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ΤΜΗΜΑ ΑΛΙΕΙΑΣ

ΚΑΙ

ΘΑΛΑΣΣΙΩΝΕΡΕΥΝΩΝ

Update Of Articles 8, 9, And 10 Of The Marine Strategy Framework-Directive (2008/56/EC) In The Marine Waters Of Cyprus

Second Assessment Report

May 2019

Contents

1 Environmental features and characteristics

1.1 Physical and chemical features

1.1.1 Topography and bathymetry

The topography of the seafloor within the marine realm under jurisdiction of the Republic of Cyprus is shown in Figure 1.1. The majority of the seafloor is occupied by the abyssal plain, while the continental margin (shelf, slope and rise) is relatively narrow. Notable features include Eratosthenes Seamount, 120 km by 80 km wide, rising from a depth of 2700 m to 690 m below sea level, and the Hecateus Rise and Larnaca Ridge, which rise to 104 m and 915 m, respectively. The deepest point in the Cyprus EEZ is located at its western-most extremity within the Herodotus abyssal plain and extends to over 3000 m in depth.

The coverage of marine waters with regards to policy-related classifications is shown in Table 1.1. The total coastline of Cyprus has a length of 1094 km.

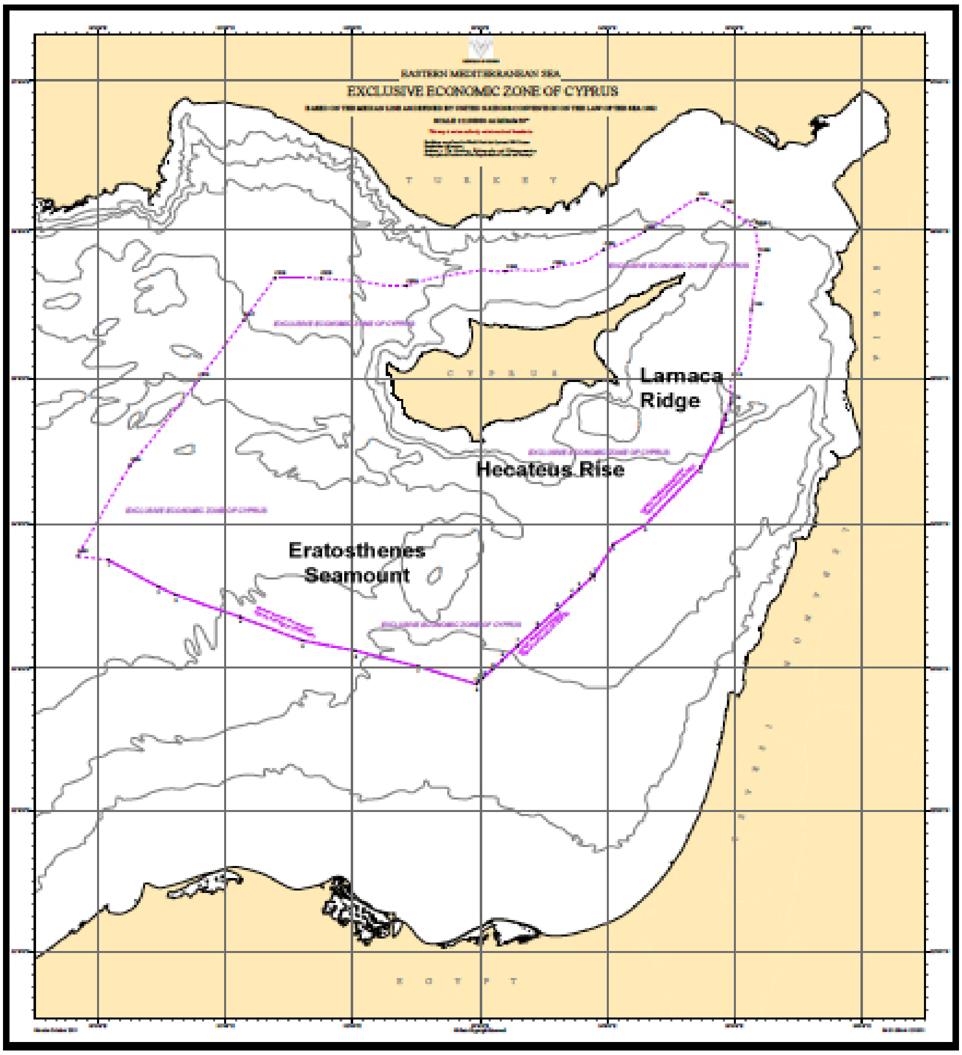


Figure 1.1 Bathymetry (1000-m contours in grey) and boundaries of the Exclusive Economic Zone of Cyprus (in purple). Map courtesy of the Department of Lands and Surveys of the Ministry of the Interior of the Republic of Cyprus. Reproduced from DFMR (2012).

Table 1.1 Sea surface areas (in km^2) of various water bodies of political/managerial and geophysical significance, calculated from the coordinates given by the Ministry of Commerce, Industry and Tourism (referenced to the UTM 36N coordinate system, USGS 84 datum) and first reported in DFMR (2012).

Water body	Definition	Sea surface area (km^2)
Coastal waters	Waters within 1 nm* from the shore of the Republic measured from the low-water mark at low tide (Water-Framework Directive 2000/60/EC, Law No. 13(I) of 2004)	1038
Territorial waters	Waters within 12 nm* from the shore of the Republic measured from the low-water mark at low tide (Law No. 45 of 1964)	11880
Exclusive Economic Zone	The zone beyond and adjacent to the territorial waters, and that extends to the boundaries shown in Figure 1.1 (Law No. 64(I) of 2004)	118886
Total sea surface area under Cyprus jurisdiction		**130766**
Total land area of Cyprus		**9262**

* One nautical mile (nm) is defined as 1852 m (Law No. 64(I) of 2004).

1.1.2 Physical characteristics

Cyprus lies in the northeastern corner of the Levantine Basin, the easternmost of the major Mediterranean Sea basins. The major water masses that provide structure to the open Levantine water column (Figure 1.2) are as follows (Zodiatis et al. 1998):

- Levantine Surface Water (LSW), a thin surface layer of very warm and salty water that may extend from 0-20 m depth in the summer to 0-200 or even 350 m in the winter due to surface mixing (Zodiatis et al. 2001),
- Atlantic Water (AW) can be found right below the mixed layer and identified by a salinity minimum (Figure 1.2) is transferred by a meandering jet from the Straits of Gibraltar across the Mediterranean, in a non-uniform fashion (Figure 1.3),
- Levantine Intermediate Water (LIW), a warm and saline water mass located at 200-400 m depth, is produced by winter cooling of LSW. The new denser water mass sinks and spreads from the Levantine Basin to the rest of the Mediterranean,
- Eastern Mediterranean Deep Water (EMDW), found at depths greater than 500 m, is formed during deep convection events.

The vertical physical structure of the water column is disrupted in the horizontal by a complex field of mesoscale features such as eddies (Figure 1.3). The anticyclonic warm-core Cyprus eddy, usually located due South of Cyprus (Figure 1.4), is the most prominent of such features in Cyprus waters, commonly measuring 80 km across and characterized by currents that can peak at 0.4 m/s. Lateral mixing between the core of the eddy and surrounding water masses is limited and the biogeochemical implications of the presence and physical characteristics of the eddy could be significant (Krom et al. 1991).

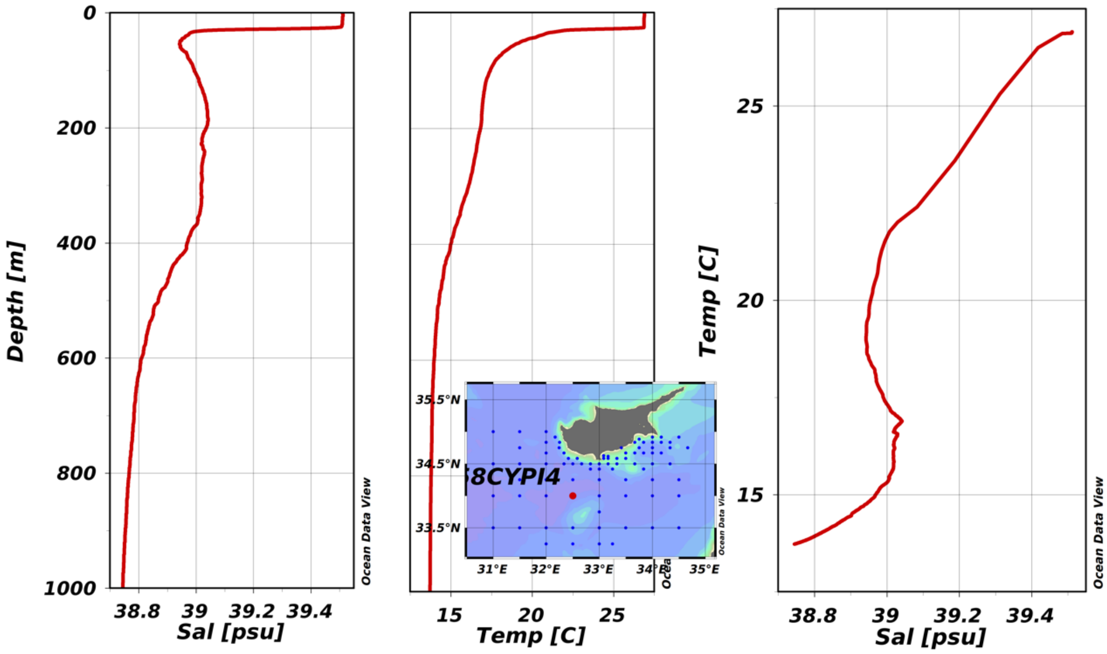


Figure 1.2 Salinity profile (left), temperature profile (center) and Temperature-Salinity diagram collected during the Cyprus Basin Oceanography cruise CYBO-19 in September 2005. (data from OC-UCY 2011a, figures published in DFMR (2012).

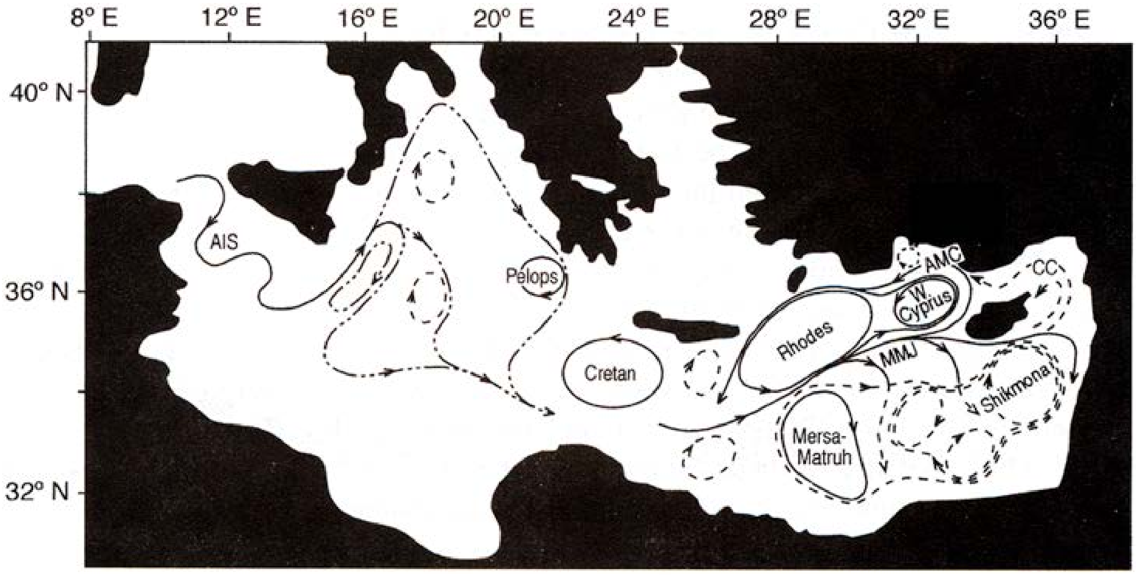


Figure 1.3 Schematic of the prototypical circulation of the Eastern Mediterranean as produced by the POEM project (Robinson et al. 1992) illustrating a complex structure of mesoscale features connected by the Mid-Mediterranean Jet transferring Atlantic Water eastwards.

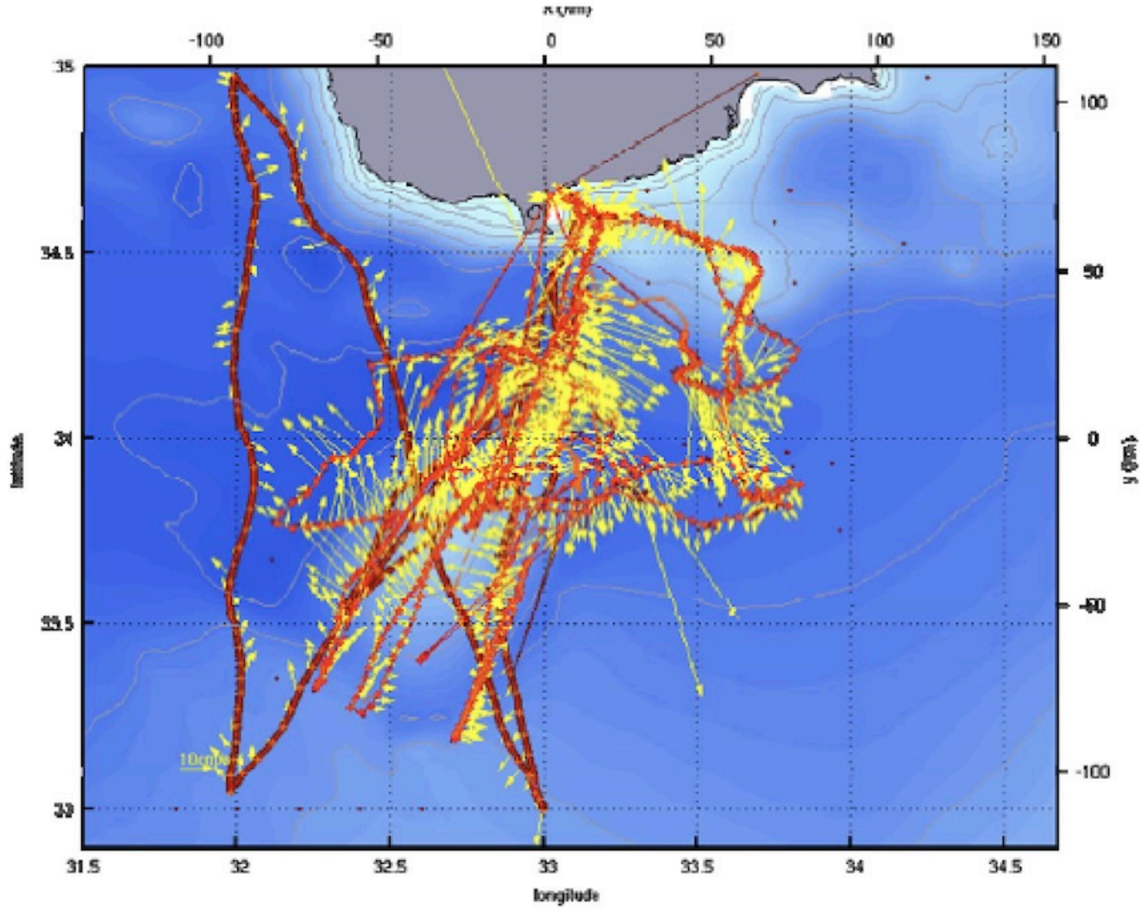


Figure 1.4 Sea glider tracks in red and dive-averaged currents across the Cyprus Eddy during the field experiment "Eye of the Levantine" in November-December 2009 (Hayes et al. 2011).

Seasonal temperature and salinity fluctuations are clearly detectable in offshore surface waters (Figure 1.5), with the formation of the thin LSW layer clearly visible during the summer months. Seasonal fluctuations in temperature are also detectable in coastal waters (Figure 1.6) with similar ranges to those of offshore waters.

Wave activity in Cyprus waters is relatively low due to the enclosed nature of the Mediterranean basin that limits fetch and, consequently, the impact of even large storms. The E-Wave project of the Oceanography Center of the University of Cyprus (OC-UCY, 2019) has produced modeled estimates of relatively low significant wave heights of up to 1.5 m, and environmental properties that affect it as part of an exploration of wave energy potential (Zodiatis et al. 2014).

Long-term changes due to climate change are sparsely documented. While sea-level trends in the region have not been observed due to the lack of long time-series observations, modeling efforts have indicated that sea level is rising by 3 mm per year (Tsimplis et al. 2008). Reconstructions of sea surface temperature using carbon and oxygen isotopes from reef-building vermetid skeletons in Israel have captured significant warming over the past two centuries with a rate of 0.8 ^{o}C per 100 years for the period of 1850-2010 (Sisma-Ventura et al. 2014).

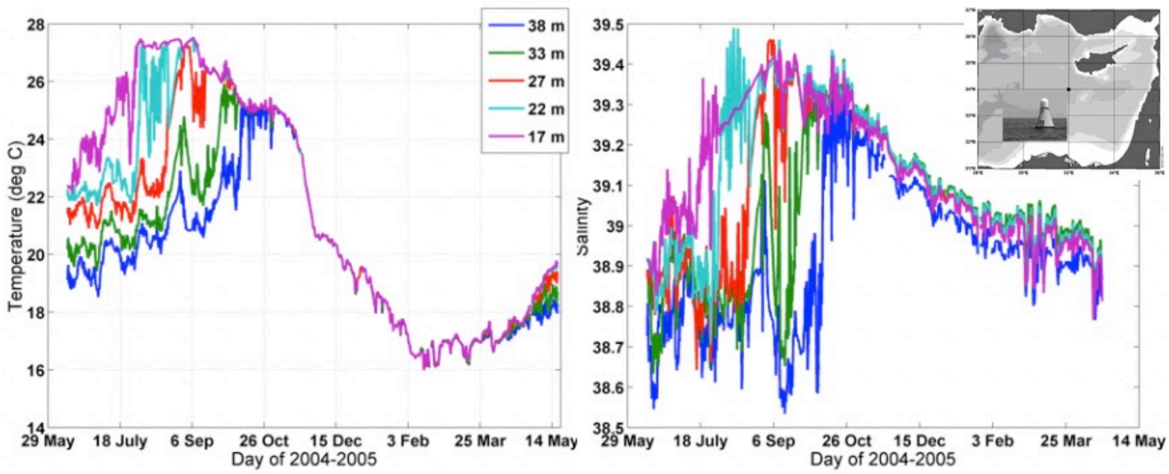


Figure 1.5 Surface temperature (left) and salinity (right) measured during 2004-2005 measured by the CYCOFOS MedGOOS-3 Observatory of the Oceanography Center of the University of Cyprus (location shown in the inset) (DFMR 2012).

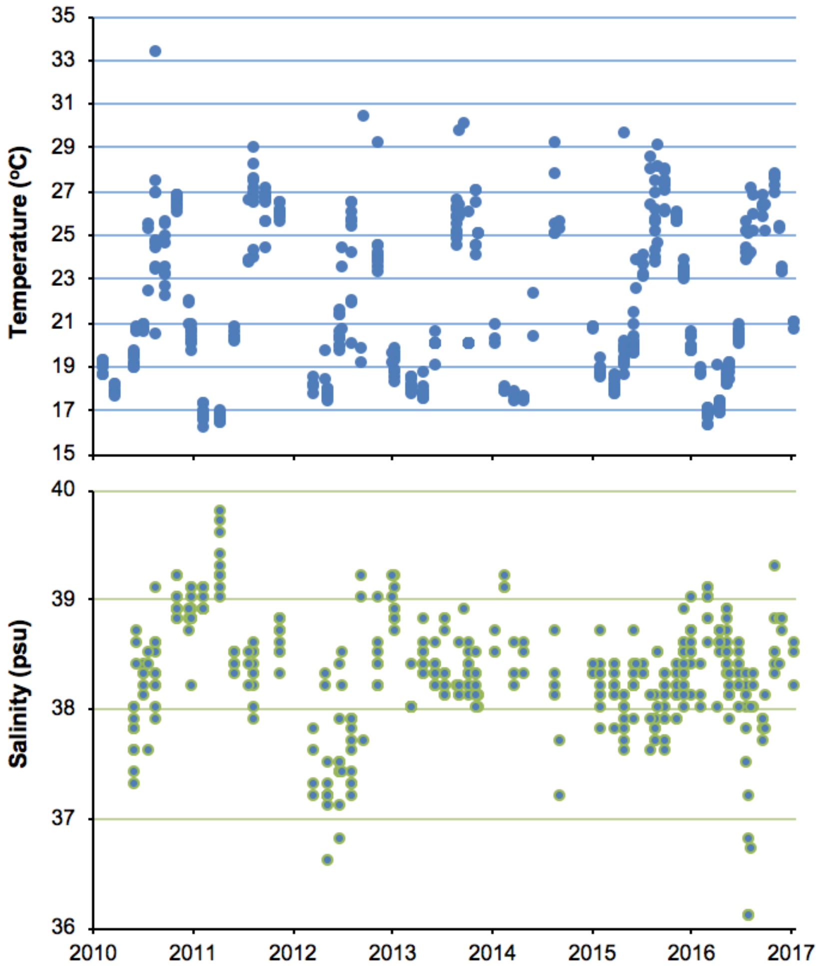


Figure 1.6 Temperature (above) and salinity (below) at coastal stations monitored by the DFMR for the period 2010-2017 (DFMR 2019).

1.1.3 Chemical characteristics

The Eastern Mediterranean, and the Levantine Basin in particular, is acutely oligotrophic (Krom 1995). This is reflected in both coastal (Figure 1.7) and offshore (Figure 1.8) inorganic nutrient concentrations. Limited production of organic matter is accompanied by low concentrations of organic compounds. Pujo-Pay et al. (2011) determined that particulate organic carbon, particulate nitrogen and particulate phosphorus at the vicinity of the Cyprus eddy in the summer of 2008 were in the vicinity of 3-3.5 μmol L^{-1}, 0.3-0.35 μmol L^{-1}, and 0.012-0.014 μmol L^{-1}, respectively. However, the concentrations of dissolved organic carbon, nitrogen and phosphorus at the same station were 68-70 μmol L^{-1}, 4.5-4.8 μmol L^{-1}, and 0.02-0.03 μmol L^{-1}, respectively, suggesting that dissolved organic nutrients can be as significant as dissolved inorganic nutrients.

Low respiration rates imply relatively high oxygen concentrations. While offshore oxygen concentration profiles with depth (Figure 1.9) are typical of open ocean conditions with a subsurface oxygen minimum zone (OMZ), the concentrations in the OMZ are far from hypoxic. Similarly, high concentrations and saturation levels of oxygen (Figure 1.10) are also observed in the many coastal stations monitored by the DFMR (2019).

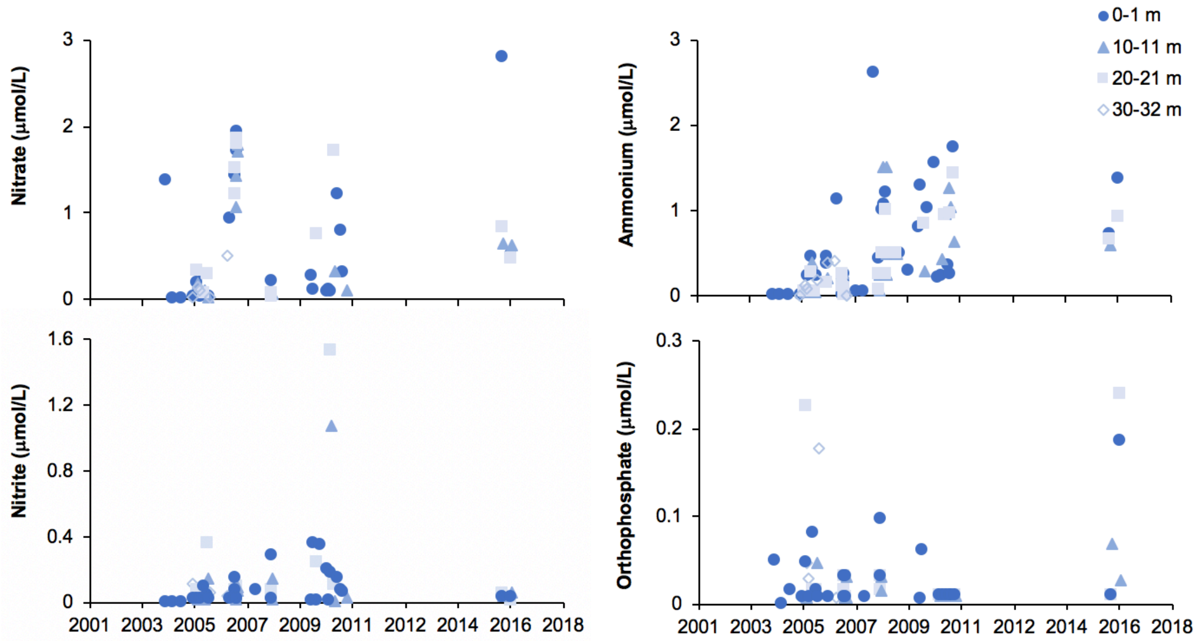
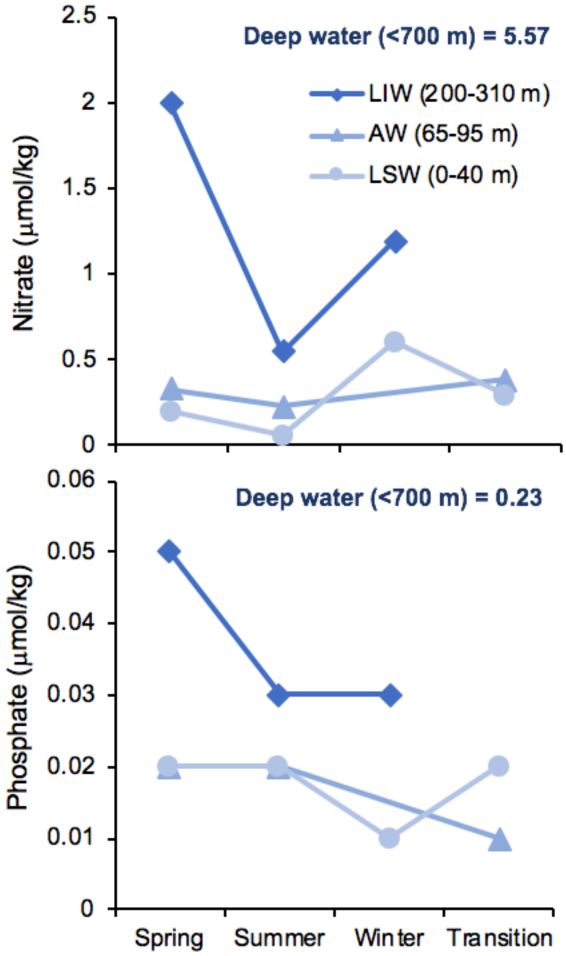


Figure 1.7 Nitrate, nitrite, ammonium and orthophosphate concentrations of coastal waters of Cyprus, as recorded at various reference stations during the compliance monitoring programmes of the Department of Fisheries and Marine Research between the years of 2004 and 2017 (Argyrou and Loizides 2005; Argyrou 2006, 2008; DFMR, 2019; EEA 2011).



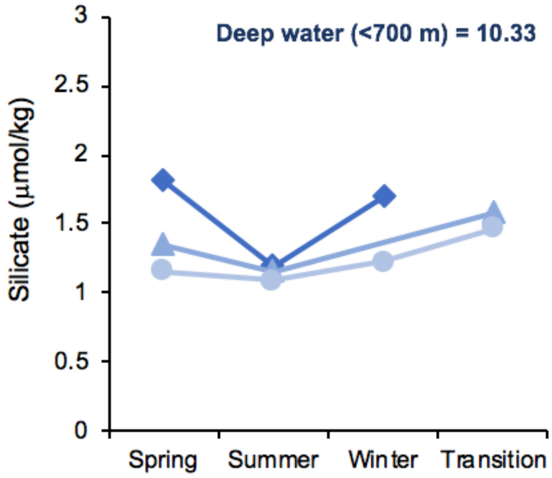


Figure 1.8 Nitrate, phosphate and silicate concentrations of major water masses in the Southern Levantine Basin throughout the year, as recorded by Kress and Herut (2001) between the years of 1989 and 1995. Water mass abbreviations: LSW – Levantine Surface Water, AW – Atlantic Water, LIW – Levantine Intermediate Water. Depths are shown in parentheses in the figure legend. Season definitions are based on Hecht et al. (1988): Spring – April to June, Summer – July to October, Winter – February to March, Transition – March to April.

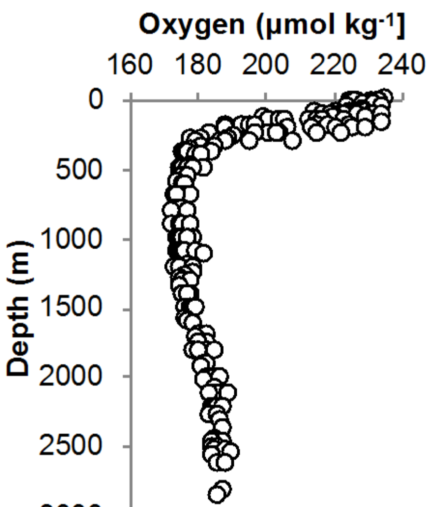


Figure 1.9 Composite oxygen profile with depth at 11 stations in the Levantine Basin cruise in April-May 1999 (Kress et al. 2003).

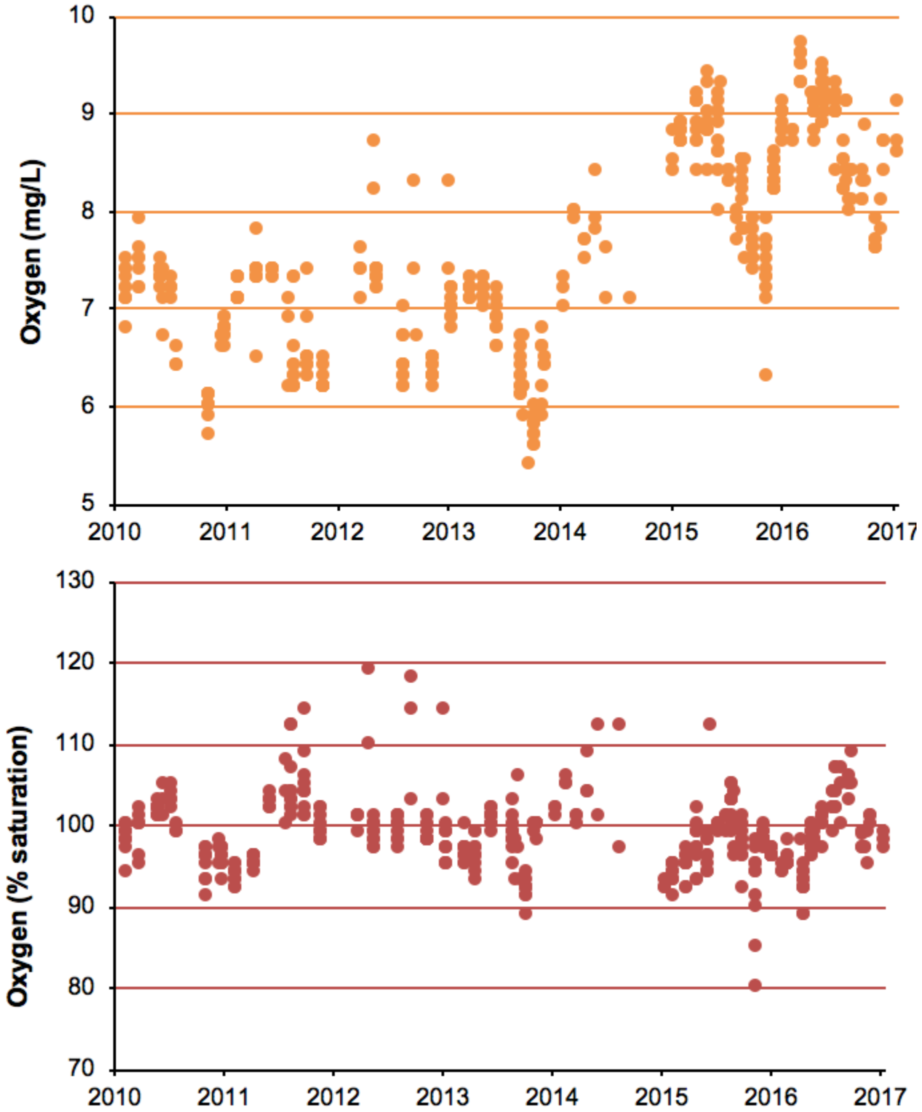


Figure 1.10 Oxygen concentration (above) and degree of saturation (below) at coastal stations monitored by the DFMR for the period 2010-2017 (DFMR 2019).

1.2 Habitat types

1.2.1 Key features

The key features of marine habitats and typical value ranges are summarized in Table 1.2 (note that many are discussed in more detail elsewhere in this report).

Table 1.2 Key features of the marine environment of Cyprus and typical state and range(s) of values.

Feature	**Typical state and range(s) of values**
Temperature	Broad range during the year in all waters. Coastal water temperatures range between 16-18 ^{o}C in winter to over 28 ^{o}C in summer (Figure 1.6). Offshore surface waters demonstrate similar fluctuations (Figure 1.5) while the deep Eastern Mediterranean Deep Water mass has a temperature slightly above 13 ^{o}C.
Salinity	Salinities are slightly elevated compared to average seawater, ranging between 37-39 psu.
Waves, currents and tides	Significant wave heights in the marine waters of Cyprus are typically lower than 1.5 m, but they can have significant impacts on the littoral zone. The tidal range rarely exceeds 0.4 m.
Light	Light penetration is very high due to very low water turbidity. As a result, macroalgal and seagrass presence can extend to 50 m depth.
Substrate	The typical substrate in coastal waters is either hard rock or coarse sand and gravel. Muddy sediments can only be found in deeper waters.
Oxygen	Oxygen levels are quite high throughout the marine waters of Cyprus and hover about 100 % saturation (Figure 1.10)
Nutrients	Nutrient levels are relatively sparse in both coastal (Figure 1.7) and offshore waters (Figure 1.8), with inorganic and organic dissolved nutrients potentially being equally important in fueling the limited primary productivity in offshore waters.

1.2.2 Special habitat types

1.2.2.1 Marine benthic and water column habitat types

Thirty-four (34) different habitat types have been identified as special in the Initial Assessment of the Marine Environment of Cyprus in 2012 (Table 1.3). The list of these habitat types was made according to EUNIS hierarchical classification system with three habitat levels. Although it includes some marine habitats that have not been documented in Cyprus, it could provide the basis for further work on the conservation and management of marine environments in the country.

Argyrou et al., (2002) reported the distribution of the marine habitats that can be characterized as special in Cyprus marine waters. Detailed information about these habitats was presented in the Initial Assessment of the Marine Environment of Cyprus (DFMR 2012). Briefly, these habitats are the following:

1) Littoral rocks *Spongites-Dendropoma* and *Lithophyllum* spp. formations (EUNIS codes: A1.2, A1.4; Natura 2000 codes: 1170)

a) Association with *Tenarea undulosa* and *Lithophyllum trochanter* auct. (UNEP/MED II.4.2.3)
b) *Neogoniolithon brassica-florida* concretions (UNEP/MED II.4.2.8)
c) Facies with vermetids (UNEP/MED III.6.1.2)

2) Upper infralittoral rocky bottoms with *Cystoseira* spp. forests (EUNIS codes: A3.2, A3.7; Natura 2000 code: 1170)

a) Association with *Cystoseira amentacea* (UNEP/MED III.6.1.2)
b) Association with shallow *Cystoseira spp.* (UNEP/MED III.6.1.16)
c) Association with *Cystoseira cf. foeniculacea* (= *C. ercegovicii*).

3) Upper circalittoral rocks with *Caulerpa racemosa* and *C. prolifera*, and Fucales (EUNIS codes: A4.2, A4.7; Natura 2000 code: 1170)

a) Association with *Cystoseira* spp. (UNEP/MED IV.3.1.1)
b) Association with *Sargassum* spp. (UNEP/MED IV.3.1.5)

4) Seagrass meadows in rocky bottoms (*Posidonia*) and soft bottoms (*Posidonia*, *Cymodocea* and *Halophila*) (EUNIS codes: A3.2, A3.7, A.5.5, A5.6; Natura 2000 codes: 1110, 1120)

a) Association with *Posidonia oceanica* meadows (UNEP/MED III.5.1)
b) Association with *Cymodocea nodosa* (UNEP/MED III.2.2.1)
c) Association with *Halophila stipulacea* (UNEP/MED III.2.2.2)
d) Biocenosis of the coastal detritic bottoms (UNEP/MED IV.2.2): Maërl facies (UNEP/MED IV.2.2.2)
e) Association with *Peyssonnelia rosa-marina* (UNEP/MED IV.2.2.3)

5) Coastal detritic bottoms with Corallinaceae (*Lithothamnion*, *Phymatolithon*), Peyssonneliaceae (*Peyssonnelia* spp.) and *Palmophyllum crassum* (EUNIS codes: A3.7, 4.7; Natura 2000 codes: 1170, 8330)

a) Facies and association of coralligenous and semi-dark biocenosis (infralittoral enclaves) (UNEP/MED III.6.1.35)
b) Circalittoral encrusting algae concretions
c) Biocenosis of the semi-dark caves (UNEP/MED IV.3.2)

Table 1.3 Possible EUNIS and Natura 2000 habitat types in Cyprus relevant for MSFD.

		EUNIS-Marine habitats (A)		Natura 2000 habitats
		Level 2	Level 3	
Pelagic habitats/ communities	Coastal water, Shelf water, Oceanic water	A7 Pelagic water column	A7.1 Neuston	
			A7.3 Completely mixed water column with full salinity	
			A7.8 Unstratified water column with full salinity	
			A7.9 Vertically stratified water column with full salinity	
			A7.A Fronts in full salinity water column	
Seabed habitats/ communities	Littoral habitats	A1 Littoral rock and other hard substrata	A1.2 Moderate energy littoral rock	1170 Reefs, 8330 Submerged or partially submerged sea caves
			A1.4 Features of littoral rock	
		A2 Littoral sediment	A2.1 Littoral coarse sediment	1110 Sandbanks which are slightly covered by sea water all the time (*Cymodocea nodosa*), 1140 Mudflats and sandflats not covered by seawater at low tide
			A2.2 Littoral sand and muddy sand	
			A3.3 Littoral mud	
			A2.4 Littoral mixed sediments	
			A2.6 Littoral sediments dominated by aquatic angiosperms	
			A2.7 Biogenic reefs	1170 Reefs
			A2.8 Features of littoral sediment	
	Shallow sublittoral habitats	A3 Infralittoral rock and other hard substrata	A3.2 Atlantic and Mediterranean moderate energy infralittoral rock	1170 Reefs, 8330 Submerged or partially submerged sea caves, 1180 Submarine structures made by leaking gases, 1120 *Posidonia* beds
			A3.7 Features of infralittoral rock	
	Shelf habitats (<200 m)	A4 Circalittoral rock and other hard substrata	A4.2 Atlantic and Mediterranean moderate energy circalittoral rock	1170 Reefs, 8330 Submerged or partially submerged sea caves, 1180 Submarine structures made by leaking gases
			A4.7 Features of circalittoral rock	
		A5 Sublittoral sediment	A5.1 Sublittoral coarse sediment	
			A5.2 Sublittoral sand	
			A5.3 Sublittoral mud	
			A5.4 Sublittoral mixed sediments	
			A5.5 Sublittoral macrophyte-dominated sediments	1120 *Posidonia* beds (Posidonion oceanicae)
			A5.6 Sublittoral biogenic reefs?	1170 Reefs
			A5.7 Features of sublittoral sediment	
	Bathyal habitats (>200 m, <4000 m)	A6 Deep-sea bed (>200 m)	A6.1 Deep-sea rock and artificial hard substrate	
			A6.2 Deep-sea mixed substrata	
			A6.3 Deep-sea sand	
			A.6.4 Deep-sea muddy sand	
			A.6.5 Deep-sea mud	
			A.6.6 Deep-sea biotherms	
			A.6. 7 Raised features of the deep-sea bed	
			A.6.8 Deep-sea trenches and canyons, channels, slope failures and slumps on the continental slope	
			A. 6.9 Vents, seeps, hypoxic and anoxic habitats of the deep sea	

Among the special habitats found in Cyprus, a descriptive mapping of *Posidonia* meadows (1120 Natura 2000 code), Sandbanks (1110 Natura 2000 code) and Reefs (1170 Natura 2000 code) is available for the Natura 2000 sites across the coastline of Cyprus and also Limassol bay (Pergent-Martini et al., 2013). Specifically, the coastline of Cyprus is covered by less than 10% of *Posidonia oceanica* meadows. The *Posidonia oceanica* meadows that covered between 10 and 50% are mostly located on the northwestern coast and the southeast coast and the most extensive coverage (>50%) is rather rare and observed on the eastern part. In Limassol and Vasilikos bay, *Posidonia oceanica* meadows are mainly found on sandy bottom in shallow waters with a limited percentage of cover (Figure 1.11).

