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

Interim Progress Report

June 2024

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Contents

Contents i

1 Introduction 5

2 Description of the Project Area 6

2.1 Oceanographic characteristics of the Project Area 8

2.2 General information of the main cetacean, seabird and sea turtle species in the Project Area 10

2.2.1 Cetaceans 10

2.2.2 Seals 16

2.2.3 Sea turtles 16

2.2.4 Seabirds 20

3 Methodology 24

3.1 Pelagic surveys 24

3.1.1 Boat surveys 24

3.1.2 Aerial surveys 28

3.2 Coastal surveys 30

3.2.1 Coastal surveys for the Scopoli's Shearwater 30

3.2.2 Coastal surveys for the Mediterranean Shag 31

3.2.3 Coastal surveys for the Mediterranean Monk Seal 31

Cave monitoring with the use of Automated Infrared Cameras 31

3.3 Sea turtle telemetry 32

3.4 Telemetry of Scopoli's Shearwater 33

4 Results 35

4.1 Pelagic surveys 35

4.1.1 Boat surveys 35

4.1.2 Aerial surveys 35

4.2 Coastal surveys 37

4.2.1 Coastal surveys for the Scopoli's shearwater 37

4.2.2 Coastal surveys for the Mediterranean Shag 37

4.2.3 Coastal surveys for the Mediterranean Monk Seal 37

4.3 Sea turtle telemetry 39

4.4 Telemetry of Scopoli's Shearwater 41

5 Conclusions 42

Bibliography 43

Annex I: Report on the coastal surveys for the Mediterranean monk seal 50

Annex II: Report on Loggerhead turtles tracking in Kyparissia 50

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

The present document consists of the **Interim Progress Report** of the **Work Packages WP I-III.** It presents the field surveys carried out during the first trimester of 2024 and the preliminary results in each Work Package of the project "Survey of the Status of Important Fauna Species in the Kyparissiakos Lease area".

The present project is the 2024 continuation of the ongoing project "Survey of the Status of Important Fauna Species in the Kyparissiakos Lease area", implemented in the period 2020-2023.

2 Description of the Project Area

The **Project Area** is located in the Ionian Sea, southeast of Zakynthos Island and west of Peloponnese, approximately from the latitude town Zacharo in the north and town Methoni in the south. It extends between latitudes of 36°50'N in the south and 37°30'N in the north and between latitudes 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).

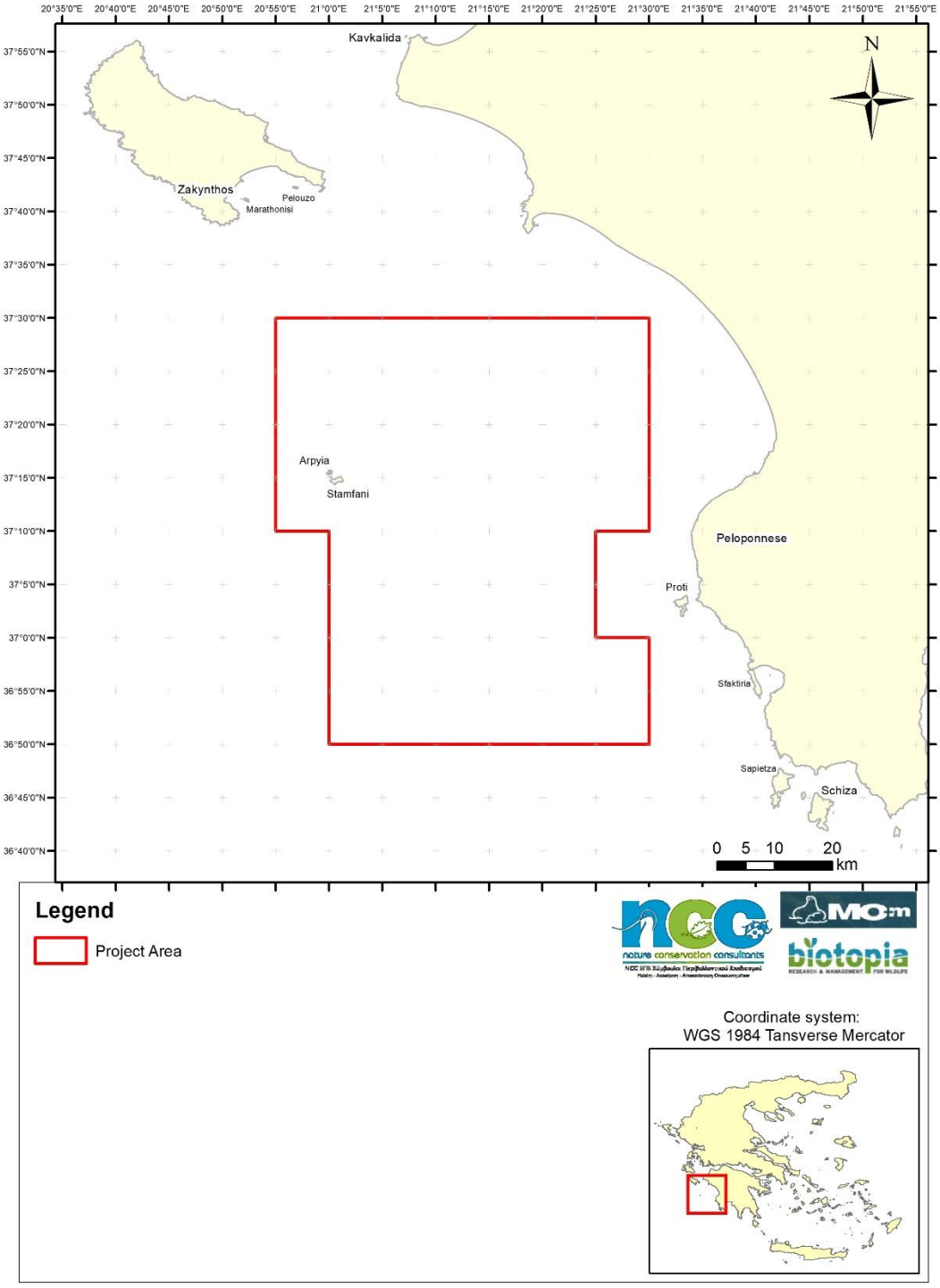

Figure 2-1. Project Area

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 the primarily the Project Area together with neighbouring waters to the east.

