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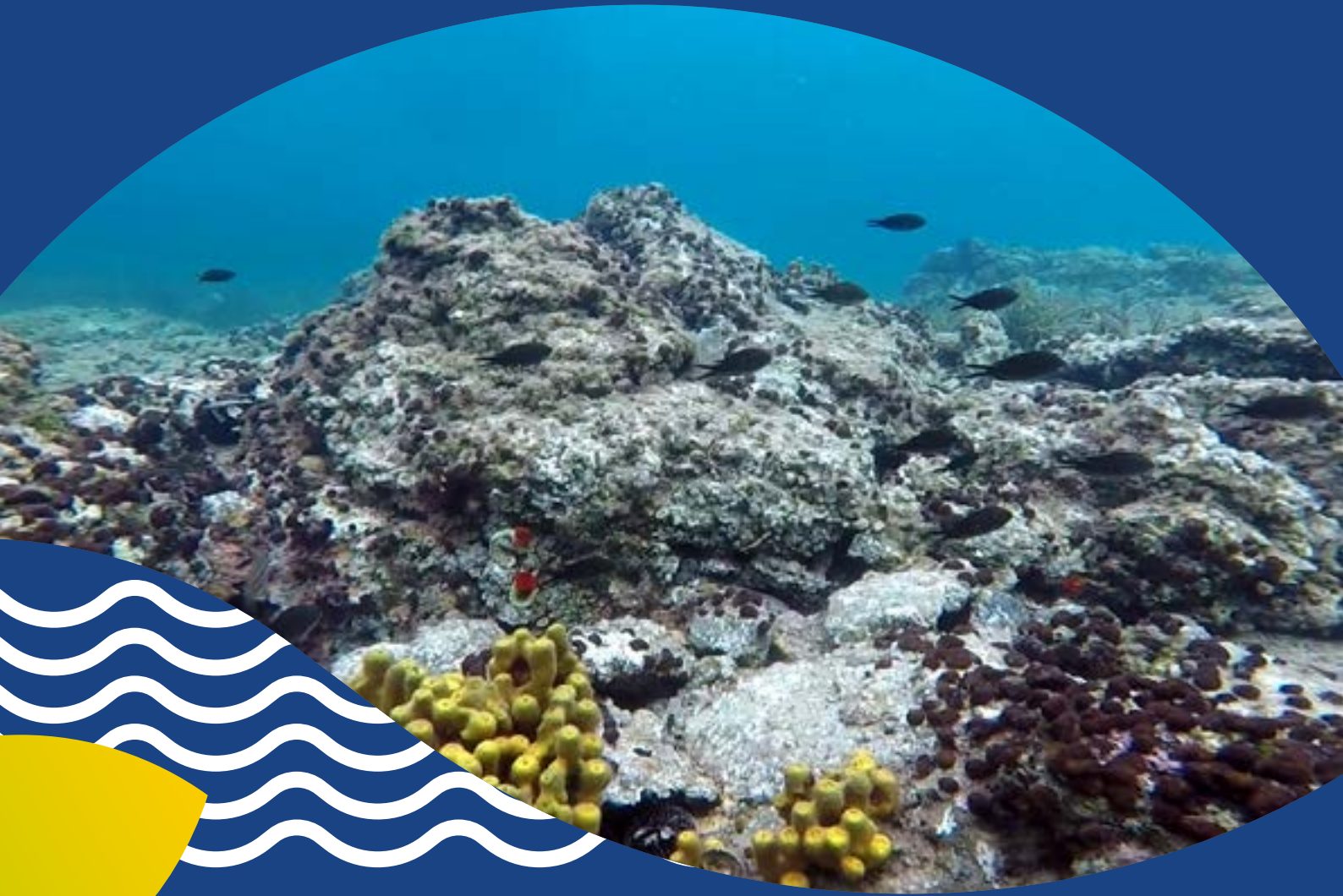


Mediterranean
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Mapping of marine key habitats and assessing their vulnerability to fishing activities

in Foça Special Environmental
Protection Area, Türkiye :
available knowledge and gap analysis





Mediterranean
Action Plan
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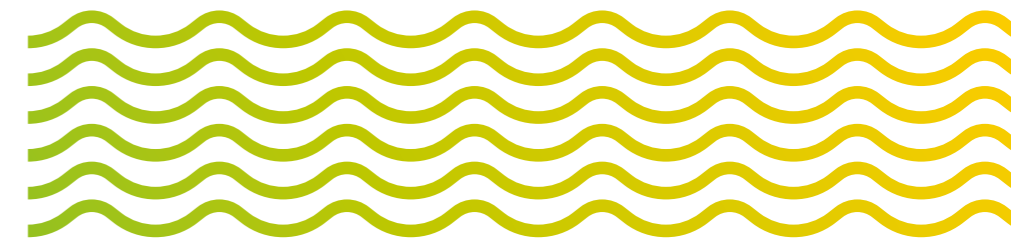


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1



1

INTRODUCTION

Coastal and marine ecosystems provide social and economic welfare as well as environmental benefits to humankind. However, these ecosystems face a variety of risks, become vulnerable and threatened by anthropogenic impacts throughout the world. In order to achieve sustainable use of these resources, several tools have been developed, one of which is marine and coastal protected areas (MCPA). The achievement of any MCPA depends on various components such as site planning and management issues, community engagement, protected area site selection criteria, and strategies and tools to be implied through institutional and legal frameworks as stated by Salm et al. (2000). In order to contribute to the appropriate management of Turkish MCPAs, one of the recent initiatives is the "Mapping of marine key habitats and assessing their vulnerability to fishing activities in Foça Special Environmental Protection Area, Türkiye" project.

The Specially Protected Areas Regional Activity Centre (SPA/RAC) and Dokuz Eylül University Institute of Marine Sciences and Technology (DEU-IMST) contracted on the abovementioned project, which is financed by MAVA Foundation within the framework of the MedKeyHabitats II Project. The major goals of this project are:

- To map and create spatial inventories of marine key habitats within 0-50 m depth range of Foça Special Environmental Protection Area (Türkiye), and
- To assess the vulnerability of these habitats to fishing activities within the study area.

In order to achieve these goals, six project objectives were determined and stated in the contract document as follows:

1. Conduct cartographic inventories of marine key habitats in the Foça Special Environmental Protection Area (SEPA) included within the 50 m bathymetry using side scan sonar;
2. Set up monitoring systems for *Posidonia* meadows
3. Conduct a socio-economic fisheries study on the importance, frequency and extent of professional fishing practices and illegal fishing practices in the study area and their impacts on marine habitats;
4. Assess the sensitivity of marine habitats to regulatory and/or non-regulatory fishing activities identified in the study area;
5. Develop management recommendations for the study area;
6. Provide on-the-job training of representatives of the Ministry of Environment and Urbanisation, universities, NGOs on the techniques used and the methodology of the work adopted.

By achieving these objectives, it is aimed to increase scientific knowledge and technical capacity in the Foça SEPA by 1) developing a Geographic Information System (GIS)-based spatial inventory of marine key habitats for the first time in Turkish MCPAs, 2) assessing marine habitat-fisheries interactions with quantification of fisheries impacts for the first time in Turkish MCPAs, and 3) making contributions to the management of the Foça SEPA by management recommendations according to the results of the project and by providing an on-the-job training to the representatives of several governmental and non-governmental institutions.

The project comprises of three phases as mentioned in the Contract N° 03/SPA/RAC_2019 MedKeyHabitats document:

- **Phase I** : Available knowledge and gap analysis,
- **Phase II** : Field work,
- **Phase III** : Restitution phase

This report is prepared as the Phase I Report of the "Mapping of marine key habitats and assessing their vulnerability to fishing activities in Foça Special Environmental Protection Area, Türkiye" project, and includes the following sections:

- 1. INTRODUCTION:** This section includes a general information on the project with its scope and the study area Foça SEPA.
- 2. AVAILABLE KNOWLEDGE AND GAP ANALYSIS:** In this section, we present a gap analysis of Foça SEPA within the scope of the project goals and objectives.

1.1. Scope of the Project

The scope of the "Mapping of marine key habitats and assessing their vulnerability to fishing activities in Foça Special Environmental Protection Area, Türkiye" project according to the abovementioned goals and objectives are as follows:

1. To obtain available knowledge and perform a gap analysis for the Foça SEPA within the scope of the project
 - Stakeholder involvement and awareness visits
 - Institutional data collection in the scope of the project objectives
 - Literature review
 - Analysis of both institutional data and literature
2. To determine spatial distribution of habitats
 - Geophysical survey (single beam echosounder bathymetry)
 - Side scan sonar survey
 - Seabed sediment sampling
 - CTD measurements
3. To characterize habitats
 - Soft bottom survey
 - Hard bottom survey
 - Transect survey
 - Dropdown camera survey
 - Underwater visualization
4. To initiate a *Posidonia oceanica* monitoring network
5. To perform fish counting by underwater visual census
6. To provide on-job training for 6 representatives from the Ministry of Environment and Urbanization, Universities, NGOs on the different stages of this project

7. To identify and quantify spatial and temporal distribution of commercial fishing activities and unauthorised fishing in the Foça SEPA
 - Existing data
 - Fisheries questionnaire survey
8. To determine the nature of the interaction between rules-based and unauthorised fishing activities and key habitats, in order to measure the risks engendered by these activities
9. To compile Standard Data Form (SDF) for the study area (0-50 m isobaths zone of the Foça SEPA)
10. To develop a GIS spatial inventory of all scientific information on habitats, fisheries and habitat-fisheries interactions produced within the project.

1.2. Study Area: Foça SEPA

Foça is a touristic destination and one of the major fishing villages of the Turkish Aegean coast, located in the Izmir province. This peninsula is an important natural, cultural, historical and social site at the north-east edge of the Izmir Bay and includes one of the 11 coastal/marine SEPAs of Türkiye (Figure-1). It was declared as a SEPA in 1990 in order to protect Mediterranean monk seals (*Monachus monachus*) in the area, and was enlarged in 2007 to present borders (TVKGM, 2011).



Figure 1
Location of Foça SEPA (Basemap from Natural Earth database, <http://www.naturalearthdata.com>)

The Foça SEPA has a total area of 71.38 km², 50.54 km² of which is the marine component. The small archipelago within this coastal/marine part of the Foça SEPA is of high ecological significance. These coasts include caves and rocky shelters for the Mediterranean monk seal *Monachus monachus* (Güçlüsoy et al., 2004; Kaboglu, 2007), nesting sites on beaches or rocky areas for marine avifauna (Güçlüsoy et al., 2006; Döndüren, 2007) and marine area includes *Posidonia oceanica* meadows with a distribution of approximately 6.7 km² (Güçlüsoy et al., 2006; Akçali et al., 2019).

On the other hand, the Foça SEPA is one of the major fishing villages along the Turkish Aegean coast, with the biggest trawl fleet (Tokaç, 2017), and a fleet of 313 (in 2010, 336 in 2019) artisanal fishing vessels (Tokaç et al., 2010) in the region. Other important coastal/marine human activities in the area are touristic tour boating (Kaboğlu, 2007; SAD, 2008) and recreational fishing (Tunca et al., 2013).

The study area of the project is the marine area lying between 0-50 m isobaths within the Foça SEPA (Figure-2), which constitutes to a marine area of about 19 km² (38.2% of the total marine area of the Foça SEPA).