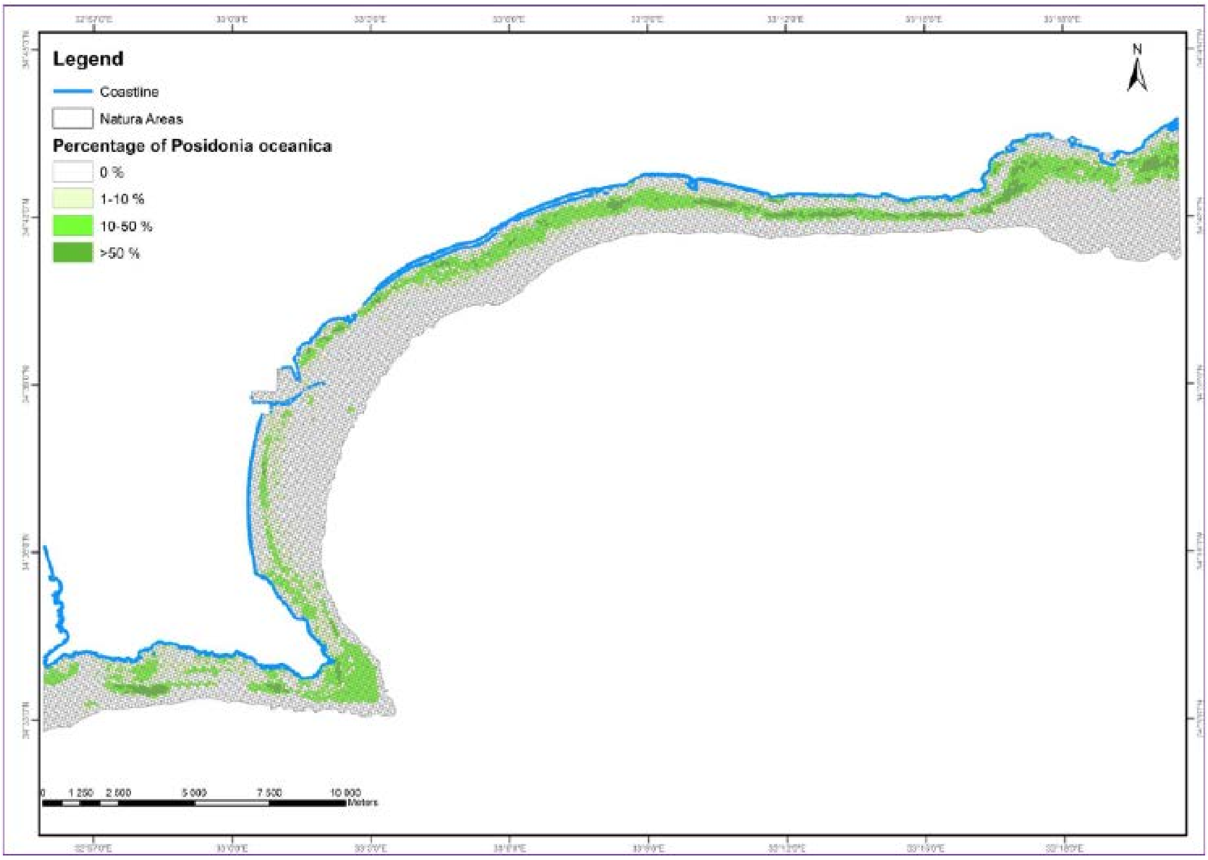


Figure 1.11 Coverage of Posidonia oceanica in Limassol-Vasilikos bay. (Source: Pergent-Martini et al., 2013)

The term “Reef” refers to rocky substrate and bioconstructions including coralligenous habitats. This ecotope is dominant in several sites in the shallow water, e.g. Nisia site and eastern part of Cape Greco (Figure 1.12) (Pergent-Martini et al., 2013). From 34m depth appears some sparse rhodoliths of the calcareous corallinaceae *Lithophyllum corallioides*, *Phymatolithon calcareum* and *Mesophyllum alternans* forming the ‘maërl’ facies of the coastal detritic bottoms (Figure 1.13). It is also developed around Cape Arnauti with the chlorophyte *Dasycladus vermicularis*. In some places the detritic bottom is covered by the chlorophytes *Caulerpa prolifera* and *C. racemosa*, mainly in Eastern Cape Greco area, with *Flabellia petiolata* and some rhodophytes as *Osmundaria volubilis, Rhodymenia ardissonei,* and *Botryocladia botryoides*. In some places with stones the fucaceans *Cystoseira spinosa* and *Sargassum trichocarpum* are present (Argyrou et al., 2002; Basso et al., 2017; Martin et al., 2015).

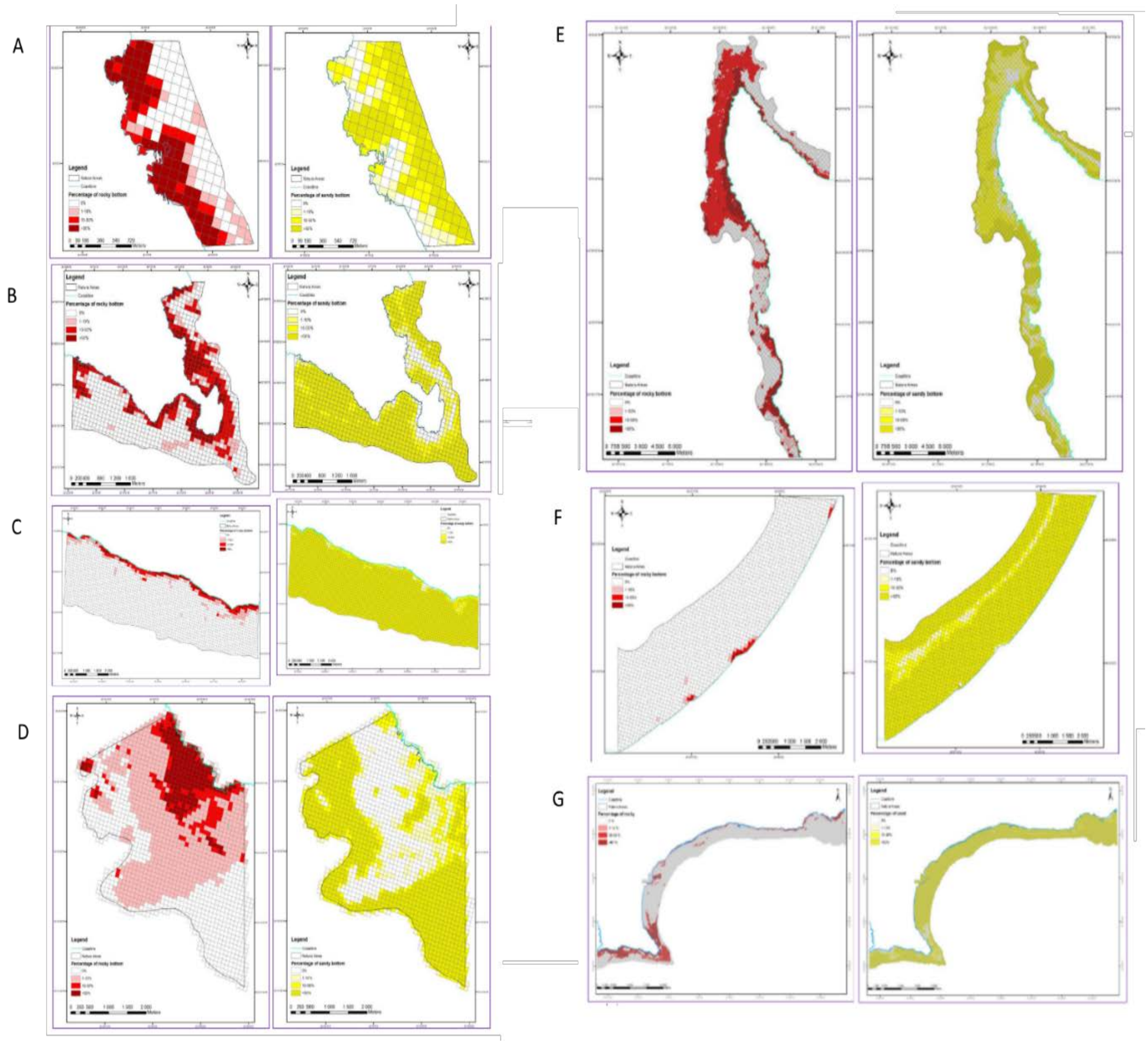


Figure 1.12 Percentage of cover of “reef” (red) and “sandbank” (yellow) ecotopes in the sites of A) Nisia, B) Cape Greco, C) Petra tou Romiou, D) Moulia, E) Akamas peninsula, F) Polis, and G) Limassol-Vasilikos bay. (Source: Pergent-Martini et al., 2013)

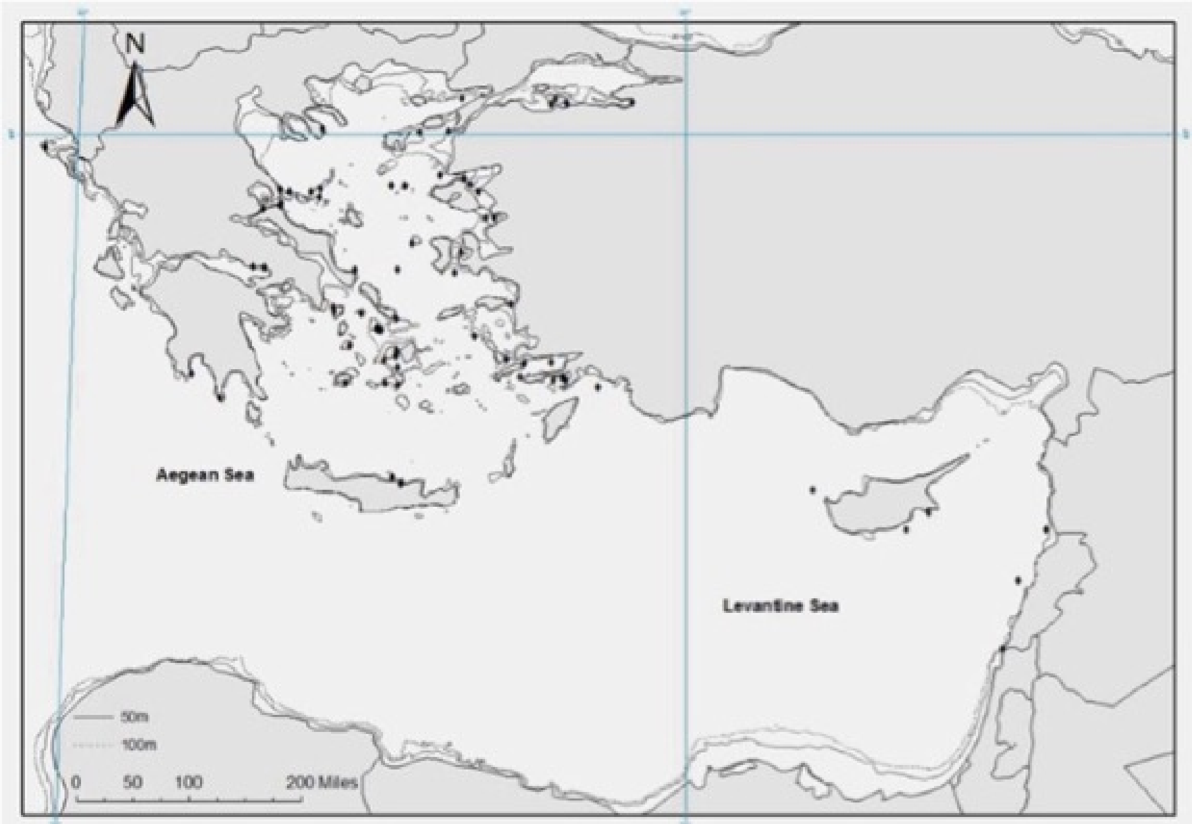


Figure 1.13 Rhodolith beds of the eastern Mediterranean. (Source: Basso et al., 2017)

The ecotope “Sandbank” has been observed in several sites across the coastline of Cyprus. In addition, sea caves (8830 Natura 2000 code) are present and located in Cape Greco, in Cape Arnaoutis, Agios Georgios Island and in Cyclops Cave, Protaras (Gerovasileiou et al., 2015). According to the latest audit for the management of Marine Protected Areas in Cyprus (DFMR, 2018), the conservation status of marine habitat types is presented in Table 1.4.

Table 1.4 Conservation status of marine habitats in Cyprus. (Source: DFMR, 2018)

	2006-2012				
Habitat type	Range	Area	Structure and function	Future prospects	Overall Assessment
Sea caves	favorable	favorable	unknown	unknown	unknown
Posidonia beds	favorable	favorable	favorable	favorable	favorable
Reefs	favorable	favorable	favorable	unknown	favorable
Sandbanks	favorable	favorable	favorable	favorable	favorable

1.2.3 Habitats in areas which merit a particular reference

Cyprus areas which merit a specific protection regime are classified in two categories, the Marine Protected Areas (MPAs) and those where the anthropogenic impact is evident. Marine areas included in the European “Natura 2000” Network as Sites of Community Importance under the provisions of Directive 92/43/EEC also comply with the provisions of the Protocol on Special Protection Areas and Biological Diversity in the Mediterranean of the Barcelona Convention. In addition to the areas reported in 2012, five marine protected areas with artificial reefs, a protected area surrounding Zenobia wreck and a fisheries restricted area on the southwest of the island have been established in the waters covering up to and including the Exclusive Economic Zone of the Republic of Cyprus (Figure 1.14). Additional information on the distribution of *Posidonia oceanica* meadows and ecotopes 1110 “sandbank” and 1170 “reef” (Pergent-Martini et al., 2013) in these areas were also reported.

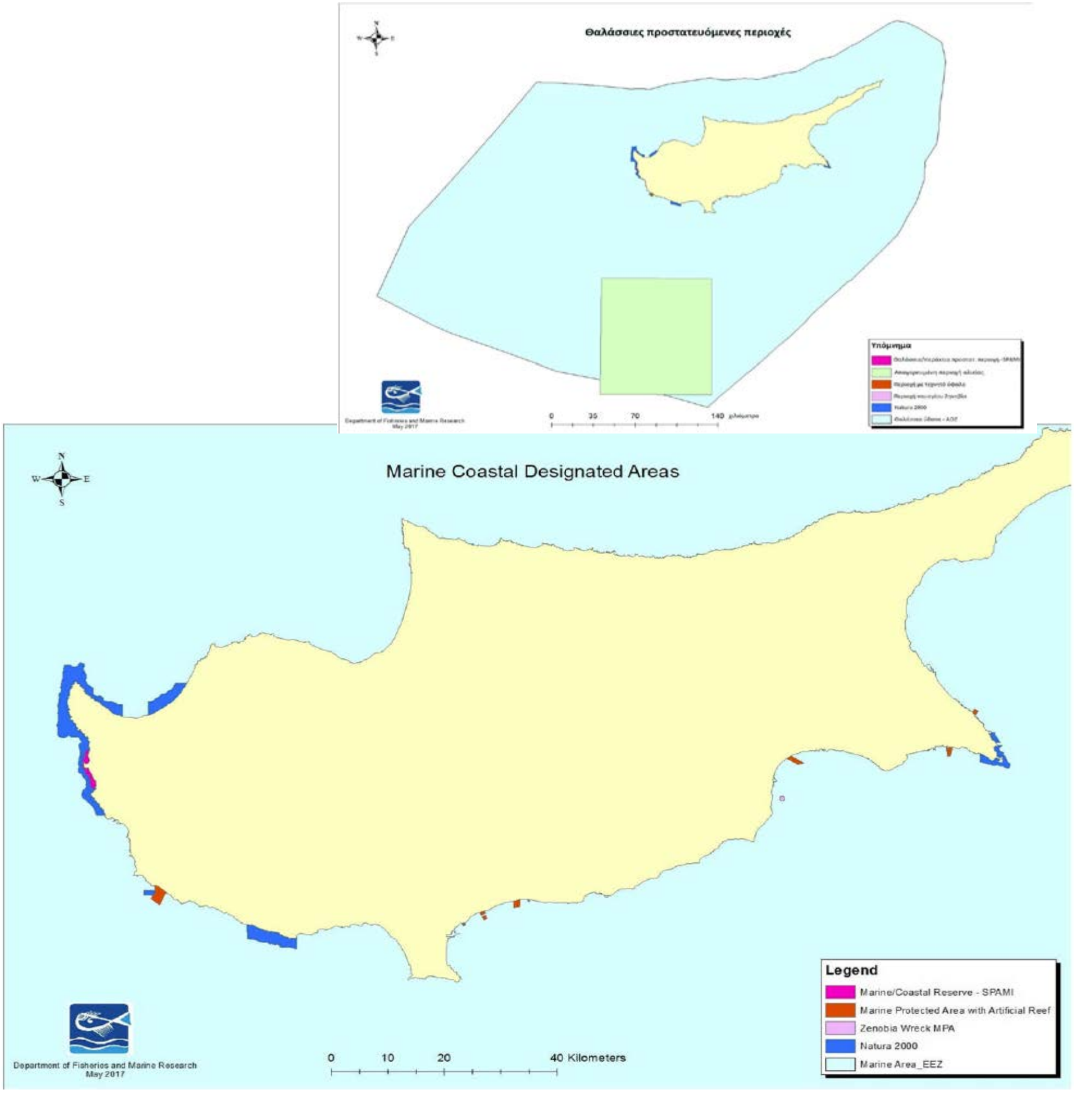


Figure 1.14 Marine protected areas in Cyprus (source: DFMR, 2018)

1.2.3.1 Polis-Yialia (Natura 2000 site)

Posidonia oceanica meadows are located mainly in the form of a continuous structure between 15 m to 30 m depth (Pergent-Martini et al., 2013). This continuous meadow is broken by erosive structures. *Posidonia* meadows are very important for many species as feeding and spawning grounds.

1.2.3.2 Akamas Peninsula (Natura 2000 site)

The site is the main nesting area for loggerhead turtles *Caretta caretta*, green turtles *Chelonia mydas* and leatherback turtles *Dermochelys coriacea* (Demetropoulos and Hadjichristophorou, 2018). The Akamas Peninsula of Cyprus is an area along the rocky shoreline with caves where Mediterranean monk seals *Monachus monachus* rest. These caves are also used to rear and nurse their pups in safety. The Mediterranean monk seal is an endangered species. A resident population of the monk seal is present in the Akamas area. Important sea caves, also present in this area, offer resting and breeding habitats for the monk seal.

The site is characterized by the presence of *Posidonia oceanica* meadows on hard bottom at the west of the peninsula. This meadow is dotted and forms patches on hard substrate with a limited percentage of cover. Inversely, the east of the peninsula shows a gentle slope. The meadow is continuous on matte with an important cover between 10 m to 38 m depth.

In the eastern part, the ecotope 1110 “sand bank” (Natura 2000, Annex 1) is dominant and ecotope 1170 “reef” (Natura 2000, Annex 1) very restricted and located only in the shallower waters. However, the western part of the peninsula is mainly occupied by the ecotope “reef” with a high percentage of cover in the north. The ecotope “sand bank” is well represented especially in areas where there is a dominant wind that pushes surface water toward the coast and they return to seaward from the bottom.

1.2.3.3 Moulia Rocks (Natura 2000 site)

The site is characterized by the presence of an extensive *Posidonia oceanica* meadow on hard bottom. This meadow is dotted (patches) between 0 and 10 m depth and it forms a continuous meadow until 42 m. The main part of the site is mainly occupied by the ecotope “reef”. The ecotope “sand bank” is well represented in the southeastern part.

1.2.3.4 Cape Aspro – Petra tou Romiou (Natura 2000 site)

The *Posidonia oceanica* meadows are mostly located between 0 and 13 m depth on hard bottom. The ecotope “reef” is only present in the very shallow water while the ecotope “sand bank” is dominant in this area.

1.2.3.5 Cape Greco (Natura 2000 site)

The *Posidonia oceanica* meadows are mostly located in the southeastern part on the hard bottom, with an important cover between 10 m to 40 m. On the western part, *Posidonia oceanica* meadow forms patches up to 40 m depth. It is associated with algae. The eastern part of the site is mainly occupied by the ecotope "reef", while in the southern part, it is only located in the very shallow areas. The ecotope “sand bank” is dominant in all the area, with a high percentage of cover in the southwest part.

1.2.3.6 Nisia (Natura 2000 site)

Posidonia oceanica meadows are located mainly in the form of a continuous structure between 20 m depth and 30 m depth, nevertheless they can be observed between 6 m to 35 m mainly on soft bottoms. The ecotope “reef” is dominant in this area in the shallow water and several *Cystoseira* sp. have been observed. The ecotope “sandbanks” with high cover is limited in the shallow part and better represented in the deeper part

1.2.3.7 Lara/Toxeftra (Turtle reserve)

The Lara-Toxeftra region, geographically located in the “Natura 2000” area of Akamas Peninsula, has also been included, in 2013, in the list of Specially Protected Areas of Mediterranean Importance (SPAMI) under the Barcelona Convention, while a strict protection regime is also applicable in the region under the national Fisheries Regulations (RAA 293/90). Green (*Chelonia mydas),* Loggerhead (*Caretta caretta*) and Leatherback (*Dermochelys coriacea)* turtles nest there. The management regulations for this area are spelled out in the Fisheries Regulations (273/90). It includes the foreshore (95m) and the adjacent sea area to the 20m isobath.

1.2.3.8 Artificial reefs in marine protected areas:

Artificial reefs are constructions that have the same characteristics as natural reefs and they are placed on the seabed aiming at providing space for refuge, feeding, reproduction and growth in size and abundance for marine organisms (Bayadas, 2014). Depth, orientation, material, and structural complexity are important controlling factors that need to be considered when planning and managing artificial reefs (Evriviadou et al., 2017; Jimenez et al., 2017). Hard substrata supporting a high diversity of encrusting communities will in turn support higher ichthyofaunal diversity, therefore enhancing the abundance of commercially, economically, and ecologically important species. Nevertheless, it should be taken in account the potential role of these artificial reefs as substrate and refugia for opportunistic and invasive species (Kletou et al., 2016), both for encrusting and nektonic species. Artificial reefs are found in Paralimni, Ayia Napa, Amanthus, Limassol and Geroskipou, as well as in the marine protected area surrounding the Zenobia wreck.

1.2.3.9 Eratosthenes seamount

The Eratosthenes seamount on the southwest of the island has been established as a fisheries restricted area, according to Recommendation GFCM/2006/3 of the General Fisheries Commission for the Mediterranean, which prohibits fishing with towed dredges and bottom trawl nets in the area.

Main habitats include c*oral species, such as Caryophyllia calveri and Desmophyllum cristagalli,* and *Kadophellia bathyalis*.

1.2.3.10 Limassol Bay (including Vasilikos bay)

Posidonia oceanica meadows are mainly on sandy bottom and appear dotted (patches more or less confluent) in the shallow waters with a limited percentage of cover. The *Posidonia oceanica* meadows are few represented near Limassol’s harbor while it is well represented at the Zevgari Cavo and near Zigi. In the western part of the site the ecotope “reef” presents a high percentage of cover while the main ecotope is "sand bank". *Cymodocea nodosa* has been found, between 1 m and 12 m on sandy bottoms. This species is found particularly near the port of Limassol and between breakwaters, designed to protect the beaches and the coast.

Caulerpa racemosa and *C. prolifera* have been identified between 30 and 40 m depth on soft bottoms (mud).

1.3 Biological features

1.3.1 Phytoplankton

Studies of the phytoplankton communities' biomass, composition, and vertical distribution in Cyprus are relatively scarce, generally restricted to particular regions e.g. the warm-core eddy to the south of Cyprus. In general, the eastern Mediterranean is an ultra-oligotrophic sea characterized by extremely low values of chlorophyll-a, primary production and cell abundance and also by dominance of small-sized phytoplankton cells. Surface Chl-a in the eastern Mediterranean is lower compared to other water bodies, varied from 0.1-0.2 μg L^{-1}. Average phytoplankton productivity and biomass is 4 and 2.5 fold lower in the eastern Mediterranean than in the western, respectively (van de Poll et al., 2015). Relative abundances of diatoms, prasinophytes, dinoflagellates, and cryptophytes showed inverse correlations with sea surface temperature (SST) and positive correlations with nutrient concentrations. In contrast, pelagophytes, chlorophytes, euglenophytes*,* *Synechoccocus* and *Prochlorococcus* showed positive correlations with SST and negative correlations with nutrient concentrations (van de Poll et al., 2015).

Despite the phytoplankton characteristics reported in the Initial Assessment of the Marine Environment of Cyprus for the Implementation of Article 8 of the Marine Strategy Framework Directive (2008/56/EC), updates on the phytoplankton community in the water bodies of Cyprus derived from the WFD monitoring program (Aplikioti et al., 2017). Specifically, 13 stations were monitored the period 2004-2016 (Figure 1.15). The results showed that the ecological status ranged from "good" to "high" in all areas except from Larnaca-northeast station that in 2015 was characterized as "moderate" according to Chl a measurements (DFMR, 2019) (Table 1.5).

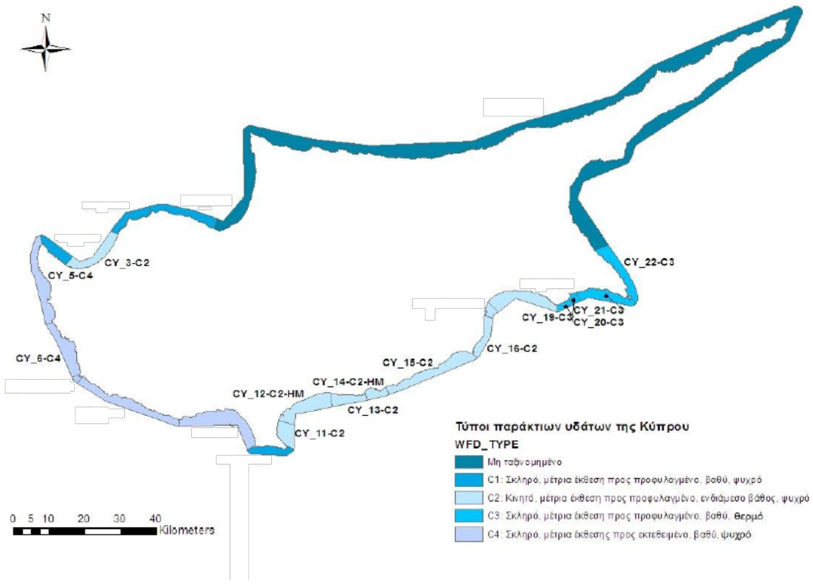


Figure 1.15 Map of the sites of the studied phytoplankton communities in Cyprus coasts within WFD monitoring program. (Source: Aplikioti et al., 2017)

Table 1.5 Results from the monitoring program of WFD in Cyprus (2003-2016) regarding the ecological status of the water bodies based on the Chl a measurements (Source: DFMR, 2019).

Water body		Station	2004-13	2014			2015			2016		
				No of samples	Months	Chla (μg/l, 90%ile)	No of samples	Months	Chla (μg/l, 90%ile)	No of samples	Months	Chla (μg/l, 90%ile)
CY_3-C2	**Chrysochou bay**	CY_3-C2_S1/LT4	High				1	7	0.01			
CY_11-C2	**Limassol -South**	CY_11-C2_S1/B4	Good				1	8	0.036	1	1	0.06
CY_12-C2	**Limassol**	CY_12-C2_O1/B4		7	2,3,5-7, 9,12	0.100	6	1,2,4, 5,8,12	0.121	10	1,2,4-8, 10-12	0.110
		CY_12-C2_O2/B1		7	2,3,5-7, 9,12	0.168	6	1,2,4 ,5,8,12	0.101	8	1,2,4,5-7, 8,12	0.134
		All	Good	14	2,3,5-7, 9,12	0.15	12	1,2,4, 5,8,12	0.115	18	1,2,4-8, 10-12	0.113
CY_13-C2	**Moni**		High									N/A
CY_14-C2	**Vasilikos bay**	CY_14-C2_S1/B4	High	8	2,3,5-7, 9,10,12	0.154	6	1,2,4, 5,7,12	0.154	9	1,2,4,5,7, 8,10-12	0.127
CY_15-C2	**Zygi- Kiti Cape**	CY_15-C2_S1/B4	High	8	2,3,5-7, 9,10,12	0.125	6	1,2,4, 5,7,12	0.119	9	1,2,4,5,7, 8,10-12	0.11
CY_16-C2	**Larnaca-West**	CY_16-C2_S1/B4	High				1	9	0.040	2	7,11	0.036
CY_18-C2	**Larnaca-Northeast**	CY_18-C2_S1/B4					1	8	0.47	2	7,11	0.13
CY_22-C3	**Protaras**	CY_22-C3_I/B4	High	1	10	0.063						

1.3.2 Zooplankton

Zooplankton influence many aspects of ecosystem function in the Mediterranean Sea such as regulating phytoplankton communities through grazing and being the major prey for small pelagic fish. In Mediterranean, differences in zooplankton diversity, biomass and abundance occur not only between coastal and offshore areas but also due to seasonality.

A comprehensive study of mesozooplankton abundance, biomass and taxa composition and its seasonal and spatial variability was conducted by Hannides et al. (2015a, 2015b). During these studies 5 stations across the coastline of Cyprus were sampled (Figure 1.16). The community was dominated by calanoid and cyclopoid copepods throughout the year (80% of total numbers), with higher abundances of predatory taxa (chaetognaths and medusae) in winter and cladocerans in summer (Hannides et al., 2015a). Mesozooplankton abundance and biomass ranged from 153-498 individuals m^{-3} and 0.7-5.2 mg dry weight m^{-3}, respectively, with significantly larger biomass observed in winter-early spring (March) than in summer (September) (Hannides et al., 2015a). Spatial variability both in winter and summer observed in mesozooplankton abundance and biomass with lower biomass values recorded in the west and north west coast in summer and opposite in winter. Significant seasonal variability was recorded only in mesozooplankton biomass (lower in summer than in winter). This may be attributed to the large numbers of cyclopoid copepods found in Cyprus waters in the summer, which contribute little biomass due to their small size and/or thin shape (i.e. *Oithona plumifera*, *Oithona setigera*) (Hannides et al., 2015a).

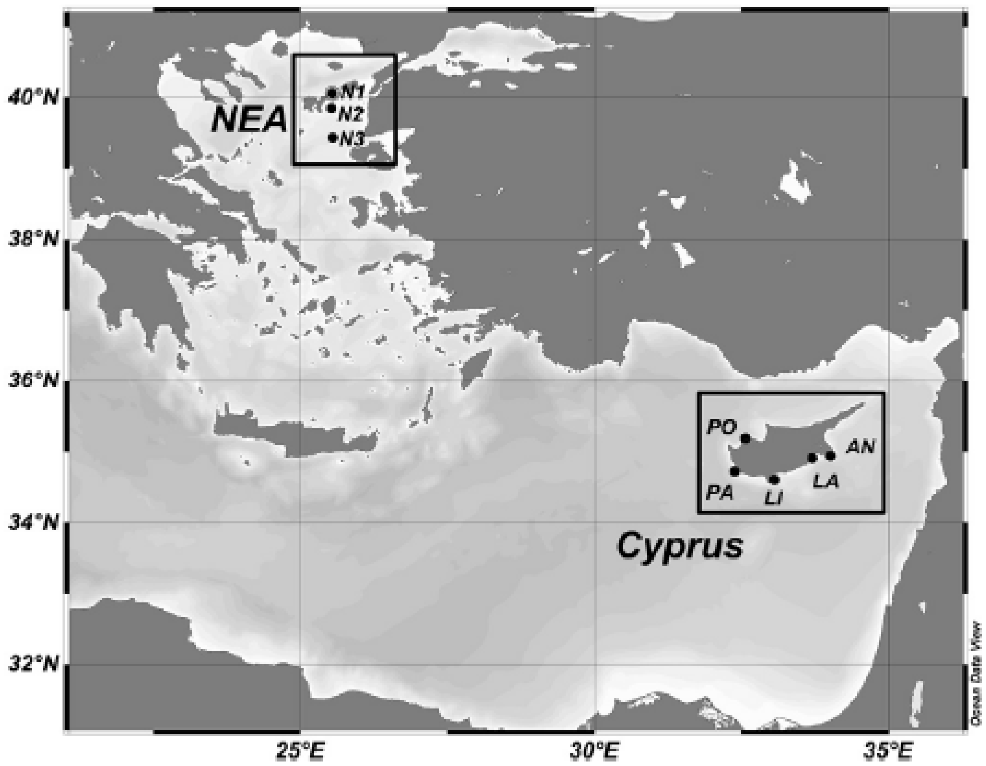


Figure 1.16 Mesozooplankton sampling locations in Cyprus. AN: Agia Napa; LA: Larnaca; LI: Limassol; PA: Pafos; PO: Pomos. (Source: Hannides et al., 2015b).

It was also interesting that coastal mesozooplankton communities around Cyprus appear to be more similar to communities in offshore waters than to communities along the Levantine coast (Hannides et al., 2015a). This is due to the significant open sea influence, with a portion of the flow moving north along the west coast of the island, and the other moving east along the south coast. In addition, Cyprus coasts have no significant fluvial inputs and are generally narrow with an open shoreline. As a result, mesozooplankton communities in Cyprus are underlie by the oligotrophy in this region of Mediterranean Sea (Hannides et al., 2015b). Specifically, stable isotope composition of Cyprus mesozooplankton reflected the ultra-oligotrophic nature of the region and indicated that differences in mesozooplankton community trophic structure were attributed to seasonal and regional change, with overall trophic position increasing by 0.2-0.3 in winter as compared to summer, which is mainly related to the larger contribution of carnivorous mesozooplankton observed in winter around Cyprus (Hannides et al., 2015b).

Note: This section will be supplemented with data from current monitoring efforts (WFD) as they become available at the end of 2019 (WFD, personal communication).

1.3.3 Angiosperms

Posidonia oceanica is the only species that makes meadows, similar to the forest habitat for the terrestrial environment. *Posidonia oceanica* meadows are the most diverse, complex and productive ecosystem existing along the coastline of the Mediterranean Sea. The regression and fragmentation of this habitat affects the composition of benthic, epiphytic and fish communities who live there (Guidetti, 2000; Telesca et al., 2015). In Cyprus, *Posidonia oceanica* beds were mapped along the entire island's coastline and available maps showed a total area of 9,040 ha. A comprehensive study on the distribution of *Posidonia oceanica* meadows in the coastline (0-50 meters depth) of Cyprus republic was conducted by Pergent-Martini et al.,(2013). The aims of this study were to map *Posidonia oceanica* meadows at Natura 2000 areas and also in areas with high anthropogenic impacts such as Limassol and Vasilikos bays. It was also evaluated the *P. oceanica* vitality in these areas. In order to evaluate the cover of *Posidonia oceanica* meadows, remote sensing methods based on aerial photographs treatment were used. To increase the accuracy of the remote sensing, a sufficient number of field data were also performed. In the deeper parts (above 20m depth), acoustic devises including side scan sonar and multi-beam echo sounder, were used and provides images of the seabed through the emission and reception of ultrasounds.

Each square of 1 km^2 across the coastline of Cyprus was classified according to the *P. oceanica* cover in three classes: a) less than 10% coverage, b) between 10% and 50% coverage and c) more than 50% coverage. The results indicated that most of the coastline of Cyprus was covered by less than 10 % of *Posidonia oceanica* meadows (Figure 1.17). The *Posidonia oceanica* meadows that covered between 10 and 50 % were essentially located on the northwestern coast and the southeast coast (Figure 1.18) and the most important coverage (> 50%) was rather rare and observed on the east part (Figure 1.19).

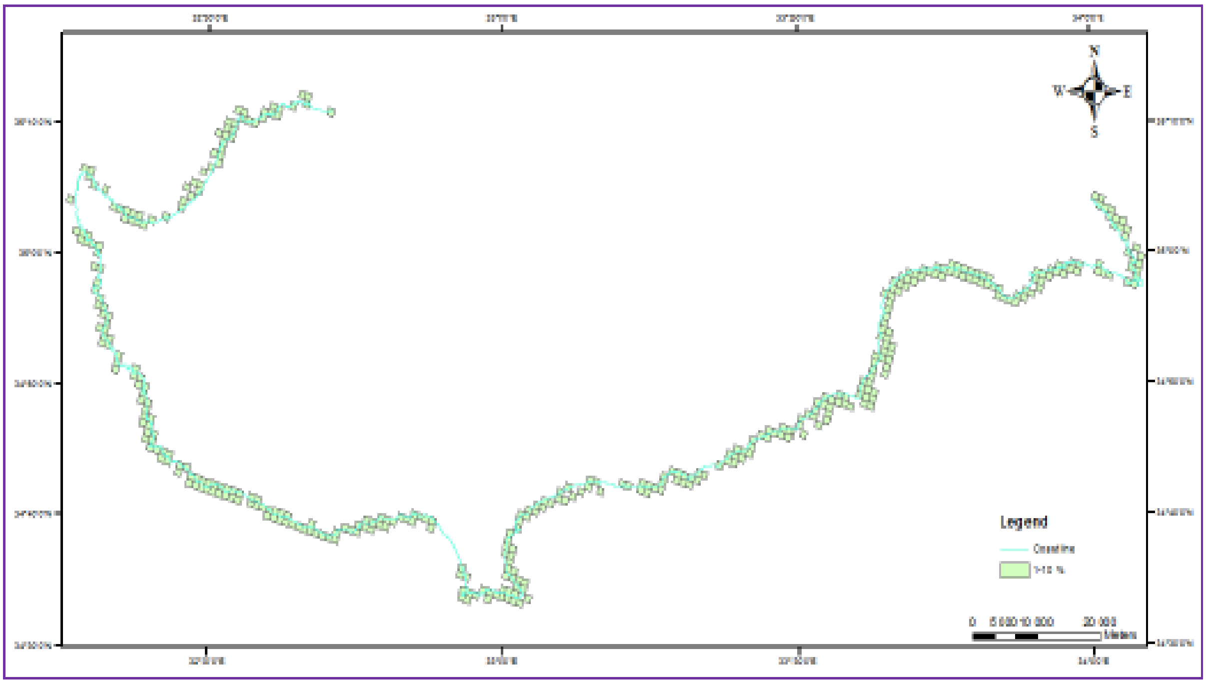


Figure 1.17 Distribution of the squares with a cover of P. oceanica meadows between 1-10% (Source: Pergent-Martini et al.,(2013).

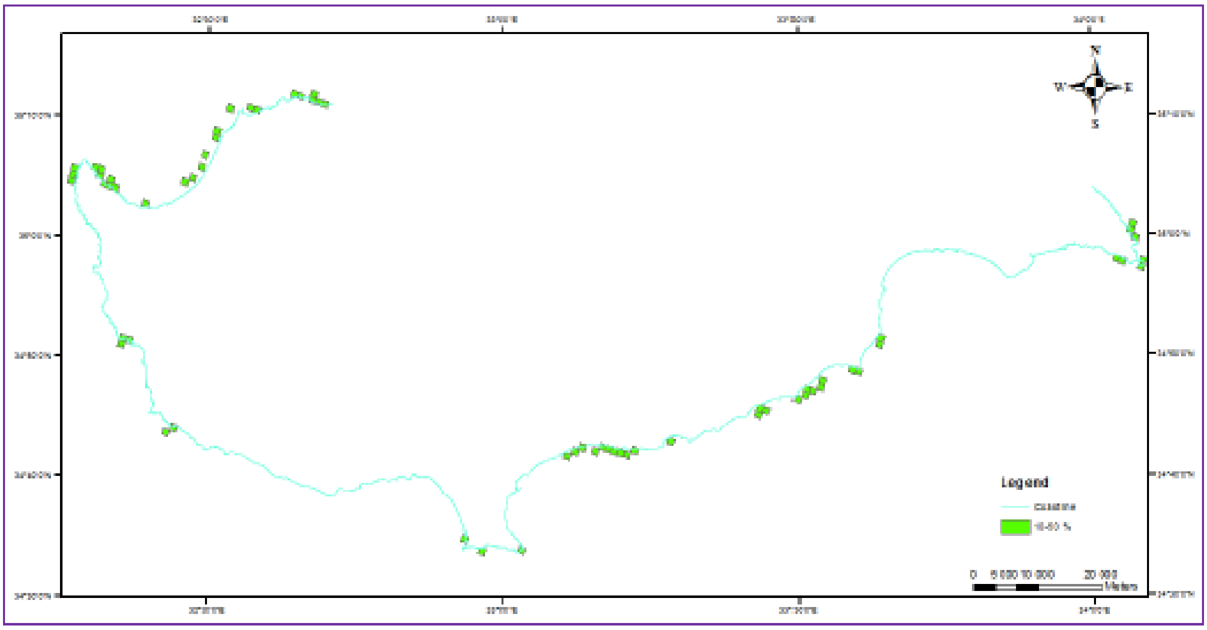


Figure 1.18 Distribution of the squares with a cover of P. oceanica meadows between 11-50% (Source: Pergent-Martini et al.,(2013).