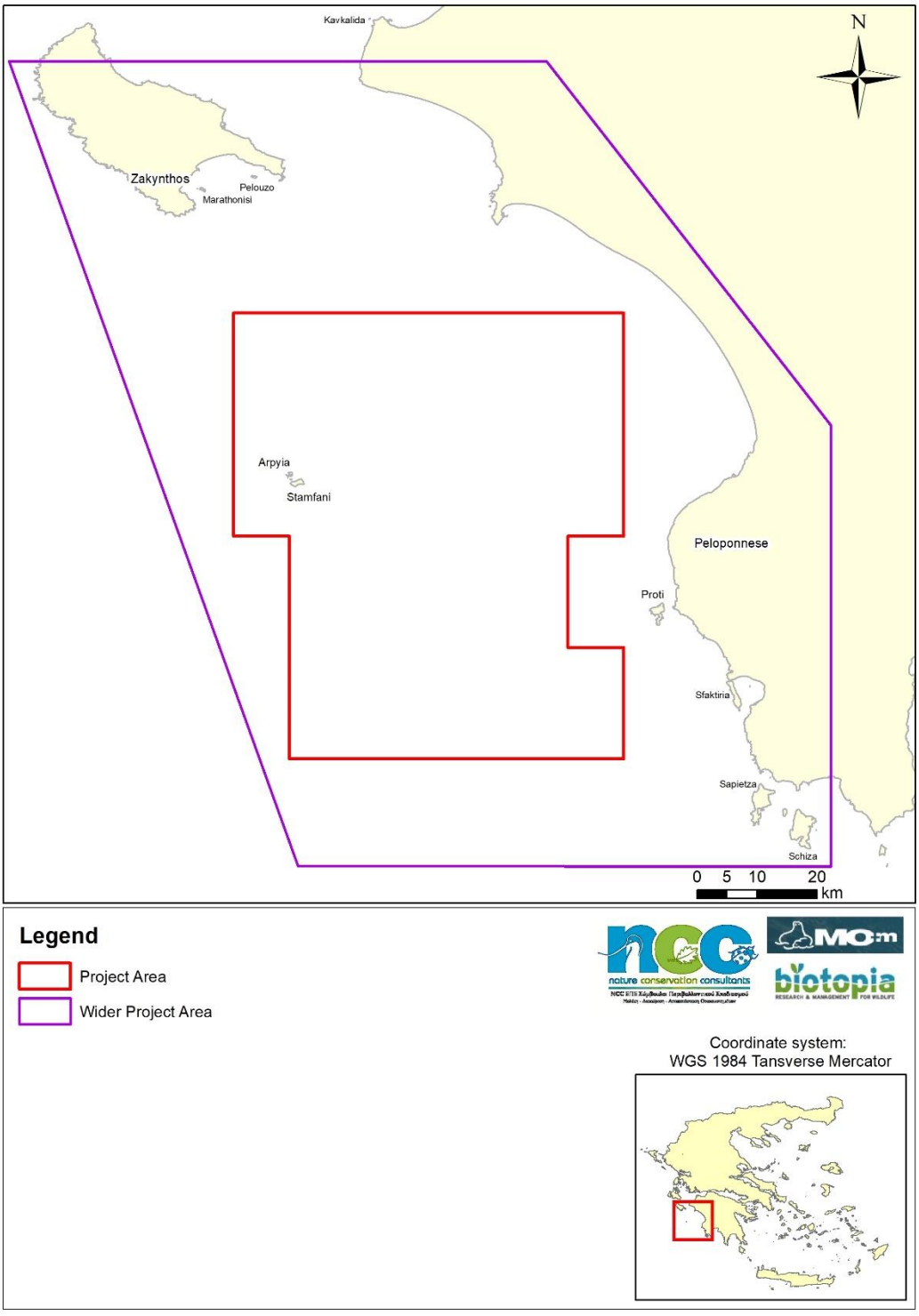

Figure 2-2. Wider Project Area

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

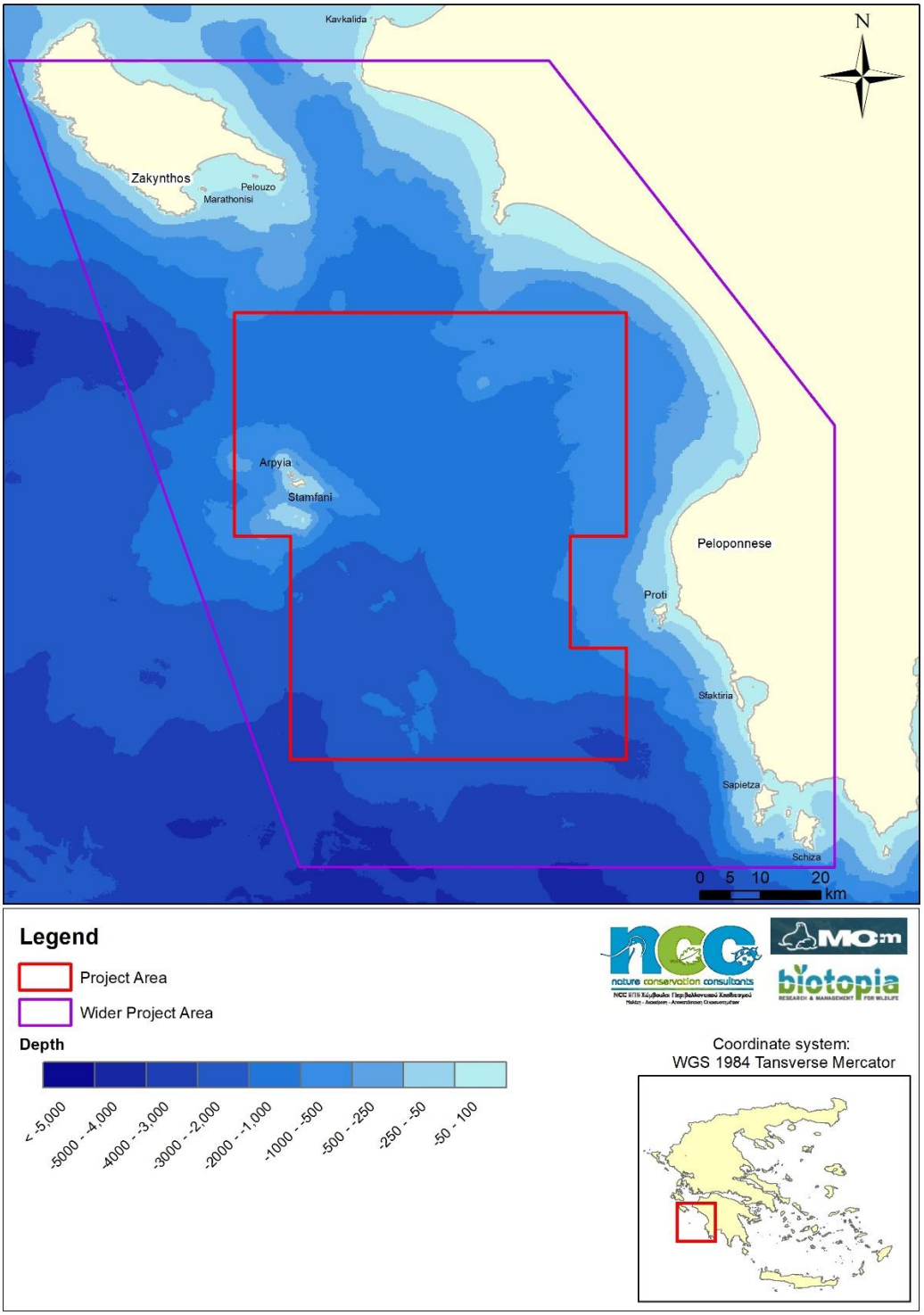

Figure 2-3. Bathymetry in the Project Area

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).

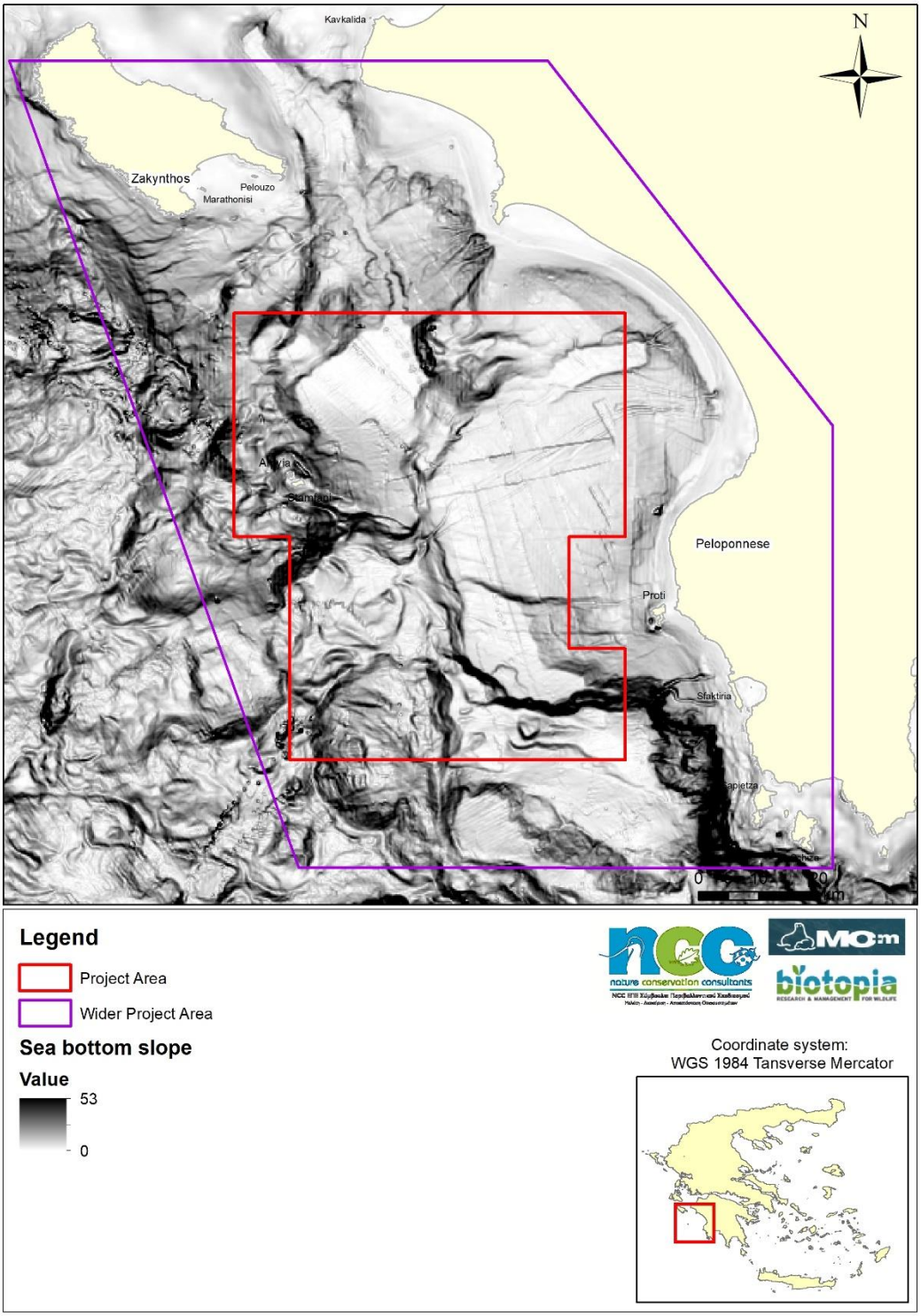

Figure 2-4. Slope of the sea floor in the Wider Project Area

2.2 General information of 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 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 the majority of cases, the Mediterranean subpopulation of cetacean species have at least one level higher in their designated threat status than the global population for the same species or are 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. With the exception of 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 stranding 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 purpose of 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 considered to be 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)

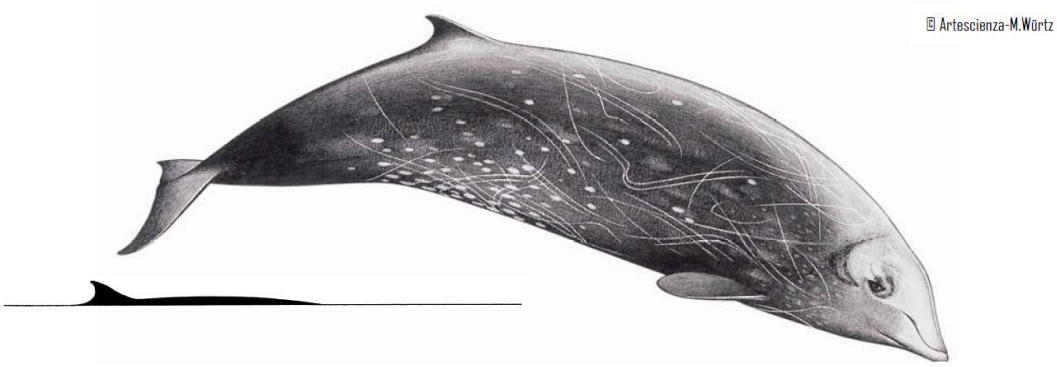

Figure 2-6. Cuvier's Beaked Whale (Ziphius cavirostris) (©Artescienza-M.Würtz)

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, the majority of 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)

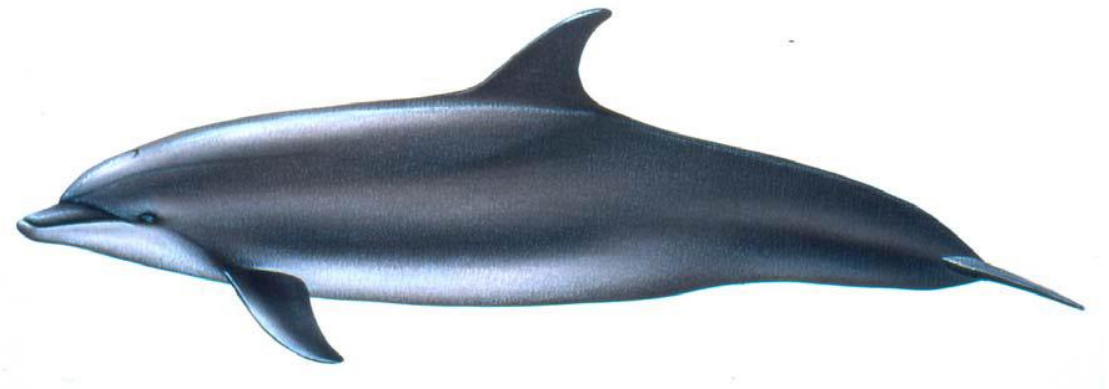

Figure 2-8. Common bottlenose dolphin (Tursiops truncatus) (© Artescienza-M.Würtz)

