Food and Agriculture Organization of the United Nations

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BASELINE REPORT

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Cover photograph: Ziya Yilmaz (80 years old) is the oldest fisher in Gökçeada Island.
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Abstract

The North Aegean Sea is heavily influenced by both the Mediterranean and Black Sea waters, and is thus very rich in terms of biodiversity. Gökçeada is Turkey's largest island, and acts as a natural center for the transition points of migrating fish, located at the entrance of Saros Bay, and at a point where the Marmara Sea and the North Aegean waters meet. The banks surrounding Gökçeada, create rich fishing beds. It also hosts Turkey's only marine park, which was established in 1999, with efforts from Turkish Marine Research Foundation (TÜDAV). A lack of stock assessments, as well as co-management, has impeded fisheries management capabilities in the region. This study presents a first baseline report on the fishers, fishing gear and fisheries of Gökçeada to facilitate its transition to incorporating the principles of an ecosystem approach to fisheries management. The goals of an ecosystem approach to fisheries are: (a) to plan, develop and manage fisheries in a way that addresses the multiple needs and desires of societies, without jeopardizing future generations' options to benefit from all the products and services provided by aquatic ecosystems, and (b) to balance various societal goals by taking into account the interactions of biotic, abiotic and human components of ecosystems and by applying an integrated approach. This report was prepared as part of the project *"Transition to Ecosystem Approach to Fisheries Management and Designing a Management Plan in Gökçeada, Turkey"*. It is carried out in cooperation with the Ministry of Agriculture and Forestry and managed by Ege University with the participation of many other stakeholders and financed by the FAO within the scope of the FAO EastMed Project. The first part of the report presents information on the fisheries, and the second section, presents threats to the sustainability of fishing. A review of all existing relevant data was completed in addition to fisher interviews performed in 2020 to properly understand the current state of the fisheries and threats affecting sustainability. In 2020, there were 51 registered local fishing vessels in Gökçeada, with 50 of these of small-scale nature and one new 13.5 m large-scale trawler that began fishing in 2019. However, there are numerous non-resident vessels that also fish in this region, and this puts exceptional pressure on the fish stocks. The small-scale vessels mostly use gillnets, trammel nets and handlines for fishing, and target different migratory fish such as bonito and bluefish. Sparidae are commonly targeted in colder months. Saddled seabream nets are unique to this island. Gökçeada is also the only place in Turkey where traditional swordfish fishing by harpooning still continues.

Fishery catches peaked in the mid-1990s and have been declining ever since, but according to fishers, the decline has been much stronger in the last five years. Illegal fishing is also commonly reported around the island, and sadly, there have been recent commercial extinctions for white grouper, dusky grouper, and bluefish. Fishers, who do not have alternative livelihood options other than fishing, require a multidisciplinary (environmental, biological, socio-economic) approach to fishing around the island. The example of the "Gökova Marine Protected Area Small Scale Fisheries Management Plan" prepared in 2018 can serve as a guide here. Within this framework, under the leadership of scientists and the FAO, with the approval and support of Directorate General of Fisheries and Aquaculture (DG-Fish) of Ministry of Agricultre and Forestry (MoAF) and provincial organizations, with the contribution and cooperation of the Gökçeada fishery cooperative, diving center, TÜDAV and all other stakeholders, the preparation of a fisheries management plan is being undertaken. The success of this initiative requires the joint willingness and determination of all stakeholders, especially from the official institutions and the fishery cooperative.

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Abbreviations and acronyms

CMAS	World Underwater Federation
CPUE	catch per unit effort
DG-Fish	General Directorate of Fisheries and Aquaculture
DİE	State Statistical Institute – former name of TUİK
EAF	ecosystem approach to fisheries
EAFM	ecosystem approach fisheries management
EastMed	FAO Regional project "Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean"
FABD	Fisheries and Aquaculture Branch Directorate
FAO	Food and Agriculture Organization of the United Nations
FMP	fisheries management plan
GCF	gross cash flow
GES	good environmental status
GFCM	General Fisheries Commission of the Mediterranean
GMKA	Southern Marmara Development Agency
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICRAM	Instituto Centrale per la Ricerca Scientifica e Tecnologica Applicata al Mare
IMO	International Maritime Organization
IUU	illegal, unreported and unregulated
MoAF	Ministry of Agriculture and Forestry

MAP	Mediterranean Action Plan
MCS	monitoring, control and surveillance
MSFD	Maritime Strategy Framework Directive
MPA	marine protected area
NGO	non-governmental organisation
PDAF	Provincial Directorate of Agriculture and Forestry
RAC/SPA	Regional Activity Centre/Special Protected Areas
SUBİS	Fisheries Information System
TÜDAV	Turkish Marine Research Foundation
TUİK	Turkish Statistical Institute
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

1 Introduction

The sustainability of fisheries in many coastal countries is closely related to establishing a rational, dynamic, participatory and comprehensive fisheries management plan that is based on a legal infrastructure. Comprehensive fisheries management should begin with the implementation of a fisheries management plan prepared with a participatory approach, considering all stakeholders and their contributions. It should also incorporate not only the biological and ecological dimensions of fisheries, but also the socio-economic, institutional, legal (institutions, laws, regulations and legislations, etc.) dimensions and external factors. Such an approach was outlined in the FAO Conduct for Responsible Fisheries (FAO, 1995) and later operationalized through the adoption of the ecosystem approach to fisheries (FAO, 2003). The ecosystem approach to fisheries (EAF) emerged as an improved strategy for fisheries management and has been promoted and applied in several differet contexts with variying degrees of success (Defeo and Vasconcellos, 2020; Vasconcellos and Ünal, 2022).

According to the FAO (2003), the purpose of EAF is: (a) to plan, develop and manage fisheries in a way that addresses the multiple needs and desires of societies, without jeopardizing future generations' options to benefit from all products and services provided by aquatic ecosystems, and; (b) trying to balance various societal goals by taking into account the interactions of biotic, abiotic and human components of ecosystems and by applying an integrated approach. The most important difference between the ecosystem approach to fisheries management and traditional management approaches is that it places people and societal goals at the center. This approach supports the participation of stakeholders, especially fishers, in management as an effective way to ensure the sustainability of fisheries. More importantly, it takes into account the social and economic consequences of particular management regulations while addressing the ecological consequences of fishing. Also, when applied in an open and coordinated manner, the EAF is designed to help understand how each of these components interacts and affects the other (FAO, 2003).

Due to their location and distance from mainland, Islands are endowed with unique cultural, economic and ecosystem characteristics and are often rich in fisheries resources. Their isolation and geographical position can also present challenges for fisheries management.

Gökçeada is the largest island in Turkey, and also the furthest from the mainland, with a 93 km coastline. However, there are other features that distinguish this island from other islands in the Aegean Sea. Gökçeada's geographical position makes it as a natural center for the transition points of migrating fish, as it is located at the entrance of Saros Bay, an important fishing area, and at a point where the Marmara Sea and the North Aegean waters meet. The bank systems surrounding Gökçeada and create rich fishing beds.

Gökçeada shores are very rich in terms of biodiversity. A total of 80 different fish species have been identified in the shallow waters of the island up to 20 m in depth (Altın *et al.*, 2020). The number of identified fish species grows to 209 with increasing depths (Ulutürk, 1984; Keskin and Ünsal, 1998; Türetken, 2009; Gönülal and Güreşen, 2014; Dalyan, 2019). On the shores of the island, *Posidonia oceanica*, one of the endemic flowering plants of the Mediterranean, *Cymodocea nodosa, Zostera marina, Zostera noltii* are present. The seaweed flora of this region includes 353 different species (Aysel *et al.*, 2001). Very valuable red coral (*Corallium rubrum*), an endemic Mediterranean species protected in Turkey (TOB, 2020a), is also found around the island (Çınar *et al.*, 2018). In addition, 34 sponge species (Topaloğlu and Evcen, 2014), a total of 223 mollusc species (Gönülal and Güreşen, 2014) including 21 cephalopod species (Erk, 2001), 219 crustacean species (Gönülal and Güreşen, 2014; Aslan and İşmen, 2019; Aslan *et al.*, 2021) and 50 echinoderm species (Gönülal and Güreşen, 2014) live in the waters of the island. Eight different species of marine mammals including whales and dolphins have also been seen in the waters around Gökçeada (Tonay *et al.*, 2015; Kesici *et al.*, 2021). The island also hosts critically endangered Mediterranean monk seals (*Monachus monachus*) and endangered sea turtles (*Caretta caretta*) (Dede, 1998; Akdeniz *et al.*, 2012; Kocabaş and Acarlı, 2019; Kesici *et al.*, 2021).

Gökçeada Marine Park was established in 1999 with the efforts of the Turkish Marine Research Foundation (TÜDAV) and is is presently the only existing marine park in Turkey. The area under protetcion was expanded in 2012 by the Ministry of Agriculture and Forestry with the suggestion of TÜDAV. The Gökçeada Marine Park is characterized by a hard sea-floor comprised of macroalgal, coralligenous communities, and sea meadows.

Gökçeada and its immediate vicinity (Saros Bay) are the only places in Turkey where swordfish are still caught with harpoons. The island's rich fisheries bring around 40 industrial fishing vessels (trawlers and purse-seiners) and about 30–60 small-scale fishing boats around the island's waters. Practically all (49 out of 50) resident fishers of the island are small-scale fishers. The fact that twice as many industrial and small-scale fishers fish in the waters of the island is considered a threat due to increasing competition, along with threatening the marine ecosystem and the economic sustainability of the island's local fishers. The island is surrounded by the Greek islands of Samothraki to its northwest and Limni (or Limnos Island) to its southwest, and the strong regional winds to a large extent prevent the island's fishers from fishing in the international waters.

In addition to this, it has been determined that around 50 recreational fishers living in Gökçeada are also engaged in part-time commercial fishing under the disguise of "recreational". Factors such as the lack of staff needed in Monitoring Control and Surveillance (MCS), high workload, and the harsh climate of the island contribute to insufficient control of the fisheries in and around the island.

Fishing in Gökçeada, earlier had lost momentum with the emigration of Greeks since the 1960s. However, it has gained importance with the settlement of 25 fishers families to the island from the Black Sea region in 1987. This immigration, and the increasing competition and intense fishing pressure due to the productive marine resources in the region has affected the island's fisheries.

The lack of ample scientific monitoring studies in diversity, scope and number of fisheries in Gökçeada currently impedes the ability to design an effective management plan. For this reason, it is of great importance to adopt an ecosystem approach to fisheries management in island fishing and to carry out necessary studies for this purpose. In this context, a project titled *"Transition to Ecosystem Approach to Fisheries Management and Designing a Management Plan in Gökçeada, Turkey"*, that is being carried out in cooperation with the Ministry of Agriculture and Forestry and Ege University, and financed by FAO within the scope of the FAO EastMed Project, has been implemented. In addition to the Ege University-Faculty of Fisheries, researchers from Dokuz Eylül University-Institute of Marine Sciences and Technology, Istanbul University-Faculty of Aquatic Sciences-Gökçeada Marine Research Unit, Çanakkale Onsekiz Mart University-Gökçeada School of Applied Sciences-Fisheries Technology and Çanakkale Onsekiz Mart University-Faculty of Marine Sciences and Technology. The FAO-EastMed Project, Ministry of Agriculture and Forestry-General Directorate of Fisheries and Aquaculture, Çanakkale Provincial Director of Agriculture and Forestry (PDAF), Gökçeada Fishery Cooperative, Turkish Marine Research Foundation (TÜDAV), and Gökçeada Municipality's staff is also contributing to this project. The project was started with the first stakeholder meeting conducted on 20 February 2020.

The main purpose of this report is to compile and document all relevant information that will constitute the basis for the preparation of a management plan for Gökçeada fisheries based on the methods and principles of the Ecosystem Approach to Fisheries (FAO, 2003; FAO, 2012a) in line with FAO's Code of Conduct for Responsible Fisheries (FAO, 1995). The report consists of two main parts. The first section includes all the pertinent information on the fisheries, and the second section discusses the main threats to fisheries sustainability. In the preparation of this report, in addition to compiling up-to-date information from all available studies and other resources, some new data collected through field studies and face-to-face interviews with fishers and also other stakeholders have also been used. A survey was conducted with a total of 39 fishers in 19–23 August 2020.

The main purpose of the fieldworks was to collect the data to complete the missing information needed in the preparation of the baseline report that reveals the status of Gökçeada fisheries in terms of EAF components in order to carry out the EAF based FMP preparation process properly. After the preparation of the draft baseline report, five-day fieldwork in 22–26 February 2021 was carried out with the representatives of the stakeholders to fill the gaps and to strengthen the draft report.

