REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE, RURAL DEVELOPMENT AND ENVIRONMENT

DEPARTMENT OF FISHERIES AND MARINE RESEARCH

Update of Articles 8, 9, And 10 of the Marine Strategy Framework-Directive (MSFD) (2008/56/EC) in the Marine Waters of Cyprus and the electronic data entry in the European Union (EU) system

Good Environmental Status Report

December 2019

FOREWORD

This report was prepared by AP Marine Environment Consultancy Ltd, and independent experts.

The consortium undertook the authorship of three reports in the framework of the implementation of Articles 8, 9, 10 of the Marine Strategy Framework Directive (2008/56/EC) on behalf of the Department of Fisheries and Marine Research (DFMR) of the Republic of Cyprus, under contract 45/2018. The three reports are: the 2nd Evaluation of the marine environment of Cyprus, a report on the Determination of Good Environmental Status, and a report on Environmental Targets.

This volume includes the report on the Determination of Good Environmental Status of the Marine Environment of Cyprus.

Project Team:

Antonis Petrou	Project leader (AP Marine)
Angelos K. Hannides	Report contributor and editor
Eirini Tsikopoulou	Habitats and Biodiversity expert
Giuseppe Scarcella	Lead fisheries expert
Ioannis Karakasis	Habitats and Biodiversity expert
Kyproula Chrysanthou	Marine Litter (AP Marine)
Louis Hadjioannou	Systematic Biologist (Enalia Physis Environmental Research Center)
Myroula Hadjichristoforou	Turtles expert (Cyprus Wildlife Society)
Stelios Katsanevakis	NIS expert
Vali Lambridi	Socioeconomics expert (Lamans SA)

Supportive Team:

Maria Patsalidou	(AP Marine)

The following Project Team members contributed to the present report as follows:

Angelos K. Hannides	Descriptors 5, 6, 7, 8 και 11
I. Karakassis & Eirini Tsikopoulou	Descriptors 1, 5, και 6
Giuseppe Scarcella	Descriptors 3 και 9
Kyproula Chrysanthou	Descriptors 10
Stelios Katsanevakis	Descriptors 2
I. Karakassis & Eirini Tsikopoulou	Descriptors 4

Acknowledgments

The Marine Environment Division of the Department of Fisheries and Marine Research (DFMR) of the Republic of Cyprus coordinated this project, through a specially convened Guidance Committee, which reviewed all the work conducted. The members of the Guidance Committee are:

Marina Argyrou	DFMR, Director DFMR,
Savvas Michailides	DFMR, Head of Marine Environment Division Project Coordinator
Melina Marcou	DFMR
Maria Rousou	DFMR
Konstantinos Antoniadis	DFMR
Charis Charilaou	DFMR

Various departments such as DFMR, Game & Fauna Dept., Department of Land and Surveys provided useful contributions in terms of data, documents, information, and suggestions, and are especially acknowledged.

This document should be cited as:

Republic of Cyprus, Ministry of Agriculture, Natural Resources and Environment, Department of Fisheries and Marine Research "Services for the Update of Articles 8, 9, And 10 of the Marine Strategy Framework-Directive (MSFD) (2008/56/EC) in the Marine Waters of Cyprus and the electronic data entry in the European Union system, Determination of Good Environmental Status of the Marine Environment of Cyprus Report". Report prepared by AP Marine Environmental Consultancy Ltd, Nicosia, December 2019.

TABLE OF CONTENTS

1 Overview

The card below summarizes the environmental status of the descriptors based on the evaluations that follow in this report (shown under 2019) as they compare to the outcomes of the 2012 assessment:

- Green - descriptors in GES (green),
- Red - descriptors not in GES (green),
- White – indeterminate.

2012	Part I Predominant Pressures and Impacts	2019
[red]	D2 Non-indigenous species	[red]
[red]	D3 Commercially exploited fish	[green]
[green]	D5 Eutrophication	[green]
[green]	D6 Seafloor integrity	[green]
[green]	D7 Alteration of hydrographical conditions	[green]
[green]	D8 Contaminant concentrations	[green]
[green]	D9 Contaminants in fish	[green]
	D10 Marine litter	
	D11 Energy introduction, including noise	[red]
	Part II Essential features and characteristics	
[green]	D1 Birds, mammals, reptiles, fish and cephalopods	
[green]	D1 Pelagic habitats	[green]
[green]	D1,6 Benthic habitats	[green]
	D1,4 Ecosystems and food webs	

2 Introduction

The approach used in determining whether Cyprus waters are in Good Environmental Status (GES) was elaborated in detail in 2012 and is described here in brief.

GES is evaluated using environmental thresholds/limits established from 2012 onwards which quantitatively describe the desired state of the environment. Where lack of data prevents a quantitative determination of GES, GES is expressed qualitatively at the level of the descriptor.

For multi-component descriptors (e.g., D5), differently weighted site-based indicators were estimated as follows: (1) Presence of reference condition sites: the deviation (%) of indicator mean value estimated at all sites from indicator mean reference condition sites value, (2) Absence of reference condition sites: Coefficient of Variance (CV=standard deviation/mean), and (3) Absence of quantitative data: expert judgment.

All descriptors and criteria were assigned a status value (between 0 as low and 1 as high) as indicated in Table 1. GES is considered to be achieved if the status is given a value of 0.75 or greater.

Table 1 Scale used for the determination of status value in the cases of descriptors and indicators that are based on rigorously quantitative-based methods. The threshold of 0.75 is used to determine whether GES is achieved or not.

Deviation (%) from Reference Condition sites	Coefficient of Variance (CV)	Assigned value	Status range	GES
0-25	0-0.25	1.0	0.75-1.0	Achieved
25-50	0.25-0.5	0.75		
50-75	0.5-0.75	0.5	< 0.75	Not achieved
75-100	0.75-1	0.25		
>100	>1	0		

3 Part I Criteria, methodological standards, specifications and standardised methods for the monitoring and assessment of predominant pressures and impacts under point (b) of Article 8(1) of Directive 2008/56/EC

3.1 Descriptor 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems

3.1.1 D2C1 Number of newly introduced non-indigenous species per assessment period

In the previous assessment period (2007-2012), 30 new NIS in Cyprus were reported, while in the current assessment period (2013-2018) 33 new NIS were reported (Figure 1). The number of newly introduced NIS is therefore 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. Many targeted surveys and relevant papers were published during that period (e.g. Cecalupo & Quadri, 1996; Buzzurro & Greppi, 1997; Cirik *et al,* 2000).

Among the 33 newly reported species to Cyprus, 12 were presumably introduced to Cyprus by shipping, for 5 the pathway of introduction is highly uncertain, while 16 most probably arrived in Cyprus by neighboring countries of the Levantine Sea through unaided dispersal.

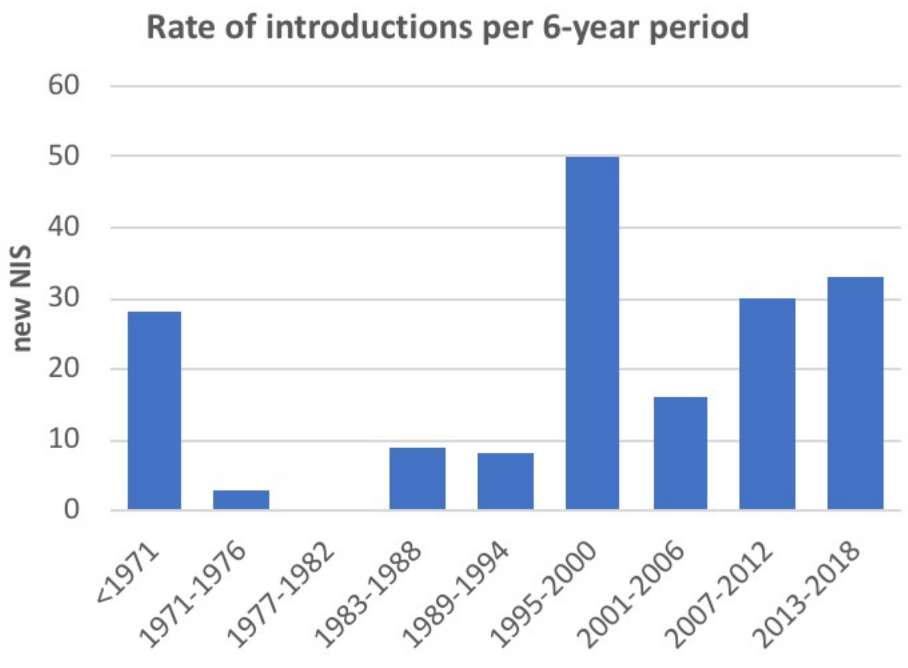

Figure 1 Number of newly introduced non-indigenous species in Cyprus, per 6-year period, based on the year of first record of each species.

3.1.2 D2C2 Abundance and spatial distribution of established non-indigenous species

Surveys in Cavo Greco and Nissia MPAs (2017-2018; DFMR, 2018)

Abundance and spatial distribution data of established NIS have been collected at two MPAs through the project "Baseline survey and monitoring of non-indigenous species in Cavo Greco and Nisia Marine Protected Areas in Cyprus", financed by the Operational Program "Thalassa 2014-2020" (75% by the European Maritime and Fisheries Fund & 25% by national funds) (DFMR, 2018). During that monitoring program six seasonal expeditions were conducted applying underwater visual survey techniques in 2017-2018. Seasonal surveys were conducted in three habitat types of the study areas, including rocky reefs, sandy bottoms and *Posidonia oceanica* meadows at a total of 27 stations (6 of each habitat at Cavo Greco and 3 of each habitat at Nisia).

During the six expeditions, a total of 339 taxa were identified, 288 of which were identified up to species level, while 51 others were identified at a higher taxa level (mostly genus). Among those taxa identified at species level, 45 were identified as alien, 2 as cryptogenic, 1 as range expanding and the rest as native. The Phylum with the most NIS was Chordata (n=18) followed by Mollusca (n=12) and Arthropoda (n=4). Overall the highest densities were observed in rocky reefs, followed by *Posidonia oceanica* beds, and the lowest in sandy bottoms. The highest alien fish density was recorded in rocky reefs at Cavo Greco in the winter of 2018 (883 ind. per 1000 m^2) and the lowest in sandy habitats at Nisia in the spring of 2017 (4 ind. per 1000 m^2). The highest alien fish biomass was recorded in rocky reefs at Cavo Greco in the summer of 2018 (8.1 kg per 1000 m^2) and the lowest in sandy habitats at Nisia in the summer of 2017 (0.1 kg per 1000 m^2). In the two MPAs (all three habitats), the average biomass density ranged between 1.5 and 4.4 kg per 1000 m^2 in Cavo Greco, and between 1.6 and 2.9 kg per 1000 m^2 in Nissia. The total abundance and biomass of alien fish varied less than these of native fish (Figure 2 and Figure 3).

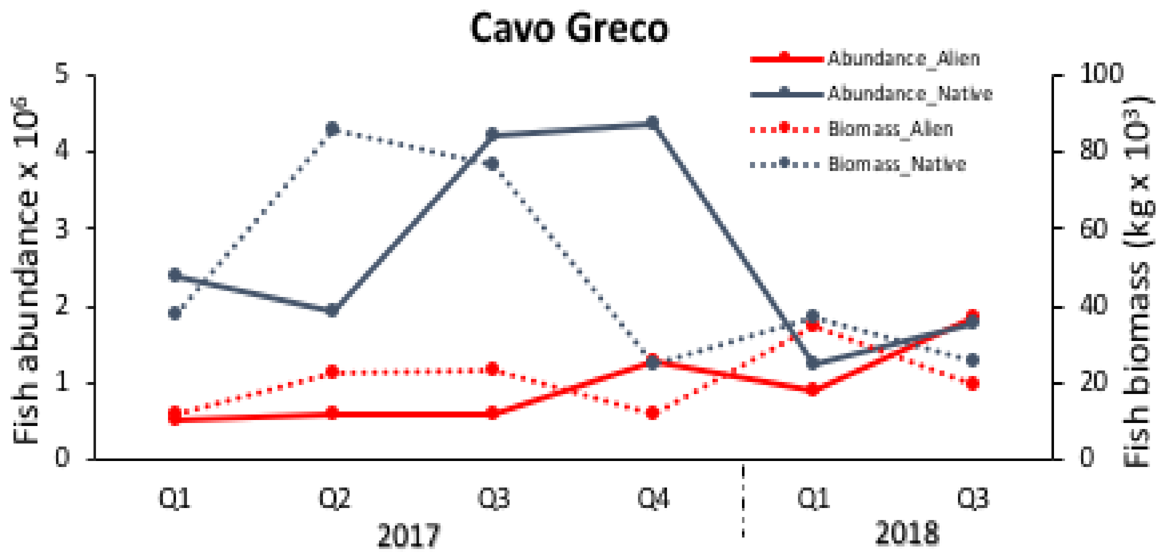

Figure 2 Variation of fish abundance and biomass in Cavo Greco in 2017 and 2018 (DFMR, 2018).

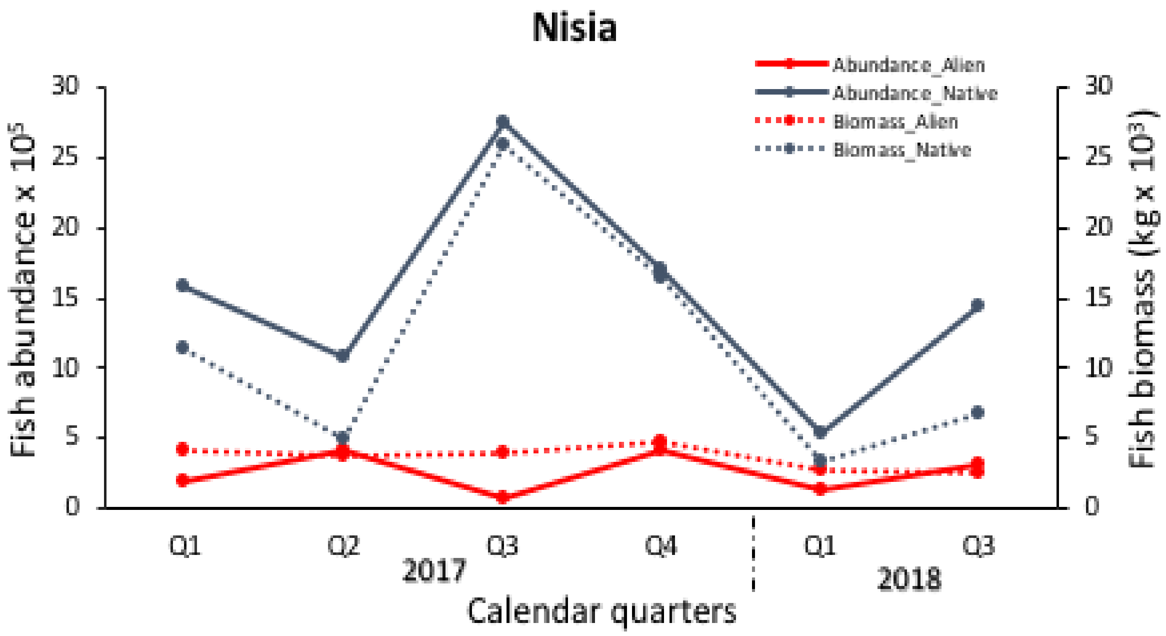

Figure 3 Variation of fish abundance and biomass in Nissia in 2017 and 2018 (DFMR, 2018).

Based on Generalized Additive Modelling, the density of alien fish was found to vary seasonally, being the highest at shallow waters (0-10 m) and in rocky reefs (Figure 4), while the biomass of alien fish was not found to significantly vary seasonally but it declined with depth and was highest in rocky habitats (Figure 5).

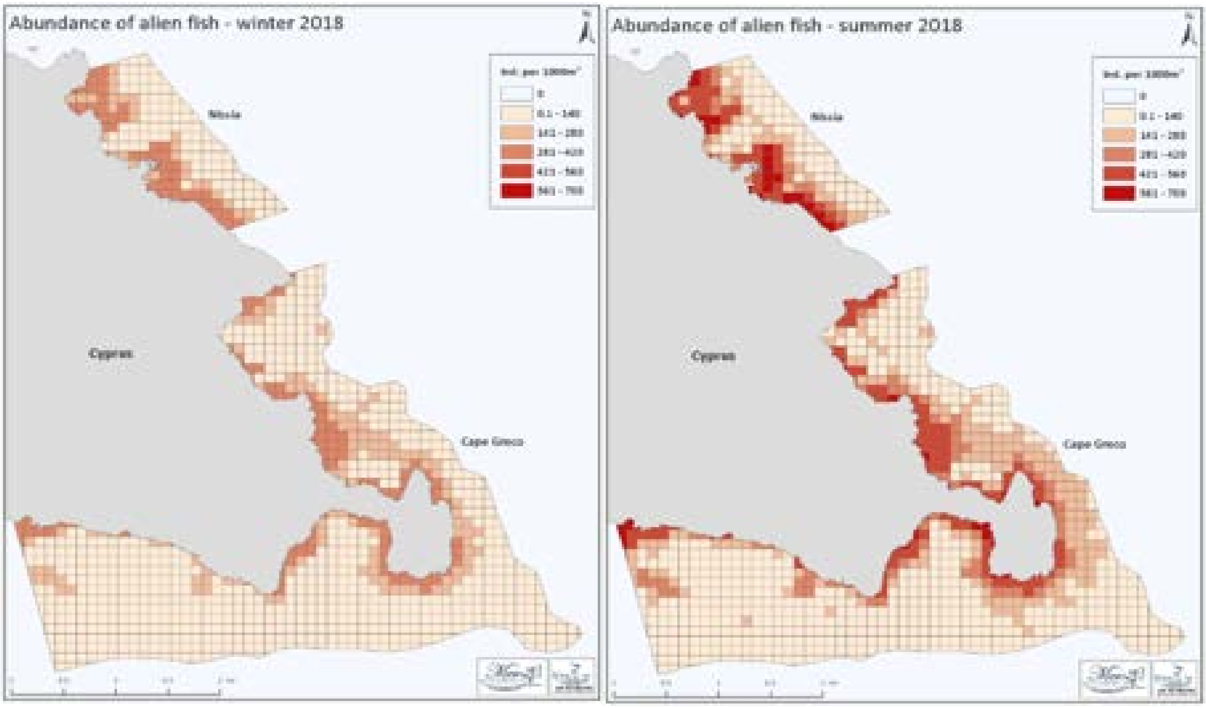

Figure 4 Distribution maps of the abundance of alien fish in the winter and summer of 2018 in the two MPAs, Cavo Greco and Nissia (DFMR, 2018).

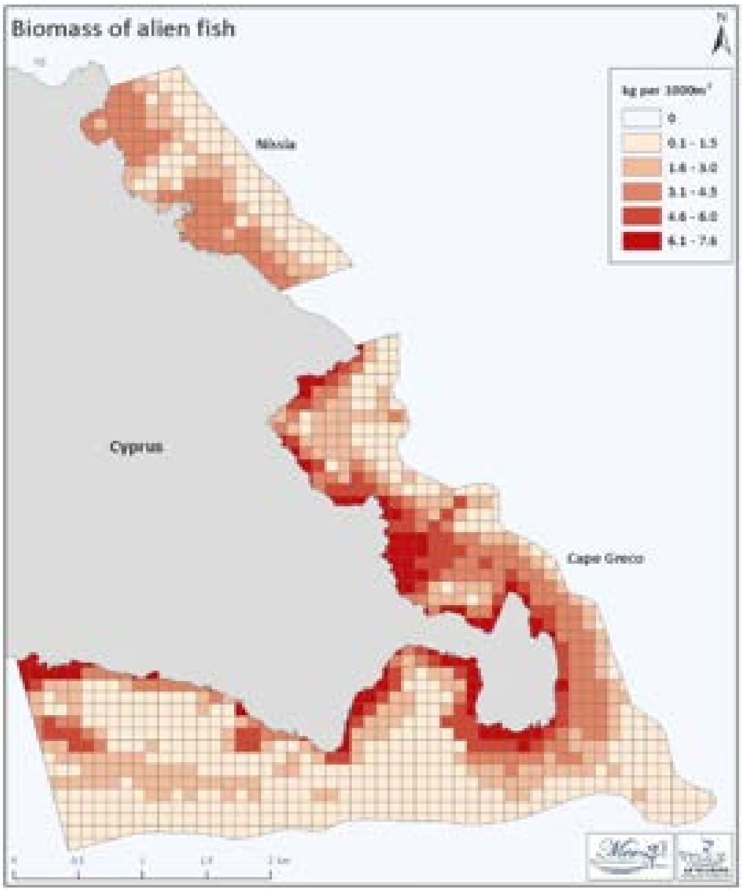

Figure 5 Distribution map of the alien fish biomass in the winter and summer of 2018 in the two MPAs, Cavo Greco and Nissia (DFMR, 2018).

Food web modelling (Michailidis *et al.* 2019)

Michailidis *et al.* (2019) developed 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. A total of 40 functional groups were defined, ranging from producers and detritus to top predators and when possible, alien species were included in exclusively alien groups. Biomass of each functional group was estimated using data from visual surveys for depths from 0 to 50 m (DFMR, 2018) and MEDITS bottom trawl surveys (swept-area method) for depths from 50 to 200 m, as well as from available literature (see Michailidis *et al.* , 2019). According to the model, 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, Lagocephalus sceleratus, Torquigener flavimaculosus*), alien siganids (*Siganus luridus, Siganus rivulatus*), and alien barracudas (*Sphyraena chrysotaenia, Sphyraena flavicauda*) (Table 2; Figure 6).

Table 2 Biomass (B: t km^{-2}), landings (L: t km^{-2} yr^{-1}) and discards (D: km^{-2} yr^{-1}) of the functional groups used by Michailidis *et al.* (2019). Exclusively alien groups are given in bold.

Functional group	B	L	D
1. Phytoplankton	2.923		
2. Phytobenthos	1.151		
3. Micro & mesozooplankton	2.111		
4. Macrozooplankton	0.156		
5. Gelatinous plankton	0.147		
6. Polychaetes	0.795		
7. Benthic small crustaceans	0.798		
8. Benthic invertebrates	3.49		
9. Shrimps	0.133	0.0005	0.0001
10. Crabs & lobsters	0.155	0.001	0.0001
11. Octopuses & cuttlefish	0.065	0.0448	0.0011
12. Squids	0.041	0.0126	0.0002
13. Demersal fishes (soft bottom)	0.308	0.0246	0.0014
14. Native mullids	0.072	0.017	0.0006
15. Alien mullids	**0.068**	**0.016**	**0.0006**
16. Flatfishes	0.015	0.0002	0.0003
17. Demersal fishes (mixed bottom)	0.571	0.0906	0.0032
18. Alien lionfish	**0.012**	**0**	**0**
19. Alien redcoat	**0.056**	**0.009**	**0.0005**
20. Other alien demersal fishes	**0.039**	**0.0018**	**0**

Functional group	B	L	D
21. Eels & morays	0.08	0.0019	0.0002
22. Large demersal fishes	0.165	0.0668	0.0004
23. Rays & skates	0.532	0.0032	0.0002
24. Small sharks	0.016	0.0008	0.0001
25. Small benthopelagic fishes	2.343	0.1269	0.0193
26. Medium benthopelagic fishes	0.149	0.0208	0.0008
27. Alien siganids	**0.15**	**0.0563**	**0.0015**
28. Alien cornetfish	**0.088**	**0.0052**	**0.0002**
29. Alien barracudas	**0.145**	**0.0036**	**0.0001**
30. Alien pufferfishes	**0.333**	**0.0358**	**0.0018**
31. Small pelagic fishes	0.442	0.0139	0.0005
32. Alien small pelagic fishes	**0.482**	**0.0055**	**0.0002**
33. Medium pelagic fishes	0.228	0.0086	0.0004
34. Large pelagic fishes	0.119	0.0482	0.0012
35. Turtles	0.36	0	0.003
36. Bottlenose dolphin	0.025		
37. Monk seal	0.002		
38. Seabirds	0.002		
39. Detritus	16.59		
40. Discards	0.038		

Figure 6 Flow diagram of the 2015-17 trophic model of the insular shelf of Cyprus, according to Michailidis *et al.* (2019). Circles represent functional groups and lines trophic flows in the system. Numbers represent functional groups as listed in Table 2. Circle area and line thickness are proportional to biomass and magnitude of trophic flows respectively. Vertical axis represents increasing trophic level and horizontal axis roughly indicates the demersal or pelagic nature of functional groups (demersal to pelagic from left to right). Exclusively alien groups are drawn red.

3.1.3 D2C3 Ratio of NIS to native species

Surveys in Cavo Greco and Nissia MPAs (2017-2018; DFMR 2018)

During the expeditions in the two MPAs of “Cavo Greco” and “Nissia” (see previous section), the NIS/native species ratio was estimated. A steady increase of the alien to native ratio was observed, which overall ranged between 0.16 in the first quarter of 2017 and 0.25 in the third quarter of 2018 (Figure 7). This ratio was much higher for some taxonomic groups, such as Mollusca (ranging between 0.32 and 0.57) and Chordata (ranging between 0.27 and 0.53) (Figure 8).

In terms of fish abundance, the overall NIS/native ratio in the two MPAs exhibited high seasonal fluctuations and ranged between 0.03 and 1.04, with the highest ratios observed in sandy bottoms and the lowest in *Posidonia oceanica* beds (Figure 9; Figure 10).

In terms of fish biomass, the highest values of NIS/native ratio were recorded in sandy habitats on Cavo Greco in winter 2018 (3.13) and in rocky habitats of Nissia in spring 2017 (1.33). Overall, in the aggregated data for all habitats, the maximum alien to native fish biomass ratio was recorded in winter 2018 at both sites, 0.93 at Cavo Greco and 0.81 at Nissia (Figure 11; Figure 12).

The NIS/native ratio of mean macrophyte coverage in rocky reefs varied between 0.01 and 0.18 in Cavo Greco and between 0.01 and 0.46 in Nissia, peaking in summer. In sandy habitats, the NIS/native ratio of mean macrophyte coverage varied between 0 and 3.51 in Cavo Greco, and between 0 and 2.75 in Nissia. No alien encrusting invertebrate was recorded in the photoquadrat samples and therefore the ratio of NIS/native species was zero in all stations at both MPAs.