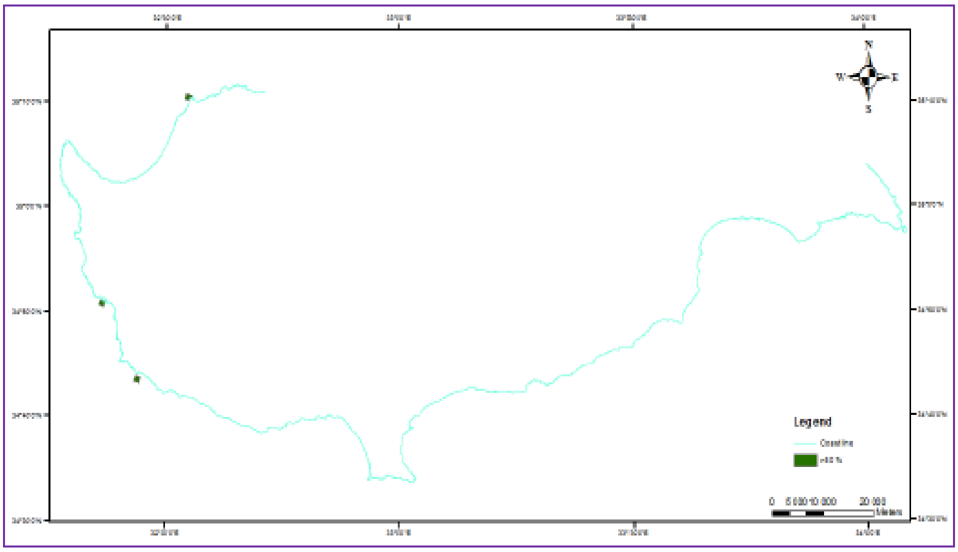


Figure 1.19 Distribution of the squares with a cover of P. oceanica meadows above 50%. (Source: Pergent-Martini et al.,(2013).

The evaluation of vitality of *P. oceanica* meadows in 2013 was carried out using the descriptors proposed in the Posidonia Monitoring Network and also in the Water Framework Directive (BiPo Index). The results indicated that the vitality of *P. oceanica* meadows in all areas exhibit high to normal values, with the lowest values to be recorded in Limassol bay while the highest in Cape Greco (Table 1.6). The Ecological Quality Ratio (EQR) based on BiPo index was high or good in all sites. Again, the lowest values were recorded in Limassol and the highest in Cape Greco (Table 1.7).

During the WFD monitoring program in Cyprus (2007-2016), PREI biotic index and shoots density of *P. oceanica* were calculated in order to determine the ecological status of the water bodies (DFMR, 2019). The results indicated at least “good” ecological status in all areas during this period with the exception of Vasilikos bay (water boy CY_14-C2) where *P. oceanica* meadows shown a decline (Table 1.8).

Mediterranean Sea, in addition to P. oceanica, hosts 6 more seagrasses species: *Cymodocea nodosa, Zostera marina, Z. noltii, Halophila stipulacea, Ruppia maritima and R. cirrhosa* (Belluscio et al., 2013). Although *P. oceanica* meadows represent the most significant and abundant ones, the other species are also important in terms of goods and services they provide. However, scientific research effort is not equally distributed between seagrasses species in the Mediterranean.

In Cyprus*, Cymodocea nodosa* has been found, between 1 m and 40 m on sandy bottoms. This species is found particularly near the port of Limassol and between breakwaters, designed to protect the beaches and the coast. This species appear sparse, but forms relatively continuous seagrass beds (Pergent-Martini et al., 2013). In addition, according to MEDISEH report, this species occurs also in Cape Greco, Larnaca, Moulia and Akamas peninsula (Belluscio et al., 2013). *Zostera marina* is mainly found in transitional water. In Cyprus, *Z. marina* is found in two coastal saline lakes, Akrotiri and Alyki Larnaca’s (Christia et al., 2011). The warm water seagrass species *Halophila stipulacea* has invaded the eastern Mediterranean and has reached the southern coasts of Italy. The species was introduced through the Suez Channel. In Cyprus, *Halophila stipulacea* has been recorded since 1970s across the coastline in Larnaca bay, Limassol and Vasilikos bay, Capes Gato and Zevgari, Akamas peninsula and also in Chrysochou bay (Lipkin, 1975). There is a lack of data concerning the other seagrass species, *Ruppia maritima, R. cirrhosa* and *Zostera noltii.*

Table 1.6 Evaluation of the Posidonia oceanica meadows measured in the Natura sites of the Cyprus Republic (High=blue, Good=green, Normal=yellow) (Source: Pergent-Martini et al.,(2013)

		Sites					
	Descriptors	Nisia	Cape Greco	Moulia	Akamas	Polis	Limassol
Lower limit	Depth (m)	38.4	34.9	35.6	34.8	30.8	31
	Type	Progressive	Progressive	Progressive	Sharp with high cover	Progressive	Progressive
	% plagiotropic rhizomes	63	33	30	33	41	21
	Coverage (%)	28	60	82	49	92	43
	Density (number of shoots/m^2)	246	355	558	230	355	415
Intermediate depth (15 m)	Density (number of shoots/m^2	507	531	424	549	686	386
	Foliar surface (cm^2/shoot)	235	295	323	298	225	285
Synthesis		4.4	4.7	4.6	4.6	4.4	4.1

Table 1.7 BiPo index measured in the Natura sites of the Cyprus Republic (High=blue, Good=green) (Source: Pergent-Martini et al.,(2013)

	Sites											
	Nisia		Cape Greco		Moulia		Akamas		Polis		Limassol	
	value	EQR	value	EQR	value	EQR	value	EQR	value	EQR	value	EQR
Lower limit depth (m)	38.4	1.00	34.9	0.90	35.6	0.92	34.8	0.90	30.8	0.77	31.0	0.77
Lower limit type	progressive	1.00	progressive	1.00	progressive	1.00	Sharp	0.89	progressive	1.00	progressive	1.00
Density (m^{-2})	507	0.92	531	0.94	424	0.85	549	0.96	686	1.00	386	0.82
Foliar surface (cm^2/shoot)	235	0.83	295	0.94	581	1.00	298	0.94	212	0.80	283	0.92
EQR	0.94		0.95		0.94		0.92		0.89		0.88	

Table 1.8 Results of the WFD monitoring program of Posidonia oceanica meadows in Cyprus (Source: DFMR, 2019)

Station Name	Station Code	Year	Ecological status Shoots density	PREI EQR	PREI Ecological status
Akamas	**CY-4-C1-S1-LT/B3**	2016	Good	0.824	High
Limassol	**CY-13-C2-O1/B3**	2014	High		
		2015	Good	0.733	Good
		2016			
Vasilikos Bay	**CY_14-C2-S1/B3**	2011	High		
		2012			
		2013	High		
		2014	Good		
		2015			
		2016	Moderate		
Cape Kiti	**CY_15-C2**	2016	High	0.728	Good
Cape Greco	**CY-23-C3-S1/B3**	2014	High		
		2016	High		

1.3.4 Macroalgae

The marine benthic flora of Cyprus remains poorly explored. The most recent survey on the marine algal species found in Cyprus was conducted by (Tsiamis et al., 2014) and included both literature data and personal collections of green, brown and red macroalgae. In total, 151 marine macroalgae were identified in this study, including 30 green algae (Ulvophyceae), 53 brown algae (Phaeophyceae), and 68 red algae (Rhodophyta). Among them, 6 green, 8 brown, and 14 red macroalgae are reported for the first time from Cyprus, raising the total number of seaweed species recorded in Cyprus to 313 taxa (Table 1.9). Nine marine benthic algae of Cyprus are currently considered as alien species, including three green algae, one brown alga, and five red algae. Among them, *Hypnea spinella* is reported for the first time from Cyprus. There is no doubt that this number is an underestimate, as most parts of the island and particularly the deeper parts of the euphotic benthos remain totally unexplored (Tsiamis et al., 2014).

Macroalgal community in Vasilikos Bay in the western part where human access is limited as well as in the industrialized and impacted part, was investigated by (Kletou et al., 2018). Brown algae of the genus *Cystoseira* formed dense forests covering rocky substrata on shorelines with limited human access. The results of this study indicated that human impacts cause the loss of perennial canopy-forming brown seaweeds and a proliferation of opportunistic macroalgae. Specifically, canopy-forming *Cystoseira* dominated shallow subtidal hard substrata showing the good environmental quality of waters, in which human access was limited. Algal biomass was considerably higher than at impacted sites as there were more perennial species present. The canopy of *Cystoseira barbatula* diminished near industrialized areas and was replaced by stress-resistant and ephemeral species such as *Halopteris scoparia* and *Ulva spp*.

Among other macroalgal species, *Caulerpa prolifera* as well as the alien species of this genus, *Caulerpa racemosa* and *C. taxifolia* were investigated in Limassol Bay (Pergent-Martini et al., 2013) and Cape Greco (Tsiamis et al., 2016). *Caulerpa racemosa* and *C. prolifera* were found between 30 and 40 m on soft bottoms (mud) in Limassol. *C. taxifolia var. distichophylla* was found both in very shallow waters and at 42 m depth in the Cape Greco. In this area, *C. taxifolia var. distichophylla* were found in sediments comprised of fine biogenic sand: shell fragments/foraminiferans, dominated by the non-native seagrass *Halophila stipulacea* and on muddy substratum dominated by *C. racemosa var. cylindracea* with scattered specimens of *Codium bursa*. They were also found growing on biogenic hard substrate (serpulid tubes and calcareous algae). The species also sparsely covered the sandy substratum of Cape Greco, along with *C. prolifera* (Tsiamis et al., 2016).

Table 1.9 Seaweed species recorded for the first time in the coastline of Cyprus according to Tsiamis et al. (2014)

Ulvophyceae	**Area found**
Chaetomorpha ligustica (Kützing) Kützing	Akamas
Cladophora albida (Nees) Kützing	Liopetri
Cladophora echinus (Biasoletto) Kützing	Cape Greco
Pseudochlorodesmis furcellata (Zanardini) Børgesen	Liopetri
Siphonocladus pusillus (C. Agardh ex Kützing) Hauck	Liopetri
Ulva flexuosa Wulfen	Liopetri
Phaeophyceae	
Arthrocladia villosa (Hudson) Duby	Cape Greco
Choristocarpus tenellus Zanardini	Cape Greco
Cladosiphon cylindricus (Sauvageau) Kylin	Akamas
Cystoseira barbatula Kützing emend. Cormaci, G. Furnari et Giaccone	Akamas, Liopetri
Cystoseira brachycarpa J. Agardh emend. Giaccone	Akamas, Cape Greco
Cystoseira foeniculacea f. latiramosa (Ercegovič) Gómez Garreta, Barceló, Ribera et Rull Lluch	Akamas
Sargassum trichocarpum J. Agardh	Akamas
Sporochnus pedunculatus (Hudson) C. Agardh	Cape Greco
Rhodophycaea	
Acrodiscus vidovichii (Meneghini) Zanardini	Akamas, Cape Greco
Alsidium helminthochorton (Schwendimann) Kützing	Liopetri
Ceramium siliquosum var. zostericola (G. Feldmann-Mazoyer) G. Furnari	Liopetri
Ceramium tenerrimum (G. Martens) Okamura var. tenerrimum	Liopetri
Gastroclonium clavatum (Roth Ardissone	Liopetri
Gelidum serra (S.G. Gmelin) E. Taskin et W.J. Wynne	Cape Greco
Hypnea spinella (C. Agardh) Kutzing	Liopetri
Lejolisia mediterranea Bornet	Liopetri
Lithothamnion corallioides (P.L. Crouan et H.M. Crouan) P.L. Crouan et H.M. Crouan	Akamas
Neurocaulon foliosum (Meneghini) Zanardini	Akamas
Osmundea pinnatifida (Hudson) Stackhouse	Akamas
Sphondylothamnion multifidum (Hudson) Nägeli	Akamas
Spongites fruticulosus Kützing	Cape Greco, Zenobia wreck
Wurdemannia miniata (Sprengel) Feldmann et G. Hamel	Liopetri

Within the Water Framework Directive (WFD) monitoring program, 5 water bodies have been monitored the period 2007-2018 in Cyprus in terms of their macroalgal communities. The values of EEI-c biotic index were calculated and indicated, in most of the cases, good and high ecological quality status in all study areas (Aplikioti et al., 2017 and DFMR, 2019) (Table 1.10).

Table 1.10 Results of the EEI biotic index from the WFD monitoring program in Cyprus (Source: DFMR, 2019).

Station			Year	Season	ESG I	ESG II	EQR	EEI	Ecological Status	EEI	Ecological Status
Water body	Name	Code									
CY_5-C1	Akamas	**CY_5-C1-S1/B2**	2011	Autumn	111.10	11.43	1.00	10.00	High	10.00	High
			2011	Winter	82.93	9.80	1.00	10.00	High		
			2012	Autumn	90.02	24.24	0.98	9.85	High	9.925	High
			2013	Summer	115.00	14.40	1.00	10.00	High		
			2014	Summer	9.90	23.47	0.99	9.95	High	9.95	High
			2017	Autumn	5,87	158,73	1	10.00	High	10	High
			2018	Spring	5.33	145.3	1	10	High	9.12	High
			2018	Autumn	8.24	94.87	0.78	8.24	High		
CY_7-C4	Pafos	**CY_7-C4_S1/B2**	2015	Summer	129.67	32.07	1.00	10.00	High	10.00	High
CY_8-C4	Pafos Airport	**CY_8-C4_S1/B2**	2015	Summer	92.87	18.73	1.00	10.00	High		
CY_19-C3	Cavo Pyla, Station 3	**CY_19-C3_S1/B2**	2011	Spring	73.50	5.79	1.00	10.00	High	10.00	High
			2011	Summer	75.37	8.40	1.00	10.00	High		
			2012	Spring	59.62	11.27	0.93	9.42	High	8.78	High
			2012	Summer	45.03	14.19	0.77	8.15	High		
			2013	Spring	46.50	9.25	0.84	8.76	High	8.25	High
			2013	Summer	59.20	28.20	0.75	7.99	High		
			2013	Winter	39.83	12.39	0.75	8.01	High		
			2014	Summer	45.83	10.50	0.82	8.60	High	8.60	High
			2015	Spring	95.60	7.27	1.00	10.00	High	9.37	High
			2015	Summer	64.77	22.33	0.85	8.75	High		
			2016	Spring	67.40	21.20	0.88	9.02	High	9.02	High
CY_20-C3	Cavo Pyla, Station 4	**CY_20-C3_S1/B2**	2011	Spring	64.93	24.53	0.83	8.61	High	7.84	Good
			2011	Summer	44.89	49.55	0.46	5.71	Moderate		
			2011	Autumn	82.37	28.05	0.90	9.21	High		
			2012	Spring	77.17	39.86	0.76	8.09	High	7.19	Good
			2012	Summer	73.05	68.05	0.54	6.29	Moderate/Good		
			2013	Spring	62.10	13.65	0.92	9.36	High	8.84	High
			2013	Summer	65.00	44.60	0.65	7.17	Good		
			2013	Winter	76.22	13.83	1.00	10.00	High		
			2014	Summer	102.75	32.77	0.95	9.63	High	9.63	High
			2015	Spring	89.67	13.93	1.00	10.00	High	8.62	High
			2015	Summer	69.53	47.30	0.65	7.24	Good		
			2016	Spring	81.67	23.13	0.95	9.58	High	9.58	High

1.3.5 Benthic macroinvertebrates

Benthic organisms contribute to regulation of carbon, nitrogen, and sulfur cycling, water column processes, pollutant distribution and fate, secondary production, and transport and stability of sediments (Snelgrove, 1998). Benthic macrofauna is categorized in soft-bottom or hard-bottom communities, coastal or deep sea; and also it has been used for decades as an indicator of sediment condition in the environmental monitoring of anthropogenic activities (Pearson and Rosenberg, 1978). Detailed information about the spatio-temporal variability of benthic communities in Cyprus was given in the Initial Assessment of the Marine Environment of Cyprus (DFMR 2012). Updates concern the results of the WFD monitoring program in Cyprus and also benthic community composition in artificial reefs (shipwrecks), marine caves and Eratosthenes Seamount.

The benthic invertebrate community changes across the coastline of Cyprus sedimentary sites were studied by Rousou et al. (DFMR, 2019) within the WFD coastal waters monitoring program. During this monitoring program, 9 stations were sampled and analyzed for benthic macroinvertebrates the period 2007-2016 (Table 1.11). Results on the diversity of macrofaunal communities in Cyprus as well as, on the benthic ecological status assessed using BENTIX, are presented on Table 1.12 and Table 1.13, respectively. Along the coasts of Cyprus, benthic ecological quality is ranged from good to high with the exception of Limassol, the most impacted area in Cyprus where in 2010 and 2015 the ecological status was in moderate conditions (DFMR, 2019).

Table 1.11 Sediment characteristics in 9 coastal stations analyzed for benthic macroinvertebrates during the WFD monitoring program in Cyprus (Source: DFMR, 2019).

Station					**Organic matter (%)**		
					0-2cm	**2-4cm**	**0-4cm**
Water body	**Name**	**Code**	**Year**	**Sediment type**			
CY_3-C2	Latsi	CY_3-C2_S1/LT4	2007	Silty sand	5,709	5,725	5,717
			2011		3.05	3.43	3.24
			2013		-	-	-
			2015		6.12	4.37	5.25
CY_11-C2_O1	Lady's Mile	CY_11-C2_S1	2015	Silty sand	-	-	-
CY-12-C2	Limassol (near port)	CY-12-C2-S1	2007	Silty sand	8,938	8,274	8,606
			2013		9.33	7.5	8.31
			2015		6,45	7,33	6,89
CY-14-C2	Vasilikos	CY-14-C2-S1	2007	Silty sand	6,394	7,015	6,705
			2014		6,00	6,76	6,38
			2015		4.96	4.42	4.69
CY-15-C2	Zygi	CY-15-C2-S1	2007	Silty sand	7,022	7,315	7,169
			2015		8,13	6,53	7,33
CY-16-C2	Larnaca W	CY-16-C2-S1	2015	Silty sand	4,61	4,00	4,27
			2016		5,02	6,25	5,64
CY-18-C2	Larnaca NE	CY-18-C2-S1	2015	Silty sand	4,71	4,57	4,64
			2016		4,46	5,02	4,77
CY-21-C2	Ayia Napa	CY_21-C3_S1	2014	Silty sand	3,62	5,56	4,91
CY-22-C2	Cape Greco	CY-22-C2-S1	2007	Sand	2,119	2,075	2,097
			2011		1,67	2,52	2,10
			2012		-	-	-
			2014		3,89	5,36	4,63

Table 1.12 Benthic diversity metrics for the stations sampled during the WFD monitoring program in Cyprus (Source: DFMR, 2019).

Water body	Values	Species only						Genus only						Family only						Family + Higher taxa					
		S	N	D	J'	H'	1-Lambda'	S	N	d	J'	H'(loge)	1-Lambda'	S	N	d	J'	H'(loge)	1-Lambda'	S	N	d	J'	H'(loge)	1-Lambda'
Latsi 2011	Total	54	898	7.794	0.7325	2.922	0.9001	50	962	7.133	0.7321	2.864	0.8968	39	1308	5.295	0.6961	2.55	0.8405	49	1359	6.653	0.6921	2.694	0.8521
	Average	54	299	9.296	0.7325	2.922	0.9022	50	321	8.492	0.7321	2.864	0.8987	39	436	6.252	0.6961	2.55	0.8418	49	453	7.848	0.6921	2.694	0.8534
Latsi 2015	Total	48	439	7.725	0.7668	2.968	0.907	40	453	6.377	0.7579	2.796	0.8992	30	563	4.579	0.74	2.517	0.8837	35	572	5.355	0.7263	2.582	0.8873
	Average	48	146	9.427	0.7668	2.968	0.9112	40	151	7.773	0.7579	2.796	0.9032	30	188	5.54	0.74	2.517	0.8869	35	191	6.476	0.7263	2.582	0.8905
Lady's Mile 2015	Total	37	128	7.42	0.8587	3.101	0.9368	43	141	8.487	0.8627	3.245	0.9452	26	118	5.24	0.8254	2.689	0.9012	30	137	5.894	0.8506	2.893	0.9217
	Average	37	43	9.591	0.8587	3.101	0.9518	43	47	10.91	0.8627	3.245	0.9589	26	39	6.808	0.8254	2.689	0.9169	30	46	7.589	0.8506	2.893	0.9355
Limassol 2013	Total	59	429	9.569	0.8329	3.396	0.9414	60	502	9.488	0.8181	3.35	0.942	42	729	6.22	0.7773	2.905	0.925	55	804	8.072	0.7836	3.14	0.937
Limassol 2015	Total	23	102	4.757	0.6306	1.977	0.6987	25	106	5.146	0.6385	2.055	0.7111	25	127	4.954	0.7005	2.255	0.7872	30	137	5.894	0.7237	2.461	0.8164
	Average	23	34	6.239	0.6306	1.977	0.7128	25	35	6.732	0.6385	2.055	0.7249	25	42	6.408	0.7005	2.255	0.7998	30	46	7.589	0.7237	2.461	0.8286
Vasilikos 2014	Total	33	94	7.043	0.9415	3.292	0.9648	34	124	6.846	0.8772	3.093	0.9375	32	172	6.022	0.8411	2.915	0.9249	37	184	6.903	0.8493	3.067	0.9338
	Average	33	31	9.29	0.9415	3.292	0.986	34	41	8.867	0.8772	3.093	0.9529	32	57	7.656	0.8411	2.915	0.9359	37	61	8.746	0.8493	3.067	0.9442
Vasilikos 2015	Total	34	94	7.263	0.7494	2.643	0.8293	33	99	6.964	0.7668	2.681	0.8437	31	130	6.163	0.767	2.634	0.8652	36	139	7.093	0.7808	2.798	0.8816
	Average	34	31	9.58	0.7494	2.643	0.8476	33	33	9.152	0.7668	2.681	0.8613	31	43	7.96	0.767	2.634	0.8789	36	46	9.124	0.7808	2.798	0.8945
Zygi 2015	Total	24	56	5.714	0.8805	2.798	0.9247	26	60	6.106	0.8853	2.884	0.9316	20	53	4.786	0.8822	2.643	0.9144	25	64	5.771	0.8955	2.882	0.935
	Average	24	19	7.859	0.8805	2.798	0.9596	26	20	8.345	0.8853	2.884	0.9643	20	18	6.616	0.8822	2.643	0.9509	25	21	7.842	0.8955	2.882	0.9657
Larnaca West 2015	Total	54	328	9.149	0.8325	3.321	0.941	63	360	10.53	0.8337	3.454	0.9484	39	341	6.516	0.8065	2.955	0.9263	46	365	7.627	0.8103	3.102	0.9345
	Average	54	109	11.29	0.8325	3.321	0.9468	63	120	12.95	0.8337	3.454	0.9537	39	114	8.028	0.8065	2.955	0.9317	46	122	9.372	0.8103	3.102	0.9397
Larnaca W 2016	Total	34	171	6.418	0.8776	3.095	0.9386	36	187	6.691	0.8824	3.162	0.9446	26	294	4.399	0.8347	2.72	0.916	32	310	5.404	0.8277	2.869	0.924
	Average	34	57	8.162	0.8776	3.095	0.9497	36	62	8.469	0.8824	3.162	0.9548	26	98	5.453	0.8347	2.72	0.9222	32	103	6.684	0.8277	2.869	0.9301
Larnaca NE 2015	Total	36	203	6.587	0.8289	2.97	0.9293	39	213	7.088	0.8349	3.059	0.9348	22	201	3.96	0.7964	2.462	0.89	26	220	4.635	0.8166	2.661	0.9066
	Average	36	68	8.304	0.8289	2.97	0.9386	39	71	8.915	0.8349	3.059	0.9437	22	67	4.994	0.7964	2.462	0.8989	26	73	5.821	0.8166	2.661	0.915
Larnaca NE 2016	Total	24	116	4.838	0.7864	2.499	0.8678	29	126	5.79	0.7991	2.691	0.8869	26	188	4.774	0.7618	2.482	0.883	31	202	5.652	0.7743	2.659	0.8976
	Average	24	39	6.293	0.7864	2.499	0.8831	29	42	7.491	0.7991	2.691	0.9013	26	63	6.042	0.7618	2.482	0.8925	31	67	7.126	0.7743	2.659	0.9067
Ayia Napa 2014	Total	61	580	9.429	0.7539	3.099	0.9085	65	683	9.806	0.7559	3.155	0.923	28	471	4.387	0.7866	2.621	0.8855	39	715	5.782	0.7518	2.754	0.8966
	Average	61	193	11.4	0.7539	3.099	0.9117	65	228	11.79	0.7559	3.155	0.9257	28	157	5.34	0.7866	2.621	0.8893	39	238	6.942	0.7518	2.754	0.8991
Cape Greco 2012	Total	51	181	9.618	0.857	3.37	0.9502	54	238	9.685	0.847	3.379	0.9507	45	326	7.603	0.8225	3.131	0.9371	54	382	8.914	0.8417	3.357	0.9505
	Average	51	60	12.2	0.857	3.37	0.9609	54	79	12.12	0.847	3.379	0.9588	45	109	9.385	0.8225	3.131	0.9429	54	127	10.94	0.8417	3.357	0.9555
Cape Greco 2014	Total	93	654	14.19	0.8567	3.883	0.9707	85	693	12.84	0.8454	3.756	0.9653	44	534	6.847	0.804	3.043	0.9269	54	669	8.147	0.8064	3.217	0.941
	Average	93	218	17.09	0.8567	3.883	0.9737	85	231	15.43	0.8454	3.756	0.9681	44	178	8.298	0.804	3.043	0.9304	54	223	9.802	0.8064	3.217	0.9439

Table 1.13 Benthic ecological status according to BENTIX results during the WFD monitoring program in Cyprus. (Source: DFMR, 2019).

Water body	Year									
	2007	2008	2009	2010	2011	2013		2014	2015	2016
CY_3-C2 Latsi	Good	Good	-	-	Good	-	-	-	Good	-
CY_11-C2 Lady's Mile	-	-	Good	-	-	-	-	-	Good	-
CY_12-C2 Limassol	Good	Good	Good	Moderate		Good	Good	-	Moderate	-
CY_14-C2 Vasilikos	Good		-	-	-	-	-	High	Good	-
CY_15-C2 Zygi	Good	-	Good	-	-	-	-	-	Good	-
CY-16-C2 Larnaca W	-	-	-	-	-	-	-	-	Good	Good
CY-18-C2 Larnaca NE	-	-	-	-	-	-	-	-	Good	Good
CY_21-C2 Ayia Napa								High		
CY_22-C2 Cape Greco	High	-	-	-	-	High	-	High	-	-

In addition, macrofaunal community changes due to fish farming were studied in two fish farms located at 70m depth in Limassol bay (Moraitis et al., 2013). The results showed that the macrobenthic assemblages that characterize the stations are diverse and consist of a variety of organisms, mainly polychaetes, molluscs, crustaceans, echinoderms and Sipuncula with moderate sensitivity to disturbance. The results also indicated that the benthic effects of tuna farming in Cyprus were insignificant since most of the samples were found to be of 'good' or 'high' ecological status according to the indicators used (BENTIX, BQI, M-AMBI etc.). This was attributed to the fact that the fish farms were located in relatively exposed offshore sites (Moraitis et al., 2013).

A rare study on the benthic communities of seamounts concerned the benthic diversity of Eratosthenes Seamount, south of Cyprus at 800m depth (Galil and Zibrowius, 1998). During this study two species of scleractinian coral, *Caryophyllia calveri* and *Desmophyllum cristagalli*, were recorded. Further records include two types of encrusting foraminiferans; two species of encrusting poriferans, abundant scyphozoan polyps, individuals of the small actiniarian *Kadophellia bathyalis*, two species of zoantharian, seven Bivalvia species, one Sipuncula, five species of serpulid polychaetes, four species of decapod crustaceans and an asteroid. Main hard substrates obtained include dead scleractinians, fossilized polychaete tubes and shell fragments of the cephalopod *Argonauta argo.*

Epibenthic communities in artificial reefs and specifically shipwrecks in Cyprus were also studied (Evriviadou et al., 2017; Jimenez et al., 2017). These studies were conducted in three wrecks located in south-eastern Cyprus - Zenobia, Touba and Cricket. The results indicate that the wrecks are normally under warm and oligotrophic conditions. Sponges were the organisms with the highest percent cover (~27%) at the Touba and Cricket wrecks, followed by four scleractinian coral species (7%–19% total coral cover) (Evriviadou et al., 2017). Sponges, bivalves and polychaetes were also dominant in Zenobia wreck (Jimenez et al., 2017) (Figure 1.5).

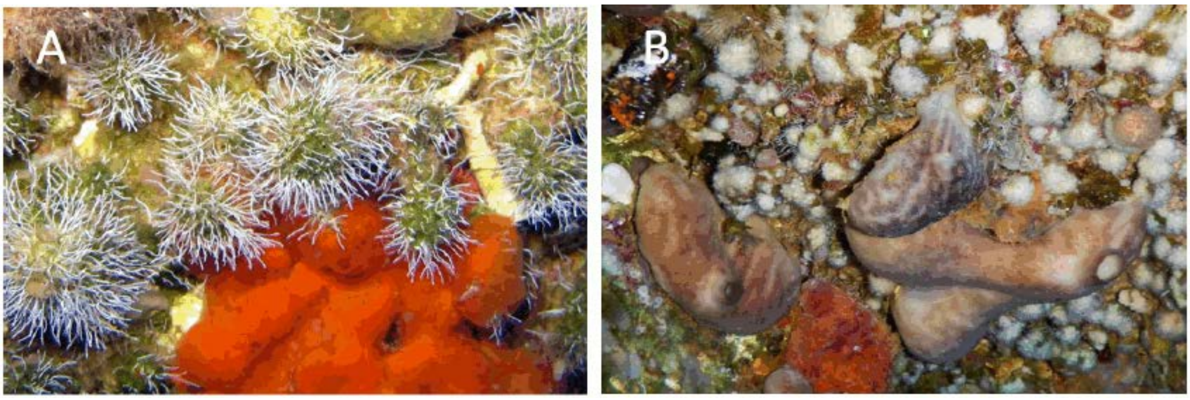


Figure 1.5. Representative examples of epibenthic communities on Zenobia shipwreck. A) Serpulid polychaetes on dead coral skeletos, sponges, green algae and ascidians, B) Azooxanthellate sponges. Source:(Jimenez et al., 2017).

To end with, a comprehensive study regarding the biodiversity in marine caves was conducted in eastern Mediterranean (Gerovasileiou et al., 2016, 2015). The study compiled the data from 62 scientific articles, 35 of which concerned marine caves of the Levantine Basin. A total of 175 taxa were reported in Levantine, mainly sponges, polychaetes, bivalves and gastropods (Gerovasileiou et al., 2015). The alien Indo-Pacific opisthobranch *Chelidonura fulvipunctata* was reported from Cyclops Cave in Portaras (Gerovasileiou et al., 2016).

1.3.6 Fish populations

Commercially exploited fish and shellfish are all living marine resources targeted for economic profit such as the bony fish, sharks and rays (known as elasmobranchs), crustacean such as lobsters and shrimps, and molluscs (including bivalves, cuttlefish and squid). It also includes other creatures such as jellyfish and starfish.

In scientific terms, Descriptor 3 has various implications. Stocks should be, (1) exploited sustainably consistent with high long-term yields, (2) have full reproductive capacity in order to maintain stock biomass, and (3) the proportion of older and larger fish/shellfish should be maintained (or increased) being an indicator of a healthy stock

Good Environmental Status is achieved for a particular stock only if all of the three attributes are fulfilled. This implies that all commercially exploited stocks should be in a healthy state and that exploitation should be sustainable, yielding the Maximum Sustainable Yield (MSY). MSY is the maximum annual catch, which can be taken year after year without reducing the productivity of the fish stock.

In the framework of the present tender, DFMR has requested to inform about the assessment of MFSD in relation to D3. The status of stocks presented in the following document (GES Assessment) is based on the outcome of ICES workshops as well as specific working groups having as objective to provide scientific advice to relevant RFMO (e.g. FAO-GFCM). Also, ad-hoc methodologies to analyse fishery data were employed to evaluate to status of the stocks according to the indicator considered in the D3 framework. The ICES workshops provide a platform to progress the assessment methodology on Descriptor 3 and draft recommendations. The workshop developed a common approach or “roadmap” for the assessment of Descriptor 3, which involves four distinct step that will be followed in the GES assessment.

Step 1 – Prepare a list of commercially exploited fish and shellfish stocks in the relevant marine region, to be used for the assessment of Descriptor 3, and provide the rationale for the selection of stocks.

Step 2 – Catalogue and document the available information for each of the stocks selected for the Descriptor 3 assessment.

Step 3 – Evaluate the stock status against the three GES criteria mentioned in EC Decision 2010/477/EU (EU, 2010), i.e. criterion 3.1 (level of pressure of the fishing activity), criterion 3.2 (reproductive capacity of the stock), and criterion 3.3 (population age and size distribution) by stock and species-functional group (i.e. pelagic, demersal/benthic, shellfish, elasmobranch, deep-water).

Step 4 – Determine the overall status and identify issues, problems, gaps.

Cyprus has a longstanding fisheries tradition and history. Despite its limited contribution to the gross domestic product, the Cypriot fisheries sector holds primary significant socio-economic importance, particularly in coastal areas. In 2013, the Cypriot fishing fleet comprised 894 vessels, with a combined grossed tonnage of 3 500 and a total engine power of 39 000 kW. For the same year, the total volume of seafood landings achieved by the Cypriot fleet was around 900 tonnes, and its total value amounted to EUR 5.3 million. In the following years the fishing pressure has been reduced in both term of fishing capacity (scrapping) and fishing effort (days at sea) as well as considering specific technical measures (e.g.: area closures).

In general, the fishery in Cyprus has a relative low impact on marine resources. However, other stressors as climate change and invasive species could determine a deterioration of the status of the exploited stocks in term of descriptor 3. Therefore, preventing the increase of fishing pressure and monitoring of the status of the resources are advisable.

1.3.7 Marine mammals

1.3.7.1 Marine mammals

1.3.7.1.1 Cetaceans

To date, only few studies have attempted to document the fauna of cetaceans off and around Cyprus and information on the presence, distribution and abundance of cetaceans and the anthropogenic pressures potentially affecting them are still scarce. The most common cetaceans to be encountered in the marine environment of Cyprus include: the sperm whale (*Physeter macrocephalus*), false killer whale (*Pseudorca crassidens*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*) and short-beaked common dolphin (*Delphinus delphis*). Also, strandings of the Cuvier's beaked whales (*Ziphius cavirostris*) have been encountered in the north and west of Cyprus but never alive.

Table 1.14 shows the cetacean species that have been documented in Cyprus' waters along with their common names (English and Greek) and category in the IUCN Red list.

Table 1.14 Scientific names, common names and place in the IUCN Red list of cetaceans encountered in Cyprus.

Scientific name	English common name	Greek common name	IUCN Red list category
Tursiops truncatus	Common bottlenose dolphin	Ρινοδέλφινο	Vulnerable
Delphinus delphis	Short-beaked common dolphin	Κοινό δελφίνι	Endangered
Stenella coeruleoalba	Striped dolphin	Ζωνοδέλφινο	Vulnerable
Grampus griseus	Risso's dolphin	Σταχτοδέλφινο	Data Deficient
Steno bredanensis	Rough-toothed dolphin	Στενόρυγχο δελφίνι	Not applicable
Pseudorca crassidens	False killer whale	Ψευδόρκα	Not applicable
Ziphius cavirostris	Cuvier's beaked whale	Ζίφιος	Data Deficient
Physeter macrocephalus	Sperm whale	Φυσητήρας	Endangered
Balaenoptera physalus	Fin whale	Βόρεια ρυγχοφάλαινα	Vulnerable

Cetacean species in the Mediterranean Sea are protected by European legislations, including the European Commission's Habitats Directive (92/43/ECC) in which cetaceans are listed in Annex IV and any "deliberate capture, killing or disturbance" of these species is forbidden. Cetaceans are also protected under the European Union's Marine Strategy Framework Directive (2008/56/EC) which requires Member States to achieve or maintain Good Environmental Status (GES) of EU marine waters by 2020. Cyprus is also part of ACCOBAMS (the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area) since 2006 and is required to implement a detailed Conservation Plan to achieve and to maintain a favorable conservation status for cetaceans. Cetaceans in Cyprus are also protected by the Nature and Wildlife Protection and Management Law (N. 153(I) 2003) which implements the EU's Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. The Fisheries Regulation (P.I. 273/1990) also protects cetaceans in the waters of the Republic of Cyprus by regulating fishing activities.

Local regulation for the protection and conservation of marine mammals and turtles in Cyprus states that it is prohibited to:

(a) kill, pursue, take, buy, sell or possess any aquatic turtle, seal, **dolphin**, freshwater crab or sand crab of the species *Ocypode cursor*;
(b) attempt to kill, pursue, take, buy or sell any of the **above species**; or
(c) buy, sell or possess turtle eggs or any part of a turtle, seal, or **dolphin**.

The basic law provides for a fine of up to €8,500 or for imprisonment for up to 6 months or both penalties, for any contravention of the regulations.

Tursiops truncatus **(Montagu, 1821)**

The most common species encountered in Cyprus is the common bottlenose dolphin (*Tursiops truncatus*) that is found in both coastal waters in small groups of 5 – 15 individuals and in offshore waters in larger groups. Common bottlenose dolphins form pods with less than 20 individuals and may sometimes be sighted with other cetaceans. At times, large herds of several hundred may be seen in offshore waters (FAO, 2019). The population of the common bottlenose dolphin (*Tursiops truncates*) in Cyprus' coastal waters is estimated to be 30 to 100 individuals. The species has been described as 'native' to Cyprus (Notarbartolo di Sciara & Birkun, 2010). Stranding of 15 individuals have been documented (from 1993 to 2014) and 7 have been reported as bycatch (from 1998 to 2013) in fishing nets in Cyprus. Depredation has been reported many times from all over Cyprus, however there is no clear evidence if this is caused from common bottlenose dolphins or Risso's dolphins (Boisseau *et al.,* 2017). The highest number of bottlenose dolphins (29 individuals) was recorded in May 2017 around the areas of Akamas Peninsula-Chrysochou Bay (north western coasts of Cyprus) and Cape Greco (south eastern coasts of Cyprus) (Boisseau *et al.,* 2017). A visual and acoustic study conducted in June 2007 documented the common bottlenose dolphins along the Turkey's coastline but not near Cyprus (Boisseau *et al.,* 2010). To date, results suggest that there is binominal temporal distribution of common bottlenose dolphins in Cyprus, with highest numbers documented from May to July and October to November. However, stranding and sightings records have been reported throughout the year. The highest bycatch numbers of common bottlenose dolphin have been reported in the months of July and November and lower numbers in February, April and December. All bycatch records derived from the areas of Liopetri, Alaminos, Zygi and Peyia (Boisseau *et al.,* 2017). Table 1.15 shows the distribution and population size of the common bottlenose dolphin.

Table 1.15 Distribution and population size data of common bottlenose dolphin (Tursiops truncatus) (Boisseau et al. 2017).

Method	Time documented	Location	Group size
Bycatch	Feb-98	Lara Bay	1
Bycatch	Jul-13	Larnaca Bay	1
Bycatch	Nov-13	Zygi, Larnaca	1
Bycatch	Nov-14	Zygi, Larnaca	1
Bycatch	Dec-14	Mazotos, Larnaca	1
Visual	Jun-15	Larnaca Bay	10
Visual	May-17	Cape Greco	15
Visual	May-17	Chrysochou Bay	15
Visual	May-17	Chrysochou Bay	5

The common bottlenose dolphin is found primarily at inshore, coastal, shelf, slope and oceanic waters from the tropical to temperate waters worldwide. Their population appears at greater abundance nearshore (Wells & Scott, 1999). Common bottlenose dolphins form pods with less than 20 individuals and may sometimes be sighted with other cetaceans. At times, large herds of several hundred may be seen in offshore waters (FAO, 2019). A recent study had shown that the common bottlenose dolphin prefers the coastal areas of Cyprus and occurs in waters less than 500 m deep and not far from land (up to 3 km inward) (Boisseau *et al.,* 2017).

Steno bredanensis **(Lesson, 1828)**

The rough-toothed dolphin is rarely encountered in the Mediterranean Sea. Yet, for the first time in June 2007, 9 individuals of rough-toothed dolphins were documented north of Pomos, Cyprus (north-west coast of Cyprus) (Boisseau *et al.,* 2010). Also, in May 2017, approximately 37 (mean total number) individuals were documented south of Larnaca Bay and Akrotiri Bay (south and south east coasts of Cyprus). The study mentioned that rough-toothed dolphins form fission-fusion groups with other dolphin species such as with striped and Risso's dolphins. Results from the same study suggested that sightings and strandings of this species are higher during the summer season, however there is only insufficient data to support this statement (Boisseau *et al.,* 2017). Another study conducted in August 2013, in the south eastern coast of Cyprus (south of Larnaca) documented the sighting of two individuals of this species (Ryan *et al.,* 2014). Table 1.16 shows the distribution and population size of rough-toothed dolphin.