2 Overview of fisheries and exploited resources

2.1 Gökçeada

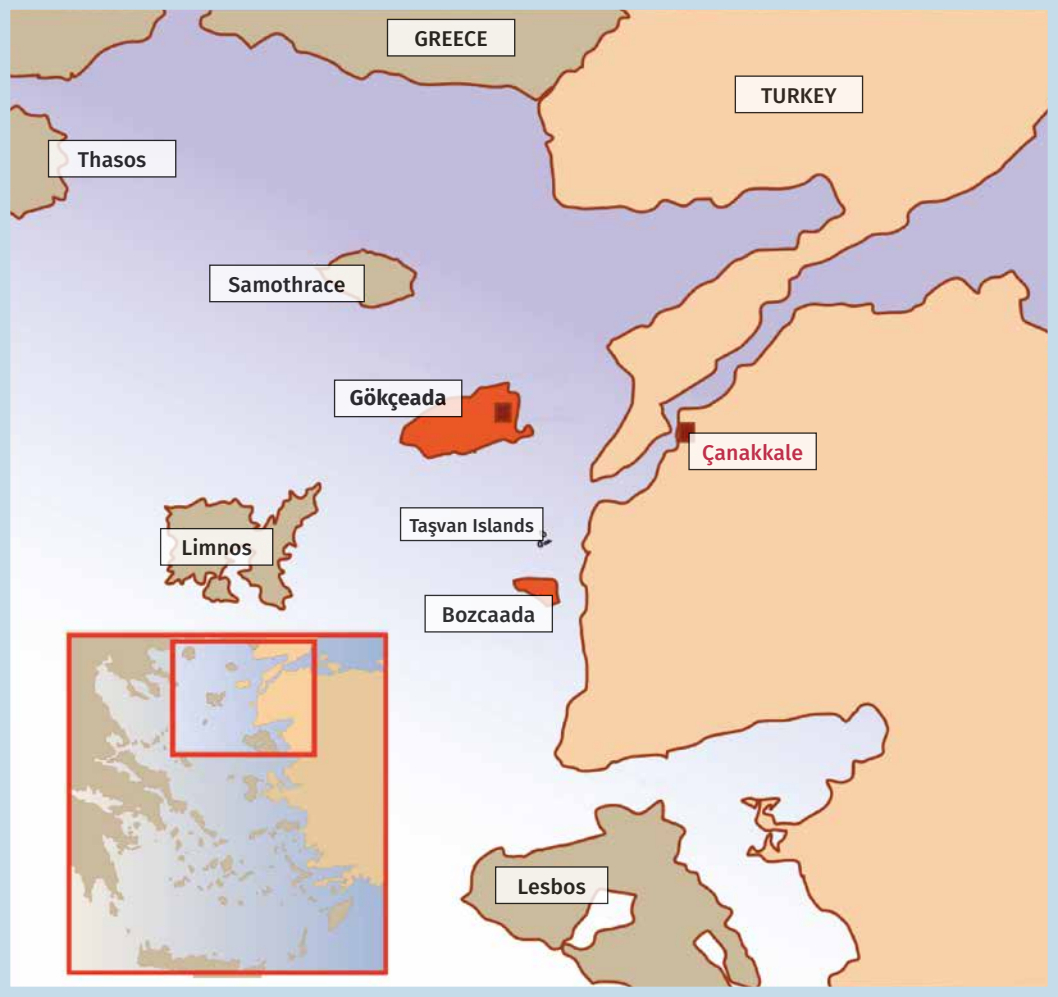
The Aegean Sea has two subregions, the Northern Aegean and Southern Aegean, which are split due to hydrographical features (Ignatiades *et al.*, 2002). Reaching the north of the Aegean Sea are the Turkish Straits System which are rich in nutrient elements with low salinity and temperature conditions, and Black Sea waters, which significantly affect the ecosystem and biodiversity of the region (Cengiz *et al.*, 2011; Petiakis *et al.*, 2014). The activity of these fertile waters in the region causes the north of the Aegean Sea to have a richer plankton variety compared to the south, and this increases in the spring months with the effect of the river waters (Theocharis, 1999; Yüce and Türker, 1991).

Gökçeada, located in the north of the Aegean Sea, is under the influence of the mentioned water inputs and current systems due to its location (Figure 1). The seasonal variation of the plankton distribution, temperature and salinity of the island greatly affects which species will be found in the ichthyofauna of the region and causes the presence of both Atlanto-Mediterranean and Sarmatic species in the region (Gönülal, 2008). These features, geographical location and hosting valuable commercial species such as swordfish have made Gökçeada an important fishing region of the North Aegean.

The population of Gökçeada, part of the Cittaslow movement, was 9 440 as of the 2019 general census and statistics. Gökçeada (formerly Imbros) is a district of Çanakkale and the largest island in Turkey (285 km^2). It is located in the north of the Aegean Sea, at the entrance to Saros Bay. The island, which has a coastline of approximately 93 km, receives annual rainfall ranging from 950 to 1 050 mm–m^2. Incirburnu, located in the west of the island, is also the westernmost point of Turkey.

As a result of the studies carried out in Gökçeada, from the Uğurlu-Zeytinlik excavation area, it was determined that the earliest settlers on the island came from Anatolia in 6500 BC. Until 5000 BC, a local culture developed independently from the mainland. It is reported that this community, which lived on agriculture (wheat, barley, lentil), livestock and possibly fishing, was in a wide-ranging trade network (Erdoğdu, 2012).

Figure 1. Location of Gökçeada



Source: Meydan, S. 2020.

Marie Gabliel-Flourens-Auguste (1752–1817) stated that the fishers returned from the expedition with plenty of red mullet and Mediterranean mussels; George-Berbard Depping (1784–1853) reported that seaweed and sea sponges were found on the sea-shore; Synvet (1872) said that the striped red mullet and swordfish were found in the harbor in Kaleköy port; Carl Fredrich (1904) said that shrimp and fish were very cheap. They reported that 1 kg of lamb was 24 phenics and 1 kg of fish was 40 phenics (Yurtseven, 2012).

Joining the Ottoman Empire in 1455, the island was occupied by Greece in 1912 and by the British in 1915; in accordance with the Lausanne Treaty, it was later included in the Republic of Turkey along with Bozcaada Island on 22 September 1923. Without mention of the Turkish-Greek Population Exchange, it would be incomplete to talk about Gökçeada, especially it's fishing. Exchange is the name given to the forced emigration process of the Greeks in Turkey to Greece and the Turks in Greece to Turkey in accordance with the additional protocol put in the Lausanne Treaty in 1923. During the exchange,

1 500 000 to 2 200 000 Greeks emigrated to Greece and 350 000 to 500 000 Turks to Turkey. In Turkey, only Greeks living in Istanbul, Gökçeada and Bozcaada, and in Greece only Turks living in Western Thrace were exempted from the population exchange. Nevertheless, the Greek population in Gökçeada decreased over time. According to a report prepared by the Southern Marmara Development Agency – GMKA (2012), 25 Greeks remained on the island.

Another very important historical feature of Gökçeada, is that it was once the center of sponge fishing in the North Aegean. It is known that up to 15 tonnes of sea sponges were collected on the island until the early 1970s and there were 22 sponge fishing boats registered in Gökçeada Port (Topaloğlu, 2002). As a result of the reduction of sea sponges due to excessive fishing with destructive fishing gears in the South Aegean, the fishing pressure increased by the sponge collectors coming from the South Aegean to Gökçeada, and a sponge disease commenced in the Mediterranean in 1986 (Gaino *et al*., 1992), finishing sponge fishing on the island (Topaloğlu, 2002). Gökçeada Sponge Research Institute, established in 1971 under the Hydrobiology Research Institute of Istanbul University, also shows the historical importance of the island for sponge fishing in Turkey. The aforementioned institute now serves as the Gökçeada Marine Research Unit affiliated with Istanbul University Faculty of Aquatic Sciences.

2.2 Gökçeada Marine Park

Gökçeada Marine Park, Çanakkale Province is located in an area of 1 mile from the coast, between Yıldız Bay (40 ° 14.186 N – 25 ° 54.230 E) and Çiftlik Bay (40 ° 14.432 N – 25 ° 56.112 E), which is on the northeast coast of Gökçeada district.

According to the TÜDAV (2022), in order to establish the marine park in Gökçeada, correspondence and meetings were held by TÜDAV from the 1997–1999 period with many institutions, including the Ministry of Agriculture and Rural Affairs and the Ministry of Environment. After obtaining the necessary permissions, it was announced that Gökçeada Marine Park was established in the Official Gazette dated 21 February 1999 and numbered 23618 with the suggestion of TÜDAV. Later, the eastern border of the park was extended in line with the suggestions of TÜDAV. The article related to the subject is published by the Ministry of Food, Agriculture and Livestock No. 2012/65 in the second part of the communique regulating fisheries in sea and inland waters, under the heading (o). Heading (o) includes: “In Çanakkale Province, Gökçeada District; Fisheries are prohibited in the area 1 mile from the shore between Yıldız Bay (40 ° 14.186´ N – 25 ° 54.230´ E) and Çiftlik Bay (40 ° 14.432´ N – 25 ° 56.112´ E) where Gökçeada Marine Park is located”.

Gökçeada Marine Park consists of various protection zones. These consist of the core region where activities are limited and the buffer regions surrounding it. The core region

is relatively shallow and the average depth is around 10 m. The buffer zone is considered as a structure that will protect the core region and has a deeper bottom structure and the depths here reach to 30 m.

Activities to be held in each zone in the park area have been determined. Since the core region is the region with the highest biological diversity, it can only be used for scientific purposes. Scuba or skin diving activities in the buffer zone are permitted with a guide. Surfing, the use of jet skis, anchoring of motor boats or larger ships are prohibited, the coastal area is completely closed to general use. Information about the park area is provided with warning signs displayed on the shore, and the prohibited areas are announced to visitors.

Since the day Gökçeada Marine Park was established, it has made significant contributions to the region as the only marine park in the country. This Marine Park was noted in the international literature as one of the best protected area practices of Turkey at the Johannesburg World Sustainable Development Summit. Many activities, including underwater photography contests, were organized in the Marine Park, which also hosts national and international research projects. Some of these activities are:

In 2008, the "Turkish Aphrodite Project" was realized in Marine Park, supported by RAC/SPA and ICRAM. The Aphrodite Project was proposed by UNEP-Regional Activity Centre/Special Protected Areas (RAC/SPA) and implemented with the cooperation of an Italian scientific research institute, Instituto Centrale per la Ricerca Scientifica e Tecnologica Applicata al Mare (ICRAM). The project, beginning in 2002, collected data in Standard Data-Entry Form (SDEF) on habitat and species diversity in specially protected areas in the Mediterranean Sea. As a part of the project, two Turkish scientists were sponsored to go to Italy to learn about underwater sampling. Detailed information on benthic fauna and flora, fish fauna, and habitat diversity on selected sites were gathered. The project also resulted in underwater maps of selected areas. "Gökçeada Marine Park Underwater Photography Contest" was organized three times by TÜDAV, the last of which was in 2011. In 2016, the "Gökçeada Marine Park Underwater Snorkel Photography Contest" was held for Recreationals, and both islanders and tourists showed great interest in the competition. Gökçeada Marine Park, protected area is an asset for the island and ultimate target is protection of the unique marine biodiversity of the island and Aegean Sea (TÜDAV, 2022).

Important steps were taken in 2016–2017, with a project on the establishment of on-site management of the park and also raising public awareness on marine biodiversity and environmental protection through educational materials. The project was executed by TÜDAV and its French partner BiEAUdiversité (CSD-ENV within the Civil Society Dialogue Program). It was co-financed by the European Union and the Republic of Turkey (TÜDAV, 2022).

"Aquarium man" Cem Karabay, the first and only Turkish underwater athlete to be included in the Guiness Book of Records, broke the record for "living in the cold sea for the longest time", 30 hours and 20 minutes, in Gökçeada Marine Park on 23 April 2018. The event was organized as part of the Troia Year with the sponsorship of TÜDAV.

2.3 Why a Marine Park in Gökçeada?

Horasanlı (2016) examined the distribution of fish species in rocks, sand and *Posidonia oceanica* habitats at depths between 0–15 meters in Yıldız Bay, which is located in Gökçeada Marine Park. Underwater Visual Counting method was applied using the SCUBA technique, and monthly observations between April and September 2016 were recorded. A total of 64 fish species were observed in the park area.

In the selection of marine parks, intact marine environments with high biodiversity are preferred. Gökçeada is located in the westernmost part of Turkey, in the Aegean Sea. Around the island, no excessive construction or settlements have affected the land, coast or seabeds. Fishing is one of the most important occupations on the island, where much of the coasts have not yet been opened to settlement.

There is rich biodiversity between Gökçeada and Saros Bay. In addition, there are underwater cave entrances in the region, which are habitats for many marine creatures, especially the endangered Mediterranean monk seal (*Monachus monachus*). Gökçeada is in a location where people can easily reach it due to its proximity to Istanbul and this accessibility is especially important in terms of environmental education.

Marine protected areas are generally established in areas with rare species, important habitats such as high sea banks, caves, and wetlands, away from any human influence. Gökçeada provides all these conditions exceedingly. As stated in the report, the existing protection area is insufficient to protect the unique ecological and biological characteristics of Gökçeada. It is obvious that developing the national network of marine and coastal protected areas will contribute to the fulfillment of Turkey's obligations arising from the Convention on Biological Diversity and Barcelona Convention.

