

Survey of the Status of Important Fauna Species in the Ionion Block Lease area

Final Report

November 2022

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Contents

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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*

Summary

The present document consists of the **Final Report** of the **Work Packages I-IV** of the project **"Survey of the Status of Important Fauna Species in the Ionion Block Lease area"** and incorporates the results of the surveys that were carried out in summer and autumn 2022.

The Work Packages included pelagic and aerial surveys for marine mammals, seabirds and sea turtles, coastal surveys for the Mediterranean monk seal and seabirds and telemetry of Scopoli's shearwater movements.

The aim of the project was to provide sufficient and documented data on the status of marine mammals, seabirds and sea turtles in the project area, as well as other sensitive elements and locations that should be prioritized by a future monitoring program.

The present project consists one of the first combined systematic pelagic recording of cetaceans, marine turtles and seabirds in the North Ionian Sea. The main results of the study are:

- Confirmation of a significant presence of striped dolphins, Cuvier's beaked whales and Bottlenose dolphins in the Project Area and the Wider Project Area.
- Assessment of the size of the breeding colony of Scopoli's shearwater at Diapontia Islands and documentation of the movements and the feeding grounds of the species through telemetry.
- Confirmation of a breeding colony of European storm petrel at Diapontia islands, which is the third known breeding colony of the species in Greece, the first in the Ionian sea.
- Confirmation of presence of pupping and resting caves of Mediterranean monk seal in the Wider Project Area.
- Confirmation of the presence of the Loggerhead turtle and Yelkouan Shearwater in the Project Area.

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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 and Production of Hydrocarbons Ionian Single Member Societe Anonyme (HELPE IONIAN 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 Ionion Block Lease area".

The Project consists of 4 work packages (WP):

I. **Pelagic Surveys for marine mammals, seabirds, sea turtles, nearshore and in the open sea**, using open water research vessels, in combination with drone surveys.
II. **Aerial surveys for marine mammals, seabirds, sea turtles, nearshore and in the open sea,** using a light aircraft.
III. **Coastal surveys for monk seals, Scopoli's shearwater and Mediterranean shag breeding sites in the coastal zones of the adjacent Natura 2000 sites,** using open water RIB vessels in combination with drone surveys.
IV. **Telemetry for seabirds at the Special Protection Area of Diapontia Islands** by tagging 10 breeding individuals with GPS/GSM transmitters

The present document consists of the **Final Report** of the **Work Packages WP I-IV.** It presents the field surveys carried out during 2022 and the results in each Work Package of the project "Survey of the Status of Important Fauna Species in the Ionion Block Lease area".

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2 Description of the Project Area

The **Project Area** is located in the North Ionian Sea, west-southwest of Corfu and Paxoi Islands and west of Lefkada Island, approximately from the latitude town Palaiokastritsa in Corfu in the north and the southern tip of Lefkada Island in the south. It extends between latitudes of 38°34'N in the south and 39°40'N in the north and between latitudes of 19°25'E in the west and 20°37'E in the east. Its total surface area is 6,668 km^2 (Figure 2-1). The sea depth within the Project Area ranges from 250m in the coastal areas to more than 2,500m at its southern part (Figure 2-1).

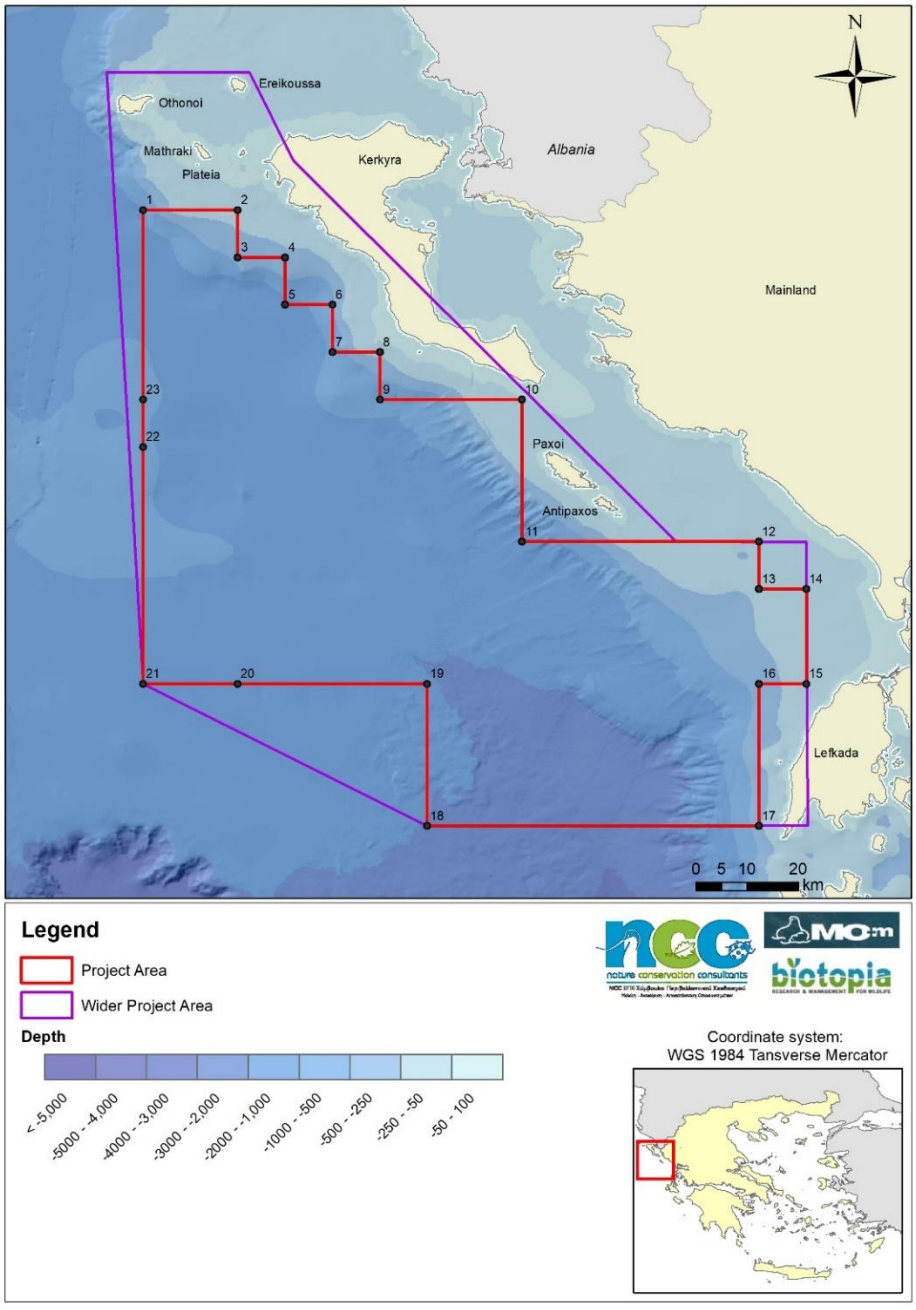

Figure 2-1. Project Area and Wider Project Area

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The **Wider Project Area** envelops the project area and extends further north and east to additionally include the Diapontia Islands, the west coast of Corfu, Paxoi and Antipaxoi and the west coast of Lefkada Island. The Wider Project Area includes three Natura 2000 sites: SPA GR2230008 “Diapontia Nisia”, SAC GR2230010 “Thalassia Periochi Diapontion Nison” and SAC GR2230004 “Nisoi Paxoi kai Evriteri Thalassia Periochi” (Figure 2-2).

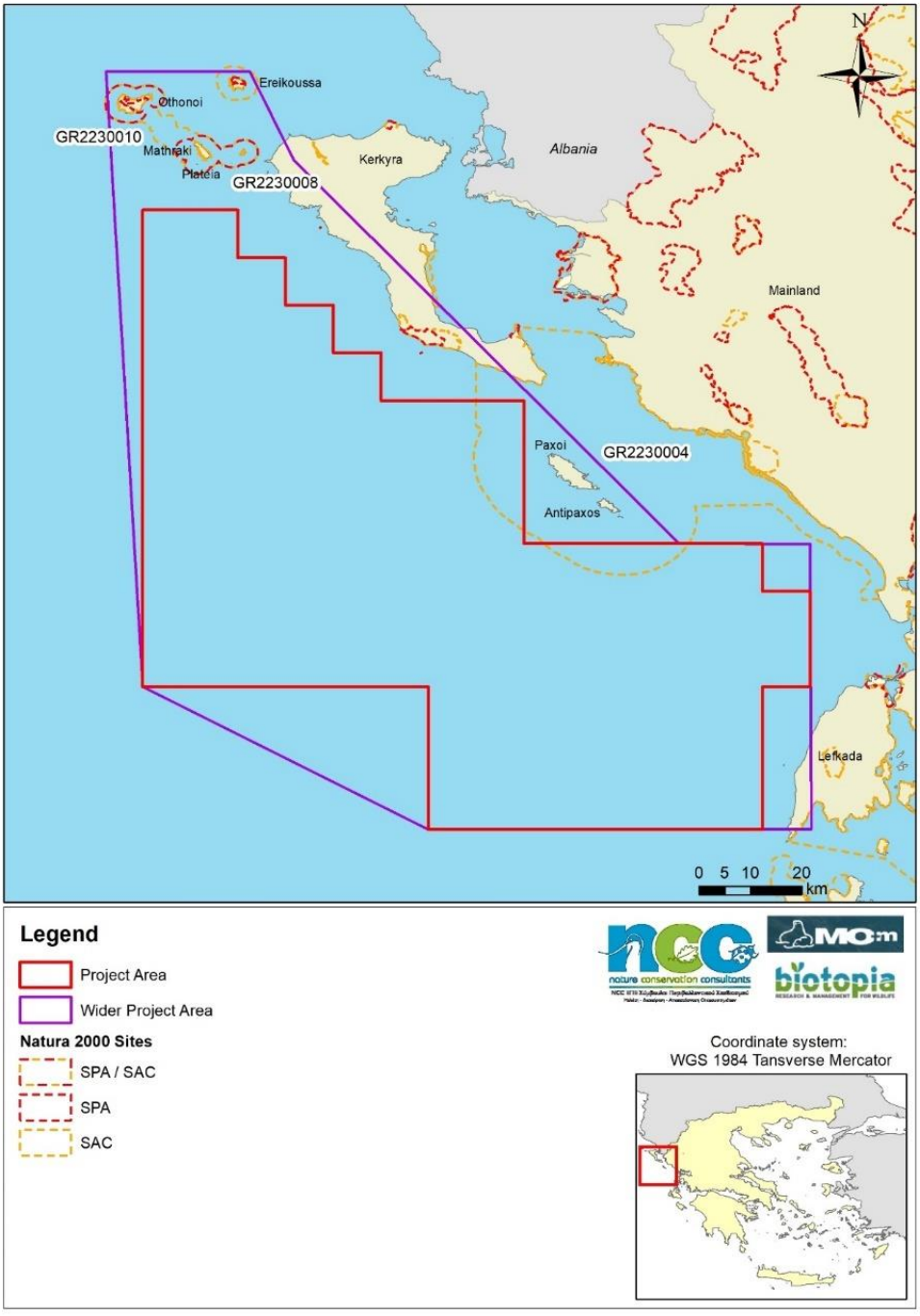

Figure 2-2. Natura 2000 sites in the wider area of the “Ionian block”

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GR2230008 "Diapontia Nisia" (SPA): The site includes three inhabited small islands, five uninhabited islets and the adjacent marine area, located NW of Corfu Island. The site is important for Scopoli's Shearwater (*Calonectris diomedea*), as an important colony of the species, which is the one of the two known colonies in the Ionian Sea, is located within the area, on Tracheia islet. Additionally, during the present study, a colony of Storm petrels *(Hydrobates pelagicus*) was discovered on the same islet, which is the third known colony of the species in Greece.

GR2230010 "Thalassia Periochi Diapontion Nison" (SAC): The site covers the marine area around the Diapontia island complex. The area is characterised by the existence of Posidonia beds, mainly in depths between 5-30m and is an important feeding area for seabirds and marine mammals.

GR2230004 "Nisoi Paxoi kai Evriteri Thalassia Periochi (SAC): The site is located in the Northern Ionian Sea and consists of a group of calcareous islands and islets (including the Paxoi and Antipaxoi Islands), as well as of the surrounding sea area confined by the isobath of 50 m. The site is important due to the occurrence of the monk seal (*Monachus monachus*) and the bottlenose dolphin (*Tursiops truncatus*). Additionally, the marine area is an important feeding ground for other cetaceans, such as the common dolphin *(Delphinus delphis*), the striped dolphin (*Stenella coeruleoalba*), and the Cuvier's beaked whale (*Ziphius cavirostris*).

Two Important Bird Areas (IBAs) are located the Wider Project Area, namely GR082 "Diapontia nisia (Othonoi, Ereikousa, Mathraki) kai nisides" and GR083 "Limnothalasses Kerkyras" (Figure 2-3) while the eastern part of the Project Area is part of the Important Marine Mammal Area (IMMA) "Ionian Archipelago" (Figure 2-4).

GR082 "Diapontia nisia (Othonoi, Ereikousa, Mathraki) kai nisides" (IBA): The site covers the same area with the SPA GR2230008 "Diapontia Nisia". It is an important area for seabirds, such as Scopoli's shearwater and Mediterranean Shag, as well as for the migration of raptors and passerines during spring and autumn.

GR083 "Limnothalasses Kerkyras" (IBA): The site includes four important coastal wetlands of Corfu Island (Korission lagoon, Antinioti lagoon, Chalikopoulou lagoon and Lefkimmi saltpans), as well as the Lagoudia islets. The area is important for the breeding, wintering and migration of wetland species (wildfowl, waders and herons). Within the wider project area are located only the Korission lagoon and the Lagoudia islets.

"Ionian Archipelago" (IMMA): The area has been characterized as important for the marine mammals due to the population of the common dolphin, which suffered a dramatic decline between 1995 and 2007, and the permanent presence of the monk seal.

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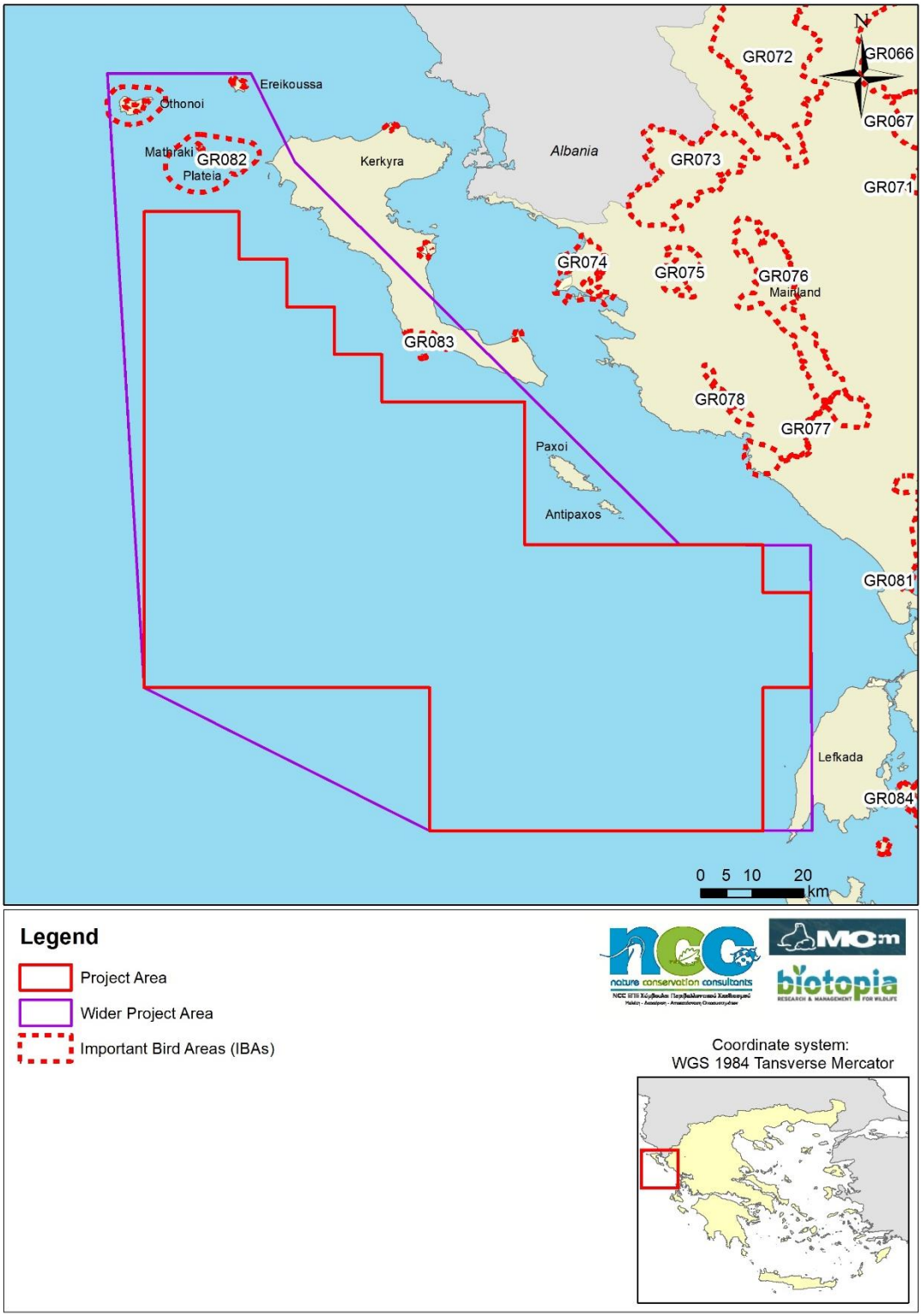

Figure 2-3. Important Bird Areas (IBAs) in the wider area of the "Ionian block"

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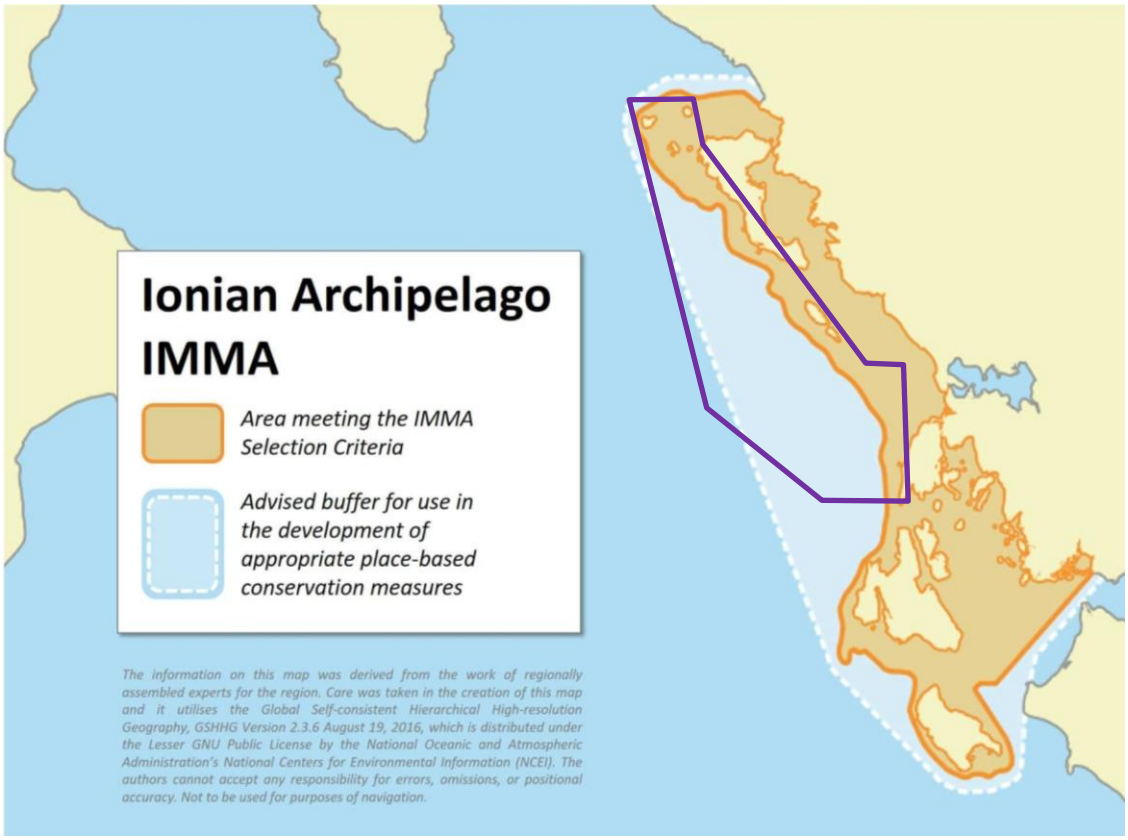

Figure 2-4. Important Marine Mammal Area (IMMA) "Ionian Archipelago" in the wider area of the "Ionian block"

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

2.1.1 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

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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), 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 coast	Mean Depth	Distance from
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

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that large data gaps are still present regarding the distribution and abundance of cetaceans in the eastern Mediterranean (Mannocci et al. 2018).

2.1.1.1 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).

2.1.1.2 Cuvier's Beaked Whale (Ziphius cavirostris)

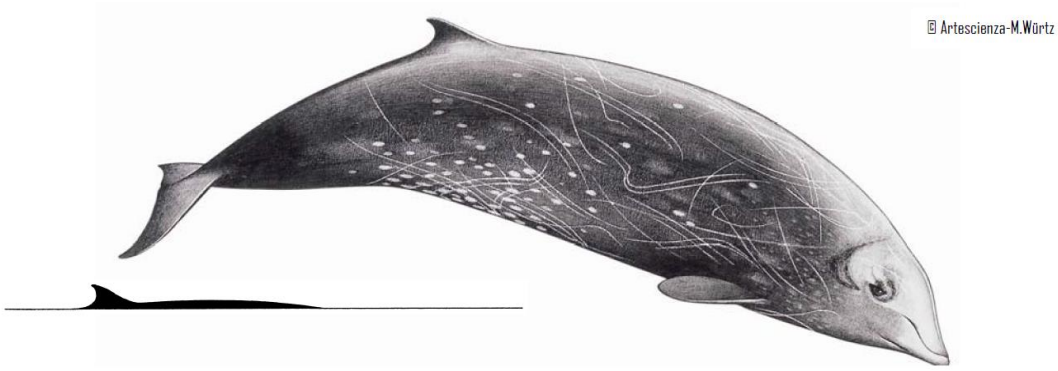

Figure 2-6. Cuvier's Beaked Whale (Ziphius cavirostris) (©Artescienza-M.Würtz)

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

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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).

2.1.1.3 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.

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2.1.1.4 Bottlenose dolphin (Tursiops truncatus)

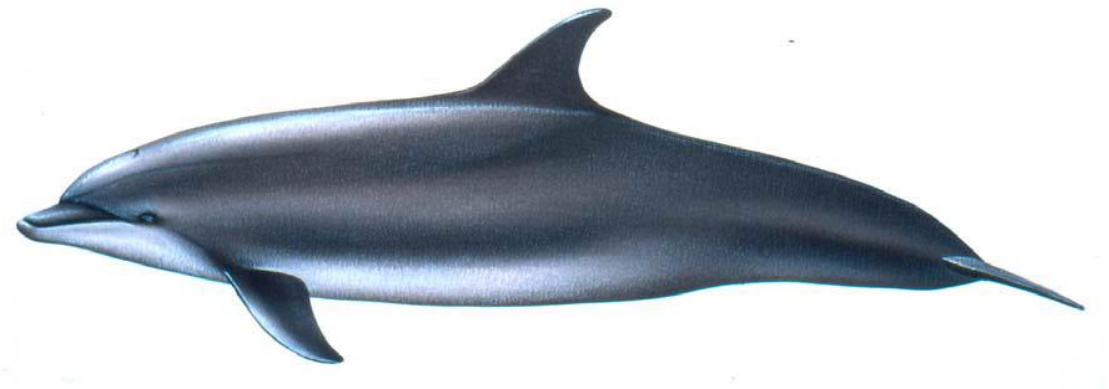

Figure 2-8. Common bottlenose dolphin (Tursiops truncatus) (© Artescienza-M.Würtz)

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.

2.1.1.5 Striped dolphin (Stenella coeruleoalba)

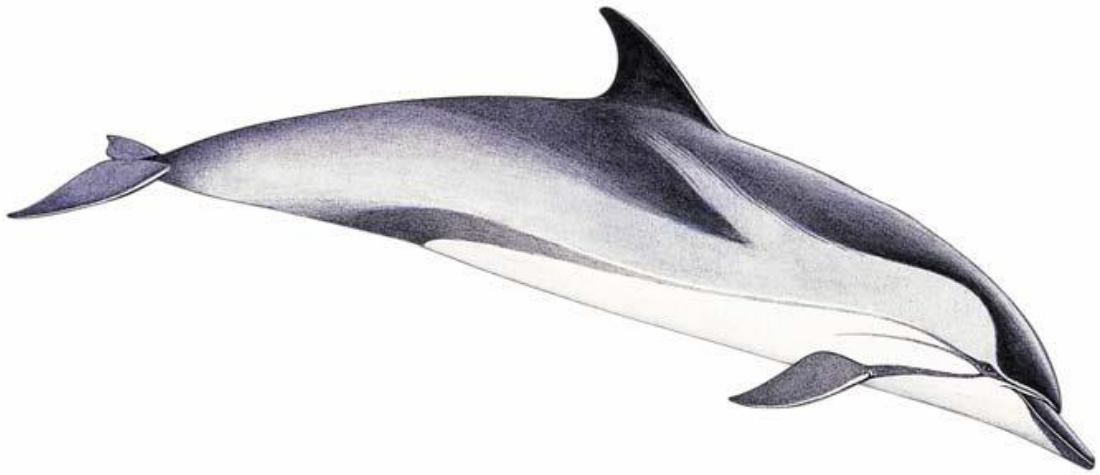

Figure 2-9. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM)

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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.

2.1.1.6 Short-beaked common dolphin (Delphinus delphis)

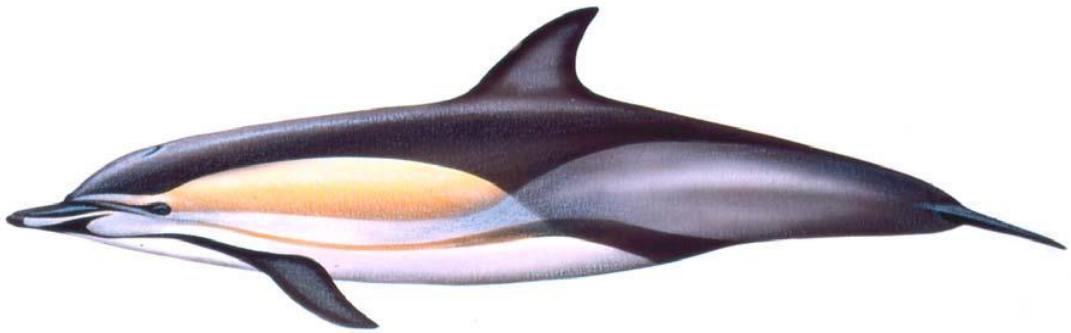

Figure 2-10. Short-beaked common dolphin (Delphinus delphis) (© Artescienza-M.Würtz)

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).

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2.1.2 Seals

2.1.2.1 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/).

2.1.3 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

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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, 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).

2.1.3.1 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 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

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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).

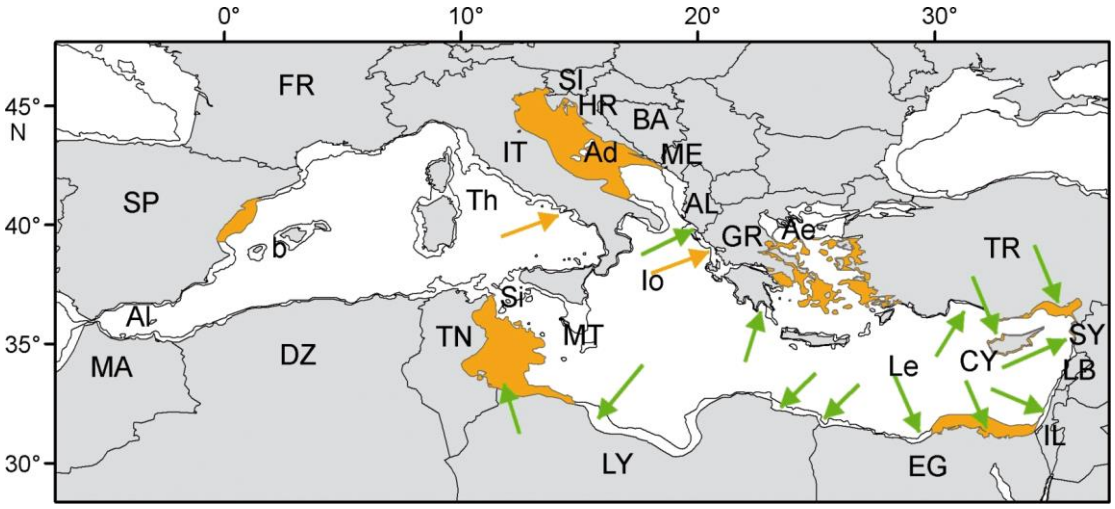

Figure 2-13. Neritic foraging and wintering sites for loggerhead turtles (orange areas and arrows) and green turtle (green arrows) (adopted from Casale et al. 2018).

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.

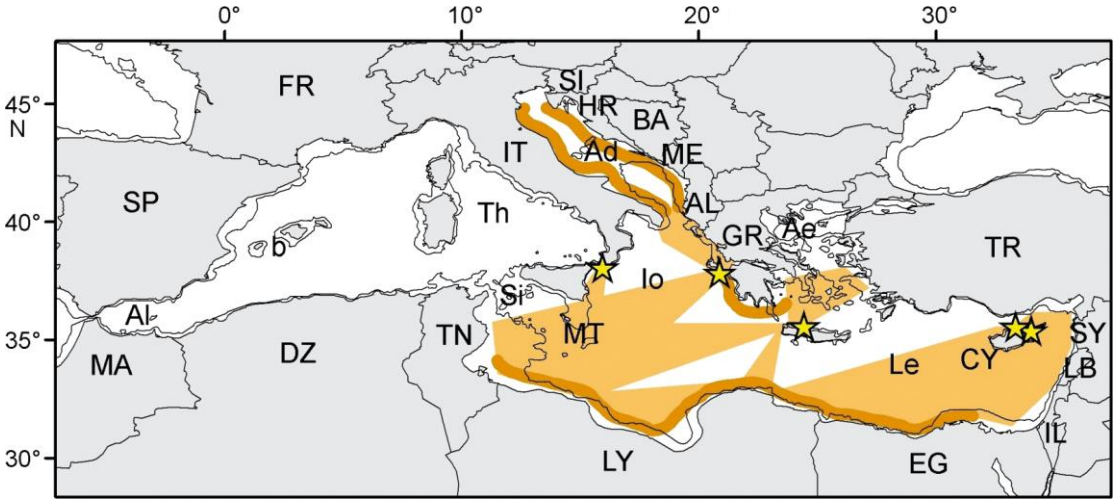

Figure 2-14. Main known migratory corridors for adult loggerhead turtles to and from breeding sites (stars). Light brown areas represent migratory funnels in the open sea while darker strips represent paths along the coasts, typically in shallow waters (adopted from Casale et al. 2018).

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

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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).

2.1.3.2 Green turtle (Chelonia mydas)

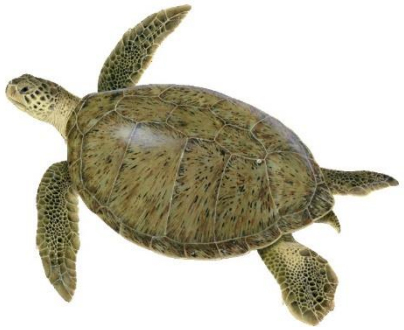

Figure 2-15. Green turtle (Chelonia mydas)

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).

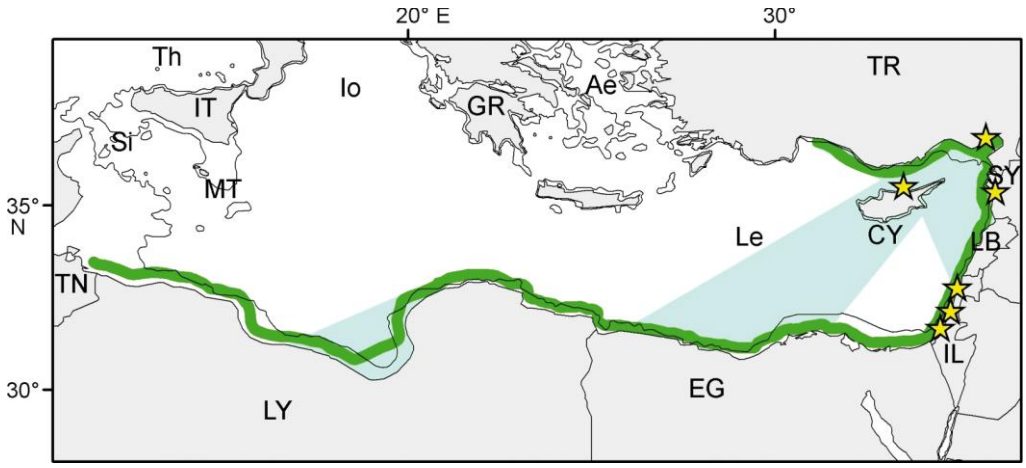

Figure 2-16. Main known migration corridors for adult female green turtles during reproductive migrations from the breeding sites (stars) (adopted from Casale et al. 2018).

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2.1.4 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*).**

2.1.4.1 Scopoli's's Shearwater (Calonectris diomedea)

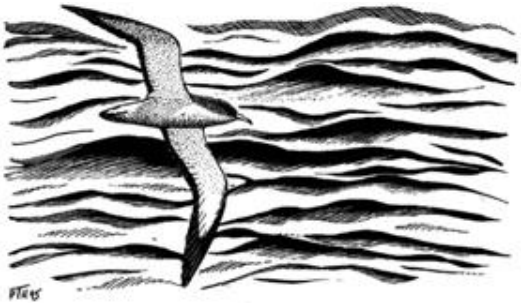

Figure 2-17. Scopoli's Shearwater (Calonectris diomedea) (© Paul Hirst)

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, 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 (within the Wider Project Area) with much smaller breeding population of 60-100 pairs (Fric et al. 2012).