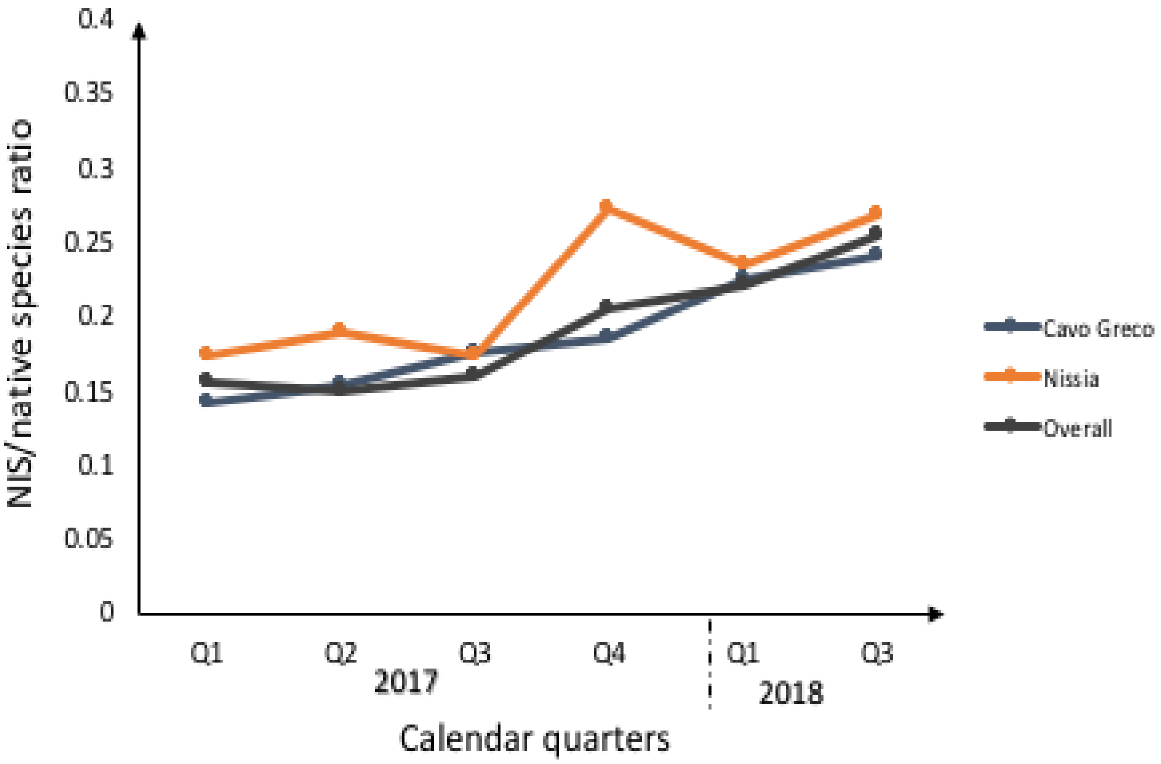

Figure 7 Time series of NIS/native species ratio at the "Cavo Greco" and "Nissia" MPAs (DFMR, 2018).

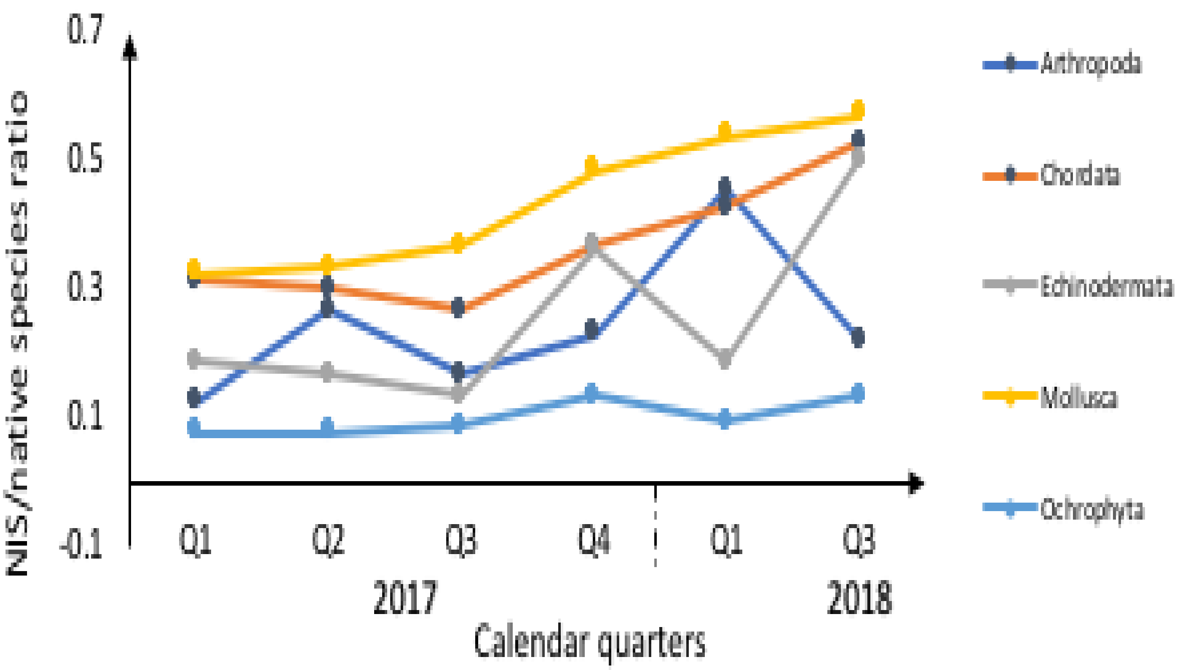

Figure 8 Time series of NIS/native species ratio at the "Cavo Greco" and "Nissia" MPAs for each of the major Phylum (DFMR, 2018).

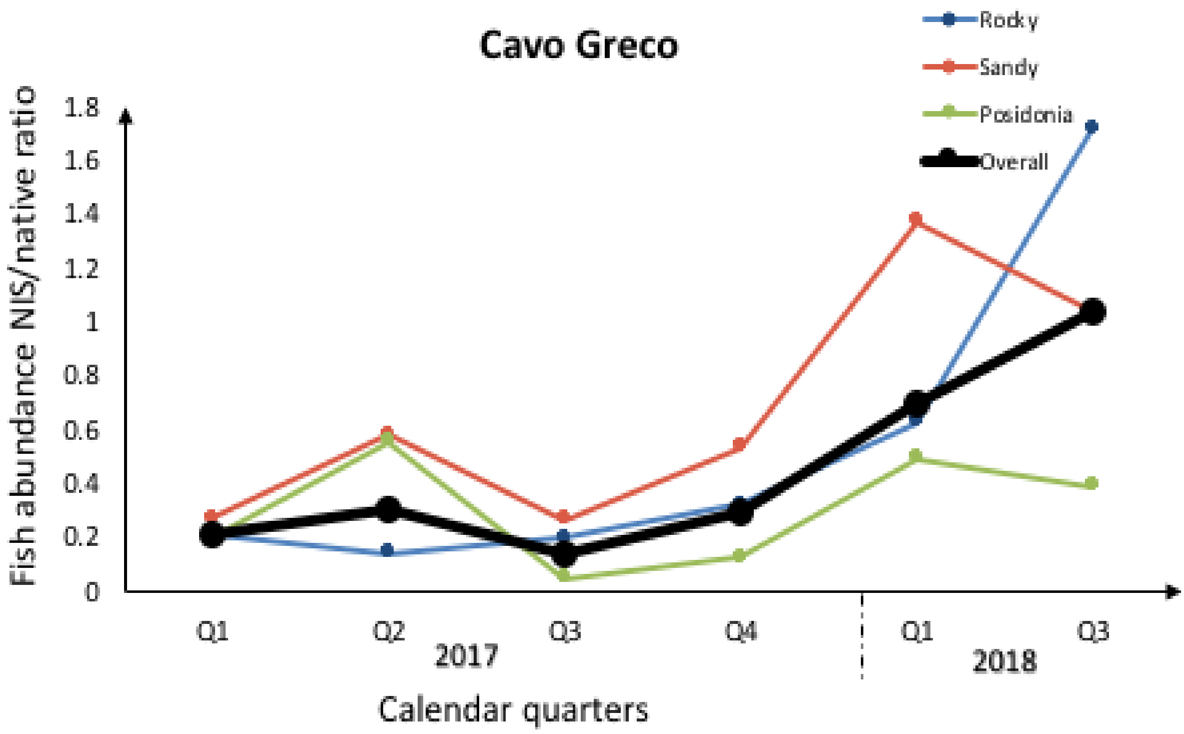

Figure 9 Time series of NIS/native ratio of fish abundance at the "Cavo Greco" MPA, in the three main habitat types and overall (DFMR, 2018).

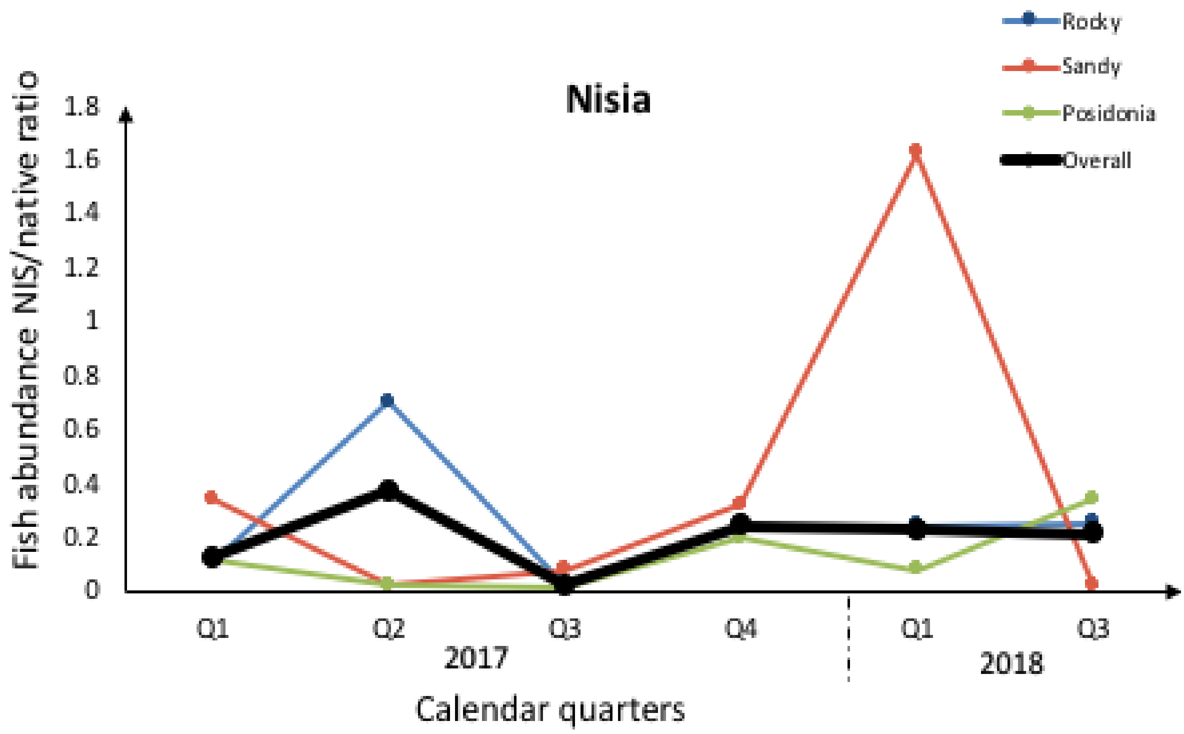

Figure 10 Time series of NIS/native ratio of fish abundance at the "Nissia" MPA, in the three main habitat types and overall (DFMR, 2018).

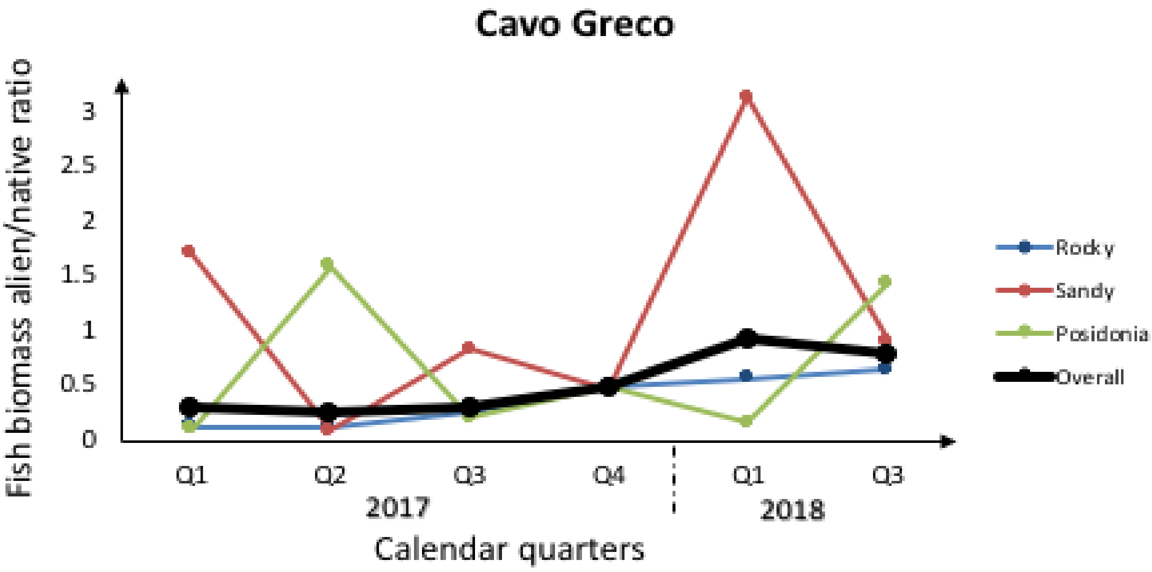

Figure 11 Time series of NIS/native ratio of fish biomass at the “Cavo Greco” MPA, in the three main habitat types and overall (DFMR, 2018).

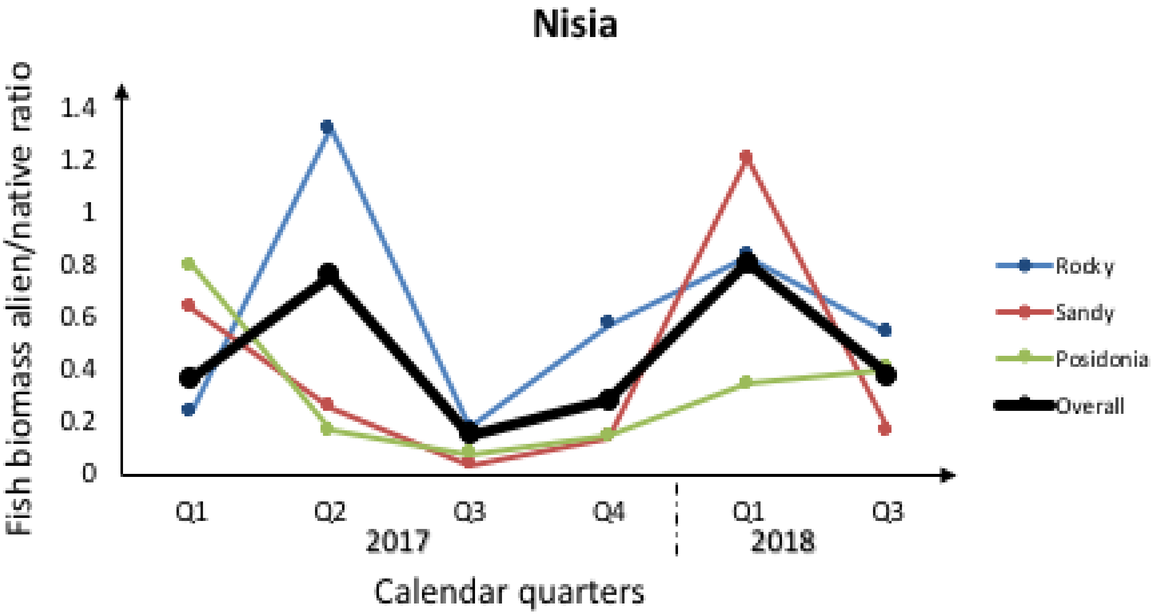

Figure 12 Time series of NIS/native ratio of fish biomass at the “Cavo Greco” MPA, in the three main habitat types and overall (DFMR, 2018).

Food web modelling (Michailidis *et al.,* 2019)

According to Michailidis *et al.* (2019), based on a trophic mass-balance Ecopath model to describe the structure and functioning of the insular shelf ecosystem of the Republic of Cyprus, alien fish accounted for 7.3% of the total living biomass, 18% of fish biomass, 29% of fish production, 28% of fish consumption, 15% of fish flows to detritus, and also for 19% of the fleets' fish catches.

3.2 Descriptor 3: 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

3.2.1 Introduction

Commercially exploited fish and shellfish are all living marine resources targeted for economic profit such as the bony fish, sharks and rays (known as elasmobranchs), crustacean such as lobsters and shrimps, and molluscs (including bivalves, cuttlefish and squid). It also includes other creatures such as jellyfish and starfish. In scientific terms, Descriptor 3 has various implications. Stocks should be: (1) exploited sustainably consistent with high long-term yields, (2) have full reproductive capacity in order to maintain stock biomass, and (3) the proportion of older and larger fish/shellfish should be maintained (or increased) being an indicator of a healthy stock. Good Environmental Status (GES) is achieved for a particular stock only if all of the three attributes are fulfilled. This implies that all commercially exploited stocks should be in a healthy state and that exploitation should be sustainable, yielding the Maximum Sustainable Yield (MSY). MSY is the maximum annual catch, which can be taken year after year without reducing the productivity of the fish stock.

Heavy fishing pressures, such as overexploitation or overfishing, can have very negative environmental impacts. They can result in the loss of significant potential yield of the stocks being fished and can even precede severe stock depletion and fisheries collapse. Because of overfishing, fish stocks can reduce dramatically to the point where they lose internal diversity and with it, their capacity to adapt to environmental changes. Fish communities can be altered in a number of ways, for example they can decrease if particular-sized individuals of a species are targeted, as this affects predator and prey dynamics (the question of trophic relationships and marine food webs is the focus of Descriptor 4).

The current situation is that most fish stocks have been overexploited as a result of excess fishing capacity (Figure 13). According to the European Commission, 63 % of EU stocks (for which the information is available) are being fished beyond MSY; this means that these fish populations could be larger and generate higher economic output if they were subject to reduced fishing pressure. In addition, 30 % of these stocks are outside safe biological limits, meaning that they have a high risk of depletion. Many European fisheries today depend on young (and smaller) fish, which are caught before they can reproduce.

Maintaining stocks within safe biological limits (to avoid depletion) is still a requirement. However, the objective of fishery management is now more ambitious, aiming for sustainability at higher long-term yields.

The MSY concept is illustrated schematically in Figure 14. Fishing mortality is directly related to the way a stock is being fished. Yield will increase as more fishing capacity is applied (more vessels or fishing effort) until it reaches a maximum level. If fishing mortality is increased further than this MSY, yield will decrease because smaller size fish (which are too young to reproduce) are being caught, leading to a continuous decline of the Spawning Stock Biomass (SSB – or total weight of mature fish) (ICES, 2007).

Figure 13 State of stocks in Community fisheries (EEA, 2010).

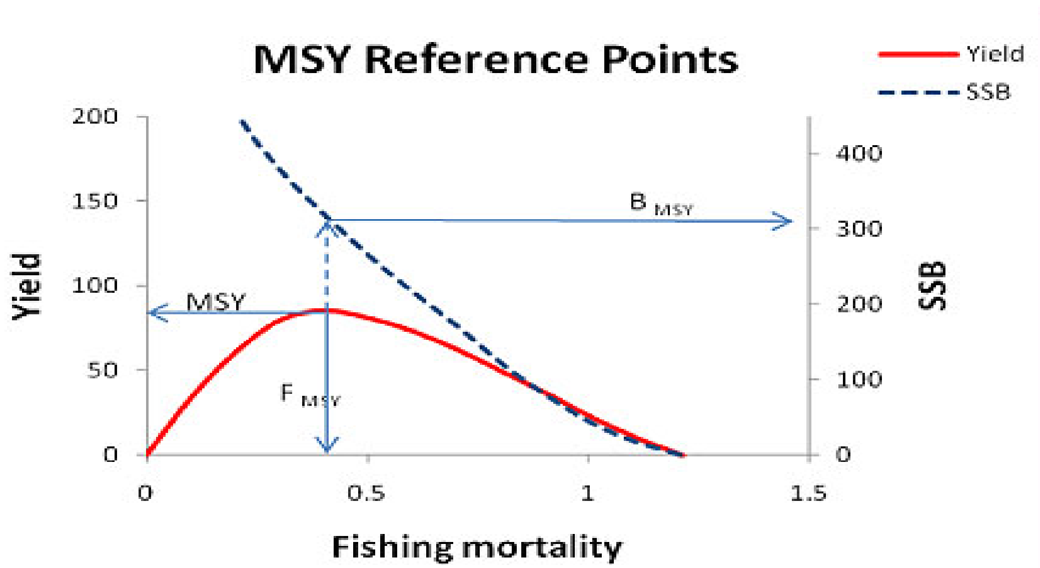

Figure 14 Schematic illustration of Maximum Sustainable Yield (MSY) concept (ICES, 2011).

ICES identified five main steps to assess Good Environmental Status GES for D3:

1. Selection of commercially exploited (shell)fish populations relevant to the MSFD (sub)region, or MS-specific sub-division, being assessed with respect to D3;
2. Identification of stocks that can be assessed in relation to the primary assessment criteria for D3.1 and D3.2;
3. Determination of criteria to apply to stocks that can not be assessed in relation to the primary assessment criteria, and identification of stocks that can be assessed according to these secondary criteria;
4. Interpretation of how to define GES for D3 with respect to combining individual stock assessments at the criteria level, and how to combine criteria level assessments at the descriptor level;
5. Assessment of current status in relation to GES.

For the selection of what can be considered the commercially exploited (shell)fish in Cyprus, the following key issues were identified:

(1) Identification of the appropriate area: FAO-GFCM Geographical Sub Are (GSA 25)
(2) Match of existing spatial units to that area: Assessment of stocks within GSA 25 and exploited in GSA 25 by Cyprus fishing fleets.
(3) Choice of data source: 2018 - EU Fleet Economic Performance (https://stecf.jrc.ec.europa.eu/dd/fleet)
(4) Choice of time period: Average 2014-2016;
(5) Selection criteria: ranking of stocks representing 95% of landing in value.

Each of these issues was seen to have some consequences for the selection of relevant populations. However, according to ICES (2012) the overall assessment appeared fairly robust against a range of sensible choices.

For commercially exploited (shell)fish populations with assessments, primary indicators and MSY-based and/or precautionary reference levels are defined in the framework of the GFCM-SAC working group of Stock Aseedssemtn on demersal species (WGSAD). Another issue in the selection of assessed stocks to be examined under D3 concerned the quality of the assessments and, thus, the information they provide:

(1) all indicators with reference levels,
(2) not all reference levels,
(3) no reference levels.

As the assessed stocks can be considered the best source of information, any decision on these aspects may have significant consequences for the GES assessment.

For commercial populations that do not have full assessments scientific monitoring surveys were identified as a potential data source for calculating some secondary indicators.

Three options for determining the current status from trend-based timeseries were considered:

(1) comparing the recent period mean with the long-term average

(2) comparing the current value of the indicator in relation to the historic mean setting a threshold based on appropriate percentile of the Normal distribution;

(3) detection of trends.

However, ICES (2012) noted that trends-based methods do not provide specific definition of reference levels in relation to “good” status and can only provide an indication of change. None of the considered methods were evaluated, and therefore no recommendations are provided with regards to secondary indicators for criteria 3.1 and 3.2 or criterion 3.3. It was noted that the “mean maximum length across all species” indicator proposed under criterion 3.3 is not appropriate as a stock condition metric and it is not advised for application under Descriptor 3.

An analysis comparing the outcomes of the GES assessments based on indicators with (from stock assessments) and without reference levels (from monitoring programs) showed some consistency, but also revealed that the GES assessment based on indicators with reference values is more strict than the one based on indicators without them. This is because with a relatively short time series (as in some cases for Cyprus) the historic mean may still be far from where GES would actually be (and which should be represented by the MSY-based reference levels).

According to ICES (2012), three possible definitions of GES at the criterion level were considered reflecting different levels of ambition:

GES Interpretation 1: strict interpretation of the Commission Decision where MSY reference levels are treated as a limit and thus all stocks must meet the MSY requirement

GES Interpretation 2: the MSY reference levels are considered as a target and thus half the stocks must achieve the MSY requirement, and all stocks must achieve precautionary reference levels

GES Interpretation 3: the MSY reference levels are considered as a target and stocks need to achieve this requirement on average. This average is calculated accounting for the “distance” individual stocks are above or below the MSY reference level.

Evaluation of the quality of the GES assessment should be provided. The quality of the assessment depends on the proportion of species/taxa that have information according to certain quality standards. A higher proportion of assessed stocks increases the quality of the GES assessment. Similarly, a higher proportion of species/taxa for which no information is available decreases the quality. The quality also increases with increasing length of the time-series of indicators without reference levels, to the extent that sufficiently long time-series would result in an assessment that could perform as well as one based on indicators with reference values. What can be considered "acceptable quality" remains unresolved but the different case studies explored a range of varying quality.

In the Initial Assessment of the Marine Environment of Cyprus, a list of species was selected, and analyses were carried out on this species in the framework of D3. In the present updated document, a wider list of species will be considered, and more efficient methodologies will be utilized. An overall comparison with the initial assessment will be also carried out to show if the measures in place are effective to reach the Environmental Targets.

3.2.2 Selection of commercially exploited (shell)fish populations relevant to the MS-specific sub-division

The selection of the stocks to be further analysed in the framework of the present document are listed in Table 3. In the present assessment the stock representing around 90% in landing value and weight were considered. The data source considered was the 2018 - EU Fleet Economic Performance (https://stecf.jrc.ec.europa.eu/dd/fleet) for Cyprus. The average of the last three years available (2014-2016) was used to rank the most important species in the landings in both term of weight (tons) and value (euros). Species distributed outside the geographical area of GSA 25 were excluded (i.e. large pelagic), because such species would benefit from regional measures rather than MS measures implemented in Cyprus. Moreover, also taxa including more than one species were excluded from the following analyses, because they can be constituted by populations having sensible difference in term of live history traits as well as fishing pressure.

Table 4 summarizes the species considered in the initial assessment and the new species analyzed in the present document along with the primary or secondary indicator estimated in the framework of the present document.

Table 3 List of the most important species landed in Cyprus. Source: 2018 - EU Fleet Economic Performance (https://stecf.jrc.ec.europa.eu/dd/fleet).

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

Table 4 List of the species considered in the present document.

Scientific name	Species code	Considered in the initial assessment 2012	Criterion 3.1 - Primary indicator (F/FMSY)	Criterion 3.1 - Secondary indicator (Harvest rate)	Criterion 3.2 - Primary indicator (SSB or B/BMSY)	Criterion 3.2 - Secondary indicator (Biomass indices)	Criterion 3.3 – Primary indicator (Mean fish length observed in research vessel surveys)
Boops boops	BOG	Y	Y	N	Y	N	Y
Dentex dentex	DEC	Y	Y	N	Y	N	N
Merluccius merluccius	HKE	N	Y	N	Y	N	Y
Mullus barbatus	MUT	Y	Y	N	Y	N	Y
Mullus surmuletus	MUR	Y	Y	N	Y	N	Y
Octopus vulgaris	OCC	N	N	Y	N	Y	Y
Pagellus acarne	SBA	Y	Y	N	Y	N	Y
Pagellus erythrinus	PAC	Y	Y	N	Y	N	Y
Pagrus pagrus	RPG	N	Y	N	Y	N	Y
Seriola dumerili	AMB	N	Y	N	Y	N	N
Serranus cabrilla	CBR	Y	Y	N	Y	N	Y
Sparisoma cretense	PRR	Y	Y	N	Y	N	Y
Spicara maena	BPI	Y	Y	N	Y	N	Y
Spicara smaris	SPC	Y	Y	N	Y	N	Y
LARGE PELAGICS							
Thunnus alalunga	ALB	N	Y	N	Y	N	N
Xiphias gladius	SWO	N	Y	N	Y	N	N
Thunnus thynnus	BFT	N	Y	N	Y	N	N

3.2.3 D3C1-D3C3 Status of selected stocks

Bogue (*Boos boops*)

The last assessment of this species in GSA 25 has been performed in 2017, during the GFCM Working Group stock of Stock Assessment on Demersal Species with a reference year of 2016 using Extended Survivor XSA on the cohorts present during 2005-2016 (GFCM, 2017). Given the results from this analysis, the stock is in Low Over-exploitation ($F_{0.1}$=0.29; $F_{current}$=0.36; $F/F_{MSYproxy}$ = 1.24) with Intermediate Spawning Biomass showing a general decreasing trend (Figure 15). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear patter (Figure 16).