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, similar to 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)

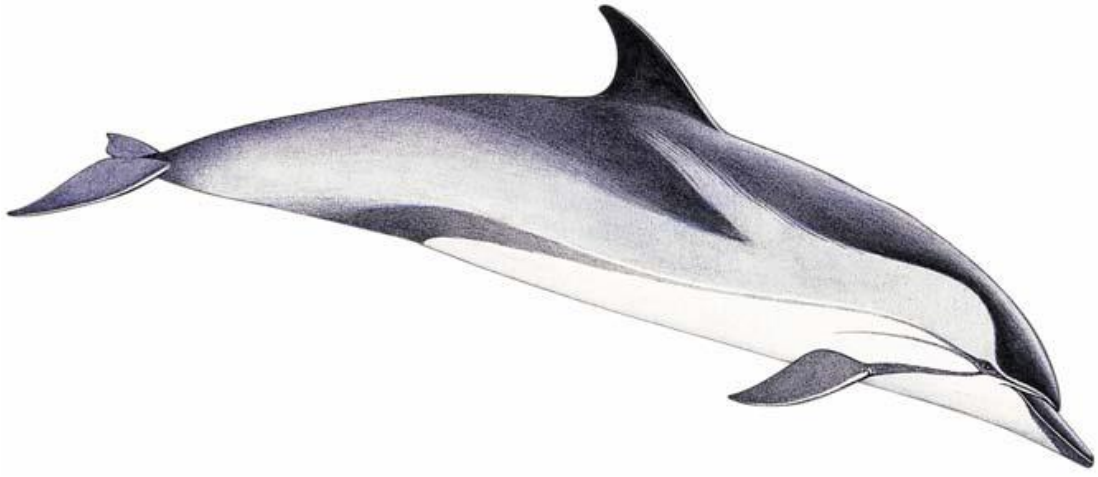

Figure 2-9. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM)

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)

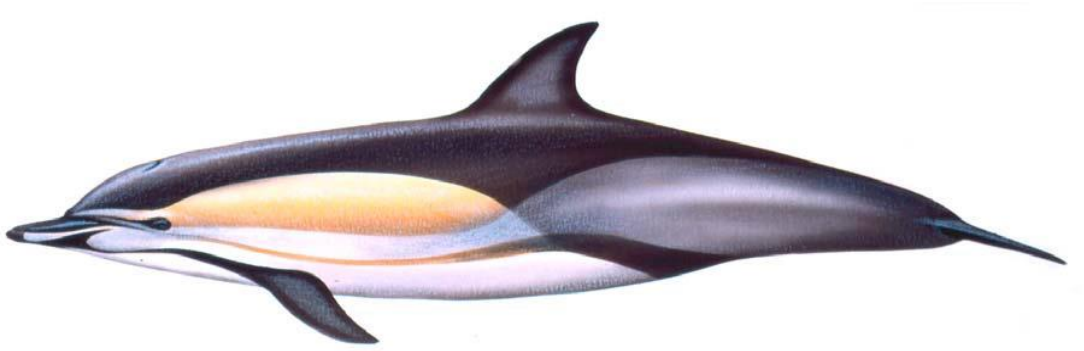

Figure 2-10. Short-beaked common dolphin (Delphinus delphis) (© Artescienza-M.Würtz)

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 the majority of nests being found in Greece. The country's two most important nesting beaches are located 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).

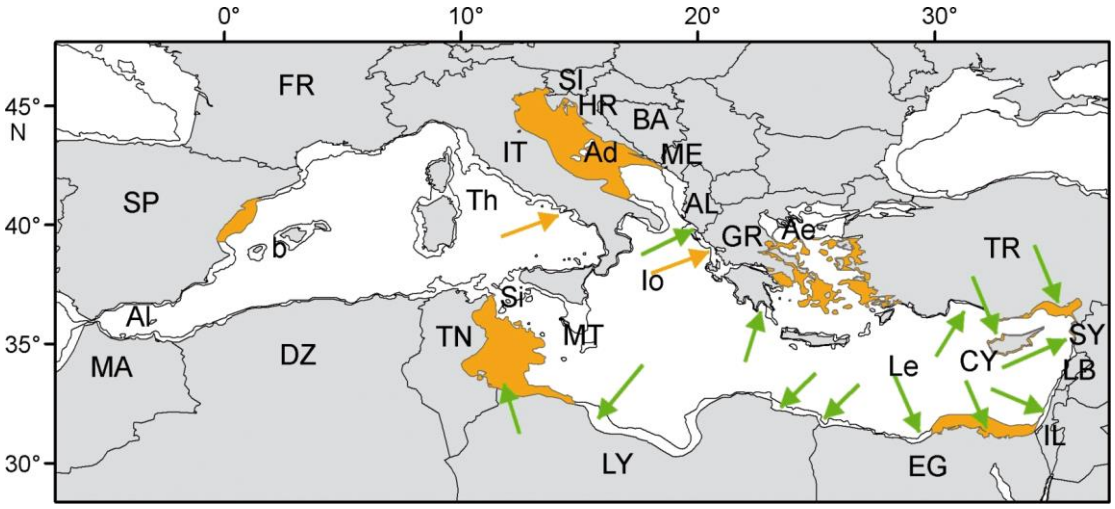

Figure 2-13. Neritic foraging and wintering sites for loggerhead turtles (orange areas and arrows) and green turtle (green arrows) (adopted from Casale et al. 2018).

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.

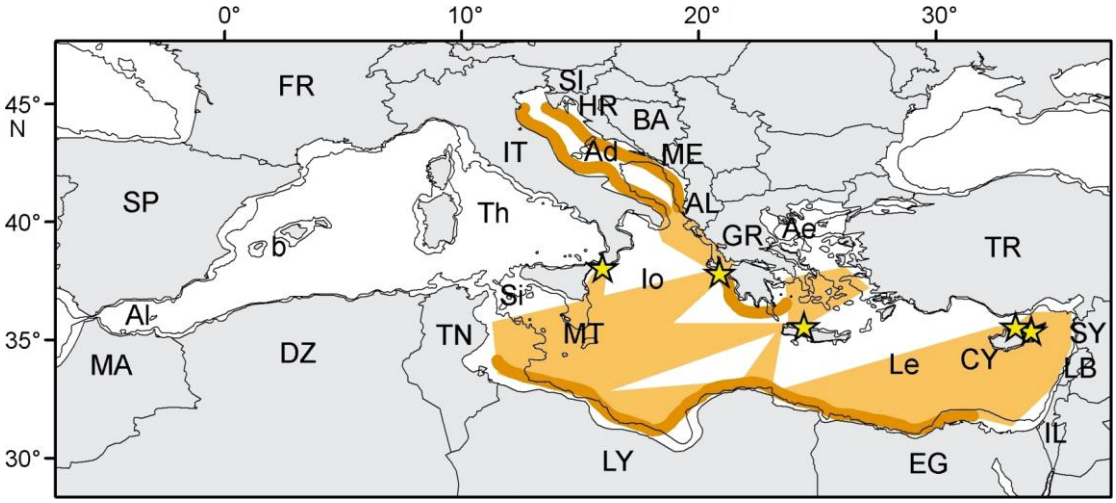

Figure 2-14. Main known migratory corridors for adult loggerhead turtles to and from breeding sites (stars). Light brown areas represent migratory funnels in the open sea while darker strips represent paths along the coasts, typically in shallow waters (adopted from Casale et al. 2018).

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)

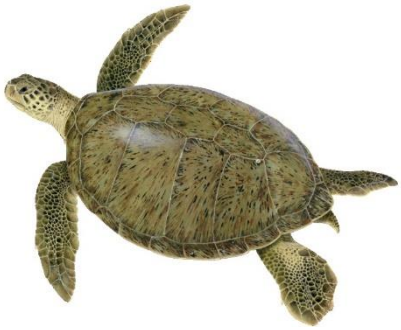

Figure 2-15. Green turtle (Chelonia mydas)

The green turtle (*Chelonia mydas*) is an 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 located 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.

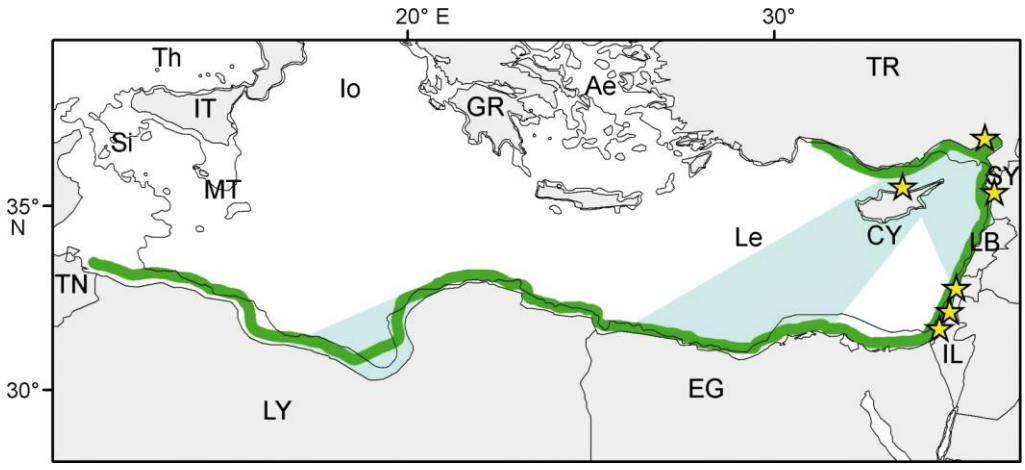

Figure 2-16. Main known migration corridors for adult female green turtles during reproductive migrations from the breeding sites (stars) (adopted from Casale et al. 2018).