2.1.4.2 Yelkouan Shearwater (Puffinus yelkouan)

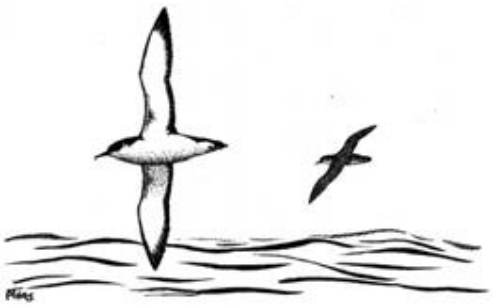

Figure 2-18. Yelkouan Shearwater (Puffinus yelkouan) (© Paul Hirst)

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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.

2.1.4.3 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).

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2.1.4.4 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).

2.1.4.5 Yellow-legged Gull (Larus michahellis)

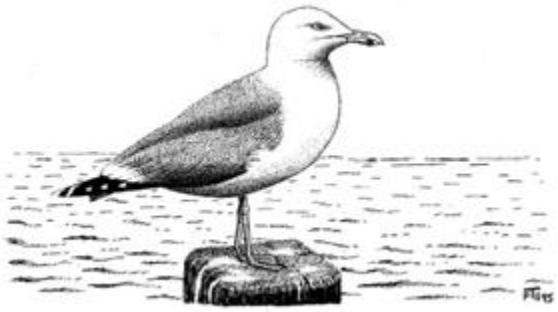

Figure 2-21. Yellow-legged Gull (Larus michahellis) (© Paul Hirst)

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

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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).

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3 Methodology

3.1 Pelagic boat surveys

Pelagic boat surveys for cetaceans, sea turtles and seabirds were carried out using i) a 7,5m length RIB boat, ii) a 9m length motorboat, iii) a 13m sailing boat, and iv) a DJI drone.

Figure 3-1. The three research vessels used for the boat surveys: RIB boat "Ydrobatis II", motorboat "Saria" and sailing boat "Andreas II".

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3.1.1 Visual boat-based surveys

The method applied for visual surveying seabirds, cetaceans and sea turtles in the Pelagic surveys area was 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.

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.

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Figure 3-2. ESAS field work

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

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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 (Figure 3-33, below).

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

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- ***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.

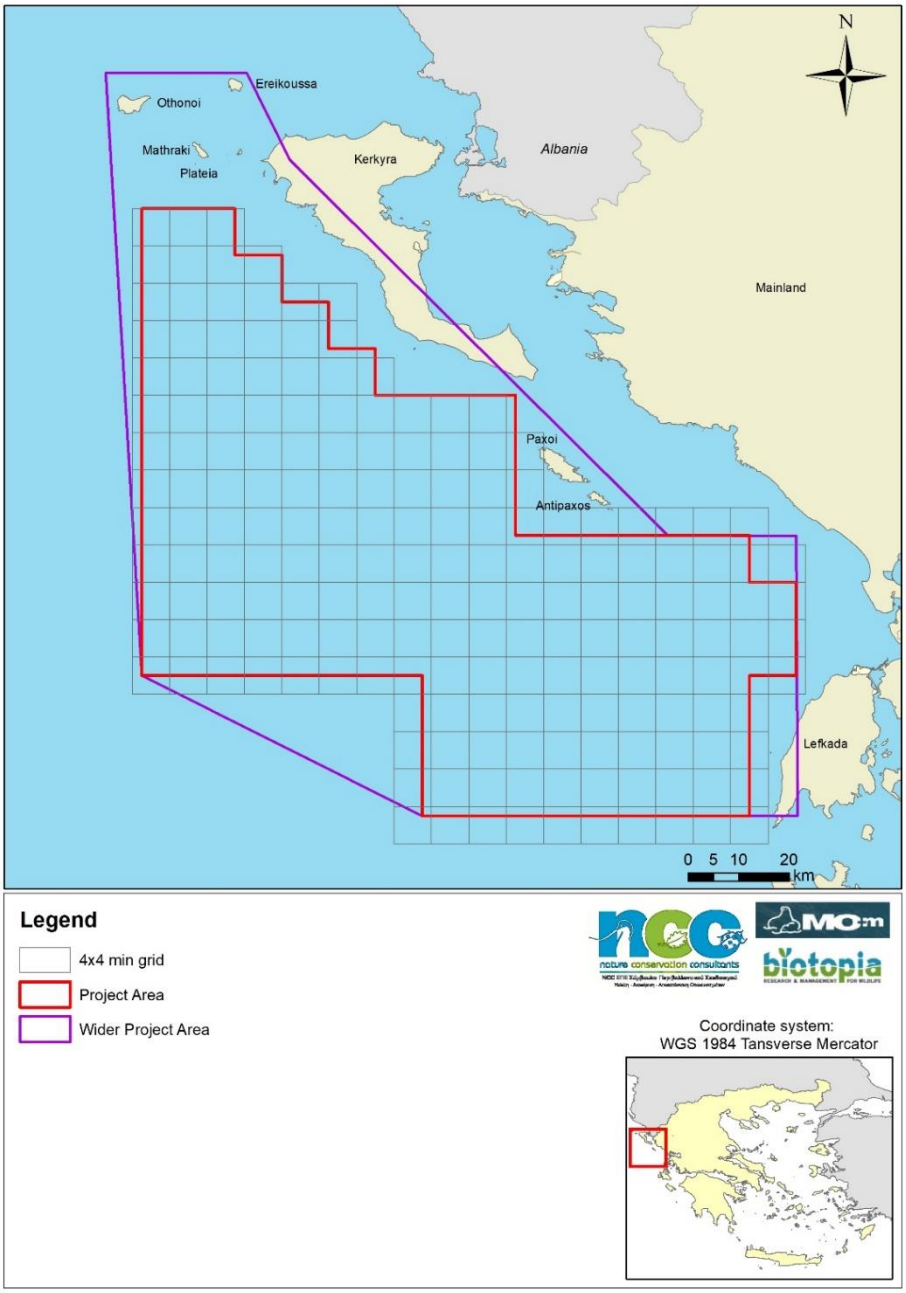

Figure 3-3. Four decimal minute (4'x4') reference grid in WGS84 coordinate system

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3.1.2 Acoustic surveys

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

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

The hydrophone recordings were analysed by PAMGUARD software using “*whistle and moan detector”* module.

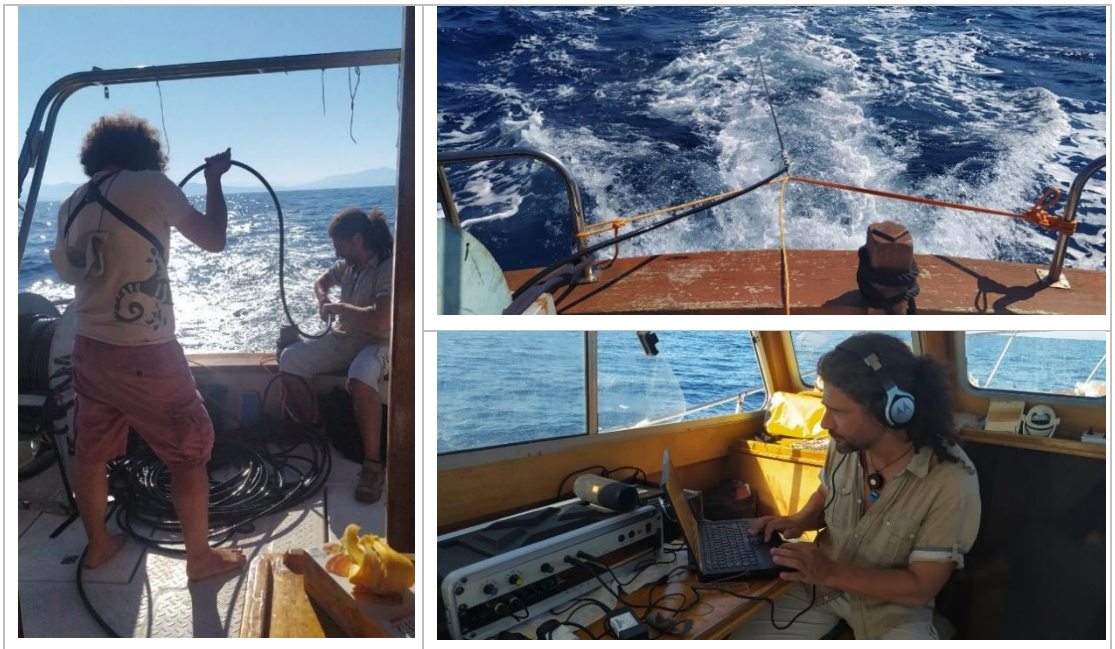

Figure 3-4. Acoustic surveys

Additionally, in the framework of the acoustic surveys, a 3-day field training workshop was carried out in Preveza by WaterProof Marine Consultancy and Services, a specialized in hydro-acoustics marine consultancy firm based in the Netherlands. During the workshop a number of field techniques and bioacoustic devices was demonstrated and tested, in order to assess their effectiveness and suitability for the implementation of acoustic surveys in the project area.

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Figure 3-5. Demonstration of field techniques and acoustic devices during the training workshop

3.1.3 Drone surveys

Drones have been deployed from the 7,5 RIB boat, during the ESAS surveys, to improve the spatial coverage of the transects grid in specific areas of interest.

Drone flights were performed only in calm sea conditions (0-2 BF) and the flight altitude varied between 30m and 200m depending on the target species.

Two different deployment protocols were followed:

1. Transects of a total length of 1km each, perpendicular to the main transect lines of the ESAS Surveys, were performed in certain sites, where suitable habitats for marine mammals and sea turtles existed. The flight altitude was determined to 200m and the drone camera was set vertical to the flight direction. Georeferenced 4K video footage was recorded to be further analyzed for the presence of target species.
2. In cases when encounter of the target species was obtained through the ESAS transects or through boat transport movements, the drone was deployed in altitudes

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of 30-50m, depending on the species, to record the numbers and characteristics of the animals of interest. This methods has been used to record marine mammals, seabirds and sea turtles.

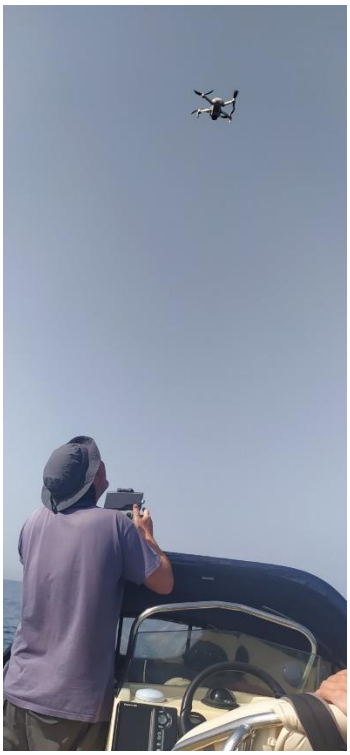

Figure 3-6. A: Drone surveys

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3.2 Aerial surveys

A high wing, light aircraft (Cessna C172 Skyhawk 2, Figure 3-7.) was used, based at Megara General Aviation Airport (ICAO designator LGMG). This four-seater aircraft offers an excellent view from its cockpit (Figure 3-4) and thus was considered suitable, reliable and cost-effective for such a mission. The flights were performed along the coasts of the Northern Ionian Sea and within the pelagic areas of the Wider Project Area at an altitude of 1000 ft and an average Speed Over Ground of 90 knots.

Figure 3-7. The aircraft used, at Corfu airport

In every case where an "object of interest" was spotted, the airplane left its track and performed one or more circles over the object 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).

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Figure 3-8. 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 3-9. A: Recording an "object of interest", B: Approaching, C: Identifying

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3.3 Coastal surveys

3.3.1 Coastal surveys for the Scopoli's Shearwater

Coastal surveys for the Scopoli's shearwater were performed using the RIB and the sailing research vessels, as well as the drone. At known colonies of the species, such as the one at Diapontia islands, an adaptation of the existing raft counting method has been developed, with the vessel following the birds gathering in front of the colony before sunset, to create the raft. When a raft was spotted, the number of birds was counted using binoculars and ZOOM cameras. The DJI Mini 2 drone was 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 was 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 were distinguished from prospectors to provide more precise estimates of the colony size.

Figure 3-10. A: Monitoring of seabirds during night using a thermal camera

3.3.2 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)

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- Identification of colony/nest sites, number of nests, suitable nesting habitat, roosting sites
- Potential localised threats
- Comments

3.3.3 Coastal surveys for the Mediterranean Monk Seal

Evaluating Habitat Availability and Suitability

To evaluate habitat availability and suitability for the Mediterranean monk seal in the project area its entire coastline was circumnavigated with an inflatable boat, at a distance of about 50 m from the shoreline to locate all potentially suitable coastal caves for resting and/or pupping. Once a cave was located, it was approached swimming and its suitability evaluated, based on a set of physical and environmental features (Dendrinos et al., 2007).

If a cave was evaluated as suitable monk seal habitat, geotagged photos was taken and its GPS position was recorded. It should be noted that Mediterranean monk seals tend to be more selective in their choice of caves used for pupping than for resting (Karamanlidis, Pires, Silva, & Neves, 2004).

Previous research has indicated that the physical and environmental features used in this study are the most important predictors of the selection of a coastal cave as a pupping site by monk seals in Greece. Suitable pupping sites tend to have among other, multiple entrances, beaches in their interior with a soft substrate, a low risk of pup washout and are not easily accessible to humans (Dendrinos et al., 2007).

During the aforementioned research efforts the field team of MOm tried also to collect information that could lead to a preliminary assessment of the demographic composition of the Mediterranean monk seal population in the area (Dendrinos, Kotomatas, & Tounta, 1999). During the cave inspections, researchers searched for the presence of recent signs of cave use, such as tracks, scats, pieces of fur or blood. If a seal was encountered, photographs or video were taken in order to enable future individual identification.

Finally, during the circumnavigation of the coastline the research team collected information on human activities and threats to the Mediterranean monk seal in the region, and more specifically information on the overall intensity of human activity and to a lesser extent on fishery – seal interactions in the area.

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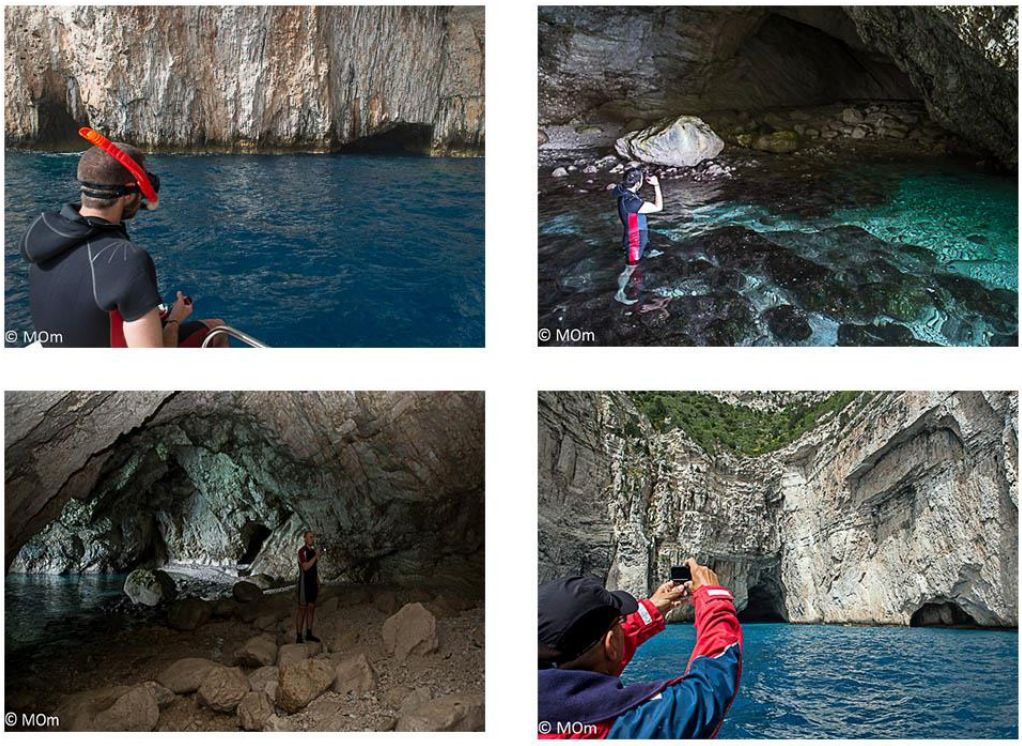

Figure 3-11. A: Monitoring of seabirds during night using a thermal camera

Collection of reports on Mediterranean monk seal sightings

Apart from performing visits to the seal shelters the researchers MOm collected and evaluated reports of seal sightings conducted by other observers (such as local citizens, tourists, divers, professional and amateur fishermen). Location, date and time of the observation, behaviour of the animal, as well as, visible characteristics (size, developmental stage, coloration, external pelage marks or scars, overall status of the animal) were recorded. This method of data collection is based on the methodology of the operation of the National Rescue and Information Network (Adamantopoulou et al., 1999). Although this information originates from non-scientists, it forms a considerable source of relevant data, which, upon careful evaluation and analysis, complements the work conducted directly in the field. In addition, the collection of data by non-scientists in combination with the data collected by researchers allows for the immediate reaction of the field team of MOm in cases of emergency, such as animals needing aid or dead animals.

3.4 Scopoli's Shearwater telemetry

In June 2022 a total of 10 transmitters have been mounted on 10 Scopoli's Shearwaters on Trachia islet, west of Mathraki, at the Diapontia islands complex. Transmitters were 15-gram waterproof Ornitrack-15 solar powered GPS-GSM/GPRS trackers produced by Ornitela UAB

(https://www.ornitela.com/), which at regular, user-defined, time intervals record the position (acquired by GPS), temperature, 3D magnetic heading and 3D acceleration and send this data via GSM network at regular time intervals (when GSM network is available). The transmitters have been mounted on breeding Scopoli's Shearwaters during the species incubation period. Incubating birds were trapped at their nesting sites, tagged and then released back to their nests. The recorded and transmitted trackers' data is viewed and downloaded from the Ornitela web interface. Spatial analysis of this data was carried out to determine presence in- and use of the Wider Project Area by the tagged birds.

Figure 3-12. GPS-GSM device used for Scopoli's Shearwater telemetry

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4 Results

4.1 Pelagic surveys

4.1.1 Boat surveys

Boat-based visual surveys and cetacean surveys were carried out in summer (21- 23/06/2022, 23-24/07/2022) and autumn (04-16/09/2022) in the Pelagic Survey Area, as well as, surrounding areas in the Wider Project Area to assess the presence, abundance and distribution of the cetacean, sea turtle and seabird species of interest. Total distances covered by pelagic boat surveys were **1.330 nautical miles (n.m.)**.

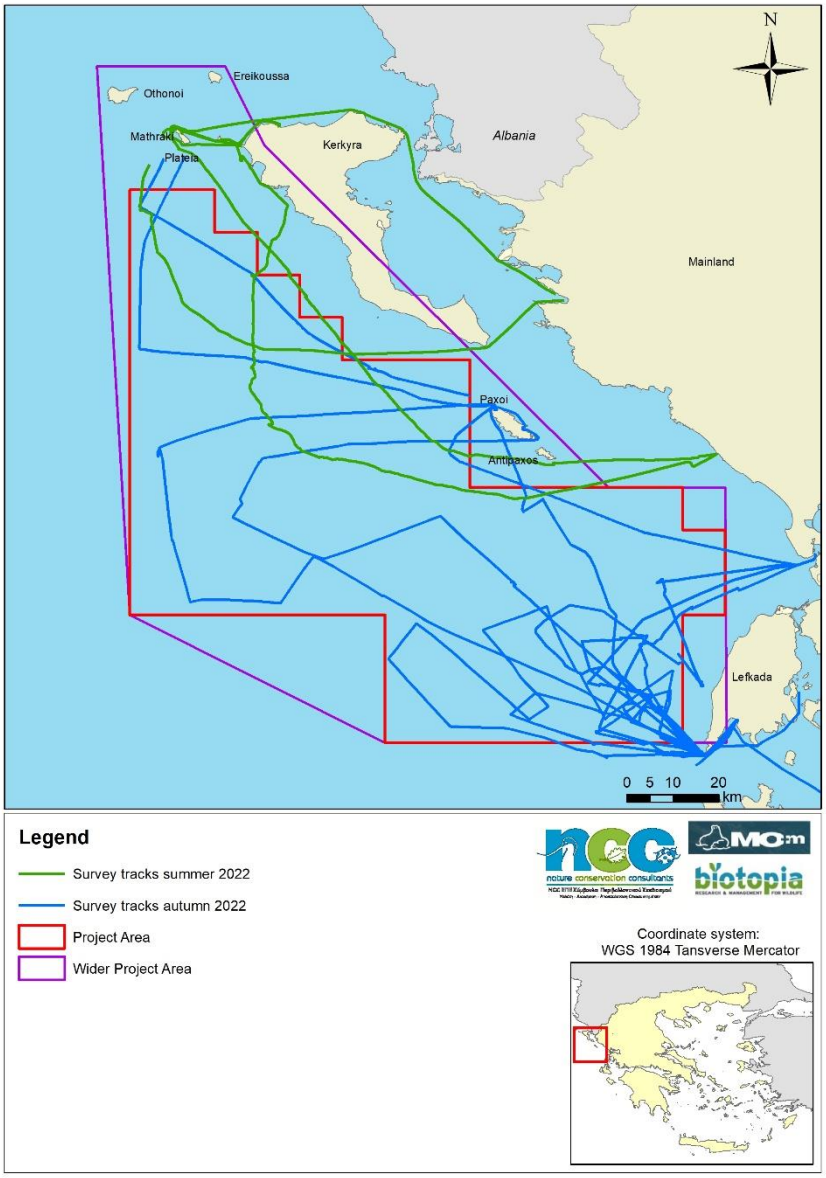

Figure 4-1. Visual boat-based survey tracks

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The pelagic surveys covered systematically the entire Pelagic Surveys Area. During these surveys, 3 cetacean species: **Cuvier's Beaked whale** (*Ziphius cavirostris*), **Striped dolphin** (*Stenella coeruleoalba*) and **Bottlenose dolphin** (*Tursiops truncatus*), 9 species: **Scopoli's Shearwater** (*Calonectris diomedea*), **European Storm-petrel** (*Hydrobates pelagicus*), **Yelkouan Shearwater** (*Puffinus yelkouan*), **Mediterranean Shag** (*Phalacrocorax aristotelis desmarestii*), **White-winged Tern** (*Chlidonias leucopterus*), **Common Tern** (*Sterna hirundo*), **Yellow-legged Gull** (*Larus michahellis*), **Pintail** (*Anas acuta*) and **Marsh Harrier** (*Circus aeruginosus*) and 1 sea turtle species (**Loggerhead turtle** (*Caretta caretta)* were recorded. All species of interest were recorded within the Wider Project Area, with some also outside in the Wider Project Area.

*Table 4-1. Species recorded in the Pelagic surveys area and the project area (species of interest are marked with **bold**).*

Species	Common name	# individuals recorded		Project Area	Wider Project Area
		summer	autumn		
Cetaceans					
Stenella coeruleoalba	Striped Dolphin	20	281	√	√
Tursiops truncatus	Bottlenose dolphin	18	30	√	√
Ziphius cavirostris	Cuvier's Beaked Whale	2	9	√	√
Sea turtles					
Caretta caretta	Loggerhead Sea Turtle	1	4	√	√
Birds					
Anas acuta		-	2		√
Calonectris diomedea	Scopoli's Shearwater	1075	450	√	√
Chlidonias leucopterus	White-winged Tern	1	-		√
Circus aeruginosus	March Harrier	-	4	√	
Hydrobates pelagicus	European Storm-petrel	2	-		√
Larus michahellis	Yellow-legged Gull	50	1	√	√
Phalacrocorax aristotelis desmarestii	Mediterranean Shag	10	-		√
Puffinus yelkouan	Yelkouan Shearwater	5	35	√	√
Sterna hirundo	Common Tern	-	1		√

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4.1.1.1 Cuvier's beaked whale (Ziphius cavirostris)

In June 2022 two Cuvier's beaked whales were recorded in the central-western part of the Project Area, where sea depth was 1,500m.

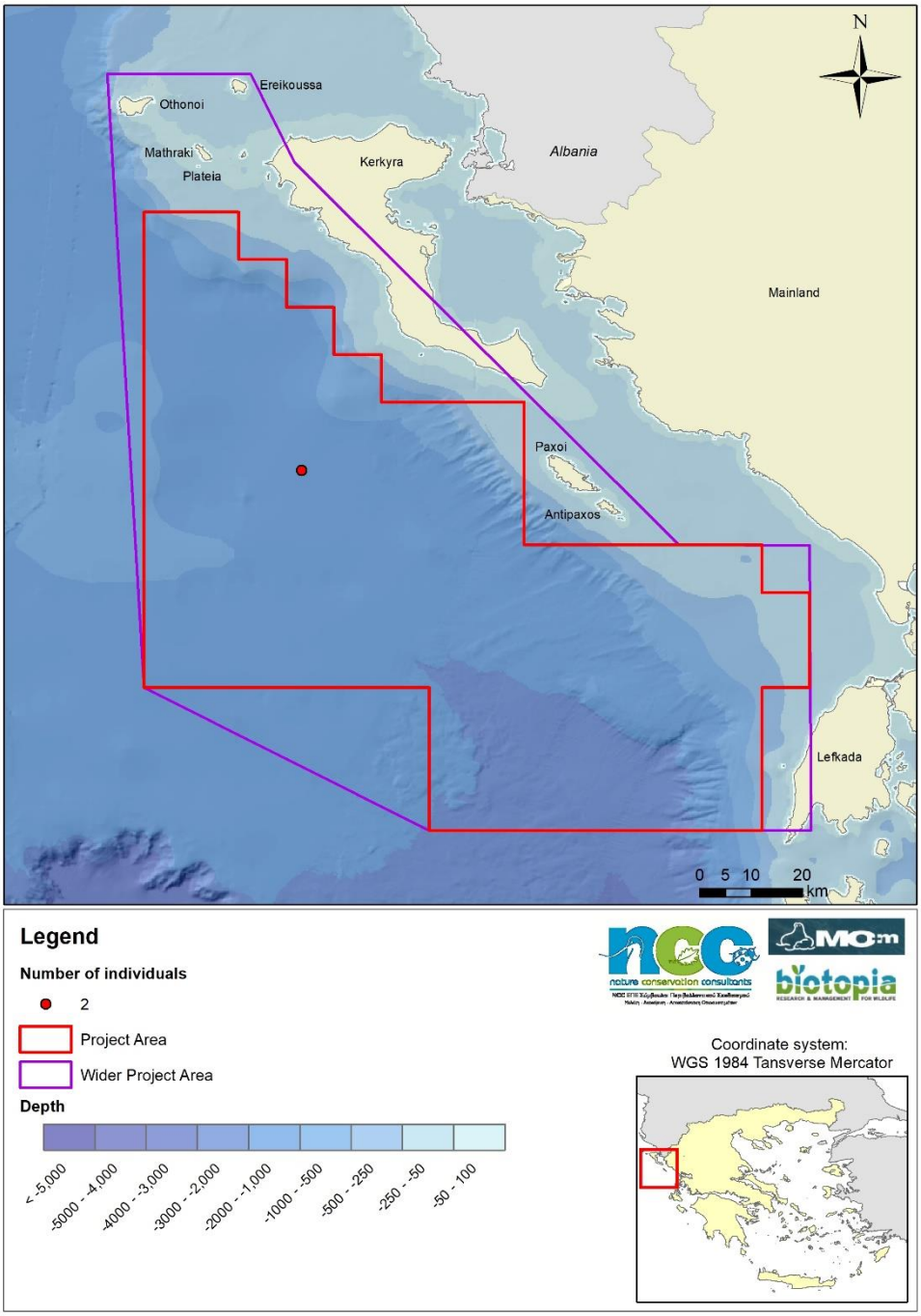

Figure 4-2. Location and number of individuals of the recorded Cuvier's beaked whales in summer 2022.

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In September 2022 a total of 9 Cuvier's beaked whales were recorded in the south-eastern and northern part of the Project Area from either as single individuals or groups of up to 3 animals, where sea depth ranged between 877 and 2,269m.

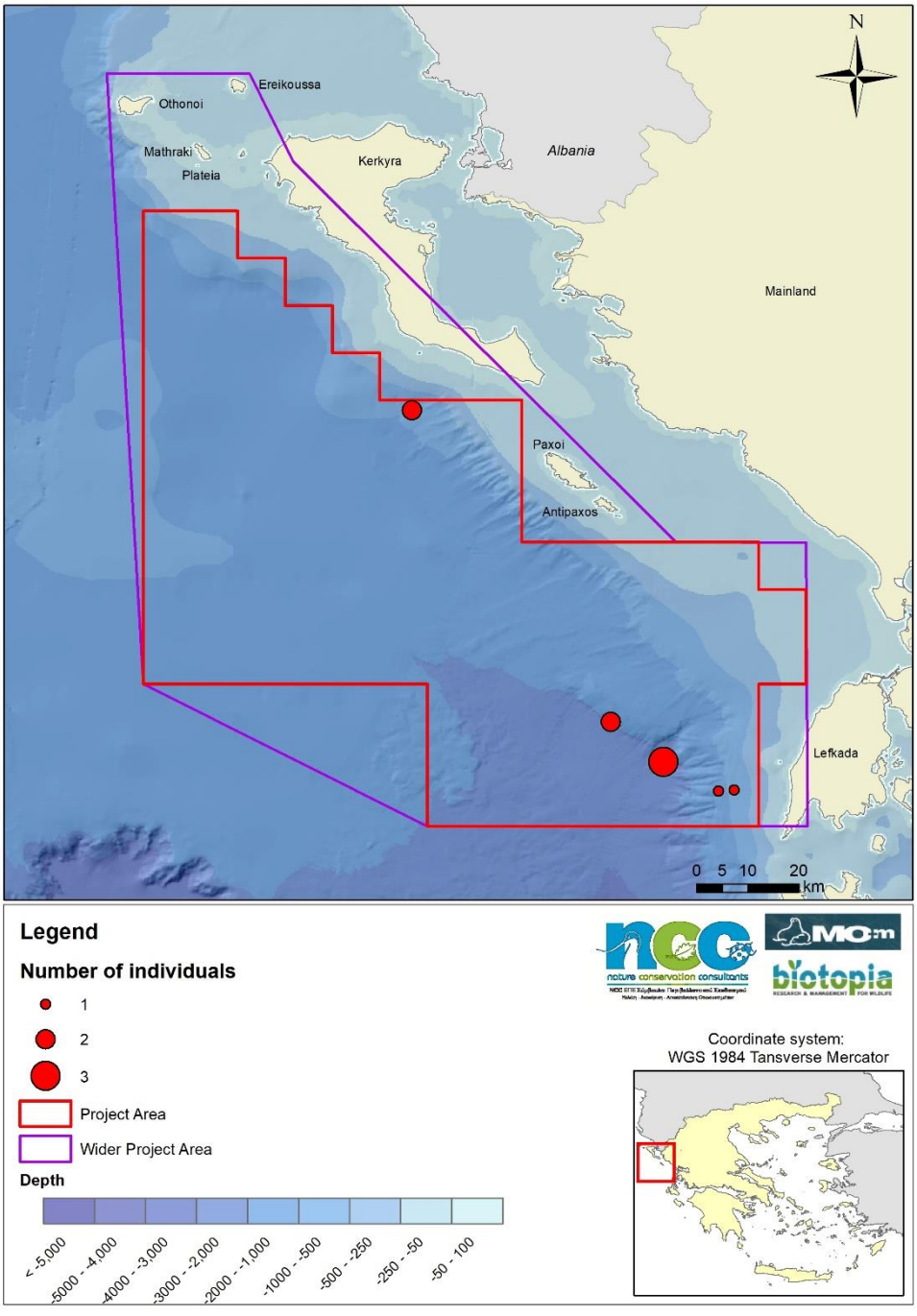

Figure 4-3. Locations and number of individuals of the recorded Cuvier's beaked whales in autumn 2022.

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In June and July 2022 the average density of recorded individuals per grid cell was 0.89 individuals/km^2.

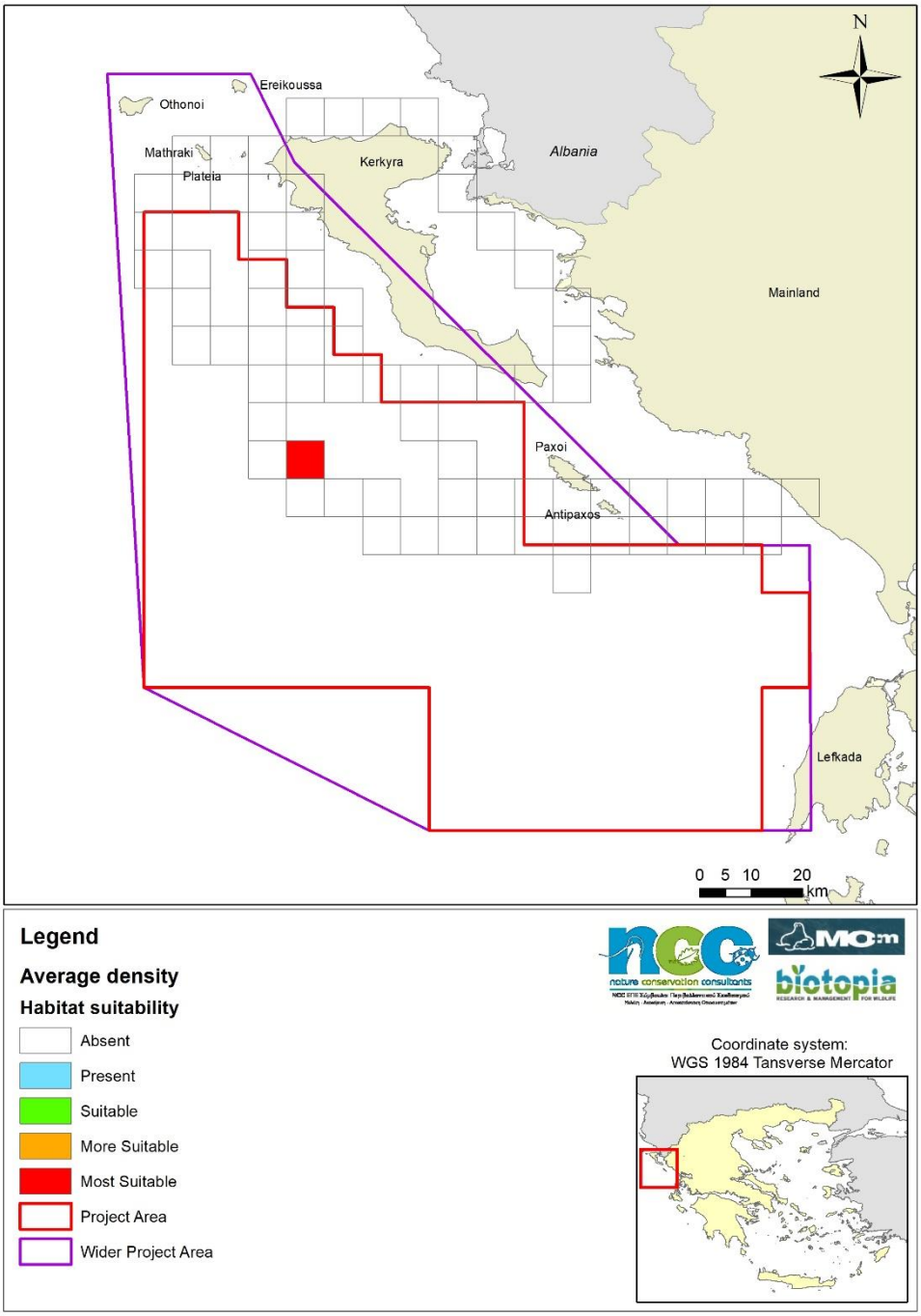

Figure 4-4. Habitat suitability based on the density of the Cuvier's beaked whales in summer 2022.