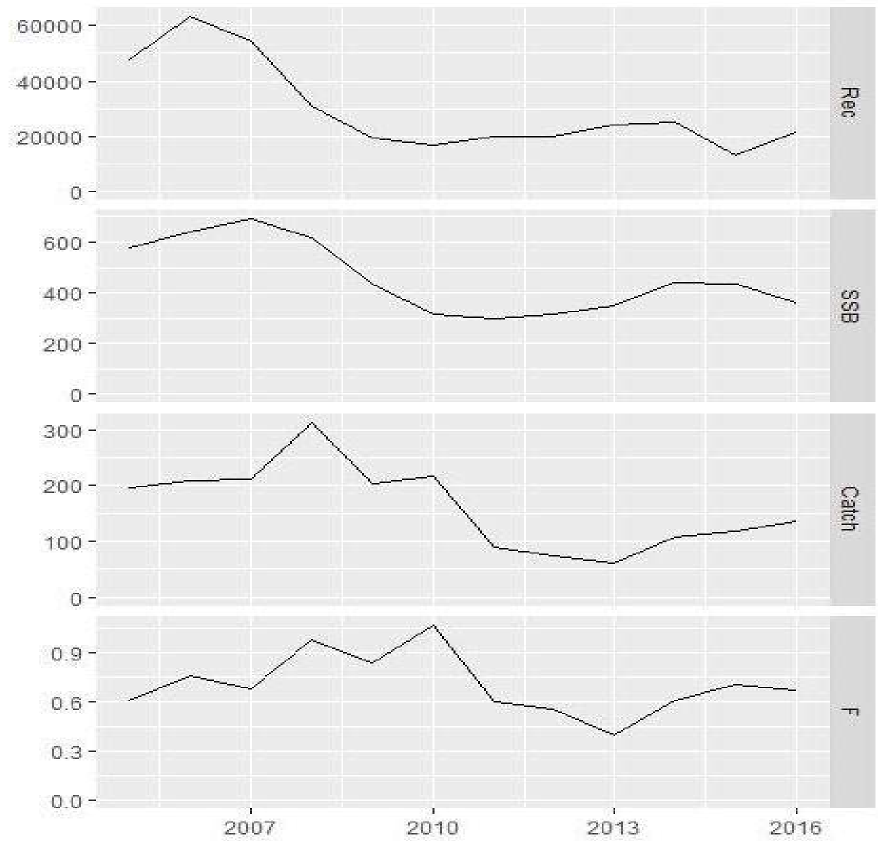

Figure 15 Bogue - XSA results for Recruitment (Rec), Spawning Stock Biomass (SSB), Landings (Catch) and Fishing mortality (F).

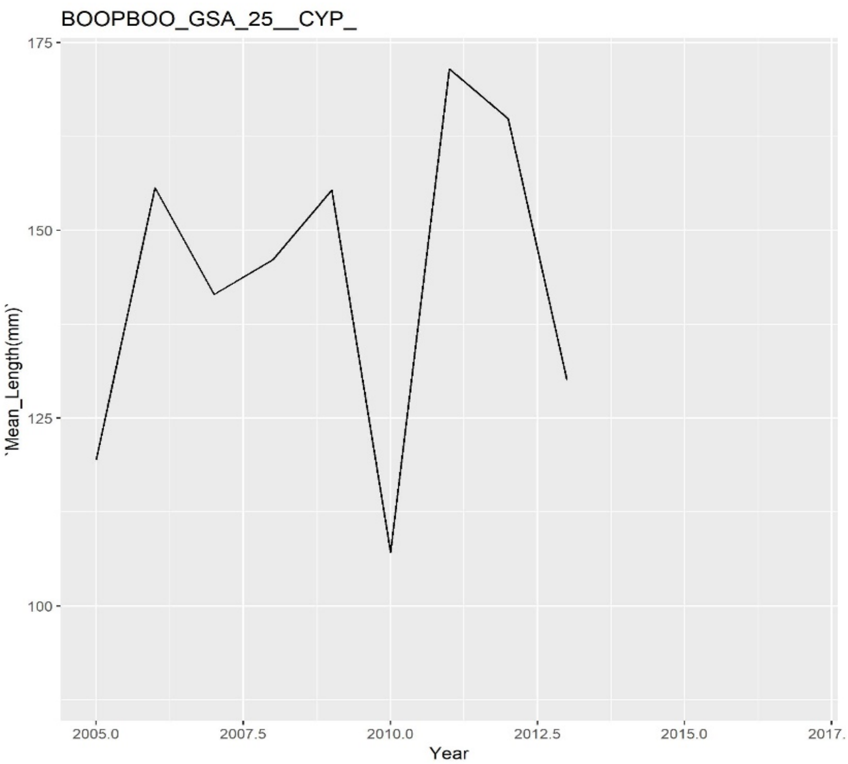

Figure 16 Bogue: Trend of the mean length observed in the trawl survey MEDITS.

Common dentex (*Dentex dentex*)

Common dentex was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessement using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs, the stock shows a ratio of F/FMSY higher than 1 and a ratio B/BMSY below 1 (Figure 17). Data on the length composition observed in MEDITS trawl survey are missing.

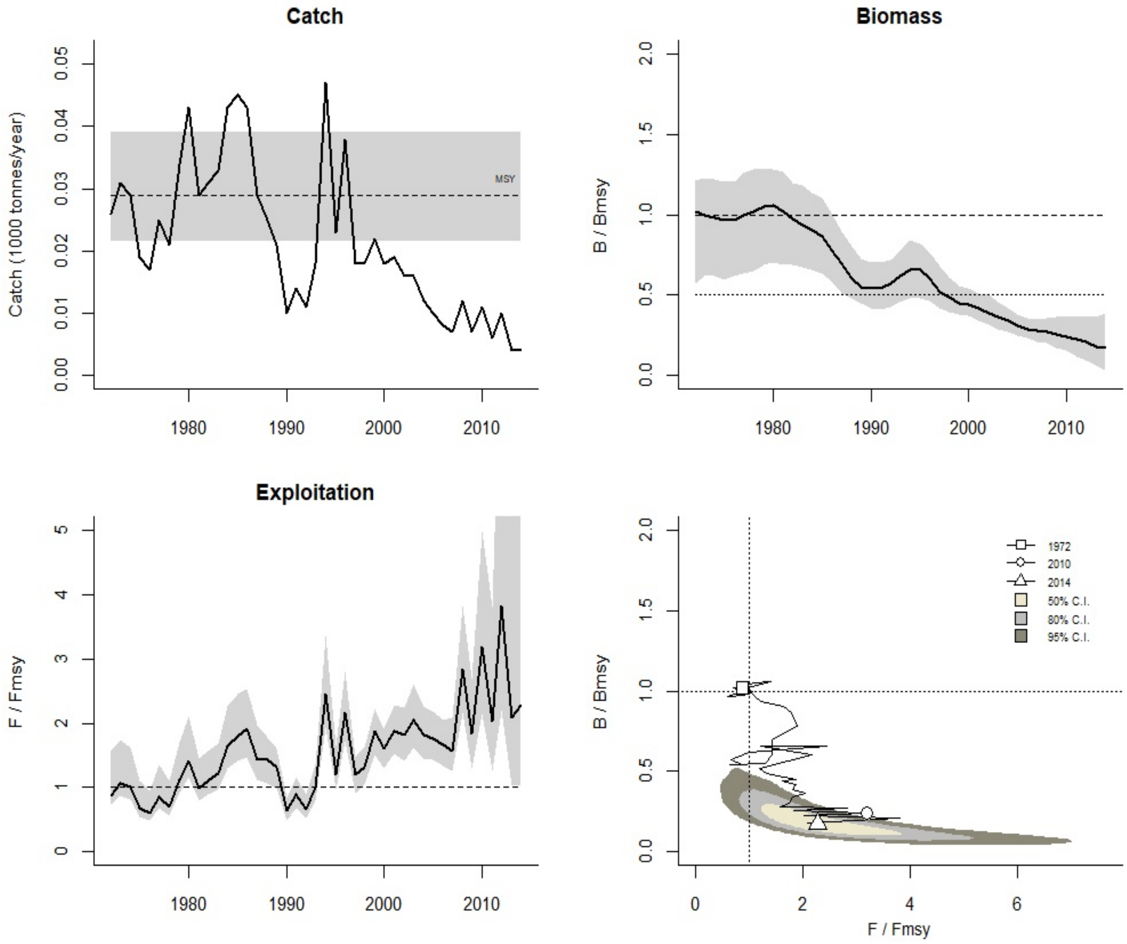

Figure 17 Common dentex: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

European hake (*Merluccius merluccius*)

European hake was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ratio B/BMSY below 1 (Figure 18). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear patter (Figure 19).

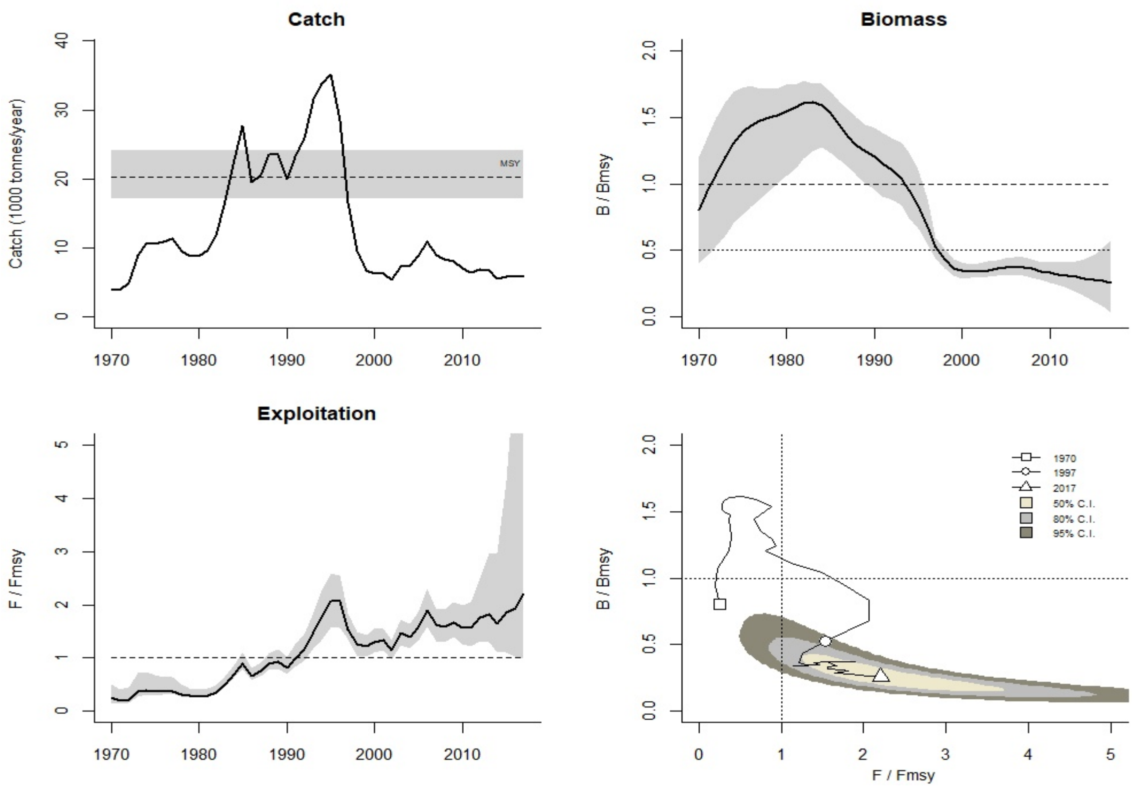

Figure 18 European hake: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

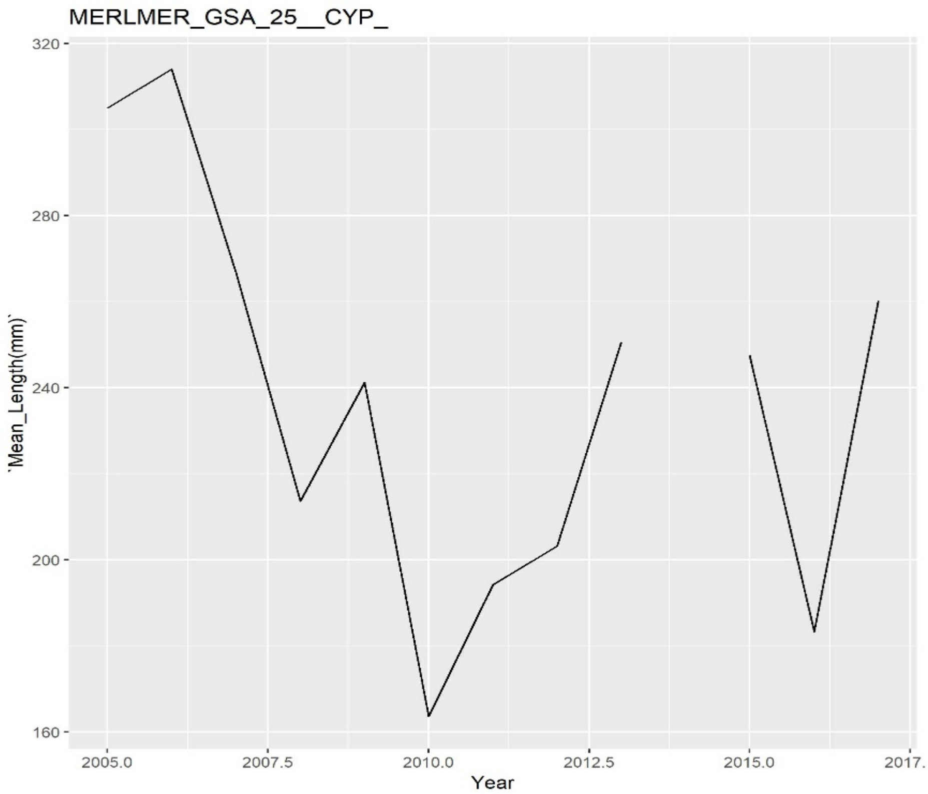

Figure 19 European hake: Trend of the mean length observed in the trawl survey MEDITS.

Red mullet (*Mullus barbatus)*

The last assessment of this species in GSA 25 has been performed in 2016, during the GFCM Working Group stock of Stock Assessment on Demersal Species with a reference year of 2015 using Extended Survivor XSA on the cohorts present during 2005-2015 (GFCM, 2016). The assessment was carried out using as input data official landings and biological data collected under the Cyprus National Data Collection Programme, covering the period 2005-2015. Medits survey data for the years 2006-2015 were used for the tuning file. Yield per recruit analysis was performed for the estimation of the reference point F0.1 as proxy of FMSY. The results of the assessment suggest that the stock is in sustainable exploitation, with a current Fbar1-2 (0.26) lower than F0.1 (0.32; F/FMSY = 0.81; Figure 20). The SSB show also a positive trend. Morever, the mean length trend observed during the Medits survey fluctuates without a showing a particular pattern (Figure 21).

Figure 20 Red mullet: XSA results for Recruitment (Rec), Spawning Stock Biomass (SSB), Landings (Catch) and Fishing mortality (F).

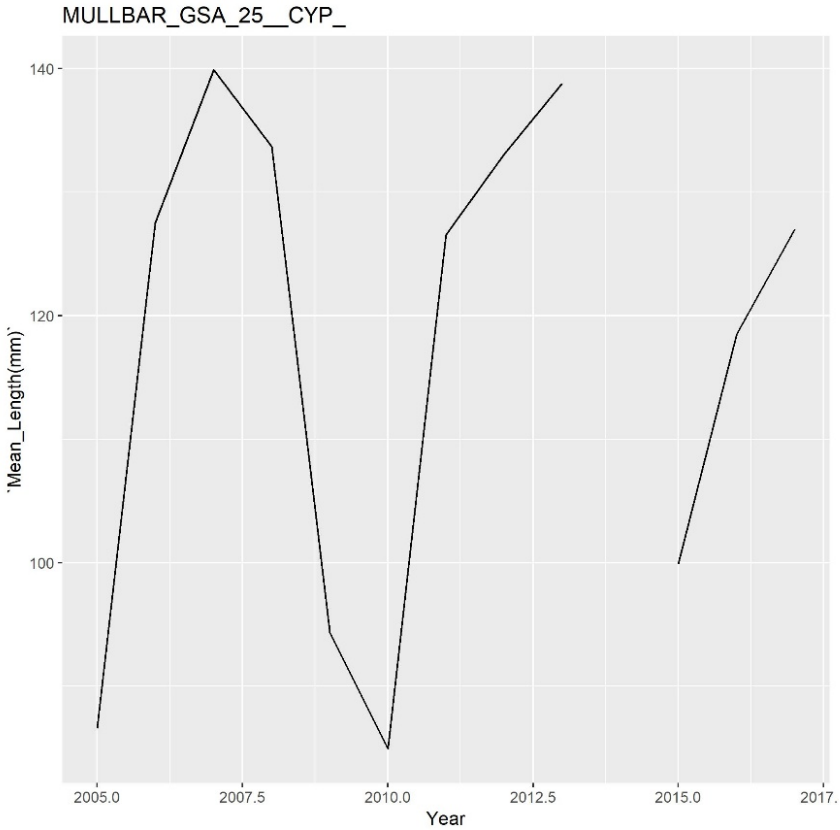

Figure 21 Red mullet: Trend of the mean length observed in the trawl survey MEDITS.

Surmullet (*Mullus surmuletus*)

The last assessment of this species in GSA 25 has been performed in 2017, during the GFCM Working Group stock of Stock Assessment on Demersal Species with a reference year of 2016 using Extended Survivor XSA on the cohorts present during 2005-2016 (GFCM, 2017). The assessment was carried out using as input data, official landings and biological data collected under the Cyprus National Data Programme, covering the period 2006-2016. Commercial CPUE from nets for the period 2009-2016 were used for the tuning file. Yield per recruit analysis was performed for the estimation of the reference point F0.1 as proxy of FMSY. The results of the assessment suggest that the stock is in overfishing status (F>FMSY). The assessment has been endorsed as “Accepted with qualitative advice”. The SSB show a stable trend (Figure 22). Moreover, the mean length trend observed during the Medits survey fluctuates without a showing a particular pattern (Figure 23).

Figure 22 Surmullet: XSA results for Recruitment (Rec), Spawning Stock Biomass (SSB), Landings (Catch) and Fishing mortality (F).

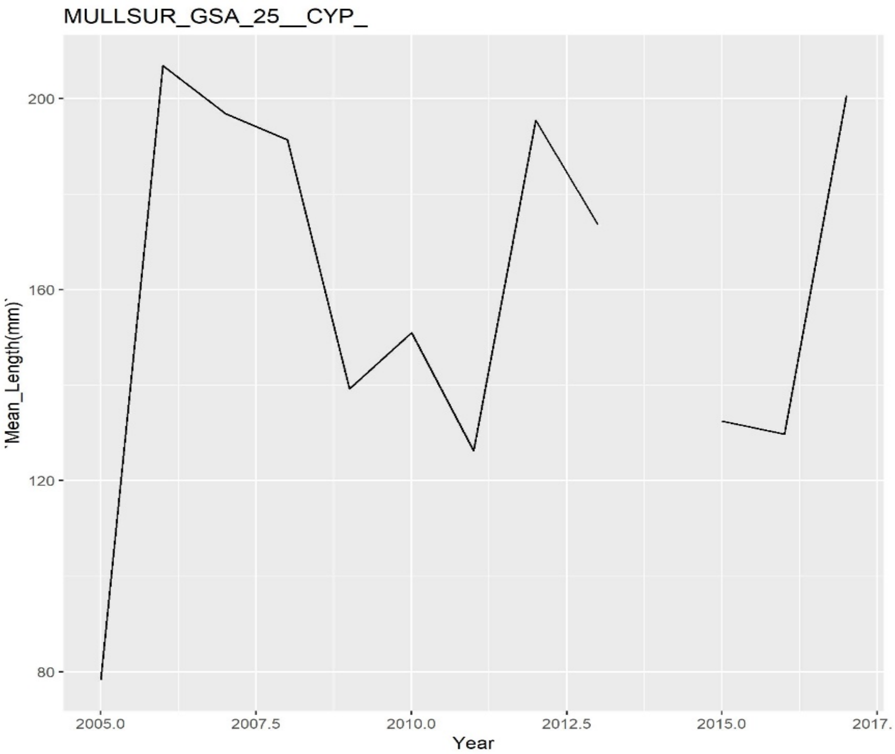

Figure 23 Surmullet: Trend of the mean length observed in the trawl survey MEDITS.

Common octopus (*Octopus vulgaris*)

Common octopus was not object of a stock assessment in the framework of the relevant RFMO. Due to the short time series of landing data was not possible to carry out a CMSY model, therefore a harvest rate and a trend of biomass index are presented for the period 2005-2016 (Figure 24). According to the biomass index from trawl survey medits a decresing patter in observed while the harvest rate shows an increasing pattern. The mean length observed in research trawl survey (MEDITS) was fluctuating showing a positive patter (Figure 25).

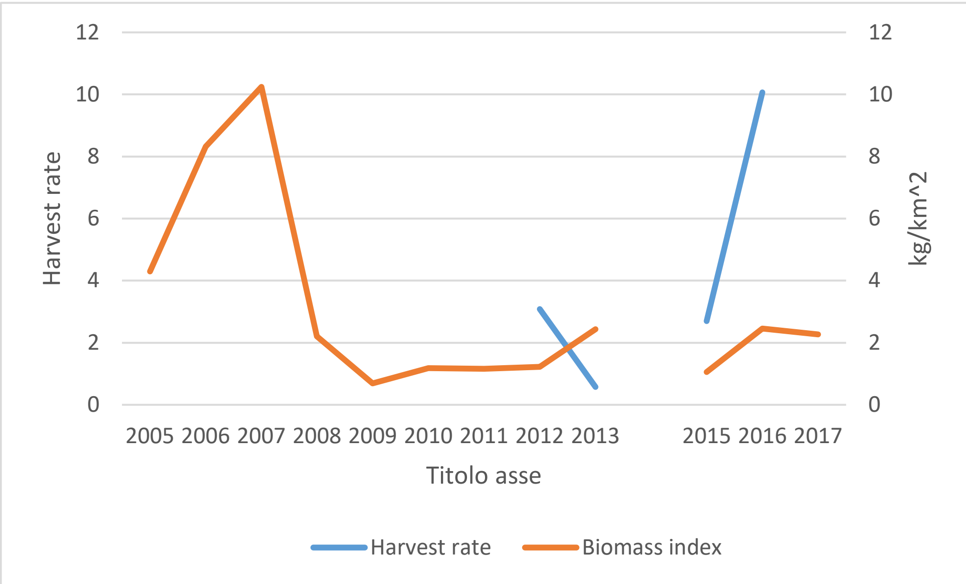

Figure 24 Common octopus: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

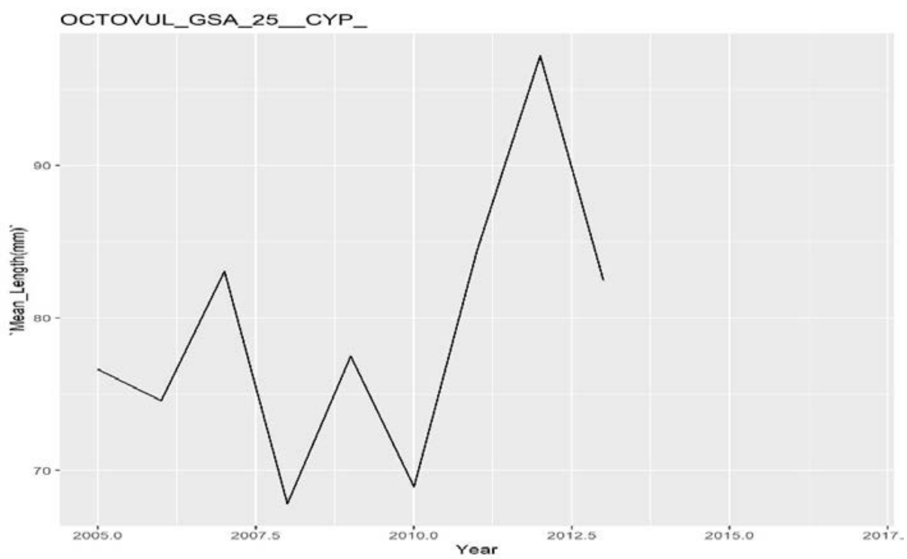

Figure 25 Common octopus: Trend of the mean length observed in the trawl survey MEDITS.

Axillary seabream (*Pagellus acarne*)

Axillary seabream was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ration B/BMSY below 1 (Figure 26). The mean length observed in research trawl survey (MEDITS) was fluctuating showing a decreasing pattern (Figure 27).

