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POST-2020 SAP BIO

CYPRUS
CONSERVATION OF MEDITERRANEAN MARINE AND COASTAL BIODIVERSITY BY 2030 AND BEYOND

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Ecological Status, Pressures, Impacts, their Drivers and Priority Response Fields

POST-2020 SAPBIO

Strategic Action Programme
for the **Conservation** of **Biodiversity**
and **Sustainable Management**
of **Natural Resources**
in the **Mediterranean Region**

United Nations Environment Programme
Mediterranean Action Plan
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For more information:

www-spa-rac.org

List of Acronyms

BFT	Blue Fin Tuna
DFMR	Department of Fisheries and Marine Research
EEZ	Exclusive Economic Zone
F/Fmsy	Fishing pressure
F	Fishing mortality
$F_{0.1}$	The fishing mortality rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin.
Fmsy	Estimated fishing mortality consistent with achieving maximum sustainable yield
FRA	Fisheries Restricted Area
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical Sub-Area
IAS	Invasive Alien Species
IMMAs	Important Marine Mammal Areas
IBAs	Important Bird Areas
MARDE	Ministry of Agriculture, Rural Development and Environment
MPA	Marine Protected Area
MRF	Marine Recreational Fisheries
MSFD	Marine Strategy Framework Directive
NIS	Non Indigenous Species
NTZ	No Take Zone
SCMEE	Subcommittee on Marine Environment and Ecosystems (GFCM)
SSB	Spawning stock biomass. Total weight of all sexually mature fish in the stock.
STECF	Scientific, Technical and Economic Committee for Fisheries
VMEs	Vulnerable marine ecosystems
WFD	Water Framework Directive

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Executive Summary

The aim of this document is to present the available information in regards to marine biodiversity of Cyprus including habitats. As it is noted, there is a lack of information on this subject, with some habitats and faunal/floral taxon having no data at all. In other cases, information needs revision. Further, the existing information regarding marine environment of Cyprus is scattered and diverse.

DFMR is the main authority in Cyprus dealing with the marine environment. DFMR is responsible for the implementation of the European Directives and National Legislation and regulation dealing with the marine environment. It carries out or participates as a collaborator in basic monitoring programmes for the assessment of the quality of bathing waters, for monitoring nutrients, pathogens, human impacts to the marine environment such as aquaculture, plastic pollution, including monitoring of the main Marine Protected areas. For the MPAs several management measures are in force, enhancing the protection of these areas. A problem revealed, is that there is no adequate surveillance of these areas, thus this is a high priority for the nation.

Further, DFMR carries out sampling surveys for keeping track of the status of the national fisheries stocks, at least for some commercially important species. A gap revealed is that the existing program regards only some species, thus it is proposed to add additional species in this monitoring program, especially vulnerable or species that may need protection due to declining populations.

In addition, all the reports that were used for the current report, were easily accessible. DFMR officers were always available if any clarification was needed by the expert. One issue that came up, is that some reports are written in Greek, thus they are not easily accessible by everyone.

A further gap, is that information regarding the marine environment (biodiversity, habitats, project reports, etc) is not collated in one place (e.g., a dynamic database), resulting in potentially key information been overlooked.

A gap of information was also noticed for the spatial distribution of main habitat types around the island. Except from some habitats (1110, 1120*, 8330 and 1170), for others there is no information on their distribution, surface area, common species they host in Cyprus, vulnerability in the local environment, etc. In addition, except from one or two examples, deep sea habitats are totally unstudied. As a consequence, no management and conservation measures can be decided. On the other hand, it should be noted that deep sea habitats (below 200 m depth) that might exist in Cyprus' marine waters, are likely to be mostly undisturbed since no trawling activity is being exercised in those depths. On the contrary, for some species, exceptional management measures are taken, such as marine turtles, with a long time-series data.

The following list summarizes the needs revealed from the identified gaps during this report. More details can be found in the main text:

1 _ Deep sea studies

2 _ Alien species studies

3 _ Marine biodiversity studies

4 _ A dynamic inventory – database of all marine biodiversity of Cyprus

5 _ Measures to establish and implement an effective system for the strict protection of the MPAs, Artificial Reefs, illegal fishing activity and other illegal actions in the marine environment

6 _ Awareness campaigns and Citizen Science engagement

7 _ Continuation of monitoring of marine litter emphasizing in plastic and especially microplastics for which no monitoring actions are taken up to date

8 _ DFMR initiative to gather all information regarding marine environment of Cyprus in one place

9 _ Targeting IAS via fishing (if possible)

10 _ Marine Spatial Planning

11 _ Investigation of Sea Acidification

In order to fill in these gaps, synergies and collaborations with other nations must take place. Especially for transboundary issues, like monitoring marine pollution, vulnerable habitats of the deep sea, fisheries. It will be very useful if specific teams in which authority officers, academics and other scientists from research centres participate, so as to share knowledge and technology infrastructure.

For sure, in order to succeed in such endeavours funding is mandatory. As it is mentioned in the main text of the current document, there are several funding schemes that can be ensured, especially those deriving from European Funds. Some problems identified related to that, are that these calls are very competitive, the proposals are made up of big teams and Cyprus might not be a key player of these, due to the lack of big infrastructure or know-how. Lastly, the national funds for the marine environment are very limited.

1.

Reference documents and information consulted

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1.1. Documents provided by SPA/RAC and international consultants

- Demetropoulos, 2002. Cyprus National Report on the Strategic Action Plan for the Conservation of Marine and Coastal Biological Diversity in the Mediterranean (SAP-BIO).
- Argyrou et al., 2002. Regional Project for the Development of Marine and Coastal Protected Areas in the Mediterranean Region (MedMPA), Report of the scientific second field survey for the development of marine protected areas in Cyprus.
- Ramos-Esplá, Cebrián D, D.A., 2007. Integrated coastal area management in Cyprus: biodiversity concerns on the coastal area management programme of Cyprus. RAC/SPA, Tunis, pp. 69.
- Katsanevakis, S., 2017. National Action Plan on species introductions and invasive species in Cyprus. UNEP/RAC-SPA, 40pp.

1.2. National documents and publications identified and available

- DFMR, 2012 Republic of Cyprus, Ministry of Agriculture, Natural Resources and Environment, Department of Fisheries and Marine Research. Initial Assessment of the Marine Environment of Cyprus (p. 260). Nicosia, Cyprus: Department of Fisheries and Marine Research.
- DFMR, 2019, Republic of Cyprus, Ministry of Agriculture, Natural Resources and Environment, Department of Fisheries and Marine Research. Second assessment of the MSFD. Provided by DFMR.
- Revision - Update of Article 5 of the Water Framework Directive (WFD, 2000/60 / EC) for the Coastal Water Bodies of Cyprus. Provided by DFMR. In Greek language.
- 2019 Annual report of DFMR – available on DFMR's webpage. In Greek language.

1.3. Other documents identified

Published available literature and personal contacts with DFMR officers or personal drafts concerning marine biodiversity issues.
Submitted Reports of relevant projects were also used.

1.4. Quality and comprehensiveness of available information documents

Most of the documents used for this report were found on-line or they were sent to the author after request, mainly from the competent authority (DFMR). The published literature was accessed via internet. One resulting problem was that the data contained in the DFMR's reports are not always easy to be edited, to concentrate the information recorded and to collect and compile the desirable data. Furthermore, data regarding the marine environment of Cyprus, especially related to biodiversity, are published in several journals and it is often hard to find the information.

Thus, a major gap identified is the lack of a depository in which one can easily find ALL the available information on marine biodiversity of Cyprus (i.e., a relevant database).

2.

Marine and coastal ecosystem status

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2.1. Biological characteristics

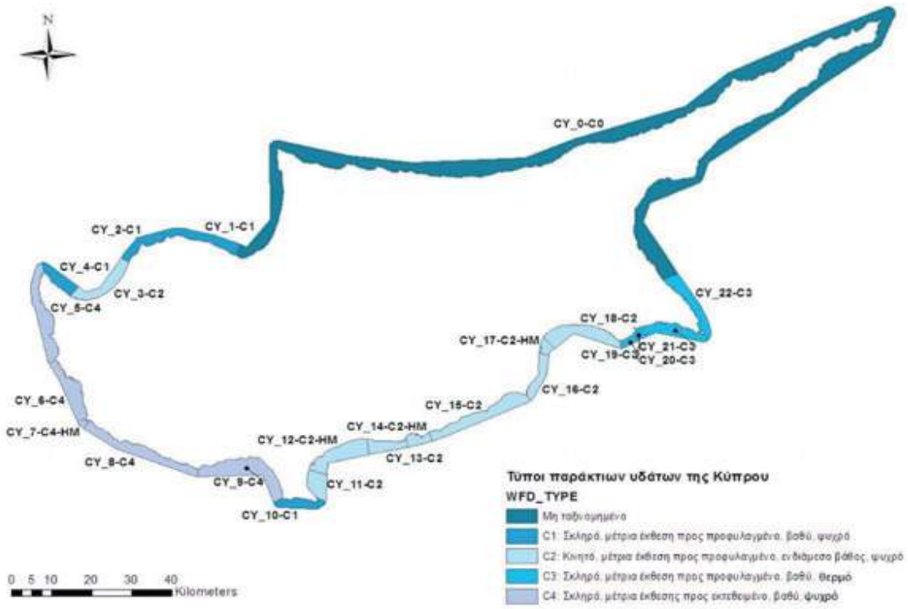
2.1.1 Description of water column biological communities

Data on phyto- and zooplankton species and their seasonal variability together with other essential information are scarce or not available. However, two PhD studies taking place in the University of Cyprus, studying Phytoplankton and Zooplankton communities in Cyprus are underway. The first results are expected to be published at the end of the current year (2020), filling in this existing gap. Further, DFMR carries out seasonal phyto- and zooplankton samplings at 4 sites as part of the MSFD. The surveys started in 2017 and the data will be presented in the 3rd cycle of MSFD

Cyprus is part of the ultra-oligotrophic Levantine Basin, thus low concentrations of nutrients, extremely low values for phytoplankton related variables, including chlorophyll a, primary production and cell abundance, are anticipated and references therein). Hannides et , (2015) gave some data on sea surface chlorophyll (SSChl) determined from analysis of satellite data. These data were referring to March and September 2010, from various stations around Cyprus and as expected, low values of SSChl were found (0.04 – 0.12 mg m-3).

Further, DFMR carries out samplings on a yearly basis in the framework of the WFD monitoring program to record the ecological status of the water bodies and Chlorophyll a is being measured. Specifically, data are taken from 13 stations around Cyprus (Fig.1). For the years 2013 – 2019, water bodies of Cyprus are categorized as High or Good quality waters (Table 2).

Figure 1.
Coastal water bodies and their typology. *Coastal water bodies that are located in Cyprus but Cyprus Government do not exert efficient control, are only estimations (CY_0-C0).
(Source: Antoniadis et *al.*, 2020)



As a result of the ultra-oligotrophic status of the marine waters of Cyprus, the quantities of zooplankton are also limited. According to Hannides et (2015) who studied the mesozooplankton biomass and abundance in Cyprus coastal waters, mesozooplankton dry biomass ranged from 2.1 – 5.2 mg m^{-3} during the winter of 2010 and from 0.8 – 2.2 mg m-3 during the summer of 2010. Total mesozooplankton abundances ranged from 267 – 532 ind. m^{-3} in winter and from 211 – 497 ind. m^{-3} in summer. The mesozooplankton in Cyprus coastal waters was dominated by copepods, (primarily calanoids both in winter and summer), although cyclopoids were also abundant during both seasons (24 – 39% of total copepods) (Table 2).

Lastly, regarding the phylum Chordata, the pelagic Thaliacea (Tunicata, Chordata) were studied by Weikert & Godeaux (2008) and recorded the standing stocks of 5 species of thaliaceans and resulted in that the counts of thaliaceans at the studied sites (including Cyprus) were low in absolute numbers and relative to the local zooplankton. As it is mentioned in this study, this is typical of oceanic sites for most of the time when there are no blooming events.

Table 1.
Results from the monitoring program of WFD in Cyprus (2013-2019) regarding the ecological status of the water bodies based on the Chl a Index (Source: Antoniadis *et al.*, 2020)

Water Body		Chlorophyll - a (µg/l, 90%ile)								
		2013	2014	2015	2016	2017	2018	2019	Average 2013-2019	Ecological status 2013-2019
CY_3-C2	Chrysochou bay	0,06		0,01		0,02	0,04	0,10	0,05	HIGH
CY_5-C1	Akamas	0,05	0,06			0,06	0,01	0,04	0,04	HIGH
CY_7-C1-HM	Paphos			0,15		0,34	0,17		0,22	GOOD
CY_8-C1	Paphos Airport			0,19		0,16	0,05		0,13	GOOD
CY_11-C2	Limassol Bay-South			0,04	0,06		0,09		0,06	HIGH
CY_12-C2 -HM	Limassol Bay	0,09	0,15	0,12	0,13	0,08	0,07	0,11	0,11	GOOD
CY_14-C2-HM	Vasilikos port	0,10	0,15	0,15	0,13	0,15	0,14	0,09	0,13	GOOD
CY_15-C2	Limassol Bay-South	0,09	0,13	0,12	0,11	0,19	0,11	0,07	0,12	GOOD
CY_16-C2	Limassol Bay-South			0,04	0,04	0,03	0,03	0,09	0,05	HIGH
CY_18-C2	Limassol Bay-South			0,05	0,13	0,07	0,03	0,10	0,08	HIGH
CY_19-C3	Limassol Bay-South	0,10	0,21	0,05	0,31	0,09	0,09	0,03	0,13	GOOD
CY_20-C3	Limassol Bay-South	0,04	0,14	0,12	0,05	0,10		0,06	0,09	HIGH
CY_22-C3	Limassol Bay-South	0,05	0,06			0,04	0,11	0,08	0,07	HIGH

Table 2.
Mean abundance (± standard deviation) of mesozooplankton groups collected around Cyprus (C1-C5), in Saronikos Gulf (S7 and S11 averaged), and in the northeast Aegean Sea (NEA) in late winter-early spring and summer. Mesozooplankton taxa include calanoid copepods (Cal), cyclopoid copepods (Cycl), harpacticoid copepods (Harp), ostracods (Ost), cladocerans (Clad), other crustaceans (O. Crust), molluscs (Moll), chaetognaths (Chaet), thaliaceans (Thal), appendicularians (App), and 'other' mesozooplankton (O. Zoop) (source: Hannides et *al.*, 2015).

Study site	Cal. ind. m^{-3}	Cycl. ind. m^{-3}	Harp. ind. m^{-3}	Ost. ind. m^{-3}	Clad. ind. m^{-3}	O. crust. ind. m^{-3}	Moll. ind. m^{-3}	Chaet. ind. m^{-3}	Thal. ind. m^{-3}	App. ind. m^{-3}	O. zoop. ind. m^{-3}
Winter											
Cyprus: C1	153 ± 9	47 ± 1	0.2 ± 0.3	3.3 ± 1.1	0.0	0.8 ± 0.6	1.3 ± 0.04	3.2 ± 1.0	9.1 ± 8.9	35 ± 34	20 ± 7
Cyprus: C3	198 ± 7	48 ± 8	0.0	4.6 ± 2.5	0.0	1.1 ± 1.5	1.4 ± 2.0	3.9 ± 2.5	0.0	41 ± 6	13 ± 6
Cyprus: C4	195 ± 43	54 ± 14	0.8 ± 1.1	1.8 ± 0.2	0.0	3.7 ± 3.0	1.8 ± 0.2	3.7 ± 3.0	4.5 ± 1.8	4 ± 3	18 ± 1
Cyprus: C5	278 ± 2	112 ± 7	0.8 ± 1.1	12 ± 1.4	0.0	4.7 ± 0.8	8.1 ± 0.3	6.2 ± 0.9	4.9 ± 0.9	12 ± 5	25 ± 12
Cyprus: AVG	206 ± 51	66 ± 30	0.4 ± 0.7	5.3 ± 4.2	0.0	2.6 ± 2.2	3.1 ± 3.2	4.2 ± 2.0	4.6 ± 4.9	23 ± 21	19 ± 7
Saronikos Gulf	334 ± 98	264 ± 92	0.0	0.5 ± 0.8	0.0	39 ± 6	36 ± 36	23 ± 13	0.0	5 ± 6	7 ± 2
NEA	570	140	0.5	3.8	0.0	2.9	1.3	9	9	16	16
Summer											
Cyprus: C1	252 ± 43	148 ± 51	1.7 ± 3.0	7.8 ± 4.2	11 ± 3.2	2.8 ± 1.7	5.5 ± 7.5	3.1 ± 3.8	2.5 ± 3.0	40 ± 8	18 ± 6
Cyprus: C2	206 ± 66	141 ± 8	0.4 ± 0.7	2.9 ± 3.0	36 ± 28	6.4 ± 6.2	5.0 ± 3.2	3.5 ± 4.2	3.1 ± 1.0	32 ± 20	16 ± 9
Cyprus: C3	193 ± 24	127 ± 9	2.3 ± 0.1	7.4 ± 4.9	12 ± 12	3.5 ± 3.4	4.2 ± 2.4	1.1 ± 1.1	0.7 ± 1.3	53 ± 11	13 ± 0.3
Cyprus: C4	80 ± 9	55 ± 9	0.4 ± 0.6	1.8 ± 0.6	6 ± 7	1.8 ± 1.2	1.1 ± 1.8	0.4 ± 0.6	1.1 ± 1.8	3 ± 3	8 ± 4
Cyprus: C5	117 ± 45	76 ± 12	0.7 ± 1.2	5.3 ± 1.1	18 ± 21	2.1 ± 1.8	2.8 ± 1.6	1.4 ± 1.2	0.4 ± 0.6	5 ± 3	8 ± 2
Cyprus: AVG	169 ± 74	109 ± 44	1.1 ± 1.5	5.0 ± 3.7	16 ± 18	3.3 ± 3.4	3.7 ± 3.7	1.9 ± 2.5	1.6 ± 1.8	27 ± 22	13 ± 6
Saronikos Gulf	824 ± 109	186 ± 81	2.2 ± 0.2	0.0	675 ± 286	20 ± 0.9	14 ± 16	20 ± 19	147 ± 30	322 ± 47	31 ± 4
NEA	152	224	1.9	1.4	78	3.8	13	38	299	44	34

2.1.2. Information on invertebrate bottom fauna, macro-algae and angiosperms including species composition, biomass and annual/seasonal variability

Invertebrate bottom fauna

Benthic fauna play important roles in bioturbation activity, mineralization of organic matter, and in marine food webs (Stratmann et , 2020). Regarding marine benthic fauna of Cyprus, there are some information concerning mainly specific macrofaunal groups, while for some others there are not available data. Regarding meiofauna, data are even more scarce (e.g., Athersuch, 1979).

Porifera (sponges)

Invertebrate bottom fauna:

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Porifera (sponges)

Only a few works concern this phylum although Mediterranean is considered an ecological hotspot for sponge biodiversity with a total of 681 species recorded (Papatheodoulou et

al., 2019). A recent work gave a list of the shallow water sponges from Cyprus (Gabriele et al., 2018) increasing to 37 the total number of sponges known for Cyprus Island. From the species recorded, 6 out of the 30 (2 %) are Mediterranean endemics. Two sponge species (*Phorbas tenacior* and *Clathria (Clathria) toxistyla* were recorded for the first time in the Levantine Sea (Table 3). According to the same study, Cyprus is one of the traditional sites of fishery and trade of bath sponges. The severe diseases at the end of the last century virtually stopped this activity, making very rare, or locally extinct, the species supporting this fishery. The record of *Spongia (Spongia) zimocca* is worth of note as a sign of resilience of this species. Also, the presence of *Calyx nicaensis*, at least in one sampling site in Cyprus, is noteworthy because this species, once common in the whole Mediterranean, is now disappearing from large areas of the western basin. Further, Ulman et al., (2017) mentioned the alien sponge *Paraleucilla magna* for the first time from Cyprus (Table 3).

TABLE 3.

Checklist of the sponges recorded from Cyprus. *= Mediterranean endemic species. °= first record in the Levantine Sea. In bold, species included in SPA protocol -Annex II or III (revised by Gabriele et *al.*, 2018).

Species
Agelas oroides (Schmidt, 1864) *
Aplysina aerophoba (Nardo, 1833)
Axinella cannabina (Esper, 1794)
Axinella polypoides (Schmidt, 1862)
Calyx nicaeensis (Risso, 1826) *
Chondrilla nucula (Schmidt, 1862)
Chondrosia reniformis (Nardo, 1847)
Clathria (Clathria) toxistyla (Sara, 1959) *°
*Cliona parenzani (*Corriero & Scalera-Liaci, 1997)
Cliona viridis (Schmidt, 1862)
Clionaparenzani Corriero & Scalera-Liaci, 1997 *
Crambe (Schmidt, 1862)
Dysidea sp.
Geodia cydonium (Linnaeus, 1767)
Haliclona (Reniera) cratera (Schmidt, 1862)
Haliclona (Rhizoniera) sarai (Pulitzer-Finali, 1969) *
Halisarca sp.
Hippospongia communis (Lamarck, 1814)
Ircinia oros (Schmidt, 1864)
Ircinia retidermata (Pulitzer-Finali & Pronzato, 1981) *
Ircinia sp.1
Ircinia sp.2
Ircinia variabilis (Schmidt, 1862)
Paraleucilla magna Klautau, Monteiro & Borojevic, 2004
Petrosia (Petrosia) clavata (Esper, 1794)
Petrosia (Petrosia) ficiformis (Poiret, 1789)
Phorbas tenacior (Topsent, 1925) °
Phorbas, fictitius (Bowerbank, 1866)
Sarcotragus fasciculatus (Pallas, 1766)
Sarcotragus foetidus (Schmidt, 1862)
Sarcotragus sp.
Sarcotragus spinosulus (Schmidt, 1862)
Scalarispongia scalaris (Schmidt, 1862)
*Spirastrella cunctatrix (*Schmidt, 1868)
Spongia (Spongia) lamella (Schulze, 1879)
Spongia (Spongia) officinalis (Linnaeus, 1759)
*Spongia (*Spongia) zimocca (Schmidt, 1862) °
Spongia sp.

Cnidaria

Unfortunately, there are not any comprehensive list of species of Cnidaria of Cyprus available. The only existing information regards only a few and scattered data, mainly about jellyfish (Scyphozoa) and corals (Anthozoa). In Katsanevakis *et* al., (2009) three more alien species previously recorded are given: Scyphozoa *Cassiopeia andromeda*; *Rhopilema nomadica*, Hydrozoa *Laodicea fijiana* (questionable). *Lytocarpia myriophyllum* (Linnaeus, 1758). In addition, a hydroid species was recently recorded for the first time from Cyprus (Gerovasileiou *et* al., 2020).