2.4 Fishing fleet

Except for a single trawler that started operating in Gökçeada during the 2019–2020 fishing season, all other boats are of small-scale nature. For this reason, the fishing methods used are mostly passive and traditional types such as set nets, long lines, multi-hooked lines and swordfish harpoons. There is one trawler boat in Gökçeada, which is 13.5 m in length, has a 500 hp engine power and is only 2 years old (Figure 2). This trawler, with a crew of five, was built in steel and spent approximately 120 days of fishing during the 2019–2020 fishing season. The main target species of trawl fisheries includes many species such as deep-water rose shrimp, European hake, blue whiting, common pandora, red mullet, anglerfish and horse mackerel (Table 1).

Figure 2. The only local trawler of Gökçeada (front) and non-resident boats coming to the island to fish (back)

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Table 1. Commercially valuable species encountered in trawls around Gökçeada*

English names of species	Scientific names
Common pandora	*Pagellus erythrinus*
Axillary seabream	*Pagellus acarne*
Blackspot seabream	*Pagellus bogaraveo*
Red porgy	*Pagrus pagrus*
Two-banded seabream	*Diplodus vulgaris*
Sharpsnout seabream	*Diplodus puntazzo*
Morocco dentex	*Dentex maroccanus*
Common dentex	*Dentex dentex*
Black seabream	*Spondyliosoma cantharus*
Bogue	*Boops boops*
Blotched picarel	*Spicara maena*
Picarel	*Spicara flexuosa*
Atlantic horse mackerel	*Trachurus trachurus*
Mediterranean horse mackerel	*Trachurus mediterraneus*
Striped red mullet	*Mullus surmuletus*
Red mullet	*Mullus barbatus*
European hake	*Merluccius merluccius*
Whiting	*Merlangius merlangus*
Blue whiting	*Micromesistius poutassou*
Greater forkbeard	*Phycis blennoides*
Tub gurnard	*Chelidonichthys lucerna*
Piper gurnard	*Trigla lyra*
Streaked gurnard	*Chelidonichthys lastoviza*
Black scorpionfish	*Scorpaena scrofa*
Blackbelly rosefish	*Helicolenus dactylopterus*
John dory	*Zeus faber*
Angler	*Lophius piscatorius*
Blackbellied angler	*Lophius budegassa*
Four-spot megrim	*Lepidorhombus boscii*
Common sole	*Solea solea*
Invertebrates	
Deep-water rose shrimp	*Parapenaeus longirostris*
Norway lobster	*Nephrops norvegicus*
Squid	*Loligo vulgaris*
Shortfin squid	*Illex coindetii*
Common cuttlefish	*Sepia officinalis*
Octopus	*Octopus vulgaris*
Musky octopus	*Elodone* spp.

* Unpublished data: O. Gönülal; Acarlı *et al.*, 2020.

It is noteworthy that studies on Gökçeada fisheries are limited in number. Karakulak (2002) reported that the main species were European pilchard, Atlantic mackerel, Atlantic chub mackerel, Atlantic bluefin tuna, skipjack tuna, swordfish, Atlantic bonito, horse mackerel among the pelagic fish migrating around Gökçeada. Demersals were European hake, red mullet, striped red mullet, tub gurnard and John dory and semi-pelagics including bogue, salema, saddled seabream, picarel, common pandora, and other commercially important species included shrimp, lobster, Norway lobster, squid, and octopus.

Turkish (local), English and scientific names of vertebrate and invertebrate marine organisms mentioned in various places in the report were listed alphabetically in Appendix 1.

Gökçeada fishers mainly use Kaleköy Port, and also Uğurlu and Kuzu Ports (Figure 3). Small-scale island boats (Figure 4) mostly use Kaleköy and Kuzu Ports, and large-scale purse seine and trawlers coming from outside (Figure 5) use Uğurlu Port.

Figure 3. Ports of Gökçeada

Source: Redrawn by Authors from Google Earth, 2020.

According to the records of the Ministry of Agriculture and Forestry, General Directorate of Fisheries and Aquaculture, Fisheries Information System (SUBİS), there are 33 boats registered in Gökçeada. Except for only one of these boats (trawler 13.5 m length), all

other boats are small scale boats under 12 m. While four boats have two owners each, the other 29 boats are owned individually. The trawler vessel is made of steel and except one (fiberglass), all other boats are made of wood.

Figure 4. Small-scale boats registered in Gökçeada (Kaleköy Port)

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Figure 5. Large-scale trawlers using Gökçeada as an operational base

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The number of active boats in Gökçeada according to the years of construction is as in Figure 6. Eight of these boats joined the Gökçeada fishing fleet between 1979–1989, 11 of them between 1990–1999, eight boats between 2000–2009 and five boats between 2009–2019. In the last decade, the number of newly built boats and additions to the fleet have decreased compared to the previous three decades.

Figure 6. Construction years of fishing boats in Gökçeada

Source: Authors' own elaboration, 2021.

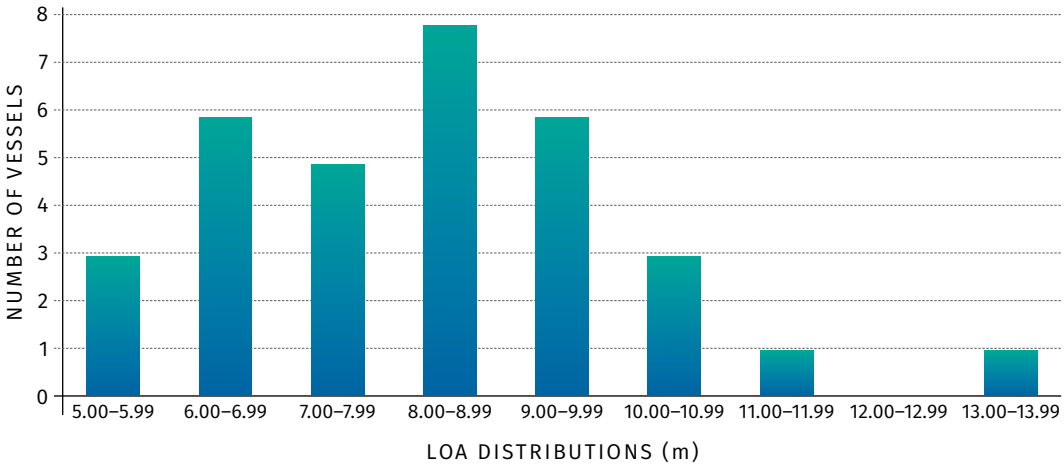
The descriptive statistical values of the length over all (LOA), gross tonnage (GT) and engine power (kW) of the fishing boats registered in Gökçeada are provided in Table 2. The average length of these 33 boats is 8.2 m, average engine power is 70.6 kW, and the sum of gross tonnage and engine power is 66.7 GT and 2 328.8 kW. The gross tonnages of the boats are low as they are typical small-scale fishing boats. The length and engine power of the only trawler is considerably higher than other boats (13.5 m, 373.1 kW).

Table 2. Descriptive statistics regarding length over all, engine power and gross tonnage of boats according to the SUBİS records

Descriptive Statistics	Length Over All (LOA) (m)	Gross Tonnage (GT)	Horse Power (kW)
Average	8.2	2.0	70.6
Standard Deviation	1.84	1.96	70.03
Range	8.1	9.4	366.4
Minimum	5.4	0.2	6.7
Maximum	13.5	9.6	373.1
95% Confidence Interval	0.65	0.70	24.83
Total		66.7	2328.8

Except for the trawler, all other boats are small-scale fishing boats under 12 m (Figure 7). Of these, most boats are in the length groups of 6.00–7.99 m and 8.00 and 9.99 m. The boats that make up the first group are generally of the non-cabin type, while those in the second group are of the cabin type.

Figure 7. Distribution of boat length groups



Source: Authors' own elaboration, 2021.

Except for the trawler, 9 percent (3) of other boats use Polyvalent (P) (multi-fishing gear) P-05 (<6 m), motorized passive fishing gear according to the fleet segment classification of the General Fisheries Commission for the Mediterranean (GFCM), and are small-scale boats. The remaining 91 percent (28), also small-scale, use P-06 (6–12 m) motorized passive fishing gears (GFCM, 2018).

According to Doğan and Gönülal (2011), many fishing boats, large and small, fish around the island during fish migrations. There were 51 fishing boats registered in Gökçeada harbor. Almost all of these vessels were small-scale. The authors reorted that data on the fisheries were scarce. The fishing grounds around the island were exploited by non-local commercial fishers, in addition to local ones. The marketing was insufficient and the fish caught were primarily sold to fish markets. Fishers sold 30.8 percent of the catch themselves as retail and the remaining 69.2 percent through middlemen (Doğan and Gönüal, 2011).

2.5 Fishing gears and target species

According to the fishing gear classification of the FAO, two of the boats registered in Gökçeada (SUBİS) have one type of fishing gear, two of them have two types, seven of them have three types, 21 of them have four types and one of them has five different types of fishing gear (Nédélec and Prado, 1990; GFCM, 2018). In this case, it was determined that there are mostly four different types of fishing gears in a boat. There are also different types of set nets and handlines. The number of boats using different fishing gears around the island is provided in Table 3. Accordingly, the most commonly used fishing gears in boats are combined nets, trammel nets and gillnets and handlines. However, in the fishing gear records, it is considered that encircling trammel nets are included in combined nets, thus the most used fishing gear on the island is actually the encircling trammel nets.

Table 3. Number of boats using different fishing gears in Gökçeada according to the SUBİS records*

Fishing gears	Code	Number
Gillnets	GN	24
Combined gillnets-trammel nets	GTN	26
Trammel nets	GTR	25
Longlines	LL	6
Multi-hooked handlines	LHC	5
Handlines and pole-lines (hand operated)	LHP	26
Handlines and pole-lines (mechanized)	LHM	2
Gear not known or not specified	NK	1
Bottom otter trawl	OTB	1

* Since Table 3 consists of outdated SUBİS records, the available information has been updated from fishers interviews conducted in this study in 2020. Accordingly, only one of the 39 boats registered in Gökçeada is a bottom trawler, all of the other 38 are small-scale fishing boats. Nine out of these 39 boats do not carry out any fishing activities

The total length of the set nets actively used by operating boats is 41 850 m (~42 km), six boats use 11 600 m targetting red mullet, six boats use 15 900 m trammel net specially designed for Sparidae (*Marya* net), 11 boats use 9 500 m encircling trammel net (*Alamana*), five boats use 3 000 m saddled seabream net and five boats use 1 850 m long voli net (a type of encircling trammel net). The distribution of 32 500 longline hooks according to boat and longline type is two boats using 1 850 pieces thin longline, 21 boats using 22 700 pieces thick longline, six boats using 9 200 pieces European hake longline and three boats using 1 500 swordfish longline hooks. For handlines, silvery multi-hooked line ranging from two to 10 pieces (40–750 hooks in total), had a total of 5 300 hooks used in 28 boats, 26 boats had squid jig lure used which varies, between 2–12 pieces (2–4 squid jig lures), for a total 264 hooks. On 24 boats, there are different types of handlines ranging

from 1–20 sets and the total number of hooks used in them is 110. These are fishing tackle used only on boats registered in Gökçeada. These numbers are much higher when the unregistered fishing tackles used by recreational fishers are also taken into account. The number of swordfish harpoons used by 14 boats registered in Gökçeada is around 80.

Only a few studies provided some insight on the fishing equipment used in Gökçeada (Table 4), and they can be listed in cronological order as: Karakulak (2002), Doyuk (2006), Özekinci *et al.* (2006), Ayaz *et al.* (2008), Akyol and Ceyhan (2010), Doğan and Gönülal (2011), Ayaz *et al.* (2012), Yıldız *et al.* (2012) and Akyol and Ceyhan (2017). The first study conducted by Karakulak (2002) provided information on the main fishing gears used in Gökçeada fisheries (Table 4).