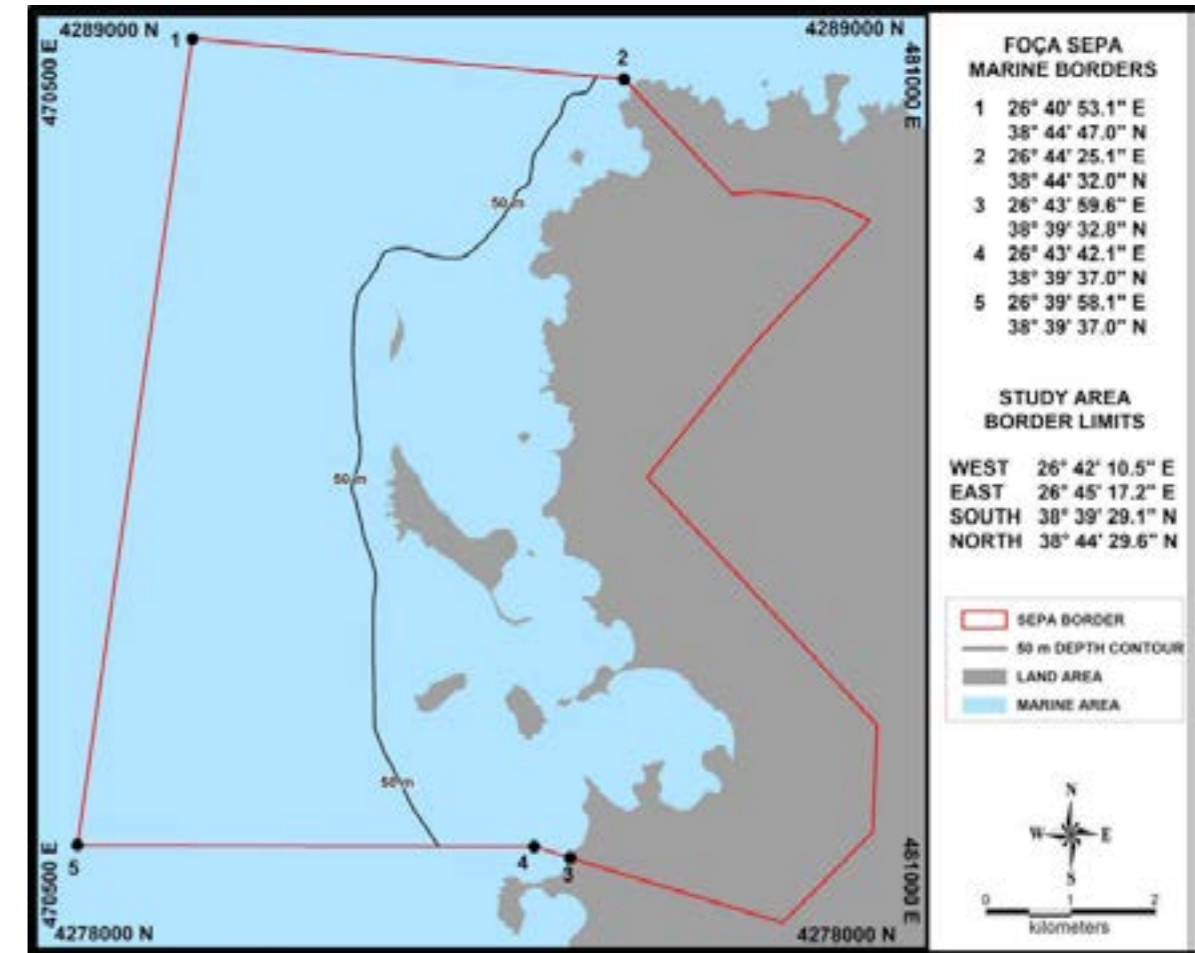
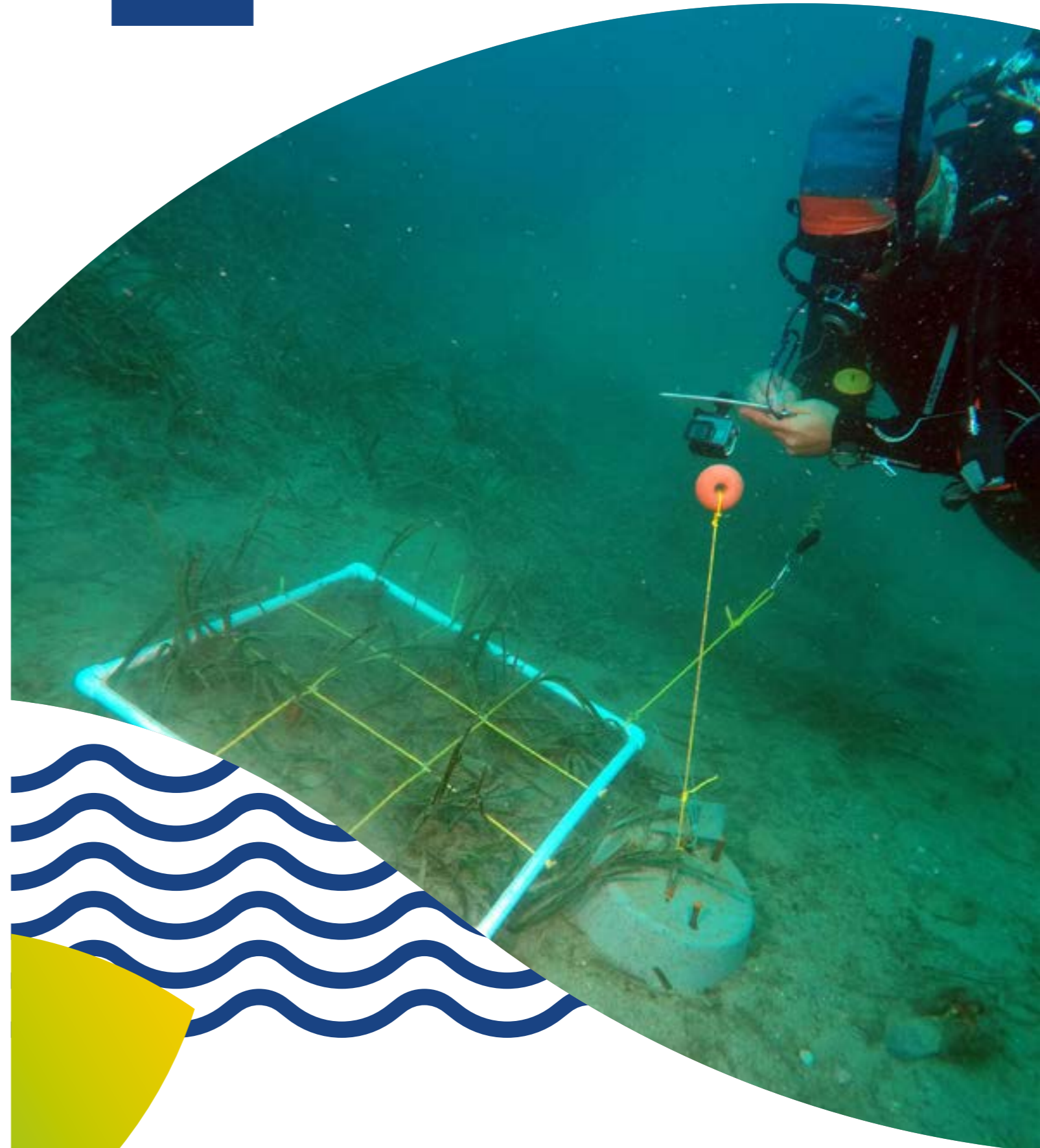


Figure 2
Location of the study area in the Foça SEPA (Source: Call for tender SPA-RAC MedKeyHabitats II Project n°42019_SPA RAC document)

2



2

AVAILABLE KNOWLEDGE AND GAP ANALYSIS

The state of available knowledge for a specific purpose –in this case marine habitats, fisheries and habitat-fisheries interactions in the Foça SEPA– is important for the determination of gaps and limitations, and to determine the priority data components for the achievement of the project goals and objectives. For this reason, we conducted the following studies in order to obtain available knowledge and perform a gap analysis (Figure-3).

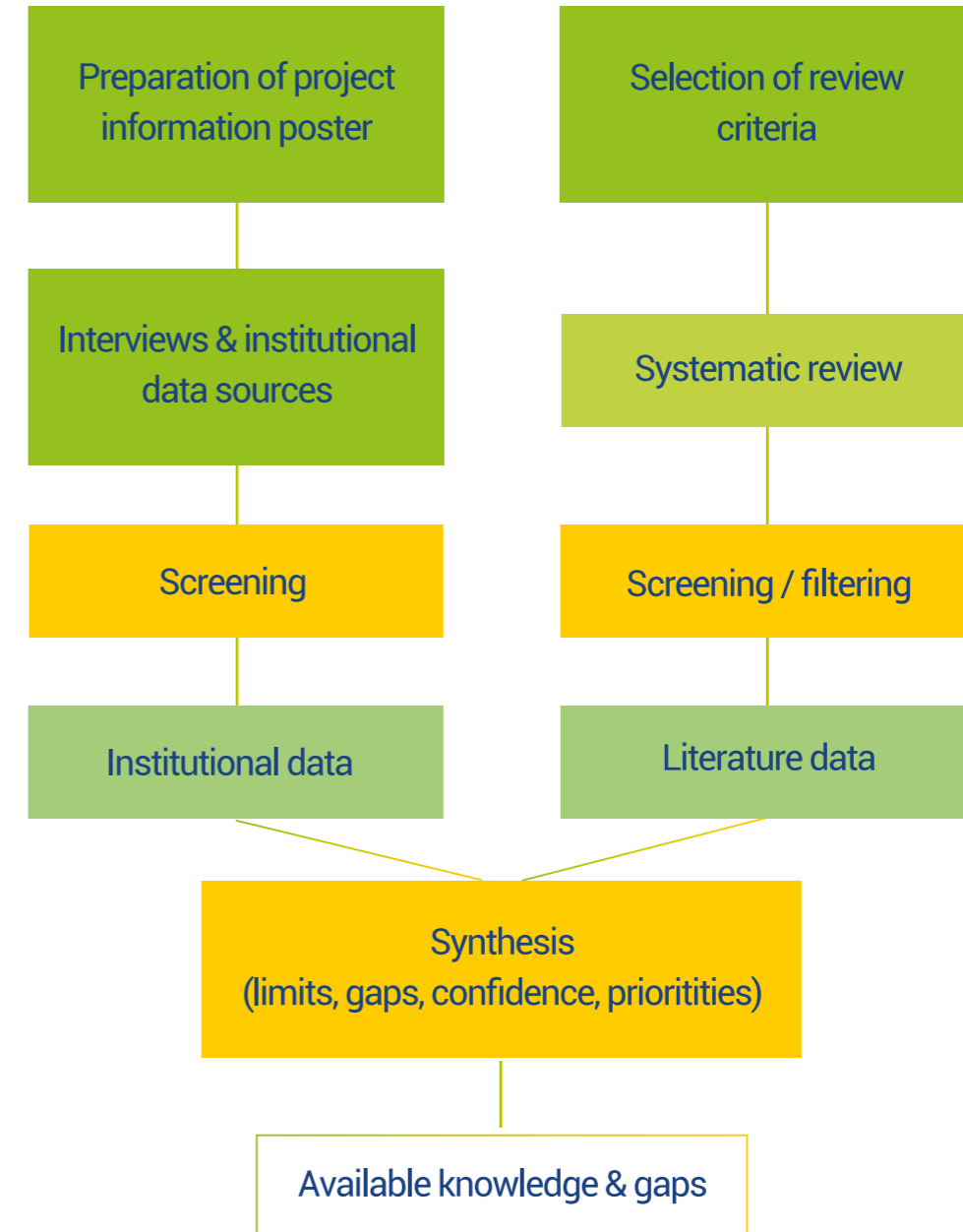


Figure 3
Flowchart presentation of gap analysis methodology

2.1. Available Knowledge in the Foça SEPA

We made interviews with the local stakeholders and responsible local authorities, and searched for their institutional available data to be used in the scope of the project.

2.1.1. Stakeholder Involvement and Awareness Visits

We prepared a mini project information poster (in Turkish) in order to submit it at the meetings (**Annex-I**). The poster briefly included following information:

- Involved institutions
- Project goals and objectives
- Project activities
- Expected outputs

A group of DEU-IMST project team, together with national coordinator, made visits to the local authorities and stakeholders in Phase I in order to present the project, to give information on its activities and to search for collaboration and available data for the project (**Table-1**). The prepared poster was submitted to the representatives of these institutions at the meetings.

Table 1
Start-up site visits

Visited institution	Date	DEU-IMST team	Project relevance
Foça District Governorship	8 August 2019	Dr. Şermin Açık Çınar (DEU-IMST director, benthos)	Local governmental body (all district authorities work under this authority)
		Dr. Gökhan Kaboğlu (Project leader, Expert-3)	
		Dr. Barış Akçalı (Expert-1)	
Foça Municipality	8 August 2019	Dr. E. Mümtaz Tıraşın (Expert-4)	Project awareness, local cooperation for logistics
		Dr. Şermin Açık Çınar (DEU-IMST director, benthos)	
		Dr. Gökhan Kaboğlu (Project leader, Expert-3)	
Foça District Directorate of Environment and Urbanization	8 August 2019	Dr. Barış Akçalı (Expert-1)	Local authority of the national focal point, fieldwork permissions
		Dr. E. Mümtaz Tıraşın (Expert-4)	
		Dr. Şermin Açık Çınar (DEU-IMST director, benthos)	
Foça Fisheries Cooperative	8 August 2019	Dr. Gökhan Kaboğlu (Project leader, Expert-3)	Fishermen of Foça SEPA, artisanal and illegal fisheries data
		Dr. Barış Akçalı (Expert-1)	
		Dr. E. Mümtaz Tıraşın (Expert-4)	
Foça Port Authority	9 August 2019	Dr. Gökhan Kaboğlu (Project leader, Expert-3)	Maritime authority, vessel records, fieldwork permissions
		Dr. Barış Akçalı (Expert-1)	
		Dr. E. Mümtaz Tıraşın (Expert-4)	

Visited institution	Date	DEU-IMST team	Project relevance
Foça District Directorate of Agriculture and Forestry	9 August 2019	Dr. Gökhan Kaboğlu (Project leader, Expert-3)	Fisheries authority, fishing fleet & landing data
		Dr. Barış Akçalı (Expert-1)	
		Dr. E. Mümtaz Tıraşın (Expert-4)	
İzmir Directorate of Culture and Tourism	4 September 2019	Dr. Şermin Açık Çınar (DEU-IMST director, benthos)	Project awareness, fieldwork permissions
		Dr. Gökhan Kaboğlu (Project leader, Expert-3)	
		Dr. Barış Akçalı (Expert-1)	

2.1.2. Institutional Data Collection in the Scope of the Project Objectives

During the meetings with local authorities, we searched for their available data sources to be used or referenced in the scope of the project. The data and their availability are listed in **Table-2**. It is worth to mention that the availability of institutional data volume was less than expected. This situation increases the importance of the data to be collected through the project phases.