Echinodermata

Demetropoulos and Hadjichristophorou (1976), developed a first list of the Echinodermata of Cyprus, lacking information on Holothuroidea. Later, Hadjichristophorou *et* al. (1997) added more species while further publications, added mainly alien species (Katsanevakis *et* al., 2009, Holothuroidea *Synaptula reciprocans*, Ophiuroidea *Ophiactis parva*, *Ophiactis savignyi*; Tzomos et al., 2010 *Aquilonastra burtoni* (*Asteroidea*); Mytilineou *et* al., 2016 *Diadema setosum* (Echinoidea)). Tzomos *et* al., (2010) *Aquilonastra* reaching a number of

55 species (Table 4).

TABLE 4.
Checklist of the echinoderms recorded from Cyprus.

Species
PELMATOZOA
Crinoidea
Antedoninae
Antedon mediterranea (Lamarck, 1816)
Asteroidea
Coscinasterias tenuispina (Lamarck, 1816)
Marthasterias glacialis (Linnaeus, 1758)
Anseropoda placenta (Pennant, 1777)
Aquilonastra burtoni (Gray, 1840)
Asterina gibbosa (Pennant 1777)
Astropecten aranciacus (Linnaeus,1758)
Astropecten bispinosus (Otto, 1823)
Astropecten irregularis (Pennant, 1777)
Astropecten jonstoni (Delle Chiaje, 1827)
Astropecten platyacanthus (Philippi, 1837)
Astropecten spinulosus (Philippi, 1837)
Tethyaster subinermis (Philippi, 1837)
Hymenodiscus coronata (G. O. Sars, 1872)
Chaetaster longipes (Retzius, 1805)
Echinaster (Echinaster) sepositus (Retzius 1783)
Peltaster placenta (Muller & Troschel, 1842)
Luidiidae
Luidia ciliaris (Philippi, 1837)
Hacelia attenuata (Gray, 1840)
Ophidiaster ophidianus (Lamarck, 1816)
Echinoidea
Arbacia lixula (Linnaeus, 1758)
Brissopsis lyrifera (Forbes, 1841)
Brissus unicolor (Leske, 1778)
Cidaris (Linnaeus, 1758)
Centrostephanus longispinus (Philippi, 1845)
Diadema setosum (Leske 1778)
Gracilechinus acutus (Lamarck 1816)
Echinocyamuspusillus (O. F. Muller, 1776)
Echinocardium cordatum (Pennant, 1777)
Echinocardium mediterraneum (Forbes, 1844)
Psammechinus microtuberculatus (Blainville, 1825)
Paracentrotus lividus (Lamarck, 1816)
Ova canaliferus (Lamarck, 1816)
Spatangus purpureus (O. F. Muller, 1776)
Stylocidaris affinis (Philippi, 1845)
Sphaerechinus granularis (Lamarck, 1816)
Holothuroidea
Holothuria (Holothuria) helleri Marenzeller von,
Holothuria (Holothuria) mammata (Grube, 1840)
Holothuria (Holothuria) tubulosa (Gmelin, 1791)
Holothuria (Platyperona) sanctori Delle Chiaje, 182
Holothuria (Thymiosycia) impatiens (Forskal, 1775)
Synaptula reciprocans (Forskal, 1775)
Oestergrenia digitata (Montagu, 1815)
Ophiuroidea
Amphiura chiajei (Forbes, 1843)
Acrocnida brachiata (Montagu, 1804)
Amphiura filiformis (O. F. Muller, 1776)
Ophiactis macrolepidota (Marktanner-Turneretscher, 188)
*Ophiactis savignyi (*Muller & Troschel, 1842)
Ophiopsila aranea (Forbes, 1843)
Ophioderma longicauda (Bruzelius, 1805)
Ophiomyxapentagona (Lamarck, 1816)
Ophiothrixfragilis (Abildgaard, in O. F. Muller, 1789)
Ophiura albida (Forbes, 1839)
Ophiura grubei (Heller, 1863)
Ophiura (Linnaeus, 1758)

Arthopoda

According to Kocatas *et al.*, (2001) the non-decapod crustacean fauna of Cyprus was mostly ignored with the exception of some few previous works. Through their research they provide a list of 343 species with 179 new additions for the island's crustacean fauna. In detail, the following taxa were mentioned:

- Cirripedia: 1 species
- Stomatopoda: 2 species
- Euphasiacea: 1 species
- Nebaliacea: 1 species
- Decapoda:
- 'Natantia' (this group is not valid anymore but the authors are referring to shrimps and prawns – Caridea & Dendrobranchiata): 44 species
- 'Macrura Reptantia' (this group is not valid anymore but the authors are referring to long-tailed decapods like lobsters and other relevant): 11 species
- Anomura: 24 species
- Brachyura: 72 species
- Mysidacea: 8 species
- Cumacea: 13 species
- Tanaidacea: 10 species

__Isopoda: 34 species

__Amphipoda: 122 species

After that publication, there are some sporadic ones which concern only specific group of Crustacea. Galil (2004) records the bathyal crab *Chaceon mediterraneus* for the first time, while (Chartosia *et al.*, 2018), raised the number of decapods in Cyprus to 163, after the addition of two common species that were recorded from Cyprus for the first time (the shrimp *Pasiphaea sivado* and the anomuran *Munida curvimana*). Further scattered literature, regards mainly alien species (i.e., Ulman *et al.* 2017 *Charybdis (Gonioinfradens) paucidentatus; Macrophthalmus indicus* Rousou & Chintiroglou, 2017 in Gerovasileiou *et al.*, 2017; *Carupa tenuipes*, Savva & Kleitou, 2017 in Gerovasileiou *et* al., 2017; Kampouris et al. 2019 *Penaeus pulchricaudatus* (already in Cyprus from 1961 as *Marsupenaeus japonicus ;* Kousteni *et al.*, 2019 *Matuta victor*).

Concerning Isopoda Kirkim *et al.* (2010) reported 5 free-living isopod species new for the Cyprus' fauna, increasing the total number to 43. Castello (2017) described a new species from Cyprus *Mesanthura pacoi* while some years later Castello *et al.* (2020) added another 2 species to the fauna of Cyprus raising the number to 45 (including parasitic species).

Christodoulou *et al.* (2013) add another one species of Amphipoda as a component of the fauna of Cyprus, while Myers *et al.* (2018) describe a new species *Microdeutopus periergos* from Cyprus.

Regarding Nebaliacea, Kocak *et al.* (2007) add one more species (*Nebalia straus*) as a new record for Cyprus.

The literature review showed that Pycnogonida is a group that is not well studied at all in Cyprus with Kocak and Katagan (2007) recording one species and Krapp *et al.* (2008) another two species of Pycnogonida found in Cyprus.

No further recent records regarding Tanaidacea and Cumacea exist.

Regarding Nematoda Russo-(1997) records only *Enoplus meridionalis* from Cyprus.

Todaro *et al.* (2003) records 4 species of Gastrotricha (Gnathostomulida) from Cyprus.

Mollusca

Regarding Mollusca, Öztürk *et al.* (2004) are giving a comprehensive list of 696 Molluscs species known from Cyprus (including fossils) while Zenetos *et al.* (2009) concluded that 645 species are living in Cyprus and added another nine (9) alien species found in their research and literature, reaching the number of 658 species in total. Tsiakkiros & Zenetos (2011) recorded four more alien opisthobranchs, thus increasing the number of alien molluscs to 48 species which represent 7% of the malacofauna of Cyprus and increases the total alien biota in Cyprus to 139. Some recent scarce studies record more alien species (Yokes *et al.* 2018 the heterobranch *Haminoea cyanomarginata*; Kleitou *et al.*, 2019 the nudibranch *Goniobranchus obsoletus*; Kleitou & Crocetta, 2020 in Bariche *et al.*, 2020; the sea slug *Berthellina citrina*; Paz-Sedano *et al.*, 2019 the nudibranch *Baeolidia moebii*; Kletou *et al.*, 2019 the gastropod *Amathina tricarinata*) raising the number of molluscs to 667.

Annelida

Regarding Annelida, Çınar (2005) outlined polychaete diversity of the island and compiled a list of 369 species and he showed that the majority of species were Atlanto-Mediterranean (45.5%), 12.5% were Endemic, 18.2% were Circum-tropical 7.6% were Disjunct, 12.5% were Cosmopolitan, and 3.8% of the species were Indo-Pacific. He also pointed that some peculiar environments such as harbour, estuarine and deep waters still remain largely unexplored. Musco *et al.* (2009) describe a new species found also rom Cyprus, *Sphaerosyllis boeroi*. Pavloudi *et al.* (2016) recorded another two species (*Pholoe minuta* and *Dipolydora armata*) associated with the sponge *Sarcotragus foetidus* from Cyprus. Katsiaras *et al.* (2018) record another one species *Gallardoneris iberica*, reaching a number of 372 polychaetes found in Cyprus. In addition, Rousou (Rousou" 2018, under submission) recorded 52 new records of polychaeta species as part of her PhD thesis. De Vries (1988) had recorded only one species of *Dugesia* (Platyhelminthes, Tricladida), *D. cretica*. It seems that no other data exist on the literature concerning this group.

Bryozoa

Bryozoa were recently studied by Achilleos *et al.* (2020) and recorded 91 bryozoan species, 26 (28%) of which are presently considered as new records for the Levantine Basin, and at least 10 (11%) are new to science. Kocak *et al.* (2002), studied the epiphytic bryozoan community of *Posidonia oceanica* in Cyprus and recorded 45 species, of which 25 were also recorded from Achilleos *et al.* (2020).

Ascidians

Hadjichristoforou *et al.* (1997), give a species list of the sublittoral soft-bottom macrobenthos of Cyprus and record twelve species of Ascidiacea from Cyprus. *Clavelina lepadiformis, Aplidium proliferum, Aplidium sp., Ascidia conchilega, Ascidia mentula, Ascidia virginea, Ascidiella aspersa, Phallusia mammilata, Halocynthia papillosa, Microcosmus claudicans, Microcosmus vulgaris* (named as *Microcosmus sulcatus), Microcosmus sp.* Monniot (2002) add another species, *Herdmania momus*. Argyrou *et al.* (2002) further record also *Ciona edwardsii, Cystodytes dellechiajei, Microcosmus sp., Molgula sp., Pyura dura, Salpa sp.* Ramos *et al.* (2007) record the following four ascidian species from Amathus Bay: *Ascidia mentula, Didemnidae spp, Halocynthia papillosa, Phallusia mammillata*. Gewing *et al.* (2016) recorded the alien *Microcosmus exasperatus* for the first time from Cyprus, while Ulman *et al.* (2017), further recorded two alien species *Clavelina oblonga* and *Phallusia nigra.* Savva & Kleitou 2017 in Gerovasileiou *et al.* 2017 reported the alien ascidian *Symplegma brakenhielmi*.

Sipuncula

Açık *et al.* (2005), was among the first who studied sipunculans from Cyprus and recorded eleven species increasing the number of total sipunculans on the island to fifteen. The species previously reported from Cyprus were *Phascolion (Phascolion) strombus*, *Nephasoma (N.) abyssorum*, *Onchnesoma steenstrupii*, *Apionsoma (A.) murinae*, *Phascolosoma sp.*, *Golfingia (Golfingia) vulgaris*, and *Sipunculus nudus*. In their study, a total of eleven species were found, of which four species (*Nephasoma (N.) constrictum, Phascolosoma (Phascolosoma) scolops, P. (P.) agassizii and P. (P.) stephensoni*) were new to the eastern Mediterranean fauna; seven species (*Nephasoma (N.) diaphanes, N. (N.) constrictum, A. (A.) muelleri cf. kovalevskii, Phascolosoma (P.) scolops, P. (P.) agassizii, P. (P.) granulatum, P. (P.) stephensoni*) are new to the Levant fauna; and eight species (*N.*

(N.) diaphanes, N. (N.) constrictum, A. (A.) muelleri, A. (A.) muelleri cf. kovalevskii, P. (P.) scolops, P. (P.) agassizii, P. (P.) granulatum, P. (P.) stephensoni) were new to the Cypriot fauna. Species reported in previous benthic studies in the Levantine Sea and not included in this study's collections were *Phascolion (Isomya) convestitum, P. (P.) strombus, N. (N.) abyssorum, S. nudus, Golfingia (Golfingia) elongata*, *Onchnesoma squamatum, Apionsoma (Apionsoma) trichocephalus*, and *Aspidosiphon (Aspidosiphon) elegans*. As overall data are concerned, the Levant Sea includes a total of 19 species, comprising 58% of the total Mediterranean sipunculan fauna and 76% of the eastern Mediterranean fauna. As for the Cypriot coast, it accounts for 45% of the total Mediterranean sipunculan fauna, 60% of the eastern Mediterranean fauna and 79% of the Levant sipunculan fauna. This study clearly shows that the reputed faunal impoverishment claimed for the Levant coast may be misleading and suggests that this generalization for the Levant Sea has been made because of the lack of knowledge about the real biodiversity of the region.

WFD: Lastly, Cyprus is monitoring benthic macroinvertebrates in certain soft sediments stations based on Bentix Index, along with other indexes in order to classify the ecological quality of coastal waters (Antoniadis *et* al., 2020).

Macrophytes of Cyprus

Macroalgae

The first comprehensive checklist of the seaweeds of Cyprus, based on both literature records and new collections, was given by (Tsiamis et , 2014). The total number of species and infraspecific taxa currently accepted were 313, including 53 green algae (Ulvophyceae), 90 brown algae (Phaeophyceae), and 170 red algae (Rhodophyta). Among them, 30 taxa were reported for the first time from Cyprus. In total, 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, is reported for the first time from Cyprus. Accoding to the same aurhors there is no doubt that this number of 313 recorded seaweed species is an underestimate, as most parts of the island and particularly the deeper parts of the euphotic benthos remain totally unexplored.

Çicek *et al.*, (2013) recorded the presence of the alien in Cyprus for the first time. Later, Aplikioti *et al.*, (2016) studied in more detail this species in Cyprus and concluded that it occurred in high abundances and dominated the benthic community, suggesting that has the potential to become a major pest in the Mediterranean. It was also observed over a wide depth range, from the sea surface to at least 100 m depth, on a variety of natural soft and hard substrates as well as abandoned fishing nets, suggesting a broad environmental plasticity.

Within the Water Framework Directive (WFD) monitoring program, DFMR is monitoring macroalgae communities by evaluating the Ecological Evaluation Index – c (EEI-c). Within this framework 5 water bodies have been assessed and the results for the period 2013-2019 of EEI-c biotic index showed that good and high ecological quality status prevail in all study areas (Antoniadis *et al.*, 2020) (Table 5).

Table 5.

Results of the biotic index EEI per water body (Source: Antoniadis ***et al.***, 2020 DFMR)

Water Body	2013	2014	2015	2016	2017	2018	2019	2013-2019
CY 5-C1	High	High	-	-	High	High	High	High
CY 7-C4	Good	Good	High	-	High	High	High	High
CY 8-C4	High	High	High	-	High	High	High	High
CY_19-C3	High	High	High	High	High	High	High	High
CY_20-C3	Good	High	High	High	High	High	Good	High

Seagrasses

Within the framework of the MEDISEH (Mediterranean Sensitive Habitats) project (Belluscio *et al.*, 2013) the distribution of seagrasses beds in different GSAs all over the Mediterranean basin according to published and unpublished data was performed. According to this study, in Cyprus the presence of *Posidonia oceanica*, *Cymodocea nodosa* and *Halophila stipulacea* is confirmed (for distribution maps see in Belluscio *et al.*, 2013). Christia *et al.* (2011) recorded *Ruppia maritima* from Akrotiri Lake and Larnaca Saltlake, while they also recorded the rare brackish angiosperm *Althenia filiformis*. According to Tziortzis *et al.* (in Siokou *et al.*, 2013) this species is a colonizer of saline shallow waters that dry up in the summer, thus it is threatened by pressures directly acting on its habitats, which alter their natural characteristics. As in many other Mediterranean wetlands, *A. filiformis* faces severe threats such us human alteration, habitat fragmentation, pollution, etc. that could lead to its extinction from the island. Therefore, conservation management measures are required urgently. In Cyprus, due to severe risk of habitat alteration and disturbance, the authors consider this rare species as endangered for the flora of Cyprus and suggest its insertion in the Red Data Book of the Flora of Cyprus.

For other angiosperms species recorded in other Mediterranean regions, no data are available for Cyprus (i.e., *Zostera noltii, Z. marina, and R. cirrhosa*).

Regarding *Posidonia oceanica* beds in Cyprus, a study on its distribution in the coastline (0-50 meters depth) of Cyprus Republic was conducted in 2013 for DFMR (DFMR, 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. And an estimation of a total area of 9,040 ha was made.

Currently, another project is running entitled: 'Mapping and evaluation of *Posidonia* meadows and other important marine habitats under the European Habitats Directive (92/43/EEC), in the coastal waters of Cyprus (Tender # 19/2018, DFMR, September 2019 – March 2022). The overall objective of the project is the mapping and evaluation of *Posidonia oceanica* meadows and other important marine habitats under the European Habitats Directive (92/43/EEC) in the coastal waters of Cyprus. This is the first national effort to map the marine ecosystems around the entire 'government controlled' coastline of Cyprus and develop high resolution cartography. It is also the first-time that underwater caves will be studied. This multi-disciplinary project will be executed with the support of a range of technological tools.

In the framework of the implementation of the WFD, Cyprus is assessing the ecological status of seawater by monitoring *P. oceanica* in a network of sampling stations, using PREI index. This index is based on five metrics: shoot density, shoot leaf surface area, E/L ratio (epiphytic biomass/leaf biomass), depth of lower limit, and type of this lower limit. According to the results for 2013 – 2019 the water bodies studied found to be in good or high ecological condition (Table 6) (Antoniadis *et al.*, 2020)

Table 6.

Results of the PREI biotic index per water body (Antoniadis *et al.*, 2020)

Water Body	2013	2014	2015	2016	2018	2013-2019
CY 4-C1	-	-	-	High	-	High
CY 12-C2	Good	-	Good	-	-	Good
CY 14-C2	-	-	-	Good	-	Good
CY 15-C2	-	-	-	Good	-	Good
CY_22-C3	High *	-	-	-	High	High

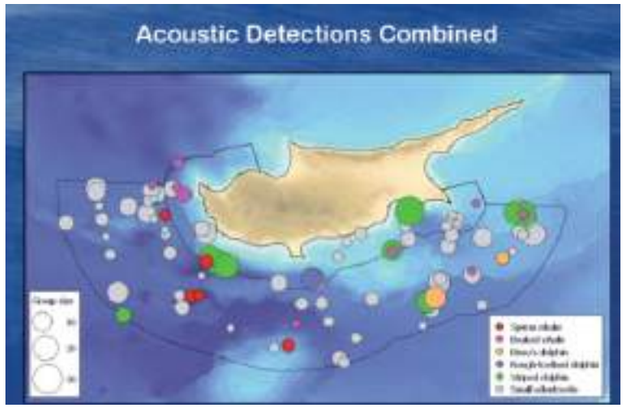
2.1.3 Information on vertebrates other than fish

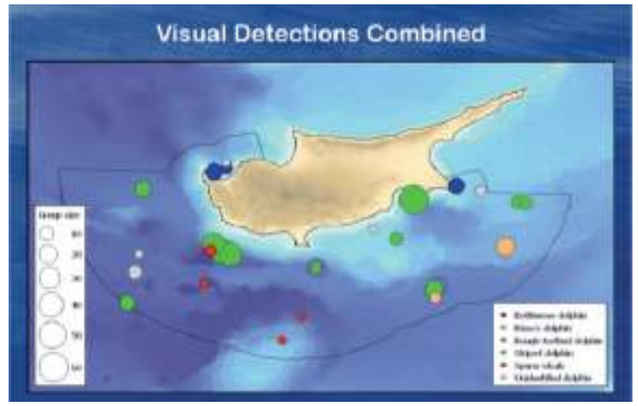
Mammals

According to the 'Second Assessment Report for MSFD' (DFMR, 2019) 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. All the aforementioned species are listed in the SPA/BD Protocol, Annex II. According to the summary results from the surveys of 2016 and 2017 for the assessment of cetacean presence, distribution and abundance conducted by international team of scientists under contract to DFMR, the results shown in Fig. 2 are given.

Figure 2.

Results from the a) visual detections and b) the acoustic detections combined from the three surveys in 2016 and 2017 (Boisseau, 2017).





Distribution and population size data for all species mentioned can be found in more details in the second assessmentfor the MSFD (DFMR, 2019).

The most common species in Cyprus seems to be the common bottlenose dolphin (*Tursiops truncatus*), found in both coastal waters in small groups of 5 – 15 individuals and in offshore waters in larger groups. The population of the common bottlenose dolphin 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 as referred in Republic of Cyprus, 2019).

The rough-toothed dolphin *Steno bredanensis* is rarely encountered in the Mediterranean Sea. In June 2007, 9 individuals of rough-toothed dolphins were documented north of Pomos, Cyprus (north-west coast of Cyprus) (Boisseau *et al.*, 2010 as recorded in the Republic of Cyprus, 2019) for the first time.

To date, individuals of *Grampus griseus* 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 survey conducted in 2016 – 2017 concluded that the most encountered marine mammal around Cyprus were the striped dolphins, *Stenella coeruleoalba*. The study

concluded that the striped dolphins occur in Cyprus waters year-round, with an increase in the sightings during the summer season.

There are no official records of common dolphins, *Delphinus delphis*, 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) (as referred in DFMR, 2019) includes Cyprus as a country of occurrence of common dolphins.

The false killer whales, *Pseudorca crassidens,* was first documented in Cyprus by two individuals seen off Cyprus near Lara Beach in June 2007 (Boisseau *et al.*, 2010 as referred in Republic of Cyprus, 2019).

Individuals of the sperm whale *Physeter macrocephalus* were documented in more than 500 m depth, with 83% detected in waters over 1000 m deep (Boisseau *et al.*, 2017 in DFMR, 2019).

Regarding Cuvier's beaked whale *Ziphius cavirostris*, all sightings from the 2016- 2017 survey were recorded in waters between 1000 and 2300 m deep. 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".