Table 1.16 Distribution and population size data of the rough-toothed dolphin (Steno bredanensis) (Boisseau et al. 2017).

Method	Time documented	Location	Group size
Visual	Aug-13	South of Zygi, Larnaca	2
Visual	Aug-13	South of Larnaca Bay	10
Visual	May-17	South of Liopetri	15
Visual	May-17	South of Akrotiri Bay	15
Acoustic	May-17	South of Akrotiri Bay	15
Visual	Mar-10	Limassol Bay	15

The rough-toothed dolphin is distributed across tropical, subtropical and warm temperate waters and ranging from north of 40^0 or south of 35^0S (FAO, 2019; Hammond *et al.,* 2012). It inhabits deep oceanic waters far from the coastline, often beyond the continental shelf. The species is found in all three major oceans, Atlantic, Pacific and Indian oceans (West *et al.,* 2011; Hammond *et al.,* 2012). They mostly form pods of 10 – 20 individuals.

Grampus griseus **(Cuvier, 1812)**

Approximately 37 individuals (mean total number) were documented in the southeastern region of Cyprus in May 2017. Approximately 5 - 10 individuals were documented south of Larnaca Bay (south-eastern coast) and 15 – 20 in individuals documented south-east of Cape Greco in May 2017. To date, individuals of these species recorded only in the south-eastern region of Cyprus (south-east). Risso's dolphin documented so far, were in waters deeper than 1000 m. The species has been also recorded in July and August but in lower numbers (Boisseau *et al.,* 2017). Two Risso's dolphins were observed south of Larnaca Bay in August 2013 and sighted along with rough-toothed dolphins (Ryan *et al.,* 2014). Table 1.16 shows the distribution and population size of the Risso's dolphin.

Table 1.17 Distribution and population size data of Risso's dolphin (Grampus griseus).

Method	Time documented	Location	Group size	Source
Visual	Mar-10	Limassol Bay	15	Boisseau *et al.,* 2017
Visual	Aug-13	Zygi, Larnaca	2	Ryan *et al.,* 2014
Visual	Aug-13	Larnaca Bay	25	Boisseau *et al.,* 2017
Visual	May-17	South of Limassol Bay	15	Boisseau *et al.,* 2017
Acoustic	May-17	South of Limassol Bay	15	Boisseau *et al.,* 2017

Risso's dolphins are distributed across the globe, found from tropical to temperate oceans. They inhabit deep oceanic waters and continental slope waters of 400 to 1000 m depth (Baird, 2009) and areas with steep bottom topography (Taylor *et al.,* 2012). They frequent subsurface escarpments and seamounts to feed on cephalopods that migrant vertically in these high energy areas (Taylor *et al.,* 2012). Risso's dolphin population distribution is linked with oceanographic conditions, often found in areas with currents and upwelling waters where marine productivity increases (Taylor *et al.,* 2012). They form groups of 10 – 50 individuals with the largest herds reported with over 4000 individuals (Baird, 2009). Risso's dolphin often co-exist with other cetaceans (FAO, 2019).

***Stenella coeruleoalba* (Meyen, 1833)**

A study conducted in June 2007 showed that the striped dolphins were uniformly dispersed in the eastern basin (area of Cyprus) of the Mediterranean Sea (Boisseau *et al.,* 2010). A survey conducted in 2016 – 2017 concluded that the most encountered marine mammal around Cyprus were the striped dolphins. In August 2016, 10 individuals were documented in coastal areas (south of Larnaca) and in offshore (east of Cape Greco), where a large group of 40 – 60 striped dolphins was documented in the coastal waters of Larnaca Bay in November 2016. A large herd of 25 – 40 striped dolphins was documented in May 2017 in the coastal waters south of Paphos. Also, 5 – 20 Individuals were documented during the same survey in May 2017 in offshore waters all around Cyprus. The study concluded that the striped dolphins occur in Cyprus waters year-round, with an increase in the sightings during the summer season. The study also showed higher levels of sightings in May (Boisseau *et al.,* 2017). As with other studies in the Mediterranean (Frantzis *et al.,* 2003), striped dolphins documented in Cyprus in waters deeper than 1000 m and far from the shore (> 18 km from the coastline) (Boisseau *et al.,* 2017). Table 1.18 shows the distribution and population size of the striped dolphin.

Table 1.18 Distribution and population size data of striped dolphin (Stenella coeruleoalba).

Method	Time documented	Location	Group size	Source
N/A	Sep-04	South-east of Cape Greco	25	Emodnet.eu., 2019
Visual	Jun-07	North of Pomos	1	Boisseau *et al.,* 2010
Visual	Jun-07	West of Chrysochou Bay	1	Boisseau *et al.,* 2010
Visual	Jun-07	Western Cyprus	1	Boisseau *et al.,* 2010
Visual	Jun-07	Western Cyprus	3	Boisseau *et al.,* 2010
Visual	Jun-07	Western Cyprus	1	Boisseau *et al.,* 2010
Visual	Jun-07	Western Cyprus	1	Boisseau *et al.,* 2010
Visual	Jun-07	Western Cyprus	1	Boisseau *et al.,* 2010
N/A	Jul-07	Akamas Peninsula	4	Emodnet.eu., 2019
N/A	Jul-07	North of Pomos	6	Emodnet.eu., 2019
N/A	Aug-13	West of Akamas Peninsula	2	Emodnet.eu., 2019

Visual	Aug-13	West of Akamas Peninsula	2	Ryan *et al.,* 2014
Visual	Aug-13	West of Akamas Peninsula	20	Ryan *et al.,* 2014
N/A	Sep-14	East of Cape Greco	30	Boisseau *et al.,* 2017
Visual	Aug-16	East of Cape Greco	10	Boisseau *et al.,* 2017
Visual	Aug-16	South of Larnaca Bay	10	Boisseau *et al.,* 2017
Visual	Nov-16	Larnaca Bay	50	Boisseau *et al.,* 2017
Visual	May-17	East of Cape Greco	10	Boisseau *et al.,* 2017
Visual	May-17	South of Liopetri	20	Boisseau *et al.,* 2017
Visual	May-17	South of Limassol Bay	10	Boisseau *et al.,* 2017
Visual	May-17	South of Aphrodite's rock	120	Boisseau *et al.,* 2017
Visual	May-17	South-east of Paphos	10	Boisseau *et al.,* 2017
Visual	May-17	West of Akamas Peninsula	10	Boisseau *et al.,* 2017
Visual	06-Jul	Akamas Peninsula	10	Boisseau *et al.,* 2017
Visual	Oct-18	Coral Bay	5	Boisseau *et al.,* 2017

A widely distributed species found in warm temperate and tropical waters of Indian, Pacific and Atlantic oceans as well as in the Mediterranean Sea. Their distribution commonly ranges between 50^0N and 40^0S. Striped dolphins are usually seen in oceanic regions but can be also found in coastal areas with deep bottoms. Striped dolphins form herds of usually 100 and 500 individuals with incidents of forming herds of thousands (FAO, 2019). Striped dolphins prefer areas with upwelling (Archer, 2009; Balance *et al.,* 2006) and continental slope waters (Archer, 2009). Striped dolphins in the Mediterranean prefer areas beyond the continental self where productivity tends to be higher (Gannier, 2005; Frantzis *et al.,* 2003).

Delphinus delphis **(Linnaeus, 1758)**

There are no official records of common dolphins in Cyprus. Common dolphins were documented in inshore and offshore areas of the Aegean Sea but not in Cyprus or in the Levantine Sea (Boisseau *et al.,* 2010; 2017). However, Hammond *et al.,* (2008) includes Cyprus as a country of occurrence of common dolphins.

The common dolphin is an oceanic widely distributed species found in tropical to warm temperate waters, nearshore and offshore (Hammond *et al.,* 2008). Its distribution commonly range between 60^0N and 50^0S. Common dolphins form herds from several thousands to over 10 000. It is also very common for common dolphins to form herds with other dolphins. They often travel at high speed while whipping the ocean's surface (FAO, 2019). In the Mediterranean, common dolphins prefer coastal and upper slope waters (Bearzi *et al.,* 2003) while in the Black Sea only appear in offshore with except some seasonal variations where they visit shallow waters to feed on anchovy and sprat. Common dolphins have also been linked with high salinity waters (Hammond *et al.,* 2008).

Pseudorca crassidens **(Owen, 1846)**

Population dynamics

For the first time, 2 individuals of False killer whales were documented off Cyprus near Lara Beach in June 2007 (Boisseau *et al.,* 2010). In August 2013, a single herd of approximately 10 individuals was documented south-west of Paphos (Ryan *et al.,* 2014). Table 1.19 shows the distribution and population size of the false killer whale.

Table 1.19 Distribution and population size data of false killer whale (Pseudorca crassidens).

Method	Time documented	Location	Group size	Source
Visual	Jun-07	Lara Beach	2	Boisseau *et al.,* 2010
Visual	Aug-13	South-west Pafos	10	Ryan *et al.*, 2014

False killer whales are found in tropical to warm temperate waters worldwide, in offshore deep waters. In Mediterranean they only occur occasionally and sometimes move into and shallow higher latitude waters (Taylor *et al.,* 2008). They normally form herds of 10 to 60 but may also form herds of more than 60. The species has been associated with bait depredation from longlines (FAO, 2019).

Physeter macrocephalus **(Linnaeus, 1758)**

Eight sperm whales were documented in the western Cyprus (Akrotiri, Paphos, Akamas) in August 2016. Four sperm whales were detected in southeast Cyprus (Larnaca Bay) in May 2017. Photo identification and analysis enforced the assumption that it was the same group documented in August 2016. All individuals in the study were documented in more than 500 m depth, with 83% detected in waters over 1000 m deep (Boisseau *et al.,* 2017). In June 2007, a sperm whale was sighted in the relatively shallow waters (370 m depth) off the coast of Libya (Boisseau *et al.,* 2010). In August 2013, sperm whale clicks were acoustically detected south of Zygi at approximately 20 nautical miles from the closest coastline (Ryan *et al.,* 2014). Table 1.20 shows the distribution and population size of the sperm whale.

Table 1.20 Distribution and population size data of Sperm whale (Physeter macrocephalus).

Method	Time documented	Location documented	Group size	Source
N/A	Jul-97	Larnaca Bay	10	Emodnet.eu., 2019
Acoustic	Aug-13	South of Zygi	1	Ryan *et al.,* 2014
Visual	Oct-15	Larnaca Bay	1	Boisseau *et al.,* 2017
Visual	Jul-16	Cape Greco	6	Boisseau *et al.,* 2017
Visual	Aug-16	South of Akrotiri Bay	4	Boisseau *et al.,* 2017
Visual	Aug-16	South of Akrotiri Bay	2	Boisseau *et al.,* 2017
Visual	Aug-16	South of Paphos	4	Boisseau *et al.,* 2017
Acoustic	Aug-16	South of Paphos	4	Boisseau *et al.,* 2017
Acoustic	Aug-16	West of Lara Beach	2	Boisseau *et al.,* 2017
Acoustic	Aug-16	Akamas Peninsula	4	Boisseau *et al.,* 2017
Visual	May-17	South of Paphos	4	Boisseau *et al.,* 2017
Visual	Jun-17	Larnaca Bay	1	Boisseau *et al.,* 2017
Visual	Jul-17	Larnaca Bay	2	Boisseau *et al.,* 2017
Acoustic	Jul-17	Larnaca Bay	10	Boisseau *et al.,* 2017

The sperm whale is a widespread species with a large geographical range and generally found in deep waters (deeper than 1000 m), continental slope waters (Taylor *et al.,* 2008) and in submarine canyons (FAO, 2019). Sperm whales often form herds of up to 50 individuals (FAO, 2019).

Ziphius cavirostris **(Cuvier, 1823)**

Two individuals of Cuvier's beaked whales were documented in shallow waters in June 2007 off the coastline of Antalya, south of Turkey but not near Cyprus (Boisseau *et al.,* 2010). Results from an acoustic survey in Cyprus in August 2016 documented a group of 6 individuals in Akamas Peninsula, 2 individuals south of Larnaca and east of Cape Greco, 1 individual west of Akamas Peninsula and south of Cape Greco. A group of approximately 2 individuals documented north of Akamas Peninsula, 1 individual west of Akamas Peninsula and 1 south of Akrotiri in November 2016. All sightings were recorded in waters between 1000 and 2300 m deep (Boisseau *et al.,* 2017). Five individuals were acoustically documented in August 2013 between Rhodes and Cyprus along the Anaximander Seamount and 1 individual west of Akamas Peninsula (Ryan *et al.,* 2014). Boisseau *et al.,* (2017, p4) stated: "Given that appropriate habitat exists in Cypriot waters for this deep-diving species, it is entirely likely they are present yet unaccounted for due to limited research effort. Further support for this presumption comes from the discovery of stranded individuals on at least two separate occasions". Table 1.20 shows the distribution and population size of the Cuvier's beaked whale.

Table 1.21 Distribution and population size data of Cuvier's beaked whale (Ziphius cavirostris).

Method	**Time documented**	**Location documented**	**Group size**	**Source**
Visual	Jun-07	Turkey's Antalya coastline	1	Boisseau *et al.,* 2010
Visual	Jun-07	Turkey's Antalya coastline	1	Boisseau *et al.,* 2010
Acoustic	Aug-13	West of Akamas Peninsula	1	Ryan *et al.,* 2014
Acoustic	Aug-16	East of Cape Greco	2	Boisseau *et al.,* 2017
Acoustic	Aug-16	South of Cape Greco	1	Boisseau *et al.,* 2017
Acoustic	Aug-16	South of Larnaca Bay	2	Boisseau *et al.,* 2017
Acoustic	Aug-16	Akamas Peninsula	1	Boisseau *et al.,* 2017
Acoustic	Aug-16	West of Akamas Peninsula	6	Boisseau *et al.,* 2017
Acoustic	Nov-16	West of Akamas Peninsula	1	Boisseau *et al.,* 2017
Acoustic	Nov-16	North-west of Akamas Peninsula	4	Boisseau *et al.,* 2017

Cuvier's beaked whales are widely distributed in both hemispheres in offshore waters from the tropics to the Polar Regions. Their range distribution does not cover shallow waters (Taylor *et al.,* 2008). From all species of beaked whales this is the only one that is found in the Mediterranean Sea (Podesta *et al.,* 2006). Cuvier's beaked whales prefer deep waters (> 200 m) and areas near the continental slope (Taylor *et al.,* 2008). They form small groups of 2 to 7, but singular individuals have also been documented (FAO, 2019).

Balaenoptera physalus **(Linnaeus, 1758)**

Fin whales are very rare in Cyprus. It has been suggested that this species has a 'visitor' status in Levantine Basin (eastern Mediterranean). In October 2001, a juvenile and two adult fin whales were sighted in Larnaca Bay (Notarbartolo-di-Sciara *et al.,* 2003). Table 1.22 shows the distribution and population size of fin whale.

Table 1.22 Distribution and population size data of Fin whale (Balaenoptera physalus).

Method	**Time documented**	**Location**	**Group size**	**Source**
Visual	Oct-01	Larnaca Bay	3	Notarbartolo-di-Sciara et al., 2003

Fin whales are distributed worldwide, mostly in offshore oceanic waters of both hemispheres. Only seen near the coast if waters are deep (Reily *et al.,* 2013). The population in the Mediterranean has been genetically distinct from the one in the North Atlantic (Bérubé *et al.,* 1998). Fin whales form groups of 2 to 7, but sometimes slightly larger (FAO, 2019).

1.3.7.1.2 Pinnipeds

Monk Seals together with dolphins and turtles have been protected in Cyprus since 1971. The relevant regulations were made under the Fisheries Law (CAP 135). The various Fisheries Regulations passed up to 1990 and were consolidated into the 1990 Fisheries Regulations (Reg.273/90) mentioned earlier.

The main legislations in place regarding the monk seals are the Fisheries Law and Regulations, the Law on the Protection and Management of Nature and Wildlife (Habitats Directive).

Monk seals are listed in the Habitats Directive (92/43/EEC) under both Annex II and Annex IV. This means that it is a strictly protected species and the designation of Special Areas of Conservation is required for its conservation. The Habitats Directive has been transposed to the national legislation in 2003 with the Law on the Protection and Management of Nature and Wildlife, No. 153(I)/2003.

In 2012 the Akamas area was accepted for inclusion in the Natura 2000 network by the European Commission (EC). Monk seals are a Priority Species in the Habitats Directive and Cyprus needs to protect monk Seal sites (as habitats listed in Annex I – Habitat 8330 "Submerged or partially submerged sea caves" and as habitats of a species listed in Annex II). The Akamas site is extensive and includes several caves and cave areas, including Halavron and Thalassines Spilies which are on the border of the Akamas area in the north and the south respectively. It also includes the other caves on the North and West coast of Akamas. The Ayia Napa caves are also partially covered by the Cape Greco Natura 2000 site, which was also declared as an MPA area in 2018 (Κ.Δ.Π. 115/2018).

On the 1st of February 2019, the Ministry of Agriculture announced the establishment of the Marine Protected Area (MPA) in Peyia (Κ.Δ.Π. 28/2019) for the sole protection of the monk seal. This action was prompted by the recent birth of a female Monk seal pup on the 5th of December 2018 at the sea caves of Peyia.

Furthermore, there are a few other provisions in the fisheries legislation that even though are not explicitly in place for the protection of the monk seals, they are indirectly relevant to their conservation. Inter alia these include the prohibitions explosives usage, fish resource management measures -especially those concerning the limitations to fishing effort- closed seasons for trawling, depth limitations to trawling and protection of Posidonia meadows.

Moreover, monk seals are included in Annex II of the Protocol for Specially Protected Areas and Biological Diversity (SPA Protocol) of the Barcelona Convention, which Cyprus ratified with the Law No. 20(III)/2001.

Other legislations that are partly relevant are:

- The Foreshore Protection Law which controls the use of the foreshore.
- The Town and Country Planning Law which provides for zoning in the use of land. The Countryside Policy is also relevant for areas which are not covered by Local Plans.
- The Forest Law and Regulations. This is relevant in areas in which forest areas extend to the sea, as in Akamas, in which case the powers of the local authorities, for the use of the foreshore, have no effect.
- Relevant Conventions and Supranational Legislation ratified by Cyprus
- Barcelona Convention (R – 1979) Amendments (Acc. 2001)
- SPA Protocol (R - 1988)
- Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (R - 2001)

- Bern Convention (R - 1988) Appendix II lists inter alia the Common and the Bottlenose dolphins
- Bonn Convention - Convention on Migratory Species (R - 2001)
- CBD - Convention on Biological Diversity (Biodiversity Convention) (R - 1996)
- CITES (R - 1974)
- GFCM Agreement (FAO)
- Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive 1992)
- Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 (the "Marine Strategy Framework Directive")
- National Action Plan for the Conservation of the Mediterranean Monk Seal in Cyprus

Furthermore, there is a National Action Plan for the Conservation of the Mediterranean Monk Seal in Cyprus has been prepared with assistance from RAC/SPA (UNEP/MAP) and has been approved by the DFMR (Demetropoulos, 2011).

Monachus monanchus **(Hermann, 1779)**

The Mediterranean monk seal (*Monachus monachus*) is one of the world's most endangered mammals. The species has been considered to be on the brink of extinction since 1965, when the International Union for the Conservation of Nature (IUCN) Red List evaluated the monk seal as "very rare" and "decreasing in numbers" (Di Sciara et al., 2016). *Monachus monachus* was later on assessed by IUCN as Endangered (E) in 1986, in 1988, in 1990 and in 1994. In 1996 it was uplisted as Critically Endangered (CR) in 1996 and remained in that category in 2008 and 2013. More recently, in 2015 the species was downlisted to Endangered (E), based on criteria C2a(i)6 (Karamanlidis and Dendrinos, 2015).

The species uses marine caves with certain geophysical characteristics such as an entry point below or submerged in water, an entrance corridor and a dry area (Dendrinos et al. 2007). They use these for resting, breeding, hauling out and pupping (Karamanlidis and Dendrinos, 2015).

The monk seal is classed as a Priority species in the Habitats Directive (Annex II and IV); it is listed as a protected species in the Bern Convention Annex II (1996-98) and the Barcelona Convention Annex II of the SPA/BD Protocol (1995).

Table 1.23 The Mediterranean monk seal (*Monachus monachus*) is under the International Union for the Conservation of Nature (IUCN)

Scientific name	**English common name**	**Greek common name**	**IUCN Red list category**
Monachus monachus	Mediterranean monk seal	Μεσογειακή φώκια μονάχους	Critically endangered

Currently, the countries in the Mediterranean hosting the bigger breeding populations are Greece and Turkey. Estimates suggest the presence of 300-400 individuals found around Greece (MOm 2009) and around 100 animals in Turkey (Güçlüsoy et al. 2004). A smaller population of monk seals is still found around the coasts of Cyprus. This is currently estimated to be 14 individuals, including 5 juveniles and pups (DFMR). Monk seals migrate; therefore it is possible that connections between the Cyprus individuals and the populations in nearby coasts (Turkey, Syria) exists and that individuals travels back and forth between the coasts (Gucu et al, 2009).

Surveys were undertaken in 1997, 2005/6 and 2011-2012 to assess the status of the monk seals in Cyprus and identify their breeding and resting caves (Dendrinos and Demetropoulos 1998, Demetropoulos et al. 2006, Demetropoulos 2011). The surveys were undertaken by the Cyprus Wildlife Society in cooperation with the Department of Fisheries and Marine Research. A network of fishermen divers, lifeguards and other stakeholders was formed, who also provide the DFMR with sightings and information on the species. Thought these combined observations and research, it has been estimated that 14 seals are still found in Cyprus, including 5 young individuals, although as mentioned above migrations around the island and between the island and the nearby mainland make it difficult to make such estimations. Work is ongoing in this field by the CWS and the DFMR. Breeding in the caves of the island was confirmed in 2009, 2011, two in 2015, 2017 and 2018 (CWS and DFMR monitoring programme). These results highlight the breeding activity of the species on the island and its use of marine sea caves both as resting as well as breeding grounds.

Historical information indicates around 7-8 small breeding colonies in the Eastern Mediterranean. In 1959, Davidson mentioned that "... seals of the Eastern Mediterranean variety breed in the island in seven or eight places, one of which was at Cape Andreas area. Members of the expedition to the islands (authors note i.e. Klidhes Islands off Cape Andreas) may see them. The seals breed on the south coast of Turkey and at Yalousa, and Paphos among other places" (Davidson, 1959).

More recent data concerning the monk seals in Cyprus were synthesized by Hadjichristophorou and Demetropoulos (1994).

Breeding/Resting areas at that time were listed as:

- Thalassines Spilies near Ayios Georgios, Peyia, on the west coast - north of Paphos
- Akamas coast (two areas - one on the west coast and one on the north coast)
- Cape Gata at Akrotiri Peninsula (in effect the area stretches halfway to Cape Zevgari)
- Dhekelia - Cape Pyla (the caves are at Cape Pyla)
- Cape Andreas and Klidhes islands on the north-eastern tip of the Island
- North coast, east of Yialousa.

The last confirmed breeding (until the recent records) was documented between 1955 and 1958.

There is now an updated list of the breeding and resting caves that were discovered during the surveys which took place in 1997, 2005/6 and 2011/12 (Dendrinos and Demetropoulos 1998, Demetropoulos et al. 2006, DFMR). Within the study area 18 different suitable monk seal habitats (sea caves) were identified, explored and charted:

- Eight of the caves were recorded in the part of coastline north of Paphos and up to Yeronisos Point.
- Two were recorded in the area of Chrysochou Bay.
- Six caves were recorded in the area of Cape Gata (Akrotiri).
- One cave was recorded in the area of Cape Pyla and one in the area of Ayia Napa.
- At least four of the above caves/seal shelters were evaluated to be suitable for breeding.

For obvious reasons the exact locations of the caves are not given here.

1.3.8 Marine reptiles

1.3.8.1 Marine reptiles

1.3.8.1.1 Species

1. *Caretta caretta* – Loggerhead turtle
2. *Chelonia mydas* – Green turtle
3. *Dermochelys coriacea* – Leatherback

Population dynamics

The estimation of the population sizes and trends of both *Caretta caretta* and *Chelonia mydas* is based on the number of nests made. Nesting in both species takes place about three times in a season. Loggerheads nest every other year while green turtles usually nest every three or more years.

1. *Caretta caretta.* Significant increases in the number of nests made continued after 2012. Such increases started in 2007. From about 340 nests in 2007 these increased to about 1000 or more in Chrysochou Bay and from about 120 nests to more than 300 on the West Coast. It should be kept in mind that Loggerheads need about 20 or so years to reach maturity, from the onset of implementation of conservation measures, so that they can start nesting. See the table below for the nesting data in the last seven years as well as the other tables in this paper.

2. *Chelonia mydas.* Very significant increases in nests have been noted since 2016. These increases were from about 100 nests, or less, prior to that year, to about 200-250 nests per year since then. Green turtles mature at about 25 – 30 or more years to reach maturity and start nesting. This explains the longer time required by them to start increasing than loggerheads. See the table below for the nesting data in the last seven years as well as the other tables in this paper.

3. *Dermochelys coriacea* – This species does not reproduce in the Mediterranean. It has been recorded on a few occasions in the sea around Cyprus, usually when these turtles are incidentally caught in fishing gear.

There is a stranding network for the collection of data on stranded dead or injured turtles. (number, size, species etc). This is maintained by the Department of Fisheries and the Cyprus Wildlife Society.

Summary of Nesting in 2012 – 2018														
Number of Nests														
Species		***Caretta caretta***						***Chelonia mydas***						
Area	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
West Coast	183	275	294	251	351	190	**350**	95	112	133	79	264	251	**221**
Chrysochou Bay	449	750	692	836	1081	588	**1081**	13	11	15	20	20	2	**27**
Other beaches	35	36	28	29	67	50	**47**	1	0	0	0	2	0	**1**
New Beaches**	12	15	23	47	35	28	**64**	0	0	6	0	3	0	**7**
Totals	679	1076	1037	1163	1534	856	**1542**	109	123	154	99	289	253	**256**

Source: Demetropoulos, A., M. Hadjichristophorou, A. Pistentis, A. Mastrogiacomo, S. Demetropoulos (2018). “Report on the Turtle Conservation Project in 2018”, as submitted to the Department of Fisheries and Marine Research (DFMR) of Cyprus. Cyprus Wildlife Society (CWS). Nicosia, Cyprus.

1.3.8.2 Habitats

1.3.8.2.1 Caretta caretta

Nesting beaches

The main nesting beaches of this species are in Chrysochou Bay (about 12km of beach) and on the West Coast (mainly in the Lara/Toxeftra Reserve and south of it). There are also significant nesting beaches to the east of the Polis – Yialia Natura 2000 site in Chrysochou Bay, stretching as far as Pyrgos and in the area west of Larnaca at Pharos and Softades.

Foraging areas

There are no known foraging areas for Loggerheads. This species feeds on benthic animals as an adult and generally travels west of the island, to the richer foraging areas of the central and possibly the western basins of the Mediterranean. Small numbers forage around Cyprus. All migrate back to their natal nesting beaches to lay their own eggs.

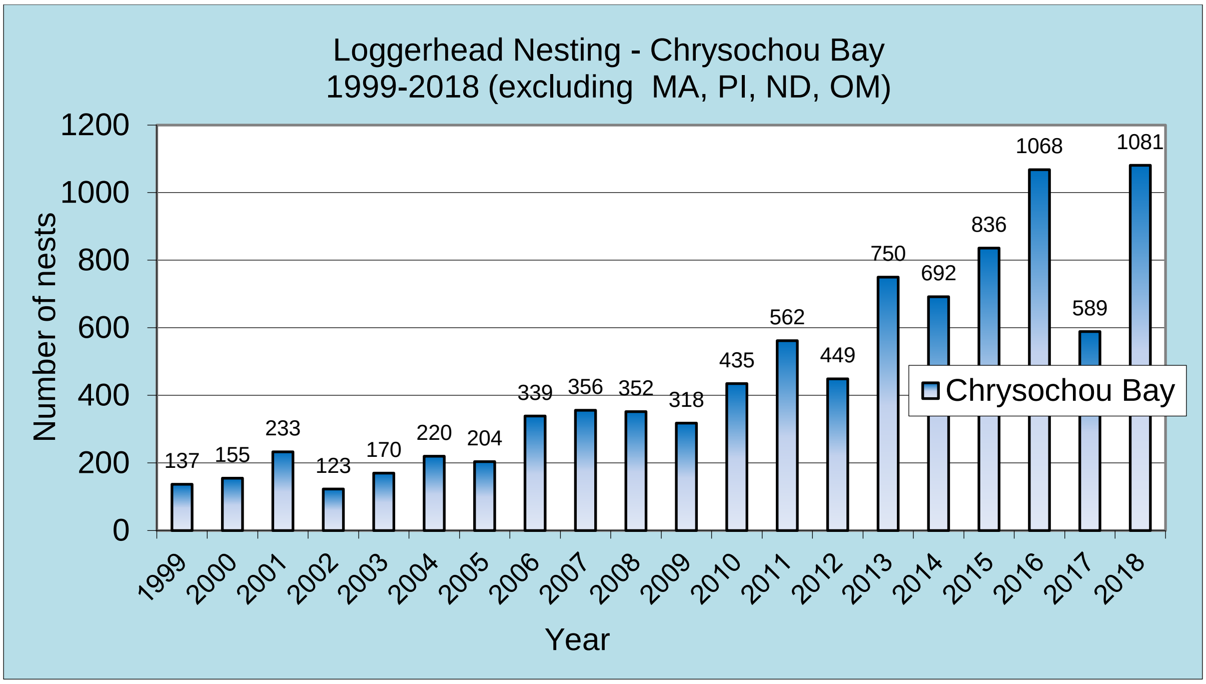
1.3.8.2.2 Chelonia mydas

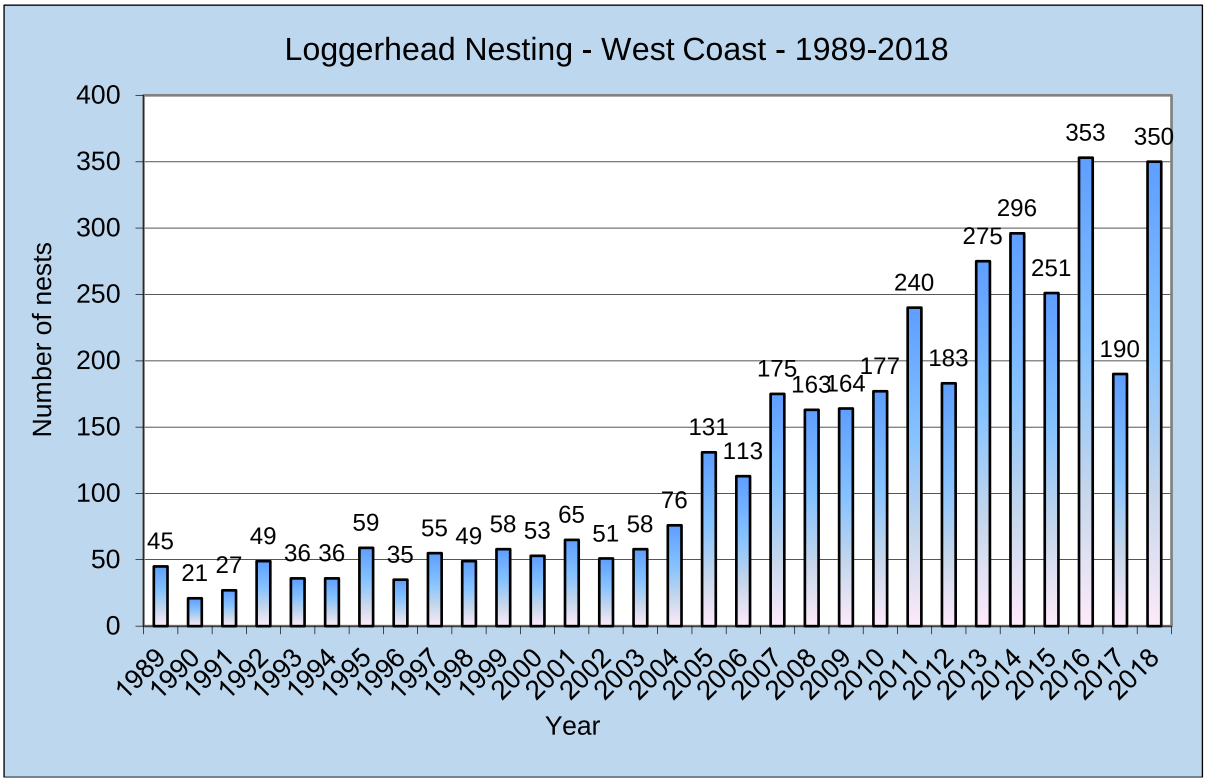
Nesting beaches

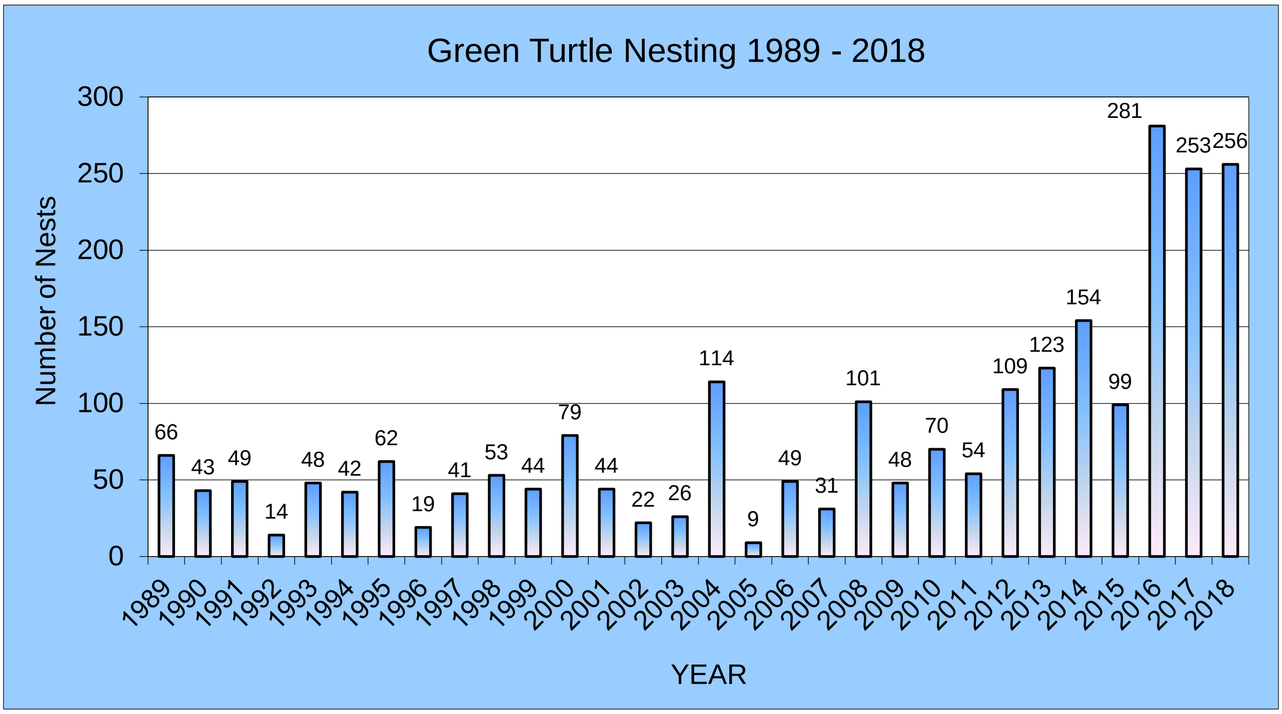
The main nesting beaches of this species, in the area under Government control, are in the Akamas area, in the Lara/Toxeftra Reserve. A small number of nests (about 10% of the total number of nests) are found on certain beaches in Chrysochou Bay and on the West Coast.

Foraging areas

The known foraging areas of this species are mainly in Chrysochou Bay, though investigations are continuing for any significant additional areas. Green turtles graze mainly on the seagrass *Cymodocea nodosa* which is apparently the main food of both juveniles and adults in our area. Adults also graze, though to a lesser degree, on the seagrass *Posidonia oceanica* in the extensive meadows this species forms (Demetropoulos and Hadjichristophorou 1995).


Loggerhead Nesting - Chrysochou Bay
1999-2018 (excluding MA, PI, ND, OM)
Number of nests
Year
Chrysochou Bay
1200
1000
800
600
400
200
0
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
137 155 233 123 170 220 204 339 356 352 318 435 562 449 750 692 836 1068 589 1081


Loggerhead Nesting - West Coast - 1989-2018
Number of nests
Year
400
350
300
250
200
150
100
50
0
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
45 21 27 49 36 36 59 35 55 49 58 53 65 51 58 76 131 113 175 163 164 177 240 183 275 296 251 353 190 350



Sources: (1) Demetropoulos and Hadjichristophorou, unpublished data for 1989-2009 (but included in the Annual Reports of the Turtle Project of DFMR) Some were included in the SWOT publications. (2) Demetropoulos, A., M. Hadjichristophorou, A. Pistentis, A. Mastrogiacomo, S. Demetropoulos (2018). "Report on the Turtle Conservation Project in 2018", as submitted to the Department of Fisheries and Marine Research (DFMR) of Cyprus. Cyprus Wildlife Society (CWS). Nicosia, Cyprus. (This covers all similar annual reports for the period 2010 – 2018).

Conservation measures

Turtles in Cyprus are protected mainly by the provisions of the fisheries legislation. Since joining the European Union turtles are also protected under the provisions of the EU Habitats Directive and Law 153(I)/2003 for the Conservation and Management of Nature and Wildlife which transposes this Directive into national law. This law has provisions for the conservation of species and habitats listed in the annexes. Both turtle species are included inter alia in Annex II and Annex IV of the Directive, as Priority Species.

Cyprus has ratified inter alia the Barcelona Convention and its Biodiversity Protocol, the Bern and Bonn Conventions and CITES, all of which have provisions for turtle conservation.

The legal protection of turtles in Cyprus is analyzed below in greater detail.

Species conservation

Turtles and their eggs have been protected under the fisheries legislation since 1971 (Fisheries Law, CAP135 and amendments and the Fisheries Regulations enacted on the basis of this law). The killing, pursuing, catching, buying, selling or possessing of a turtle or attempting to do any of these is prohibited, as is the buying or selling or possession of any turtle egg or turtle part or derivative.

Habitat conservation

West coast – In 1989 habitat protection was given to the main nesting area on the west coast of the island on the basis of the Fisheries Law and Regulations. A 10 km stretch of coastline was declared, on the basis of the above legislation, as a turtle reserve. This was the Lara/Toxeftra Turtle Reserve. It includes the coastline and the adjacent sea area, down to the 20 m isobath (about 1-1.5 km distance from the coast). The Reserve includes the 5 main Green turtle nesting beaches, which also support loggerhead nesting. The management regulations are in the Law. These foresee that the public is not allowed to:

- Stay on the beaches or the coastal area at night
- Drive any vehicle on a beach or tolerate such action
- Place any umbrella, caravan, tent etc., in the Protected Area
- Use or anchor a boat or tolerate such action (to the 20m isobath)
- Fish, except with a rod and line (to the 20m isobath)

In 2018 an order by the Minister of the Environment was issued, prohibiting the passage of any boat in the Lara/Toxeftra Reserve in May and October. Professional fishermen are exempt. (See (ΚΔΠ 234/2018)

Chrysochou Bay – In 2002 the Polis/Limni was declared on the basis of the Town and Country Planning legislation as a "Shore for Ecological Protection". Its provisions include: no permits for the commercial use of beach; no breakwaters or marinas and restrictions for the adjacent area regarding lights.

In 2005, the Polis/Limni area was extended to include the Yialia area and the whole area was proposed to the European Commission as "Natura 2000" site. It was accepted in 2008. The site includes an 11 km stretch of coastline (65-200 m wide) and the adjoining sea area down to the 50m isobath. The management regulations are at their final stage of adoption at the time of writing.

Enforcement

The Fisheries legislation is implemented by the Department of Fisheries and Marine Research (DFMR) and its Inspectorate Service, which has offices and patrol boats in the coastal towns. The management plans for all "Natura 2000" sites are being elaborated and law implementation and enforcement is partly in place already. Licensing and law enforcement on the basis of this law is the responsibility of the Environment Department of the Ministry of Agriculture Natural Resources and Environment, in cooperation with the DFMR in the marine/coastal sites. Licensing and law enforcement based on the Fisheries legislation remains the responsibility of the DFMR.

Conservation efforts

Conservation activities started in 1978, after earlier surveys, with the setting up of the Lara Turtle station. They continued without interruption since then. The main initial aim was to protect nests and hatchlings from predation by foxes. The turtle conservation project is a government project and is implemented by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society has undertaken the implementation of the Cyprus Turtle Conservation Project since 2009. It used to help implement the project prior to that. The project covers all the nesting beaches that are in the part of the island that is under government control. Law enforcement remains the responsibility of the DFMR.