Table 4. Small-scale fishing gears used in Gökçeada and its affiliated province Çanakkale

Small-scale traditional shore based fishing gears	Doyuk (2006) Çanakkale	Özekinci *et al.* (2006) Çanakkale	Ayaz *et al.* (2008) Saros Bay	Karakulak (2002) Gökçeada	Akyol and Ceyhan (2010) Gökçeada	Ayaz *et al.* (2012) Gökçeada	Yıldız *et al.* (2012) Gökçeada	This study (2020) Gökçeada
GILLNETS AND ENTANGLING NETS								
Gillnets for target species								
Bluefish	2							
Red mullet	2		16			4		
Mackerel/Chub mackerel			2					
Bogue	2		2					
Atlantic bonito	2							
Whiting			4					
Sharks								
Spiny lobster/Common lobster								
Turbot								
Saddled seabream								
Trammel nets								
Marya (specially designed for sparidae)			15					
Bluefish	3							
Common sole								
Prawn								
Turbot								
Red mullet/Surmullet								
European flounder								
Bogue/Grey mullets								
Atlantic bonito								
Porgy/Pandora/Dentex								
Garfish								
Sharks								
Voli (specially designed for multi-species)				*		4		
Release net for multi-species			2					
Salema								
Driftnets								
Swordfish								
Atlantic bonito								

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Small-scale traditional shore based fishing gears	Doyuk (2006) Çanakkale	Özekinci *et al.* (2006) Çanakkale	Ayaz *et al.* (2008) Saros Bay	Karakulak (2002) Gökçeada	Akyol and Ceyhan (2010) Gökçeada	Ayaz *et al.* (2012) Gökçeada	Yıldız *et al.* (2012) Gökçeada	This study (2020) Gökçeada
Encircling nets								
Alamana (vertical multi-trammel net)	3					2		
Alamana (vertical multi-gillnet)						2		
Sardine gillnet								
Garfish gillnet								
Big-scale sand smelt gillnet								
Trammel net				*				
Combined nets								
Bluefish								
HOOKS AND LINES								
Handlines and pole-lines								
Handline (mainline-snood) for bluefish								
Handline (mainline-snood) for porgy-dentex								
Handline (longer snood) for bluefish								
Adrift handline	3							
Multi-hooked angling handline	2			**				
Multi-hoohed trolling handline								
Trolling handline for swordfish								
Multi-hooked handline for bluefish/mackerels								
Squid jig lure handline								
Handline for blackspot seabream								
Handline for red seabream								
Adrift handline for leerfish/dentex								
Adrift handline for white grouper								
Longlines								
Thin								
Thick							2	
Swordfish								
Hake								
GRAPPLING AND WOUNDING								
Swordfish harpoon								
TRAPS								
Octopus pot								

* Trammel and encircling net; ** Vertical handlines or pole-lines (mechanized); *** Numbers indicate different type of fishing gears

Akyol and Ceyhan (2010) described the fishing activities and fisheries resources in Gökçeada coastal fishing. The authors also provided information on the technical characteristics of the set nets, fishing rods and longlines used on the island. The study determined that in Gökçeada small-scale coastal fisheries use five different types of set nets, three of which are trammel nets, two of them plain, and four types of fishing using rod/line and longlines. The technical features of these fishing gears were defined according to the FAO catalogue (Nédélec and Prado, 1990).

Yıldız *et al.* (2012) conducted surveys to determine the technical characteristics of fishing gears used in Gökçeada coastal fisheries and the general characteristics of fishing: they

found 17 types of fishing gears, including seven different types of set nets, six types of fishing rods, three different longlines types and a swordfish harpoon on the island, and the technical drawings of these fishing gears were made in accordance with FAO catalogues (Yıldız *et al.*, 2012).

Doyuk (2006) and Özekinci *et al.* (2006) in Çanakkale Province and Ayaz *et al.* (2008) in Saros Bay investigated in detail the used fishing gears and their features. In these studies, while Doyuk (2006) defined the fishing gears used in Çanakkale according to the FAO classification, Ayaz *et al.* (2008) found that there are many different types of fishing gears. From these two studies, the numbers indicated on the fishing gears refer to the number of different types of fishing gear in question (Table 4).

The following studies provided detailed information on the following types of gears: Akyol and Ceyhan (2010) on five set nets, three longlines and a trolling line for swordfish, Ayaz *et al.* (2012) on 16 different set nets and Yıldız *et al.* (2012) on seven set nets, three longlines, six different handlines and a swordfish harpoon.

Fishers stated that Gökçeada fish stocks have decreased considerably in the last ten years, but even more so in the last five years compared to the past. Fishers are no longer catching bluefish, European pilchard and Atlantic chub mackerel. The decrease in fish quantity is also reflected in the diversity of fishing gears used (Table 4). In the field survey carried out in this study from 2020–2021, it was determined that only bluefish encircling trammel net, trammel net specially designed for Sparidae, voli net a type of encircling trammel net, and red mullet net were used as trammel net types, while saddled seabream and red mullet gill-nets were used for gillnet types. Most encircling trammel nets now lay idle at the port or warehouse. In addition to thick longline, thin longline, European hake and swordfish longline, swordfish fishing with harpoons is also still traditionally practiced. Multi-hooked lines, squid jig lures and different types of hand and fishing rods have become more commonly used gears among commercial fishers in recent times, as many are no longer profiting from longlining.

Ayaz *et al.* (2012) defines the set nets, which are named according to the targeted species in Gökçeada, as fishing gear that are used during migratory events and defines them as non-standard fishing gear. In addition, they mention that, it is known that many non-local fishers coming to the region to fish these species create extra pressure on the stocks. For example fishing with lobster nets and trammel nets specially designed for Sparidae constitutes typical examples of this situation.

According to Gönülal and Güreşen (2017), approximately 10 boats from Çakıl Village (in Bandırma, the Marmara Sea) engaged in European lobster and spiny lobster fishing in the northern Aegean for four months each year (except between April 15 and June 15).

The length of the total nets used by these ten fishers totals approximately 60 km. Due to the mesh size of the trammel nets used for fishing these species, the variety and quantity of non-target and discarded fish are low. Fishers, who caught 200–250 kg of European and spiny lobsters a day 10–15 years ago, have stated that in recent years their catch yield has fallen to 10–15 kg, and European lobsters, each weighing upto 12.5 kg were replaced with spiny lobsters of 1–2 kg. During the interviews with fishers in 2020, it was mentioned that this catch amount has further decreased to 300 g of European lobsters per year (Personal communication; Mustafa Özcan). Lobster nets are usually cast in rocky and corralligeneous habitats, often getting stuck in these areas, becoming ghost fishing nets.

Set nets

On the shores of Gökçeada, it is common to target migrating fish species with set nets. These nets include *Alamana* for bluefish and Atlantic bonito, *Marya* net for Sparidae, and red mullet and saddled seabream nets for other species. Technical and structural features of these fishing nets are detailed in Table 5.

Table 5. Structural features of set nets used in Gökçeada

	Gillnet – Inner wall			Trammel – Outer walls			Hanging Ratio	Outer wall rigging	Head line	Lead line
	Mesh Size	Twine Thickness	Depth (mesh)	Mesh Size	Twine Thickness	Depth (mesh)				
Alamana (3 floor height)	50 mm	210d/4 PA	80–100	280 mm	210d/9 PA	10	0.50 0.66	1 blank 1 wall	Double line 8–3 mm PP 5 No. 1 blank 1 buoy 2 blank 1 buoy	Double line 4–4 mm PP 100 gr 2–3 blank 1 lead 1 blank 1 lead
	56 mm	210d/4 PA	80–100	280 mm	210d/9 PA	13.5	0.50 0.66	1 blank 1 wall at second (3–2–3)	Double line 8–3 mm PP 5 No. 1 blank 1 buoy 2 blank 1 buoy	Double line 4–4 mm PP 100 gr 2–3 blank 1 lead 1 blank 1 lead
	60 mm	210d/4 PA	80–100	280 mm	210d/9 PA	13.5	0.50 0.66	1 blank 1 wall at second (3–2–3)	Double line 8–3 mm PP 5 No. 1 blank 1 buoy 2 blank 1 buoy	Double line 4–4 mm PP 100 gr 2–3 blank 1 lead 1 blank 1 lead
Marya	84 mm	210d/4 PA	40	320 mm	210d/9 PA	6.5	0.50 0.66	1 blank 1 wall at second (3–2–3)	Double line 4–3 mm PP 2 No. 4 blank 1 buoy	Double line 4–4 mm PP 50 gr 3 blank 1 lead
Saddled sea bream	56–60 mm	210d/4 PA	105	–	–	–	0.50	–	Double line 6–2.5 mm PP 5 No. 4 blank 1 buoy	Double line 4–4 mm PP 40 gr 3 blank 1 lead
Red mullet	42 mm	210d/2 PA	40	–	–	–	0.50	–	Double line 6–2.5 mm PP 3 No. 3 blank 1 buoy 2 blank 1 buoy	Double line 5–2.5 mm PP 40 gr 2 blank 1 lead 1 blank 1 lead

* *Alamana* (vertical multiple trammel net); headline 1 blank-1 buoy, leadline 2–3 blank-1 lead=float, headline 2 blank-1 buoy, leadline 1 buoy-1 lead=sink.

Akyol and Ceyhan (2010) and Ayaz *et al.* (2012) identified a total of 16 different types of set nets on the island, while this diversity of the set nets has decreased considerably in recent years (Table 4). Ayaz *et al.* (2012) calculated the total fishing net presence in boats as ~72 km ten years ago, while this length has decreased to ~42 km today.

Targeting mostly bluefish, encircling trammel nets are mostly used in shallow (7–10 m) coastal waters between September–November with a *voli net* (Figure 8). With these fishing nets, the main target species are Atlantic bonito, salema, grey mullet and bluefish. For bluefish fishing, after the net encircles the school of fish, the boat travels through the circle-shaped fishing net to scare the fish into the fishing net. For Atlantic bonito, the fish are entangled in the fishing net by shining a bright light (headlight) at night to scare them. In bluefish fishing, a person stationed at the head of the boat looks under the water from a place called 'mirror' and detects the bluefish school by sight. Bluefish fishing with encircling trammel net is done during the day and Atlantic bonito fishing is done on dark nights when the moon is not full, using phosphorescence to detect the fish. Other commercial species caught in encircling trammel nets are sand steenbras, grey mullet, salema, saddled seabream, bogue, European barracuda as well as the non-targeted species, common stingray and comber, which are discarded.

Figure 8. Bluefish caught with *Alamana*-encircling trammel net

©T. Ceyhan

In the cold months (February–April), *Marya* trammel nets specially designed for Sparidae are cast in rocky habitats, around 15–20 m depths in the evening and collected in the morning. With these fishing nets, shallow demersal species such as red porgy, common dentex, brown meagre, white seabream, two-banded bream, anglerfish, tub gurnard, John dory, shark, wrasse, weever, red scorpion fish, common cuttlefish, squid, European lobster and common spiny lobster are caught (Figure 9). When European lobster and common spiny lobster are targeted the nets have a two day soak time. Discarded fish include wrasse, damselfish, angelsharks, electric rays, and common stingrays or skates. Angelsharks are protected by national law due to their status as critically endangered species, but awareness of prohibited species is not strong amongst all fishers.

One type of fishing net unique to this region is the saddled seabream set nets. In May–June, these fishing nets, which are thrown perpendicularly to the shore at a depth of about 6–7 m on the island beaches and left in coiled snail form, are cast in the evening and collected the following morning after dusk. Apart from saddled seabream, fish species such as grey mullet, European barracuda, two-banded bream, white seabream, brown meagre, small size common pandora, horse mackerel, Mediterranean chub mackerel are also caught from set nets. The discarded species are weever, wrasse, red scorpionfish and comber. Stones are added as an additional sinker, especially at the bottom of the snail shaped turning parts of the net in currents where lead is insufficient (Figu re 10). Although the net is usually made in one piece in terms of height, it can sometimes be three times high.

Figure 9. Fish caught with *Marya* trammel net specially designed for Sparidae

Figure 10. Additional sinker stones used in saddeled seabream nets

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Longlines

Although thick longline is mostly used in Gökçeada; thin, European hake and swordfish longlines are also used.

Thick longlines, as their name suggests, consist of a thick longline, a main body with a length of 1 000 m of Ø 1.20 mm monofilament twine, snoods with a length of 170 cm of Ø 0.80 mm monofilament twine with baited 8–9 number hooks, placed nearly 10 m apart, with 110 J (straight) hooks in total. Fishing with thick longline in Gökçeada is practiced between October and June. Red porgy, common dentex, tub gurnard and black seabream are among the target species, while grouper and smooth-hounds are bycatch species. The main taxa discarded from longlines are sharks and skates. The thick longline is cast early in the morning, and if the bait used is shrimp, it has a one hour soaking time, and if octopus is used for bait, the soaking time is three hours. Each basket increases the hauling time of the longline by one hour. Shrimp, octopus, squid, and European pilchard are used as bait. The stones on the seafloor determine the way the thick line will be set in the sea.

Thin longlines are thrown at depths between 10–13 m around the island in summer and are collected after 3–4 hours. Shrimp, octopus, squid, cuttlefish, sea cucumber are preferred bait species, and fish species such as saddled seabream, sand steenbras, two-banded seabream, common pandora, common dentex, gilthead seabream, black seabream, white seabream and brown meagre are most commonly caught.

The European hake longline is placed in depths between 390–650 m to catch large-sized European hake. In this longline, the main body of 1 000 m consists of floating (PP) or sinking (PA) rope of Ø 2.5 mm diameter, the snoods are made of 70–80 cm in length of Ø 0.10 mm monofilament twine. When floating rope is used in the main body, a 100 g sinker among every 10 snoods is placed in order to sink the body. The distance between the snoods is nearly 7.5 m, and a number 7 straight hook is baited at the end. European pilchard is used as bait. A 600 m float rope is used to extend the longline to 400 m depth. A sphere float of Ø 10 cm is attached at the end of this rope to lift the weight the surface, and depending on this float another larger sphere float of Ø 25–30 cm, is used as a marker buoy. Although the hake longline is thrown in a zigzag pattern, it positions in a S-shape at varying depths underwater. It is used throughout the year, but provides the highest catches between December and July. The target species are European hake and red scorpionfish, and damsel fish are caught incidentally, and discarded taxa are European conger and sharks.