Fin whales of *Balaenoptera physalus*, are very rare in Cyprus. It has been suggested that this species has a 'visitor' status in Levantine Basin (eastern Mediterranean).

Mediterranean monk seal *Monachus*

The Mediterranean monk seal *Monachus* is categorized as Endangered on the IUCN Red List and it is also listed in the SPA/BD Protocol, Annex II, with <700 individuals remaining (Karamanlidis & Dendrinos, 2015 as referred in Nicolaou *et al.*, 2019). In Cyprus previous evidence suggested that the species became extinct, at the end of the 20th century. Recently, Nicolaou *et al.*, (2019) during the period 2009 - 2018, using field surveys, photographs from camera traps and an information network, recorded an increasing number of seal sightings in Cyprus, and the birth of several pups, indicating the permanent presence of the species on the island. The information network recorded 361 monk seal sightings, most of which were in three areas in the north- west and south: Pafos–Akamas (166 sightings), Limassol (118 sightings), and Kavo Greko–Kavo Pyla (68 sightings). The majority of sightings (95%) were of juvenile and adult individuals, but 18 sightings of new-born pups were also reported. Some of these sightings may refer to the same individuals. Further, as mentioned in DFMR (2019) the number of individuals is estimated to be 14 individuals, including 5 juveniles and pups. In Cyprus Mail in January 2020 (Theodoulou, 2020) three new individuals of Mediterranean seals were born during 2019, boosting Cyprus' seal population to 19. Further, certain areas with marine caves in Cyprus that are hosting monk seal, are characterised as IMMAs. For further details, see section 2.3.

Marine reptiles

In Cyprus three species of marine turtles are recorded, all listed in the SPA/BD Protocol, Annex II. These are the Loggerhead turtle Caretta, the Green turtle *Chelonia mydas* and the Leatherback turtle *Dermochelys coriacea*. Regarding the last species, it seems that it does not reproduce in the Mediterranean and it has been rarely recorded in the sea around Cyprus, as incidentally caughts in fishing gear.

According to Demetropoulos & Hadjıchrıstophorou, 2018 (in Hochscheid *et al.*, 2018.), the first turtle nesting surveys in Cyprus were undertaken in 1976 and 1977. Actual conservation activities started in 1978, with the setting up of the Lara Turtle Station on the west coast of the island. Conservation activities continued since then. The Cyprus Turtle Conservation Project is a government project and is implemented by the DFMR. The Cyprus Wildlife Society (CWS) has been helping the DFMR with the project since 1989 and has been implementing it on behalf of the DFMR since 2010. This project covers all the beaches in the part of the island that is under government control. About 80% of all loggerhead nesting and more than 90% of all Green turtle nesting takes place in two protected area one on the West Coast and one in Chrysochou Bay. For *C. caretta*, 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. The estimation of the population sizes and trends of both *Caretta* and *Chelonia mydas* is based on the number of nests made (Figs. 3, 4) (Demetropoulos & Hadjıchrıstophorou, 2018 in Hochscheid *et al.*, 2018.). 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.

Figure 3.

Loggerhead nesting in a) Chrysochou Bay and b) West Coast, 1999-2018.
(Source: DFMR, 2019 and references therein)

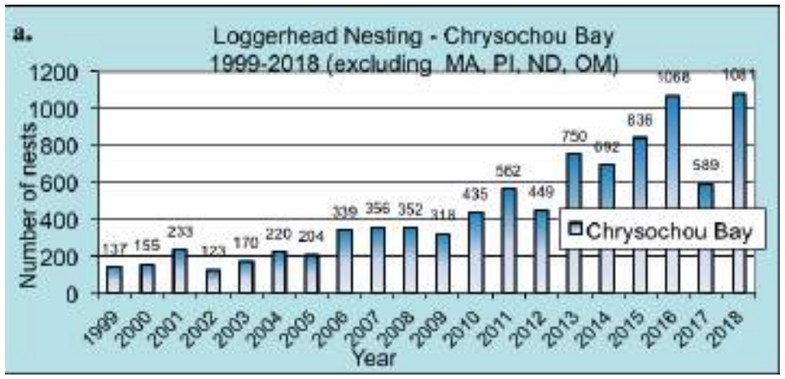
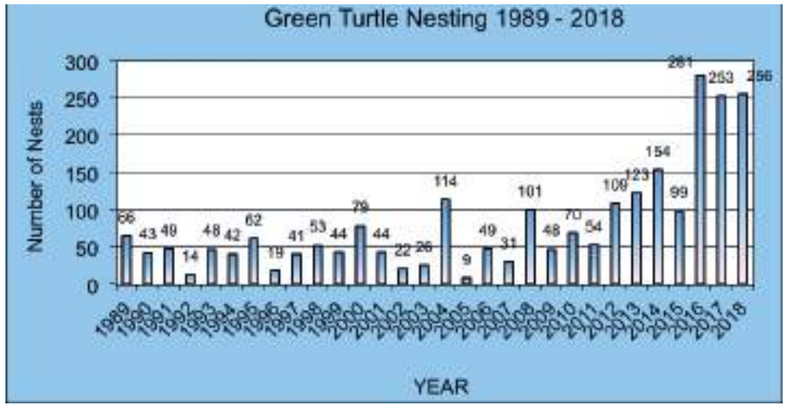


Figure 4.

Green turtle nesting on the West Coast, 1989-2018.
(Source: DFMR, 2019 and references therein).



After 40 years of implementing conservation measures in Cyprus, the conservation status of the two species of marine turtle in Cyprus, is in the category Favourable. Because of the long-time of the measures, valuable knowledge was gained which has resulted in the designation of protected areas, the identification and prohibition of harmful human activities, resulting in effective targeted conservation measures. Key measures to improve turtle breeding and reduce hatching mortality have included legal protection, prohibiting cars, sunbeds and parasols on beaches and caging nests to reduce natural predation by red foxes.

Seabirds

According to Cecere *et al.*(2012) seabirds are the most threatened of all bird groups and their status has deteriorated faster over the last decades. Through the Important Bird Areas (IBAs) programme, BirdLife International aims to identify key areas for the conservation of seabird species. Due the geographical position of Cyprus, it is an important migration route for birds travelling between Europe, Africa and the Middle East. As a result, Cyprus is amongst the six European regions which are included in the list of Endemic Bird Areas of the World (BirdLife International, 2020).

BirdLife International (2020), records 23 species of seabirds in Cyprus, with one being characterised as Vulnerable from the IUCN (*Puffinus yelkouan*) (Table 8). Concerning population data for Cyprus these are scarce, apart from some isolated published data referring to specific species (e.g., 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).

Additional data is published by birdwatchers and the non-governmental organisation BirdLife Cyprus. BirdLife Cyprus is also curator of the IBA inventory for Cyprus, drawn up on the basis of recognized and scientifically rigorous BirdLife International criteria, and approved by BirdLife International. The IBA inventory catalogues the key sites for bird conservation on the island and includes details on qualifying species and populations, site boundaries and characteristics. In addition to such systematic data, BirdLife Cyprus also holds 'raw' bird-watching data, referring simply to unsystematic sightings at various locations and various times of the year, mostly provided voluntarily by its active members and other birdwatchers who share their records. These data tend to be biased towards popular bird-watching sites, towards rarer species and towards the migration seasons. None-the-less such data can be of value in assessing the status of birds, provided its limitations are allowed for. These data are also collated in monthly and annual bird reports.

In Table 7, the status of birds in Cyprus listed in Annex II of SPA/BD is given (source: DFMR, 2019).

Table 7.

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", (Source: UNEP-MAP-RAC/SPA 2013 in DFMR, 2019).

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 Iescenaultii 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

Table 8.

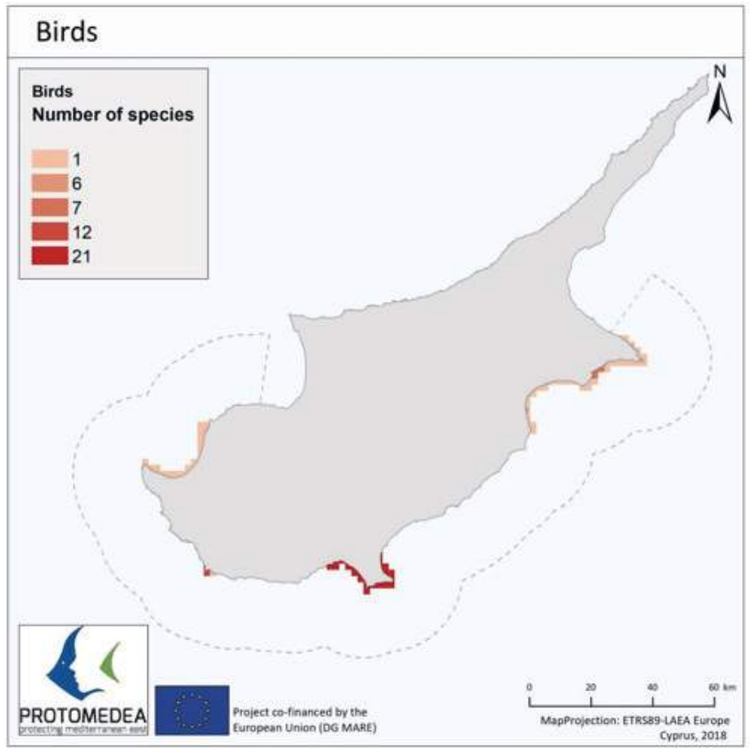
Seabirds of Cyprus (BirdLife International, 2020).

Scientific name	Common name	Family	Global IUCN Red List Category
Mergus serrator	Red-breasted Merganser	Anatidae (Ducks, Geese, Swans)	**LC**
Podiceps cristatus	Great Crested Grebe	Podicipedidae (Grebes)	**LC**
Podiceps nigricollis	Black-necked Grebe	Podicipedidae (Grebes)	**LC**
Calonectris diomedea	Scopoli's Shearwater	Procellariidae (Petrels, Shearwaters)	**LC**
*Puffinus yelkoua*n	Yelkouan Shearwater	Procellariidae (Petrels, Shearwaters)	**VU**
Pelecanus onocrotalus	Great White Pelican	Pelecanidae (Pelicans)	**LC**
Gulosus aristotelis	European Shag	Phalacrocoracidae (Cormorants)	**LC**
Phalacrocorax carbo	Great Cormorant	Phalacrocoracidae (Cormorants)	**LC**
Phalaropus lobatus	Red-necked Phalarope	Scolopacidae (Sandpipers, Snipes, Phalaropes)	**LC**
Hydrocoloeus minutus	Little Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus genei	Slender-billed Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus ridibundus	Black-headed Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus melanocephalus	Mediterranean Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus audouinii	Audouin's Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus canus	Mew Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus fuscus	Lesser Black-backed Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Larus michahellis	Yellow-legged Gull	Laridae (Gulls, Terns, Skimmers)	**LC**
Sternula albifrons	Little Tern	Laridae (Gulls, Terns, Skimmers)	**LC**
Hydroprogne caspia	Caspian Tern	Laridae (Gulls, Terns, Skimmers)	**LC**
Chlidonias niger	Black Tern	Laridae (Gulls, Terns, Skimmers)	**LC**
Sterna hirundo	Common Tern	Laridae (Gulls, Terns, Skimmers)	**LC**
Thalasseus sandvicensis	Sandwich Tern	Laridae (Gulls, Terns, Skimmers)	**LC**
Stercorarius parasiticus	Arctic Jaeger	Stercorariidae (Skuas)	**LC**

PROTOMEDEA stands for "PROTecting MEDiterranean EAst" and was a project, in response to the call for Marine Protected Areas: network(s) for the enhancement of sustainable fisheries in EU Mediterranean waters" (Ref. MARE/2014/41), funded by the European Union DG MARE (2015 - 2018) (Karachle, 2019). The project aimed to contribute towards the establishment of fishery related Marine Protected Area networks in the Eastern Mediterranean. Among its main goals was the Mapping of existing Marine Protected Areas (MPAs) and planning of proposed MPA networks in two areas of the Eastern Mediterranean, the Aegean Sea and Cyprus. The map in Figure 5 data concerning number of sightings of specific seabirds in Cyprus, that are under protection (data from Birdlife Cyprus, 2017).

Figure 5.

Records of seabirds (number of species per Planning Unit, PU) present in the study area (Karachle *et al.*, 2019)



2.1.4 Inventory of the temporal occurrence, abundance and spatial distribution of non-indigenous, including invasive species

In 2009 that Katsanevakis *et al.* (in DFMR, 2019b) first published an inventory of the NIS of Cyprus which included 126 alien or cryptogenic marine alien species (42 molluscs, 28 fish, 19 polychaetes, 15 phytobenthic species, 12 crustaceans, and 10 species from other taxa) with 117 classified as NIS (80 established) and 9 as cryptogenic.

The second inventory was given again by Katsanevakis in 2019 (DFMR, 2019b) including 179 species in total, of which 167 NIS and 12 cryptogenic species. The classification by Phylum of the NIS and cryptogenic species of Cyprus, included 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.

In the current inventory, 7 more species are added, reaching a number of 186 alien species in Cyprus. The new additions regard 2 Crustacea (1 Amphipoda and 1 Decapoda), 2 Mollusca (Gastropoda) and 4 Chordata (Osteichthyes) (Table 9).

Table 9.

*I*nventory of alien species in Cyprus, reported until August 2020. In bold: new additions; NIS: Non- Indigenous Species; IAS: Invasive Alien Species (Modified by DFMR, 2019)

Phylum	Species	Year of introduction	Status	Establishment
Rhodophyta	***Acanthophora nayadiformis***	1997-98	cryptogenic	unknown
Chordata	***Acanthurus coeruleus***	2011	NIS	casual
Mollusca	***Acteocina mucronata***	1992	NIS	established
Chordata	***Alepes djedaba***	1961	NIS	established
Mollusca	***Alvania dorbignyi***	1985	cryptogenic	established
Bryozoa	***Amathia verticillata***	2016	NIS	unknown
Mollusca	***Amathina tricarinata***	2012	NIS	casual
Crustacea	**Ampithoe bizseli**	2016	NIS	unknown
Foraminifera	***Amphistegina lobifera***	1976	NIS	established
Arthropoda	***Apanthura addui***	1998	NIS	
Arthropoda	***Apanthura sandalensis***	1998	NIS	established
Mollusca	***Aplysia dactylomela***	2004	cryptogenic	established
Chordata	***Apogonichthyoides pharaonis***	1964	NIS	established
Echinodermata	***Aquilonastra burtoni***	2003	NIS	established
Chordata	Arothron hispidus	2018	NIS	casual
Rhodophyta	***Asparagopsis armata***	1998	NIS	casual
Arthropoda	***Atergatis roseus***	2015	NIS	established
Chordata	***Atherinomorus forskalii***	1929	NIS	established
Mollusca	**Baeolidia moebii**	2017	NIS	unknown
Arthropoda	***Balanus trigonus***	2016	NIS	established
Mollusca	**Berthellina citrina**	2019	NIS	unknown
Mollusca	***Biuve fulvipunctata ex Chelidonura fulvipunctata***	2003	NIS	established
Rhodophyta	***Botryocladia madagascariensis***	2008	NIS	casual
Mollusca	***Brachidontes pharaonis***	1960	NIS	established
Annelida	***Branchiomma luctuosum***	1998	NIS	unknown
Mollusca	***Bulla arabica***	2000	NIS	established
Mollusca	***Bursatella leachii***	2016	NIS	established
Arthropoda	***Callinectes sapidus***	1964	NIS	established
Chordata	***Callionymus filamentosus***	2016	NIS	casual
Arthropoda	***Carupa tenuipes***	2016	NIS	casual
Cnidaria	***Cassiopea andromeda***	1903	NIS	established

Phylum	Species	Year of introduction	Status	Establishment
Chlorophyta	*Caulerpa chemnitzia*	1992	cryptogenic	unknown
Chlorophyta	*Caulerpa cylindracea*	1991	NIS (IAS)	invasive
Chlorophyta	*Caulerpa racemosa var. lamourouxii f. requienii*	1997	NIS	casual
Chlorophyta	*Caulerpa taxifolia var. distichophylla*	2009	NIS	established
Bryozoa	*Celleporaria vermiformis*	2016	NIS	unknown
Annelida	*Ceratonereis mirabilis*	1997	NIS	established
Mollusca	*Cerithidium perparvulum*	1995	NIS	casual
Mollusca	*Cerithiopsis pulvis*	1985	NIS	established
Mollusca	*Cerithiopsis tenthrenois*	1985	NIS	established
Mollusca	*Cerithium scabridum*	1983	NIS	established
Mollusca	*Chama asperella*	2007	NIS	casual
Mollusca	*Chama pacifica*	1998	NIS	established
Arthropoda	*Charybdis helleri*	1998	NIS	established
Arthropoda	*Charybdis longicollis*	1969	NIS	established
Chordata	*Cheilodipterus novemstriatus*	2015	NIS	established
Rhodophyta	*Chondria coerulescens*	2008	cryptogenic	unknown
Mollusca	*Cingulina isseli*	1998	NIS	established
Chlorophyta	*Cladophora cf. patentiramea*	1991	NIS	established
Chordata	*Clavelina lepadiformis "interior form, Turon et al 2003"*	2016	NIS	unknown
Chordata	*Clavelina oblonga*	2016	NIS	established
Mollusca	*Conomurex persicus*	1985	NIS	established
Mollusca	*Coryphellina rubrolineata ex Flabellina rubrolineata*	2008	NIS	established
Foraminifera	*Coscinospira hemprichii*	2009	NIS	established
Chordata	Cyclopterus lumpus	2017	NIS	unknown
Mollusca	*Cycloscala hyalina*	1992	NIS	casual
Mollusca	*Dendostrea cf folium*	2008	NIS	established
Echinodermata	*Diadema setosum*	2012	NIS	established
Chordata	*Dussumieria elopsoides*	2005	NIS	established
Chordata	*Equulites klunzingeri*	1961	NIS	established
Mollusca	*Ergalatax junionae*	1993	NIS	established
Arthropoda	*Erugosquilla massavensis*	1956	NIS	established
Chordata	*Etrumeus golanii misid. E. teres*	1999	NIS	established
Annelida	*Eusyllis kupfferi*	1998	NIS	established
Mollusca	*Finella pupoides*	1996	NIS	casual
Chordata	*Fistularia commersonii*	1999	NIS (IAS)	invasive
Chordata	Fistularia petimba	2019	NIS	unknown
Mollusca	*Fulvia fragilis*	1983	NIS	established
Mollusca	*Gafrarium savignyi*	2005	NIS	established
Rhodophyta	*Ganonema farinosum*	1997-98	cryptogenic	unknown
Mollusca	*Goniobranchus annulatus*	2009	NIS	established
Arthropoda	*Gonioinfradens paucidentatus*	2016	NIS	established
Tracheophyta	*Halophila stipulacea*	1967	NIS	established

Phylum	Species	Year of introduction	Status	Establishment
Mollusca	*Haminoea cyanomarginata*	2016	NIS	established
Chordata	*Hemiramphus far*	1964	NIS	established
Chordata	Heniochus **sp.**	2018	NIS	unknown
Chordata	*Herdmania momus*	1998	NIS	established
Chordata	*Hippocampus fuscus*	2014	NIS	casual
Annelida	*Hydroides elegans*	1996	NIS	established
Annelida	*Hydroides heterocera*	1998	NIS	established
Annelida	*Hydroides homoceros*	2016	NIS	unknown
Rhodophyta	*Hypnea spinella*	2012	NIS	established
Mollusca	*Hypselodoris infucata*	2007	NIS	established
Mollusca	*Indothais lacera*	1988	NIS	casual
Chordata	*Kyphosus vaigiensis*	2016	cryptogenic	casual
Chordata	*Lagocephalus guentheri mis Lagocephalus spadiceus*	2006	NIS	established
Chordata	*Lagocephalus sceleratus*	2004	NIS (IAS)	invasive
Chordata	*Lagocephalus suezensis*	2007	NIS	established
Cnidaria	*Laodicea fijiana*	1972	NIS	questionable
Mollusca	*Leucotina natalensis*	1996	NIS	established
Mollusca	*Liloa mongii ex Cylichna cf. mongii*	1992	cryptogenic	casual
Arthropoda	*Linguimaera caesaris ex Hamimaera hamigera*	1997	NIS	established
Annelida	*Linopherus canariensis*	1997	NIS	casual
Rhodophyta	*Lophocladia lallemandii*	1997-98	NIS	established
Annelida	*Lysidice collaris*	1968	NIS	established
Arthropoda	*Macrophthalmus indicus*	2011	NIS	established
Mollusca	*Malleus regula*	1970	NIS	established
Crustacea	Matuta victor	2019	NIS	uknown
Mollusca	*Melibe viridis*	2001	NIS	established
Arthropoda	*Mesanthura cf. romulea*	2016	NIS	unknown
Arthropoda	*Metapenaeopsis aegyptia*	2004	NIS	established
Arthropoda	*Metapenaeus monoceros*	1961	NIS	established
Annelida	*Metasychis gotoi*	1997	NIS	established
Mollusca	*Metaxia bacillum*	1995	NIS	casual
Chordata	*Microcosmus exasperatus*	2014	NIS	established
Bryozoa	*Microporella coronata*	1998	NIS	unknown
Ctenophora	*Mnemiopsis leidyi*	2012	NIS	unknown
Mollusca	*Mnestia girardi ex Cylichnina*	1996	NIS	established
Chordata	*Nemipterus randalli*	2014	NIS	established
Annelida	*Neopseudocapitella brasiliensis*	1997-98	NIS	established
Annelida	*Notomastus aberans*	1997	NIS	established
Annelida	*Notomastus mossambicus*	1997	NIS	established
Annelida	*Oenone cf. fulgida*	1996	NIS	questionable
Echinodermata	*Ophiactis macrolepidota*	1998	NIS	established
Echinodermata	*Ophiactis savignyi*	1998	NIS	established
Chordata	*Ostorhinchus fasciatus*	2014	NIS	casual