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In September 2022 the average density of recorded individuals per grid cell ranged between 0.06 and 0.52 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.36 individuals/km^2, More Suitable: density ≥ 0.52 individuals/km^2 and Most Suitable: density ≥ 0.52 individuals/km^2.

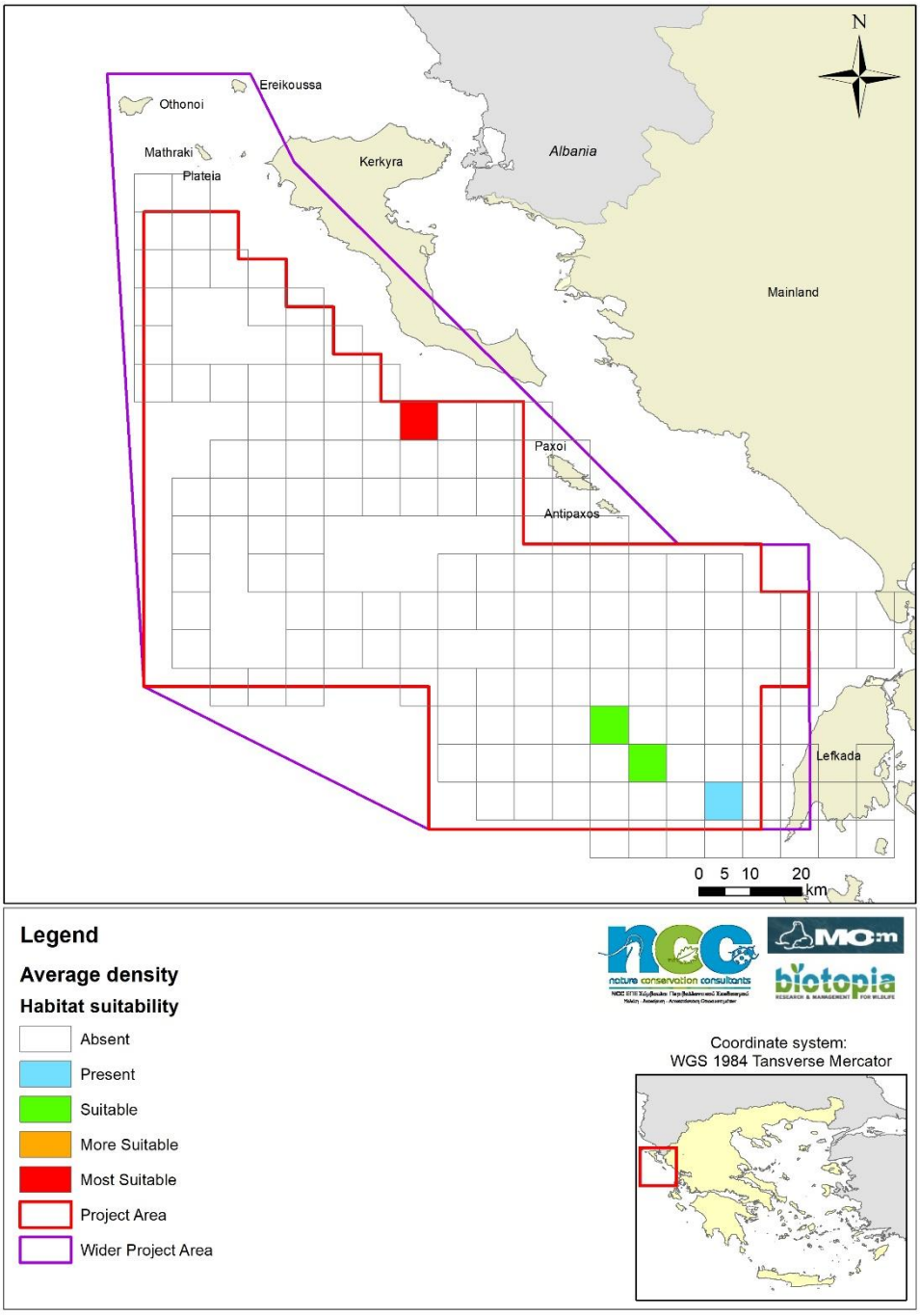

Figure 4-5. Habitat suitability based on the density of the Cuvier's beaked whales in autumn 2022.

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4.1.1.2 Common bottlenose dolphin (Tursiops truncatus)

In June and July 2022 Common bottlenose dolphins were recorded at the northern part of the Project Area and in east of the Wider project area.

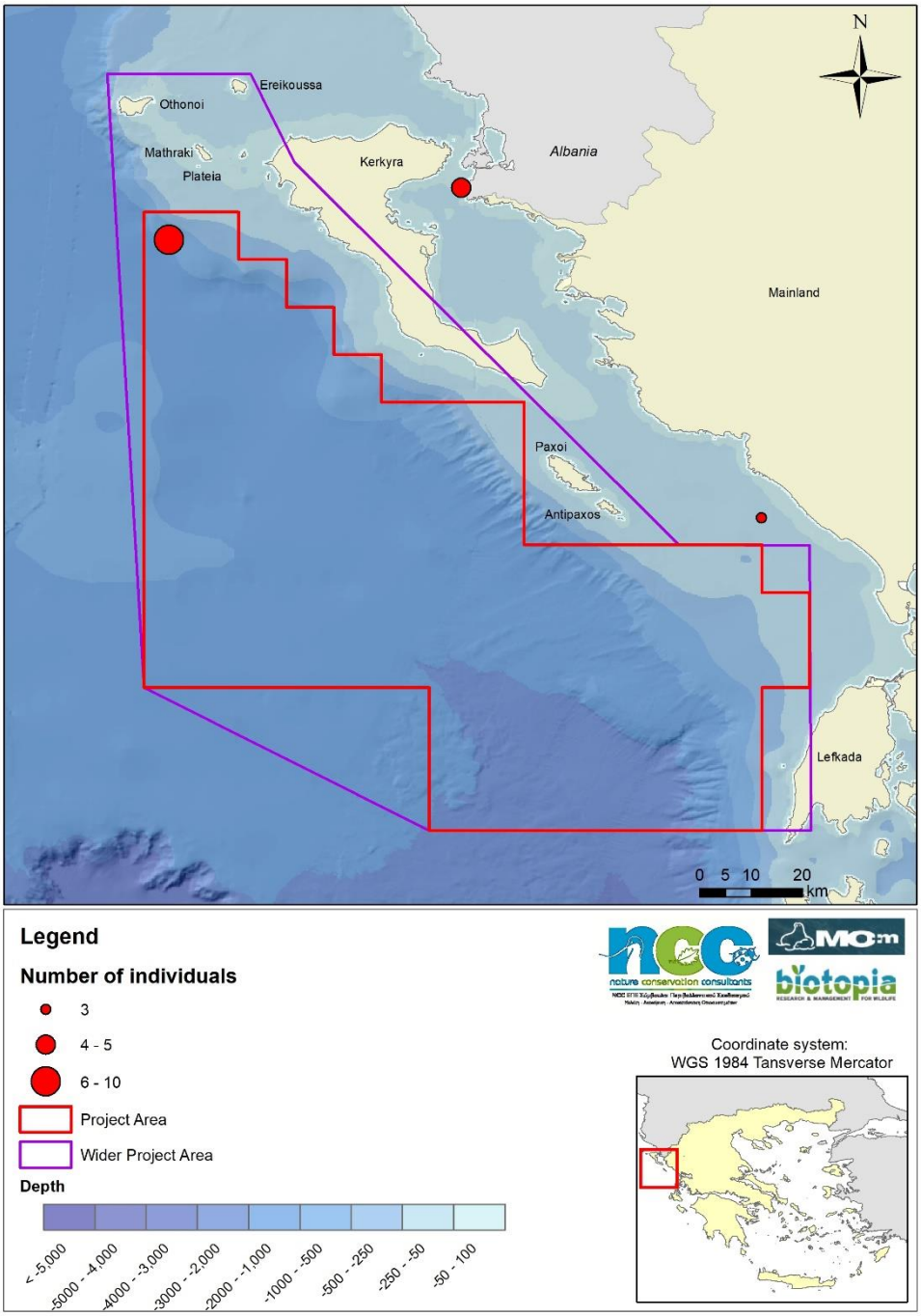

Figure 4-6. Location and number of individuals of the recorded Common bottlenose dolphins in summer 2022.

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In September 2022 a total of 30 Common bottlenose dolphins were recorded, primarily east and southeast of the Winder Project Area, either as single individuals or groups of up to 8 animals.

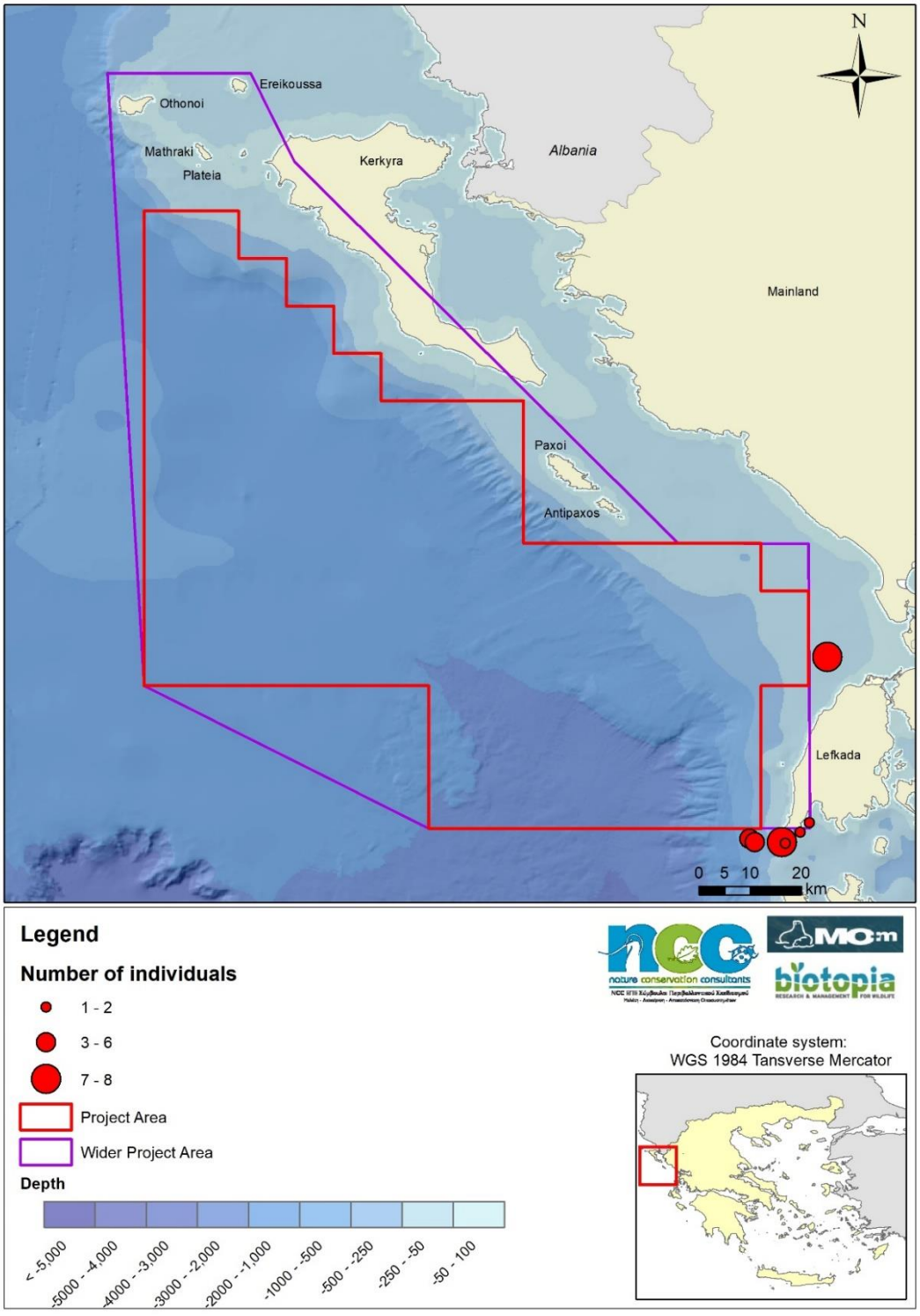

Figure 4-7. Locations and number of individuals of the recorded Common bottlenose dolphins in autumn 2022.

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In June and July 2022, the density of recorded individuals per grid cell range between 0.37 and 2.71 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.37 individuals/km^2 and Most Suitable: density ≥ 2.71 individuals/km^2.

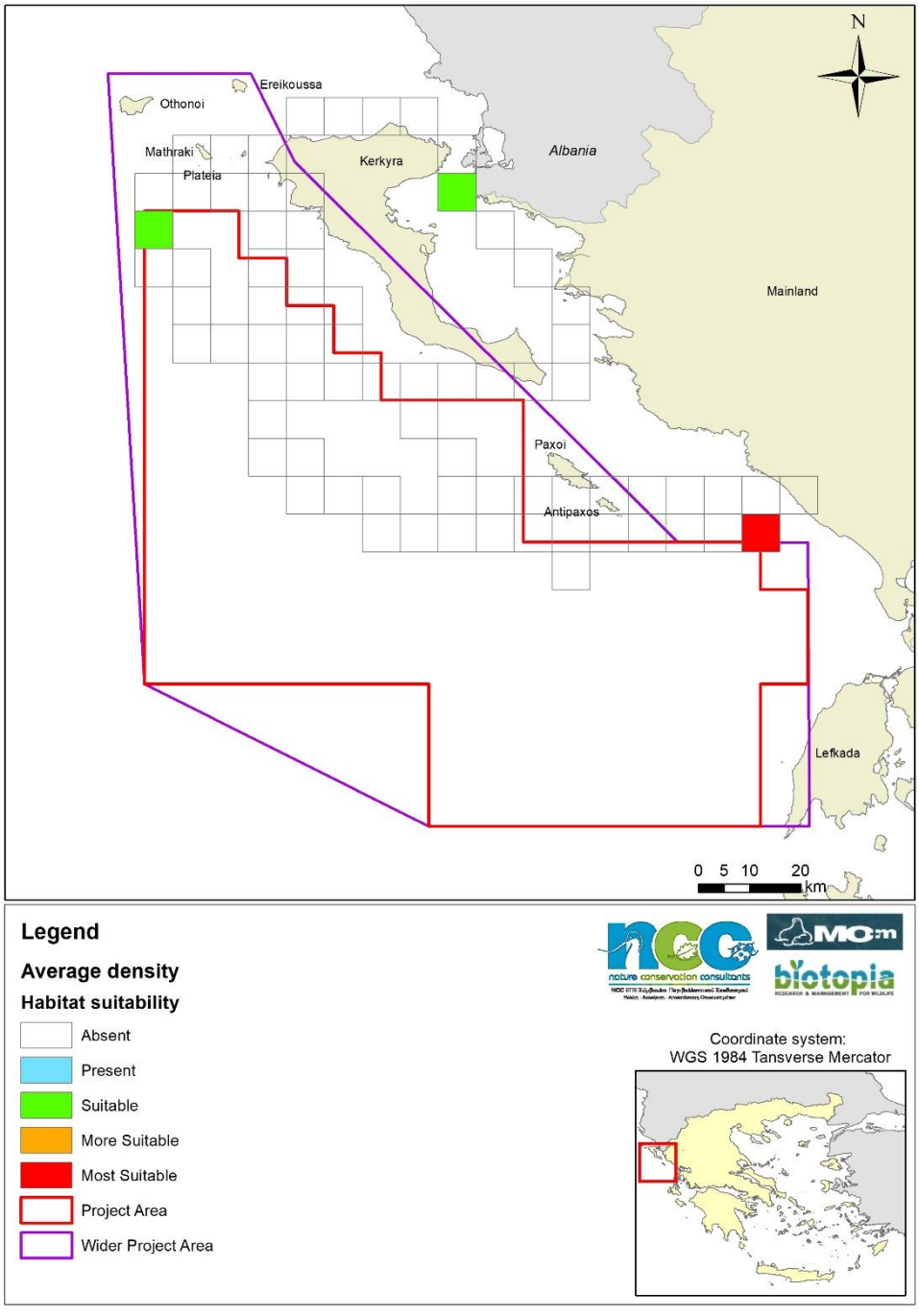

Figure 4-8. Habitat suitability based on the density of the Common bottlenose dolphins in summer 2022.

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In September 2022 the density of recorded individuals per grid cell range between 0.64 and 1.44 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.64 individuals/km^2, More Suitable: density ≥ 1.44 individuals/km^2 and Most Suitable: density ≥ 1.44 individuals/km^2.

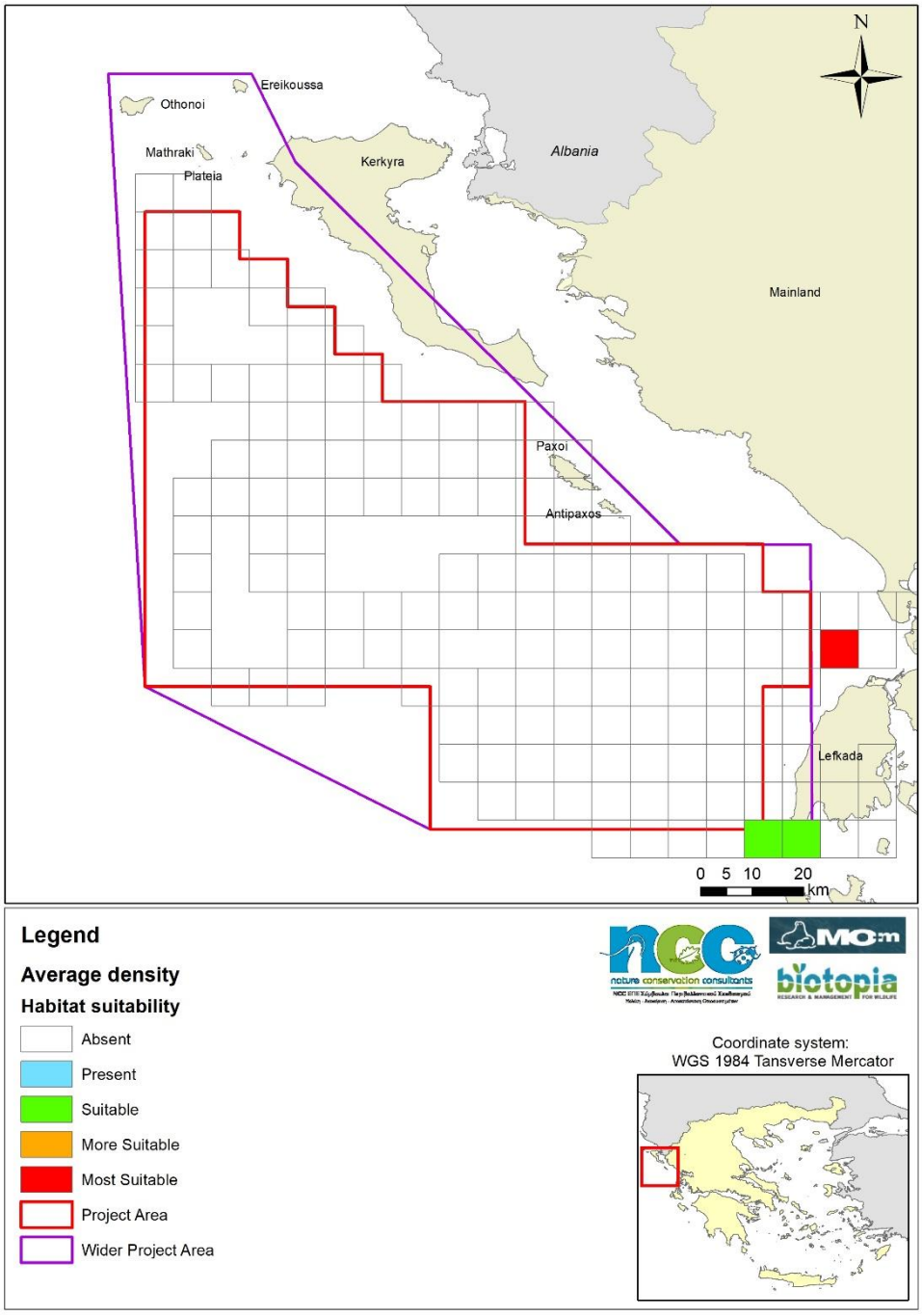

Figure 4-9. Habitat suitability based on the density of the Common bottlenose dolphins in autumn 2022.

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4.1.1.3 Striped dolphin (Stenella coeruleoalba)

In June and July 2022 a group of 20 Striped dolphins was recorded in the central-western part of the Project Area, where sea depth was 1,460m.

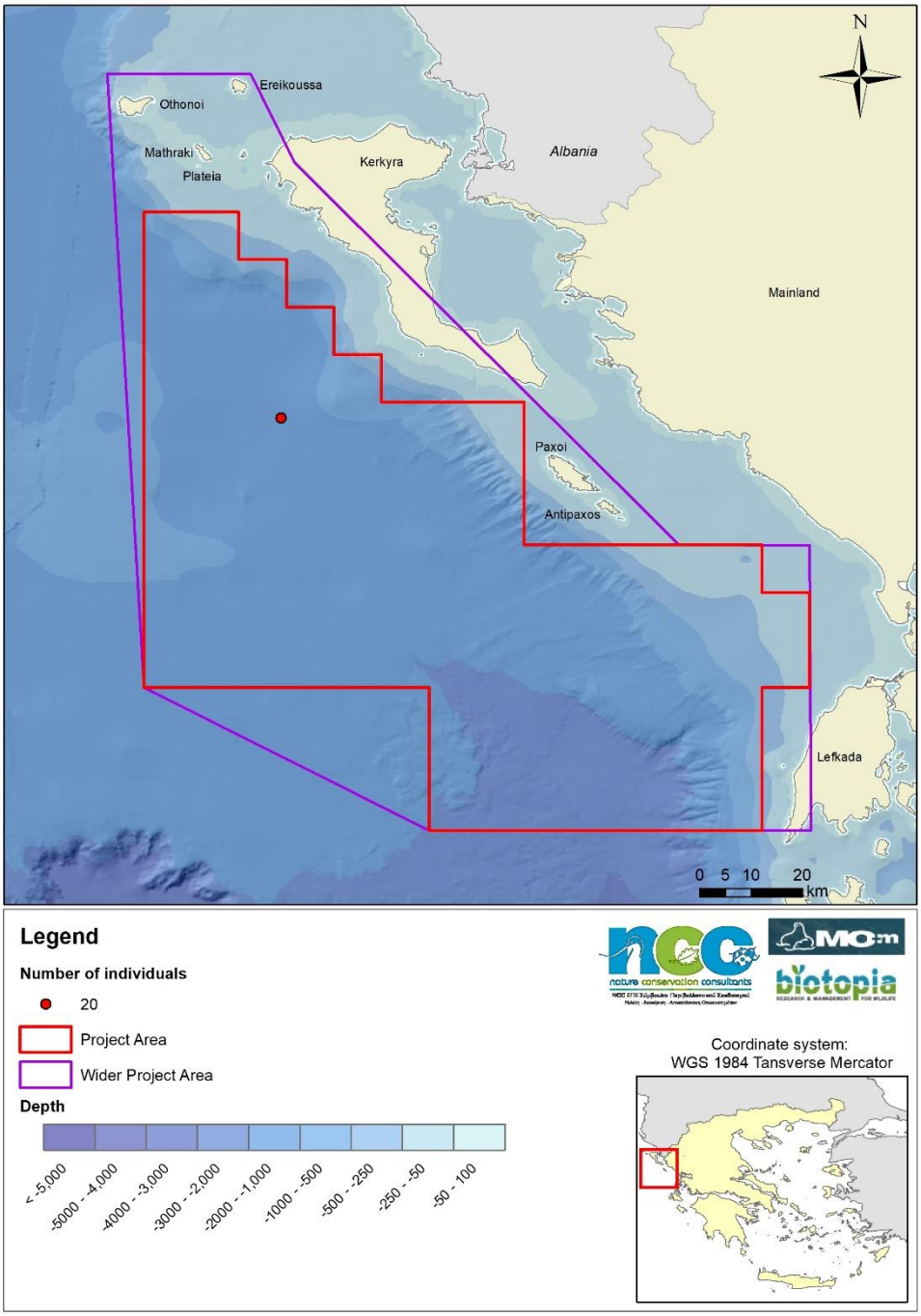

Figure 4-10. Location and number of individuals of the recorded Striped dolphins in summer 2022.

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In September 2022 groups of striped dolphins, ranging in size from 3 to 50 animals, were recorded in almost all parts of the Project Area, with the largest groups being recorded in the south-eastern and western part of the Project Area.

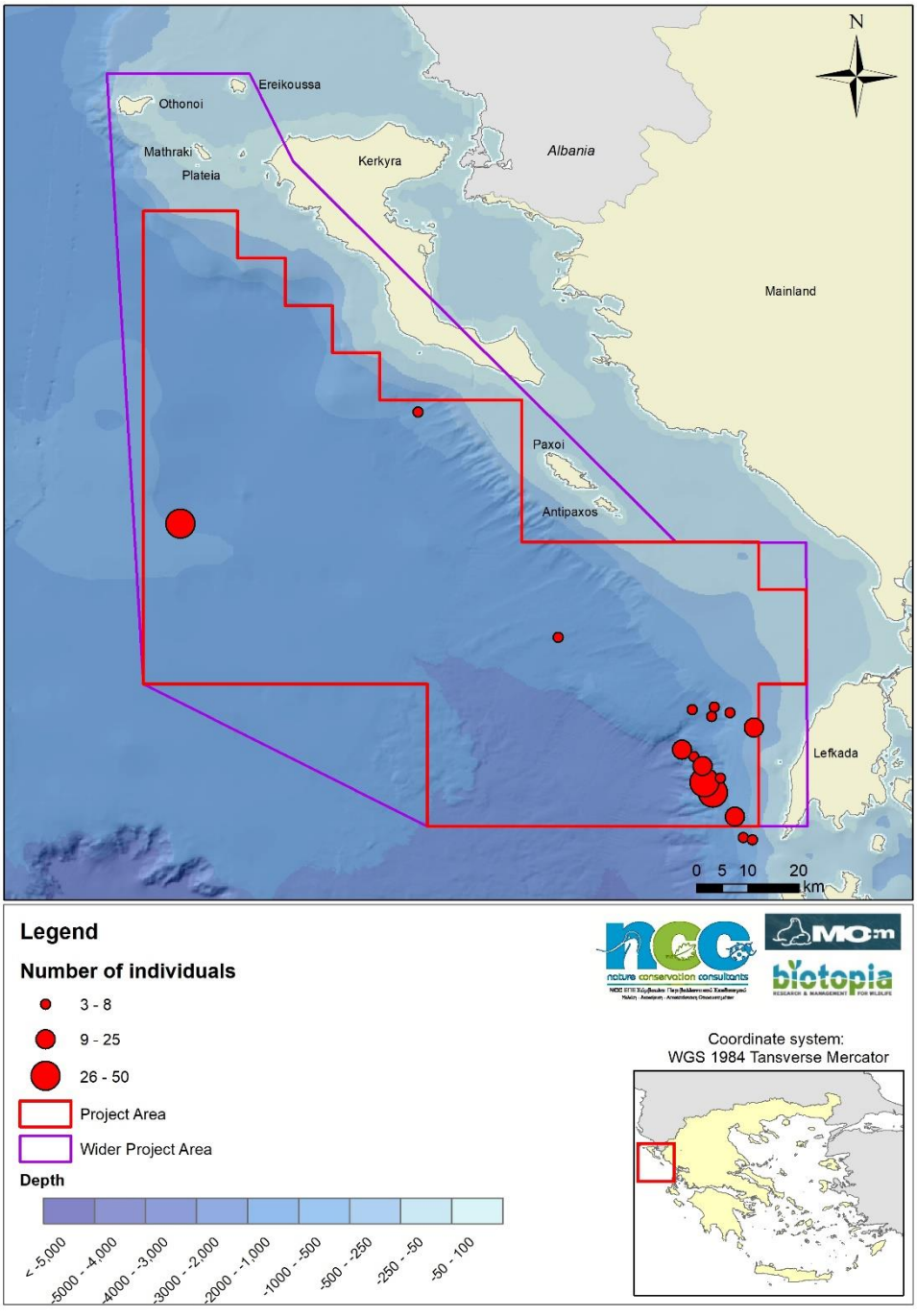

Figure 4-11. Locations and number of individuals of the recorded Striped dolphins in autumn 2022.

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In summer 2022 the average density of recorded individuals per grid cell was 4.25 individuals/km^2.

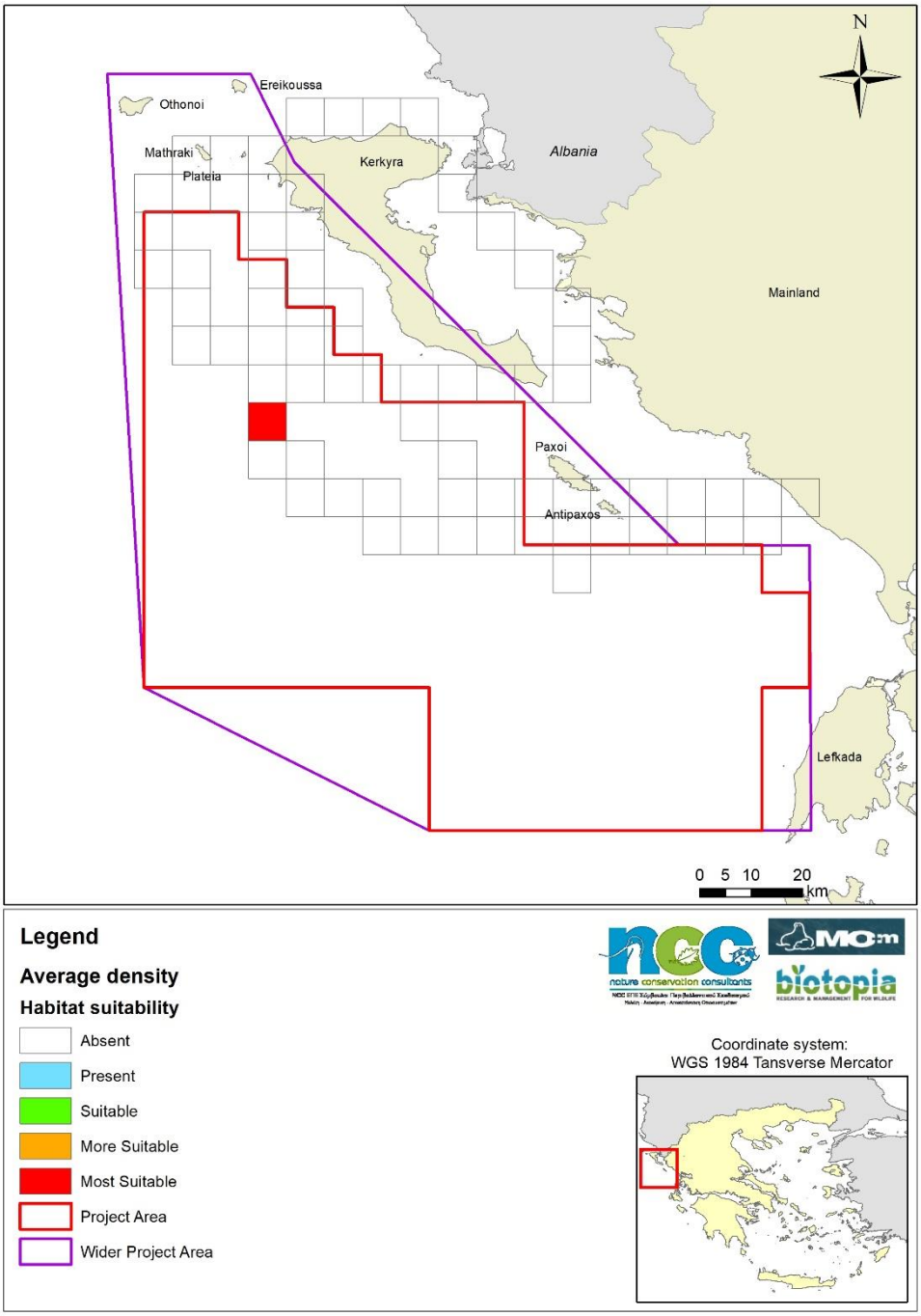

Figure 4-12. Habitat suitability based on the density of the Striped dolphins in summer 2022.

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In September 2022 the density of recorded individuals per grid cell range between 0.41 and 9.79 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.56 individuals/km^2, More Suitable: density ≥ 2.12 individuals/km^2 and Most Suitable: density ≥ 9.79 individuals/km^2.

