (Rees et al. 2023) uses satellite telemetry to determine equivalent and comparable data that can be used to further support adapting and updating conservation and management plans, verify any overlap between Block 10 Lease Area, designated by the Greek State to HELLENiQ Upstream S.A. for hydrocarbon exploration and internesting habitat of breeding turtles thus resulting in the most effective protection of this regionally important breeding population.

We located turtles for the study along southern section of the 9.5 km core loggerhead turtle nesting area at the south of Kyparissia Bay (37.3399°N, 21.6952°E; Margaritoulis & Rees 2001). We patrolled the beach between 23:00 and 03:00 to locate nesting turtles. Turtles were selected for study upon completion of a nesting emergence, confirmed through the observation of egg laying. Eight satellite transmitters (Model SPOT-375; Wildlife Computers, Redmond, Washington, USA) were attached to a subset of observed flipper-tagged turtles to track them using the Argos system (www.argos-system.org). Turtles were moved into a large plastic box to retain them on the beach during transmitter deployment that took ~2 h. Transmitters were attached to the turtles' carapaces, centred over the second vertebral scute, using the Wildlife Computers attachment kit and their recommended methods (www.wildlifecomputers.com).

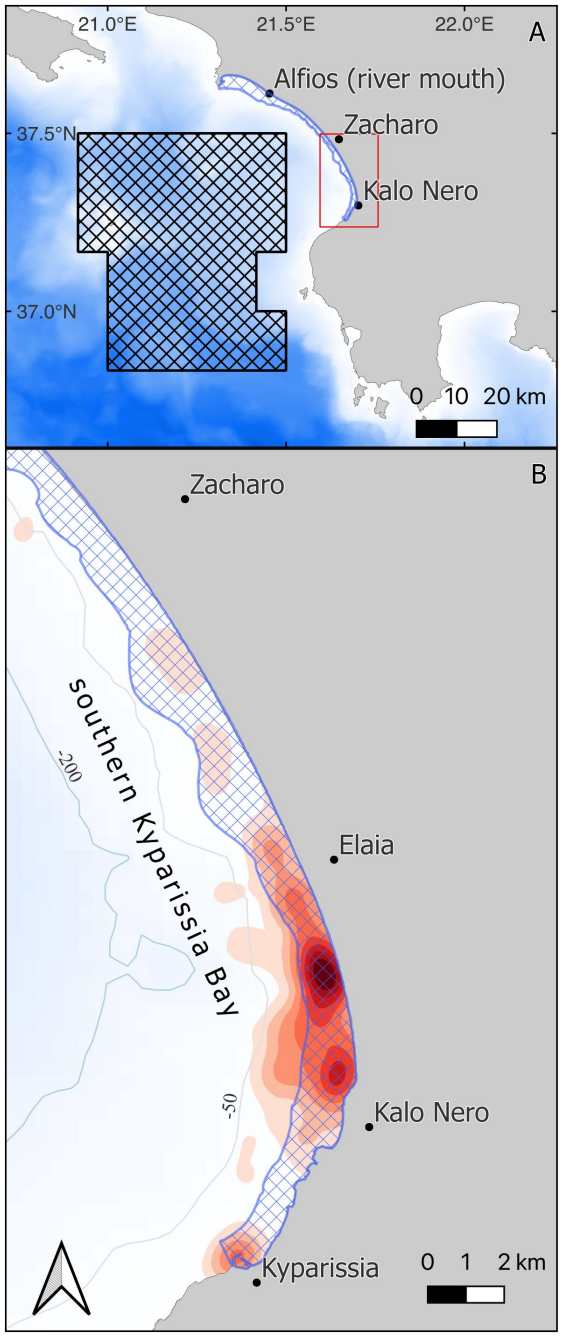

Figure 1. Hotspots during the internesting period for loggerhead turtles in Kyparissia Bay, Greece. (A) southwestern Peloponnese, showing the marine Natura 2000 site relating to sea turtles in blue hatching (GR2330008: *Thalassia Periochi Kolpou Kyparissias* (Marine Area Kyparissia Bay)) and Block 10 Lease Area (black hatching) an area of marine habitat leased for petrochemical exploration and potential extraction. (B) Heatmap density distribution with darker reds representing higher kernel densities. Isobaths are derived from global GEBCO bathymetry dataset (www.gebco.net/)