The main aims of the project now are:

- Protecting and managing the nesting beaches and the adjacent sea
- Protecting nesting females on the nesting beaches and adjacent sea during nesting
- Protecting eggs and hatchlings from predation - and from human activities
- Protecting turtles at sea
- Monitoring the turtle population and nesting activity in Cyprus
- Raising public awareness in turtle conservation

A Rescue Centre operates as needed at Meneou, where DFMR has its Mariculture Research Station.

Conservation methods used

In the Lara -Toxeftra Reserve and on the Polis/Limni/Yialia beaches as well as on practically all other beaches that have any nesting, all nests are protected in situ, i.e., where the eggs are laid, by placing open, self-releasing, aluminium (non-magnetic) cages over them. These cages have been used in the Cyprus Turtle Conservation Project since 1995. The cages used allow hatchlings to escape to the sea, as soon as they emerge from the sand, but prevent foxes from getting at the nest.

The minimum of intervention is aimed for, at all stages of conservation. A “hatchery” is used for a small number of nests (ca. 10-20) that cannot be adequately protected where they were laid. Loggerhead nests are relocated there mainly from two tourist beaches on the west coast (Coral Bay area). The hatchery is a fenced off part of the beach. No green nests are relocated to the hatchery at Lara, as there is no green turtle nesting on the Coral Bay beaches.

The conservation practices used are the ones described in the Manual for Marine Turtle Conservation in the Mediterranean (Demetropoulos and Hadjichristophorou 1995) and its 2008 Addendum 1 (Demetropoulos and Hadjichristophorou 2008). The conservation practices used have evolved during the life of the project with the experience and knowledge gained. Part of the work carried out in the project is focused on the mitigation of the impact of tourism development on turtle nesting beaches. The recommended strategies and actions are outlined in Demetropoulos (2003b).

The Cyprus Turtle Conservation Project was recognized both at European and international level as one of the most successful biodiversity protection programs and was evaluated both by the European Commission and by the Barcelona Convention under the Protocol on Specially Protected Areas and the Biodiversity.

This is reflected by the Project’s inclusion in the NATURA 2000 Award 2015 as a Finalist in the Conservation Category as well as in the recent issue of the NATURA 2000 Newsletter, Number 45 February 2019.   See below.

European Commission

EUROPEAN NATURA 2000 AWARD 2015

FINALIST

Conservation

Presented to

Cyprus Turtle conservation project

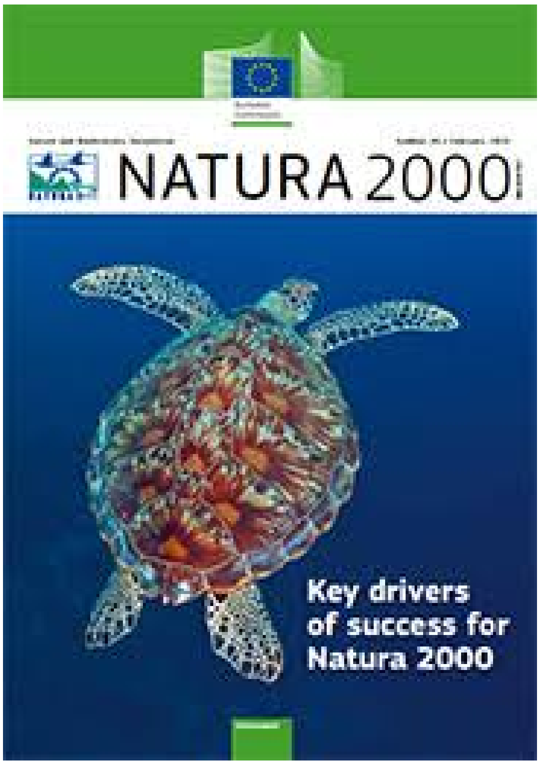
Cyprus Wildlife Society

Chersonisos Akama – Cyprus

In recognition of your efforts and dedication to achieving the objectives of the Natura 2000 network.

Karmenu Vella
European Commissioner for the Environment, Maritime Affairs and Fisheries

Environment



LOGGERHEAD TURTLE (AND GREEN TURTLE) - CYPRUS

Conservation status: Mediterranean: Unfavourable - bad, Cyprus: Favourable

Massive over-exploitation of turtles from the end of the First World War to 1970 led to a virtual collapse of the turtle populations of **the region.** More recently both turtle species have been under pressure again, mainly from habitat loss and disturbance as well as from fishing bycatch. After 40 years of implementing conservation measures in Cyprus, steady improvements have been seen in turtle populations. Time was the key to seeing results, keeping in mind that turtles need at least 20-30 years to mature.

Knowledge gained through these efforts has resulted in the designation of protected areas, the identification of harmful activities, and the targeted implementation of effective conservation measures. Joint action between dedicated NGOs, the Government, local authorities, supported by volunteers, ensures the continuation of conservation efforts and the spread of public awareness. Key measures to improve turtle breeding and reduce hatchling mortality have included legal protection, prohibiting cars, sunbeds and parasols on beaches, and caging nests to reduce natural predation by red foxes.

1.3.9 Seabirds

Currently, more than 400 bird species are recorded in Cyprus regularly every year. Forty of these species are migrant breeders that commonly breed on the island and 60 of these species are resident. Cyprus is also hosting two endemic species of birds. These are the Cyprus Wheatear *Oenanthe cypriaca* and the Cyprus Warbler *Sylvia melanothorax*. Furthermore, Cyprus is also home to four sub-endemic species. The Cyprus Jay (*Garrulus glandarius glaszneri*), the Cyprus Coal Tit (*Parus ater Cypriotes*), the Short-toed Treecreeper (*Certhia brachydactyla dorotheae*) and the Cyprus Scops Owl (*Otus scops cyprius*). As a result of the geographical position of Cyprus, it is an important migration route for birds travelling between Europe, Africa and the Middle East. As a result of these, Cyprus is amongst the six European regions which are included in the list of Endemic Bird Areas of the World (BirdLife International http://datazone.birdlife.org/eba/results?reg=7&cty=0, Accessed 18 April 2019).

These migrant birds include raptors, waterbirds and seabirds. These can be found out at Sea, in coastal areas or wetlands (Flint and Stewart, 1992; Gordon, 2004; Richardson, 2005; 2006; 2007; 2008; 2009). Systematic monitoring of these birds, as well as resident species which are found on the island all year round, takes place on a monthly basis at wetlands by BirdLife Cyprus and the Game Fund (Charalambidou et al., 2008; Kassinis et al., 2010; BirdLife Cyprus, 2017; 2018; 2019). Coastal birds are monitored regularly and while offshore birds used to be overlooked, they are now monitored a bit more regularly (BirdLife Cyprus, 2019).

Cyprus provides an important migration stopover or breeding grounds for internationally important bird populations, such as the Greater Flamingo (*Phoenicopterus roseus*) the Demoiselle Crane (*Grus virgo*) and the Eurasian Stone Curlew (*Burhinus oedicnemus*). It also regularly hosts endangered species at Mediterranean level such as the Audouin's Gull (*Larus audouinii*) and the European Shag (*Phalacrocorax aristotelis*). Furthermore, internationally threatened species like the Near Threatened (NT) Spur-winged Lapwing (*Vanellus spinosus*) (BirdLife International, 2019) also breed in Cyprus (Charalambidou et al., 2012). Cyprus' wetlands are also important habitats and hold important breeding populations of the Kentish Plover (*Charadrius alexandrines*) and the Black-winged Stilt (*Himantopus himantopus*) (Kassinis, 2007; 2008).

1.3.9.1 Existing data and status

Data on birds that frequent the wetlands of Cyprus is abundant as a result of systematic, monthly waterbird counts carried out since 2003 by the Research Unit of the Cyprus Game Fund, Ministry of Interior of the Republic of Cyprus. Additional data is published by birdwatchers (Flint and Stewart, 1992; Gordon 2004; Richardson, 2005; 2006; 2007; 2008; 2009) and the non-governmental organisation BirdLife Cyprus (BirdLife Cyprus, 2003; 2004; 2005; 2006; 2007; 2008; 2009; Iezekiel et al., 2004). Furthermore, since 2007, monthly waterbird counts are being carried in the whole of Cyprus as a result of two bi-communal projects (Charalambidou et al., 2008; Kassinis et al., 2010). All these data have contributed to the evaluation of distribution ranges and calculation of population sizes of birds that utilize wetland areas.

1.3.9.1.1 Birds at coastal areas

On the other hand, birds that frequent coastal areas are not monitored as systematically. However, there is an annual 'Survey of Eleonora's Falcon (*Falco eleonorae*) Breeding Colonies' on the coastal cliffs between Limassol and Paphos conducted since 2002 (Wilson, 2005), and regular surveys of breeding Griffon Vultures (*Gyps fulvus*) in the same area, by the Forestry Department (Ministry of Agriculture) and Game Fund Service (Ministry of Interior), of the Republic of Cyprus. Moreover, few studies have focused on population sizes of other coastal birds, i.e. breeding population size and breeding success of Audouin's Gull (*Larus* *audouinii*) and European Shag (*Phalacrocorax aristotelis*) colonies at Kleidhes Islands (Charalambidou and Gücel, 2008), and population sizes of migrating birds in autumn at the South-eastern Peninsula and Cape Greco (Roth and Corso, 2007; Roth, 2008). Additional data is published by birdwatchers and the non-governmental organisation BirdLife Cyprus (Flint and Stewart, 1992; BirdLife Cyprus, 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2016; 2017; 2018; 2019; Gordon, 2004; Richardson, 2006; 2007; 2008; 2009; 2005).

Overall, the absence of systematic data collection for coastal birds, doesn't allow for accurate population size estimates. These data tend to focus on breeding but not on wintering populations, however, it is usually sufficient to define distribution ranges for species that utilize these areas. It has to be noted though that it does not cover the whole coastline and tends to be biased in locations that are preferred by birdwatchers.

1.3.9.1.2 Birds that occur offshore

Data on the following pelagic seabird species which mainly occur offshore is less regular: Scopoli's Shearwater (*Calonectris diomedea*), Yelkouan Shearwater (*Puffinus yelkouan*), European Storm Petrel (*Hydrobates pelagicus*), and Northern Gannet (*Morus bassanus*) (Flint and Stewart, 1992).

All bird species that frequent wetlands, coastal and offshore areas are protected under the EU Birds (2009/147/EC) and Habitats (92/43/EEC) Directives, and the Cyprus Law 152 (I) of 2003 as well as under the Barcelona Convention (UNEP, 2005).

1.3.9.1.3 The Barcelona Convention list of protected species

The Mediterranean is a small but important Sea in the context of global biodiversity (UNEP-MAP RAC/SPA 2010). The Protocol concerning 'Specially Protected Areas and Biological Diversity in the Mediterranean' (SPA/BD Protocol) of the Barcelona Convention, was established in order to safeguard the areas and species that best represent the conservation value of Mediterranean ecosystems. Seabirds are a good example of the region's richness in which eight of the nine breeding taxa of exclusively marine birds are either endemic species or subspecies (Zotier et al., 1999). Annex II lists seabird species of the highest conservation concern (Table 1.24).

Table 1.24 Status of birds in Cyprus currently listed in Annex II of the 'Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean', "List of Endangered or Threatened Species", published by the UNEP-MAP-RAC/SPA 2013.

Common Name	Scientific name	Status in Cyprus
Scopoli's Shearwater	*Calonectris diomedea*	Scarce offshore passage migrant
Pied Kingfisher	*Ceryle rudis*	Scarce and irregular passage migrant
Kentish Plover	*Charadrius alexandrinus*	Breeding resident and passage migrant
Greater Sand Plover	*Charadrius lescenaultii columbinus*	Passage migrant
Eleonora's Falcon	*Falco eleonorae*	Common migrant breeder
Gull-billed Tern	*Gelochelidon nilotica*	Uncommon passage migrant
Mediterranean Shag	*Gulosus aristotelis desmarestii*	Resident breeder
European Storm Petrel	*Hydrobates pelagicus*	Accidental visitor
Caspian Tern	*Hydroprogne caspia*	Rare and irregular passage migrant
Armenian Gull	*Larus armenicus*	Regular winter visitor
Audouin's Gull	*Larus audouinii*	Resident breeder
Slender-billed Gull	*Larus genei*	Common passage migrant
Mediterranean Gull	*Larus melanocephalus*	Regular winter visitor and passage migrant
Osprey	*Pandion haliaetus*	Uncommon, but regular passage migrant

Great White Pelican	*Pelecanus onocrotalus*	Scarce passage migrant
Pygmy Cormorant	*Phalacrocorax pygmeus*	Irregular and scarce passage migrant
Balearic Shearwater	*Puffinus mauretanicus*	One unconfirmed record
Yelkouan Shearwater	*Puffinus yelkouan*	Very scarce offshore passage migrant
Little Tern	*Sterna albifrons*	Scarce passage migrant, occasional summer breeder
Sandwich Tern	*Thalasseus sandvicensis*	Scarce passage migrant, occasional summer breeder

1.3.9.1.4 Individual species notes

Scopoli's (Cory's) Shearwater breeds on rocky coasts and islands in the Mediterranean and the Atlantic. Evaluated in Europe as Vulnerable (BirdLife International, 2004). Recently, the systematic counts at sea has increased the monitoring of the species. It has been observed during March and May, and from July to October, mainly off the north and west coasts (Cape Kormakitis, Karpasia peninsula, Polis Chrysochou Bay, Cape Pomos) (BirdLifeCyprus, 2019).

The Pied Kingfisher resides around water bodies such as lakes, rivers, coastal lagoons, dams and reservoirs with either fresh or brackish water. The European breeding population has been estimated at around 200-400 mature individuals and Europe hosts less than 5% of the global population of the species (BirdLife International, 2015). In Cyprus, it is a scarce and irregular passage migrant that has been recorded in all months. It has also bred once on the island in 1996.

The Kentish Plover prefers coastal sandy, silt or dry mud areas. In Europe there are around 43,100-69,600 mature individuals, which is approximately 15% of the global range (BirdLife International, 2015). In Cyprus the species is a breeding resident, a passage migrant and a winter visitor. Their local population shows a decline over the years. The bird is observed throughout the year in numbers varying from 10 to 200, usually in areas such as Paralimni Lake and Akrotiri Peninsular (BirdLife Cyprus, 2017, 2018, 2019).

The Greater Sandplover is mainly breeding in dry, open, uncultivated areas and usually near water bodies. Outside the breeding season the Greater Sandplover prefers littoral habitats (Urban et al. 1986) and while on migration it occasionally utilises habitats such as brackish swamps and salt-lakes. The population in Europe is estimated to around 1,200-2,000 mature individuals (BirdLife International, 2015, Wetlands International, 2016). In Cyprus, mainly the subspecies *Charadrius lescenaultii columbinus* occurs as passage migrant and winter visitor, usually in small but significant numbers. The bird is a qualifying species for the classification of three areas in Cyprus as Important Bird Areas (IBA) since they are considered important migration staging points and wintering sites for the Greater Sandplover (Iezekiel et al., 2004).

Eleonora's Falcon is a common migrant breeder in Cyprus with the major counts from Kensington Cliffs. Europe covers about 95% of the global breeding population of the species and the population is considered to be increasing (BirdLife International, 2019). In Cyprus, this bird is present from April to early November. The breeding period occurs during the end of July and August and during this time, they hunt in the coastal airspace. Based on annual surveys of this species, breeding populations of 227 mature adults and 118 nestlings in 2017 with 70 nests. The pairs are mainly located at Akrotiri, Cape Aspro and Episkopi (BirdLife Cyprus, 2019).

The Gull-billed Tern breeds on a variety of habitats including bare or patchy vegetated islands, spits of dry mud, dunes, swamps, marches and saltpans. During migration, the bird forages over coastal lagoons, mashed, wet fields and possible overwintering locations include estuaries and sewage ponds (Del Hoyo et al., 1996). The European breeding population is estimated at around 33,200-42,400 mature individuals (BirdLife International, 2015). In

Cyprus, it is an uncommon spring passage migrant at major wetlands such as Akrotiri Salt Lake and Asprokremmos Dam and an occasional migrant in summer, while they occur less frequently in autumn (BirdLife Cyprus, 2019).

The Mediterranean Shag (*Gulosus aristotelis desmarestii*) is a subspecies of the European Shag and a breeding resident species in Cyprus. It is endemic to the Mediterranean and usually found in coastal areas with cliffs, small islets and rocks. The population in Europe is estimated at around 153,000-157,000 mature individuals (BirdLife International, 2015). In Cyprus, the population of the species on rocky islets is estimated at 60 individuals found in at least 8 colonies, with the major colony found at Kleidhes islands (BirdLife Cyprus, 2019).

The European Storm Petrel breeds within Europe and nests on offshore islands in the Atlantic. Evaluated in Europe as Secure (BirdLife International, 2004). The species is and accidental visitor in Cyprus, with few records from Cape Andreas and Larnaca (Flint and Stewart, 1992).

The Caspian Tern's breeding habitat is predominantly along the coasts and at large lakes. The global population of the species has undergone a significant increase in the past years and the European population is estimated at 23,600-29,600 mature individuals (BirdLife International, 2015). In Cyprus it is a rare and irregular passage migrant, mainly in spring and in small numbers (usually less than 20) (BirdLife Cyprus, 2019).

The Armenian Gull occurs near water bodies, both inland and coastal such as lakes, rivers and flooded meadows (Del Hoyo et al., 1996). Both the global and the European population are decreasing, and last estimates show a size of 38,000-58,000 mature individuals in Europe (BirdLife International, 2015). The Armenian Gull was first assessed as Near Threatened (NT) by the IUCN in 2015 (under criteria A2ab+3b+4ab) and still remains in that category. In Cyprus it is a regular winter visitor between October and March in relatively small numbers (BirdLife Cyprus, 2019).

Audouin's Gull forms colonies on offshore islets or islands and exposed rocky cliffs which are usually around 50 m above sea level (Cramp and Simmons, 1983). Europe holds at least 90% of the global population of the species, which has been increasing within the past years. Therefore, the species was downlisted from Near Threatened (NT) to Least Concern (LC) in 2015 and remained in this category after the 2016 and 2018 assessment. The main breeding colonies in Europe are found in Spain with estimates of 19,461 pairs (BirdLife International, 2015). A few pairs breed in Cyprus, on Kleidhes Islands and there are also a few records of possible wintering birds (Charalambidou and Gücel, 2008; BirdLife Cyprus, 2019) Recent estimates of the Cypriot breeding population show a total of 15 birds and seven nests on Kleidhes Islands and Kasteletta islet (BirdLife Cyprus, 2019).

The Slender-billed Gull breeds on areas such as mudflats, sandpits, beaches and marshes while outside of the breeding season it can occur at salt lakes and freshwater lagoons (Del Hoyo et al., 1996). The global population is estimated at around 310,000-380,000 individuals (Wetlands International, 2015), while the European population is estimated at around 280,000-345,000 individuals (BirdLife International, 2015). In Cyprus, it is a common passage migrant, especially in spring, while occasionally some birds overwinter in coastal and wetland areas such as Lady's Mile and Larnaca salt lakes.

The Mediterranean Gull has most of its breeding population in Europe and its preferred breeding grounds are mostly coastal lagoons and estuaries, while occasionally it also breeds at saltmarshes (Del Hoyo et al., 1996). Recent estimates show around 236,000-656,000 mature individuals in Europe (BirdLife International, 2015). In Cyprus, it is a regular winter visitor and passage migrant in small numbers, usually restricted to the south coast in areas such as Larnaca Salt Lake and Oroklini Marsh (BirdLife Cyprus, 2016; 2017; 2018; 2019).

The European breeding population of the Osprey *Pandion haliaetus* is estimated at 16,700-24,600 mature individuals, which is around 14% of the global range (BirdLife International, 2015). It is an uncommon, but regular passage migrant in Cyprus. Most birds overfly, while some individuals stop to fish at wetlands, e.g. Kouris Dam and Oroklini Lake (Charalambidou et al. 2008) where they sometimes remain for days and exceptionally up to three weeks (Flint and Stewart 1992).

The Great White Pelican is evaluated as having a secure population (BirdLife International, 2019). In Cyprus, it is a scarce passage migrant, mainly recorded in autumn on the south coast, and at the salt lakes or dams, with about 3 to 5 records per year (BirdLife Cyprus 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2016; 2017; 2018; 2019; Charalambidou et al., 2008). Birds usually remain on the island for a few days and occasionally remain on the island for a few weeks, usually in flocks of around 30 individuals or singly (BirdLife Cyprus, 2017).

The Pygmy Cormorant breeds in south and southeastern Europe and has a relatively small European breeding population. Evaluated as Secure in Europe and globally as a Near Threatened Species (BirdLife International, 2004). In Cyprus it is a scarce and irregular visitor with records from Akrotiri, and Polemidhia, Yermasoyia, Asprokremmos and Achna Dams (Flint and Stewart, 1992).

The Balearic Shearwater is a globally Critically Endangered (CR) species. Its global breeding range is confined to the Balearic Islands (Spain) and it has a population size of about 19,000 individuals. In Cyprus, there is one potential first record of two individuals sighted at Mandria on 9 April 2011 (Pelagic Birds of the Eastern Mediterranean, 2011).

The Yelkouan Shearwater breeds almost exclusively within Europe and is evaluated as Vulnerable (V) from the IUCN (BirdLife International, 2019 - Factsheet) on a global scale. In Cyprus this species is fairly common offshore from August to September, and scarce from December to March (Flint and Stewart, 1992). There are records from Konnos Beach, Cape Pomos, Cape Greco and Paphos.

Some of the chosen breeding habitats of the Little Tern are patchy vegetated or barren beaches, saltmarshes, saltpans, offshore coral reefs and reservoirs (Del Hoyo et al., 1996). Occasionally it also breeds on dry mudflats or islets around both fresh and saline water (Del Hoyo et al., 1996). Outside of the breeding season it can occur at coastal lagoons and saltpans (Urban et al., 1986). In Europe the population is estimated at around 71,900-106,000 mature individuals (BirdLife International 2015), while in Cyprus, it is a localised summer breeding visitor and a scarce passage migrant (BirdLife Cyprus, 2019). Breeding on the island has been previously estimated at around 2-5 pairs in Larnaca, Achna Dam and Oroklini Lake (Charalambidou et al. 2008, Kassinis et al. 2010). In recent years breeding has been occasional and therefore we are unable to make any accurate estimates on the breeding population on the island. Breeding behaviour was observed in 2014, but no nests were recorded (BirdLife Cyprus, 2016), while in 2015 mating and juvenile feeding had been observed at Oroklini Marsh, together with records of juveniles at Akrotiri Salt Lake (BirdLife Cyprus, 2017). In 2016 no juveniles or nests were recorded (BirdLife Cyprus, 2018) and in 2017 there was no evidence of breeding, despite records of the species during the summer period (BirdLife Cyprus, 2019).

The Sandwich Tern breeds on sandy spits and islands, sand dunes, single beaches and extensive deltas and forms colonies (Snow and Perrin, 1998). It prefers raised and open gravel, mud or bare coral for nesting (Del Hoyo et al., 1996). Putside of the breeding period the species frequently occurs on estuaries, harbours, rocky beaches and mudflats and feeds at sea or over bays (Del Hoyo et al., 1996). The European population is around 160,000-295,000 mature individuals (BirdLife International, 2015) and in Cyprus it is an uncommon winter visitor and spring passage migrant, mostly occurring in the south coast, in small numbers at locations such as Akrotiri Gravel Pits and Cape Greco.

1.3.9.2 Special Protection Areas (SPAs) for the conservation of coastal and wetland birds

Seven designated SPAs in Cyprus include coastal areas in part of their territory, for the protection of bird species listed in Annex I of the EU Birds Directive (2009/147/EC), and protected under Cyprus law 152 (I) of 2003.

1.3.9.2.1 Cape Greco

This area constitutes the easternmost edge of Cyprus, serves as the first station for some migratory birds and is considered one of the most important stop-over sites on the island (Flint and Stewart 1992, Roth and Corso 2007, Roth 2008). About 90% of the site is terrestrial with heath, scrub, maquis, and garrigue, phrygana habitat cover, while 10% of the site is marine including shingle, sea cliffs and islets (LIFE 1998). The total number of species documented in the area are 200. Among these, 70 are listed in Annex I of the EU Birds Directive (2009/147/EC) (Table 1.25). The area is used for nesting by the endemics Cyprus Warbler (*Sylvia melanothorax*) and Cyprus Wheatear (*Oenanthe cypriaca*) while thousands of passerines and other migratory species stop-over during migration. Irregular bird species for Cyprus, and sometimes for Europe, are recorded here, such as the Bateleur Eagle (*Terathopius ecaudatus*; first record for Europe), Short-toed Snake Eagle (*Circaetus gallicus*), Booted Eagle (*Aquila pennata*) and Corn Crake (*Crex crex*) (LIFE 1998). The species that characterise the area is the Red-footed Falcon (*Falco vespertinus*), pallid harrier (*Circus macrourus*) and Cyprus Warbler (*Sylvia melanothorax*) (Διαχειριστικό Σχέδιο Περιοχής ΖΕΠ «Κάβο Γκρέκο», 2016.).

Table 1.25 List of bird species documented at Cape Greco SPA (Διαχειριστικό Σχέδιο Περιοχής ΖΕΠ «Κάβο Γκρέκο», 2016). Status abbreviations: R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor.

A/A	Scientific name	Status	Listed in Annex I of EU Birds Directive + = Yes; - = No
1	*Calonectris diomedea diomedea*	M	+
2	*Puffinus yelkouan*	M	+
3	*Phalacrocorax carbo*	W/M	-
4	*Phalacrocorax aristotelis desmarestii*	R	+
5	*Pelecanus onocrotalus*	M	+
6	*Nycticorax nycticorax*	M	+
7	*Ardeola ralloides*	M	+
8	*Bubulcus ibis*	M	-
9	*Egretta garzetta*	W/M	+
10	*Ardea alba*	M	+
11	*Ardea cinerea*	M	-
12	*Ardea purpurea*	M	+
13	*Ciconia ciconia*	M	+
14	*Plegadis falcinellus*	M	+
15	*Platalea leucorodia*	M	+
16	*Phoenicopterus roseus*	M	+
17	*Tadorna tadorna*	M	-
18	*Anas acuta*	M	-
19	*Anas querquedula*	M	-
20	*Anas clypeata*	M	-
21	*Pernis apivorus*	M	+

22	*Milvus migrans*	M	+
23	*Neophron percnopterus*	M	+
24	*Circus aeruginosus*	W/M	+
25	*Circus cyaneus*	W/M	+
26	*Circus macrourus*	M	+
27	*Circus pygargus*	M	+
28	*Accipiter nisus*	W/M	-
29	*Buteo buteo*	W/M	-
30	*Buteo buteo vulpinus*	M	-
31	*Buteo rufinus*	R/M	+
32	*Aquila fasciata*	M	+
33	*Pandion haliaetus*	M	+
34	*Falco naumanni*	M	+
35	*Falco tinnunculus*	M	-
36	*Falco vespertinus*	M	+
37	*Falco columbarius*	W/M	+
38	*Falco subbuteo*	M	-
39	*Falco eleonorae*	M	+
40	*Falco cherrug*	M	+
41	*Falco peregrinus*	W/M	+
42	*Alectoris chukar*	NR	-
43	*Francolinus francolinus*	NR	-
44	*Coturnix coturnix*	W/M	-
45	*Porzana parva*	W/M	+
46	*Crex crex*	M	+
47	*Gallinula chloropus*	M	-
48	*Grus grus*	M	+
49	*Himantopus himantopus*	M	+
50	*Recurvirostra avosetta*	M	+
51	*Burhinus oedicnemus*	NR/M	+
52	*Cursorius cursor*	M	+
53	*Charadrius hiaticula*	W/M	-
54	*Charadrius alexandrinus*	M/W	+
55	*Charadrius leschenaultii*	M	-
56	*Vanellus spinosus*	W/M	+
57	*Vanellus vanellus*	M	-
58	*Gallinago gallinago*	M	-
59	*Numenius arquata*	M	-
60	*Tringa nebularia*	M	-
61	*Tringa ochropus*	M	-
62	*Tringa glareola*	M	+
63	*Actitis hypoleucos*	W/M	-
64	*Larus melanocephalus*	W/M	+
65	*Hydrocoloeus minutus*	W/M	+
66	*Larus ridibundus*	W/M	-
67	*Larus genei*	W/M	+
68	*Larus audouinii*	W	+
69	*Larus fuscus fuscus*	W/M	-
70	*Larus heuglini*	W/M	-
71	*Larus michahellis*	R	-
72	*Larus cachinnans*	W/M	-
73	*Larus armenicus*	W/M	-
74	*Rissa tridactyla*	RV	-
75	*Gelochelidon nilotica*	M	+
76	*Hydroprogne caspia*	M	-
77	*Sterna sandvicensis*	W/M	+
78	*Chlidonias hybrida*	M	+

79	*Chlidonias niger*	M	+
80	*Columba livia*	NR	-
81	*Columba palumbus*	NR/W	-
82	*Streptopelia decaocto*	NR	-
83	*Streptopelia turtur*	M	-
84	*Stigmatopelia senegalensis*	RV/NR	-
85	*Clamator glandarius*	NM/M	-
86	*Cuculus canorus*	M	-
87	*Athene noctua*	NR	-
88	*Asio otus*	NR	-
89	*Asio flammeus*	W/M	+
90	*Caprimulgus europaeus*	M	+
91	*Apus apus*	NM/M	-
92	*Tachymarptis melba*	M	-
93	*Apus affinis*	RV	-
94	*Alcedo atthis*	W/M	+
95	*Merops apiaster*	M	-
96	*Coracias garrulus*	M	+
97	*Upupa epops*	M	-
98	*Jynx torquilla*	W/M	-
99	*Melanocorypha calandra*	W/M	+
100	*Melanocorypha bimaculata*	M	-
101	*Calandrella brachydactyla*	M	+
102	*Calandrella rufescens*	RV	-
103	*Galerida cristata*	NM	-
104	*Lullula arborea*	W/M	+
105	*Alauda arvensis*	W/M	-
106	*Riparia riparia*	M	-
107	*Ptyonoprogne rupestris*	M	-
108	*Hirundo rustica*	NM/M	-
109	*Cecropis daurica*	NM/M	-
110	*Delichon urbicum*	NM/M	-
111	*Anthus campestris*	M	+
112	*Anthus trivialis*	M	-
113	*Anthus pratensis*	W/M	-
114	*Anthus cervinus*	W/M	-
115	*Anthus spinoletta*	W/M	-
116	*Motacilla flava*	M	-
117	*Motacilla flava flava*	-	-
118	*Motacilla flava thunbergi*	-	-
119	*Motacilla flava beema*	-	-
120	*Motacilla flava feldegg*	-	-
121	*Motacilla alba yarellii*	-	-
122	*Motacilla cinerea*	W/M	-
123	*Motacilla alba*	W/M	-
124	*Prunella modularis*	W/M	-
125	*Erithacus rubecula*	W/M	-
126	*Luscinia luscinia*	M	-
127	*Luscinia megarhynchos*	M	-
128	*Luscinia svecica*	W/M	+
129	*Irania gutturalis*	RV	-
130	*Phoenicurus ochruros*	W/M	-
131	*Phoenicurus phoenicurus*	M	-
132	*Phoenicurus phoenicurus samamisicus*	RV	-
133	*Saxicola torquatus*	W	-
134	*Saxicola rubetra*	M	-

135	*Saxicola maurus*	M	-
136	*Oenanthe isabellina*	M	-
137	*Oenanthe oenanthe*	M	-
138	*Oenanthe pleschanka*	RV	+
139	*Oenanthe cypriaca*	NM	+
140	*Oenanthe melanoleuca*	M	-
141	*Oenanthe deserti*	M	-
142	*Oenanthe finschii*	W/M	-
143	*Oenanthe monacha*	RV	-
144	*Monticola solitarius*	NR/W/M	-
145	*Turdus merula*	W/M	-
146	*Turdus philomelos*	W/M	-
147	*Turdus viscivorus*	W	-
148	*Cettia cetti*	NR	-
149	*Cisticola juncidis*	NR	-
150	*Locustella luscinioides*	M	-
151	*Acrocephalus schoenobaenus*	M	-
152	*Acrocephalus arundinaceus*	M	-
153	*Iduna pallida*	NM/M	-
154	*Hippolais icterina*	M	-
155	*Sylvia conspicillata*	NR	-
156	*Sylvia cantillans*	M	-
157	*Sylvia melanocephala*	W	-
158	*Sylvia melanothorax*	NM/NR	+
159	*Sylvia rueppelli*	M	+
160	*Sylvia crassirostris*	M	-
161	*Sylvia nisoria*	M	+
162	*Sylvia curruca*	M	-
163	*Sylvia communis*	M	-
164	*Sylvia borin*	M	-
165	*Sylvia atricapilla*	W/M	-
166	*Phylloscopus bonelli orientalis*	M	-
167	*Phylloscopus sibilatrix*	M	-
168	*Phylloscopus collybita*	W/M	-
169	*Phylloscopus trochilus*	M	-
170	*Muscicapa striata*	M	-
171	*Ficedula semitorquata*	M	+
172	*Ficedula albicollis*	M	+
173	*FIcedula hypoleuca*	M	-
174	*Parus ater cypriotes*	W	+
175	*Parus major aphrodite*	NR	-
176	*Oriolus oriolus*	M	-
177	*Lanius isabellinus*	RV	-
178	*Lanius collurio*	M	+
179	*Lanius minor*	M	+
180	*Lanius meridionalis*	RV	-
181	*Lanius senator*	M	-
182	*Lanius nubicus*	M	+
183	*Pica pica*	NR	-
184	*Corvus monedula*	NR	-
185	*Corvus cornix*	NR	-
186	*Sturnus vulgaris*	W/M	-
187	*Passer domesticus*	NR/M	-
188	*Passer hispaniolensis*	NR/M	-
189	*Fringilla coelebs*	W/M	-

190	*Fringilla montifringilla*	W	-
191	*Serinus serinus*	W/M	-
192	*Carduelis chloris*	NR/W/M	-
193	*Carduelis carduelis*	NR/W/M	-
194	*Carduelis spinus*	W	-
195	*Carduelis cannabina*	NR/W/M	-
196	*Bucanetes githagineus*	RV	+
197	*Emberiza hortulana*	M	+
198	*Emberiza caesia*	M	+
199	*Emberiza melanocephala*	M	-
200	*Emberiza calandra*	NR/W/M	-

1.3.9.2.2 Ayia Thekla – Liopetri

Agia Thekla – Liopetri SPA is linear and ribbon-like, stretching along the coastal belt, west of Ayia Napa town. The avifauna of the site includes at least 92 bird species. Among these, 38 are listed in Annex I of the EU Birds Directive (2009/147/EC) (Table 1.26). Moreover, the site has been classified by BirdLife Cyprus as an "Important Bird Area" as it is considered among the three most important migration staging points and wintering sites in Cyprus for the Greater Sandplover (*Charadrius leschenaultii*), and regularly holds 1% of the European flyway of this species. The population of the Greater Sandplover in Ayia Thekla – Liopetri was estimated at 20 – 50 individuals in winter and 10 – 40 individuals in the autumn. The area has a great value for birds, even though the area has undergone several interventions and significant degradation in recent years (Διαχειριστικό Σχέδιο Περιοχής ΖΕΠ "Αγία Θέκλα-Λιοπέτρι", 2016).

Table 1.26 List of bird species documented at Ayia Thekla – Liopetri SPA (Διαχειριστικό Σχέδιο Περιοχής ΖΕΠ "Αγία Θέκλα-Λιοπέτρι", 2016). Status abbreviations: R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor

A/A	**Scientific name**	**Status**	**Listed in Annex I of EU Birds Directive + = Yes; - = No**
1	*Tachybaptus ruficollis*	W	-
2	*Morus bassanus*	M	-
3	*Phalacrocorax carbo*	W/M	-
4	*Phalacrocorax aristotelis desmarestii*	R	+
5	*Nycticorax nycticorax*	M	+
6	*Ardeola ralloides*	M	+
7	*Bubulcus ibis*	M	-
8	*Egretta garzetta*	W/M	+
9	*Ardea cinerea*	W/M	-
10	*Ardea purpurea*	M	+
11	*Plegadis falcinellus*	M/W	+
12	*Phoenicopterus roseus*	W/M	+
13	*Anas clypeata*	W/M	-
14	*Mergus serrator*	W	-
15	*Pernis apivorus*	M	+
16	*Circus aeruginosus*	W/M	+
17	*Circus cyaneus*	W/M	+
18	*Buteo buteo*	W/M	-
19	*Buteo rufinus*	M	+
20	*Falco vespertinus*	M	+
21	*Falco peregrinus*	W/M	+
22	*Alectoris chukar*	R	-
23	*Francolinus francolinus*	R	-

24	*Coturnix coturnix*	W/M	-
25	*Himantopus himantopus*	M	+
26	*Recurvirostra avosetta*	W/M	+
27	*Burhinus oedicnemus*	M	+
28	*Cursorius cursor*	M	+
29	*Charadrius hiaticula*	W/M	-
30	*Charadrius alexandrinus*	M/W	+
31	*Charadrius leschenaultii*	W/M	-
32	*Pluvialis apricaria*	W	+
33	*Pluvialis squatarola*	W/M	-
34	*Vanellus spinosus*	M	+
35	*Vanellus vanellus*	W/M	-
36	*Calidris alpina*	W/M	-
37	*Philomachus pugnax*	W/M	+
38	*Numenius phaeopus*	W/M	-
39	*Numenius arquata*	W/M	-
40	*Tringa erythropus*	W/M	-
41	*Tringa totanus*	W/M	-
42	*Tringa ochropus*	W/M	-
43	*Tringa glareola*	M	+
44	*Actitis hypoleucos*	W/M	-
45	*Arenaria interpres*	W/M	-
46	*Larus ridibundus*	W/M	-
47	*Larus genei*	W/M	+
48	*Larus audouinii*	W	+
49	*Larus cachinnans*	W/M	-
50	*Gelochelidon nilotica*	M	+
51	*Sterna sandvicensis*	W/M	+
52	*Streptopelia decaocto*	R	-
53	*Apus apus*	M	-
54	*Apus pallidus*	M	-
55	*Halcyon smyrnensis*	RV	-
56	*Alcedo atthis*	W/M	+
57	*Coracias garrulus*	M	+
58	*Upupa epops*	M	-
59	*Calandrella brachydactyla*	M	+
60	*Galerida cristata*	NR	-
61	*Lullula arborea*	W	+
62	*Alauda arvensis*	W/M	-
63	*Hirundo rustica*	NM/M	-
64	*Cecropis daurica*	M	-
65	*Anthus campestris*	M	+
66	*Anthus pratensis*	W/M	-
67	*Motacilla alba*	W/M	-
68	*Erithacus rubecula*	W/M	-
69	*Phoenicurus ochruros*	W/M	-
70	*Saxicola torquatus*	W	-
71	*Saxicola rubetra*	M	-
72	*Oenanthe isabellina*	M	-
73	*Oenanthe oenanthe*	M	-
74	*Oenanthe cypriaca*	M	+
75	*Oenanthe deserti*	M	-
76	*Cisticola juncidis*	NR	-
77	*Sylvia conspicillata*	NR	-
78	*Sylvia melanocephala*	W	-
79	*Sylvia melanothorax*	W	+
80	*Lanius collurio*	M	+

81	*Lanius minor*	M	+
82	*Lanius nubicus*	M	+
83	*Passer domesticus*	NR/M	-
84	*Passer hispaniolensis*	NR/M	-
85	*Serinus serinus*	W/M	-
86	*Carduelis chloris*	NR/W/M	-
87	*Carduelis carduelis*	NR/W/M	-
88	*Carduelis cannabina*	W/M	-
89	*Emberiza hortulana*	M	+
90	*Emberiza caesia*	M	+
91	*Emberiza melanocephala*	M	-
92	*Emberiza calandra*	W/M	-

1.3.9.2.3 Larnaca Salt Lake

Larnaca Salt Lake, which constitutes a network of four salt lakes, is considered one of the most important wetlands for birds in Cyprus and was designated a Ramsar site in 2001 and Natura 2000 SCI and SPA sites in 2004. The avifauna of the site includes at least 228 bird species. Among these, 78 are listed in Annex I of the EU Birds Directive (2009/147/EC) of which 10 nest in the area (Table 1.27). The site was designated as SPA based on four bird species that are listed in Annex I of EU Birds Directive which breed in the area in significant numbers and on nine species that are found in significantly high numbers during migration season and/or in winter. The four species that nest in the area are the Kentish plover (*Charadrious alexandrines*), Black-winged stilt (*Himantopus himantopus*), Spur-winged lapwing (*Vanellus spinosus*) and Calandra lark (*Melanococypha calandra*). The nine species which are found in significantly high numbers are the Greater flamingo (*Phoenicopterus roseus*) (during migration and in winter), Common crane (*Grus grus*) (during migration), Demoiselle crane (*Grus vigro*) (during migration), White-headed duck (*Oxyura leucocephala*) (during winter), Common curlew (*Numenius arquata*) (during migration and winter), Little egret (*Egretta garzetta*) (during migration), Kentish plover (*Charadrius alexandrines*) (during migration and winter), Collared practincole (*Glareola pratincola*) (during migration) and Common shelduck (*Tadorna tadorna*) (during winter) (Διαχειριστικό Σχέδιο ΖΕΠ "Αλυκές Λάρνακας", 2016).

