

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

Final Report

October 2026

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Contents

1 Introduction 8
2 Description of the Project Area 9
2.1 General information about the main cetacean, seabird, and sea turtle species in the Project Area 12
2.1.1 Cetaceans 12
2.1.2 Seals 18
2.1.3 Seabirds 22
3 Methodology 26
3.1 Pelagic surveys 26
3.1.1 Boat surveys 26
3.1.2 Aerial surveys 31
3.2 Coastal surveys 33
3.2.1 Coastal surveys and cave monitoring for the Mediterranean Monk Seal 33
3.2.2 Coastal surveys for seabirds 34
3.3 Colony surveys - Telemetry 35
3.3.1 Colony surveys of Scopoli's Shearwater at the Strofades islets SPA with nest cameras 35
3.3.2 Telemetry of Scopoli's Shearwater at the Strofades islets SPA with satellite transmitters 35
4 Results 38
4.1 Pelagic surveys 38
4.1.1 Boat surveys 38
4.1.2 Aerial surveys 46
4.2 Coastal surveys and cave monitoring for the Mediterranean Monk Seal 48
4.3 Ecology of Scopoli's shearwaters from the Strofades Islands 55
4.3.1 Telemetry results 55
4.3.2 National context: comparison with four other Greek colonies 64
4.3.3 Scopoli's Shearwater Breeding Phenology – Nest-Camera Monitoring 75
4.4 Telemetry of Loggerhead turtles: comparison with Scopoli's shearwater GPS tracking 81
4.4.1 Data and methods 81
4.4.2 Results 82
5 Conclusions 88

6 Bibliography 91
Annex I: Survey protocols 99
ESAS protocol datasheet for collection of seabird data 100
Protocol datasheet for collection of cetacean visual records 101
Protocol datasheet for collection of cetacean acoustic records 101

List of Figures

Figure 2-1. Wider project area 9
Figure 2-2. Bathymetry in the Project Area 10
Figure 2-3. Slope of the sea floor in the Wider Project Area 11
Figure 2-4. Sperm Whale (Physeter macrocephalus) (© Massimo Demma/ICRAM) 14
Figure 2-5. Cuvier's Beaked Whale (Ziphius cavirostris) (©Artescienza-M. Würtz) 14
Figure 2-6. Risso's dolphin (Grampus griseus) (© Massimo Demma) 15
Figure 2-7. Bottlenose dolphin (Tursiops truncatus) (© Artescienza-M. Würtz) 16
Figure 2-8. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM) 16
Figure 2-9. Short-beaked common dolphin (Delphinus delphis) (© Artescienza-M. Würtz) .. 17
Figure 2-10. Mediterranean Monk seal (Monachus monachus) 18
Figure 2-11. Loggerhead Turtle (Caretta caretta) 19
Figure 2-12. Neritic foraging and wintering sites for loggerhead turtles (orange areas and arrows) and green turtle (green arrows) (adopted from Casale et al. 2018). 20
Figure 2-13. 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). 20
Figure 2-14. Green turtle (Chelonia mydas) 21
Figure 2-15. Main known migration corridors for adult female green turtles during reproductive migrations from the breeding sites (stars) (adopted from Casale et al. 2018). 22
Figure 2-16. Scopoli's Shearwater (Calonectris diomedea) (© Paul Hirst) 22
Figure 2-17. Yelkouan Shearwater (Puffinus yelkouan) (© Paul Hirst) 23
Figure 2-18. European Storm-petrel (Hydrobates pelagicus) (© Paul Hirst) 24
Figure 2-19. Mediterranean Shag (Phalacrocorax aristotelis desmarestii) (© Jens Overgaard Christensen) 24
Figure 2-20. Yellow-legged Gull (Larus michahellis) (© Paul Hirst) 25
Figure 3-1. Visual boat surveys 28
Figure 3-2. Night PAM boat survey. 28
Figure 3-3. Deployment of the towed hydrophone array behind the sailing boat 29
Figure 3-4. The aircraft used for the aerial surveys spotting a group of Sperm whales 31
Figure 3-5. ARTINA sailboat from the aircraft's cockpit 32
Figure 3-6. A: Recording an "object of interest", B: Approaching, C: Identifying 32
Figure 3-7. Installation of infrared camera systems in a monk seal shelter 34
Figure 4-1. Visual and acoustic boat-based survey tracks 38
Figure 4-2. Locations of cetacean species visual records. 40

Figure 4-3. Locations of bird species visual records. 41
Figure 4-4. Location of Loggerhead sea turtle visual records. 42
Figure 4-5. Locations of cetaceans acoustic records. 43
Figure 4-6. Visual effort during the boat surveys 44
Figure 4-7. Acoustic effort during the boat surveys 44
Figure 4-8. Solitary sperm whale male individual recorded North West of Zakynthos island. 45
Figure 4-9. Aerial survey tracks 46
Figure 4-10. Aerial surveys records 47
Figure 4-11. General view of the SW coast of Zakynthos was significant monk seal pupping activity has been recorded. 48
Figure 4-12. Geographic distribution of sightings during the period 31/10/2025-11/10/2026 within the wider project area. 50
Figure 4-13. Two adult females nursing their pups in a cave at the SW of Zakynthos island (captured date: 9/2/2026). 51
Figure 4-14. A group of five monk seals in a cave at the SW of Zakynthos island (captured date: 18/1/2026) 52
Figure 4-15. Adult male resting alongside two adult females in a cave at the SW of Zakynthos island (captured date: 14/4/2026) 52
Figure 4-16. A male sub adult monk seal found dead on the coast of Kyparissiakos Bay on the 24th of February 2026. 53
Figure 4-17. Still from video collected through RINT taken by tourists on an inflatable boat closely approaching the two females with their pups resting in the monitored cave in SW Zakynthos island. 54
Figure 4-18. Mediterranean tracks of ten Scopoli's shearwaters from the Strofades (star), coloured by breeding phase. 55
Figure 4-19. Foraging trips. (a) Trip duration against maximum distance from the colony (log scales). The dashed line marks the 2-day split between short and long trips. (b) Farthest point of each trip; larger symbols are long trips. 57
Figure 4-20. Utilisation distributions by breeding phase (equal weight per bird). Shades show the 25, 50, 75 and 95% isopleths. The dark line is the 50% core area. n = number of birds with at least 50 at-sea fixes in the phase. 58
Figure 4-21. Representativeness of the tracking sample: share of foraging fixes of left-out birds that fall inside the 50% UD of random subsets of tracked birds (mean ± SD of 60 draws). ... 60
Figure 4-22. (a) Foraging (search flight + active on water) and (b) resting utilisation distributions. (c) Behavioural states along an 8-day trip of device 201548 to the Gulf of Taranto and southern Adriatic 60
Figure 4-23. Share of behavioural states by hour of local solar time (all birds and phases pooled). 61
Figure 4-24. Environmental conditions at foraging positions and at available points, per bird (paired dots; bars = medians across birds). Counts give the number of birds whose foraging median was lower (depth, slope) or higher (chlorophyll, SST) than availability. 62
Figure 4-25. Approximate prey-habitat indices for (a) anchovy and (b) round sardinella spawning in June and (c) sardine in September, with the shearwater core area (50% UD) of incubation (a, b) and chick-rearing (c). 63

Figure 4-26. Apparent trawl fishing effort (AIS, Global Fishing Watch; June–October) and the shearwater foraging core area (50% UD). Effort off North Africa is under-represented by AIS. 64
Figure 4-27. Duration (a) and maximum distance from the colony (b) of complete foraging trips by colony (log scales). Black ticks mark the medians of short (under 2 days) and long trips. 65
Figure 4-28. Breeding-season core areas (50% UD, filled) and ranges (95% UD, dashed) of Scopoli's shearwaters from five Greek colonies (stars). n = number of birds..... 67
Figure 4-29. Foraging versus available conditions by colony during the breeding season, per bird (paired dots; bars = medians across birds): (a) bottom depth, (b) chlorophyll-a, (c) share of positions on the shelf, (d, e) share in high-index anchovy spawning and sardine habitat, (f) share in cell-months with AIS trawling..... 70
Figure 4-30. Natura 2000 sites with a marine part of more than 2 km² (dark green: SPA, including sites designated under both directives; light green: SCI/SAC only) and breeding-season core areas (50% UD) of the five colonies. Natura 2000 covers EU member states only. 72
Figure 4-31. Zones of the planned Ionian Marine Park, offshore hydrocarbon blocks and breeding-season foraging positions of birds from the five colonies (stars) in the southern Ionian and around Crete. 74
Figure 4-32. Setting up the cameras at the Strofades Scopoli's Shearwater colony. (a) The coastal limestone slope where the nests are. (b) The chick in its nest under a boulder. (c) Solar panel hidden among the rocks. (d) Reolink 4K camera Reo52 with a wooden shade, pointing into the nest chamber. e) A camera being fixed under a rock overhang..... 76
Figure 4-33. Chick development in the nest..... 79
Figure 4-34. Pre-fledging activity at the burrow entrance..... 80
Figure 4-35. Daily positions of 11 loggerhead turtles from Kyparissia (lines), their residence core areas (50% UD, green), the foraging core areas of Scopoli's shearwaters from five Greek colonies (50% UD, blue) and the shared core areas (purple)..... 83
Figure 4-36. Cumulative distribution of bottom depth at turtle residence positions, shearwater foraging positions and points available to shearwaters (log scale). The dashed line marks the shelf break (200 m)..... 85
Figure 4-37. Bottom depth, chlorophyll-a and sea-surface temperature at available and used positions of shearwaters (foraging, breeding season) and turtles (residence, June–October). Boxes show the interquartile range and median; whiskers the 5th–95th percentile range. . 85
Figure 4-38. Turtle daily positions near Kyparissia, marine Natura 2000 sites, the zones of the planned Ionian Marine Park and the Kyparissiakos hydrocarbon block (ELPE). The Strofades shearwater colony lies inside the block. 87
Figure 4-39. Turtle daily positions by phase and residence core areas (50% UD) in relation to Natura 2000 sites, the planned Ionian Marine Park and the five hydrocarbon exploration blocks. Yellow: the ten daily positions inside a block (four near Kyparissia, six during migration, none in residence areas). Right: close-up of Kyparissiakos Bay..... 87

List of Tables

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). 13
Table 4-1. Species visually recorded..... 39
Table 4-2. Monk seal records through RINT within the Wider Project Area..... 49
Table 4-3. Individuals of Monk seal identified with the infrared camera traps 51
Table 4-4. Tracking summary per bird (Mediterranean records only). Colony days: days with at least one record at the colony..... 56
Table 4-5. Foraging-trip metrics by breeding phase and trip type (complete trips). Values are medians, with the range in brackets. 56
Table 4-6. Share of foraging time by sea area (mean of per-bird shares, %) and number of birds using each area (more than 2% of their foraging fixes). 59
Table 4-7. Foraging trips by colony (complete trips, breeding season and post-breeding combined). Durations in days, distances in km, medians. 65
Table 4-8. Breeding-season utilisation distributions and distance of foraging positions from the colony, by colony. 66
Table 4-9. Share of breeding-season foraging time by sea area and colony (mean of per-bird shares, %). Areas with more than 2% for at least one colony are shown. – = less than 0.5%. 67
Table 4-10. Foraging (used) versus available conditions by colony during the breeding season. Values are foraging / available, pooled over positions. In brackets: number of birds whose foraging value exceeded availability (for depth: was lower). Prey and trawl columns give the share of positions in high-index habitat (0.5 or more) and in trawled cell-months. 69
Table 4-11. Breeding-season foraging inside Natura 2000 sites by colony: mean of per-bird shares (%), with the range across birds in brackets, by directive, and share of the colony's 95% UD covered by sites (%). Main sites: the sites with the largest share of foraging, in decreasing order. 71
Table 4-12. Ionian Marine Park and hydrocarbon blocks: breeding-season use by colony. Each cell gives the share of at-sea positions / share of foraging positions inside the area (%, mean of per-bird shares), with the number of birds that entered the area out of those tracked. – = no bird entered..... 73
Table 4-13. Summary of the operation of the two nest cameras 75
Table 4-14. Tracking summary per turtle (F: adult female caught after nesting, M: male caught in the port of Kyparissia). Days near Kyparissia: daily positions within 60 km of the release area. Residence: days outside migration and away from Kyparissia. 82
Table 4-15. Environmental conditions at turtle residence positions and shearwater foraging positions, June–October (medians and shares of positions). Shearwaters: 24 birds from five colonies, breeding season. 85
Table 4-16. Share of turtle daily positions inside Natura 2000 sites, the planned Ionian Marine Park and the five hydrocarbon blocks, by phase (mean of per-turtle shares, %). 86

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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	Bottlenose Dolphin
WP	Work Package
Ziphius cavirostris	*Cuvier's Beaked Whale*

1 Introduction

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

The Project consists of 3 work packages (WP):

I. Pelagic Surveys for marine mammals, seabirds, sea turtles, nearshore and in the open sea, using an open water RIB vessel, a sailing boat, and a single-engine aircraft.
II. Coastal surveys for monk seals and seabirds breeding sites in the coastal zones of the adjacent Natura 2000 sites, using inflatable RIB boats.
III. Colony surveys at the Strofades islets SPA and the surrounding project area, using GSM nest cameras, thermal cameras and GPS/GSM transmitters, as well as analysis of the transmitters' data fitted on Loggerhead turtles in the previous years.

The present document constitutes the Final Report for Work Packages WP I–III. It presents the field surveys carried out during 2026 and the results in each Work Package.

The present project represents the 2026 continuation of the ongoing project entitled "Survey of the Status of Important Fauna Species in the Kyparissiakos Lease Area", which has been implemented during the period 2020–2026.

2 Description of the Project Area

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

The **Wider Project Area** envelops the project area and extends further north and east to additionally include the southwestern, south-eastern and eastern coast of Zakynthos, and the western coast of Peloponnese south of Kyllini, together with their neighbouring islets (Figure 2-1)

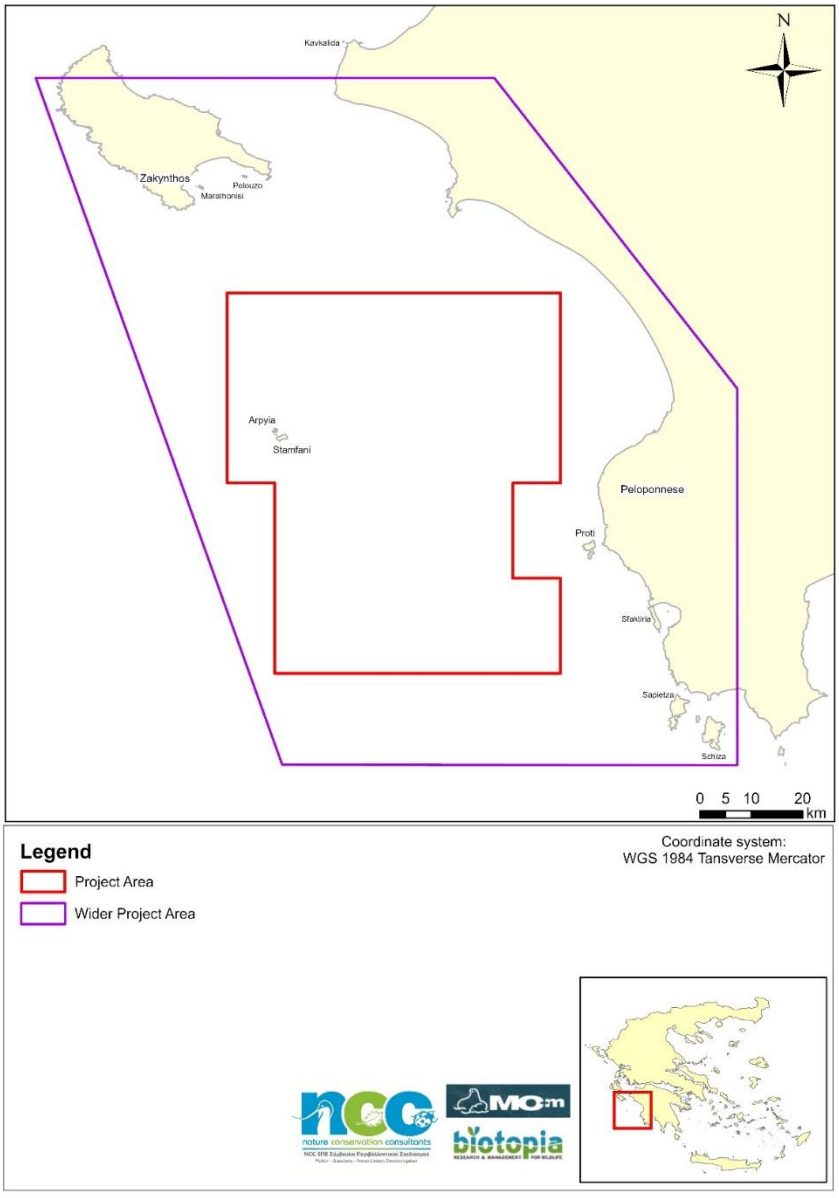


Figure 2-1. Wider project area

Oceanographic characteristics of the Project Area

The sea depth within the Project Area exceeds 500m and reaches more than 3,500m at its southwestern corner. The only exception is the Strofades islets in the west, which are surrounded by a narrow belt of coastal waters (Figure 2-2).

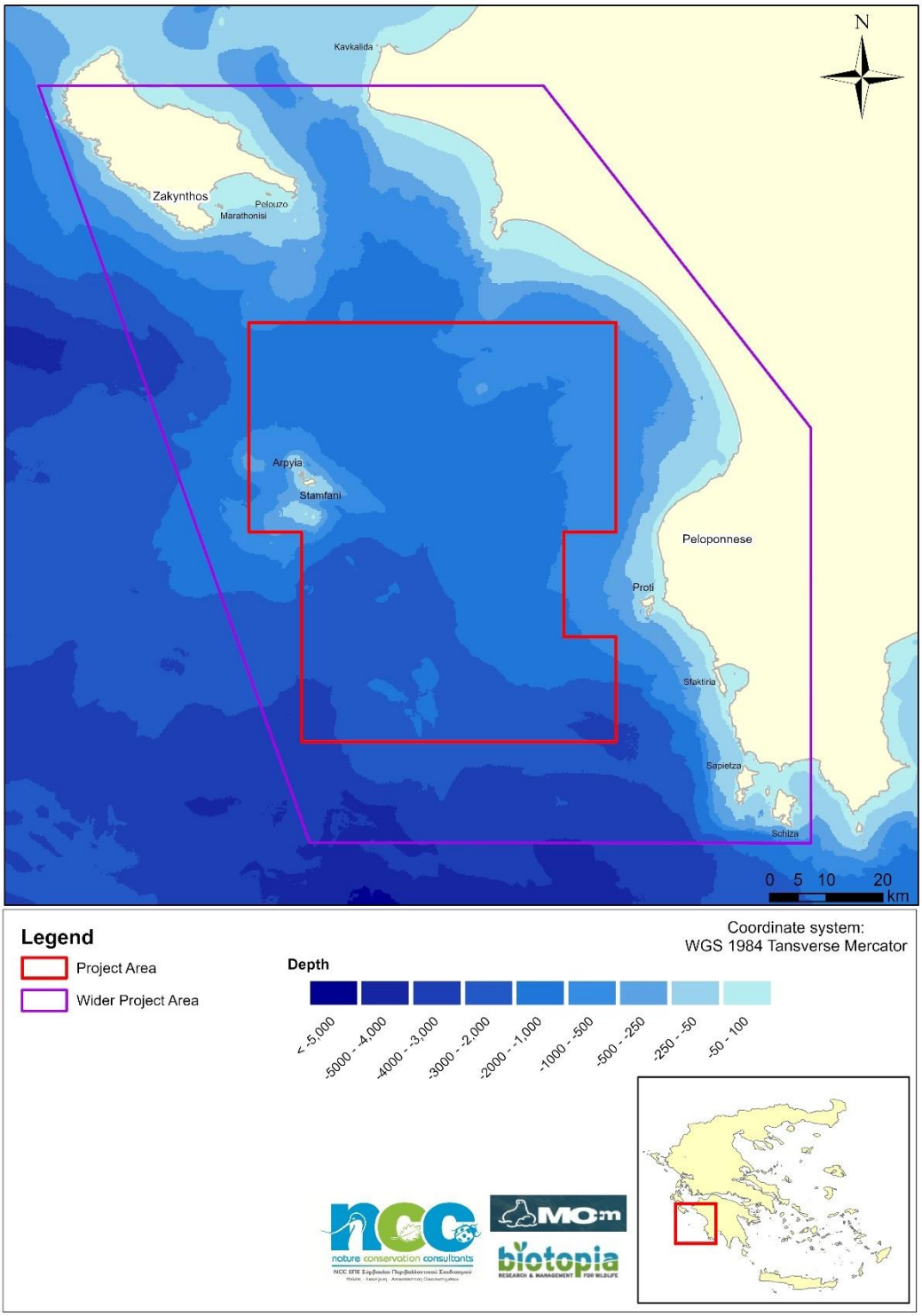


Figure 2-2. Bathymetry in the Project Area

In northern, north-eastern and eastern part of the Wider Project Area the slope of the sea floor descends gradually, without abrupt breaks towards southwest, however the southern and the western part exhibit numerous abrupt descends of the sea floor, accompanied by step slopes of the sea floor reaching up to 53^{o} (Figure 2-3).

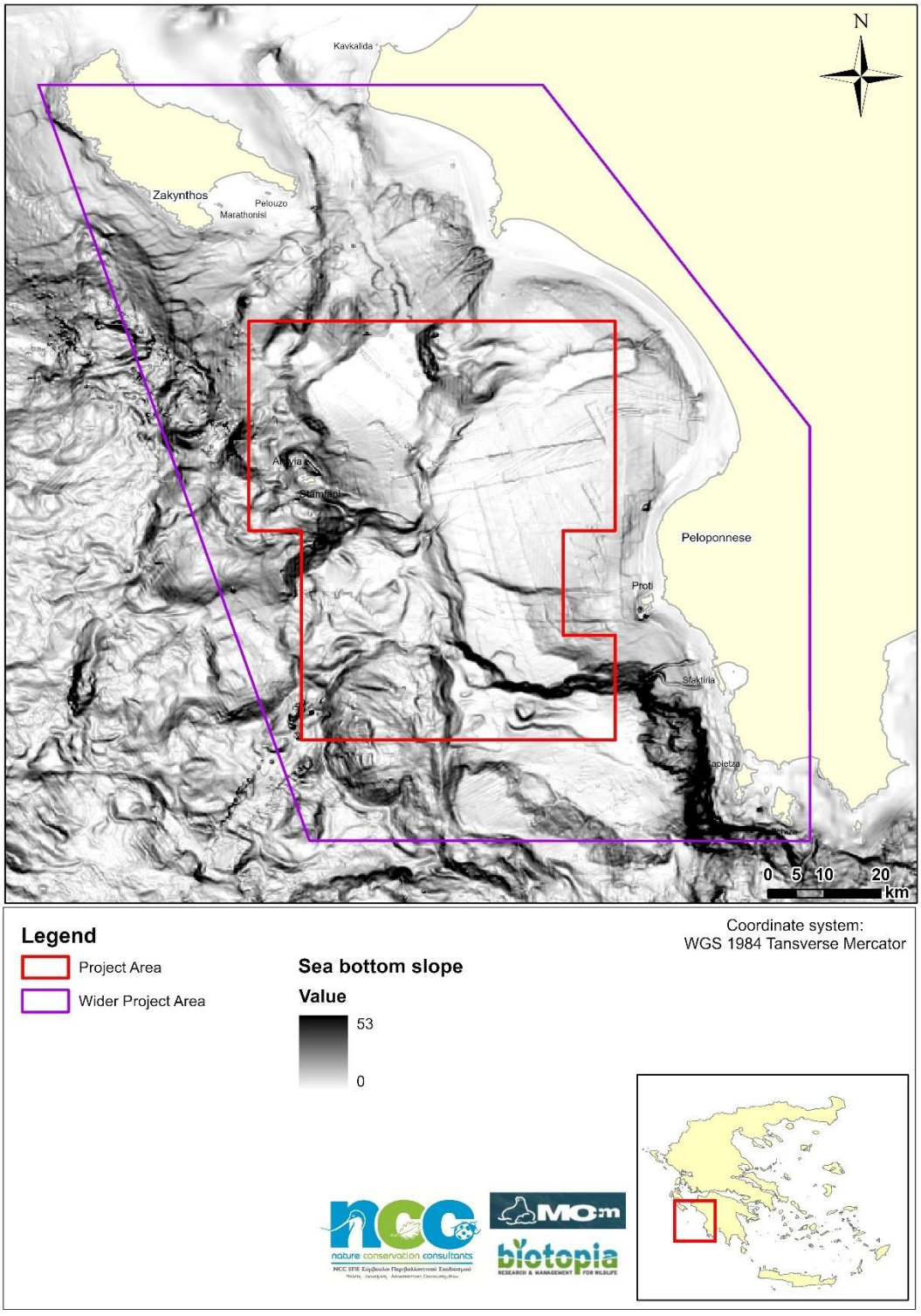


Figure 2-3. Slope of the sea floor in the Wider Project Area

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

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

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

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

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

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

2.1.1.1 Sperm Whale (*Physeter macrocephalus*)



Figure 2-4. Sperm Whale (Physeter macrocephalus) (© Massimo Demma/ICRAM)

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

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

2.1.1.2 Cuvier's Beaked Whale (*Ziphius cavirostris*)

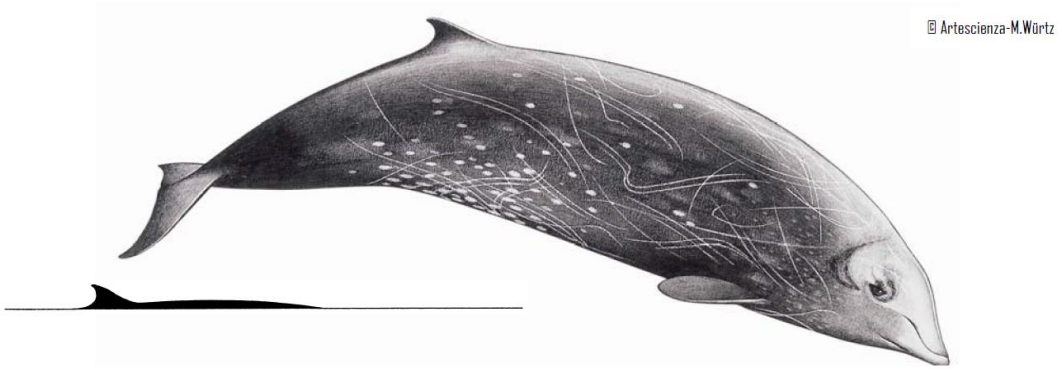


Figure 2-5. Cuvier's Beaked Whale (Ziphius cavirostris) (©Artescienza-M. Würtz)

Cuvier's Beaked Whale, a medium sized odontocetes, shares the same habitat and distribution as that described for the Sperm Whale, namely the continental slope. Almost all past species sightings occurred above depths of 500-1,500m (Frantzis et al. 2003). It is the only beaked whale common in the Mediterranean Sea. In Greece, most past sightings are associated with the Hellenic Trench, from eastern Rodos Island to northwest Corfu Island (Frantzis et al. 2003,

Frantzis 2009) with the highest number of sightings south of Crete and west of Lefkada (Frantzis et al. 2003, Podestà et al. 2016). Along the Hellenic Trench the species feed 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 of 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 2-6. 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 on squid and occasionally on 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 Wider Project Area is unknown.