Phylum	Species	Year of introduction	Status	Establishment
Arthropoda	*Paracerceis sculpta*	2016	NIS	unknown
Arthropoda	*Paradella dianae*	2003	NIS	established
Porifera	*Paraleucilla magna*	2016	NIS	unknown
Bryozoa	*Parasmittina egyptiaca*	2016	NIS	unknown
Mollusca	*Paratapes textilis*	2004	NIS	established
Chordata	*Parexocoetus mento*	<2002	NIS	established
Chordata	*Parupeneus forsskali*	2014	NIS	established
Foraminifera	*Pegidia lacunata*	2010	NIS	established
Chordata	*Pempheris rhomboidea*	1995-96	NIS	established
Arthropoda	*Penaeus pulchricaudatus ex Marsupenaeus japonicus*	1961	NIS	established
Arthropoda	*Penaeus semisulcatus*	2010	NIS	casual
Arthropoda	*Percnon gibbesi*	2006	NIS	established
Chordata	*Phallusia nigra*	2016	NIS	established
Sipuncula	*Phascolosoma scolops*	1998	NIS	established
Arthropoda	*Pilumnopeus vauquelini*	1963	NIS	established
Mollusca	*Pinctada imbricata radiata*	1899	NIS	established
Annelida	*Pista unibranchia*	1997	NIS	established
Mollusca	*Plocamopherus ocellatus*	2015	NIS	established
Rhodophyta	*Polysiphonia atlantica*	2008	cryptogenic	questionable
Chordata	*Pomadasys stridens*	2014	NIS	casual
Arthropoda	*Portunus segnis*	1958	NIS	established
Annelida	*Prosphaerosyllis longipapillata*	1997	NIS	casual
Mollusca	*Psammacoma gubernaculum*	2009	NIS	casual
Foraminifera	*Pseudolachlanella slitella*	2010	NIS	unknown
Annelida	*Pseudonereis anomala*	1969	NIS	established
Chordata	*Pteragogus trispilus*	1997	NIS	established
Chordata	*Pterois miles*	2012	NIS	invasive
Mollusca	*Purpuradusta gracilis notata*	2000	NIS	established
Mollusca	*Pyrgulina pupaeformis ex Pyrgulina maiae*	1995	NIS	established
Mollusca	*Pyrunculus fourierii*	1995	NIS	casual
Mollusca	*Rhinoclavis kochi*	1976	NIS	established
Cnidaria	*Rhopilema nomadica*	1995	NIS	established
Mollusca	*Rissoina bertholleti*	1985	NIS	established
Chordata	*Sargocentron rubrum*	1961	NIS	established
Chordata	*Saurida lessepsianus*	1960	NIS	established
Chordata	*Scarus ghobban*	2010	NIS	casual
Chordata	*Scomberomorus commerson*	2008	NIS	established
Mollusca	*Sepioteuthis lessoniana*	2009	NIS	established
Mollusca	*Septifer cumingii*	2005	NIS	established
Chordata	*Siganus luridus*	1964	NIS (IAS)	invasive
Chordata	*Siganus rivulatus*	1928	NIS (IAS)	invasive
Chordata	*Sillago suezensis ex S. sihama*	2009	NIS	casual
Mollusca	*Smaragdia souverbiana*	1995	NIS	casual
Chordata	*Sphyraena chrysotaenia*	1964	NIS	established
Chordata	*Sphyraena flavicauda*	2014	NIS	established
Annelida	*Spirobranchus tetraceros*	1996	NIS	established
Annelida	*Spirorbis marioni*	1996	NIS	unknown
Mollusca	*Spondylus spinosus*	2001	NIS	established
Chordata	*Spratelloides delicatulus*	2014	NIS	established
Chordata	*Stephanolepis diaspros*	1935	NIS	established
Mollusca	*Sticteulima cf. lentiginosa*	1995	NIS	casual
Ochrophyta	*Stypopodium schimperi*	1990	NIS	established
Chordata	*Symplegma brakenhielmi*	2016	NIS	established
Echinodermata	*Synaptula reciprocans*	1967	NIS	established
Chordata	*Synchiropus sechellensis*	2016	NIS	casual
Mollusca	*Syrnola fasciata*	1995	NIS	casual
Mollusca	*Tayuva lilacina*	?	cryptogenic	unknown
Annelida	*Terebella ehrenbergi*	1969	NIS	questionable
Arthropoda	*Thalamita poissonii*	1969	NIS	established
Chordata	*Torquigener flavimaculosus*	2009	NIS (IAS)	established
Mollusca	*Trochus erithreus*	1985	NIS	established
Mollusca	*Turbonilla edgarii*	1996	NIS	casual
Chordata	*Upeneus moluccensis*	1961/1964	NIS	established
Chordata	*Upeneus pori*	2004	NIS	established
Chordata	*Variola louti*	2018	NIS	casual
Rhodophyta	*Vertebrata fucoides ex Polysiphonia*	2008	cryptogenic	questionable
Mollusca	*Viriola cf. bayani*	2017	NIS	casual
Bryozoa	*Watersipora subtorquata*	2010	cryptogenic	established
Rhodophyta	*Womersleyella setacea*	2008	NIS	established
Mollusca	*Zafra savignyi*	1995	NIS	casual
Mollusca	*Zafra selasphora*	1995	NIS	casual

As stated by Katsanevakis (in DFMR, 2019b), in the previous assessment period (2007-2012), 30 new NIS in Cyprus were reported, while in the assessment period 2013-2018, 33 new NIS were reported. The number of newly introduced NIS was therefore calculated at the same levels as in the previous period. A peak in newly introduced species occurred between 1995 and 2000, but this is to some extent affected by the increased scientific interest in documenting NIS during that period, contrary to the past. In this assessment concerning the period 2018 – Aug. 2020, seven more alien species are added to the list. It seems that there is an increase in the number of records these 2 years, but it remains to see if there will be an increase on the rate of entrance or not.

Data regarding biology or/and ecology of alien species in Cyprus or else in the Mediterranean are scarce. *Pterois miles* (lionfish) is a species that was recently studied by Savva *et al.* (2020) from populations from Cyprus. In this work, the basic biology and ecology of lionfish was studied, examining morphometrics, reproduction and diet as well as population structure and distribution. It seems that the population density of lionfish has increased dramatically in Cyprus since the first sighting in late 2012. By 2018 aggregations of up to 70 lionfish were found on rocky grounds with complex reefs and artificial reefs in depths of 0–50 m. Lionfish in Cyprus become mature within a year, and adults are capable of

spawning year-round, with peak spawning in summer when the sea-surface temperature reaches 28.4oC. The Cypriot lionfish grow faster and bigger than in their native range, and females are more common than males. Lionfish are generalist predators in these waters, consuming a range of teleost and crustacean prey, some of which are of high economic value (e.g., *Spicara smaris* and *Sparisoma cretense*) or have an important role in local trophic webs (e.g., *Chromis chromis*).

Currently, the diet and maturity stages of some more alien species is being studied by Chartosia et al. (under preparation). The analysis of the stomach contents of *Torquigener flavimaculosus* from Cyprus revealed that it is an omnivorous species with a preference to animal prey, especially invertebrates with limited mobility (crustaceans, molluscs, echinoderms). The length-weight relationship indicated a negative allometric growth for both sexes while it seems that it reproduces mainly during the warmer months of the year (spring to late summer).

Chartosia *et al.* (under preparation) studied the diet and maturity stages of the alien Red Sea goatfish, *Parupeneus forsskali*. The diet of *P. forsskali* was dominated by Crustaceans, mainly Brachyura, while Polychaeta, Nematoda, Mollusca and Echinodermata were secondary prey taxa. The length-weight relationship showed positive allometry. It seems that the spawning period starts in summer, in individuals with a total length less than 12 cm. According to this study, *P. forsskali* has diverse diet, thrives in its new habitat, thus it has a high potential to adversely impact the local biodiversity.

2.1.5 Information on species of commercial interest for fishing (fish, mollusk and shellfish)

According to STECF (2019) the weight of seafood landed in Cyprus, reached 1.74 thousand tonnes a significant increase of 19%, with a value of EUR 10.38 million in 2017 representing an amazing rise of 34% compared to 2016. However, two important events took place in 2017, the introduction of a new fleet segment -the purse seiner targeting BFT and the fact that Cyprus changed its sampling strategy.

The Cyprus fleet is dominated by small-scale-vessels. The small-scale fleet (vessels under 12m using passive gears) is by far the most significant segment of the Cyprus fleet since it represents around the 95% of the total fleet both in 2017 and in 2018 in terms of number of vessels and thus, employment. In addition, it represents 40% in regards to total weight of landings and 54.5% regarding to value of landings in 2017. The higher percentage in relation to value of landings compared to weight of landings is that SSCF generally improves production price to a higher degree than the Large-scale Fleet (LSF), and the gap between prices at first sale can be very high. These gaps may be explained by both the differences in quality linked to freshness and the size of the products but also the marketing channels.

The selling prices of SSCF are really high. The same species caught by SSCF are much higher than the ones caught by demersal trawlers. This is evident if looking two of the main commercial species "surmullet (*Mullus surmuletus*) and red mullet (*Mullus barbatus*) of the Cyprus fishery.

The bottom trawl fishery in the territorial waters and the inshore fishery with polyvalent passive gears target a mix of demersal species, as it is the case in all Mediterranean demersal fisheries. The exploited stocks are not shared with other countries' fleets. Landings of both fisheries are mainly composed by picarel (*Spicara smaris*), bogue (*Boops boops*), red mullet (*Mullus barbatus*), surmullet (*M. surmuletus*), common pandora (*Pagellus erythrinus*) and cephalopods: common octopus (*Octopus vulgaris*), musky octopus (*Eledone moschata*), European squid (*Loligo vulgaris*) and common cuttlefish (*Sepia officinalis*).

The inshore fishery with polyvalent passive gears catches also relatively large quantities of parrotfish (*Sparisoma cretense*), blotched picarel (*Spicara maena*) and spinefeet or rabbitfishes (*Siganus* spp.).

Concerning the large pelagic fishery, polyvalent vessels operate in the Eastern Mediterranean, catching basically swordfish (*Xiphias gladius*), albacore (*Thunnus alalunga*) and Atlantic bluefin tuna (*Thunnus thynnus*) with drifting longlines. For first time in 2017 Atlantic bluefin tuna caught by the purse seiner.

According to Michailidis *et al.*, (2019) small-scale fishing boats, mostly using bottom set nets and longlines, constitute more than 90% of the professional fishing fleet in Cyprus. In terms of catch the 5 most important species for the previous year (2019) for artisanal fisheries are (DFMR unpublished fishery statistics):

1 _ *Boops boops*
2 _ *Serranus cabrilla*
3 _ *Lagocephalus spp.*
4 _ *Spicara smaris*
5 _ *Spicara maena*

In terms of value, the 5 most important species are:

1 _ *Boops boops*
2 _ *Mullus surmuletus*
3 _ *Sparisoma cretense*
4 _ *Siganus rivulatus*
5 _ *Siganus luridus*

Recently Michailidis *et al.*, (2020) gave for the first time, data regarding MRF in Cyprus and made a comparison with the commercial fisheries (Figure 6, 7). In these figures, the main target species for both sectors can be seen in terms of catch and value (Figure 6) and in terms of weight per type of fisheries (Figure 7).

Figure. 6.

Total catch (t/year) and value (m€/year) of recreational (by type) and coastal commercial fisheries, by species (first 30 shown) (source: Michailidis *et al.*, 2020).

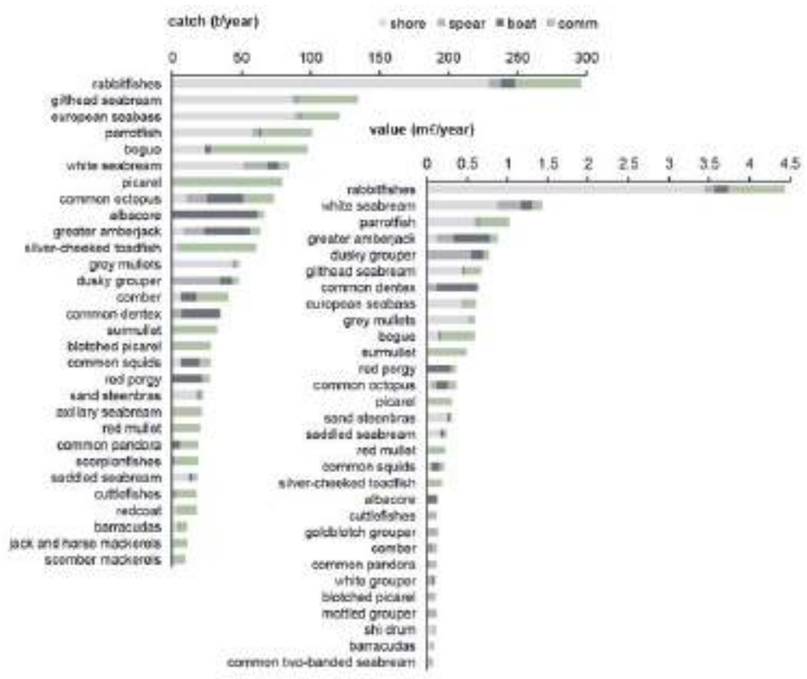
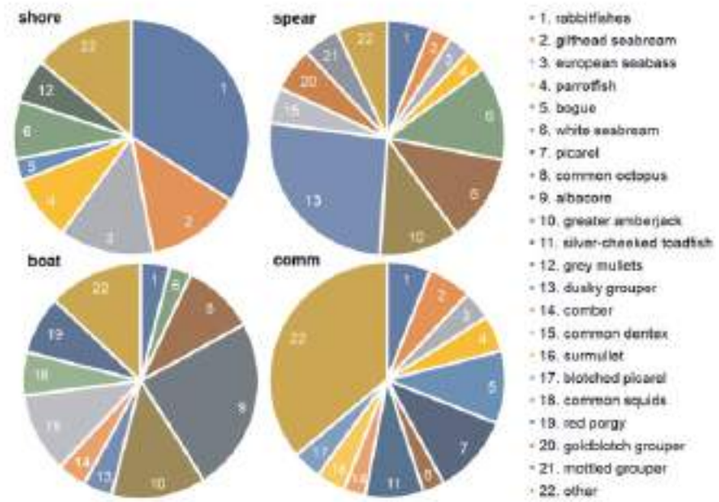


Figure. 7.

Recreational (by type) and coastal commercial fisheries species composition by weight (species < 3% in other) (source: Michailidis *et al.*, 2020).



Scarcella (in DFMR, 2019b) gave a list of the most important species landed in Cyprus for the years 2014 – 2016 (Table 10) and the status of selected stocks that were included in the GES report of the second assessment of the MSFD for Cyprus. Data regarding the species that are in top five for artisanal fisheries (if data available) or/and are included in annex III to the SPA/BD Protocol are all taken from the 'Determination of Good Environmental Status of the Marine Environment of Cyprus Report' (DFMR, 2019b).

Table 10.

List of the most important species/families landed in Cyprus.
(Source: 2018 - EU Fleet Economic Performance from DFMR, 2019b)

Scientific name	Species code	Live weight of landings (tons) - Mean 2014-2016	Value of landings (1000 x EURO) - Mean 20142016	Percentage weight (%)	Percentage value (%)
Thunnus alalunga	ALB	513.75	1,126.35	36.21	14.81
Boops boops	BOG	112.90	641.44	7.96	8.43
Serranus cabrilla	CBR	73.69	214.48	5.19	2.82
Spicara smaris	SPC	67.44	291.74	4.75	3.84
Xiphias gladius	SWO	51.58	446.94	3.64	5.88
Mullus surmuletus	MUR	49.34	907.92	3.48	11.94
Spicara maena	BPI	33.89	141.05	2.39	1.85
Thunnus thynnus	BFT	32.74	207.61	2.31	2.73
Sparisoma cretense	PRR	32.58	365.58	2.30	4.81
Osteichthyes	MZZ	32.43	112.34	2.29	1.48
Mullus barbatus	MUT	31.30	451.62	2.21	5.94
Pagellus acarne	SBA	27.67	97.61	1.95	1.28
Spicara spp	PIC	25.82	84.66	1.82	1.11
Octopodidae	OCT	22.13	128.19	1.56	1.69
Sepia officinalis	CTC	21.86	180.92	1.54	2.38
Pagellus erythrinus	PAC	14.99	122.91	1.06	1.62
Tetraodontidae	PUX	14.98	38.56	1.06	0.51
Siganus rivulatus	SRI	14.56	225.88	1.03	2.97
Diplodus sargus	SWA	13.88	226.86	0.98	2.98
Holocentridae	HCZ	12.64	34.98	0.89	0.46
Scorpaena spp	SCS	12.42	57.29	0.88	0.75
Sparus aurata	SBG	11.59	52.06	0.82	0.68
Sargocentron rubrum	HWH	10.91	30.00	0.77	0.39
Octopus vulgaris	OCC	10.27	54.10	0.72	0.71
Sarda spp	BON	9.70	28.70	0.68	0.38
Siganus spp	SPI	9.17	112.67	0.65	1.48
Merluccius	HKE	8.55	73.69	0.60	0.97
Dicentrarchus labrax	BSS	7.69	38.39	0.54	0.50
Seriola dumerili	AMB	7.53	93.24	0.53	1.23
Pagrus spp	RPG	7.21	123.69	0.51	1.63
Dentex	DEC	6.50	68.90	0.21	0.81

Bogue *(Boops boops)*

The stock is in Low Over-exploitation with Intermediate Spawning Biomass showing a general decreasing trend. The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear pattern.

Comber *(Serranus cabrilla)*

According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ratio B/BMSY around 1 (Figure 8). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear pattern (DFMR, 2019).

Parrotfish *(Sparisoma cretense)*

According to CMSY outputs the stock shows a ratio of F/FMSY close to 1 as well as the ratio B/BMSY. The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear pattern.

Blotched picarel *(Spicara maena)*

According to CMSY outputs the stock shows a ratio of F/FMSY below 1 and a ratio B/BMSY above 1. The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear pattern.

Picarel *(Spicara smaris)*

The status of the species was assessed using an integrated approach (SS3 environment) where all available historical data since 1965 have been analyzed. Given the results from this analysis, the stock is sustainably exploited (F0.1=0.36; Fcurrent=0.05; F/FMSY = 0.14). The abundance indices agree with the stock assessment results, indicating an increase both in recruitment and in SSB and the subsequent increase in recent catch. The mean length observed in research trawl survey (MEDITS) was fluctuating showing a positive pattern.

Swordfish *(Xiphias gladius)*

The swordfish is listed in Annex II of SPA/BD. According to DFMR (2019b) the status of the resource is assessed with an analytical model (XSA, ICCAT, 2016) combining the fishing statistics of the entire Mediterranean basin, considering that this species is distributed throughout the area as a single stock. It is important to note that the evaluation results and projections presented in the 2016 ICCAT report are based on the 2016 evaluation results, including data up to 2015 that were available at the time of the evaluation. Based on several hypotheses on natural death rates and landed levels of undersized fish, the analysis (XSA) indicated that current levels of spawning biomass (SSB) are much lower than those of the 1980s. The results also indicate that recruitment shows a negative trend in the last decade.

In terms of fishing mortality, a recent decline has been observed in recent years. The current biomass is lower than BMSY, while fishing mortality F is almost double FMSY. The results therefore indicate that the stock is both overfished in an over-exploitation state.

Bluefin tuna *(Thunnus thynnus)*

The bluefin tuna is also listed in Annex II of SPA/BD. The status of the resource is assessed with an analytical model (VPA, ICCAT, 2017b) combining the fishing statistics of the whole Mediterranean basin and the Eastern Atlantic, considering that this species is distributed throughout the area and is considered as a single stock. The trend of fishing mortality (F) for young specimens (2-5 years) has shown a continuous increase up to the last years. Since 2008, fishing mortality of bluefin tuna 2 and 5 years has dropped dramatically to reach historically lower values. For the most adult fish (aged 10 years and over), fishing mortality showed a negative trend until 1980 and then increased in the following years until 2010. From 2010 onwards, a clear reduction in fishing mortality is observed. Spawning stock biomass has clearly increased in recent years while recruitment has shown a reverse trend. These recent trends are consistent with those obtained during the 2012 stock evaluation (ICCAT, 2017b).

From the data presented in DFMR (2019b), it is evident that the fishing mortality is below the reference point (F0.1 = 0.07), while if a high recruitment rate is assumed the breeding biomass is below the precautionary one (SSB0.1).

2.2. Main Habitat types

Regarding marine habitats in Cyprus, except from the habitats that are included in the Habitats directive, there is still a relatively an information gap regarding their main ecological features and distribution. Especially in regards to the deep part of Cyprus, the available information is even more scarce.

Priority habitats including *P. oceanica*, soft and hard substrates, have been mapped in 2013 in all the Natura 2000 as well as the Vasilikos – Limassol coastal area. A repetition of a similar project has just started to map the seafloor habitats of Cyprus coastline (up-to 50m depth) ('Mapping and evaluation of *Posidonia* meadows and other important marine habitats under the European Habitats Directive (92/43/EEC), in the coastal waters of Cyprus (Tender # 19/2018, DFMR, September 2019 – March 2022)', and will soon shed light on this subject. During the first Phase of the project, important habitat i.e., *Posidonia oceanica* meadows (Habitat 1120*), sand banks with *Cymodocea nodosa* meadows (Habitat 1110) and submerged reefs (Habitat 1170) will be mapped. Sea caves (Habitat 8330) will be identified, and divers will scan selected caves to produce 3-D maps. During the second Phase, a monitoring program will be initiated for these key marine habitats in the six marine areas of the Natura 2000 network and assessment of the ecological status will be carried out.

In the following paragraphs, existing information on marine habitats of Cyprus is given. Ramos *et al.*, (2007) and Argyrou *et al.* (2002) gave information on the marine habitats (Table 12) and species of Cyprus that are of conservation interest gathered from previous and this work, emphasising in Moulia, Akamas, Cape Gkreko. Further, information on marine habitats from samplings from Larnaca (South of Larnaca city to Cape Kiti) is also given. In the current report, the habitats of conservation interest are assigned also to the new codes according to the habitat reference tool the 2019 Barcelona Convention "Classification of Benthic Marine Habitat Types for the Mediterranean Region and

Reference List of Marine and Coastal Habitat Types in the Mediterranean" (see also Table 11).