Table 2
Institutional data and their availability

Data category	Data	Data source type	Institution	Availability	Reference
Physical (geophysical, geomorphologic and oceanographic) features	Bathymetry	Scanned map	Office of Navigation, Hydrography and Oceanography (Turkish Naval Forces) TUBITAK-MRC and MoEU-GDEM	Yes	SHOD (2002), TUBITAK-MRC and MoEU-GDEM (2014)
	Sonar	-	-	-	-
	Sediment	Map & Report	SHOD TUBITAK-MRC and MoEU-GDEM	Yes	SHOD (2002), TUBITAK-MRC and MoEU-GDEM (2014)
Biological features	CTD	Report	General Directorate of Natural Assets Protection (GDNAP), TUBITAK-MRC and MoEU-GDEM	Yes	SAD (2008), TUBITAK-MRC and MoEU-GDEM (2014)
	Marine habitats	Report (<i>P. oceanica</i> only)	Foça Municipality (FM)-SAD-DEU-IMST	Yes	FM-SAD-DEU-IMST (2006)
	Benthos	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)
Posidonia oceanica monitoring	Fish	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)
	Marine mammals	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)
Posidonia oceanica monitoring	Monitoring parameters	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)

Data category	Data	Data source type	Institution	Availability	Reference
Fisheries	Socio-economic	Report	GDNAP	Yes	Tunca et al. (2013)
	Gears, area use, effort	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)
	Fishing fleet	Interview	GDNAP	Yes	FFC & FPA (2019)
	Landing	Report	GDNAP	Yes	Bann & Başak (2011)
Fisheries impact	Marine habitats	GIS layer	FM-SAD-DEU-IMST	Yes	FM-SAD-DEU-IMST (2006)
	Fisheries gears, area use, effort	Report	GDNAP-SAD-DEU-IMST	Yes	SAD (2008)

2.2. Gap Analysis

The conceptual, technical, and organizational bases of gap analysis have been developed and widely used since the underlying principles of gap analysis were discussed in 1980s (Scott et al., 1993; Jennings, 2000). In this study, we applied a simplified and modified form of gap analysis method (Figure-3) presented by Langhammer et al., 2007. Gap analysis within the context of this study can be defined as follows:

"A method for determining the gaps in the available knowledge for the achievement of predetermined goals and objectives in a specific area, which specifies the limits and prioritization of components of interest"

The meaning of the terms used in the definition and applied methodology are as follows:

Predetermined goals and objectives: The goals and objectives of the project "Mapping of marine key habitats and assessing their vulnerability to fishing activities in Foça Special Environmental Protection Area, Türkiye" (See section 1. Introduction)

Specific area: Foça SEPA (0-50 m isobaths)

Components of interest:

1. Physical (geophysical, geomorphologic and oceanographic) features: bathymetry, sonar, sediment, CTD (conductivity-temperature-depth)
2. Biological features: marine habitats, benthos, fish, marine mammals
3. *Posidonia oceanica* monitoring
4. Fisheries socio-economics: socio-economics of fishermen, gears-area use-effort, fleet, target species, fish underwater visual survey
5. Fisheries impact on marine habitats: marine habitats, fishing gears-area use-effort

Gap/limits: no-data (full gap), geographical coverage, acquisition date, resolution, reliability

Priority: the level of obligation to fill the gap in each component of interest as high, moderate or low priority

2.2.1. Literature Review

We performed a systematic review in order to obtain all scientific and grey literature, in addition to the institutional available data, and performed a synthesis to both datasets to define the gaps. A systematic review is defined as a research method that "...attempts to collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question" (Higgins & Green, 2008). We performed our systematic review in Google, Google Scholar, ISI Web of Knowledge, SCOPUS and ResearchGate platforms in order to reach to all peer reviewed and grey literature about the defined components of interest subjects. The results were then filtered according to the case that if they include any data/results for the Foça SEPA. Table-3 gives the logical combinations of keywords used in the systematic review and their results.

Table 3
Systematic review: Logical combinations of keywords used in the search and their results

#	Category	Search criteria	Unfiltered search results	Filtered search results
1	Physical (geophysical, geomorphologic and oceanographic) features	(seabed OR seafloor OR oceanography OR sediment OR CTD) AND map AND (GIS OR Geographic Information System OR acoustic OR sonar OR bathymetry) AND Foça AND (Izmir OR Türkiye)	140	27
2	Biological features	("marine habitat" OR "coastal habitat" OR biocenosis OR meadow OR benthic OR benthos OR "marine biodiversity") AND Foça AND (Izmir OR Türkiye)	199	41
3	<i>P. oceanica</i> monitoring	("P. oceanica" OR "Posidonia oceanica" OR seagrass OR meadow) AND monitoring AND Foça AND (Izmir OR Türkiye)	204	12
4	Fisheries socio-economic study (including fish counting)	1.(fisheries OR fishing) AND (socio-economic OR artisanal OR "fishing effort" OR "fishing gear" OR commercial OR "illegal fishing") AND Foça AND (Izmir OR Türkiye) 2.(fish OR demersal OR pelagic) AND "visual census" AND Foça AND (Izmir OR Türkiye)	251	42
5	Fisheries impact on marine habitats	(fisheries OR fishing) AND (interaction OR impact OR sensitivity OR threat OR risk OR "rule-based" OR unauthorised) AND Foça AND (Izmir OR Türkiye)	211	33

#	Category	Search criteria	Unfiltered search results	Filtered search results
6	İzmir Bay: physical & biological features, <i>P. oceanica</i> monitoring, fisheries socio-economic study (including fish counting), fisheries impact on marine habitats	((seabed OR seafloor OR oceanography OR sediment OR CTD) OR (GIS OR Geographic Information System OR acoustic OR sonar OR bathymetry)) OR ("marine habitat" OR "coastal habitat" OR biocenosis OR meadow OR benthic OR benthos OR "marine biodiversity") OR ((fisheries OR fishing) AND (socio-economic OR artisanal OR "fishing effort" OR "fishing gear" OR commercial OR "illegal fishing") OR ((fish OR demersal OR pelagic) AND "visual census") OR (fisheries OR fishing) AND (interaction OR impact OR sensitivity OR threat OR risk OR "rule-based" OR unauthorised) AND ("izmir bay" "gulf of izmir"))	465	29

In this systematic review, searches #1-5 were specified to the Foça SEPA whereas search #6 was specified to the İzmir Bay studies, which include all or part of the study area. The type of obtained literature is presented in Table-4.

Table 4
Type of literature documents after filtering of search results

#	Category	Type of literature	Filtered search results
1	Physical (geophysical, geomorphologic and oceanographic) features	Paper: 11 Book: 1 Proceeding: 5 Report: 8 Other: 1 map, 1 catalogue	27
2	Biological features	Paper: 15 Book: 2 Proceeding: 11 Report: 8 Other: 4 dissertation, 1 catalogue	41
3	<i>P. oceanica</i> monitoring	Paper: 1 Book: 1 Proceeding: 3 Report: 3 Other: 1 catalogue, 1 project dissemination, 2 legal bulletin	12

#	Category	Type of literature	Filtered search results
4	Fisheries socio-economic study (including fish counting)	Paper: 13 Book: 5 Proceeding: 6 Report: 12 Other: 3 dissertation, 2 legal bulletin, 1 news	42
5	Fisheries impact on marine habitats	Paper: 9 Book: 4 Proceeding: 2 Report: 12 Other: 3 dissertation, 2 legal bulletin, 1 news	33
6	İzmir Bay: physical & biological features, <i>P. oceanica</i> monitoring, fisheries socio-economic study (including fish counting), fisheries impact on marine habitats	Paper: 16 Book: 2 Proceeding: 2 Report: 6 Other: 1 dissertation, 1 project dissemination	29

2.2.2. Gap Analysis of Both Institutional Data and Literature

After screening all the acquired literature, the gaps, limits and priorities of data/information were identified for all components of interest within the scope of the project. The gap analysis is presented according to the specified components of interest categories in the following tables.

Table 5
Gap analysis of physical features in the Foça SEPA

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
Bathymetry	Map	SHOD (2002)	Yes	Full	Before 2002	Very low	Moderate	HIGH	HIGH
	Scientific paper	Özçelik & Arısoy (2010)	No	Partly	Satellite image 2005	Moderate	Moderate		
	Report	Beşiktepe & Kaboğlu (2013)	Yes	Full	Before 2002	Very low	Moderate		
Sonar	-	-	-	-	-	-	-	HIGH	HIGH
Sediment	Map	SHOD (2002)	Yes	Partly	Before 2002	Very low	Very low	HIGH	HIGH
	Scientific paper	Duman et al. (2004)	Yes	Partly	1994-2001	Very low	High		
	Report	Beşiktepe & Kaboğlu (2013) TUBITAK-MRC and MoEU-GDEM (2014)	Yes	Full	Before 2002	Very low	Very low		

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
CTD	Scientific paper	Sayin (2003)	Yes	Partly	1994-1999	Very low	High	MODERATE	LOW
	Scientific paper	Sayin et al. (2006)	Yes	Partly	1994-2003	Very low	High		
	Report	SAD (2008)	Yes	Partly	2008	Moderate	High		
	Report	Beşiktepe & Kaboğlu (2013) TUBITAK-MRC and MoEU-GDEM (2014)	Yes	Full	Before 2002	Very low	High		
	Scientific paper	Eronat (2017)	Yes	Partly	-	Very low	High		
	Scientific paper	Sayin & Eronat (2018)	Yes	Partly	1996-	Very low	High		

Table 6
Gap analysis of biological features in the Foça SEPA

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
Marine habitats	Report Scientific paper	Foça Municipality-SAD-DEU-IMST (2006) Akçalı et al. (2019)	Yes	Partly (only <i>P. oceanica</i>)	2005	Moderate	High	HIGH	HIGH
Benthos	Dissertation	Cengin (2001)	Yes	Partly	1999-2000	Low	High	MODERATE	MODERATE
	Report Proceeding	SAD (2008) Güçlüsoy et al. (2019)	Yes	Partly	2008	Moderate	High		
	Proceeding	Çulha et al. (2018)	No	Partly	2016	Low	High		
Fish	Report Proceeding	SAD (2008) Güçlüsoy et al. (2019)	Yes	Partly	2008	Moderate	High	HIGH	HIGH
	Scientific paper	Güçlüsoy & Savaş (2003)	Yes	Full	1994-1998	High	High	MODERATE	LOW
Dissertation	Kaboğlu (2007)	Yes	Full	1993-2004	High	High			
Marine mammals	Report	Kıraç & Ververi (2012)	Yes	Full	2011-2012	High	High		
	Dissertation	Saydam (2016)	Yes	Full	2013-2016	High	High		
	Dissertation	Alan (2015)	Yes	Partly	2013	High	High		
	Scientific paper	Alan et al. (2017)	Yes	Partly	2013-2014	High	High		

Table 7
Gap analysis of *P. oceanica* monitoring in the Foça SEPA

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
<i>P. oceanica</i> monitoring parameters	Report	SAD (2008)	Yes	Partly	2008	Moderate	High	MODERATE	HIGH
	Proceeding	Akçalı et al. (2008)	Yes	Partly	2008	Moderate	High		

Table 8
Gap analysis of fisheries in the Foça SEPA

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
Socio-economics	Dissertation	Ünal (2001)	Yes	Full	-	High	High	LOW	LOW
	Scientific paper	Ünal (2003)	Yes	Full	1999-2000	High	High		
	Dissertation	Kaboğlu (2007)	Yes	Full	2004-2005	High	High		
	Scientific paper	Ünal & Franquesa (2010)	Yes	Full	2004-2005	High	High		
	Book	Tokaç et al. (2010)	Yes	-	-	-	High		
	Report	Bann & Başak (2011)	Yes	-	2011	Low	High		
Fishing gears	Dissertation	Ünal (2001)	Yes	Full	-	High	High	MODERATE	HIGH
	Book	Tokaç et al. (2010)	Yes	-	-	-	High		
	Book	Kara & Sağlam (2017)	No	-	-	-	High		
Fishing areas	Dissertation	Ünal (2001)	Yes	Full	-	High	High	MODERATE	HIGH
	Dissertation	Kaboğlu (2007)	Yes	Full	2004-2005	High	High		
	Report	SAD (2008)	Yes	Partly	2008	Moderate	High		
Fishing effort	Dissertation	Ünal (2001)	Yes	Full	-	High	High	MODERATE	HIGH
	Dissertation	Kaboğlu (2007)	Yes	Full	2004-2005	High	High		
Target species	Book	Tokaç et al. (2010)	Yes	-	-	-	High	LOW	LOW
	Report	Bann & Başak (2011)	Yes	-	2010	Low	High		
Underwater visual survey	Report Proceeding	SAD (2008) Güçlüsoy et al. (2019)	Yes	Partly	2008	Moderate	High	HIGH	HIGH

Table 9
Gap analysis of fisheries impacts on marine habitats in the Foça SEPA

Data	Data source type	Reference	GAP ANALYSIS (LIMITS-GAP DEGREE-PRIORITY)						
			Availability	Geographical coverage	Data acquisition date	Resolution	Reliability	Gap degree	Priority
Marine habitats	Report Scientific paper	Foça Municipality-SAD-DEU-IMST (2006) Akçalı et al. (2019)	Yes	Partly (only <i>P. oceanica</i>)	2005	Moderate	High	HIGH	HIGH
	Dissertation	Ünal (2001)	Yes	Full	-	High	High		
Fishing gears	Book	Tokaç et al. (2010)	Yes	-	-	-	High	MODERATE	HIGH
	Book	Kara & Sağlam (2017)	No	-	-	-	High		
Fishing areas	Dissertation	Ünal (2001)	Yes	Full	-	High	High		
	Dissertation	Kaboğlu (2007)	Yes	Full	2004-2005	High	High	MODERATE	HIGH
	Report	SAD (2008)	Yes	Partly	2008	Moderate	High		
Fishing effort	Dissertation	Ünal (2001)	Yes	Full	-	High	High		
	Dissertation	Kaboğlu (2007)	Yes	Full	2004-2005	High	High	MODERATE	HIGH
	Book	Tokaç et al. (2010)	Yes	-	-	-	High		

Remarks on gap analysis

- The gap analysis showed that the physical data (bathymetry, sonar and sediment) needed to map habitat types are missing in the study area, which is obligatory to be acquired.
- There is a considerable data on biological features, especially for the marine mammals (*Monachus monachus* and cetaceans). On the other hand, it is worth to note that since the aim of each study -except for *Posidonia oceanica* meadow mapping- was out of habitat mapping, the suitability of these data for the habitat mapping purpose is questionable.
- *Posidonia oceanica* monitoring data in the Foça SEPA needs to be enhanced, and representativeness of the site should be assessed well.
- There are numerous fisheries socio-economic studies performed in the Foça SEPA. The major lack in fisheries data (for both rule-based and illegal) is the spatial and temporal components of fishing practices. The spatial and temporal distributions of gears used, fishing areas and fishing effort are not known.
- The only study to quantify fisheries pressure in the Foça SEPA is the study of Kaboğlu, 2007. Still it lacks to determine fisheries impacts on the marine habitats.

