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Implementation of the ecosystem approach to fisheries for the small-scale fisheries in Gökova Bay, Turkey

Baseline report



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Preparation of this document

Upon the request of Turkey, a pilot case study on the ecosystem approach to fisheries (EAF) in Gökova Bay, Turkey, was initiated in 2016 within the framework of the FAO Mediterranean Project EastMed (Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean). The case study was funded by the FAO EastMed project and implemented in collaboration with the Mediterranean Fisheries Research, Production and Training Institute, Antalya, Turkey. One of the first steps in the pilot case study was the elaboration of an EAF Baseline Report (EAF-BL), which is presented in this publication. The objective of the EAF–BL is to complete the EAF planning phase by defining the scope of the case study. The EAF–BL is a document that outlines the available information on the small-scale fisheries in Gökova Bay that can assist with the remainder of the EAF management planning process. It documents all relevant information about the fishery, the species and geographical areas covered in the case study, the socio-economic profile of the fishery and the institutional arrangements for its management.

Abstract

Gökova Bay is situated in the eastern Aegean Sea, southwest of Anatolia, Turkey. In 1988, a considerable part of the land and marine areas of Gökova Bay were incorporated into a Special Environmental Protection Area. In addition, six no-fishing zones were established in 2010.

With over 723 identified marine macroscopic species, 34 of which are protected under national and international treaties, the biodiversity in Gökova Bay is considered to be high. Fishing is an important economic activity in the region and has developed as a small-scale enterprise because of the conditions of the coastline, geography and productivity of the bay, and the conservation status of the area. The fishery in the bay is characterized as a typical multispecies and multigear small-scale fishery that targets both demersal and pelagic species, as in many other Mediterranean countries. To secure the sustainability of the fisheries in the Gökova Bay marine protected area (MPA), a pilot case study on the implementation of the EAF in Gökova Bay was initiated in 2016 within the framework and with the financial support of the FAO Mediterranean Project EastMed. Various stakeholders, including fishery cooperatives, non-governmental organizations, several ministerial and other governmental and public institutions, as well as universities contributed to, and collaborated with, the project.

This technical paper presents the EAF baseline report that was prepared to complete the planning phase of the project by defining the scope of the case study. It outlines the available information on the small-scale fisheries in Gökova Bay and documents relevant information about the fishery, the species and geographical areas covered in the case study, the socio-economic profile of the fishery and the institutional arrangements for its management.

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Acronyms

DG-Fish	Directorate General of Fisheries and Aquaculture (within the Ministry of Food, Agriculture and Livestock)
DSI	State Water Supply Administration
EAF	Ecosystem approach to fisheries
EastMed	Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean
EPASA*	Environmental Protection Agency for Special Areas
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FMC	Fisheries management committee
FMP	Fisheries management plan
GAS-DER	Gökova Akyaka Lovers Association
GDNCNP	General Directorate of Nature Conservation and National Parks
GFCM	General Fisheries Commission for the Mediterranean
LWG	Local working group
MARA*	Ministry of Agriculture and Rural Affairs
MARA–GDPC	MARA – General Directorate of Protection and Control
MCPA	Marine and coastal protected area
MEF	Ministry of Environment and Fisheries
MEF*	Ministry of Environment and Forestry
MEU	Ministry of Environment and Urbanization
MFAL	Ministry of Food, Agriculture and Livestock
MPA	Marine protected area
NFZ	No fishing zone
NGO	Non-governmental organization
SAD	Underwater Research Society
SEPA	Special Environmental Protection Area
SIS	State Institute of Statistics
SÜR-KOOP	Central Union of Fishery Cooperatives
TAC	Total allowable catch
TRY	Turkish New Lira
TurkStat	Turkish Statistical Institute (TÜIK)

* Obsolete public institution

Introduction

Turkey's coasts have access to three different seas, (the Marmara Sea, Black Sea and Mediterranean Sea) and the management of living marine resources is the responsibility of the Directorate General of Fisheries and Aquaculture (DG-Fish) within the Ministry of Food, Agriculture and Livestock (MFAL). The Fisheries Law No. 1380 is the main legislative framework for the management of the sector. However, the different characteristics of the seas and the multispecies and multi-gear nature of the sector create several difficulties for managing fisheries. There is now broad agreement at the international policy level that the EAF is the appropriate and necessary framework for fisheries management. The EAF, which flows from and is consistent with the FAO Code of Conduct for Responsible Fisheries, is defined as an integrated approach to fisheries that strives to balance diverse societal objectives in the use of aquatic ecosystems. One of the key outcomes of the EAF is the development of comprehensive fishery management plans. These plans can guide the implementation of agreed management measures, as well as their adaptation in the face of changing conditions, thus helping managers to make more informed decisions for the sustainable use of fisheries resources. However, putting an EAF into practice all at once and to cover all three seas fished by Turkey is not easy. Case studies have to be conducted and information about the background, history and conditions of each fishery need to be collected in order to start the EAF process.

There is no doubt that in Turkey, the Gökova MPA fishery is an ideal case study because of the solidarity and cooperation among fishers, the existence of fishery cooperatives, the interest of non-governmental organizations (NGOs) and universities in the MPA, the implementation of projects through joint ventures with stakeholders, both in the past and presently, and most importantly the special status of the area. A part of Gökova Bay, including marine and land areas, was designated a Special Environmental Protection Area (SEPA) by Decree no. 88/13019 of the Cabinet of Ministers of Turkey (dated 12 June 1988). Later, a border change of the Gökova SEPA was approved by Decree no. 90/1117 of the Cabinet of Ministers (dated 22 October 1990). However, because we consider only the marine area of Gökova SEPA, we prefer to use the term Gökova MPA. Therefore, hereafter the area is referred to as Gökova MPA.

An estimated 346.138 hectares of marine area are presently under legal protection within 31 marine and coastal protected areas in Turkey and about 4 percent of the country's territorial waters are protected. Gökova MPA is one of the 31 protected areas (Figure 1; Aktas *et al*., 2011). On the other hand, fisheries in Turkey presently need an example of best practice much more than ever. The cumulative effects of many projects and studies in Gökova MPA in the past have helped researchers, NGOs and fishery cooperatives to act together to solve problems such as illegal fishing, decreasing catch and income. They established six no fishing zones (NFZs) in the bay in 2010 and after five years of protection, they recorded great success with improved catch volumes and fishing income. However, the MPA needs to be sustainable. At this point, it is important that the implementation of a management strategy follows the planning process of an EAF.

1. Overview of the fishery and the resources exploited

1.1 Fishing gear used and areas fished

With a land area of 270 km^2 and a marine area of 827 km^2, the economy of the Gökova region depends on tourism, agriculture and fishing. Fishing in the region has developed as a small-scale enterprise because of the conditions of the coastline, the geography and productivity of the bay and the conservation status of the area.

FIGURE 1
Map of Gökova MPA and protected area, Southern Aegean Sea, Turkey



Gökova MPA is abundant with eggs and larvae, reaching 667 eggs per m^2 in patches. The diversity of species is also relatively high. Researchers have identified 723 macroscopic species belonging to 19 systematic groups within the Gökova MPA area. Thirty four of these species are protected under national and international treaties. Twenty six species have moved into the Mediterranean through various routes and some have even become dominant over the local species over time (Okuş *et al*., 2006).

Fishers, whether they are members of cooperatives or not, use traditional and small-scale fishing gears such as longlines and gillnets, and fish in Gökova MPA throughout the year using vessels of approximately 8.1±0.6 m length (Table 1; Ünal and Erdem, 2009). The main targeted species are listed in Table 1.

TABLE 1
The main target species fished in Gökova MPA, fishing gears and fishing periods

Species	Target species	Fishing gear	Fishing period
Octopus (*Octopus vulgaris*)	X	Entangling	November–April
Amberjack (*Seriola dumerili*)	X	Gillnet/entangling	April–September
European hake (*Merluccius merluccius*)		Longline/gillnet/ entangling	February–June
Red mullets (*Mullus* spp.)	X	Gillnet/entangling	February–May
Narrow barred Spanish mackerel (*Scomberomorus commerson*)	X	Gillnet/entangling	December/March–April
Leer fish (*Lichia amia*)		Gillnet/entangling	November–December/ March–April
Gilthead sea bream (*Sparus aurata*)	X	Longline	July–October
Grey triggerfish (*Balistes capriscus*)		Gillnet/entangling	April–May
Common sole (*Solea solea*)	X	Gillnet/entangling	December–February
Painted comber (*Serranus cabrilla*)		Longline/gillnet/ entangling	All the year round
Barracuda (*Sphyraena* spp.)		Gillnet/entangling	January–February/ March–April
Horse mackerel (*Trachurus* spp.)	X	Gillnet/entangling	Winter months
Picarel (*Spicara smaris*)		Gillnet/entangling	April–May
Goldblotch grouper (*Epinephelus costae*)	X	Longline/gillnet/ entangling	July–September
Two-banded sea bream (*Diplodus vulgaris*)	X	Longline	All year round
Caramote prawn (*Melicertus kerathurus*)	X	Gillnet/entangling	March–June
Grey mullet (*Mugilidae*)	X	Gillnet/entangling	March–April
Common pandora (*Pagellus erythrinus*)	X	Longline/gillnet/ entangling	All year round
Chub mackerel (*Scomber colias*)		Gillnet/entangling	Summer months
Silver scabbardfish (*Lepidopus caudatus*)		Longline/gillnet/ entangling	September–November
Bogue (*Boops boops*)		Gillnet/entangling	All year round
Grouper (*Epinephelus aeneus*)	X	Longline/gillnet/ entangling	July–September
Sea bass (*Dicentrarchus labrax*)	X	Gillnet/entangling	All year round
Brushtooth lizardfish (*Saurida undosquamis*)		Gillnet/entangling	All year round
Brown meagre (*Umbrina cirrosa*)		Gillnet/entangling	October–November/ April–May
Goldband goatfish (*Upeneus molluccensis*)	X	Gillnet/entangling	February–May
Dusky grouper (*Epinephelus marginatus*)	X	Longline/gillnet/ entangling	All year round
Atlantic bonito (*Sarda sarda*)		Gillnet/entangling	November–April
John dory (*Zeus faber*)		Gillnet/entangling	November–December
Salema (*Sarpa salpa*)		Gillnet/entangling	May–July
Dentex (*Dentex dentex*)	X	Longline/gillnet/ entangling	All year round
Dusky spinefoot (*Siganus* spp.)	X	Gillnet/entangling	July–August
Axillary sea bream (*Pagellus acerna*)		Gillnet/entangling	All year around

Updated information on fishing gears used in Gökova MPA, and target species, are listed in Table 2 and bycatch and discard species are shown in Table 3 (AKD, 2016).

TABLE 2
Target species caught by fishing gears used in Gökova MPA

Name of gear	Target species
Red mullet bottom-set gillnet	Red mullet, twaite shad, chub mackerel, yellowmouth barracuda, brushtooth lizardfish, pandora
Pink dentex bottom-set gillnet	Red porgy
Yem[1] bottom-set gillnet	Sardine, goldband goatfish, yellowmouth barracuda, horse mackerel, chub mackerel
Hava balığı[2] bottom-set gillnet	Grey mullet, horse mackerel, saddled sea bream, chub mackerel, barracuda, bonito, garfish
Atlantic bonito bottom-set gillnet	Bonito, little tuny, pompano
Red mullet trammel net	Red mullet, goldband goatfish, striped red mullet, chub mackerel, sardine, brushtooth lizard fish, tub gurnard, European hake, grey mullet, horse mackerel
Piç[3] trammel net	Red mullet, rabbitfish, salema, dentex, pandora, randall sea bream, bluetooth lizardfish, bonito, twaite shad, pompano, bogue, two-banded sea bream, barracuda, scorpionfish, annular sea bream, striped red mullet, goldband goatfish
Voli[4] trammel net	Grey mullet, rabbitfish, saddled sea bream, two-banded sea bream, barracuda, chub mackerel, horse mackerel, white grouper, red mullet, bonito, greater amberjack, leerfish
Common dentex trammel net	Dentex, white grouper, octopus, cuttlefish, squid, greater amberjack, red porgy, two-banded sea bream, tub gurnard, spiny lobster
Common sole trammel net	Sole
Combined bottom-set net	Dentex, pandora, gilthead sea bream, white grouper, brushtooth lizardfish
Thin longline	Pandora, two-banded sea bream
Middle longline	Comb grouper, dentex, red porgy
Thick longline	Goldblotch grouper, dentex, red porgy

TABLE 3
Bycatch and discard species caught by fishing gears used in Gökova MPA

Name of gear	Bycatch species	Discarded species
Red mullet bottom-set gillnet	Brushtooth lizard fish, annular sea bream	Crab, slipper lobster
Pink dentex bottom-set gillnet	White grouper, greater amberjack, dentex	Shark, ray
Yem bottom-set gillnet	Brustooth lizardfish	Annular sea bream, john dory, brushtooth lizardfish
Hava balığı bottom-set gillnet		Ray, pufferfish
Atlantic bonito bottom-set gillnet	Grey mullet, chub mackerel, barracuda, two-banded sea bream, pandora, horse mackerel, octopus	Shell snail
Red mullet trammel net	Brush tooth lizardfish, annular sea bream, blotched picarel	Crab, slipper lobster, shell snail
Piç trammel net		Crab, lizardfish
Common dentex trammel net		Shell snail
Common sole trammel net	Pandora, cuttlefish, brushtooth lizardfish, octopus, dentex	Crab, lizardfish, shell snail
Combined bottom-set net		Ray, pufferfish
Thin longline	White grouper, gilthead sea bream, dentex	Shark, ray
Middle longline	Gilthead sea bream, red porgy, pandora, two-banded sea bream	
Thick longline		Ray

[1] 36 mm mesh size, 3.1 m drop length
[2] 64 mm mesh size, 8.0 m drop length
[3] 50–56 mm mesh size, 320 mm trammel mesh size
[4] 60 mm mesh size, 320 mm trammel mesh size, 5.2 m drop length

According to the recent study by AKD (2016), the fishing gears used in Gökova MPA according to the season, are listed in Table 4. While some of the fishing gears (green) are used for the whole year, others (blue) are used only, or more intensively, in certain months (e.g. longlines). Some of the fishing gears (gray) are not used at certain times because they are not very efficient. Temporal restrictions also limit the use of some fishing gears (red).

TABLE 4
Temporal preference and usage of fishing gears in Gökova MPA

Name of gear	January	February	March	April	May	June	July	August	September	October	November	December
Red mullet bottom-set gillnet												
Pink dentex bottom-set gillnet												
Yem bottom-set gillnet												
Hava balığı bottom-set gillnet												
Atlantic bonito bottom-set gillnet												
Red mullet trammel net												
Piç trammel net												
Voli trammel net												
Common dentex trammel net												
Common sole trammel net												
Combined bottom-set net												
Purse seine net												
Thin longline												
Middle longline												
Thick longline												

Intensive season | Preferred season | Not-preferred season | Closed season

Fishing gear used in Gökova MPA and compliance with European Union regulations
From a technical and regulatory perspective, only a few of the fishing gears used in Gökova MPA do not match European Union (EU) regulations. Considering the drop length regulation, bonito bottom-set gillnets and *voli* trammel nets are not consistent with EU regulations (Table 5). However, with small modifications, such as reducing the mesh number in the depth of the net, the problem can be easily solved (AKD, 2016).

TABLE 5
Conformity of the fishing gears used in Gökova MPA to the EU regulations (sizes with ✔symbol comply with EU regulations)

Name of gear	Bottom-set gillnets > 16 mm	Drop length (bottom-set gillnet) < 10 m	Drop length (trammel) < 4 m	Drop length (combined bottom-set net) < 10 m
Red mullet bottom-set gillnet	40 mm ✔	1.40 m ✔		
Pink dentex bottom-set gillnet	220 mm ✔	4.70 – 9.50 m ✔		
Yem bottom-set gillnet	36 mm ✔	3.10 m ✔		
Hava balığı bottom-set gillnet	64 mm ✔	7.20 m ✔		
Atlantic bonito bottom-set gillnet	72-84 mm ✔	13.00 – 15.00 m		
Red mullet trammel net			1.10 m ✔	
Piç trammel net			1.60 m ✔	
Voli trammel net			5.20 m	
Common dentex trammel net			1.30 m ✔	
Common sole trammel net			1.25 m ✔	
Combined bottom-set net				5.70 m ✔
Purse seine net	Purse seine > 14 mm	Headline length < 800 m	Drop length < 120 m	
Menekse	14 mm ✔	540.00 m ✔	164.00 m	
Gökovalı-5	14 mm ✔	420.00 m ✔	82.00 m ✔	

Various types of gillnets and trammel nets

AKD (2016) classified all kinds of gillnets and trammel nets used in Gökova MPA. Researchers reported detailed plans of these nets which will not be presented in this report because they are available in the separate report prepared under the EU Project managed by the Mediterranean Conservation Society (AKD).