2.2.4 Seabirds

For the purpose of 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)

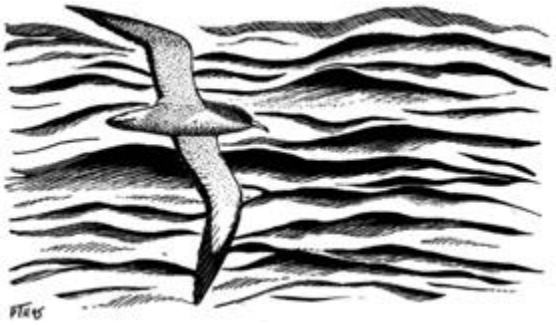

Figure 2-17. Scopoli's Shearwater (Calonectris diomedea) (© Paul Hirst)

Scopoli's Shearwater (C*alonectris diomedea*) breeds across Mediterranean with the majority 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 located 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 considered to be 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)

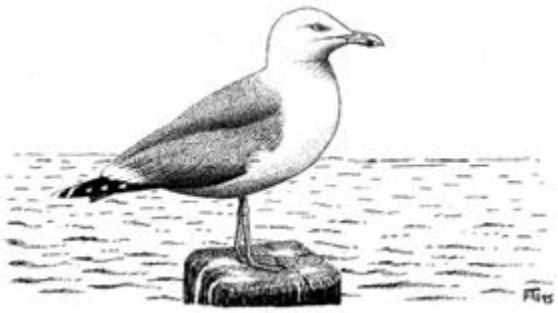

Figure 2-21. Yellow-legged Gull (Larus michahellis) (© Paul Hirst)

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 have an effect on 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), behavior and association with human activities or other species. Datasheets for observation vessel data and species data are provided in Annex I.

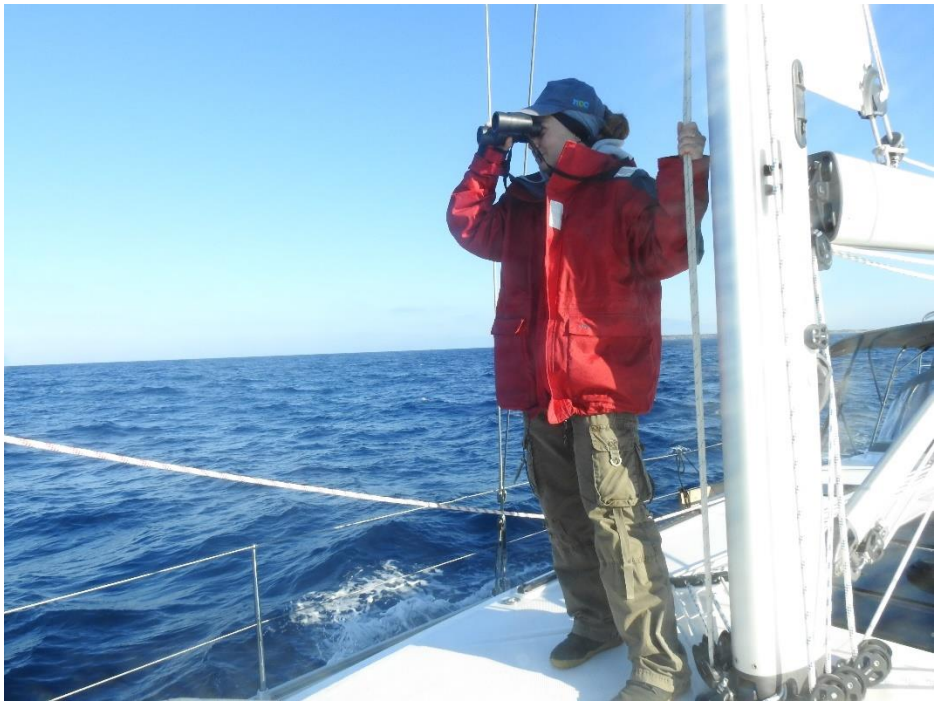

Figure 3-1. ESAS field work

The **survey design for cetaceans** is similar to the established methodology designs for such surveys, used over the past 4 decades (Buckland et al. 2001, Buckland et al. 2004) and used a grid of parallel line transects, that provided comprehensive coverage of the study area.

The transect lines acted as the basis for the daily track line followed by the vessel providing a roughly uniform coverage of the study area. Attempts were made when selecting the orientation of the transect lines, to have them move across (at an angle to) the depth gradient in the area as opposed to moving along (parallel to) the depth gradient. This was done to allow for the coverage of different depth levels during navigation of each transect, in order to minimize detection bias on individual transect lines when mapping sighting data.

When a group of cetaceans is sighted (group defined 'dolphins observed in apparent association, moving in the same direction and often, but not always, engaged in the same activity' (Bearzi et al. 2005) by any of the on-effort observers, the systematic search effort is interrupted while the vessel diverted from the track line toward the sighted animals in order to achieve more accurate determinations of the species, the group size, group age class composition and group activity of the group sighted. In addition to basic environmental data (e.g., Beaufort sea state, visibility conditions etc.) collected at regular 1 hour intervals as well as at the start and at the end of each transect line, data collected for each sighting includes the time, GPS coordinates, initial bearing and radial distance to the cetacean group (used to calculate the perpendicular distance of the sighting to the track line), species identity, group size, group age class composition (3 age classes: Calf < 1/2 length of adult, Juvenile < 2/3 length of adult and adult) and the general activity in which the group is engaged in at the time of approach (e.g. foraging, travelling, milling). For the purpose of the correct identification of the species as well as the correct recording of group size and group age class composition

attempts are made to approach the animals to obtain photographs. Where possible the photographs taken are also used for the photo-identification of individuals. This is done to ensure the same group of animals was not counted twice during the same survey day.

Encounter Rates are calculated as the number of encounters / 100km of "on effort" navigation.

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

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

The numbers of individuals of each species recorded by ESAS surveys were transformed into species densities per km^2, taking into account the *2x300m=600m* transect survey width and the distance travelled by the survey vessels per 5-minute time interval *distance travelled = boat speed x 5 min*. The locations of number of recorded individuals per species and the density of individuals per species were overlaid 4 geographical minutes (4'x4') reference grid in WGS84 projection coordinate system (Map 5).

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

- The **average** over all survey trips of the **total number of individuals per species** recorded in a 4'x4' grid cell per trip
- The **maximum** over all survey trips of the **total number of individuals per species** recorded in a 4'x4' grid cell per trip
- The **average** over all survey trips of the **average density of individuals per km^2 per species** in a 4'x4' grid cell per trip
- The **average** over all survey trips of the **maximum density of individuals per km^2 per species** in a 4'x4' grid cell per trip
- The **maximum** over all survey trips of the **average density of individuals per km^2 per species** in a 4'x4' grid cell per trip
- The **maximum** over all survey trips of the **maximum density of individuals per km^2 per species** in a 4'x4' grid cell per trip

It should be noted that individuals recorded outside transect are excluded from density calculation. The densities of the species per reference grid cell are representative of the **habitat suitability**. The variable "**average** over all survey trips of the **average density of individuals per km^2 per species** in a 4'x4' grid cell per trip" was used as a measure of habitat suitability for each species. This variable was classified into 4 classes:

- ***Most suitable habitats*** – top 5% of positive (i.e., non-zero) densities in grid cells
- ***More suitable habitats*** – 25-5% top values of positive densities in grid cells

- ***Suitable habitats*** – 75-25% top values of positive densities in grid cells, and
- ***Presence*** – remaining grid cells with species presence (bottom 25% values).

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

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

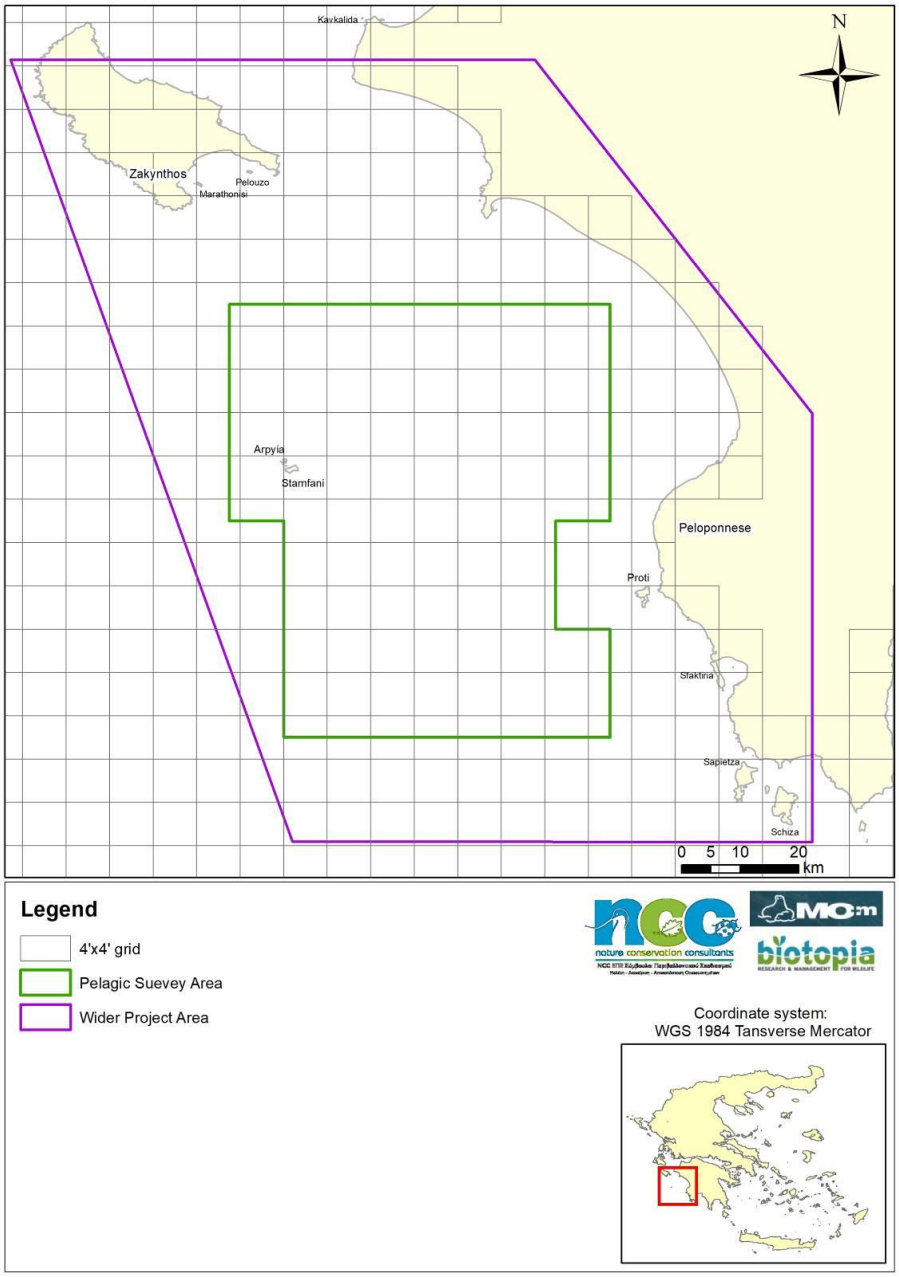

Figure 3-2. Four decimal minute (4'x4') reference grid in WGS84 coordinate system.