In the following sections, we present a review of existing knowledge from the literature on the Foça SEPA and the components of interest of the project, including a general description of the Foça SEPA, its physical and biological features, fisheries of and marine monitoring activities performed in the Foça SEPA.

2.3. The Foça Special Environmental Protection Area

Foça has a 3000-year of history based on documents (Keskin et al., 2011). Foça settlement was called as Phokaia in ancient times. The name of Phokaia was given for the resemblance of the isles in the bay as Seal (Phoca), which is considered to be because of the existence of the seal figures on the archaic period coins and natural living spaces in the region strengthen the idea that the settlement was named from phocas (Çetin, 2002).

In addition to its historical and cultural sites, the Foça SEPA has also marine and land biological values with national and international significance: the endangered Mediterranean monk seal (*Monachus monachus*), the Mediterranean endemic seagrass *Posidonia oceanica*, rich avifauna, commercial and non-commercial fish species, and rich marine and land biodiversity (TVKBM, 2016).

The area attracted conservation efforts in 70s because of its natural, historical and cultural values mentioned above. 11 national SIT status categories were assigned in the area in order to protect land components of the SEPA (Figure-4). These categories remain the same with some spatial modifications in the recent years (TVKBM, 2016).

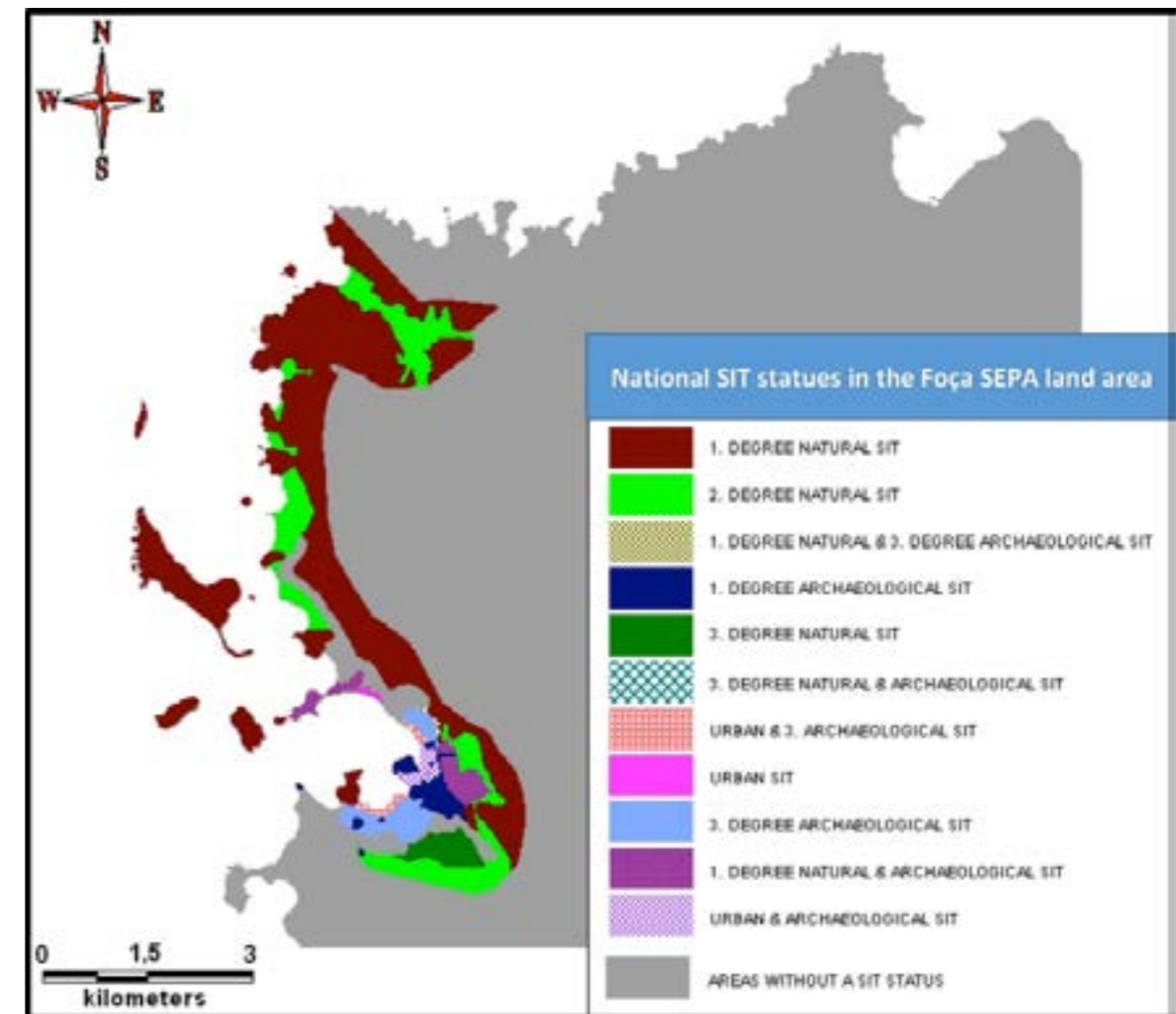


Figure 4
Sit status in the Foça SEPA (Source: Kaboğlu, 2007)

On the other hand, regulations in the marine component of the Foça SEPA started in 90s. The area was granted SEPA status in 1990, largely on account of its monk seal population, and was enlarged to its present borders in 2007, being still the smallest marine and coastal SEPA in Türkiye with an area of 71.38 km² (TVKGM, 2011; Bann & Başak, 2011) (Figure-5). There have been some other regulations such as navigation regulation zone, which bans cargo vessels greater than 300 GRT and all vessels carrying dangerous substances in some part of the marine components of the SEPA, in addition to fishing regulations (Kaboğlu, 2007).

The Foça Peninsula (including part or all of the SEPA borders) was also designated as Pilot Monk Seal Conservation Area for the protection of monk seals (Güçlüsoy & Savaş, 2003), and was assigned as Key Biodiversity Area (BirdLife International, 2010 & 2017) and Important Natural Area (Eken et al., 2006).

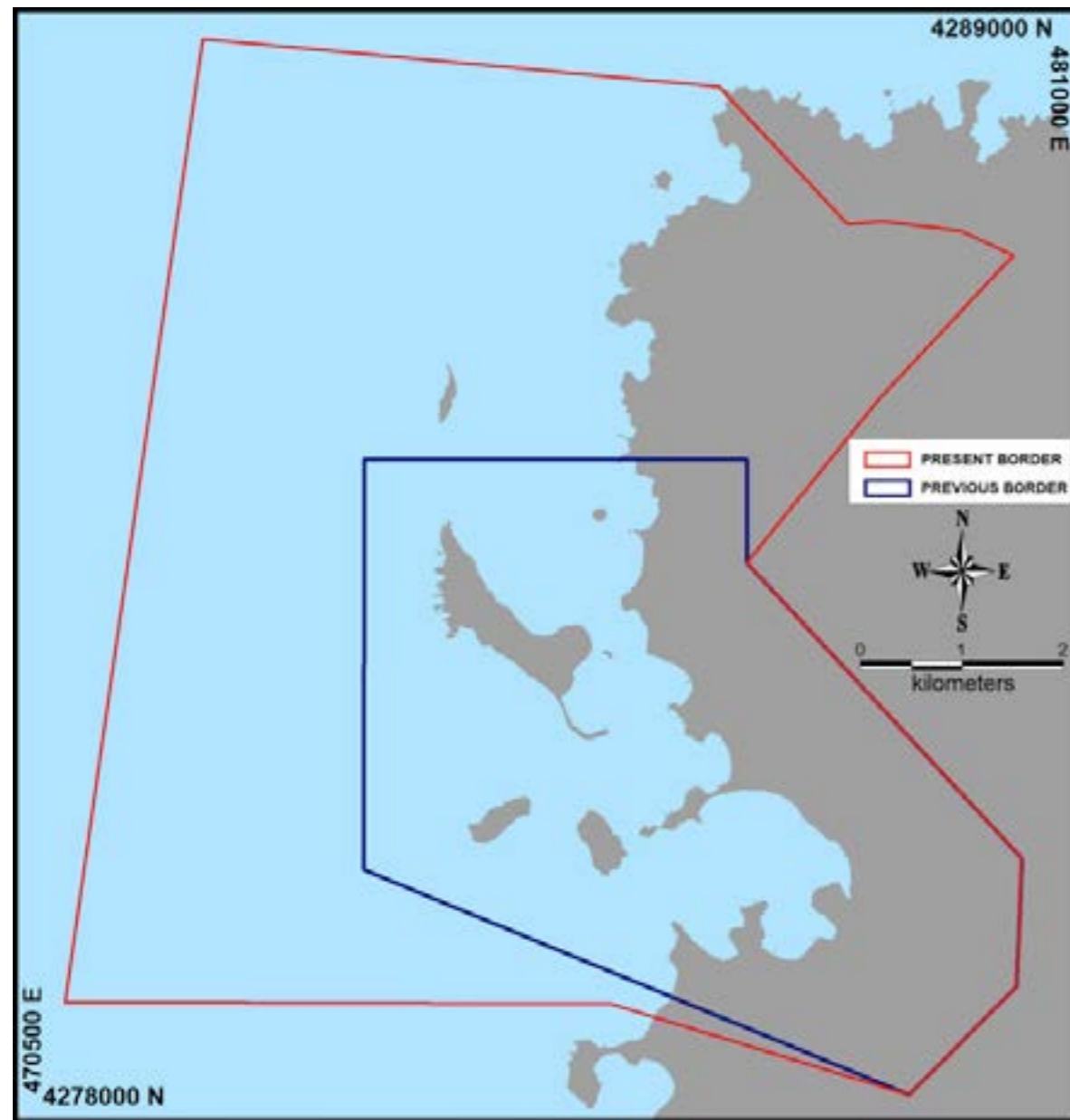


Figure 5
Previous and present borders of the Foça SEPA

The major pressures in the Foça SEPA are listed as 1) Overexploitation and illegal extraction of the fish stocks, 2) Increasing human usage of the marine and coastal environment, 3) Coastal and marine pollution, 4) Damage and destruction of the sea bottom, 5) Invasive marine species *Caulerpa cylindracea*, and 6) Lack of freshwater supplies and water treatment facilities in the Economic Analysis of the Foça SEPA (Bann & Başak, 2011). Foça region is also considered as one of the major environmental threatened areas due to ports and untreated industrial wastewater (AÇA, 2006). The management plans for the Foça SEPA were prepared in 2011 and 2016 in order to produce legal and managerial framework in the area, but these plans still remain as advisory documents rather than being legal instruments.

2.4. Physical (Geophysical, Geomorphologic and Oceanographic) Features of the Foça SEPA

The Foça SEPA coasts are located within the Aslan Cape at the northern and Deveboynu Cape at the southern borders (Figure-6). Geological units of the Foça SEPA coasts and their seaward and landward extensions are characterized generally by Early and Middle Miocene pyroclastics, volcanites and Holocene beach deposits. Volcanic structure had formed a rough terrain in the area (TVKGM, 2016). The archipelago formation is also a result of this structure.