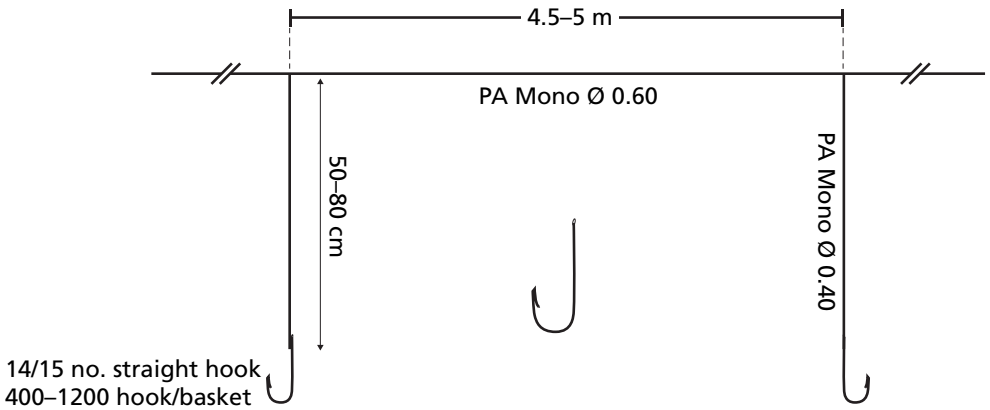
Longlines

Three types of longlines are used by fishers in Gökova MPA. These are classified and called "thin bottom", "medium" and "thick longlines" by local fishers. Information below, taken from AKD (2016), presents the characteristics of the longlines used in Gökova MPA.

a) Thin bottom longline

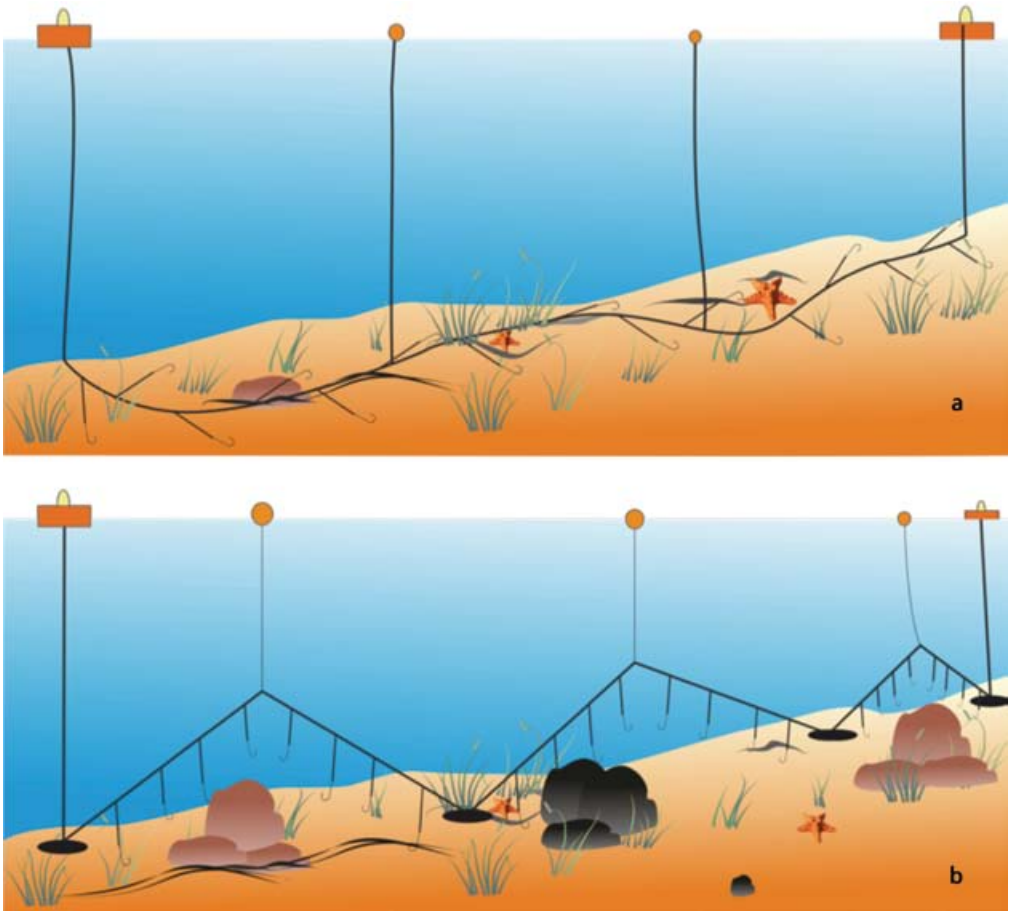
Those fishers who prefer thin bottom-set longlines use J–hooks numbered 14 to 15. Almost all fishers who prefer thin longlines have one or two baskets of longlines on the decks of their fishing vessels. In general, each basket contains 600 hooks but the range varies from 400 to 1 200. The distance between the snoods is about 4.5 m to 5 m (Figure 2).

FIGURE 2
Characteristics of thin bottom longlines used in Gökova MPA



Thin bottom-set longlines are laid as shown in Figure 3(a) where the seabed is flat and Figure 3(b) where the seabed is rocky.

FIGURE 3
Methods of laying longlines on (a) muddy and flat ground; (b) rocky seabeds



The photographs in Plate 1 show an example of a thin bottom-set longline and some fish species caught by the thin longlines used in Gökova MPA.

PLATE 1

Part of a thin longline and some sparid species caught by this fishing gear in Gökova MPA

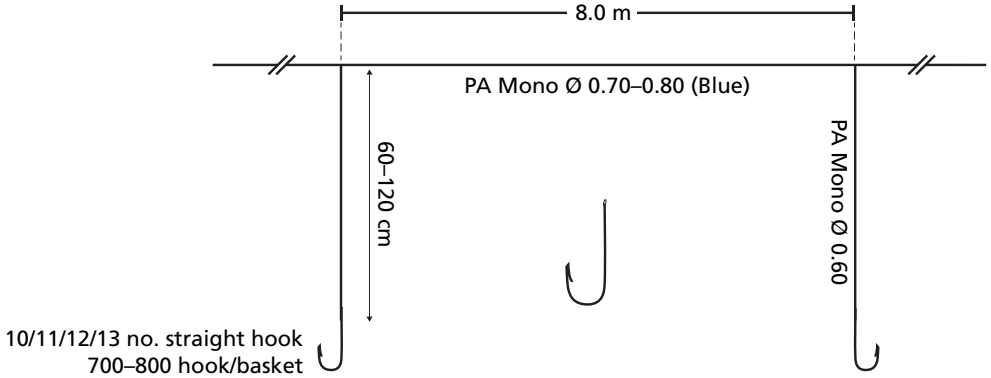


b) Medium bottom longline

Fishers use J–hooks (hooks no.: 10/11/12/13/13) for the medium longlines in Gökova MPA (Figure 4). Medium longlines are not commonly used, with only a few fishers carrying one basket of medium longlines on their vessels. Each basket has about 700 to 800 hooks. Distance between the snoods is about 8 m.

FIGURE 4

Technical plan of medium longlines used in Gökova MPA



The essential materials and tools used with medium longlines are shown in Plate 2 below.

PLATE 2

The basket preferred for use with medium longlines, with typical anchor stones



c) Thick bottom longline

Fishers prefer number 7 to 8 J–hooks for the thick longlines used in Gökova MPA (Figure 5). The number of hooks in each basket is 300. The distance between the snoods ranges from 15 m to 40 m. In general, the preferred bait used with thick longlines is the Mediterranean mud shrimp (*Upogebia pusilla*) (Plate 3).

FIGURE 5
Technical plan of thick longlines used in Gökova MPA

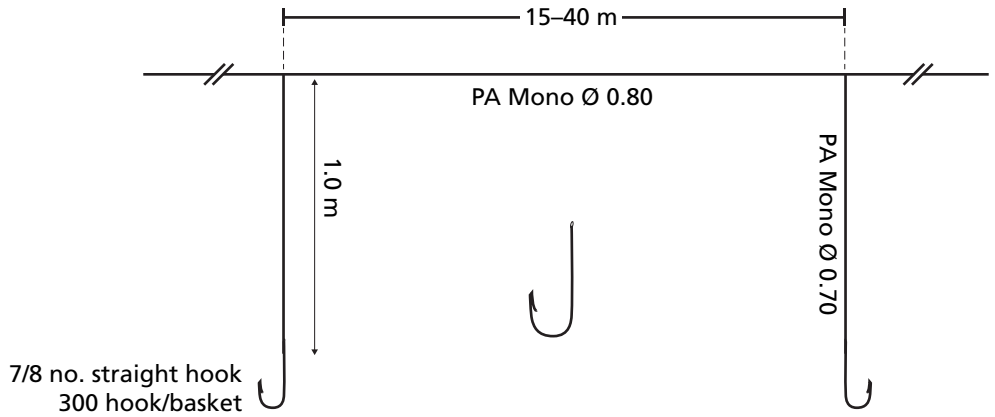
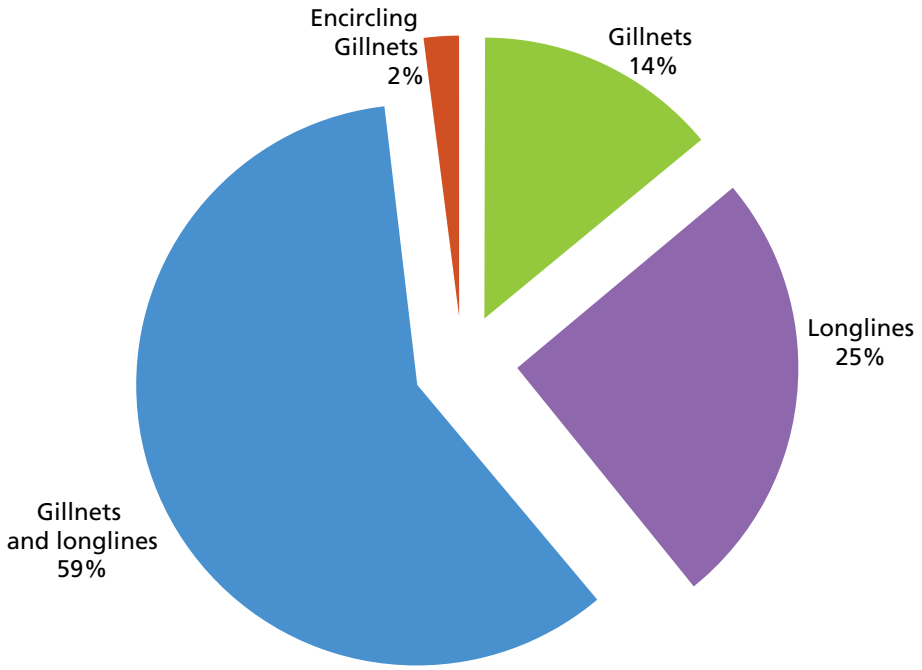


PLATE 3
Hooks and baits used with thick longlines



The types and distribution of the different fishing gears used in Gökova MPA are shown in Figure 6 (Ünal, 2010).

FIGURE 6
Distribution of preferred fishing gears



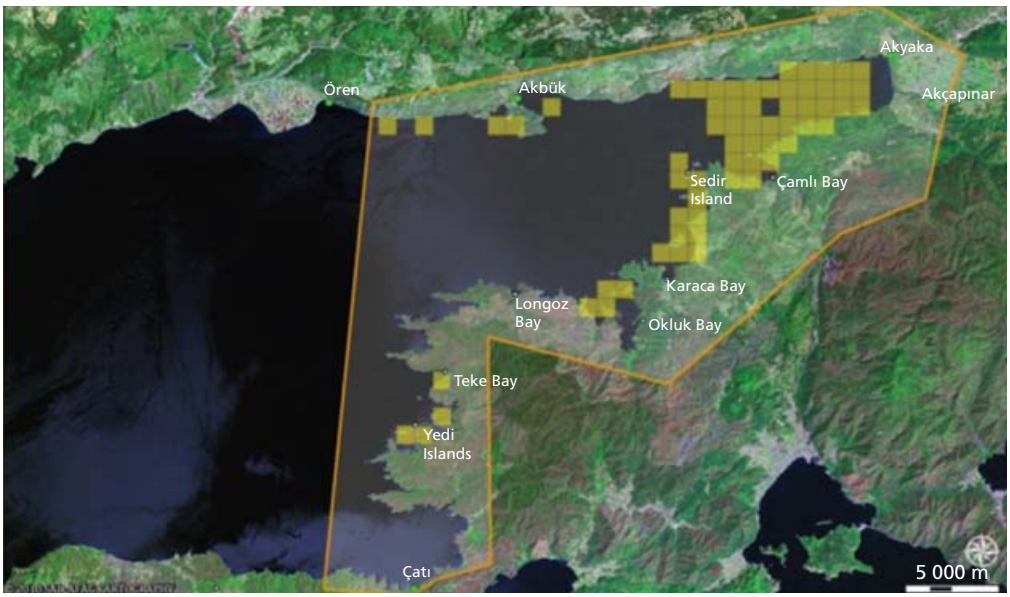
Figures 7, 8, 9 and 10 show the fishery mooring areas and the areas in which encircling nets, traditional longlines, trammel and gillnets are used in Gökova MPA (Ünal, 2010).

FIGURE 7
Fishery mooring areas in Gökova MPA



Source: 2010 SAD-AFAG Cartography.

FIGURE 8
Areas in which encircling nets are used in Gökova MPA

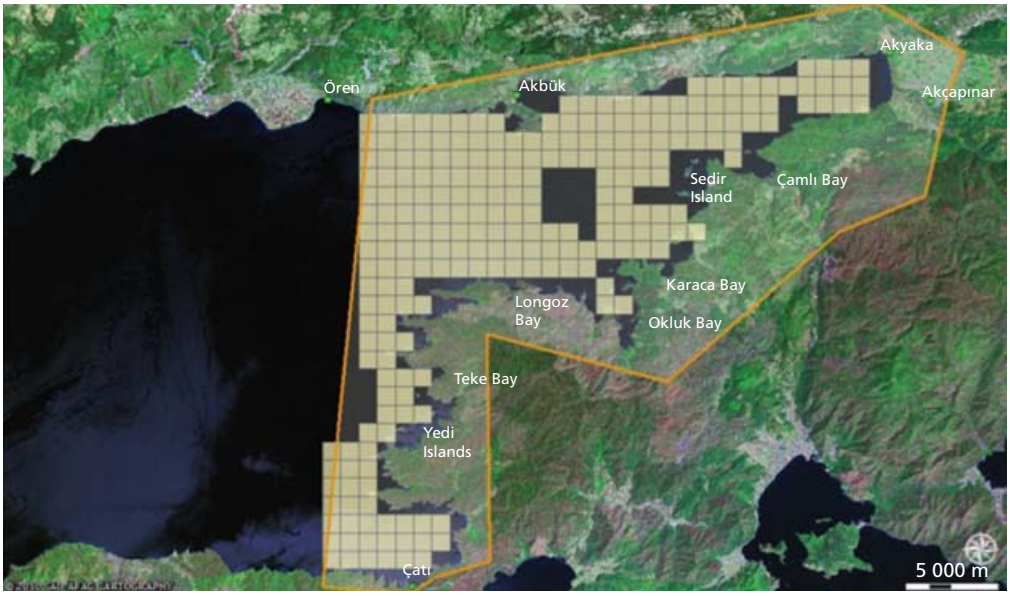


Encircling gillnet & trammel net fishing areas

ENCIRCLING GILLNET & TRAMMEL NET FISHING AREAS
Gökova SEPA Integrated Marine & Coastal Zone Management Planning Project

Source: 2010 SAD-AFAG Cartography.

FIGURE 9
Areas in which traditional longlines are used in Gökova MPA

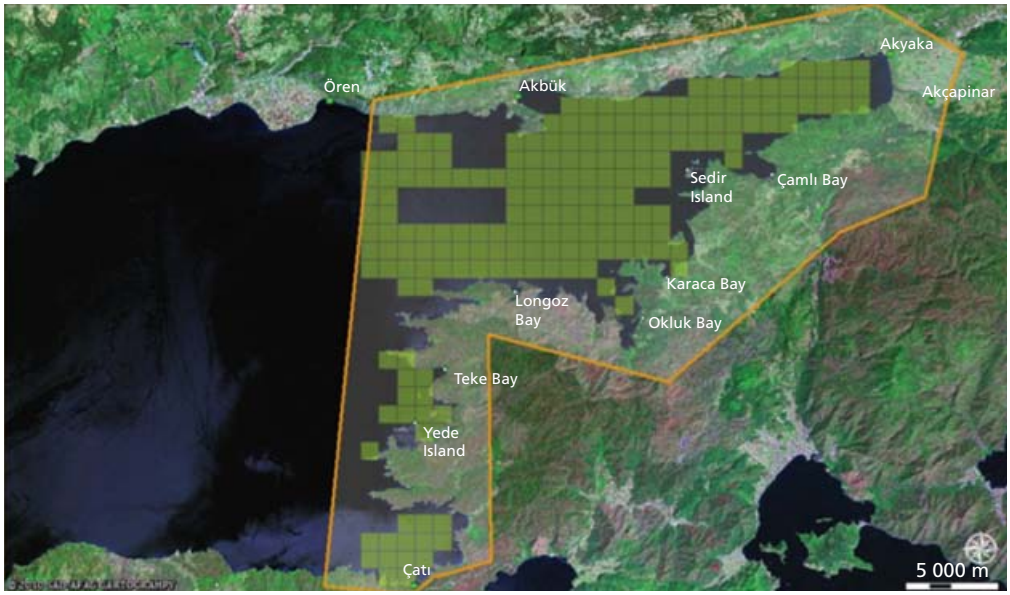


Traditional longline fishing areas

TRADITIONAL LONGLINE FISHING AREAS
Gökova SEPA Integrated Marine & Coastal Zone Management Planning Project

Source: 2010 SAD-AFAG Cartography.