2.1.1.4 Bottlenose dolphin (Tursiops truncatus)

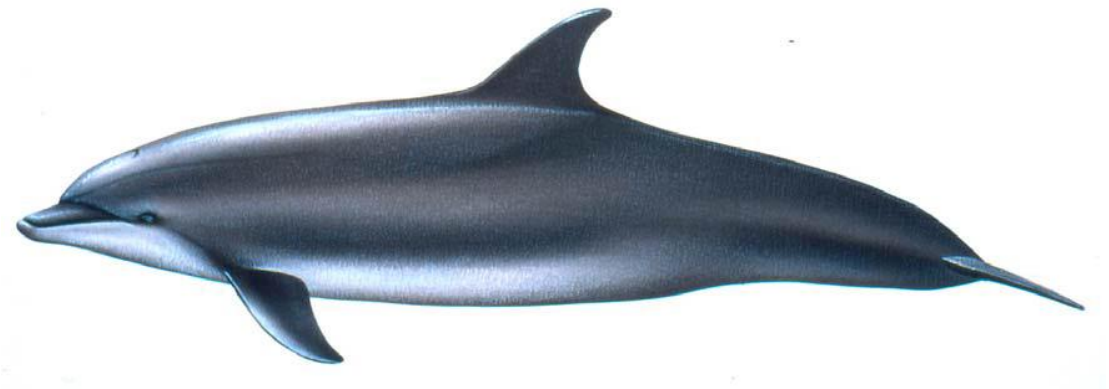


Figure 2-7. Bottlenose dolphin (Tursiops truncatus) (© Artescienza-M. Würtz)

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

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

2.1.1.5 Striped dolphin (Stenella coeruleoalba)

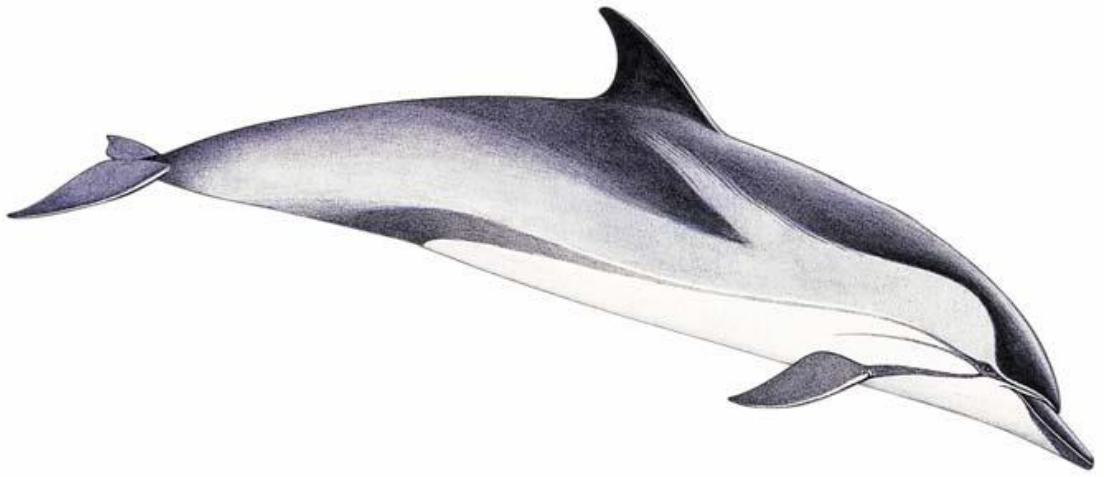


Figure 2-8. Striped dolphin (Stenella coeruleoalba) (© Massimo Demma/ICRAM)

The Striped Dolphin, a small delphinid, has a year-round presence in Greek waters. It is the most abundant dolphin species in Greece and the Mediterranean overall (Frantzis 2009). Its

distribution in Greece is widespread, and it occurs in all deep (>500m), pelagic waters and the continental slope but it can also inhabit intermediate depths of 200-500m (Frantzis 2009). The Striped Dolphin is frequently sighted along the length of the Hellenic Trench. The species diet includes mainly cephalopods, as well as fish and crustaceans.

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

2.1.1.6 Short-beaked common dolphin (Delphinus delphis)

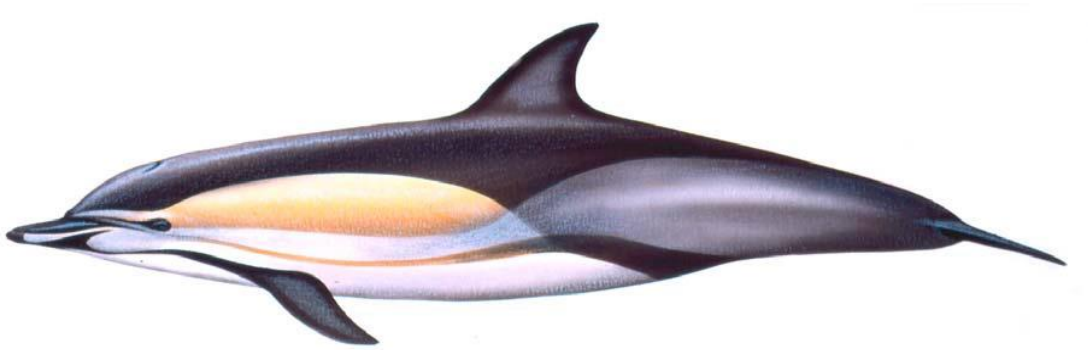


Figure 2-9. Short-beaked common dolphin (Delphinus delphis) (© Artescienza-M. Würtz)

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 is limited to shallow waters between north Lefkada, Kefallonia and south Zakynthos and the mainland. In the Inner Ionian Sea, the main prey includes shoaling fish e.g., anchovies and sardines.

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

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

2.1.2 Seals

2.1.2.1 Mediterranean Monk Seal



Figure 2-10. Mediterranean Monk seal (Monachus monachus)

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, & 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/).

2.1.2.2 Sea turtles

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

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

2.1.2.3 Loggerhead turtle (Caretta caretta)



Figure 2-11. 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 kilometers to forage and to return to its breeding sites. After hatching, logger-head turtles adopt an oceanic lifestyle in major current systems (Bolten and Witherington 2003). After 4-19 years spent in the oceanic zone, they move to neritic areas where they forage and mature over 10-39 years (Avens and Snover 2013). After attaining sexual maturity, they migrate between neritic foraging grounds and nesting areas. The Mediterranean, where the species is nesting in the eastern basin (Legakis & Maragou 2009), the breeding population of the loggerhead turtle is spread over tens of rookeries which are estimated to produce over 7,200 nests annually (Casale & Margaritoulis 2010) with most nests being found in Greece. The country's two most important nesting beaches are in the Wider Project Area, namely on Zakynthos (Laganas Bay) and on Peloponnese (Kyparissia Bay), which host 43% and 19% of all nests in Greece, respectively (Legakis & Maragou 2009). The average number of nests per season for the period 1984-2007 at Laganas Bay and at Kyparissia Bay are 1,244 nests/season (range: 833-2,018 nests/season) and 621 nests/season (range: 286-927 nests/season) (Casale & Margaritoulis 2010). Currently, Kyparissia Bay hosts the largest Loggerhead turtle nesting aggregation in the Mediterranean Sea (Rees et al. 2020).

In Greece and in the Central Mediterranean, the turtles after hatching disperse mainly in the Ionian, south-central Mediterranean and Adriatic Seas (Casale & Mariani 2014). Loggerhead turtles, especially juveniles, forage in almost all oceanic areas in the Mediterranean. Water circulation system has the greatest effect on their distribution (Casale et al. 2018). The neritic

foraging areas (i.e., those located above continental shelf) are more frequently used by larger turtles, including adults (Casale et al. 2018). Loggerhead turtles generally overwinter within or close to their foraging areas, however some may move from cold areas e.g., Adriatic Sea during winter (Casale et al. 2018).

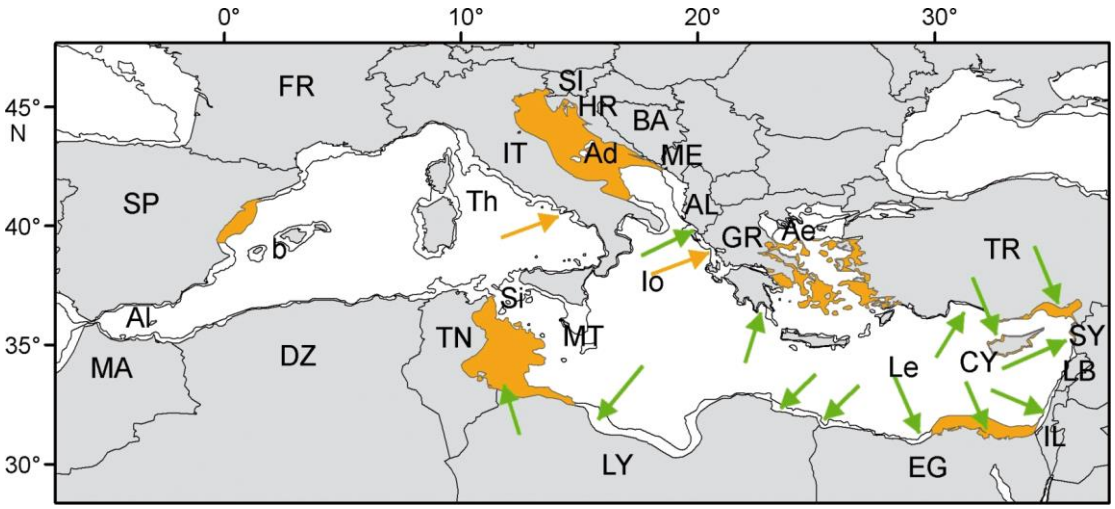


Figure 2-12. Neritic foraging and wintering sites for loggerhead turtles (orange areas and arrows) and green turtle (green arrows) (adopted from Casale et al. 2018).

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 2-13.

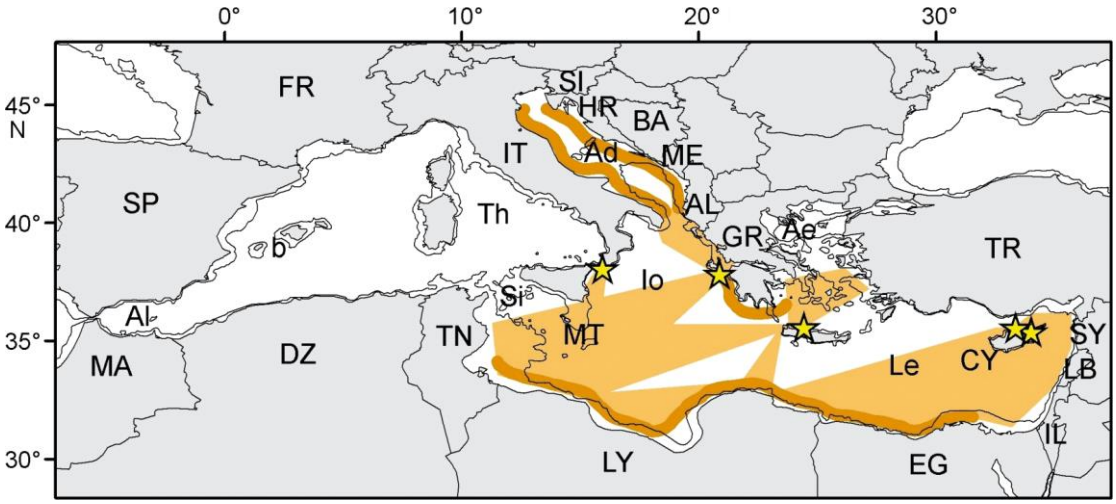


Figure 2-13. Main known migratory corridors for adult loggerhead turtles to and from breeding sites (stars). Light brown areas represent migratory funnels in the open sea while darker strips represent paths along the coasts, typically in shallow waters (adopted from Casale et al. 2018).

The movements of the Loggerhead turtles nesting in the Ionian Sea, particularly those from Zakynthos have been well studied by satellite or GPS telemetry (e.g., Zbinden et al. 2008, Schofield et al. 2010a-c, Schofield et al. 2013, Luschi & Casale 2014). The data from 75 tracked turtles breeding on Zakynthos showed after breeding the turtles migrate to neritic sites with waters shallower than 100m, with the majority of turtles migrate north to the Adriatic Sea and Amvrakikos Gulf (42%) or south-west to Libya and Tunisia (32%), while the remaining either stay in the Ionian Sea or move to the eastern or western Mediterranean (Zbinden et al. 2008, Schofield et al. 2013). After leaving their foraging areas (in October – November) the tracked turtles move to their overwintering areas further south (Zbinden et al. 2008). The main foraging and overwintering areas are presented in the Map 11, below. The main foraging areas are located over the continental shelves and slopes (Ullmann & Stachowitsch 2015) in the Northern and Southern Adriatic Sea, Ionian Sea, the Strait of Sicily and the Tunisian shelf. A small proportion (~7%) were residents of Zakynthos. Significantly more males than females remain within 100km of Zakynthos (Schofield et al. 2013).

2.1.2.4 Green turtle (Chelonia mydas)

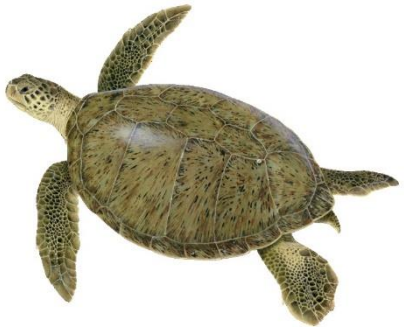


Figure 2-14. Green turtle (Chelonia mydas)

The green turtle (*Chelonia mydas*) is a migratory oceanic turtle with a global distribution. Their nesting sites in the Mediterranean are located mostly in Turkey, Cyprus and Syria (Figure 2-12) with an average of 1500 nests per year. No regular nesting areas are in Greece. They use mostly marine areas in the Levantine basin, but also forage in Greece and Libya, as well as occasionally in the Adriatic Sea and the western Mediterranean basin (Figure 2-13). In Greece local concentration have been found in Lakonikos Bay, southern Peloponnese. Stranding data indicate that there is a more frequent presence of adult green turtles in southern Aegean (Casale & Margaritoulis 2010). The species has been recorded in the Wider Project Area.

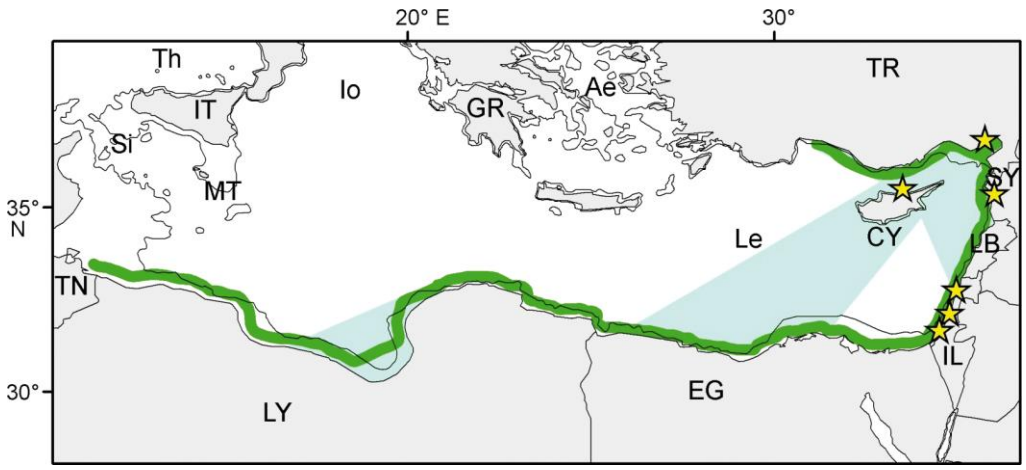


Figure 2-15. Main known migration corridors for adult female green turtles during reproductive migrations from the breeding sites (stars) (adopted from Casale et al. 2018).

2.1.3 Seabirds

To the present study, only those seabird species which are exclusively associated with the marine environment and the pelagic area, that have been recorded in the Ionian Sea in the past and their presence in the wider Project area has been 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*).**

2.1.3.1 Scopoli's Shearwater (Calonectris diomedea)

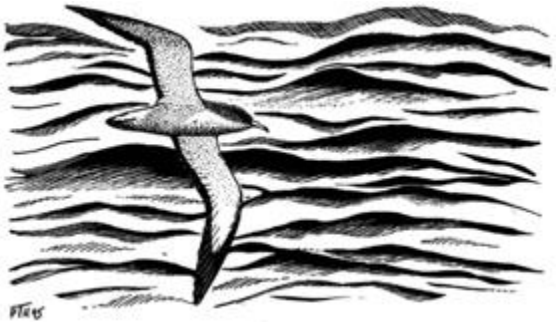


Figure 2-16. Scopoli's Shearwater (Calonectris diomedea) (© Paul Hirst)

Scopoli's Shearwater (C*alonectris diomedea*) breeds across Mediterranean with most of the population spending the non-breeding season in the Atlantic. In the past it was considered conspecific with the Cory's Shearwater (C*alonectris borealis*) which breeds in the Atlantic. In Greece the species breeding in the Aegean and Ionian Sea with the largest known colony being located at Strofades Islets (within the Project Area), south of the Zakynthos Island in the Ionian

Sea, with an estimated breeding population of 5,550 pairs (Karris et al. 2017). Other large colonies occur mainly in the southern, central and eastern Aegean Sea although breeding has also been confirmed in the northern Aegean Sea (Fric et al. 2012). The only other known breeding area in the Ionian Sea is at Diapontia islands at Kerkyra with much smaller breeding population of 60-100 pairs (Fric et al. 2012).

2.1.3.2 Yelkouan Shearwater (Puffinus yelkouan)

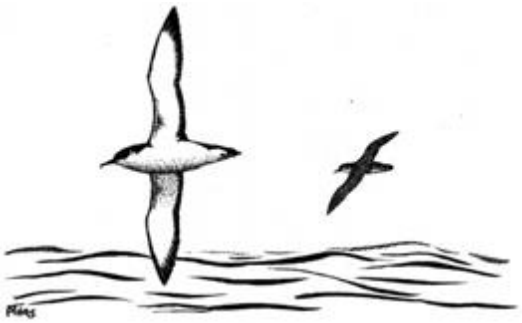


Figure 2-17. Yelkouan Shearwater (Puffinus yelkouan) (© Paul Hirst)

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

The global species population is estimated at 15,337-30,519 pairs with a decreasing population trend (30% in the next 54 years 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.

2.1.3.3 European Storm-petrel (Hydrobates pelagicus)



Figure 2-18. European Storm-petrel (Hydrobates pelagicus) (© Paul Hirst)

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

2.1.3.4 Mediterranean Shag (Phalacrocorax aristotelis desmarestii)



Figure 2-19. Mediterranean Shag (Phalacrocorax aristotelis desmarestii) (© Jens Overgaard Christensen)

Mediterranean Shag is a cormorant species, resident and widely spread in Greece which usually occurs in coastal waters. Shags breed colonially, forming small, loose (rarely dense) colonies, on cliff ledges or small caves or even under thick vegetation. Nesting sites are re-used in successive years by the same birds. They often roost in large groups (Fric et al. 2012). It is a good swimmer and a foot-propelled diver which feed on benthic and pelagic fish in

waters with depths up to 80 m which are usually located in coastal zones within a 20 km radius around their colony or roosting sites (Wanless *et al.* 1991; Velando and Friere 1999).

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

2.1.3.5 Yellow-legged Gull (Larus michahellis)

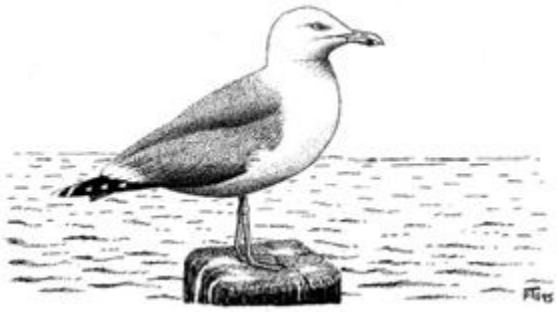


Figure 2-20. Yellow-legged Gull (Larus michahellis) (© Paul Hirst)

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

3 Methodology

3.1 Pelagic surveys

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

3.1.1 Boat surveys

"Zig-zag" transect lines will be used, focusing on the deeper part of the area (below 800m depth), with a total length of 900-1000 nm (including the transfer to and from ports) to ensure uniform coverage of both the study area and the most suitable habitat for the deep-dwelling marine mammals, such as the sperm whale and the Cuvier's beaked whale. Binoculars will be used for the accurate identification of encountered animals from a distance and for a more precise estimation of group size. All on-transect/on-effort navigation data and sighting locations will be recorded using a specialized software for subsequent analysis.

Visual surveys will be conducted for 6 to 10 hours per day, with an average of 8 hours. Researchers will aim for the upper time limit of 10 hours, however when sighting conditions deteriorate beyond an acceptable threshold (usually ≥3 Beaufort scale, cresting waves, scattered whitecaps), the survey effort will have to be interrupted. Surveys will continue during night hours with the use of the boat thermal camera.

The acoustics detection team works in cooperation with the visual observers, detecting cetacean vocalizations by using a hydrophone array towed behind the sailing boat. The hydrophone array system consisting of High Frequency Magrec HP03 hydrophone elements, comprising a HP03 preamp (Low cut filter set at 2kHz) with a nominal sensitivity of 1.5kHz – 150kHz along with a topside Magrec HP/27ST Amplifier along with a Lenovo Thinkpad Laptop using the PAMGUARD acoustic analysis software specifically developed for cetacean monitoring, covering the range of possible vocalizations for species likely to be encountered during our surveys. The towed hydrophone system is submerged and active, and a Passive Acoustic Monitoring (PAM) operator is active on the equipment during all "On Effort" times during the survey. The hydrophone system consists of 4 hydrophones, which record on 4 different channels. The visual observers and PAM operator rotate every 1.5 hours to minimize fatigue.

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

The hydrophone recordings are analysed real-time during the survey by PAMGUARD software using the "*whistle and moan detector"* and the *"Click Detector"* modules.

PAM surveys will take place during day and night. The improved 2025 survey protocol will be followed, to enable the identification of animal groups and possibly of individual animals. This will mainly focus on Cuvier's Beaked whales and Sperm whales. Once an animal is spotted visually or acoustically, the research vessel will stop the sampling transect and remain on the site to further spot possible groups of the

species, take evidence of its presence (including pictures, video and possibly biological material), using the drones and the zodiac boat..

The PAM acoustic surveys will include:

1. Line-transect type surveys using towed hydrophone.
2. Searching and tracking activities, especially for sperm whales in deep water areas. Combination of towed hydrophone and directional hydrophone.
3. Dipping hydrophones, compact recording systems for opportunistic recording. Useful for collecting recordings from known species, through drone deployment.

The marine mammal observations will be visual, conducted by qualified researchers, certified MMO/PAM operators. Statistical analysis will be performed to make adequate extrapolations from the sampling data. Relative abundance will be expressed with a specific index as a frequency of observations, which will be the number of encounters with cetaceans (each species separately), per unit of effort to find them. The total effort will be the nm (nautical miles) that the research vehicle (vessel or aircraft) has traveled under adequate observation conditions (sea state <3 Beaufort). At the same time, the absolute abundance will be approximated by counting the number of recorded individuals. The results will be comparable with the results of the same sampling effort that can be carried out in the future using the exact same methodology to determine any change in potential trends, to increase or decrease the frequency of presence and abundance in the study area.

In parallel with the cetaceans surveys, two experienced observers will be counting seabirds using the ESAS methodology. Researchers will follow the standardized European Seabirds at Sea (ESAS) methodology, which is a standardized method of recording seabirds at sea in Europe. The method is based on the survey of seabirds by vessels moving at low speed. Seabirds swimming in the sea are recorded in a 300 m wide belt along the 5-minute intervals, while flying seabirds, are recorded once a minute to avoid any double counting. The result of spatial analysis of the data collected by the ESAS method is the estimation of spatial abundance of seabirds (in number of individuals per km^2). This method focuses mainly on pelagic species of seabirds such as Cory's Shearwater, Yelkouan shearwater and Storm Petrel, as well as on coastal species (e.g. Yellow-legged Gull and Mediterranean Shag).



Figure 3-1. Visual boat surveys

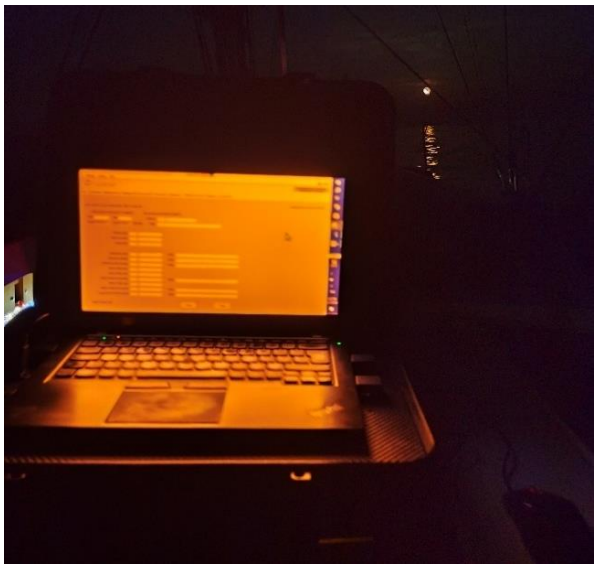


Figure 3-2. Night PAM boat survey.



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

Photo – Identification

Photo-identification (photo-ID) is one of the most reliable non-invasive methods for identifying individual marine mammals. It relies on the unique natural characteristics of each animal, including the shape, scars, and pigmentation patterns on the tail fluke or dorsal fin, which act as a biological "fingerprint" for individual recognition.