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 PAM operator is active on the equipment during all "On Effort" times during the survey. The hydrophone system consists of 2 hydrophones which record in 2 different channels. The visual observers and PAM operator rotate every 1.5 hour 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 "*whistle and moan detector"* module.

Figure 3-3. Part of the hydrophone array towed behind a 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 in order to visually identify it. Furthermore, the object was photographed so that a proper record of its observation and identification is kept. The photographic operation was performed using a full frame DSLR (Nikon D750) with a 70-200mm F/2.8 Tamron SP lens. All photographs were georeferenced since the camera was equipped with a GPS Unit (Nikon GP-1A). The flights were monitored and recorded with the use of two specialized applications namely the GARMIN-Pilot and the Fore-Flight.

Figure 3-4. The aircraft used for the aerial surveys

Figure 3-5. View 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 for the Scopoli's Shearwater

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

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

3.2.2 Coastal surveys for the Mediterranean Shag

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

The data recorded during field surveys included:

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

3.2.3 Coastal surveys for the Mediterranean Monk Seal

Cave monitoring with the use of Automated Infrared Cameras

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

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

3.3 Sea turtle telemetry

The fieldwork therefore had two main goals:

1)Retrieve transmitters from male turtles tracked from 2023 to access stored data.

2)Deploy transmitters on a further two male turtles

To identify if the turtles from 2023 had returned to the Kyparissia in 2024 we deployed a drone (DJI Phantom 3) to systematically search the field site for evidence of turtles with transmitters. This was undertaken throughout the field period, whilst the other work was being carried out.

We acquired the two male turtles to receive transmitters using turtle rodeo technique as used in the previous fieldwork, namely a small RIB was used to approach the turtles and then they were caught by hand, secured in a net and taken ashore to receive the transmitters. Should we have seen a male turtle with a transmitter in place, we would have used the same rodeo technique to catch it to retrieve the transmitter.

Figure 3-8. Wildlife Computers SPLASH10-385 satellite transmitter used in the project.

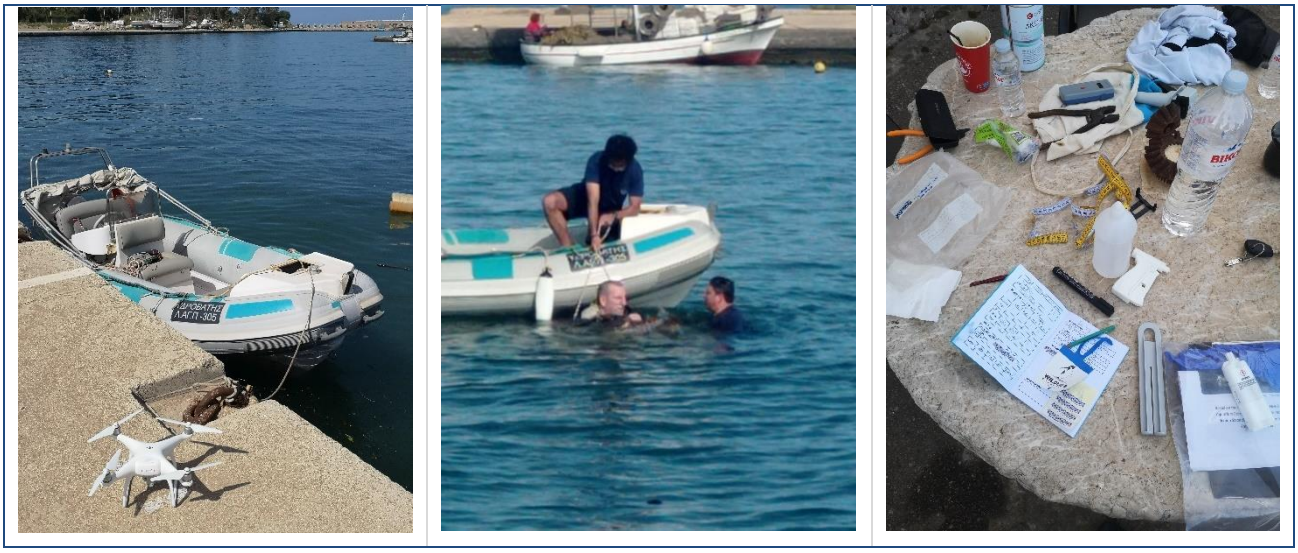

Figure 3-9. Left to right: The RIB and drone used to spot and catch the turtles. Capturing the turtle ready to bring ashore. Tagging and other field equipment used to record details of the captured turtle.

3.4 Telemetry of Scopoli's Shearwater

The bird flights at the species breeding colony at Strofades islands will be recorded by a drone and stationary thermal cameras and will be stored to a geodatabase.

The birds movements will be monitored in the vicinity of island colonies and foraging aggregations of seabirds and marine mammals will be spotted and mapped within the project area. An array of trail cameras and bio-acoustic microphones will be deployed at the Strofades colony to record the colony activities, threats and social interactions among breeding and non-breeding individuals.

10 GPS/GSM tags will be deployed to Scopoli's shearwater fledglings on September-early October 2024, to record the maiden journeys of the fledged birds and identify possible threats and mortality factors during this high-risk period.

By processing the data through Artificial Intelligence and machine learning software, the bird populations, movements, patterns of space use by the species for foraging in the "Kyparissiakos block" lease area will be further explored.

4 Results

4.1 Pelagic surveys

4.1.1 Boat surveys

Boat surveys are planned to be implemented in the second trimester of 2024.

4.1.2 Aerial surveys

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

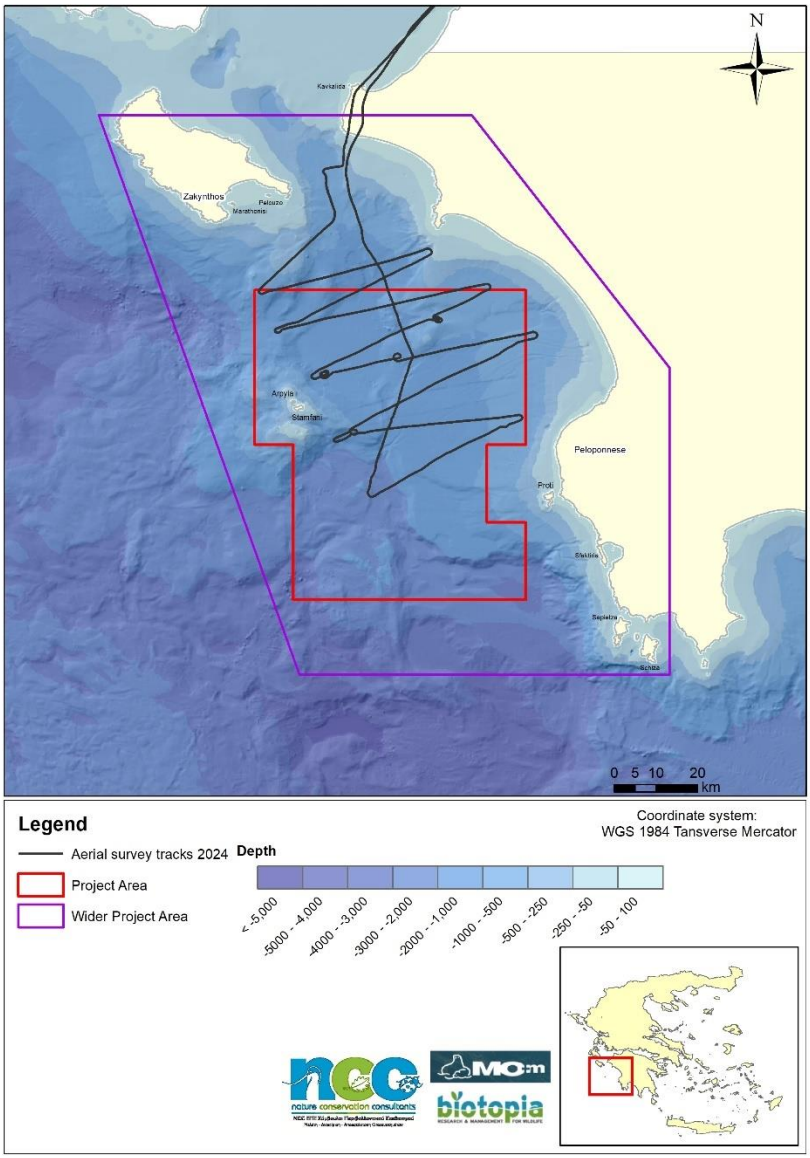

Figure 4-1. Aerial surveys track.

Figure 4-2. A group of 4 grey herons (Ardea Cinerea) migrating in the project area

Figure 4-3. A trawler operating in the project area

4.2 Coastal surveys

4.2.1 Coastal surveys for the Scopoli's shearwater

Coastal surveys of Scopoli's shearwaters are planned to took place in the second and third trimester of the project (June to September 2024) at the colony of Strofades islets.

4.2.2 Coastal surveys for the Mediterranean Shag

Coastal surveys for the Mediterranean Shag are planned to be implemented during the second trimester of the project (June – August 2024), using the RIB boat.

4.2.3 Coastal surveys for the Mediterranean Monk Seal

The cameras were collected during the current project period (in April 2024) and the photographs were analyzed for the presence of seals and the identification of individuals. The number of pups born in the monitored caves were also counted. The cameras that were set on a time lapse recorded images continuously from 29/7/2023 to 14/4/2024 for a total of 261 days. The second camera installed in ZAK6 and set on a motion sensor mode, ran out of battery on 28/1/2024.

A total of 13329 photographs were obtained. The analysis of the photographs revealed a regular presence of seals in the caves as well as the birth of 4 pups, (1 female and 3 males) during the of 2023-2024 pupping season. All of these were born in cave ZAK6. The analysis also allowed for the identification of individual mature seals and the counting of the total number of individuals using these caves.

A total of 2 adult males and 7 adult females were identified. In addition, at least **2 sub-adult animals** were also found to use these caves**.**

It is worth noting that this is the first time that the importance of this area for the Mediterranean seal has been documented using infrared cameras in sea caves.

Based on the above mentioned important findings, a first estimate of the population status in the area indicates a total number of **at least 20 animals** that use this area.

A more thorough assessment of the status of the species in this area will be presented in the final report of the present research period when all the data simultaneously collected through RINT will be also available.

Figure 4-4. The earliest-born pup in cave ZAK6 suckling from its mother along two other adult females and a sub-adult.

Figure 4-5. Animals of all age classes photographed in ZAK6.