FIGURE 10
Areas in which trammel and gillnets are used in Gökova MPA



Source: 2010 SAD-AFAG Cartography.

The average number of hooks used in longline fishing using thick longlines to target Sparidae is 740. The average number of hooks used with thick longlines to target Epinephelinae is 345. The mean length of gill and trammel nets is approximately 3 000 m per fishing boat in Gökova MPA (Table 6; Ünal, 2010).

TABLE 6
Mean number of active fishing gears per fishing boat in Gökova MPA

	Mean number of hooks used in longline fishery		Mean number of gill and trammel net panels	
Fishing district	Operational hooks per longline (thin line)±sd	Operational hooks per longline for (thick line)±sd	Operational panel* thinner 210d/4	Operational panel thicker 210d/4
Akbük	668.2±205.3	308.3±91.7	28.1±14.3	34.0±15.4
Akyaka	771.2±148.9	320.0±67.9	35.8±12.6	26.1±14.7
Akcapınar	723.3±164.6	378.2±131.5	24.9±22.3	28.3±13.8
Other				
(Ören, Çatı)	744.4±303.8	370.8±165.9	28.6±20.1	35.0±22.4
Gökova MPA	740.9±204.3	345.1±115.1	29.4±18.0	30.7±16.8

*One panel equals 100 m net

1.2 Importance of the fishery to the local/national/regional economy

Marine capture fisheries provide full-time and part-time employment opportunities for 150 to 200 fishers, respectively, who directly work on fishing boats in the bay. Fishery cooperatives pay salaries to directors, heads and fish cleaners which means there are five full-time workers in these cooperatives. In addition, three former fishers have been employed as full-time marine rangers in the bay since 2013.

There are three permanent retailers/fish shops (cooperatives excluded) and two fish stands at Gökova bazaar (only on Saturdays) and nine employees (11 during high

season) work in these shops. They only buy and sell fish but they do not only buy fish from Gökova, they also purchase fish from outside the region.

There are 10 to 20 (depending on the season) fish restaurants located around the Gökova MPA and they operate throughout the year. Fish restaurants provide employment opportunities for approximately 142 people, including the restaurant owners.

In general, within the borders of Gökova MPA, there are two restaurants open throughout the year at Akbük Bay. This number increases to 10 in summer and approximately 40 people work in these restaurants. There is only one fish restaurant at Akçapınar and it has two employees. Ten restaurants are active with approximately 110 workers in Akyaka.

There are four people who fix and prepare nets and one of them also works on board a fishing vessel with her husband. Those engaged in repairing and preparing fishing nets earn approximately TRY 90 (26 USD) per 100 m of net.

The percentage of people in the region who identified fishing as their only source of income is determined as follows: 38.9 percent (Akyaka), 50 percent (Akçapınar), and 100 percent (Sarnıç-Akbük) (Ünal, 2010).

The only study that provides information on the socio-economic status of small-scale fishing in the Gökova MPA (Ünal and Franquesa, 2010) indicates operational indicators, socio-economic indicators and economic performance indicators of fishing vessels from Akyaka Fishery Cooperative and Akçapınar Fishery Cooperative (Table 7, 8, 9, 10, 11).

TABLE 7
Some operational characteristics of small-scale fishing vessels

Fishery cooperatives		Operational indicators			
		Crew size Mean ± sd	Days at sea Mean ± sd	Running costs per fishing day (USD) Mean ± sd	Per vessel day share income ($/Day)
Southern Aegean	Akyaka*	1.1±0.2	224.2±58	8.9±4.2	25.1
	Akçapınar*	1.6±0.5	185.6±46	7.7±2.3	8.0
	Marmaris	1.3±0.6	147.8±64	8.5±4.2	14.1

* Akyaka and Akçapınar Fishery Cooperatives are two active fishery cooperatives out of three existing cooperatives operating in Gökova MPA.

TABLE 8
Some socio-demographic and economic characteristics of small-scale fishers

	Socio-demographic characteristics									
	Fishery cooperatives	Age of fishers Mean ± sd	Experience of fishers (years) Mean ± sd	Household population Mean ± sd	Dependent family members Mean ± sd	Defining fishery as main occupation (%)	Fishers declared fishery as only income source (%)	Having social security (%)	House owner (%)	Married (%)
Southern Aegean	Akyaka*	43.2±10.1	23.4±9.1	4.4±1.9	2.4±2	95	63	58	62	77
	Akçapınar*	45±9.3	23.5±9.2	4.3±1.3	2.6±1.7	100	46	77	8	89
	Marmaris	45.9±12.8	28.1±11.8	4.4±1.4	2.2±1.3	100	56	75.5	21	82

*Akyaka and Akçapınar Fishery Cooperatives are two active fishery cooperatives out of three existing cooperatives operating in Gökova MPA.

TABLE 9
Socio-economic indicators of the small-scale fishery in selected fishing cooperatives

Fishery cooperatives		Indicators and items												
		Vessel physical productivity (kg)	Capacity physical productivity (kg/length)	Power physical productivity (kg/HP)	Per vessel day physical productivity (kg/day)	Fisher physical productivity (kg/fisher)	Landing prices (USD/kg)	Fisher productivity (USD/ fisher)	Invested capital (USD)	Opportunity cost (USD)	Capacity productivity (USD/ length)	Vessel productivity (USD)	Power productivity (USD/HP)	Per vessel day productivity
Southern Aegean	Akyaka*	1 199.3	156.9	101	2.4±2	1 139.3	6.4	7 248.7	40 241.4	1 126.8	998.4	7 630.2	642.9	34
	Akçapınar*	416.4	51.2	25.7	2.6±1.7	257.8	7.0	1 804.2	75 234.0	2 106.6	358.5	2 914.4	179.8	15.7
	Marmaris	492.1	73.9	39.5	2.2±1.3	445.2	5.7	2 549.5	25 099.2	702.8	422.9	3 346.2	226.4	22.6

* Akyaka and Akçapınar Fishery Cooperatives are two active fishery cooperatives out of three existing cooperatives operating in Gökova MPA

TABLE 10
Gross and net cash flow of small-scale fishing vessels (USD)

		Economic Performance								
	Fishery cooperatives	Total earnings	Running costs	Labour costs	Vessel costs	Other costs	Gross cash flow	Depreciation	Imputed opportunity cost	Net cash flow
Southern Aegean	Akyaka*	144 982.4	37 918.2	21 808.6	15 512.1	0	69 743.5	4 116.8	1 126.8	64 499.9
	Akçapınar*	75 779.1	37 357.0	38 201.3	11 796.3	0	-11 575.5	6 401.6	2 106.7	-20 083.8
	Marmaris	53 541.6	20 074.8	14 671.2	6 286.3	0	12 509.3	2 267.8	702.8	9 538.7

* Akyaka and Akçapınar Fishery Cooperatives are two active fishery cooperatives out of three existing cooperatives operating in Gökova MPA

TABLE 11
Economic/financial results of small-scale fishing vessel

	Economic/financial results			
	Fishery cooperatives	Net profit/Total earning (%)	Return on investment (%)	Total cost/Total earning (%)
Southern Aegean	Akyaka*	44.5	160	55.5
	Akçapınar*	-26	-27	127
	Marmaris	17.8	38	82.2

According to Ünal and Franquesa (2010), the economic results of the Akyaka and Akçapınar Fishery Cooperatives are completely different. This might be as a result of misreporting by respondents from the Akçapınar Cooperatives, in which all fishers define "fishery" as their main occupation. Additionally, 46 percent of them have no alternative income source; their livelihood is entirely dependent on fishing. It was expected that the economic results for both cooperatives would be similar because their members work on the same fishing grounds, but this was not the case. The data are important and essential for making decisions in the fisheries management process. However, reliable data are required for proper socio-economic monitoring.

Most of the fishers work alone. Only one fisher from Akyaka Cooperative works with a partner in a sharing system. Five fishers from Akyaka Cooperative go fishing with their wives who are very capable of baiting lines, fixing fishing gear, laying nets/longlines and steering the boat.

Although women are employed in fisheries work all over the world, including in fishing, aquaculture, marketing and distribution, processing, administration, management and the public sector, the ratio of women to men working in these subsectors in Turkey is unknown (Göncüoğlu, Ünal and Kızılkaya, 2015).

Currently there are limited official records of the numbers of women working in the fisheries sector (only the numbers of women working on board fishing vessels is known) and there have been efforts to make women fishers visible and accepted since 2008. These efforts are captured in a Masters thesis (Göncüoğlu, 2008). The first international article on women fishers was published in 2011. (Göncüoğlu and Ünal, 2011) and between 2012 and 2014 there were two social responsibility projects with an emphasis on women carried out at Gökova and Datça-Bozburun MPAs (Göncüoğlu, Ünal and Kızılkaya, 2015). Besides the public focus on women fishers, the aims of these two projects were to improve education about the role of women fishers, to donate health and safety equipment and to offer financial support. Details of these projects are provided in Table 12 (Göncüoğlu, Ünal and Kızılkaya 2015).

TABLE 12
Project details on women fishers

Name of project	**Fisherwomen of the Aegean Sea: Gökova Bay (*Ege'nin Kadın Balıkçıları: Gökova Körfezi*)**	**Fisherwomen of the Aegean Sea: Datça-Bozburun Peninsula (*Ege'nin Kadın Balıkçıları:Datça-Bozburun Yarımadası*)**
Date	March 2012 – August 2012	February 2013 – March 2014
Budget	USD 60.000	USD 57.000
Supporters	Personal support by Aysegül Dinçkök Underwater Research Society	Mediterranean Conservation Society, SGP (The Small Grants Programme) COMDEKS, National System of Marine Protected Areas Vehbi Koç Foundation
Objective	To help acknowledge that fisheries, generally known in Turkey as men's job, are also done by women To assess the needs of the active women fisher	Support the existence of women fisher in Datça-Bozburun Peninsula SEPA where they play a key role in the traditional and economic sustainability of artisanal fisheries Share the basic problems of marine protected areas and their solutions with public

Name of project	Fisherwomen of the Aegean Sea: Gökova Bay (*Ege'nin Kadın Balıkçıları: Gökova Körfezi*)	Fisherwomen of the Aegean Sea: Datça-Bozburun Peninsula (*Ege'nin Kadın Balıkçıları:Datça-Bozburun Yarımadası*)
Target Group	21 women fishers	70 women fishers
Activities	Educational support: Women fisher in Turkey and in the world; Importance of organization in fisheries: Fishery cooperatives; Ecosystem-based fisheries; Safety at sea and first aid trainings. Equipment support: Safety equipment, apparel, longline sets; Six traditional Turkish Gold coins for each women fisher; Monetary support for fishery cooperatives that have women members.	Educational support: Women fisher in Turkey and in the world; Importance of organization in fisheries: Fishery cooperatives and how to manage fisheries; Do we know the marine ecosystem? What to consider when fishing? Puffer fish: dangers and injuries; Safety at sea and first-aid trainings; Turkish Grameen Microcredit Finance Applications; Introduction of the Italian women fishers cooperative, *La Pesca Rosa*; Problems of local fisher, why women fisher are important? Equipment support: Apparel, longline sets; Documentary on women fisher; Microcredit application draft; One traditional Turkish Gold coin for each woman fisher; Certificate of attendance for each fisher women.

The total number of fishers in the entire Aegean region was 25 896 in 2007. Among these fishers were 427 women, 4.2% of whom worked in the southern Aegean region. This demonstrated that the number of women fishers was higher in this area than in other parts of the Aegean region. The southern Aegean region has 3 911 legally licensed fishers, of whom 163 are women, which is a higher ratio in comparison to the rest of the Aegean. In the entire Aegean region 38 percent of women fishers are legally licensed (Göncüoğlu and Ünal, 2011).

In the southern Aegean, 41 percent of women fishers were between 40 and 49 years of age. Considering the fishing portion of the population, it could be concluded that the younger generations do not prefer to work as fishers. Most of the women fishers (76 percent) fish with their husbands, most (79 percent) have an elementary level of education, and 90 percent are homeowners. Almost all women fishers live as part of nuclear families, with an average household size of 4 ± 1 family members. The number of dependents is commonly 1 to 3. The number of persons per family earning their living by fishing was also calculated as 1 to 3. The reasons women gave were: helping their husband (70 percent), contributing to the family income (19 percent), obligations (6 percent) and love for the sea (5 percent). Some 64 percent were involved in all aspects of the work, except marketing. The remainder were generally involved in sailing, catching and cleaning the nets (24 percent), repairing nets and assisting their husbands in the kitchen of the boat (10 percent), doing repairs on land (1 percent) and other similar work related to the job (1 percent) (Göncüoğlu and Ünal, 2011).

Among the future plans of women fishers, if provided with financial support, are upgrading to newer equipment and technologies that would help them improve their fishing experiences (39 percent), modernizing their vessels (37 percent), quitting the job (12 percent), or converting the vessel to a cafe or restaurant (12 percent), which is a growing trend. Most (96 percent) of the women fishers think the future of fishing is not promising, and again most of them (93 percent) do not want their children to do the same work. Women fishers define fishing as a job with uncertainty and irregular income and have advised their children to apply for work with a regular income. They want their children to consider fishing as a hobby rather than as employment. However, only 6 percent think that fishing has no positive aspects (Göncüoğlu and Ünal, 2011).

Only four out of 21 fishery cooperatives in the southern Aegean have women members. Women fishers constitute only 1 percent of the total cooperative membership in the entire region. Among the cooperatives in the entire Southern Aegean region, only ten women are cooperative members and five of them are women fishers from Gökova-based fishery cooperatives. Although women fishers truly fulfill all functions that the profession requires (both pre and post-harvest phases), study results demonstrate that they are largely ignored by related policies. The study suggests that gender-oriented data should also be collected, the presence of women fishers in fisheries should be taken into consideration and included in relevant policies (Göncüoğlu and Ünal, 2011).

Because of a lack of regular monitoring of fisheries in the bay, the value and landing of catches from the fishery per year, by species, are not available for the past five years. However, the relevant data is provided by some researchers (Ünal *et al*., 2009), NGOs (e.g. AKD) and fishery cooperatives (e.g. Akyaka Fishery Cooperative). The quantity of landings and value data generated by the aforementioned sources for the years 2006 to 2008, 2009 and 2015 are provided in Tables 13, 14 and 15. These data represent records of the fishery cooperatives rather than all of the fishers operating in Gökova MPA.

Table 13 shows the quantity and value of species caught in Gökova MPA for the years 2006 to 2008, while Table 14 indicates the quantity of fish marketed by the two cooperatives from 2009 to 2010. Table 15 represents comparative catch volume and values by years in Gökova MPA (Ünal and Erdem, 2009).