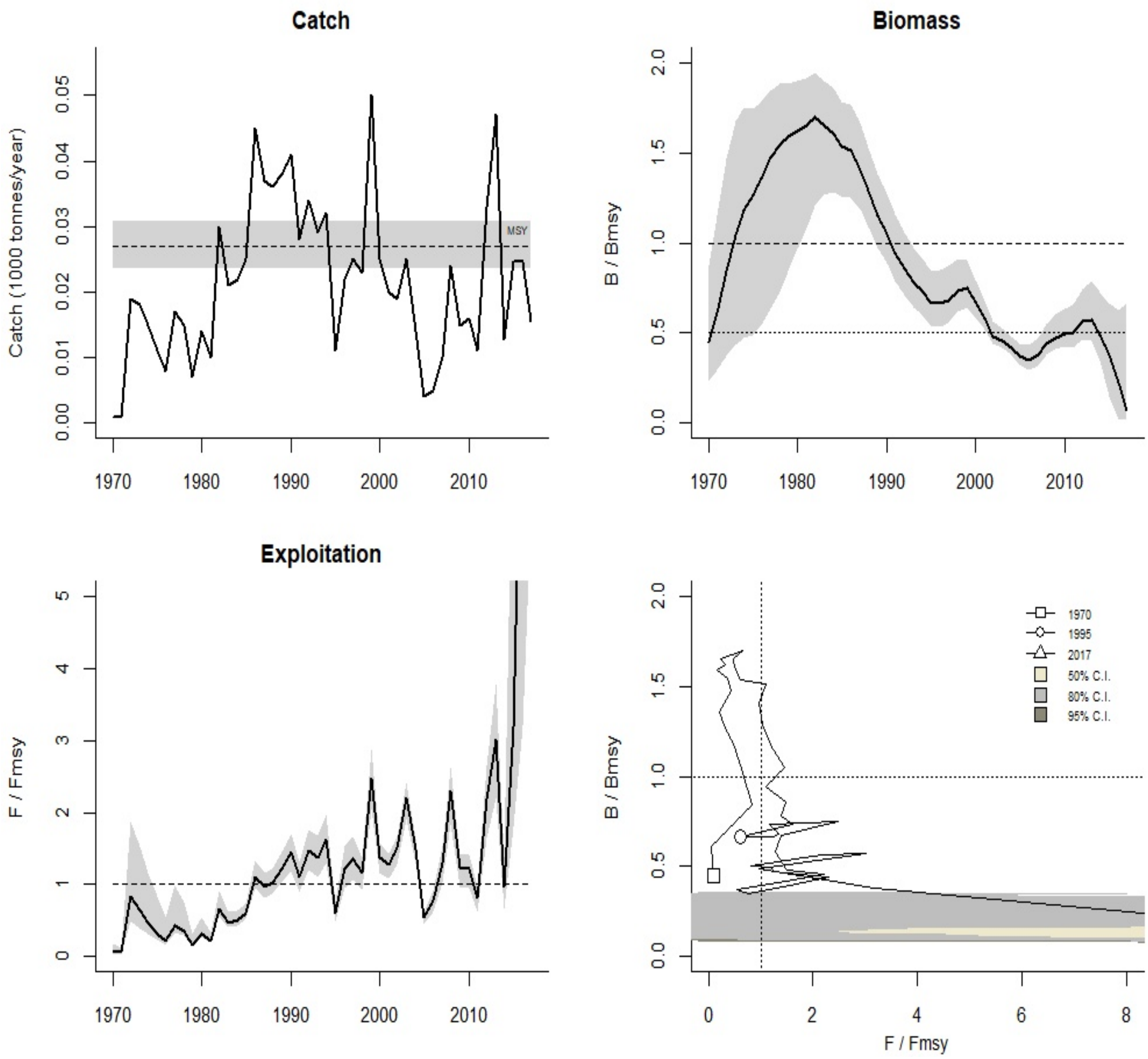

Figure 26 Axillary seabream: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

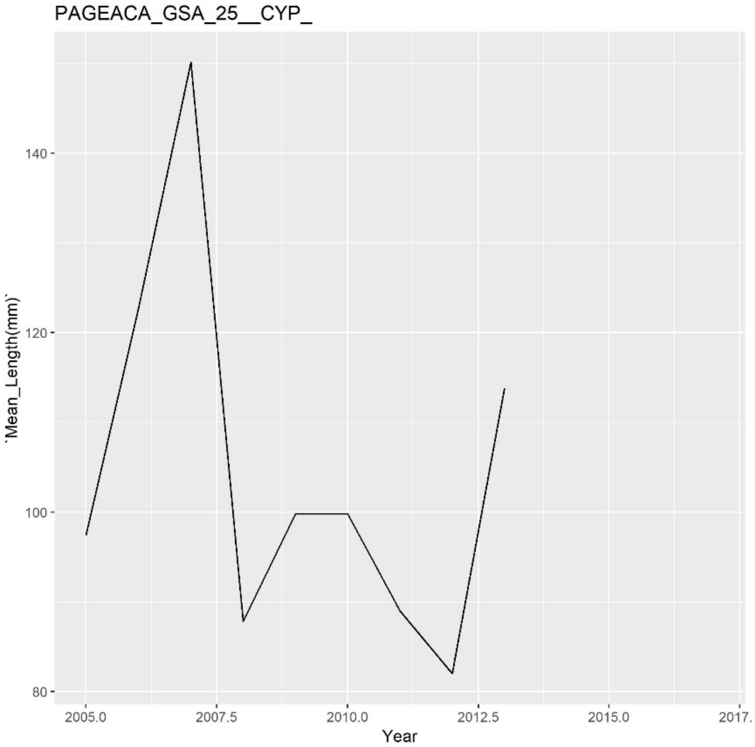

Figure 27 Axillary seabream: Trend of the mean length observed in the trawl survey MEDITS.

Common pandora (*Pagellus erythrinus*)

The last assessment of this species in GSA 25 has been performed in 2018, during the GFCM Working Group stock of Stock Assessment on Demersal Species with a reference year of 2017 (GFCM, 2018). The stock is exploited from all fleet segments and by recreational fishery too. The lack of data from the last segment is one of the major reasons of postponing the assessment of this species. In 2017 a pilot study on recreational fishery (RF) provided the first preliminary quantities of catches derived from this activity. Data from Cyprus official statistics were compiled into a surplus production model in continuous time (SPiCT) under the R language environment. Abundance index derived from effort of Trawl fleet which is believed to be more consistent and reliable than other fishery dependent information. Results show that the stock is in sustainable exploitation with biomass above optimum levels (Figure 28). The mean length observed in research trawl survey (MEDITS) was fluctuating showing a decreasing pattern (Figure 29).

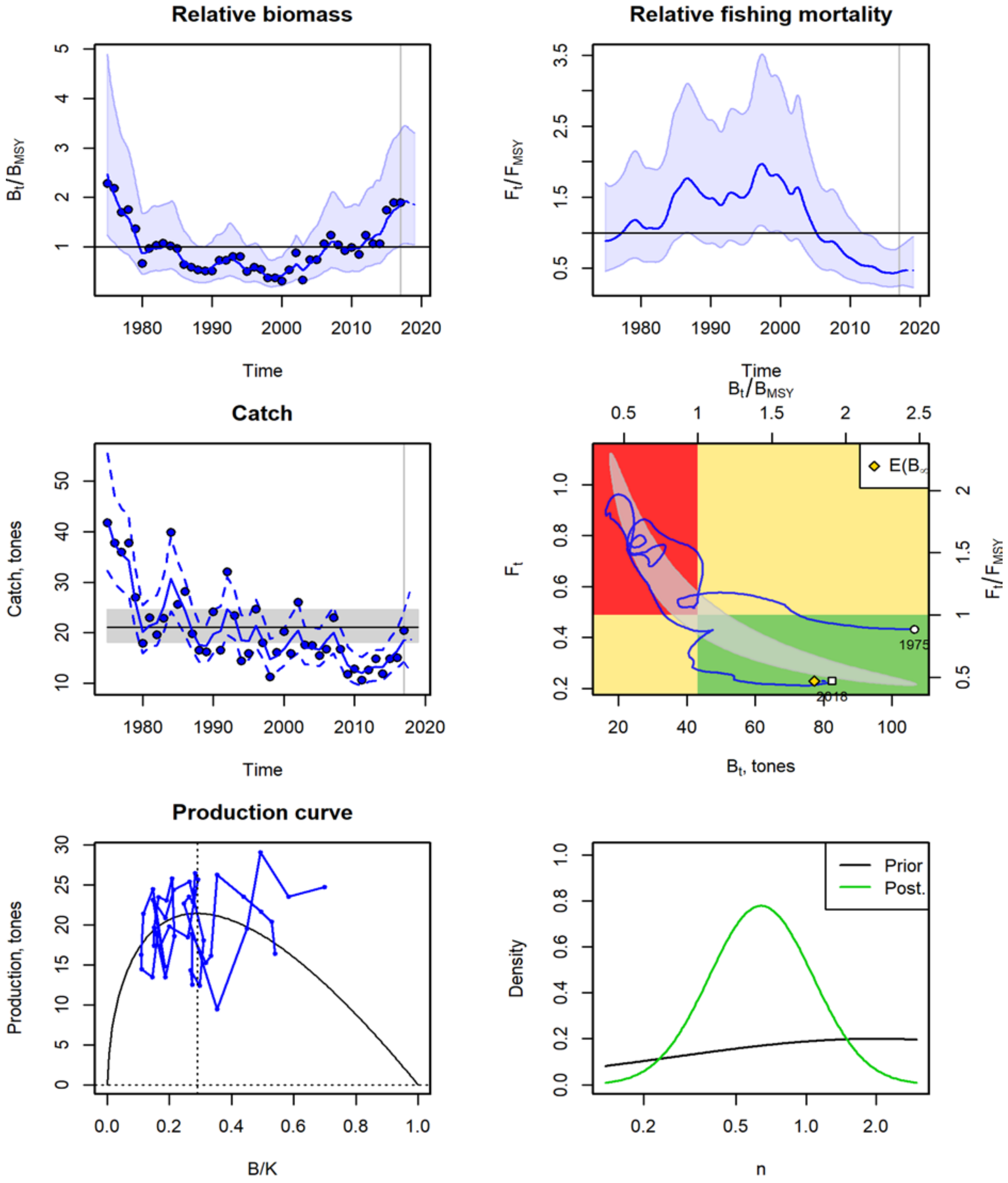

Figure 28 Common Pandora: Upper row: Median (blue solid line) of relative biomass and relative fishing mortality with 95% CI (blue shaded area). Middle row: Observed (blue points) and estimated catch with 95% CIs (left) and Kobe plot of relative fishing mortality versus relative biomass (right). Bottom row: Production curve (left) and comparison of prior and posterior distributions of the n parameter, which determines the shape of the production curve in the Pella-Tomlinson model (right).

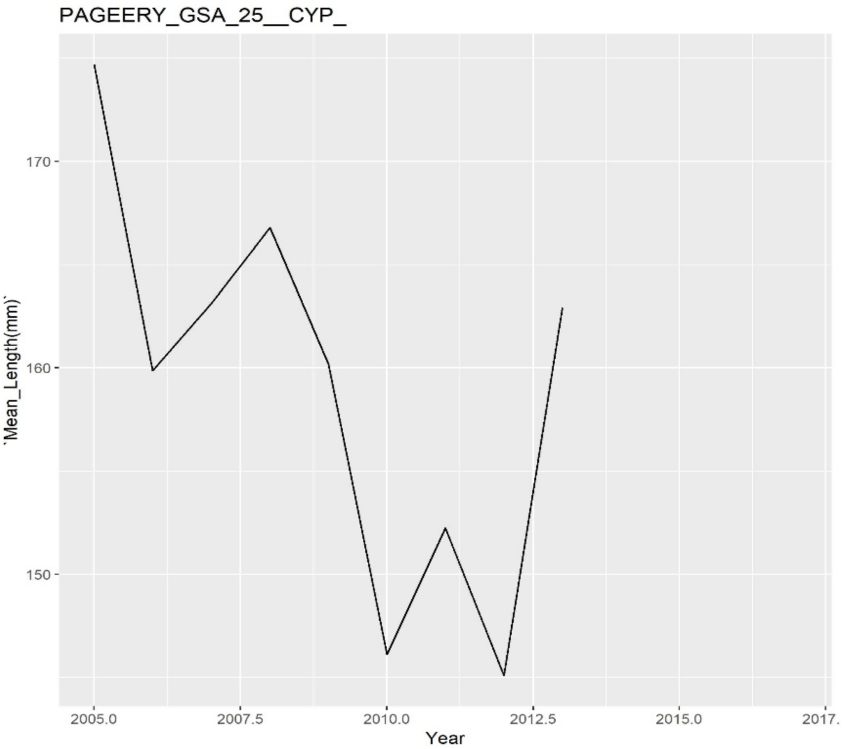

Figure 29 Common pandora: Trend of the mean length observed in the trawl survey MEDITS.

Red porgy (*Pagrus pagrus*)

Red porgy was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ration B/BMSY below 1 (Figure 30). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear pattern (Figure 31).

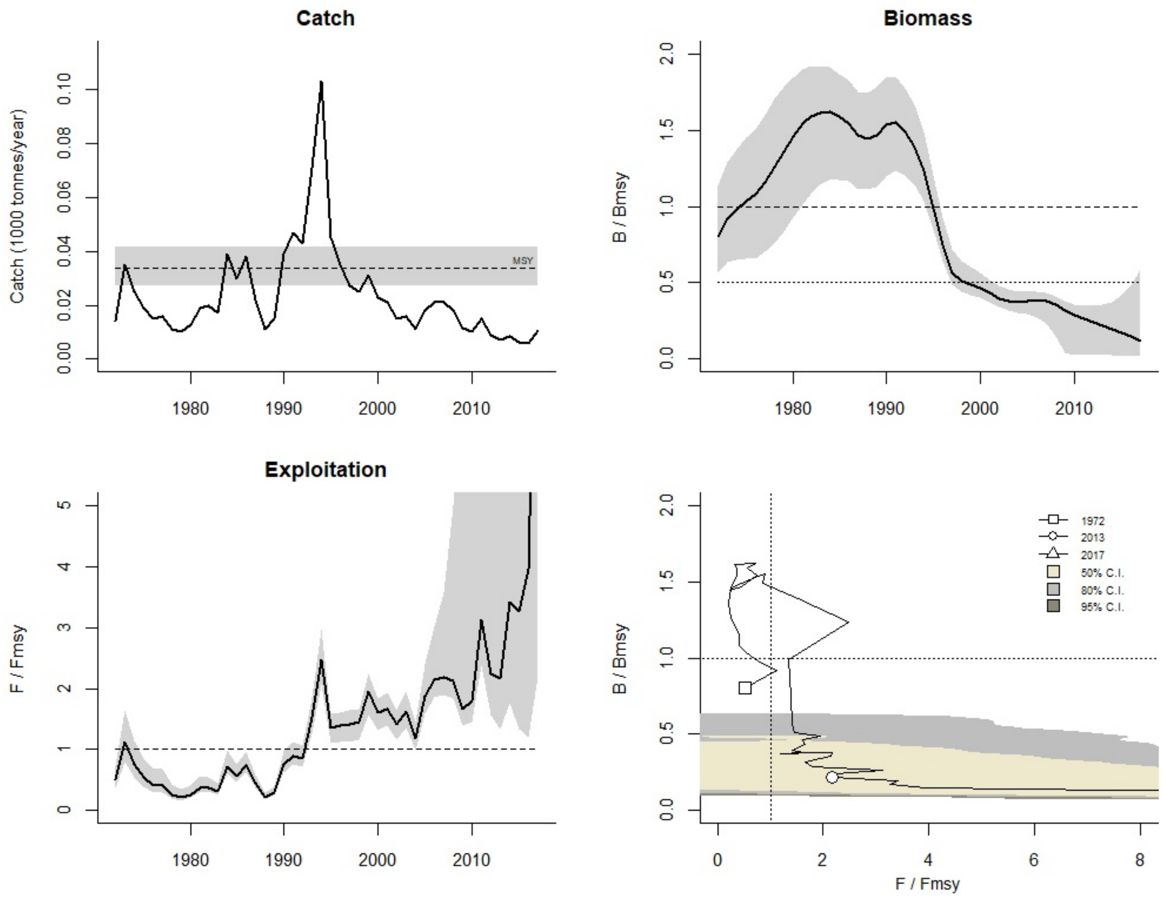

Figure 30 Red porgy: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

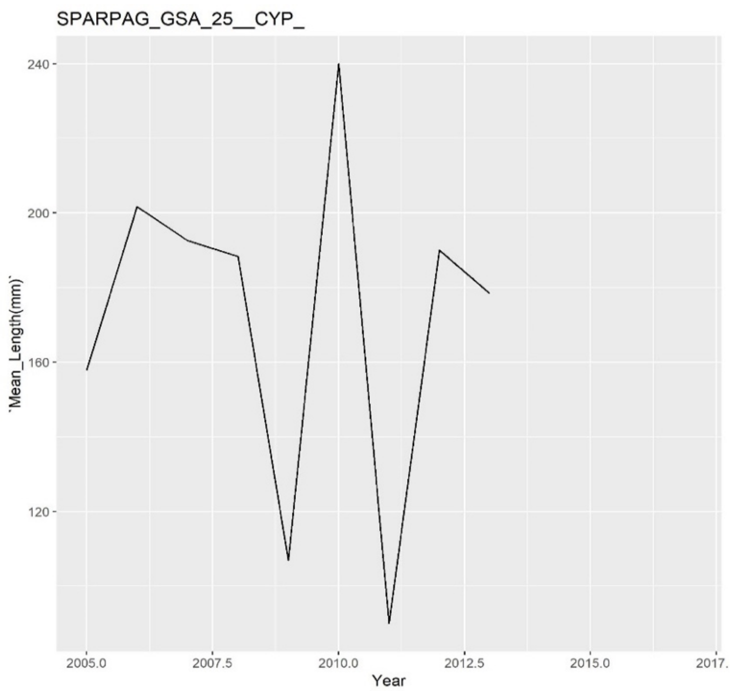

Figure 31 Red porgy: Trend of the mean length observed in the trawl survey MEDITS.

Greater amberjack (*Seriola dumerilii*)

Greater amberjack was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ration B/BMSY below 1 (Figure 34). Data on the length composition observed in MEDITS trawl survey are missing.

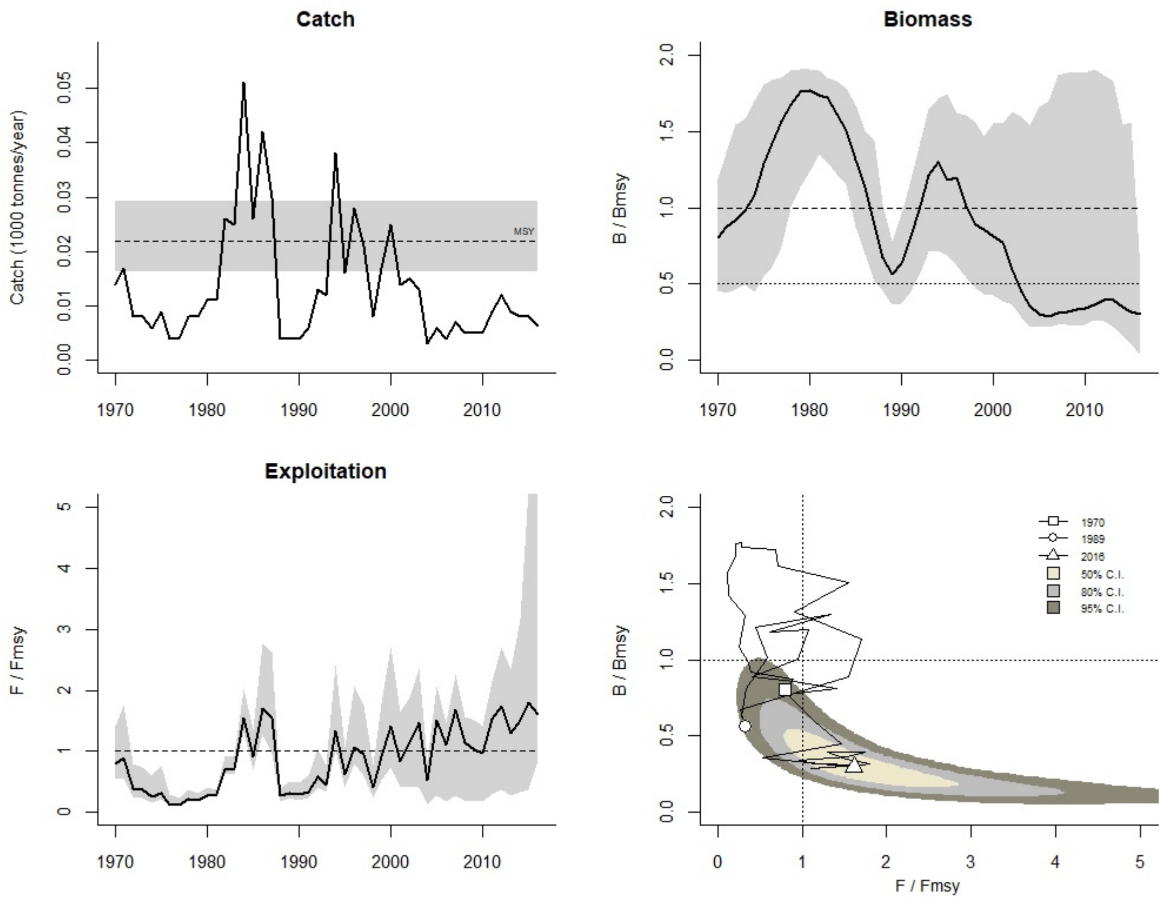

Figure 32 Greater amberjack: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

Comber (*Serranus cabrilla*)

Comber was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY higher than 1 and a ratio B/BMSY around 1 (Figure 35). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear patter (Figure 36).

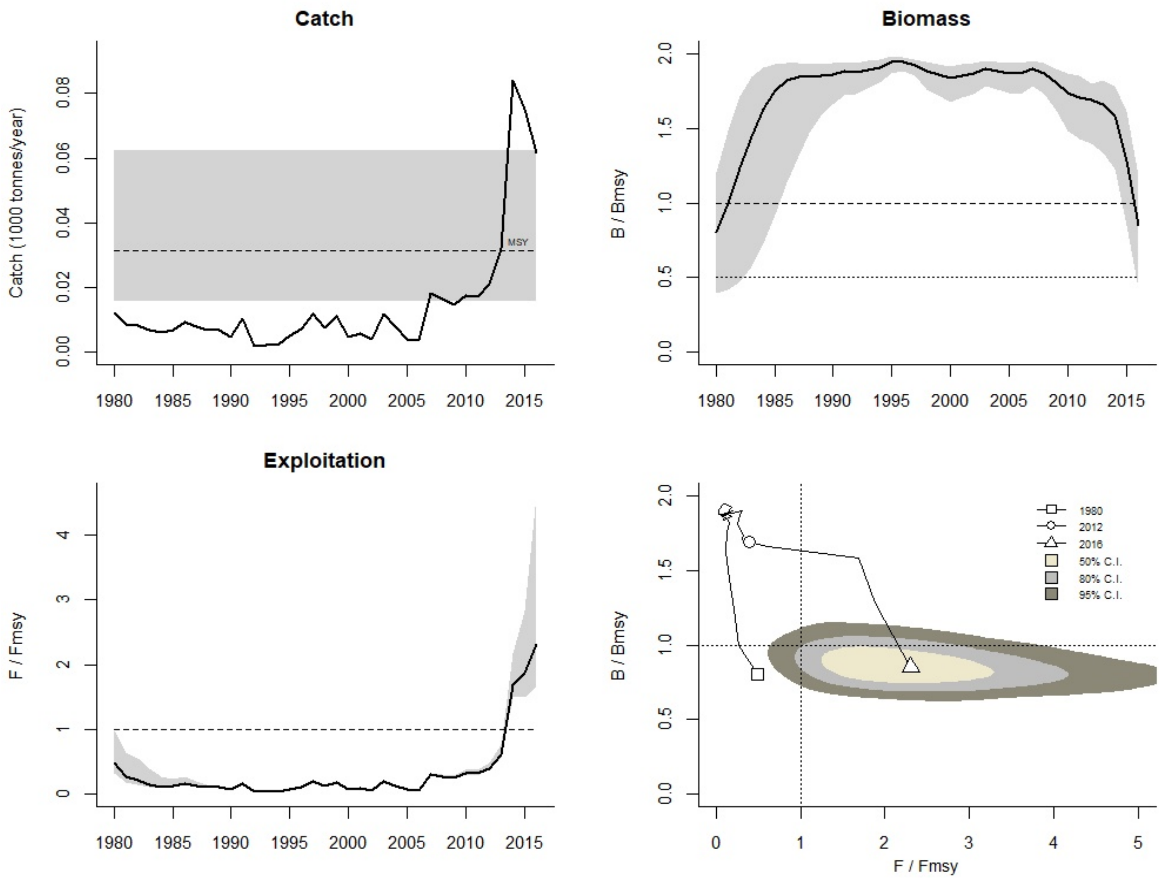

Figure 33 Comber: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

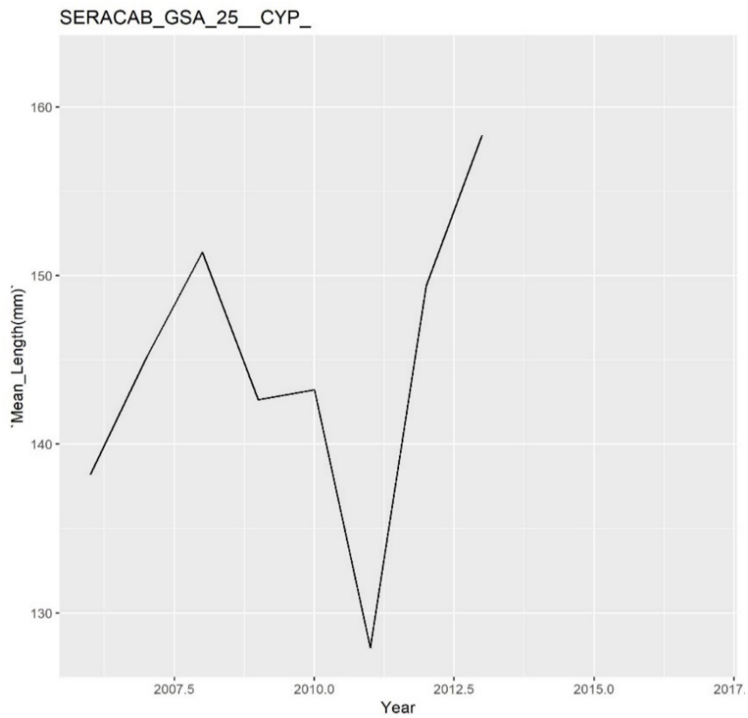

Figure 34 Comber: Trend of the mean length observed in the trawl survey MEDITS.

Parrotfish (*Sparisoma cretense*)

The parrotfish was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY close to 1 as well as the ratio B/BMSY (Figure 37). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear patter (Figure 38).

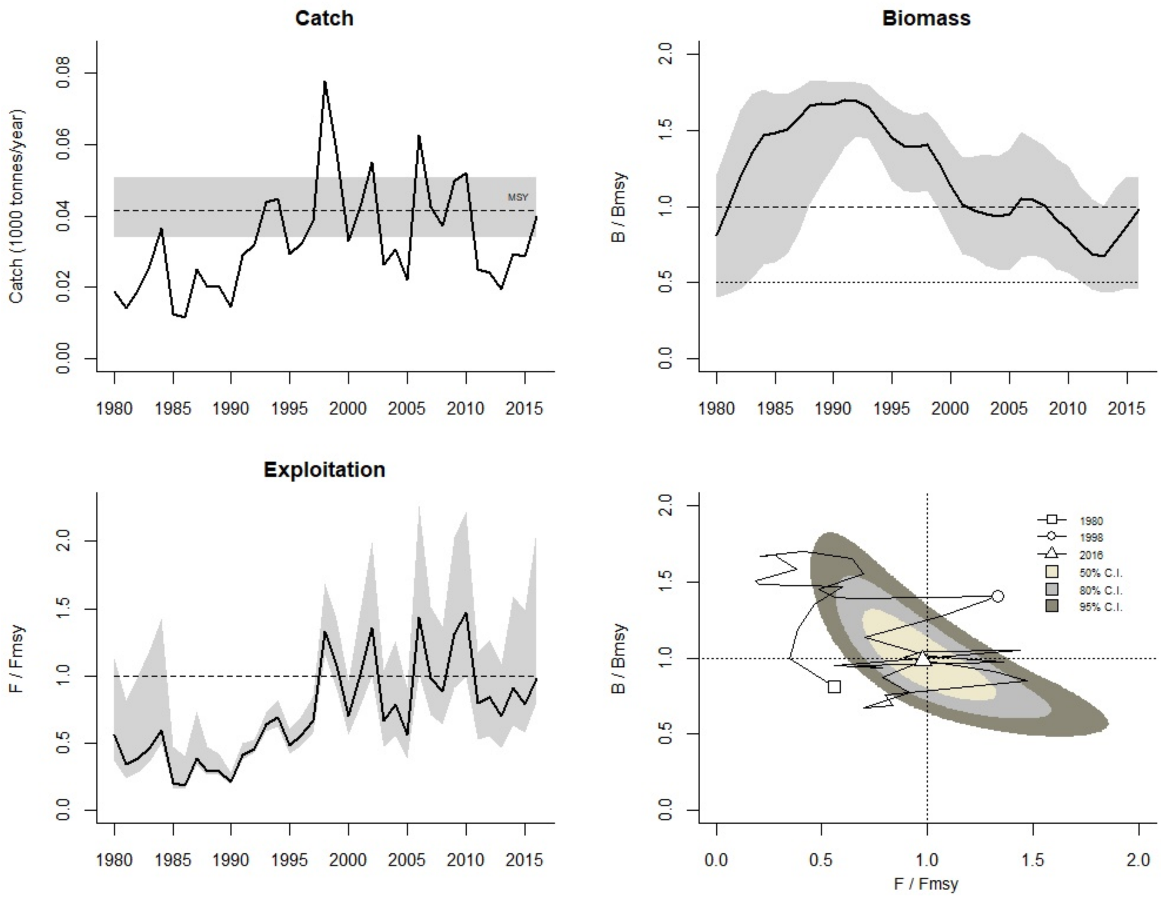

Figure 35 Parrotfish: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

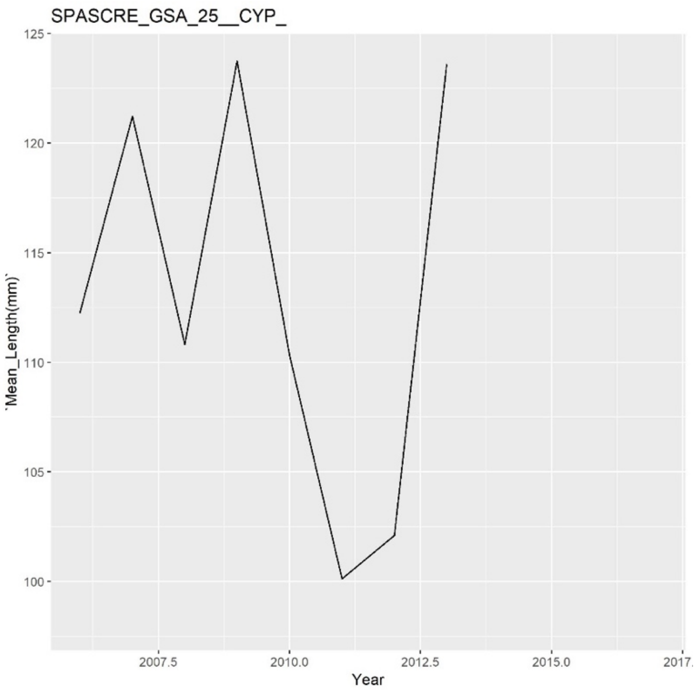

Figure 36 Parrotfish: Trend of the mean length observed in the trawl survey MEDITS.