Photo-identification is widely applied across different species of marine mammals such as dolphins, seals, and whales by using permanent external traits (scars, pigmentation patterns, and notches) that remain stable over time. This approach enables the estimation of population trends, spatial distribution, and individual movement patterns. In the case of the sperm whale (*Physeter macrocephalus*), the technique focuses primarily on the tail fluke, whose morphology is distinct for each individual and represents a highly reliable feature for identification. The shape of the fluke, the pattern of its trailing edge, notches, scars, and pigmentation marks remain consistent over time and can be used as diagnostic characteristics for individual recognition. Through this approach, it is possible to estimate the minimum number of individuals observed, detect potential re-sightings, and assess the spatial and temporal distribution of sperm whales within the study area.

During field surveys, photographs were taken whenever sperm whales were sighted, focusing particularly on moments of deep diving when the tail fluke was fully raised above the water

surface (fluke-up). For each encounter, the date and time of the first and last observation, the group size and composition, and the general behaviour of the animals were recorded. From the total number of photographs, only those meeting the quality criteria for identification clear focus, full fluke exposure, and near-perpendicular angle were selected for further analysis. The selected images were organized by encounter and uploaded to the Flukebook platform, which applies an automated algorithm for pattern matching. The system-generated matches are not considered final; each proposed match is visually reviewed by the analyst to confirm specific morphological traits such as the outline of the fluke, notches, and scars. Each identified individual is assigned a unique code (e.g. SW1, SW2) and archived in a dedicated reference folder containing one or two representative photographs. All individual codes (SW1–SW14) correspond to entries in the NCC Flukebook database (Project: Ionian_2025_PhotoID).

The results of algorithmic matching are always interpreted with caution, as similar scores alone do not constitute definitive evidence of identification. The final confirmation relies on expert visual assessment of morphological features to ensure that every identification is scientifically valid and well-documented. Photo-identification metadata are compiled in a dedicated Excel database, which includes, for each individual, the corresponding photo codes, observation times, group composition, behavioral notes, and key morphological characteristics. This database serves both as a validation record and as a reference for future cross-comparison of observations.

Photo quality control is conducted at two stages: initial field selection (sharpness, angle, full fluke exposure) and subsequent post-processing review to ensure temporal and spatial consistency across identifications. Potential limitations of the method include environmental and behavioral factors such as lack of full fluke-up, distance from the observer, sea state, or lighting conditions which can reduce the reliability of individual recognition. Despite these limitations, photo-identification remains a fundamental and effective tool for documenting the number, composition, and behaviour of sperm whales observed during the surveys.

3.1.2 Aerial surveys

For the aerial surveys, a high-wing, light aircraft Cessna C172R Skyhawk is used, powered with a Lycoming IO-360-L2A, 160 Hp. This four-seater aircraft offers an excellent view from its cockpit and is considered suitable, reliable, and cost-effective for such a mission. Messolonghi Airport (ICAO designator GR-0008) is used as a base for the aerial expeditions. The flights are performed along the Project Area at an altitude of 1000 ft MSL and an average Speed Over Ground of 90 knots. The aircraft travels in predetermined transect lines that are randomly placed to allow for homogeneous coverage probability over the study area. When animals are spotted, the aircraft deviates from its predetermined course and circles over the area of interest so that the observer can more accurately identify the species and count the number of individuals in the group. Whenever possible, photographs are taken to provide the most comprehensive confirmation of the data. The aircraft then resumes coverage of the predetermined route from the point where it was interrupted. The photographic operation is performed using a full frame DSLR (Nikon D750) with a 70-200mm F/2.8 Tamron SP lens. All photographs are georeferenced since the camera is equipped with a GPS Unit (Nikon GP-1A). The flights are monitored and recorded with the use of two specialized applications, namely the GARMIN-Pilot and the Fore-Flight.



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

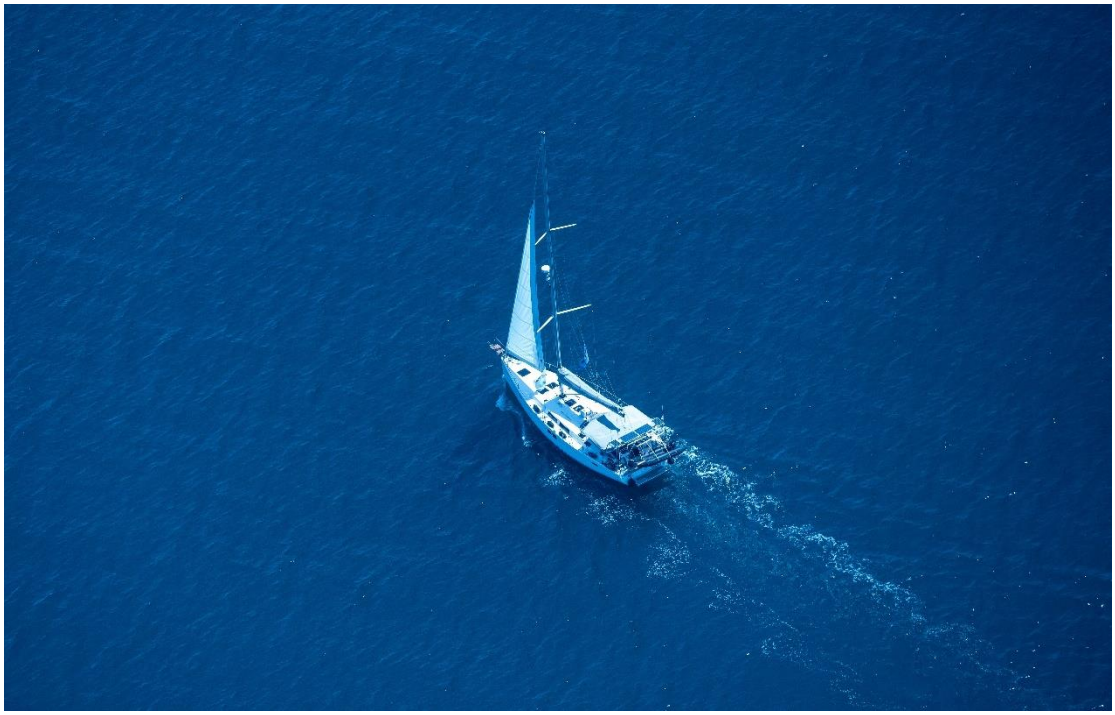


Figure 3-5. ARTINA sailboat from the aircraft's cockpit

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



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

3.2 Coastal surveys

3.2.1 Coastal surveys and cave monitoring for the Mediterranean Monk Seal

Data on the Mediterranean monk seal are collected along the coastlines of the wider study area. The data collections is carried out using two very well-established methods, which have been developed by MOm and have been used on an ongoing basis in Greece for the past four decades.

More specifically, the methods used are:

A) The operation of the Rescue and Information Network (RINT). This is a well-established network that collects continuously information on monk seal observations (alive or dead individuals) throughout the Hellenic coastline.

B) The continuous monitoring of important monk seal pupping sites (marine caves) through the use of infrared (IR) trap camera systems. The data collected through the use of these systems support the detailed assessment of monk seal breeding activity. Depending on the monitoring objective, cameras either operate in time-lapse mode capturing images at regular intervals (e.g., every 2 hours) for continuous observation of known pupping sites, or in motion-triggered mode to record presence-absence data of the species. The photographs obtained through the use of these camera systems support also the identification of monk seal individuals. In previous years, MOm's research team conducted a detailed mapping of the coastline of the broader study area, documented the important caves used by the seals, and installed a permanent data collection system that is used to continuously record data related to the species' reproductive activity. This was deemed extremely important, as the species' key breeding area, identified on the southwestern coast of Zakynthos, is located within the broader region likely to be affected by future mining activities in the area.Coastline surveys will be conducted across southwest Zakynthos Island, the Strofades Islands, the Kyparissiakos Gulf, and the southwestern Peloponnese to identify and monitor marine caves that may serve as suitable pupping sites for the Mediterranean monk seal (Monachus monachus). Surveys will be carried out using a Rigid Inflatable Boat (RIB), enabling efficient coverage of extensive and complex coastal areas to ensure that no potential pupping site is overlooked.

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

Lastly, records of seal observations are collected through the operation of Rescue and Information Network (RINT).

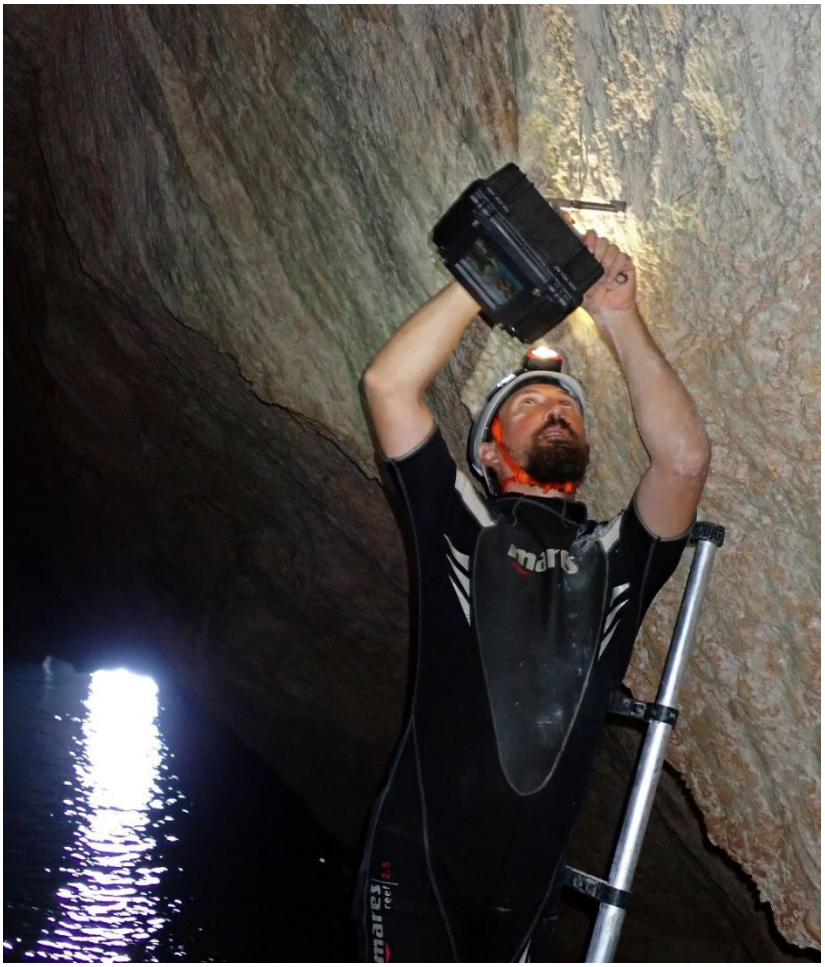


Figure 3-7. Installation of infrared camera systems in a monk seal shelter

3.2.2 Coastal surveys for seabirds

Boat-based coastline surveys are conducted, with the vessel navigating parallel to the shoreline at a distance of approximately 50–100 m, where navigation is feasible and safe. Observations are carried out visually using binoculars, covering both the terrestrial coastal zone and the adjacent marine environment.

For each observation, the species, number of individuals and geographic position are recorded using a GPS device, while all observations are documented on standardized field protocols and survey maps. For birds observed at sea, behavioural information (e.g. foraging, resting, commuting) is also recorded, together with any anthropogenic activities that may influence their presence or distribution.

In addition, the presence and activity of birds on land are documented, including evidence of nesting, roosting, resting, and low-altitude flights or other behaviours associated with habitat use.

3.3 Colony surveys - Telemetry

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

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

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

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

3.3.2.1 Tracking data

Ten adults were fitted with solar-powered OrniTrack OT-15 GPS–GSM transmitters (Glosendas, 15 g) while incubating, and data were downloaded from the manufacturer's platform. Devices recorded a GPS fix every 10 min (six birds) or 20 min (four birds) and transmitted data when within GSM coverage. Each record also carries a single static tri-axial acceleration and magnetometer sample.

3.3.2.2 Data processing

Positions with fewer than four satellites or no HDOP value were treated as failed fixes. Test positions recorded before deployment were removed, as were speed spikes above 100 km/h between consecutive fixes and positions falling on land outside the colony. Records west of the Strait of Gibraltar (5.6° W) were excluded, so the analysis covers the Mediterranean only.

Breeding phase was assigned by date from the known phenology of the species (Cianchetti-Benedetti et al. 2018): incubation until 15 July, chick-rearing 16 July–20 October, post-breeding thereafter. Positions in March–mid-May of a subsequent season were labelled pre-laying.

3.3.2.3 Colony attendance and foraging trips

A bird was considered at the colony when a valid fix lay within 5 km of the Strofades, or when a failed fix was bracketed by colony fixes, as burrows prevent satellite reception. Colony stays were runs of such records with gaps under 3 h. A foraging trip was the interval between two colony stays. Trip duration, maximum distance from the colony, cumulative path length and bearing to the farthest point were computed. Trips under 2 days were classed as short and longer ones as long. Absences over 30 days, which span migration, were not treated as foraging trips.

3.3.2.4 Behavioural states

Tracks were regularised to a 20-min grid and split where gaps exceeded 40 min. A four-state Gaussian hidden Markov model (Langrock et al. 2012) was fitted to the instantaneous GPS speed, the step speed between fixes and the cosine of the turning angle. The states were interpreted as **transit flight** (fast, straight), **search flight** (fast instantaneous speed but tortuous, low net displacement, i.e. area-restricted search), **active on water** (on the water with short, tortuous movements) and **resting on water** (straight drift). Search flight and active-on-water were pooled as foraging for the spatial analyses. The static acceleration sample was used as an independent check.

3.3.2.5 Utilisation distributions and representativeness

Utilisation distributions (UD) were estimated with a fixed Gaussian kernel (bandwidth 15 km) on a 5-km equal-area grid, separately per bird, and then averaged with equal weight per bird. The 50% isopleth was taken as the core area and the 95% isopleth as the home range. Sample representativeness was assessed as in track2KBA (Beal et al. 2021; Lascelles et al. 2016): random subsets of 1 to n−1 birds were drawn, and the share of foraging fixes of the remaining birds falling inside the subset's 50% UD was recorded (60 iterations per subset size). Foraging time was further summarised by sea area, giving each bird equal weight.

3.3.2.6 Habitat selection

Each foraging position (search flight or active on water) was paired with five availability points drawn at random within the population 95% UD of all at-sea positions, on the same date. Bottom depth and seabed slope were taken from ETOPO1 (1 arc-minute). Sea-surface temperature (SST) came from MODIS Aqua 8-day composites (4 km). Chlorophyll-a came from the current NASA reprocessing of MODIS Aqua (R2022, 8-day composites, sampled at about 8 km). Composites missing from that dataset (parts of June and October 2020, May and October–December 2021) were filled from the previous MODIS Aqua version, cross-calibrated to R2022 with a log–log regression fitted on 46 composites present in both versions ($r = 0.99$). Cloud gaps in both variables were filled by the median of three consecutive composites. Distance to the 200-m isobath (shelf break) was computed from the bathymetry. Selection was modelled with a binomial GLM (used vs available) with linear and quadratic terms for standardised log-depth, log-chlorophyll and SST, and a linear term for slope. Standard errors were clustered by bird, the unit of replication. As a model-free check, the medians of used and available values were also compared bird by bird. The analysis covers the period of the satellite composites (late May to December).

3.3.2.7 Prey habitat

Published habitat models for the main small pelagic prey were reproduced approximately as fuzzy-membership indices (0–1), following the shape of their fitted responses. Anchovy and round sardinella spawning habitat followed Schismenou et al. (2008): an interaction of bottom depth (shelf, intermediate depths) and high chlorophyll, plus increasing probability with SST. Sardine habitat followed Tugores et al. (2011): June model with SST below 22 °C and depth

under 65 m, and September model with SST 20–26 °C, depth under 110 m and chlorophyll 0.13–1.49 mg m^{-3}. Chlorophyll was expressed relative to the median of shelf waters in the same 8-day composite, and sea-level anomaly terms were omitted. For each bird, the share of foraging and available positions falling in areas with an index of 0.5 or more was compared with a paired Wilcoxon test.

3.3.2.8 Fishing activity

Apparent fishing effort from AIS (Global Fishing Watch; Kroodsma et al. 2018) was aggregated by month, gear and 0.1° cell. We tested (a) whether foraging positions fall in cell-months with trawling more often than available points, and (b) whether resting on the water, which Cianchetti-Benedetti et al. (2018) linked to the presence of fishing vessels, was more frequent where trawling effort was higher (binomial GLM of resting vs active on water, cluster-robust by bird. The prey indices are simplified reconstructions of published response curves, not the original fitted models, and the original models were calibrated outside the Ionian. They share depth and chlorophyll with the habitat-selection model, so their overlap with foraging positions is not fully independent evidence. AIS covers most EU trawlers but few North African vessels, so fishing effort off Tunisia and Libya is strongly under-represented.

4 Results

4.1 Pelagic surveys

4.1.1 Boat surveys

A total of **653 nautical miles** of boat-based visual and acoustic surveys using the sailing boat were carried out in June and September 2026 in the Project Area, as well as in the Wider Project Area and the surrounding areas, to assess the presence and distribution of the cetacean, sea turtle and seabird species of interest.

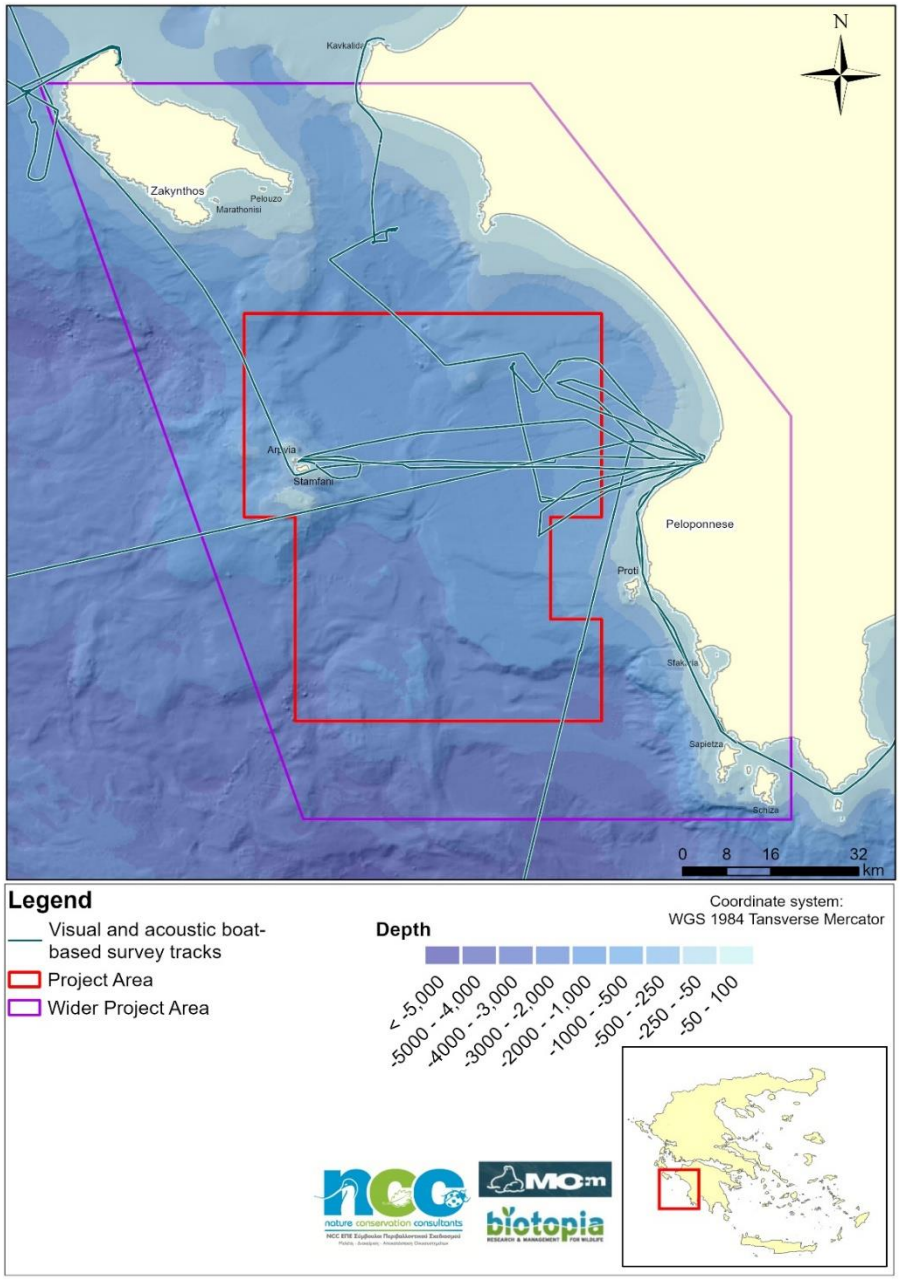


Figure 4-1. Visual and acoustic boat-based survey tracks

During the boat surveys the following species were recorded visually within the Wider Project Area and its surroundings:

- 3 cetacean species: **Sperm whale** (*Physeter macrocephalus*), **Striped dolphin** (*Stenella coeruleoalba*) and **Cuvier's beaked whale** (*Ziphius cavirostris*)
- 3 seabird species: **Scopoli's shearwater** (*Calonectris diomedea*), **Yelkouan shearwater** (*Puffinus yelkouan*) and **Yellow-legged gull** (*Larus michahellis*).
- 1 sea turtle species: **Loggerhead sea turtle** (*Caretta caretta*)

Table 4-1. Species visually recorded

Species	Common name	Total No of individuals	No of individuals within Project Area
Physeter macrocephalus	Sperm whale	1	0
Stenella coeruleoalba	Striped dolphin	10	10
Ziphius cavirostris	Cuvier's beaked whale	1	0
Calonectris diomedea	Scopoli's shearwater	19	10
Puffinus yelkouan	Yelkouan shearwater	29	3
Larus michahellis	Yellow-legged gull	3	8
Caretta caretta	Loggerhead sea turtle	1	0

During the acoustic surveys conducted using a towed hydrophone array, a total of **10 acoustic detections of cetaceans** were recorded within the Wider Project Area and its surroundings. These included **three detections of Cuvier's beaked whales**, one of which was also confirmed through a visual sighting, **one detection of a sperm whale**, which led to the visual identification of an adult male following acoustic tracking and **six detections of dolphins**, for which species-level identification was not possible based on the acoustic data alone.

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

4.1.1.1 Cetacean species visual records

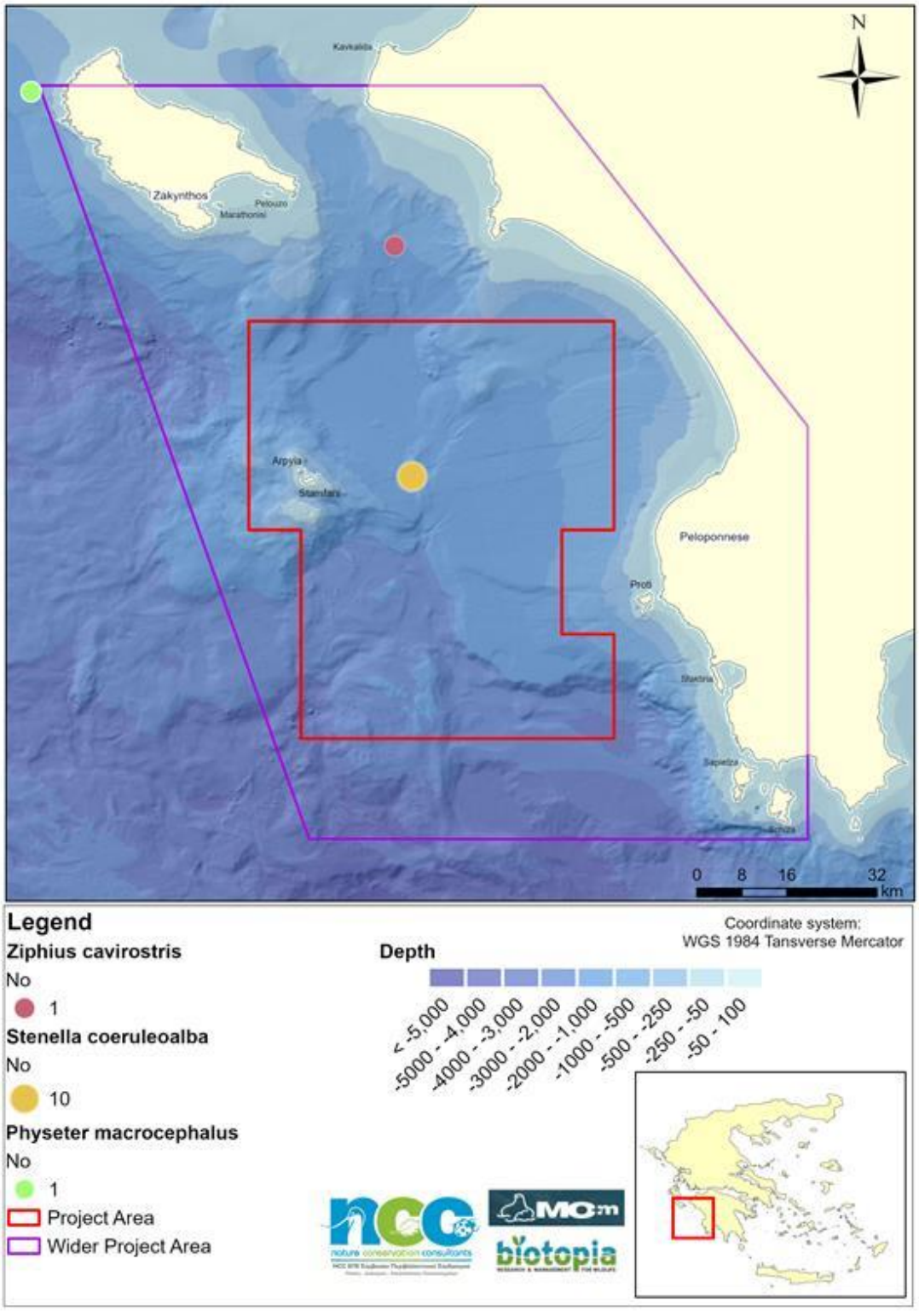


Figure 4-2. Locations of cetacean species visual records.