Table 11.
Combinations codes for marine EUNIS level 2

Zone		Substrate					
		Hard/firm		Soft			
		Rock*	Biogenic habitat*	Coarse	Mixed	Sand	Mud
Phytal gradient / hydrodynamic gradient	**Littoral**	MAI	MA2	MA3	MA4	MA5	MA6
	Infralittoral	MB1	MB2	MB3	MB4	MB5	MB6
	Circalittoral	MCI	MC2	MC3	MC4	MC5	MC6
	Offshore circalittoral	MD1	MD2	MD3	MD4	MD5	MD6
Aphytal/ hydrodynamic gradient	**Upper bathyal**	MEI	ME2	ME3	ME4	ME5	ME6
	Lower bathyal	MFI	MF2	MF3	MF4	MF5	MF6
	Abyssal	MG1	MG2	MG3	MG4	MG5	MG6

Table 12.
Main Mediterranean sensitive habitats observed in Cyprus according to Ramos *et al.*, 2007 and Argyrou *et al.*, 2002 (black letters, according to EUNIS classification). In blue letters, habitat coding according to the "Classification of Benthic Marine Habitat Types for the Mediterranean Region and Reference List of Marine and Coastal Habitat Types in the Mediterranean" Barcelona Convention, 2019. Legend: (RB) Mediterranean 'Red Book' UNEP/ IUCN/GIS (1990); (EU1) Habitat Directive European Union (1992); (EU2) Mediterranean Marine Living Resources Directive (2006); (BaC) Barcelona Convention (1995); (AC) Alghero Convention (1995); (BeC) Bern Convention (1996). (Modified from: Ramos-Esplá, *et al.*, 2007)

MARINE HABITATS	RB	EU1	EU2	BaC	AC	BeC
Littoral organogenic concretions						
- *Dedropoma petraeum* (platforms, cushions) **MA1.546 Belt of** Neogoniolithon brassica-florida**/** *Dendropoma* **spp.**	+			+	+	+
Goniolithon byssoides (cushions) **MA1.542 Belt of** Lithophyllum byssoides	+			+	+	+
- *Lithophyllum trochanter* & *Tenarea undulosa* (cushions) **MA1.543 Community of** *Tenarea tortuosa*	+	+		+	+	+
Pools and lagoons sometimes associated with vermetids (infralittoral enclave) **MB1.51Y Coralligenous (in enclave)**						
Fucales forests						
- *Cystoseira spp.* exposed rock *(C. amentacea)* **MB1.513 Community of** *Cystoseira amentacea var. stricta*	+	+		+	+	+
- *Cystoseira spp.* sheltered rock *(C. humilis, C. spinosa)* **MB1.51K with** *Sargassum vulgare* **with** *Cystoseira* ***spp.***	+				+	
- *Cystoseira spp.* deep forests (*C. spinosa, C. zosteroides)* **MC1.511 with** *Cystoseira zosteroides/C. spinosa* ***var.*** *compressa*	+			+		+
Maerl beds (rhodolithes) **MC3.523 Maërl beds dominated by** *Phymatolithon calcareum/Lithothamnion corallioides*	+		+		+	+
Circalittoral biogenic formations ('coralligenous') **MC1.517 with** *Lithophyllum* **spp. (most probably)**	+		+		+	+
Submarine caves **MC1.53 Semi-dark caves and overhangs** **ME1.52 Caves and ducts in total darkness (in enclave in upper zones)**		+		+	+	+
Seagrass meadows						+
- *Posidonia oceanica* **MB2.52 Meadows of** *Posidonia oceanica* **MB2.541** *Posidonia oceanica* meadow **on rock** **MB2.542 Meadows on well-developed matte MB2.543** *Posidonia oceanica* **meadow on sand, coarse or mixed sediment**	+	+	+	+	+	+
- *Cymodocea nodosa* **MB5.534 with** *Cymodocea nodosa*						+

Mapping of *Posidonia* meadows (1120* Natura 2000 code), Sandbanks (1110 Natura 2000 code) and Reefs (1170 Natura 2000 code) is available for the marine Natura 2000 sites across the coastline of Cyprus and also Limassol - Vasilikos bay (DFMR, 2013). According to the final report for *Posidonia* meadows mapping within the Operational Programme for Fisheries 2007-2013 in Cyprus (DFMR, 2013), the coastline of Cyprus is covered by grids with less than 10% *Posidonia oceanica* meadows. Grids with *Posidonia oceanica* meadows coverage between 10 and 50% are mostly located on the north-western 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. In the report under the Article 17 of the Habitats Directive it was presented that the conservation status of *Posidonia* beds in Cyprus was in favourable condition regarding its range, area, structure and functions and also future prospects (European Environment Agency, 2019).

"Reef" habitats refer to rocky substrate and bioconstructions including coralligenous habitats. Specifically, for Cyprus, reefs mostly refer to rocky substrates with *Cystoseira* spp. and/or *Sargassum trichocarpum*. This habitat is dominant in several sites in the shallow water, e.g. Nisia site and eastern part of Cape Greco (DFMR 2013). In the latest report under the Article 17 of the Habitats Directive, it was documented that conservation status for "Reefs" in Cyprus have been changed from unfavourable to favourable due to more accurate and informative data (European Environment Agency, 2019). Moreover, some sparse rhodoliths of the calcareous corallinaceae *Lithophyllum corallioides*, *Phymatolithon calcareum* and *Mesophyllum alternans* forming the 'maërl' facies of the coastal detritic bottoms are present in Cyprus coastline from 34m depth (Argyrou *et al.*, 2002, DFMR, 2013).

The habitat "Sandbanks which are slightly covered by sea water all the time" (1110 Natura 2000 code) has been observed in several sites across the coastline of Cyprus. The marine Angiosperm *Cymodocea nodosa*, together with photophilic species of algae living on the leaves is the most associated vegetation with this habitat type. In the latest report under

the Article 17 of the Habitats Directive it was documented that the conservation status of "Sandbanks" in Cyprus was in favourable condition (European Environment Agency, 2019).

In addition, "Submerged or partially submerged sea caves" (8830 Natura 2000 code) are present and located in Cavo Greco – CY3000005, in Chersonisos Akamas - CY4000010 (and specifically in Cape Arnaoutis, Agios Georgios Island and Thalassines Spilies Peyias), in Ayia Napa and Akrotiri – Limassol areas (Argyrou *et al.* in Argyrou et al., ès 2012; Gerovasileiou *et al.*, 2015; Ramos-Esplá *et al.*, 2007). In the report under the Article 17 of the Habitats Directive it was documented that the conservation status of "Sea caves" in Cyprus was in favourable condition (European Environment Agency, 2019).

In the framework of PROTOMEDEA (2015 – 2018) (Karachle *et al.*, 2019), 41 ecological features were mapped, including a wide variety of marine habitats and species encountered in Cyprus that are under strict protection according to EU and national legislation, and international conventions. The overall aim of this planning exercise was to contribute towards the development and the propose of an efficient MPA network, considering the protection of ecological characteristics and Essential Fish Habitats (EFH), significant areas for fisheries, as well as their socio-economic impacts through a participatory bottom-up process. To this end, the most widely applied conservation planning software was used, i.e. MARXAN with Zones, to provide alternative management solutions through a transparent and robust analysis. The ecological information regarding the distribution of biodiversity in Cyprus was retrieved from: (i) scientific (peer-reviewed) and grey literature; (ii) on-line databases; (iii) datasets provided to the PROTOMEDEA project by universities (e.g. University of Cyprus), Ministries and administrative organizations of Cyprus (e.g., Ministry of Interior, Statistical Service), research institutes and NGOs (e.g. BirdLife, MoM etc.); (iv) previous scientific projects (e.g., Mediterranean Sensitive Habitats 'MEDISEH' project: Mediterranean Sensitive Habitats, 2013; Giannoulaki *et al.*, 2013; Martin et al, 2014); (v) EEA-ETC/BD reporting under Article 17 of the Habitats Directive updated on 16/01/2014 (Article 17 Reporting 2007 – 2012; http://cdr.eionet.europa.eu/cy/eu/ art17). The maps created in the framework of PROTOMEDEA are given above (figure. 8 - 10).

Figure 8.

Spatial distribution of marine habitats (*Dendrophyllia ramea*, coralligenous and reef habitats) present in the study area (source: Karachle *et al.*, 2019).

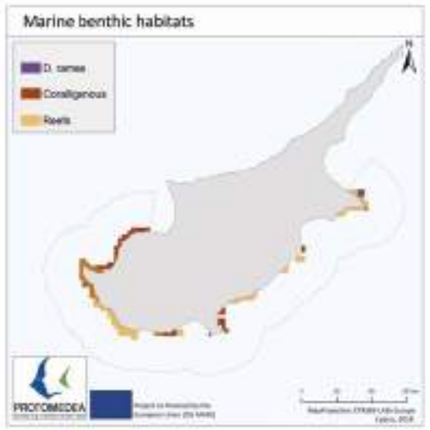


Figure 9.

Spatial distribution of marine habitats (marine caves, hard substrate, rhodolith beds, Posidonia oceanica meadows, soft substrate) present in the study area. (source: Karachle *et al.*, 2019).

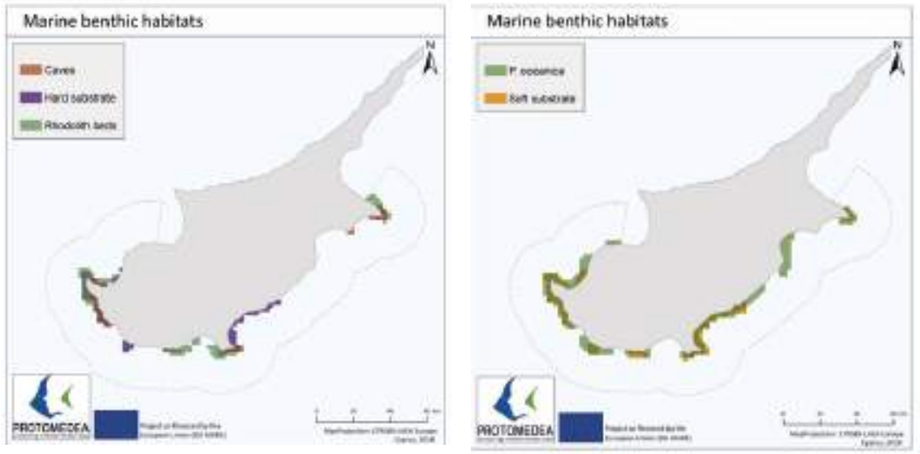
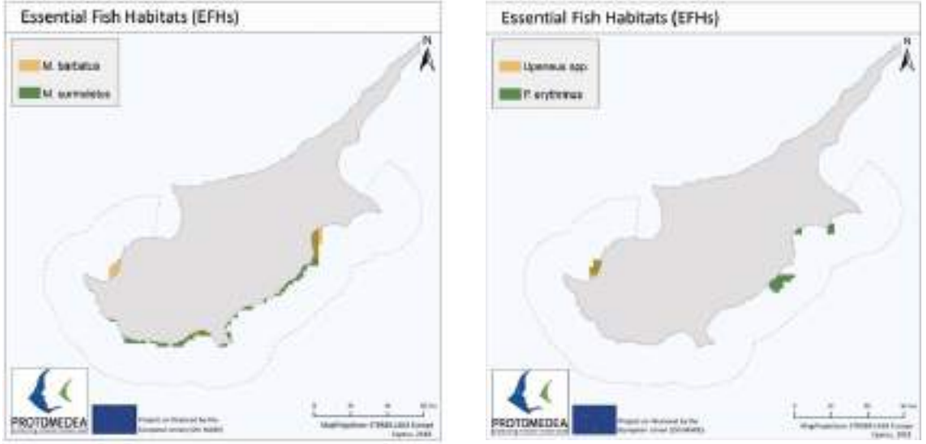


Figure 10.

Spatial distribution of essential fish habitats (EFHs) for certain species in the study area (source: Karachle *et al.*, 2019).



2.3. Singular habitats in the country

Very recently Orejas *et al.*, (2019) quantitatively described for the first time a *Dendrophyllia ramea* population in Cyprus (Figure. 8). This population is the deepest ever described until now in the Mediterranean and was found on the outer insular shelf off eastern Cyprus (Protaras, 35°02'N; 34°05'E). The well-developed population of the coral *D. ramea* located on a sandy seabed at 125–170 m depth. The highest density was 6 colonies m−2 and on average 1.6 ± 1.4 (SD) colonies m−2. The population consists of isolated or piled up branches of various sizes and large colonies, some 50 cm max width. The corals thrive on soft bottoms, representing a rather novel aspect of the research on *D. ramea*, since the species is still considered to be mostly associated with rocky substrates. The occurrence of the species in sedimentary grounds makes it especially vulnerable to bottom contact fishing gears as bottom trawling. The habitat code for this habitat according to Barcelona Convention 2019, can be ME6.5 Mediterranean upper bathyal muds - Bathyal muds with Scleractinia - Bathyal muds with Dendrophyllia ramea. Currently, a more specific code cannot be assigned to this habitat.

Jimenez *et al.*, (2019) gave an overview of the characteristics of the Kakoskali Cave, a submerged marine cave in north-western Cyprus, located in the Marine Protected Area of Kakoskali, the first of its kind to be discovered on the island. According to the authors, the cave communities develop in a dark, nutrient-poor environment where low water circulation restricts dispersion over prolonged periods of time. Sections of the cave are covered by bio-stalactites, which are built by skeletal organisms and microbialites. The macro-organisms responsible for these build-ups are serpulid polychaetes (i.e. bioconstructers), mainly *Protula* sp. and on a lesser extent *Josephella* marenzelleri, that form a meshwork of tubes providing thus a substrate to other epibionts (i.e. encrusters). Among the epibionts there are other serpulids (e.g. *Semivermilia crenata*, *Pileolaria militaris*), sponges (*Agelas oroides, Diplastrella bistellata, Spirastrella cunctatrix, Merlia spp., Phorbas tenacior, Plakina weinbergi*, boring clionaids and several undetermined species), foraminifers (e.g. *Miniacina miniacea*), bryozoans (e.g. *Monoporella bouchardii*, *Glabrilaria pedunculata*, *Onychocella* cf. *vibraculifera*), bivalves (*Spondylus gaederopus*, *Chama gryphoides*), brachiopods (*Argyrotheca cuneata*, *Argyrotheca cordata*, *Gwynia capsula*), and scleractinian corals (depending on the position in the cave: *Madracis pharensis*, *Polycyathus muellerae*, *Guynia annulata*, *Caryophyllia inornata*). The framework of the Kakoskali biostalactites is strengthened by microbial derived micrite that, similarly to other biostalactites in Sicily and Belize caves, contribute to cement together the skeletons.

Marine areas that are under protection measures in Cyprus, are categorised in the following:

1 _ Natura 2000 sites: Marine areas included in the European "Natura 2000" Network as Sites of Community Importance under the provisions of Directive 92/43/EEC which also comply with the provisions of the Protocol on Special Protection Areas and Biological Diversity in the Mediterranean of the Barcelona Convention.

According to DFMR (personal communication with Melina Marcou), within the framework of the implementation of the European Habitats Directive (92/43/EEC), which has been transposed in the national legislation with the Law no. 153 (I)/2003, the Natura 2000 network has been established, which includes six (6) coastal areas, with a total area of around 130 Km^2.

In addition to the marine coastal areas, one (1) offshore area (Oceanid) has been proposed in 2019 for approval by the European Commission to be incorporated in the N2000 network. The designation of the Oceanid marine area as a proposed SCI, covers an area of 8.317 km2 of 100% marine area. This area includes a very steep slope of the outer edge of the continental slope of the west coast of Cyprus and part of the deep sea offshore. It starts approximately from the 200 m isobaths, in order to include smaller marine mammals, especially the bottlenose dolphin (*Tursiops truncatus*) and the monk seal (*Monachus monachus*). It also includes the continental shelf and the deeper areas down to more than 2km deep, where a number of other cetacean species were visually and acoustically identified. Species identified are the sperm whale (*Physeter macrocephalus*) and Cuvier's beaked whale (*Ziphius cavirostris*). In addition, this area is a major migratory route of sea turtles (*Chelonia mydas* & *Caretta caretta*) to their feeding grounds in the African shores. The proposed MPA aims to ensure the migratory corridors of marine turtles and create of a marine protected area for marine turtles offshore. (Table 13).

It is noted that the marine Natura 2000 network in Cyprus with the Oceanid included, consists the 8.5% of all the marine waters of Cyprus, including the areas where the Republic of Cyprus does not have effective control and its Exclusive Economic Zone (EEZ).

Table 13.

Marine Natura 2000 sites in Cyprus. For details for each "area" see text (source: DFMR, 2020 personal communication with Melina Marcou)

A/A	AREA	DECLARATION YEAR	SURFACE AREA Km²	% COVER OF THE TOTAL MARINE AREA OF CYPRUS
1	CHERSONISOS AKAMA	2010	79	**0.081**
2	AKROTIRIO ASPRO - PETRA ROMIOU	2004	21.07	**0.021**
3	THALASSIA PERIOCHI NISIA	2004	1.91	**0.002**
4	THALASSIA PERIOCHI MOULIA	2004	2	**0.002**
5	PERIOCHI POLIS - GIALIA	2004	16.58	**0.017**
6	KAVO GKREKO	2004	9.62	**0.010**
7	OCEANID	2019	8317	**8.482**
TOTAL			**8447.18**	**8.61**

The importance of these areas for their protection lies in the presence of important marine ecosystems, such as the meadows of *Posidonia*, the extensive reefs, the underwater caves and the sand-banks with the angiosperm *Cymodocea nodosa*. In addition, nesting habitats and feeding areas of the two marine turtles *Caretta caretta* & *Chelonia mydas* can be found, while in others breeding and resting caves of the endangered Mediterranean seal, *Monachus monachus*, are present.

More details for each N2000 side are following, according to the Second Assessment for the MSFD (DFMR, 2019).

Periochi Polis-Gialia (CY4000001 N2000):

The marine site supports extensive sea grass meadows consisting of *Posidonia oceanica* (1120, MB2.52) starting at about 15 m in depth and extending to about 40m. The sea bottom is mainly sandy. At shallower depths, 8-13 m, along the sandy coast there are *Cymodosa nodosa* beds (1110, MB5.534).

The site is the main nesting area for loggerhead turtle *Caretta* and it is a feeding area for both loggerhead and green turtle (*Chelonia mydas*) which feed on the extensive sea grass meadows. There are important *Posidonia oceanica* meadows in the bay starting at about 15 m in depth and extending to about 40 m depth.

Chersonisos Akama (CY4000010 N2000):

Akamas Peninsula is located at the westernmost part of Cyprus. The coastline of the peninsula consists of sandy beaches, rocky shores and small islets. Apart from the *Posidonia* beds, well-developed habitat is that of the reefs (habitat type 1170) which is characterized by dense *Cystoseira* forests. Further, sea caves can be found, where the Mediterranean monk seal, *Monachus monachus*, breeds, nurse its pups and rests. A resident population of around 5-7 monk seals, is present in the Akamas area. The site is also the main nesting area for the green turtle *Chelonia mydas*, while the loggerhead turtle *Caretta caretta* also nests in this area.

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

In the eastern part, the habitat 1110 “sand bank” (Natura 2000, Annex 1) is dominant and habitat 1170 “reef” (Natura 2000, Annex 1) is very restricted and located only in the shallower waters. However, the western part of the peninsula is mainly occupied by the habitat “reef” with a high percentage of cover in the north. The habitat “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.

Lara/Toxeftra, (Turtle reserve) is cited within the Chersonisos Akama (CY4000010 N2000) site. The Lara – Toxeftra Reserve is located in the south-western part of the Akamas peninsula (within the N2000 site). The Protected Area covers about 10 kilometres of coastline. It extends inland to 90 m from the sea (from the mean sea level) and extends seaward to the 20 m isobath, which is about 0.4 to 1 km from the coast.

The marine and coastal ecosystem includes the Lara/Toxeftra turtle nesting beaches which are among the few important Green turtle (*C. mydas*) nesting beaches remaining in the Mediterranean. Loggerhead turtles (*C caretta*) also nest here. They are protected by a number of conventions such as the Bern, Barcelona and Bonn. The sea caves which are important habitats for the highly endangered and protected Monk seal still occurs in the area in small numbers. Cetaceans such as *Tursiops truncatus* and *Delphinus delphis* are also occasional visitor in open waters of this area.

The area has been protected since 1989 under the national Law (Fisheries Law & regulations) and the management regulations for this area are spelled out in the Fisheries Regulations (273/90). The Foreshore Protection Law was also amended at the same time (1989) incorporating into it the notion of Ecologically Important areas. An Order was issued on the basis of the Foreshore Protection Law also declaring the Lara/Toxeftra coastal area as Ecologically Important, thus giving effect to some of the provisions of the Fisheries Law. In 2013, the area was included in the list of Specially Protected Areas of Mediterranean Importance (SPAMI) under the Barcelona Convention.

Thalassia Periochi Moulia (CY4000006 N2000):

According to the NATURA 2000 – standard data form. The site is situated in the western region of Cyprus, close to Pafos which is one of the favourite tourist sites in Cyprus with vast archaeological interest. It is located at a distance of approximately 800 m from the closest shore, at a water depth which ranges from 4 to about 15 m. The site is characterized by a mosaic of extensive limestone reefs which alternate with dense meadows of *Posidonia oceanica* (1120). The reefs (1170) form an extensive underwater shelf which is dominated by the forests of the brown algae *Cystoseira barbata* and *C. compressa.* Other macroalgae such as *Halimeda tuna, Udotea petiolata, Laurencia obtusa, Polysiphonia serularioides, Amphiroa rigida, Jania rubens, Padina pavonica* and *Stypopodium shimperi* are present among the *Cystoseira* forests. The sea-urchin *Paracentrotus lividus* was found on rocks among the aforementioned algae. The rocky substrate is elevated in some cases beyond the sea level (maximum height about 2 m) forming small rocky islands. Within the *Posidonia oceanica* beds a great variety of fish and invertebrates are found. The site has great ecological value since the existing habitats, *Posidonia oceanica* meadows and reefs, are well conserved, supporting high biodiversity. There are many species of fish and invertebrates, some of which are protected by the Barcelona Convention, such as the *Hippocampus guttulatus*.

Akrotirio Aspro – Petra Romiou (CY5000005 N2000):

P. oceanica meadows are mostly located between 0 and 13 m depth on hard bottom. The habitat “reef” is only present in the very shallow water while the habitat “sandbank” is dominant in this area.

Kavo Gkreko (CY3000005, N2000) (also a SPA site):

P. oceanica meadows as well as “reefs” which are dominated by the brown alga *Cystoseira barbata* are well conserved, supporting high biodiversity. Invertebrate species are found in this site, such as *Charonia tritonis* and *Pinna nobilis* which are included in the annexes of international conventions such as the Bern Convention. The dolphin species *Tursiops truncatus* (Annex II 92/43/EEC) and *Stenella coeruleoalba* occur sparsely in the area.