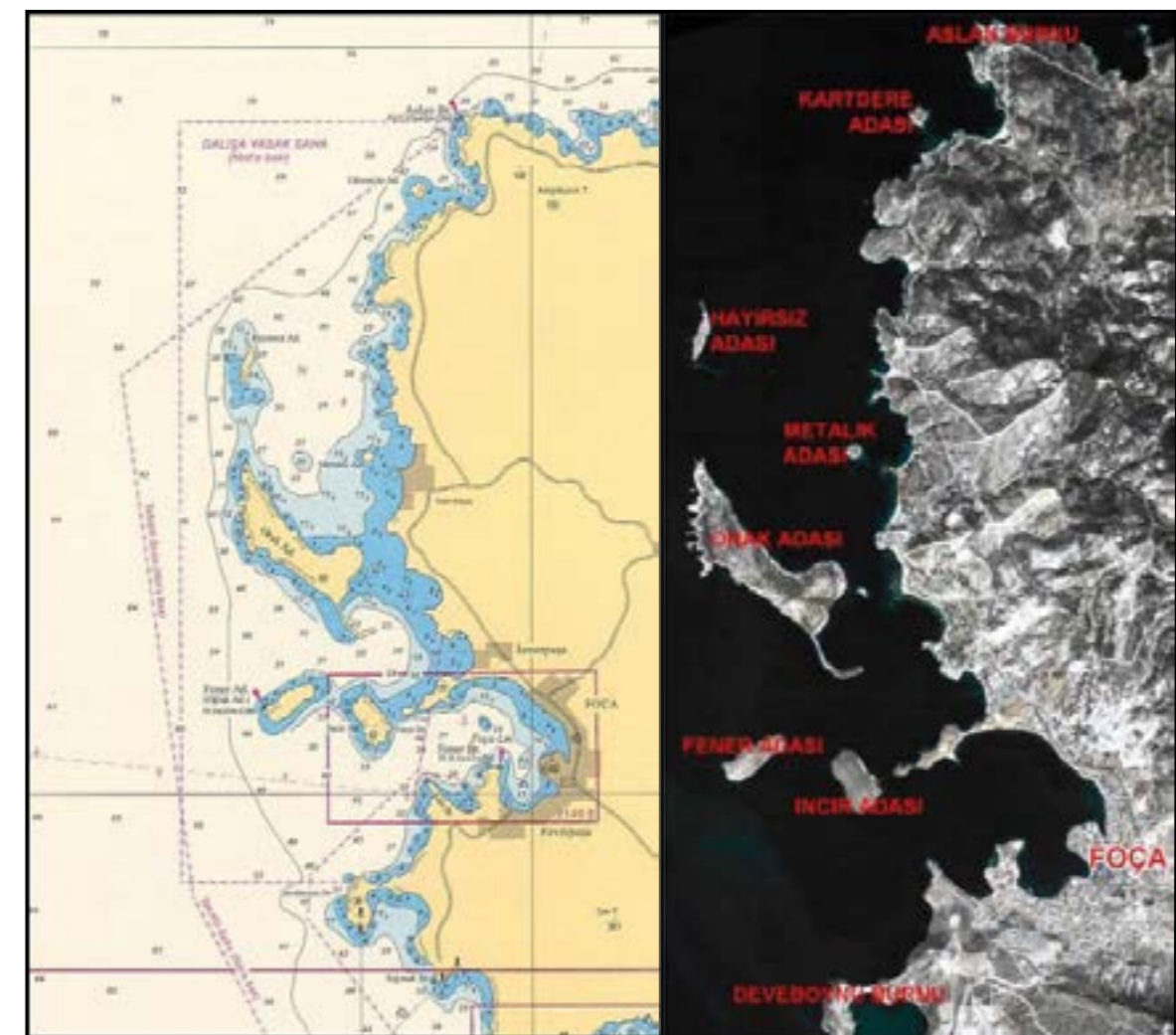


Figure 6
Left: the bathymetry chart of the Foça SEPA (Source: SHOD, 2002), Right: the Foça SEPA islands (Source: SAD, 2008)

The morphology of the Foça SEPA seafloor also shows a rough structure because of the same phenomena. The shelf slopes are minimum at the middle, resulting in a large shallow area between Orak Island and the mainland (Figure-7). The northern part, which is the opening of the İzmir Bay to the Aegean Sea, has a steeper form than the southern part. The bathymetric complexity of the seafloor can be seen in more detailed bathymetry map (Figure-8).

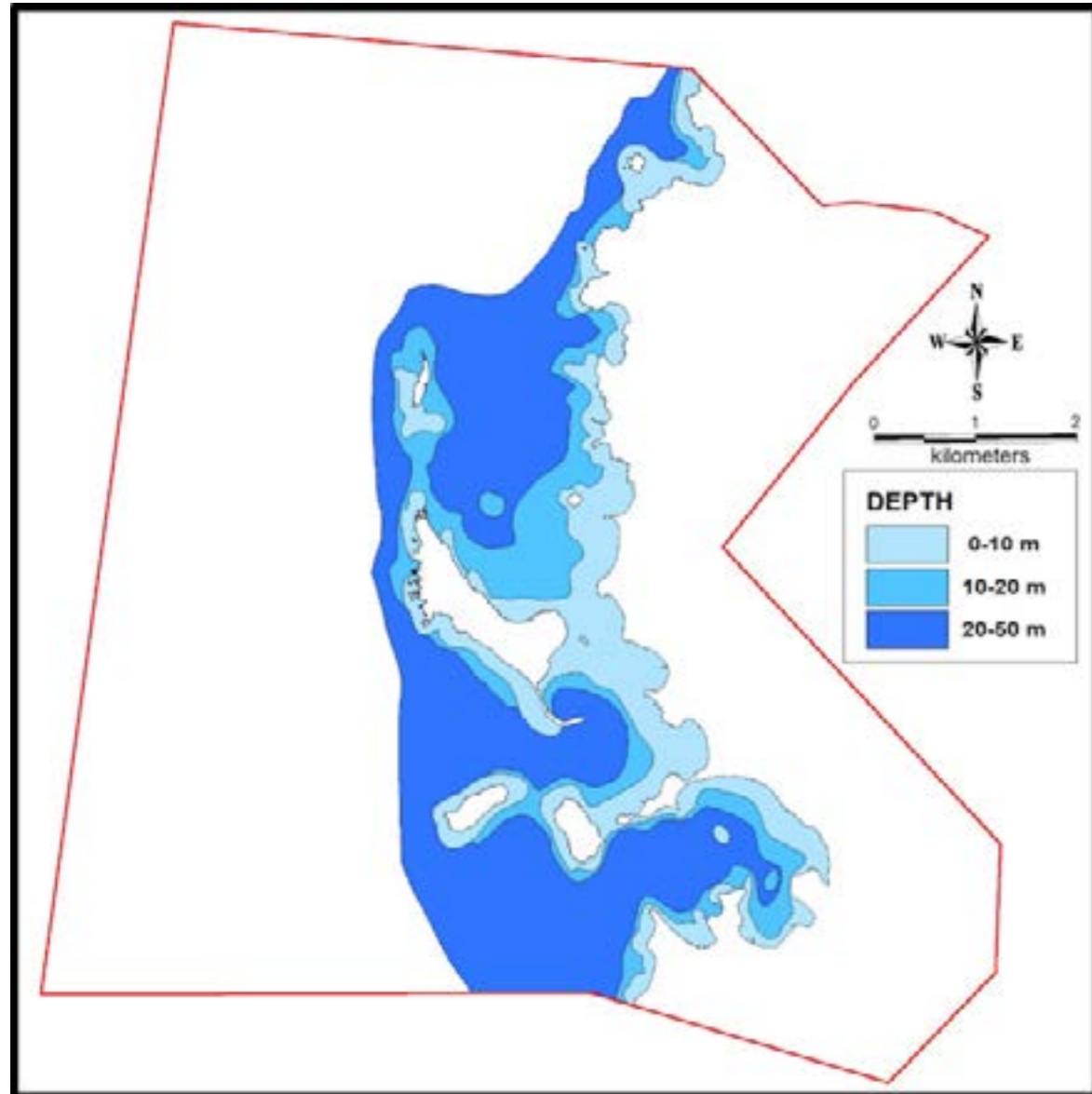


Figure 7
The bathymetric structure of study area in the Foça SEPA (bathymetry data is derived by digitizing SHOD, 2002)

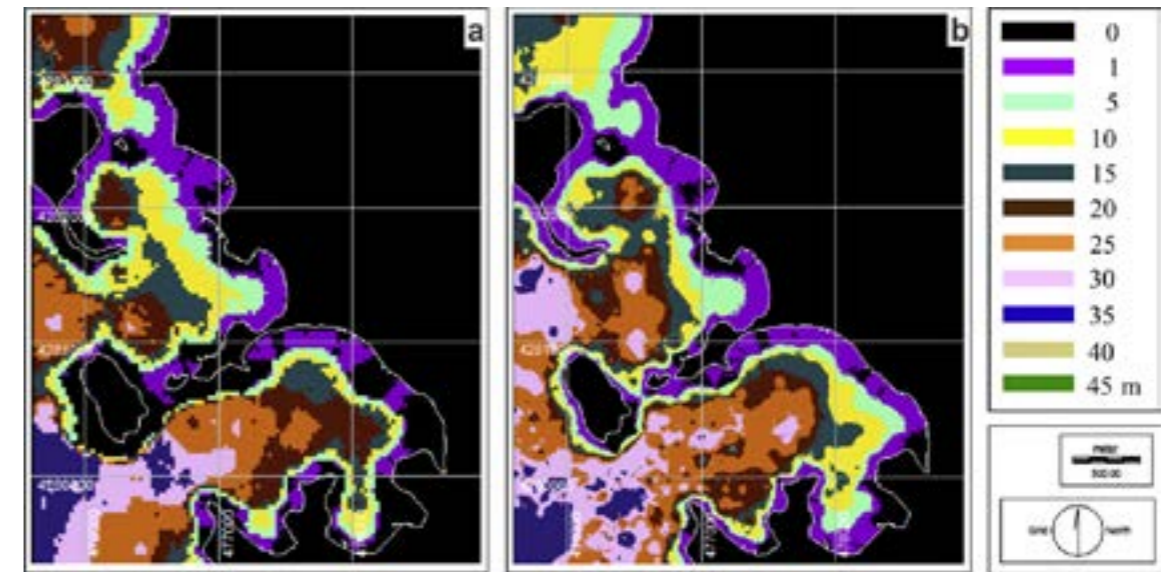


Figure 8
Bathymetric maps derived for (a) Aster, (b) Quickbird ANN models (Source: Özçelik & Arısoy, 2010)

According to long term monitoring data, there are three recognized water masses in the İzmir Bay: Aegean Sea Water, İzmir Bay Inner Water and İzmir Bay Water between these two water masses under several local influences. Aegean Sea Water inflow is from Karaburun. The outflow occurs in the surface and bottom layer near the coast of Foça in winter. As a result of thermohaline behaviour of stratified water in summer, it flows to the Aegean Sea under the pycnocline (Sayın et al., 2006).

The CTD values show a high spatial and temporal variation in the surface and bottom water masses of the Foça SEPA due to the water exchange mentioned above (SAD, 2008). The current velocity measurement in the same study showed that the current values have minimum values increase at the Foça port area (ave. 11 cm/s), and increase to the northern sections (ave. 15 cm/s).

The seabed sediment characteristics are not well known in the area. 40-50 m depth of the southern part of the SEPA is muddy sediment (Duman et al., 2004), but other regions or shallow areas lack in sediment data. On the other hand, there are two assigned coastal water typology to the Foça SEPA: 1) high saline-shallow-hard substrate and 2) high saline-shallow-soft substrate (Beşiktepe & Kaboğlu, 2013; TUBITAK-MRC and MoEU-GDEM, 2014).

There are no any data in the literature about seabed forms and textures acquired by sonar measurements.

2.5. Biological Features of the Foça SEPA

2.5.1. Marine Habitats

The only marine habitat mapping activity in the Foça SEPA is the mapping of *Posidonia oceanica* meadows in 2005 (Foça Municipality-SAD-DEU-IMST, 2006; Akçalı et al., 2019). According to this study, *P. oceanica* distribution is about 6.7 km², and the meadows are distributed along the whole coasts of the SEPA, except for the port area (Küçük Deniz and Büyük Deniz) (Figure-9).

Regarding the technical approach used in the study, mapping exhibits a high resolution of the upper limit using satellite imagery, but lower resolution of the lower limit since only GPS data of drop-down camera observations was used for polygonization. Accordingly, the patches could be identified at shallow areas whereas they could not be identified in deeper areas. The scientific measurements were done at 12 stations at 10-15 meters for determining the status of *P. oceanica* at Foça SEPA in 2008 (SAD, 2008). According to the results, the density of *P. oceanica* at 10-15 meters were min. 100.0 ± 4.0 m²/shoot at İngiliz Harbour and max. 312.5 ± 10.6 m²/shoot at Club Med. The values were increased from the city center to north. It is because of the reduction of the anthropogenic effects.

There is no available data on other marine habitat types in the area.

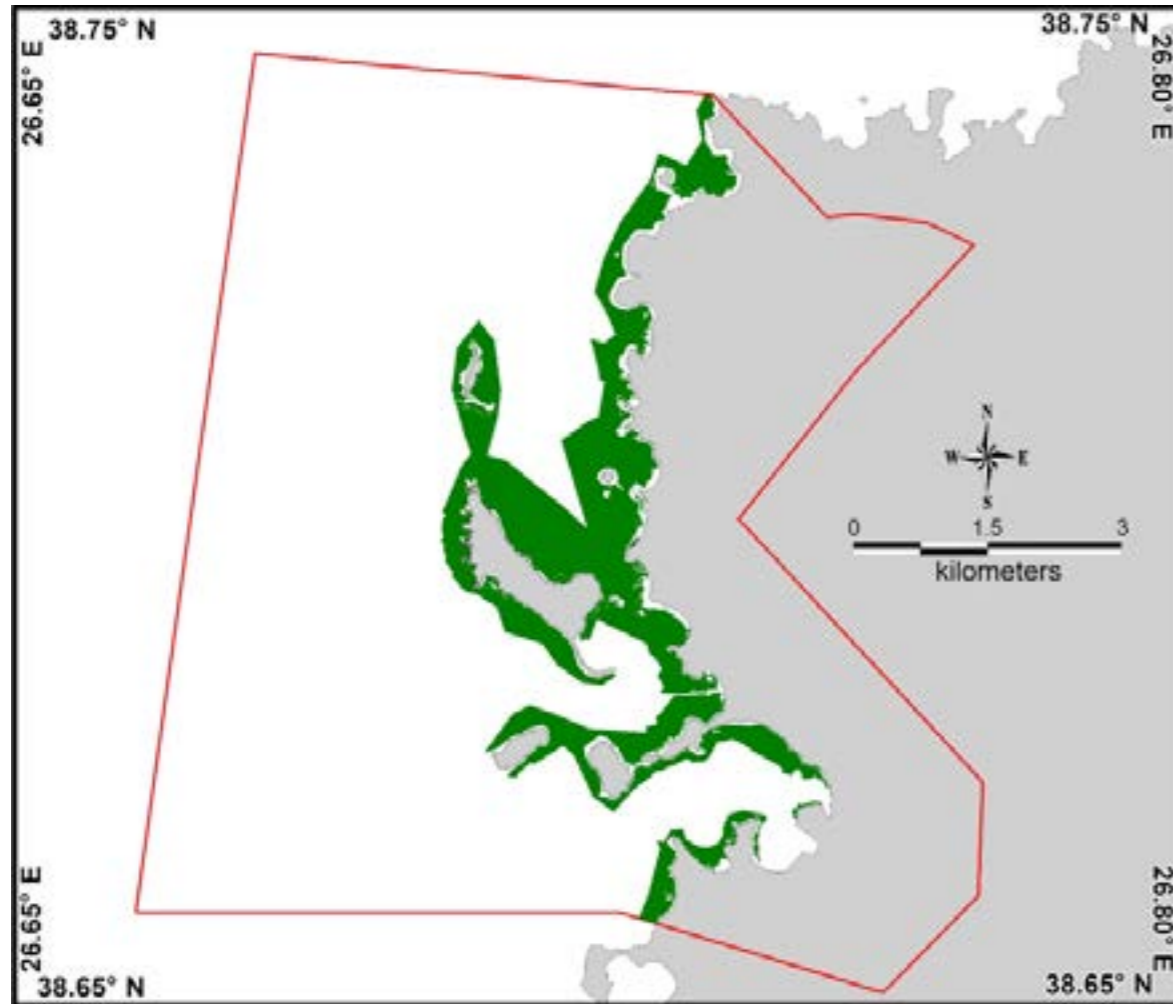


Figure 9
Posidonia oceanica map of the Foça SEPA (Source: Akçalı et al., 2019)