Table 1.27 List of bird species documented at Larnaca Salt Lake SPA (Διαχειριστικό Σχέδιο ΖΕΠ "Αλυκές Λάρνακας", 2016).). Status abbreviations: R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor

A/A	Scientific name	Status	Listed in Annex I of EU Birds Directive + = Yes; - = No
1	*Tachybaptus ruficollis*	R+NR/W/M	-
2	*Podiceps cristatus*	W/M	-
3	*Podiceps nigricollis*	W	-
5	*Phalacrocorax carbo*	W/M	-
6	*Phalacrocorax aristotelis desmarestii*	R	+
7	*Pelecanus onocrotalus*	M	+
8	*Ixobrychus minutus*	M/W	+
9	*Nycticorax nycticorax*	M/W	+
10	*Ardeola ralloides*	M	+
11	*Bubulcus ibis*	W/M	-
12	*Egretta garzetta*	W/M	+
13	*Ardea alba*	W/M	+
14	*Ardea cinerea*	W/M	-
15	*Ardea purpurea*	M	+

16	*Ciconia nigra*	M	+
17	*Ciconia ciconia*	M	+
18	*Plegadis falcinellus*	M/W	+
19	*Platalea leucorodia*	M	+
20	*Phoenicopterus roseus*	W/M	+
21	*Cygnus olor*	T	-
22	*Anser albifrons*	W	-
23	*Anser anser*	W	-
24	*Tadorna ferruginea*	W	+
25	*Tadorna tadorna*	W/M	-
26	*Anas penelope*	X/M	-
27	*Anas strepera*	W/M	-
28	*Anas crecca*	W/M	-
29	*Anas platyrhynchos*	NR/W/M	-
30	*Anas acuta*	W/M	-
31	*Anas querquedula*	M	-
32	*Anas clypeata*	W/M	-
33	*Marmaronetta angustirostris*	RV	+
34	*Netta rufina*	W	-
35	*Aythya ferina*	W/M	-
36	*Aythya nyroca*	W/M	+
37	*Aythya fuligula*	W/M	-
38	*Oxyura leucocephala*	W	+
39	*Pernis apivorus*	M	+
40	*Milvus migrans*	M	+
41	*Neophron percnopterus*	M	+
42	*Circus aeruginosus*	W/M	+
43	*Circus cyaneus*	W/M	+
44	*Circus macrourus*	M	+
45	*Circus pygargus*	M	+
46	*Accipiter nisus*	W/M	-
47	*Buteo buteo*	W/M	-
48	*Buteo rufinus*	R/M	+
49	*Aquila pennata*	M/W	+
50	*Aquila fasciata*	R/M	+
51	*Pandion haliaetus*	M	+
52	*Falco naumanni*	M	+
53	*Falco tinnunculus*	NR/M	-
54	*Falco vespertinus*	M	+
55	*Falco subbuteo*	M	-
56	*Falco eleonorae*	M	+
57	*Falco cherrug*	M	+
58	*Falco peregrinus*	R/W/M	+
59	*Alectoris chukar*	NR	-
60	*Francolinus francolinus*	NR	-
61	*Coturnix coturnix*	W/M	-
62	*Rallus aquaticus*	W/M	-
63	*Porzana porzana*	M	+
64	*Porzana parva*	W/M	+
65	*Gallinula chloropus*	NR/W/M	-
66	*Fulica atra*	NR/W/M	-
67	*Grus grus*	W/M	+
68	*Grus virgo*	M	-
69	*Himantopus himantopus*	NM/M	+
70	*Recurvirostra avosetta*	W/M	+
71	*Burhinus oedicnemus*	NR/M	+
72	*Cursorius cursor*	M	+
73	*Glareola pratincola*	M	+

74	*Glareola nordmanni*	M	-
75	*Charadrius dubius*	M	-
76	*Charadrius hiaticula*	W/M	-
77	*Charadrius alexandrinus*	NM/M/W	+
78	*Charadrius leschenaultii*	W/M	-
79	*Charadrius asiaticus*	RV	-
80	*Charadrius morinellus*	M	-
81	*Pluvialis apricaria*	W	+
82	*Pluvialis squatarola*	W/M	-
83	*Vanellus spinosus*	R+NR/W/M	+
84	*Vanellus vanellus*	W/M	-
85	*Calidris alba*	W/M	-
86	*Calidris minuta*	W/M	-
87	*Calidris temminckii*	W/M	-
88	*Calidris ferruginea*	M	-
89	*Calidris alpina*	W/M	-
90	*Limicola falcinellus*	M	-
91	*Philomachus pugnax*	W/M	+
92	*Lymnocryptes minimus*	W/M	-
93	*Gallinago gallinago*	W/M	-
94	*Gallinago media*	M	+
95	*Limosa limosa*	W/M	-
96	*Numenius phaeopus*	W/M	-
97	*Numenius arquata*	W/M	-
98	*Tringa erythropus*	W/M	-
99	*Tringa totanus*	W/M	-
100	*Tringa stagnatilis*	M	-
101	*Tringa nebularia*	W/M	-
102	*Tringa ochropus*	W/M	-
103	*Tringa glareola*	M	+
104	*Actitis hypoleucos*	W/M	-
105	*Arenaria interpres*	W/M	-
106	*Phalaropus lobatus*	M	+
107	*Stercorarius parasiticus*	M	-
108	*Larus ichthyaetus*	RV	-
109	*Larus melanocephalus*	W/M	+
110	*Hydrocoloeus minutus*	W/M	+
111	*Larus ridibundus*	W/M	-
112	*Larus genei*	W/M	+
113	*Larus audouinii*	W	+
114	*Larus canus*	W	-
115	*Larus fuscus fuscus*	W/M	-
116	*Larus heuglini*	W/M	-
117	*Larus michahellis*	R	-
118	*Larus cachinnans*	W/M	-
119	*Larus armenicus*	W/M	-
120	*Gelochelidon nilotica*	M	+
121	*Hydroprogne caspia*	M	-
122	*Sterna sandvicensis*	W/M	+
123	*Sterna hirundo*	NM/M	+
124	*Sternula albifrons*	NM/M	+
125	*Chlidonias hybrida*	M	+
126	*Chlidonias niger*	M	+
127	*Chlidonias leucopterus*	M	-
128	*Columba palumbus*	NR/W	-
129	*Streptopelia decaocto*	NR	-
130	*Streptopelia turtur*	M	-
131	*Clamator glandarius*	NM/M	-

132	*Cuculus canorus*	M	-
133	*Tyto alba*	NR	-
134	*Athene noctua*	NR	-
135	*Asio flammeus*	W/M	+
136	*Caprimulgus europaeus*	M	+
137	*Apus apus*	NM/M	-
138	*Apus pallidus*	M	-
139	*Tachymarptis melba*	M	-
140	*Alcedo atthis*	W/M	+
141	*Merops apiaster*	M	-
142	*Coracias garrulus*	NM/M	+
143	*Upupa epops*	M	-
144	*Jynx torquilla*	W/M	-
145	*Melanocorypha calandra*	NR/W/M	+
146	*Calandrella brachydactyla*	M	+
147	*Galerida cristata*	NR	-
148	*Lullula arborea*	W/M	+
149	*Alauda arvensis*	W/M	-
150	*Riparia riparia*	M	-
151	*Hirundo rustica*	NM/M	-
152	*Cecropis daurica*	NM/M	-
153	*Delichon urbicum*	NM/M	-
154	*Anthus campestris*	M	+
155	*Anthus trivialis*	M	-
156	*Anthus pratensis*	W/M	-
157	*Anthus cervinus*	W/M	-
158	*Anthus spinoletta*	W/M	-
159	*Motacilla flava*	M	-
160	*Motacilla flava flava*	M	-
161	*Motacilla flava thunbergi*	M	-
162	*Motacilla flava feldegg*	NM	-
163	*Motacilla citreola*	M	-
164	*Motacilla cinerea*	W/M	-
165	*Motacilla alba*	W/M	-
166	*Cercotrichas galactotes*	M	-
167	*Erithacus rubecula*	W/M	-
168	*Luscinia megarhynchos*	M	-
169	*Luscinia svecica*	W/M	+
170	*Phoenicurus ochruros*	W/M	-
171	*Phoenicurus phoenicurus*	M	-
172	*Saxicola torquatus*	W/M	-
173	*Saxicola rubetra*	M	-
174	*Oenanthe isabellina*	M	-
175	*Oenanthe oenanthe*	M	-
176	*Oenanthe cypriaca*	NM	+
177	*Oenanthe melanoleuca*	M	-
178	*Turdus merula*	W/M	-
179	*Turdus philomelos*	W/M	-
180	*Cettia cetti*	NR	-
181	*Cisticola juncidis*	NR	-
182	*Locustella luscinioides*	M	-
183	*Acrocephalus melanopogon*	W	+
184	*Acrocephalus schoenobaenus*	M	-
185	*Acrocephalus scirpaceus*	NM/M	-
186	*Acrocephalus arundinaceus*	M	-
187	*Iduna pallida*	NM/M	-
188	*Hippolais icterina*	M	-
189	*Sylvia conspicillata*	NR	-

190	*Sylvia cantillans*	M	-
191	*Sylvia melanocephala*	W/M	-
192	*Sylvia melanothorax*	R+NM	+
193	*Sylvia rueppelli*	M	+
194	*Sylvia nana*	RV	-
195	*Sylvia crassirostris*	M	-
196	*Sylvia curruca*	M	-
197	*Sylvia communis*	M	-
198	*Sylvia atricapilla*	W/M	-
199	*Phylloscopus sibilatrix*	M	-
200	*Phylloscopus collybita*	W/M	-
201	*Phylloscopus trochilus*	M	-
202	*Muscicapa striata*	M	-
203	*Ficedula semitorquata*	M	+
204	*Ficedula albicollis*	M	+
205	*Ficedula hypoleuca*	M	-
206	*Parus major aphrodite*	NR	-
207	*Remiz pendulinus*	W/M	-
208	*Oriolus oriolus*	M	-
209	*Lanius collurio*	M	+
210	*Lanius minor*	M	+
211	*Lanius senator*	M	-
212	*Lanius nubicus*	M	+
213	*Pica pica*	NR	-
214	*Corvus cornix*	NR	-
215	*Sturnus vulgaris*	W/M	-
216	*Passer domesticus*	NR/M	-
217	*Passer hispaniolensis*	NR/M	-
218	*Fringilla coelebs*	W/M	-
219	*Serinus serinus*	NR/W/M	-
220	*Carduelis chloris*	NR/W/M	-
221	*Carduelis carduelis*	NR/W/M	-
222	*Carduelis spinus*	W	-
223	*Carduelis cannabina*	NR/W/M	-
224	*Emberiza hortulana*	M	+
225	*Emberiza caesia*	M	+
226	*Emberiza schoeniclus*	W	-
227	*Emberiza melanocephala*	M	-
228	*Emberiza calandra*	NR/W/M	-

1.3.9.2.4 Akrotiri Peninsula - Episkopi Cliffs

Akrotiri Peninsula, together with Larnaca Salt Lake, is considered one of the most important wetlands for birds in Cyprus. Large parts of the wetlands were designated in 2003 as the Akrotiri Ramsar Site, for which they qualified due to the wintering populations of Greater Flamingo. In 2011, Akrotiri Wetlands and Akrotiri Cliffs were designated as Natura 2000 SPAs. The avifauna of the site includes at least 308 bird species. Among these, 28 are listed in Annex I of the EU Birds Directive (2009/147/EC) or are new additions to the Annex. Qulifying species for the SPA designation of Akrotiri Wetlands and Akrotiri Cliffs are the Demoiselle Crane (*Grus virgo*), Purple Heron (*Ardea purpurea*), Squacco Heron (*Ardeola ralloides*), Ferruginous Duck (*Aythya nyroca*), Little Stint (*Calidris minuta*), Kentish Plover (*Charadrius alexandrines*), Greater Sandplover (*Charadrius leschenaultia*), White-winged (Black) Tern (*Chlidonias leucopterus*), Western Marsh-harrier (*Circus aeruginosus*), Pallid Harrier (*Circus macrourus*), Saker Falcon (*Falco cherrug*), Eleonora‟s Falcon (*Falco eleonorae*), Peregrine Falcon (*Falco peregrinus*), Red-footed Falcon (*Falco vespertinus*), Collared Pratincole (*Glareola pratincola*), Common Crane (*Grus grus*), Black-winged Stilt (*Himantopus himantopus*), Slender-billed Gull (*Larus genei*), European Bee-eater (*Merops apiaster*), Great White Pelican (*Pelecanus onocrotalus*) and European Honey Buzzard (*Pernis apivorus*).

This site is of major importance as a staging area during spring and autumn passage for hundreds to thousands of waterbirds. Among these, Cyprus Wheatear (*Oenanthe cypriaca*), Cyprus Warbler (*Sylvia melanothorax*), Cyprus Coal Tit (*Parus ater cypriotes*), Cyprus Short-toed Treecreeper (*Certhia brachydactyla dorothea*), Woodlark (*Lullula arborea*) and Masked Shrike (*Lanius nubicus*). Non-qualifying breeders worth noting are Cyprus Scops Owl (*Otus scops cyprius*), Cyprus Jay (*Garrulus glandarius glaszneri*), Cretzschmar's Bunting (*Emberiza caesia*), European Nightjar (*Caprimulgus europaeus*), Bonelli's Eagle (*Aquila fasciata*), Goshawk (*Accipiter gentilis*), Crag Martin (*Ptyonoprogne rupestris*) and Blackbird (*Turdus merula*). The area is also important for raptor migration, with large numbers of the Red-footed Falcon (*Falco vespertinus*), European Honey Buzzard (*Pernis apivorus*), and Harriers (*Circus spp*.) using the site (Iezekiel et al. 2004).

Moreover, it is an important wintering site for many duck (Anas), Shelduck, and wader species, as well as the Greater Flamingo (Charalambidou et al. 2008, Kassinis et al. 2010). During spring and summer, Akrotiri and Episkopi sea cliffs are important breeding sites for the Eleonora's and Peregrine Falcons and the Mediterranean Shag, while Episkopi cliffs is the most important breeding site for the Griffon Vulture in Cyprus (Iezekiel et al. 2004). The area has been classified by BirdLife Cyprus as an 'Important Bird Area' according to the qualifying species shown in Table 1.28 (Iezekiel et al. 2004).

Table 1.28 Qualifying species for the classification of Akrotiri Peninsula IBA– Episkopi Cliffs (BirdLife International, 2019).

A/A	Scientific name	Season	Population estimate
1	*Francolinus francolinus*	breeding	50-249 breeding pairs
2	*Tadorna tadorna*	winter	400-1,200 individuals
3	*Aythya nyroca*	breeding	1-5 breeding pairs
4	*Phoenicopterus roseus*	winter	2,000-15,000 individuals
5	*Anthropoides virgo*	passage	200-800 individuals
6	*Grus grus*	passage	100-500 individuals
7	*Plegadis falcinellus*	passage	100-600 individuals
8	*Egretta garzetta*	passage	100-750 individuals
9	*Himantopus himantopus*	breeding	2-55 breeding pairs
10	*Charadrius alexandrinus*	passage	200-450 individuals
11	*Charadrius alexandrinus*	breeding	12-125 breeding pairs
12	*Numenius arquata*	winter	10-40 individuals
13	*Glareola pratincola*	passage	50-300 individuals
14	*Neophron percnopterus*	passage	2-7 individuals
15	*Gyps fulvus*	breeding	2-4 breeding pairs
16	*Circus macrourus*	passage	20-60 individuals
17	*Coracias garrulus*	passage	250-999 individuals
18	*Falco peregrinus*	breeding	4-5 breeding pairs
19	*Falco vespertinus*	passage	500-2,000 individuals
20	*Falco eleonorae*	breeding	50-70 breeding pairs
21	*Falco cherrug*	passage	5-20 individuals
22	*Sylvia melanothorax*	breeding	700-1,000 breeding pairs
23	A4iv *Species group - soaring birds/cranes*	passage	2,000-6,000 individuals
24	A4iii *Species group - waterbirds*	winter	6,000-22,000 individuals

1.3.9.2.5 Cape Aspro - Petra tou Romiou SPA

This site was designated as a Special Protected Area (SPA) in 2005 (CY5000005). It includes a terrestrial and a marine part. The highest point is 250 m above sea level and the lowest is at sea level, spanning 10 km of coastline. Along the coast there are gravelly beaches and steep, un-vegetated sea cliffs extending at 70 % of the coastline. The avifauna that can be observed in the area includes a total 102 species (Table 1.29). Among these, 23 are nesting in the area and 32 of them are listed in Annex I of the EU Birds Directive, and 64 are regularly occurring migratory species (Διαχειριστικό Σχέδιο ΖΕΠ «Ακρωτήριο Άσπρο – Πέτρα Του Ρωμιού», 2016).

The site is extremely important, as it is one of two nesting areas the Eleonora's Falcon (*Falco eleonorae*) on the island for (BirdLife Cyprus, 2016). The site is also used for nesting by the Peregrine Falcon (*Falco peregrinus*), the endemic Cyprus Warbler and Cyprus Wheatear as well as the Mediterranean Shag (*Phalacrocorax aristotelis desmarestii*). Another important aspect of this SPA is that it among the feeding areas for the threatened Griffon Vulture (*Gyps fulvus*), which nests about 10 km from the site. The area has been classified by BirdLife Cyprus as an 'Important Bird Area' based on the nesting of the above-mentioned qualifying species (Διαχειριστικό Σχέδιο ΖΕΠ «Ακρωτήριο Άσπρο – Πέτρα Του Ρωμιού», 2016).

Table 1.29 List of bird species documented at Cape Aspro – Petra tou Romiou SPA (Διαχειριστικό Σχέδιο ΖΕΠ «Ακρωτήριο Άσπρο – Πέτρα Του Ρωμιού», 2016). R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor.

A/A	Scientific name	Status	Listed in Annex I of EU Birds Directive + = Yes; - = No
1	*Phalacrocorax carbo*	W/M	-
2	*Phalacrocorax aristotelis desmarestii*	NR	+
3	*Pelecanus onocrotalus*	M	+
4	*Ardeola ralloides*	M	+
5	*Egretta garzetta*	W/M	+
6	*Ardea alba*	W/M	+
7	*Ardea cinerea*	W/M	-
8	*Ardea purpurea*	M	+
9	*Plegadis falcinellus*	M/W	+
10	*Platalea leucorodia*	M	+
11	*Pernis apivorus*	M	+
12	*Neophron percnopterus*	M	+
13	*Gyps fulvus*	E	+
14	*Circus aeruginosus*	W/M	+
15	*Circus cyaneus*	W/M	+
16	*Circus macrourus*	M	+
17	*Accipiter gentilis*	M	-
18	*Accipiter nisus*	W/M	-
19	*Buteo buteo*	W/M	-
20	*Buteo rufinus*	R/M	+
21	*Aquila fasciata*	M	+
22	*Falco tinnunculus*	NR/M	-
23	*Falco vespertinus*	M	+
24	*Falco eleonorae*	NM	+
25	*Falco cherrug*	M	+
26	*Falco peregrinus*	NR/W/M	+
27	*Alectoris chukar*	NR	-
28	*Grus grus*	W/M	+

29	*Himantopus himantopus*	M	+
30	*Burhinus oedicnemus*	NR/M	+
31	*Charadrius dubius*	M	-
32	*Charadrius alexandrinus*	M/W	+
33	*Numenius arquata*	W/M	-
34	*Arenaria interpres*	W/M	-
35	*Larus genei*	W/M	+
36	*Larus michahellis*	NR	-
37	*Columba livia*	NR	-
38	*Clamator glandarius*	NM/M	-
39	*Athene noctua*	NR	-
40	*Caprimulgus europaeus*	M	+
41	*Tachymarptis melba*	NM/M	-
42	*Alcedo atthis*	W/M	+
43	*Merops persicus*	M	-
44	*Merops apiaster*	M	-
45	*Coracias garrulus*	M	+
46	*Upupa epops*	M	-
47	*Jynx torquilla*	M	-
48	*Galerida cristata*	NR	-
49	*Lullula arborea*	W/M	+
50	*Hirundo rustica*	NM/M	-
51	*Cecropis daurica*	NM/M	-
52	*Delichon urbicum*	NM/M	-
53	*Anthus campestris*	M	+
54	*Anthus trivialis*	M	-
55	*Anthus pratensis*	W/M	-
56	*Motacilla alba*	W/M	-
57	*Erithacus rubecula*	W/M	-
58	*Luscinia megarhynchos*	M	-
59	*Phoenicurus ochruros*	W/M	-
60	*Phoenicurus phoenicurus*	M	-
61	*Saxicola torquatus*	X/M	-
62	*Saxicola rubetra*	M	-
63	*Oenanthe isabellina*	M	-
64	*Oenanthe oenanthe*	M	-
65	*Oenanthe cypriaca*	NM	+
66	*Oenanthe melanoleuca*	M	-
67	*Monticola solitarius*	W/M	-
68	*Turdus philomelos*	W/M	-
69	*Iduna pallida*	NM/M	-
70	*Sylvia conspicillata*	NR	-
71	*Sylvia melanocephala*	NR/W	-
72	*Sylvia melanothorax*	R+NM	+
73	*Sylvia rueppelli*	M	+
74	*Sylvia crassirostris*	M	-
75	*Sylvia curruca*	M	-
76	*Sylvia communis*	M	-
77	*Sylvia borin*	M	-
78	*Sylvia atricapilla*	W/M	-
79	*Phylloscopus collybita*	W/M	-
80	*Phylloscopus trochilus*	M	-
81	*Muscicapa striata*	M	-
82	*Ficedula hypoleuca*	M	-
83	*Parus major aphrodite*	NR	-

84	*Oriolus oriolus*	M	-
85	*Lanius collurio*	M	+
86	*Lanius minor*	M	+
87	*Lanius senator*	M	-
88	*Lanius nubicus*	M	+
89	*Pica pica*	NR	-
90	*Corvus monedula*	NR	-
91	*Corvus cornix*	NR	-
92	*Passer domesticus*	NR	-
93	*Corvus corax*	R	-
94	*Passer hispaniolensis*	NR/M	-
95	*Fringilla coelebs*	W/M	-
96	*Serinus serinus*	W/M	-
97	*Carduelis chloris*	NR/W/M	-
98	*Carduelis carduelis*	NR/W/M	-
99	*Carduelis cannabina*	NR/W/M	-
100	*Emberiza hortulana*	M	+
101	*Emberiza caesia*	M	+
102	*Emberiza melanocephala*	M	-

1.3.9.2.6 Kato Pafos Lighthouse

Kato Pafo Lighthouse SPA consists of Pafos Headland immediately to the west of Kato Pafos town, and Pafos castle and marina. About 95% of the site is a fenced-in area that is an archaeological site. This area is dominated by open grassland with remnant patches of scrub and planted species. Beyond and to the seaward side of the fenced-in archaeological area, and consisting 5% of the site, is a narrow coastal stretch with mostly rocky and some sandy shores. The avifauna of the site includes a total of 195 bird species, 27 of which breed in the area and 162 migratory species (Table 1.30). Out of those, 62 bird species are listed in Annex I of the EU Birds Directive (Διαχειριστικό Σχέδιο ΖΕΠ ««Φάρος Κάτω Πάφου», 2016).

Additionally, the site has been classified by BirdLife Cyprus as an 'Important Bird Area' as is considered among the three most important migration staging points and wintering sites in Cyprus for the Greater Sandplover (*Charadrius leschenaulti*) (Iezekiel et al., 2004, BirdLife Cyprus, 2016). In addition, the site hosts breeding populations of two endemic species of the island, the Cyprus Wheatear (*Oenathe cypriaca*) and the Cyprus Warbler (*Sylvia melanothorax*). The coastal strip is an important migration stop-over point for waders, such as the Wood Sandpiper (*Tringa glareola*), while the open grassland and low scrub on the headland is important for migrating passerines like the Tawny pipit (*Anthus campestris*).

Table 1.30 List of bird species documented at Kato Paphos Lighthouse SPA (Διαχειριστικό Σχέδιο ΖΕΠ ««Φάρος Κάτω Πάφου», 2016). Status abbreviations: R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor

A/A	Scientific name	Status	Listed in Annex I of EU Birds Directive: + = Yes; - = No
1	*Calonectris diomedea diomedea*	M	+
2	*Puffinus yelkouan*	M	+
3	*Tachybaptus ruficollis*	W/M	-
4	*Podiceps cristatus*	W/M	-
5	*Morus bassanus*	RV	-
6	*Phalacrocorax carbo*	W/M	-
7	*Phalacrocorax aristotelis desmarestii*	R	+
8	*Nycticorax nycticorax*	M	+
9	*Ardeola ralloides*	M	+
10	*Bubulcus ibis*	W/M	-
11	*Egretta garzetta*	W/M	+
12	*Ardea alba*	W/M	+
13	*Ardea cinerea*	W/M	-
14	*Ardea purpurea*	M	+
15	*Plegadis falcinellus*	M	+
16	*Platalea leucorodia*	M	+
17	*Phoenicopterus roseus*	M	+
18	*Anas crecca*	W/M	-
19	*Anas platyrhynchos*	W/M	-
20	*Anas acuta*	W/M	-
21	*Anas querquedula*	M	-
22	*Anas clypeata*	W/M	-
23	*Mergus serrator*	W	-
24	*Neophron percnopterus*	M	+
25	*Circus macrourus*	M	+
26	*Circus pygargus*	M	+
27	*Pernis apivorus*	M	+
28	*Circus aeruginosus*	W/M	+
29	*Circus cyaneus*	W/M	+
30	*Buteo buteo*	W/M	-
31	*Buteo rufinus*	M	+
32	*Accipiter nisus*	W/M	-
33	*Pandion haliaetus*	M	+
34	*Falco vespertinus*	M	+
35	*Falco peregrinus*	W/M	+
36	*Falco naumanni*	M	+
37	*Falco tinnunculus*	NR/M	-
38	*Falco subbuteo*	M	-
39	*Falco eleonorae*	M	+
40	*Falco cherrug*	M	+
41	*Alectoris chukar*	NR	-
42	*Francolinus francolinus*	NR	-
43	*Coturnix coturnix*	W/M	-
44	*Rallus aquaticus*	W/M	-
45	*Porzana parva*	W/M	+
46	*Grus grus*	W/M	+
47	*Grus virgo*	M	-
48	*Himantopus himantopus*	M	+
49	*Recurvirostra avosetta*	W/M	+

50	*Burhinus oedicnemus*	M	+
51	*Cursorius cursor*	M	+
52	*Glareola pratincola*	M	+
53	*Charadrius hiaticula*	W/M	-
54	*Charadrius alexandrinus*	M/W	+
55	*Charadrius leschenaultii*	W/M	-
56	*Charadrius dubius*	M	-
57	*Pluvialis apricaria*	W	+
58	*Pluvialis squatarola*	W/M	-
59	*Pluvialis fulva*	RV	-
60	*Vanellus spinosus*	W/M	+
61	*Vanellus vanellus*	W/M	-
62	*Calidris alpina*	W/M	-
63	*Calidris minuta*	W/M	-
64	*Philomachus pugnax*	W/M	+
65	*Numenius phaeopus*	W/M	-
66	*Numenius arquata*	W/M	-
67	*Tringa erythropus*	W/M	-
68	*Tringa totanus*	W/M	-
69	*Tringa ochropus*	W/M	-
70	*Tringa glareola*	M	+
71	*Actitis hypoleucos*	W/M	-
72	*Arenaria interpres*	W/M	-
73	*Stercorarius parasiticus*	RV	-
74	*Larus ichthyaetus*	W/M	-
75	*Hydrocoloeus minutus*	W/M	+
76	*Larus fuscus fuscus*	W/M	-
77	*Larus heuglini*	W/M	-
78	*Larus michahellis*	R	-
79	*Larus armenicus*	W/M	-
80	*Larus ridibundus*	W/M	-
81	*Larus genei*	W/M	+
82	*Larus audouinii*	W	+
83	*Larus cachinnans*	W/M	-
84	*Gelochelidon nilotica*	M	+
85	*Sterna sandvicensis*	W/M	+
86	*Sterna hirundo*	M	+
87	*Chlidonias hybrida*	M	+
88	*Streptopelia decaocto*	NR	-
89	*Columba palumbus*	NR/W	-
90	*Streptopelia decaocto*	NR	-
91	*Streptopelia turtur*	M	-
92	*Clamator glandarius*	NM/M	-
93	*Cuculus canorus*	M	-
94	*Apus apus*	M	-
95	*Apus pallidus*	M	-
96	*Tachymarptis melba*	M	-
97	*Halcyon smyrnensis*	RV	-
98	*Alcedo atthis*	W/M	+
99	*Coracias garrulus*	M	+
100	*Upupa epops*	M	-
101	*Merops apiaster*	M	-
102	*Jynx torquilla*	W/M	-
103	*Caprimulgus europaeus*	M	+
104	*Tyto alba*	NR	-
105	*Athene noctua*	NR	-
106	*Asio flammeus*	W/M	+
107	*Calandrella brachydactyla*	M	+

108	*Galerida cristata*	NR	-
109	*Lullula arborea*	W/M	+
110	*Alauda arvensis*	W/M	-
111	*Melanocorypha calandra*	W/M	+
112	*Hirundo rustica*	NM/M	-
113	*Cecropis daurica*	M	-
114	*Riparia riparia*	M	-
115	*Ptyonoprogne rupestris*	M	-
116	*Delichon urbicum*	NM/M	-
117	*Anthus campestris*	M	+
118	*Anthus pratensis*	W/M	-
119	*Anthus richardi*	M	-
120	*Anthus trivialis*	M	-
121	*Anthus cervinus*	W/M	-
122	*Anthus spinoletta*	W/M	-
123	*Motacilla alba*	W/M	-
124	*Motacilla flava*	M	-
125	*Motacilla flava flava*	M	-
126	*Motacilla flava thunbergi*	M	-
127	*Motacilla flava cinereocapilla*	M	-
128	*Motacilla flava feldegg*	M	-
129	*Motacilla citreola*	M	-
130	*Motacilla cinerea*	W/M	-
131	*Erithacus rubecula*	W/M	-
132	*Phoenicurus ochruros*	W/M	-
133	*Phoenicurus phoenicurus*	M	-
134	*Luscinia megarhynchos*	M	-
135	*Saxicola torquatus*	W/M	-
136	*Saxicola rubetra*	M	-
137	*Saxicola maurus*	M	-
138	*Saxicola maurus variegatus*	M	-
139	*Oenanthe isabellina*	M	-
140	*Oenanthe oenanthe*	M	-
141	*Oenanthe cypriaca*	NM	+
142	*Oenanthe deserti*	M	-
143	*Oenanthe monacha*	RV	-
144	*Oenanthe melanoleuca*	M	-
145	*Turdus merula*	W/M	-
146	*Turdus philomelos*	W/M	-
147	*Monticola solitarius*	W/M	-
148	*Acrocephalus schoenobaenus*	M	-
149	*Acrocephalus arundinaceus*	M	-
150	*Cettia cetti*	NR	-
151	*Cisticola juncidis*	NR	-
152	*Iduna pallida*	NM/M	-
153	*Sylvia conspicillata*	NR	-
154	*Sylvia cantillans*	M	-
155	*Sylvia melanocephala*	NR/W	-
156	*Sylvia melanothorax*	R+NM	+
157	*Sylvia rueppelli*	M	+
158	*Sylvia nana*	RV	-
159	*Sylvia crassirostris*	M	-
160	*Sylvia nisoria*	M	+
161	*Sylvia curruca*	M	-
162	*Sylvia communis*	M	-
163	*Sylvia borin*	M	-
164	*Sylvia atricapilla*	W/M	-
165	*Phylloscopus bonelli orientalis*	M	-

166	*Phylloscopus sibilatrix*	M	-
167	*Phylloscopus collybita*	W/M	-
168	*Phylloscopus trochilus*	M	-
169	*Muscicapa striata*	M	-
170	*Ficedula albicollis*	M	+
171	*Ficedula semitorquata*	M	+
172	*Ficedula hypoleuca*	M	-
173	*Parus major aphrodite*	NR	-
174	*Oriolus oriolus*	M	-
175	*Lanius collurio*	M	+
176	*Lanius minor*	M	+
177	*Lanius nubicus*	M	+
178	*Lanius senator*	M	-
179	*Pica pica*	NR	-
180	*Corvus monedula*	R	-
181	*Corvus cornix*	NR	-
182	*Sturnus vulgaris*	W/M	-
183	*Passer domesticus*	NR/M	-
184	*Passer hispaniolensis*	M	-
185	*Fringilla coelebs*	W/M	-
186	*Fringilla montifringilla*	W	-
187	*Serinus serinus*	W/M	-
188	*Carduelis chloris*	NR/W/M	-
189	*Carduelis carduelis*	NR/W/M	-
190	*Carduelis cannabina*	NR/W/M	-
191	*Emberiza hortulana*	M	+
192	*Emberiza caesia*	M	+
193	*Emberiza melanocephala*	M	-
194	*Emberiza calandra*	NR/W/M	-
195	*Emberiza melanocephala*	M	-

1.3.9.2.7 Akamas Peninsula

Akamas Peninsula constitutes the westernmost edge of Cyprus, with a total area of 18082 ha and it has a great ecological value based on both the landscape as well as the biodiversity it holds. Furthermore, it is one of the most important areas for migratory birds (Flint and Stewart 1992, Iezekiel et al. 2004). The area is included in the Natura 2000 network (CY4000010) since 2012. A total of 197 bird species have been recorded in the area, out of which 105 are migratory species.

Among the total of 197 bird species, 69 are listed in Annex I of EU Birds Directive and are observed mainly during spring and autumn migration (Table 1.31). These are species like the Osprey (*Pandion haliaeus*) and the Ortolan Bunting (*Emberiza hortulana*). In addition, 45 bird species are nesting in the Akamas Peninsularof which 13 are listed in Annex I of EU Birds Directive, most notable being the Black Francolin (*Francolinus francolinus*) and the endemic sub-species Cyprus Scops Owl (*Otus scops cyprius*). Here it is worth noting that the nearly extinct (nationally) Griffon Vulture (*Gyps fulvus*) used to breed in the area in the 1990s (Διαχειριστικό Σχέδιο ΖΕΠ «Χερσόνησος Ακάμα», 2016).

The north tip of Akamas (offshore) is the gathering point for a large number of raptors and egrets during autumn migration and may well be one of the best areas on the island where most of the heron and egret species of Cyprus can be seen (Gordon, 2004; Richardson, 2005; 2006; 2007; 2008; 2009). As a result, Akamas Peninsula has been classified by BirdLife Cyprus as an ‘Important Bird Area’ according to the qualifying species shown in Table 1.30 (Iezekiel et al. 2004).

Table 1.31 List of bird species documented at Akamas Peninsula (Διαχειριστικό Σχέδιο ΖΕΠ «Χερσόνησος Ακάμα», 2016). Status abbreviations: R – Resident; NR – Nest, Resident; M – Migratory incident; NM – Nest, Migratory; W – Winter visitor; RV – Random Visitor

A/A	***Scientific name***	***Status***	***Listed in AnneW I of EU Birds Directive + = Yes; - = No***
1	*Podiceps cristatus*	X	-
2	*Calonectris diomedea diomedea*	M	+
3	*Puffinus yelkouan*	M	+
4	*PhalacrocoraW carbo*	W/M	-
5	*PhalacrocoraW aristotelis desmarestii*	NR	+
6	*Pelecanus onocrotalus*	M	+
7	*IWobrychus minutus*	M	+
8	*NycticoraW nycticoraW*	M	+
9	*Ardeola ralloides*	M	+
10	*Bubulcus ibis*	M	-
11	*Egretta garzetta*	M	+
12	*Ardea alba*	M	+
13	*Ardea cinerea*	M	-
14	*Ardea purpurea*	M	+
15	*Ciconia nigra*	M	+
16	*Ciconia ciconia*	M	+
17	*Plegadis falcinellus*	M	+
18	*Platalea leucorodia*	M	+
19	*Anas crecca*	M	-
20	*Anas platyrhynchos*	M	-
21	*Anas querquedula*	M	-
22	*Aythya ferina*	M	-
23	*Pernis apivorus*	M	+
24	*Milvus migrans*	M	+
25	*Gyps fulvus*	RV	+
26	*Circus aeruginosus*	W/M	+
27	*Circus cyaneus*	W/M	+
28	*Circus macrourus*	M	+
29	*Circus pygargus*	M	+
30	*Accipiter gentilis*	M	-
31	*Accipiter nisus*	W/M	-
32	*Buteo buteo*	W/M	-
33	*Buteo rufinus*	NR/M	+
34	*Aquila pennata*	M	+
35	*Aquila fasciata*	NR/M	+
36	*Pandion haliaetus*	M	+
37	*Falco naumanni*	M	+
38	*Falco tinnunculus*	NR/M	-
39	*Falco vespertinus*	M	+
40	*Falco subbuteo*	M	-
41	*Falco eleonorae*	M	+
42	*Falco cherrug*	M	+
43	*Falco peregrinus*	NR/W/M	+
44	*Alectoris chukar*	NR	-
45	*Francolinus francolinus*	NR	-
46	*Coturnix coturnix*	NR/W/M	-
47	*Rallus aquaticus*	M	-
48	*Porzana porzana*	M	+

49	*Porzana parva*	M	+
50	*Porzana pusilla*	M	+
51	*Crex crex*	M	+
52	*Gallinula chloropus*	M	-
53	*Grus grus*	M	+
54	*Grus virgo*	M	-
55	*Haematopus ostralegus*	M	-
56	*Himantopus himantopus*	M	+
57	*Recurvirostra avosetta*	M	+
58	*Burhinus oedicnemus*	NR/M	+
59	*Cursorius cursor*	M	+
60	*Glareola pratincola*	M	+
61	*Charadrius dubius*	M	-
62	*Charadrius hiaticula*	M	-
63	*Charadrius alexandrinus*	M	+
64	*Charadrius leschenaultii*	W/M	-
65	*Pluvialis apricaria*	W	+
66	*Vanellus spinosus*	M	+
67	*Vanellus vanellus*	M	-
68	*Calidris minuta*	M	-
69	*Philomachus pugnax*	M	+
70	*Gallinago gallinago*	M	-
71	*Limosa limosa*	M	-
72	*Numenius phaeopus*	M	-
73	*Numenius arquata*	M	-
74	*Tringa totanus*	M	-
75	*Tringa stagnatilis*	M	-
76	*Tringa nebularia*	M	-
77	*Tringa ochropus*	M	-
78	*Tringa glareola*	M	+
79	*Actitis hypoleucos*	W/M	-
80	*Arenaria interpres*	W/M	-
81	*Hydrocoloeus minutus*	M	+
82	*Larus ridibundus*	M	-
83	*Larus genei*	M	+
84	*Larus audouinii*	W	+
85	*Larus canus*	W	-
86	*Larus fuscus fuscus*	M	-
87	*Larus heuglini*	M	-
88	*Larus michahellis*	NR	-
89	*Larus cachinnans*	M	-
90	*Sterna sandvicensis*	M	+
91	*Chlidonias leucopterus*	M	-
92	*Columba livia*	NR	-
93	*Columba palumbus*	NR/W	-
94	*Streptopelia decaocto*	NR	-
95	*Streptopelia turtur*	NM/M	-
96	*Clamator glandarius*	NM/M	-
97	*Cuculus canorus*	M	-
98	*Tyto alba*	NR	-
99	*Otus scops cyprius*	NR/M	-
100	*Athene noctua*	NR	-
101	*Asio otus*	NR	-
102	*Caprimulgus europaeus*	NM/M	+
103	*Apus apus*	NM/M	-
104	*Tachymarptis melba*	NM/M	-
105	*Alcedo atthis*	W/M	+
106	*Merops apiaster*	NM/M	-

107	*Coracias garrulus*	NM/M	+
108	*Upupa epops*	NM/M	-
109	*Jynx torquilla*	W/M	-
110	*Melanocorypha calandra*	W/M	+
111	*Calandrella brachydactyla*	M	+
112	*Galerida cristata*	NR	-
113	*Lullula arborea*	W/M	+
114	*Alauda arvensis*	W/M	-
115	*Riparia riparia*	M	-
116	*Ptyonoprogne rupestris*	M	-
117	*Hirundo rustica*	NM/M	-
118	*Cecropis daurica*	NM/M	-
119	*Delichon urbicum*	NM/M	-
120	*Anthus campestris*	M	+
121	*Anthus trivialis*	M	-
122	*Anthus pratensis*	W/M	-
123	*Anthus cervinus*	W/M	-
124	*Motacilla flava*	M	-
125	*Motacilla flava flava*	M	-
126	*Motacilla flava feldegg*	M	-
127	*Motacilla cinerea*	W/M	-
128	*Motacilla alba*	W/M	-
129	*Troglodytes troglodytes*	NR	-
130	*Erithacus rubecula*	W/M	-
131	*Luscinia luscinia*	M	-
132	*Luscinia megarhynchos*	NM/M	-
133	*Phoenicurus ochruros*	W/M	-
134	*Phoenicurus phoenicurus*	M	-
135	*Saxicola torquatus*	W	-
136	*Saxicola rubetra*	M	-
137	*Oenanthe isabellina*	M	-
138	*Oenanthe oenanthe*	M	-
139	*Oenanthe cypriaca*	NM	+
140	*Oenanthe melanoleuca*	M	-
141	*Oenanthe deserti*	M	-
142	*Oenanthe finschii*	W/M	-
143	*Monticola solitarius*	NR/W/M	-
144	*Turdus merula*	W/M	-
145	*Turdus philomelos*	W/M	-
146	*Cettia cetti*	NR	-
147	*Cisticola juncidis*	NR	-
148	*Locustella luscinioides*	M	-
149	*Acrocephalus schoenobaenus*	M	-
150	*Acrocephalus scirpaceus*	M	-
151	*Acrocephalus arundinaceus*	M	-
152	*Iduna pallida*	NM/M	-
153	*Hippolais icterina*	M	-
154	*Sylvia conspicillata*	NR	-
155	*Sylvia cantillans*	M	-
156	*Sylvia melanocephala*	NR/W	-
157	*Sylvia melanothorax*	R+NM	+
158	*Sylvia rueppelli*	M	+
159	*Sylvia crassirostris*	M	-
160	*Sylvia nisoria*	M	+
161	*Sylvia curruca*	M	-
162	*Sylvia communis*	M	-
163	*Sylvia borin*	M	-

164	*Sylvia atricapilla*	W/M	-
165	*Phylloscopus bonelli orientalis*	M	-
166	*Phylloscopus sibilatrix*	M	-
167	*Phylloscopus collybita*	W/M	-
168	*Phylloscopus trochilus*	M	-
169	*Muscicapa striata*	NM/M	-
170	*Ficedula semitorquata*	M	+
171	*Ficedula albicollis*	M	+
172	*Ficedula hypoleuca*	M	-
173	*Parus ater cypriotes*	NR	+
174	*Parus major aphrodite*	NR	-
175	*Oriolus oriolus*	NM/M	-
176	*Lanius collurio*	NM	+
177	*Lanius minor*	M	+
178	*Lanius senator*	NM/M	-
179	*Lanius nubicus*	NM/M	+
180	*Pica pica*	NR	-
181	*Corvus monedula*	NR	-
182	*Corvus cornix*	NR	-
183	*Passer domesticus*	NR/M	-
184	*Passer hispaniolensis*	NR/M	-
185	*Fringilla coelebs*	W/M	-
186	*Serinus serinus*	NR/W/M	-
187	*Carduelis chloris*	NR/W/M	-
188	*Carduelis carduelis*	NR/W/M	-
189	*Carduelis spinus*	W	-
190	*Carduelis cannabina*	NR/W/M	-
191	*Carpodacus erythrinus*	RV	-
192	*Coccothraustes coccothraustes*	W	-
193	*Emberiza cineracea*	M	+
194	*Emberiza hortulana*	M	+
195	*Emberiza caesia*	NM/M	+
196	*Emberiza melanocephala*	NM	-
197	*Emberiza calandra*	NR/W/M	-

Table 1.32 Qualifying species for the classification of Akamas Peninsula as an Important Bird Area (Important IBA of Cyprus book BirdLife 2014; Διαχειριστικό Σχέδιο ΖΕΠ «Χερσόνησος Ακάμα», 2016).