P. oceanica meadows are mostly located in the south-eastern part on the hard bottom, with an important cover between 10 m to 40 m. On the western part, the meadow forms patch up to 40 m depth and it is associated with algae. The eastern part of the site is mainly occupied by the habitat type "reef", while in the southern part, it is only located in the very shallow areas. The “sandbank” habitat is dominant in all the area, with a high percentage of cover in the southwest part. This area is also important as biotope for migratory birds.

Thalassia Periochi Nisia (CY3000006 N2000):

According to the NATURA 2000 – standard data form the site includes the important habitat type 1120 of *Posidonia oceanica* and the reefs (habitat type 1170) which are covered by dense vegetation of *Cystoseira* spp. These habitats support high biodiversity, especially of the invertebrate fauna such as sponges (*Cacospongia communis, Clathrina coriacea, Geospongia communis, Halichodria panicea, Spongia officinalis and Spongia officinalis ssp. mollissima*) and bivalves as *Spondylus gaederopus* which is very rare in Cyprus waters. Also, dense populations of several species of fish such as *Coris julis, Diplotus sargus, Diplotus vulgaris, Serranus cabrilla* etc occur in the area. The area is a prime example of this kind of marine ecosystem of the eastern coast, which is characterised by calm seas.

2 _ Marine Protected Areas (MPAs) (MPAs Designation via Ministerial Decrees under the Fisheries Legislation)

Within the priorities of the Department of Fisheries and Marine Research (DFMR), Marine Protected Areas (MPAs) are established through Ministerial Decrees, for the protection of marine species and habitats, as well as for the recovery of fish stocks. For details on the MPAs see the following chapter 4.1. (Marine protected areas and other area-based conservation measures).

3 _ Fisheries Restricted Areas (FRAs) - 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.

Habitats subject to intense or specific pressures:

Limassol Bay (including Vasilikos bay): *P. 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 *P. oceanica* meadows are few represented near Limassol's harbour while it is well represented at the Zevgari Cavo and near Zygi. In the western part of the site the habitat type "reef" presents a high percentage of cover while the main habitat 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). The results of the PREI index (WFD 2000/60/EC) PREI to determine the ecological status of the water bodies (DFMR, 2019). For the 2008-2016 period indicated that *P. oceanica* meadows show a decline Vasilikos bay.

4 _ IMMAs:

Important Marine Mammal Areas (IMMAs) are defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation. In Cyprus 3 IMMAs are described:

a) Akamas and Chrysochou Bay:

The Akamas Peninsula of Cyprus is an area of 284 km2 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 area extends to the 200m isobath and follows the same boundary as the existing Convention on Biological Diversity's Ecologically or Biologically Significant Area (EBSA). The Mediterranean monk seal is an Endangered species. A resident population of the monk seal is present in the Akamas area. Furthermore, a database of recording sightings of the monk seals around the island of Cyprus is maintained by the Department of Fisheries and Marine Research (DFMR). Through these activities, it is confirmed that within Akamas area, there are 4-5 individuals and it is confirmed that the area contains important caves were monk seals have been observed to be used for pupping.

b) Akrotiri:

Akrotiri is the southernmost part of the island of Cyprus, within the British Sovereign Base Area. The area of Akrotiri (45 km2) extends along the coast between Cape Gata and Cape Zevgari, and outward to the 200m isobath. The area has several caves where Mediterranean monk seals (*Monachus monachus*) rest and pup. The discovery of a pup in 2011 in one of these caves has confirmed the area as an important habitat for the Endangered Mediterranean monk seal. The area contains important habitat (caves) were monk seals have been observed using. In addition, a confirmed breeding was reported in 2011, when a pup was discovered in one of the caves.

c) Northern Coast of Cyprus:

The northern coastal area of Cyprus (518 km2) includes many important biological features. It contains breeding and pupping habitats of the monk seal. There are some feeding areas of monk seals on the northern coast of Cyprus where seals have been reported to feed. Monk seals are known to feed on cephalopod and fish species in coastal habitats. Approximately 40 individuals are estimated to inhabit the area which extends seawards towards the 200m isobath.

2.4. Transboundary issues

Cyprus EEZ is adjacent to the EEZ's of several countries in the region, including Greece, Turkey, Lebanon, Syria, Israel, and Egypt. Among major transboundary issues is the effects of offshore hydrocarbon activities. According to the Strategic Environmental Assessment (SEA) Concerning Hydrocarbon Activities (2008) (Ministry of Commerce, 2008), various issues that will impact biodiversity can emerge from these activities either from prospecting activities such as airgun noise, from exploitation activities such as drilling discharges, from accidents such as oil spills. Existing control measures are identified and further mitigation measures are proposed for these activities. At first an Environmental Baseline Study is carried out and when the activities start, on-going monitoring are carried out. Up to date, there are no production wells yet, but when the production will start monitoring will take place.

The problem of marine litter, including plastic, is another transboundary issue causing pollution in the marine environment in neighbouring areas. In Cyprus, there are some initiatives targeting the problem of marine pollution especially plastic pollution, through collaboration with other nearby areas (e.g., MELTEMI project https://meltemi-balkanmed.eu/; MARLITCY Marine Litter for Synergies, Capacity-building and Peacebuilding http://www.marlitcy.eu/; BLUEISLANDS https://blueislands.interreg-med.eu/). Duncan (2018), found that some of the turtle nesting beaches of Cyprus are exposed to the highest published microplastic abundances within the Mediterranean, second globally only to Hong Kong, China. Levels in Cyprus were 5–1000 times higher in comparison to other regional studies from Greece, Malta and Spain. The majority of microplastic found in their study originated from industrial spills, followed by fragments from the breakdown of larger plastic pieces and they concluded that it is likely Cyprus to receive microplastic via ocean currents from around the eastern Mediterranean. Lastly, in section 3.3 marine pollution in deeper waters is being discussed.

Introductions of species beyond their natural range are rising fast especially in Cyprus because of increased marine traffic, trade and tourism, but also due to its geographical proximity to the Suez Canal These provide vectors and pathways for live organisms to cross biogeographical barriers. It is well known that the problem of alien species needs coordinated international action to minimize their effects (economical and environmental).

2.5. Identification of the country's marine and coastal biodiversity gaps needed for scientifically sound based conservation

After the revision of the available data concerning marine biodiversity of Cyprus, certain knowledge gaps have revealed. The following issues must be addressed in order to have a more comprehensive idea on the marine biodiversity of Cyprus:

1 _ Deep-sea research - study of the current deep-sea biodiversity, of vulnerable habitats, of impacts of human activities on habitats and organisms of deep-sea (impacts of noise pollution, drilling, plastic and other types of pollution)

2 _ Mapping of priority and vulnerable habitats of the island, together with the biodiversity they host. For example, marine caves, biogenic habitats in midlittoral/infralittoral zones, , deep sea habitats etc. The detailed distribution, for some marine habitats, is still poorly known.

3 _ Monitoring programs aiming in recording marine biodiversity in certain areas (e.g., further MPA's from those currently monitored, areas that are under pressure because human activities, especially marinas, etc), to gain time-series data in order to study the impacts of various human pressures, like coastal constructions and other activities which in the coastal zone of Cyprus due to tourist industry all these actions are intense (construction of marinas, wave-breakers, boat tourism, villas, hotels, etc).

4 _ A national list of all the marine species of the country does not exist. This must include endangered and threatened species of flora and fauna, together with their habitats and distribution. Alien species must also be included. No Red Book for marine species exists.

5 _ Study of the biology and ecology of alien species (including invasive) and their impacts on the native environment. For most of the alien species, there is no information regarding their abundance, current distribution on the island, biological cycle and diet. Further, a long-term monitoring of IAS is essential and will give clearer results on their impacts for better management measures even for the rest European areas.

6 _ Population assessment for the cetaceans, especially for the proposed offshore Natura 2000 site “Oceanid”.

3.

Pressures and impacts

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3.1. Biological disturbance

The main pressures in the marine environment of Cyprus are presented in detail in the Second Assessment of the MSFD (DFMR, 2019). Further, new publications (Michailidis *et al.*, 2019; 2020), documented the impact of fisheries on fishing stocks and of recreational fisheries in fish populations and economy, accordingly, for the first time for Cyprus.

Non-Indigenous species

According to DFMR (2019), from 2013 to 2018, 33 new NIS were reported in Cyprus. Until the current report (August 2020), 7 more species are added, reaching a number of 186 alien species known from Cyprus. Katsanevakis (2017) conducted surveys in Cavo Greco and Nessie MPAs (2017-2018; DFMR, 2018) in order to record abundance and spatial distribution data of established NIS at the aforementioned MPAs through the project "Baseline survey and monitoring of non-indigenous species in Cavo Greco and Nisia Marine Protected Areas in Cyprus". The NIS/native species ratio showed a steady increase of the alien to native ratio, (overall range: 0.16 in the first quarter of 2017, 0.25 in the third quarter of 2018). This ratio was higher for some taxonomic groups, such as Mollusca (range 0.32 - 0.57) and Chordata (range 0.27 - 0.53).

Michailidis et al. (2019) developed for the first time a trophic mass-balance Ecopath model to describe the structure and functioning of the insular shelf ecosystem of the Republic of Cyprus and assess the impact of fishing and alien species during the mid-2010s. Forty functional groups were defined, ranging from producers and detritus to top predators and some of the most common alien species were included in exclusively alien groups. Their results highlight the significant role of alien species within the ecosystem, where alien fish accounted for 29% of fish production and 18% of total fish biomass. Among alien species the highest biomasses were predicted for alien small pelagic fish (*Dussumieria elopsoides*, *Etrumeus golanii*, *Hemiramphus far*), followed by alien pufferfishes (*Lagocephalus guentheri*, *L. sceleratus*, *Torquigener flavimaculosus*), alien siganids (*Siganus luridus*, *S. rivulatus*), and alien barracudas (*Sphyraena chrysotaenia*, *S. flavicauda*). Negative impacts of alien fish were predicted, in particular by alien siganids on phytobenthos, and some alien demersal fishes on eels and morays. The impact of this species on the local environment, fishery stocks etc is poorly known.

Recreational and commercial fisheries

According to Michailidis *et al.* (2019) fishing has noticeable impacts on the ecosystem and based on their model a strong negative impact of small-scale fisheries on small sharks and turtles, and of recreational fisheries on the large demersal and pelagic fishes is predicted. The study suggested a moderate impact of fishing which could imply that the ecosystem is currently recovering from a previous overexploited state, possibly related to recent management measures like the reduction of the coastal fishing fleet during the period 2008–2014 (−16% in number of vessels, −18% in tonnage, −10% in engine power) or that the main cause of strong disturbances is not only fisheries but also other types of stressors, such as climate change or the increasing pressure by alien species that may also act synergistically.

Michailidis *et al.*(2020) showed that the three existing MRF types (boat fishing, spearfishing and shore fishing) have a vast magnitude in terms of catches, as well as a social and economic significance. Around 2.7 % of the population of Cyprus seems to be involved in MRF, of which 86 % in shore fishing, 10 % in boat fishing and 8.5 % in spearfishing. Overall recreational catches exceeded in weight (1065 t/year) and value (11.6 m€/ year) the coastal commercial catches. 64 % of MRF catches came from shore fishing, 24 % from boat fishing and 12 % from spearfishing. By far the most important species in terms of weight and value were the invasive rabbitfishes. One third of shore catches were rabbitfishes, while boat and spearfishing catches were dominated by top predatory species, namely albacore, greater amberjack (*Seriola dumerili*), common dentex (*Dentex dentex*), common squids (*Loligo* spp.) and red porgy (*Pagrus pagrus*) for boat fishing and common octopus (*Octopus vulgaris*) and dusky grouper (*Epinephelus marginatus*) for spearfishing. Many of the most important species for the coastal commercial fleet, like picarel (*Spicara smaris*), bogue (*Boops boops*), silver-cheeked toadfish (*Lagocephalus sceleratus*), surmulet (*Mullus surmuletus*), blotched picarel (*Spicara maena*), etc., were not important for any type of MRF. The study indicates that MRF in Cyprus has been underestimated thus far and it should definitely be considered when considering measures for fisheries management from now on.

Microbial pathogens

The monitoring of marine bathing waters of Cyprus in certain marine stations in the framework of the Directive concerning the management of bathing water quality (2006/7/ EC) involves measuring the abundances of specific microbial pathogens, intestinal enterococci and *Escherichia coli*, in more than 110 coastal locations around Cyprus. In accordance with these results, Cyprus has for once more the best top-quality bathing waters in all of Europe for the year 2019 (DFMR, 2019b).

Aquacultures

All fish farms operate under the method of sea-cage, in 1 to 4 km from the shore and water depth of 20-70m. 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 (Kletou, 2019). Fish farming started in the mid-nineties with small production units (100-300 tonnes per year), using floating cages starting at depth of 22- 28 m and located over seagrass meadows. Some of these farms are now each licenced to produce 1000-1800 tonnes per year, but a prerequisite to receiving expansion permits by the national authorities was to relocate cages in deeper water and further away from *P. oceanica* meadows. Now, the shallowest cages in Vasiliko-Moni area are found at a depth of about 37 m, but seagrass meadows still exist within the impact zone of aquaculture effluents It seems that moving fish farms away from *P. oceanica* has helped ensure meadow recovery at the deepest margins of their distribution, an important success story given that these meadows are at the upper thermal limits of the species.

Regarding the marine fish farms, since 2002 they are obliged by relevant legislation, to carry out and implement an Environmental Control Program, twice a year (winter and summer), which is submitted for evaluation to the DFMR. According to the results of these programs, the environmental impact of the operation of the units does not extend beyond 200 meters around the points of the floating facilities (fish cages) of the units.

Other human pressures

Kletou *et al.*, (2018) investigated macroalgal community metrics in the upper subtidal across ca 10 km of shoreline, encompassing undeveloped areas with limited human access as well as the most industrialised and impacted coast of Cyprus (Vasiliko Bay). Brown algae of the genus *Cystoseira*, e.g., *Cystoseira barbatula*, formed dense forests covering rocky substrata on shorelines with limited human access. *Cystoseira* spp. decreased in abundance around bathing waters and was very rare in heavily industrialised parts of the bay. Iin impacted areas, fleshy and filamentous opportunistic species such as opportunistic *Ulva* and *Chaetomorpha* species with lower biomass than perennial species, proliferated in spring. The Ecological Evaluation Index (EEI-c) used was a robust biotic index reflecting anthropogenic stress.

3.2. Vulnerable marine ecosystems

According to Thomson *et al.*, (2016) GFCM has not defined VMEs within its management regulations, and there are no formally declared and adopted VMEs within the Mediterranean Sea. In 2017 (GFCM, 2017) a draft list of Mediterranean VME indicator species was compiled, going a step forward regarding these special ecosystems. Through its ecosystem approach, the GFCM has adopted FRAs as a multi-purpose spatial-management tool used to restrict fishing activities in order to protect deep-sea sensitive habitats, such as VMEs, and essential fish habitats. A FRA was defined as "a geographically-defined area in which all or certain fishing activities are temporarily or permanently banned or restricted in order to improve the exploitation and conservation of harvested living aquatic resources or the protection of marine ecosystems" (GFCM, 2007).

"The Eratosthenes Seamount" FRA (10306 km2) is located in the eastern Mediterranean Sea, about 100 km south of Cyprus (GSA25), between the Levantine Platform to the south and the Cyprus margin to the north, near the subduction zone of the African plate (Table 14, Figure 11). This flat-topped seamount measures approximately 120 km in diameter at the base, and rises 1500m above the adjacent bathyal plain, with a summit 756m below sea level. Studies carried out in the area revealed a rich and diverse ecosystem (Varnavas *et al.*, 1988; Galil and Zibrowius, 1998 as mentioned in Thomson *et al.*, 2016), comprised of two species of scleractinian corals (*Caryophyllia calveri* and *Desmophyllum cristagalli*; these were the first records of these species from the Levant Basin, and significantly extended their known depth range), a rare deep-water sponge (*Hamacantha implicans*, known previously from a canyon in the western Mediterranean Sea), a remarkably dense population of the deep-water actinarian (*Kadophellia bathyalis*), and unidentified zoantharians and antipatharians. The high faunal diversity and density indicate a uniquely rich environment in the Levant Basin, possibly an isolated refuge for relict populations of species that have disappeared from the adjacent continental slope. According to the SCMEE (GFCM, 2005), this area represents probably one the most pristine environments found in the Mediterranean Sea, and therefore its protection from fishing activities was considered a priority.

Table 14.

FRAs regulated by GFCM in Cyprus (source: Thomson *et al.*, 2016)

Name	Type	Year	Reason	Gear	Recommendation
Eratosthenes Seamount FRA	Closure	2006	To protect the deep-sea sensitive habitats.	Towed dredges and bottom trawl nets	GFCM/30/2006/3

3.3. Emerging issues such as climatic change effects and open sea including deep-sea ecosystem concerns

Unfortunately, the available data for the open and the deep sea in the area of Cyprus, are very limited.

A recent study (Spedicato *et al.*, 2020) showed that the southern side of Cyprus is among the hotspots of plastic accumulation in the Mediterranean, after the analysis of data revealed from recording the collection of macro-litter items, during the MEDITS surveys (2013-2015) in different areas of the Mediterranean, over the depth range 10-800 m. The topography of the eastern basin of the Mediterranean Sea has a crucial role in influencing one of the most important components of the water movements in this area: The Mid-Mediterranean Jet (MMJ) of the Levantine basin, which bifurcates into two branches. The northern branch of the MMJ, pointing to Cyprus and then northward to feed the Asia Minor Current, and the Cretan Cyclon) might be responsible for hotspots of macro-litter accumulation in this part of the basin.

Regarding monitoring of coastal and seabed marine litter, DFMR applies the EU and IMAP/UNEP/MAP Guidelines for the last years in all areas under the effective governance of the Republic of Cyprus. 6 beaches have been chosen according to the criteria defined by the above guidelines and they are monitored seasonally, while more beaches are added every year by other initiatives.

Also, some initiatives in collaboration with other countries are taking place. The MarinE litter transnational LegislaTion EnhanceMent ("MELTEMI"), is an improvement project funded by Interreg 2014-2020, Balkan – Mediterranean. The project is in progress since September 2018 and is designed to address the problem of marine litter. Most of the marine litter collected following the "Guidance on Monitoring of Marine Litter in European Seas" on the 2 beaches surveyed (Faros Paphou and Lara beach) was plastic.

BLUEISLANDS project (https://blueislands.interreg-med.eu/), aim to identify, address and mitigate the seasonal variation of waste generated on 8 Mediterranean islands (including Cyprus) as an effect of tourism by assessing the seasonal dynamics of marine litter in high touristic coastal areas, with a special attention paid to both the microplastics (<5mm) and macroplastics (>5mm, including mesoplastics: 0.5cm–2.5cm), in highly touristic coastal areas. Clean-up campaigns, over the summers of 2016 and 2017 on nine Blue Flag beaches around Cyprus were organized after the beaches were cleaned by the responsible authorities aiming to see if the regular beach clean-ups by local authorities is efficient and what is left on a clean beach. The results suggest that microplastics are most likely related to tourism and recreational activities, with a seasonal variation, and are probably never removed and most likely accumulate overtime with some items becoming a potential source of marine litter.

Regarding the study of marine noise in the marine environment and especially in the deep sea, no explicit observation/monitoring of marine noise is currently taking place. Anthropogenic noise has been documented during acoustic cetacean surveys (Boisseau *et al.* 2017; Boisseau, 2017 in DFMR, 2019a), and the relevant findings are summarized below. Specifically, acoustic data were gathered over 6183 km in the marine waters of Cyprus during three surveys in 2016-2017. Anthropogenic noise was detected during all three surveys with distinct detection of three sources. Ambient noise in excess of 90 90 db re 1 μPa2 Hz-1 at low frequencies, especially at 125 Hz or lower, was ever-present throughout the area and this is typical of extensive shipping activity. Sounds by military sonar and seismic airguns used in oil and gas surveying were also detectable, especially in November 2016 and May 2017. Anthropogenic noise is pervasive in the marine waters of Cyprus at levels that constitute a threat to many marine organisms and especially cetaceans. Shipping noise intensity may be intensified by high speeds and seismic surveys in the EEZ of Cyprus are covered by SEA/EIA regulations.

4.

Current response measures

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4.1. Marine protected areas and other area-based conservation measures

Four marine areas within the Natura 2000 network, have been declared as protected through Ministerial Decrees:

a) Ministerial Decree for the Declaration of the Cavo Greco MPA (Κ.Δ.Π. 115/2018).

One Core Zone which is the No-take zone and two neutral zones, where only the professional fishermen are allowed to fish, have been created. The Core Zone (NTZ) has a surface area of 1.66 Km2 and the two Neutral Zones have a total of 1.79 Km^2.

b) Ministerial Decree on the Prohibition of the Transit of Vessels in Marine Protected Area of Lara (Κ.Δ.Π. 234/2018).

The Lara-Toxeftra MPA is a seasonal (from 1st June – 30th September) NTZ from the shore up to the 20 m isobaths. With the 2018 decree the seasonal prohibition of the transit of vessels in the MPA has increased from 1st May – 31st October.

c) Ministerial Decree for the Prohibition of Fishing and the Transit of Vessels in the Marine Protected Area of the Sea Caves of Pegeia (Κ.Δ.Π. 28/2019).

On the1st of February 2019 the Pegeia Sea Caves MPA was established. It has a Core - NTZ and a Neutral Zone, were only professional fishermen are allowed to enter and fish. This MPA was declared for the protection of the sea caves (habitat 8330) and the Mediterranean Monk Seal that breeds and rests there.

d) Ministerial Decree for the Prohibition of Fishing in the Marine Protected Area of Kakoskali (Κ.Δ.Π. 258-2019).

On the 26th of July 2019 the Kakoskali MPA was established. It has a Core - NTZ and a Neutral Zone, were only professional fishermen are allowed to enter and fish. This MPA was declared for the protection of the great biodiversity present in the area. It is noted that the Kakoskali MPA is included in the marine area of the Chersonisos Akama (CY4000010) N2000 site.

In addition to the above natural MPAs, six (6) MPAs with Artificial Reefs have been created and designated, while one more is being planned, as an alternative approach to fisheries management and contribution to the recovery of fish stocks. Furthermore, there are two more MPAs, the snorkelling park "Mpania" of Kato Pafos and the marine area 500 m around the Zenobia Wreck (Table 15). In all of these areas no fishing is allowed. The offshore Oceanid site (Figure 12), is pending approval by EU, while there are also five Marine Protected Areas with Artificial Reefs (Table 15) (Figures 11 & 12).

Eratosthenis Fisheries Restricted Area.