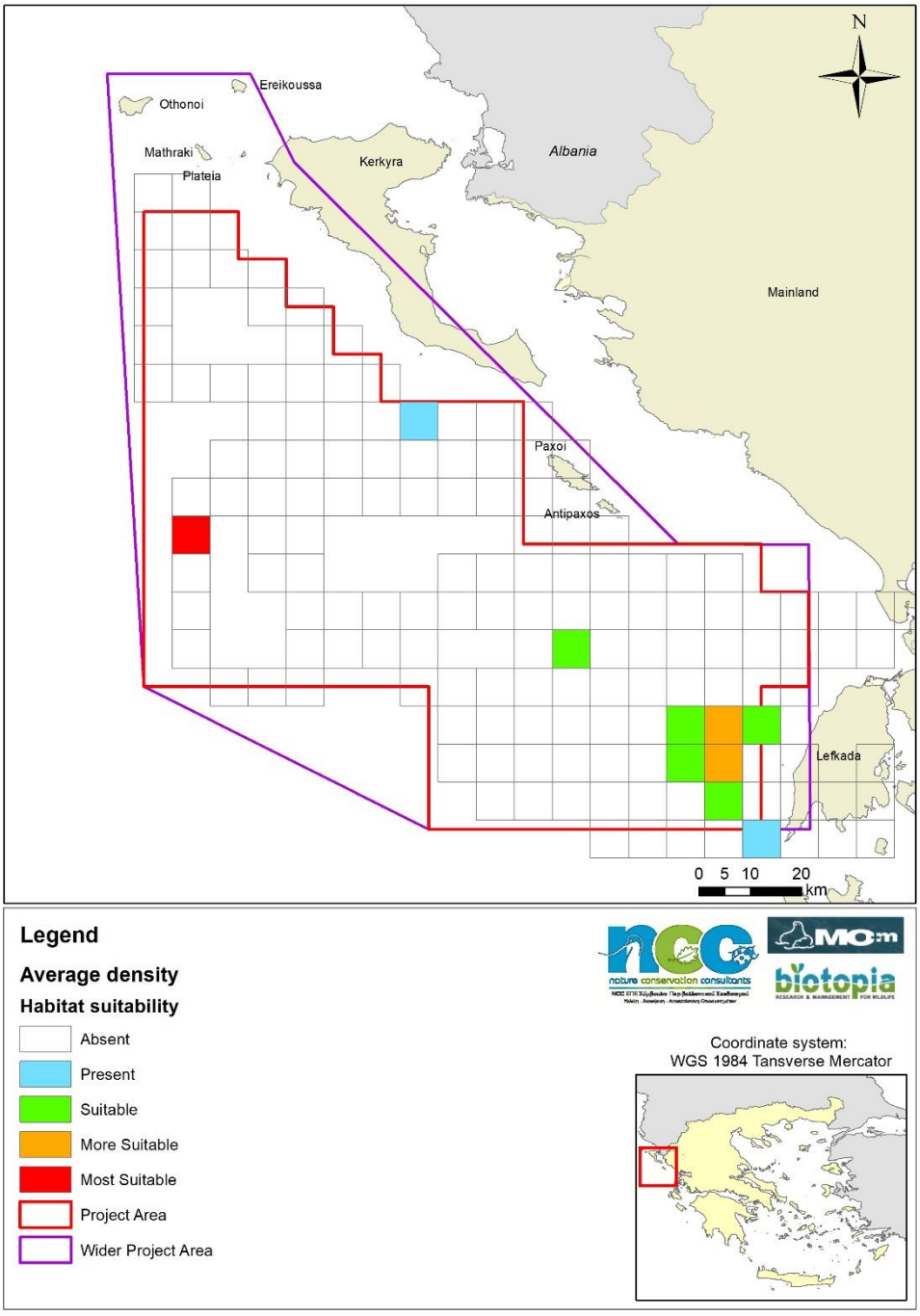

Figure 4-13. Habitat suitability based on the density of the striped dolphins in autumn 2022.

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4.1.1.4 Loggerhead turtle (Caretta caretta)

In June and July 2022 a single Loggerhead turtle was recorded north of the Project Area.

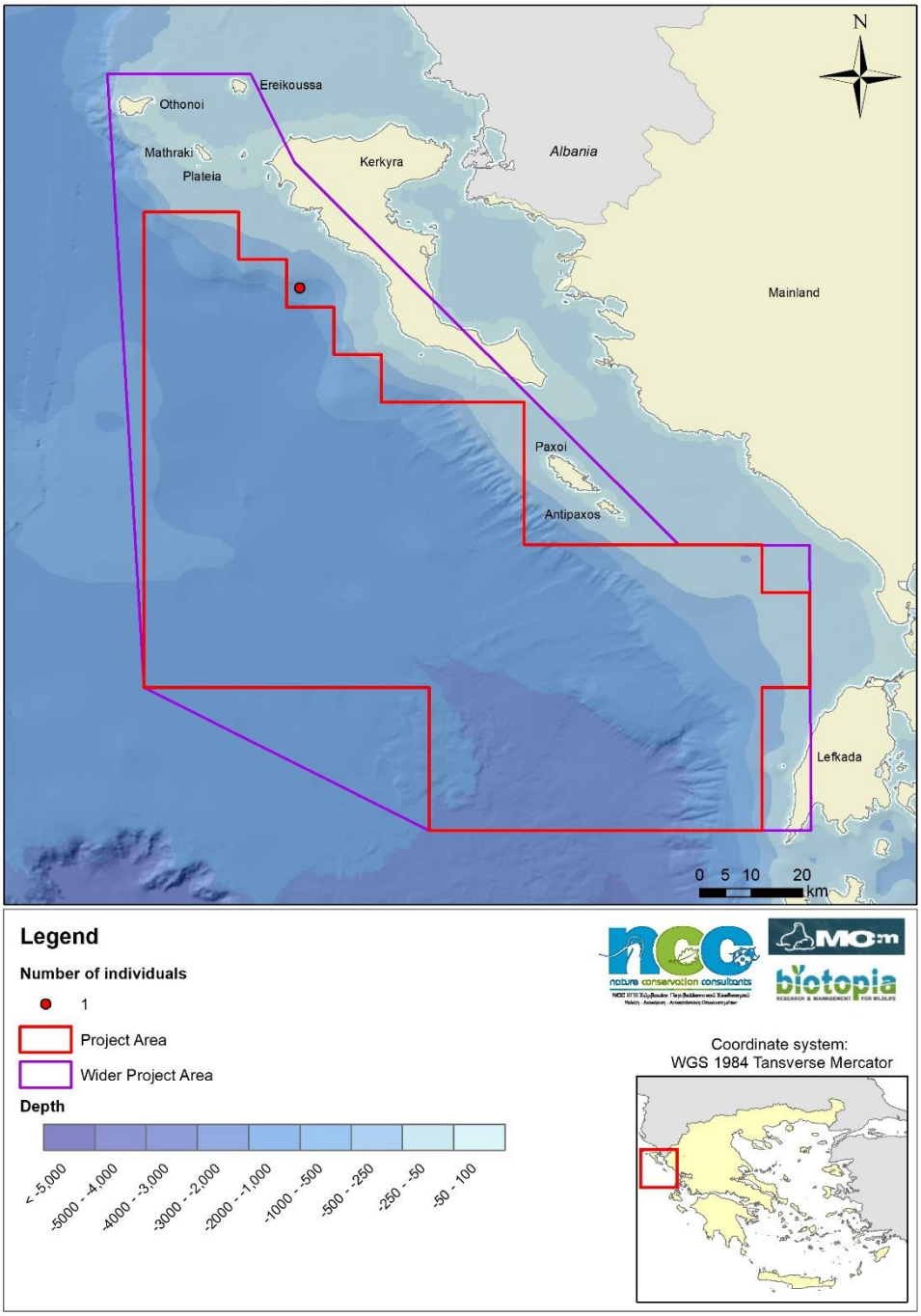

Figure 4-14. Location and number of individuals of the recorded Loggerhead turtle in summer 2022.

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In September 2022 single individual Loggerhead turtles were recorded in the south-eastern and northern part of the Project Area.

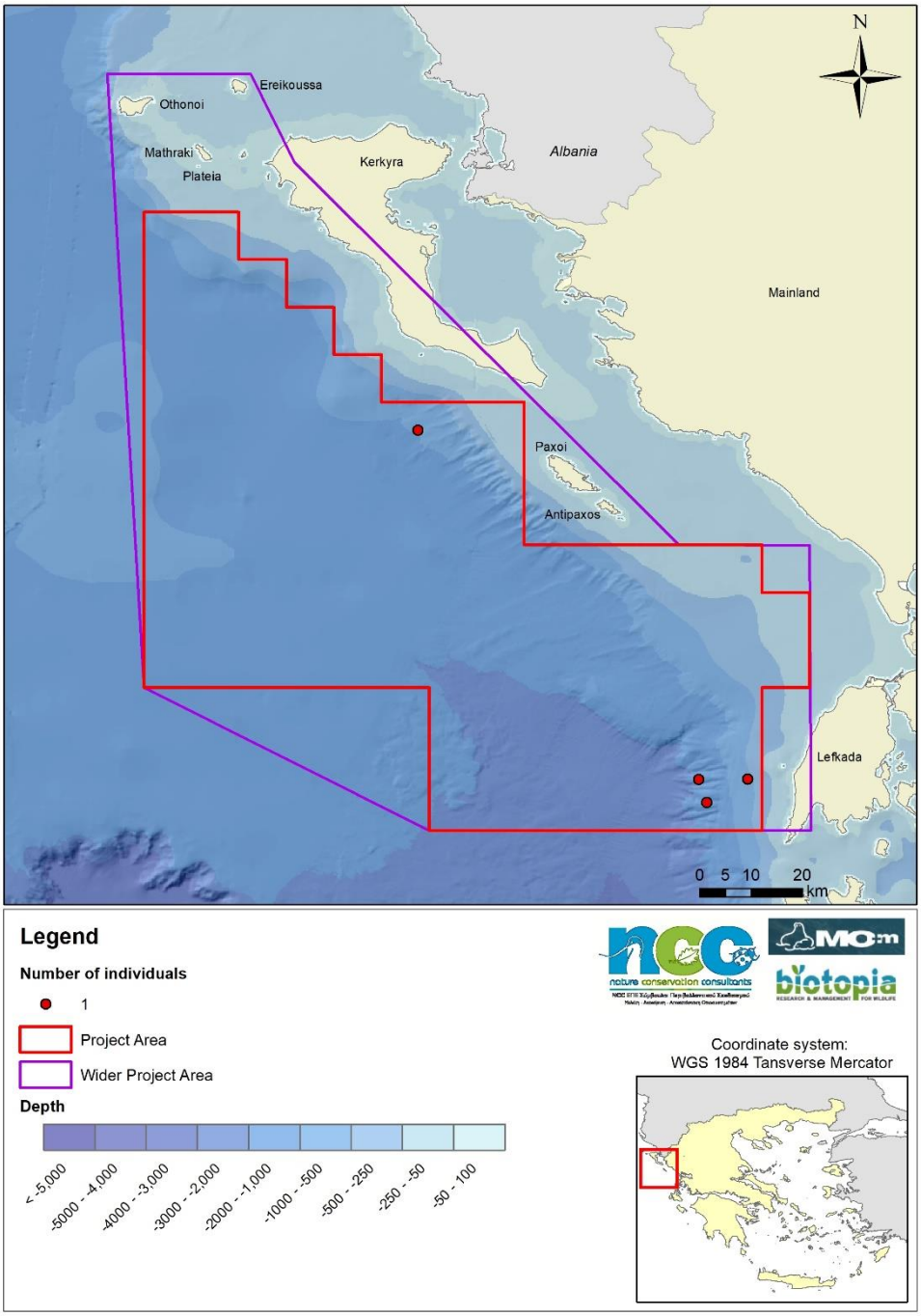

Figure 4-15. Locations and number of individuals of the recorded Loggerhead turtles in autumn 2022.

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In June and July 2022 the average density of recorded individuals per grid cell was 0.11 individuals/km^2.

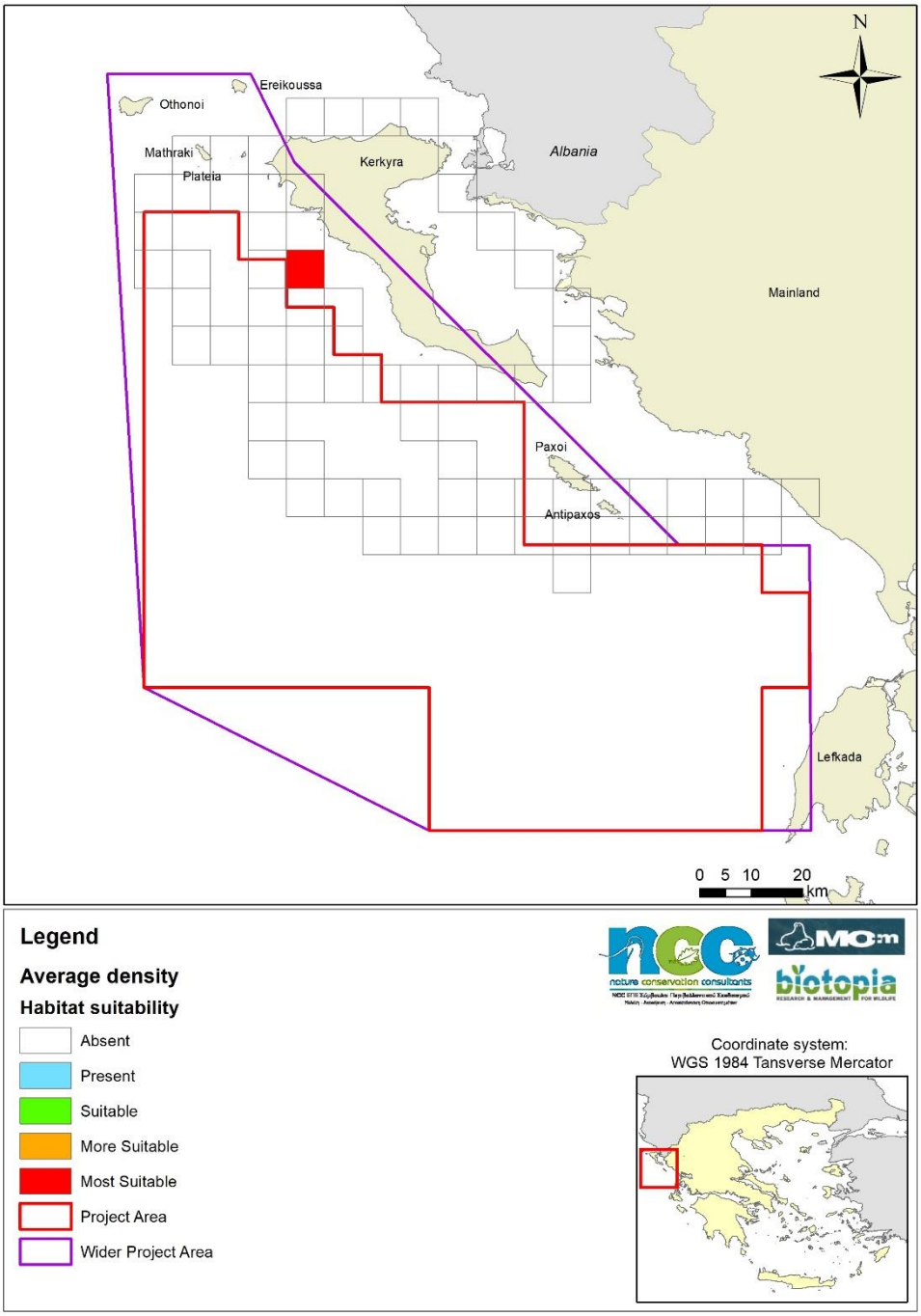

Figure 4-16. Habitat suitability based on the density of the Loggerhead turtle in summer 2022.

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In September 2022 the average density of recorded individuals per grid cell ranged between 0.02 and 0.15 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.02 individuals/km^2, More Suitable: density ≥ 0.15 individuals/km^2 and Most Suitable: density ≥ 0.15 individuals/km^2.

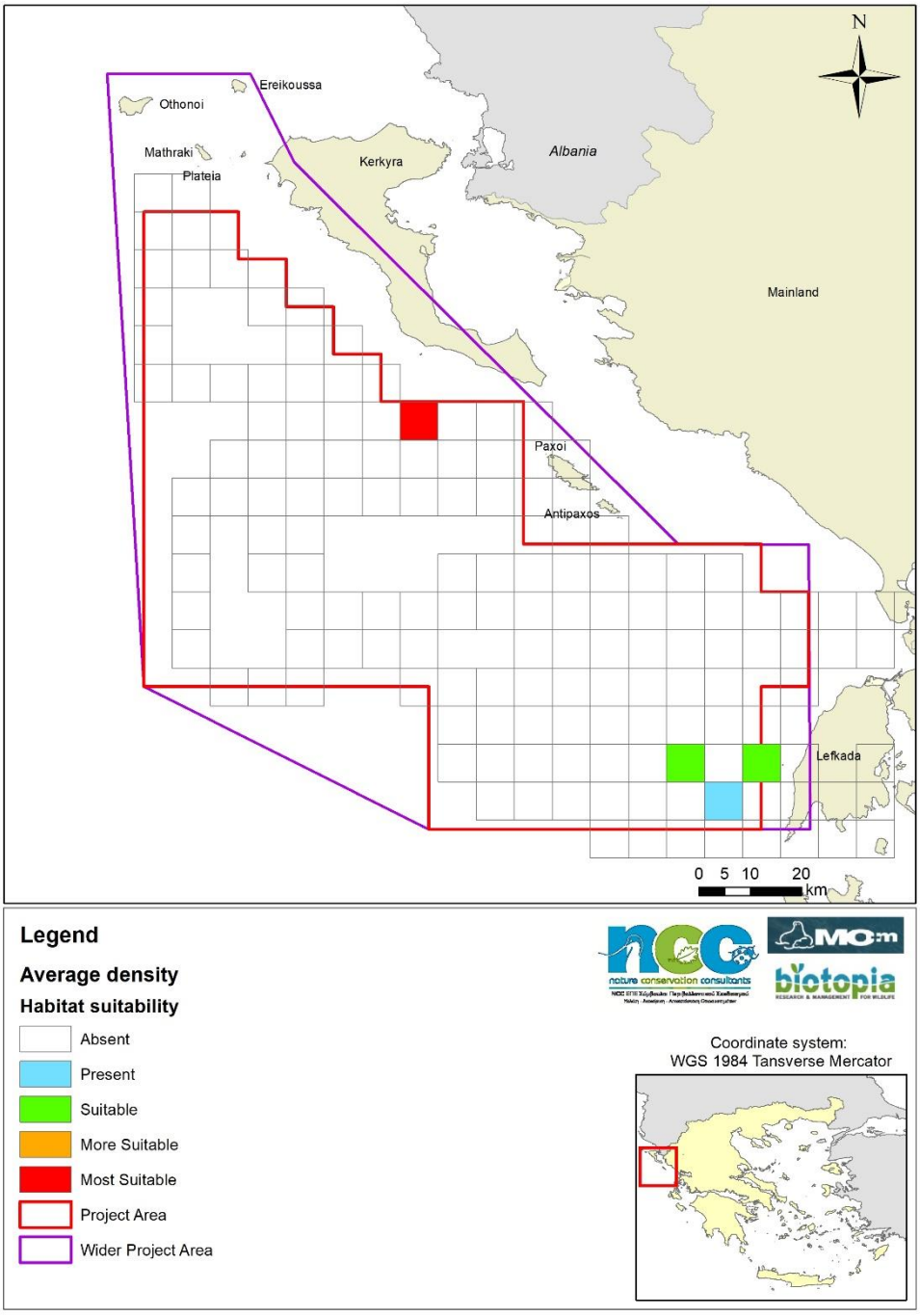

Figure 4-17. Habitat suitability based on the density of the Loggerhead turtle in autumn 2022.

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4.1.1.5 Scopoli's Shearwater (Calonectris diomedea)

In June and July 2022 individual birds or small groups of birds were recorded in the Project Area, while up to 1000 individuals were recorded rafting in the vicinity of the species colony in the northern part of the Wider Project Area.

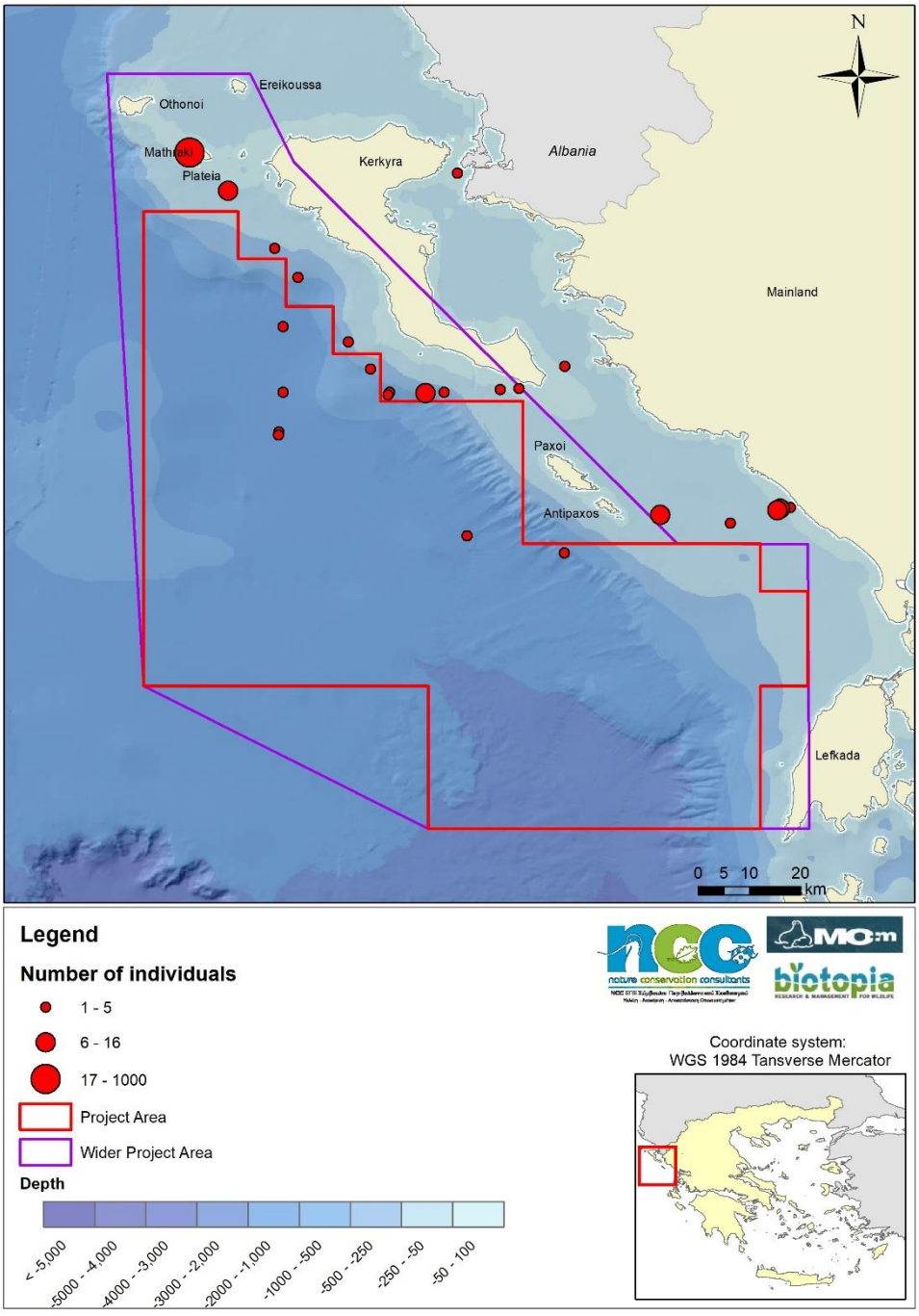

Figure 4-18. Locations and number of individuals of the recorded Scopoli's Shearwater in summer 2022.

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In September 2022 individual birds and flocks of up to 40 individuals were recorded primarily in shallower water closer to islands and the mainland within and outside Wider Project Area, as well as individual birds or small groups dispersed within the Project Area

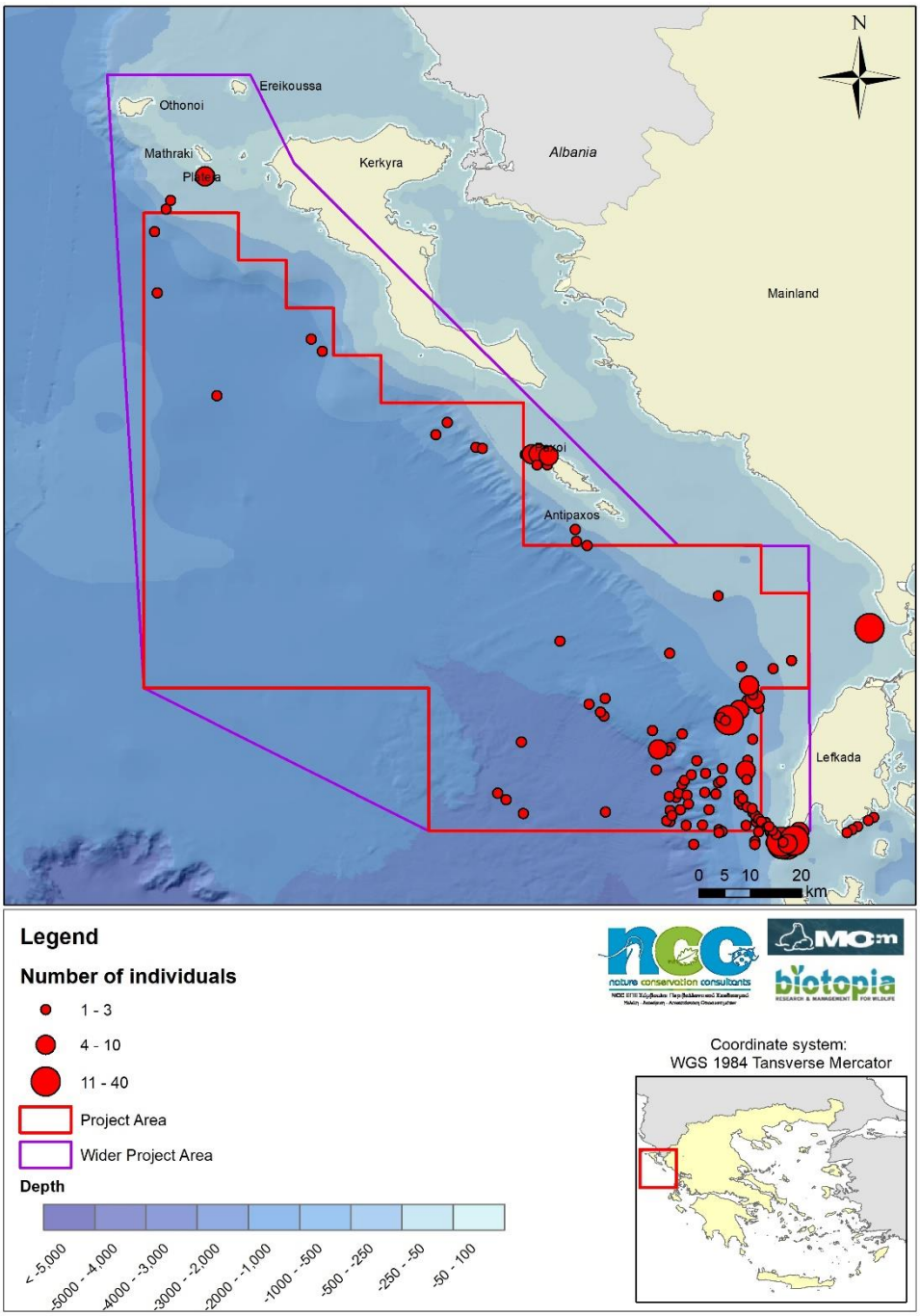

Figure 4-19. Locations and number of individuals of the recorded Scopoli's Shearwater in autumn 2022.

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In June and July 2022, the average density of recorded individuals per grid cell ranged between 0.13 and 402 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.28 individuals/km^2, More Suitable: density ≥ 1.13 individuals/km^2 and Most Suitable: density ≥ 4.5 individuals/km^2.

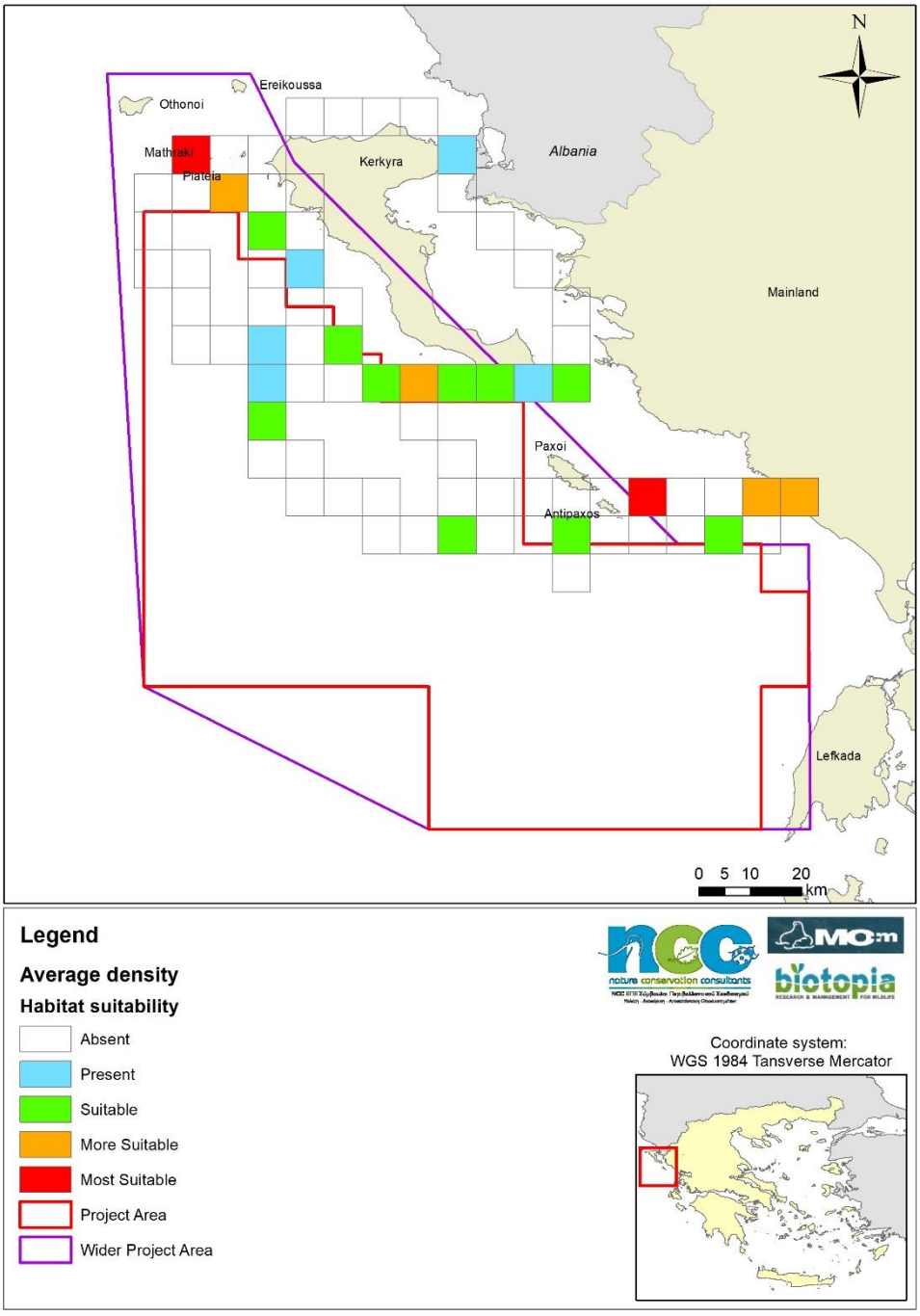

Figure 4-20. Habitat suitability based on the density of the Scopoli's Shearwater in summer 2022.

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In September 2022 the average density of recorded individuals per grid cell ranged between 0.04 and 7.02 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.21 individuals/km^2, More Suitable: density ≥ 0.52 individuals/km^2 and Most Suitable: density ≥ 2.36 individuals/km^2.

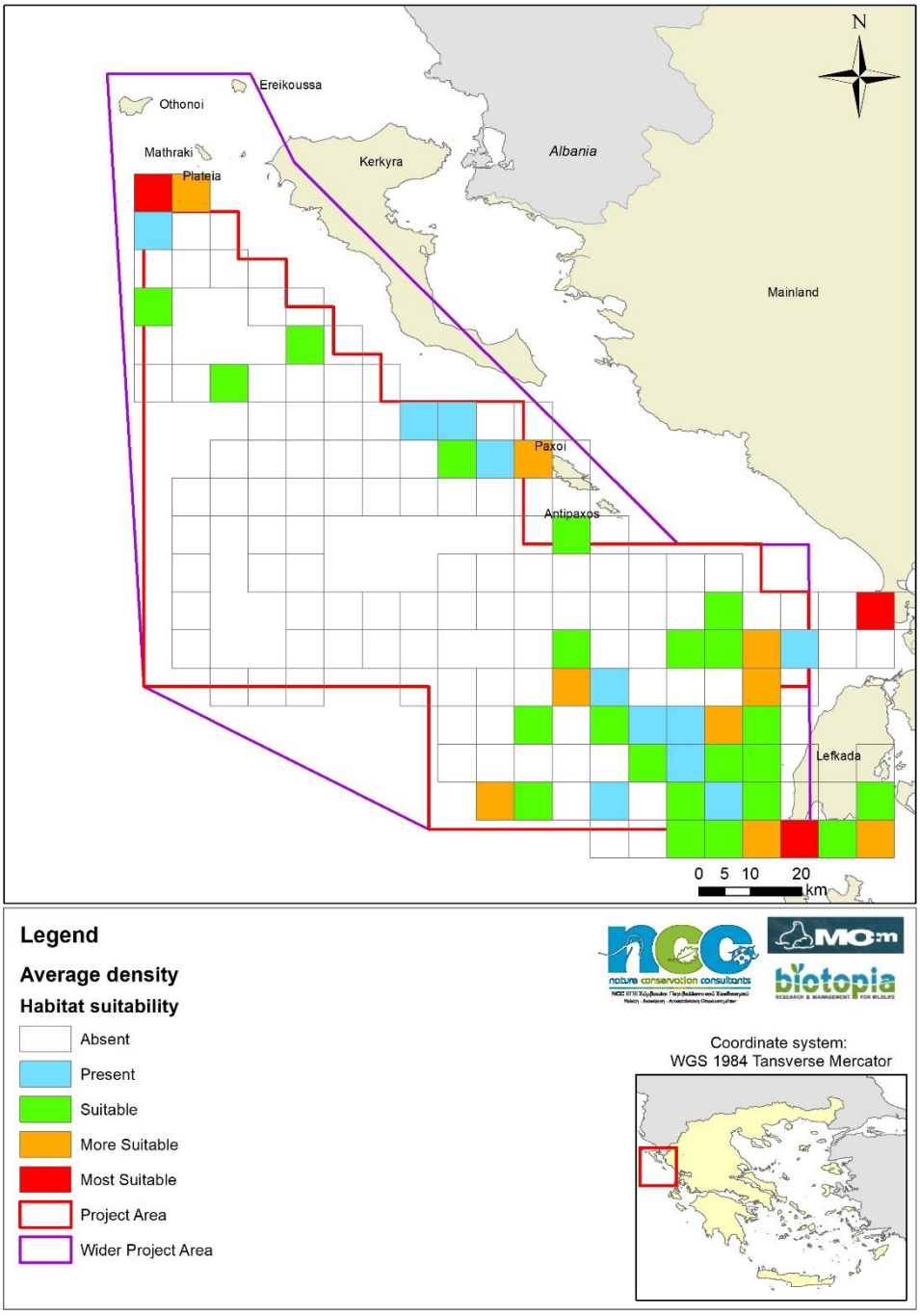

Figure 4-21. Habitat suitability based on the density of the Scopoli's Shearwater in autumn 2022.