Common name	Scientific name	Estimated Population	Status
Chukar Partridge	*Alectoris chukar*	1500-3,000 pairs	Resident breeder
Bonelli's Eagle	*Aquila fasciata*	1-3 pairs	Resident breeder
Little Owl	*Athene noctua*	400-700 pairs	Resident breeder
European Nightjar	*Caprimulgus europaeus*	150-250 pairs	Resident breeder
European Roller	*Coracias garrulus*	80-300 pairs	Migrant breeder
Little Egret	*Egretta garzetta*	500-1,000	Passage migrant
Cretzschmar's bunting	*Emberiza caesia*	400-1,000 pairs	Resident breeder
Black-headed Bunting	*Emberiza melanocephala*	400-900 pairs	Resident breeder
Peregrine Falcon	*Falco peregrinus*	6-8 pairs	Resident breeder
Black Francolin	*Francolinus francolinus*	250-1,000 pairs	Resident breeder
Demoiselle Crane	*Grus virgo*	100-500	Passage migrant
Masked Shrike	*Lanius nubicus*	100-200 pairs	Resident breeder
Cyprus Wheatear	*Oeanthe cypriaca*	1000-1,500 pairs	Resident breeder
Cyprus Scops Owl	*Otus scops cyprius*	300-700 pairs	Resident breeder
Glossy Ibis	*Plegadis falcinellus*	300-1,000	Passage migrant
Cyprus warbler	*Sylvia melanothorax*	500-1,000 pairs	Resident breeder

Raptor Bottleneck	*Various raptor species (ie. Falco tinnuculus and Pernis apivorus)*	3000-4,000	Passage migrants (10 species)

1.3.9.3 Future trends

Overall, there is sufficient data to define the distribution ranges of most species on the island. Some of the data is sufficient for the calculation of trends in some bird populations, e.g., data collected at wetland areas, and for two coastal species (Eleonora's Falcon, Griffon Vulture). However, few published records or studies exist presenting population sizes and trends.

While it is not possible to calculate future trends for the majority of bird populations, it is well known that many species, e.g. the Great White Pelican, Greater Flamingo and Eleonora's Falcon, are vulnerable to human disturbance. These species do not readily tolerate human proximity and favour areas guarded against disturbance by natural barriers, such as extensive reedbeds and water, or steep inaccessible cliffs. The Great White Pelican and Greater Flamingo are also intolerant of low-flying aircrafts and are known to collide with power lines and fences (Iezekiel et al. 2004). Flamingos collided with commercial aircraft at Larnaca airport after its expansion in 2008 and 2009.

Future building and tourism development in terrestrial coastal areas, which are already extensive in and around some of the SPAs, will pose a serious threat to the sites' integrity and will lead to further loss of habitat and increased disturbance to birds if they are unregulated. Domestic pets such as dogs and cats pose a serious predation risk for birds. In particular, potential wind farms, golf courses and marinas will pose unrecoverable negative impact as the site's quality and characteristics will be affected (LIFE 1998, Iezekiel et al. 2004). Moreover, some species are also threatened by illegal hunting, such as the Eleonora's Falcon, and bird trapping with lime-sticks and nets at Cape Greco (BirdLife Cyprus 2003, 2004, 2005, 2006, 2007, 2008, 2009).

Some issues also relate to particular species. The use of sandy beaches in areas frequented by the Greater Sandplover, for example, is not an issue when human activities take place in summer. A serious disturbance risk is posed by the uncontrolled use of the area by walkers in autumn, winter and spring, which is when the birds are present in the area, especially as many have dogs with them (Iezekiel et al. 2004). Another example is the Mediterranean Shag, which is generally threatened by competition with the Great Cormorant (Phalacrocorax carbo), which is larger, more numerous and widely distributed. It is also often mistaken for this particular species and accidentally persecuted, since the Great Cormorant is considered as a pest for fishing, particularly near fish farms (LIFE 1998, Iezekiel et al. 2004).

2 Pressures and impacts

2.1 Physical disturbance

During the Initial Assessment of the marine environment of Cyprus (DFMR 2012), an analysis of the coastal zone of Cyprus was conducted to quantify the length of the coastline and area of coastal waters affected by infrastructure. The coastal zone was divided into 12 littoral cells (Figure 2.1) and length and area of inventoried infrastructure were quantified within each cell. For the purposes of the second assessment, the inventory was updated and is shown in Table 2.1. It is estimated that 11 % of the coastline length and 8 % of a coastal zone (0-100 m) within these 12 littoral cells is affected by infrastructure.

Figure 2.1 The boundaries of the 12 littoral cells used in the estimation of pressures in coastal areas.

Table 2.1 Quantitative estimates of physical pressures as estimates of impacted coastal length and area with present infrastructure.

Coastal littoral cell	**Infrastructure types**	**Length (m)**	**Area (m^2)**
1 Tilliria	Offshore-detached breakwaters (4)	550	55000
	Groynes (5)	250	375
	Fishing shelters (2)	530	27000
2 Chrysochou Bay	Offshore detached breakwaters (11)	2000	167200
	Fishing shelters (1)	660	61500
	Revetment	200	2000
3 Akamas	Fishing shelters (1)	200	17500
4 Pafos North	Offshore detached breakwaters (7)	700	12600
	Fishing shelters (1)	190	10350
5 Pafos South	Offshore detached breakwaters (10)	1330	22100
	Groynes (8)	400	600
	Coastal walls	1500	-
	Harbour (1)	700	51600
6 Episkopi Bay	Fishing shelter (1)	130	3000
7 Cape Gata	None	-	-
8 Limassol	Offshore detached breakwaters (70)	7000	12600
	Groynes (31)	1550	2325
	Marinas (2)	2448	279050
	Harbour (1)	3760	1053400
	Fishing shelters (3)	970	51350
9 Zygi-Kiti	Groynes (4)	400	600
	Offshore detached breakwaters (17)	1700	30600
	Fishing shelters (2)	680	9750
	Other shelters (4)	2520	218600
	Marina (1)	760	47300
10 Larnaka	Groynes (19)	950	1425
	Offshore detached breakwaters (24)	2400	43200
	Harbor (1)	1810	235000
	Marina (1)	650	102900
	Shelters (5)	1100	43700
11 Dekelia-Ayia Napa	Shelters (2)	600	16250
	Marina	600	210000
12 Protaras	Offshore detached breakwaters (5)	500	9000
	Shelters (2)	340	12450

Total covered by infrastructure	40.1 km	2.8 km^2
Total investigation region length and area (0-100 m from shore	36.33 km	36.23 km^2
Fraction affected by infrastructure	11.1 %	7.8 %

2.2 Hazardous substances

Data collected by the DFMR was analyzed using the approach outlined during the Initial Assessment (DFMR 2012; Argyrou et al. 2012) to document the presence and magnitude of metal concentrations in components of the marine system. Water column (Figure 2.2), sedimentary (Figure 2.3) and fish tissue (Figure 2.4) metal concentrations for the time period since the Initial Assessment do not change the state of this criterion. Data from additional analyses not yet digitized will be included in the next draft.

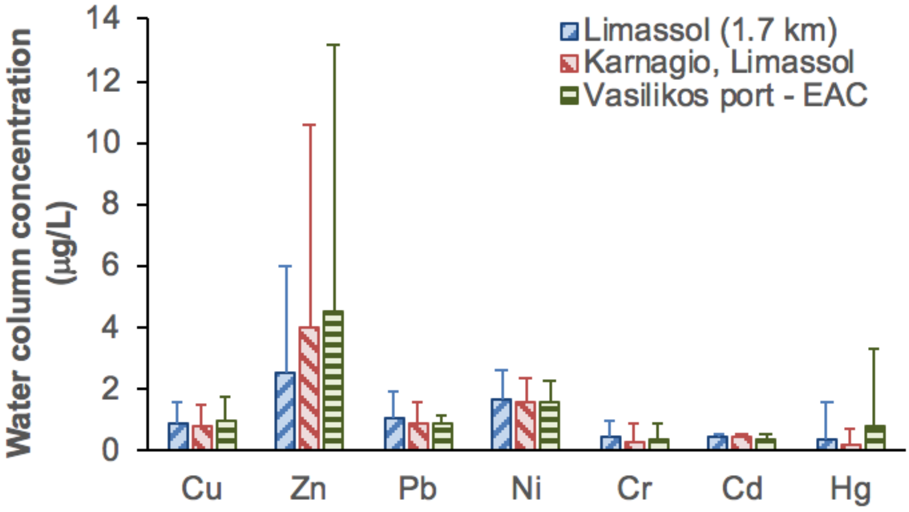


Figure 2.2 Average water column metal concentrations at selected sites during the years 2011-2017. Error bars represent one standard deviation.

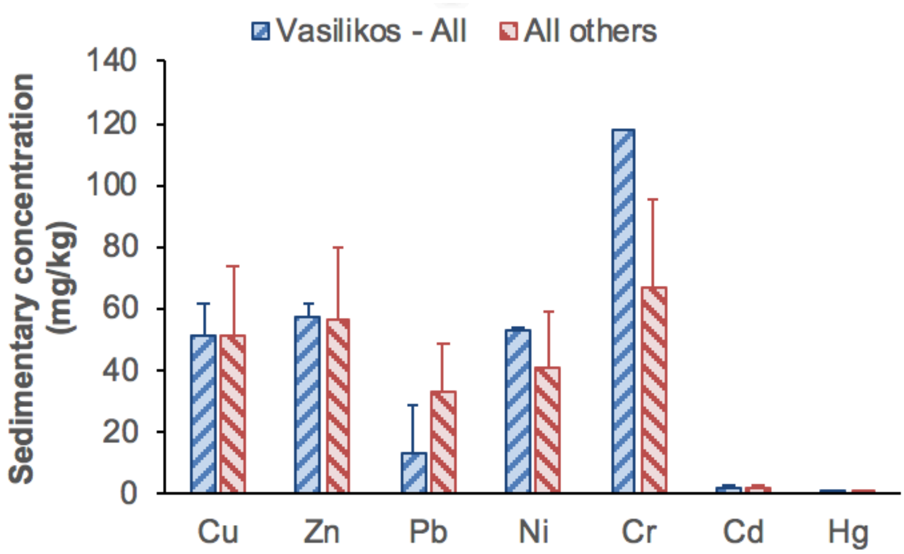


Figure 2.3 Average sedimentary metal concentrations at selected sites during the years 2013-2016. Error bars represent one standard deviation.

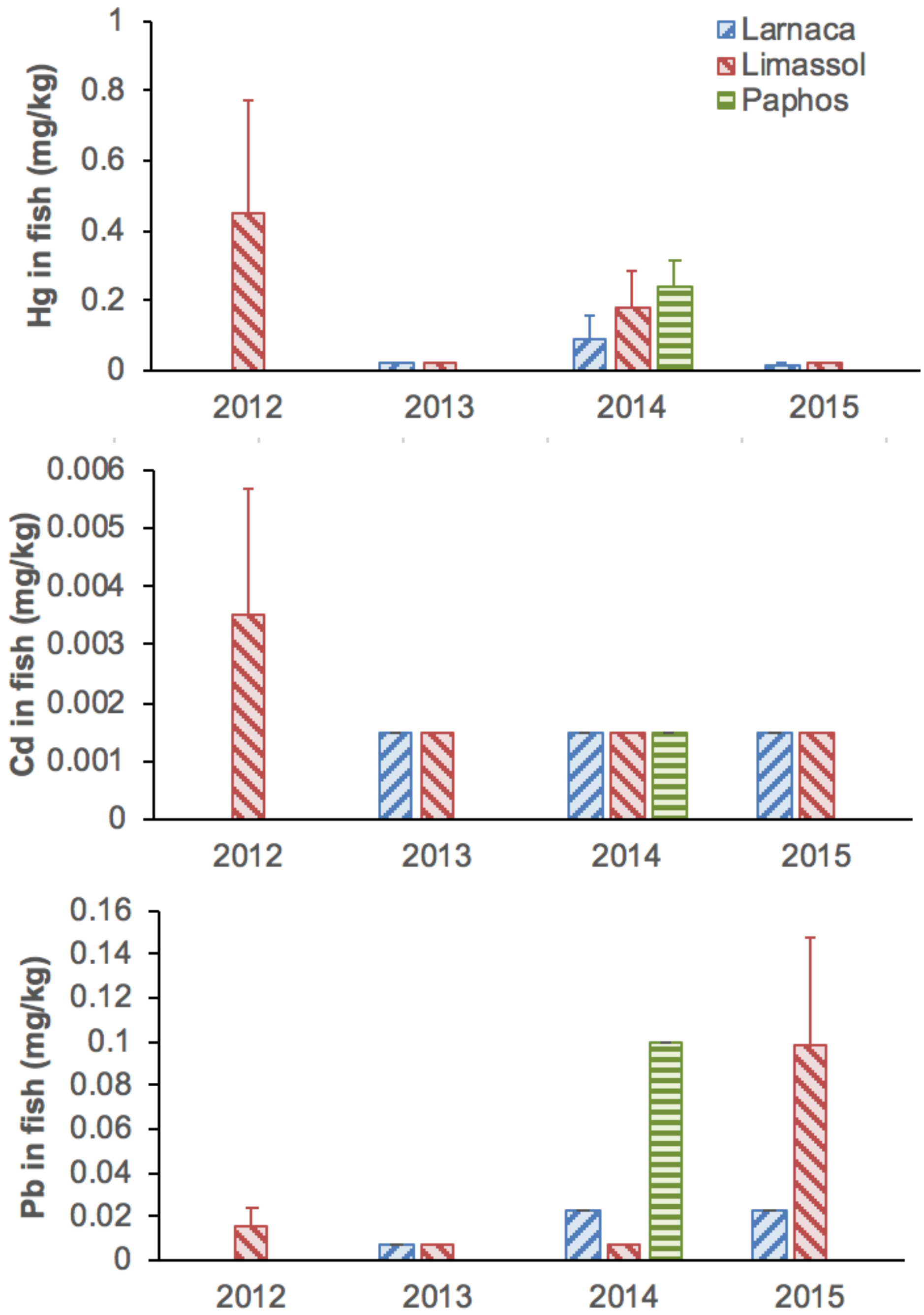


Figure 2.4 Mercury, cadmium and lead in Mullus sp. tissue in three regions. Error bars represent one standard deviation.

2.3 Nutrient and organic matter enrichment

Nutrient levels recorded in non-reference stations since the Initial Assessment (Figure 2.5) indicate that nutrient enrichment is rather transient and difficult to capture. Analysis of inputs is being conducted using the approach in the Initial Assessment (DFMR 2012), but preliminary results indicate that the status of nutrient and organic matter inputs hasn't changed since the Initial Assessment.

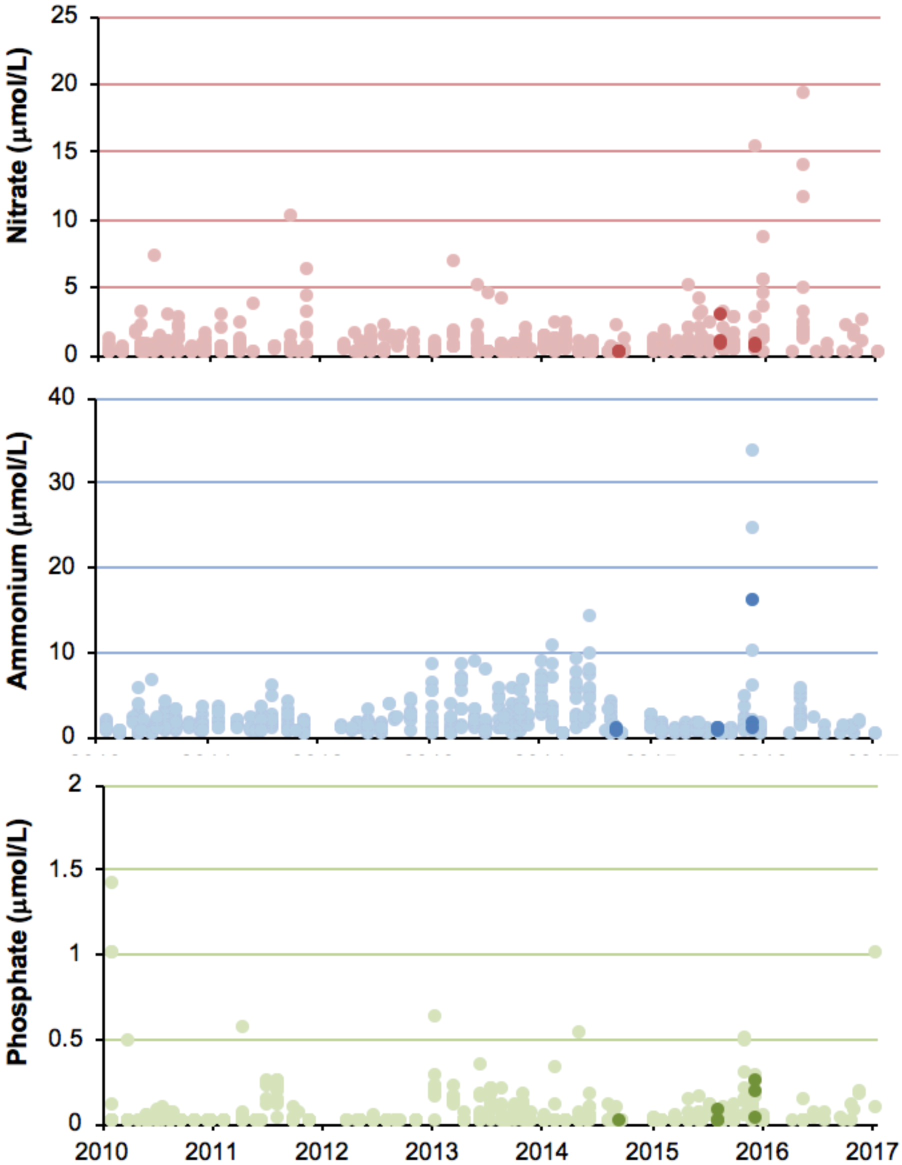


Figure 2.5 Nitrate, ammonium and orthophosphate concentrations of coastal waters of Cyprus, as recorded at various stations during the compliance monitoring programmes of the Department of Fisheries and Marine Research in years 2010-2017 (DFMR 2019). Dark symbols indicate reference station data.

2.4 Biological disturbance

2.1 Introduction – NIS in the Mediterranean Sea

Biological invasions are among the most important drivers of native biodiversity loss in marine ecosystems, severely challenging the conservation of biodiversity and natural resources (Katsanevakis et al. 2014; Gallardo et al., 2016). **Non-indigenous species (NIS)** (also known as alien, exotic, introduced, allochthonous, or non-native species) are any taxa crossing biogeographic barriers that were introduced outside their natural past or present distribution by human agency, including any part, gamete seeds, eggs, or propagules that might survive and subsequently reproduce (Essl et al., 2018). **Invasive** alien species (IAS) are those NIS whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services (EU Regulation 1143/2014). In marine ecosystems, NIS may become invasive and substantially change community structure, cause the loss of native genotypes, modify habitats, affect food web properties and ecosystem processes, impede the provision of ecosystem services, impact human health, and cause substantial economic losses (Perrings 2002; Molnar et al. 2008; Vilà et al. 2010; Katsanevakis et al. 2014). This is done through a range of mechanisms such as competition, predation, overgrazing, algal blooms, release of toxins, hybridization, disease transmission, habitat modification, and ecosystem engineering (Katsanevakis et al. 2014).

The Mediterranean Sea is considered as a hotspot of biological invasions. The inventory by Zenetos et al. (2010), later updated by Zenetos et al. (2012), reported a total of 986 alien and cryptogenic species in the Mediterranean. It included both multicellular and unicellular species, and also species flagged as questionable or cryptogenic. The Galil (2012) inventory, later updated by Galil et al. (2018), included 726 multicellular alien species in the Mediterranean Sea of which 614 were considered as established; it did not include cryptogenic species. Recently, Zenetos et al. (2017) made a critical evaluation of all previous reviews and reported a total of 821 multicellular alien species in the Mediterranean of which 613 were assessed as established. In terms of alien species richness, the dominant group is Mollusca, followed by Crustacea, Polychaeta, Macrophyta, and Pisces (Figure. 25).

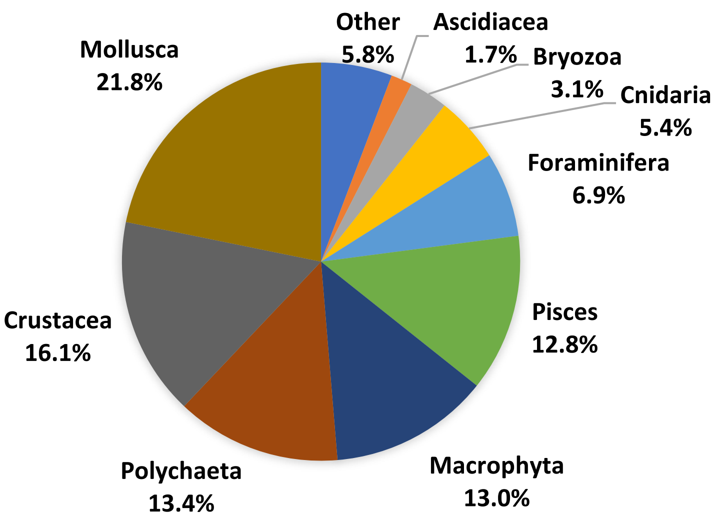


Figure 6 Classification of the Mediterranean NIS. Modified from Zenetos et al. (2012)

The main **pathways** of introduction of alien species in the Mediterranean Sea are the Suez Canal (53.9% of species), shipping through ballast waters and hull fouling (44.9% of species), aquaculture (11.6% of species), and aquarium trade (2.0% of species) (Zenetos et al. 2012). The Suez Canal is the most important pathway in the Mediterranean Sea, contrary to the case in Europe (Katsanevakis et al. 2013) and globally (Molnar et al. 2008), where shipping is the most important pathway, with canals ranking second and third respectively (Figure. 26). More NIS are expected to invade the Mediterranean Sea through the Suez Canal, as it has been continuously enlarged and the barriers for the invasion of Red Sea species have been substantially decreased (Katsanevakis et al. 2013; Galil et al. 2015). The observed increasing trend in new introductions by shipping is expected to halt due to the recent ratification of IMO's (International Maritime Organisation) "International Convention for the Control and Management of Ships' Ballast Water and Sediments" (BWM Convention). Nevertheless, introductions by hull-fouling, which was identified as the most common vector for marine alien species so far introduced in European seas (Katsanevakis et al. 2013), will remain or even increase due to the recent adoption of the IMO Anti-fouling Convention in 2004 and the banning of the most effective (i.e. most toxic) of the anti-fouling hull coatings.

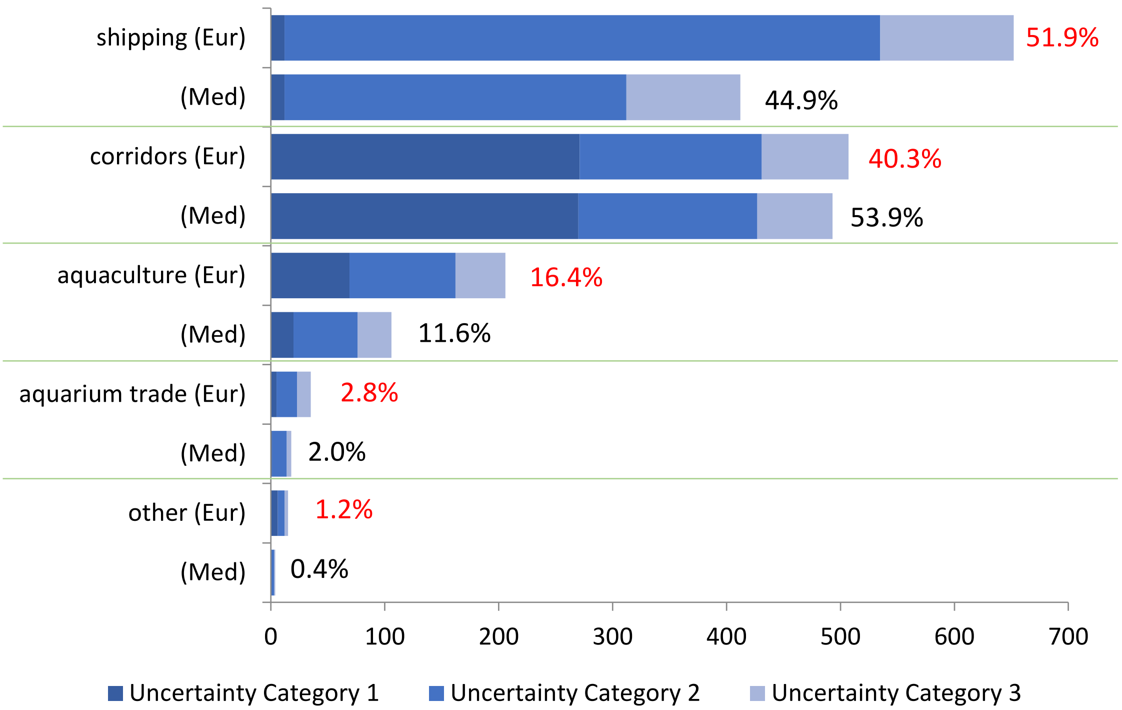


Figure 7 Number of marine alien species known or likely to have been introduced by each of the main pathways, in Europe (Eur) and the Mediterranean (Med). Percentages add to more than 100% as some species are linked to more than one pathway (red percentages refer to the European total, while black percentages to the Mediterranean total). Uncertainty categories: (1) there is direct evidence of a pathway/vector; (2) a most likely pathway/vector can be inferred; (3) one or more possible pathways/vectors can be inferred; (4) unknown (not shown in the graph). Source: Katsanevakis 2017 (modified from Katsanevakis et al. 2013, Zenetos et al. 2012, and Katsanevakis and Crocetta 2014).

2.2 NIS in Cyprus

The first inventory of the NIS of Cyprus was published in 2009 (Katsanevakis et al. 2009). It included 126 alien or cryptogenic marine alien species, of which 42 mollusks, 28 fish, 19 polychaetes, 15 phytobenthic species, 12 crustaceans, and 10 species from other taxa. Most of these species (101) had an Indo-Pacific or Indian Ocean origin and their dominant mode of introduction was the Suez Canal. Among the 126 species, 117 were classified as NIS (80 established) and 9 as cryptogenic.

Since that first inventory, many more species have been recorded (e.g. Iglésias and Frotté 2015; Crocetta et al. 2015; Lipej et al. 2017; http://www.ris-ky.eu/cydas). The current inventory of marine NIS of Cyprus (A. Zenetos, pers. comm.) includes 179 species in total, of which 167 NIS and 12 cryptogenic species (Table 2.2). The classification by Phylum of the NIS and cryptogenic species of Cyprus, based on the latest inventory, includes 54 Mollusca, 47 Chordata (of which 41 Pisces and 6 Ascidiacea), 22 Arthropoda, 19 Annelida, 10 Rhodophyta, 5 Chlorophyta, 5 Echinodermata, 5 Bryozoa, 4 Foraminifera, 3 Cnidaria, and of one in each of the following Phyla: Ctenophora, Ochrophyta, Porifera, Sipuncula, Tracheophyta (Figure. 27).

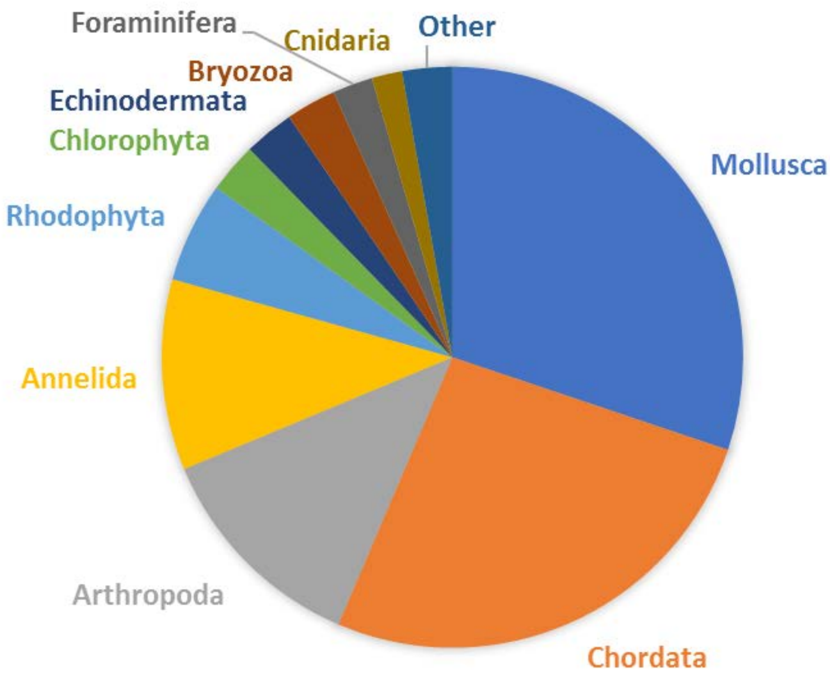


Figure 8 Classification of the non-indigenous and cryptogenic species of Cyprus by Phylum.

Among the 179 NIS and cryptogenic species of Cyprus, six are documented as being invasive (based on the classification by EASIN, Katsanevakis et al. 2014, and the specificities of their populations in Cyprus). These are: *Caulerpa cylindracea*, *Fistularia commersonii, Lagocephalus sceleratus, Pterois miles, Siganus luridus,* and *Siganus rivulatus*.

Caulerpa cylindracea**:** The alga develops on various types of substrata, both soft and hard bottom, both in polluted and unpolluted areas, down to 60 m depth in Cyprus (Argyrou et al. 1999a, Argyrou and Hadjichristophorou 2000). Furthermore, it has colonized "empty niches" where there is no surface algal or other growth in deep and shallow waters. The low nutrient environment of deeper, stable substrate environments around Cyprus appears to be available to colonization by *C. cylindracea*. Although dedicated studies on the impact of the species in Cyprus have not been conducted, there is a multitude of relevant studies elsewhere in the Mediterranean. The species may form compact multilayered mats up to 15 cm thick that trap sediment; an anoxic layer may develop underneath (Piazzi et al. 2007; Klein and Verlaque 2008). Its stolons can quickly elongate and easily overgrow other macroalgal (Piazzi et al. 2001, 2005; Piazzi and Ceccherelli 2006) or invertebrate species (Kružić et al. 2008; Baldacconi and Corriero 2009; Žuljević et al. 2010) causing their elimination. Important changes in the biocommunities of the invaded areas have been reported (see Katsanevakis et al. 2014 and references therein).

Fistularia commersonii: It is a high-order carnivore preying on native commercially important fish, such as *Spicara smaris*, *Boops boops*, and *Mullus* spp. (Kalogirou et al. 2007; Bariche et al. 2009). Although this species has not been specifically studied in Cyprus, it has become highly abundant in artisanal catches. There are concerns of possible impacts on the structure and population dynamics of native communities (Kalogirou et al. 2007). *F. commersonii* is of minor commercial importance; however, it is increasingly acquiring economic significance in eastern Mediterranean local markets, as it has white, palatable flesh and no spines (Otero et al. 2013).

Lagocephalus sceleratus: It has become abundant and well-established in Cyprus and the entire Levantine basin (Katsanevakis et al. 2009; Kalogirou 2011). It is caught as by-catch mainly on set trammel nets, gillnets and longlines and is known to cause considerable damage to the gear and the catch of fishermen, who have to alter their fishing practices (gear, depths, time of the day, etc.) in order to avoid the species (Katsanevakis et al. 2009). It has been considered an economical pest by fishermen in three ways: deterring customers from buying fish; introducing additional work to discard toxic fish; and reducing local stocks of commercial squids and octopus through predation (Kalogirou 2011; 2013). It is a host of alien and some indigenous parasites, with low host specificity, facilitating their establishment and spread to other species (Bakopoulos et al, 2017). In Cyprus, most catches occur at depths <50 m, which is an important zone for the coastal fisheries. *L. sceleratus* presents a potential risk to humans, since it contains tetrodotoxin, which may cause poisoning and even death (Bentur et al. 2008; Eisenman et al. 2008; Katikou et al. 2009). Since its arrival in the Mediterranean Sea, it has caused numerous hospitalizations after human consumption, including a number of fatal intoxications (Souissi et al. 2014).

Pterois miles: *Pterois miles* was not present in Cyprus during the previous reporting period. It was first recorded in Cyprus in 2012 and has rapidly become invasive (Kletou et al. 2016). Lionfish are very effective ambush predators and significantly affect the environment they inhabit, considered as among the most invasive fish worldwide. As a mesopredator, lionfish has the potential to predate on small native fish and invertebrate species and compete with the native mesopredators. The impacts of lionfish in the western Atlantic were associated to habitat modification (Lesser and Slattery 2011) and substantial declines in native biodiversity (Albins and Hixon 2008; Green et al. 2012; Ballew et al. 2016). They are characterized as generalist predators as they have been found to consume a large range of species, reducing the abundance and recruitment of native fish (Albins and Hixon 2008) and outcompeting native predators (Albins 2013; Raymond et al. 2015). In Cyprus, the RELIONMED-LIFE project aims to restrict the impacts in Cyprus from the invasion of *Pterois miles* through a variety of actions for the control of its population (Kleitou et al. 2019).

Siganus luridus & ***Siganus rivulatus***: The two siganids are considered to be high-impact invasive species in the eastern Mediterranean Sea (Katsanevakis et al. 2009, 2014). They have become dominant in many coastal areas (e.g. Sala et al. 2011; Vergés et al. 2014), likely outcompeting the main native herbivores, *Sparisoma cretense* (Linnaeus, 1758) and *Sarpa salpa* (Linnaeus, 1758) (Bariche et al. 2004; Kalogirou et al. 2012), and altering the community structure and the native food web of the rocky infralittoral zone (Sala et al. 2011; Giakoumi 2014). Based on a caging experiment, Sala et al. (2011) concluded that *S. luridus* and *S. rivulatus* were able to create and maintain barrens (rocky areas almost devoid of erect algae) and contribute to the transformation of the ecosystem from one dominated by lush and diverse brown algal forests to another dominated by bare rock. Some of these algal forests, such as *Cystoseira* spp. forests, are ecologically very important as nurseries for a number of littoral fish species. The species are edible and are caught by trammel nets and gillnets; they are marketed in many Mediterranean countries. In Cyprus they have a high market value, and *S. rivulatus* was cultured on an experimental scale (Katsanevakis et al. 2014).