TABLE 13
The amount of fish marketed by the two fishery cooperatives currently operating in Gökova MPA, 2006 to 2008

Species (English and Latin name)	**Total fisheries catch** (kg)	(%)	**Price (TRY)** (Mean ± SD)	**Total value of fishing** (TRY)	(%)
Grouper *(Epinephelus aeneus)*	2 905	11	33.5±2	100 782	31
Caramote prawn *(Melicertus kerathurus)*	1 106	4	31±3	33 516	10
Octopus *(Octopus vulgaris)*	3 842	15	7.5±1	27 762	9
Common pandora *(Pagellus erythrinus)*	1 549	6	17.5±5	24 778	8
Common sole *(Solea solea)*	824	3	30.5±3	24 643	8
Gilted sea bream *(Sparus aurata)*	938	4	25.5±4	23 295	7
Grey mullet *(Mugilidae)*	900	3	11.6±0	10 499	3
Two-banded sea bream *(Diplodus vulgaris)*	792	3	12.5±1	10 113	3
Goldband goatfish *(Upeneus molluccensis)*	761	3	10±0	7 538	2
European hake *(Merluccius merluccius)*	1 642	6	5±0	5 711	2
Barracuda (*Sphyraena* spp.)	1 517	6	5±0	5 084	2
Dentex *(Dentex dentex)*	148	1	32.5±4	5 036	2
Brushtooth lizardfish *(Saurida undosquamis)*	1 309	5	4±1	4 800	1
Northern Pike *(Esox lucius)*	349	1	13±4	4 684	1
Atlantic bonito *(Sarda sarda)*	2 167	8	5±0	4 586	1

Species (English and Latin name)	**Total fisheries catch** (kg)	(%)	**Price (TRY)** (Mean ± SD)	**Total value of fishing** (TRY)	(%)
Goldblotch grouper *(Epinephelus costae)*	170	1	21.5±2	3 729	1
Horse mackerel (*Trachurus* spp.)	305	1	10±0	3 024	1
Sea bass *(Dicentrarchus labrax)*	141	1	20±5	2 671	1
Salema *(Sarpa salpa)*	334	1	8±2	2 658	1
Red mullet (*Mullus* spp.)	187	1	13±9	2 486	1
Axillary sea bream *(Pagellus acerna)*	584	2	6±2	2 334	1
Bogue *(Boops boops)*	900	3	4±1	2 301	1
Amberjack *(Seriola dumerili)*	161	1	11.5±1	1 833	1
Dusky spinefoot (*Siganus* spp.)	543	2	5±0	1 714	1
Narrow barred Spanish Mackerel *(Scomberomorus commerson)*	267	1	10±0	1 672	1
Brown meagre *(Umbrina cirrosa)*	126	0.5	12±1	1 512	0.5
Silver scabbardfish *(Lepidopus caudatus)*	404	2	5±0	1 419	0.4
Dusky grouper *(Epinephelus marginatus)*	56	0.2	17.5±2	1 038	0.3
Chub mackerel *(Scomber colias)*	345	1	4±2	784	0.2
John dory *(Zeus faber)*	87	0.3	10±0	772	0.2
Picarel *(Spicara smaris)*	300	1	4±1	767	0.2
Grey triggerfish *(Balistes capriscus)*	210	1	5±0	752	0.2
Leer fish *(Lichia amia)*	62	0.2	9±1	555	0.2
Painted comber *(Serranus cabrilla)*	120	0.5	5±0	312	0.1
Total	**26 051**	**100**	**–**	**325 160**	**100**

TABLE 14
The amount of fish marketed by the two fishery cooperatives currently operating in Gökova, 2009 to 2010*

Common name	Latin name	Landing volume (kg)	Landing volume (%)	Landing value (TRL)*	Landing value (%)
Total		14 989	100	332 854	100
Grey mullet	*Mugilidae*	2 400	16	72 000	21.6
Common pandora	*Pagellus erythrinus*	2 650	17.7	66 250	19.9
Gilthead sea bream	*Sparus aurata*	1 300	8.7	45 500	13.7
Dentex	*Dentex dentex*	900	6	36 000	10.8
White grouper	*Epinephelus aeneus*	755	5	33 975	10.2
Other species		4 352	29	30 464	3.2
Goldband goatfish	*Upeneus molluccensis*	565	3.8	14 125	4.2
Common octopus	*Octopus vulgaris*	800	5.3	12 000	3.6

Common name	Latin name	Landing volume (kg)	Landing volume (%)	Landing value (TRL)*	Landing value (%)
Two-banded sea bream	*Diplodus vulgaris*	480	3.2	7 200	2.2
European hake	*Merluccius merluccius*	300	2	4 500	1.4
Barracuda	*Sphyraena* spp.	295	2	4 425	1.3
Goldblotch grouper	*Epinephelus costae*	125	0.8	4 375	1.3
Dusky grouper	*Epinephelus marginatus*	45	0.3	1 350	0.4
Common sole	*Solea solea*	20	0.1	600	0.2
Caramote prawn	*Melicerthus kerathurus*	2	0.01	90	0.02

*Catch quantity and value data were derived from members of the two fishery cooperatives (those providing a marketing service) located in the Gökova MPA.

According to the recent data for 2015 provided by the AKD and based on the Akyaka Fishery Cooperative, in terms of quantity, the top five species caught in the bay are *Pagellus erythrinus*, *Epinephelus aeneus*, *Merluccius merluccius*, *Sparus aurata* and *Mugil* spp. Considering the value of the species or their contribution to the gross income of the cooperatives, *Epinephelus aeneus*, *Pagellus erythrinus*, *Sparus aurata*, *Mugil* spp. and *Epinephelus costae* are the most important species in Gökova MPA (Table 15).

TABLE 15
Landing volume and value of Akayaka Fishery Cooperative in Gökova MPA

Common name	Latin name	Landing volume (kg)			Landing volume (%)			Landing value (TRL)			Landing value (%)		
		2006	2009	2015	2006	2009	2015	2006	2009	2015	2006	2009	2015
Other species	*Other species*	8 901	3 152	12 181	33.5	25	53.1	40 636	21 434	166 564	12	7.4	34.4
White grouper	*Epinephelus aeneus*	2 905	755	1 763	11	6	7.7	100 782	33 975	90 893	21	11.8	18.8
Common pandora	*Pagellus erythrinus*	1 549	2 550	2 693	6	20.2	11.7	24 778	63 750	82 183	8	22.1	17
Gilthead sea bream	*Sparua aurata*	938	1 200	1 446	4	9.5	6.3	23 295	42 000	56 614	7	14.6	11.7
Grey mullet	*Mugilidae*	900	2 100	858	3	16.7	3.7	10 499	63 000	13 720	3	21.9	2.8
Goldblotch grouper	*Epinephelus costae*	170	95	283	1	0.8	1.2	3 729	3 390	11 110	1	1.4	2.3
Dentex	*Dentex dentex*	148	500	239	1	4	1	5 036	20 000	10 896	2	6.9	2.3
Common sole	*Solea solea*	824	20	203	3	0.2	0.9	24 643	600	10 863	8	0.2	2.2
Common octopus	*Octopus vulgaris*	3 842	800	540	15	6.3	2.4	27 762	12 000	10 089	9	4.2	2.1
Two-banded sea bream	*Diplodus vulgaris*	792	380	451	3	3	2	10 113	5 700	8 393	3	2	1.7
Barracudas	*Sphyraena* spp.	1 517	235	475	6	1.9	2.1	5 084	3 525	7 277	2	1.2	1.5
European hake	*Merluccius merluccius*	1 642	250	1 367	6	2	6	5 711	3 750	6 835	2	1.3	1.4
Goldband goatfish	*Upeneus mollucensis*	761	550	391	3	4.4	1.7	7 538	13 750	6 254	2	4.8	1.3
Caramote prawn	*Melicertus kerathurus*	1 106	2	38	4	0	0.2	33 516	90	1 906	10	0	0.4
Dusky grouper	*Epinephelus marginatus*	56	20	7	0.2	0.2	0	1 038	600	259	0.3	0.2	0.1
Total		26 051	12 609	22 934	100	100	100	324 160	287 564	483 856	100	100	100

1.3 Available knowledge on the status of fisheries resources

Brief biology of the major species

The Aegean Sea harbours a rich and diverse fish fauna that presently includes a total of 449 species (Bilecenoğlu *et al*., 2014). Consequently, the fishery of Gökova Bay is a typical multispecies fishery similar to many other places in the Mediterranean and exploiting an ample number of fish species. Some of these species are caught more frequently than others, regardless of season, while others are caught less regularly or their availability is affected by season change. Members of the Sparidae and Serranidae families are the most important and most targeted fish species in Gökova Bay. Several other demersal and pelagic fish species from various families, including Nemipteridae, Soleidae, Mullidae, Mugilidae, Carangidae, Sciaenidae, Scombridae, Siganidae, Sphyraenidae and Zeidae, are also targeted or landed as bycatch.

Common pandora (*Pagellus erythrinus*)

Common pandora is a demersal fish from the family Sparidae. It is distributed along the European and African coasts of the Atlantic Ocean, from Norway to Angola, and around São Tomé and Príncipe and the Canary Islands. It is also present in the Mediterranean and Black seas. In the Atlantic and the Mediterranean, spawning takes place from May to September. *Pagellus erythrinus* can attain a maximum size of 60 cm, but is most commonly caught at a length of about 25 cm (Bauchot and Hureau, 1986). These fish are protogynous hermaphrodites; females become males around their third year, at a size of about 16 cm to 18 cm (Papaconstantinou, Petrakis and Vassilopoulou, 1986). The body colour is red without stripes or bars. Common pandora is carnivorous and preys on molluscs, crustaceans and fish (Froese and Pauly, 2016).

Gilthead sea bream (*Sparus aurata*)

Gilthead sea bream is distributed all along the eastern Atlantic coasts from Denmark to Cape Verde and Senegal and also in the Mediterranean Sea. It is also one of the most important food species in the European aquaculture industry (Alarcón *et al*., 2004). *Sparus aurata* often inhabits seagrass beds and sandy bottoms, usually to depths of about 30 m; however, adults may occur down to a depth of 150 m. It is a euryhaline species and known to move in early spring towards protected coastal waters in search of abundant food and milder temperatures, and return to the open sea in late autumn (Sola *et al*., 2007). Gilthead sea bream is a highly fecund mass spawning species but the number of fish involved, and the potential range of individual contributions to a spawning event, is unknown. Gilthead sea bream is also a protandrous hermaphrodite species and the sex of individual fish is determined primarily by social factors. Existing evidence suggests that the sex ratio is balanced in groups of adult fish (Brown, Wooliams and McAndrew, 2005). *Sparus aurata* is a carnivore and its diet consists of a wide variety of food organisms, although it preferentially selects gastropods and bivalves (Sola *et al*., 2007; Froese and Pauly, 2016).

Common dentex (*Dentex dentex*)

The common dentex is a littoral species which lives on rocky bottoms and beds of the seagrass *Posidonia oceanica*. Although common down to a depth of 50 m, it is also found at 100 m. It is a highly valued table fish in the Mediterranean region and elsewhere in the tropics. Common dentex inhabit the Mediterranean Sea most frequently south of 40 degrees, although it rarely occurs in the Black Sea. The species also occurs in the Atlantic Ocean from the Bay of Biscay to Cape Blanc and Madeira, but not around Great Britain and Northern Ireland. In the Mediterranean Sea the abundance of this species changes depending on the area. Whereas in the northern part (Catalonia, France, Ligurian Sea and Northern Adriatic) its occurrence is low,

it is relatively abundant in the central and southern areas. In the Balearic Islands it occurs relatively frequently, being caught by bottom longlines between a depth of 30 and 60 m. Juveniles are caught by trammel net and surface trolling (Morales-Nin and Moranta, 1997). Catches are usually small because only juveniles group together; adults tend to be solitary. The reproductive period of dentex in the wild seems to be relatively short and takes place between March and July (Beauchot and Hureau, 1986; Morales-Nin and Moranta, 1997). The first sexual maturation occurs between the second and fourth age classes (Morales-Nin and Moranta, 1997). Dentex may reach over 100 cm in length and weigh up to 13 kg, although catch lengths average 35 cm to 40 cm (Bauchot and Hureau, 1986; Rueda and Martínez, 2001). The maximum lifespan appears to be approximately 20 years (Morales- Nin and Moranta, 1997). No morphological or size differences are observed between males and females. However, females grow somewhat faster than males, reaching a slightly larger eventual size (Rueda and Martínez, 2001). Common dentex preys upon a wide variety of species, most likely depending on their availability in the wild (Morales-Nin and Moranta, 1997).

Pink dentex (*Dentex gibbosus*)
The pink dentex is a demersal fish distributed along the coast of West Africa from Gibraltar to Angola, and around São Tomé and Príncipe and the Canary Islands. They also live off Portugal and in the Mediterranean Sea (Pajuelo and Lorenzo, 1995). The young fish (1 to 2-year age class) live closer to the shore, often inhabiting estuaries, whereas adults inhabit rocky areas of deeper waters up to the limit of the continental shelf. Pink dentex is considered to be a rapid growing sparid that grows to a length of 120 cm and a weight of 25 kg. A carnivorous species, the pink dentex feeds on fish, crustaceans and cephalopods (Katavic, Grubisic and Skakelja, 2000).

Two-banded sea bream (*Diplodus vulgaris*)
The two-banded sea bream is a sparid fish distributed along the Mediterranean coasts, the Atlantic Ocean and from the Gulf of Guascogna to Senegal. It lives on rocky and sandy bottoms, close to the seagrass habitat of *Posidonia oceanica* or in lagoons (Arculeo *et al*., 2003). It generally forms small schools and is distributed from very shallow waters down to 150 m depth, but more commonly found in the coastal areas shallower than 30 m (Pajuelo and Lorenzo, 2003). This sparid species is also characterized by a rudimentary hermaphroditism with a low proportion of protandric sex reversal. Two-banded sea breams feed on benthic invertebrates, crustaceans, worms and molluscs (Bauchot and Hureau, 1986).

White grouper (*Epinephelus aeneus*)
Groupers of the genus *Epinephelus* are widely distributed throughout the tropical and subtropical waters of the world. Adults are found on rocky or muddy and sandy bottoms at depths of 20 m to 200 m; juveniles have been taken in coastal lagoons and estuaries (Heemstra and Randall, 1993). The species can reach a maximum length of 120 cm and a maximum weight of 25 kg. Bruslé and Bruslé (1976) confirmed that *Epinephelus aeneus* is a protogynous hermaphrodite, changing sex from female in early life to male at older age (Hassin *et al*., 1997). Protogynous hermaphroditism is a reproductive strategy common in serranid species. According to Bruslé (1985), the white grouper matures at 50 cm to 60 cm total length and at a weight of about 3 kg. It feeds on fish, crustaceans and cephalopods (Heemstra and Randall, 1993). It is a commercially important species that is highly regarded as a favourite marine food fish.

Dusky grouper (*Epinephelus marginatus*)
The dusky grouper inhabits rocky bottoms, from shallow waters to depths of more than 200 m and lives in caves. It is a popular food fish that is widely distributed along the southern coast of Brazil, throughout the Mediterranean Sea and the eastern Atlantic Ocean from Great Britain and Northern Ireland to South Africa and including Azores, Madeira, Canary Islands and Cape Verde. Like its congeneric species, the white grouper, dusky grouper is a protogynous hermaphrodite that matures first as a female at 44 cm to 53 cm total length and an estimated age of 6 to 8 years in the western Mediterranean (Heemstra and Randall, 1993). In Europe, sex reversal occurs when females are 14 to 17 years old and about 80 to 90 cm in total length (Froese and Pauly, 2016). *Epinephelus marginatus* can attain a maximum total length of 120 cm and weigh up to 60 kg. It preys on fish, crustaceans and cephalopods (Heemstra and Randall, 1993).

Goldblotch grouper (*Epinephelus costae*)
The goldblotch grouper is distributed throughout the Mediterranean Sea and in the Atlantic Ocean, from the coast of Portugal to Namibia. It inhabits sandy, muddy and rocky bottoms at depths of 10 m to 300 m (Glamuzina *et al*., 2000). It is a predatory, carnivorous fish that feeds on a large variety of crustaceans, molluscs and other fishes. The available data on grouper feeding habits demonstrate that they are similar to other large predatory fish, which feed throughout the day, although there are studies that suggest peaks of feeding activity during daylight or during the night. It is reported that higher feeding activity is observed before sunrise and after sunset (López and Orvay, 2005).

Red mullet (*Mullus barbatus*)
The red mullet is distributed in the eastern Atlantic Ocean, from Great Britain and Northern Ireland in the north, to Senegal in the south. It is also present in the Mediterranean, Marmara and Black seas. The species may occur at depths of 200 m. In the Mediterranean Sea, the red mullet ranks among the most commercially important demersal species and it is one of the main target species of the bottom trawl multi-species fishery in this region. Consequently, it is subjected to intense fishing pressure. Red mullet can reach a maximum size of 30 cm in length, but commonly range in size between 10 cm and 20 cm (Hureau, 1986). It is a multiple spawning species and the median maturity values for females in red mullet populations across the Mediterranean Sea show differences ranging from 11 cm to 14.4 cm in fork length (Kokokiris *et al*., 2014). It feeds on small benthic crustaceans, polychaetes and molluscs (Hureau, 1986).

Goldband goatfish (*Upeneus molluccensis*)
The goldband goatfish is a Lessepsian migrant species which penetrates into the Mediterranean Sea through the Suez Canal. Goldband goatfish is a commercially important demersal species, living in shoals mostly in sandy and muddy habitats at depths of between 20 m and 130 m (Kaya *et al*., 1999). It matures at about 10 cm in length and at an age of around one year. The size that is commonly encountered is between 7 cm and 20 cm (Golani *et al*., 2002). The goldband goatfish feeds mostly on crustaceans (Kaya *et al*., 1999).

Common sole (*Solea solea*)
The distribution area of common sole in the eastern Atlantic extends from the northwest African coast in the south to the Irish Sea, southern North Sea, Skagerrak and Kattegat in the north. The species also inhabits the Mediterranean Sea, including the Marmara and Black seas. It is one of the most commercially important species in the Mediterranean region. Sole spawns in late winter and spring. Larvae settle at the bottom during metamorphosis, at a length of 7 mm to 10 mm and about three weeks

after hatching. The duration of the planktonic phase is determined by the ambient temperature but is normally about four weeks. As the duration of the planktonic phase is relatively short, the surviving post-larval sole usually settle close to the spawning area. Sole generally prefers sandy and muddy bottoms down to 200 m (Quéro *et al*., 1986). The study by Rijnsdorp *et al*. (1992) indicates that *Solea solea* does not undergo long migrations; it is a relatively sedentary species. However, variations in spatial distribution between juveniles and adults are seen, with only large fish migrating to deeper and colder areas. (Imsland *et al*., 2003; Grati *et al*., 2013). Reproduction starts after 3 to 5 years of age, when a size of 25 cm to 30cm size is reached (Froese and Pauly, 2016). The maximum length of common sole can be as much as 70 cm (Quéro, Desoutter and Lagardère, 1986) but it commonly occurs at a size of 30 cm to 35 cm (Froese and Pauly, 2016). The diet of sole includes polychaetes, molluscs and small benthic crustaceans (Quéro, Desoutter and Lagardère, 1986).