Data were processed as per Rees et al. (2023) to simplify comparison with the published dataset. Wildlife Computers' data portal (www.wildlifecomputers.com) was used to retrieve and archive Argos location data. From the downloaded data, we used the first best location per day from Argos Location Classes 3, 2, 1 (Class 3 assumed better than Class 2, better than Class 1 etc.; www.argos-system.org) to register turtle positions and movement, with expected accuracy of no better than 250 m. Inland locations were retained to avoid skewing average position data offshore. Maps were created in QGIS (v3.40; www.qgis.org). Turtle high-use areas were determined using the integrated Heatmap (Kernel Density Estimation) symbology function (https://docs.qgis.org/3.28/en/docs/user_manual/processing_algs/qgis/interpolation.html#heatmap-kernel-density-estimation) with 1,000 m at scale entered as the radius and automatic selected for Maximum Value.

We deployed the first three satellite transmitters between 29 June 2021 and 04 July 2021 and a further five transmitters between 09 and 13 June 2022 (Table 1).

After data filtering, we retained 268 daily internesting locations. We retained an average of 33.5±13.7 (SD) locations per turtle (range, 13-50, n = 8). All eight turtles remained within Kyparissia Bay, nearshore in shallow water generally < 50 m deep (Fig. 1). The main cluster of locations ranged along the shore for about 10 km from Kalo Nero in the south to just past Elaia in the north, adjacent to the main nesting beach. An additional distinct hotspot of locations was present south of the nesting beach, centred on Kyparissia harbour (Fig. 1). This hotspot was mainly created by the repeated presence of one turtle from the 2021 cohort, but three other turtles provided locations near to the harbour.

It is clear from the results presented above that the findings of this study, very closely reflect and therefore support those of the previously published work (Rees et al. 2023). The internesting habitat used by the turtles generally reflects the core nesting habitat located between Elaia and Kalo Nero (Fig. 1) but extends a short way to the south and includes the very specific habitat created in Kyparissia harbour, as was previously found (Rees et al. 2023). Likewise, turtle locations range further than the 25 m isobath and are generally confined to the 50 m isobath. Overall, the turtles resided in nearshore shallow habitats as reported for other breeding populations within Greece (Zbinden et al. 2007, Panagopoulou 2015, Schofield et al. 2007, 2010) and elsewhere in the Mediterranean such as southwest Turkey (Cerritelli et al. 2022) and Alagadi, Cyprus (Snape et al. 2018). During the internesting period no turtle locations were recorded within or near to the designated hydrocarbon exploration Block 10 Lease Area. However, at least some turtles travelling to and from Kyparissia Bay

Table 1. Dates of satellite tag deployment and turtle departure (onset of a turtle's permanent migration away from the nesting area) from Kyparissia Bay during 2021 and 2022.

Turtle	Tag Deployment	Turtle Departure	Internesting Period (days)
2021-01	29 June 2021	21 July 2021	22
2021-02	03 July 2021	23 July 2021	20
2021-03	04 July 2021	17 July 2021	13
2022-01	9 June 2022	30 July 2022	51
2022-02	12 June 2022	21 July 2022	39
2022-03	12 June 2022	25 July 2022	43
2022-04	13 June 2022	28 July 2022	45
2022-05	13 June 2022	19 July 2022	36

migrate through the area (manuscript in preparation). HELLENiQ Upstream S.A., following the requirements of the Greek state and based on the results of its monitoring programs, carries out all of its exploration activities between November and March, which is outside the breeding and nesting season.

In conclusion, as per previous publications, our results show that the marine Natura 2000 site in Kyparissia Bay covers a large portion of the key summer habitat used by internesting turtles. However, extending the seaward boundary to the 50 m isobath (ca. 1 km) would incorporate the majority of internesting turtle locations and the protection measures established therein would further benefit turtles. We can now add context to these data regarding the spatial distribution of internesting locations and their lack of proximity to the leased petrochemical exploration area.

Acknowledgments

Satellite tracking was funded by NCC in the context of the Biodiversity Monitoring and Critical Habitats Assessment project. The authors wish to thank ARCHELON, the Sea Turtle Protection Society of Greece, for field support, using personnel from their on-going sea turtle nest monitoring and conservation program in the area to assist with locating turtles and deploying transmitters.