Table 2.2 Inventory of alien species in Cyprus, reported until December 2018

Species	Phylum	Year of introduction	Status	Establishment
Acanthophora nayadiformis	Rhodophyta	1997-98	cryptogenic	unknown
Acanthurus coeruleus	Chordata	2011	NIS	casual
Acteocina mucronata	Mollusca	1992	NIS	established
Alepes djedaba	Chordata	1961	NIS	established
Alvania dorbignyi	Mollusca	1985	cryptogenic	established
Amathia verticillata	Bryozoa	2016	NIS	unknown
Amathina tricarinata	Mollusca	2012	NIS	casual
Amphistegina lobifera	Foraminifera	1976	NIS	established
Apanthura sandalensis	Arthropoda	1998	NIS	established
Aplysia dactylomela	Mollusca	2004	cryptogenic	established
Apogonichthyoides pharaonis	Chordata	1964	NIS	established
Aquilonastra burtoni	Echinodermata	2003	NIS	established
Arothron hispidus	Chordata	2018	NIS	casual
Asparagopsis armata	Rhodophyta	1998	NIS	casual
Atergatis roseus	Arthropoda	2015	NIS	established
Atherinomorus forskalii	Chordata	1929	NIS	established
Balanus trigonus	Arthropoda	2016	NIS	established
Biuve fulvipunctata ex Chelidonura fulvipunctata	Mollusca	2003	NIS	established
Botryocladia madagascariensis	Rhodophyta	2008	NIS	casual
Brachidontes pharaonis	Mollusca	1960	NIS	established
Branchiomma luctuosum	Annelida	1998	NIS	unknown
Bulla arabica	Mollusca	2000	NIS	established
Bursatella leachii	Mollusca	2016	NIS	established
Callinectes sapidus	Arthropoda	1964	NIS	established
Callionymus filamentosus	Chordata	2016	NIS	casual
Carupa tenuipes	Arthropoda	2016	NIS	casual
Cassiopea andromeda	Cnidaria	1903	NIS	established
Caulerpa chemnitzia	Chlorophyta	1992	cryptogenic	unknown
Caulerpa cylindracea	Chlorophyta	1991	NIS	invasive
Caulerpa racemosa var. lamourouxii f. requienii	Chlorophyta	1997	NIS	casual
Caulerpa taxifolia var. distichophylla	Chlorophyta	2009	NIS	established
Celleporaria vermiformis	Bryozoa	2016	NIS	unknown
Ceratonereis mirabilis	Annelida	1997	NIS	established
Cerithidium perparvulum	Mollusca	1995	NIS	casual

Cerithiopsis pulvis	Mollusca	1985	NIS	established
Cerithiopsis tenthrenois	Mollusca	1985	NIS	established
Cerithium scabridum	Mollusca	1983	NIS	established
Chama asperella	Mollusca	2007	NIS	casual
Chama pacifica	Mollusca	1998	NIS	established
Charybdis helleri	Arthropoda	1998	NIS	established
Charybdis longicollis	Arthropoda	1969	NIS	established
Cheilodipterus novemstriatus	Chordata	2015	NIS	established
Chondria coerulescens	Rhodophyta	2008	cryptogenic	unknown
Cingulina isseli	Mollusca	1998	NIS	established
Cladophora cf. patentiramea	Chlorophyta	1991	NIS	established
Clavelina lepadiformis "interior form, Turon et al 2003"	Chordata	2016	NIS	unknown
Clavelina oblonga	Chordata	2016	NIS	established
Conomurex persicus	Mollusca	1985	NIS	established
Coryphellina rubrolineata ex Flabellina rubrolineata	Mollusca	2008	NIS	established
Coscinospira hemprichii	Foraminifera	2009	NIS	established
Cycloscala hyalina	Mollusca	1992	NIS	casual
Dendostrea cf folium	Mollusca	2008	NIS	established
Diadema setosum	Echinodermata	2012	NIS	established
Dussumieria elopsoides	Chordata	2005	NIS	established
Equulites klunzingeri	Chordata	1961	NIS	established
Ergalatax junionae	Mollusca	1993	NIS	established
Erugosquilla massavensis	Arthropoda	1956	NIS	established
Etrumeus golanii misid E. teres	Chordata	1999	NIS	established
Eusyllis kupfferi	Annelida	1998	NIS	established
Finella pupoides	Mollusca	1996	NIS	casual
Fistularia commersonii	Chordata	1999	NIS	invasive
Fulvia fragilis	Mollusca	1983	NIS	established
Gafrarium savignyi	Mollusca	2005	NIS	established
Ganonema farinosum	Rhodophyta	1997-98	cryptogenic	unknown
Goniobranchus annulatus	Mollusca	2009	NIS	established
Gonioinfradens paucidentatus	Arthropoda	2016	NIS	established
Halophila stipulacea	Tracheophyta	1967	NIS	established
Haminoea cyanomarginata	Mollusca	2016	NIS	established
Hemiramphus far	Chordata	1964	NIS	established
Herdmania momus	Chordata	1998	NIS	established
Hippocampus fuscus	Chordata	2014	NIS	casual
Hydroides elegans	Annelida	1996	NIS	established
Hydroides heterocera	Annelida	1998	NIS	established
Hydroides homoceros	Annelida	2016	NIS	unknown
Hypnea spinella	Rhodophyta	2012	NIS	established
Hypselodoris infucata	Mollusca	2007	NIS	established
Indothais lacera	Mollusca	1988	NIS	casual

Kyphosus vaigiensis	Chordata	2016	cryptogenic	casual
Lagocephalus guentheri mis Lagocephalus spadiceus	Chordata	2006	NIS	established
Lagocephalus sceleratus	Chordata	2004	NIS	invasive
Lagocephalus suezensis	Chordata	2007	NIS	established
Laodicea fijiana	Cnidaria	1972	NIS	questionable
Leucotina natalensis	Mollusca	1996	NIS	established
Liloa mongii ex Cylichna cf. mongii	Mollusca	1992	cryptogenic	casual
Linguimaera caesaris ex Hamimaera hamigera	Arthropoda	1997	NIS	established
Linopherus canariensis	Annelida	1997	NIS	casual
Lophocladia lallemandii	Rhodophyta	1997-98	NIS	established
Lysidice collaris	Annelida	1968	NIS	established
Macrophthalmus indicus	Arthropoda	2011	NIS	established
Malleus regula	Mollusca	1970	NIS	established
Melibe viridis	Mollusca	2001	NIS	established
Mesanthura cf. romulea	Arthropoda	2016	NIS	unknown
Metapenaeopsis aegyptia	Arthropoda	2004	NIS	established
Metapenaeus monoceros	Arthropoda	1961	NIS	established
Metasychis gotoi	Annelida	1997	NIS	established
Metaxia bacillum	Mollusca	1995	NIS	casual
Microcosmus exasperatus	Chordata	2014	NIS	established
Microporella coronata	Bryozoa	1998	NIS	unknown
Mnemiopsis leidyi	Ctenophora	2012	NIS	unknown
Mnestia girardi ex Cylichnina	Mollusca	1996	NIS	established
Nemipterus randalli	Chordata	2014	NIS	established
Neopseudocapitella brasiliensis	Annelida	1997-98	NIS	established
Notomastus aberans	Annelida	1997	NIS	established
Notomastus mossambicus	Annelida	1997	NIS	established
Oenone cf. fulgida	Annelida	1996	NIS	questionable
Ophiactis macrolepidota	Echinodermata	1998	NIS	established
Ophiactis savignyi	Echinodermata	1998	NIS	established
Ostorhinchus fasciatus	Chordata	2014	NIS	casual
Paracerceis sculpta	Arthropoda	2016	NIS	unknown
Paradella dianae	Arthropoda	2003	NIS	established
Paraleucilla magna	Porifera	2016	NIS	unknown
Parasmittina egyptiaca	Bryozoa	2016	NIS	unknown
Paratapes textilis	Mollusca	2004	NIS	established
Parexocoetus mento	Chordata	<2002	NIS	established
Parupeneus forsskali	Chordata	2014	NIS	established
Pegidia lacunata	Foraminifera	2010	NIS	established
Pempheris rhomboidea	Chordata	1995-96	NIS	established
Penaeus pulchricaudatus ex Marsupenaeus japonicus	Arthropoda	1961	NIS	established
Penaeus semisulcatus	Arthropoda	2010	NIS	casual

Percnon gibbesi	Arthropoda	2006	NIS	established
Phallusia nigra	Chordata	2016	NIS	established
Phascolosoma scolops	Sipuncula	1998	NIS	established
Pilumnopeus vauquelini	Arthropoda	1963	NIS	established
Pinctada imbricata radiata	Mollusca	1899	NIS	established
Pista unibranchia	Annelida	1997	NIS	established
Plocamopherus ocellatus	Mollusca	2015	NIS	established
Polysiphonia atlantica	Rhodophyta	2008	cryptogenic	questionable
Pomadasys stridens	Chordata	2014	NIS	casual
Portunus segnis	Arthropoda	1958	NIS	established
Prosphaerosyllis longipapillata	Annelida	1997	NIS	casual
Psammacoma gubernaculum	Mollusca	2009	NIS	casual
Pseudolachlanella slitella	Foraminifera	2010	NIS	unknown
Pseudonereis anomala	Annelida	1969	NIS	established
Pteragogus trispilus	Chordata	1997	NIS	established
Pterois miles	Chordata	2012	NIS	invasive
Purpuradusta gracilis notata	Mollusca	2000	NIS	established
Pyrgulina pupaeformis ex Pyrgulina maiae	Mollusca	1995	NIS	established
Pyrunculus fourierii	Mollusca	1995	NIS	casual
Rhinoclavis kochi	Mollusca	1976	NIS	established
Rhopilema nomadica	Cnidaria	1995	NIS	established
Rissoina bertholleti	Mollusca	1985	NIS	established
Sargocentron rubrum	Chordata	1961	NIS	established
Saurida lessepsianus	Chordata	1960	NIS	established
Scarus ghobban	Chordata	2010	NIS	casual
Scomberomorus commerson	Chordata	2008	NIS	established
Sepioteuthis lessoniana	Mollusca	2009	NIS	established
Septifer cumingii	Mollusca	2005	NIS	established
Siganus luridus	Chordata	1964	NIS	invasive
Siganus rivulatus	Chordata	1928	NIS	invasive
Sillago suezensis ex S. sihama	Chordata	2009	NIS	casual
Smaragdia souverbiana	Mollusca	1995	NIS	casual
Sphyraena chrysotaenia	Chordata	1964	NIS	established
Sphyraena flavicauda	Chordata	2014	NIS	established
Spirobranchus tetraceros	Annelida	1996	NIS	established
Spirorbis marioni	Annelida	1996	NIS	unknown
Spondylus spinosus	Mollusca	2001	NIS	established
Spratelloides delicatulus	Chordata	2014	NIS	established
Stephanolepis diaspros	Chordata	1935	NIS	established
Sticteulima cf. lentiginosa	Mollusca	1995	NIS	casual
Stypopodium schimperi	Ochrophyta	1990	NIS	established
Symplegma brakenhielmi	Chordata	2016	NIS	established
Synaptula reciprocans	Echinodermata	1967	NIS	established
Synchiropus sechellensis	Chordata	2016	NIS	casual

Syrnola fasciata	Mollusca	1995	NIS	casual
Tayuva lilacina	Mollusca		cryptogenic	unknown
Terebella ehrenbergi	Annelida	1969	NIS	questionable
Thalamita poissonii	Arthropoda	1969	NIS	established
Torquigener flavimaculosus	Chordata	2009	NIS	established
Trochus erithreus	Mollusca	1985	NIS	established
Turbonilla edgarii	Mollusca	1996	NIS	casual
Upeneus moluccensis	Chordata	1961/1964	NIS	established
Upeneus pori	Chordata	2004	NIS	established
Variola louti	Chordata	2018	NIS	casual
Vertebrata fucoides ex Polysiphonia	Rhodophyta	2008	cryptogenic	questionable
Viriola cf. bayani	Mollusca	2017	NIS	casual
Watersipora subtorquata	Bryozoa	2010	cryptogenic	established
Womersleyella setacea	Rhodophyta	2008	NIS	established
Zafra savignyi	Mollusca	1995	NIS	casual
Zafra selasphora	Mollusca	1995	NIS	casual

3 Economic and social parameters

3.1 Introduction

The sectors constituting the blue economy make a major contribution to the economy, particularly in the case of an island state such as Cyprus. The importance of the sea for Cyprus as a source of growth and progress has always been crucial for the development of a number of sectors such as coastal tourism, commercial shipping, fisheries and aquaculture. Currently, newly developing sectors emerge from the sea, such as oil and gas extraction.

In fact, since antiquity marine waters are inseparably linked with the economic and social evolution of Cyprus. The contribution and importance of marine waters ranges from the food provision, to generating income and ensuring social wellbeing.

Method

For the re-assessment of economic and social parameters of marine waters the method adopted is the Marine Water Accounts. Marine waters are assessed by calculating the financial benefits of the sectors/economic activities which are direct users of marine waters using the most recent data available. The main reason for choosing this method is because it focuses on financial results generated through the market therefore directly quantifiable through market prices from official statistical sources and are meaningful to everyone. Furthermore, the indicators and codes are common in the European System of National Accounts and thus comparable among member states. A second reason is because this method was adopted in the Initial Assessment of economic and social parameters of marine waters and therefore can capture the evolution of the passing years.

Each sector's template is composed of three sections. The first section gives a brief profile of the sector, including the historical background, a mostly qualitative picture of its importance, the basic parameters of the activity. The second section refers to the basic economic indicators of the sector, in other words its contribution to Cyprus economy. The basic economic and social indicators used are: The Production Value, the Value Added and the Employment. The third section presents the future trends of the sector. It is an estimation based on several parameters or evolutions which justifies the estimated trend.

Marine sectors presented are those that are considered important either because of their size (e.g. tourism) or because of their contribution on the well-being of coastal areas (e.g. fishing) or because they address an urgent need (e.g. desalination units for sufficient water supply).

3.2 Sectors Related To Marine Waters

3.3 Tourism

3.3.1 Brief profile of the Sector

Tourism industry in Cyprus is one of the most important sources of economic robustness. The development of Tourism in Cyprus is mainly due to the sea. 95% f the tourists that visit Cyprus admit that the main reason for choosing Cyprus as destination is "Sun and Sea"[1]. The long

[1] Departing passengers' profiling, Hermes Airports Ltd. & Pulse Marketing Research, 2015.

coastline, the diversity of beaches and the excellent quality of bathing waters coupled with good weather are the main poles of attraction in this country.

The ratio of visitors to permanent residents (4,5/1) is the highest in Europe[2]. Over the past three years an increase in arrivals and revenues has been reported, shown in the table below, following several years of relative stagnation.

Tourists arrivals and revenues						
Month	Arrivals			Revenues (in million €)		
	2016	2017	2018	2016	2017	2018
January	48.607	62.611	75.867	29,1	35,4	38,4
February	65.988	82.209	101.481	37,6	46,6	52,7
March	137.013	140.873	192.090	80,9	86,1	110,0
April	225.575	286.331	314.143	137,9	189,6	181,4
May	364.943	418.732	450.495	244,7	291,5	294,7
June	413.114	472.450	511.073	301,0	347,2	357,7
July	482.132	531.030	539.626	402,2	425,7	426,6
August	458.645	523.651	534.847	392,2	423,6	428,2
September	421.201	483.716	520.138	337,1	371,0	378,8
October	357.194	406.870	433.617	266,0	277,1	293,8
November	124.192	144.676	158.685	83,8	89,5	91,9
December	87.927	98.924	106.563	50,9	55,8	56,4
TOTAL	**3.186.531**	**3.652.073**	**3.938.625**	**2.363,4**	**2.639,1**	**2.710,6**

Source: CYSTAT

[2] Contribution of Cyprus Vice-Minister of Tourism Mr. Perdios in the Conference “Mediterranean, our sea, our homeland”, Athens 13/4/2019.

Cypriot Tourism industry is heavily dependent on two markets, those of United Kingdom and Russia. As figures in Table 2 indicate 34-36% of total tourists' arrivals are of UK origin, while the two countries together cover over the 50% of the total arrivals. Other important markets are those of Germany, Scandinavian countries, and Greece.

Main countries of tourists' origin			
Origin	2016	2017	2018
Total arrivals	3.186.531	3.652.073	3.938.625
Of which:			
United Kingdom	1.157.978	1.253.939	1.327.805
Russia	781.634	824.494	783.631

Source: CYSTAT

Although this heavy dependence on only two markets is quite risky, (if for example a negative event affects the tourist demand generated in either country), at the same time demonstrates the high development potentials by attracting other markets.

The distribution of tourists in various locations in Cyprus indicates[3] that Paphos is the most popular place to stay followed by Agia Napa, Limasol, Paralimni, and Larnaca, all coastal areas.

Despite the increase in arrivals and revenues during the three last years, the expenditure per person, both by trip and per day is decreasing (see Table 3). This demonstrates that there is a need to upgrade the value of the offered product in order to regain the lost revenue yield.

Per capita expenditure and per day expenditure				
	Average days of stay	**Per capita expenditure**	**Expenditure/capita/day**	**Revenues (in million €)**
2016	9,5	741,7	78,1	2.363
2017	9,5	722,6	76,1	2.600
2018	9,2	688,2	74,8	2.700

Source: CYSTAT, Tourism statistics and http://www.eurokerdos.com/me-esoda-rekor-gia-ton-kypriako-toyrismo-ekleise-to-2018/

From the supply side of the sector Cyprus has a wide range of natural and cultural attractions including numerous archaeological and historical sites, 11 National Parks, 3 UNESCO sites. Good weather all year round is a very strong advantage too. Above all, Cyprus has 90 kms of beaches, 59 beaches awarded blue flag and excellent quality of bathing waters, as it is shown in the following table.

[3] CYSTAT, figures 2015

Bathing water quality in Cyprus 2014-2017							
Year	Total number of bathing waters	Excellent quality		At least sufficient [4] quality		Quality classification not possible[5]	
		Number	%	Number	%	Number	%
2014	112	112	100,0	112	100,0	0	0,0
2015	113	112	99,1	112	99,1	1	0,9
2016	113	112	99,1	112	99,1	1	0,9
2017	113	110	97,3	111	98,2	2	1,8

Source: European Environment Agency, Cypriot bathing water quality, Country Report, May 2018

In the tourist infrastructure field Cyprus has two international airports, 2 cruise ports, 3 Marinas (Larnaca, Limasol, and St. Raphael), 9.458 rental cars and 1.784 taxis[6].

In the field of service providers there are 430 travel agencies[7], a number of Tour Operators representing 33 countries, 21 Recreational and water parks, and 4 golf courses.

The accommodation capacity of Cyprus is shown in the following table. During the reference period 2014-2016 the total capacity shows a relative shrinking, with a decrease in available beds of 2%.

Capacity of Accommodation establishments		
Year	Number of accommodation establishments	Number of beds
2014	801	86.005
2015	788	84.529
2016	790	84.238

Source: CYSTAT

3.3.2 Economic and Social indicators

Travel and Tourism is a very important sector for the Cypriot economy generating not only direct economic impacts but also indirect and induced impacts. Direct contribution refers to economic activities that are directly linked with tourists, such as hotels food and beverage, travel agencies, recreational and leisure services. Indirect impacts include investment spending in Travel &Tourism, Government spending that helps tourism (e.g. marketing and promotion), domestic purchases of goods and services by the sectors dealing directly with tourists, while induced impacts refer to the spending of those who are directly or indirectly employed by the Travel & Tourism Industry

[4] the class “At least sufficient” also includes bathing waters which are of excellent quality
[5] Quality classification not possible: not enough samples /new bathing waters/bathing waters subject to changes/closed
[6] THR, Cyprus Tourism Strategy final report, March 2017
[7] https://www.visitcyprus.com/files/travel_agencies/List_Travel_Agencies_gr.pdf

According to the national report for Cyprus[8] of the World Travel and Tourism Council (WTTC), the direct contribution of the sector Travel & Tourism to the GDP in 2017 was milion € 1.363 or 7,3% of the GDP. The same source estimates that the direct contribution is going to increase by an average annual rate of 4% for the next decade.

Basic Indicators for Travel and Tourism			
	2015	2016	2017
Direct contribution to GDP (in million. €)	1.109 (6,4% of GDP)	n/a	1.363 (7,3% of GDP)
Total contribution to GDP	3.344(19.3% of GDP)	n/a	4.164 (22,3% of GDP)
Direct contribution to Employment (Number of jobs)	24.000 (6,6% of the total employment)	n/a	26.000(6,9% of the total employment)
Total contribution to Employment	73.500(22,6&% of the total employment)	n/a	85.000(22,7% of the total employment)

Source: World Travel and Tourism Council, Cyprus reports 2015, 2017,

Using data from the Cyprus Statistical Authority for the year 2016, the basic economic and social indicators are presented in the following table.

Basic indicators for accommodation units and food services 2016			
Economic activity	Production Value (in .000€)	Value added (in .000€)	Number of jobs
Accommodation units	1.075.960	646.774	19.078
Food & beverage services	1.091.891	497.136	21.970
Total	2.167.851	1.143.910	41.048

Source: CYSTAT, Survey of Services and Transportation 2016

Though the two tables are not quite compatible, the picture for tourism contribution is clear for all the three years

3.3.3 Future trends

Despite the significant number of tourists that travel to Cyprus, which in comparison to the local population is really impressive, a certain stagnation is observed in the recent decades. The number of arrivals in 2018 does not exceed the relevant figure of 2001, record year for Cyprus Tourism.

However, the future outlook seems encouraging. This estimation is based on the following elements:

- The last three years there is a modest but stable increase of the arrivals. In 2017 arrivals increased by 15% compared to 2016, while in 2018 arrivals were more by 8% compared to the previous year.

[8] World Travel & Tourism Council, Travel & Tourism, Economic Impact 2018, Cyprus

- Since March 2018 the Vice- Ministry of Tourism was established (with responsibilities equivalent to Ministry) upgrading in this way the political and administrative representation of the Sector. This decision expresses the willingness of Cyprus leadership to prioritize the enforcement and upgrading of the industry.
- Within the same context, the Cyprus Tourism Strategy 2018-2030 was prepared with concrete actions aiming at the enrichment of the tourist product, diminishing of seasonality, addressing the issue of air connectivity, attracting visitors who are engaged in special forms of tourism (e.g. diving tourism), improving the quality of services offered. The ultimate goal is to attract visitors of high income and therefore higher tourism expenditure.
- Finally, during the recent years the cooperation of Cyprus with Greece, Egypt and other countries has been intensified in order the brand East Med to be strengthened as pole of attraction for tourists' movements.

3.4 Marine Transports

3.4.1 Brief profile of the Sector

3.4.1.1 Shipping

Cypriot Shipping Registry includes 1.100 sea-going ships under the Cypriot flag and 700 smaller ships with a total capacity of 24 million.

It is the 3rd merchant fleet in European Union. Cyprus is also one of the most important ship-management centers in the world.

Cypriot Ship Registry				
	2014	2015	2016	2019[9]
Number of registered ships	1.765	1.704	1.663	1.800

Source: CYSTAT

According to a statement from the Shipping Vice-Ministry, during the last 12 months the number of shipping companies based in Cyprus increased by 21%, from 168 to 03, and the trend is strongly upward. The main reason for this increasing trend is the influx of foreign companies that choose Cyprus for their new headquarters. Compared to 2013 the number of the companies has been almost doubled.

3.4.1.2 Ports

Cyprus, as an island, is heavily based on its ports as they are the most important gates that serve the international trade of goods and the movement of passengers.

[9] Figures for 2019 are from Shipping Vice-Minister's speech

Cyprus has five ports. The biggest and most important is that of Limasol, whose management was recently, 2017, granted in a private company by the Cyprus Port Authority.

The volume of movement of ships, passengers and goods through the main ports of Cyprus appears in Table 9.

Movement of main ports										
Ships arrivals										
Year	**Number of Ships**				**Number of Passengers**			**Imports of gross weight in MT**		
	Lim	**Larn**	**Paf.**	**TotalL**	**Limas[10].**	**Larn[11]**	**Total**	**Limsol**	**Larnaca**	**Total**
2013	3.014	886	284	4.184	166.068	53.982	220.050	2.421.347	2.629.174	5.371.858
2014	2.441	980	220	3.641	100.414	43.392	143.806	2.275.625	2.986.565	5.262.190
2015	2.386	1.048	196	3.630	104.174	33.061	137.235	2.397.868	4.339.686	6.737.554
2016	2.149	1.118	182	3.449	82.312	24.460	106.772	3.009.943	4.234.259	7.244.202
2017	2.300	1.367	190	3.857	63.831	21.951	85.782	2.908.035	4.899.174	7.807.209
Ships departures										
	Number of Ships				**Number of Passengers**			**Exports of gross weight in MT**		
	Lim	**Larn**	**Paf**	**Total**	**Limas**	**Larn**	**Total**	**Limas**	**Larnaca**	**Total**
2013	2.880	891	255	4.026	165.307	53.982	219.289	1.243.378	1.316.600	2.559.978
2014	2.378	975	220	3.573	101.246	43.392	144.638	1.264.217	1.884.510	3.148.727
2015	2.310	1.041	193	3.544	103.374	33.061	136.435	1.691.755	4.140.706	5.832.461
2016	2.099	1.123	174	3.396	83.512	24.460	107.972	1.850.169	3.007.783	4.857.952
2017	2.130	1.366	186	3.682	68.269	21.951	90.220	1.424.886	3.530.899	4.955.785

Source: Ministry of Finance, Department of Customs, Annual report 2017

[10] Limasol includes also Moni and Akrotiri
[11] Larnaca includes Vasiliko, Zygi, and Dekeleia

3.4.2 Economic and Social indicators

Table 10 **Basic Indicators for Marine Transport 2016**				
Economic activity	Number of enterprises	Production Value (in .000€	Value Added (in.000€)	Number of jobs
Water transport[12]	56	49.325	-.5.677	476
Service activities incidental to water transportation	15	75.141	54.457	324
Cargo handling)	111	20.536	4.262	413
Other support activities (including ship management)	461	1.807.561	289.484	7.067
Operation of Marinas	104	10.326	5.073	204

Source: CYSTAT, Survey of Services and Transport

3.4.3 Future trends

Marine transport is already a very important sector for the economy of Cyprus and ship management is the driving force. Forecasts for the sector's evolution are extremely promising due mainly to the developments in the energy sector, after the positive results of drilling in Cyprus exclusive Economic Zone.

Other factors that are expected to play an important role in shaping the predicted positive prospects for the industry are:

- The Government has placed shipping among its main priorities, that is why it has set up a Shipping Vice-Ministry[13], since March 2018.
- Cyprus has put in place a quite ambitious plan to promote the country as an international maritime center, exploiting opportunities and competitive advantages.
- Because of its special relations with the United Kingdom has focused in an effort to attract part of London's famous Shipping center, taking advantage of the ever-growing uncertainty because of the Brexit.
- Cyprus Ship Register is in the "White List" of the relevant Control bodies (Paris MOU and Tokyo MOU). This advantage offers less inspections and controls in various ports and other benefits as the ships are going to be registered in a Registry inside the territory of European Union.
- The geographical location and the tax system of Cyprus offer great opportunities for shipping companies.

[12] Includes also figures for NACE code 51

[13] Announcement of the Minister of Transport, Communications and Works in Cyprus Shipping Forum, Limasol, 14/2/2018

3.5 Fishery

3.5.1 Brief profile of the Sector

The annual contribution of marine fishery in Cypriot economy is rather small, but the fishing sector is considered valuable mainly because creates economic benefits in coastal communities, creates jobs and offers products of high nutritional value to the consumers.

Cypriot marine fishery is characterized by a variety of fishing gears and a mixed species catch.

The fishing fleet is divided among three segments the small-scale segment consisting of vessels of less than 12 m., the polyvalent vessels which is part of the large-scale segments over 12m. length which use passive gears, and very few trawlers, the other part of large-scale segment, fishing in territorial and international waters. The fishing fleet is dominated by the small- scale vessels. It is in general a small fleet and the number of vessels during the last decade was reduced gradually due to the low biological productivity of the area and in an effort to diminish fishing pressure to an already bad condition of fish stocks.

The evolution of the fishing fleet capacity appears in the following table.

Fishing fleet capacity				
	2015	**2016**	**2017**	**2018**
Number of vessels	905	838	817	739
Gross tonnage (GT)	3.600	3.400	3.500	N/A
Engine Power (KW)	41.200	36.400	37.700	N/A

Source: The 2018 Annual Economic Report on EU Fishing Fleet, Cyprus National report, 2018 STECF

Landings composed mainly by albacore (*Thunnus alalunga*), bogue (*Boops boops*), Atlantic bluefin tuna (*Thunnus thynnus*), surmullet (*Mullus surmuletus*), picarel (*Spicara smaris*), cuttlefish (*Sepia officinalis*), swordfish (*Xiphias gladius*), common pandora (*Pagellus erythrinus*).

The small-scale fishing vessels and trawlers (of both territorial and international waters) target a mix of demersal species like surmullet, common pandora, red mullet, bogue, picarel. While polyvalent vessels target large pelagic species like albacore, swordfish, bluefin tuna.

Marine fishery in Cyprus is a sector that face problem of sustainability due to the bad condition of some of the main commercially exploited fish stocks. The low biological productivity of the area combined with the fishing pressure lead to overfishing of these stocks with negative impacts on the fleet catches and therefore on the economic performance of the sector and fishers' income.

However, over the last three years (2015-2017), signs of fleet production recovery can be traced. The production increased from 1.278 tons in 2015 to 1.479 tons in 2016 and 1.736 tons in 2017, a cumulative increase of 35% in the reference period. It must be underlined though that this level of production is well below the relevant figure of last decade (2007: 2.429 tons).

3.5.2 Economic and Social indicators

Basic Indicators for Fishery				
	2015	**2016**	**2017**	**2018**
Gross Value Added (in .000€)	1.100	2.610	2.890	2.570
Value of Landings (in 000€)	7.560	7.720	8.220	8.020
Number of persons employed	1.285	1.117	1.160	1.109
Full Time Equivalent	794	668	695	670

Source: The 2018 Annual Economic Report on EU Fishing Fleet, Cyprus National report, 2018 STECF

3.5.3 Future trends

Growth prospects of marine fishery in Cyprus is rather limited. The competent authority's (Department of Fisheries and marine research) efforts for the upgrading of the fish stocks and the management measures of fleet through effort limitations and technical measures, if proved to be successful, may achieve a sustainable balance between fishing capacity and fishing opportunities and improve the current picture but they cannot overturn the inherent weaknesses, such as the low productivity of Cyprus waters and the limited fishing areas.

3.6 Marine Aquaculture

3.6.1 Brief profile of the Sector

Marine aquaculture started in Cyprus in an experimental basis by the Department of Fisheries and Marine Research in 1972, while the first private nursery and the first private fattening units started in 1986 and 1988 respectively. Today is one of the most important export industries in the primary sector.

There are nine farms of Mediterranean fish species and four hatcheries of which three for fish fry and one for shrimps.

All fish farms operate under the method of sea-cage, in 1-4 kilometers from the shore and water depth of 20-70 meters. This method was chosen as it is considered more environmentally friendly and, additionally, for economic reasons as due to many competitive uses the availability of the coastal areas was limited.

Aquaculture composes almost 75 - 80% of the total quantity of Cyprus fishing production. Sea bream is the main species cultured in Cyprus and accounts for 71% of the total volume and 64% of total value of production in 2017. Sea bass on the other hand accounts for 22% of the total volume and 35% of the value produced in 2017. Efforts are being made to culture other species, but without commercial results yet

An important share of domestic production is exported, mainly in third countries.

The following tables present production figures for fish and fries by species

Marine Aquaculture production 2017 by species		
Species	Total Production (tons)	Total Value (in .000€)
Sea bream	4.950	24.002,7
Sea bass	1.517	13.072,0
Shrimp	28	306,4
Total	6.945	37381,1

Source: DFMR

Hatcheries production 2017 by species		
Species	Total Production (fingerlings)	Total Value (in .000€)
Sea bream	18.964.715	3.157,4
Sea bass	8.715.024	1.322,1
Shrimp	4.100.000	41,0
Total	31.779.739	4.520,6

Source: DFMR

3.6.2 Economic and Social indicators

Basic Indicators of Aquaculture			
	2015	2016	2017
Value of fish production (in.000€)	32.730	36.100	37.381
Value of fry production (in .000€)		5.700	4.250
Total Value of production (in .000€)		41.800	41.631
Number of persons employed	300	350	314

Source: DFMR, annual reports

3.6.3 Future trends

Aquaculture has positive growth rates in recent years. The average annual rate of increase of fish production was 5% the last three years (2015-2017), while in value the respective figure was 7,2%.

Aquaculture is the only solution in order to reduce the fishing deficit due to the very low production of catching fishery. At the same time offers to the consumers products of high nutritional value in affordable prices.

The positive course of aquaculture is expected to continue as both the measures taken by the state administration (e.g. the location of new fish farming areas, investment aid for aquaculture from the OP Sea) and the financial soundness of enterprises are expected to have the desired results.

In addition, clean and oligotrophic seas, high water temperatures, and relatively low wind intensities ensure very favorable growth conditions

3.7 Desalination

3.7.1 Brief profile of the Sector

The problem of the lack of sufficient water resources to meet the water supply and irrigation needs in Cyprus is particularly acute. Prolonged droughts as well as climate change conditions that are beginning to emerge, make policy of better water management in itself insufficient to tackle the problem. Finding additional water resources is a necessity. In order to separate the supply of drinking water from climatic conditions, the competent Ministry proceeded with the construction of desalination plants.

Four desalination units operate in Cyprus, in Dhekelia, Episkopi, Vasiliko and Larnaca. The total production capacity of the units amounts to 220,000 cubic meters per day or 80,3 million cubic meters per year

In the following table appear the total available water quantity by all sources and that coming from desalination units.

Total Available Quantity of water and quantity from desalination units			
Έτος	Total Available Quantity of water (in million cubic meters)	Quantity from desalination units (in million cubic meters)	Water Balance
2010	262	63	5
2011	328	49	70
2012	438	18	179
2013	145	11	-116
2014	222	33	-39
2015	284	38	23
2016	285	69	22
2017	224	69	-40

Source: Department of Water Development, Ministry of Agriculture, Natural Resources and Environment

Note: The very low production of desalination plants in 2013 is due to the decision - because of the economic crisis and the fact that there were quite enough reservoirs of water in the dams - all desalination units, with the exception of Dhekelia, put into reserve.

Three of the four desalination plants (Dhekelia, Larnaca and Episkopi) were constructed using the self-financing method following the tenders announced by the Water Development Department (WDD).

Under the relevant signed BOOT-type contracts, the unit investor / developer has assumed all the costs of completing the works as well as the operating costs of the plants for a specific period of 10 or 20 years, and sells the produced water to State at a fixed price under which they won the contest.

This cost includes capital cost, operating and maintenance costs and energy costs, and is adjusted taking into account fluctuations in oil and electricity prices as well as increases in labor costs.

The Government has undertaken the obligation to take a minimum amount of water for the specified duration of the contract. After the expiry of the period specified in the contracts, the units automatically become the ownership of the State and the redemption right may also be granted before the end of the period.

The desalination plant at Vassiliko was erected in an area belonging to the Electricity Authority of Cyprus (EAC) and the agreement, signed with the EAC, stipulates the government's obligation to purchase specific quantities of water per year for a period of 20 years, without offering the possibility of transferring the unit to the Government

Cost of water per desalination unit						
Unit	**Average cost per cubic meter produced in €**		**Average cost of non-supplied water (Reserve) per cubic meter in €**		**Difference between cost of produced and cost of non-supplied water in €**	
	2015	2014	2015	2014	2015	2014
Vassiliko	0,797	1,057	0,338	0,359	0,459	0,698
Episkopi	0,875	1,179	0,378	0,388	0,497	0,791
Larnaca	0,433	–	0,048	–	0,385	–
Dhekelia	0,790	1,114	0,160	0,164	0,630	0,950 –

Source: Audit Office of the Republic of Cyprus, Water Resources Management in Cyprus, October 2016

It is noted that during 2014, the Larnaca desalination plant was undergoing renovation and did not produce any water. When it was launched in the second quarter of 2015, it was observed that this unit offers, by contrast, the most advantageous for the state price. The low price offered by the Larnaca desalination plant is due to the fact that the plant is now owned by the State and most of the capital investment has been depreciated.

3.7.2 Economic and Social indicators

Basic Indicators of Desalination			
	Value of Production (in million. €)	Quantities bought (in million cubic meters)	Number of jobs
2013	30,7	10,9	n/a
2014	41,9	32,5	n/a
2015	37,3	37,8	n/a

Source: Audit Office of the Republic of Cyprus, Water Resources Management in Cyprus, October 2016

3.7.3 Future trends

The sharpness of the problem of water shortages in Cyprus makes the desalination sector particularly important despite its small contribution to the country's macroeconomic aggregates. Needs are expected to increase, and due to the increase in tourist flows, the total capacity and number of desalination units will also increase accordingly.

It is already expected that the desalination plant in Paphos, with a total capacity of 15,000 cubic meters daily will be fully operational in 2020, while in 2018 the Water Development Department began consultations with the Vassiliko and Episkopi units in order to expand their production to address the Limassol water scarcity problem.

Finally, quite recently requests have been submitted to the Ministry of Agriculture, Rural Development and the Environment, mainly by hoteliers, for the creation of private desalination units to meet the needs of their units.

3.8 Energy

Recent developments in the drilling program in the EEZ of Cyprus mark drastic changes in the country's energy future and create reasoned expectations for Cyprus to be promoted to a Regional Energy Center in the Eastern Mediterranean.

Although the impact on the Cypriot economy cannot be quantified at this early stage, it is certain that the extraction of natural gas from the Cyprus EEZ marks a new era in the Cyprus energy map.

In addition, significant gains in other sectors of the Cyprus economy, such as shipping, ports, supportive activities, are expected. It is indicative that the press reports that "this could be the beginning of a new era for the national economy of Cyprus[14]".

[14] https://www.tovima.gr/2019/03/02/finance/handelsblatt-dieneksi-gia-to-fysiko-aerio-stin-kypro/

4 Cost Of Degradation

4.1 General Approach

The general approach used for the calculation of the Degradation Cost is the Cost-based approach. The components of the approach are described in WG ESA Guidance document (EU, 2011).

The cost-based approach looks for an estimation of the current cost of degradation using only existing quantitative data on costs of measures currently implemented to prevent degradation of the marine environment. The cost-based approach does not include a reference condition. By providing an overview of the current costs incurred by the various sectors, this approach indicates who is currently paying how much, as well as how the burden is shared among economic actors. This provides an insight over the existing financing structure for the protection of the marine environment. This approach is based on the assumption that current costs for measures to prevent environmental degradation would only have been made if the value of what is obtained (preventing degradation) is higher than the cost of the measures. In this way, current costs can be seen as a lower-bound estimate for the cost of degradation.

The steps of the cost-based approach are:

a) Identify all current legislation that is intended to improve the marine environment.

b) Assess the costs of this legislation to the public and private sectors.

c) Assess the proportion of this legislation that can be justified on the basis of its effect on the marine environment (as opposed to health or onshore environmental effects).

d) Add together the costs that are attributable to protecting the marine environment from all of the different legislation assessed

As mentioned above current costs of measures for avoiding further degradation of marine environment represent the lower bound (in fact the certain part) of the value that society places on the marine environment.

Data for the calculation of the current costs will be collected through literature and internet research. Additionally, when the accessibility and quality of data is not sufficient, administrative officers' and experts' opinion will be used to cover the information gaps and to check on the accuracy of assumptions that the team will make to calculate costs.

4.2 Current legislation aiming at improving/avoiding further degradation of the marine environment

The search for the current relevant legislation so far identifies the following EU and national laws.

- The Marine Strategy Framework Directive (MSFD, 2008/56/EC), which is the most directly linked legislation. The focus will be on the Programme of Measures for the implementation of articles 13 and 14 of MSFD (Ministry of Agriculture, Rural Development and Environment, Department of Fisheries and Marine Research).

Where information is available on costs for other measures not mentioned in the MSFD Programme of Measures, this will also be included in the analysis.

- Habitats Directive (92/43/EEC) Measures for the protection of the Marine Protected Areas (MPA), Implementation of monitoring programs for the conservation of priority species and habitats (e.g. *Carreta carreta, Chelonian mydas, Monachus Monachus, Posidonia oceanica* meadows).
- The EU Water Framework Directive (2008/105/EC), through which four biological quality elements: (i) Benthic macro invertebrates, (ii) Macroalgae, (iii) Phytoplankton / Chlorophyll a and (iv) Posidonia oceanica, are investigated in a number of representative sampling stations in coastal waters.
- The Nitrates Directive (91/676 / EEC), based on which the coastal waters of the Kokkinohoria area, which are considered vulnerable to eutrophication due to agricultural nitrates inputs, are monitored.
- The Priority Substances Directive (2013/39 /EC), by which a large number of pollutants referred to in that Directive are analyzed in Cypriot marine waters of Cyprus.
- The Directive 2010/75/EU for industrial emissions and the national legislature and specifically the “Water and Soil Pollution Control Law of 2002”, the implementation of which aims at controlling all the discharges to the sea from land- based sources

- The Urban Wastewater Treatment Directive (91/271/EEC) the National Waste Prevention Program and the Waste Management Plans.
- The Sub- regional Contingency Plan for preparedness and response to major hydrocarbon marine pollution incidents elaborated by Cyprus, Greece and Israel will also be assessed due to the increase of hydrocarbon exploration activities in Eastern Mediterranean the disastrous consequences of a hydrocarbon marine pollution incident.

4.3 Different types of costs

There are many different types of costs of measures as the methodology outlined above suggests, costs of measures of different nature, of different agents taking the burden, which occur over different time scales. Referring to the most basic categories we can identify:

1. Sea-based and land-based costs

   The report will cover both categories. The sea-based costs refer to costs generated to sectors such as fishing, shipping and, for Cyprus sea-cage aquaculture. Examples of costs of measures taken by such sea-based activities are the costs of complying with regulations for shipping such as non-toxic anti-fouling paint or changing fishing gear for fisheries.

   Land-based costs are important because land-based activities can have significant effects on the marine environment, either directly or, mostly, indirectly. Activities which occur inland include activities such as ports, tourism, agriculture, waste treatment.

2. Public and private costs

   There are several types of public costs, such as the costs of subsidies to encourage the adoption of preventing or mitigation measures with less environmental impact, or the costs of measures undertaken by the public sector itself (e.g. technical reefs)

   Another type of public costs is the running cost of the governmental departments that deal with the management, monitoring, surveillance, research of marine environment or those public bodies that manage land-based activities which have an impact on the marine waters.

   The cost of private sector includes the cost of compliance either as direct expenditure or as change in profits. The best available data will be used and in any case data limitations will be clearly stated.

3. The parameter of time in costs calculations

There is an issue regarding the parameter of time when calculating the costs. As many measures or specific projects have different time scale the analysis will use assumptions depending on the specific nature of the measure

4. Categorization of costs

Irrespectively of the above-mentioned types of costs the categorization of costs will follow the types of cost from the dropping list of the MSFD official templates

Accordingly, the categorization of measures will follow the categorization for uses and human activities in or affecting the marine environment, which were proposed by the Marine Strategy Regulatory Committee in November 2016[15] (European Commission, 2017) and which are relevant to the case of Cyprus.

4.4 Additional issues

Apart of the calculation of costs of current measures aiming to avoid further degradation, our intention is to provide an insight into the costs of potential new measures if the current analysis of marine water status shows that there is a justifiable risk that some indicators cannot meet the targets[16]. This can only be done by comparing the Programme of Measures of DFMR with the ra-assessment of the status of marine waters

Special attention will be paid to the country specific recommendations of the Commission's working staff as well as in the gaps and needs included in the Programme of Measures for the implementation of articles 13 and 14 of MSFD.

It is considered quite probable that for some measures information about the costs will not be available even after the consultation with experts. In such cases a range of minimum-maximum cost will be estimated.

[15] https://circabc.europa.eu/sd/a/ff8555fc-1d49-42c5-b19b-09b91cdbb955/DRAFT%20Commission%20Directive%20replacing%20Annex%20III%20MSFD.pdf

[16] This does not include the justified derogations like the one granted for non-indigenous species

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