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4.1.1.6 Yelkouan Shearwater (Puffinus yelkouan)

In June and July 2022 five Yelkouan Shearwaters were recorded in the northern part of the Project Area.

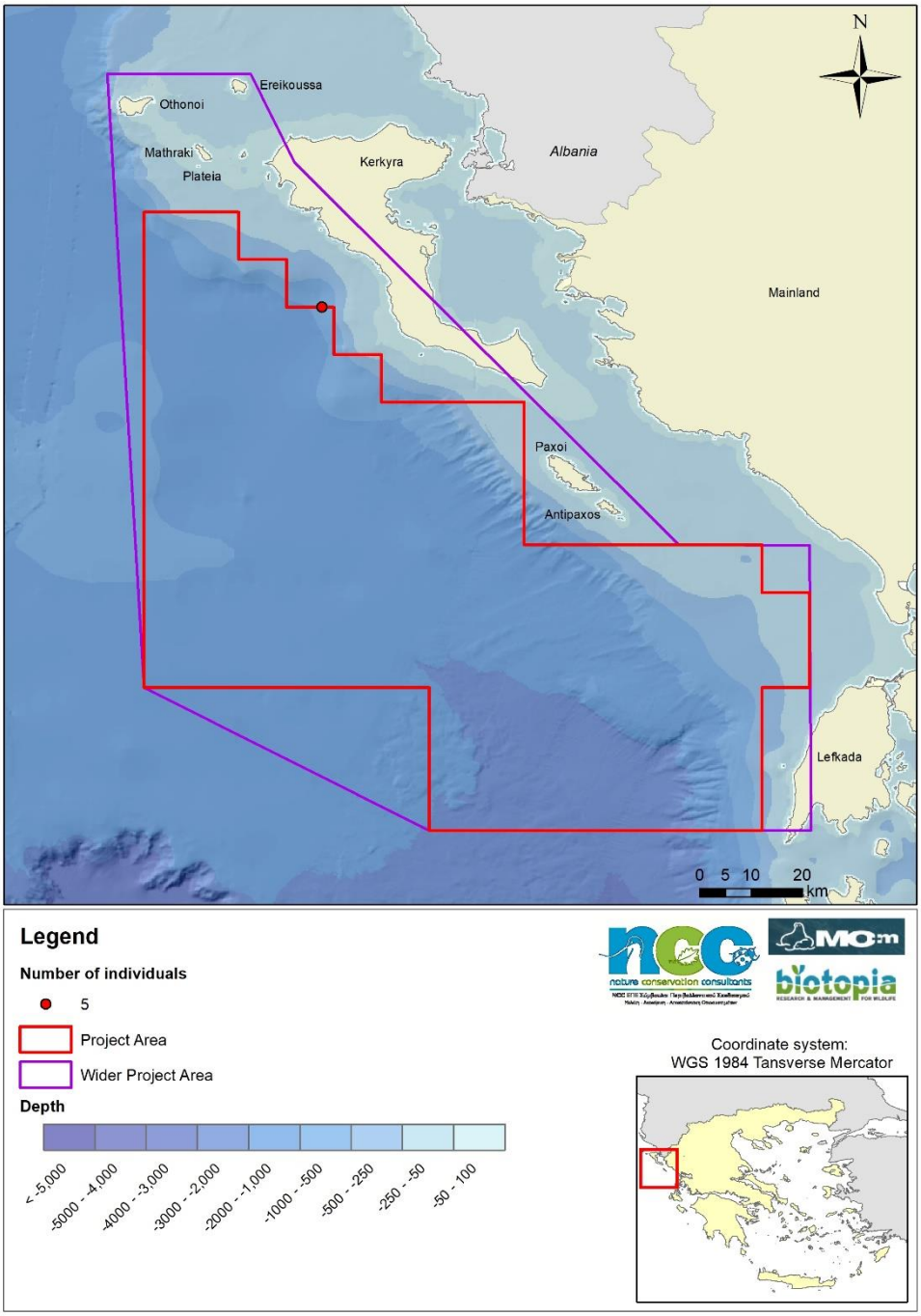

Figure 4-22. Location and number of individuals of the recorded Yelkouan Shearwater in summer 2022.

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

In September 2022 Yelkouan Shearwaters were recorded primarily southeast of the Project Area, while two single individuals were also recorded within the Project Area.

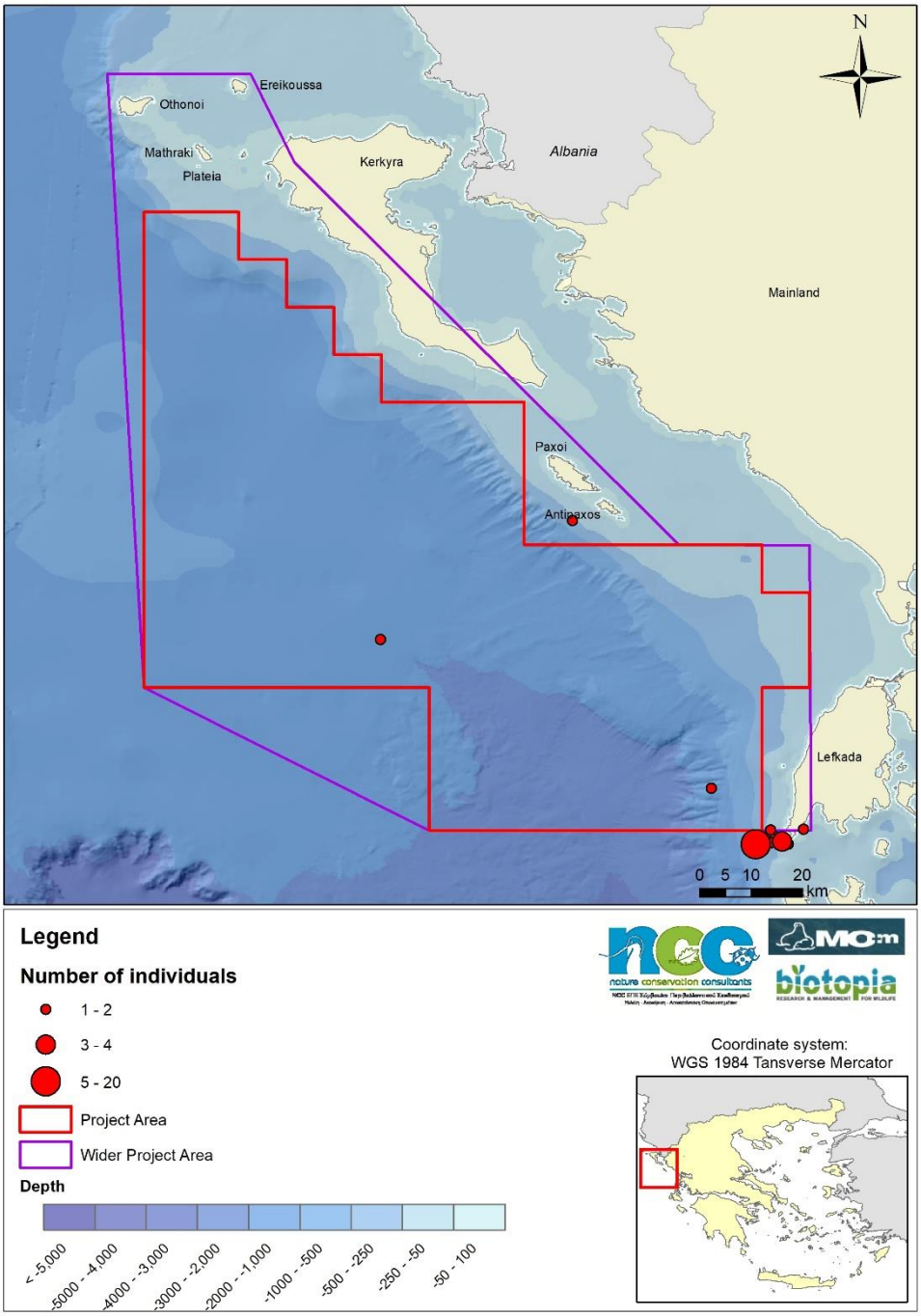

Figure 4-23. Locations and number of individuals of the recorded Yelkouan Shearwater in autumn 2022.

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In June and July 2022 the average density of recorded individuals per grid cell was 0.94 individuals/km^2.

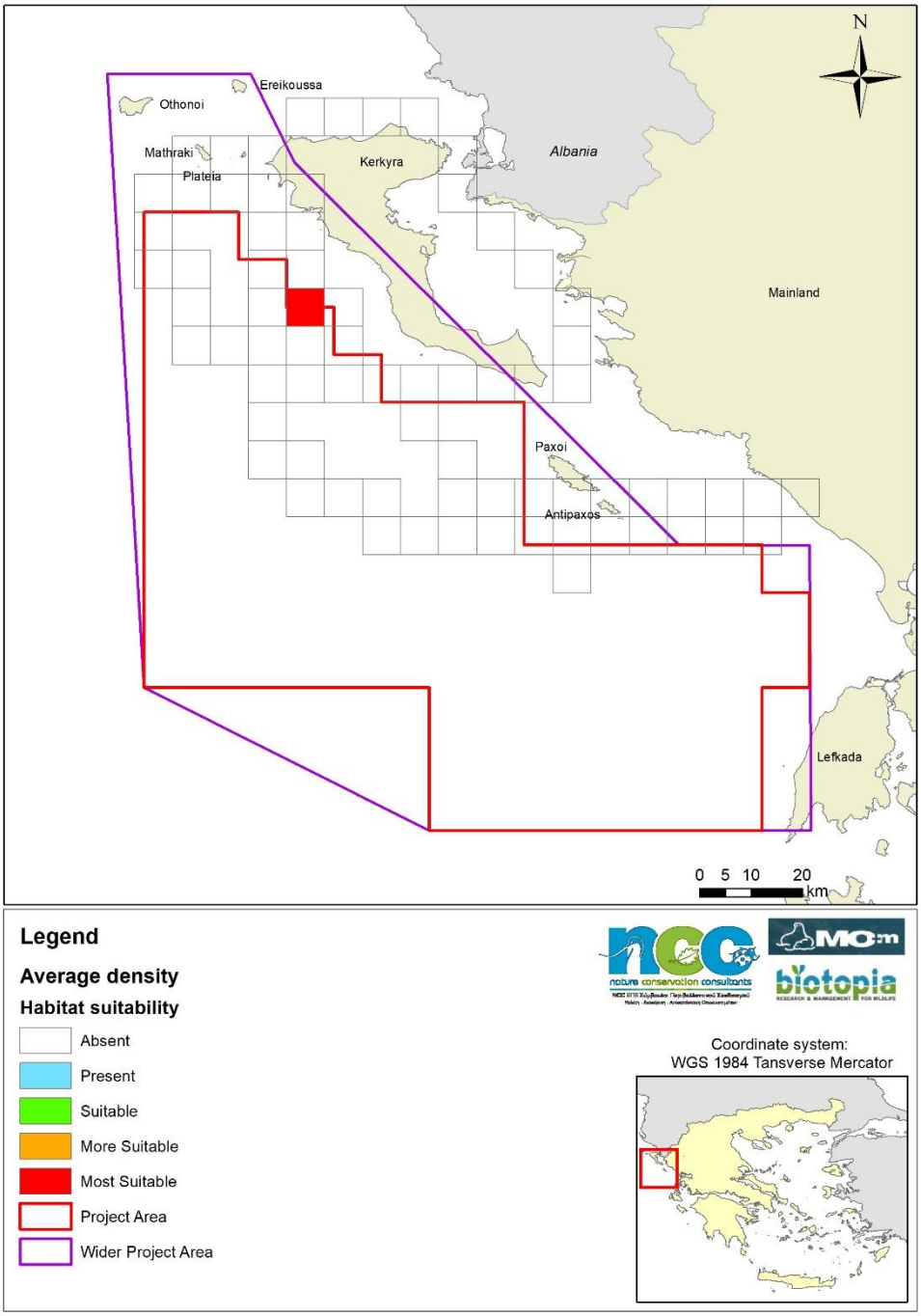

Figure 4-24. Habitat suitability based on the density of the Yelkouan Shearwater in summer 2022.

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In September 2022 the average density of recorded individuals per grid cell ranged between 0.05 and 1.61 individuals/km^2. Based on the densities, the habitat suitability classes were Suitable: density ≥ 0.10 individuals/km^2, More Suitable: density ≥ 0.23 individuals/km^2 and Most Suitable: density ≥ 1.61 individuals/km^2.

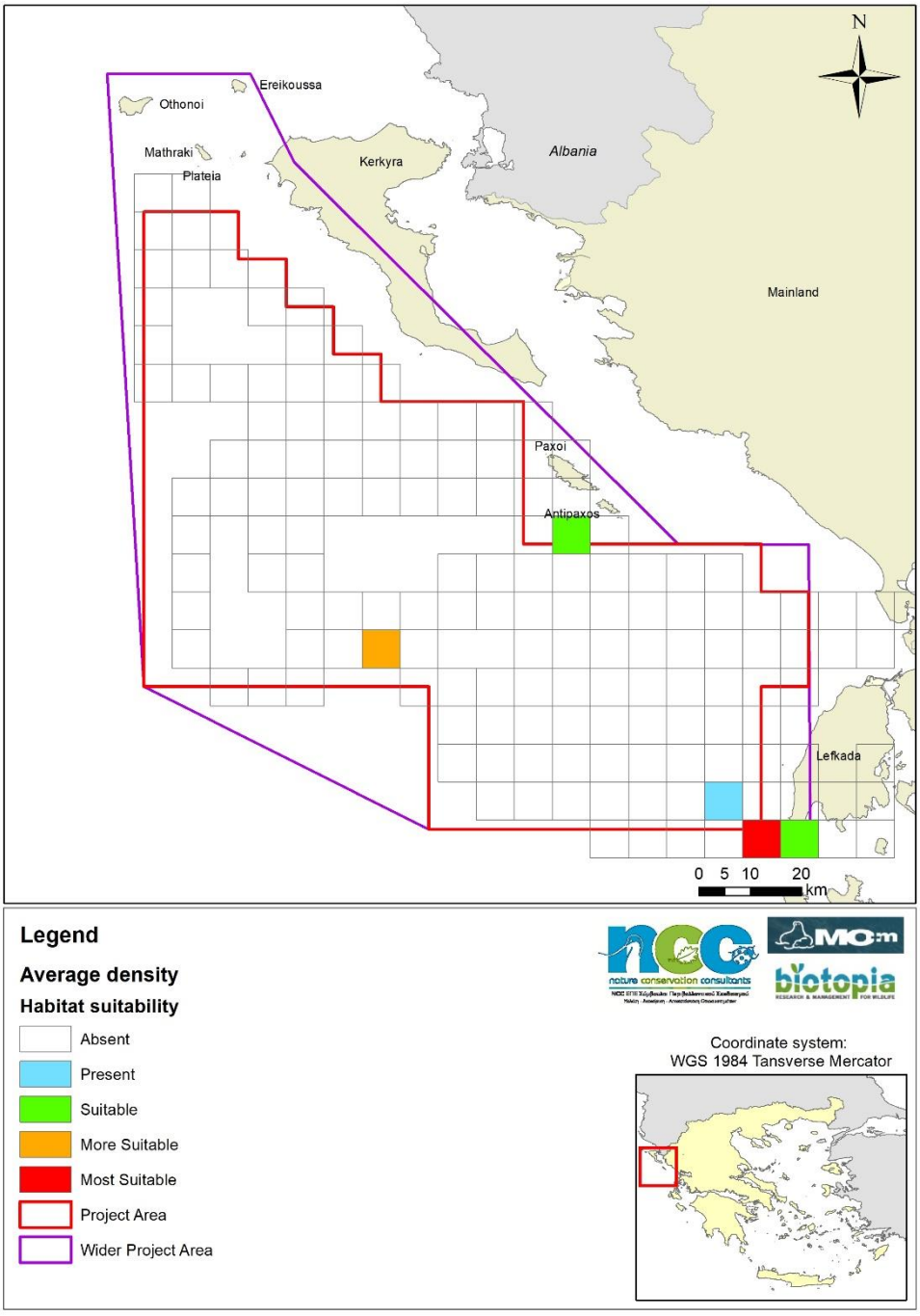

Figure 4-25. Habitat suitability based on the density of the Yelkouan Shearwater in autumn 2022.

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4.1.1.7 European Storm-petrel (Hydrobates pelagicus)

In June 2022 two European Storm-petrels were recorded in a vicinity of land in the northern part of the Wider Project area, presumably associated with a breeding colony. During a follow up visit in July, when trail cameras and 4 bio-acoustic stations were placed at the colony site, at least 8 individuals have been recorded with the thermal camera at the islet.

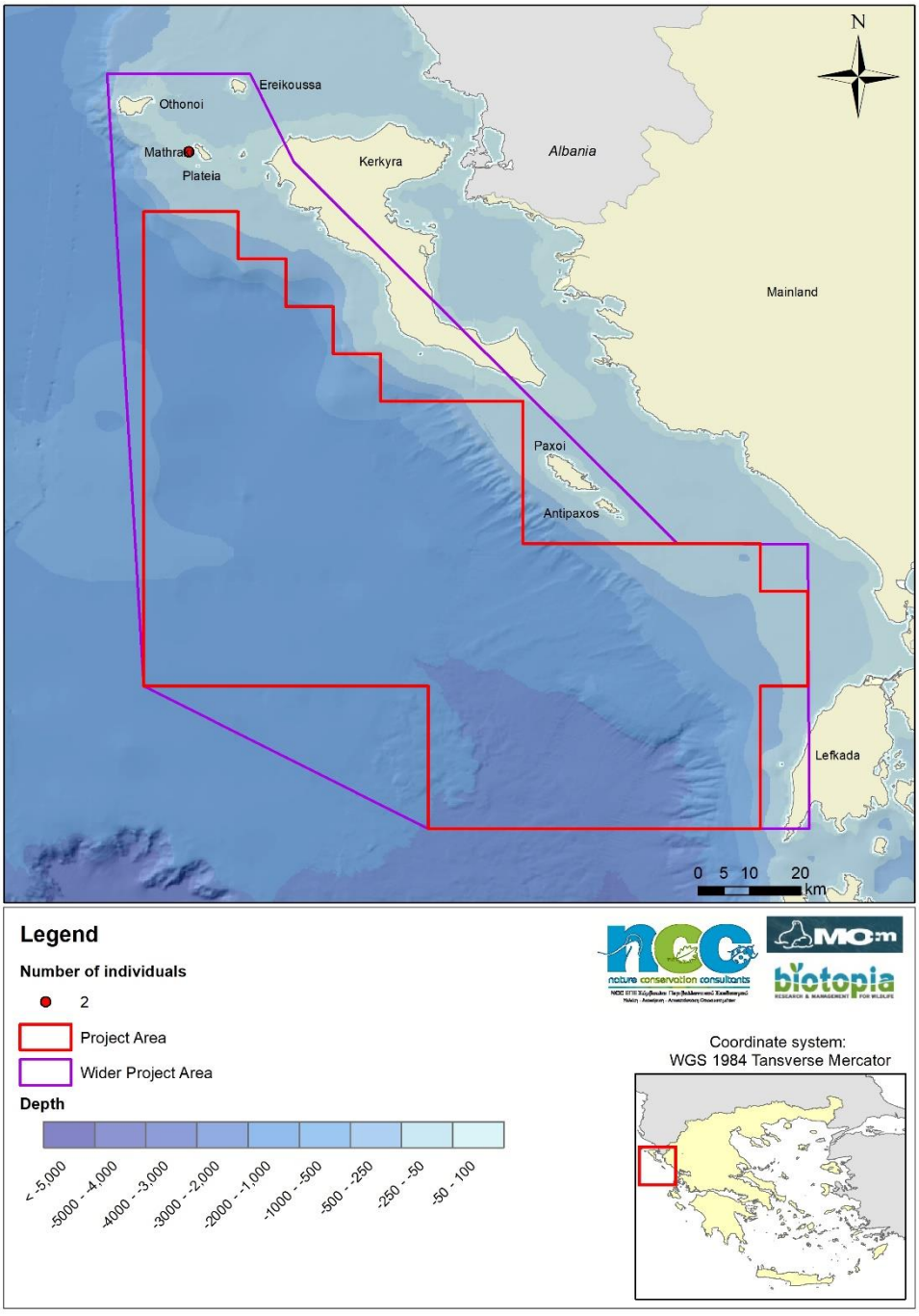

Figure 4-26. Location and number of individuals of the recorded European Storm-petrel in summer 2022.

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4.1.1.8 Mediterranean Shag (Phalacrocorax aristotelis desmarestii)

In June 2022 Mediterranean Shags have been recorded along the coast of islands in the eastern and northern part of the Wider Project Area.

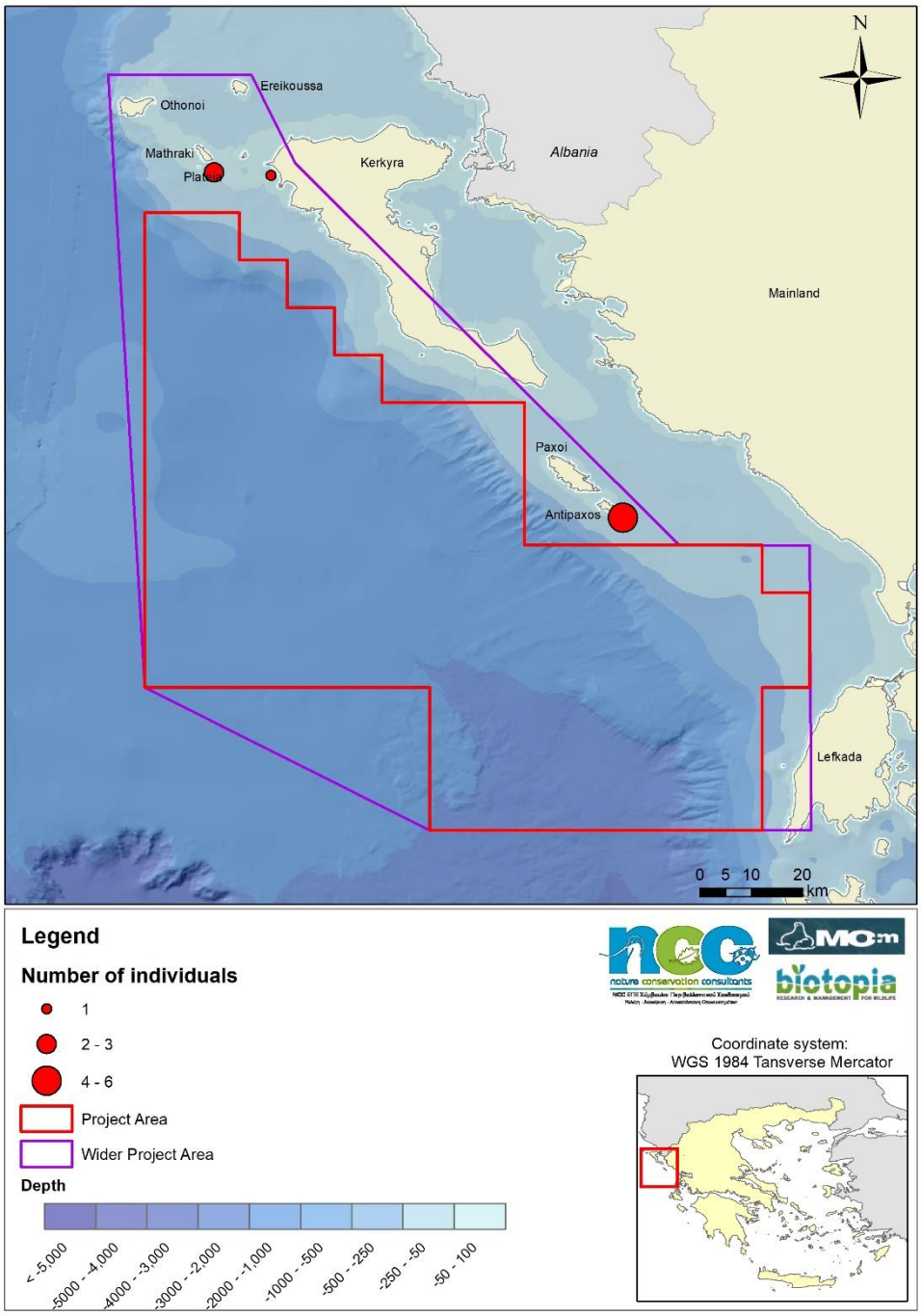

Figure 4-27. Locations and number of individuals of the recorded Mediterranean Shag in summer 2022.

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4.1.1.9 Yellow-legged Gull (Larus michahellis)

In June 2022 a flock of Yellow-legged Gulls was recorded at Antipaxos, while in September 2022 only a single individual was recorded in the northern part of the Project Area.

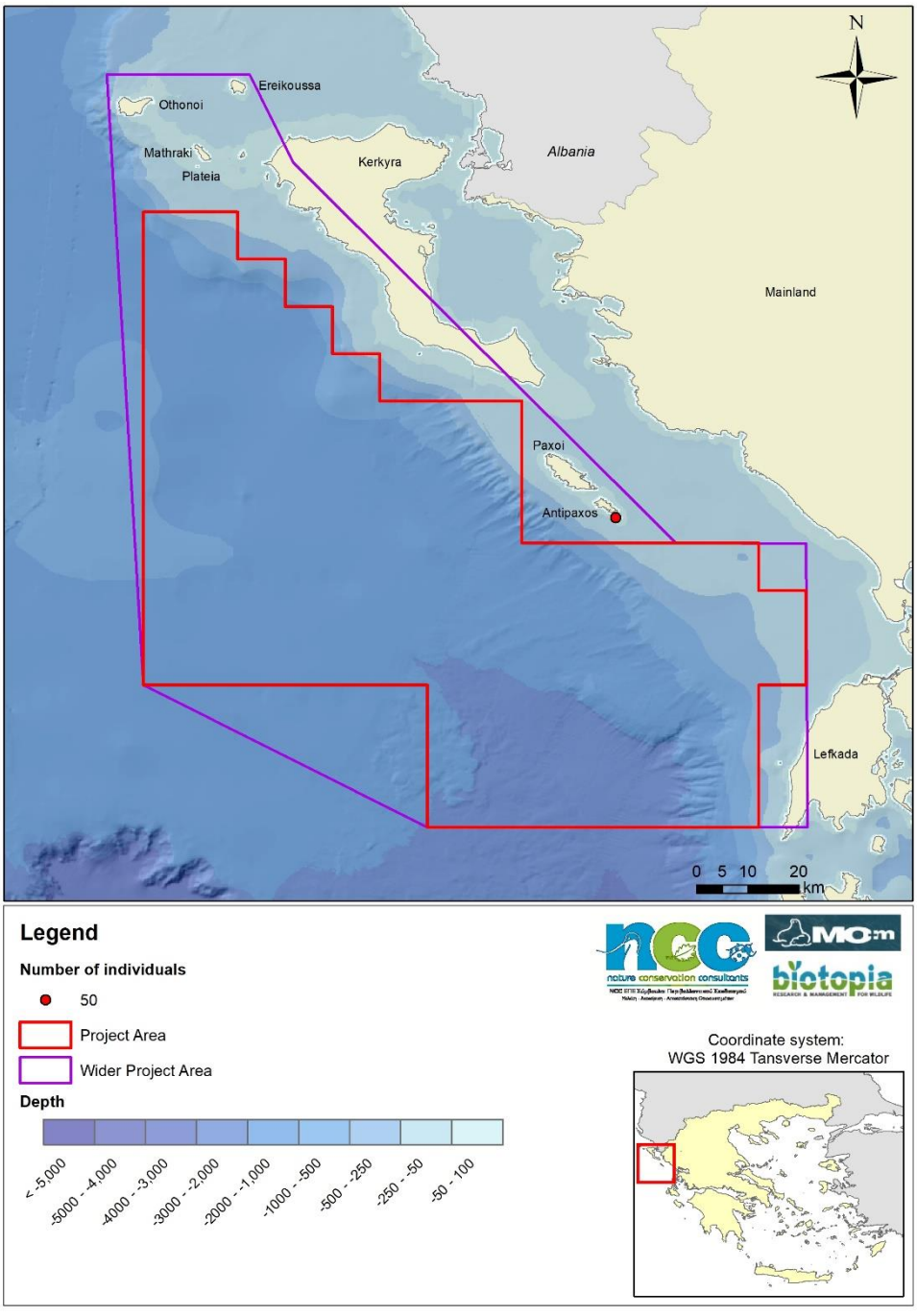

Figure 4-28. Location and number of individuals of the recorded Yellow-legged Gull in summer 2022.

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

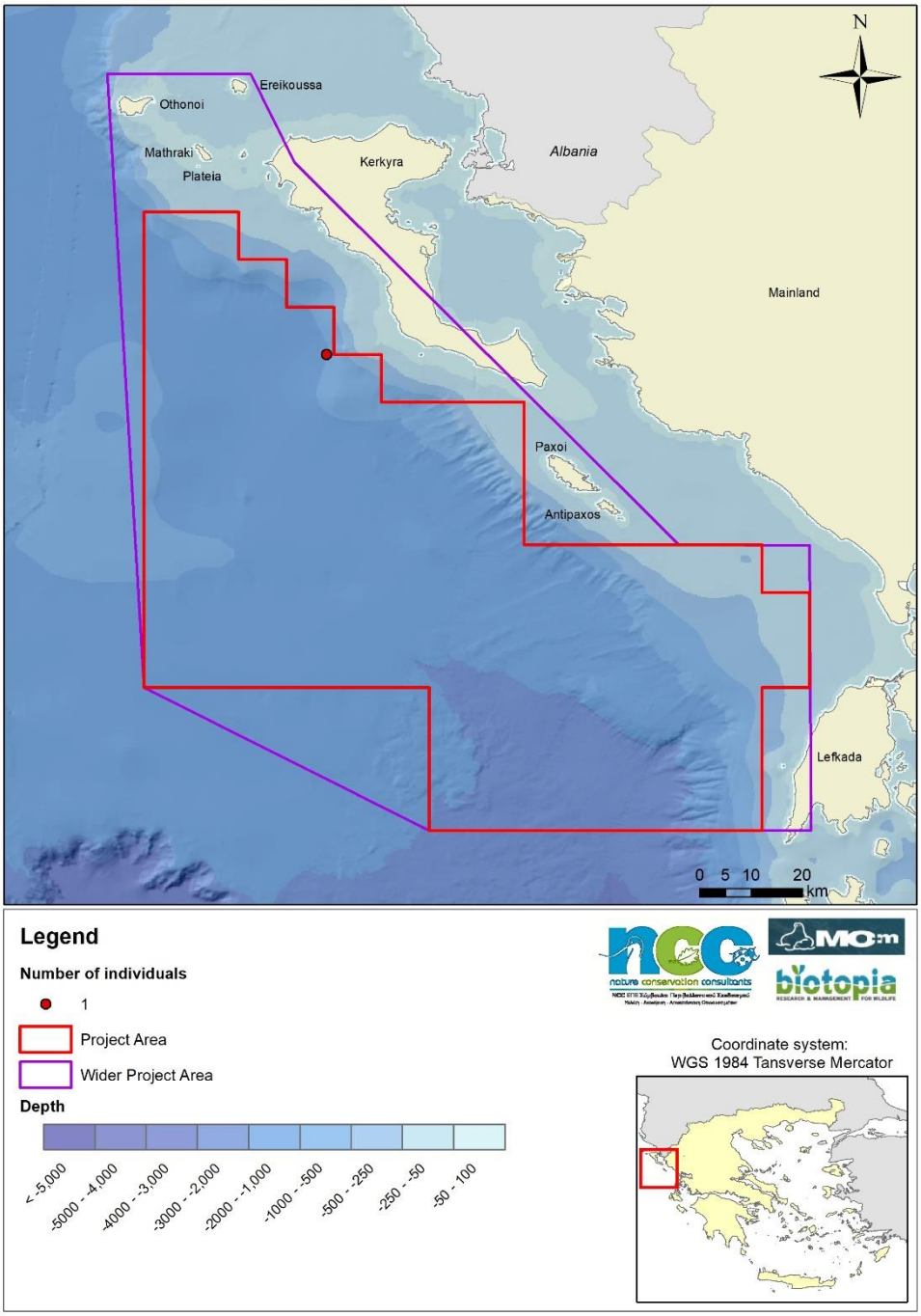

Figure 4-29. Location and number of individuals of the recorded Yellow-legged Gull in autumn 2022.

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

4.1.2 Cetacean surveys

Visual observations were combined with acoustic surveys for the detection and identification of cetaceans during the pelagic surveys. Effort was measured in km of navigation under the following conditions: (1) daylight and good visibility; (2) sea state <3 Beaufort with little to no swell (including either completely flat sea, flat sea with capillary waves or wavelets with no foam or breaking crests); (3) at least three experienced observers scanning the sea surface in search of dolphins; (4) eye elevation of at least 2m for all observers.

Summer 2022

In summer 2022 the total effort of cetacean surveys within the Wider Project Area during the present study was 561km, during which 3 cetacean species were encountered:

1) Striped Dolphin – *Stenella coeruleoalba*
2) Common bottlenose dolphin - *Tursiops truncatus*
3) Cuvier's Beaked Whale – *Ziphius cavirostris*

Overall Encounter Rates as well as encounter rates for each species sighted during our surveys are shown in Table below. Values are provided both for groups encountered/100km and individuals encountered/100km for each species.