Please refer to Annex I for the full report on cave monitoring and demographic parameters of the Mediterranean Monk Seal.

4.3 Sea turtle telemetry

Despite multiple hours of searching with the drone, with many turtles observed, none was recognised as having a transmitter in place. We therefore concluded that the two previously tracked turtles had not returned to Kyparissia in 2024. Our survey methods were validated as the drone observed one of the 2024 turtles in the field area after it had received its transmitter.

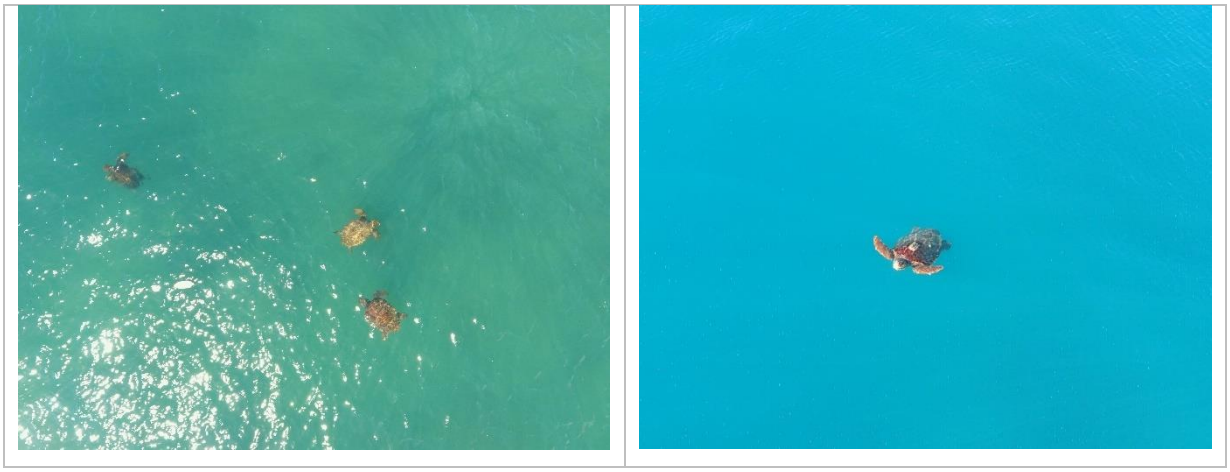

Figure 4-6. Left: Three turtles observed in close proximity to each other during drone surveys. None have a transmitter in place. Right: The first turtle to receive a transmitter in 2024 observed during the drone surveys after his release.

On the deployment side, we were able to successfully catch the planned two adult male turtles and equip them with transmitters. At the time of writing (four weeks after transmitter deployment) both transmitters continue to function and indicate the turtles are still in Kyparissia to breed.

Figure 4-7. The two adult males that were successfully equipped with satellite transmitters during the April 2024 field mission.

Please refer to Annex II for the full report on Loggerhead turtles tracking in Kyparissia.

4.4 Telemetry of Scopoli's Shearwater

The monitoring of the flights and the colony activities is planned to be implemented during the second and third trimester of the project (June – September 2024), using the RIB boat.

5 Conclusions

During the first trimester of the project, telemetry of marine turtles was an important scheduled activity of the project.

The fieldwork was successful in terms of the situation present, i.e. we could not catch turtles which were not there, but we were able to catch two more to deploy additional tags. This work with adult males is providing novel data on their behaviour and movements, helping fill a gap in the understanding of sea turtle biology, not only in Greece but globally.

Regarding the Mediterranean Monk Seal, the results of the current Monitoring Survey for the species population of Zakynthos Island provide an updated (and for the first time well documented) assessment of the status of this rare species in the area.

The evidence collected during the project verify Zakynthos Island as indeed being a highly important hub for the Mediterranean monk seal not only in the Kyparisiakos Gulf wider area but in the Ionian Sea in general. Specifically cave ZAK6 shows an intense use by monk seals to give birth and raise their pups.

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

The main bulk of the project's activities are planned to be implemented during the second and third trimester of the project, including boat, aerial and coastal surveys, as well as the telemetry activities for Scopoli's Shearwater.

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Annex I: Report on the coastal surveys for the Mediterranean monk seal

Annex II: Report on Loggerhead turtles tracking in Kyparissia

Status of the important fauna species in the Kyparisiakos lease area

WPII: Coastal surveys for monk seals and Mediterranean shag breeding sites in the coastal zones of the adjacent Natura 2000 sites

Annex I. Report on the coastal surveys for the Mediterranean monk seal

June 2024

Contents

Summary 4
Introduction 5
Context of the project 5
General information on the species 6
Status and legal protection of monk seal in Greece 7
Importance of the project area for the Mediterranean monk seal 9
Methodology 10
Project Area 10
Cave Monitoring with the use of Automatic Infrared Cameras 11
Results 13
Cave Monitoring and Demographic Parameters 13
Conclusions 16
Future research 18
References 19

Index of Figures

Figure 1: Map of Project Area 10
Figure 2: Map of caves identified during the coastal surveys of summer 2023 11

Index of Photos

Photo 1:. An adult male monk seal resting on a beach on the west coast of Zakynthos island 9
Photo 2: Installation of infrared camera systems iin a monk seal shelter in the project area 12
Photo 3: The earliest-born pup in cave ZAK6 suckling from its mother along two other adult females and a sub-adult 13
Photo 4: 3 more pups born in ZAK6 visible along animals of other age classes 14
Photo 5: An adult male resting on an open beach at the area of Navagio (4-5-2024) 14
Photo 6: Three adult females with visible characteristic scars in ZAK6 15
Photo 7: Animals of all age classes photographed in ZAK6 16
Photo 8: Mother and pup captured in ZAK7 17
Photo 9: Adult male captured in ZAK7 with identifiable white patch visible 18
Photo 10: A sub adult seal resting at Porto Romano (16-3-2024) 18

Project team

Name	Expertise	Role
Panagiotis Dendrinos	PhD Biologist, Monk Seal Expert	Field Research Coordinator
Styliani Adamantopoulou	Biologist, Monk Seal Expert	Data Analysis
Kimon Koemtzopoulos	MSc. Biologist, Marine Mammal Specialist	Field Research & Data Compilation
Panagiotis Mpatzios	System Engineer/Field Technician	Field Research and technical coordination
Odysseas Paxinos	Msc, Oceanographer, Seal Specialist	Field Research & Data Compilation

Summary

The Mediterranean monk seal (*Monachus monachus*) is the rarest extant member of the Phocidae family and one of the rarest marine mammals in the world. It has been recently re-classified as "Vulnerable", down from "Endangered" by the International Union for the Conservation of Nature. Many challenges to its survival still remain. The specific aim of the present study is the monitoring of the monk seal population along the coastline of the Kyparisiakos Gulf area in the Ionian Sea, and more specifically, along the coast of Zakynthos island situated within the sphere of influence of drilling operations. The area has been hypothesized to be an important breeding hub for the Mediterranean monk seal, based on preliminary data.

During the previous stages of the project, the coastline within the Wider Project Area was surveyed for the presence of suitable monk seal pupping habitat (marine caves). Monitoring efforts of the monk seal population during the previous reporting period focused on the island of Zakynthos. 3 automatic infrared camera systems were placed in 2 pupping caves selected in the island of Zakynthos: ZAK6 and ZAK7. As Zakynthos island's caves and the monk seal population using them are the most vulnerable in relation to any future drilling activities and potential spills in the Kyparisiakos lease area, monitoring of these caves was considered essential.

The present report focuses on the results of the infrared cameras placed in the aforementioned caves.

The results of this effort to date are summed up as follows:

- **261 days of monitoring**
- **13329 photographs collected**
- **15 total different individuals captured on camera**
    - **7 Adult females**
    - **2 Adult males**
    - **2 Sub-adult**
    - **1 Female pup**
    - **3 Male pups**

All of these animals were photographed in cave ZAK6 and some were re-captured in ZAK7. Cave ZAK6 seems to be used more regularly while cave ZAK7 seems to be used only circumstantial but of course longer in time data series are needed in order to achieve safe conclusions.

Based on this information, **the total number of monk seals** inhabiting the area of Zakynthos island is estimated to be **at least 20 individuals**

These results **document for the first time the importance of Zakynthos island as a monk seal breeding hub in the Ionian region.**

Introduction

Context of the project

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 and Production of Hydrocarbons Ionian Single Member Societe Anonyme (HELPE IONIAN S.A.) company has assigned to the company Nature Conservation Consultants (NCC) Ltd, a contract for conducting the present **Project**, namely the "Survey of the Status of Important fauna species in the Kyparisiakos lease Area".

In the framework of the Project, the project team, consisting of experienced biodiversity experts from the NCC, MOm and Biotopia, implemented field surveys, at the Kyparisiakos lease Area (marine and coastal areas), which is defined as the Project Area (PA), using appropriate field sampling techniques, in order to provide sufficient and documented data on the status of marine mammals, seabirds and sea turtles, as well as other sensitive biodiversity elements and locations that should be prioritized for a future biodiversity monitoring program.

This review of the marine environment is expected to contribute to updating the existing data for the Mediterranean Monk Seal, cetaceans, seabirds and sea turtle populations, and other protected and / or threatened species in this part of the Ionian Sea.

The present document consists of the latest results of the monitoring effort for the Mediterranean monk seal using Infrared Cameras placed in previously identified (potential) pupping caves for the species on the island of Zakynthos, considered to be the main breeding hub of the species in the wider Kyparisiakos Gulf region and one of the main breeding hubs in the Ionian Sea.

General information on the species

The Mediterranean monk seal (*Monachus monachus*) is the rarest extant member of the Phocidae family and one of the rarest marine mammals in the world. It has been recently re-classified as "Vulnerable" (down from "Endangered") by the International Union for the Conservation of Nature (Karamanlidis & Dendrinos, 2015) and is strictly protected by the Council of European Communities Directive 92/43/EEC, the Bonn, Bern, CITES, Barcelona and Rio Conventions, as well as by the Greek law (Karamanlidis et al., 2016a).

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., 2016a). 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.

A number of threats jeopardize the survival of the Mediterranean monk seal (Karamanlidis et al., 2016a). The most important are:

• **Habitat deterioration and loss** by coastal development, including disturbance by tourism and leisure boating.

• **Deliberate killing** by fishermen, who consider the animal a pest that damages their nets and 'steals' their fish.

• **Accidental entanglement** in fishing gear leading to death by drowning.

• **Other stochastic events**, such as disease outbreaks.