2.5.2. Benthos

58 benthic species (9 Foraminifera, 11 Polychaeta, 33 Mollusca, 3 Crustacea and 2 Echinodermata) were observed in the Foça port area-Küçük Deniz and Büyük Deniz (Cengin, 2001) (Table-10). Another study in the same area in 2016 revealed 27 Mollusca species with fewer sampling stations (Çulha et al., 2018). According to this study, *Mytilus galloprovincialis* was the highest dominant species, followed by *Patella caerulea*, *Phorcus turbinatus* and *Nucula nucleus*.

The most comprehensive benthos research from the spatial point of view was performed within the "Determination of the Carrying Capacity at the Foça SEPA Coastal Areas" project, which was conducted in 2008, which was financed by GDNAP. This study was based on the determination of the macroorganisms in the Foça SEPA, thus also includes species other than benthos. According to this study, a total of 176 macroorganisms were identified in the Foça SEPA (Annex-II) (SAD, 2008; Güçlüsoy et al., 2019).

Table 10
List of benthic species of the Foça port area (Source: Cengin, 2001)

FORAMINIFERA	MOLLUSCA
<i>Elphidium crispum</i>	<i>Abra alba</i>
<i>Miliolide tenera</i>	<i>Arca lactea</i>
<i>Globigeria sp.</i>	<i>Arca noae</i>
<i>Rotalia beccari</i>	<i>Cardium echnatum</i>
<i>Spirillina vivipara</i>	<i>Cardium tuberculatum</i>
<i>Textularia fucosa</i>	<i>Chlamys multistriatus</i>
<i>Monionina scapha</i>	<i>Chlamys sp.</i>
<i>Polystomella crispa</i>	<i>Circomphalus casinus</i>
<i>Nummulites sp.</i>	<i>Callistoma granulatum</i>
POLYCHAETA	<i>Corbula gibba</i>
<i>Nereis zonata</i>	<i>Philine aperta</i>
<i>Nereis rava</i>	<i>Gibbula varia</i>
<i>Arabella irocolor</i>	<i>Haminea sp.</i>
<i>Playthynereis dumerilli</i>	<i>Raphitoma bicolor</i>
<i>Autolytus sp.</i>	<i>Lutaina guillemini</i>
<i>Eumice sp.</i>	<i>Modiolus barbatus</i>
<i>Nereis hombergi</i>	<i>Mytilus galloprovincialis</i>
<i>Neanthes caudata</i>	<i>Nucula nucleus</i>
<i>Nereis pelagica</i>	<i>Nuculana pella</i>
<i>Nereis sp.</i>	<i>Ostrea edulis</i>
<i>Sylis sp.</i>	<i>Pecten jacabeus</i>
CRUSTACEA	<i>Propecten glaber</i>
<i>Gammarus sp.</i>	<i>Peringia ulvae</i>
<i>Elasmapus sp.</i>	<i>Rissoa ventricosa</i>
<i>Lysianasya sp.</i>	<i>Cardium paucicostatum</i>
ECHINODERMATA	<i>Sliquaria obtusa</i>
<i>Sphaerechinus granularis</i>	<i>Tellina distora</i>
<i>Ophioderma longicaudum</i>	<i>Trutella communitis</i>
	<i>Tricola speciosa</i>
	<i>Turbona cimex</i>
	<i>Ascorpes pes pelacani</i>
	<i>Bittum reticulatum</i>
	<i>Fusinus sp.</i>

2.5.3. Fish

The knowledge on the fish species of the Foça SEPA is limited to the surveys applied to professional (Tokaç et al., 2010; Bann & Başak, 2011) and recreational (Tunca et al., 2013) fishermen, except for the macroorganism inventory study, which was held in 2008 (SAD, 2008; Güçlüsoy et al., 2019). In this study, a specific fish survey was conducted at transects along the coastlines by underwater visual survey. As a result, 56 fish species belonging to 26 families were identified (Annex-II). The fish species list consists of all teleost fishes, except for one cartilaginous species. When fish species distributed according to the stations were analysed, it was found out that all transects were more than 50% similar.

Professional targeted fish species are given in the fisheries section.

2.5.4. Marine Mammals

The most studied species has been the endangered *Monachus monachus* in the Foça SEPA. There are breeding and sheltering caves and feeding grounds of this pinniped in the area (Güçlüsoy & Savaş, 2003; Kaboğlu, 2007; Kırac & Veryeri, 2012). According to long term sighting data, the species use most part of the SEPA, with high area use frequencies around Orak, Hayırsız and İncir Islands (Figure-10) (Kaboğlu, 2007). More recent sighting data supports that the species still continues to use almost the same areas with different frequencies and spatial distributions (Figure-11) (Saydam, 2016).

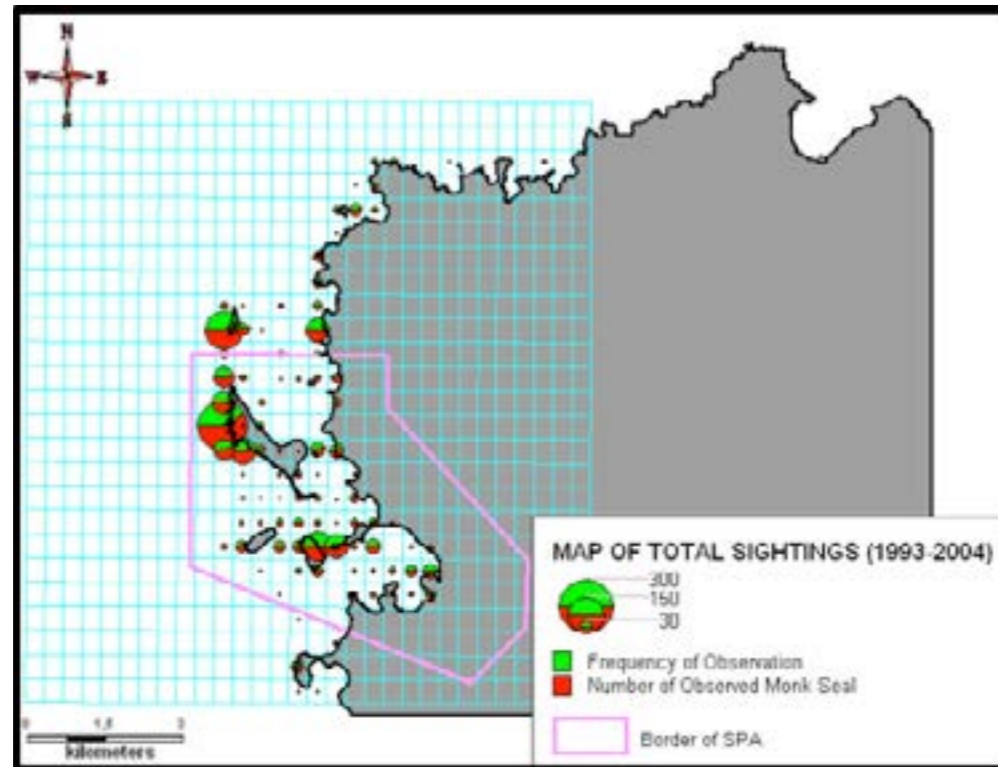


Figure 10

Map of *Monachus monachus* sightings in the Foça SEPA between 1993 and 2004 (Source: Kaboğlu, 2007)

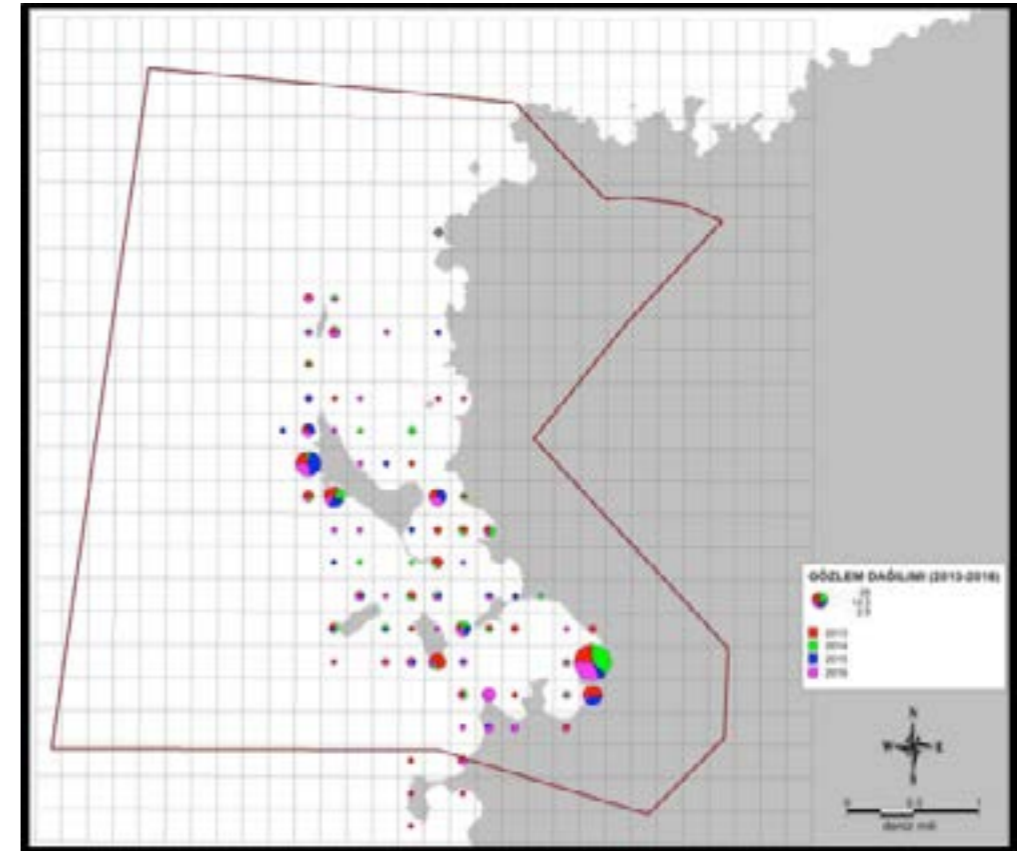


Figure 11

Map of *Monachus monachus* sightings in the Foça SEPA between 2013 and 2016 (Source: Saydam, 2016)

Other marine mammal of the Foça SEPA is the bottlenose dolphin (*Tursiops truncatus*). Alan et al. (2017) identified 11 individuals with the photo-id technique in the area. The species is observed to use at least the areas between and offshore the Foça islands (Figure-12), and is probably to use more area when the observation effort and its spatial distribution are taken into consideration.