The swordfish longline, only used by a few fishers, is cast at depths of 300–350 m around the island in summer and winter. European pilchard, squid, Atlantic chub mackerel and Atlantic mackerel are used as bait for swordfish longlines.

Swordfish harpoon

Fishers of Gökçeada hunt swordfish sunbathing in the shallow waters along Saros Bay and Gökçeada Canal by shooting them with a specially made double-edged harpoon between April and June. The length of the dart at the tip is approximately 30 cm, and there are double-sided barbs of the harpoon shaft to prevent them from coming out after the fish is speared. During the hunt, these two darts are placed in the nests of the shaft-bearing at the end of the rod. The lengths of swordfish harpoons (sticks) vary between 3.8 and 4.2 m, and average 4 m. The sticks are made of wood, the dart and the shaft-bearing are made of stainless-steel. The PP rope used in the swordfish harpoon can be Ø 4 mm in diameter and 400 and 600 m in length. In addition to this, a rope of 200 m which is wrapped in cork, is kept in reserve in case of need (Figure 11).

The harpoons are thrust by the stick by the harpooner at the end of the 3–4 m wooden plank or metal extension, which is attached to the front of the boat. (Figure 12). When the fish is sighted, the boat approaches quickly, and when it is close enough the harpooner thrusts the harpoon (which is attached to a float rope) from the front of the boat into the fish. After the harpoon penetrates the fish, the stick retracts, so the shaft-bearing the harpoon remains in the fish. When the harpoon is embedded in the fish, the fish is taken into the boat very quickly before it can dive deep. If the fish is not easily retrieved from the water, float and attached ropes are released, and the fish is watched until either the float stops or the fish gets exhausted. Then the rope and the buoy attached to the

harpoons are taken to the boat, while the fish is brought closer to the boat (Figure 13) and taken to the boat with the help of a gaff.

Figure 11. Pieces of swordfish harpoon: (a) barbs on the harpoon shaft and shaft bearing; (b) sticks and shaft bearing; (c) floaters and ropes

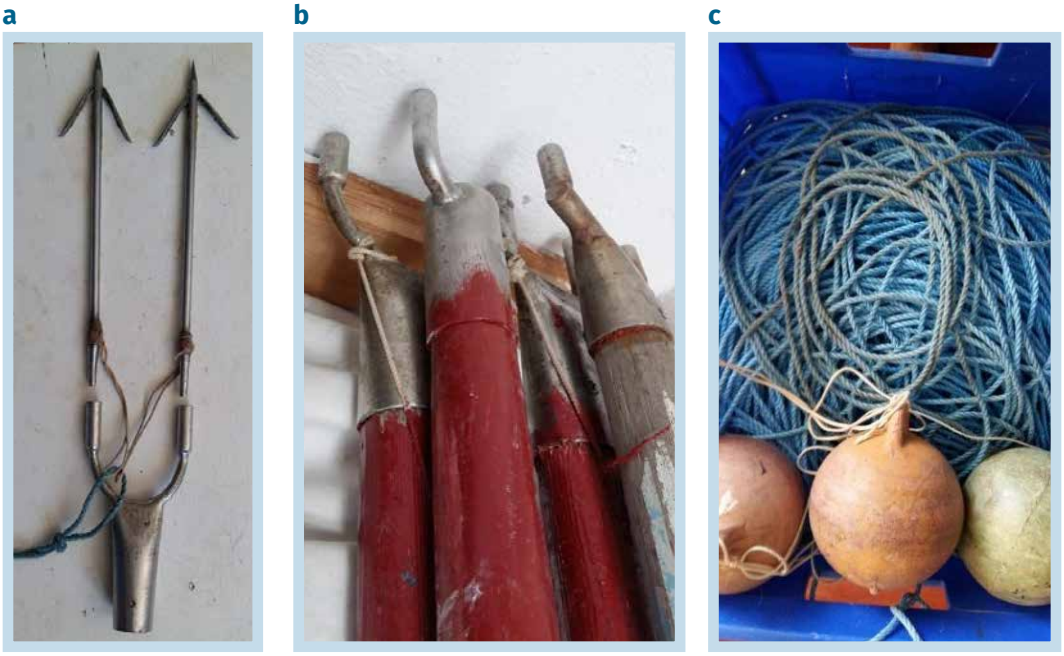

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Figure 12. Swordfish fishing with harpoon

©S. Konya

In swordfish fishing with a harpoon, a team of at least three people is required: a captain who manages the boat, a harpooner who spears the fish from the boat and a man who manages the line to help land the fish on the boat.

Figure 13. Exhausted swordfish getting reeled to boat by the fisher managing the line

©S. Konya

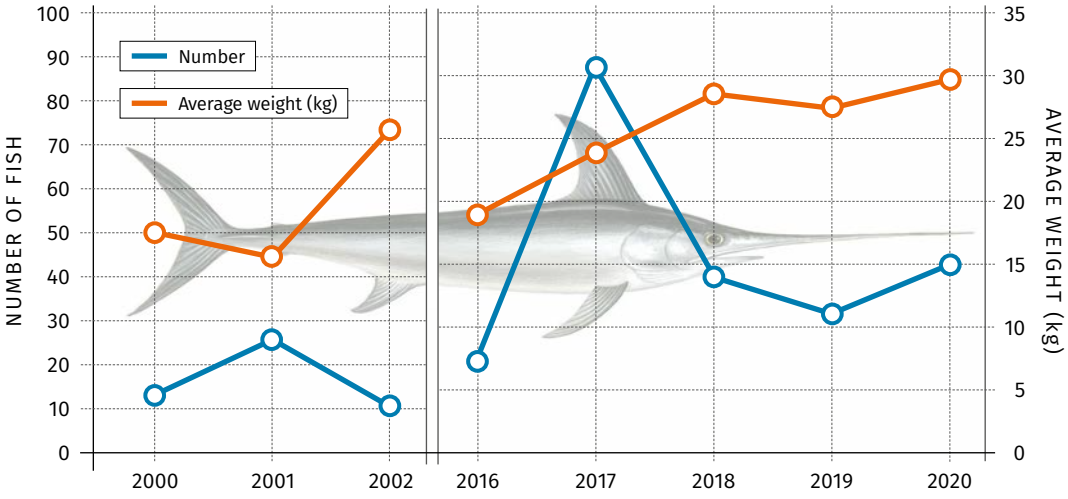
There are 14 boats engaged in swordfish fishing with each boat having 3–6 swordfish harpoon sets.

There are no official existing records for swordfish caught in Gökçeada. During the interviews with the fishers, it became clear that over 40 tonnes of swordfish had been caught in 2017, which was reduced to just 10 tonnes by 2020. In the last 2020 fishining season included in this study, the number of swordfish caught by boats varied from 15 and 50, and their weights ranged from 20 to 55 kg. A total of 544 (20.5 t) swordfish were fished with swordfish harpoons in 2009 and 2010 (Akyol and Ceyhan, 2014). The catch per unit effort was calculated as 49.7 kg/boat/ day for 2009 and 25.7 kg/boat/day for 2010. Altın *et al*. (2016) mentioned that boats fishing swordfish, on average, operated for 25 days in the 2015 fishing season, the average CPUE per vessel was 0.88 swordfish per day for a total of 463 swordfish and a total weight of 11.7 tonnes.

A new regulation entered into force on 1 January 2021, which will disqualify some current swordfishers. Article 48 of the Notification No. 2020/20 on Commercial Fishing, subparagraph 31, states that fishing boats of 12 m and above catching Atlantic bluefin tuna, swordfish, skipjack tuna, bullet tuna, and albacore are required to obtain an International Maritime Organization (IMO) Identification Number. Thus, many of the non-resident vessels coming from Marmara Island to Gökçeada for swordfishing will no longer be able to fish around Gökçeada since their length is >12 m. This situation creates an advantage for local fishers, but also needs to be routinely monitored and managed to determine the changes in CPUE values for Gökçeada fishers.

The annual data on numbers and average weight (kg) of swordfish caught between 2000 and 2020 by one small-scale fishing boat from Gökçeada are provided in Figure 14. According to a fisher interviewed, in the past years fewer but larger swordfish were caught as can be seen in Figure 15. However, some of the fishers stated that nowadays they catch more swordfish both in numbers and total catch weight compared to the past catches. The increasing trend in yield (both in number and weight) is also confirmed by the data presented in Figure 14, with a tendency of increase in average weight of captured fish. The rise in swordfish catches may be explained by addition of new fishing grounds. In addition, the other measures arranged by the ICCAT (2016), i.e. the closed fishing season including the period from 1 October to 30 November and an additional period between 15 February and 31 March, minimum landing size regulation (100 cm LJFL in EU countries) and hook size regulation of 7 cm in height in order to protect juvenile swordfish may be the contributing factors to explain the increase in length and average weight of the catch.

Figure 14. The total number and average weight (kg) of swordfish caughtby a small-scale fishing boat operating in Gökçeada from 2000 to 2020*



* no available data for the period between 2003–2015
Source: Authors' own elaboration, 2021.

According to the data obtained from the same boat, which kept full records for the 2020 fishing season, 14 swordfish were caught in seven days of fishing in April, 26 were caught in 12 days in May, and three were caught in one day in June, totalling 43 swordfish over in 20 days. Descriptive statistics of the length and weight of these fish are given in Table 6. Accordingly, the average fork length of swordfish was 133.2 cm and the average weight was 29.7 kg. Most of the swordfish are around 125 cm and their maximum fork length was 175 cm (Figure 16). At the beginning of the season, small-sized swordfish come to the fishing area, and towards the end of the season, the swordfish caught are larger. The fact that smallest length of the captured fish was about 125 cm is related to the minimum leagal landing size limit for this species (i.e. 125 cm fork length), hence smaller ones are not targeted. In 2015, the catch lengths of 300 swordfish around Gökçeada ranged between 70–174 cm, with the majority between 120–140 cm (Alver *et al.*, 2016). Approximately 30 percent of these fish were caught under the minimum legal landing size. Akyol and Ceyhan (2013) determined that the vast majority of swordfish caught by gillnets, pelagic longline and purse seine were below the legal catch limit. These studies reveal that harpoon fishing for swordfish, based on first seeing and individually spearing the fish, is more selective than other fishing methods.

Figure 15. Large swordfish caught in the past years (2017)

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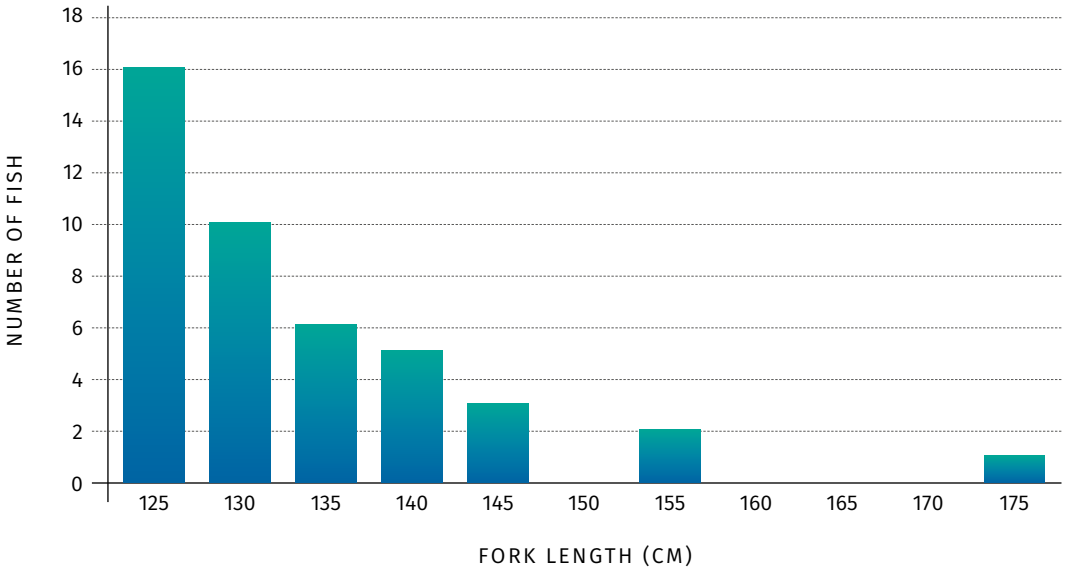
Table 6. Desciriptive statistics of total length and weight of swordfish caught by harpooning by a boat registered in Gökçeada in the 2020 fishing season

Descriptive Statistics	Fork Length (cm)	Weight (kg)
Average	133.2	29.7
Standard Error	1.59	1.69
Median	130	27
Range	50	51
Minimum	125	18
Maximum	175	69
Total Number of Fish	43	43
95% Confidence Interval	3.22	3.40

Figure 16. Size distribution (cm) of harpoon caught swordfish from one boat in Gökçeada in 2020



Source: Authors' own elaboration, 2021.