Blotched picarel (*Spicara maena*)

The blotched picarel was not object of a stock assessment in the framework of the relevant RFMO. Therefore, an independent assessment using CMSY (Froese *et al.,* 2016a; 2016b) has been carried out in the framework of the present study. According to CMSY outputs the stock shows a ratio of F/FMSY below 1 and a ratio B/BMSY above 1 (Figure 39). The mean length observed in research trawl survey (MEDITS) was fluctuating without showing a clear patter (Figure 40).

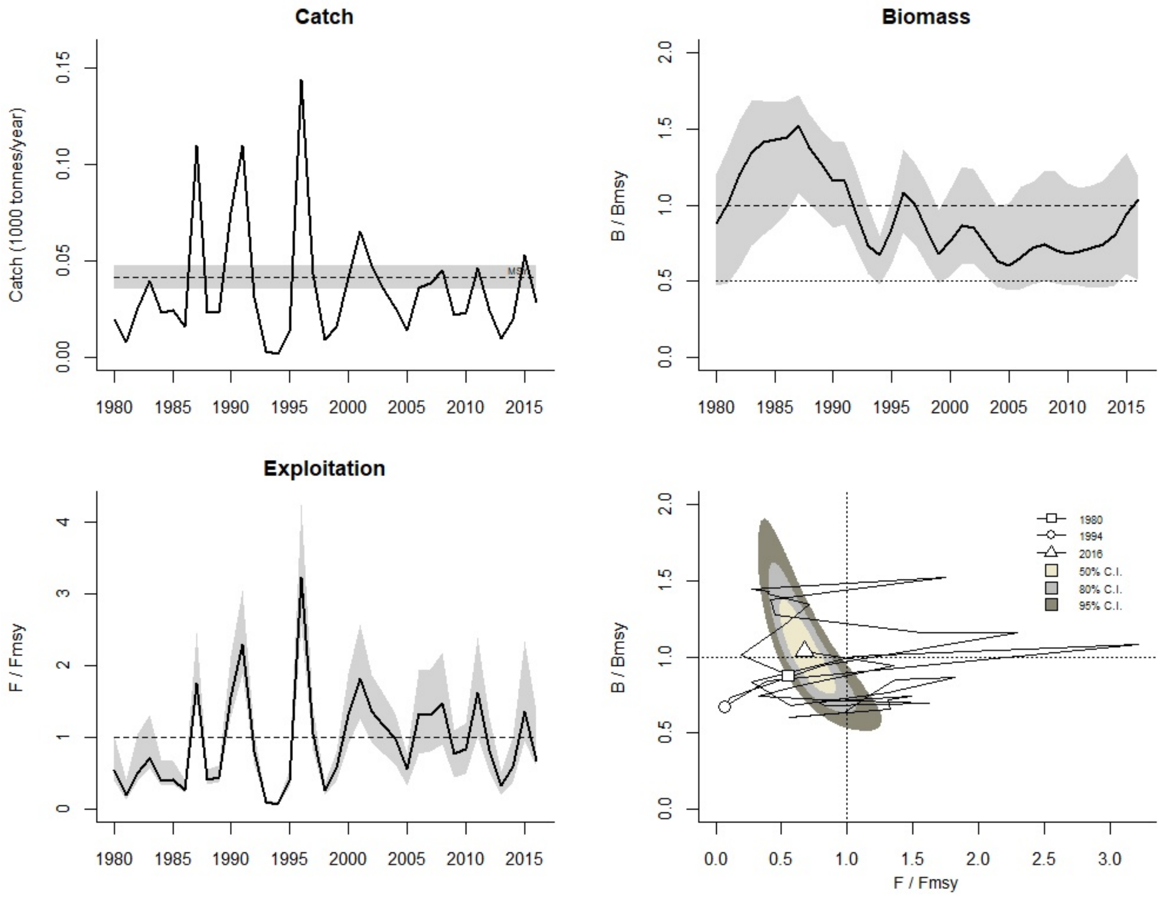

Figure 37 Blotched picarel: CMSY results for Catch, Biomass (B/BMSY), Exploitation (F/FMSY) and Kobe plot.

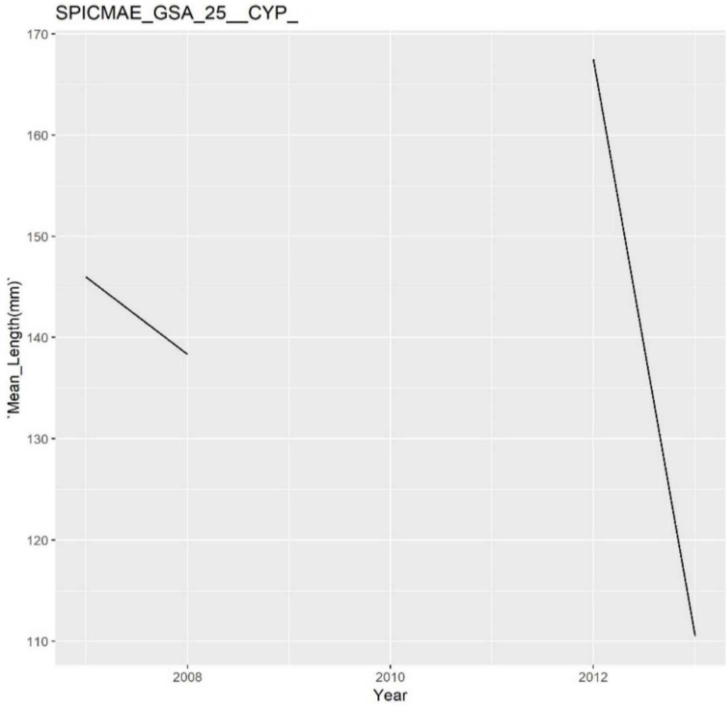

Figure 38 Blotched picarel: Trend of the mean length observed in the trawl survey MEDITS.

Picarel (*Spicara smaris*)

The last assessment of this species in GSA 25 has been performed in 2016, during the GFCM Working Group stock of Stock Assessment on Demersal Species with a reference year of 2015 (GFCM, 2016). 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 are in agreement with the stock assessment results, indicating an increase both in recruitment and in SSB and the subsequent increase in recent catch (Figure 41). The mean length observed in research trawl survey (MEDITS) was fluctuating showing a positive pattern (Figure 42).

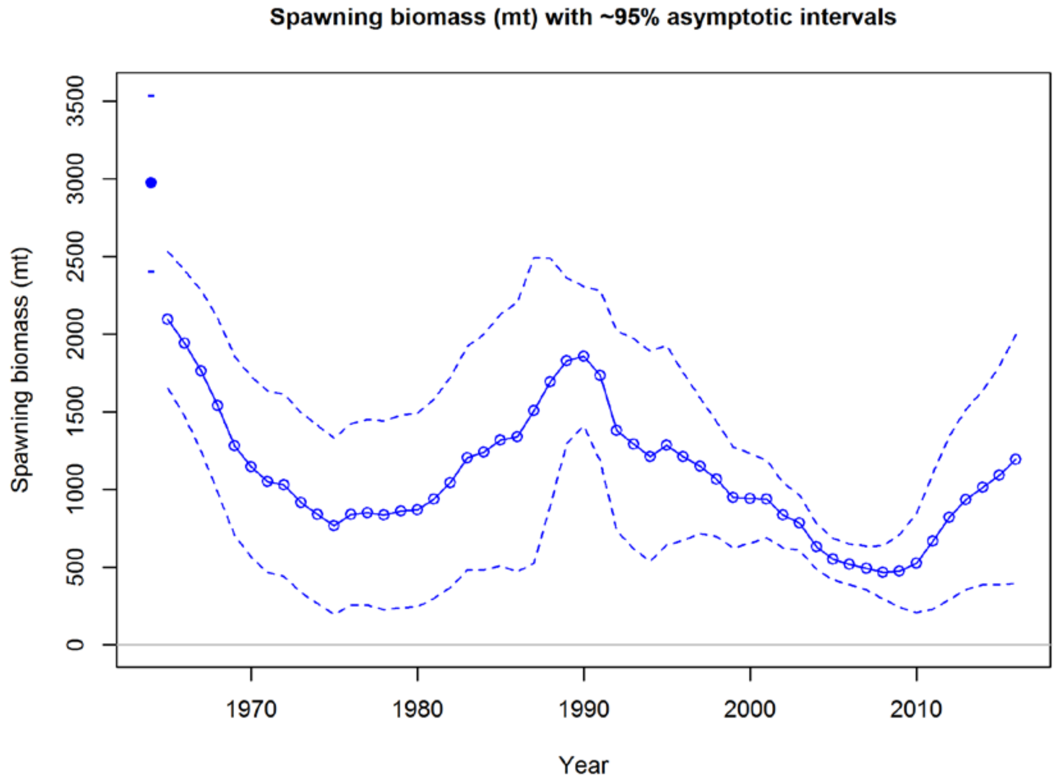

Figure 39 Picarel: SS3 results for Spawning Stock Biomass (SSB).

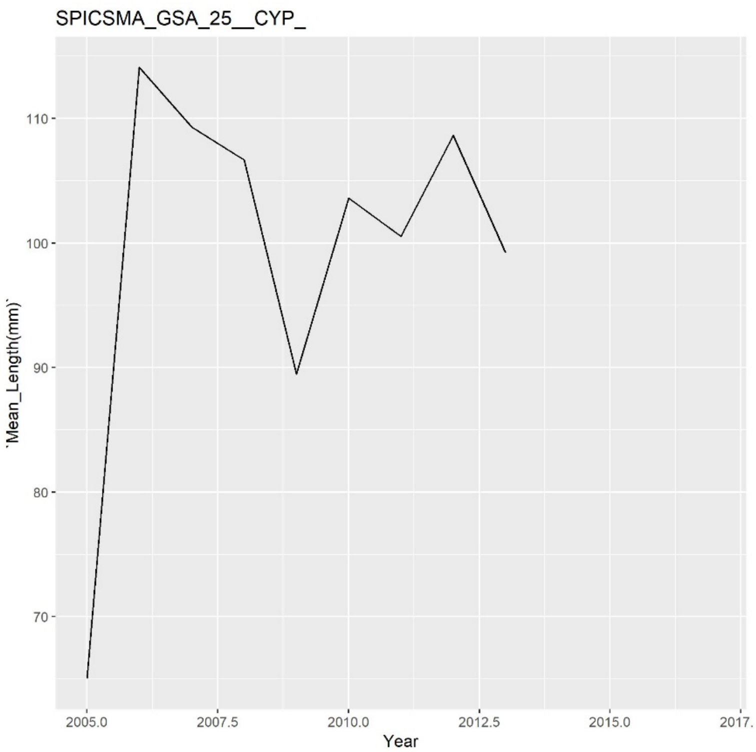

Figure 40 Picarel: Trend of the mean length observed in the trawl survey MEDITS.

3.2.3.1 *Albacore* (Thunnus alalunga)

The status of the resource is assessed with a production model (CMSY model, ICCAT, 2017a) combining the fishing statistics of the entire Mediterranean basin, considering that this species is distributed throughout the area and is considered a single stock.

During the last evaluation, which took place in 2017, the historical series of catches available in the ICCAT database has been revised. In 2016, the total Mediterranean landings reported were 3,519 tonnes, similar to those of the last decade. Most of the catches came from longline fishing and Italy is the main producer, with around 57% of landings in the last 10 years. In 2016 Italian capture remained similar to the average of the last five years. Otherwise, 2015 was an unusual year with landing data very different from that of previous years, probably this change is related to the anticipation of management measures related to swordfish that changed the fishing strategy in 2015. Therefore, relative abundance estimates for the 2015 CPUE indices were not used in the evaluation. Since this estimate seems highly influential and perhaps suspect, the production model took into account catch data up to 2015 and relative abundance data (CPUE) until 2014. However, it is important to consider that alternative solutions that include 2015 CPUE are not biologically plausible.

The results of the 2017 evaluation, based on the limited information available, show that the state of the stock is extremely uncertain both in terms of fishing mortality and biomass. Despite the high uncertainty, the results would seem to indicate that the biomass is at a level similar to BMSY, and the fishing mortality is lower than FMSY (Figure 43). However, the ICCAT working group noted the lack of CPUE in 2015 and given the recent downward trend of the series available, reiterates that it is very important to confirm, in the coming years, whether this trend continues or not. The ICCAT also reiterates that the ability to monitor stock trends is limited and that current abundance indices (CPUE from commercial fishing) may be influenced by the management measures undertaken for the swordfish recovery plan.

Figure 41 Albacore: Results of the evaluation of the albacore (*Thunnus alalunga*) in the Mediterranean Sea (ICCAT, 2017a).

*3.2.3.2 Swordfish (*Xiphias gladius*)*

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 (Figure 44). The results therefore indicate that the stock is both overfished in an over-exploitation state (Figure 44).

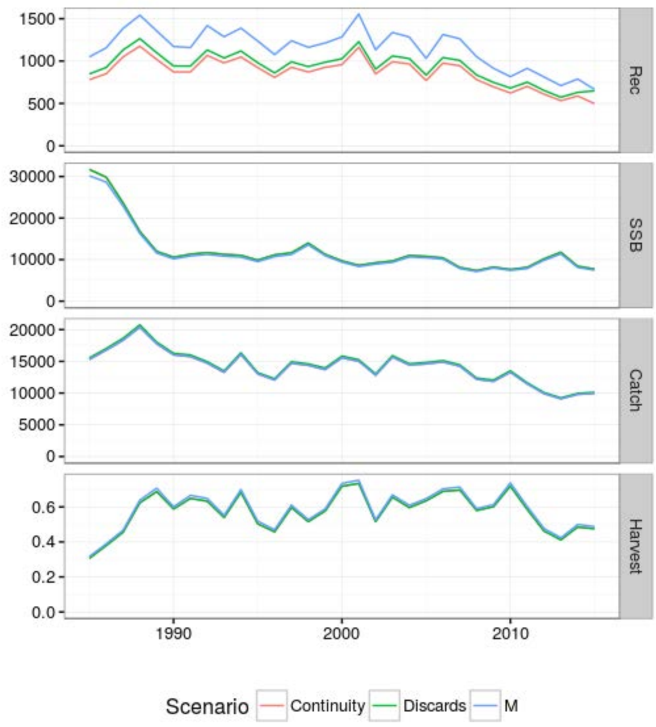

Figure 42 Swordfish: Results of the evaluation of swordfish (Xiphias gladius) in the Mediterranean Sea (ICCAT, 2016).

3.2.3.3 Bluefin tuna (Thunnus thynnus)

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 (Figure 45). 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).

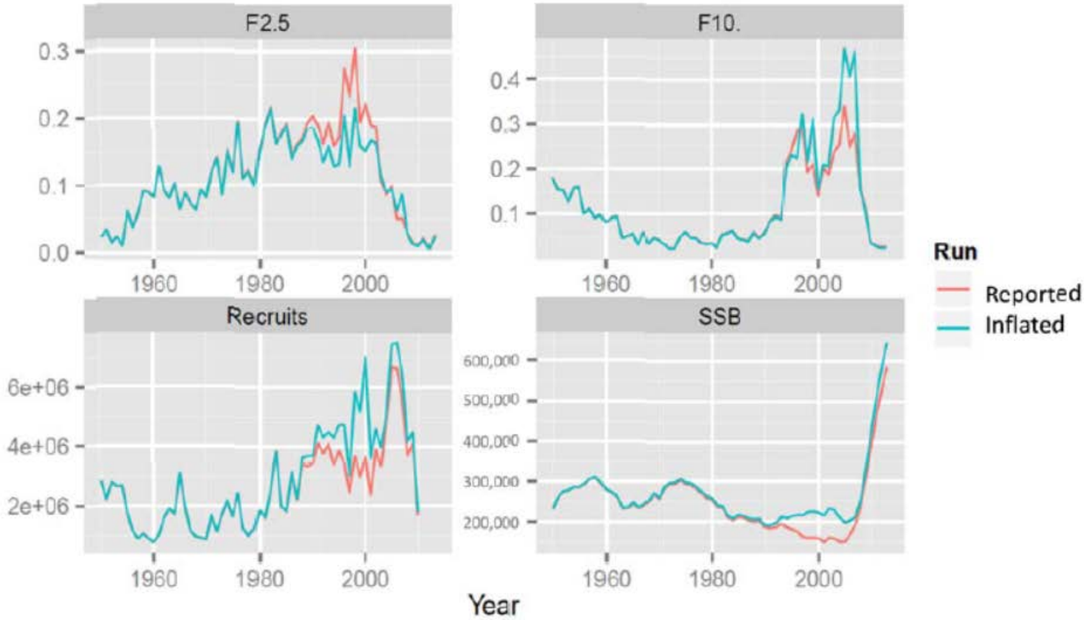

Figure 43 Bluefin tuna: result of the evaluation of Bluefin tuna (Thunnus thynnus) in Mediterranean and the eastern Atlantic (ICCAT, 2017b).

From what is reported in Table 5, 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).

Table 5 Bluefin tuna: diagnosis of the status of the bluefin tuna (Thunnus thynnus) stock in the Mediterranean and the eastern Atlantic (ICCAT, 2017b).

EAST ATLANTIC AND MEDITERRANEAN BLUEFIN TUNA SUMMARY		
Current reported yield (2014)	13,243 t*	
	Reported catch	Inflated catch
Maximum Sustainable Yield[1]		
Low recruitment scenario (1970s)	23,256 t	23,473 t
Medium recruitment scenario (1950-2006)	33,662 t	36,835 t
High recruitment scenario (1990s)	55,860 t	74,248 t
$F_{0.1}$ [2,3]	$0.07 yr^{-1}$	$0.07 yr^{-1}$
$F_{2013}/F_{0.1}$	0.40	0.36
$SSB_{F0.1}$		
Low recruitment scenario (1970s)	351,500 t	354,600 t
Medium recruitment scenario (1950-2006)	508,700 t	556,600 t
High recruitment scenario (1990s)	843,800 t	1,121,000 t
$SSB_{2013}/SSB_{F0.1}$		
Low recruitment scenario (1970s)	1.60	1.74
Medium recruitment scenario (1950-2006)	1.10	1.11
High recruitment scenario (1990s)	0.67	0.55
Stock Status:		
Overfished		
Low recruitment scenario	No	
Medium recruitment scenario	No	
High recruitment scenario	Yes	
Overfishing	No	
TAC (2013 - 2015)	13,400 t – 13,400 t – 16,142 t	
TAC (2016-2017)	19,296 t – 23,155 t	

[1] Approximated as the average of the potential longterm yield that is expected at a $F_{0.1}$ strategy. The levels of these yields have been computed using the selectivity pattern over 2009-2011 and can substantially change according to different selectivity patterns.
[2] The Committee decided, on the basis of current published literature, to adopt $F_{0.1}$ as the proxy for F_{MSY}. $F_{0.1}$ has been indeed shown to be more robust to uncertainty about the true dynamics of the stock and observation errors than F_{MAX}. Values are given for both reported and inflated catch scenarios, respectively. $F_{0.1}$ have been also computed using the 2012 selectivity pattern and can thus substantially change according to different selectivity patterns.
[3] The recruitment levels do not impact $F_{0.1}$.
* As of 25 September 2015.

Conclusion

Table 6 summarizes the present outcomes of the analyses, compared with the initial assessment carried out in 2012. In general, is possible to observe an improvement of the status of the species for most of the Criteria considered in the descriptor 3. It is important to stress that the present analyses comprised a higher number of species characterized in most of the case by a sustainable exploited status. It is plausible to conclude that the management measures implemented in the period between the previous and present assessment were effective in determining an improvement of Descriptor 3 toward the GES.

Table 6 Summary of the results obataind in the prevous assessment and in the present. (red = F/FMSY > 1 or HR = increasing trend; B/BMSY < 1 or SSB – Biomass index = decreasing trend; Mean length = decreasing trend; green = F/SMSY ≤ 1 or HR = stable or increasing trend; B/BMSY ≤ 1 or SSB-Biomass index = stable or increasing trend; Mean length = stable or increasing trend; grey = no data).

Scientific name	Species code	2012 initial assessment output			Present assessment		
		Criterion 3.1	Criterion 3.2	Criterion 3.3	Criterion 3.1	Criterion 3.2	Criterion 3.3
Boops boops	BOG	red	red	grey	red	red	green
Dentex dentex	DEC	green	green	grey	red	red	grey
Merluccius merluccius	HKE	grey	grey	grey	red	red	green
Mullus barbatus	MUT	red	red	grey	green	green	green
Mullus surmuletus	MUR	red	red	grey	red	green	green
Octopus vulgaris	OCC	grey	grey	grey	red	red	green
Pagellus acarne	SBA	red	green	grey	red	red	green
Pagellus erythrinus	PAC	green	red	grey	green	green	red
Pagrus pagrus	RPG	green	red	grey	red	red	green
Seriola dumerili	AMB	grey	grey	grey	red	red	grey
Serranus cabrilla	CBR	green	green	grey	red	green	green
Sparisoma cretense	PRR	red	red	grey	green	green	green
Spicara maena	BPI	green	green	grey	green	green	green
Spicara smaris	SPC	green	green	grey	green	green	green
Thunnus alalunga	ALB	grey	grey	grey	green	green	grey
Xiphias gladius	SWO	grey	grey	grey	red	red	grey
Thunnus thynnus	BFT	grey	grey	grey	green	red	grey

3.3 Descriptor 5: Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters

3.3.1 D5C1 Nutrients

Nutrient concentrations, along with target concentrations at coastal water stations monitored by the DFMR are shown inFigure 46, along with key statistics and targets introduced by the DFMR in 2014. Comparison of the means with targets, results in an average deviation of +90% (above the targets), and an assigned value of 0.25 for this criterion.

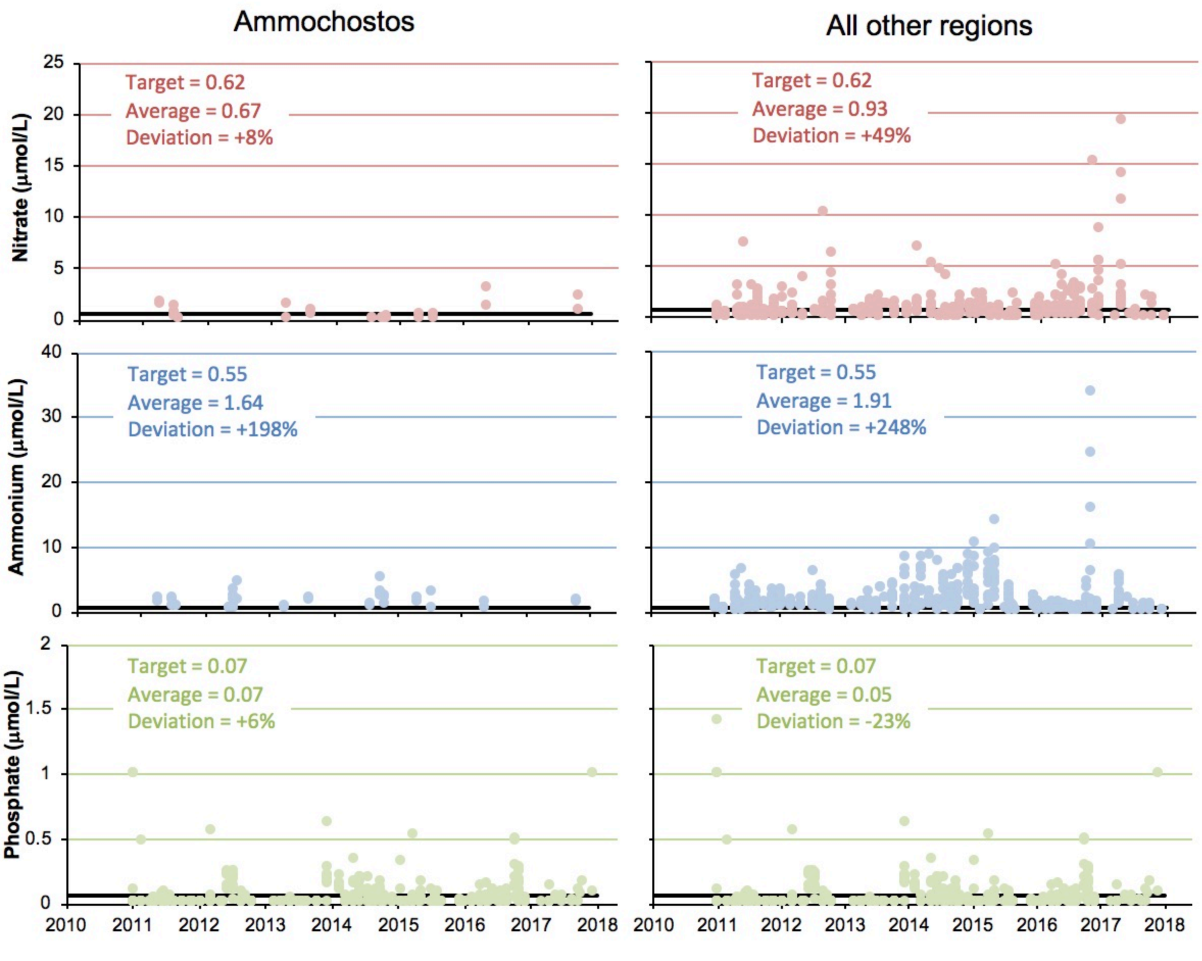

Figure 44 Time-series of nutrient concentrations in all coastal water stations monitored by the DFMR between 2010 and 2018. Ammochostos district stations are shown separately, since the district is characterized as a nitrate vulnerable zone. Dark horizontal lines indicate the target levels introduced by the DFMR in 2014 (Revision of 2012 reports) as defined for oligotrophic waters by Pagou *et al.* (2002).