4.1.1.2 Seabird species visual records

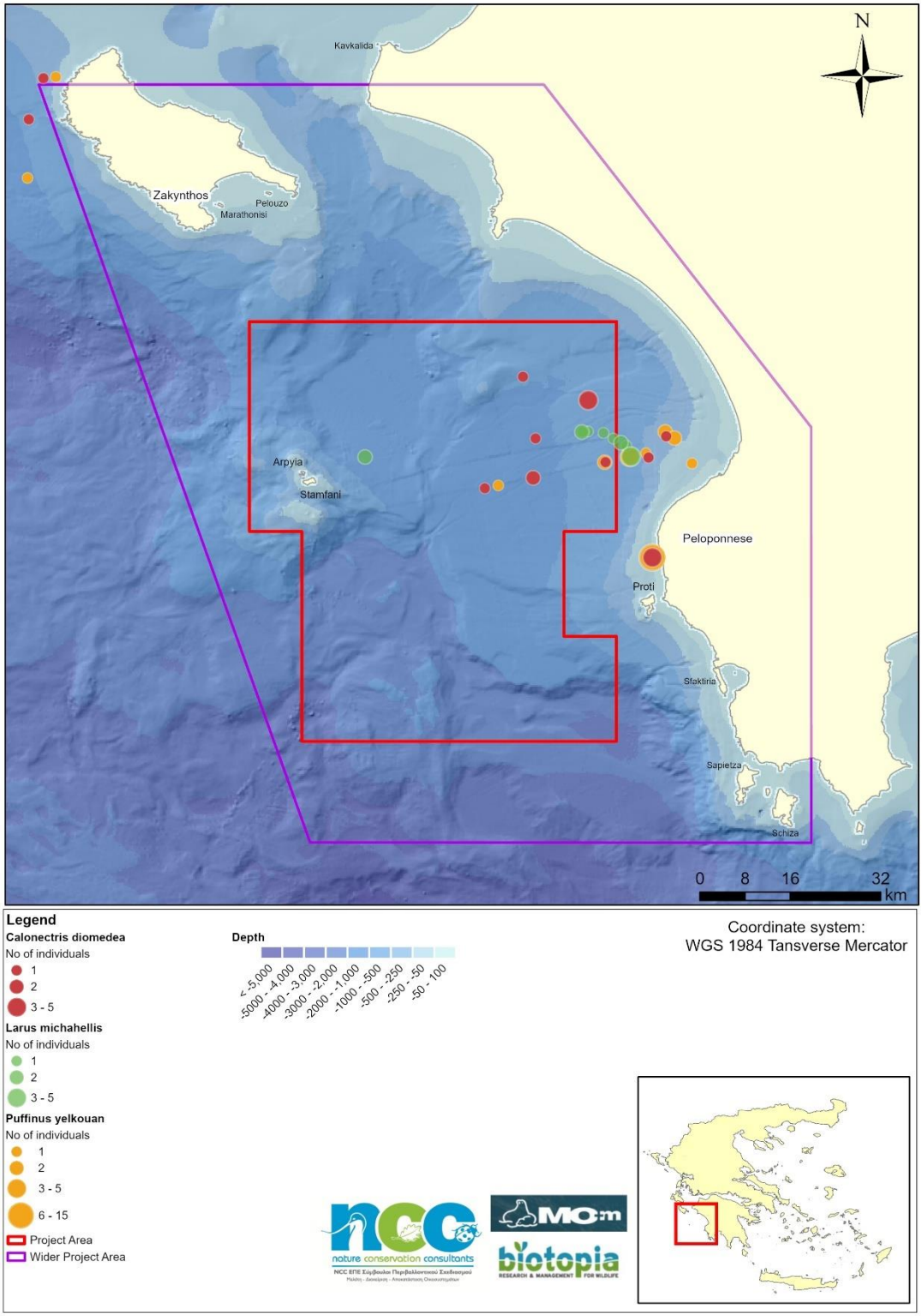


Figure 4-3. Locations of bird species visual records.

4.1.1.3 Sea turtle visual records

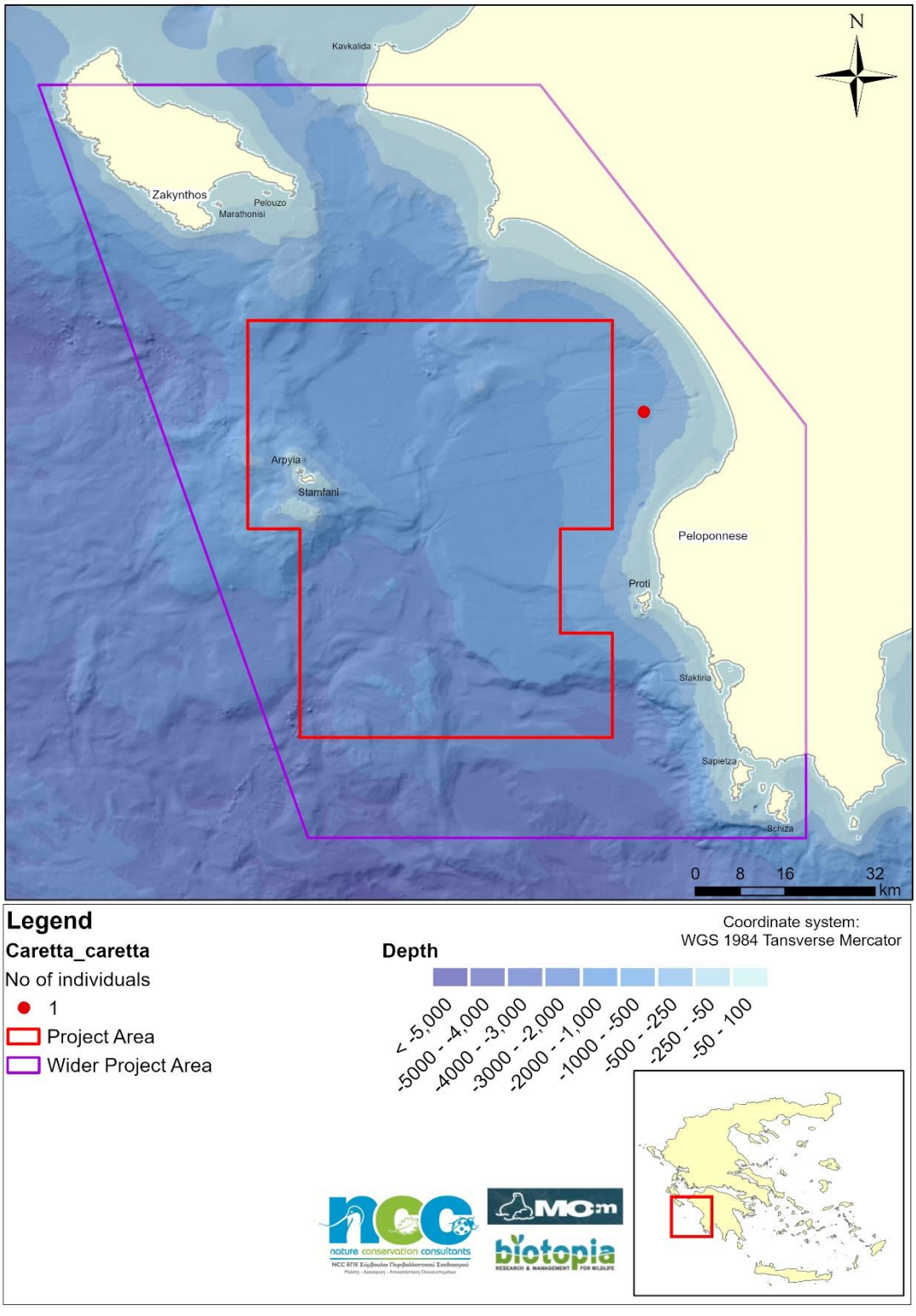


Figure 4-4. Location of Loggerhead sea turtle visual records.

4.1.1.4 Cetacean species acoustic records

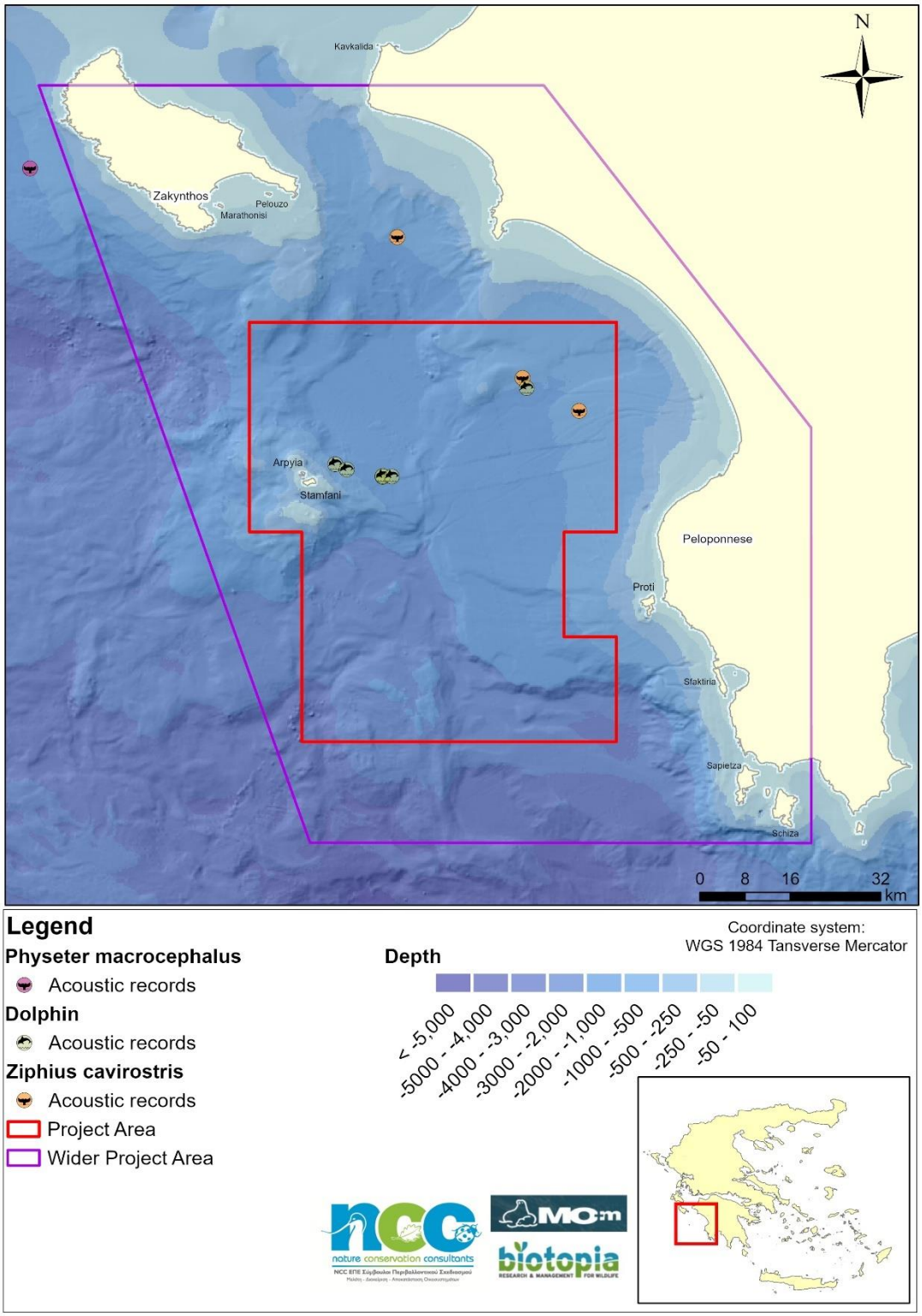


Figure 4-5. Locations of cetaceans acoustic records.



Figure 4-6. Visual effort during the boat surveys



Figure 4-7. Acoustic effort during the boat surveys



Figure 4-8. Solitary sperm whale male individual recorded North West of Zakynthos island.

4.1.2 Aerial surveys

The aerial surveys have been conducted in two separate expeditions: on the 15th and 16th of June 2026 and on the 24th of October 2026. A total of **1870 km** have been surveyed, covering the Wider Project Area.

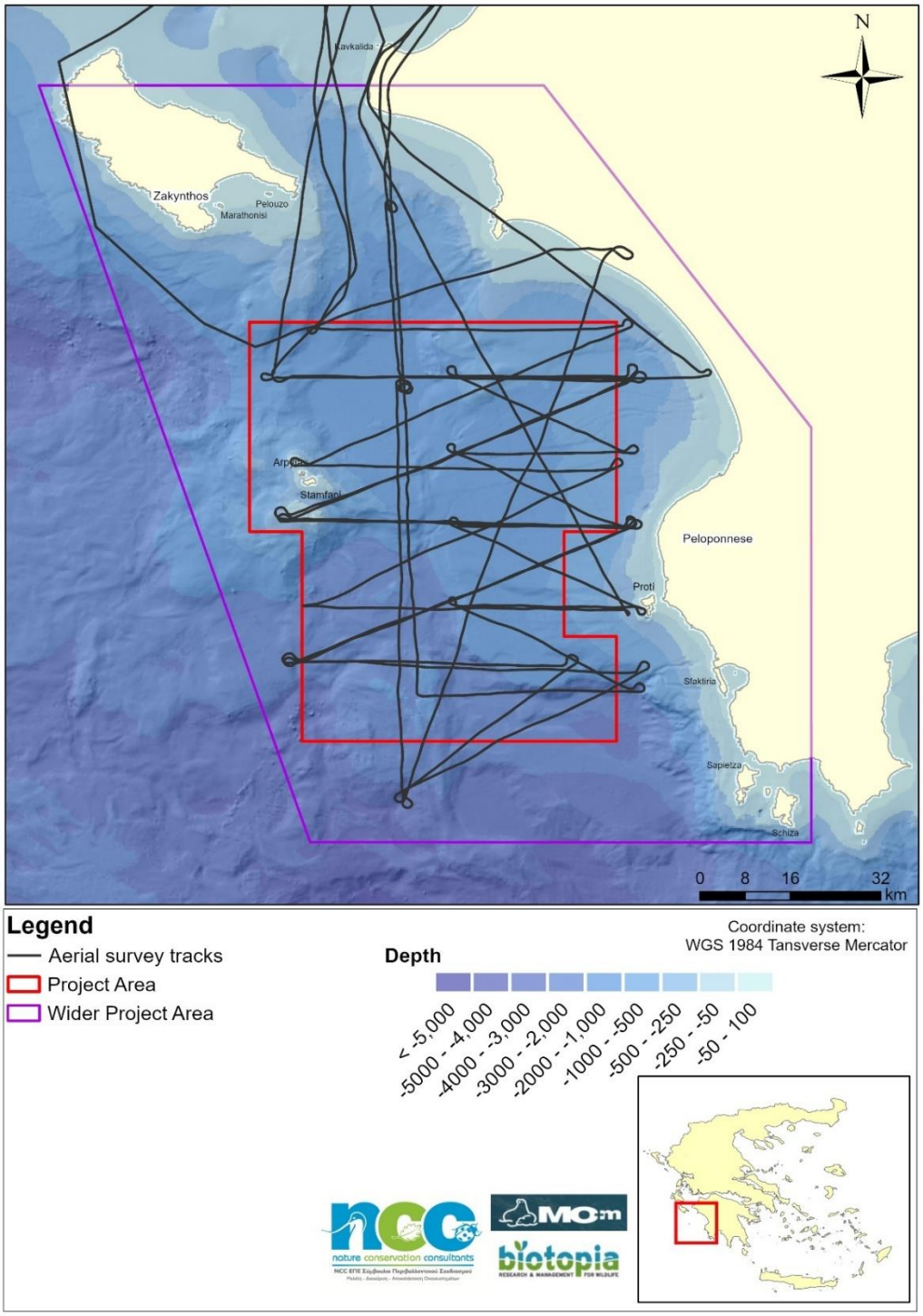


Figure 4-9. Aerial survey tracks

During the first round of aerial surveys (920 km) in June 2026 two groups of **striped dolphin** (*Stenella coeruleoalba*) **with 20 individuals each** were recorded visually inside the wider Project Area. It was confirmed that these were two different groups of animals, as they were located 13 kilometers apart within a period of less than 12 minutes. During the second round of surveys (950 km) in October 2026 a solitary **Cuvier's Beaked Whale** (*Ziphius cavirostris*) was recorded.

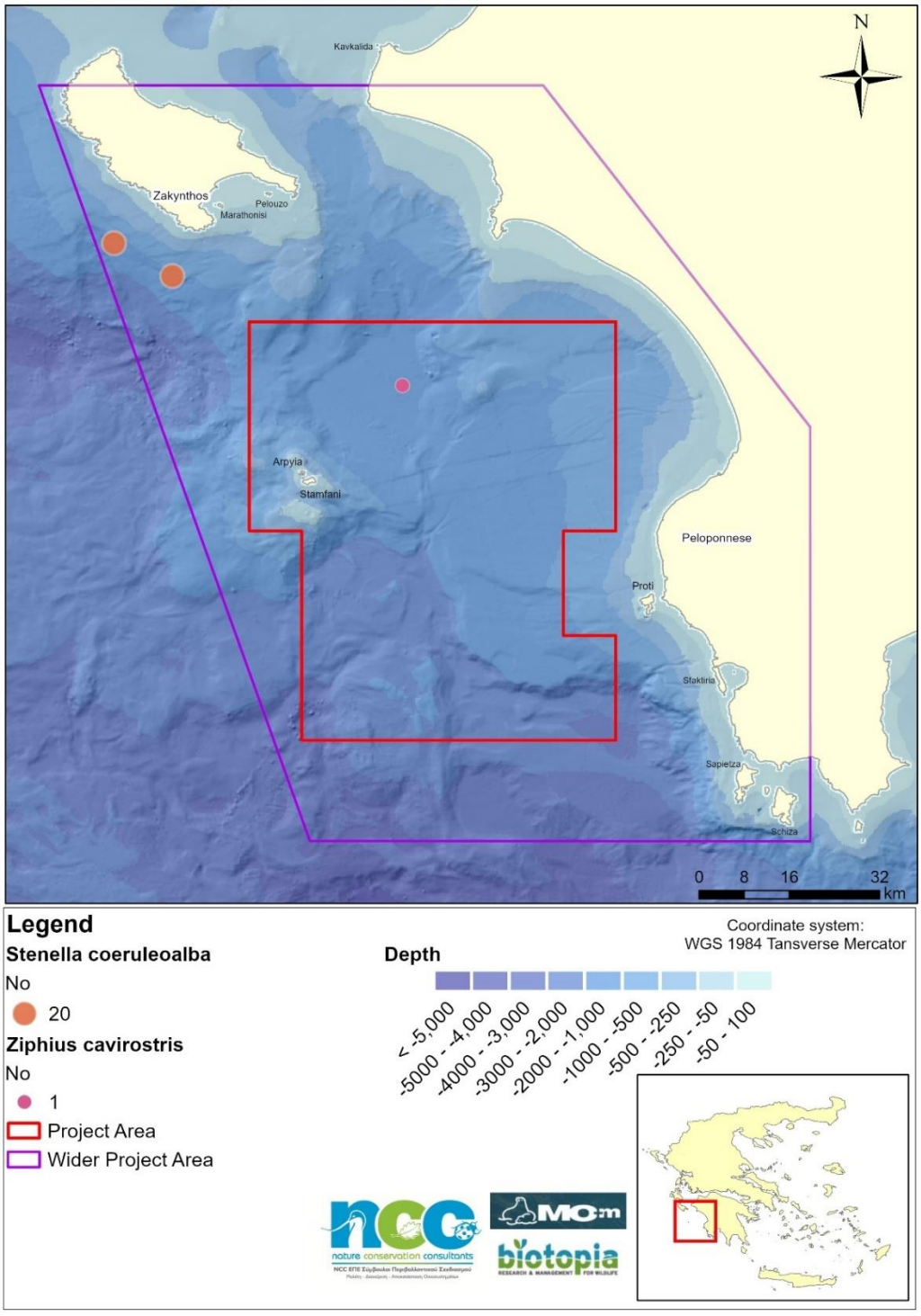


Figure 4-10. Aerial surveys records

4.2 Coastal surveys and cave monitoring for the Mediterranean Monk Seal

Zakynthos has been previously identified as the main area of interest for the Mediterranean monk seal. Its coastline includes areas with formations that offer good feeding, resting and breeding grounds for the Mediterranean monk seal. For the purposes of this report, this also makes it the most vulnerable area in terms of the possibility of an accident occurring. Therefore, monitoring efforts for the Mediterranean monk seal in the Wider Project Area have focused on the island of Zakynthos.



Figure 4-11. General view of the SW coast of Zakynthos was significant monk seal pupping activity has been recorded.

Throughout the monitoring period from October 2025 to October 2026, systematic monitoring of the Mediterranean monk seal population continued under the National Rescue and Information Network (RINT). Particular emphasis was placed on the southwestern coast of Zakynthos, an area previously recognized as critically important for the species' reproduction in the Ionian Sea.

Through the RINT, a total of 15 monk seal sightings were recorded between 31 October 2025 and 11 October 2026m including 2 dead animals and 12 alive. The details for each sighting are given in Table 4-2 below.

Table 4-2. Monk seal records through RINT within the Wider Project Area

No.	Date	Area	Stage	Sex	Condition
1	22/2/2026	Achaia	Subadult	Male	Dead
2	24/2/2026	Ilia	Subadult	Male	Dead
3	17/4/2026	Zakynthos	Adult	Unknown	Alive
4	24/4/2026	Zakynthos	Subadult	Unknown	Alive
5	26/7/2026	Zakynthos	Subadult	Unknown	Alive
6	17/8/2026	Zakynthos	Adult	Male	Alive
7	31/8/2026	Zakynthos	Subadult	Unknown	Alive
8	3/9/2026	Zakynthos	Adult	Female	Alive
9	19/9/2026	Zakynthos	Adult	Female	Alive
10	19/9/2026	Zakynthos	Adult	Female	Alive
11	19/9/2026	Zakynthos	Adult	Female	Alive
12	19/9/2026	Zakynthos	Pup	Unknown	Alive
13	19/9/2026	Zakynthos	Pup	Unknown	Alive
14	5/10/2026	Zakynthos	Subadult	Unknown	Alive
15	11/10/2026	Zakynthos	Adult	Male	Alive

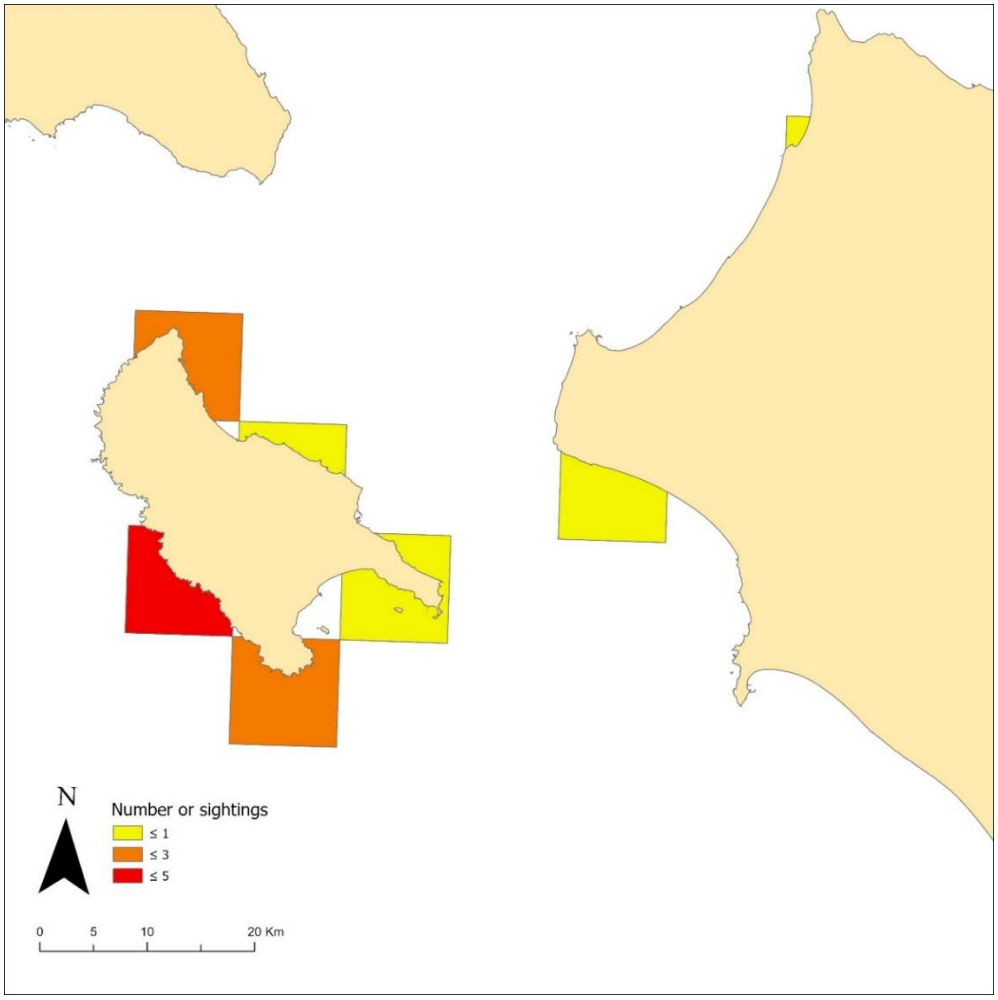


Figure 4-12. Geographic distribution of sightings during the period 31/10/2025-11/10/2026 within the wider project area.

In addition, for the further characterization of the population, analysis of cave use and the monitoring of the breeding activity in the region, six infrared Camera Trap Systems were placed in early October 2025 and remained operational in two caves along the southwestern coast of Zakynthos Island, within the Wider Project Area. Of these, four cameras were programmed to operate in Time Lapse mode, capturing images at intervals of one hour or 2.5 hours, while the remaining two operated in Motion Detection mode. All cameras were installed on the rocky walls of the caves and strategically positioned to maximize coverage of their terrestrial sections, particularly the internal beaches.

In early June 2026, MOm researchers undertook a field mission to the southwestern coast of Zakynthos to evaluate the condition of the area's sea caves and inspect the infrared monitoring systems. The recorded data were retrieved, and the cameras were reset to ensure the continuation of monitoring. Over 25000 photographs were collected. We analyzed these for the presence and identification of seals. A total of 10 animals were observed on the cameras. Two adult females were recorded nursing their respective pups (both identified as female). Three subadult animals and one weaner (all of unknown sex) were recorded resting

in the caves. An adult male and another adult female were also recorded resting in the caves. These numbers are shown in Table 4-3 below.