Literature Cited

Casale P, Broderick AC, Camiñas JA, Cardona L, Carreras C, Demetropoulos A, Fuller WJ, et al. (2018) Mediterranean sea turtles: current knowledge and priorities for conservation and research. Endangered Species Research 36: 229-267

Cerritelli G, Casale P, Sozbilen D, Hochscheid S, Luschi P, Kaska Y (2022) Multidirectional migrations from a major nesting area in Turkey support the widespread distribution of foraging sites for loggerhead turtles in the Mediterranean. Marine Ecology Progress Series 683:169-177

Dimopoulos D (2001) The National Marine Park of Zakynthos: A refuge for the loggerhead turtle in the Mediterranean. Marine Turtle Newsletter 93: 5-9

Dujon AM, Schofield G, Lester RE, Esteban N, Hays GC (2017) Fastloc-GPS reveals daytime departure and arrival during long-distance migration and the use of different resting strategies in sea turtles. Marine Biology 164: 187

Margaritoulis D (1983) The inter-nesting interval of Zakynthos loggerheads. In Adaptations to Terrestrial Environments. Margaris NS, Arianoutsou-Faraggitaki M, Reiter RJ (editors). Plenum Press, New York New York, USA. pp 135-144

Margaritoulis D, Rees AF (2001) The loggerhead turtle, *Caretta caretta*, population nesting in Kyparissia Bay, Peloponnesus, Greece: results of beach surveys over seventeen seasons and determination of the core nesting habitat. Zoology in the Middle East 24: 71-95

Margaritoulis D, Argano R, Baran I, Bentivegna F, Bradai MN, Camiñas JA, Casale P, et al. (2003) Loggerhead turtles in the Mediterranean Sea: present knowledge and conservation perspectives. In Bolten AB, Witherington BE (editors). Loggerhead Sea Turtles. Smithsonian Institution Press, Washington, D.C. pp 175-198

Omeyer LCM, Fuller WJ, Godley BJ, Snape RTE, Broderick AC (2019) The effect of biologging systems on reproduction, growth and survival of adult sea turtles. Movement Ecology 7: 2

Panagopoulou A (2015) Sea turtles and small-scale fisheries: designing conservation policies for a marine area on Crete, Greece. Ph.D. Dissertation, Drexel University, Philadelphia, Pennsylvania, USA.

Patel SH, Morreale SJ, Panagopoulou A, Bailey H, Robinson NJ, Paladino FV, Margaritoulis D, Spotila JR (2015) Changepoint analysis: a new approach for revealing animal movements and behaviors from satellite telemetry data. Ecosphere 6(12): 1-13

Rees AF, Papathanasopoulou N, Papoulias P, Samlidou G, Theodorou P, Margaritoulis D (2023) Internesting habitat preference and updated clutch frequency values for loggerhead turtles (*Caretta caretta*) nesting in Kyparissia Bay, Greece. Herpetological Conservation and Biology 18(3): 551-559

Schofield G, Dimadi A, Fossette A, Katselidis KA, Koutsoubas D, Lilley MKS, Luckman A, Pantis JD, Karagouni AD, Hays GC (2013) Satellite tracking large numbers of individuals to infer population level dispersal and core areas for the protection of an endangered species. Diversity and Distributions 19: 834-844

Schofield G, Bishop CM, MacLean G, Brown P, Baker M, Katselidis KA, Dimopoulos P, et al. (2007) Novel GPS tracking of sea turtles as a tool for conservation management. Journal of Experimental Marine Biology and Ecology 347: 58-68

Schofield G, Hobson VJ, Lilley MKS, Katselidis KA, Bishop CM, Brown P, Hays GC (2010) Inter-annual variability in the home range of breeding turtles: implications for current and future conservation management. Biological Conservation 143: 722-730

Snape RTE, Broderick AC, Çiçek BA, Fuller WJ, Glen F, Stokes K, Godley BJ (2016) Shelf life: neritic habitat use of a turtle population highly threatened by fisheries. Diversity and Distributions 22: 797-807

Snape RTE, Bradshaw PJ, Broderick AC, Fuller WJ, Stokes KL, Godley BJ (2018) Off-the-shelf GPS technology to inform marine protected areas for marine turtles. Biological Conservation 227: 301-309

Zbinden JA, Aebischer A, Margaritoulis D, Arlettaz R (2007) Insights into the management of sea turtle internesting area through satellite telemetry. Biological Conservation 137: 157-162

Zbinden JA, Aebischer A, Margaritoulis D, Arlettaz R (2008) Important areas at sea for adult loggerhead sea turtles in the Mediterranean Sea: satellite tracking corroborates findings from potentially biased sources. Marine Biology 153: 899-906