3.3.2 D5C2 Chlorophyll

Updates on the chlorophyll concentration in the water bodies of Cyprus derived from the WFD monitoring program (Aplikioti *et al.* 2017; DFMR, 2019). Specifically, 8 water bodies were monitored the period 2014-2016 (Table 7). The results showed that the ecological status ranged from "good" to "high" in all areas. In addition, as it was estimated at the present report, the % Coefficient of Variance (CV%) of chlorophyll concentration, temporally and spatially, was 44% and as a result this index is assigned a 0.75.

Table 7 Results from the monitoring program of WFD in Cyprus (2004-2016) regarding the ecological status of the water bodies based on Chl a measurement (DFMR, 2019).

Water body		2004-13	Chl *a* (μg/l, 90%ile)		
			2014	2015	2016
CY_3-C2	Chrysochou bay	High		0.01	
CY_11-C2	Limassol -South	Good		0.036	0.06
CY_12-C2	Limassol		0.100	0.121	0.110
			0.168	0.101	0.134
		Good	0.15	0.115	0.113
CY_13-C2	Moni	High			N/A
CY_14-C2	Vasilikos bay	High	0.154	0.154	0.127
CY_15-C2	Zygi- Kiti Cape	High	0.125	0.119	0.11
CY_16-C2	Larnaca-West	High		0.040	0.036
CY_18-C2	Larnaca-Northeast			0.047	0.13
CY_22-C3	Protaras	High	0.063		

3.3.3 D5C3 Harmful algal blooms

None were reported. Assigned a value of 1.

3.3.4 D5C4 Photic limit

No photic limitation has been historically observed. Assigned a value of 1.

3.3.5 D5C5 Dissolved oxygen in bottom water

Oxygen concentrations in coastal waters of Cyprus are high overall (Figure 47). Reference station data were available for years 2016 and 2017 and the target value evaluated for those years indicates that Cyprus waters are in GES with respect to oxygen and this criterion was assigned a value of 1.

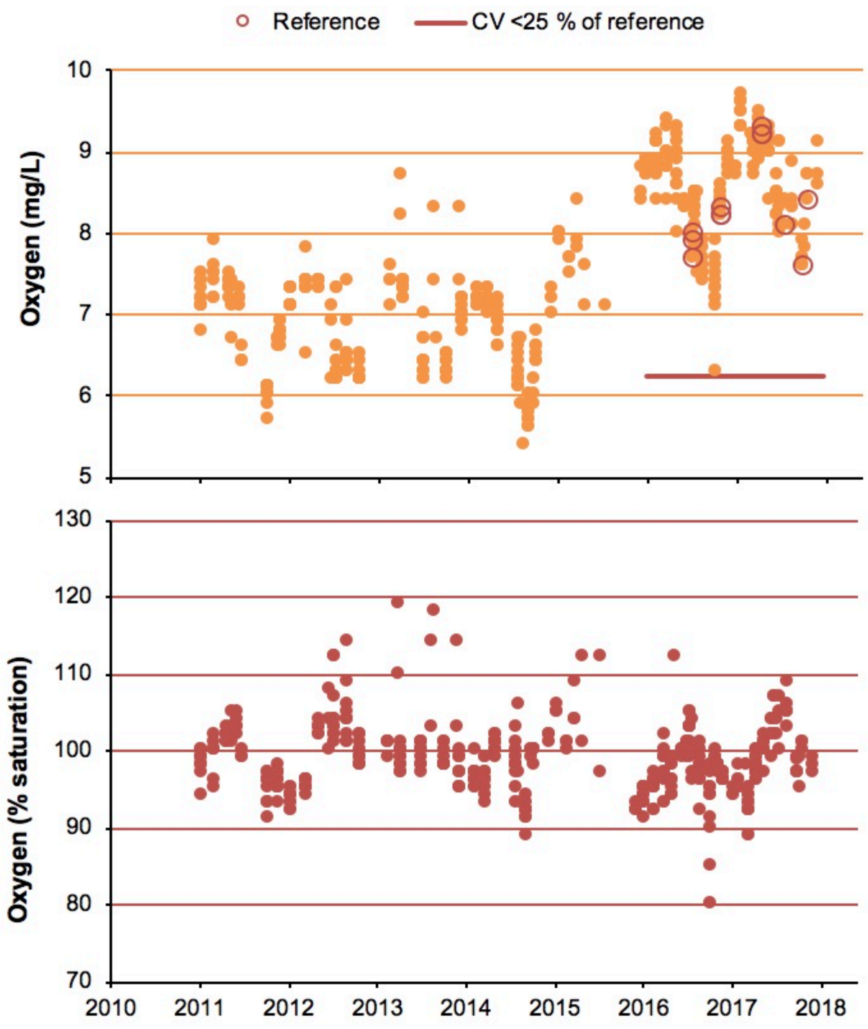

Figure 45 Oxygen concentration (above) and degree of saturation (below) at coastal stations monitored by the DFMR for the period 2010-2017 (DFMR 2019). Reference station oxygen concentrations were used to determine the target value (CV<25% of reference) for the years 2016-2017, shown by the bold line.

3.3.6 D5C6 Opportunistic benthic macroalgae

The temporal and spatial variation of % coverage of ESG II seaweeds in the coasts of Cyprus is shown in Table 15 (Aplikioti *et al.* 2017, DFMR, 2019). Coefficient of Variance % of the coverage of opportunistic seaweeds (ESG II) in Cyprus coasts was 108% this index was assigned a 0.25.

3.3.7 D5C7 Benthic macrophytes

PREI was implemented in three differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program and the results are shown in

Table 17 (Aplikioti *et al.* 2017, DFMR 2019). Since the CV% of Cyprus coasts PREI values was 5.9% this index is assigned a 1.

3.3.8 D5C8 Benthic macrofauna

BENTIX was implemented in eight differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program from 2011 to 2016 (Table 18) (DFMR, 2019). Since the Coefficient of Variance (CV) % of Cyprus coasts BENTIX values from reference conditions was 16.8% this index is assigned a 1.

3.3.9 Final environmental status value for Descriptor 5

According to the methodology established in 2012, the estimation of environmental status at the Descriptor 5 level is based on the sum of the products of assigned value for each criterion and its weighted value (shown below in Table 8). According to the 2019 assessment, GES is achieved with respect to eutrophication (D5).

Table 8 Environmental status assessment of Cyprus marine waters for Descriptor 5, Eutrophication.

Criterion	Criterion value (0-1)	Weighed factor	Weighed value
D5C1 Nutrients	0.25	0.1	0.025
D5C2 Chlorophyll	0.75	0.1	0.075
D5C3 Harmful algal blooms	1	0.05	0.05
D5C4 Photic limit	1	0.05	0.05
D5C5 Dissolved oxygen	1	0.1	0.1
D5C6 Opportunistic macroalgae	0.25	0.2	0.05
D5C7 Benthic macrophytes	1	0.2	0.2
D5C8 Benthic macrofauna	1	0.2	0.2
	Sum	1.0	0.75

3.4 Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected

3.4.1 D6C1 Spatial extent and distribution of physical loss

The length of permanently altered coastline and estimated 100 m wide coastal water band have increased by 44% and 8% between 2012 and 2019. However, the actual fraction of affected coastline remains relatively low. A value of 0.75 is ascribed to this criterion.

Table 9 Permanent alteration of the coastline and coastal waters (0-100 m from shore) in 2012 (Initial Assessment) and 2019.

	Length (km)	Area (km^2)
Total investigation region length and area (0-100 m from shore)	362.33	36.23
2012 - Total covered by infrastructure	27.8	2.6
2012 - Fraction affected by infrastructure	7.7 %	6.3 %
2019 - Total covered by infrastructure	40.1	2.8
2019 - Fraction affected by infrastructure	11.1 %	7.8 %
Percent change from 2012 to 2019	+44 %	+8 %

3.4.2 D6C2 Spatial extent and distribution of physical disturbance pressures

Pressures such as sealing, smothering and siltation can result from physical alteration of the seafloor. Based on the information compiled for this reporting, up to 7.8 % of the coastal seafloor can be impacted by these activities in 2019.

An additional pressure from other activities such as bottom trawling and selective extraction of resources is abrasion, the scouring and ploughing of the seabed. The extent of bottom trawling in territorial waters and the EEZ is currently unknown. Prospecting for and extraction of marine hydrocarbons is expected to have minimal imprint on seafloor integrity given the limited spatial scale of actual structures and operations (see analysis in DFMR, 2012).

Because of the unknown extent of bottom trawling in offshore Cyprus waters, a conservative overall score of 0.75 is ascribed to this criterion.

3.4.3 D6C3 Spatial extent of adversely affected habitat types

While the total area of the seabed directly impacted by various human activities could potentially be quantified, both the indirectly impacted area as well as the effects on distinct biogenic substrates/habitats cannot be estimated at this point. Therefore, the precise determination of the status of this criterion is not currently feasible.

However, through to the implementation of the Water-Framework Directive (2000/60/EC) in the coastal waters of Cyprus, a number of indices exist which describe the condition and function of the benthic community in the coastal waters of Cyprus. A full analysis of these components in provided in Part II and is briefly summarized below.

The temporal and spatial variation of % coverage of ESG I seaweeds (sensitive and/or tolerant species) in the coasts of Cyprus is shown in Table 15. Coefficient of Variance % of the coverage of late-successional seaweeds (ESG I) in Cyprus coasts was 45% this index was assigned a 0,75.

The temporal and spatial variation of % coverage of ESG II seaweeds (opportunistic macroalgae) in the coasts of Cyprus is shown in Table 15. Coefficient of Variance % of the coverage of opportunistic seaweeds (ESG II) in Cyprus coasts was 108% this index was assigned a 0,25.

The Ecological Evaluation Index (EEI) was implemented in the framework of the implementation of the Water-Framework Directive (2000/60/EC) in the coastal waters of Cyprus in five differently impacted sites of the rocky Cyprus coasts (Table 15). Since the CV% of Cyprus coasts EEI values was 8,85% this index was assigned a 1.

PREI as an indicator of the extent and condition of *Posidonia* meadows was implemented in three differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program (

Table 17) (DFMR, 2019). Since the CV% of Cyprus coasts PREI values was 5,9% this index is assigned a 1.

The macrobenthic index BENTIX was implemented in eight differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program from 2011 to 2016 (Table 18) (DFMR, 2019). Since the Coefficient of Variance (CV)% of Cyprus coasts BENTIX values from reference conditions was 16,8% this index is assigned a 1.

Assuming that the above indicators contribute equally to criterion D6C3, an average value of 0.8 can be ascribed to the criterion itself.

3.4.4 Final environmental status value for Descriptor 6

According to the methodology established in 2012, the estimation of environmental status at the Descriptor 6 level is based on the sum of the products of assigned value for each criterion and its weighted value (shown below in Table 10). According to the 2019 assessment, GES is achieved with respect to seafloor integrity (D6). Further analysis of seafloor integrity indicators is included in Part II.

Table 10 Environmental status assessment of Cyprus marine waters for Descriptor 6, Seafloor Integrity, criteria D6C1-3.

Criterion	Criterion value (0-1)	Weighed factor	Weighed value
D6C1 Physical loss	0.75	0.3	0.225
D6C2 Physical disturbance pressures	0.75	0.3	0.225
D6C3 (Condition of benthic communities)	0.8	0.4	0.32
	Sum	1.0	0.77

3.5 Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems

3.5.1 D7C1 Spatial extent and distribution of permanent alteration of hydrographic conditions

In the absence of detailed mapping of the hydrographic conditions around coastal structures and discharge locations of power plant cooling waters and desalination brine, a brief calculation is presented in Table 11, indicating that a minor fraction of the coastal waters of Cyprus may be impacted by hydrographic alterations.

Table 11 Evaluation of the potential areal coverage of hydrographically altered water in 2019 compared to the total area of coastal waters under the control of the Republic (455 km^2). The impact of power plant cooling waters and desalination brine discharge was based on the daily output (volume) calculated for the Second Assessment report and an average depth of 10 m.

Feature/activity	Area (km^2)	% of coastal water area
Coastal structures	2.8	0.6
Power plants	0.5	0.1
Desalination plants	0.035	0.01
	Sum	0.71

3.5.2 D7C2 Spatial extent of adversely affected habitat types due to permanent alteration of hydrographic conditions

The determination of this criterion is currently not possible due to the lack of data in the vicinity of the features and activities that may potentially impact the hydrographic conditions. It can only be surmised that the areal coverage of the impacted habitats will be small, given that the total area impacted is slightly less than 3,5 km^2 (Table 11).

3.6 Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects

3.6.1 D8C1 Concentrations of contaminants

Data collected by the DFMR was analyzed using the approach outlined during the Initial Assessment (DFMR 2012; Argyrou *et al.* 2012) to document the presence and magnitude of metal concentrations in sediments (Figure 48). Indicators and targets were set for lead, cadmium and mercury during the 2014 revision. The results of this analysis indicate that Cyprus waters are in GES with respect to metals in sediments.

Moreover, analyses were conducted for various Polycyclic Aromatic Hydrocarbons (PAH) in marine sediments from numerous stations in 2017 (Table 12) that are consistent with GES, given that only one target (for Benzo(a)pyrene) has been instituted for this indicator since 2012.

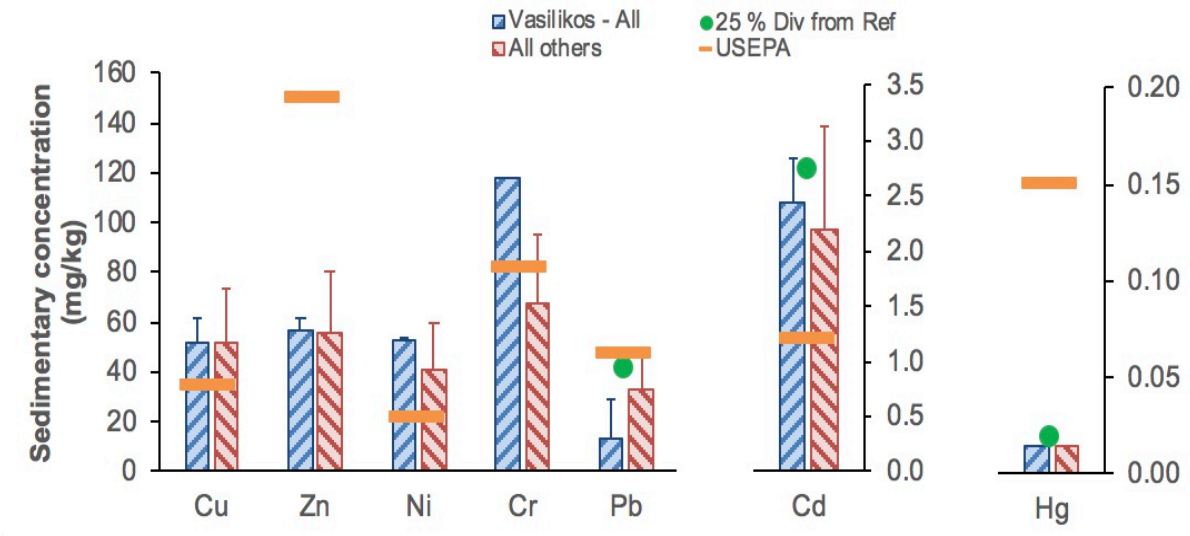

Figure 46 Average sedimentary metal concentrations at selected sites during the years 2013-2016. Error bars represent one standard deviation. Green dots indicate a 25 % divergence from the average values at all other sites (stand-ins as reference) for lead, cadmium and mercury. Also shown are the Effects Range-Low (ERL) established by the United States Environmental Protection Agency (US EPA) for comparison (reported in Tornero *et al.* 2019).

Table 12 Sedimentary concentrations of various Polycyclic Aromatic Hydrocarbons (PAH) measured in samples collected in 2017 across Cyprus waters. A national standard of 30 μg/kg for Benzo(a)pyrene was reported in Tornero *et al.* (2019).

PAH Compound	Concentration in 2017 (g/kg dry sediment)
Anthracene	< 10.0
Fluoranthene	Traces to 12.5
Naphthalene	< 150.0
Benzo(a)pyrene	< 10.0 to 12.5
Benzo(b)fluoranthene	< 10.0
Benzo(g,h,i)perylene	< 10.0 to 12.6
Benzo(k)fluoranthene	< 10.0
Indeno(1,2,3-cd)pyrene	< 10.0

3.6.2 D8C2 Health of species and habitats at risk from contaminants

Analyses of contaminants in wild fish populations (D9) have repeatedly recorded low contaminant levels relative to reported/instituted standards. Contaminant concentrations in top predators have not been reported to this date.

3.6.3 D8C3 Spatial extend and duration of significant acute pollution events

No significant acute pollution events have been reported for the period 2012-2019.

3.6.4 D8C4 Adverse effects of significant acute pollution events on health of species and habitats

None reported for the period 2012-2019.

3.7 Descriptor 9: Contaminants in fish and other seafood for human consumption do not exceed levels established by Union legislation or other relevant standards

3.7.1 D9C1 Contaminants in edible tissues

Mercury, Cadmium and Lead in *Mullus* sp. from Cyprus waters between 2012-2015 (Figure 49) is substantially below maximum levels for *Mullus* sp./fish tissues according to EC Regulation 1881/2006. Similarly, PAH and PCB concentrations in *Boobs boobs* (Table 13) and *Mullus* sp. (Figure 50) are well below declared standards. Therefore, Cyprus waters are deemed to be in GES with respect to contaminants in fish.

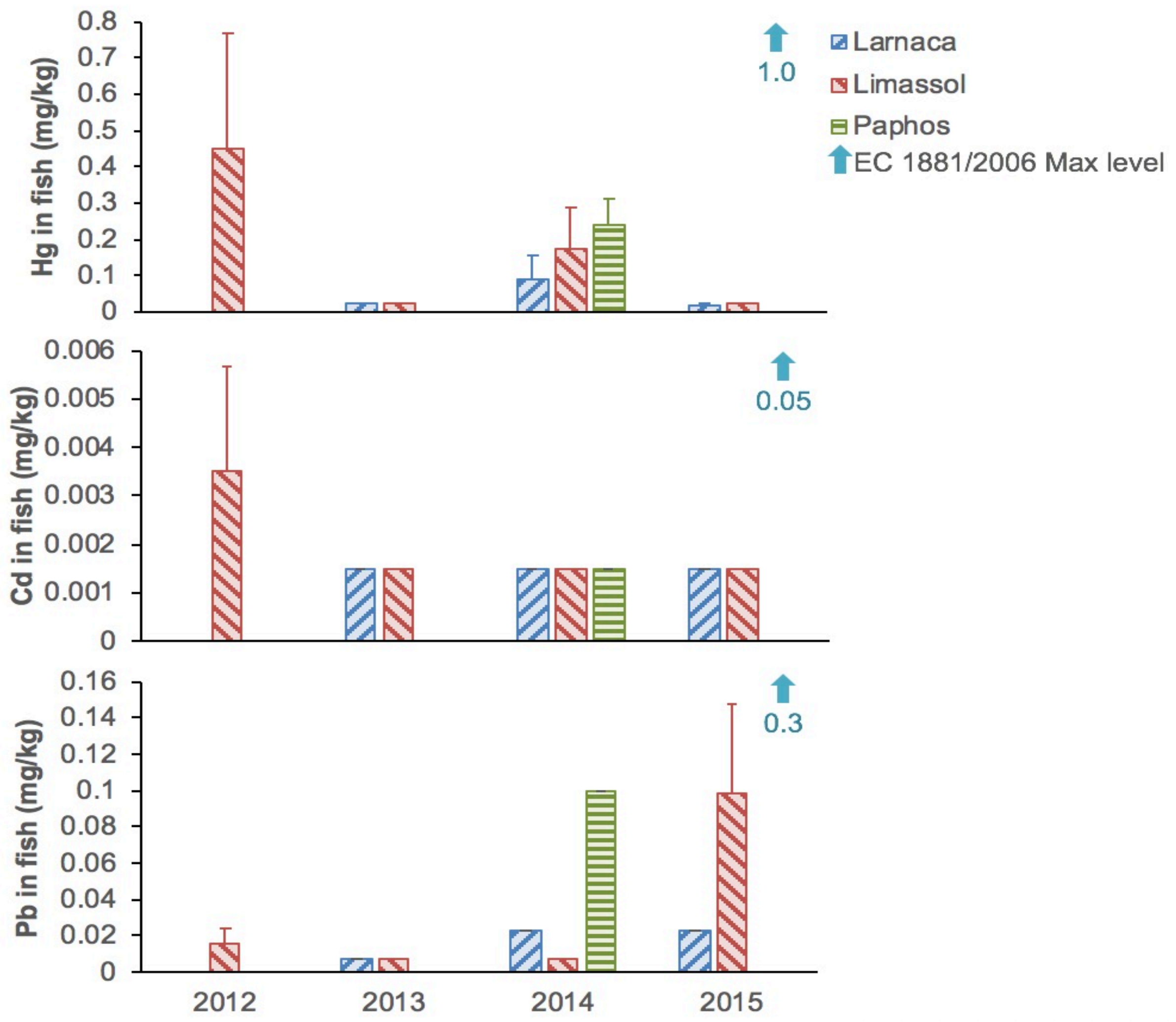

Figure 47 Mercury, Cadmium and Lead in tissue of *Mullus* sp. caught in three different areas of Cyprus waters in 2012-2015. Maximum levels for *Mullus* sp./fish tissues according to EC Regulation 1881/2006 are shown on the graphs as out-of-range (high) values.

Table 13 Concentrations of various Polycyclic Aromatic Hydrocarbons (PAH) measured in *Boops boops* tissue collected in 2016 across Cyprus waters. A national standard of 30 μg/kg for Benzo(a)pyrene was reported in Tornero *et al.* (2019).

PAH Compound	Concentration in 2016 (g/kg tissue)
Benzo(a)Anthracene	< 0.17
Chrysene	< 0.16
Benzo(a)pyrene	< 0.15
Benzo(b)fluoranthene	< 0.15

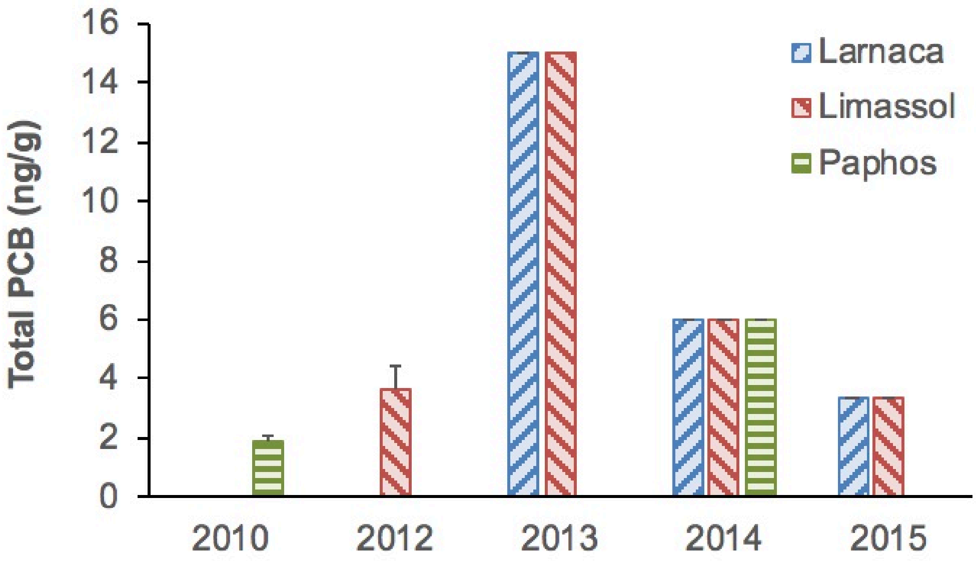

Figure 48 Total PCB concentration (sum of concentrations of PCBs 28, 52, 101, 138, 153 and 180) in wet tissue of *Mullus* sp. caught in three different areas of Cyprus waters in 2012-2015. A national standard of 75 μg/kg for non-dioxin-like PCBs was reported in Tornero *et al.* (2019) based on EC Regulations 1881/2006 and 1259/2011.

3.8 Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment

3.8.1 Introduction

Seafloor assessment (MEDITS project) (>50 m depth)

The aim of the project “Mediterranean International bottom Trawl Survey” (MEDITS) in the Cyprus coastal zone is the assessment of the distribution and the demographic structure of the demersal and benthic fauna around the island. The survey takes place within the framework of the Cyprus National Data Collection Programme, under the Community Data Collection Framework (DCF, Regulations (EC) 199/2008, 665/2008 and Regulation 2017/1004-recast/EU). The guidelines for the project are given by the MEDITS instruction manual (version 9, 2017).

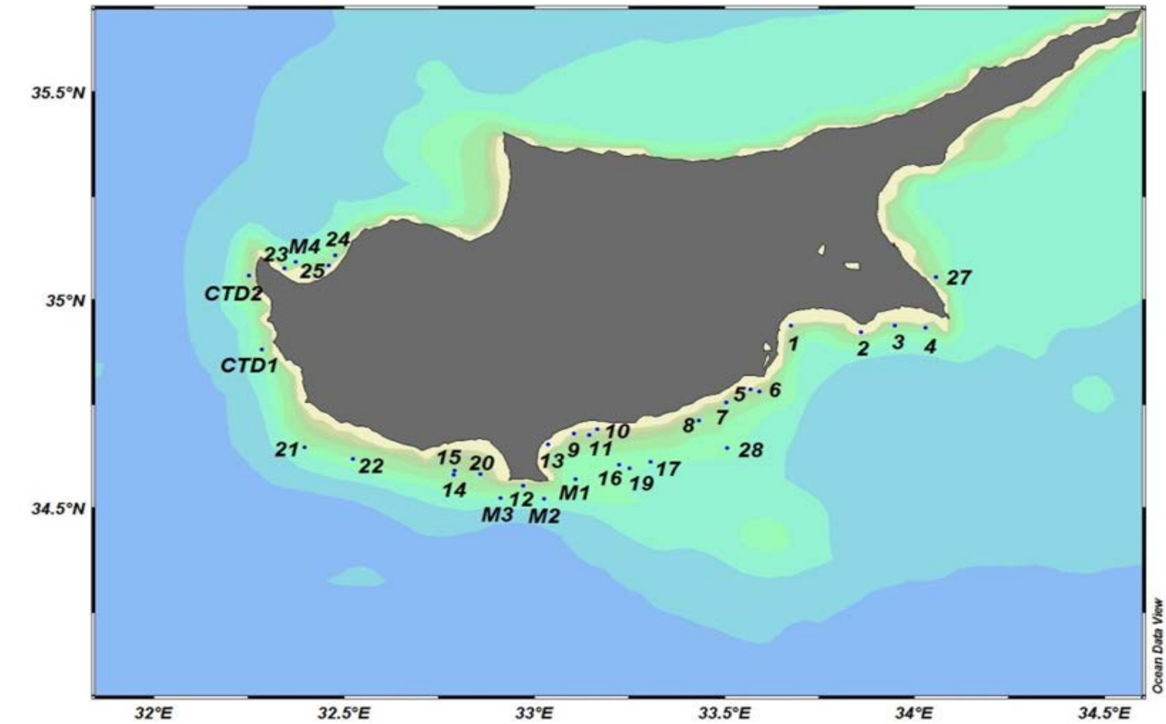

Figure 49 Spatial distribution of the MEDITS survey sampling sites.