Table 4-3. Individuals of Monk seal identified with the infrared camera traps

No.	Stage	Sex
1	Adult	Female
2	Adult	Female
3	Pup	Female
4	Pup	Female
5	Subadult	Unknown
6	Subadult	Unknown
7	Subadult	Unknown
8	Weaner	Unknown
9	Adult	Male
10	Adult	Female



Figure 4-13. Two adult females nursing their pups in a cave at the SW of Zakynthos island (captured date: 9/2/2026)



Figure 4-14. A group of five monk seals in a cave at the SW of Zakynthos island (captured date: 18/1/2026)



Figure 4-15. Adult male resting alongside two adult females in a cave at the SW of Zakynthos island (captured date: 14/4/2026)



Figure 4-16. A male sub adult monk seal found dead on the coast of Kyparissiakos Bay on the 24th of February 2026.

Through the direct field work in the area combined with information received through the Rescue and Information Network, certain threats and pressures have been identified as playing a key role for the species in the region presently and expected to increase in the future.

The greatest pressure for the species currently identified in the region is anthropogenic disturbance. Tourism, in most cases legally unrestricted regarding their impacts on wildlife and habitats, plays a significant role in the island of Zakynthos. The photograph below is a still image from a video collected through RINT by tourists approaching the animals in an inflatable boat at a very close distance. While the animals in this case seem “unbothered”, repeated disturbance of a cave is known to often lead to displacement of the animals to less suitable pupping locations, increasing the risk of pup mortality. Additionally, habituation (as exhibited to a certain extent by the animals in the video), also usually has negative long-term effects on the individuals involved.

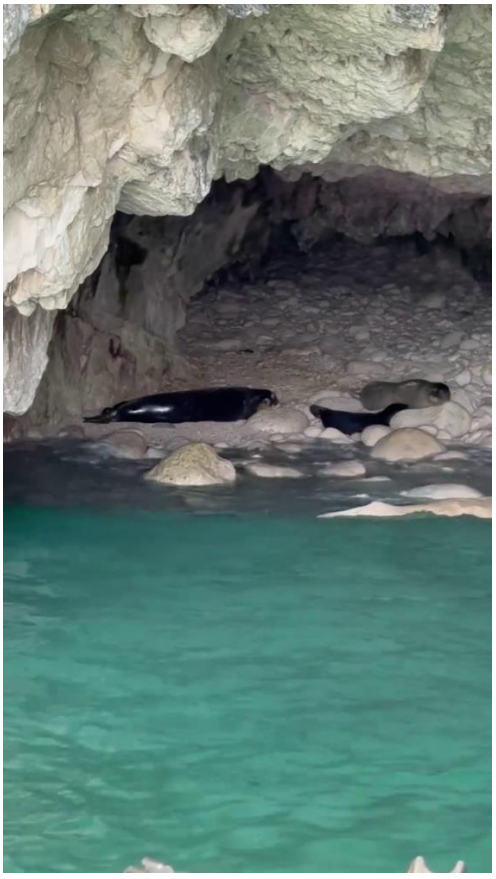


Figure 4-17. Still from video collected through RINT taken by tourists on an inflatable boat closely approaching the two females with their pups resting in the monitored cave in SW Zakynthos island.

4.3 Ecology of Scopoli's shearwaters from the Strofades Islands

4.3.1 Telemetry results

4.3.1.1 Dataset

The ten birds provided 105,196 valid Mediterranean positions, 104,011 of them at sea, over 34–789 days per bird (median 154). The share of failed fixes ranged from 4% to 83% per device. Device Code_07 was tracked through three consecutive breeding seasons (Figure 4-18, Table 4-4).

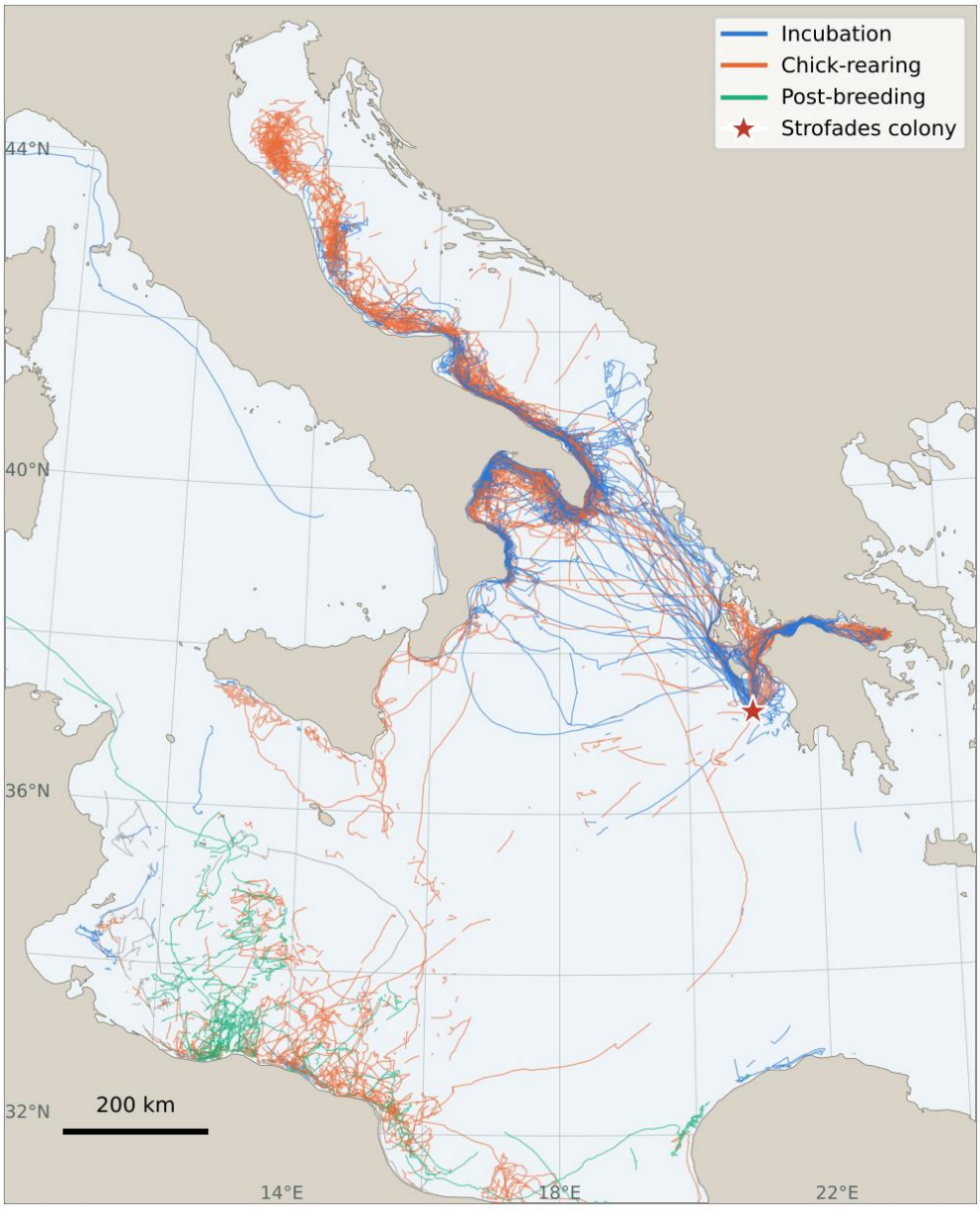


Figure 4-18. Mediterranean tracks of ten Scopoli's shearwaters from the Strofades (star), coloured by breeding phase.

Table 4-4. Tracking summary per bird (Mediterranean records only). Colony days: days with at least one record at the colony.

Device	Interval (min)	Days tracked	Complete trips (short / long)	Max. range (km)	Colony days	End of Mediterranean record
Code_01	10	113	0 / 4	500	6	Sicily Channel, Sep
Code_02	20	34	1 / 1	112	4	Southern Adriatic, Jun
Code_03	20	160	1 / 2	614	5	Central Adriatic, Nov
Code_04	10	147	6 / 14	201	39	Western Ionian, Oct
Code_05	10	144	8 / 5	662	21	Southern Adriatic, Oct
Code_06	20	167	9 / 5	1,017	14	Tunisian shelf, Nov
Code_07	10	789	5 / 4	472	14	Atlantic, Nov; returned in two further seasons
Code_08	10	226	3 / 6	857	10	Atlantic, Nov
Code_09	10	220	1 / 3	952	13	Egyptian coast, early Jan
Code_10	20	145	0 / 0	–	1	Tripolitanian shelf, Nov; Atlantic in Dec

4.3.1.2 Foraging trips and colony attendance

Nine birds completed 78 foraging trips (Table 4-5, Figure 4-19). The distribution of duration and range was clearly bimodal. **Short trips** (34) lasted a median 0.9 days and reached a median 62 km (incubation) to 90 km (chick-rearing) from the colony. Departures were concentrated around dusk (median 20:00 local time). **Long trips** (44) lasted a median 13.5 days during incubation and 4.8 days during chick-rearing. Their median maximum range was 460 km and 154 km respectively, with a maximum of 1,017 km. Of the long trips, 84% headed north-west (bearing 270–30°, median 315°), towards the Gulf of Taranto and the Adriatic (Figure 2b).

Table 4-5. Foraging-trip metrics by breeding phase and trip type (complete trips). Values are medians, with the range in brackets.

Phase / type	Trips (birds)	Duration (days)	Max. distance (km)	Path length (km)
Incubation – short	20 (6)	0.9 (0.3–1.1)	62 (31–172)	160 (73–355)
Incubation – long	26 (8)	13.5 (3.6–27.0)	460 (32–1,017)	1,876 (73–4,139)
Chick-rearing – short	14 (5)	0.9 (0.2–2.0)	90 (10–128)	224 (24–395)
Chick-rearing – long	18 (6)	4.8 (2.6–16.1)	154 (128–823)	917 (515–4,649)

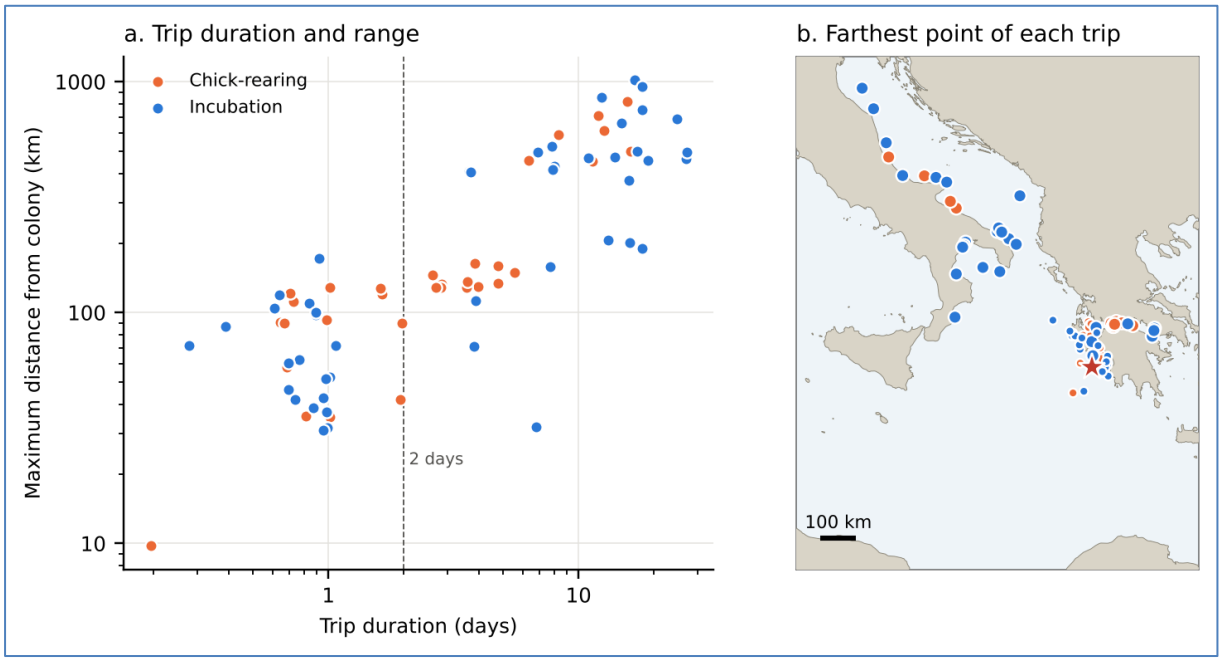


Figure 4-19. Foraging trips. (a) Trip duration against maximum distance from the colony (log scales). The dashed line marks the 2-day split between short and long trips. (b) Farthest point of each trip; larger symbols are long trips.

Colony stays were mostly short: of 139 stays, only three exceeded 24 h (maximum 89 h). Incubation shifts of several days would be expected for breeding birds (Cecere et al. 2013). The low recorded attendance after mid-July in most birds is therefore notable (Table 4-4).

4.3.1.3 Core areas and their stability

The population-level home range (95% UD) covered about 332,000 km², and the core area (50% UD) about 42,000 km². During **incubation** the core areas lay in the Gulf of Taranto, along the Apulian coast to the Strait of Otranto, in the central Adriatic off the Gargano promontory, in the Gulf of Patras and around the colony (Figure 4-20a). During **chick-rearing** the Adriatic cores extended north to about 44° N and the Gulf of Corinth was used intensively, while a diffuse range opened towards the Sicily Channel and the Libyan shelf (Figure 4-20b). After breeding, the core area moved to the **Tunisian–Tripolitanian shelf** with a secondary core in the Gulf of Sirte (Figure 4-20c).

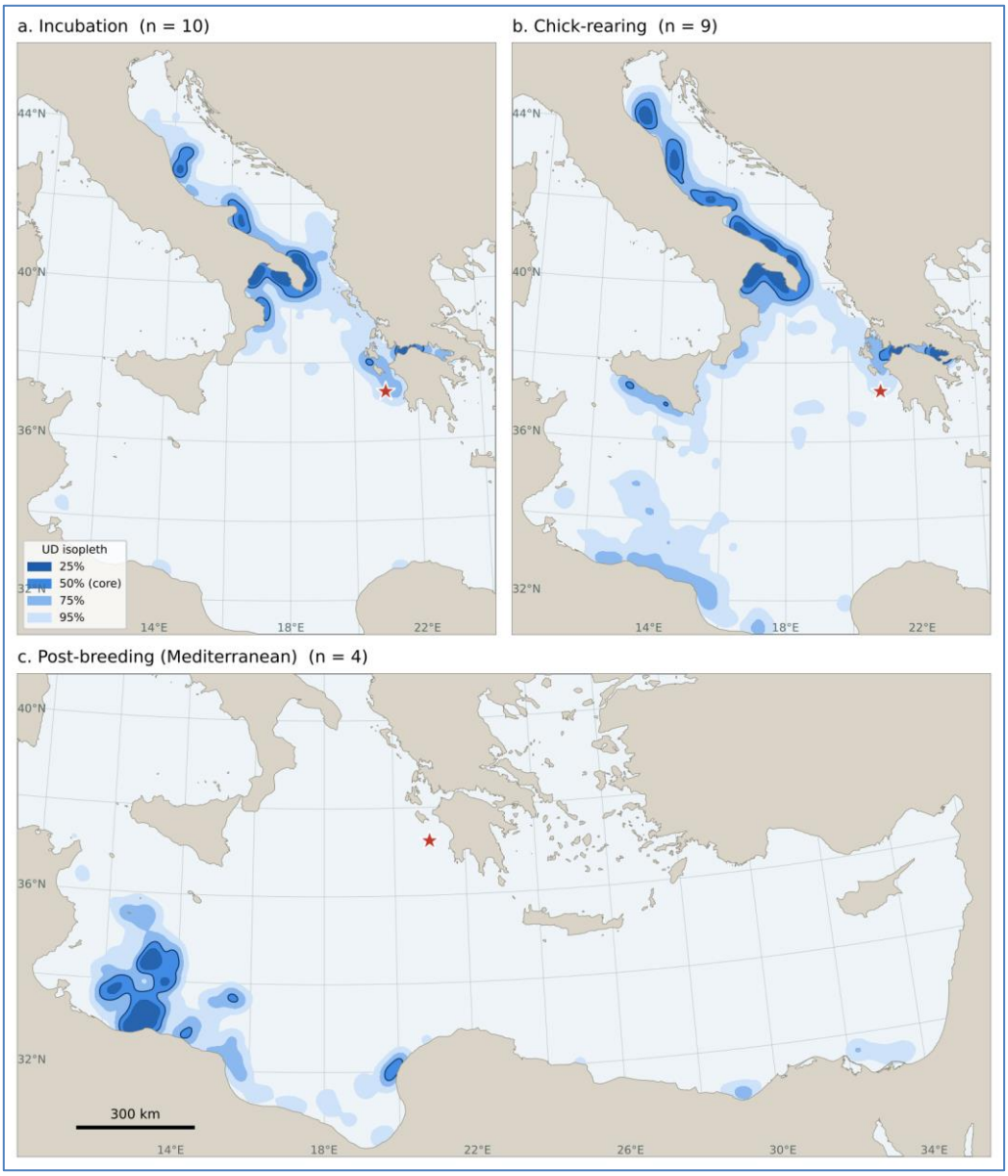


Figure 4-20. Utilisation distributions by breeding phase (equal weight per bird). Shades show the 25, 50, 75 and 95% isopleths. The dark line is the 50% core area. n = number of birds with at least 50 at-sea fixes in the phase.

Table 4-6. Share of foraging time by sea area (mean of per-bird shares, %) and number of birds using each area (more than 2% of their foraging fixes).

Sea area	Incubation % (birds)	Chick-rearing % (birds)	Post-breeding % (birds)	All phases % (birds)
Strofades waters (<50 km)	3.1 (2)	0.5 (1)	–	0.7 (1)
Gulfs of Patras & Corinth	12.1 (2)	13.8 (2)	–	11.9 (2)
Eastern Ionian (Greek shelf & slope)	5.4 (8)	4.4 (6)	–	4.6 (7)
Gulf of Taranto	23.2 (6)	10.9 (5)	–	15.6 (7)
Southern Adriatic & Otranto	19.1 (8)	13.4 (6)	–	15.4 (7)
Western Ionian (Calabria)	9.4 (5)	2.7 (5)	–	3.7 (5)
Central Adriatic	12.1 (3)	22.3 (7)	–	18.5 (7)
Northern Adriatic	–	0.4 (1)	–	0.3 (1)
Sicily Channel & Malta	0.4 (1)	3.8 (2)	3.7 (1)	3.1 (3)
Tunisian–Tripolitanian shelf	1.2 (1)	14.3 (4)	82.7 (4)	14.0 (4)
Gulf of Sirte & Cyrenaica	0.6 (1)	0.4 (1)	8.7 (2)	1.1 (3)
Levantine shelf (Nile delta–Gaza)	–	–	4.8 (1)	0.6 (1)
Open Ionian / other	13.5 (6)	13.2 (8)	0.1 (0)	10.4 (9)

By area (Table 4-6), the Gulf of Taranto (23%) and the southern Adriatic (19%) dominated incubation, and the central Adriatic (22%) chick-rearing. Seven of the nine birds with chick-rearing data used the central Adriatic. The Gulfs of Patras and Corinth held 12–14% of foraging time, but this came from only two birds: Code_04 spent 75% of its foraging time there, making 14 long trips of 2–6 days, and used the Adriatic for only 3%, while Code_09 spent 43% of its foraging time there in August. The eastern Ionian shelf close to the colony was visited by most birds (six to eight) but for a small share of time. Device Code_07 returned to the Gulf of Taranto–southern Adriatic area in the summer of all three seasons, which indicates individual site fidelity.

The out-of-sample inclusion rate rose steadily from 10% with one bird to 39% with nine, without approaching an asymptote (Figure 4-21). Under the track2KBA framework this means the sample does not yet capture the range of the colony. Core areas should therefore be treated as a minimum set of important areas, and further tracking would probably add new sites.

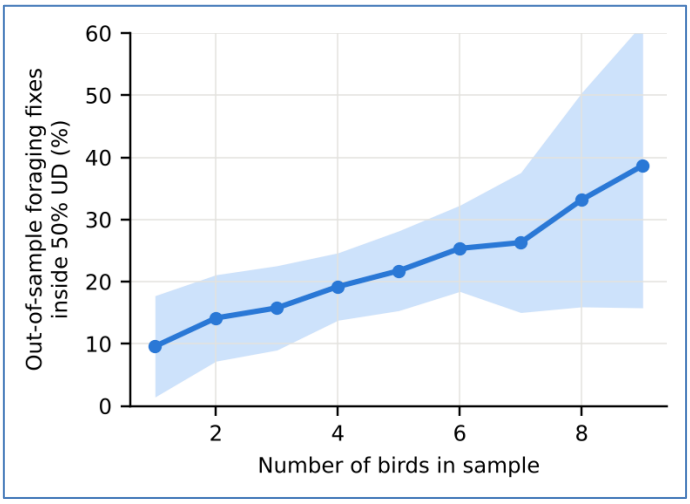


Figure 4-21. Representativeness of the tracking sample: share of foraging fixes of left-out birds that fall inside the 50% UD of random subsets of tracked birds (mean ± SD of 60 draws).

4.3.1.4 Behaviour at sea and daily activity

Of 49,503 regularised at-sea fixes, 35% were classed as active on water, 35% as resting on water, 21% as search flight and 9% as transit flight. The deviation of the static acceleration magnitude from 1 g (median) was more than three times larger in the two flight states (0.27 g) than on the water (0.08 g), which independently supports the classification. The spatial distribution of foraging closely matched that of all at-sea positions (Figure 4-22a, b). Along a typical long trip, birds commuted straight to the Gulf of Taranto and then alternated search flights with periods on the water along the shelf (Figure 4-22c).

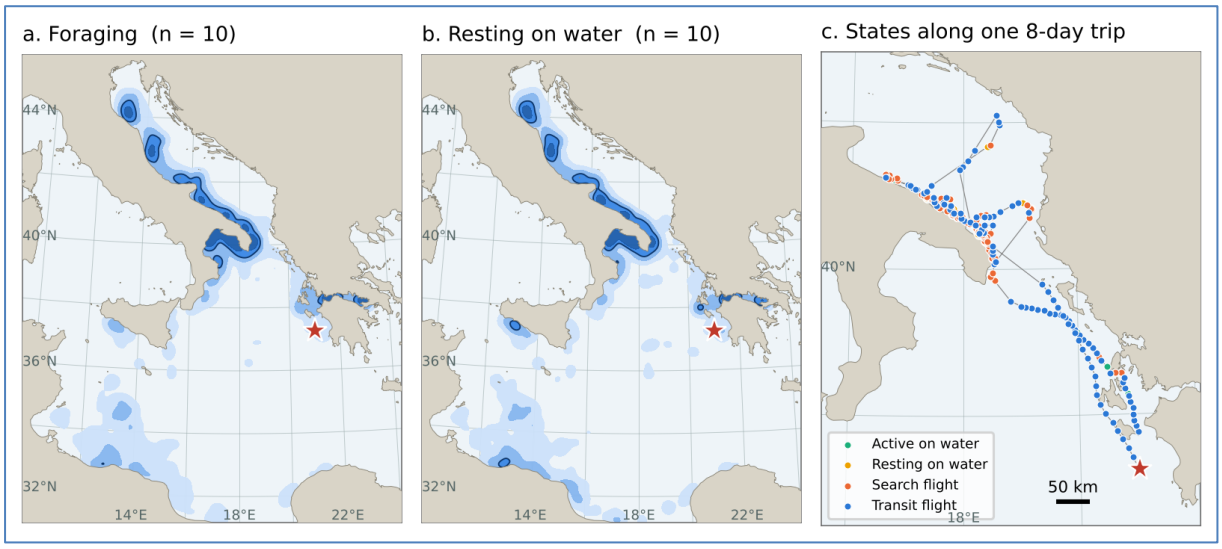


Figure 4-22. (a) Foraging (search flight + active on water) and (b) resting utilisation distributions. (c) Behavioural states along an 8-day trip of device 201548 to the Gulf of Taranto and southern Adriatic

Activity followed a pronounced diel rhythm (Figure 4-23). Flight peaked at dawn (06:00 solar time, 55% of fixes in flight) and in the late afternoon (17:00, 56%). Activity on the water dominated the middle of the day (40–44%), and resting on the water dominated the night (54–58% between 21:00 and 03:00). This crepuscular pattern is consistent with feeding on prey that approach the surface at twilight, as well as with commuting at the start and end of the day.

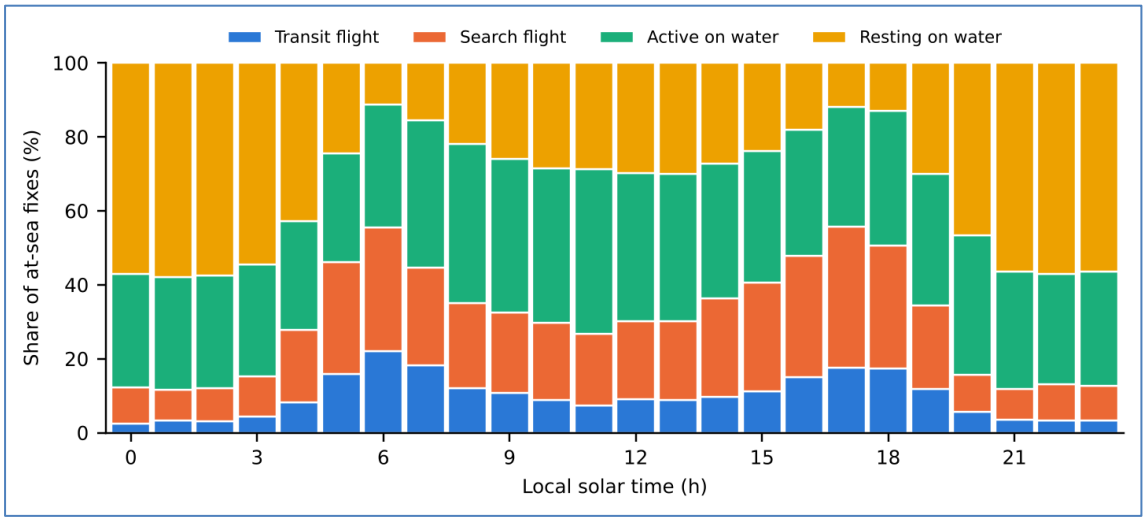


Figure 4-23. Share of behavioural states by hour of local solar time (all birds and phases pooled).

4.3.1.5 Post-breeding movements

Six birds were tracked after mid-October. Four moved to the Tunisian–Tripolitanian shelf and the Gulf of Sirte, where 83% and 9% of their post-breeding foraging took place (Figure 4-20c). Three birds (Code_07, Code_08, Code_10) then crossed the Strait of Gibraltar in mid-November to early December. Device Code_07 also used the Tunisian–Tripolitanian shelf in April of both following seasons on its return from the Atlantic, before moving to the Gulf of Taranto and southern Adriatic in June.