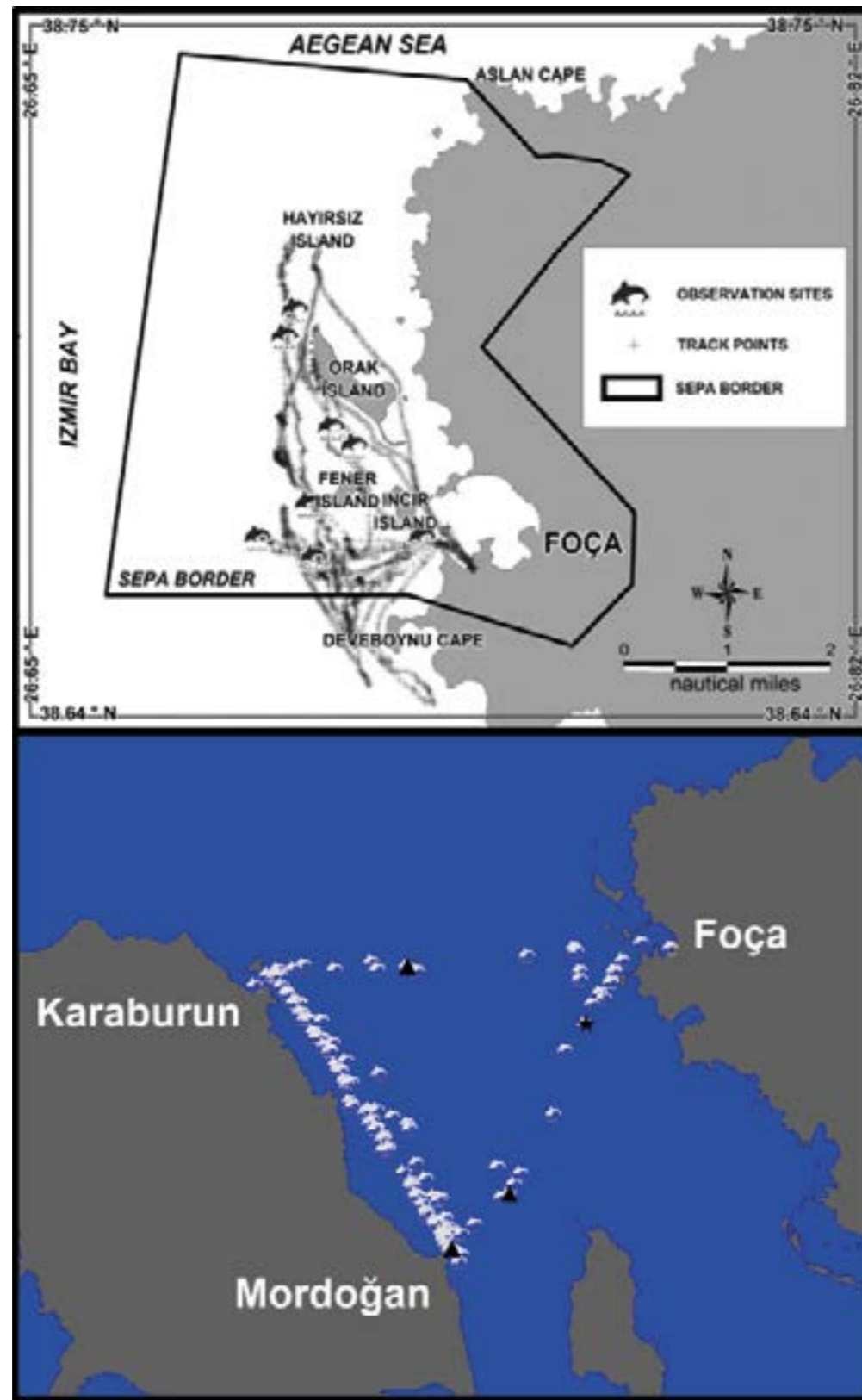


Figure 12
Map of *Tursiops truncatus* sightings in two different studies (top: Alan et al., 2017; bottom: Alan, 2015)

2.6. Fisheries in the Foça SEPA

Foça is one of the largest fishing harbors in the Turkish Aegean (Veryeri et al., 2001) and the district is estimated to provide 20% of the Aegean region's fish supply (İZKA, 2009). About 30% of Foça's population is estimated to earn their income from fishing activities (Bann & Başak, 2011). There are 15 trawling and 97 artisanal fishing vessels in the Foça port by 2019 (Foça Fisheries Cooperative, 2019). Trawling and purse seining was banned in the area in 1991. Moreover, all gears other than trammel nets, longlines and fishgarths are prohibited within the SEPA (Anonymous, 2016a).

Despite the fact that Foça is the landing site for the most effective trawling fleet in the Turkish Aegean, artisanal is the characteristic fishery within the borders of the Foça SEPA and almost all forms of artisanal fishing are applied in the area (Tokaç et al., 2010). Among 112 fishery cooperative members, about 70 of them depend on fishing for their main occupation (Foça Fisheries Cooperative, 2019).

13 fish species were reported by Tokaç et al. (2010) as target species whereas 24 species were reported contributing to the major fishery landings in the Foça SEPA by Bann & Başak (2011) (Table-11).

Table 11
Volume of fish caught in the Foça region in 2010, by species (Source: Bann & Başak, 2011)

Fish type	Amount caught (kg/year)	Percentage of total catch (%)	Fish type	Amount caught (kg/year)	Percentage of total catch (%)
Pilchard (<i>Sardina pilchardus</i>)	900 000	42%	White bream (<i>Diplodus sargus</i>)	9 000	0,42%
Anchovy	800 000	37%	Poor cod	9 000	0,42%
Horse mackerel (<i>Trachurus sp</i>)	120 000	6%	Red porgy (<i>Pagrus pagrus</i>)	5 000	0,23%
Bogue (<i>Boops boops</i>)	100 000	5%	Mackerel (<i>Scomber scombrus</i>)	5000	0,23%
Annular seabream	30 000	1%	Garpike	5 000	0,23%
Blotched picarel (<i>Spicara maena</i>)	20 000	1%	Squid	5 000	0,23%
Grey mullet (<i>Chelon labrosus</i>)	20 000	1%	Shrimp (<i>Penaeus kerathurus</i>)	5 000	0,23%
Salema	20 000	1%	Seabass (<i>Dicentrarchus labrax</i>)	5 000	0,14%
Octopus (<i>Octopus vulgaris</i>)	20 000	1%	Gilthead seabream (<i>Sparus aurata</i>)	3 000	0,14%
Striped red mullet (<i>Mullus surmuletus</i>)	18 000	1%	Bonito (<i>Sarda sarda</i>)	3 000	0,14%
Sole (<i>Solea solea</i>)	12 000	1%	Swordfish	2 000	0,09%
Red mullet (<i>Mullus barbatus</i>)	11 000	1%	Saddled seabream	2 000	0,09%
Total	2 137 000	100			

The Foça artisanal fishermen use some combinations of gears in different locations and seasons. Although the spatial information is not available for their fishing effort, previous studies show that they spend an average of 186 days/year at the sea (Tokaç et al., 2010), and they use areas close the mainland and island coastlines (SAD, 2008) (Figure-13).

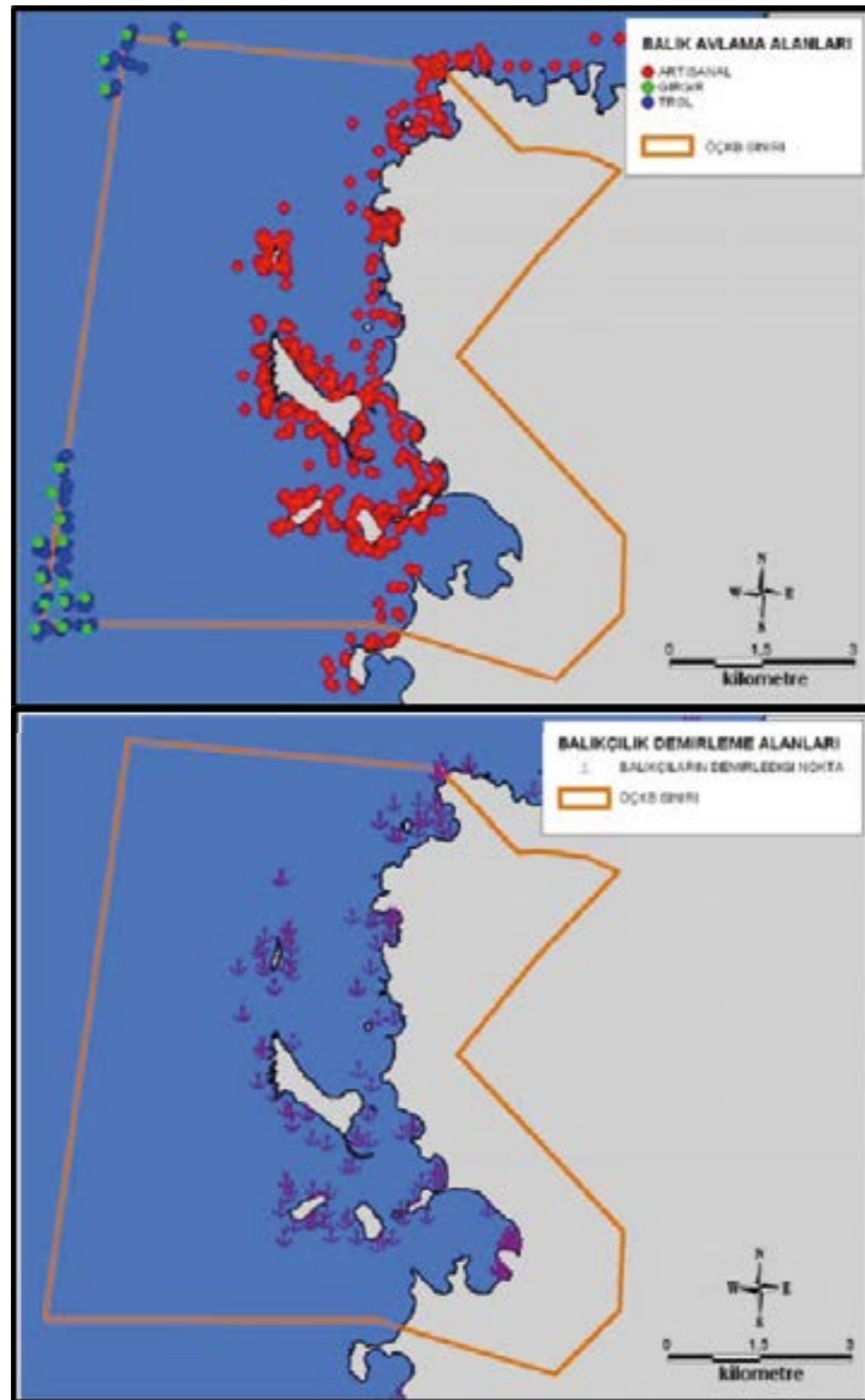


Figure 13 Map of fishing grounds at top (red: artisanal, green: purse-seine, blue: trawl), and anchoring areas of fishing vessels at bottom (Source: SAD, 2008)

2.6.1. Fishing Impacts on the Marine Environment in the Foça SEPA

Direct pressure of the fisheries in the Foça SEPA is mentioned as overexploitation and illegal extraction of the fish stocks and is described as follows in Bann & Başak (2011): "Even though Foça is a protected area, it is a heavily exploited fishing ground both for artisanal and illegal industrial means (trawlers and purse-seiners) shence any opportunity had caught. This is depleting local fish stocks and affecting the marine food chain, including the feeding stocks of the threatened Mediterranean monk seals (which can in turn impact their breeding and nursing abilities). The peak tourism season in summer months increases the demand for seafood (SAD, 2008), while the growing demand for recreational fishing is also be putting further pressure on the stocks." Other fishing related effects can be perceived as increasing human usage of the marine and coastal environment and damage and destruction of the sea bottom by anchoring or fishing practices.

The only study that quantifies fishing pressure is the Kaboğlu (2007) according to 2004-2005 data (Figure-14). He defined fishing pressure as grid factor in each defined grid cell, taking into account only the spatial extent of fishing grounds, anchoring sites and navigation routes, neglecting the temporal component of these activities. The results support the area use characteristics given in Figure-13.

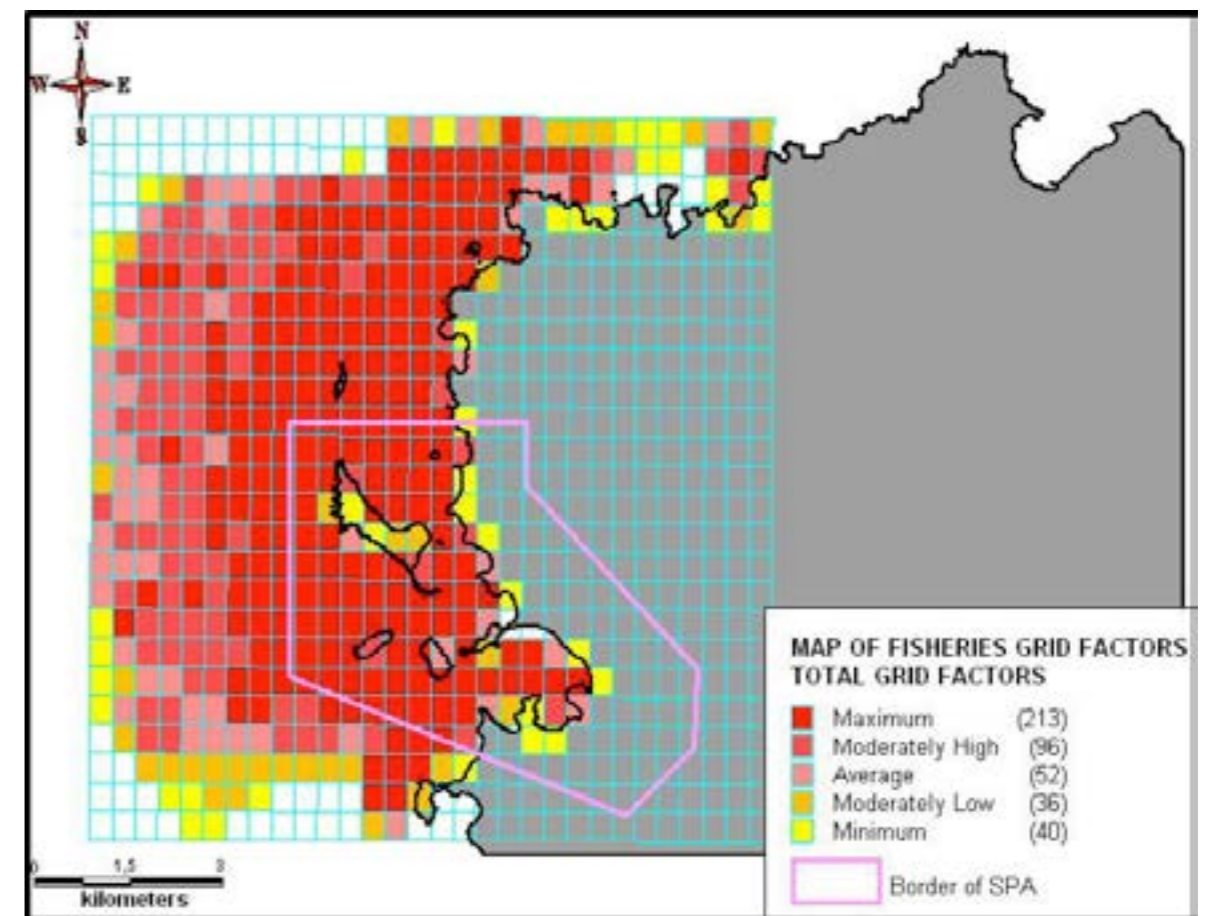


Figure 14 Map of fishing pressure quantified according to only spatial dimension (Kaboğlu, 2007)

On the other hand, Güçlüsoy (2008) analysed the interaction of the Mediterranean monk seal and artisanal fisheries between 1994 and 2002 (Figure-15). During this period, a total of 352 and 96 seal sightings were recorded from full-time and part-time artisanal fishermen, respectively. During these sightings, seals were observed 142 times (32%) around fishing gear, and 90 attacks on fishing gear were reported.