European hake (*Merluccius merluccius*)
European hake is a commercially very valuable species and it is an important predator of deeper shelf–upper slope Mediterrenean communities. It is a nectobenthic species distributed over a wide depth range (20 m to 1 000 m) throughout the Mediterranean Sea and the northeast Atlantic region (Carpentieri *et al*., 2005). European hake is reproductively active throughout the year, peaking in the autumn. Males mature at smaller sizes than females, both in the Atlantic and the Mediterranean, though lengths at first maturity are bigger in the Atlantic (47 cm to 58 cm for females and 36 cm to 39 cm for males). In terms of age, both sexes mature at 3 to 3.5 years in the Gulf of Lions, 3 to 4 years in the Balearic Sea, and 3 years for males and 4 years for females in the Eastern Mediterranean. In the Atlantic, however, maturity is not reached until 5 years. Young adults (30 cm to 40 cm) may be found over the whole depth range, whereas large adults (>50 cm) are scarce at depths greater than 100 m (Bozzano, Sardà and Ríos, 2005). Adults feed mainly on fish and squids. The young feed on crustaceans (Froese and Pauly, 2016).

Grey mullets (*Mugilidae*)
Several species of grey mullets are distributed in the region and it is often difficult to distinguish between species. However, flathead grey mullet *Mugil cephalus*, golden grey mullet *Liza aurata*, leaping grey mullet *Liza saliens* and thicklip grey mullet *Chelon labrosus*, are among the more frequently occuring species. Grey mullets commonly inhabit tropical and warm temperate estuaries. Although these species always spawn at sea, they are highly euryhaline and thrive in a wide range of salinities. (Cardona, 2006). Adults are found in coastal waters, often entering estuaries, rivers, lagoons and hypersaline environments. They are usually found in schools over sandy or muddy bottoms, between the surface and depths of up to 10 m. Grey mullets mature sexually at 3 to 4 years of age. They are mainly diurnal, feeding on detritus, micro-algae and benthic organisms (Froese and Pauly, 2016).

Randall's threadfin bream (*Nemipterus randalli*)
Randall's threadfin bream is another demersal Lessepsian migrant species which penetrated the Mediterranean Sea through the Suez Canal. The original distribution of the species includes the western Indian Ocean, including the east and west coast of India, Pakistan, Persian Gulf, Red Sea, Gulf of Aden, the East African coast, Seychelles and Madagascar (Froese and Pauly, 2016). The colour of the body of *Nemipterus randalli* is silvery pink and the upper lobe of the caudal fin has a long, trailing light red filament. The species grows to a maximum size of over 20 cm total length, but is commonly caught at a length of around 15 cm (Froese and Pauly, 2016).

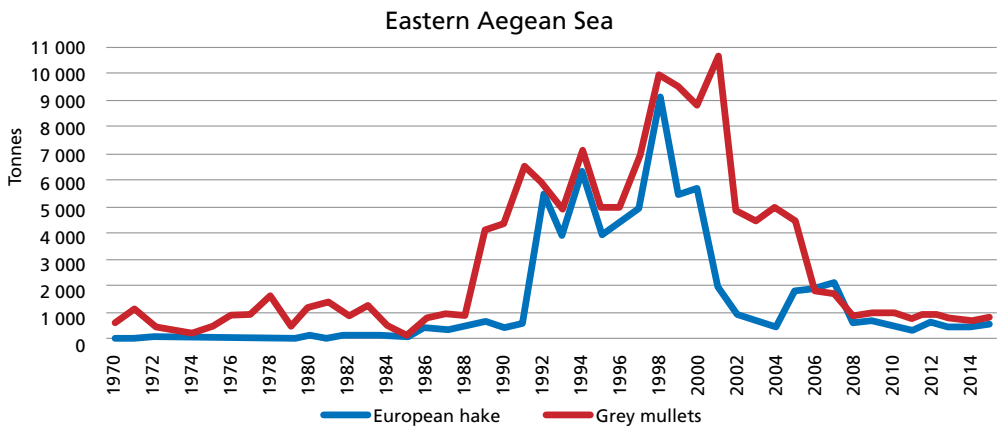
Common octopus (*Octopus vulgaris*)

The common octopus has a worldwide distribution in the tropical, subtropical and temperate waters of the Atlantic, Indian and Pacific oceans; it is also present in the Mediterranean Sea. *Octopus vulgaris* is a coastal benthic species and is a typical inhabitant of littoral waters, existing up to the limit of the continental shelf at depths of up to 200 m. In very shallow waters, the species occurs mostly in coral reefs or rocks, but in many areas it is equally, or even more abundant, over sandy and muddy bottoms or in seagrass beds. Maximum life span is 3 to 4 years for males and 2 to 3 years for females (Mangold, 1983).

Status of the stocks

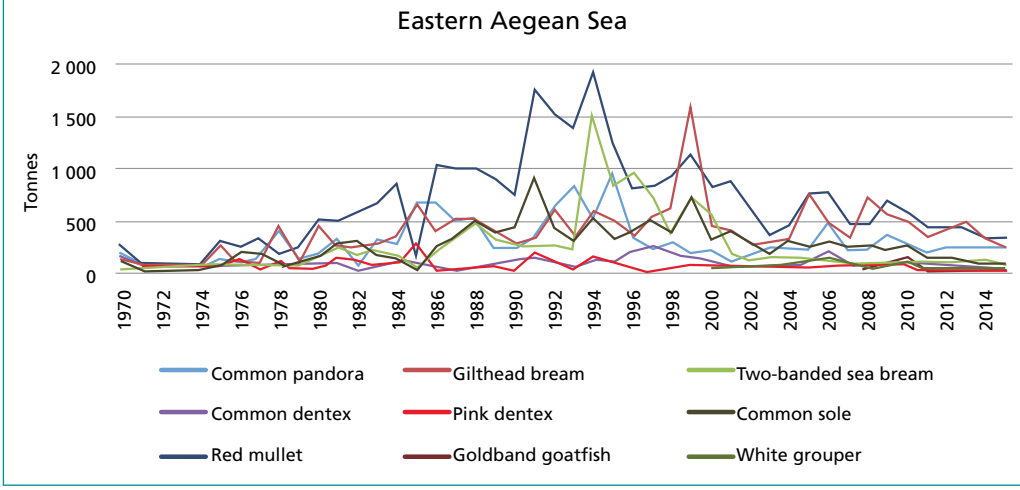
No assessments have been conducted for any of the fish stocks of the southeastern Aegean Sea. Nor is any scientific or managerial information available for the boundaries of the stocks. The only primary and continuous source of information regarding the status of fisheries in Turkey is the official fishery statistics which are collected, compiled and published annually by the Turkish Statistical Institute (TurkStat). Unfortunately, these statistics pool all the data collected in different regions of the Turkish Aeagean Sea and present one figure – an annual total catch for the whole sea area. Data regarding fishing effort are provided in a similar fashion. In addition, the accuracy, precision, coverage and representability of these catch statistics have long been debated (Tıraşın and Ünlüoğlu, 2012). There seems to be consensus that the catch figures reported in these statistics are underestimates of the fish that are actually caught and that a substantial part of the catch goes unreported. Yet, to date, there has been no agreement about the magnitude of the bias. Another concern is the inaccuracy of the provided information, particularly at the species level. The organism names given in the statistics do not always strictly correspond to the distinct biological species. Sometimes, data on several closely related species are merged and presented under only one name. Again, the statistics for some similar looking species are considered to be inaccurate because these species are often mistaken for one another and their common names are repeatedly swapped locally (Tıraşın and Ünlüoğlu, 2012). While all these concerns are duly noted, for the purposes of this document, the official catch statistics are considered to be a useful index reflecting the overall variation in fisheries resources. Thus, the trends seen in Figure 11 and 12, presented below based on the official statistics, can be regarded as reasonably valid. Because the historical catches of grey mullets and European hake were much higher than the remainder of the species, two separate graphs – one for these two species (Figure 11) and one for the remaining species (Figure 12) – were prepared in order to ensure that the variations in the annual landings of the latter group would be more conspicuous.

FIGURE 11
Annual total catch statistics for European hake and grey mullets (tonnes) in the Eastern Aegean Sea from 1970 to 2015



Source: SIS (1970–2003) and TurkStat (2004–2016).

FIGURE 12
Annual total catch statistics in tonnes of the major species (excluding European hake and grey mullets) in the Eastern Aegean Sea from 1970 to 2015



Source: SIS (1970–2003) and TurkStat (2004–2016).

European hake was the most abundant fish species in the demersal fisheries in the Aegean Sea (TurkStat, 2004–2016). The dominance of European hake in the demersal fish landings was more pronounced between 1992 and 2000 (Figure 11). This period included three top years (1992, 1994 and 1998) for European hake production, with respective catches of 5 500 tonnes, 6 300 tonnes and 9 100 thousand tonnes. Following the historical maximum catch in 1998, European hake landings began to decrease. The registered amount of European hake caught in 2015 was as low as 599 tonnes (Figure 11).

Grey mullet is one of the more abundant species in the pelagic fish group to occur in the Aegean Sea. The amount of grey mullets caught in the region rose fast from 900 tonnes in 1988, with relatively small fluctuations, to over 10 000 tonnes in 2001 (Figure 11). Following this historical maximum catch year, the landings declined sharply and the catch in 2008 was again about 900 tonnes. Since 2009, grey mullet catches have remained within a range of 10 to 700 tonnes.

Red mullet was the second most abundant demersal fish species caught in the Aegean Sea according to the TurkStat figures. There were two peaks in the production of red mullet – the first was 1 800 tonnes in 1991 and the second was 1 900 tonnes in 1994 (Figure 12). After this highest recorded yield, catches of red mullet dropped drastically down to slightly more than 300 tonnes in 2003. After a few years of minor elevations, the downward trend in yield continued and total production was just above 300 tonnes in 2015.

Catches of other demersal fish species, such as gilthead sea bream, common pandora, two-banded bream and sole, were recorded in the fisheries in the Aegean Sea, albeit with relatively minor catch levels.

Octopus was the dominant and commercially most important invertebrate in the region. Octopus catches oscillated between three notable peaks of 1 600 tonnes, 1 300 tonnes and 1 000 tonnes in 1989, 1998 and 2001, respectively. After 2001, landings gradually declined and have remained under 300 tonnes since 2011.

The overall view provided by Figures 11 and 12 is that the fisheries resources in the Aegean Sea show a clear declining trend since 2009.

1.4 Legal and administrative frameworks

Centralized fisheries management is practiced in Turkey. All fishing laws and guidelines are based on the principal Fisheries Law No. 1380 which was enacted in 1971, and which was amended by Law No. 3288 in 1986 and No. 4950 in 2003. These principal laws provide the basis for both commercial and recreational regulations, including the regulation of fishing licenses, sanitation of fishing equipment, inspection and control, penalties, prohibitions, limitations and liabilities (updated from MARA, 2009; Ünal and Göncüoğlu 2012). The current fisheries laws are perceived as providing the necessary foundation for the provision of effective fisheries management.

In the Official Gazette dated June 2011 (Issue No. 27958), the head of the national fisheries management was transferred from the Ministry of Agriculture and Rural Affairs (MARA) to the MFAL; and the DG-Fish.

Today DG-Fish is the main state organization responsible for fisheries management. It oversees the provision of fisheries regulations and provides fisheries protection monitoring and technical assistance. However, responsibility for fisheries surveillance is shared between several other institutions such as the Coastguard and the Gendarmerie.

The Ministry of Development selects an expert committee consisting of representatives of NGOs, fishery cooperatives, universities, the Coastguard and other related institutions and stakeholders, which sets the objectives for fisheries management policy in Turkey. The general objective is to manage the fishery resources sustainably. Thus, regionally based preliminary fisheries management plans (for the Black Sea, Marmara Sea and Mediterranean Sea) need to be designed, with sustainability at the forefront of the objective of rebuilding depleted stocks to some pre-determined historical level. However, in practice, the sustainability of marine resources is not being addressed by any tangible measures. Therefore, management plans that attempt to counteract the serious state of resource depletion are much needed at the species, sectoral and regional levels and should be considered for design, adoption and implementation.

Owing to Turkey's candidacy for membership of the EU, the most notable achievements for improving national marine policy resulted from the institutional twinning programme in support of the alignment with the EU acquis in 2008.

The biodiversity is rich in the Mediterranean region but the productivity there is poor. In the Black Sea, the situation is reversed; biodiversity is quite poor but the remaining pelagic stocks display high productivity, especially anchovy and sprat. Therefore, the regions require different management practices to enhance their respective fisheries stocks. To date, national management has not specifically designed different management systems to foster the diverse nature of the ecosystems.

A management plan for anchovy in the Black Sea was prepared after the finalization of a five-year stock assessment project for the species. So far, fisheries co-management has only been at a "consultative level" on the national scale. This means the government-based management authority has the mechanism to act, but it takes all the decisions on its own. However, according to Ünal and Göncüoğlu (2014), a strong co-management movement has developed in Gökova MPA, especially since 2009 and 2010 when six NFZs were established by local fishers, NGOs, academics and other stakeholders. At this time, fishers and other stakeholders were introduced to the concept of co-management, which is the sharing of power and responsibility between the state and resource user groups in the management of natural resources. Fishers and other stakeholders were informed about the benefits of NFZs. The facilitators of co-management meetings were independent, experienced fishers and leaders with influence among the fisher stakeholders. Examples of co-management success stories from different parts of the world, especially Mediterranean countries with similar characteristics, were provided and eventually six areas were decided and designated as NFZs in Gökova MPA, with the agreement and participation of almost all stakeholders. DG-Fish was asked by local fishery cooperatives to put this decision into practice. Finally, six NFZs shown in Figure 13, were published in the Official Gazette in 2010 and announced in fishing notifications.

Fisheries management plan

Ünal (2010) reported the minimum required information for a fisheries management plan for the Gökova MPA fishery. The state of fisheries was presented in detail. First, a literature review was presented and then a range of pertinent subjects was discussed, including fishery cooperatives; fishing gears, fishing areas, fishing fleet and target species; socio-demographic and economic characteristics of fishers; the role of women in fisheries; the main problems of fisheries, as well as current management measures in place. Length frequency ratios and an estimation of undersized fish being caught were also reported. In recent years, knowledge of the Gökova MPA fishery has improved. It is now time to pull all the information together into a single document that outlines how management is actually going to proceed for the Gökova Fishery. Ünal (2010) prepared a first draft fisheries management plan for the Gökova MPA fishery (Annexure I).

Although it has not been formalized, co-management has already begun in the Gökova MPA fisheries. With a considerable part of the area declared a SEPA, the required foundations have been laid for the Gökova MPA fishery to be well managed. The experience gained and procedures followed in the process of establishing six separate NFZs within the Gökova MPA, may be accepted as a good example of fisheries co-management and represent the first success of the co-management movement in Turkey, which is an important approach to fisheries management (Ünal *et al*., 2015).

1.5 Management measures

Existing management measures and regulations in the Gökova MPA fishery

a) Restrictions on fishing gear

The use of beach seine nets, boat seine nets, fish traps, fyke nets and monofilament nets is prohibited not only in Gökova MPA but in all seas of Turkey.

Any trawling activity is prohibited in the areas located to the east of the line connecting Mersincik Point to Gerence Point, and to the east of the line connecting Ören Point (37o 01' 055" N – 27o 56' 751" E) to Teke Point (36º 54' 410 N – 28º 00' 921" E).

Any purse seine fishing is prohibited in the area that is located to the east of the line connecting Akbük Point (37° 00' 971" N – 28° 06' 918" E) to Kargılı Point (36° 56' 501" N – 28° 05' 822" E).

b) Restrictions on hook sizes

The use hooks with a gape smaller than 7.2 mm is prohibited with longlines. In addition, the use of hooks with a gape smaller than 2.8 cm is prohibited for catching swordfish.

c) Regulations for species

- Due to the toxins that *Lagocephalus sceleratus, Lagocephalus spadicenus* and *Mola mola* release, fishing for these species is strictly prohibited for all fishery sectors along the Turkish coastline.
- Fishing of *Sarda sarda* with any fishing gear is prohibited between 1 April and 31 August each year. However, trolling for *Sarda sarda* is allowed between 15 and 31 August.
- It is prohibited to lay *Sarda sarda* nets between 07.00 hours and 19.00 hours in Gökova MPA.
- Fishing of *Psetta maxima* is prohibited between 15 April and 15 June each year.
- Fishing of *Solea solea* and *Pleuronectes* spp. is prohibited between 15 December and 15 January each year. The mesh size of the nets used to catch these species should not be smaller than 80 mm.
- Fishing *Thunnus thynnus* is prohibited between 25 June and 25 May each year.
- Fishing *Lichia amia* is prohibited between 15 April and 15 May each year.
- It is prohibited to lay *Lichia amia* nets between 07.00 hours and 19.00 hours in Gökova MPA.
- Fishing *Coryphaena hippurus* is prohibited between 1 January and 14 August each year.
- Fishing *Xiphias gladius* is prohibited between 15 February and 15 March and between 1 October and 30 November each year. There are also restrictions on hook sizes (a minimum gape of 2.8 cm) and a minimum landing size (minimum catch size is 125 cm).
- Fishing of caramote prawn by means of all fishing gears, except for gillnets, is prohibited between 15 April and 15 September in the Mediterranean Sea and between 15 April and 31 August in the Aegean Sea.
- Fishing *Epinephelus marginatus* and *Epinephelus aeneus* is totally prohibited for all kinds of fishing gear because of a sharp decrease in catches, according to the fishery statistics of TurkStat.
- Fishing of *Octopus vulgaris* is prohibited between 15 April and 31 October each year.