As part of the MEDITS project, Marine litter seafloor assessment is carried out following the methodology described on the document "Procédure pour l'observation des macro déchets au cours des campagnes halieutiques", version 1.0 (2012) prepared by Badts and Galgani (Ifremer). The document was prepared taking into account the suggestions of Marine Litter Technical Recommendations for the Implementation of MSFD Requirement (Galgani *et al.* , 2011), CEFAS protocol for the litter recording (ICES, 2012), as well as the results of a relevant study in the Tyrrhenian Sea (Serena *et al.* , 2011).

The analysis of marine litter from 2015 to 2018 revealed that a significant amount of marine litter is collected throughout the sampling process. The total weight of the collected marine litter in 2018 (116.65 kg) was higher compared to the 2017 survey (109.94 kg), but lower compared to the 2016 survey (128.95 kg). The raw materials with the higher weight were metal (38.25 kg), plastic (34.26 kg), glass/ceramic items (28.60 kg), and cloth (textile)/ natural fibres (12.89 kg). Generally, litter items were found in every haul. The total number of collected items was N=976, more than it was recorded in 2017 (N=619) and 2016 (N=377). Overall, the most frequent marine litter found was plastic with 50.09%, followed by glass/ceramic items with 22.11% and metal with 13.10% (Figure 52).

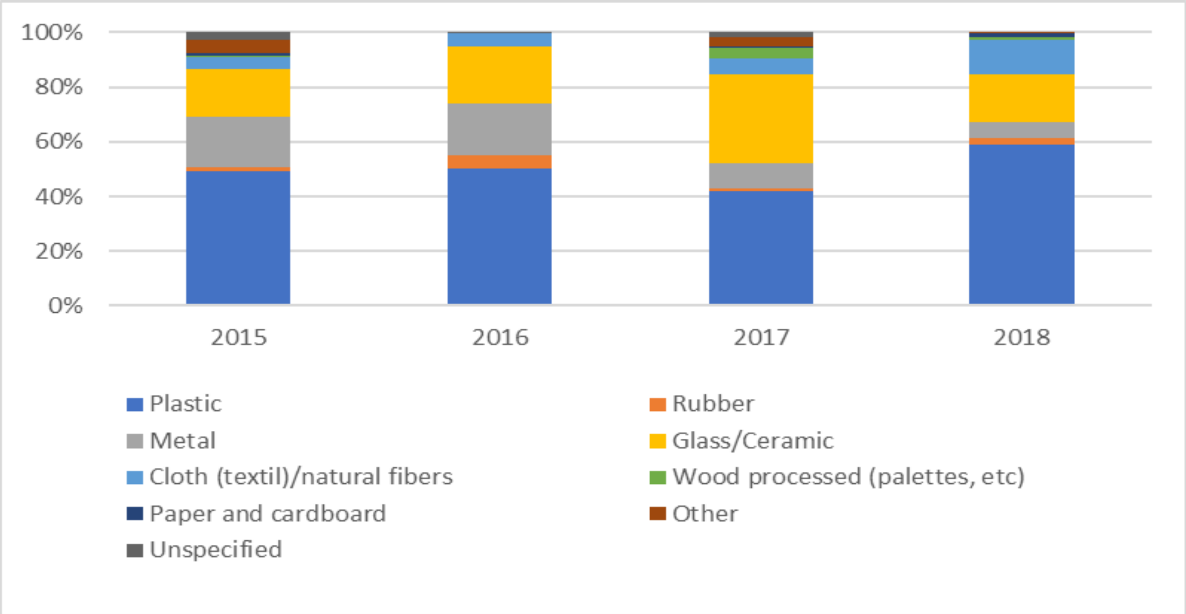

Figure 50 Percentage (%) of total litter items collected during MEDITS survey per category type (plastic, rubber, cloth, paper/cardboard, wood, metal, glass) per year.

The highest densities of plastics were recorded around areas which correlated with intensive tourist activities (Limassol Gulf, Agia Napa and Pafos area). The highest densities were recorded in Haul 4 (Agia Napa, 949.01 N/km^2), Haul 10 (697.89 N/km^2) and Haul 16 (675.53 N/km^2), both in Limassol Gulf. Figure 53 shows the geographical distribution of abundances for plastic marine litter.

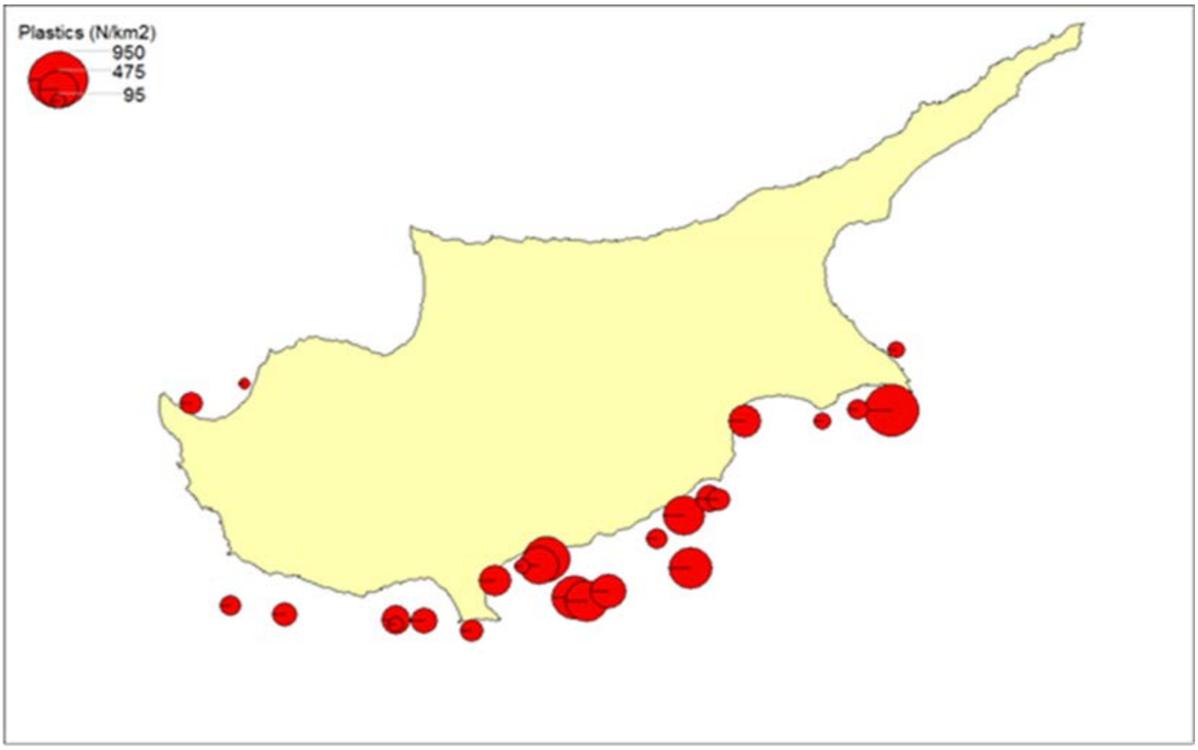

Figure 51 Abundance distribution of plastic marine litter.

Limassol is one of the most important commercial harbours of Cyprus. Therefore, hauls' proximity to this harbour resulted in the highest litter total mass recorded (Figure 54). When comparing the CyMedits 2018 marine litter biomass data with the years 2017 and 2016, a reduction of marine litter is observed in all regions except of Limassol Gulf.

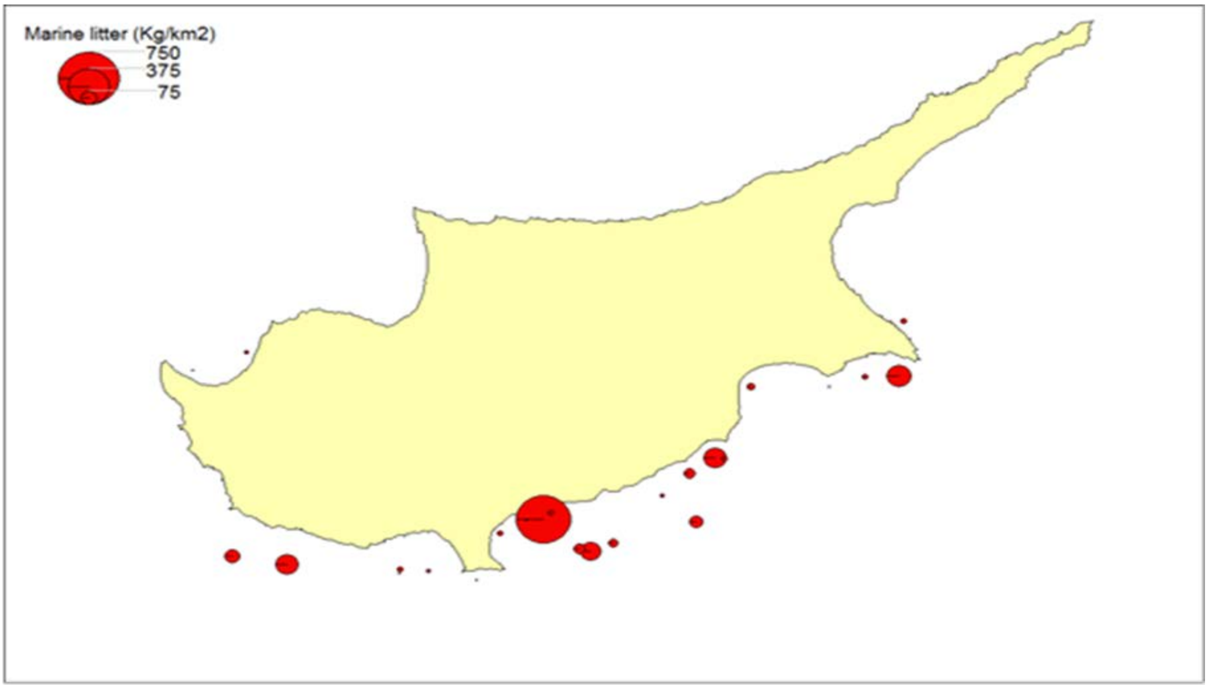

Figure 52 Mass distribution of marine litter in MEDITS survey 2018.

Seafloor assessment (<20 m depth)

The sampling method used for the seafloor survey in MELTEMI project (MELTEMI, 2019) has been prepared based on the “5.4. Protocol for shallow sea-floor (< 20m)” described in TSG-ML/JRC Final Report “Guidance on Monitoring of Marine Litter in European Seas”, pages 58-59.

According to the results of the sampling survey, that took place in March 2019, on Macronissos, Alykes-Airport, Governor’s, Limni-Argaka, Faros Paphou and Lara seafloor, marine litter items recorded were classified into 10 major groups of material types (Figure 55). The dominant material type found on the seafloor was Plastic/Polystyrene (95.45%), while the second most abundant group of litter was Cloth (4.55%).

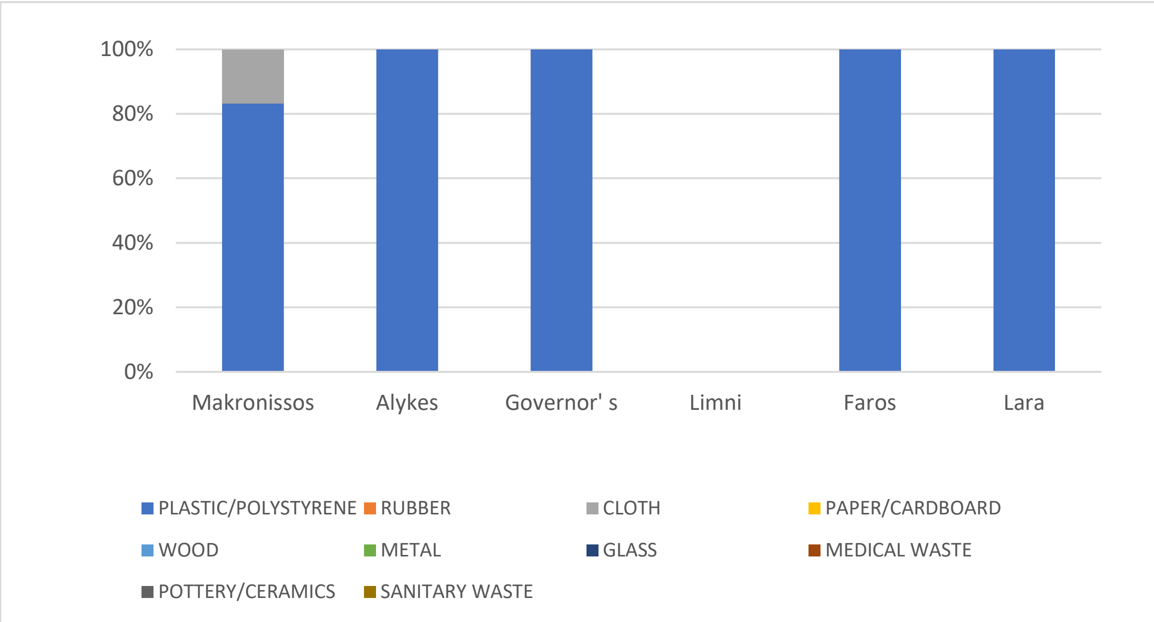

Figure 53 Percentage (%) of total litter items per category type (plastic/polystyrene, rubber, cloth, paper/cardboard, wood, metal, glass, medical waste, pottery/ceramics, sanitary waste) on each surveyed seafloor.

Beach Marine Litter Assessment

Data on MSFD selected beaches

The beach marine litter assessment started in 2018 and is carried out in six beaches: Faros Paphou, Lara beach, Akamas, Makronissos beach, Ayia Napa, Governor’s beach, Pentakomo, Limni-Argaka beach, Polis Chrysoschous, and Alykes-Airport beach, Larnaca (Figure 56).

Table 14 MSFD selected beaches.

Beach Name	Code (BWD)	Relevant coastal water body (WFD)	Related to SCI, SPA, MPA
		Urban/tourist beaches	
Makronisos	Makronisos CY0003100000000018	Agia Napa CY_24-C3	Partly Agia Thekla-Liopetri SPA CY3000009
Faros Paphou	Faros CY000600000000134A	Next to Pafos city CY_7-C1-HM	Faros Kato Pafou CY4000013
Semi-urban beaches			
Governor's beach Pentakomo	Governor's beach CY0005126000000066	Next to Vasilikos Port EAC CY_17-C2_S1/PS	-
Semi-rural beaches			
Limni Argaka	-	Chrysochou Bay North CY_3-C2	Polis-Gialia SCI CY4000001
Remote/natural beaches			
Alykes-Airport	Airport CY0004000000000050	Larnaka West CY_19-C2	Alykes Larnakas SCI & SPA CY6000002
Lara	-	Akamas CY_5-C1	Lara-Toxeftra MPA

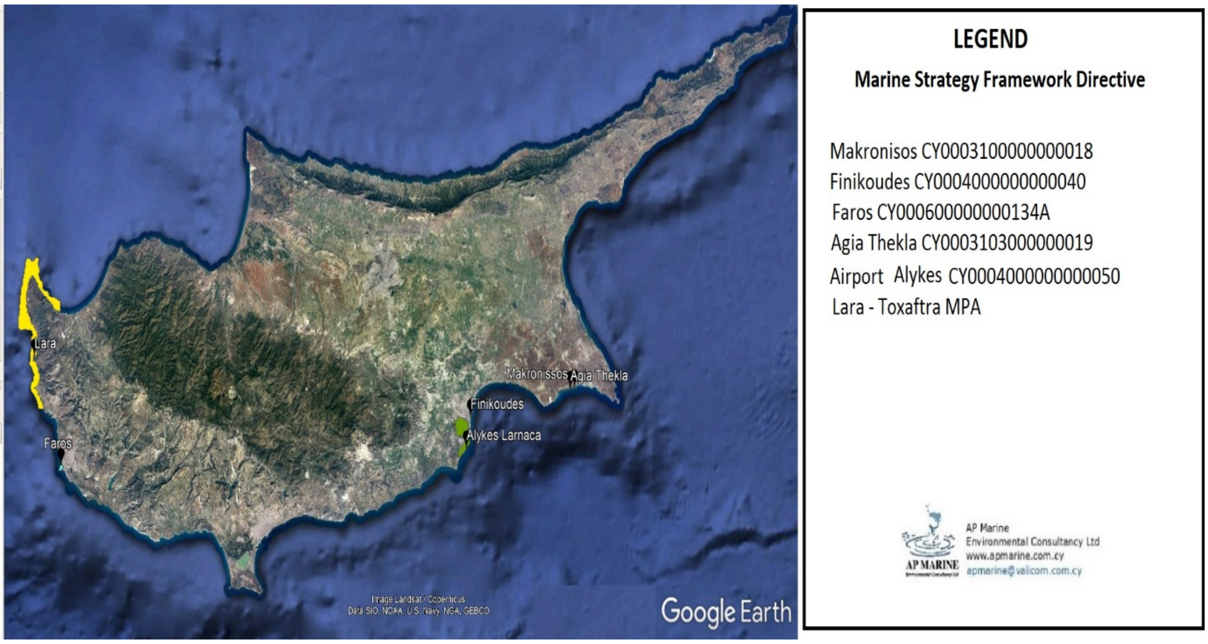

Figure 54 Map of selected beaches under MSFD.

The samplings are implemented by following the "Guidance on Monitoring of Marine Litter in European Seas" (2013), developed by the TSG-ML/JRC.

According to the survey results, that took place in March 2018, October 2018, December 2018 and April 2019, the dominant material type found on Makronissos, Alykes-Airport,Governor' s and Limni-Argaka beach was Plastic/Polystyrene (58.42%), while the second most abundant group of litter items found were Paper/Cardboard items (17.83%) (Figure 57).

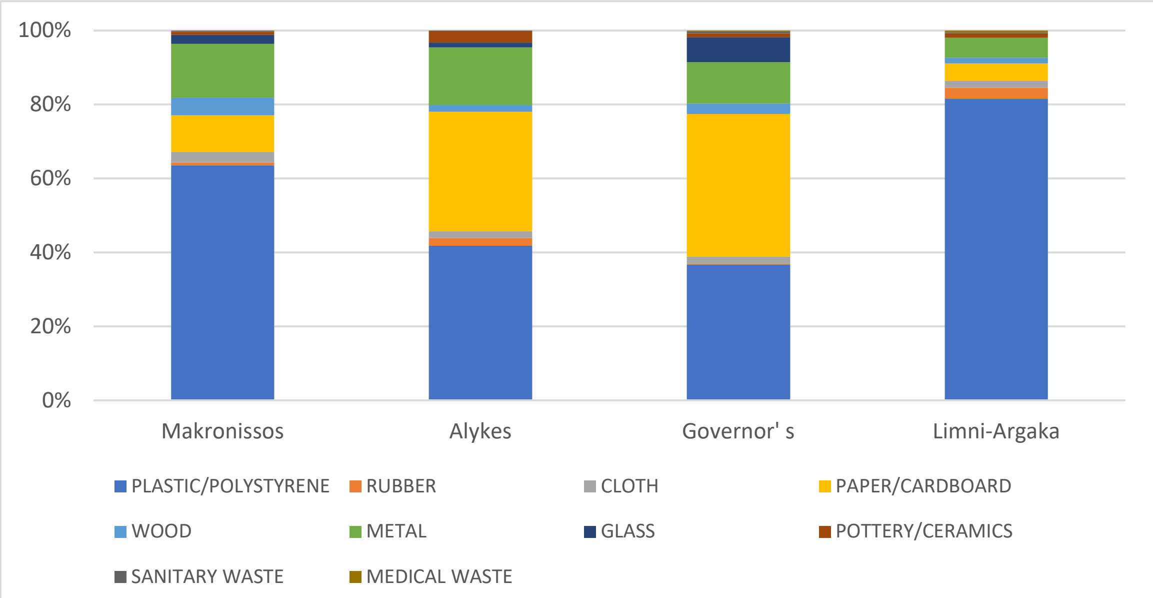

Figure 55 Percentage (%) of total litter items per category type (plastic/polystyrene, rubber, cloth, paper/cardboard, wood, metal, glass, medical waste, pottery/ceramics, sanitary waste) on Makronissos, Alykes, Governor' s and Limni beach.

Similar to the above, the dominant material type found on Faros Paphou beach and Lara beach, during March 2018, October 2018, December 2018 and April 2019 surveys, was Plastic/Polystyrene (58.75%), and Paper/Cardboard items (30.24%) (Figure 58).

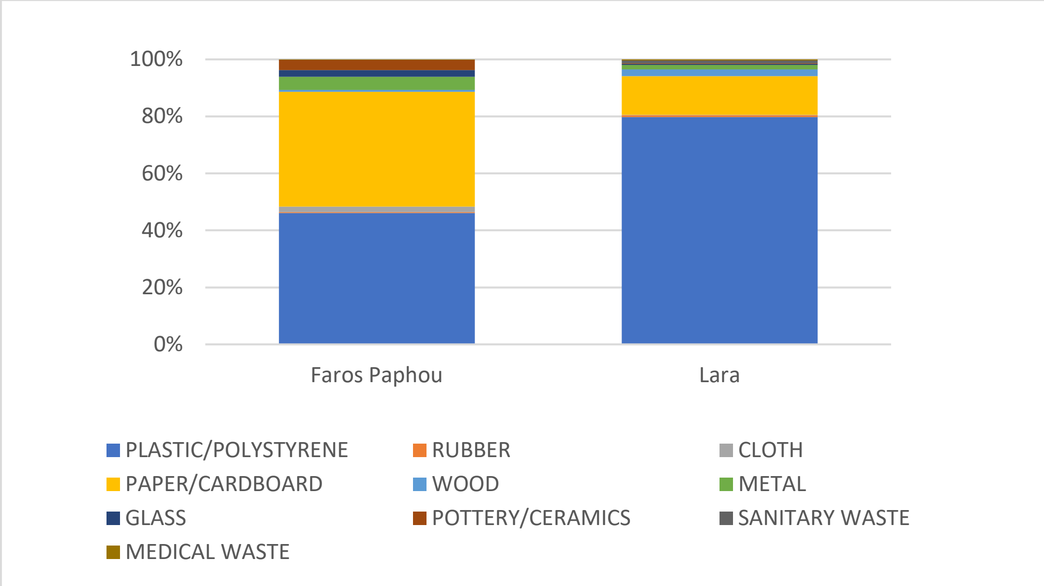

Figure 56 Percentage (%) of total litter items per category type (plastic/polystyrene, rubber, cloth, paper/cardboard, wood, metal, glass, medical waste, pottery/ceramics, sanitary waste) on Faros Paphou and Lara beach.

Additional Data on Beach Marine Litter Assessments

BLUEISLANDS is an Interreg Mediterranean project, co-financed by the European Regional Development Fund, coordinated by the Ministry of Agriculture, Rural Development and Environment of Cyprus that aims to identify, address and mitigate the seasonal variation of waste generated on Mediterranean islands as an effect of tourism by assessing the seasonal dynamics of marine litter in high touristic coastal areas.

A total of 8 islands from the Mediterranean Sea are involved including Cyprus. For each island, 3 specific beaches have been monitored for marine litter during low and high seasons.

For Cyprus, the following beaches were chosen: urban beach Sunrise, a touristic beach located in the Municipality of Protaras in the southwestern side of Cyprus, semi-urban beach Faros, mainly used by locals, located in the municipality of Perivolia in the south eastern of Cyprus and the semi-rural beach Timi, a remote beach, located in the Municipality of Timi in the southwestern side of Cyprus.

For each selected beach, a fixed 100 m stretch of beach was defined and has been periodically monitored for marine litter: once a month during the high touristic season (May- September) and one time before (February – April) and after (October – November) the high season. During the surveys, all the items with an anthropogenic origin were collected, counted and characterized.

Overall, 21 marine litter surveys were conducted in Cyprus in 2017 and have revealed that:

- The touristic beach of Sunrise is the most affected by the marine litter (5813 items collected; average: 830.4 items/survey), followed by the beach of Faros, mainly used by locals (2689 items collected; average: 384.1 items/survey) and the remote beach of Timi (2070 items collected; average: 295.7 items/survey).
- The items collected are mainly composed of artificial polymer materials: they represent 93.22% (Sunrise), 93.87% (Faros) and 89.44% (Timi) of the total marine litter items collected.
- On the touristic beach of Sunrise, 4 items (cigarette butts, cutlery/trays/straws, cups and caps/lids), most likely related to tourism and recreational activities, are representing 23.95% of the total marine litter items collected. To this, can possibly be added 3 items (mesoplastics, microplastics and other paper items), accounting for additional 43.71% as they presented a recognizable seasonal variation.
- On the beach of Faros, mainly used by locals, 4 items (cigarette butts, cutlery/trays/straws, caps/lids and drink cans), most likely related to tourism and recreational activities, are representing 22.41% of the total marine litter items collected. To this, can possibly be added 3 items (mesoplastics, microplastics and other plastic/polystyrene items), accounting for additional 64.39% as they presented a recognizable seasonal variation.
- On the remote beach of Timi, 4 items (caps/lids, drink bottles, cigarette butts and cups), most likely related to tourism and recreational activities, are representing 8.88% of the total marine litter items collected. To this, can possibly be added 4 items (mesoplastics, microplastics, macroplastics and other plastic/polystyrene items), accounting for additional 73.93% as they presented a recognizable seasonal variation.
- The cleanliness of the beaches (Clean-Coast Index – CCI) is considered as moderate/moderate for the low/high season in Sunrise (CCI of 7.8/7.5), very clean/very clean for the low/high season in Faros (CCI of 1.4/1.9) and very clean/clean for the low/high season in Timi (CCI of 1.95/2.8).

Furthermore, cleanup campaigns were organized over the summers of 2016 and 2017 on nine Blue Flag beaches around the island of Cyprus (Loizidou et al, 2018). The cleanups were organized after the beaches were cleaned by the responsible authorities. The aim was to see if the regular beach cleanups by local authorities is efficient and what is left on a clean beach.

The top ten list of identifiable collected litter by number was made up of cigarette butts (n = 4552; 59.4%), food wrappers (n =452; 5.9%),straws (n = 434; 5.7%), plastic bottle caps (n = 124; 1.6%), other plastic or foam packaging (n = 119; 1.6%), beverage cans (n = 80, 1.0%), metal bottle caps (n = 70; 0.9%), plastic grocery bags (n = 63; 0.8%), balloons (n = 63; 0.8%), and plastic cups and plates (n = 55; 0.7%).

The results suggest that local authority cleanup efforts are quite successful at collecting larger pieces of marine litter, leaving the beach seemingly clean. However, small pieces of litter, such as cigarette butts and small pieces of plastic items related to recreational activities, remain on the beach. These items are probably never removed and most likely accumulate or are buried overtime, with some items becoming a nuisance to beachgoers and a potential source of marine litter.