The Mediterranean monk seal is particularly sensitive to human disturbance, with coastal development and tourism pressures driving the species to inhabit increasingly marginal and unsuitable habitat. In some birth caves, pups are vulnerable to storm surges and may be washed away and drowned.

Although rather slow and patchy, conservation of the Mediterranean monk seal has been underway since the late 1970s (Johnson & Lavigne, 1998) and has focused mainly on the *in situ* protection of the species. *In situ* conservation efforts include the establishment of marine protected areas, rescue and rehabilitation of orphaned and wounded seals, environmental education and public awareness. By providing additional knowledge into little understood aspects of the monk seal's biology and behaviour scientific research (Formigaro et al., 2016; Karamanlidis et al., 2016b; Charrier, Marchesseau, Dendrinos, Tounta, & Karamanlidis, 2017), plays also a key role in promoting *in situ* conservation efforts.

Taking into consideration the feeding and breeding movements of monk seals between remnant colonies, there is a consensus of scientific opinion that a network of well-managed sites are essential for the survival of the species (Adamantopoulou et al., 2000). To date, marine protected areas for the species have been established in only a fraction of areas throughout the current species distribution.

Status and legal protection of monk seal in Greece

Greece has been traditionally one of the species strongholds in the eastern Mediterranean and a focal point of monk seal research and conservation during the last fifty years. The first studies on the species date back to the 1970's and focused mainly on the assessment of the size of the population and geographical distribution of the species in the country (Marchessaux & Duguy, 1977; Marchessaux, 1979; Vamvakas, Tsimenidis, & Kainadas, 1979). Since then, several studies have been carried out, both, in the Aegean and Ionian Seas (Verriopoulos, 1985; Vlachoutsikou & Lazaridis, 1990; Panou, Jacobs, & Panos, 1993; Adamantopoulou, Androukaki, & Kotomatas, 1999; Panou, Alimantiri, Aravantinos, & Verriopoulos, 1999), giving us a picture of the status of the species in the country in the past 30 years. A common conclusion of all these studies has been that despite the significant decrease and the reduction of some subpopulations, the Mediterranean monk seal remained widely distributed throughout Greece and that small actively-reproducing groups exist scattered throughout the country. In recent years encouraging signs of population recovery have been observed throughout the country, including areas where the species was thought to be extinct and areas with increased human activities. Rough population estimates indicate that Greece hosts more than the 50% of the world's populations of the species (Karamanlidis & Dendrinos, 2015).

The Mediterranean monk seal *Monachus monachus* is included in the Red Data Book of Greece (Δενδρινός, Καραμανλίδης, & Παράβας, 2009) and is strictly protected by the Presidential Decree 67/1981. Organized actions to protect the species began in the country in the late 1980s. These included the establishment of protected areas, the organization of a National Rescue and Information Network and a seal care and rehabilitation program, as well as systematic environmental education in schools. The creation in 1992 of the National Marine Park of Alonnisos, Northern Sporades, which was the first Marine Protected Area established in Greece, was a milestone in monk seal conservation history in the country. Following the

identification of additional important areas for the species in the country, two more (marine) protected areas have been/are being established for the Mediterranean monk seal in Greece. Today most of the important for pupping areas of the species are included in the Natura 2000 network of the countru though effective management and protection of these areas is still pending.

Importance of the project area for the Mediterranean monk seal

While the general Kyparisiakos Gulf area is not in itself a particularly important area for the Mediterranean monk seal in the Ionian Sea, the island of Zakynthos, directly north of the study area and in a position to be affected by operations in the lease area, was considered as an important hub for the species. This was, to date, based on observation reports collected through the Rescue and Information Network and on past opportunistic field visits to the island. The present research, as described below, clearly showed that on the coasts of Zakynthos there are very important breeding sites for the species.

Photo 1:. An adult male monk seal resting on a beach on the west coast of Zakynthos island

Methodology

Project Area

The **Project Area** is located in the Ionian Sea, southeast of Zakynthos Island and west of Peloponnese, approximately from the latitude town Zacharo in the north and town Methoni in the south. It extends between latitudes of 36°50'N in the south and 37°30'N in the north and between latitudes 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 1)

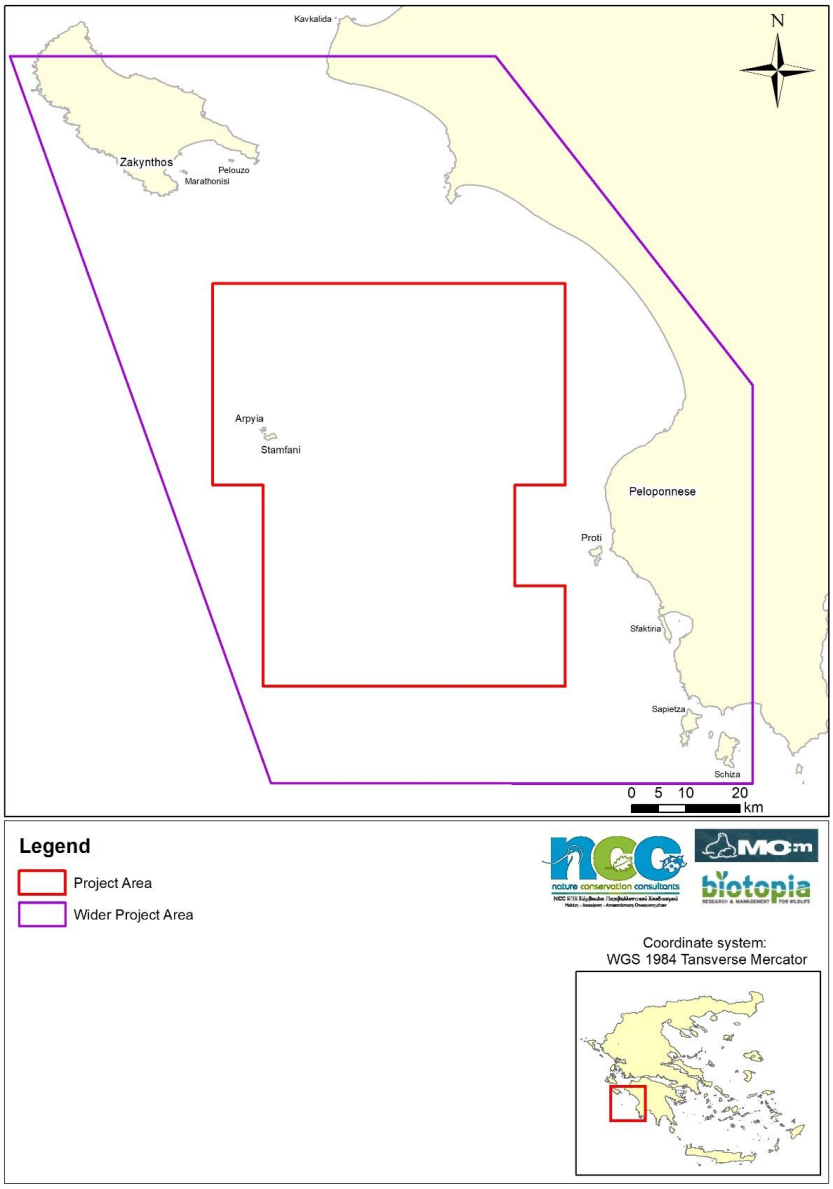

Figure 1: Map of Project Area

The **Wider Project Area** envelops the project area and extends further north and east to additionally include the south-western, south-eastern and eastern coast of Zakynthos, and the western coast of Peloponnese south of Kyllini, together with their neighbouring islets (Figure 1). The **Pelagic Survey Area**, where pelagic surveys are carried out includes the primarily the Project Area together with neighbouring waters to the east.

Zakynthos Island

This phase of the project focused on the island of Zakynthos and the potential pupping caves identified during the coastal surveys of 2023. These can be seen on the map below.

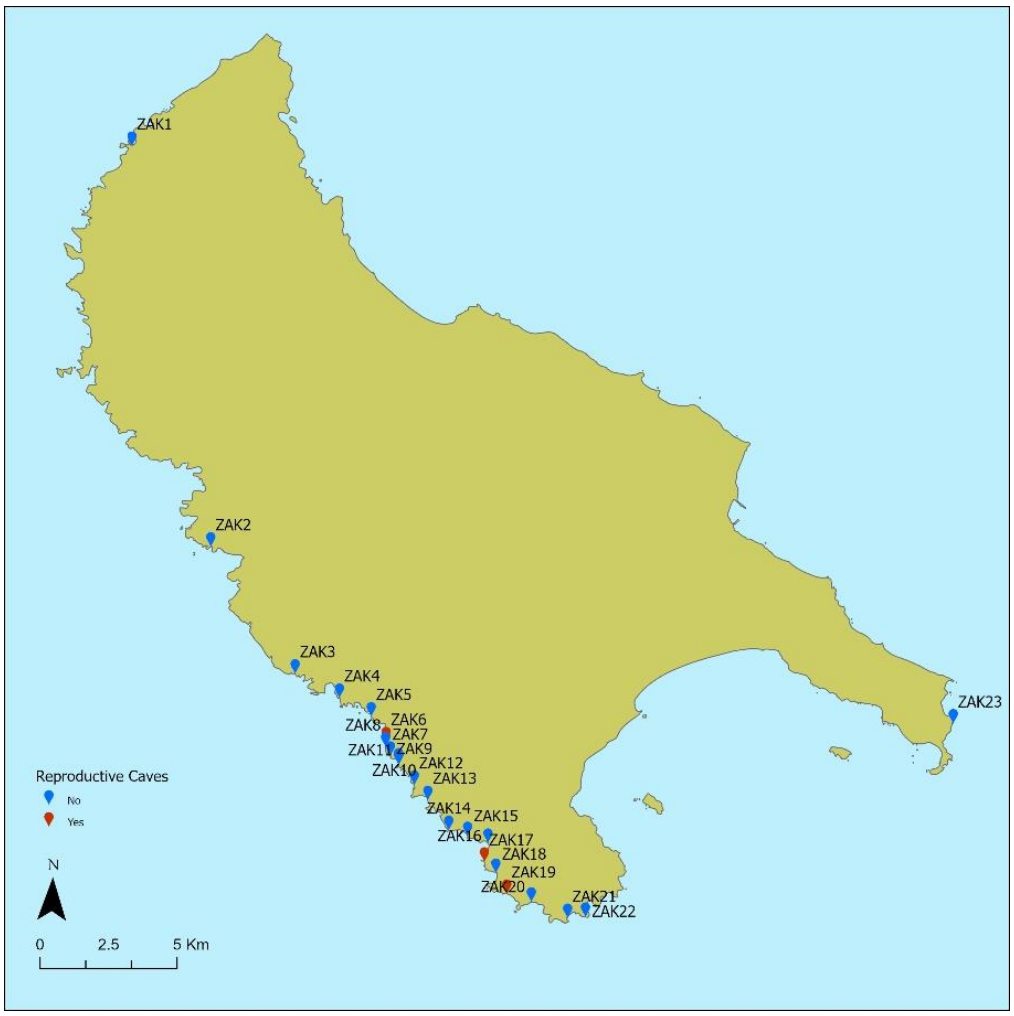

Figure 2: Map of caves identified during the coastal surveys of summer 2023

Cave Monitoring with the use of Automatic Infrared Cameras

During the previous phase of the project, 4 Infrared Camera Traps were placed in 2 caves in the wider project area: ZAK6 and ZAK7. Three camera systems were installed in cave ZAK6 and 1 was installed in cave ZAK7. These were placed on rocky walls of the caves and were positioned to maximize the coverage of the

terrestrial component of the cave (internal beach). Three of the camera systems were set to take time lapse photos (every 1 and 2.5 hours) of the cave beach to record the presence or absence of animals while one camera system set on motion detection operation.