TABLE 16

Size and weight restrictions

Species	Minimum length (cm)	Minimum weight (kg)
Octopus vulgaris		1
Tapes decussatus	2.4	
Tapes philippinarum		
Lichia amia	40	
Merluccius merluccius	20	
Mullus barbatus	13	
Sparus auratus	20	
Palinarus vulgaris	25	
Solea solea	20	
Scia naumbra	25	
Engraulis encrasicolus	9	
Homarus gammarus	25	
Trachurus Trachurus	13	
Trachurus mediterraneus		
Ostrea edulis	6	
Psetta maxima	45	
Diplodus vulgaris	18	
Mugil soiuy	35	
Mugil (Oedalechius) labeo	20	
Chelon labrosus		
Liza ramada		
Liza saliens		
Mugil cephalus	30	
Liza aurata	30	
Xiphias gladius	125*	
Chelidonichthys lucerna	18	
Pagellus erythrinus	15	
Venus verrucosa	3	
Scomber colias	18	
Donax trunculus	2.5	
Dicentrarchus labrax	25	
Scorpaena scrofa	15	
Pomatomus saltatrix	18	
Callinectes sapidus	13	
Merlangius merlangus	13	
Chamelea gallina	1.7	
Umbrina cirrosa	25	
Upeneus moluccensis	10	
Sarda sarda	25	
Pleuronectes spp.	20	
Sardina pilchardus	11	
Sardinella aurita		
Diplodus sargus	21	
Argyrosomus regius	25	
Seriola dumerili	30	
Dentex dentex	35	
Mullus surmuletus	11	
*Thunnus thynnus***	115*	30
Scomber scombrus	20	
Euthynus alletteratus	45	

* Fork length
** Based on either length or weight

d) Spatial restrictions

There is no closed season or closed area for fishing with longlines and gillnets. However, fishing is prohibited throughout the year within 500 m of the perimeter of harbours and river mouths. This prohibition includes all gears.

With the participation of stakeholders, consensus was reached and six critical areas within Gökova MPA were declared NFZs (Figure 13; Kıraç and Veryeri, 2010). These areas were announced in issue 27637 of the Official Gazette (10 July 2010) and appeared in the Fishing Notification which regulates fisheries.

FIGURE 13

Designated NFZs in Gökova MPA, Eastern Mediterranean, Turkey



The coordinates of the NFZs, as shown in Figure 13, are provided below.

Any kind of fishing activity has been prohibited in these six areas since 10 July 2010.

- In Akbük harbour; on the eastern part of the line connecting 37° 01,431' N – 28° 06,863' E and 37° 02,108' N – 28° 06,915' E, in Akyaka; at the east part of the line connecting the point 37° 03,041' N – 28° 18,600' E and 37° 01,540' N – 28° 18,600' E.
- In Çamlı; at the south part of the line connecting the Çapa Cape (37° 00,044' N – 28° 13,250' E) and the point 37° 00,240' N – 28° 14,731' E.
- At the east part of the line connecting Boncuk cove – Karaca harbour (36° 59, 016' N – 28° 11,828' E) and Dedek cape (36° 56, 967' N – 28° 11,618' E).
- At the southeast part of the line connecting English harbour (Degirmen Bükü) (36° 56,170' N – 28° 08,358' E) and (36° 56,812' N – 28° 09,542' E).
- Bördübet harbour; at the east part of the line connecting two points (36° 49, 800' N – 28° 02,649' E) and (36° 48,156' N – 28° 03,176' E).

In 2016, MFAL announced a new fisheries regulation which revised and increased the surface area of the following NFZs. Shore-based fishing activities are permitted in three of the six NFZs (Akyaka, Akbük and Çamlı).

Revised version (GTHB, 2016a; GTHB, 2016b):

- Bördübet harbour; at the east part of the line connecting two points (36° 49.810' N – 28° 02.293' E) and (36° 48.045' N – 28° 02.552' E).
- Boncuk Cove – Karaca harbour (36° 58.933' N – 28° 11.815' E) and Andızlı Cape (36° 56.912' N – 28° 10.805' E).
- At the east part of the line connecting two points Ören Cape (37° 01.055' N – 27° 56.751' E) and Teke Cape (36° 54.410' N – 28° 00.92' E) fishing is prohibited for both for purse seine vessels and trawlers.

The main management measures in place in Gökova MPA are described and their effectiveness was evaluated as 1 = weak, 2 = fairly good, 3 = very good in Table 17.

TABLE 17
Management measures in Gökova MPA

Management measures	Description	Effectiveness
Spatial restrictions (e.g. closed areas, MPAs, etc.)	Gökova MPA is 827 km^2. Within the MPA there are six NFZs which were officially designated in July 2010. Trawling and purse seining are prohibited within the MPA.	2
Temporal restrictions (e.g. closed seasons)	There is no closed season for small-scale fisheries in general but temporal restrictions for certain species are in place.	2
Gear restrictions (e.g. prohibited gears, limits to mesh size, etc.)	Beach seines and boat seines are prohibited in Gökova MPA, as well as in all Turkish waters. It is also forbidden to use monofilament nets. The minimum mesh size for *Solea solea* is 80 mm.	3
Minimum size	There is a minimum landing size regulation in place for many species. These are presented in Table 16 above.	3
Participatory restrictions (e.g. licensing, TURFs, etc.)	Licensing system is in place.	3
Limits to fishing capacity (e.g. max. number of vessels; fleet reduction, etc.)	These are not in place. Five buy-back programmes were applied to fisheries at the national level.	2
Others		3

An annual total allowable catch (TAC) or "quota system" is currently in place for only two commercial species: bluefin tuna (*Thunnus thynnus*) and striped Venus clam (*Chamelea gallina*). The initial TAC for the striped Venus clam introduced in 2008 was 35 000 tonnes. In 2015, the TAC was 1 223 tonnes for tuna and 30 000 tonnes for striped Venus clam. If TACs could be established and implemented for the remaining pelagic fisheries that are the target of commercial fishers, it would benefit the livelihoods of the fishers in the small-scale sector.

Strengthening the System of Marine and Coastal Protected Areas of Turkey Project

The project "Strengthening the System of Marine and Coastal Protected Areas of Turkey" is partially funded by the Global Environment Facility (GEF). It is implemented by the General Directorate for Protection of Natural Assets (formerly the Environmental Protection Agency for Special Areas; EPASA) in the Ministry of Environment and Urbanization, in close cooperation and partnership with the General Directorate for Nature Conservation and National Parks, and the Ministry of Food, Agriculture and Livestock. The United Nations Development Programme (UNDP) is the implementing partner. The project was implemented between May 2009 and April 2014 in Foça, Köycegiz-Dalyan, Gökova, Fethiye-Göcek and Datça-Bozburun SEPAs and Ayvalık Adaları Nature Park. Its aim was to facilitate the expansion of the national system of marine and coastal protected areas and improve its management effectiveness.

One of the main outcomes of the Project was the development of the capacities of the bodies responsible for prioritizing the establishment of new marine and coastal protected areas (MCPAs), and for more effectively managing existing MCPAs. To this

end, local working groups (LWGs) were established for each SEPA in Muğla Province, with the goal of preparing and implementing management plans so that conservation practices may be carried out in an integrated manner.

The second meeting of LWGs for the SEPAs of Muğla Province carried out two main tasks. These were "Evaluation of the Action Plan of Gökova SEPA" (Annexure II) that was finalized through the facilitation of the Underwater Research Society and the Rubicon Foundation, and a general evaluation of the SEPAs of Muğla Province.

Fishing vessels monitoring system

The fishing vessels monitoring system (*Balıkçı Gemilerini İzleme Sistemi* – BAGİS) is mandatory for use on all fishing vessels longer than 12 m and required by the Ministry of Food, Agriculture and Livestock (Official Gazette, 2016). The system collects and saves the identities, location, time, speed, cruising information, fishing activities and the catch data of fishing vessels by the Global System for Mobile Communication (GSM) and satellite communication devices (Figure 17). A total of 1 350 fishing vessels from 28 coastal provinces were expected to set up the on-board system by 1 January 2017 (MFAL, 2016).

PLATE 4

The BAGIS vessel monitoring system for fishing vessels



1.6 Main stakeholders

Fishery cooperatives are the primary and main stakeholders in Gökova MPA fishery owing to their direct interest in the resources – either because they depend on them for their livelihoods, or because they are directly involved in their exploitation. There are three fishery cooperatives: one in Akyaka (29 members), one in Akçapınar (25 members) and one in Akbük (12 members). Fishery cooperatives are established and run by small-scale fishers and therefore represent small-scale fishers. There are also large-scale fishers who live in the same region, fish in the same bay, but outside of the MPA borders. There are also many recreational fishers utilizing the bay which is one of the favorite places for spearfishers, especially those targeting groupers. Although recreational fishing is quite common in the bay, recreational fishers are not organized into a club or association. Therefore, the primary stakeholders may be considered as follows:

- Fishery cooperatives and small-scale fishers (see below).
- Purse seiners – there are two active purse seiners which use a small part of the SEPA in the bay. There is also one vessel of 14 m that uses encircling nets. There have been conflicts and competition between these vessels and small-scale fishers in the bay.
- Recreational fishers – Gökova MPA is very popular for many kinds of outdoor activities, including recreational fishing. Gökova MPA covers an area of 827 km², making it the largest MPA in Turkey. There are six NFZs (Akbük, Akyaka, Çamlı, Boncuk, İngiliz Limanı and Bördübet). Capture fisheries are not permitted in these areas, with the exception of Akyaka and Boncuk, where only shore-based recreational fishing is allowed.
- The Central Union of Fishery Cooperative (SÜR-KOOP) – presently there are 15 regional associations of fishery cooperatives built around 270 fishery cooperatives and one central union fishery cooperative (SÜR-KOOP) built around 14 regional associations of fishery cooperatives and 270 primary fishery cooperatives. These cooperatives are all based on marine capture fisheries and represent some of the 572 fishery cooperatives in Turkey (marine and inland fishery cooperatives). Two of the 270 marine capture fishery cooperatives are Akyaka and Akçapınar Fishery Cooperatives and they are represented within the SÜR-KOOP thanks to their membership of the Muğla Regional Association of Fishery Cooperatives.

Secondary stakeholders who have an indirect interest, such as those involved in institutions or agencies concerned with managing the resources, or those who depend at least partially on wealth or business generated by the resource are as follows:

- Provincial Directorate of Food, Agriculture and Livestock, Fisheries and Aquaculture Branch Office (DG-Fish)
- Ministry of Environment and Urbanization, Provincial Directorate of Environment and Urbanization, Protection of Natural Assets Branch Office
- Governorship of Muğla Province
- Muğla Municipality
- Coastguard
- Gendarmerie
- NGOs (AKD; Underwater Research Society)
- Universities
- Fish restaurants
- Fishmongers or retailers
- Harbours
- Fishing gear shops.

Fishery cooperatives

There are three active fishery cooperatives in the study area. The oldest cooperative was founded in 1973 (the Akcapinar Fishery Cooperative). The Akyaka Fishery Cooperative was founded in 1992 – almost 20 years after establishment of the Akcapinar Fishery Cooperative – and the Sarnıç Akbük Fishery Cooperative was founded in 1999. There was also a fishery cooperative in Ören, located adjacent to Gökova MPA, but it has not survived due to several reasons.

According to recent data provided by cooperatives, the cooperation rate (numbers of fishery cooperative members divided by numbers of total fishers) among small-scale fishers in Gökova MPA is 66 percent. However, 85 percent of fishers in Sarnıç-Akbük are members of the cooperatives and 50 percent of fishers in Akçapinar and 78 percent of fishers in Akyaka are fishery cooperative members. Overall in Gökova MPA, the number of fishers belonging to cooperatives is relatively low because the fishery cooperative in Ören closed down and fishers in Bördübet, Çamlı, etc. have not organized under any fishery cooperative so far.

Akyaka is a region with a population of approximately 2 500 inhabitants. This number increases to between 25 000 and 30 000 in the summer season and does not include daily visitors and campers.

The Akyaka Fishery Cooperative is an active fishery cooperative in the region and has 29 members, but all the fishers in the village do not belong to the cooperative. Gillnet and longline fisheries dominate the small-scale fisheries. Species belonging to the Sparidae and Epinephelinae families are the most important target species of the region.

Akçapınar is a region with a population of approximately 700 inhabitants. It is located on the southern Turkish Aegean coast where Gökova MPA meets the land. With agriculture, fishing is the main economic activity in the village. The fishery cooperative was founded in 1973. All fishers in the region were cooperative members until 2008. However, because of mismanagement of the cooperative and associated corruption, the membership rate of the cooperative started to decrease between 2006 and 2009. A general assembly was organized in 2014 and the management board of the cooperative was changed. According to face to face interviews carried out with the head of the fishery cooperative, the numbers of registered members and active fishers (vessel owners) in Akçapınar are 25 and 10, respectively.

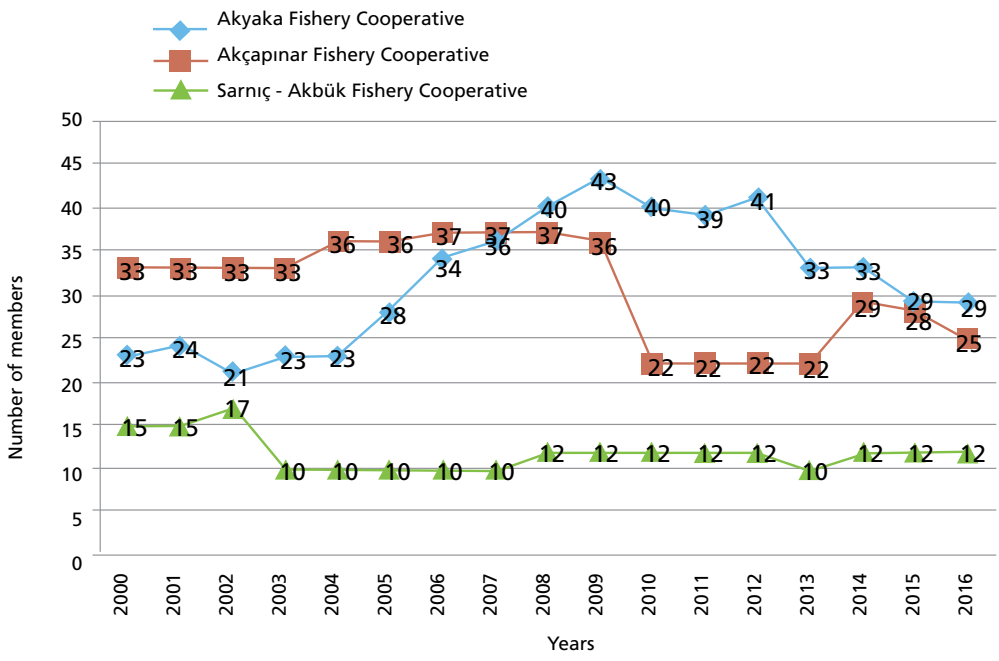
Sarnıç is a village located 10 km away from Akbük Bay with a population of approximately 485 inhabitants. This number increases to a minimum of 700 people in the summer season. There are 12 small-scale and five or six subsistence fishing vessels in Akbük. Eighty five percent of owners of small-scale professional fishing vessels are members of the Sarnıç-Akbük Fishery Cooperative (Table 18).

TABLE 18
Characteristics of fishery cooperatives located and operating in Gökova MPA

Fishery cooperatives	Akyaka Fishery Cooperative	Akçapınar Fishery Cooperative	Sarnıç-Akbük Fishery Cooperative
Year of foundation	1992	1973	1999
Major activities	Fishing and marketing	Fishing and marketing	Fishing
Registered members	29	25	12
Active members	23	15	11
Active members (%)	79	60	92
Total number of fishers (vessel owners) in the cooperative area	37	50	13
Membership rate (%)	78	50	85
Employees	3	1	0

Over the last decade, the number of members of the Akyaka Fishery Cooperative increased when compared to the two other fishery cooperatives in the region (Figure 14). Furthermore, considering several characteristics (cooperation rate, rate of active members, volume and value of catch) Akyaka Fishery Cooperative shows positive results.

FIGURE 14
Changes in the number of cooperative members over the last decade in Gökova MPA



In all three fishery cooperatives, group sizes were small enough to retain the interest of fishers; additionally, there was no evidence of corruption, larceny or other dishonest activities in any of the cooperatives. All were formed on the basis of local interest, initiated by the fishers themselves (Ünal and Erdem, 2009).