Under the General Fisheries Commission for the Mediterranean (GFCM), a Fisheries Restricted Area (FRA), the "Eratosthenes Seamount", with an area of 10298.47 Km^2, was established in order to protect the deep-sea sensitive habitats in the Exclusive Economic Zone (EEZ) of Cyprus.(see more details in Section 3.2 Vulnerable marine ecosystems).

The protected marine area of Cyprus, including the Eratosthenes FRA, currently amounts to 10.6% of its total marine area, i.e., territorial waters and the Exclusive Economic Zone.

With the inclusion of "Oceanid", the percentage of marine protected areas in Cyprus rises to 19.13% (Table 15).Recently, a new project has funded in Cyprus entitled: "LIFE IP PHYSIS: Managing the Natura 2000 network in Cyprus and shaping a sustainable future". This is an Integrated Project that is funded by the LIFE programme for Cyprus with the participation of fifteen partners. The primary objective of LIFE IP PHYSIS is to achieve and/or maintain a favourable conservation status for species and habitat types of community importance in Cyprus, through actions in the whole Natura 2000 network. This will mainly be possible through the implementation of the Prioritised Action Framework (PAF) for Natura 2000 in Cyprus for the Multiannual Financing Period 2014-2020, as well as the fulfilment of several targets of the EUs 2020 Biodiversity Strategy. The project's approach is to catalyse financial support from complementary funds and to ensure synergies between policy sectors for the purpose of Natura 2000 protection. The project will address all the weaknesses identified in the management of the Natura 2000 network in Cyprus, will fill knowledge gaps for species and habitats, improve the governance of the network, exploit ecosystem services and implement action and management plans for species and habitats.

Table 15.

The MPAs Network of Cyprus. For the purposes of the calculation of the percentage the four aforementioned MPAs that have been declared in Natura 2000 sites are not included in the table, to avoid double counting. (source: DFMR, 2020, personal communication with M. Marcou).

A/A	AREA	DECLARATION YEAR	SURFACE AREA Km²	% COVER OF THE TOTAL MARINE AREA OF CYPRUS
1	CHERSONISOS AKAMA	2010	79	**0.081**
2	AKROTIRIO ASPRO - PETRA ROMIOU	2004	21.07	**0.021**
3	THALASSIA PERIOCHI NISIA	2004	1.91	**0.002**
4	THALASSIA PERIOCHI MOULIA	2004	2	**0.002**
5	PERIOCHI POLIS - GIALIA	2004	16.58	**0.017**
6	KAVO GKREKO	2004	9.62	**0.010**
7	OCEANID	2019	8317	**8.482**
8	"Eratosthenis Seamount" FRA	2006	10298.47	**10.503**
9	"Paralimni" MPA with AR	2014	0.67	**0.001**
10	"Agia Napa" MPA with AR	2015	1.31	**0.001**
11	"Amathous" MPA with AR	2009	1.71	**0.002**
12	"Limassol - Dasoudi" MPA with AR	2014	1.13	**0.001**
13	"Geroskipou" MPA with AR	2014	5.56	**0.006**
14	"Larnaca" MPA with AR	2019	2.21	**0.002**
15	"Zenobia Wreck" MPA	2008	0.65	**0.001**
16	"Mpania - Pafos" MPA	2017	0.09	**0.000**
TOTAL			**18758.98**	**19.13**

Figure 11.

a) Marine protected areas in Cyprus; b) Eratosthenes seamount MPA (source: DFMR, 2018)

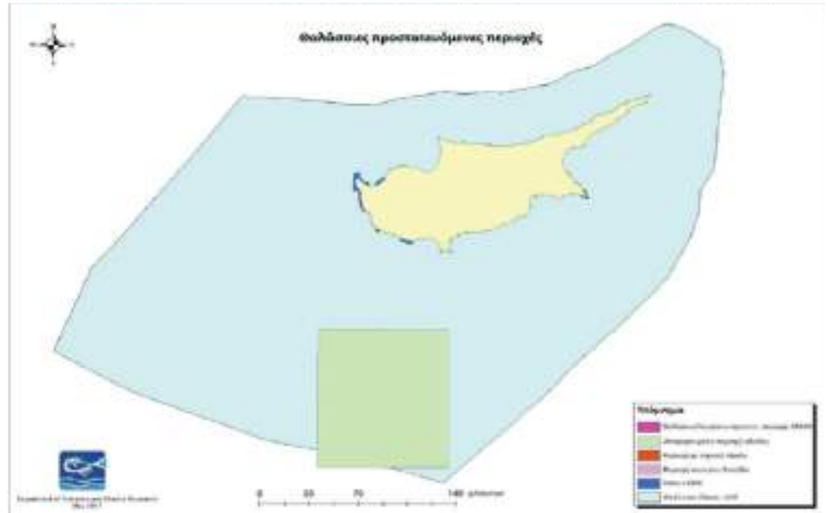
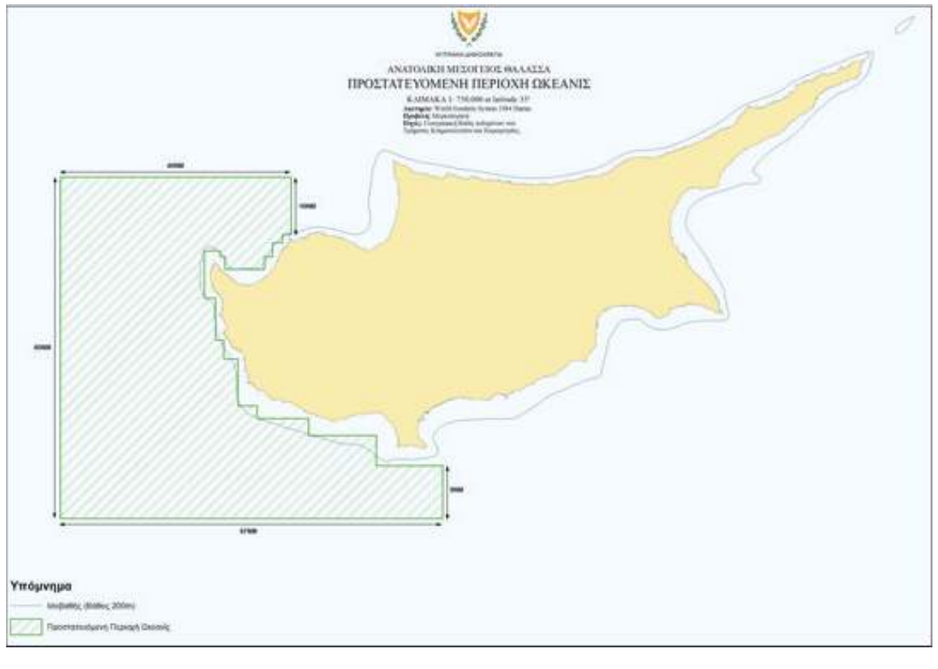


Figure 12.
Oceanid proposed MPA in Cyprus.



It should be noted, that DFMR progressed significantly on the designation of marine N2000 on the basis of scientific approach to fulfil the requirements of the Habitat Directive. With the inclusion of Oceanid as a SCI, DFMR considers that it covers any gaps for marine N2000 sites. What is more and depending on the data that will arise from various studies / surveys, the DFMR will proceed to enhance the management measures, including efficient surveillance and monitoring activities, in the marine N2000 network, if necessary, on the basis of the scientific approach.

4.2. Legal and institutional frameworks governing the conservation and sustainable use of marine and coastal biodiversity

National bodies dealing with the conservation of marine and coastal biodiversity Marine/ coastal biodiversity are the following:

a. Department of Environment (MARDE)

b. Department of Fisheries and Marine Research (MARDE) c. Forestry Department (MARDE) d. Game Fund (Ministry of Interior) - Waterfowl

***Fisheries*:** Department of Fisheries and Marine Research (MARDE).

Protection of the Sea (Pollution control/combating): Department of Fisheries and Marine Research; Department of Environment, Merchant Shipping Deputy

Protection of the coastal zone: Department of Town and Country Planning (Ministry of Interior) District Officers (Ministry of Interior) E Department of Environment (MARDE) Department of Fisheries and Marine Research (MARDE), Forestry Department (MARDE) Central Committee for the Beaches Local Authorities.

Protected areas: Marine/Coastal Areas – Department of Fisheries and Marine Research Wetlands – Department of Environment & Forestry Department in protected areas in coastal forest areas.

The Department of Environment, advises on environmental policy and coordinates programs for the environment. It supervises the implementation of policy and the adoption of European policy and legislation on the environment. Moreover, the department chairs of the Committee for Environmental Impact Assessment, promotes the enforcement of laws relating to the Control of Pollution of Water and Management of Solid and Hazardous Waste and encourages environmental awareness and information. It is also the administrative arm of the Environment Council. Moreover, it is the National Focal Point for the intergovernmental Organizations CSD, MCSD, SMAP, MAP, INFOTERRA and the Treaties:

- On International Trade in Endangered Species of Flora and Fauna CITES,
- Bern for the Protection of Endangered Species of Flora and Fauna,the Basel for the Cross-Border Transport of Hazardous Waste,
- The Vienna and Montreal Protocol on Substances that Deplete the Ozone Layer,
- Biodiversity ,
- Combating Desertification,
- Climate Change,
- Ramsar for the Protection of Wetlands,
- Transboundary Environmental Impact Assessment and
- Aarhus for public access to information about the Environment

Further DFMR is the national focal point for UNEP and Barcelona Convention for the Protection of the Mediterranean and its Protocols.

Below, current and relevant National and international conventions, directives and laws applicable in the Republic of Cyprus is recorded (source: DFMR, 2019a):

1 _ Barcelona Convention, Barcelona Convention Ammendements, and its protocols: (Dumping Protocol (and ammendments), Emergency Protocol, Prevention and Emergency Protocol (pollution from ships and emergency situations), Land-based Sources and Activities Protocol, Specially Protected Areas and Biological Diversity Protocol, SPA and Biodiversity Protocol and Annexes, Offshore Protocol (pollution from exploration and exploitation)).

2 _ The Marine Strategy Framework Directive (MSFD, 2008/56/EC). (Ministry of Agriculture, Rural Development and Environment, Department of Fisheries and Marine Research).

3 _ Habitats Directive (92/43/EEC) Measures for the protection of the Marine Protected Areas (MPAs), Implementation of monitoring programs for the conservation of priority species and habitats (e.g., ***Carreta carreta, Chelonian mydas, Monachus monachus, Posidonia oceanica*** meadows).

4 _ The EU Water Framework Directive (2000/60/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.

5 _ 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.

6 _ 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.

7 _ 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

8 _ The Urban Wastewater Treatment Directive (91/271/EEC), the National Waste Prevention Program and the Waste Management Plans.

9 _ Regulation (EC) No 1013/2006 of the European Parliament and of the Council on shipments of waste

10 _ 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 consequences of a hydrocarbon marine pollution incident.

11 _ 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).

12 _ 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.

13 _ The Fisheries Regulation (P.I. 273/1990) protects vulnerable species 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.

For ***Monachus monachus***

- 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, 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).

— 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.

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. (ΚΔΠ 234/2018).

The management regulations for Lara - Toxeftra are spelled out in the Fisheries Regulations (273/90). The Foreshore Protection Law was also amended at the same time (1989) incorporating into it the notion of Ecologically Important areas. An Order was issued on the basis of the Foreshore Protection Law also declaring the Lara/Toxeftra coastal area as Ecologically Important, thus giving effect to some of the provisions of the Fisheries Law.

In 2013, the area was included in the list of Specially Protected Areas of Mediterranean Importance (SPAMI) under the Barcelona Convention.

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 accepted from the European Commission as "Natura 2000" site, designated as a Site of Community Importance (SCI). The site includes an 11 km stretch of coastline (65-200 m wide) and the adjoining sea area down to the 50m isobath. The area is an important sea turtle nesting and feeding area, both for the Loggerhead Turtle (*Caretta caretta*) and the Green Turtle (*Chelonia mydas*). In addition, the marine part includes important areas of *Posidonia oceanica* and the inland part is characterised by sand dunes which accommodate a remarkable diversity of flora species. The management regulations are at their final stage of adoption at the time of writing.

— 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 Rural Development 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.

Table 16.

Sources of information, data-collecting mechanisms and monitoring programmes (revised after DFMR, 2012).

Element	Monitoring activities, other sources of information
Birds	Monthly water bird counts by the Game Fund of the Republic of Cyprus,
	Monitoring of selected coastal species by the Game Fund and the Forestry Department of the Republic of Cyprus.
Cetaceans	Cetacean and turtle stranding's program of the DFMR - 2016-2017 Surveys (DFMR)
Monk seal	National Action Plan for the Conservation of the Mediterranean Monk Seal in Cyprus (UNEP/MAP, DFMR) - National Monitoring Program of ***Monachus*** (DFMR)
Turtles	Cyprus Turtle Conservation Project (DFMR, Cyprus Wildlife Society) Cetacean and turtle stranding program of the DFMR Habitats Directive (92/43/EEC), specifically the Site of Community Importance of Polis-Gialia (CY4000001; terrestrial and marine) for the protection of the turtle ***Caretta caretta*** and for Chersonisos Akama (Site_CY4000010) where the Lara-Toxeftra MPA is included.
Fish and cephalopods	Mediterranean International Trawling Survey (MedITS) o Data Collection Framework (DCF)
Water column physicochemical parameters	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Water Framework-Directive (2000/60/EC) Nitrates Directive (91/676/EEC) MedPOL programme (UNEP/MAP)
Phytoplankton	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Water Framework-Directive (2000/60/EC) MedPOL programme (UNEP/MAP)
Zooplankton	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Mediterranean International Trawling Survey (MedITS)
Macroalgae	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Water Framework-Directive (2000/60/EC)
Zoobenthos	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Water Framework-Directive (2000/60/EC)
Angiosperms	Marine Strategy Framework Directive (MSFD, 2008/56/EC) Water Framework-Directive (WFD, 2000/60/EC) Habitats Directive (92/43/EEC) - ***Posidonia*** meadows mapping
Plastic pollution	MSFD (DFMR – from 2017)

Cyprus has developed a National Action Plan on species introductions and invasive species in Cyprus (Katsanevakis, 2017) in which the following measures are proposed:

- Restrictions in the use of non-indigenous species in aquaculture (existing measure): Control or/and restrictions in the use of non-indigenous species in aquaculture by implementing Regulation 708/2007 of 11 June 2007 concerning the use of alien and locally absent species in aquaculture.

- Program for the reduction of the population of ***Lagocephalus*** spp (existing measure): Efforts to reduce the populations of ***Lagocephalus*** spp. by targeted fishing, on the basis of previous efforts of monitoring and sampling.
- Reduction of the populations of non-indigenous species by selective removal methods (new measure): Extension of the fishing period for the program for the reduction of the population of ***Lagocephalus*** spp. by targeted fishing, and investigation of selective removal methods to reduce invasive alien species that have documented negative impacts on important fisheries resources and the marine environment of Cyprus.
- Monitoring program of alien species (new measure): Implementation of a monitoring program of alien species, especially in coastal waters.

4.3. Transboundary issues and existing, planned or needed coordination / harmonisation at subregional or regional level

As mentioned in section 2.4, among the transboundary issues are the hydrocarbon activities taken place in the EEZ of Cyprus but demand transboundary collaboration in case for instance of an accident such as oil spill. Cyprus is party to a number of international conventions and protocols, including MARPOL and the Barcelona Convention. A Sub-Regional Contingency Plan on combat major oil pollution incident between Cyprus, Greece and Israel has been formulated and agreed with the assistance of the Secretariat of Barcelona Convention.

The Republic of Cyprus transposed the Directive 2013/30/EU into the national legislative framework with the Health and Safety at Work (Safety of Offshore Oil and Gas Operations) Regulations of 2015 (P.I. 424/2015). Additionally, according to the Environmental Impact Assessment from Certain Projects Law (L.127(I)/2018) for drilling and exploration well and the production of hydrocarbons the submission of an Environmental Impact Assessment Study ("EIAS") is required. The EIAS are evaluated by the Environmental Impact Assessment Committee and the Environmental Authority (Department of Environment) issues an Environmental Approval, which includes terms, which the licensees are bound to follow and comply. The Republic of Cyprus was among of the first Mediterranean countries which ratified the Protocol for the Protection of the Mediterranean Sea against Pollution resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil (Offshore Protocol) of the Barcelona Convention, with the Convention for the Protection of the Mediterranean Sea Against Pollution and on Relevant Protocols (Ratification) (Amending) Law (L.20(III)/2001). The Offshore Protocol entered into force on the 24th of March 2011 and the competent authority is the Minister of Agriculture, Rural Development and Environment.

The Cyprus Ministry of Agriculture, Rural Development and Environment and Israel Ministry of Environmental Protection expressed the interest to prepare a Feasibility Study to investigate the opportunity of developing a CAMP project of transboundary cooperation between the countries. Transboundary CAMP aims to "promote cross-border harmonisation of coastal management and common approaches towards implementation of obligations" under the provisions of the Integrated Coastal Zone Management Protocol (article 28) and EU Directives. (Constantinidou and Haim, 2020).

The problem of marine litter is among the problems that in order to eliminate its impacts, transboundary collaboration is needed, especially concerning the open and deep sea. Further, the pollution from the maritime traffic is not monitored in any way, thus a collaboration between nations is essential to find solutions on that subject. In order to be in accordance with goal 14 of the UN SDGs (Conserve and sustainably use the oceans, seas and marine resources) actions must be taken to eliminated pollution. For open ocean and deep-sea areas, sustainability can be achieved only through increased international cooperation to protect vulnerable habitats We should eliminate plastic usage as much as possible and organize beach clean-ups. (SDG Goal14). Since the Initial Assessment of the marine environment of Cyprus (DFMR, 2012), a collection of data on marine litter is being carried out in the framework of the MEDITS research program (>50m depth) and the MarinE litter transnational LegislaTion EnchanceMent ("MELTEMI") project. For further results, one can see DFMR's report (2019) which refers to the second assessment of MSFD.

5.

Asessment of the marine and coastal status and pressures on marine and coastal areas

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5.1. Marine and coastal status and pressures relevant for national marine and coastal areas

Marine and coastal environment in Cyprus seems to be affected by various anthropogenic pressures. The impacts though are not always defined, because, except from a few examples and monitoring programs that are under the DFMR (see table 16), a lot of information is still missing. In addition, due to the lack of Marine Spatial Planning (MSP) of the marine area of Cyprus, information regarding activities and pressures in specific marine areas is missing.

Regarding the last point for MSP, one of the few attempts made for the marine environment of Cyprus was through the PROTOMEDEA project, where a planning exercise was set which took into consideration the most important biodiversity and fishery features present in the area of Cyprus, while socio-economic costs of important uses and existing management actions (e.g., FRAs, MPAs, N2000 network) were integrated into the proposed plans (Karachle *et al.*, 2019). The method used respects the principles of Systematic Conservation Planning (SCP) under a general Ecosystem-Based Management (EBM) framework to fisheries management and attempts to integrate issues such as the mitigation of conflicting uses and the cumulative effects of human activities, while ensuring the sustainability of commercially important fish stocks and biodiversity. This is the first time that such an integrated approach was applied in the marine territory of Cyprus. Some of the results regarding human activities in the marine area of Cyprus can be seen in the following figures (Figures 13, 14). Unfortunately, because of the poor quality of data available for tourism (number of arrivals at the scale of regions) and the lack of threshold for defining massive tourism this information was excluded as it was evaluated that it could add bias to the results.

Figure 13.
Human activities present in the study area (Karachle *et al.*, 2019)

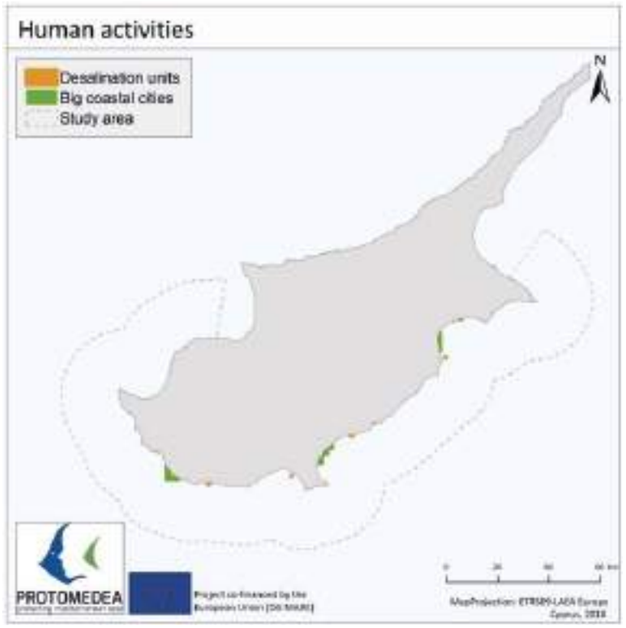
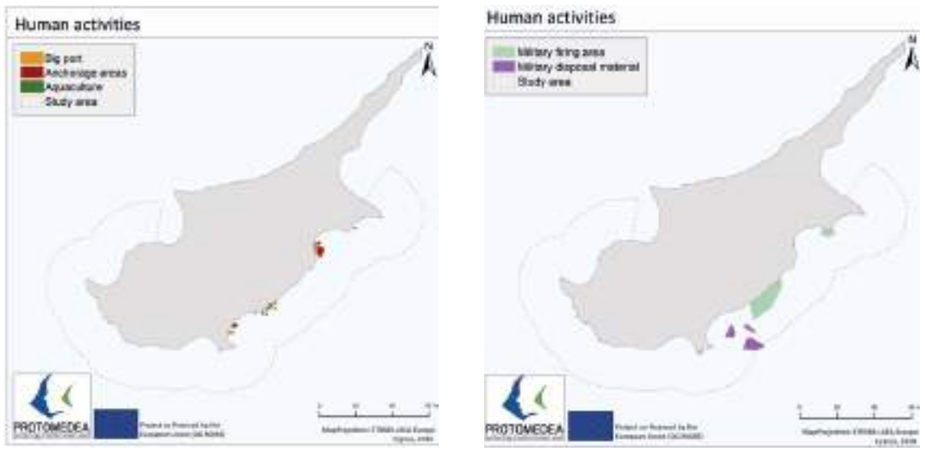


Figure 14.
Human activities present in the study area (Karachle *et al.*, 2019)



As mentioned also in Section 3 (Pressures and Impacts) among the main pressures on the marine and coastal biodiversity in Cyprus, are the non-indigenous species (NIS) for which, at least for most of them, there are not any data regarding their impacts on the native environment. Additionally, there are some alien species mainly invasive, that are known to harm human health with their toxins they carry. Such examples are the pufferfishes (*Lagocephalus* & *Torquigener*) carrying tetrodotoxins that could be fatal for humans and the lionfish (*Pterois miles*) which is otherwise edible. Especially for *Lagocephalus*, 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. Currently, only for these two species some management measures are in place. DFMR, has a management scheme to combat *Lagocephalus sceleratus* in the coastal zone of Cyprus using commercial fishermen to add intense fishing pressure in the breeding population of the species. This scheme is implemented through the Action 1.18.7 "Participation in other actions aimed at maintaining and enhancing biodiversity and ecosystem services, such as the restoration of specific marine and coastal habitats in support of sustainable fish stocks, including their scientific preparation and evaluation" from the European Maritime and Fisheries fund (EMFF), through the Operational Programme "Thalassa" 2014-2020 and it runs from 2016. From the first call (2016 – 2019) 229.395€ was compensated to commercial fishers for fishing 76.465 kg of *Lagocephalus sceleratus*, while during the second call (2019) 164.960€ were payed to fishers for fishing 54.987 kg of fish. Regarding lionfish, the RELIONMED-LIFE project aims to restrict the impacts of this species in the marine waters of Cyprus through a variety of actions (targeted removals by scuba and free-divers, promoting the consumption of the species, promoting other uses like jewellery designs) for the control of its population (https://relionmed.eu/).