Table 4-2. Overall Encounter Rates for the cetacean survey

Species	# of Groups Enc.	# of Ind. Enc.	Enc. Rate (groups/100km)	Enc. Rate (Ind./100km)
Stenella coeruleoalba	1	20	0.18	3.57
Tursiops truncatus	3	18	0.53	3.21
Ziphius cavirostris	1	2	0.18	0.36
All	5	40	0.89	7.13

Relative abundance of species in the Wider Project Area is shown in the followingTable.

Table 4-3. Species relative abundance

Species	Relative abundance	
	Groups	Individuals
Stenella coeruleoalba	20.0%	50.0%
Tursiops truncatus	60.0%	45.0%
Ziphius cavirostris	20.0%	5.0%

The mean depths at which each species was encountered were the following:

Striped Dolphin: 1,460m

Common bottlenose dolphin: 95m

Cuvier's Beaked Whale: 1,500m

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Autumn 2022

In September 2022 the total effort of cetacean surveys within the Wider Project Area during the present study was 1.715km, during which 3 cetacean species were encountered:

1) Striped Dolphin – *Stenella coeruleoalba*
2) Common bottlenose dolphin - *Tursiops truncatus*
3) Cuvier's Beaked Whale – *Ziphius cavirostris*

Overall Encounter Rates as well as encounter rates for each species sighted during our surveys are shown in Table below. Values are provided both for groups encountered/100km and individuals encountered/100km for each species.

Table 4-4. Overall Encounter Rates for the cetacean survey

Species	# of Groups Enc.	# of Ind. Enc.	Enc. Rate (groups/100km)	Enc. Rate (Ind./100km)
Stenella coeruleoalba	17	281	0.99	16.38
Tursiops truncatus	8	30	0.47	1.75
Ziphius cavirostris	5	9	0.29	0.52
All	30	320	1.75	18.66

Relative abundance of species in the Wider Project Area is shown in the following Table.

Table 4-5. Species relative abundance

Species	Relative abundance	
	Groups	Individuals
Stenella coeruleoalba	56.7%	87.8%
Tursiops truncatus	26.7%	9.4%
Ziphius cavirostris	16.7%	2.8%

The mean depths at which each species was encountered were the following:

Striped Dolphin: 1090m (Range: 559m-1670m)

Common bottlenose dolphin: 208m (Range: 27m-650m, Median depth 64m)

Cuvier's Beaked Whale: 1,446m (Range: 877m – 2,269m)

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Figure 4-30. Common bottlenose dolphins and Cuvier's Beaked Whale during the cetacean surveys.

Figure 4-31. Striped dolphins during the cetacean surveys.

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4.1.3 Drone surveys

Two drone transect surveys took place during June 21 and 22 and 23 of June boat surveys, at the offshore part of the project area, to record marine mammals and seabirds. In the first case drone transects took place 15 n.m west of Corfu and Paxoi at suitable habitats with water depths exceeding 1.200 m. (total transect length 5km). For the second case drone transects took place at the offshore boat transects 10 n.m west of Corfu Island.

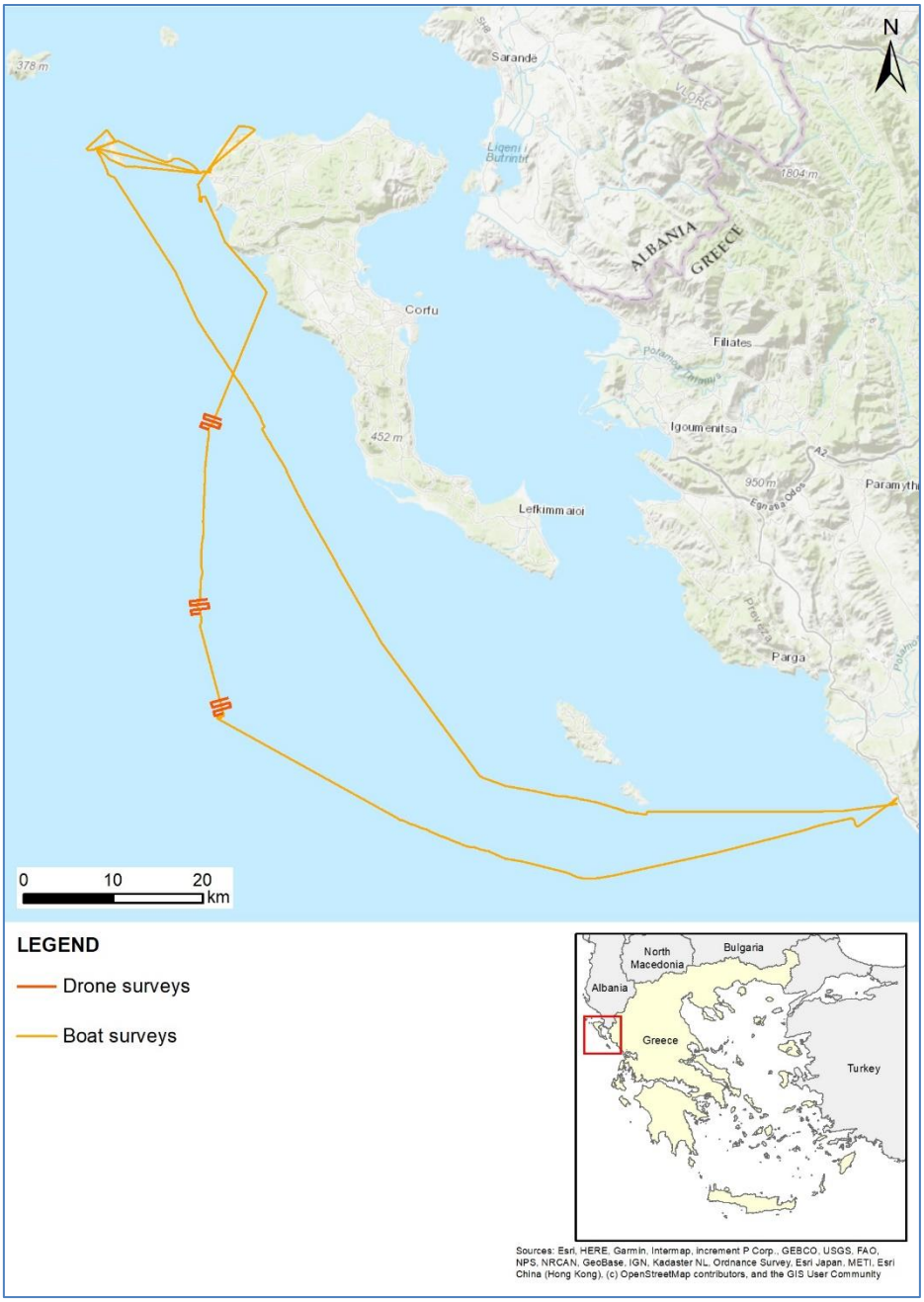

Figure 4-32. Drone surveys tracks

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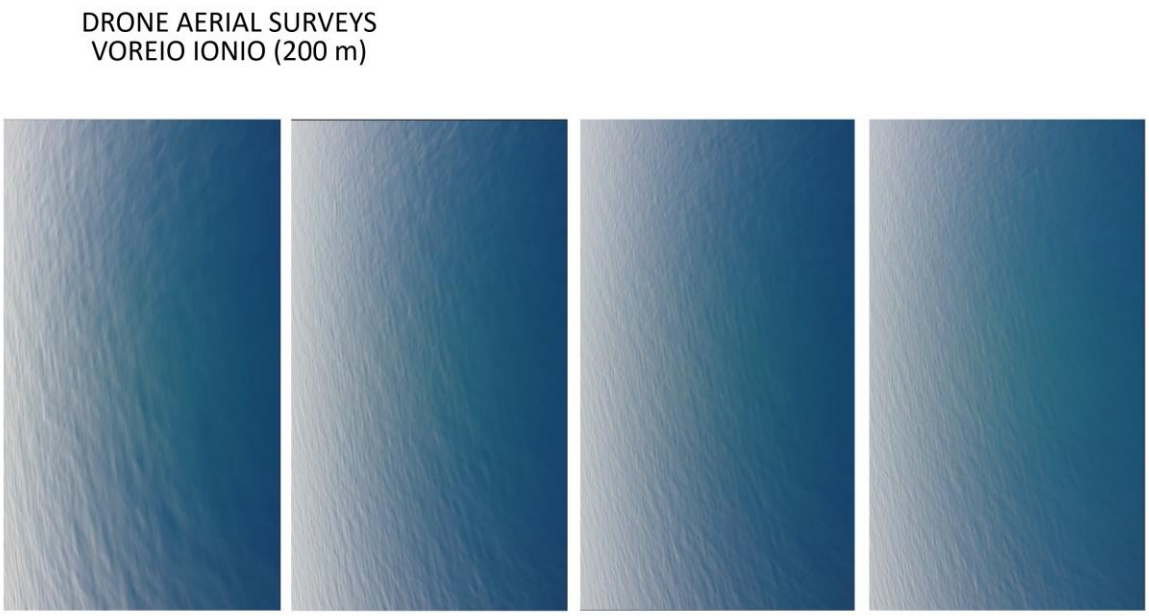

Figure 4-33. Offshore drone surveys

Additionally, a number of low height flights were carried out, when species of interest were spotted during the boat surveys. These flights confirmed the presence of two Cuvier's Beaked whales (Figure 4-5), as well as a group of 20 individuals of Striped dolphins (Figure 4-6) within the Project Area. The drone flights also revealed cases of synergistic fishing of Scopoli's shearwaters with tunas (Figure 4-7).

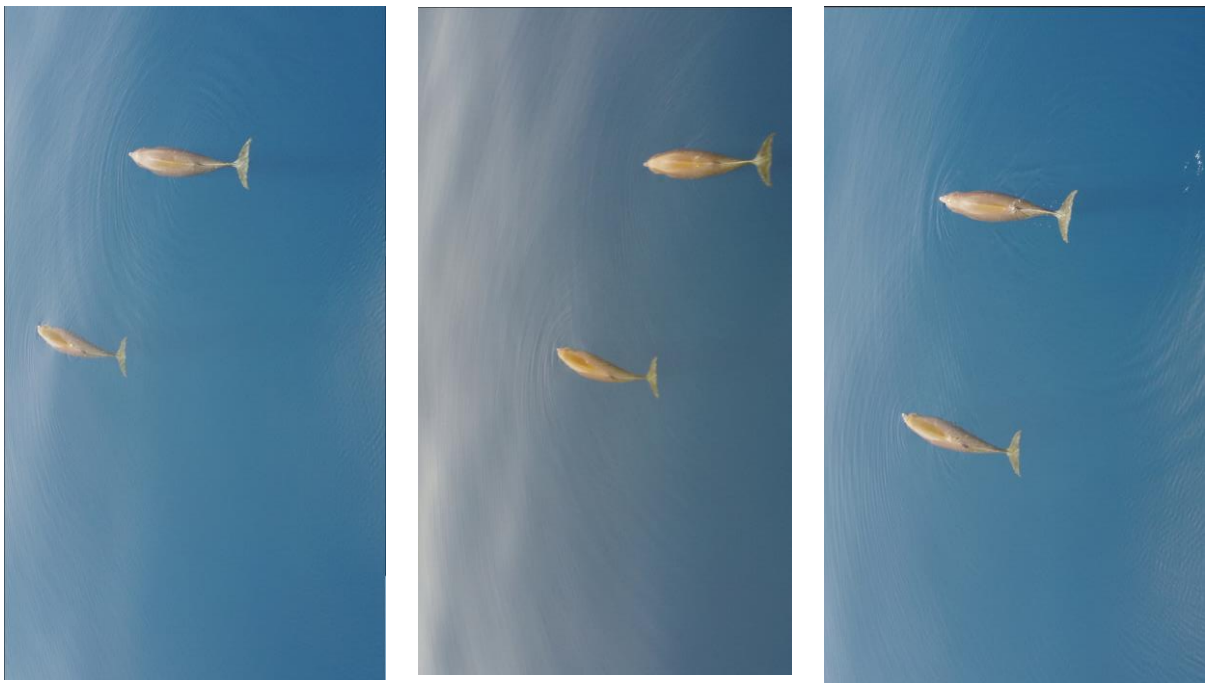

Figure 4-34. Cuvier's Beaked whales

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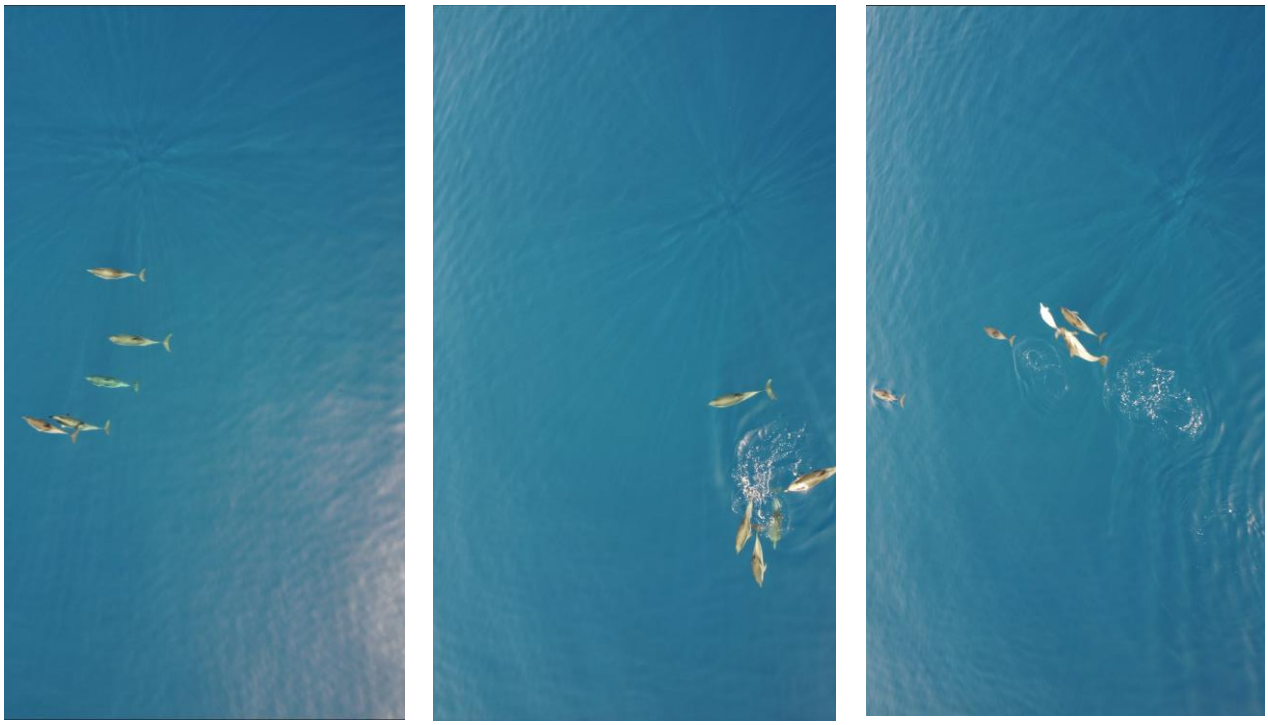

Figure 4-35. Striped dolphins

Figure 4-36. Synergistic fishing of Scopoli's shearwaters with tunas

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4.2 Aerial surveys

Five aerial surveys were conducted on 14-15/3/2022, 28-29/10/2022 and 31/10/2022. The total distance of aerial surveys in the wider Project Area was 2,170km. During the surveys, a group of 18 striped dolphins, as well as 3 Cuvier's beaked whales, were spotted.

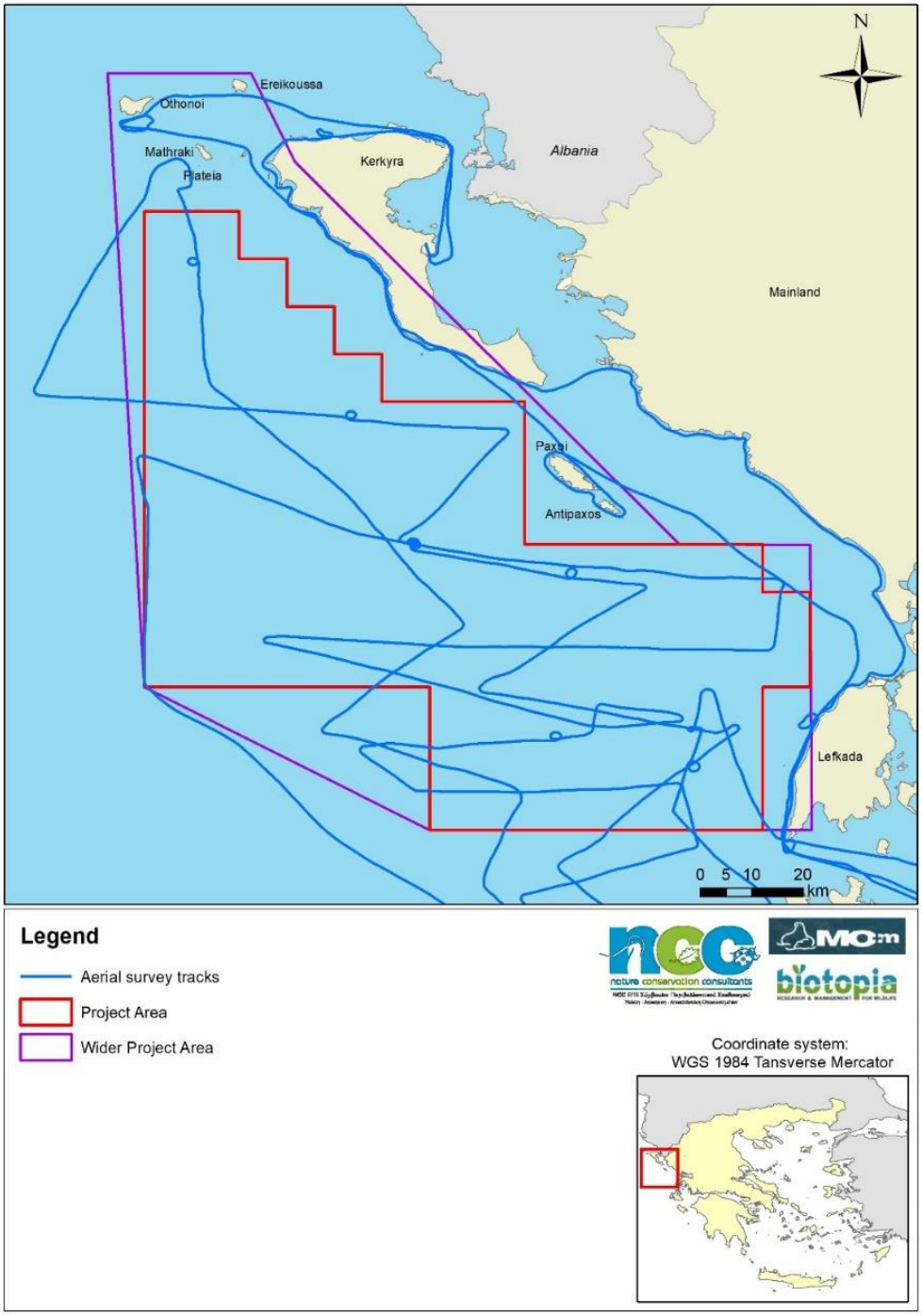

Figure 4-37. Aerial surveys tracks

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

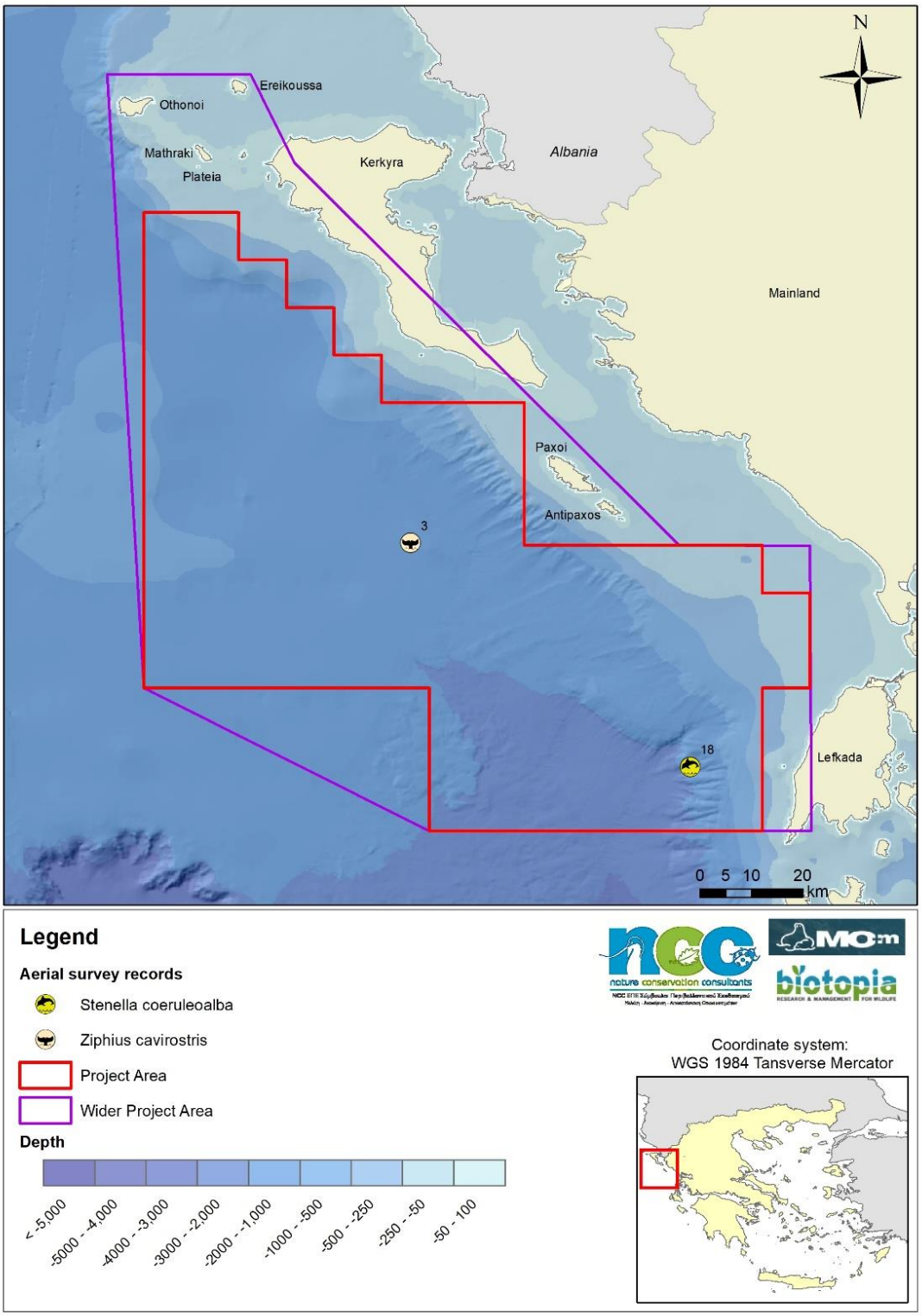

Figure 4-38. Aerial survey records

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During the aerial surveys marine traffic was also recorded in the area. The type and position of all vessels observed was recorded and georeferenced photographs were taken. In the Figure 4-39 the distribution of vessels is presented (Cs: commercial ships, Fb: Fishing boats, Ws: War ships). It is important to underline the activity of war ships within the project area (at least two during the aerial surveys, one Russian and one Spanish (NATO) frigate). From a quick search in the world wide web numerous articles describe an intense activity of such boats in the Ionian area. Taking into account that these types of boats are equipped with powerful sonar (and other electronic) devices and the current situation (war in Ukraine), it is plausible that this kind of activity somehow affects the behavior and/or distribution of cetacean species in the wider project area.

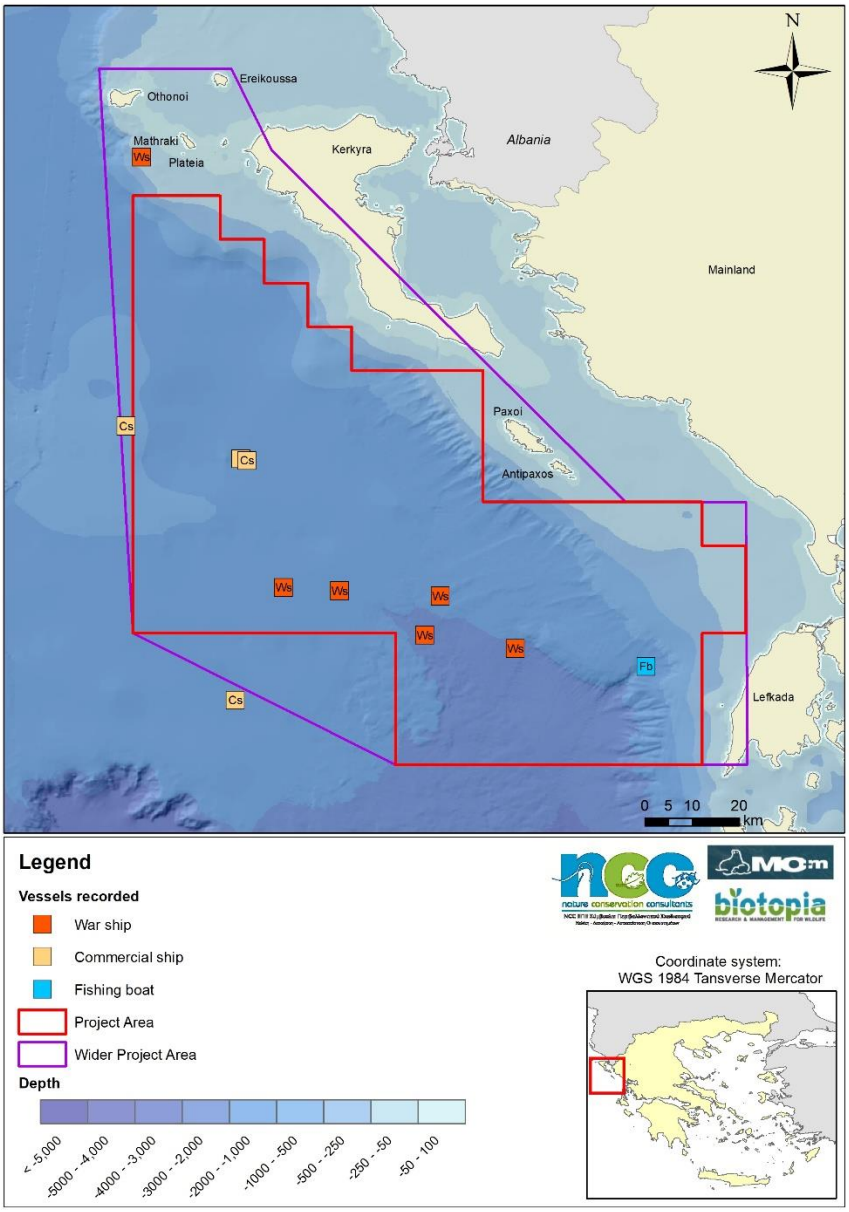

Figure 4-39. Ships recorded during the aerial surveys

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Figure 4-40. Spanish (NATO) war ship (left) and Russian war ship (right) during the aerial surveys

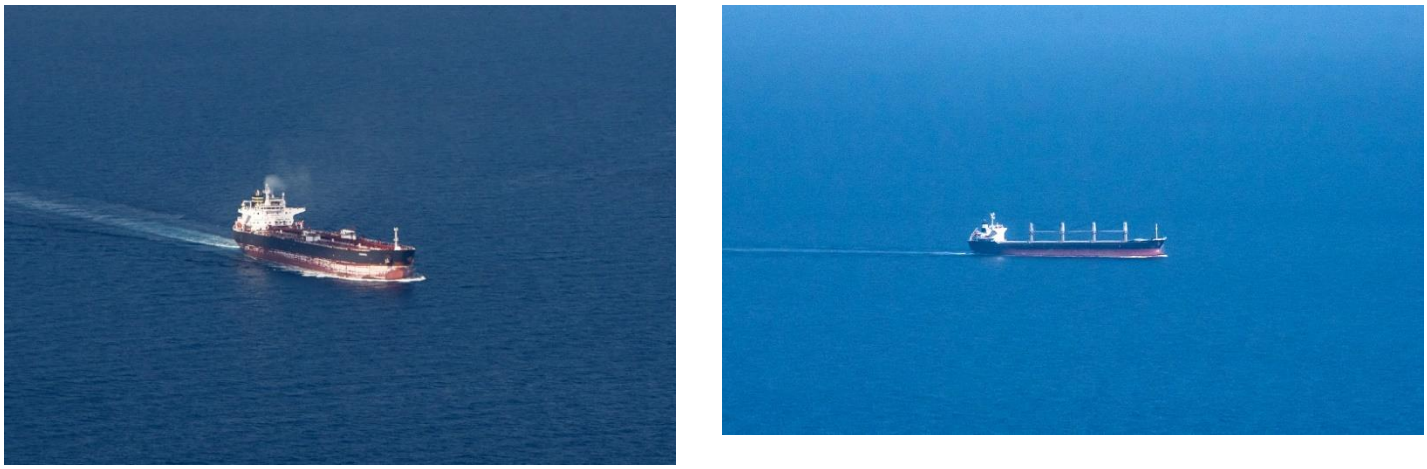

Figure 4-41. Commercial ships during the aerial surveys

4.3 Coastal surveys

4.3.1 Coastal surveys for the Scopoli's shearwater

Coastal surveys of Scopoli's shearwaters took place at the colony of Diapontia Islands. The surveys took place in June, July and September 2022. A combination of field techniques was applied, i.e. drones surveys of rafts, monitoring with trap cameras and thermal camera monitoring.

In each survey rafts were spotted west of Trachia islet, consisting of >500 individuals. The rafts were formed 0,5 hour before sunset (20.30) and were maintained as a solid group until 1 hour after sunset (22.00), when birds started the movements towards the colony site.

Intensive flights took place from 21.30, starting almost exclusively with breeding individuals, with prospector birds following until 23.00. After that time birds flights decreased.

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Figure 4-42. 4K drone video snapshot (30 m altitude), showing part of the Scopoli's raft at Trachia

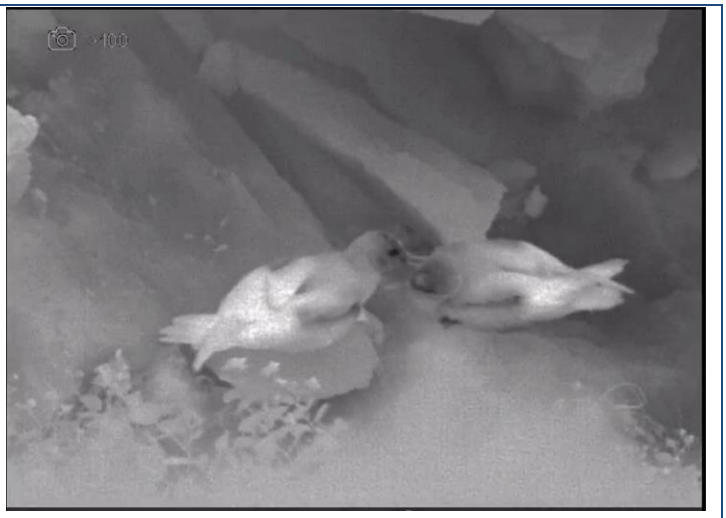

Figure 4-43. Thermal camera video snapshots, showing Scopoli's flights over the Trachia colony site

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Figure 4-44. Thermal camera video snapshots, showing Scopoli's flights over the Trachia colony site

Figure 4-45. Installation of trap cameras at the Trachia colony site

The coastal surveys in Scopoli's colony revealed also the breeding of **European Storm-Petrels** on Trachia islet. **The confirmation of Storm-petrels breeding on Trachia islet is of great importance, as, until now, there are only two known breeding colonies of the species in Greece, and none of them is located in the Ionian Sea**.

Figure 4-46. European Storm-petrel spotted by the thermal camera and the trap camera

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4.3.2 Coastal surveys for the Mediterranean Shag

Coastal surveys for the Mediterranean shag at the Wider Project Area revealed possible breeding of the species on:

i) Karavi islet near the west coast of Corfu Island,
ii) Platia islet in the Diapontia islands complex,
iii) Plaka islet near the south coast of Antipaxoi Island.

4.3.3 Coastal surveys for the Mediterranean Monk Seal

During the study period, **596 km of coastline** were circumnavigated and thoroughly investigated by the researchers. Throughout the coastline examined, 26 suitable coastal caves were identified. Considering the findings of Dendrinos et al. (2007), 7 of these caves were evaluated as suitable both for Resting and Breeding, while the remaining 19 caves were evaluated as suitable only for resting.

No monk seal sightings were recorded during the coastal surveys for the project.