Cooperatives with a marketing facility (Akyaka and Akçapınar) have four employees in total; none has a professional manager. In terms of marketing the fish, members are supposed to bring their catch to the cooperatives and sell it through the cooperative; however, some difficulties are being faced on the marketing side and some of the members sell their fish outside of the cooperative. Marketing fish generates 99 percent of the cooperatives' revenue. The Akyaka Fishery Cooperative is the most active fishery cooperative within Gökova MPA, especially with regard to combating illegal fishing, marketing fish and meeting the expectations of its members. It seems to be more successful than the Akcapinar and Sarnıç-Akbük Fishery Cooperatives.

2. THREATS TO FISHERIES SUSTAINABILITY

2.1 Threats to ecological well-being

Small-scale fisheries dominate the fisheries sector within Gökova MPA. The exact number of recreational fishers is currently unknown, as it is in other Mediterranean countries because a licence system is not in place for recreational fishers. This creates a gap in knowledge and a consequent inability to estimate the fishing effort exerted by recreational fishers, and also creates difficulties for the management of the fishery. For this reason, the General Fisheries Commission for the Mediterranean (GFCM) organized a workshop on "Monitoring Recreational Fisheries in GFCM areas" in

Palma de Mallorca in 2010. The workshop emphasized the importance of recreational fisheries management to member countries.

Other human activities that impact ecological well-being are anchorage, dredging, grazing pressure of invasive alien species and other land-based activities that cause dramatic **habitat degradation**. Spawning and nursery areas are under as much threat as fishing grounds. In addition, fisheries activities leave some footprints such as ghost nets in the long-term (Ayaz *et al*., 2010). This has a substatial impact on the habitats of important fish species in the fisheries sector. Ayaz *et al*. (2010) conducted a survey to determine the amount of fishing gear loss and the reasons for the loss. Bad weather conditions, bottom structure, conflicts with other gear, vandalism, large fish species and marine mammals are the main factors contributing to gear loss. About 82 000 m of monofilament line, 220 m of multifilament trammel net, 100 m of monofilament and of 35 m multifilament gillnet were assessed within a 22 600 m^2 area under the water. As a solution, the "ghost net hunters" project identified and removed 7 000 m of monofilament line and approximately 600 m of nets in 2013 (Lise, Çekiç and Argun, 2015). Compared to the earlier underwater survey, the ghost net issue is still a big cause of both economic and ecological loss in the area.

Invasive species have a significant impact on native species and their habitats (Sala *et al*., 2011). Even if there are studies on the prey and predator relationships of these species, it is still not possible to foresee the long-term impacts that alien species have on native species. This is due to the fact that records of alien invasions are increasing every year as a result of human impacts and global warming. The fish composition of the Mediterranean Sea, including Gökova MPA, has been changing rapidly.

In recent years the invasive *Lagocephalus sceleratus* (silver-cheeked toadfish) had the biggest impact on both local species and the socio-economic well-being of fishers. Its first record from Gökova MPA was in 2003 (Akyol *et al*., 2005). The fish generates tetrotoxin which is lethal for humans and other species if consumed, and landing the fish has been banned in Turkey. Ünal *et al*. (2015) carried out face-to-face interviews with a total of 261 fishers from İzmir in the Middle Aegean region to Hatay in the Eastern Mediterranean region – including Gökova MPA – to ascertain the problems that arise from the presence of the silver-cheeked toadfish in the ecosystem, and the resulting economic losses for a one-year period (1 January to 30 December 2011). There is no predator for this species in the Mediterranean at present; it has been dramatically damaging the catch of the fishers, as well as their fishing gears. Ninety one percent of fishers agree that silver-cheeked toadfish is a major problem, 82 percent believe that silver-cheeked toadfish negatively affects biodiversity, and 89 percent believe it reduces the efficiency of their catches. Economic losses caused by damage to fishing gears and the number of hours spent by the fishers in repairing fishing gear (additional labour cost), amounts to as much as TRY 6 033.577 (≈ € 2 051 416) per year for the Turkish small-scale fishing fleet along the Mediterranean coast of Turkey.

There are three major suggestions for managing this species. These are to start a bounty system for fishers, to start an education and awareness program, and to support research projects on alternative uses for *Lagocephalus sceleratus*, in association with pharmaceutical companies.

Although the Coastguard and other responsible institutions pay significant attention to and put great effort into combating **illegal fishing**, it is still one of the most important threats to the resources of Gökova MPA. It is considered the most important problem among local traditional fishers due to diminishing fishing incomes and increasing illegal spearfishing which targets only high value species such as groupers.

Even though there is an effort to increase the surveillance of the area (Kızılkaya, Ünal and Yıldırım, 2015) the entire bay needs to be more strictly monitored and controlled for illegal activities. The AKD set up a community-based marine ranger patrol programme in 2013. Two patrol boats and four marine rangers were equipped

for conducting patrols. Although community rangers cannot impose a fine for an illegal activity, they record any incident with a camera and immediately report it to the Coastguard which completes the lawsuit using the pictures and video recordings as evidence.

2.2 Threats to community (human) well-being

The vessels used in small-scale fisheries in Gökova MPA are 5 to 12 meters in length, locally built and wooden. Usually, each boat is operated by one or two fishers. Fishers using longlines and gillnets go to the fishing grounds in the evenings, set the gear and return home. In the morning, they retrieve the gear and return to the port with their catch. The mean catch usually ranges from 2.0 to 7.2 kg per day. Fishers usually want to sell their whole catch to maximize the income. On the other hand, they also wish to bring some low value species home for household consumption (Ünal, 2010).

Almost one third (30 percent) of fishers choose fishing as an occupation and this is highly correlated to the lack of employment or job opportunities in the coastal area where they live. A further one third (33 percent) of fishers emphasized their passion for the sea as their motivation for entering the profession, and 28 percent of fishers embarked on a career in fishing because it was his/her parents' profession (Ünal, 2010).

The average age of fishers in the project area was found to be more than 40 years for all the regions (oldest in Akçapınar, 51.3 years old, and youngest in Sarnıç-Akbük, 41.3 years old). The **future generation** does not consider fishing to be a job and this is seen as a cultural loss.

Small-scale fisheries may be considered a family business in the Aegean Region and there are considerable numbers of women who practice fishing as a job. Göncüoğlu (2011) recorded 427 **women fishers** in the Aegean region, with 41 percent of females working in fishing aged between 40 and 49 years. Considering the fishing portion of the population, it may be concluded that the younger generations do not choose to work as fishers. Most of the women fishers (76 percent) fish with their husbands and the reasons given is that they help their husbands (70 percent), contribute to the family income (19 percent), have obligations (6 percent), and a love for the sea (5 percent). Some 64 percent of women fishers were involved in all aspects of the work, except marketing. The remainder were generally involved in sailing, catching and cleaning the nets (24 percent), repairing nets and assisting their husbands in the kitchen of the boat (10 percent), doing repairs on land (1 percent) and other similar work related to the job (1 percent). Only 10.4 percent of women fishers were cooperative members.

Conflicts between different user groups is another impact. Small-scale fisheries compete with large-scale fisheries and recreational fisheries.

Recreational fishers are another group of stakeholders that definitely need to be well managed. Although recreational fishing appears to be a hobby that involves spending time at the sea, it is a sector in itself. Even though there are some regulations for recreational fishers (size, quantity, seasonal limits, etc.) fisheries management cannot take place if the exact number of recreational fishers remains unknown. Although there is a licence system, acquiring a license is not an obligation. There is currently no proper education or monitoring system for recreational fishers. (Ünal, 2014). FAO (2012) shows the key elements for managing recreational fisheries. A major first step is to collect data and gain a better understanding of the fishery.

Recreational fishing is not economically beneficial and it is strictly prohibited to sell the catch, but it has an economic impact on other fishery sectors. The annual economic value of recreational fisheries in the Gökova MPA was calculated at TRY 33 250.144 in 2013. This includes food, bait, accommodation, travel, boat fuel, boat maintenance and fishing gear costs (Tunca, Ünal and Miran, 2013). Even though they share the same resources with commercial fishers, the proportion of the catch that is taken by recreational fishers is unknown.

Fishing is one of the major employment sectors in the Gökova MPA. However, local fisheries resources are in serious decline (Dereli *et al*., 2015) and fishing communities are suffering from a loss of income (Ünal and Franquesa, 2010) while marine species and habitats suffer from human-induced pressures and the lack of basic understanding on the importance of a healthy marine ecosystem (Kızılkaya, Ünal and Yıldırım, 2015).

Over population causes both land- and marine-based pressures such as pollution, damage caused by anchorage and **overexploitation of resources**. Compared to the whole Aegean coastline, the Gökova MPA has less urbanization, but increased usage of the region in the summer has some impacts, like pollution. Research reports demonstrate that pollution occurs in most of the bays (Okuş *et al*., 2006). Water quality was lower than expected, especially at English Bay. Boat traffic is very high in this bay which is also very sheltered and less affected by currents and waves. It is expected that a low dissolved oxygen rate is related to poor water circulation and high boat traffic (EKAD, 2013).

2.3 Ability to achieve (including external drivers)

Management of marine living resources in **MPAs** is the responsibility of the MFAL. On the other hand, the Directorate General for the Preservation of Natural Heritage is responsible for the management of the MPAs. Therefore, there is an urgent need for the two institutions to cooperate in order to effectively manage MPAs within the whole of Turkey, including the Gökova MPA.

Bureaucratic overlap is one of the root causes of the poor implementation of conservation measures. As is mentioned in section 1.6, the Ministry of Food, Agriculture and Livestock; the Ministry of Environment and Urbanization; the Coastguard; and the Gendarmerie are the main decision-makers and law enforcement agencies for fisheries management, spatial management and surveillance within the Gökova MPA. This is an advantage if these agencies are in communication with one another and cooperate, but if they do not, the problem of bureaucratic overlap occurs.

Consistency within the relevant departments is a very important issue. This is an essential approach with the potential to ensure the permanency of the established and well-implemented solutions, or even to create long-term plans.

MFAL is responsible for preparing and implementing the **fisheries regulations** for both the commercial and recreational fisheries in marine and inland waters. The Ministry reviews and revises the regulations every four years with the assistance of relevant faculties or institutions of universities and other partners. Even though there is an effort to create cooperation, there have been imbalances between different sectors created by the regulations. These circumstances occur because of a lack of **multidisciplinary scientific studies** and **participatory approach**. Understanding the needs of the community is as essential as understanding the ecological needs. To achieve this, all the stakeholders that impact the resources or are affected by the regulations have to be involved in different management steps. In this way, **ownership** would be created for the communities and the sustainability of the conservation measures would be ensured.

A **bottom-up approach** was achieved in the area during the process of establishing the NFZs in the Bay (Kızılkaya, Ünal and Yıldırım, 2015). The same approach, rather than a top-down approach, needs to be carried out in further planning and management strategies. Even though there are some **gaps in the institutionalization of the approach (cooperatives, clubs, societies, etc.)** the bottom-up approach needs to be encouraged for the improved management of the fisheries sector in Turkey (Ünal, Güçlüsoy and Franquesa, 2009).

Local level fisheries management is essential for special areas such as MPAs. Since the Gökova MPA has been a SEPA since 1988, it was under the authorization of EPASA until 2012. This department used to have its own budget and staff at local level

which allowed it to focus on the needs of these areas and creating financial mechanisms to respond to these needs. Since the closure of EPASA, however, all MPAs including Gökova MPA have been under **central management**, without a local management team or budget.

Consumer demand is one of the biggest issues to take into account for fisheries management. Consumers are the ones who demand that fish are caught for consumption. In this case **education and publicity** plays an important role. There needs to be more effort to educate people so as to help with the control and surveillance of illegal activities, or for decreasing the pressure of demand on threatened species.

The backbone of an effective management plan is having a strong **database for both biological and socio-economic** aspects. Collaborative studies need to be done to find out the needs of the ecosystem and the communities.

Conclusions

Many projects and studies of biodiversity and integrated coastal zone management have been carried out in Gökova MPA over the past decade. Establishing NFZs by stakeholder participation, and the progress made with implementing a co-management approach are milestones for fisheries management in the area, and in Turkish fisheries in general. In conclusion, Gökova MPA, with its unique characteristics, fishery cooperatives, NGOs and other interested stakeholders, seems to be more ready than ever to a prepare fisheries management plan according to an EAF.

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Annexures

Annexure I

First draft of a fisheries management plan for the Gökova MPA fishery
(Ünal, 2010)

The FAO Technical Guidelines for Responsible Fisheries (FAO, 1997) provide a very specific definition of a fisheries management plan (FMP):

"A fisheries management plan is a formal or informal arrangement between a fishery management authority and interested parties which identifies the partners in the fishery and their respective roles, details the agreed objectives for the fishery and specifies the management rules and regulations which apply to it and provides other details about the fishery which are relevant to the task of the management authority".

While we were preparing the draft FMP, this definition was taken into account and extra attention was paid to identifying the contents that a comprehensive FMP should have. The FMP for Gökova MPA fishery includes following contents:

- An analysis of the current status of the fishery.
- Management objectives and goals to be achieved.
- How these objectives are to be achieved (according to FAO [2002], one of the greatest challenges of fisheries management is to choose and implement the best management strategies to achieve the objectives).
- How and when the plan is to be reviewed.
- The consultation process for review.

Berkes *et al.* (2001) reported that a wide variety of social and economic benefits may be derived from fisheries through management, and any of these benefits can be an objective of fisheries management. The list in the table "The Main Goals of Fisheries Management in General and Suitability for the Gökova MPA Fishery", adapted from Berkes *et al.* (2001) includes most of the objectives commonly stated for fisheries management. Authors report that these objectives appear to fall into three main groupings. The first grouping relates to the sustainability of the resources and ensuring that their productive capacity is assured into the foreseeable future (termed "biological" by Clark, 1985). The other two groupings are economic and related either to the optimization of returns from the fishery (efficiency) or to the distribution of those returns among stakeholders; that is, equity. We considered these objectives for the Gökova MPA fishery and reviewed the suitability of each for the fishery.

In general terms, the goal of fisheries management can be divided into four subsets: biological, ecological, economic and social, where social goals include political and cultural goals (achieving equity, providing employment, etc). The biological and ecological goals may be more correctly thought of as constraints to achieving desired economic and social benefits, but for the sake of simplicity, and in order to be consistent with the terminology most commonly used in fisheries management, and the many guide books related to fisheries management (e.g. FAO, 2002), we use the term "goals". Similarly, success in fisheries management has at least three dimensions: biological (meeting conservation objectives), economic (meeting wealth and efficiency objectives) and social (meeting the equity objectives, both in terms of distribution and access). Successful fisheries thus require institutional capacity, both to define an appropriate balance of these parameters within management objectives, and to implement and adapt these responsively over time (Cunningham and Bostock, 2005).

First draft of a fisheries management plan and the current situation in Gökova MPA

Contents and main goals of the FMP	Current status of fisheries in Gökova MPA and available information	Operational objectives	Responsible institution	Were the negotiations with the attendant stakeholders held out?
Description of fishery Target species Fishing fleet Fishing gears and methods Socio-economic situation Problems	Fishing fleet, target species, fishing gears and methods, fishery cooperatives, problems have been detected and reviewed. The species that play the most important role in the amount of production and income were reviewed in terms of their economic and physical contribution to the fishery cooperatives. Length frequency graphics of target species were prepared in order to understand whether these species are overfished or not. Socio-demographic and socio-economic characteristics of fishers and the rates of their dependence on the fishery were identified. Weak monitoring, control and surveillance of illegal fishing.	To describe the fishery in Gökova MPA.	Fisheries Management Committee (FMC) prepares a report on state of fishery periodically.	No need
Distribution of roles in fisheries management Stakeholders Administrative mechanism Regulations	The stakeholders were defined and several meetings were held which almost all stakeholders attended. The administrative mechanism was reviewed and the requirements of decentralization and fisheries co-management, as well as the establishment of a FMC were reported. Existing regulations were reviewed and new and additional regulations were prepared to submit to the central management authority for the amendment. However, a meeting is required to clearly define the roles of stakeholders in fisheries management.	To provide the legal, institutional and administrative basis for stakeholder participation in fisheries management; To establish a FMC; To add new and additional regulations to the Fishing Notification and consider EU regulation (1967/2006/EC) which regulates fishing in the Mediterranean.	FMC	Yes / No