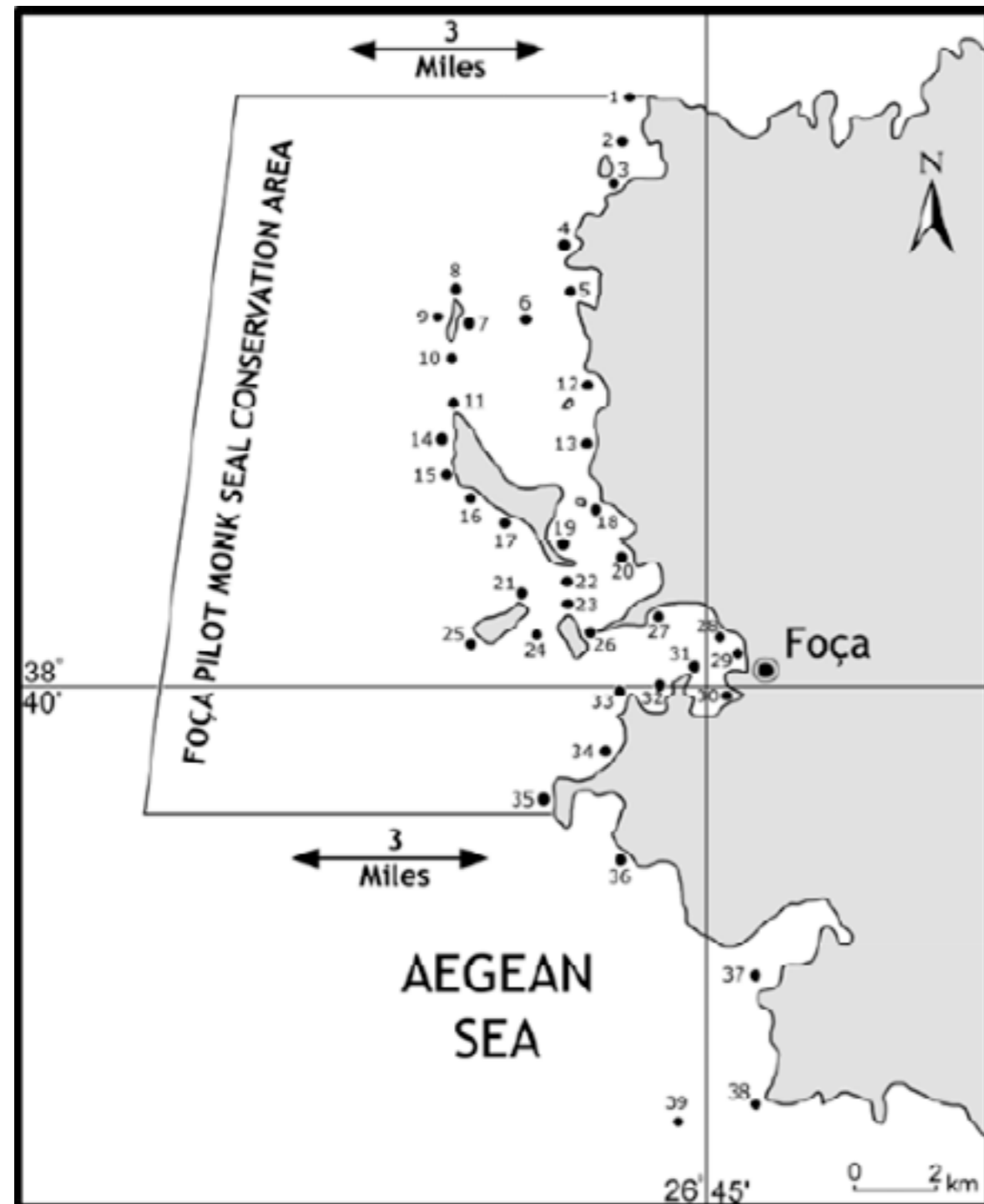


Figure 15
The localities where Monk Seals were encountered around the set fishing gear between 1994 and 2002 (Source: Güçlüsoy, 2008)

2.6.2. Illegal Fishing in the Foça SEPA

Illegal fishing activities by trawlers, purse seiners, and other boats known as "şebeke" locally occur within the SEPA (Kıraç & Güçlüsoy, 2008) as well as by individuals using spear-guns (Bann & Başak, 2011). Another recently increasing illegal fishing activity in the area is the illegal exploitation of sea cucumber. Seven or eight vessels are estimated to perform illegal fishing in the area. Foça Fisheries Cooperative has attempts to monitor and battle against these activities, but not supported well by the local authorities. In 2019, they noticed the Coast Guard around 30-35 times for illegal fishing, but only a few of them was taken legal action (Foça Fisheries Cooperative, 2019). Additionally, the trade of amateur fishermen, which is an illegal practice according to Turkish legislation (Anonymous, 2016b), take place in the area. This results in overexploitation of the marine resources and conflict with the artisanal fisheries.

2.7. Monitoring Activities of the Components of Interest in the Foça SEPA

There have been some monitoring initiatives in the Foça SEPA, all of which lack in continuity because of the fact that the protected area still does not have a specific monitoring programme. The up-to-date monitoring activities are listed below:

2.7.1. Monitoring of Physical Features

There are two on going and one finalized activities for the monitoring of oceanographic properties in the Foça SEPA. Other components of interest (e.g. bathymetry, seafloor) are not monitored.

Integrated National Monitoring Programme: CTD at 1 station (Ministry of Environment and Urbanization, 2017)

İzmir Bay Monitoring: temperature, pressure, current, sea level at 2 stations (Beşiktepe et al., 2016; İzmir Municipality, 2019)

GDNAP water quality monitoring: water quality was monitored at 9 stations between 1996 and 2014 (TVKGM, 2016).

2.7.2. Monitoring of Biological Features

There are two species specific (*Monachus monachus* and *Posidonia oceanica*) monitoring activities which are not presently in effect. *P. oceanica* monitoring was performed as to monitor meadow habitat. Other components (benthos, fish, etc.) are not monitored.

***Posidonia oceanica* monitoring:** 2 monitoring systems were established at Hamamlık and Toprak Su Kampı in the area (Figure-16), and meadow health parameters were obtained at 12 stations in 2008 (SAD, 2008; Akçalı et al., 2008). However, the measurements of those stations were done once for the baseline but fortunately couldn't continue because of funding issues. On the other hand, those stations were investigated in 2016 after 8 years of establishment. The lower limit of *P. oceanica* at Hamamlık station was 22 meters and the density 83 m²/shoot. The lower limit of *P. oceanica* at Toprak Su Kampı was 16 meters and the density 99 m²/shoot. The situation was poor considering those results for the baseline.

The reason could be the increasing turbidity at those stations because of sewage discharge and intensive use of pleasure boats. In 2016, the monitoring stations were investigated for the second time. However, the Toprak Su kampı station was demolished because of pipeline construction. There was no regression at Hamamlık station compared to 2008.

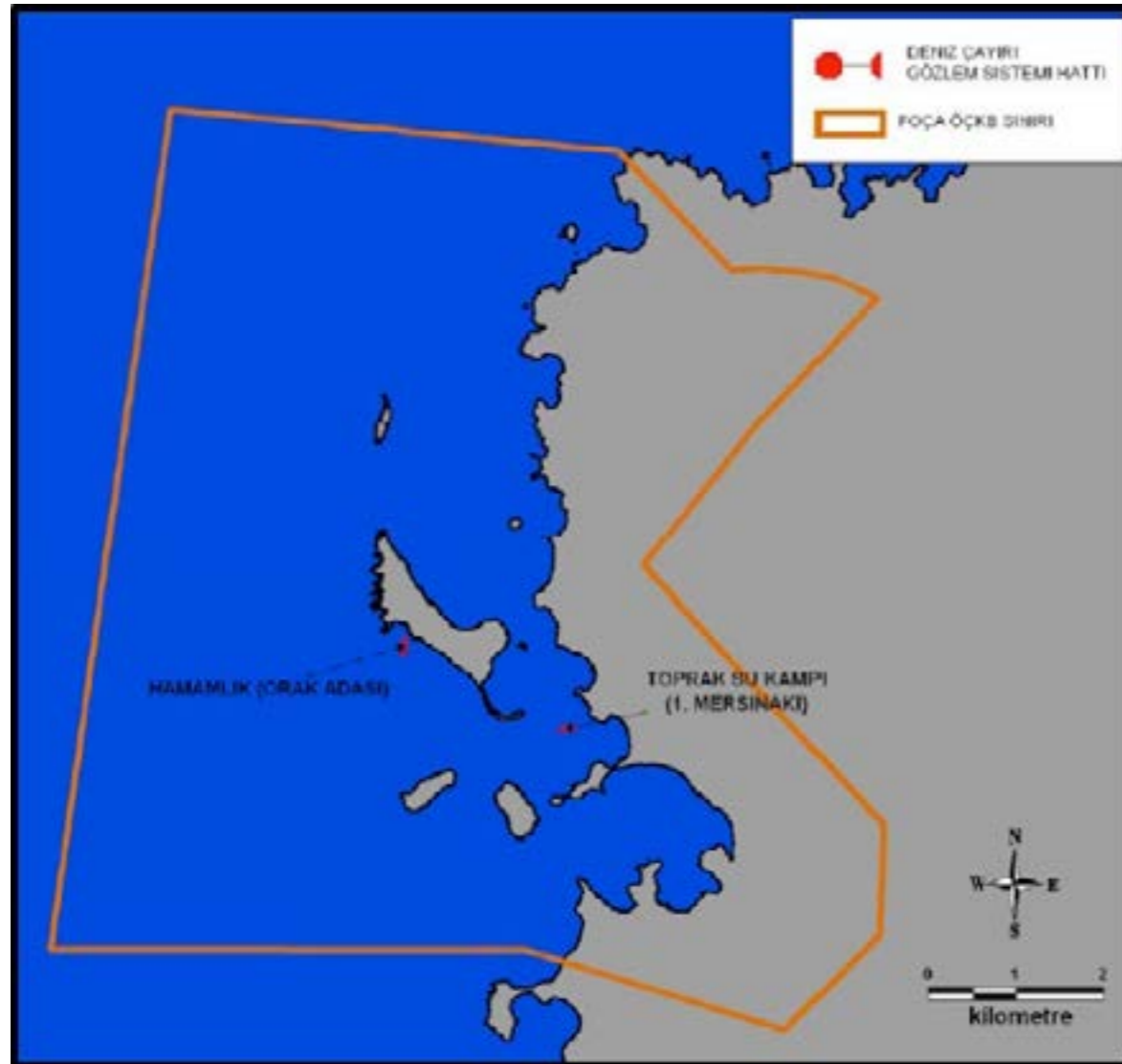


Figure 16
The location of *P. oceanica* monitoring systems (Source: SAD, 2008)

Mediterranean monk seal monitoring by Underwater Research Society-Mediterranean Monk Seal Research Group (SAD-AFAG): Between 1991 and 2004, SAD-AFAG conducted consistent conservation and monitoring activities in the region specific to the species (Bann & Başak, 2011). These monitorings included cave and site observations as well as records from the interviews.

Mediterranean monk seal monitoring by GDNAP: Two monitoring projects were conducted in 2008 and 2012 (Kıraç & Güçlüsoy, 2008; Kıraç & Veryeri, 2012). The former monitoring included cave and sighting records between 2005 and 2008, the latter included only sighting records of 2011-2012. Additionally, monitoring of the species was conducted within PIMS 3696 Project of GDNAP and Saydam (2016). Cave checks were performed in 2013-2014 by the support of SAD-AFAG and sighting records were collected from 2013 to midst of 2016.

2.7.3. Monitoring of Fisheries

There is no any biological monitoring.

Fish landings monitoring: Data is officially collected by TÜİK (Turkish Statistical Institute). The sampling verification is unavailable.

Fishing practices monitoring (illegal fishing): There is not a standard monitoring. Ineffective monitoring and control of fishing activities (Coast Guard + the Environmental boat of GDNAP & municipality are not operational) are stated by Bann & Başak (2011).

SPA/RAC WORKING AREAS

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



Marine turtles



Cetaceans



Mediterranean Monk Seal



Cartilaginous fishes
(Chondrichthyans)



Marine and coastal bird species

Listed in Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean



Specially Protected Areas



Monitoring



Coralligenous and other calcareous bio-concretions



Marine vegetation



Dark Habitats

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



Species introduction and invasive species



Mediterranean
Action Plan
Barcelona
Convention



The Mediterranean
Biodiversity
Centre

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