Device Code_09 did not leave the Mediterranean. In December it travelled east along the Libyan coast to the Levantine shelf off the Nile delta and Gaza, and its last at-sea positions were on the Egyptian coast west of Alexandria.

4.3.1.6 Habitat selection

Foraging positions lay over much shallower water than available points (median 83 m vs 238 m) and mostly on the continental shelf: the median foraging position was 17 km inside the 200-m isobath, while the median available point lay 3 km beyond it. Chlorophyll-a at foraging positions was higher (0.19 vs 0.11 mg m^{-3}), while SST did not differ (26.1 °C in both). The pattern was consistent across individuals: nine of ten birds foraged over shallower water than available and nine over higher chlorophyll (Figure 4-24). The exception for depth (Code_01)

foraged over the same median depth as available. In the model, selection decreased with depth and increased with chlorophyll up to intermediate–high values (negative quadratic term). SST had a weak positive effect. Slope had a positive coefficient in the pooled model, but seven of ten birds foraged over gentler slopes than available, so the slope effect is not robust.

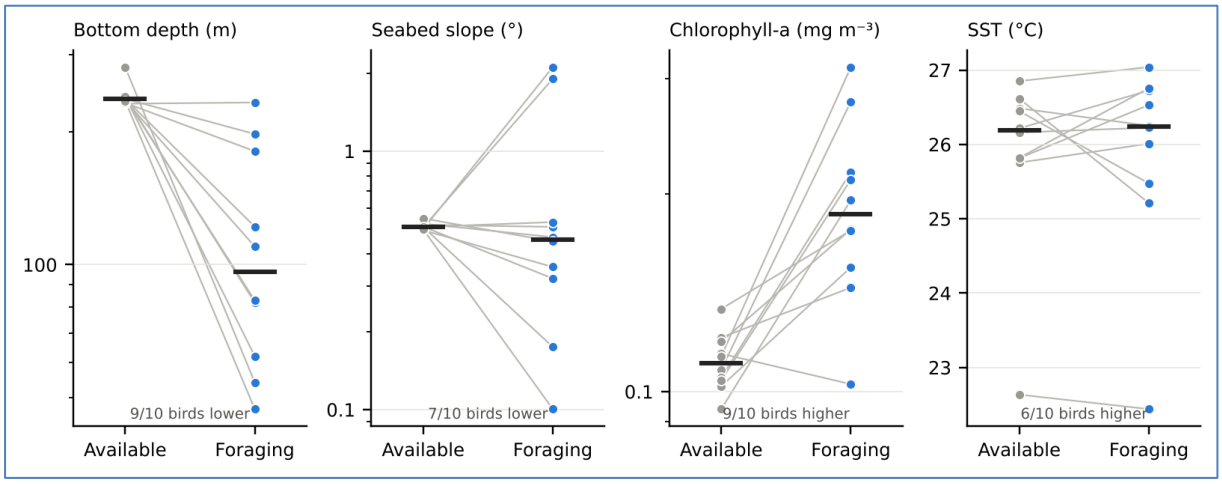


Figure 4-24. Environmental conditions at foraging positions and at available points, per bird (paired dots; bars = medians across birds). Counts give the number of birds whose foraging median was lower (depth, slope) or higher (chlorophyll, SST) than availability.

4.3.1.7 Overlap with prey habitat

Foraging positions fell in high-index areas (0.5 or more) far more often than available points for the two spawning-habitat indices: anchovy 48% vs 14% (all ten birds higher, p = 0.002) and round sardinella 38% vs 12% (nine of ten, p = 0.010). For sardine habitat the difference was in the same direction but less consistent (38% vs 17%, seven of ten birds, p = 0.064). The overlap was concentrated in the Adriatic (central Adriatic: 64% anchovy, 87% sardine; southern Adriatic: 71% anchovy) and in the Gulfs of Patras and Corinth (45% anchovy). It was low in the Gulf of Taranto (18% anchovy) and around the colony (Figure 4-25). The Gulf of Gabès stood out as high-index anchovy and round sardinella habitat in June, before most birds moved there after breeding.

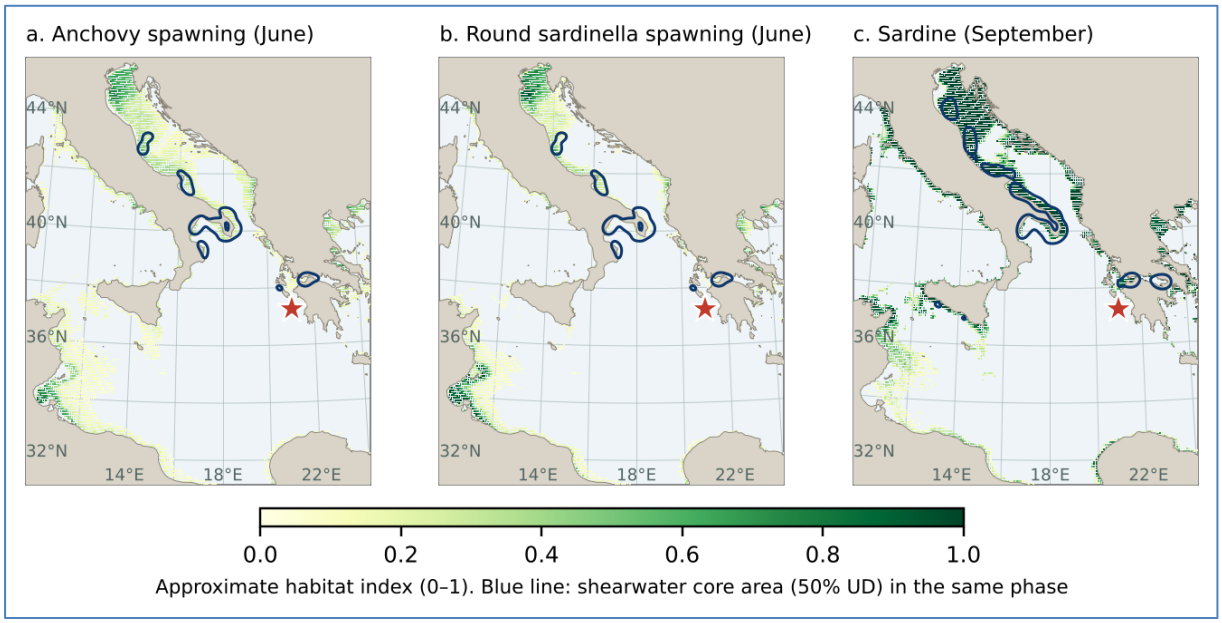


Figure 4-25. Approximate prey-habitat indices for (a) anchovy and (b) round sardinella spawning in June and (c) sardine in September, with the shearwater core area (50% UD) of incubation (a, b) and chick-rearing (c).

4.3.1.8 Overlap with fishing activity

Trawlers accounted for 90% of AIS fishing hours in the study area. Foraging positions fell in cell-months with trawling more often than available points (57% vs 33%, eight of ten birds, p = 0.037). The Adriatic and Gulf of Taranto cores coincide with some of the most intensively trawled shelf in the Mediterranean (Figure 4-26). Within these areas, however, resting on the water was not more frequent where trawling effort was higher, either over the whole day or in daylight only (coefficient −0.01, p = 0.38 and 0.62). The data therefore show strong spatial overlap with trawling, but no behavioural signal of attraction to vessels at this resolution. Off Tunisia and Libya, only 4% of resting positions fell in cells with AIS trawling, which mainly reflects the AIS gap rather than an absence of fishing.

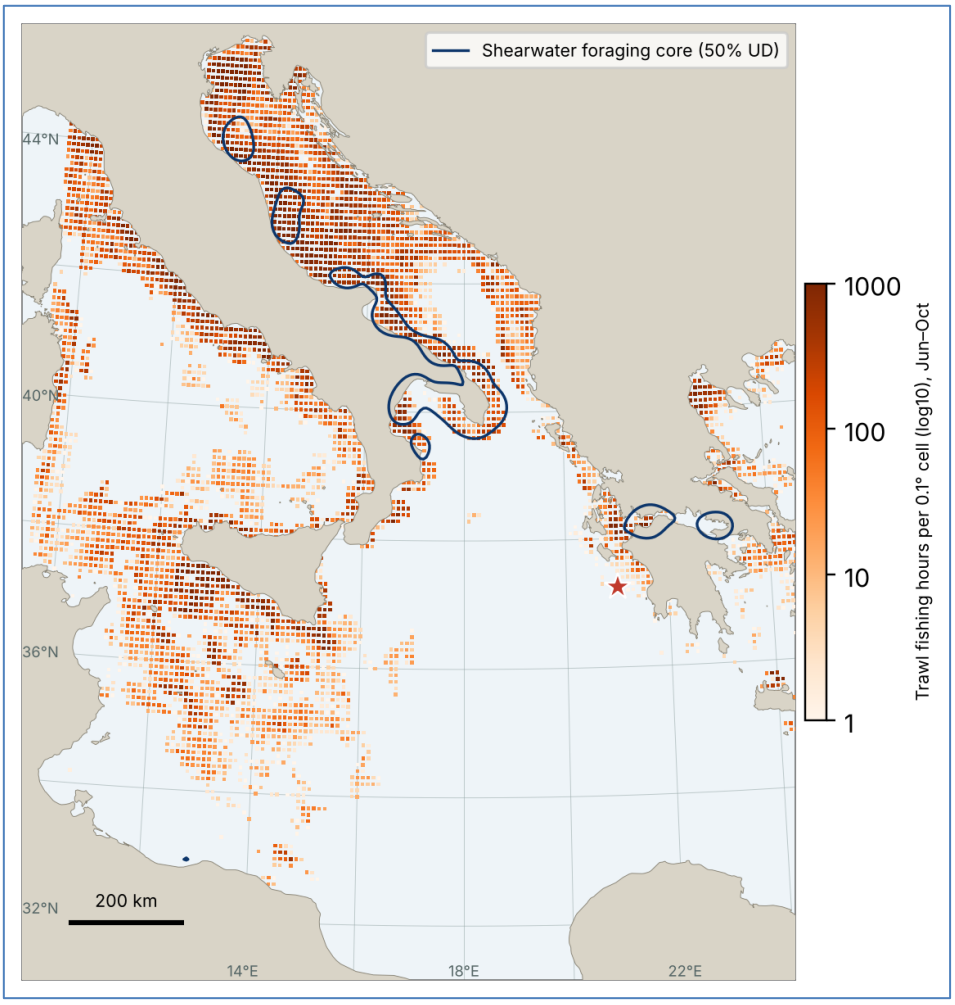


Figure 4-26. Apparent trawl fishing effort (AIS, Global Fishing Watch; June–October) and the shearwater foraging core area (50% UD). Effort off North Africa is under-represented by AIS.

4.3.1.9 Overlap with the planned Ionian Marine Park

Only 3.6% of breeding-season foraging positions fell inside the zones of the planned Ionian Marine Park, although eight birds used it to some extent. Within the park, foraging was concentrated in the inner Ionian zone (46% of in-park foraging positions) and in the open-Ionian arc from western Lefkada to southern Zakynthos (31%). The three park zones around the Strofades held about 1% of in-park foraging.

4.3.2 National context: comparison with four other Greek colonies

4.3.2.1 Data and approach

NCC tracked breeding adults with the same transmitter model at four further colonies, each in a different breeding season from the Strofades: the Diapontia Islands (northern Ionian), Gramvousa (north-western Crete), the Dionysades (north-eastern Crete) and Skantzoura (Northern Sporades). Of 20 further devices, 14 produced colony-based tracks. The comparison therefore covers 24 birds from five colonies and 282,657 Mediterranean positions.

All datasets were processed with the same pipeline as the Strofades data (Sections 4.3.1.2–4.3.1.5). The behavioural model was refitted on the pooled data so that states are directly comparable between colonies. Strofades state shares therefore differ slightly from Section 4.3.1.4. Spatial comparisons use the breeding season (incubation and chick-rearing), and overlap between colonies was measured with Bhattacharyya's affinity between utilisation distributions (0 = no overlap, 1 = identical; Fieberg & Kochanny 2005).

4.3.2.2 Trip structure

All five colonies showed the same dual foraging strategy, with short trips of less than a day alternating with long trips (Table 4-7, Figure 4-27). Short trips were similar everywhere (median 0.7–0.9 days, 39–72 km). Long trips differed markedly. Strofades birds made the longest trips (median maximum range 423 km against 166–253 km elsewhere) and the highest share of long trips (56% of trips against 20–36%). The longest median duration of long trips was also recorded at the Strofades (8.2 days), followed by north-western Crete (7.7 days), and the shortest in north-eastern Crete (3.6 days).

Table 4-7. Foraging trips by colony (complete trips, breeding season and post-breeding combined). Durations in days, distances in km, medians.

Colony	Birds	Trips (short / long)	Short: duration	Short: range	Long: duration	Long: range (min–max)	% long
Strofades	10	34 / 44	0.9	72	8.2	423 (32–1,017)	56
N Ionian	3	34 / 10	0.7	72	5.3	203 (135–360)	23
NW Crete	3	28 / 16	0.8	39	7.7	253 (39–875)	36
NE Crete	4	91 / 34	0.7	42	3.6	208 (29–678)	27
N Sporades	4	64 / 16	0.7	41	4.7	166 (64–222)	20

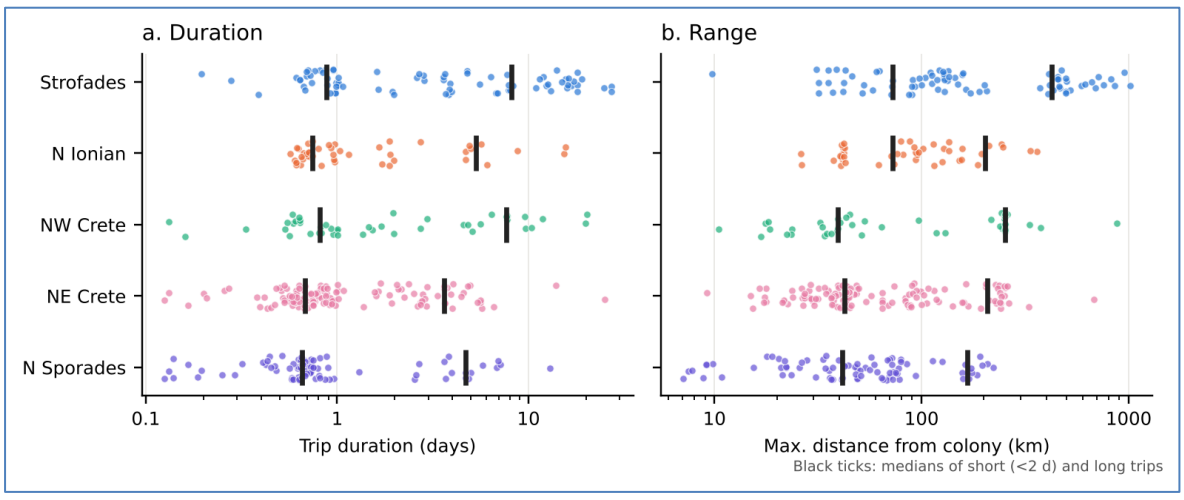


Figure 4-27. Duration (a) and maximum distance from the colony (b) of complete foraging trips by colony (log scales). Black ticks mark the medians of short (under 2 days) and long trips.

4.3.2.3 Foraging areas and overlap between colonies

Each colony exploited a distinct seascape (Figure 4-28, Table 4-9). Birds from the **Northern Sporades** foraged most locally: 66% of their foraging positions lay within 100 km of the colony, mostly in the North Aegean. **North-eastern Crete** birds used the waters around the colony and the Karpathos–Rhodes area, but also made long trips to the Egyptian and Levantine shelf, which held a third of their foraging time. **North-western Crete** birds concentrated in the Kythira, Myrtoan and Argolic seas, with secondary use of the Gulf of Sirte and the Libyan Sea. **Northern Ionian** birds foraged across the Gulf of Taranto, the western Ionian off Calabria and the Adriatic, and spent only 4% of their foraging time near the colony. The **Strofades** birds were the least local: only 3% of foraging positions lay within 100 km of the colony, and the median distance was 473 km (Table 4-8).

Table 4-8. Breeding-season utilisation distributions and distance of foraging positions from the colony, by colony.

Colony	Birds	Core area, 50% UD (km²)	Home range, 95% UD (km²)	Median distance of foraging (km)	% of foraging within 100 km
Strofades	10	37,925	292,575	473	3
N Ionian	3	36,275	191,625	215	10
NW Crete	3	9,700	119,725	239	14
NE Crete	4	26,325	178,650	372	30
N Sporades	4	12,450	99,625	75	66

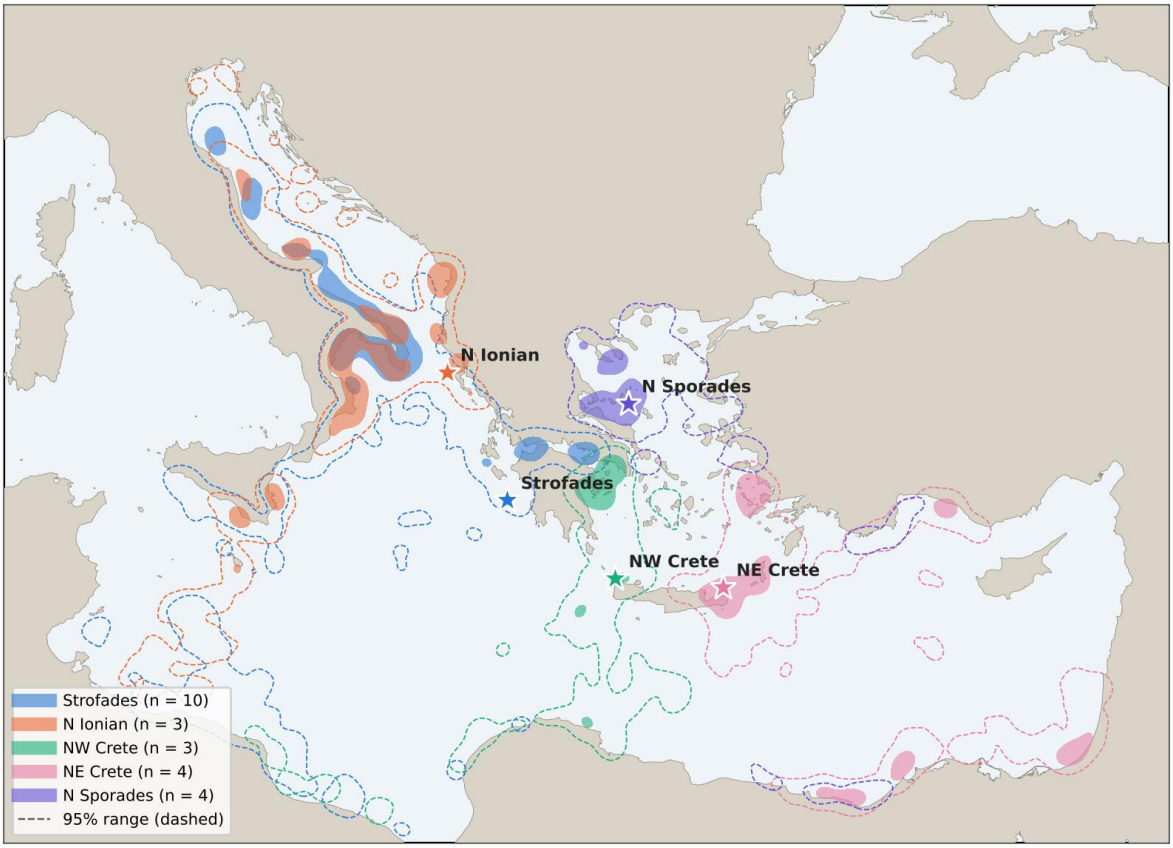


Figure 4-28. Breeding-season core areas (50% UD, filled) and ranges (95% UD, dashed) of Scopoli's shearwaters from five Greek colonies (stars). n = number of birds.

Table 4-9. Share of breeding-season foraging time by sea area and colony (mean of per-bird shares, %). Areas with more than 2% for at least one colony are shown. – = less than 0.5%.

Sea area	Strofades	N Ionian	NW Crete	NE Crete	N Sporades
Central & northern Adriatic	19	15	–	–	–
Southern Adriatic & Otranto	16	14	–	–	–
Gulf of Taranto	16	16	–	–	–
Gulfs of Patras & Corinth	14	–	–	–	–
Other / open sea	12	16	12	19	7
Tunisian–Tripolitanian shelf	10	8	5	–	–
Western Ionian (Calabria–Sicily)	5	17	–	–	–
Eastern Ionian (Greek shelf)	4	–	–	–	–
Sicily Channel & Malta	2	5	–	–	–
Own colony waters (<50 km)	1	4	9	19	27

Sea area	Strofades	N Ionian	NW Crete	NE Crete	N Sporades
Northern Ionian & Albanian shelf	1	5	–	–	–
Gulf of Sirte & Cyrenaica	1	–	9	–	–
Cretan Sea	–	–	1	3	–
Central Aegean & Cyclades	–	–	1	2	2
NE Levantine (Cyprus–Syria)	–	–	–	7	–
Karpathos–Rhodes	–	–	–	14	–
Egyptian–Levantine shelf	–	–	–	32	4
Libyan Sea (south of Crete)	–	–	4	4	–
Kythira–Myrtoan–Argolic seas	–	–	59	–	–
North Aegean	–	–	–	–	60

Overlap between colonies was low, with one clear exception. The breeding-season distributions of the **Strofades and the northern Ionian** colonies had an affinity of 0.70, because both converged on the Gulf of Taranto, the southern Adriatic and the central Adriatic. All other pairs had affinities of 0.12 or less. The highest of these (north-eastern Crete and Northern Sporades, 0.12) arose from shared use of the Egyptian shelf, and the Strofades and north-western Crete overlapped only marginally (0.06). Behavioural time budgets were broadly similar. North-eastern Crete birds spent more time in flight (46% of fixes against 32–40% elsewhere), consistent with their long commuting trips.

4.3.2.4 Habitat, prey and fishing across colonies

The habitat, prey and fishing analyses of Sections 4.3.1.6–4.3.1.8 were repeated for all five colonies, restricted to the breeding season so that colonies are comparable. Availability was drawn from each colony's own breeding-season range (95% UD), on the same dates as the foraging positions, and SST, chlorophyll (MODIS R2022) and AIS effort were matched to the year of tracking. Strofades values therefore differ slightly from Section 4.3.1, which also included the post-breeding period. In total, 60,491 foraging positions of 24 birds were analysed (Table 4-10, Figure 4-29).

Shelf selection was a shared trait. Twenty-two of the 24 birds foraged over shallower water than available and 22 over higher chlorophyll (both $p < 0.001$), while SST and slope showed no consistent direction (16 and 13 of 24 birds). In the pooled model, selection declined with depth (coefficient −0.78, with a negative quadratic term) and increased with chlorophyll up to intermediate–high values (+0.96, negative quadratic term), and the depth effect did not differ significantly between colonies (all depth × colony terms $p \geq 0.12$). The contrast was sharpest at the two Cretan colonies, whose range lies mostly over deep water (median available depth

806–853 m, a quarter of it on the shelf): their birds still concentrated their foraging over the shelf (60–71% of positions, median depth about 100 m). The **Northern Sporades** were the exception for depth. Their birds foraged over the same depths as available (median 247 vs 278 m; three of four birds slightly shallower, but only one used the shelf more than available), although all four selected more productive water. In the North Aegean much of the reachable sea is of similar depth, so productivity rather than bathymetry appears to set foraging locations there.

Prey habitat. Across colonies, foraging positions fell in high-index areas more often than available points for anchovy spawning habitat (28% vs 9%, 20 of 24 birds, $p < 0.001$) and round sardinella spawning habitat (23% vs 9%, 18 of 24, $p = 0.001$). For sardine habitat the pooled difference was in the same direction but inconsistent between birds (29% vs 14%, 13 of 24, $p = 0.06$). In absolute terms, high-index anchovy habitat was scarcer around Crete (9–17% of foraging positions) than in the Ionian–Adriatic system (35–36%), consistent with the narrow shelves of the southern Aegean.

Fishing. Trawlers again accounted for 89% of AIS fishing hours. Pooled over colonies, foraging positions fell in trawled cell-months more often than available points (42% vs 26%, 16 of 24 birds, $p = 0.015$). The association was driven by the two Ionian colonies (Strofades 9 of 10 birds, northern Ionian 3 of 3), whose foraging areas in the Gulf of Taranto and the Adriatic are among the most heavily trawled in the Mediterranean. At the Cretan and Sporades colonies, most foraging positions (72–79%) fell in cells with no AIS fishing at all, compared with 34–37% for the Ionian colonies, so overlap with trawling there was low and inconsistent between birds. As at the Strofades, resting on the water was not more frequent where trawling effort was higher (coefficient −0.02, $p = 0.08$). The low AIS coverage of small-scale and non-EU fleets limits all of these comparisons.

Table 4-10. Foraging (used) versus available conditions by colony during the breeding season. Values are foraging / available, pooled over positions. In brackets: number of birds whose foraging value exceeded availability (for depth: was lower). Prey and trawl columns give the share of positions in high-index habitat (0.5 or more) and in trawled cell-months.