Akyol and Ceyhan (2014) reported for the first time the Catch Per Unit Effort (CPUE) in swordfish harpoon fishery in the Aegean Sea. This study was carried out with commercial boats using harpoons at Gökçeada Kaleköy Port during the 2009–2010 seasons. Daily catch data (total numbers caught and weight of each fish) were recorded by both scientific observations and surveys with the skippers. Active fishing days at sea were considered as units of fishing effort. Harpoon catch data obtained from 21 boats in Saros Bay area consisted of a total of 20 555 kg and 544 individuals over two seasons

(2009–2010). Average CPUE in 2009 was 49.7 ± 8.5 kg and 1.3 ± 0.2 number of fish per day, and for 2010 it was 25.7 ± 12.5 kg and 0.8 ± 0.3 number of fish per day. No statistically significant difference was found in average CPUE values, in terms of both numbers and weight, between the two consecutive seasons (Akyol and Ceyhan, 2014).

Altın *et al.* (2016) reported the technical characteristics of the boats engaged in harpoon fishing around Gökçeada during the 2015 swordfish fishing season and the total catch and estimated the CPUE during the season. A survey was conducted to determine the technical characteristics of the boats. The amount of fish caught (in numbers and weight) was recorded throughout the season. During the swordfish fishing season, 20 fishing boats, varying in length from 8 to 15 m and engine power between 75 and 450 hp, used Gökçeada ports for fishing. According to the study, swordfishing activities were carried out at depths between 100–1 000 m in three regions especially. Boats targeting swordfish operated for an average of 25 days in the 2015 fishing season. A total of 463 fish were caught, and the average CPUE per boat (number/day) was calculated as 0.88. The amount of fish landed in Gökçeada was 11 732 kg. The economic value of this fishery was calculated to be USD 148 208 (Altın *et al.*, 2016).

Silvery multi-hooked line

Silvery multi-hooked line (other name is vertical longline) used in Gökçeada consists of as Ø 1.10 mm main body (monofilament), 2 swivels between the in front of the first snood and the lead; Ø 0.80 mm intermediate body, Ø 0.35 mm 15 cm long snoods with 1/0–2/0 number of an average of 50 hooks tied silvery threads (Figure 17). In this multi-hooked line the distance between the snoods is 30 cm. After the second swivel, a 650 g weight is attached to a 15 cm long Ø 0.45 mm line. Fishers use this gear between May, June and July to target Atlantic chub mackerel, horse mackerel and Atlantic mackerel species at depths of 80–120 m during the daytime (Figure 18).

Figure 17. Silvery multi-hooked line (a) and hooks (b) used in Gökçeada

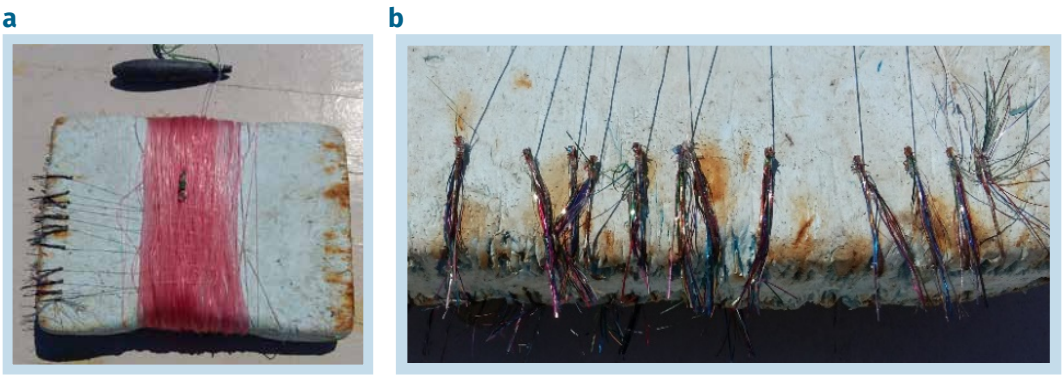


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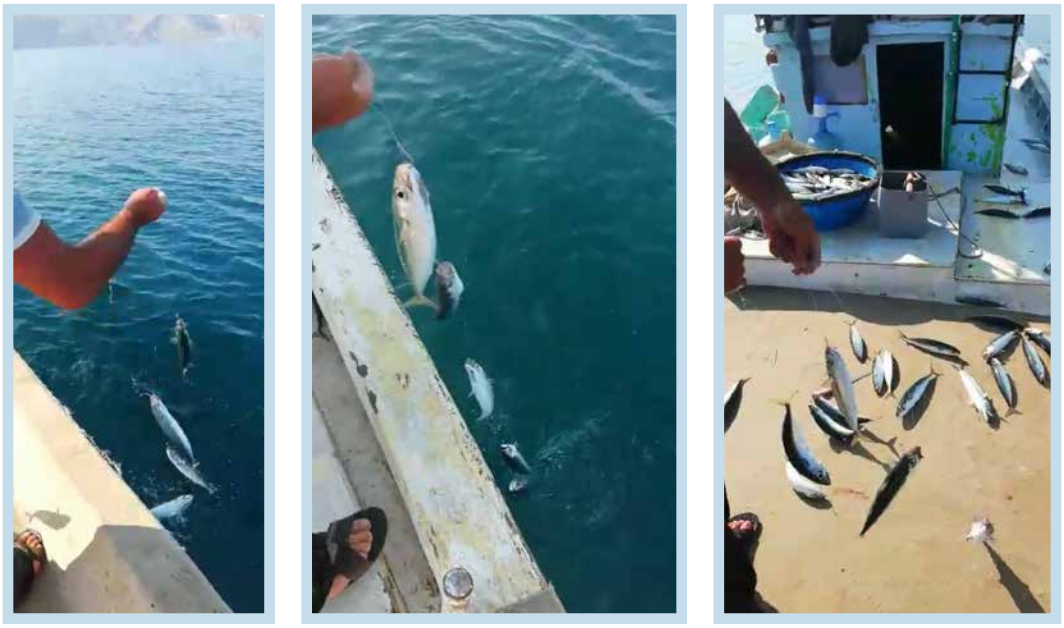
Figure 18. Fishes caught by silvery multi-hooked line

a b c



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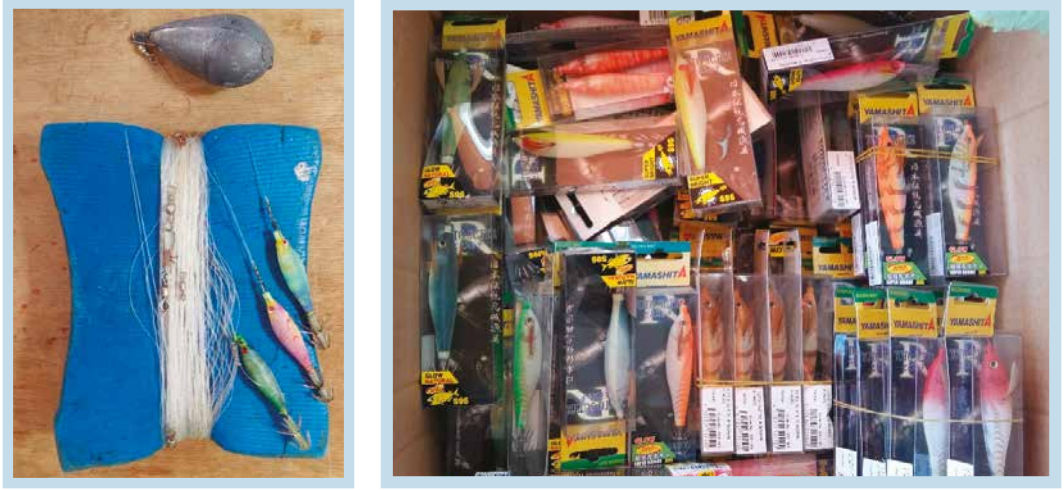
Squid jig lure handline

All commercial boats on the island, aside from having multi-hooked lines on board, also have squid jig handline (squid jig lure), along with hundreds of spare hooks, at least 2–3 sets, of which are used for squid fishing (Figure 19). These squid jig lure handlines are mostly used between October and March at night, and have squid jig lures in different numbers and colors.

Figure 19. Squid jig handline (a) and squid jig lure (b)

a b



©C. Yılmaz

Handline with tandem hook

This fishing line has a main 0.8–1.0 mm diameter line and the intermediate body with a number 3 swivel and 1.5 m length Ø 0.50–0.60 from swivel to the lead (650–700 g plumb). It also consists of another intermediate body that is away from the swivel with a length of 2.5 m with a length of Ø 0.70–0.80 mm, using a hook number 10 at the end. There is a second tandem hook 12 cm long. Targeted species are common dentex and red porgy between September and April.

Although Gökçeada fishing is commonly small-scale in nature, bottom trawling and purse seining are also carried out in this area by non-resident vessels. In addition, traditional swordfishing with harpoons and the use of different types of fishing rods are also commonly practiced. Bottom trawlers catch mainly deep-water rose shrimp, European hake, blackbelly rose fish, greater forkbeard, angler fish and John dory and other such demersal species. Purse seiners catch mainly European pilchard, European anchovy, Atlantic mackerel, Atlantic chub mackerel, horse mackerel, bluefish and bogue. For the local small-scale fisheries, the target species caught in the high quantities with set-nets and longlines are provided in Table 7, according to the fishing gear and the fishing season.

Table 7. Target species, fishing gears and seasons in Gökçeada

Species name	Target species	Fishing gear	Fishing season
Bluefish (*Pomatomus saltatrix*)	X	Alamana	Sept.–Nov./Apr.–June
Swordfish (*Xiphias gladius*)	X	Harpoon	March–June
		Longline	July–October
European hake (*Merluccius merluccius*)	X	Longline	December–July
Red mullet (*Mullus* spp.)	X	Gillnet/Trammel	Throughout the year
Gilthead seabream (*Sparus aurata*)	X	Trammel/Longline	Throughout the year
Red porgy (*Pagrus pagrus*)	X	Trammel/Longline/ Handline	Feb.–Apr./Oct.–Nov.
Common dentex (*Dentex dentex*)	X	Trammel/Longline/ Handline	June–August
Horse mackerel (*Trachurus* spp.)	X	Gillnet/Handline	May–July
Two-banded seabream (*Diplodus vulgaris*)	X	Gillnet/Trammel/ Longline	May–October
White seabream (*Diplodus sargus*)	X	Gillnet/Longline	May–October
Leerfish (*Lichia amia*)		Longline/Handline	June–August
Grey mullet (*Mugil* spp.)	X	Alamana/Gillnet	May–June
Common pandora (*Pagellus erythrinus*)	X	Gillnet/Trammel/ Longline	December–April
Med. chub mackerel (*Scomber colias*)	X	Gillnet/Handline	May–July
Bouge (*Boops boops*)	X	Trammel	September–March

>>>

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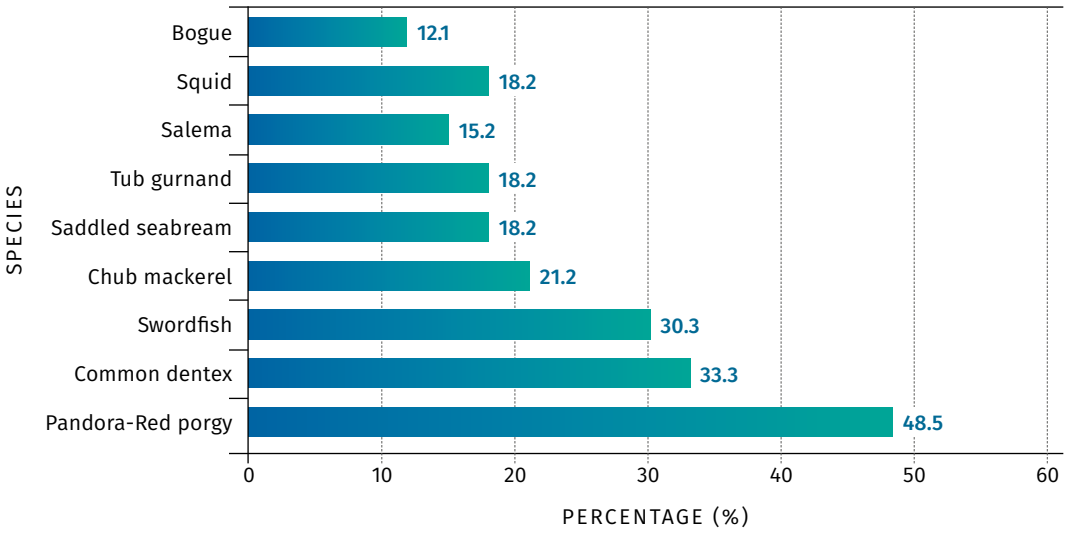
Species name	Target species	Fishing gear	Fishing season
Brown meagre (*Umbrina cirrosa*)		Gillnet/Trammel/ Longline	May–October
Atlantic bonito (*Sarda sarda*)	X	Alamana	November–January
Salema (*Sarpa salpa*)	X	Trammel	Throughout the year
Sand steenbras (*Lithognathus mormyrus*)		Alamana/Longline	June–October
Barracuda (*Sphyraena* spp.)		Alamana/Gillnet	Sept.–Nov./May–June
Tub gurnard (*Chelidonichthys lucerna*)		Trammel/Longline	February–April
Shark (*Mustelus mustelus*)		Trammel	May–June
Black scorpionfish (*Scorpaena porcus*)		Trammel	February–April
European lobster (*Homarus gammarus*)	X	Trammel	May–August
Common spiny lobster (*Palinurus elephas*)	X	Trammel	May–August
Saddled seabream (*Oblada melanura*)	X	Gillnet/Trammel/ Longline	May–June
Squid (*Loligo vulgaris*)	X	Handline	October–March

According to the data from fisher surveys, the most fished species in Gökçeada are provided in Figure 20. However, catches from non-resident vessels, especially for red mullet, are not included.