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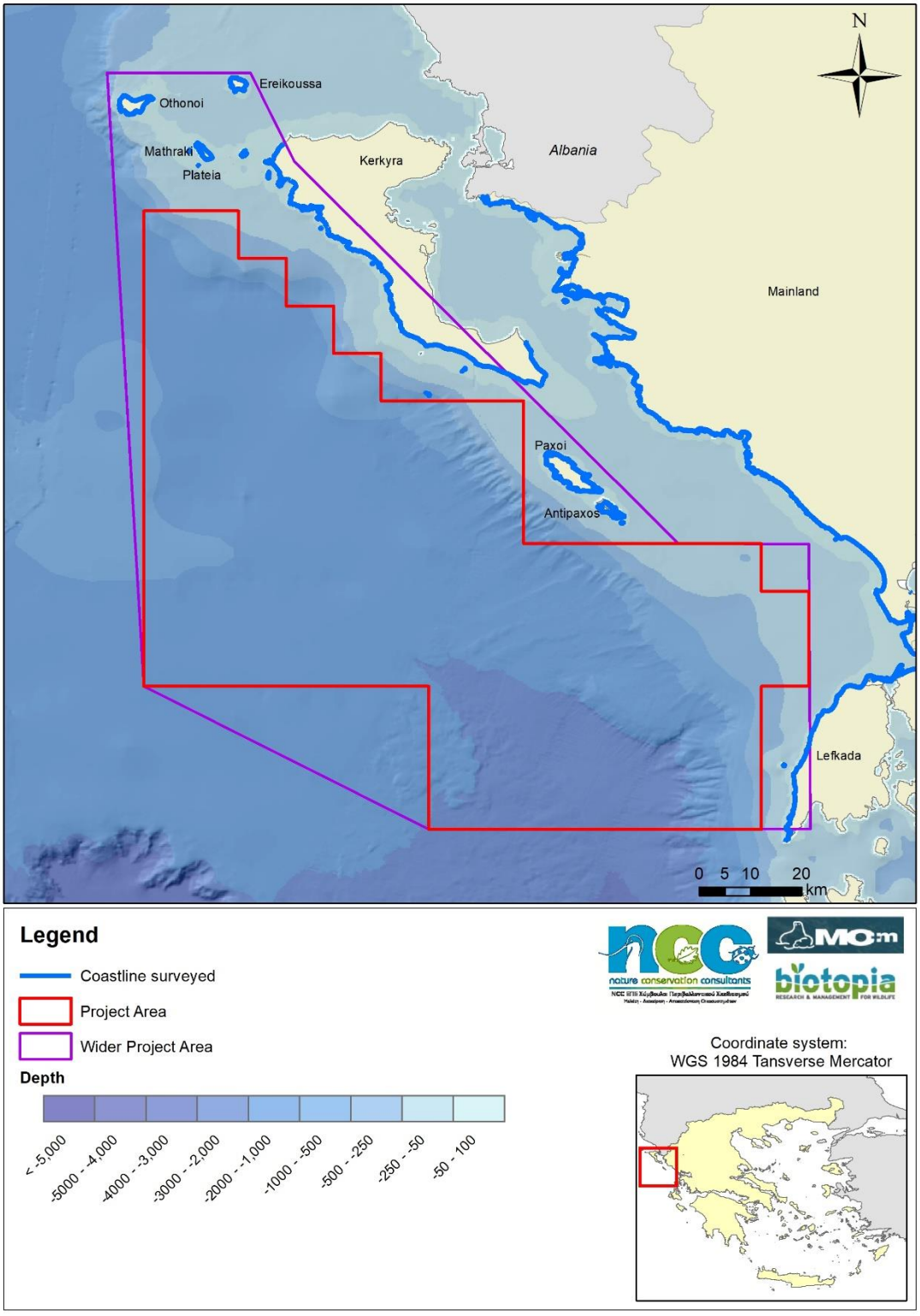

Figure 4-47. Coastline surveyed during coastal surveys for the Mediterranean Monk Seal.

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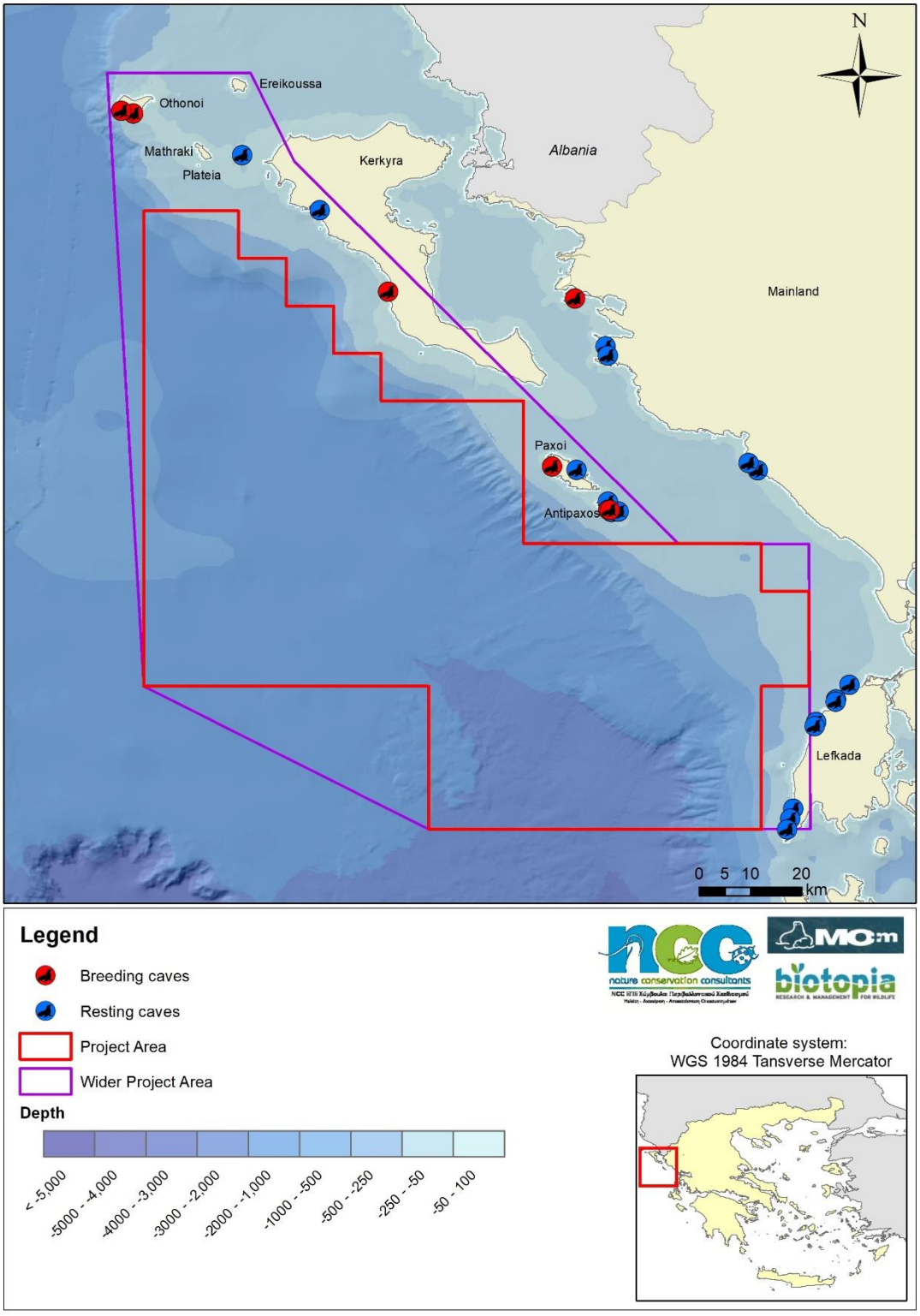

Figure 4-48. Locations of the Mediterranean Monk Seal breeding and resting caves.

4.3.4 Monk seal sightings collected through the National Rescue and Information Network

The National Rescue and Information Network (RINT) of MOm has been operating continuously since 1991, collecting information on monk seal presence in Greece. Based on the information collected by RINT, this area has a low-to-medium seal presence. Within the previous 6 years (2016-2022), a total of 21 sightings of live animals have been recorded. In the same timeframe, 3 monk seals have been found dead in the region. This information is highly dependent on the existence and number of observers and therefore it can in no way be viewed as an absolute representation of the distribution of monk seal individuals in the area - it does however provide a very good indication of the presence of animals.

It is important to note that on the 25th of October 2016 the RINT of MOm was informed of the presence of a new-born pup near the port of Othonoi; the area where the pup was sighted is in the proximity of cave OTH1, thus verifying the evaluation of the cave as a pupping site. At the same time this recording is the most northern recording of Mediterranean monk seal reproduction in recent history and could be viewed as one event in a series of events related to the recovery of the local monk seal population in the Ionian Sea. Additionally, on the 18th of October and on the 7th of November 2020, pups were recorded in cave "PAX1" also verifying its use as a breeding cave by the species.

Figure 4-49. A pup near a marine shelter at Othonoi island

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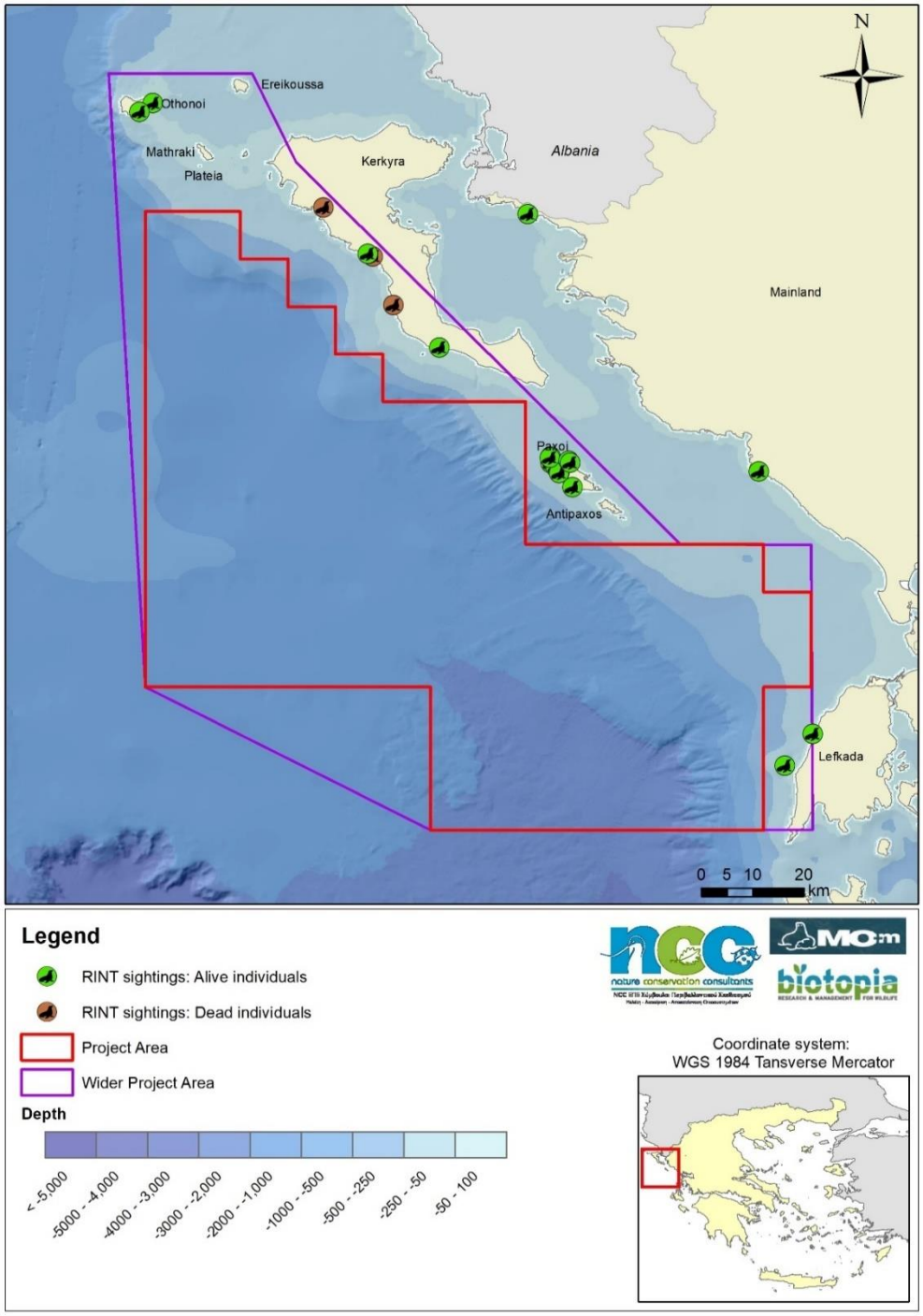

Figure 4-50. Locations of the Mediterranean Monk Seal national Rescue and Information Network (RINT) records.

The full report on the surveys for the Mediterranean monk seal could be found in Annex III of the present study.

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4.4 Scopoli's Shearwater telemetry

Ten GPS/GSP tags (Ornitela 15 gr) were deployed on June 22 and June 23 on breeding Scopoli's shearwaters (incubation phase) on Trachia colony.

After tagging the birds were returned to their nesting sites.

The main foraging areas of the tagged individuals were located outside Project Area, mainly in the Adriatic along the Albanian coast and along the western Adriatic coast. The Project Area in general does not seem to be important neither as a foraging area neither as transit area during the breeding season. This is consistent with relatively low abundance of Scopoli's Shearwater within the Project Area, as recorded by pelagic surveys.

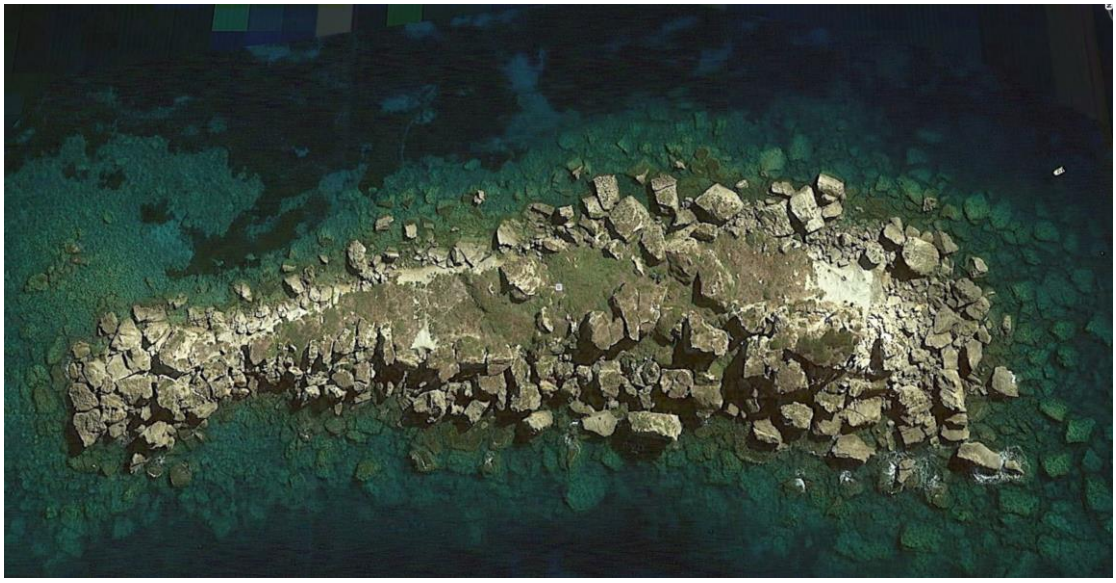

Figure 4-51. The islet of Trachia where the tagging of Scopoli's shearwaters took place

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Figure 4-52. Tagging of Scopoli's shearwaters and nests on Trachia islet

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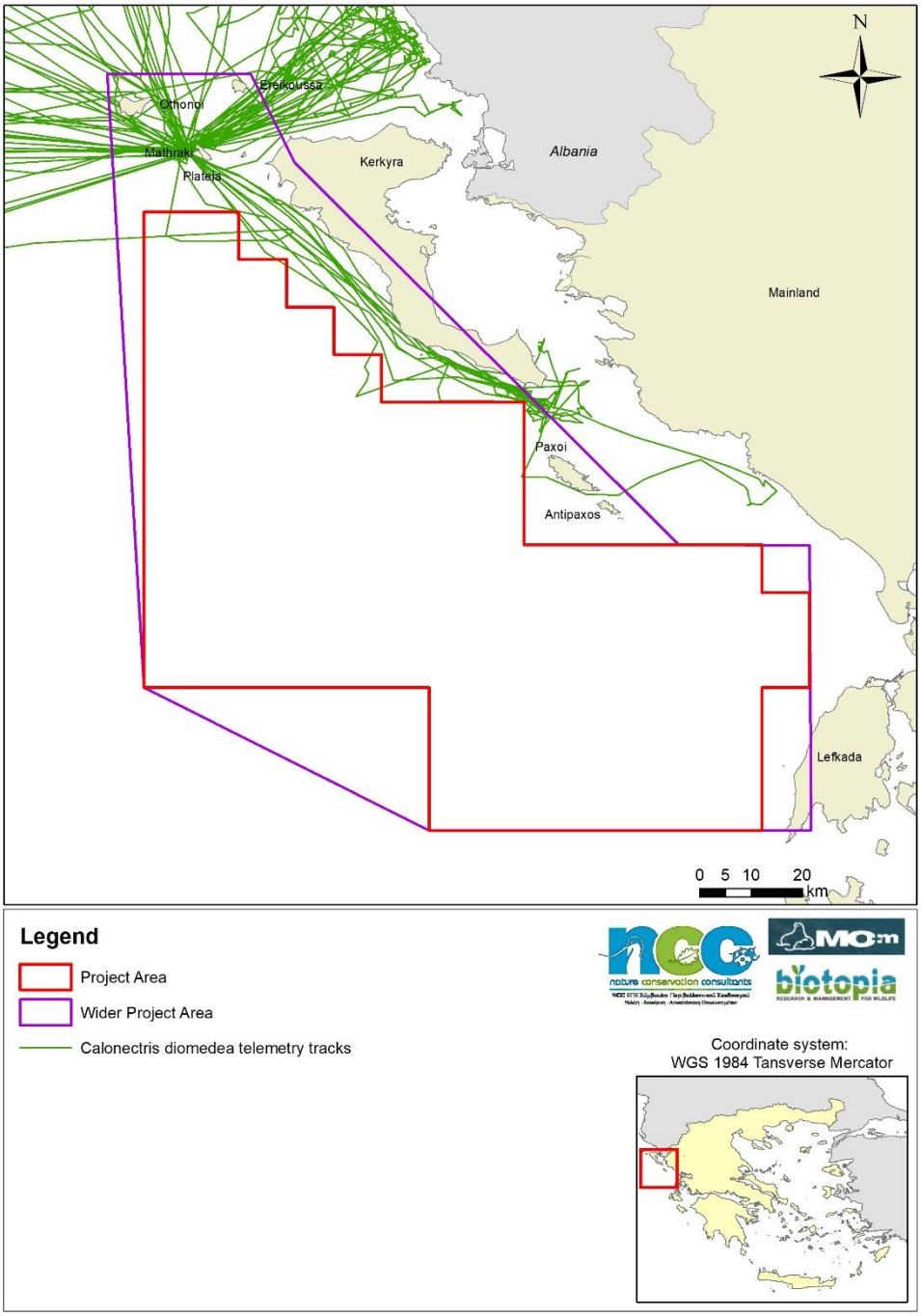

Figure 4-53. Foraging trips of tagged Scopoli's shearwaters in the project area until end of October 2022.

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

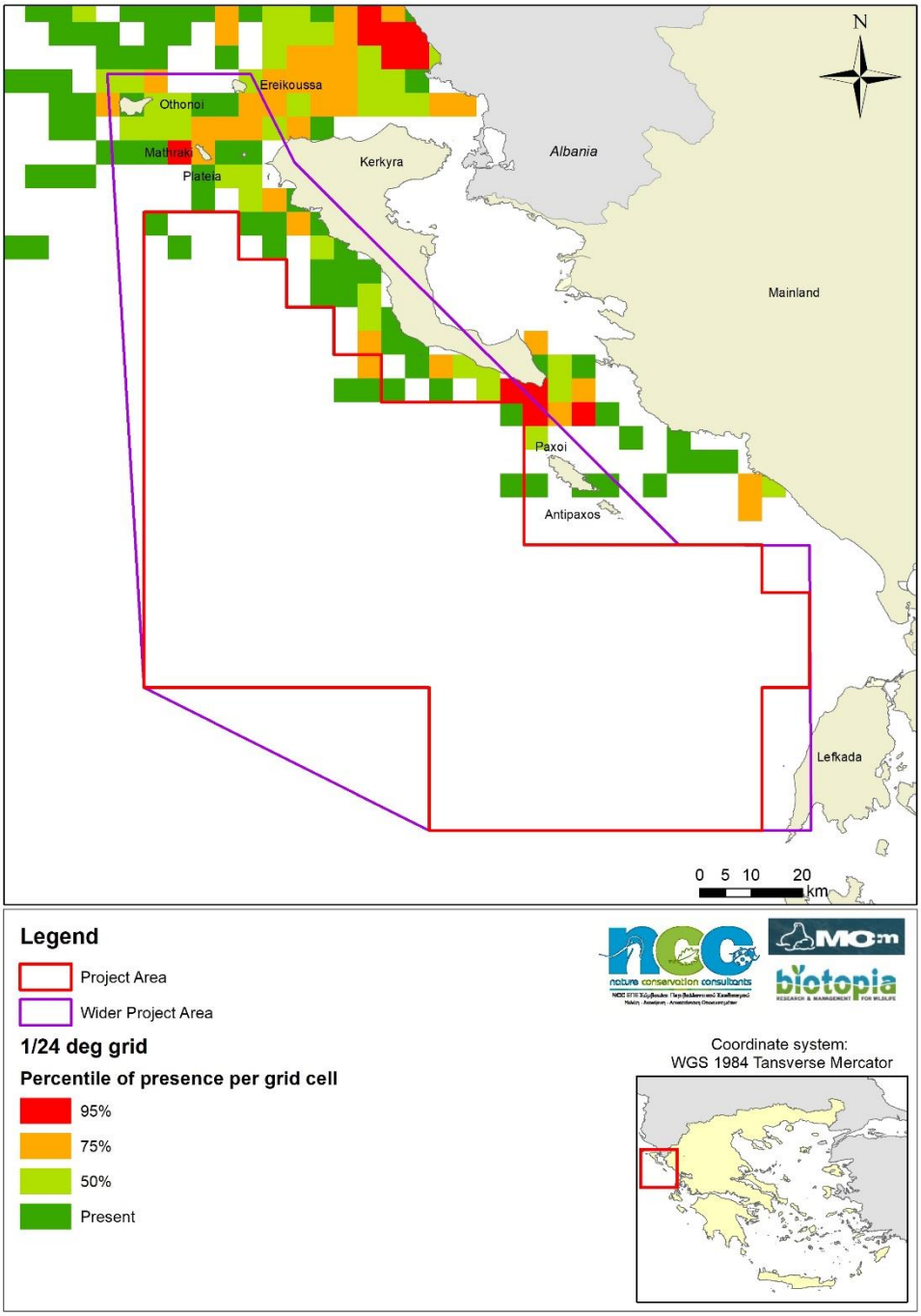

Figure 4-54. Space use by the tracked Scopoli's Shearwaters in the Wider Project Area on a 1/24^{o} grid. Cells with most time spent are red (top 5%) and orange (top 25%).

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

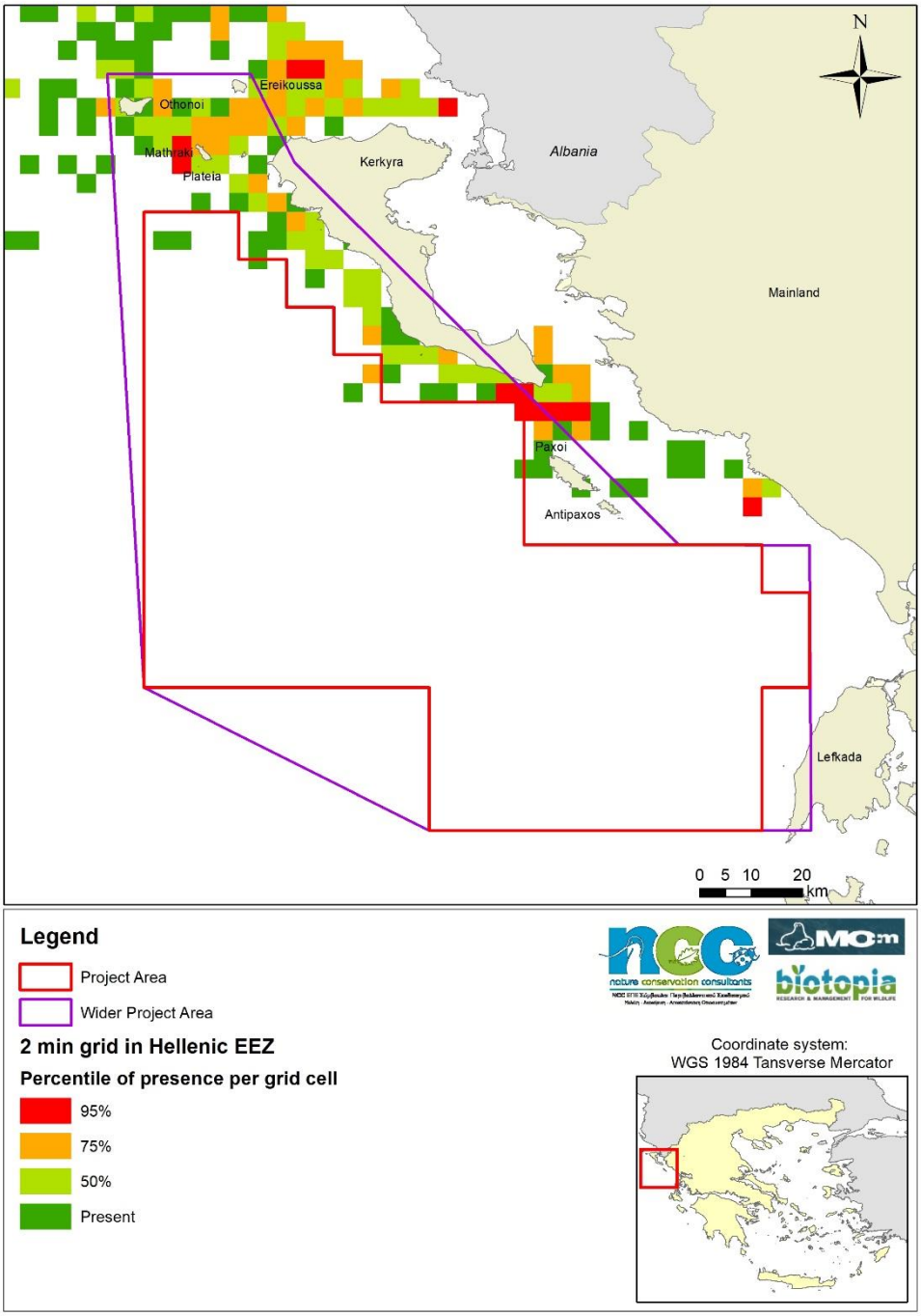

Figure 4-55. Space use by the tracked Scopoli's Shearwaters in the Hellenic EEZ on a 1/24^{o} grid. Cells with most time spent are red (top 5%) and orange (top 25%).

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

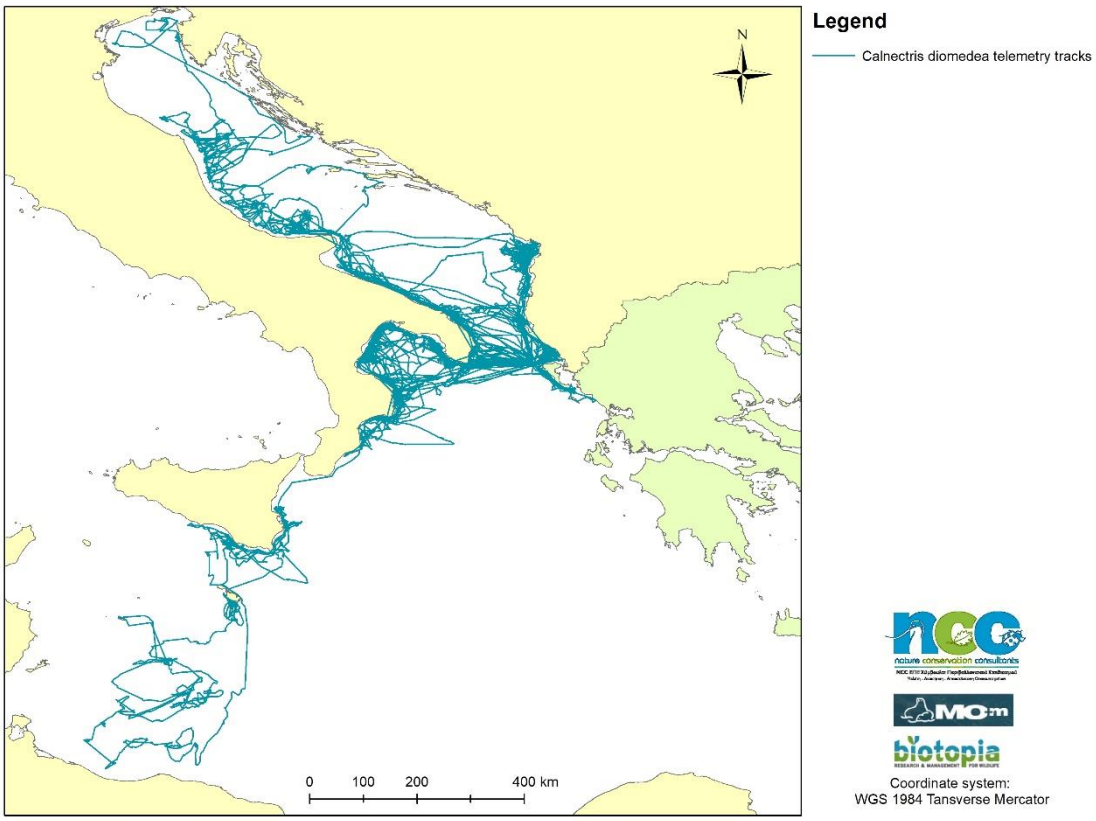

Figure 4-56. Foraging trips of tagged Scopoli's shearwaters in the Central Mediterranean until end of October 2022.

NCC, Gytheiou 4, 15231 Chalandri, Tel: +30210 6743044 Fax: +302106743041, email: info@n2c.gr, http: //www.n2c.gr

5 Conclusions

The current study presents the results of the pelagic and coastal surveys, that took place in 2022 in the Wider Project of the Ionion Block Lease Area in the offshore area of North Ionian Sea. The present project consists of one of the first systematic combined pelagic recording of cetaceans, marine turtles and seabirds in the Project Area, although the Wider Project Area has been the subject of systematic pelagic and acoustic surveys of cetaceans in the past. The project results include:

- Modern, innovative field methods, such as the use of drones for aerial surveys and the use of thermal cameras to monitor the bird behaviour at seabirds colonies, were tested with very promising results. In combination with telemetry, aerial surveys, bioacoustics surveys and the more conventional boat surveys, the field work methods provide a solid basis to gather meaningful, biodiversity data for the project area.
- A significant presence of cetaceans was confirmed in the area. More particularly, the area seems to host significant populations of striped dolphins and Cuvier's Beaked Whales. Both species feed in deep waters and they have been observed at depths usually greater than 800-1000m. Although Sperm whales have been reported in the area in previous studies, the presence of the species was not detected during the present project. On the other hand, as expected, bottlenose dolphins use coastal waters outside of the project area but within the wider project area.
- The telemetry of Scopoli's shearwaters revealed that the feeding grounds of the species, are located mostly outside of the project area, at North Ionian and South Adriatic Sea, as well as at the coastal waters west of Corfu, Paxoi, Antipaxoi and Lefkada islands. The most important concentrations of the species within the wider project area, are located at the southwestern coastal waters of Lefkada Island and in Diapontia island complex, where there is a breeding colony of the species.
- The breeding colony of the Scopoli's shearwaters on Tracheia islet at the Diapontia islands complex, is considered as one of the most important for the species at national level. The colony is one of the two known breeding sites of the species in Ionian Sea and its size exceeds the 200 pairs, at least double than previously estimated.
- The current study confirmed for the first time the breeding of European storm petrels on Diapontia islands. There is very limited existing knowledge regarding the breeding sites of the species in Greece, and the breeding colony on Diapontia is the first known colony in Ionian Sea and only the third one at national level.
- The surveys for the monk seal revealed 26 suitable marine caves along the coastline of the study area. Seven (7) of these were evaluated as suitable for pupping and 19 were evaluated as suitable only for resting.
- Monk seal exhibits a low-to-medium, but possibly increasing, presence in the area as indicated by the observations collected since 2016 through the operation of the RINT.

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- The presence of the loggerhead turtle and Yelkouan shearwater was confirmed in the project area, but in low numbers.
- Considering all the above, we can easily draw the conclusion that the Project Area hosts very significant numbers of marine mammals, seabirds and marine turtles. Further monitoring of the species seasonal distribution and population trends is needed to provide a more concrete assessment of their status in the Project Area.

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Annexes

Annex I. Photo gallery

Annex II. ESAS datasheets

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

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Annex I. Photo gallery






Striped dolphins during the boat surveys

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Cuvier's beaked whales (left) and Bottlenose dolphins (right) during the boat surveys

Visual boat-based surveys

Trachia islet

Nest with Scopoli's shearwarer

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Aerial surveys

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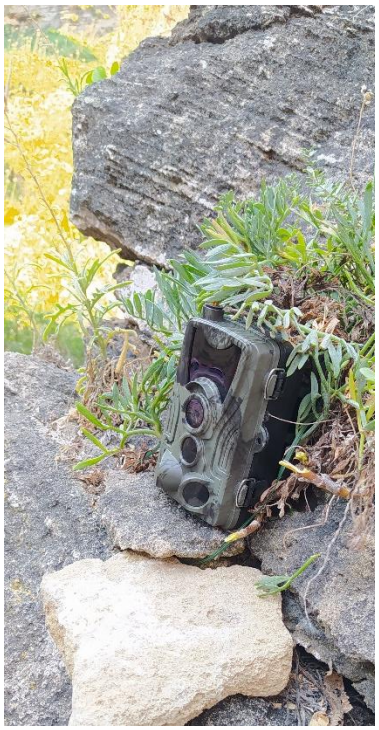
Field training on bioacoustic techniques



Installation of trap cameras on Tracheia islet

Drone surveys

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Tagging of Scopoli's shearwaters on Trachia islet

Field team in Lefkada Island

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Annex II. ESAS datasheets

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BIRD DATA Ship-based seabird surveys (ESAS)

HELLENIC ORNITHOLOGICAL SOCIETY

Ορνιθολογική

Date: … - … - … **Ship:** **Obs.:** **Page:** of

Distance[1]:
- **F** = in flight
- **A** = swims, 0-50m
- **B** = swims, 50-100m
- **C** = swims, 100-200m
- **D** = swims, 200-300m
- **E** = swims, >300m
- **W** = swims, no distance

Tr[2]: 1 = out, 2 = in transect

Κατεύθυνση πτήσης[3]:

9 NW	**2** N	**3** NE
8 W	**1**	E **4**
7 SW	S **6**	SE **5**

Associated with[3]:
- 10= fish shoal
- 11= cetaceans
- 14= floating wood
- 15= floating litter
- 16= oil slick
- 17= floating seaweed
- 18/21= obser./ other vessel
- 22/23= buoy/platform
- 26= fishing vessel
- 28= land
- 29= sand banks

MSFAs[3] (Dirn codes)
- 50= participant
- 51= joined
- 52= joining

Behaviour codes[4]:
- 30 = holding fish
- 33 = "feeding"
- 40= scavenging
- 41= at trawl
- 43 = surf.seizing
- 46 = shallow plunging
- 47= pursuit plunging
- 48= pursuit diving
- 49 = actively searching
- 60 = resting/asleep
- 67= Colony rafts
- 74= At the bow of the ship
- 79= Basking, afloat
- 95= Injured
- 96= Entangled in fishing gear or rope
- 97= Oiled
- 99= Dead

Poskey	Time	G	Species	Age	Number	Dist.[1]	Tr[2]	Dirn.[3]	Behav.[4]	Prey/notes

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

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Status of the important fauna species in the Northern Ionian lease area

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

Technical report

October 2022

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Project team

Name	Expertise	Role
Panagiotis Dendrinos	PhD Biologist, Monk Seal Expert	Field Research Coordinator
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Panagiotis Mpatzios	System Engineer/Field Technician	Field Research and technical coordination
Odysseas Paxinos	Msc, Oceanographer, Seal Specialist	Field Research & Data Compilation
Alexandros Karamanlidis	PhD Biologist, Monk Seal Expert	Field Research & Data Compilation
Antonis Bourikas	Skipper	Skipper

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 classified as "Endangered" by the International Union for the Conservation of Nature. The specific aim of the present study was the identification of suitable monk seal resting and pupping habitats along the coastline of the Northern Ionian sea islands and the adjacent mainland.