3.8.2 D10C1 Composition, amount and spatial distribution of litter and D10C2 micro-litter

Through BLUEISLANDS project a special attention is paid to both the microplastics (<5mm) and macroplastics (>5mm, including mesoplastics: 0.5cm – 2.5cm), in highly touristic coastal areas. According to the results of the project, the marine litter items collected on the beach of Sunrise is dominated by the mesoplastics (34.31%), followed by the cigarette butts (19.88%). Microplastics account for 8.05% of the total marine litter items collected.

Similar on Faros beach, the marine litter items collected is dominated by the mesoplastics (53.16%) followed by the cigarette butts (17.17%). The microplastics account for 10.48% of the total marine litter items collected.

Finally, on the remote beach of Timi, the marine litter items collected is dominated by the mesoplastics (55.05%) followed by the microplastics with 15.73% of the total marine litter items collected.

These items can be attributed to the shoreline source, including poor waste management practices, tourism and recreational activities, presenting a clear seasonal pattern.

Another study conducted in Cyprus concerning microplastic pollution (Duncan, 2018), took place in 17 nesting sites for loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*). Microplastics (< 5 mm) were found at all locations and depths, with particularly high abundance in superficial sand. The top 2 cm of sand presented grand mean ± SD particle counts of 45,497 ± 11,456 particles m^{-3} (range 637–131,939 particles m^{-3}). The most polluted beaches were among the worst thus far recorded, presenting levels approaching those previously recorded in Guangdong, South China. Microplastics decreased with increasing sand depth but were present down to turtle nest depths of 60 cm (mean 5,325 ± 3,663 particles m^{-3}. Composition varied among beaches but hard fragments (46.5 ± 3.5%) and pre-production nurdles (47.8 ±

4.5%) comprised most categorised pieces. Particle drifter analysis hind cast for 365 days indicated that most plastic likely originated from the eastern Mediterranean basin. Worsening microplastic abundance could result in anthropogenically altered life history parameters such as hatching success and sex ratios in marine turtles.

The following criteria have not yet been assessed. The monitoring programmes are expected to start in 2020.

3.8.3 D10C3 Amount of ingested litter and micro-litter

The monitoring programmes are expected to start in 2020.

3.8.4 D10C4 Number of individuals adversely affected by litter

The monitoring programmes are expected to start in 2020.

3.9 Descriptor 11: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

Cyprus waters are currently not in GES with respect to underwater noise.

3.9.1 D11C1 Spatial distribution, temporal extent and level of impulsive sound

Acoustic surveys for cetaceans reviewed in the Second Assessment indicated that sounds by military sonar and seismic airguns used in oil and gas surveying were detectable throughout the surveyed time period, at levels that constitute a threat to many marine organisms and especially cetaceans.

3.9.2 D11C2 Spatial distribution, temporal extent and level of continuous low-frequency sound

The same surveys also documented excessive ambient low-frequency noise, typical of shipping activity, throughout the study period, perhaps exacerbated by high speeds, constituting a threat to many marine organisms and especially cetaceans.

4 PART II Criteria and methodological standards, specifications and standardised methods for monitoring and assessment of essential features and characteristics and current environmental status of marine waters under point (a) of Article 8(1) of Directive 2008/56/EC

4.1 Species groups of birds, mammals, reptiles, fish and cephalopods (relating to Descriptor 1)

Details on efforts to evaluate criteria relating to the conditions of the populations and habitats of the above groups have been described extensively in the Second Assessment report, and the key points are summarized below. At this stage, these criteria relating to descriptor 1 cannot be conclusively evaluated for these important species groups.

While wetland birds are systematically monitored by government departments and non-governmental organizations, surveys of coastal birds are sporadic and don't allow for accurate population size estimates, and distribution range definitions may be biased by observer preferences. Surveys of offshore birds are rare and opportunistic.

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. A recent acoustic and visual marine mammal survey collected acoustic data from 6183 km and visual data over 3928 km, and registed a total of 27 sightings, corresponding roughly to 0.08 groups per 100 km (Boisseau et al. 2017). Strandings and bycactch are fairly rare. Based on government data, 15 *Tursiops truncatus* strandings have been documented from 1993 to 2014 and seven were reported as bycatch from 1998 to 2013 in fishing nets.

Regarding the Mediterranean monk seal, *Monachus monachus*, the government has instituted an observation program and additional research programs to characterize the population and to map its distributional range. At present, 14 individuals have been recorded, five of which have been born since 2011, using sea caves for reproduction and resting. In that direction, a marine protected area in Peyia has been established to protect a key species habitat.

The two sea turtle species actively nesting in Cyprus, *Caretta caretta* and *Chelonia mydas*, have been extensively protected and monitored for decades, and laws and regulations are in place to protect specific nesting sites during nesting months. Population sizes, inferred from nesting activity, have recorded significant increases in recent years, continuing a trend that has become particularly evident in the past two decades.

Regarding impacts of human activites on the above, Michailidis et al. (2019), using a trophic mass-balance model of the insular shelf ecosystem, determined that fishing has noticeable impacts on the ecosystem, especially on small sharks and turtles in the case of small-scale fisheries and on large demersal and pelagic fishes in the case of recreational fisheries.

4.2 Pelagic habitats (relating to Descriptor 1)

4.2.1 D1C6 Adverse effects from anthropogenic pressures on pelagic habitats

The extent of pelagic habitats adversely affected by human activity (in either areal or three-dimensional metrics) is currently not known. Permanent alteration of the seafloor (D6) and changes in hydrographical conditions (D7) have relatively limited extent. Values for some eutrophication properties (D5) are suggestive of human activity but contaminant levels in water, sediment and biota (D8 and D9) are fairly low. Low spatial extent of activity and few impacted indicators are suggestive of relatively healthy pelagic habitats.

4.3 Benthic habitats (relating to Descriptors 1 and 6)

4.3.1 D6C4 Extent of benthic habitat loss from anthropogenic pressures

This criterion cannot be evaluated at present.

4.3.2 D6C5 Adverse effects from anthropogenic pressures on benthic habitats

The marine environment of Cyprus is considered to be in good environmental status by the year 2020 if the structure and function of the ecosystem are safeguarded and not adversely affected. Specifically, diversity and productivity are maintained, and any pressures do not hinder the ecosystem components to recover and/or retain their natural diversity, productivity and dynamic ecological processes.

With the current data availability, or rather the lack thereof, the determination of the GES of this criterion relies heavily on the various multimetric indices that have been developed in the framework of the Water-Framework Directive (2000/60/EC) for angiosperms, macroalgae and macrobenthos. The overall weighed value calculated from selected indicators from Descriptor 1 (the method is shown below and in

Table 16), is 0.9. Therefore, this criterion is assigned a value of 0.9, concluding that Cyprus waters are in GES with regards to benthic habitats.

4.3.3 Type, abundance, biomass and areal extent of relevant biogenic substrate

The total areal coverage of most relevant habitats, abundance, biomass, and other metrics of key species, are currently not known. The current effort to map *Posidonia* meadows could constitute a model on which to base the mapping of many of these other habitats and to thus achieve a quantitative measure of their areal coverage.

As is evident from the Initial Assessment, knowledge of important habitats, especially of the benthos, is heavily skewed in favor of shallow water habitats. Various deep-sea habitats may exist that significantly enrich the habitat, community, and species diversity of Cyprus. For example, deep-water corals and fauna associated with reducing, chemosynthetic communities are known to exist and have been documented in the literature (Galil and Zibrowius 1998, Mayer *et al.* 2011) but their extent and condition is a major unknown.

According to the study of Pergent-Martini *et al.* (2013), the *Posidonia oceanica* meadows that covered between 10 and 50% are mostly located on the northwestern coast and the southeast coast and the most extensive coverage (>50%) is rather rare and observed on the eastern part. In Limassol and Vasilikos bay, *Posidonia oceanica* meadows are mainly found on sandy bottom in shallow waters with a limited percentage of cover (Pergent-Martini *et al.* 2013). Although the estimation of extent (the area of the habitat type) and the distribution (the pattern of the habitat across the area of interest) of this habitat have been recently initiated this index was assigned as 1.

The ecotope “Reefs” is dominant in several sites in the shallow water, e.g. Nisia site and eastern part of Cape Greco (Pergent-Martini *et al.* 2013). From 34m depth, some sparse rhodoliths of the calcareous corallinaceae *Lithophyllum corallioides*, *Phymatolithon calcareum* and *Mesophyllum alternans* forming the “maërl” facies of the coastal detritic bottoms, appear.

Since the magnitude of the areal extent of the major biogenic habitats of Cyprus, as well as the biomass and abundance of the major species, cannot be currently estimated, we can only qualitative determine these indicators. Specifically, based on the latest audit for the management of Marine Protected Areas in Cyprus (DFMR, 2018), the conservation status (structure and function) of these two marine habitat types is favorable and as a result this index was assigned a 1.

4.3.3.1 Extent of the seabed significantly affected by human activities for the different substrate types

As mentioned above, while the total area of the seabed directly impacted by various human activities could potentially be quantified, both the indirectly impacted area as well as the effects on distinct biogenic substrates/habitats cannot be estimated at this point. Therefore, the determination of this indicator is not currently feasible.

4.3.4 Condition of benthic community

Due to the implementation of the Water-Framework Directive (2000/60/EC) in the coastal waters of Cyprus, a number of indices exist which describe the condition and function of the angiosperm, macroalgal and macrobenthic communities in these waters. Therefore, and while the presence and condition of particularly sensitive and/or tolerant species, as well as length/size distribution data of macrobenthic populations are currently not collected, this criterion can be determined with relevant confidence, at least for the coastal waters, and can be used to describe the condition of the benthic community.

4.3.4.1 Presence of particularly sensitive and/or tolerant species (ESG I)

The temporal and spatial variation of % coverage of ESG I seaweeds in the coasts of Cyprus is shown in Table 15. Coefficient of Variance % of the coverage of late-successional seaweeds (ESG I) in Cyprus coasts was 45% this index was assigned a 0.75.

4.3.4.2 Abundance of opportunistic macroalgae (ESG II)

The temporal and spatial variation of % coverage of ESG II seaweeds in the coasts of Cyprus is shown in Table 15. Coefficient of Variance % of the coverage of opportunistic seaweeds (ESG II) in Cyprus coasts was 108% this index was assigned a 0.25.

4.3.4.3 Multi-metric indexes assessing benthic community condition and functionality, such as species diversity and richness, proportion of opportunistic to sensitive species

Multimetric indices have been and are continuously determined in the framework of the implementation of the Water-Framework Directive (2000/60/EC) in coastal waters of Cyprus.

Table 15 Spatio-temporal variation of % coverage of late-successional (ESG I) and opportunistic seaweeds (ESG II) and Ecological Evaluation Index (EEI) in Cyprus coastal waters studied within WFD program (DFMR 2019).

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

4.3.4.3.1 Ecological Evaluation Index (EEI)

EEI was implemented in the framework of the implementation of the Water-Framework Directive (2000/60/EC) in the coastal waters of Cyprus in five differently impacted sites of the rocky Cyprus coasts (Table 15). Since the CV% of Cyprus coasts EEI values was 8.85% this index was assigned a 1.

4.3.4.3.2 PREI (Posidonia)

PREI was implemented in three differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program (

Table 17) (DFMR, 2019). Since the CV% of Cyprus coasts PREI values was 5.9% this index is assigned a 1.

4.3.4.3.3 BENTIX

BENTIX was implemented in eight differently impacted sites across the sedimentary coasts of Cyprus within the WFD monitoring program from 2011 to 2016 (Table 18) (DFMR, 2019). Since the Coefficient of Variance (CV)% of Cyprus coasts BENTIX values from reference conditions was 16,8% this index is assigned a 1.

4.3.4.4 Proportion of biomass or number of individuals in the macrobenthos above some specified length/size

Macrobenthos length/size distribution data are currently not collected.

Parameters describing the characteristics (shape, slope and intercept) of the size spectrum of the benthic community

Macrobenthos length/size distribution data are currently not collected.

4.3.5 Final environmental status value for Descriptor 6

According to the 2019 assessment, GES is achieved with respect to benthic habitats (Table 16).

Table 16 Environmental status assessment of Cyprus marine waters for benthic habitats.

Indicator	Value	Weight	Status value
Coverage of *Posidonia* meadows	1	0.1	0.1
Coverage of the ecotope "Reefs"	1	0.1	0.1
Abundance of perennial seaweeds (ESG I)	0.75	0.1	0.075
Abundance of opportunistic macroalgae (ESG II)	0.25	0.1	0.025
EEI-c (macroalgae)	1	0.2	0.2
PREI (*Posidonia*)	1	0.2	0.2
BENTIX (zoobenthos)	1	0.2	0.2
	Sum	1	0.9

Table 17 Results of the WFD monitoring program of *Posidonia oceanica* meadows in Cyprus (Source: DFMR, 2019)

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

Table 18 Spatial variation of zoobenthos (BENTIX) indices in Cyprus sedimentary coasts monitored during WFD program (DFMR, 2019).

Stations	Year	Confidence Level	GS(sensitive)	GT(tolerant)	Bentix	Classification
CY_05-C2-S1 (Latsi)	2011	√	36.77%	62.50%	3.46	GOOD
	2015	√	30.07%	69.93%	3.20	GOOD
CY_12-C2 (Lady's Mile)	2015	√	40.56%	59.44%	3.62	GOOD
CY-13-C2 (Limassol)	2013	√	37.05%	62.95%	3.48	GOOD
	2015	√	19.26%	80.00%	2.76	MODERATE
CY-14-C2 (Vasilikos)	2014	√	59.14%	40.86%	4.37	HIGH
	2015	√	29.20%	70.80%	3.17	GOOD
CY-15-C2 (Zygi)	2015	√	36.51%	63.49%	3.46	GOOD
CY_16-C2 (Larnaca W)	2015	√	32.53%	67.47%	3.30	GOOD
	2016	√	31.60%	68.40%	3.26	GOOD
CY_18-C2 (Larnaca N/E)	2015	√	25.57%	73.97%	3.01	GOOD
	2016	√	27.86%	72.14%	3.11	GOOD
CY_24-C2-S1 (Ayia Napa)	2014	√	71.39%	28.61%	4.86	HIGH
CY_25-C3 (Cavo Gkreko)	2012	√	54.95%	44.80%	4.19	HIGH
	2014	√	46.08%	53.16%	3.83	GOOD
CY_25-C2 (Cavo Gkreko)	2014	√	65.58%	33.85%	4.61	HIGH

4.4 Ecosystems, including food webs (relating to Descriptors 1 and 4)

The marine environment of Cyprus is considered to be in good environmental status by the year 2020 if all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

Apart from top predators, groups of interest with regards to this indicator are groups with fast turnover rates (e.g. phytoplankton, zooplankton) that respond quickly to ecosystem change and are useful as early warning indicators. Apart from mesozooplankton, the food web structure of any of the key habitats of the marine environment of Cyprus has only recently begun to be studied. Michailidis et al. (2019) developed a trophic mass-balance model to describe the structure and functioning of the insular shelf ecosystem, specifically addressing impacts of fishing and alien species over the last decade. They defined 40 functional groups, ranging from producers and detritus to top predators and alien species, when possible. They considered all fishing activities in the area and used data from local surveys, fishery statistics, published data on stomach content analyses, other scientific and grey literature, as well as empirical equations. Their findings suggest that the insular shelf ecosystem of Cyprus shares structural and functional characteristics with other Mediterranean ones, especially those of the eastern basin. However, fishing has noticeable impacts on the ecosystem, especially on small sharks and turtles in the case of small-scale fisheries and on large demersal and pelagic fishes in the case of recreational fisheries. The model also predicts negative impacts of alien fish, which accoung for 29% of fish production.

While this modeling study provides important directions for future field investigations and modeling exercises, an evaluation of this descriptor cannot be conclusively completed.

4.4.1 Productivity (production per unit biomass) of key species or trophic groups

Performance of key predator species using their production per unit biomass (productivity)

The determination of this indicator is not currently feasible.

4.4.2 Proportion of selected species at the top of food webs

4.4.2.1 Large fish (by weight)

The determination of this indicator is not currently feasible.

4.4.3 Abundance/ distribution of key trophic groups/species

4.4.3.1 Abundance trends of functionally important selected groups/species

With the current data availability, phytoplankton communities across the Cyprus coasts can only be determined through their biomass expressed as chlorophyll a concentration (μg/l 90%ile). These measurements derived from the WFD monitoring program (Aplikioti *et al.* 2017, DFMR 2019). Specifically, 8 water bodies were monitored the period 2014-2016 and the Coefficient of Variance % (CV%) of the chl a concentration was 70% and as a result this index is assigned a 0.5.

Mesozooplankton influence numerous aspects of ecosystem function in the Mediterranean Sea. It has a significant grazing impact on phytoplankton and microzooplankton, modulate the response of the microbial food web to nutrient availability and is the major prey of small pelagic fish. A comprehensive study of mesozooplankton abundance and biomass and also its seasonal and spatial variability was conducted by Hannides *et al.* (2015a, 2015b). During these studies 5 stations across the coastline of Cyprus were sampled. The CV% of the mesozooplankton abundance across the Cyprus coasts was 29.7% and as a result this index is assigned a 0.75.

Nevertheless, as it has been mentioned previously, the GES with regards to Descriptor 4 cannot be conclusively stated using only the indicators of phytoplankton and mesozooplankton.

4.5 References

Abu-Hilal, A.H., Al-Najjar, T. (2009). Litter pollution on the Jordanian shores of the Gulf of Aqaba (Red Sea). Mar. Environ. Res. 58, 39–63.

Aplikioti M, Markou M, Stavrou P, Antoniadis K, Vasileiou E, S M, Iosifidis M, Argyrou M (2017) Report on the Monitoring Programme of coastal waters as per article 8 of the Water Framework Directive (WFD, 2000/60/EC) for the period 2011-2014. DFMR, Cyprus

Argyrou, M., Antoniadis, C.D., Aplikioti, M., Demetriou, E., Ioannou-Kakouri, E., Stamatis, N. and Orfanidis, S. (2012) Concentration levels of heavy metals in water column, sediment and fish in Cyprus (in Greek). In: *Proceedings of the Tenth Hellenic Symposium in Oceanography & Fisheries*. Presented at the Tenth Hellenic Symposium in Oceanography & Fisheries.

Bauer, L.J., Kendall, M.S., Jeffrey, C.F.G., (2008). Incidence of marine debris and its relationships with benthic features in Gray's Reef National Marine Sanctuary, Southeast USA. Mar. Pollut. Bull. 56, 402–413.

Badts V., & F. Galgani, (2012). Procédure pour l'observation des macro déchets au cours des campagnes halieutiques", version 1.0 (2012) (Ifremer).

Boisseau, O., Frantzis, A., Petrou, A., van Geel, N., McLanaghan, R., Alexiadou, P. & Moscrop, A. 2017. Visual and passive acoustic survey report. Report submitted to the Department of Fisheries and Marine Research by the AP Marine Environmental Consultancy Consortium: 49 pages.

Buzzurro G, Greppi E (1997) Notes on the molluscs of Cyprus, with special attention to the allochthone species. *La Conchiglia* 283: 21-31 & 61-62.

Cecalupo A, Quadri P (1996) Contributo alla conoscenza malacologica per il nord dell' isola di Cipro (parte III). *Bollettino Malacologico* 31:95-118.

Cirik S, Aysel V, Benli HA, Cihangir B, Unluoglou A (2000) Preliminary studies on the marine vegetation of Northern Cyprus. *Turkish Journal of Marine Sciences* 6:31-40.

Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006R1881-20150731&from=EN

Derraik, J.G.B. (2002). The pollution of the marine environment by plastic debris: a review. Mar. Pollut. Bull. 44: 842–852.

DFMR (2012) DFMR (2012) Initial Assessment of the Marine Environment of Cyprus, Department of Fisheries and Marine Research, Nicosia, Cyprus, pp. 273

DFMR (2018) Baseline survey and monitoring of non-indigenous species in Cavo Greco and Nisia Marine Protected Areas in Cyprus, Final Report, Prepared by Marine & Environmental Research Lab Ltd & AP Marine Environmental Consultancy Ltd, November 2018, 176 pp.

DFMR 2019. Internal database of water quality monitoring data, Personal Communication.

EEA, 2010. Annual report 2010 Environmental statement.

Elliott M, Borja Á, McQuatters-Gollop A, Mazik K, Birchenough S, Andersen JH, Painting S, Peck M (2015) Force majeure: Will climate change affect our ability to attain Good Environmental Status for marine biodiversity? Mar Pollut Bull 95:7–27

European Union, 2010. Marine Litter: Time To Clean Up Our Act. http://ec.europa.eu/environment/marine/pdf/flyer_marine_litter.pdf

Froese, R., Demirel, N., Coro, G., Kleisner, K.M., and Winker, H. (2016a) Estimating fisheries reference points from catch and resilience. Fish and Fisheries 18(3): 506-526. (http://oceanrep.geomar.de/33076/;see also http://www.fishbase.de/rfroese/Appendix_4.pdf).

Froese, R., Garilao, C., Winker, H., Coro, G., Demirel, N., Tsikliras, A., Dimarchopoulou, D., Scarcella, G. and Sampang-Reyes, A. (2016b) Exploitation and status of European stocks. World Wide Web electronic publication (http://oceanrep.geomar.de/34476/).

Hannides CCS, Siokou I, Zervoudaki S, Frangoulis C, Lange MA (2015) Mesozooplankton biomass and abundance in Cyprus coastal waters and comparison with the Aegean Sea (eastern Mediterranean). Mediterr Mar Sci 16:373

Hannides CCS, Zervoudaki S, Frangoulis C, Lange MA (2015) Mesozooplankton stable isotope composition in Cyprus coastal waters and comparison with the Aegean Sea (eastern Mediterranean). Estuar Coast Shelf Sci 154:12–18

ICCAT, 2016. https://www.iccat.int/Documents/SCRS/ExecSum/SWO_ATL_ENG.pdf

ICCAT, 2017a. https://www.iccat.int/Documents/SCRS/ExecSum/ALB_ENG.pdf

ICCAT, 2017b. https://www.iccat.int/Documents/SCRS/DetRep/BFT_ASS_ENG.pdf

ICES. 2007. General Context of ICES Advice. Report of the ICES Advisory Committee, 2007. ICES Advice, 2007. Book 1, Section 1.2.

ICES. 2011. Report of the ICES Advisory Committee, 2010. ICES Advice, 2011. Book 1, Section 1.5.1.8.

ICES. 2012. Report of the Workshop 3 on implementing the ICES FMSY Framework (WKFRAME3), 9–13 January 2012. ICES CM 2012/ACOM:39.

ICES. 2012. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 1-IBTS VIII. 68 pp.

Galgani F., G. Hanke, S. Werner and H. Piha, (2011). Marine Litter Technical Recommendations for the Implementation of MSFD Requirement. MSFD GES Technical Subgroup Marine Litter. JRC Scientific and Technical Reports. EUR 25009 EN. ISSN 1831-9424. DOI 10.2788/92438: 93 pp.

Galgani F, Hanke G, Werner S, Oosterbaan L, Nilsson P, Fleet D, Kinsey S, Thompson RC, van Franeker J, Vlachogianni Th, Scoullos M, Veiga JM, Palatinus A, Matiddi M, Maes T, Korpinen S, Budziak A, Leslie H, Gago J, Liebezeit G., (2013). Guidance on Monitoring of Marine Litter in European Seas. Scientific and Technical Research series, Luxembourg: Publications Office of the European Union.

Galil, B., Zibrowius, H., 1998. First benthos samples from Eratosthenes Seamount, eastern Mediterranean. Senckenbergiana Maritima 28, 111–121. doi:10.1007/BF03043142

GFCM, 2016. Stock assessment of *Spicara smaris* in GSA 25. WGSAD – GFCM – FAO. https://gfcmsitestorage.blob.core.windows.net/documents/SAC/SAFs/DemersalSpecies/2014/SPC_GSA_25_2014_CYP.pdf

GFCM, 2016. Stock assessment of *Mullus barbatus* in GSA 25. WGSAD – GFCM – FAO. https://gfcmsitestorage.blob.core.windows.net/documents/SAC/SAFs/DemersalSpecies/2015/MUT_GSA_25_2015_CYP.pdf

GFCM, 2017. Stock assessment of *Boops boops* in GSA 25. WGSAD – GFCM – FAO. https://gfcmsitestorage.blob.core.windows.net/documents/SAC/SAFs/DemersalSpecies/2016/BOG_GSA_25_2016_CYP.pdf

GFCM, 2017. Stock assessment of *Mullus surmuletus* in GSA 25. WGSAD – GFCM – FAO. https://gfcmsitestorage.blob.core.windows.net/documents/SAC/SAFs/DemersalSpecies/2016/MUR_GSA_25_2016_CYP.pdf

GFCM, 2018. Stock assessment of *Pagellus erythrinus* in GSA 25. WGSAD – GFCM – FAO. https://gfcmsitestorage.blob.core.windows.net/documents/SAC/SAFs/DemersalSpecies/2017/PAC_GSA_25_2017_CYP.pdf

Katsanevakis, S., Katsarou, A., (2004). Influences on the distribution of marine debris on the seafloor of shallow coastal areas in Greece (eastern Mediterranean). Water Air Soil Pollut. 159, 325–337.

Mayer, L., Croff Bell, K.L., Ballard, R., Nicolaides, S., Konnaris, K., Hall, J., Tibor, G., Austin, J.A. and Shank, T. (2011) Discovery of sinkholes and seeps on Eratosthenes Seamount. *Oceanography*, 24: 28–29.

MEDITS 2018. Mediterranean International bottom Trawl Survey in the Cyprus Republic coastal area report.

MELTEMI 2019. MarinE litter transnational LegislaTion EnchaceMent and Improvement project. Marine litter unpublished data.

Michailidis N, Corrales X, Karachle PK, Chartosia N, Katsanevakis S, Sfenthourakis S (2019) Modelling the role of alien species and fisheries in an Eastern Mediterranean insular shelf ecosystem. *Ocean and Coastal Management*, 175: 1152-171.

Monitoring Guidance for Marine Litter in European Seas 2013. MSFD GES Technical Subgroup on Marine Litter (TSG-ML).

OSPAR 2009. Marine litter in the North-East Atlantic Region: Assessment and priorities for response. London, United Kingdom.

Pagou, K., Siokou-Frangou, I. & Papathanassiou, E. (2002). Nutrients and their ratios in relation to eutrophication and HAB occurrence. The case of Eastern Mediterranean coastal waters. 2nd Workshop on "Thresholds of Environmental Sustainability: The case of nutrients", 18-19/6/2002, Brussels.

Pergent-Martini C, Bonacorsi C, Bein A, Kremmer L, Braschi J, Pergent G (2013) Mapping of coastlines of the Republic of Cyprus Final report – April 2013.

Serena F., A.J Abella., R.T.Baino, E. Cecchi, M. Ria , R. Silvestri & A. Voliani, (2011). Anthropogenic waste in the Marine Ecosystem. Biol. Mar. Mediterr. 18 (1): 161-164.

Tornero, V., Hanke, G., and the MSFD Expert Network on Contaminants. Marine chemical contaminants – support to the harmonization of MSFD D8 methodological standards: Matrices and threshold values/reference levels for relevant substances. EUR (where available), Publications Office of the European Union, 2019, ISBN 978-92-79-98395-5, doi 10.2760/052740, JRC114795.

UNEP/MAP 2015. Marine Litter Assessment in the Mediterranean. ISBN No: 978-92-807-3564-2.