Colony	Birds	Depth, m	Shelf <200 m, %	Chl-a, mg m^{-3}	Anchovy high, %	Sardine high, %	Trawled, %
Strofades	10	81 / 254 (9)	74 / 46 (9)	0.20 / 0.12 (10)	36 / 10 (9)	36 / 17 (7)	62 / 36 (9)
N Ionian	3	75 / 172 (3)	78 / 54 (3)	0.16 / 0.12 (3)	35 / 11 (3)	34 / 20 (1)	59 / 46 (3)
NW Crete	3	92 / 806 (3)	71 / 26 (3)	0.18 / 0.08 (2)	16 / 1 (2)	23 / 4 (2)	18 / 3 (2)
NE Crete	4	102 / 853 (4)	60 / 24 (4)	0.10 / 0.08 (3)	9 / 6 (3)	21 / 5 (2)	23 / 5 (1)
N Sporades	4	247 / 278 (3)	41 / 40 (1)	0.19 / 0.17 (4)	25 / 15 (3)	17 / 17 (1)	15 / 21 (1)

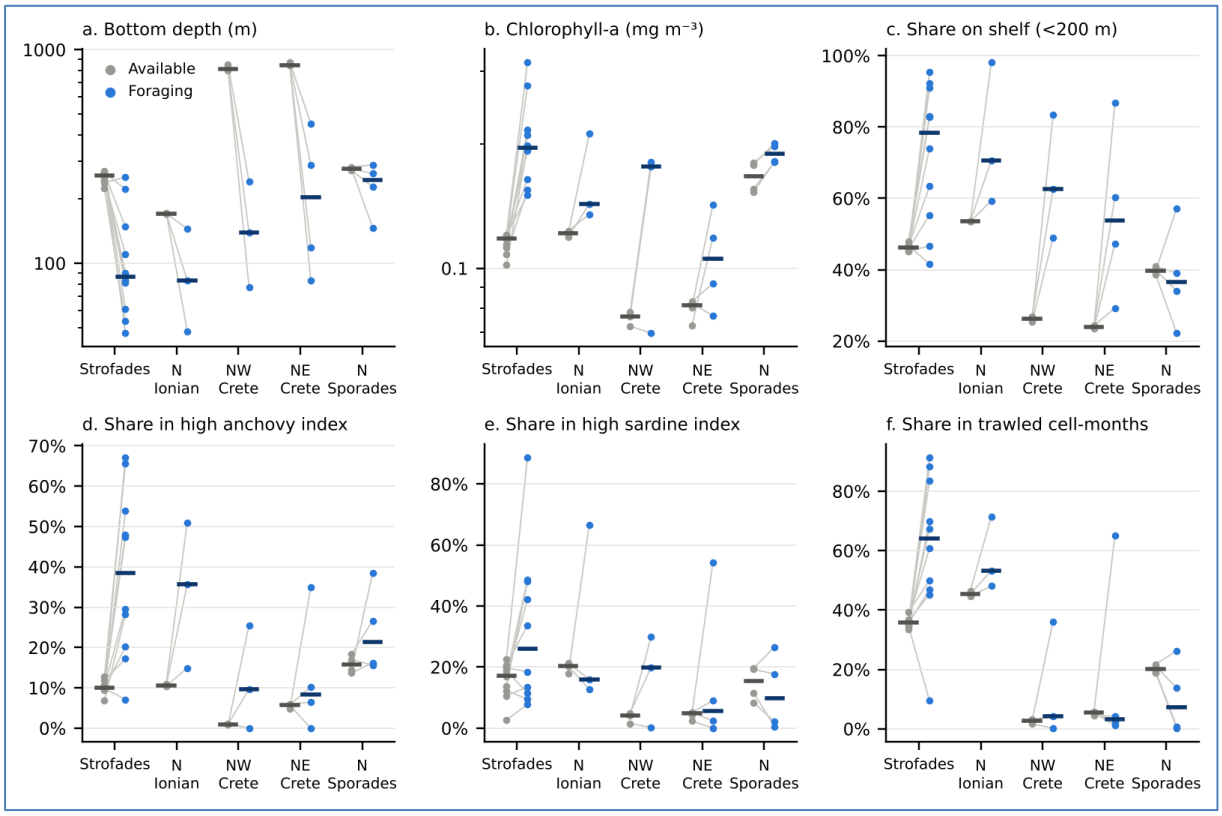


Figure 4-29. Foraging versus available conditions by colony during the breeding season, per bird (paired dots; bars = medians across birds): (a) bottom depth, (b) chlorophyll-a, (c) share of positions on the shelf, (d, e) share in high-index anchovy spawning and sardine habitat, (f) share in cell-months with AIS trawling.

4.3.2.5 Overlap with Natura 2000 sites

The Natura 2000 network was intersected with the breeding-season foraging positions of all five colonies, using the EEA Natura 2000 dataset “end 2024” (reference year 2024, published 2025; EEA 2025), clipped by NCC to the study area (30–46° N, 9.5–36.5° E; 4,684 sites). Sites designated under the Birds Directive (SPA) and under the Habitats Directive (SCI/SAC) were analysed separately, and sites listed under both count in each. The share of each bird’s foraging positions inside a site was averaged per colony. For comparison, the share of the colony’s range (95% UD) covered by Natura 2000 sites was used as the expected value if birds foraged at random within their range.

Between 3% and 22% of breeding-season foraging took place inside Natura 2000 sites (Table 4-11, Figure 4-30). For four colonies this was two to three times the share of their range covered by sites (Strofades 20% vs 8%, northern Ionian 17% vs 9%, north-eastern Crete 6% vs 2%, Northern Sporades 22% vs 11%). This follows from the preference for coastal shelf waters (Section 4.4), where most marine sites lie. North-western Crete birds, which foraged mainly in the Kythira, Myrtoan and Argolic seas, used sites less than expected (3% vs 4%). Strofades birds varied widely (4–66%). The highest value came from device Code_09, whose foraging in the Gulf of Corinth fell inside the site Korinthiakos Kolpos (GR2530007). Half of the in-site

foraging of Strofades birds was in Italian sites along the Apulian coast and around the Tremiti Islands, and 80% for the northern Ionian colony. After breeding, at most 3% of foraging fell inside sites at any colony, as the post-breeding areas off Tunisia, Libya and Egypt lie outside the EU.

Table 4-11. Breeding-season foraging inside Natura 2000 sites by colony: mean of per-bird shares (%), with the range across birds in brackets, by directive, and share of the colony's 95% UD covered by sites (%). Main sites: the sites with the largest share of foraging, in decreasing order.

Colony	Birds	In any site	In SPA	In SCI/SAC	Range covered	Main sites
Strofades	10	20 (4–66)	9	15	8	Korinthiakos Kolpos (GR2530007, SCI); Isole Tremiti (IT9110040, SPA); Litorale di Gallipoli (IT9150015, SPA/SCI)
N Ionian	3	17 (13–23)	11	11	9	Isole Tremiti (IT9110040, SPA); Litorale di Gallipoli (IT9150015, SPA/SCI)
NW Crete	3	3 (1–5)	1	2	4	Western and south-western Crete marine area (GR4340024, SCI); Saronic Gulf islets (GR3000020, SPA)
NE Crete	4	6 (1–10)	3	4	2	North-eastern cape of Crete – Dionysades (GR4320006, SCI); Chalki and islets (GR4210026, SPA)
N Sporades	4	22 (8–38)	14	19	11	Alonissos – Northern Sporades National Marine Park (GR1430004, SPA/SCI); Paliouri (GR1270008, SCI); NE Evia (GR2420014, SCI)

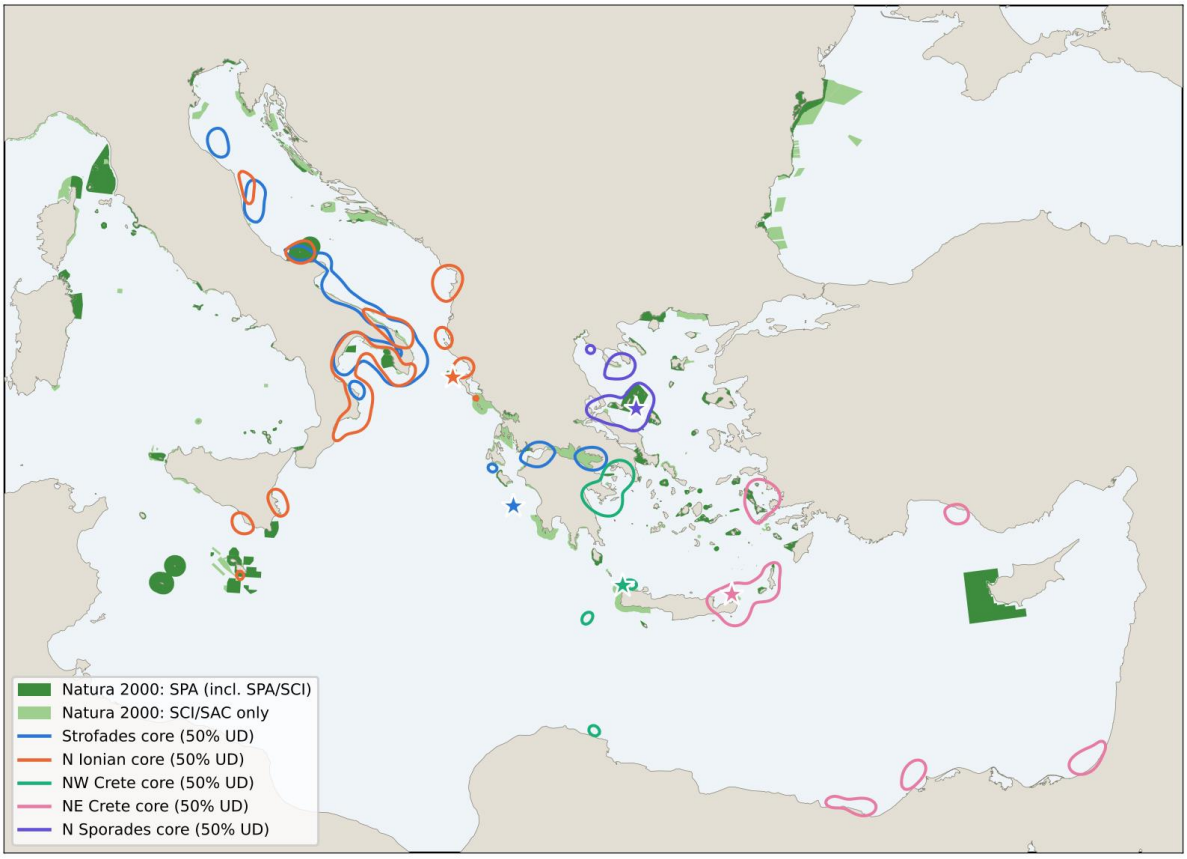


Figure 4-30. Natura 2000 sites with a marine part of more than 2 km² (dark green: SPA, including sites designated under both directives; light green: SCI/SAC only) and breeding-season core areas (50% UD) of the five colonies. Natura 2000 covers EU member states only.

4.3.2.6 Ionian Marine Park and hydrocarbon blocks

The comparison with protected and planned areas was completed with two further layers: the zones of the planned Ionian Marine Park (Section 4.3.1.9) and five offshore hydrocarbon exploration and exploitation blocks in the Ionian Sea and south of Crete (Kyparissiakos [ELPE], A2, South Peloponnese, South of Crete 1 and South of Crete 2). For each colony, the share of each bird's at-sea and foraging positions inside each area was averaged per colony, and the number of birds that entered each area was counted (Table 9, Figure 14). Positions within 5 km of the colony were excluded, as in the rest of the analysis.

Ionian Marine Park. Only Strofades birds used the park to any extent (3.6% of breeding-season at-sea positions, all ten birds). North-western Crete birds entered its southern zones off Kythira–Elafonisos (0.6%, two of three birds), and the other three colonies did not use it at all. The northern Ionian colony lies 136 km north of the park's northern limit, and its birds foraged mainly in Italian waters.

Hydrocarbon blocks. The Strofades colony itself lies inside the Kyparissiakos block, and 46 km from blocks A2 and South Peloponnese. Gramvousa (north-western Crete) lies 24 km from the South Peloponnese block, and the Dionysades (north-eastern Crete) 60 km from South of

Crete 2. Despite this proximity, the share of breeding-season time spent inside the blocks was small: 0.7% of at-sea positions for Strofades birds (Kyparissiakos, seven of ten birds), 3.3% for north-western Crete (South Peloponnese and both South of Crete blocks) and 1.1% for north-eastern Crete (South of Crete 2, two of four birds). Strofades birds crossed the Kyparissiakos block at the start and end of trips and foraged there only occasionally (0.5% of foraging positions), as their main foraging areas lay far to the north-west. After breeding, one north-eastern Crete bird spent 7% of its time in the South of Crete blocks. The northern Ionian and Northern Sporades birds did not enter any block.

Table 4-12. Ionian Marine Park and hydrocarbon blocks: breeding-season use by colony. Each cell gives the share of at-sea positions / share of foraging positions inside the area (%, mean of per-bird shares), with the number of birds that entered the area out of those tracked. – = no bird entered.

Area	km²	Strofades	N Ionian	NW Crete	NE Crete	N Sporades
Ionian Marine Park	17,707	3.6 / 3.6 (10/10)	–	0.6 / 0.6 (2/3)	–	–
Kyparissiakos (ELPE)	3,422	0.7 / 0.5 (7/10)	–	–	–	–
A2	826	–	–	–	–	–
South Peloponnese	10,209	<0.1 / 0 (1/10)	–	1.3 / 1.6 (2/3)	–	–
South of Crete 1	12,781	–	–	1.5 / 1.5 (1/3)	–	–
South of Crete 2	22,138	–	–	0.5 / 0.6 (1/3)	1.1 / 1.0 (2/4)	–

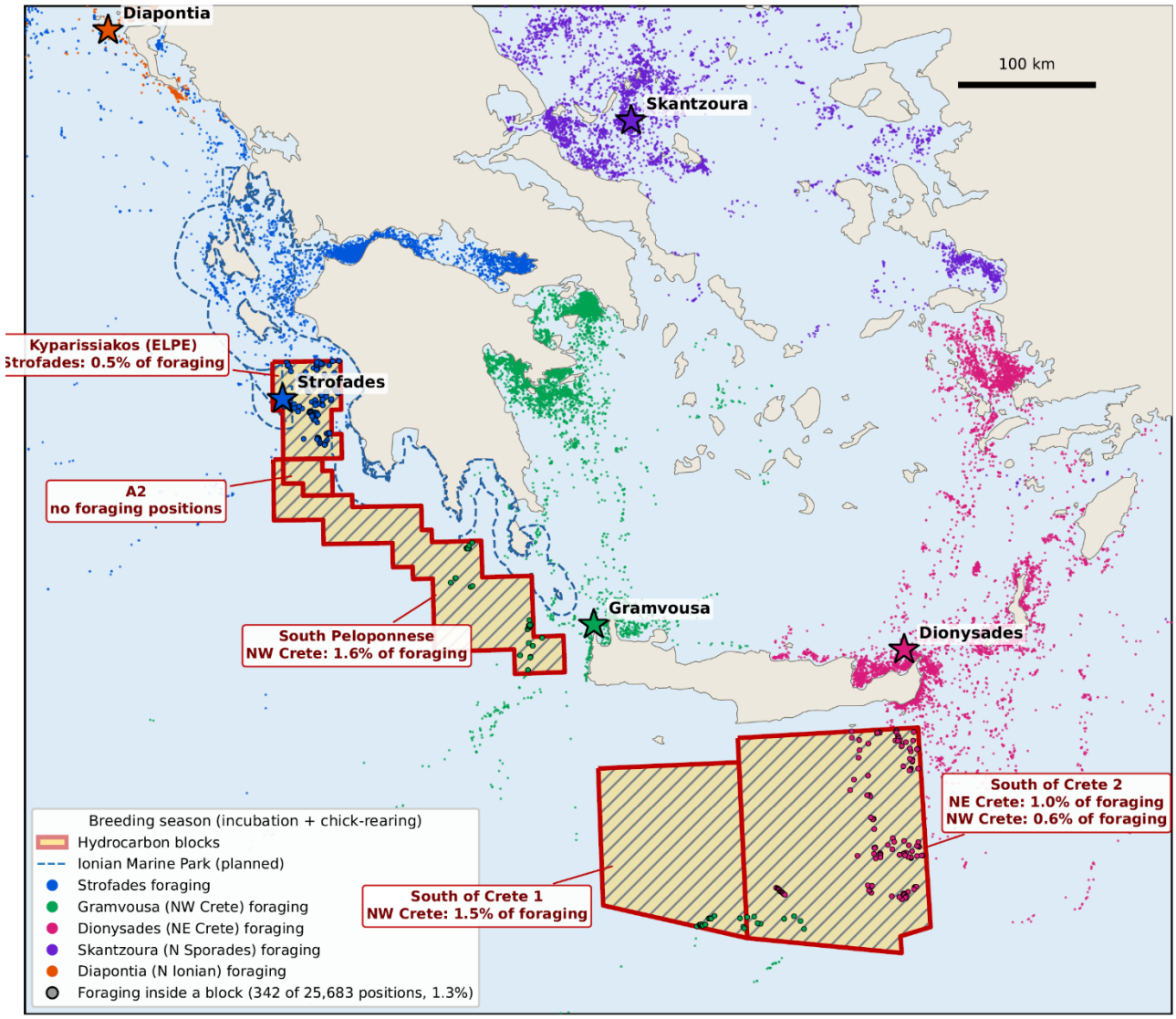


Figure 4-31. Zones of the planned Ionian Marine Park, offshore hydrocarbon blocks and breeding-season foraging positions of birds from the five colonies (stars) in the southern Ionian and around Crete.

4.3.3 Scopoli's Shearwater Breeding Phenology – Nest-Camera Monitoring

Nest cameras on the Strofades islands followed Scopoli's Shearwater (*Calonectris diomedea*) breeding phenology during the 2026 breeding season. This method supports the telemetry study with direct observations of breeding phenology at the colony.

Two Reolink cameras with infrared night vision were set up at Scopoli's Shearwater nests on the Strofades (Table 4-13). They record short clips when they detect motion, and every frame carries a date and time stamp.

Table 4-13. Summary of the operation of the two nest cameras

Camera	Position	Clips analysed	Period covered
Reo52	Inside the nest chamber, under a boulder	14	Sep – Oct 2026
Reo56	Facing the burrow entrance	4	Sep – Oct 2026

We reviewed each clip frame by frame. For each one we recorded:

- the date and time
- how many birds were present, and whether each was an adult or the chick
- how much down the chick still had
- what the birds were doing, such as resting, preening, being fed or exercising their wings

We chose one thumbnail per clip to show each stage. The fledging dates come from the last time each chick was seen at its nest on camera.

(a) Colony habitat	(b) Downy chick in the nest chamber	
		
(c) Solar panel powering the camera	(d) Mounting a camera	(e) Camera Reo52 in place
		

Figure 4-32. Setting up the cameras at the Strofades Scopoli's Shearwater colony. (a) The coastal limestone slope where the nests are. (b) The chick in its nest under a boulder. (c) Solar panel hidden among the rocks. (d) Reolink 4K camera Reo52 with a wooden shade, pointing into the nest chamber. e) A camera being fixed under a rock overhang.

Over the 45 days of footage, the Reo52 chick went from mostly downy (beginnings of September) to fully feathered and exercising its wings (10–13 October).

4.3.3.1 Chick development in the nest chamber (Reo52)

Before the end of September the chick still had a thick coat of down, but its wing and tail feathers were already coming through. Down was clearly thinner by 4–8 October. By 10–11 October the chick looked like a fully feathered juvenile. Adults were filmed visiting at night on 30 September, 3 October and 7 October. During the day the chick was alone, resting at the back of the chamber.

Date, time	Frame	Observation
29 Sep, 14:33		Chick alone during the day, resting at the back of the chamber.
30 Sep, 01:10		Chick still densely downy; a second bird (adult) in the chamber during a night visit.
1 Oct, 05:01		Body still covered in thick down; barred wing feathers showing through.
3 Oct, 02:25		Adult with smooth plumage and no down at the nest during a night visit.
3 Oct, 06:37		Chick preening; down left on its back and head, flight feathers well grown.

Date, time	Frame	Observation
4 Oct, 21:32		Chick sitting facing the camera; white underparts mostly feathered.
7 Oct, 04:37		Chick flapping its wings inside the chamber; patches of down on its back.
7 Oct, 23:53		Chick and adult together, consistent with a feeding visit.
8 Oct, 14:10		Chick resting alone during the day; plumage close to juvenile.
10 Oct, 12:58		Chick standing at the inner opening of the chamber in daylight.
10 Oct, 21:27		Chick flapping its wings hard.
11 Oct, 06:47		Fully feathered chick walking through the chamber at dawn.

Date, time	Frame	Observation
13 Oct, 10:00		Chick exercising its wings in daylight; condensation on the lens.
24 Oct, 17:48		After fledging: live view shows the cliff and sea, with no shearwater present.

Figure 4-33. Chick development in the nest

4.3.3.2 Pre-fledging activity at the burrow entrance (Reo56)

A bird regularly came out to the burrow entrance at night to exercise its wings, starting by 18 September and continuing until at least 9 October.

Date, time	Frame	Observation
18 Sep, 01:23		Bird at the entrance flapping its wings, then withdrawing into the burrow.
25 Sep, 05:15		Wings stretched and flapped at the entrance just before dawn.
29 Sep, 05:44		Repeated wing-flapping on the rock in front of the burrow.

Date, time	Frame	Observation
9 Oct, 00:22		Vigorous wing exercise at the entrance, about a week before fledging.

Figure 4-34. Pre-fledging activity at the burrow entrance

4.3.3.3 Fledging

The chicks left their nests on **16 and 17 October 2026**. After those nights they were no longer seen at the nests. The live view from Reo52 and Reo56 on 18 October showed no shearwater activity.

4.4 Telemetry of Loggerhead turtles: comparison with Scopoli's shearwater GPS tracking

Analysis of GPS tracking of Scopoli's shearwaters from the Strofades and four other Greek colonies showed that birds from the southern Ionian forage on distant productive shelves, mainly in the Gulf of Taranto and the Adriatic, and spend little time in the waters around the colony. Kyparissiakos Bay lies 60 km east of the Strofades, and NCC has tracked loggerhead turtles tagged there.

This section examines whether the two species, which share the same departure area, use similar seascapes and habitats, and how well both are covered by protected areas and affected by the offshore hydrocarbon blocks of the region.

4.4.1 Data and methods

4.4.1.1 Tracking data

Eleven turtles were tagged at Kyparissia with Wildlife Computers Argos transmitters over three seasons. The eight turtles tagged in June and early July were adult females, caught on the Kyparissia nesting beaches immediately after nesting. The three turtles tagged in early May were males, caught in the port of Kyparissia. Capture and transmitter attachment were carried out by specialists of ARCHELON and Dr Alan Rees. Locations were downloaded from the Wildlife Computers portal.

4.4.1.2 Processing and movement phases

Argos locations of classes 3, 2, 1, 0 and A were kept, and classes B and Z were removed. Positions before the first location within 30 km of the release area were removed as tests. A location was removed when the speeds from the previous and to the next location both exceeded 8 km/h (iterated), and locations more than 3 km inland were removed. One position per day was retained, the mean of that day's locations of the best available class.

Each day was assigned to a phase: **Kyparissiakos** (within 60 km of the release area), **migration** (running three-day displacement of 25 km/day or more) or **residence** (all other days, interpreted as foraging or overwintering). Residence days were grouped by sea area.

4.4.1.3 Space use and overlap with shearwaters

Utilisation distributions (UD) of residence positions were estimated per turtle with a fixed Gaussian kernel (bandwidth 20 km, wider than for shearwaters because of Argos error) on the same 5-km equal-area grid used for the shearwaters, and averaged with equal weight per turtle (ten turtles with at least 20 residence days). They were compared with the shearwater foraging UD of all five colonies (24 birds, weighted by sample size) using Bhattacharyya's affinity (Fieberg & Kochanny 2005), and by the share of turtle residence days inside the shearwater core (50%) and range (95%).

4.4.1.4 Environmental conditions

Bottom depth (ETOPO1), sea-surface temperature and chlorophyll-a (MODIS Aqua 8-day composites, R2022 reprocessing, about 8 km) were sampled at each residence position, using the composite nearest in time, as for the shearwaters. Each residence position was paired with five random sea points within the turtles' 95% residence UD on the same date. Turtles and shearwaters were compared over the same months (June–October).

4.4.2 Results

4.4.2.1 Departures and destinations

The females stayed near Kyparissia for 15–95 days after tagging (median 42), which probably includes further nesting, and most left between mid- and late July. Elpida stayed until late December. The males, tagged in early May before the nesting season, left after 3–26 days (median 12). All turtles then migrated to residence areas 120–1,130 km away (Table 4-14, Figure 4-35). Destinations were varied: the northern and central Adriatic (Archadia, Kallisti), the Gulf of Gabès off Tunisia (Aurore, who remained there for almost a year), the Thermaikos Gulf (Galini, 467 days), the Thracian Sea off Kavala and the Nestos delta (Panos III), the northern Ionian off Albania and the Amvrakikos Gulf (Maro, Korina), the Argolic Gulf (Barnaclos) and the eastern Ionian off Kefalonia, from where Kartellas also visited the Gulf of Taranto and the Adriatic. Elpida behaved differently: she remained in oceanic waters of the open Ionian and the Sicily Channel, over depths of 2,000–3,000 m. Linda's transmitter stopped while she was migrating towards Libya. The three males went to the Thracian Sea, the Argolic Gulf and the eastern Ionian, all neritic areas similar to those used by the females.

Table 4-14. Tracking summary per turtle (F: adult female caught after nesting, M: male caught in the port of Kyparissia). Days near Kyparissia: daily positions within 60 km of the release area. Residence: days outside migration and away from Kyparissia.