Figure 20. Most caught species based on declaration of fishers*



* Data refers to the precentage of fishers interviewed that declared targeting the species

Source: Authors' own elaboration, 2021.

2.6 Fishing grounds

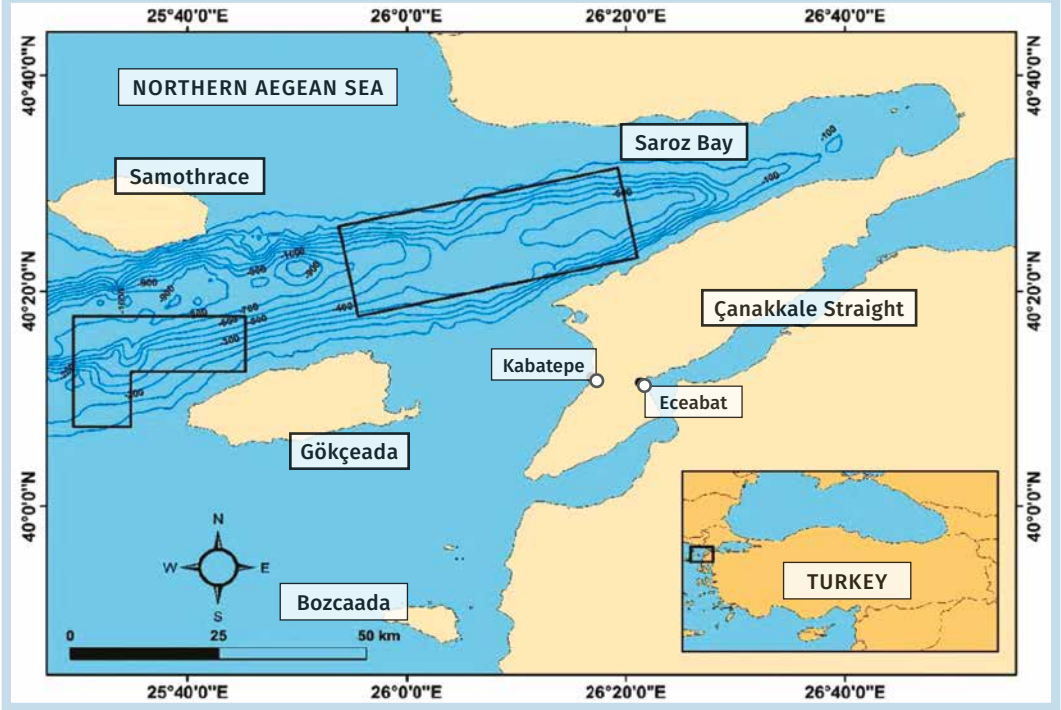
Gökçeada is a very important fishing locality in the North Aegean Sea (Yıldız *et al.*, 2012; Akyol and Ceyhan, 2017). The North Aegean is heavily influenced by both the Mediterranean and Black Sea waters, and is thus very rich in terms of biodiversity. The presence of the island in the North Aegean, with its complex and unique surrounding water currents, and seasonal variations in salinity and temperature create very favourable conditions for primary plankton production (Yüce and Türker, 1991).

Another factor affecting the island's fisheries is its geomorphological structure (Ulutürk, 1984). The continental slope on the north side of the island is steep, and as you move further offshore, a deep tectonic trough is present (named Saros graben). Due to this, the continental shelf has a width of approximately 2 km. The other parts of the island are surrounded by continental shelf not exceeding 80 m. Topographically the trenches which begin from Saros Bay in the north and extend to the north of Crete in an S-shape, divides the Aegean Sea as a deep trough passing behind Gökçeada and Limni Island into two plateaus in a north-south direction (Türkoğlu *et al.*, 2004). The eastern part of these two plateaus forms the continental shelf of Turkey. The wide and shallow sea-floor in the north of this channel and behind Samothrace Island creates an advantageous habitats for bottom fishing (Kocataş and Bileck, 1992). In addition to these fishing grounds, some areas in the region are closed to fishing. For example, Gökçeada Marine Park and the north of the island are closed to large-scale (purse-seine, trawl) fishing. Similarly, between Yıldız Bay (40 ° 14.186 'N - 25 ° 54.230' E) where the Marine Park is located and Çiftlik Bay (40 ° 14.432 'N - 25 ° 56.112' E), fisheries are prohibited within 1 mile from the shore (TOB, 2020a).

Gökçeada has very suitable areas for small-scale fishing both around its coast and offshore (Çoker and Akyol, 2018). Pelagic fish are especially targeted. Akyol and Ceyhan (2014) explained that swordfish are fished especially at depths between 400–500 m, from the north of Gökçeada to the interior of Saros Bay, while Altın *et al.* (2016) reports that this fishery operates between 100–1 000 m in the northwest of Gökçeada, especially in the regions (Figure 21): between Saros Bay and Samothrace, and between Samothrace and the northwest of Gökçeada.

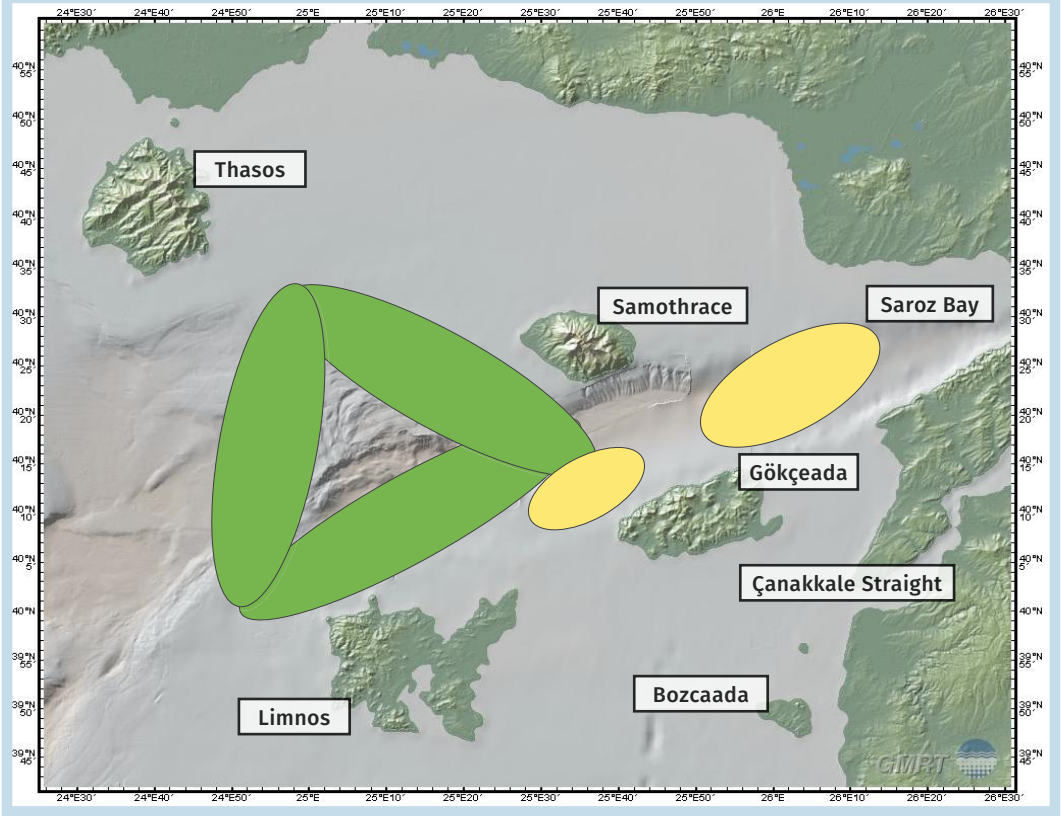
For the last five years, fishers in Gökçeada have discovered new swordfish fishing grounds by extending their fishing region by 60 nautical miles, along with increasing their engine power (Figure 22). Swordfishing with harpoons starts at around 9.00 in the morning, with the warming of the sun, but fishers leave earlier to reach their destination around this time. During the 1990s, local fishers around the island and in Saros Bay did not catch many swordfish (about 8–10 swordfish per boat), but those they did catch were reportedly much larger than today (Personal comm. N. Yılmaz). According to the fishers, swordfish population increased after the prohibition of driftnets in 2011, which was also reflected in the catches.

Figure 21. Swordfish fishing areas around Gökçeada



Source: Altın *et al.*, 2016.

Figure 22. Old (yellow) and new (green) fields for swordfish fishing off Gökçeada*



* Drawn in GMRT Map Tool, Ryan *et al.*, 2009

Although European lobster and common spiny lobsters are caught at depths of 50–150 m in the North Aegean Sea, between Saros Bay and Babakale, larger Mediterranean lobsters can be found in the shallow waters south of Limni Island and around Gökçeada, (Gönülal and Güreşen, 2017). Lobster fishing in the North Aegean using trammel nets up to 10 km long with soak times of about three days is likely to become a serious threat for the future of lobster stock (Gönülal, 2015). Therefore, for sustainable fishing of European and spiny lobsters, an alternative to trammel nets, such as the use of lobster traps or no fishing zones should be established to support stocks (Gönülal, 2015).

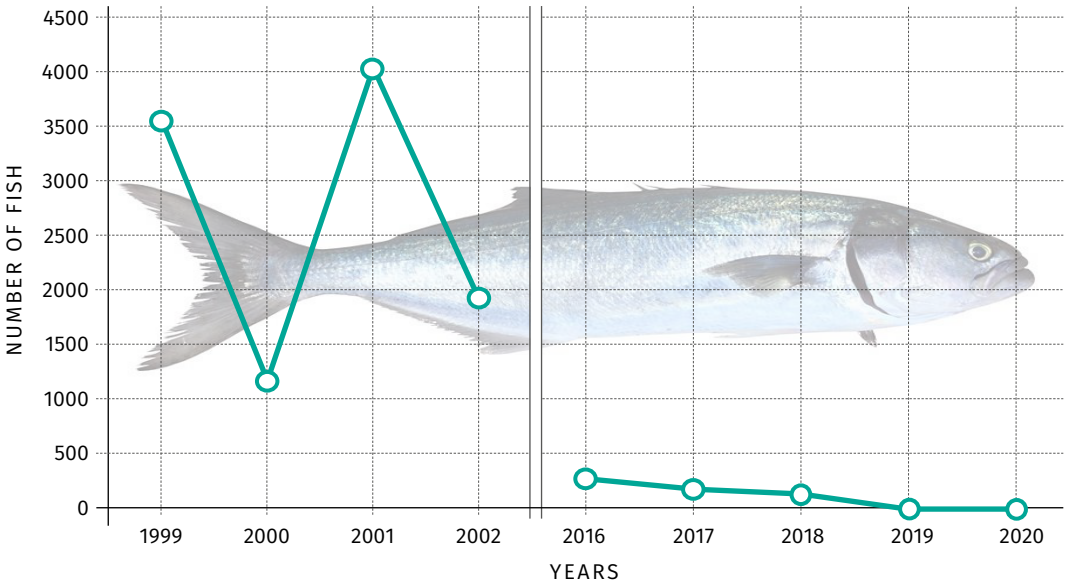
2.7 Fisher's own perceptions of main issues affecting the fishery

It was stated by almost all small-scale fishers engaged on the island that legal and illegal large-scale (trawl, purse-seiners particularly from Bandırma) and recreational fishing are the major issues negatively affecting fish stocks and fisheries in Gökçeada. The main violations of purse-seiners leading to their illegality is their failure to comply with the depth limit (24 m) for the use of gear and with the restrictions for using light in fishing operations at depths below 30 m in the Aegean Sea. The fact that the number of light boats and their intensity is much higher than the limits specified in the notification is one of the main purse-seiner violations. In certain periods, it has been observed that around 20 trawl boats do not obey the distance regulations and temporal restrictions around the north and south of the island. It was personally observed by fishers on the island that two trawlers off Kabatepe Port and 10–15 trawlers in the south of the island violated the 1.5 mile distance ban in August 2020. The minimum trawling distance regulation decreased from 3 to 1.5 miles in 2004, which is likely to be the main reason affecting biodiversity, catch quantities and fish size. These trawls also damage small-scale fishing gears (eg., set nets and longlines). Since bottom trawl nets are not very selective, they also commonly catch juveniles species (deep-water rose shrimp, European hake, etc.).