The scope of the project was to increase our knowledge regarding the habitat use of the Mediterranean monk seal population in the project area and the adjacent NATURA 2000 sites and also to allow for the evaluation of the threats posed to the species and the quantification of the possible damages caused in the eventuality of an oil spill during drilling operations in the region.

During late September and October 2022, 596 km of coastline was circumnavigated and thoroughly investigated by the researchers. Data collected during the field research were combined with data collected by MOm's Rescue and Information Network (RINT). Overall evaluation of all available data showed that the area examined contains some highly suitable caves for monk seal breeding and many caves suitable for resting. The caves suitable for Breeding are located in areas that are highly vulnerable in the case of a potential drilling accident in the future.

Throughout the coastline examined, 26 suitable coastal caves were identified. Considering the findings of Dendrinos et al. (2007), 7 of these caves were evaluated as suitable both for Resting and Breeding, while the remaining 19 caves were evaluated as suitable only for resting.

No seals were observed during the team's visit to the area.

The present findings in respect to habitat quality and density, annual pup productivity and overall seal presence indicate that the area examined during this first phase of the project is important for the conservation of the species in Greece.

Furthermore, it should be emphasized that the importance of this area extends beyond the national borders of Greece. This area is situated in the north-western-most limit of the Mediterranean monk seal's current distribution. It is expected by experts that this area will play a vital role in the re-establishment of breeding populations of the species progressively in the neighbouring countries of Albania, Montenegro and Croatia in the Eastern Adriatic

(situated North of the project area) as well as Italy (In the West and North-west).

1 Introduction

1.1. 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 Northern Ionian lease Area".

During summer and autumn of 2022, in the framework of the Project, the project team, consisting of experienced biodiversity experts from the NCC, MOm and Biotopia, is implementing field surveys, at the Northern Ionian 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 Final Report of **WP III: Coastal survey for monk seal pupping sites and seabird breeding sites. More specifically this document focuses on the Mediterranean monk seal**. The Report provides **updated information on the presence and status of the monk seal in the PA, based on project field surveys, combined with already existing datasets, as well as bibliographical information. The report includes the identification and mapping of the most important/sensitive locations for this rare species in the Project Area**.

1.2. Specific aims of WP II

The specific aim of the present study was the identification of suitable monk seal resting and pupping habitats along the coastline of the Northern Ionian and adjacent areas. Following the initial identification of habitats, the

demographic and reproductive status of the Mediterranean monk seal population in the area is to be assessed through the monitoring of pupping activity during the main pupping season.

Target of the project was to increase our knowledge regarding the demographic status, reproductive status and habitat use of the Mediterranean monk seal population in the area, and also to allow for the evaluation of the threats posed to the species and the quantification of the possible damages caused in the eventuality of an oil spill during drilling operations in the region.

1.3. 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 classified as "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 jeopardise 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.

1.4. Status and legal protection of Monachus monachus 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. 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 good 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 remains 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. 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. A marine protected area (MPA) has been established at Northern Karpathos and the island of Saria in the Dodecanese Islands and its management body is already fully operational. A second MPA has been proposed for the islands of Kimolos and Polyaigos in the southwestern Cyclades islands, however its establishment is still being delayed by the Hellenic Government. More recently, efforts are underway to establish a protected area at the island of Gyaros in the northern Cyclades, while six areas holding important monk seal populations were added in 2017 to the list of the Natura 2000 sites of Greece.

Current research and conservation priorities for the Mediterranean monk seal in Greece include the identification and gradual formal protection of the most important pupping and resting sites for the species in the country. Within these efforts, identifying suitable habitat for the Mediterranean monk seal in the Northern Ionian region is important.

1.5. Importance of the project area for the Mediterranean monk seal

The Northern Ionian area has not been the subject of regular study regarding the presence of the Mediterranean monk seal. Parts of the coastline have been researched by MOm regarding the presence of suitable monk

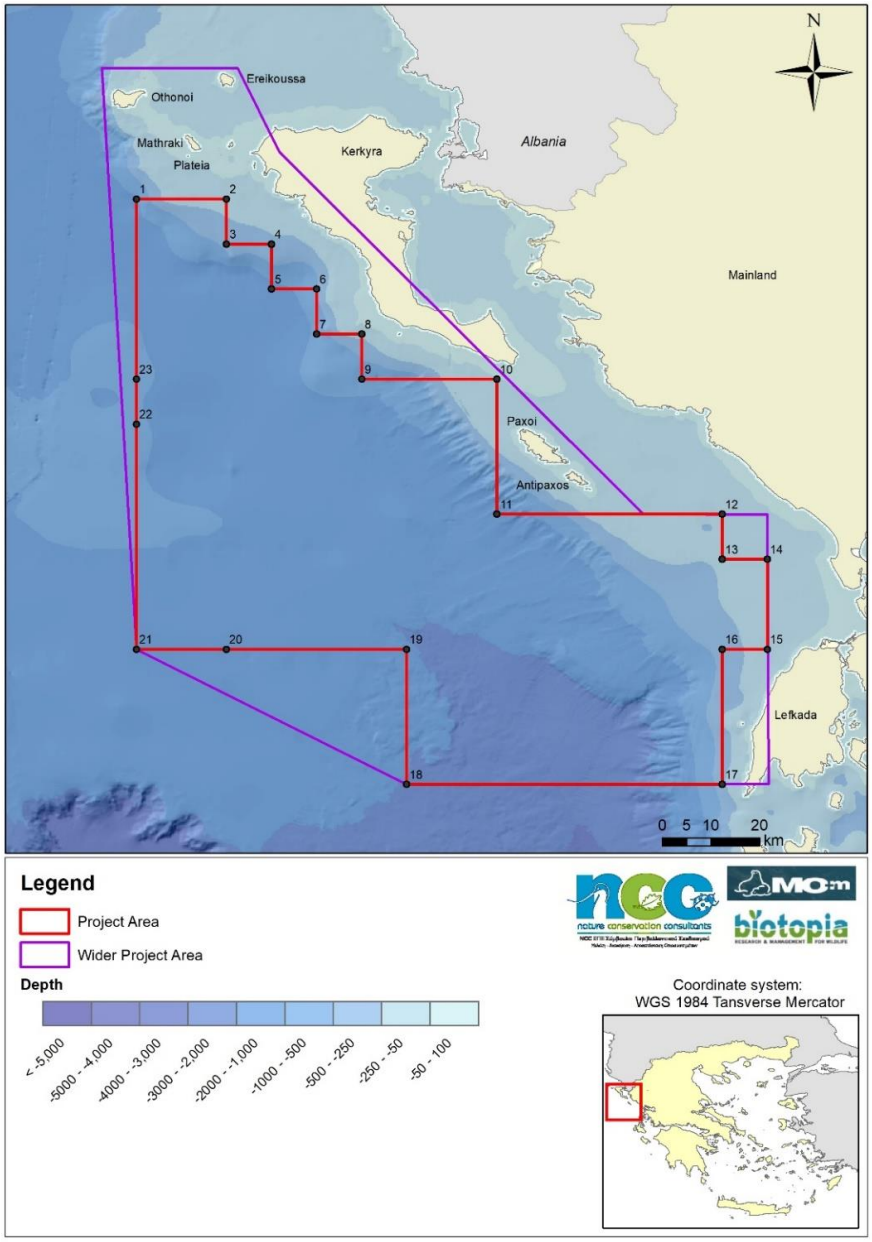
seal habitat. The results yielded by these studies have revealed the presence of some suitable marine caves that may be used by seals for resting and for breeding (pupping). Additionally, through the operation of MOm's Rescue and Information Network (RINT), coupled with opportunistic visits to the region by MOm's staff, have revealed some significant seal activity in the area.

The importance of the Northern Ionian area for the monk seal cannot be overstated, as it is situated at the North-Westernmost geographic distribution of the species in Greece (the largest subpopulation of the species globally and the only one in the Mediterranean). It is believed by experts that, as the population of the Mediterranean monk seal increases, the islands of the Northern Ionian and the coasts of the adjacent mainland will act as the major stepping stone from which the population can spread to the Adriatic sea and re-establish breeding colonies in the countries of Albania, Montenegro, Croatia and Italy.

2 Methodology

2.1. Project Area

The Project Area is situated in the Northern Ionian Sea and includes mainly the marine area west of the mainland coasts of Epirus, North and Northwest of the island of Lefkada, west of the islands of Paxoi and Antipaxoi and south and southwest of the island of Kerkyra.



Map 1. Project area

More specifically the Coastal Project Area includes the western coast of mainland Greece from Preveza to the borders with Albania to the North as well as the islands of Lefkada (western coast), the islands of Paxoi and Antipaxoi, the western coast of Kerkyra island and the islets of Othonoi, Erikousa and Mathraki.

These areas, large parts of which are included in the Natura 2000 network, are in the primary sphere of influence of the core (pelagic) project area and may be affected by an oil spill event in the future, so their importance for the species should be thoroughly

investigated and their sensitivity to possible future threats should be evaluated.

Based on a preliminary research of available aerial photography and video , the coastline of the Project area is mostly rocky and includes both low rocky formations that are usually not suitable for the formation of marine caves but also rocky coastal formations that appear promising regarding the existence of suitable monk seal breeding marine caves.

Photo 1. Characteristic morphology of the coast in the project area. Low rocky coasts

Photo 2. Characteristic morphology of the coast in the project area. Rock formations potentially suitable for the creation of marine caves.

2.2. Evaluating Habitat Availability and Suitability

Photo 3. The team during the coastal survey for the evaluation of monk seal habitat in the Project Area

To evaluate habitat availability and suitability for the Mediterranean monk seal in the project area its entire coastline was circumnavigated with an inflatable boat, at a distance of about 50 m from the shoreline to locate all potentially suitable coastal caves for resting and/or pupping. Once a cave was located, it was approached swimming and its suitability evaluated, based on a set of physical and environmental features (Dendrinos et al., 2007).

Photo 4. Aerial photo of part of the project area coastline

If a cave was evaluated as suitable monk seal habitat, geotagged photos were taken and its GPS position was recorded. It should be noted that Mediterranean monk seals tend to be more selective in their choice of caves used for pupping than for resting (Karamanlidis, Pires, Silva, & Neves, 2004).

Previous research has indicated that the physical and environmental features used in this study are the most important predictors of the selection of a coastal cave as a pupping site by monk seals in Greece. Suitable pupping sites tend to have among other, multiple entrances, beaches in their interior with a soft substrate, a low risk of pup washout and are not easily accessible to humans (Dendrinos et al., 2007).

During the aforementioned research efforts the field team of MOm tried also to collect information that could lead to a preliminary assessment of the demographic composition of the Mediterranean monk seal population in the area (Dendrinos, Kotomatas, & Tounta, 1999). During the cave inspections, researchers searched for the presence of recent signs of cave use, such as tracks, scats, pieces of fur or blood. If a seal was encountered, photographs or video were taken in order to enable future individual identification.

Finally, during the circumnavigation of the coastline the research team collected information on human activities and threats to the Mediterranean monk seal in the region, and more specifically information on the overall intensity of human activity and to a lesser extent on fishery – seal interactions in the area.

2.3. Collection of reports on Mediterranean monk seal sightings

Apart from performing visits to the seal shelters the researchers MOm collected and evaluated reports of seal sightings conducted by other observers (such as local citizens, tourists, divers, professional and amateur fishermen). Location, date and time of the observation, behaviour of the animal, as well as, visible characteristics (size, developmental stage, coloration, external pelage marks or scars, overall status of the animal) were recorded. This method of data collection is based on the methodology of the operation of the National Rescue and Information Network (Adamantopoulou et al., 1999). Although this information originates from non-scientists, it forms a considerable source of relevant data, which, upon careful evaluation and analysis, complements the work conducted directly in the field. In addition, the collection of data by non-scientists in combination with the data collected by researchers allows for the immediate reaction of the field team of MOm in cases of emergency, such as animals needing aid or dead animals.

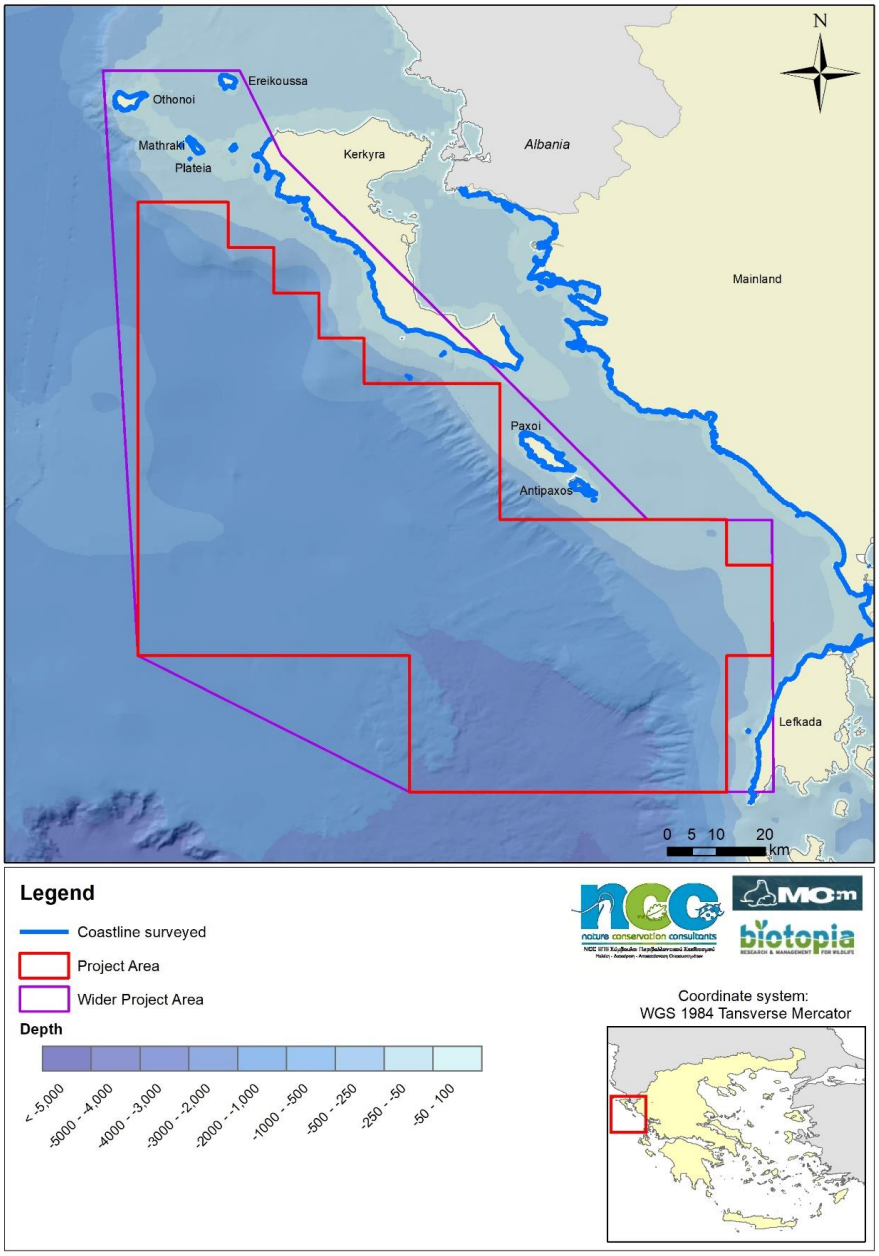
2.4. Cave Monitoring

Infrared Camera Traps were placed in 3 caves in the project area. A Reconyx PC800 HYPERFIRE PROFESSIONAL IR, a Reconyx HYPERFIRE2 HF2X and a Wing Home 630M were placed in caves OTH1, OTH2 and CRF1. These were placed on rocks by drilling and were positioned to maximize the coverage of the terrestrial component of the cave (beach). They 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.

3 Results

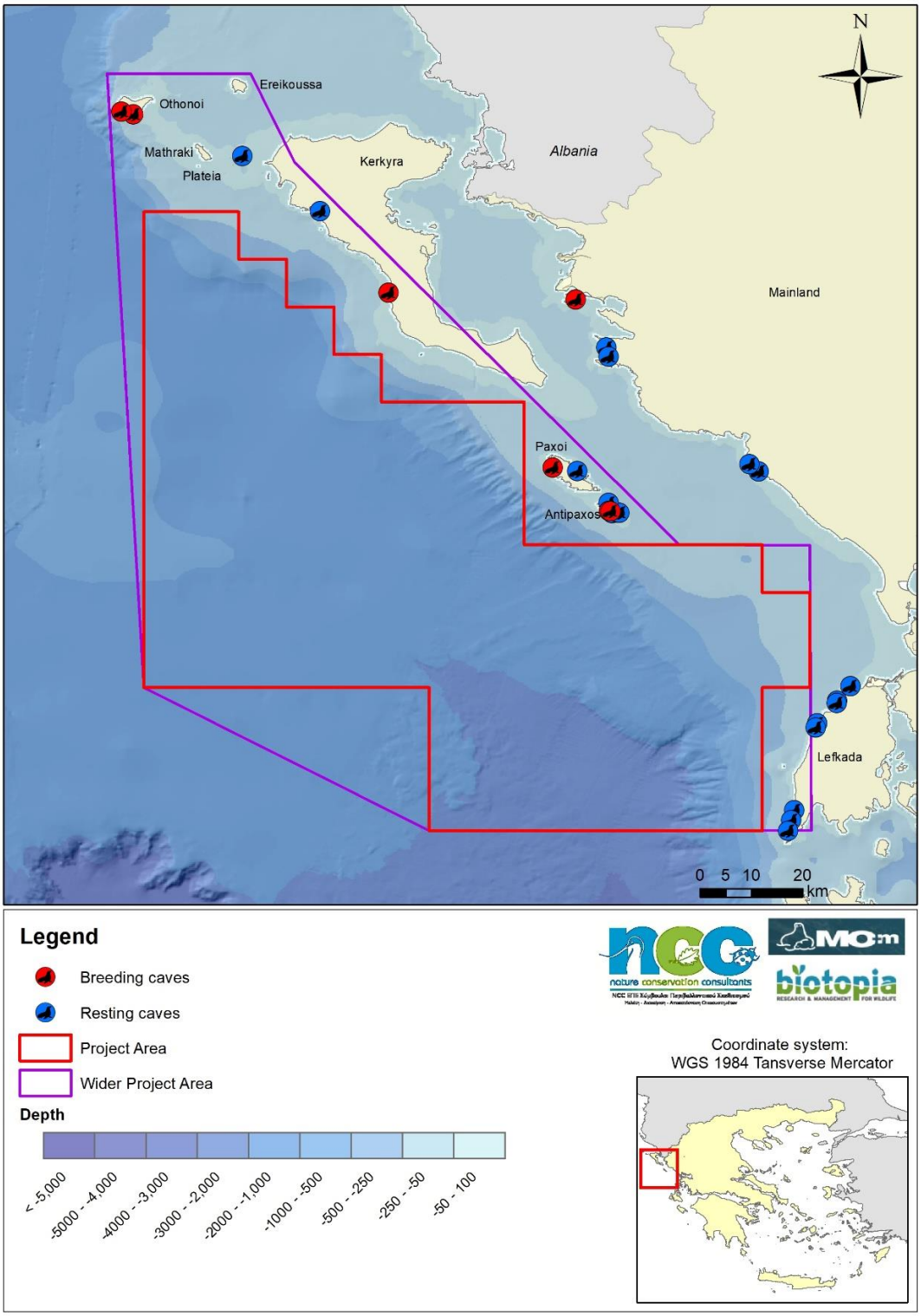
3.1. Description of Mediterranean monk seal terrestrial habitat availability and suitability

During the study period, 596 km of coastline were circumnavigated and thoroughly investigated by the researchers. Throughout the coastline examined, 26 suitable coastal caves were identified.



Map 2. Coast Surveyed

Considering the findings of Dendrinos et al. (2007), **7 of these caves were evaluated as suitable both for Resting and Breeding, while the remaining 19 caves were evaluated as suitable only for resting.**



Map 3. Location of suitable marine caves/monk seal shelters in the project area

Table 1: Catalogue of Marine Caves/Monk Seal Shelters recorded during the study

Cave Code	Cave Type	Area	Longitude	Latitude
APX1	Breeding	Antipaxos	20.23	39.14
APX2	Breeding	Antipaxos	20.23	39.14
APX3	Resting	Antipaxos	20.24	39.14
APX4	Resting	Antipaxos	20.25	39.14
APX5	Resting	Antipaxos	20.25	39.14
APX6	Resting	Antipaxos	20.23	39.16
CRF1	Breeding	Kerkyra	19.85	39.52
CRF2	Resting	Kerkyra	19.73	39.67
CRF3	Resting	Kerkyra	19.59	39.76
EPI1	Breeding	Thesprotia	20.17	39.51
EPI4	Resting	Thesprotia	20.23	39.43
EPI5	Resting	Thesprotia	20.23	39.41
EPI6	Resting	Thesprotia	20.49	39.21
EPI7	Resting	Thesprotia	20.48	39.22
LEU1	Resting	Lefkada	20.65	38.84
LEU2	Resting	Lefkada	20.63	38.81
LEU3	Resting	Lefkada	20.63	38.81
LEU4	Resting	Lefkada	20.60	38.77
LEU5	Resting	Lefkada	20.59	38.76
LEU6	Resting	Lefkada	20.56	38.62
LEU7	Resting	Lefkada	20.55	38.60
LEU8	Resting	Lefkada	20.55	38.58
PAX1	Breeding	Paxoi	20.13	39.22
PAX2	Resting	Paxoi	20.18	39.21
OTH1	Breeding	Othonoi	19.40	39.84
OTH2	Breeding	Othonoi	19.38	39.84

3.2. Monk seal sightings in the wider study area

3.2.1. Sightings during the field research

No monk seal sightings were recorded during the coastal surveys for the project.

3.2.2. Monk Seal Sightings collected through the National Rescue and Information Network

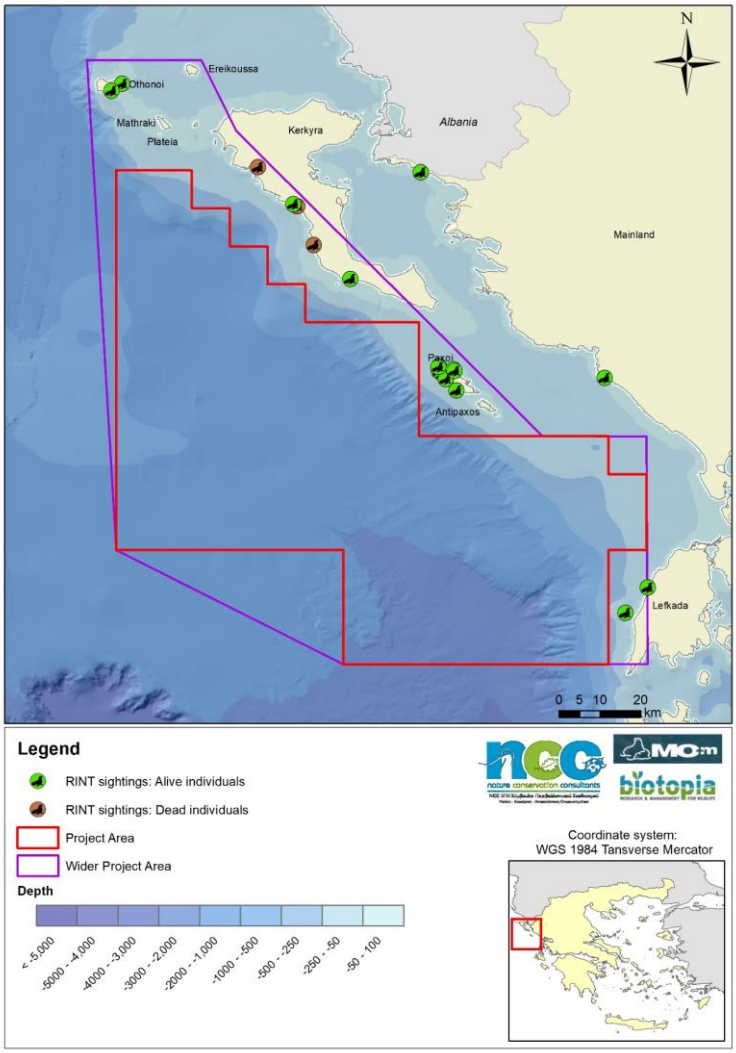
The National Rescue and Information Network (RINT) of MOm has been operating continuously since 1991, collecting information on monk seal presence in Greece. Based on the information collected by RINT, this area has a low-to-medium seal presence. Within the previous 6 years (2016-2022), a total of 21 sightings of live animals have been recorded. In the same timeframe, 3 monk seals have been found dead in the region. This information is highly dependent on the existence and number of observers and therefore it can in no way be viewed as an absolute representation of the distribution of monk seal individuals in the area - it does however provide a very good indication of the presence of animals. The location of pups is also highly important and indicative of the presence of pupping caves in the vicinity,

Table 2: Information on Mediterranean monk seal sightings collected by the Rescue and Information Network of MOm since 2016.

Date	Area	STAGE	SEX	Alive	Dead
7/27/2022	Othonoi	ADULT	Unknown	✓	
3/11/2022	Thesprotia	ADULT	Female	✓	
9/15/2021	Paxoi	ADULT	Unknown	✓	
7/4/2021	Paxoi	UNKNOWN	Unknown	✓	
3/1/2021	Paxoi	WEANER	Unknown	✓	
1/24/2021	Kerkyra	SUBADULT	Unknown		✓
11/7/2020	Paxoi	PUP0	Unknown	✓	
11/7/2020	Paxoi	ADULT	Female	✓	
11/7/2020	Paxoi	ADULT	Female	✓	
10/18/2020	Paxoi	ADULT	Female	✓	
10/18/2020	Paxoi	PUP1	Unknown	✓	
9/30/2020	Lefkada	SUBADULT	Unknown	✓	
9/6/2020	Kerkyra	ADULT	Male	✓	
8/27/2020	Lefkada	UNKNOWN	Unknown	✓	
5/18/2020	Paxoi	SUBADULT	Unknown	✓	
1/30/2020	Kerkyra	UNKNOWN	Unknown		✓
9/24/2019	Paxoi	ADULT	Female	✓	
6/13/2018	Paxoi	ADULT	Unknown	✓	
11/19/2017	Kerkyra	ADULT	Female		✓
5/28/2018	Paxoi	ADULT	Male	✓	

10/25/2016	Othonoi	PUP2	Unknown	✓	
10/19/2016	Kerkyra	UNKNOWN	Unknown	✓	
9/6/2016	Paxoi	ADULT	Female	✓	
6/25/2016	Paxoi	ADULT	Unknown	✓	

It is important to note that on the 25th of October 2016 the RINT of MOm was informed of the presence of a new-born pup near the port of Othonoi; the area where the pup was sighted is in the proximity of cave OTH1, thus verifying the evaluation of the cave as a pupping site. At the same time this recording is the most northern recording of Mediterranean monk seal reproduction in recent history and could be viewed as one event in a series of events related to the recovery of the local monk seal population in the Ionian Sea. Additionally, on the 18th of October and on the 7th of November 2020, pups were recorded in cave "PAX1" also verifying its use as a breeding cave by the species.



Map 4. Locations of Alive and Dead Monk seals collected through RINT since 2016

Photo 5. A pup near a marine shelter at Othonoi island

Photo 6. Pup photographed inside a breeding cave in Paxos island

Photo 7. Weaner found dead on the coast of Kerkyra island during 2021

Photo 8. Video from a fish farm worker, of an adult female monk seal swimming near fish farm cages in 2022.

3.3. Cave Monitoring and Demographic Parameters

During the survey no monk seal observations were recorded. Two of the three cameras placed in caves (OTH1 and OTH2) have been collected. The Third camera placed in western Corfu (CRF1) has not been collected yet. The photographs collected through the infrared camera traps placed in OTH1 have shown the use of the cave by at least 1 adult female and 1 adult male. RINT observations over the past 6 years are relatively limited and hard to draw conclusions from. Even though data are still incomplete, a preliminary estimation is that a minimum of 15 animals use the area.

Photo 9: An adult female monk seal captured with a RECONYX trap camera inside the monk seal shelter OTH1.

Photo 10: An adult male monk seal in another part of the monk seal shelter OTH1.

3.4. Threats to the Mediterranean monk seal identified in the Study Area

Tourism

Human disturbance affects the behaviour and the abundance and distribution of pinnipeds (Mattlin 1978; Mathews & Pendleton 2006; Orsini, Shaughnessy & Newsome 2006). Depending on the level of human disturbance, reactions of endangered seal species have varied, ranging from no significant effect by New Zealand sea lions (*Phocarctos hookeri*) (Childerhouse & Gales 1998) to the abandonment of pupping sites and the active search for new breeding locations away from human activities by southern fur seals (*Arctocephalus australis*) (Stevens & Boness 2003). In the genus *Monachus* and *Neomonachus*, human disturbance has affected the hauling behaviour of the now extinct Caribbean monk seal (*Neomonachus tropicalis*) (Adam 2004) and has currently a negative effect on the pupping and hauling behaviour and abundance of the critically endangered Hawaiian (*Neomonachus schauinslandi*) and Mediterranean monk seals (Gerrodette & Gilmartin 1990; Karamanlidis *et al.* 2016a). In Greece, Mediterranean monk seals seek-out pupping sites that offer them the best protection against human disturbance (Dendrinos *et al.* 2007). Thus, such habitat may progressively become a limiting factor for this species as human density increases. Identifying and protecting such locations, in an environment increasingly under pressure from human development and fishing activities (Karamanlidis *et al.* 2008) is considered one of the highest conservation priorities for the survival of the species (Karamanlidis *et al.* 2016a).

As is the case elsewhere in the Ionian sea, the massive amounts of tourism in this area coupled with a tourist season that can extend to the end of October and well into the peak of the Mediterranean monk seal breeding period, have become problematic for the species. Kayaking, diving, sailing and daily boat tours are all activities which cause high disturbance, especially considering the fact that visitations to caves are actively advertised by tourism related businesses in the area. The result of this disturbance has been an under-utilization of high quality marine caves, an increasingly rare commodity, by monk seals for pupping. A characteristic example of such a disturbance in the area is found in the breeding cave “OTH2”. Known as “Kalypso” cave, daily tour boats visit the cave and allow tourists to walk inside.

Photo 11: Image of the interior of cave OTH2 in the summer, filled with tourists (image from the internet)

This extremely valuable cave of high quality as a pupping location for the monk seal and located at the very furthest extent of the species' distribution in the north of Greece and is considered to be of great importance for the establishment of a solid breeding population in the area and the future re-establishment of breeding populations in the neighbouring countries of Albania, Montenegro, Croatia and Italy.

Another example is that of cave "PAX1" in Paxoi island. Similarly, this cave in which pupping has been verified in 2020 is under threat from tour boats using the cave as a tourist attraction.

Coastal Fishing

Interactions with coastal fisheries remain one of the most important threats to the Mediterranean monk seal globally, both directly, through accidental entanglement in nets (particularly of young individuals) and through intentional killings resulting from the perception of the seal as a competitor for resources, but also indirectly through the reduction in the seal's food source.

4 Conclusions

The results of the current Coastal Survey for the identification of Monk Seal breeding sites in the Northern Ionian area provide an updated assessment of the status of this rare species in the area.

The main findings of these survey can be concluded as following:

- Twenty-six (26) suitable marine caves were recorded along the coastline of the study area. Seven (7) of these were evaluated as suitable for **pupping** and 19 were evaluated as suitable only for **resting**.
- The species exhibits a low-to-medium but possibly increasing presence in the area as indicated by the observations collected since 2016 through the operation of the RINT.
- Pupping has been verified *in situ* in Othonoi and Paxoi islands and historically in western Corfu. These 3 areas are considered the most vulnerable to future operations in the area.
- According to available data, an estimated minimum of 15 individual monk seal use the area.

The evidence collected during the project indicate that a large part of the project area (i.e., mainly around the island of Corfu and the south-eastern part of Paxoi) have been made inhospitable for the Mediterranean monk seal due to intense human development of the coastline and intense human activity throughout the year. This is a familiar situation throughout the biggest part of the species' range in the Mediterranean Sea (Karamanlidis *et al.* 2016a). However, the coastal caves suitable for Mediterranean monk seals identified in the project area are of similar quality to some of the caves used by the species at the already known pupping areas in the Northern Sporades in the northern Aegean (Dendrinos *et al.* 1994), and Kimolos & Polyaigos, and Karpathos & Saria in the southern and south-eastern Aegean, respectively (MOm 2005). Given appropriate levels of protection these caves could again function as the basis for the increase of the local population. However, the fact that during our inspections we did not find any signs of cave use, even during the pupping season, the high levels of human activity in the area indicate that the project area is currently not used by Mediterranean monk seals to the desired extent. However, observations through RINT show an annual increase so it is probable that more individuals have been using the area in more recent years. Overall, the evidence collected during the project is consistent with the area being an integral part of the species range, especially considering it is situated

on the expansion front of the recovering monk seal population in the Ionian Sea. This would be consistent with information we have from the genetic monitoring of the species in the area (Karamanlidis *et al.* 2016b), but also with the recent sightings of juvenile monk seals in the region of Lecce in Italy and Vlorë in Albania (Note: these areas are approximately 40 n.m. away).

Future research

The continued monitoring of selected breeding caves in the area through the use of infrared cameras is considered essential to achieve an estimation of the local population as well as to discern any population trends.

Through visitations and strategic partnerships, the local Rescue and Information Network for the Monk seal will be enhanced in order to collect as much information as possible on monk seal activity in the wider project area.

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