Although until recently (DFMR, 2019; Michailidis *et al.*, 2019) it was thought that fisheries in Cyprus seem to have a relative low impact on marine resources, this result was mainly based on data regarding commercial fishing or also on hypothetical estimations for MRF (Michailidis *et al.*, 2019). Adding real estimations from MRF might change this situation, since as Michailidis *et al.*, (2020) showed that some vulnerable species (e.g., the dusky grouper *Epinephelus marginatus*, the common dentex *Dentex dentex*) or with high intrinsic vulnerability index (e.g., the red porgy *Pagrus pagrus*, the white seabream *Diplodus sargus*) are primarily exploited by MRF, and much less by commercial fisheries. Similarly, some high TROPH species, for example large demersal and pelagic fish, were harvested in significantly larger quantities by MRF than by commercial fisheries, but due to lack of data on stock status on these species there is no evidence that these stocks are indeed overfished. Another pressure with uknown impacts on fisheries stocks is illegal fishing. In order to eliminate this problem, more dense patrolling and surveillance methods (e.g. sensors, cameras) must come into force.

Urban and tourism development of the coastal zone of Cyprus is very intense. According to DFMR (2019) it is estimated that 11 % of the coastline length and 8 % of the coastal zone (0-100 m) is affected by infrastructure (groynes, offshore detached breakwaters, harbours, marinas and shelters). Regarding, management measures, EIAs are carried out before the construction's approval. Furthermore, according to the new EIA directive, for all the constructions in the sea and coasts, monitoring programmes are applied for the construction phase and afterword for the operational phase. Further, in the aforementioned estimations, no data regarding urban and touristic constructions (hotels, villas, houses) on the coastal zone are considered. In Cyprus, travel and tourism were responsible for creating revenues reaching 2024 million € in 2014 with an anticipated contribution of 24% to country's Gross Domestic Product (GDP). This figure is projected to follow a rising path of 5.1% per annum reaching 6,067.7 million € by 2024 (30.9% of GDP), in line with the increasing demand in global tourism (Michopoulos *et al.*, 2017). Thus, high pressure is added by the overexploitation of most of the beaches in Cyprus. This can cause several problems, by the use of numerous umbrellas disturbing vulnerable habitats and species sand living (e.g., *Ocypode cursor*), numerous recreational boats anchoring in vulnerable or protected coastal habitats, or free camping in areas that vulnerable or protected species inhabit (e.g. Akamas). Although tourism is so important for Cyprus, there is a gap regarding the impacts of tourism on the marine environment (wastes, landscape alteration, habitats disturbance etc). A study was made regarding recreational scuba diving in Cyprus (Sicilliano *et al.* 2016). The case study was the well-known Zenovia wreck in Larnaca and it was concluded that diving is having a significant negative effect on the macroalgae coverage of the shipwreck, especially in

areas subject to high levels of use (e.g., meeting stations) when compared to control sites in the same wreck. Divers' behaviour and popular dive routes at the wreck are factors associated to the observed decrease in macroalgae benthic cover. Moreover, 110 km of the coastline (30%) under the control of the Republic of Cyprus is subject to erosion (European Commission-Cyprus, 2009; Report by the Republic of Cyprus under Recommendation 2002/413/EC). The approach adopted by Cyprus is the reduction of the wave action on the eroded beaches. A series of offshore detached breakwaters have been built in numerous areas and more such measures are under implementation. These breakwaters are typically erected at a water depth of the order of 4m and the crest of the breakwater is slightly above mean sea level, of the order of 0,5m (Paris, 2016).

Another pressure that the marine environment of Cyprus is facing is due to the power and desalination plants which are situated in several coastal areas of Cyprus (Figure 13). The cooling water used in thermal power plants, and brine production during desalination release, can altered water. The Department of Environment gives permits for discharge of waters following strict rules including a monitoring program and it seems that according

to DFMR relevant monitoring programs, the impact is localised. In accordance with DFMR (2019) the total electricity-generating capacity through thermal energy production has slightly increased between 2010 and 2019 (2.8 %), and the associated increase in cooling water usage has a low increase of 2.6 % from the previous assessment (2010). Output of brine produced during desalination has increased by 65 % between 2010 and 2019 but the DFMR after monitoring the desalination plans recorded no important impacts beyond a certain distance from the discharge point.

Further, nutrient levels (Nitrate, ammonium and orthophosphate concentrations) recorded in non-reference stations indicate that nutrient enrichment is rather transient and difficult to capture. Based on the Nitrates Directive (91/676/EEC), the coastal waters of the Kokkinohoria area (Ammochostos district) is characterized as a nitrate vulnerable zone due to agricultural nitrates inputs, and this area is monitored (DFMR, 2019).

For Vasilikos bay which, as mentioned previously, is an area with high human pressures (aquacultures, energy plant, etc), the Department of Fisheries and Marine Research is taking steps aiming to designate the western waters of Vasiliko Bay as an aquaculture zone and a large investment is planned to construct a port west of Vasiliko to accommodate the fish farmers of the area (Kletou, 2019).

Further, marine noise is another pressure in the marine environment. As mentioned in section 3.3, no explicit observation/monitoring of marine noise is currently taking place. Anthropogenic noise has been documented during acoustic cetacean surveys (Boisseau et al. 2017; Boisseau, 2017 in DFMR, 2019a), and from acoustic data gathered over 6183 km in the marine waters of Cyprus during three surveys in 2016-2017, anthropogenic noise was detected during all three surveys with distinct detection of three sources. Ambient noise in excess of 90 db re 1 μPa2 Hz-1 at low frequencies, was ever-present throughout the area and this is typical of extensive shipping activity. Sounds by military sonar and seismic airguns used in oil and gas surveying were also detectable. Anthropogenic noise is pervasive in the marine waters of Cyprus at levels that constitute a threat to many marine organisms and especially cetaceans. Shipping noise intensity may be intensified by high speeds and seismic surveys in the EEZ of Cyprus are covered by SEA/EIA regulations.

Last but not least, tourism in Cyprus is among the major human activities that put pressure in the marine environment.

5.2. Critical impacts and effects on marine and coastal biodiversity

Coastal (hotels, houses etc) and marine constructions (groynes, offshore detached breakwaters, harbours, marinas, shelters): These structures affect and alter marine habitats (e.g., sandy sediment habitats and their communities) and currents direction. The impacts can be detected mainly on the change of the long- shore transport of sediments and natural habitats and the species dependant on them (e.g., turtles, ghost crabs, sea grasses etc) (Demetropoulos, 2002). Due to excess development there might be a general degradation of littoral habitats, biodiversity decline, degradation of priority habitats (e.g., sand dunes) and vegetation (Demetropoulos, 2002).

Although N2000 and MPAs areas are being protected through European and national legislation, illegal actions still remain undetectable (extracting of species, free camping on protected beaches, recreational vessels anchoring, illegal fishing).

Wetlands: In the framework of the 'Inventory of Cyprus Wetlands' project undertaken by the Cyprus Conservation Foundation - Terra Cypria (financial support of the Fondation pour la Nature – MAVA, 2014 - 2015) it was found that many wetlands of Cyprus are degraded and continue to be further degraded mainly due to land reclamation, earthworks, construction works, road openings, and restriction or deprivation of water supply. The main causes leading to wetland degradation are: a) dam construction that led to degradation of wetlands downstream due to the halting of water supply, b) unsatisfactory implementation of laws, c) strong pressures resulting from tourist development on coastal areas, and, d) the ignorance of competent departments and citizens regarding the presence, meaning and value of island wetlands.

Fisheries resources: Several aspects are still unknown. The Stock status of various fish is unknown and a decline in some of them exist and might exist also in other species without been aware. Furthermore, as previously mentioned, illegal fishing must be controlled.

Vulnerable habitats of the deep sea: these are mostly unknown except the examples given in previous sections, thus the danger of deterioration of these habitats due to anthropogenic pressures is even higher (underwater noise, drilling, marine litter, oil spills and oil pollution).

6.

Asessment of priority needs and response actions

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6.1. Needs

The revision of the existed data regarding marine biodiversity and habitats of Cyprus revealed some important knowledge gaps together with some need to fill in these gaps. Emphasis should be given in scientific knowledge which is still scarce, especially in regards to some habitats and organisms, and secondly a method to ensure that the regulations and laws that are anyway in force in Cyprus, are adhered to. For filling the gaps international cooperation and assistance is needed.

In details:

1 _ Update of the National Action Plan for monk seal: after all new information in regards to population and distribution studies for monk seal, there is an urgent need for updating the existing national plan.

2 _ Measures to establish and implement an effective system for the strict **protection of the Natura 2000 sites, MPAs, artificial reefs, illegal fishing** activity and other illegal actions: a priority need is to find a good solution regarding surveillance of MPAs and all illegal actions mainly in these areas due to the limited personnel and financial resources. Synergies with other countries and private companies that gave or know how to give solutions on these matters should be sought. A source of funding could be the Operational Programme "THALASSA".

3 _ Awareness campaigns and Citizen Science: As highlighted in Goal 14 of SDG,there is a need to spread the message about how important marine life is and why we need to protect it. Thus, it is important for Cyprus to raise on a permanentbasis awareness campaigns concerning marine environment and its importancefor humans, especially for the island of Cyprus. This can be done in colaborationwith local NGO's. In addition to that, citizen scientists should be involved (if people are well informed they will have more interest to participate in suchactions) in order to gain valuable information regarding NIS (new introductionsand range distributions), biodiversity (new records of organisms other thanNIS) illegal actions in the sea (fishing or else), pollution events etc.

4 _ Monitoring of marine litter emphasizing in plastic (macro- microplastics): Along-term monitoring system must be set by the authorities in certain beaches and marine areas in order to measure pollution and study the impacts on organisms and habitats. These should be set as a permanent activity and notas part of external funded projects so as to have a long-term view on thesubject and to act faster and more appropriate, if necessary.

5 _ DFMR initiative to gather all information regarding marine environment ofCyprus in one place: One problem identified during this report, is how scatteredand diverse the information is regarding marine environment of Cyprus.Information from projects' final reports or webpages, internal reports of DFMR, publications, books were all sources of valuable information. It would be very helpful in order to know what was studied and what not, to gather all this information in one place for further use. Maybe DFMR, can set a new rule/condition for everyone working in subjects related to marine enviornment to send to the department a report with the main details of their work. A partly solution for that, will also be the biodiversity database where all the relevant literature will be cited.

6 _ Deep sea studies: Danovaro *et* al. (2020) indicated an information gap in regards to meso- and bathypelagic species of non-commercial interest, hard bottom habitats between 200 and 800 m depth, in general all habitats below 800 m depth, meiofauna and deeper dwelling populations. In order for Cyprus to achieve this kind of studies, cooperation with international experts must be sought. A long-term collaboration must be built and training of local scientists must take place in order not only to fill in the information gap, but also to keep monitoring these important ecosystems.

7 _ Alien species studies: There is a huge gap regarding the biology and ecology of alien species in Cyprus and in the Mediterranean in general, thus the impacts are difficult to be identified. Scientific knowledge regarding life cycles, diet, habitat needs etc is needed so as to be able to manage as better as possible IAS in Cyprus (and in the Mediterranean). Knowing that eradication is impossible in the marine environment, other methods can be used to eliminate the impacts of IAS in Cyprus (target species for fishing if this is effective, etc). Early warning systems must be set in collaboration with neighbouring countries, in order to be better prepared to manage new introductions. Thus, constant monitoring of these species starting from certain marine areas is essential.

8 _ Marine biodiversity studies: there is still a big knowledge gap regarding marine biodiversity of Cyprus. Some groups are not studied at all (small crustaceans, Pycnogonida, molluscan groups, etc) or the information is too old and needs revision. It is important for a country to know its biodiversity so to take any conservation measures, but also it is very important for this information to be easily accesible (i.e., through an on-line database). Collaboration with national and international research centers and universities, with experts on different groups, is essential to fulfill this gap. Further, knowledge on the local distribution, abundances, and other population characteristics is also missing for Cyprus' marine fauna and flora. In addition a population assessment for the cetaceans is of a great importance. Other important actions include the production of new scientific knowledge regarding the marine environment of Cyprus (cetacean population, species including NIS and habitats). Thus, collaboration among universities and research units must urgently started. The infrastructure of all committed parties must be available for all participants (e.g., research vessels, microscopes, sampling equipment, software, mapping systems). For a better collaboration, it would be useful to have a discussion first of the interested parties with the competent authorities in order to priotirize, the information needed.

9 _ A dynamic inventory – database of all marine biodiversity of Cyprus: This will give the opportunity to scientists, other stakeholdes and the public, to use, study, share or learn about marine life of Cyprus helping in this way to reveal the existing data gaps, to make comparisons at a national level with other countries. Further, it will be a tool where one can assess the impact of alien species vs native ones. Information like distribution, biology and ecology of species will be accompanied. This inventory must be updated every few months in order to add all new information regarding the biodiversity of Cyprus. Collaboration of DFMR with academia is essential for the creation and the long-term maintance of such a database.

10 _ Targeting IAS via fishing: Extend the current measure of *Lagocephalus* fishing for recreational fishers with a fishing license and further target other IAS (lionfish, other pufferfish). Of course, in order to target IAS species for fishing, requires, among others, scientific evidence that this is a feasible and also an effective method, an information that does not exist yet.

11 _ Marine Spatial Planning: The Ecosystem Approach (Barcelona Convention EcAp) is a way of making decisions in order to manage human activities sustainably. It recognises that human's activities both affect the ecosystem and depend on it. Although it is recognised that marine activities are continuously increasing in Cyprus, resulting in high competition between interests of different marine uses, such that shipping and maritime transport, offshore energy, developing ports, fisheries, aquaculture and environmental protection, no marine spatial plan has established yet. The MSP shall be established as soon as possible, and at the latest by 31 March 2021 (Maritime Spatial Planning and Related Matters Law of 2017 - Law 144(I)/2017).

12 _ Investigation of Sea Acidification: As highlighted in Goal 14 of SDG, there is a need for the investigation of the impacts of sea acidification in coastal **areas of Cyprus.**

6.2. Urgent actions proposed

Amongst the most urgent action is the surveillance system and a better control of the marine protected areas and other areas and activities of interest that can negatively impact marine environment. Measures to establish and implement an effective surveillance system for the strict protection of the MPAs and other important areas and illegal activities are more than urgent. Solutions from other countries already employed such systems, must be considered

A further action is to have a long-term monitoring of tourist activities in Cyprus coastal area (more statios and methods to be added) in order to record impacts on natural environment for taking more drastic and sustainable measures.

Updating the National Action plan regarding monk seal is also urgent, because new and important data are gathered due the recent work on that subject.

In addition, the dynamic marine biodiversity database must be created as soon as possible, with the initiative of DFMR and the collaboration with universities and other research units. This must be a long-term collaboration. A good dissemination plan must be organised so once it is ready then spread the word to all interested parties.

The creation of an international and national team and education of local researchers on the know-how for the study of the deep-sea of Cyprus is also essential. Funding can be sought from Horizon 2020 (or the developing program Horizon Europe) or other funding mechanisms.

Finally, the addition of further species in the fisheries monitoring program, especially vulnerable or species that may need protection due to declining populations is also recommended.

7.

Funding problems and opportunities

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7.1. Regular national sources, potential co-financing for international funding

Most of the national funds are in collaboration with European ones. Thus, main funding sources are given together from national and international sources, in the following section 7.3, along with some of problems that someone might face in order to get a grant.

7.2. Other sources (private, public, partnership)

Some local foundations might fund research regarding marine environment. These are:

Leventis Foundationhttp://www.leventisfoundation.org)

Companies that occasionally fund actions regarding marine environment emphasizing in cleaning activities "."

7.3. International funds, projects, programmes, national eligibility for international programmes/funds (e.g., green funds) identified

a) Research and Innovation Foundation (RIF): It is the executive arm of the new National Research and Innovation Governance Structure. The RESTART 2016-2020 Programmes constitute a multiannual framework of Programmes for Research, Technological Development and Innovation Support in Cyprus, co-funded by national and European funds and implemented in conjunction with other national initiatives and programmes.

PROBLEMS: Although it targets reasearch in Cyprus, these programm is very competitive while only very few proposal will be chosen. Further, there is no dedicated call for marine research.

b) Operational Programme «THALASSA» 2014-2020: It provides the financing of projects in the fisheries sector, with emphasis on supporting small-scale coastal fisheries, aquaculture and the development of fisheries and aquaculture areas. The program also included measures for the control of fishing activities, data collection and integrated maritime policy. In addition, great importance is given to measures affecting the marine environment.

PROBLEMS: The open calls of this programme, are usually very specific and not commonly related with basic research. Usually it does not target scientific knowledge. Eligible for participation are the Central Government, Fishermen, Aquaculturists, Owners of Vessels, Local Authorities, Private Bodies and Small and Medium Enterprises (SMEs).

c) LIFE program: EU's funding instrument for the environment and climate action created in 1992. Funds for nature conservation and biodiversity, environment and resource efficiency, environmental governance and information.

PROBLEMS: The program is the main funding instrument in Europe for natural environment. But, NO basic research is funded under this program.

d) Interreg Europe: This program helps regional and local governments across Europe to develop and deliver better policy.

PROBLEMS: Interreg Europe will co-finance up to 85% of project activities that are carried out in partnership with other policy organisations based in different countries in Europe. Through interregional cooperation projects, partners must identify a common interest and then work together for 3-5 years. Thus, no regional studies are supported.

e) COST Actions: COST (European Cooperation in Science and Technology) is a funding organisation for research and innovation networks that help connect research initiatives across Europe and beyond and enable researchers and innovators to grow their ideas. COST Actions are bottom-up networks with a duration of four years that boost research, innovation and careers.

PROBLEMS: Funding only for networking not research, although very useful in gaining knowledge and share scientific ideas.

f) Directorate-General for Maritime Affairs and Fisheries: Various calls are opening under DG-Mare which mainly targeting fisheries, blue economy, blue technology etc.

PROBLEMS: calls open only in specific subjects that are under the interest of DG-MARE.

8.

Conclusions and recommendations

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Having in mind that the pressures on the marine environment are getting more intense as time passes, it is useful to set priorities for Cyprus.

As a major issue is the lack of information regarding the marine environment of Cyprus, and relevant studies must start as soon as possible via scientific methodology. Further, marine biodiversity must be recorded in order to assess the population status of species that are either endangered or they are threatened to specific anthropogenic pressures.

Habitat types must be mapped, so as to assess the status mainly of priority habitats or the discovery of singular habitats, especially in the deep sea that need further management measures. Having in mind that climate change is here to stay, some of these priority habitats are more prone to degradation (wetlands, sand dunes, mediolittoral zone). A possible rise of the sea level or further erosion will cause further deterioration of these important habitats.

The study of the status of fisheries stocks must be continued and enriched also with other species in order to get a clearer view on the status of fishing pressure in Cyprus. Studying stocks will allow Cyprus to take measures in order to comply with the Descriptor 3 of MSFD, for having GES 'Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock'. In general, many current fishery problems in the world seas are the legacy of a misplaced belief in the inexhaustibility of marine resources, which led to management that did not create incentives for conservation. As a result, many species have been overexploited and more are at risk; there is severe overcapacity of fishing power, which puts pressure on managers to make risk-prone decisions, and as a result many marine fisheries under current management practices are not sustainable at societally acceptable levels. In order for Cyprus, to make further decisions on management measures that will ensure sustainability of fisheries stocks, it will need to obtain all the needed information, from all fishing activities (including MRF).

Citizens must be continually updated regarding marine environment and its value, emphasizing in the fact that society depends on the seas for survival. Efficient ways of engaging them in the protection of marine environment must be a priority for the next years. Target groups must be of all ages, emphasizing in students and younger people through specialised material (courses, games, apps, etc). Many of these actions and tasks apply also for other countries, therefore it would be useful to set a collaboration network with other countries facing similar problems (e.g., Cigliano *et al.*, 2015). Further Citizen Science must be used as a tool in research and conservation (Earp and Liconti, 2020)

Regarding NIS, collaboration with neighbouring countries must be set in order to monitor the appearance and establishment of these species, aiming in early response measures. This collaboration can be agreed within governmental authorities of each country in order to be long-term, reliable and mandatory.

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SPA/RAC WORKING AREAS

*SPA/ RAC, the UNEP/ MAP **Specially Protected Areas Regional Activity Centre**, was created in 1985 to assist the Contracting Parties to the Barcelona Convention (21 Mediterranean contries and the European Union) in implementing the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol).*

POST-2020 SAPBIO

Strategic Action Programme for the **Conservation** of **Biodiversity** and **Sustainable Management** of **Natural Resources** in the **Mediterranean Region**

SPAMI

Specially Protected Areas of **Mediterranean Importance**

Marine turtles

Cetaceans

Specially Protected Areas

Monitoring

Mediterranean Monk Seal

Cartilaginous fishes
(Chondrichtyans)

Coralligenous and other calcareous bio-concretions

Marine vegetation

Marine and coastal bird species
Listed in Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean

Dark Habitats
Habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena

Species introduction and invasive species

POST-2020

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Mediterranean Action Plan
Barcelona Convention

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