Contents and main goals of the FMP	Current status of fisheries in Gökova MPA and available information	Operational objectives	Responsible institution	Were the negotiations with the attendant stakeholders held out?
The main goals of fisheries management * Biological Ecological Social Economic	The management of a fishery is closely related to the sustainability of fish stocks and the marine environment. It is known that fisheries management should have biological, economic, ecological and social goals. In Gökova Bay many studies and projects have been carried out related to the biological, economic, ecological and social components of fisheries management. Some of these are detailed here: Hydro-biological characteristics and the fishery of Gökova MPA (Cihangir *et al*., 1998). Relationship between the management of the coastal zone and the traditional fishery (Erdem, 2001; Erdem, Ünal and Kınacıgil, 2002). Problems of the small-scale fishery in Gökova MPA (Ünal *et al*., 2005). Biodiversity of Special Environmental Protection Area (SEPA) of Gökova MPA (Okuş *et al*., 2006). Longline fishery and gillnet fishery in two main fishing ports of Gökova MPA (Akyol, Kınacıgil and Sevik, 2007). Woman fishers and their problems and occupational satisfactions (Göncüoğlu, 2008). Success and failure of Fishery Cooperatives (Ünal, Güçlüsoy and Franquesa, 2009). Length–weight relationship of 17 species caught from Gökova MPA (Ceyhan, Akyol and Erdem, 2009). Management paradox of groupers in Gökova MPA (Ünal *et al*., 2009). Lost fishing gears and their distribution in Gökova Special Environmental Protection Area (Ayaz *et al*., 2010). Illegal fishing in Gökova MPA (Ünal and Erdem, 2009). Socio-economic indicators and viability in small-scale fisheries (Ünal and Franquesa, 2010). Sustainable small-scale fishery in Gökova MPA (Ünal and Erdem, 2009).	To maintain the target species at or above the levels necessary to ensure their continued productivity (biological); To minimize the impacts of fishing on the physical environment and on non-target, associated and dependent species (ecological); To maximize the net incomes of the participating fishers (economic); To maximize employment opportunities for those dependent on the fishery for their, livelihoods (social).	EPASA & Ministry of Agriculture and Rural Affairs – Directorate General of Protection and Control (MARA) & FMC	Yes (proposed closed areas were decided with the participation of stakeholders/ No (management objectives were not agreed with fishers)
Management system Right of access to the fishery Input-based fisheries management License system	Presently, an input-based fisheries management system is in use in Gökova MPA fishery. The boats and fishers have fishing licenses which allow commercial fishing. However, fishing licenses are obtained by non-fishers, causing an increase in the fishing effort.	To create and accept a fishery management system that consists of a combination of fishery management systems; To freeze the number of vessels in the fishing fleet; To continue to keep management measures that support input-based fisheries; To limit the amount or number of fishing gears used in fishing operations for each fishing boat.	MARA & FMC	No

Contents and main goals of the FMP	Current status of fisheries in Gökova MPA and available information	Operational objectives	Responsible institution	Were the negotiations with the attendant stakeholders held out?
Research – scientific contribution Status of stocks Data collection system Socio-economic studies Environmental issues	There is no stock assessment study or programme in the Gökova MPA fishery. However, length–weight data were collected and it was determined that the related species are caught at sizes less than the legal minimum landing size and there is fishing pressure on these species. There is no available study on the status of the stocks, nor is there a locally-based data collection system. Socio-economic and environmental studies are limited.	To establish a local level data collection system under the fishery cooperatives and ensure the minimum data required for the FMC is collected periodically; To monitor the stocks of target species and key species.	FMC & EPASA	No
Monitoring, control and inspection Determining the existing fishing capacity Existing regulations Data collection system and improvements	Existing fishing capacity and the average fishing gears used on a daily basis were calculated. All available rules and regulation related to the project area, and which are clearly mentioned in Fishing Notifications, were identified. Data collection systems that can play a role in fisheries management have not been established in the area yet. Fishery co-operatives should provide necessary data to the FMC or EPASA periodically.	To monitor the fishery and to strengthen inspection and enforcement;	MARA & EPASA & Coastguard	Yes
Negotiations with stakeholders Identifying stakeholders Process of negotiation	During the project, meetings with stakeholders were held and these were characterized by broad participation. As a result of the negotiations, "closed areas for fishing", consisting of six different areas, were designated to support the sustainable fishery in Gökova MPA.	To identify stakeholders, organize stakeholder meetings and invite all the interested parties to the meeting.	EPASA & FMC & Fishery cooperatives	Yes
Marketing Marketing through cooperatives Direct marketing Possible amendments	Local fish market is disrupted by the products imported from Senegal, as well as illegal catch. Available marketing channels, off the record fish sale and marketing problems were reviewed by a previous project. Price analysis shows the monthly price changes of the six species during the year. The top ten species in terms of value and quantity were also reported.	To minimize market disruption; To encourage marketing through the fishery cooperatives and supporting this with laws or local regulations; To encourage membership of fishery cooperatives.	MARA & Fishery cooperatives	No

Contents and main goals of the FMP	Current status of fisheries in Gökova MPA and available information	Operational objectives	Responsible institution	Were the negotiations with the attendant stakeholders held out?
Reviewing the plan When and how will the FMP be reviewed? Who is responsible for reviewing the FMP?	Assessments and proposals were put forward regarding the person or persons who should take responsibility for reviewing the FMP, the time periods in which this should take place and the form the reviews should take. Theoretical studies were reviewed for the adoption of a fisheries co-management approach, forming a local FMC and the management of resources. It was proposed that both articles nine and ten be dealt with in a workshop which all stakeholders attend. The FMC may consist of representatives of the following interested parties: • Three fishery cooperatives located in Gökova SEPA • Muğla Region Fishery Cooperatives Association Universities (Muğla and Ege), Faculty of Fisheries Ministry of Agriculture and Rural Affairs –Directorate of Protection and Control • Coastguard Group Command • EPASA • Muğla Provincial Gendarmerie Command • Recreational fisheries • Local NGOs • Local fish restaurants • Fishmongers (retailers).	Three fishery cooperatives located in Gökova SEPA		
		To review the plan every five years; To review the plan by Fisheries Management Committee of Gökova MPA, MARA and EPASA and to make sure that all interested parties (stakeholders) in the fishery should participate in its development, reviewing and improvement.	FMC & EPASA & MARA	No
Costs of fisheries management Who will bear the costs of fisheries management? Who will be responsible for covering the costs incurred during the review of the FMP and conducting the necessary studies?		To meet the cost of fisheries management (from data collection to reviewing FMP)	Fishery cooperatives & EPASA & MARA	

*The main goals of fisheries management in the Gökova MPA fishery
The overall goal of fisheries management: to ensure the optimum sustainable utilization of the fisheries resources and adopt a precautionary approach to fisheries management for the benefit of the people settled in the coastal area of Gökova MPA.

Subsets of main goals in fmp	**Objectives of fisheries management** (adapted from Berkes *et al.*, 2001)	**Main purpose Sustainability (S) Efficiency (E) Equity (Eq)**	**Responsible institution**	**Data requirements**	**Reference points**
Economic	Optimum sustainable yield (OSY) which takes place between maximum economic yield (MEY) and maximum sustainable yield (MSY)	**E & S**	MARA & EPASA & Fishery cooperatives	Average income per fishing unit, per year for all fleets; Costs per fishing unit, per year; Profitability of each fleet; Dependence on fishery; Consumer satisfaction; Economic and financial performance of fleet.	20 Euro per day, per fisher; An economic performance ratio of >10% for each fishing boat; Harvest at the level of two-thirds of MSY; Right-based fishing in Gökova SEPA.
Economic	Stabilize catch rates	**E**	MARA & EPASA		
Economic	Increase cost effectiveness	**E**	Fishery cooperatives		
Economic & biological	Stop open access fishery	**S & E**	Fishery cooperatives		
Economic & biological	Reduce overcapacity	**S & E**	MARA		
Biological	Conservation of fish stocks	**S**	MARA & EPASA	Total landings by major species per fleet, per year; Total effort by fleet, per year; Length and/or age composition of landings for major species; Discards of major species per fleet per year; Length and/or age composition of discards per species, per fleet, per year; Areas fished by each fleet.	Two-thirds of MSY
Biological	Stabilize fish stocks	**S**	MARA & EPASA		
Ecological	Create closed areas for fishing	**S**	MARA & EPASA & Fishery cooperatives	Total catches of bycatch species (including discards), or selected indicator species, per fleet, per year. Length and/or age composition of catches of bycatch species or selected indicator species; Impact of fishing gear and activities on the physical habitat; Changes in critical habitats brought about by non-fishing activities.	Catch of juvenile fish is less than 10%; Discarded fish is less than 5% of total catch; Retrieving lost fishing nets is performed once every two years.
Ecological	Prevent waste of fish	**S & E**	Fishery cooperatives		
Ecological	Maintain healthy ecosystem	**S**	MARA & EPASA & Fishery cooperatives		

Subsets of main goals in fmp	**Objectives of fisheries management** (adapted from Berkes *et al.*, 2001)	**Main purpose Sustainability (S) Efficiency (E) Equity (Eq)**	**Responsible institution**	**Data requirements**	**Reference points**
Economic & social	Provide employment	**Eq**	MARA & EPASA	Total number of fishers employed by each fleet; Total number of people employed in fishing or shore-based activities per fleet, by gender and age group, where appropriate; Dependence of fishers and shore-based workers for their livelihoods, for each fleet; Survey data on satisfaction of recreational fishers, consumers, women fishers.	Freeze the size of the fishing fleet and keep fishing areas for local fishers; Maximize employment in the fishery but not by increasing the numbers of active fishers; Social welfare and meeting the equity objectives; Absence of conflict or minimal conflicts between interested users.
Economic & social	Increase fishers' income	**Eq**	MARA & EPASA		
Social	Reduce conflicts between fisher groups or with non-fishery stakeholders	**Eq**	FMC & MARA		
Social	Protect recreational fishing	**E & Eq**	EPASA & MARA		
Social	Maintain low consumer prices	**Eq**	Fishery cooperatives		
Social	Increase women's participation	**Eq**	Fishery cooperatives		
Social	Stop unfair competition between fishers	**Eq**	MARA		

Annexure II

Draft action plan for Gökova MPA
(by Kıraç and Veryeri, 2010)

	Target	Activity	Action by	Deadline
1	General	Complete and approve Gökova SEPA Integrated Coast and Marine Management Plan	EPASA	December 2011
2		Include local NGOs in the management plan mechanism	Local NGOs MARA EPASA	Continuous process
3		Activities at the local level to promote communication and the exchange of information realized	EPASA Municipality NGOs	Continuous process
4		Share information on environmental risks and problems with relevant decision-makers and scientists	Local NGOs Fishery cooperatives Tour boat cooperatives	Continuous process
5		Re-evaluate the results of monitoring activities within nature conservation-oriented criteria	EPASA	Continuous process
6		Control of illegal fishing within Gökova SEPA	Ministry of Environment and Forestry (MEF) Gendarmerie Village elders	Continuous process
7		Information boards designed and deployed at selected points within Gökova SEPA	EPASA NGOs	March 2012
8		Public awareness and education activities on poaching designed and implemented	EPASA MEF – General Directorate of Nature Conservation and National Parks (GDNCNP) Gökova Akyaka Lovers Association (GAS-DER) Akyaka City Council Muğla Governorship	Continuous process
9		Create public awareness and a communication system and tools (information office; education; publications; informative sign boards on restrictions, sensitive habitats, invasive, resilient, endangered species and exotic species)	MEF MARA EPASA Local NGOs	December 2012
10		Redefine the responsibility zones of Gendarmerie stations so as to attain the optimal intervention	Gendarmerie EPASA	
11		Complete urban sewage projects with waste water treatment and construction for the settlements within Gökova SEPA	EPASA Muğla Governorship Municipality	June 2015
12		Construct solid waste collection and treatment facilities	Muğla Governorship EPASA Municipality	June 2013
13		Carry out scientific research studies on the terrestrial fauna and flora of Gökova basin and coastlines	EPASA	December 2013
14		Improve and sustain consistent character in the reconstruction (ekistics) of Akyaka and nearby settlements	EPASA Municipality Akyaka City Council	Continuous process
15	Agriculture	Educate and guide activities towards the adoption of ecologically friendly agriculture practices	Provincial and District Directorate of MARA Local NGOs	December 2012
16		Constitute an effective and science-oriented water management plan	The State Water Supply Administration (DSI) MARA	December 2011
17		Enforce regulations prohibiting the planting of exotic flora in the region	EPASA MEF MARA	December 2015
18		Monitor wells and illegal water withdrawal	MARA DSI EPASA	Continuous process
19	Fishery	Quota regulations in force to limit the number of fishing boats and the type of fishing equipment	MARA–GDPC	January 2012
20		Fish stocks of Gökova calculated	EPASA MARA	December 2011

	Target	Activity	Action by	Deadline
21		Speargun fishing (with SCUBA or skin diving) to be prohibited in Gökova SEPA	MARA EPASA	June 2011
22		Classification of fishing areas based on fishing activities applied	MARA–GDPC	January 2011
23		Defining and assigning No Fishing Zones approved	MARA-GDPC	Done
24		Strengthen the patrolling system by responsible organizations in both terrestrial and marine areas	MARA–GDPC Undersecretariat for Maritime Affairs EPASA Coastguard Headquarters Gendarmerie Headquarters	December 2012
25		Patrol boat of MARA operated for the prevention of illegal fishing	MARA	March 2011
26		Monitor and prevent the exploitation of seaweed from Kadınazmagı river for use as fish bait.	EPASA, Gendarmery and Akyaka Municipality	December 2010
27		Prohibition of nets made of nylon thread by regulations	MARA-GDPC	September 2011
28		Collecting ghost nets in Gökova MPA	Muğla University Ege University Eylül University Fishery cooperatives Local NGOs Underwater Research Society (SAD) MARA EPASA	December 2011
29		Cooperation and coordination of local fishery cooperatives improved	Fishery cooperatives MARA SAD	December 2011
30		Cooperation with relevant specialist institutions and organizations to fill the gaps in the aqua products regulation of MARA completed	MARA-GDPC	April 2012
31	Sailing tour boat owners	Buoys and mooring anchors to be established in adequate numbers along suitable coasts of Sedir Island	EPASA	December 2011
32		Quota calculation for number of tour boats to Sedir Island	EPASA	March 2011
33		Re-designed and construction of Akyaka wave breaker	EPASA Municipality	December 2013
34		Shelter for amateur boats planned at Maden Port	EPASA Municipality UMA	December 2012
35		Monitoring of illegal discharge of boats	Undersecretariat for Maritime Affairs-UMA MEF MARA Tour cooperatives Fishers Nature sports schools Local NGOs	Continuous process
36		Enforcement of punishment for marine pollution	Municipality Coast Guard Muğla Governership	Continuous process
37		Construction of solid waste collection and treatment facilities	Muğla Governership EPASA Municipality	June 2013
38		Construction of adequate port reception facilities for liquid oily waste by marine vessels	UMA	June 2014

	Target	Activity	Action by	Deadline
39	Tourism	Public awareness and education activities on illegal fishery designed and implemented	Akyaka City Council Local NGOs SAD Muğla University EPASA	Continuous process
40		Design, print and distribution of posters, brochures and stickers on illegal fishery and trade	MARA EPASA	April 2012
41		Monitoring and revising management decisions on excursion areas	EPASA General Directorate of MEF Muğla Governorship	Continuous process
42		Local business activities attached to the municipality management classified into sectors	Municipality	March 2012
43		Invest in and increase the capacity of local waste management facilities	EPASA Municipality	March 2012
44		Planning parking areas for commercial boats in Azmak	EPASA	March 2011
45		Kadınazması river management plan and exploit principles to be set out by EPASA	EPASA	January 2011
46		To sustain better quality of social and cultural local life, educational, recreational and social activity areas planned in detailed scales (1/1 000 and smaller)	EPASA Municipality Muğla Governorship Universities Local NGOs Local operations Kitesurf schools	January 2014
47		Boat yard locations defined and planned	EPASA Muğla Governorship	April 2011
48		Boat yards constructed	Fishery cooperatives Private investors	August 2011
49	Wild boar	Monitoring wild boar population	MEF EPASA	Continuous process
50	Mediterranean monk seal	Carry out high quality monitoring projects to improve the knowledge on Mediterranean monk seal behavior and habitat use	EPASA	December 2012
51		Design, print and distribute posters, and relevant publications for public awareness	EPASA	December 2012
52	Sandbar shark	Carry out high quality monitoring projects to improve the knowledge on sand bar shark behavior and habitat use	EPASA	April 2011
53		Design, print and distribute posters and relevant publications for public awareness	EPASA	Done – December 2011
54	*Posidonia* sea grass meadow	Exact distribution mapping and percentage coverage to be completed	EPASA Muğla	December 2012
55		Define, apply and monitor buoying activity to prevent hazards of anchoring	EPASA	March 2013
56	Fish and macrobenthos	Carry out monitoring projects determining biomass values of existing species and their ecological roles in Gökova Bay	EPASA	December 2012
57	Commercial fish species	Carry out monitoring projects on the diversity and biomass value change in No Take Zones in Gökova Bay.	EPASA	Done – continuous process
59	Natural coastline habitats	Control and monitoring of illegal lumbering and shrub cutting	MEF EPASA Gendarmery	Continuous process
60		Control and monitoring of illegal sand extraction from the beaches and dunes in Gökova SEPA	EPASA Municipality Governorship	Continuous process
61	Wetlands	Control and monitoring of illegal land filling around the wetlands	EPASA Municipality Governorship	Continuous process
62		Control and monitoring of wetland torching	EPASA Muğla Governorship MEF Gendarmery	Continuous process

This technical paper presents a baseline report that was prepared under an ecosystem approach to fisheries (EAF) case study initiated for the small-scale fisheries of Gökova Bay, eastern Aegean Sea, Turkey. The baseline report is the outcome of the planning phase of the case study. It was prepared as a contribution to an EAF fisheries management plan for the small-scale fisheries of Gökova Bay. The baseline report outlines the available information on the small-scale fisheries and documents essential information, including the species and geographical areas covered in the case study, the socio-economic profile of the fisheries, threats to the sustainability of the fisheries and the institutional arrangements for their management.



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