Photo 2: Installation of infrared camera systems in a monk seal shelter in the project area

Results

Cave Monitoring and Demographic Parameters

The cameras were collected during the current project period (in April 2024) and the photographs were analyzed for the presence of seals and the identification of individuals. The number of pups born in the monitored caves were also counted. The cameras that were set on a time lapse recorded images continuously from 29/7/2023 to 14/4/2024 for a total of 261 days. The second camera installed in ZAK6 and set on a motion sensor mode, ran out of battery on 28/1/2024.

A total of **13329 photographs** were obtained. The analysis of the photographs revealed **a regular presence of seals in the caves** as well as **the birth of 4 pups, (1 female and 3 males) during the of 2023-2024 pupping season.** All of these were **born in cave ZAK6**. The analysis also allowed for the identification of individual mature seals and the counting of the total number of individuals using these caves.

Photo 3: The earliest-born pup in cave ZAK6 suckling from its mother along two other adult females and a sub-adult

Photo 4: 3 more pups born in ZAK6 visible along animals of other age classes

A total of 2 adult males and 7 adult females were identified. In addition, at least **2 sub-adult animals** were also found to use these caves**.**

Photo 5: An adult male resting on an open beach at the area of Navagio (4-5-2024)

Photo 6: Three adult females with visible characteristic scars in ZAK6

It is worth noting that this is the first time that the importance of this area for the Mediterranean seal has been documented using infrared cameras in sea caves.

Based on the above mentioned important findings, a first estimate of the population status in the area indicates a total number of **at least 20 animals** that use this area.

A more thorough assessment of the status of the species in this area will be presented in the final report of the present research period when all the data simultaneously collected through RINT will be also available

Photo 7: Animals of all age classes photographed in ZAK6

Conclusions

The results of the current Monitoring Survey for the Monk Seal population of Zakynthos island provide an updated (and for the first time well documented) assessment of the status of this rare species in the area.

The evidence collected during the project verify Zakynthos island as indeed being a highly important hub for the Mediterranean monk seal not only in the Kyparisiakos Gulf wider area but in the Ionian Sea in general. Specifically cave ZAK6 shows an intense use by monk seals to give birth and raise their pups.

Some of the animals, including an adult male, a sub-adult, two adult females and at least two mother-pup pairs were also captured in cave ZAK7. The image quality from this cave was not good enough to confidently identify individual seals. Cave ZAK7 seems to be used less frequently, possibly to shelter from adverse weather conditions affecting ZAK6 as seen on the cameras. Even though the pups weren't born in ZAK7, this cave still constitutes an important component of what makes this area so attractive to monk seals as a pupping location.

Photo 8: Mother and pup captured in ZAK7

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

Photo 9: Adult male captured in ZAK7 with identifiable white patch visible

Future research

Considering the importance of the area of Zakynthos and the caves ZAK6 and ZAK7 specifically, the continuation of the monitoring of these caves using Infrared Cameras is proposed.

Photo 10: A sub adult seal resting at Porto Romano (16-3-2024)

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Tracking male turtles breeding in Kyparissia Bay: April 2024 update

Prepared by ALan Rees, PhD

Field Personnel:

Field leader:	ALan Rees
Skipper:	Kostas Papaconstantinou
Field assistant (boat):	Odysseas Paxinos
Field assistant (drone)	Odysseas Stamatakis
Field assistant (land)	Konstantinos Margaris

Cover image: View of the field site, Kyparissia Harbour, taken from a drone.

Introduction

Following successful tracking of adult female loggerhead turtles nesting in Kyparissia Bay, funded by HELPE, in 2021 we successfully deployed three transmitters on males breeding in the area in 2023. The three males received top of the range transmitters that, in addition to location, recorded and stored depth and temperature time series data with a subset of data transmitted remotely via satellite. By early spring 2024, after the turtles had reached their selected foraging locations two of the transmitters were no longer sending signals.

Male turtles often migrate to breeding sites annually, which suggested we may be able to locate the turtles in Kyparissia Bay again in 2024, and therefore retrieve the tags that contain valuable data on their behaviour from the previous 12 months.

Purpose of fieldwork

Based on the potential to retrieve the transmitters from two males we arranged a brief field visit to Kyparissia Bay. To ensure the fieldtrip would have a positive outcome even if the previously tracked turtles were not present, we arranged to deploy similar transmitters on a further two breeding males. These transmitters were supplied by ARCHELON, as part of a broader study on turtles across Greece. The fieldwork therefore had two main goals:

1) Retrieve transmitters from male turtles tracked from 2023 to access stored data.
2) Deploy transmitters on a further two male turtles

Methods

To identify if the turtles from 2023 had returned to the Kyparissia in 2024 we deployed a drone (DJI Phantom 3) to systematically search the field site for evidence of turtles with transmitters. This was undertaken throughout the field period, whilst the other work was being carried out.

We acquired the two male turtles to receive transmitters using turtle rodeo technique as used in the previous fieldwork, namely a small RIB was used to approach the turtles and then they were caught by hand, secured in a net and taken ashore to receive the transmitters. Should we have seen a male turtle with a transmitter in place, we would have used the same rodeo technique to catch it to retrieve the transmitter.

Figure 1. Left to right: The RIB and drone used to spot and catch the turtles. Capturing the turtle ready to bring ashore. Tagging and other field equipment used to record details of the captured turtle.

Results

Despite multiple hours of searching with the drone, with many turtles observed, none was recognised as having a transmitter in place. We therefore concluded that the two previously tracked turtles had not returned to Kyparissia in 2024. Our survey methods were validated as the drone observed one of the 2024 turtles in the field area after it had received its transmitter.

Figure 2. Left: Three turtles observed in close proximity to each other during drone surveys. None have a transmitter in place. Right: The first turtle to receive a transmitter in 2024 observed during the drone surveys after his release.

On the deployment side, we were able to successfully catch the planned two adult male turtles and equip them with transmitters. At the time of writing (four weeks after transmitter deployment) both transmitters continue to function and indicate the turtles are still in Kyparissia to breed.

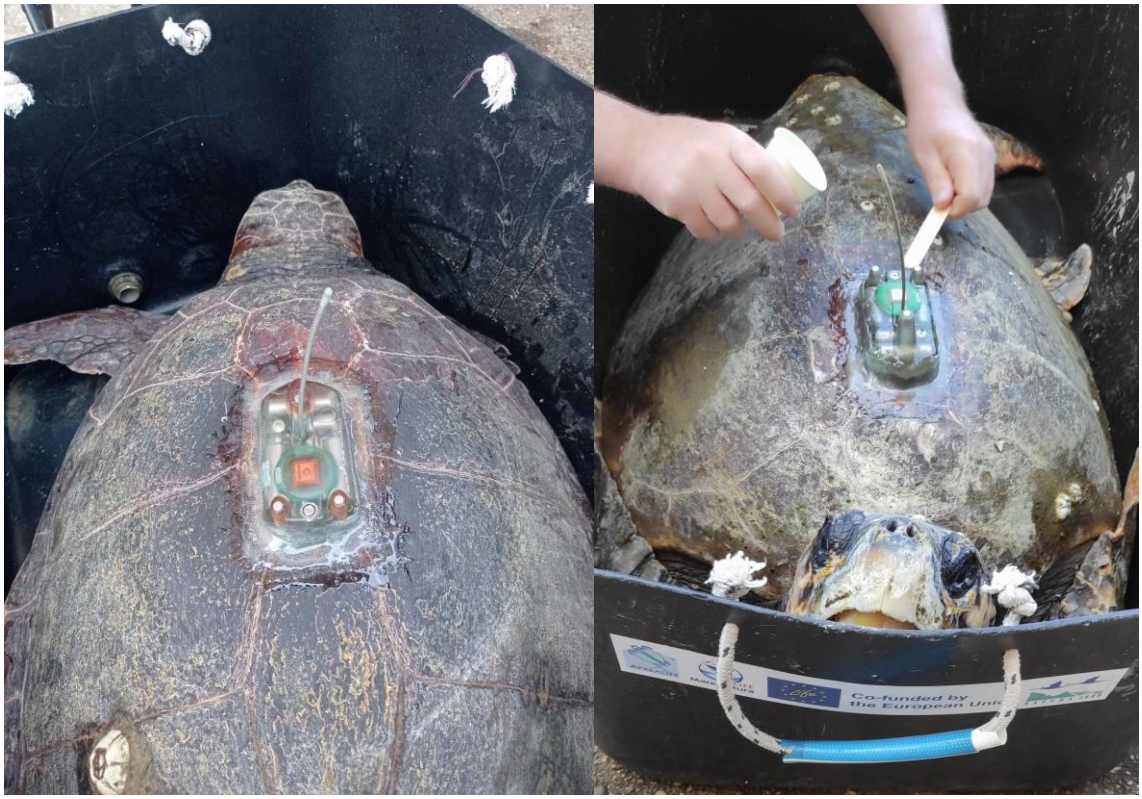

Figure 3. The two adult males that were successfully equipped with satellite transmitters during the April 2024 field mission.

Conclusions

The fieldwork was successful in terms of the situation present, i.e. we could not catch turtles which were not there, but we were able to catch two more to deploy additional tags. This work with adult males is providing novel data on their behaviour and movements, helping fill a gap in the understanding of sea turtle biology, not only in Greece but globally.