Turtle	Sex	Days tracked	Days near Kyparissia	Migration days	Residence days	Main residence area	Median depth at residence (m)
Linda	F	70	53	17	0	— (stopped during migration)	—
Korina	F	48	41	4	3	Amvrakikos Gulf	1
Maro	F	481	45	11	425	Northern Ionian & Albanian shelf	20
Kallisti	F	89	37	29	23	Northern Adriatic	19
Aurore	F	424	47	21	356	Gulf of Gabès	46
Galini	F	517	24	26	467	Thermaikos Gulf	5
Elpida	F	686	95	129	462	Open Ionian & Sicily Channel (oceanic)	2,844
Archadia	F	196	15	25	156	Central Adriatic	5

Turtle	Sex	Days tracked	Days near Kyparissia	Migration days	Residence days	Main residence area	Median depth at residence (m)
Panos III	M	98	3	21	74	Thracian Sea (Kavala–Nestos)	3
Barnaclos	M	139	12	8	119	Argolic Gulf	3
Kartellas	M	510	26	54	430	Eastern Ionian, Gulf of Taranto, Adriatic	103

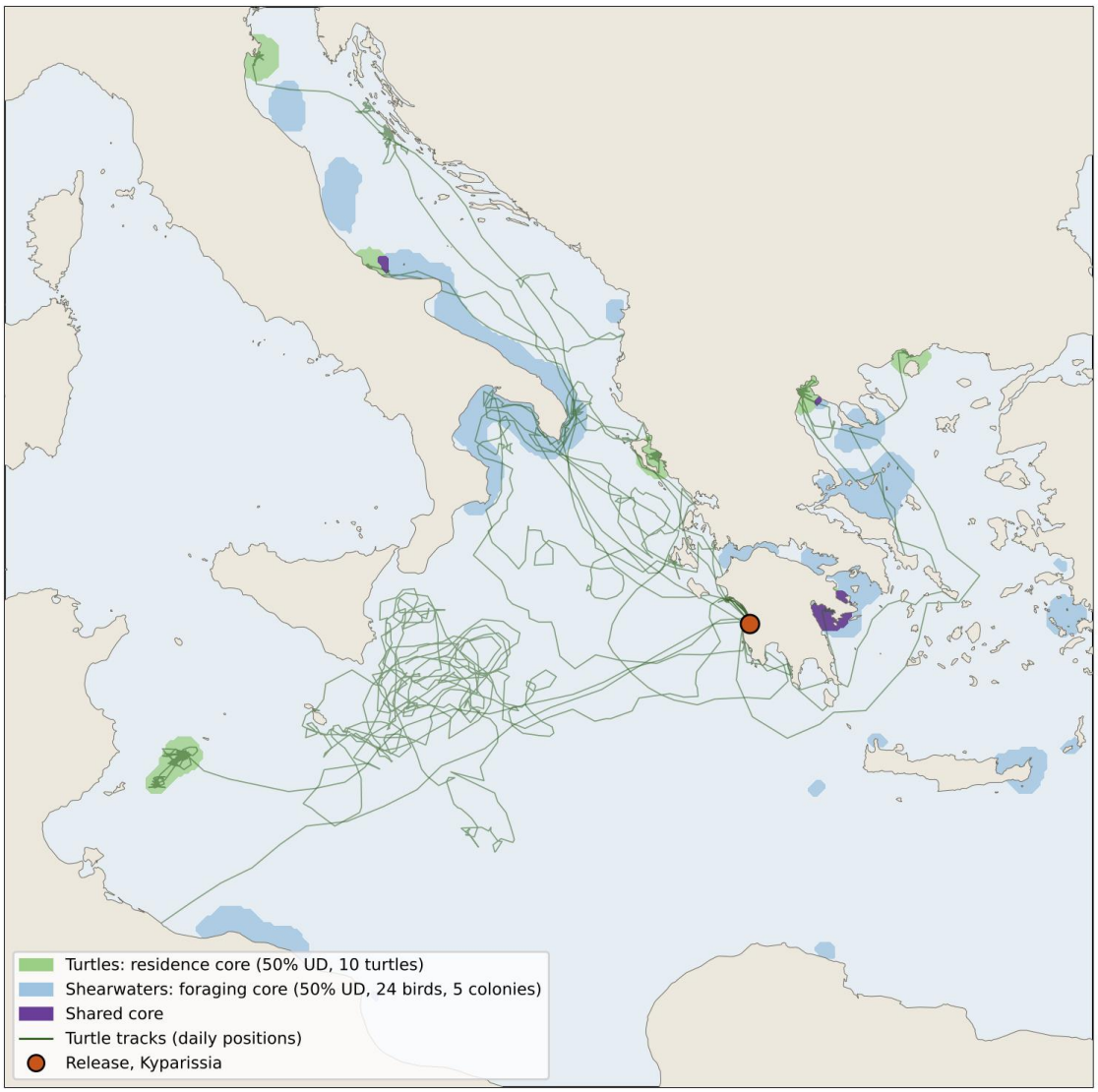


Figure 4-35. Daily positions of 11 loggerhead turtles from Kyparissia (lines), their residence core areas (50% UD, green), the foraging core areas of Scopoli's shearwaters from five Greek colonies (50% UD, blue) and the shared core areas (purple).

4.4.2.2 3.2 Overlap with shearwater foraging areas

At the scale of seascapes, turtles and shearwaters used many of the same regions: 64% of turtle residence days fell inside the shearwater foraging range (95% UD). At the scale of core areas the overlap was small. The affinity between the two distributions was 0.35 overall, highest with the two Ionian shearwater colonies (Strofades 0.28, northern Ionian 0.30) and lowest with north-eastern Crete (0.01). Only 13% of turtle residence days fell inside the shearwater core, and the shared core covered about 3,200 km², against 23,800 km² of turtle core and 92,800 km² of shearwater core (Figure 4-35).

The shared cores were the Argolic Gulf (95% of Barnaclos's residence days lay in a shearwater core), the Gulf of Taranto (69% of turtle days there) and the southern Adriatic off Gargano (56%). Elsewhere the two species used neighbouring but distinct parts of the same seascape. In the Gulf of Gabès, which is also the main post-breeding area of Strofades shearwaters, Aurore stayed in the shallow inner gulf around the Kerkennah Islands, while the shearwaters' post-breeding core lay farther offshore on the Tripolitanian shelf, and their core areas did not overlap. In the Thermaikos Gulf and the Thracian Sea the turtles were in shallow coastal waters close to river deltas, while shearwaters from the Northern Sporades foraged over the open North Aegean.

4.4.2.3 Depth, chlorophyll and temperature

Turtles resided in much shallower water than was available to them: nine of ten turtles had a lower median depth at residence than at available points (median 33 m vs 653 m), the exception being the oceanic Elpida. Eight of ten resided in water with more chlorophyll than available (median 0.30 vs 0.16 mg m^{-3}, p = 0.01), while temperature showed no consistent selection (three of ten). Residence temperature followed the season, from 15–16 °C in January–February to 28 °C in July–August.

Compared over the same months (June–October), both species favour productive shelf waters over the oligotrophic open sea, but at different depths (Table 4-15, Figure 4-36 and Figure 4-37). The two depth distributions cross at about 300 m: turtles concentrate in the shallow inner shelf, with 68% of positions in less than 50 m, whereas shearwaters concentrate on the middle and outer shelf (50–200 m), where the spawning grounds of anchovy and round sardinella lie (shearwater memo, Section 3.7). Turtle positions also had higher chlorophyll, consistent with their use of estuaries, lagoons and enclosed gulfs.

Table 4-15. Environmental conditions at turtle residence positions and shearwater foraging positions, June–October (medians and shares of positions). Shearwaters: 24 birds from five colonies, breeding season.

Variable	Turtles (residence)	Shearwaters (foraging)
Bottom depth (median)	25 m	94 m
Positions on the shelf (<200 m)	83%	67%
Positions in water <50 m deep	68%	27%
Chlorophyll-a (median)	0.25 mg m^{-3}	0.17 mg m^{-3}
Positions with chlorophyll-a >0.3 mg m^{-3}	43%	11%
Sea-surface temperature (median)	26.5 °C	26.3 °C

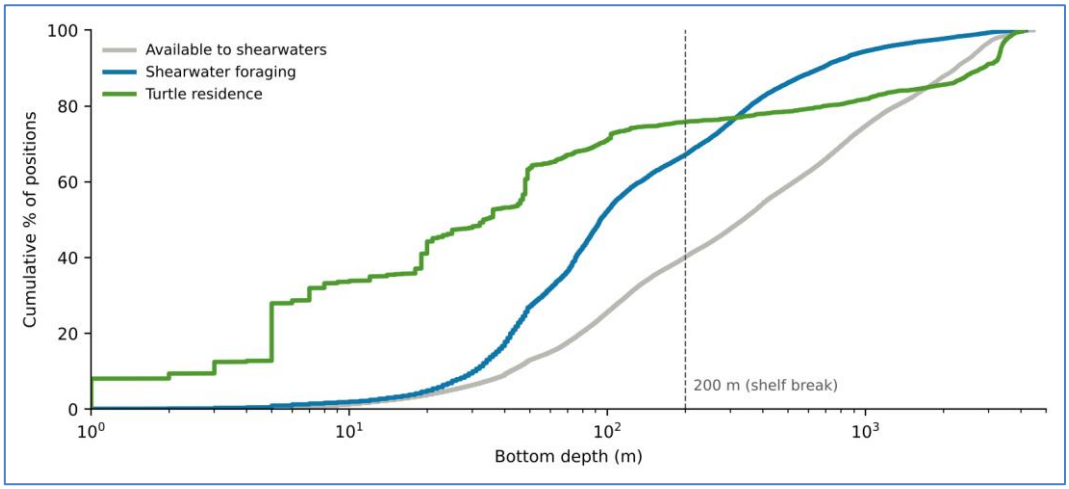


Figure 4-36. Cumulative distribution of bottom depth at turtle residence positions, shearwater foraging positions and points available to shearwaters (log scale). The dashed line marks the shelf break (200 m).

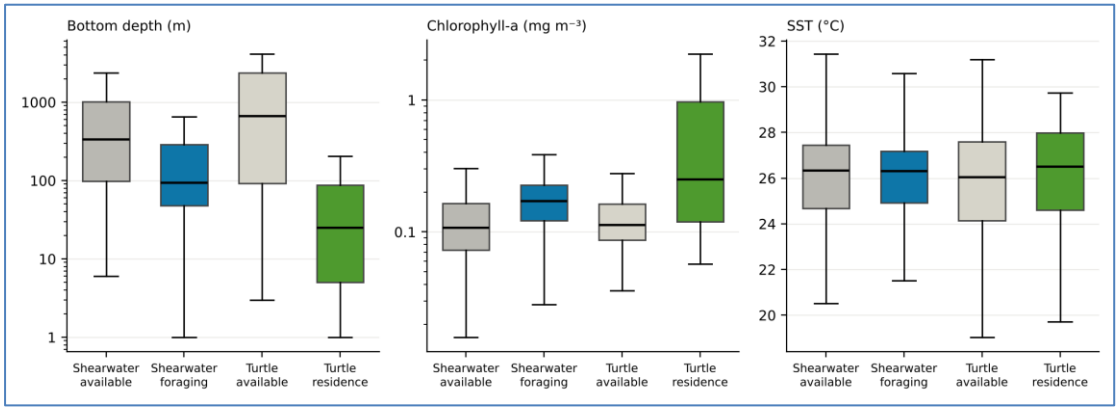


Figure 4-37. Bottom depth, chlorophyll-a and sea-surface temperature at available and used positions of shearwaters (foraging, breeding season) and turtles (residence, June–October). Boxes show the interquartile range and median; whiskers the 5th–95th percentile range.

4.4.2.4 Kyparissiakos Bay, protected areas and hydrocarbon blocks

Near Kyparissia the turtles stayed mainly in a narrow coastal strip between Kyparissia and Katakolo (Figure 4-38). This strip lies within the marine Natura 2000 site of Kyparissia Bay (GR2330008), which all ten turtles with positions there used, and within the planned Ionian Marine Park. On average 61% of turtle positions near Kyparissia were inside Natura 2000 sites and 85% inside the park zones (Table 4-16). The coastal strip lies east of the Kyparissiakos hydrocarbon block: only 0.6% of positions near Kyparissia fell inside the block. In contrast, the Strofades shearwater colony lies inside the block.

In the residence areas, the share inside Natura 2000 sites fell to 16% and inside the Ionian Marine Park to 4%. The exception was Panos III, with 81% of residence days inside Natura 2000 sites of the Nestos delta and Kavala–Thasos.

No residence position fell inside any of the five hydrocarbon blocks, and only six migration days crossed the South Peloponnese and Kyparissiakos blocks (Figure 4-39).

Table 4-16. Share of turtle daily positions inside Natura 2000 sites, the planned Ionian Marine Park and the five hydrocarbon blocks, by phase (mean of per-turtle shares, %).

Phase	Natura 2000	Ionian Marine Park	Hydrocarbon blocks
Near Kyparissia	61	85	0.6
Migration	13	12	1.3
Residence	16	4	0

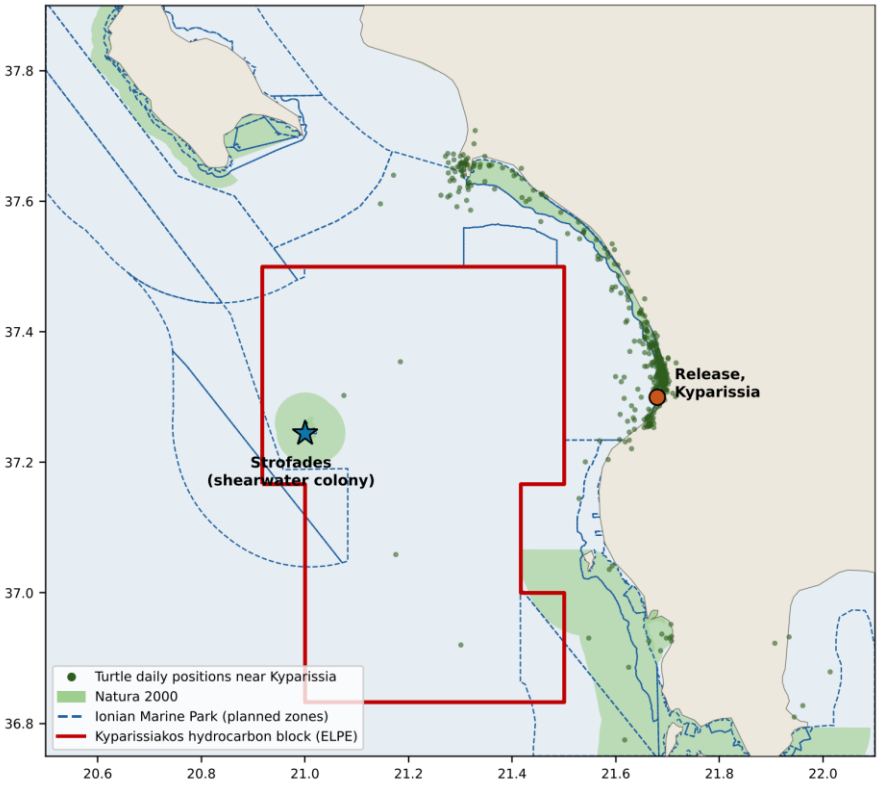


Figure 4-38. Turtle daily positions near Kyparissia, marine Natura 2000 sites, the zones of the planned Ionian Marine Park and the Kyparissiakos hydrocarbon block (ELPE). The Strofades shearwater colony lies inside the block.

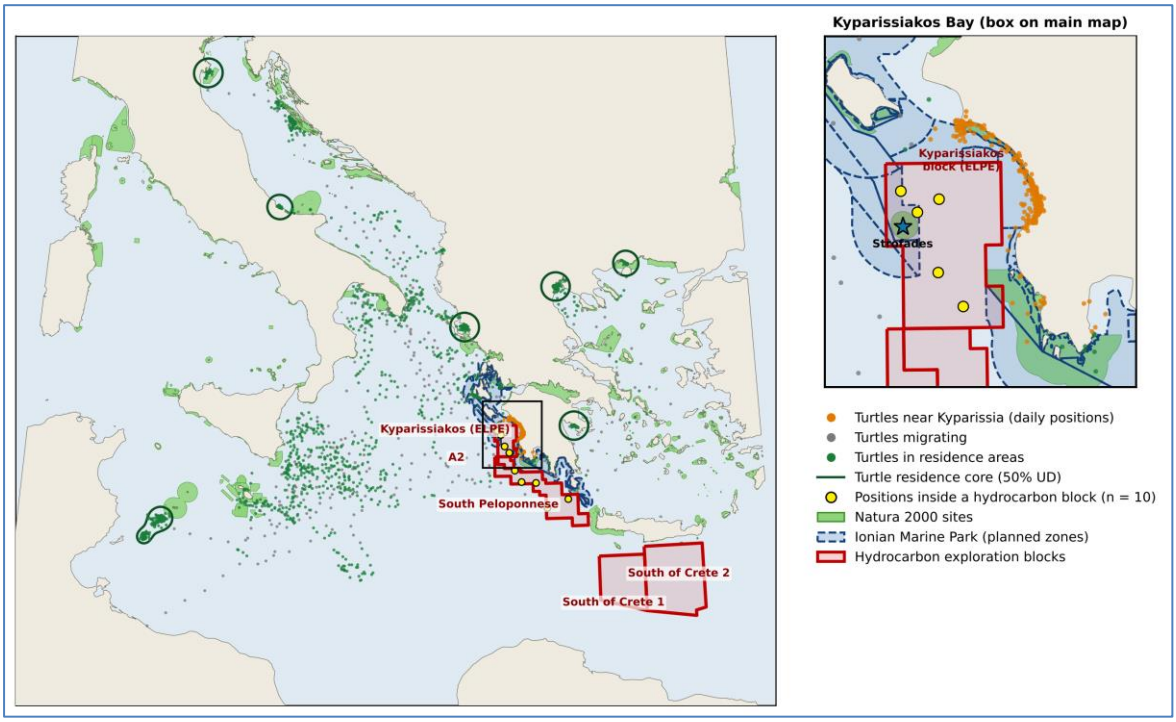


Figure 4-39. Turtle daily positions by phase and residence core areas (50% UD) in relation to Natura 2000 sites, the planned Ionian Marine Park and the five hydrocarbon exploration blocks. Yellow: the ten daily positions inside a block (four near Kyparissia, six during migration, none in residence areas). Right: close-up of Kyparissiakos Bay.

5 Conclusions

During 2026 all project's planned survey activities for the reporting period were successfully completed, providing an additional year of standardized information on the occurrence and distribution of marine mammals, seabirds and Mediterranean monk seals within the Kyparissiakos Lease Area and the surrounding waters. The continuation of the long-term monitoring project, initiated in 2020, further strengthens the baseline dataset available for the assessment of biodiversity in one of the most important marine areas of the Hellenic Trench.

Boat-based visual and passive acoustic surveys, complemented by aerial surveys, confirmed the continued presence of protected marine megafauna within the Wider Project Area. During the 2026 boat surveys, three cetacean species were visually recorded: sperm whale, Cuvier's beaked whale and striped dolphin, while passive acoustic monitoring additionally detected sperm whale, Cuvier's beaked whale and dolphin species. These findings once again demonstrate the importance of combining visual observations with passive acoustic monitoring, particularly for deep-diving cetaceans that spend only limited periods at the sea surface and may therefore remain undetected by visual surveys alone. The occurrence of sperm whales within the project area is consistent with previous years and further supports the significance of the Hellenic Trench as critical habitat for the eastern Mediterranean population of this endangered species.

The aerial surveys provided a complementary perspective to the vessel-based monitoring, enabling broader spatial coverage within a limited timeframe. During the first round of flights In June, two groups of striped dolphins, each consisting of approximately 20 individuals, were observed. During the second round of flights in October 2026, a solitary Cuvier's Beaked Whale was recorded. These findings highlight the contribution of aerial monitoring to the overall survey effort, particularly in identifying pelagic species with extensive movement patterns that may be difficult to detect consistently through vessel-based observations alone.

Seabird observations during the boat surveys were dominated by Scopoli's shearwater, while Yelkouan shearwaters and Yellow-legged gulls were also recorded. The predominance of Scopoli's shearwater is consistent with previous years and reflects the ecological importance of the Strofades Islands, which support the largest breeding colony of the species in Greece and whose breeding birds regularly exploit the surrounding marine environment, including the project area, for foraging.

The telemetry results highlight the importance of colony-specific foraging seascapes, as Greek colonies separated by only a few hundred kilometres exploit largely distinct marine areas. This spatial segregation indicates that conservation measures should be developed at the colony level rather than relying on a single national-scale assessment of important foraging areas. Nevertheless, some important areas are shared between colonies, most notably the Gulf of Taranto–Adriatic system, which represents the principal foraging area for both Ionian colonies and the most significant shared foraging hotspot identified so far for Greek breeding populations.Despite these geographical differences, the colonies exhibit similar habitat preferences, primarily targeting productive continental shelf waters that potentially support

spawning grounds of small pelagic fish. For the Strofades colony, as well as the Diapontia islands one, these conditions are mainly encountered in the heavily trawled shelf waters of the Adriatic Sea and the Gulf of Taranto.

The Strofades colony stands out for its particularly extensive foraging range. Previous research has suggested that colony-specific foraging ranges tend to increase with colony size (Grémillet et al., 2014). The relatively large breeding population of Strofades (Karris et al., 2017), combined with the oligotrophic conditions prevailing in the surrounding marine environment, may explain the longer foraging distances observed. However, potential interannual variability cannot be excluded based on the currently available data.

Regarding potential interactions with hydrocarbon exploration and exploitation activities, the results indicate that the overlapping between the investigated hydrocarbon blocks and the species' principal foraging grounds is very limited, as less than 4% of the total time recorded during the breeding season was spent within any of the five examined blocks.

The assessment of the Natura 2000 network further revealed that existing protected areas encompass only a relatively small proportion of the identified foraging habitats, accounting for approximately 3–22% of breeding-season foraging activity. Although Natura 2000 sites are used more frequently than expected where they include productive coastal shelf habitats, extensive offshore foraging areas remain outside the network. These findings highlight important spatial gaps in the current protected-area network and underline the need to incorporate colony-specific foraging distributions into future marine conservation planning.

Finally, camera monitoring at the Strofades colony provided valuable information on chick development, adult attendance and fledging phenology. Chicks fledged on 16–17 October 2026, following approximately four weeks of wing exercises that had begun by mid-September. During the final two to three weeks before fledging, the monitored chick underwent a rapid transition from predominantly downy plumage to fully developed feathers. Adult visits to the nest occurred exclusively during nighttime, consistent with the typical behaviour of the species, while the chick remained alone at the nest during the final week before departure. The use of solar-powered cameras with remote access proved particularly effective, enabling the precise determination of fledging dates and continuous documentation of breeding behaviour without requiring physical visits to the colony. This approach demonstrates the considerable potential of remote camera systems as a non-invasive tool for monitoring breeding phenology and reproductive behaviour in remote seabird colonies.

Turtles from Kyparissia and shearwaters from the southern Ionian share a departure area and a destination pattern. Both leave the oligotrophic southern Ionian and travel hundreds of kilometres to productive shelves, and several destinations are common to both: the Adriatic, the Gulf of Taranto, the Tunisian shelf and the North Aegean. Within these seascapes the two species are separated by depth. Turtles occupy the inner shelf, estuaries and enclosed gulfs, and shearwaters the middle and outer shelf where small pelagic fish spawn. This separation explains why the overlap is substantial at the scale of regions but small at the scale of core areas.

For both species, Natura 2000 and the planned Ionian Marine Park cover the area near the colony or nesting beaches, but only a small part of the distant foraging and residence areas, many of which lie outside Greece. Regarding the foraging grounds, the Argolic Gulf, the Gulf of Taranto and the southern Adriatic hold core areas of both species and could be considered as multi-species priority areas, together with the Thermaikos Gulf and the Amvrakikos Gulf for turtles and the Gulfs of Patras and Corinth for shearwaters. On the other hand, overlap of both species with the five hydrocarbon blocks is very limited. The main proximity is in Kyparissiakos Bay, where the Strofades colony lies inside the ELPE block and the turtles' coastal strip lies just east of it.

Male turtles were present at Kyparissia in spring, before the nesting season, and females stayed in the coastal waters for several weeks after nesting. The bay's inshore waters are therefore used by both sexes over much of the breeding season, not only by nesting females on the beaches. As turtles concentrate in shallow coastal waters, near river deltas and in enclosed gulfs, pressures from coastal fisheries and coastal development are likely to matter more for them than for shearwaters.

Monitoring activities targeting the Mediterranean monk seal were maintained throughout the reporting period, combining observations reported through the National Rescue and Information Network (RINT) with on-site surveys along the southwestern coast of Zakynthos and data collected through the direct observation of marine caves identified as Mediterranean monk seal habitat using infrared camera systems. The findings from October 2025 to October 2026 further demonstrate the ongoing importance of this area for the species, with records indicating its continued presence and recurrent use of the local coastal habitat, and most importantly, the regular birthing of pups. The photographic material obtained during this period revealed several seals using the monitored caves, including females accompanied by pups, reinforcing the significance of southwestern Zakynthos as a major reproductive site for the Mediterranean monk seal in the South Ionian Sea. Nevertheless, records of deceased animals, the increasing pressures such as tourism and the possibility of operational accidents with disastrous ecological effects still serve as a reminder there remain concerns for the local population and emphasize the importance of sustained surveillance and targeted conservation measures.

Overall, the results of the 2026 surveys confirm the continued ecological importance of the Kyparissiakos Gulf and the adjacent Hellenic Trench for several protected marine vertebrate species. The combination of boat-based surveys, passive acoustic monitoring, aerial surveys, telemetry and coastal monitoring provides complementary information that substantially improves species detectability and the understanding of habitat use across different ecological guilds.

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Annex I: Survey protocols

ESAS protocol datasheet for collection of seabird data

Empty species datasheet

BIRD DATA Ship-based seabird surveys **EUROPEAN SAS / Royal NIOZ**

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

Direction of flight[3]:
2
9 N 3
NW NE
8 W 1 E 4
SW SE
7 S 5
6

Associated with[3]:
11 = cetaceans
12/3 = front/line in sea
14/5/6 = wood/litter/oil
18/21 = own/other ship
22/5 = buoy/stick
23/4 = near/on platform
26 = fishing vessel
27/8/9 = ice/land/shallows

Behaviour codes[4]:
30/1 = holding/without fish
32 = feeding chick
33 = "feeding"
34/5 = wading/scooping
36/7 = aerial purs/skimm.
38/9 = hydropl/pattering
40/1 = scavenging/at trawl
42/3 = dipping/surf.seizing
44 = surface pecking
45 = deep plunging
46 = shallow plunging
47 = pursuit plunging
48 = pursuit diving
49 = actively searching
60 = resting/asleep
61/2 = courtship displ/fd
65 = guarding chick
66 = preening/bathing

91 = kleptoparasitised
92/3 =attacked (brd/mm)

MSFAs[3] (Dirn codes)
50 = "participant"
51/2 = joined / joining
53 = scrounger type
54 = solitary diver
55 = beater (e.g. dolphins)
56 = social feeder/diver

Poskey	Time	G	Species	Age	Plum	Number	Dist[1]	Tr[2]	Dirn[3]	Behav.[4]	Prey[5]/notes

Prey examples[5]: 10 = "fish", 11 = small fish (bill length), 12 = medium fish (2-5 bl), 13 = large fish, 14 = sandeel ball, 15 = clupeoid ball, 16 = "fish ball", 21 = clupeoid fish, 22 = sandeel, 23 = gadoid, 24 = flatfish, 25 = regurg. fish, 32 = jellyfish, 34 = worm, 41 = swimming crab, 42 = starfish, 50 = carrion, corpse, 51 = seal carcass, 52 = whale carcass, 53 = bird carcass, 56 = active bird kill, 60 = fishery waste, 61-66 = specified discards

Protocol datasheet for collection of cetacean visual records

Index	GpsIndex	GpsTime	SightingNo	Time	Platform	Angle	Distance	Heading	Cue	Species	Confidence	MinNo	MaxNo	Adults	Juveniles	Calves	Birds	Behaviour1	Behaviour2	Behaviour3	SeenFrom	SeenBy	SightingEffort	Notes	ButtonRef	MagBearing	Reticles	RelBearing	EyeHeight

Protocol datasheet for collection of cetacean acoustic records

Index	GpsIndex	GpsTime	DateTime	Observer	End Time	Notes	SelfBoat	OtherBoat	WaterNoise	DOClicks	DOCNotes	DOWhistle	DOWNotes	DOOther	DONotes	SWClicks	SWCodas	SWOther	SWNotes	BWMoan	BWOther	BWNotes