Another pressing issue for the island is that of illegal recreational fishing particularly relating to divers who catch octopus, sea cucumber and fish and do so illegally, eg., using scuba gear, at night, or sell their catches commercially. Parachute (sailing) longlines, which are used from the shore, is another illegal fishing technique that has been common around the island for some time. For all these reasons, the quality and quantity of fish catches have been declining over the last ten years, even more noticeably over the last five years. In recent years, some species such as bluefish, European pilchard and bluefin tuna have become commercially extinct around the island; bluefish have been absent since 2018 according to almost all local fishers. This decline in bluefish population can easily be seen from the records of a local fisher (Figure 23). For this reason, fishers from

Eceabat come to Gökçeada coasts to fish with other fishing gears (trammel net specially designed for Sparidae, red mullet set net) instead of encircling trammel net.

Figure 23. The total number of bluefish caught by a small-scale fishing boat operating in Gökçeada over the years*



* Data are not available for the period between 2003–2015.
Source: Authors' own elaboration, 2021.

Another problem expressed by fishers is that the trammel nets specially designed for Sparidae, which are set in very long lengths, create a barrier and prevent migrating fish from coming to shore. Many fishers express the need to limit the lengths of such nets.

Huge differences have been identified between the SUBİS records and the fishing gears described in other studies. Converting SUBİS records and definitions of fishing gear to FAO standards is very important in terms of making fishing gear more understandable and comparable.

Approximately 20 of the 44 boats registered to the Eceabat Fishery Cooperative, fish along the coasts of Gökçeada between 5–10 days at a time, in certain times of the year. The main fishing gears used by these boats are trammel nets specially designed for Sparidae, red mullet nets and also thick and thin longlines. Eceabat fishers used to fish around the island when there were no fishers in Gökçeada. There are 44 boats registered to the Eceabat cooperative (Figure 24) and although most of them have encircling trammel net (Figure 25), those who go to Gökçeada do not fish with encircling trammel nets because the state of pelagic stocks have been drastically reduced due to the forementioned reasons.

The non-residental vessels coming to the region to catch swordfish puts tremendous pressure on the stocks. It is suggested that the conservation of traditional swordfish hunting in Gökçeada for "fishing tourism (pescatourism)" will be very beneficial for decreasing the fishing pressure on this species and creating a new income source for the fishers. This type of activity can also contribute to the tourism and recognition of the island.

Figure 24. Fishing boats in Eceabat Port operating in Gökçeada

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Figure 25. Fishers from Eceabat

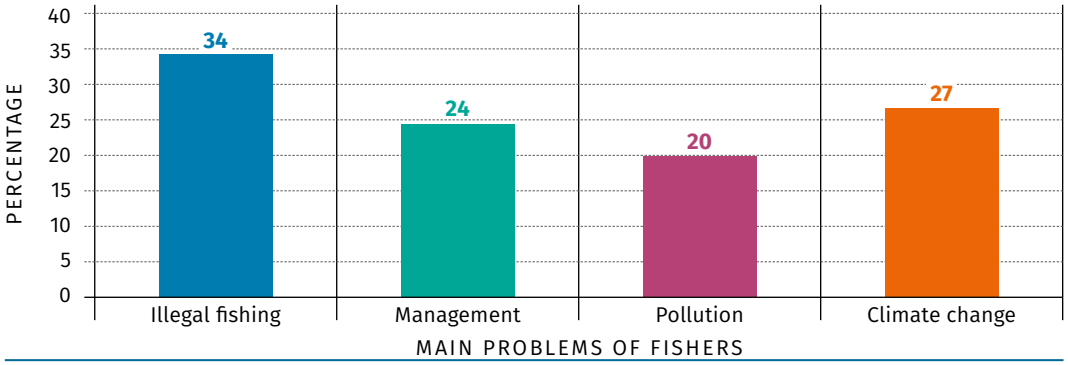
©Vahdet Ünal

According to the available data and from fisher interviews conducted by this study in August 2020, the important problems affecting the coastal fishing in Gökçeada are:

- legal and illegal activities by large-scale trawlers and purse seiners from other regions that damage island's fishery resources;
- the local commercial extinction of white grouper and dusky grouper, which used to be abundant in the eastern parts of the island and were depleted by illegal trawling activities in a short time period;
- the negative effect of intense purse seine lights on fish populations around the island;
- mucilage and pollution;
- an insufficient infrastructure of the fishing port in Kaleköy;
- difficulty in towing boats as the dock is too high in the port;
- the cooperative does not have an administrative building;
- the cooperative's ice machine is not operational;
- illegal poaching of bluefish that enter the Marine Park in winter;
- damages to fishing gears and fish stocks by dolphins;
- uncontrolled illegal recreational fishing activities around the island;
- fishing rules and regulations are not adequate nor fair; and
- climate change including water temperature, seasonal changes and increasing populations of alien species.

According to the survey data, fishers identify illegal fishing, management problems, local pollution and climate change amongst the main issues affecting fisheries in Gökçeada. Figure 26 shows the main problems in order of importance according to the interviewed fishers.

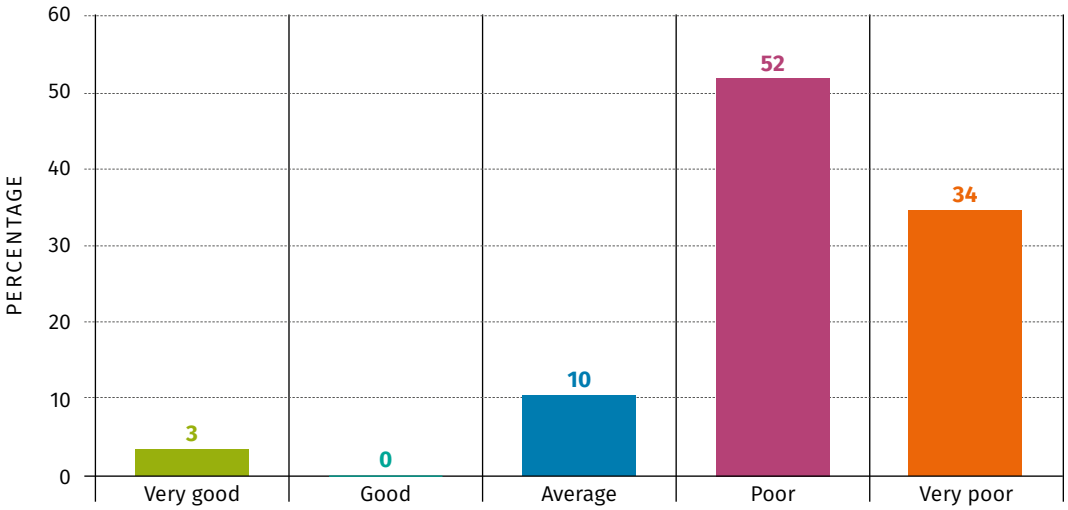
Figure 26. The main issues in order of priority according to fishers



Source: Authors' own elaboration, 2021.

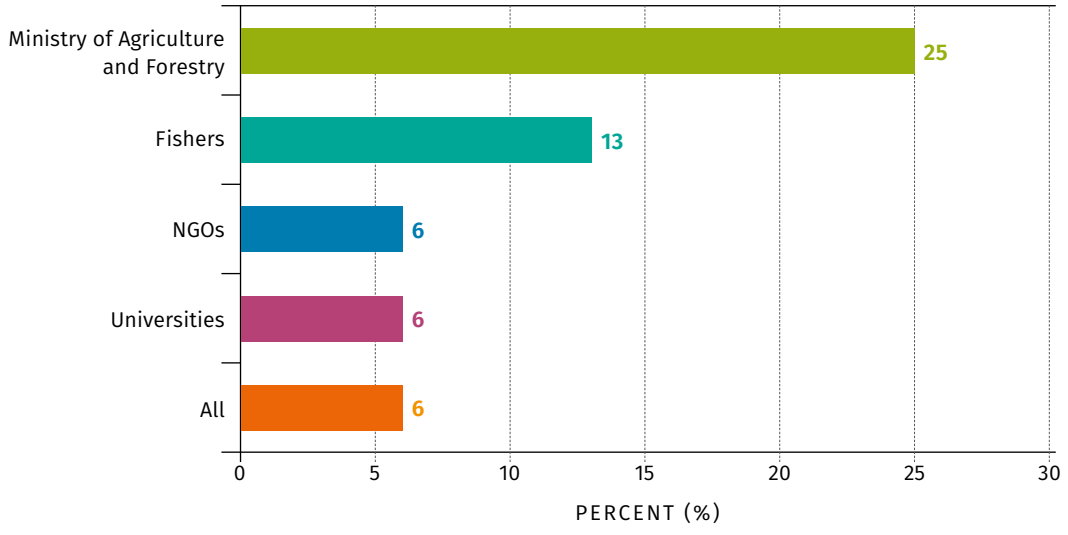
A significant portion of fishers (86 percent) think that the historical and current management of fisheries is poor (Figure 27). According to surveyed fishers, almost all actors are responsible from the existing status of the fisheries management, but mainly the fisheries adminstration and fishers themselves (Figure 28).

Figure 27. Fishers' opinion about the management of fisheries from past to present



Source: Authors' own elaboration, 2021.

Figure 28. Responsibility for the current state of the fishery management



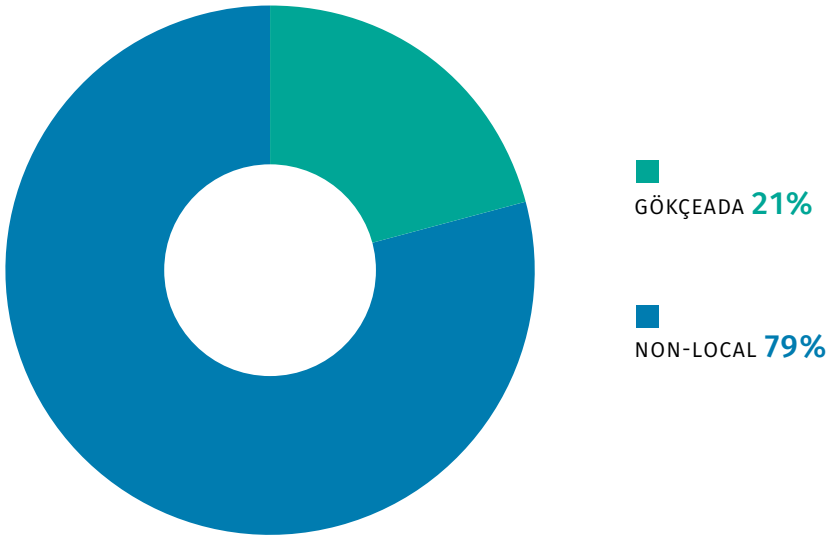
Source: Authors' own elaboration, 2021.

In terms of solutions for ensuring the sustainability of fisheries in the area, the following options were proposed by fishers: conducting inspections, installing quotas, imposing correct fishing bans and restricting large-scale fishing within the three miles zone around the island.

2.8 Socio-demographic and socio-economic characteristics of fishers

Information gathered during the field works and face to face interviews with fishers revealed that only 21 percent of Gökçeada fishers were born in Gökçeada (Figure 29). The average age of fishers on the island is 52.6 years, and the youngest fisher is 35 years old. Average fishing experience is 29.5 years. 63 percent of the fishers were educated at primary and secondary school level. The rate of fishers with a household population of more than 4 people is 30 percent. Fish are consumed on average two days a week on a household basis. Only 10 percent of fishers stated that they consume fish at least three days a week at home.

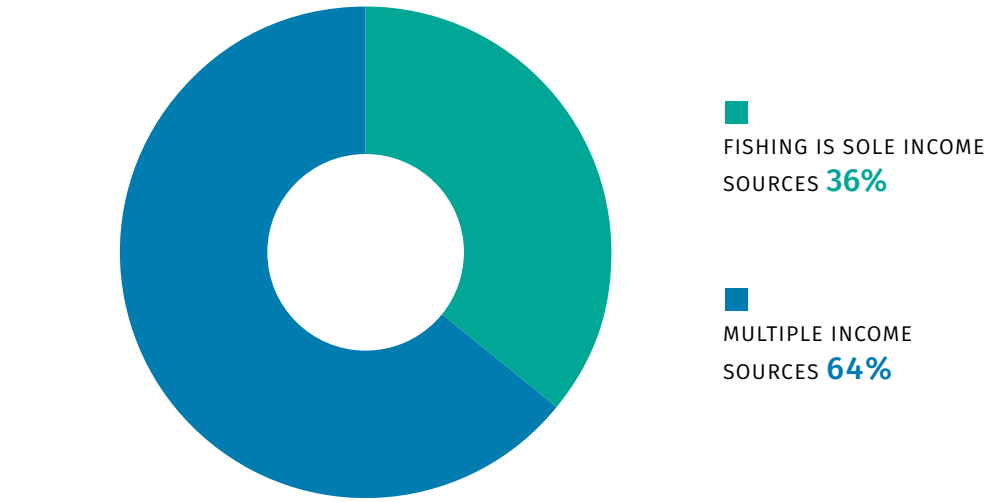
Figure 29. Origin of Gökçeada fishers



Source: Authors' own elaboration, 2021.

For 36 percent of Gökçeada fishers, fishing is their only income source (Figure 30). 72 percent of fishers have two or more income sources (e.g. agriculture and husbandry, tourism, pension). 94 percent of the fishers are boat owners and they do not earn any other type of income from their boats.

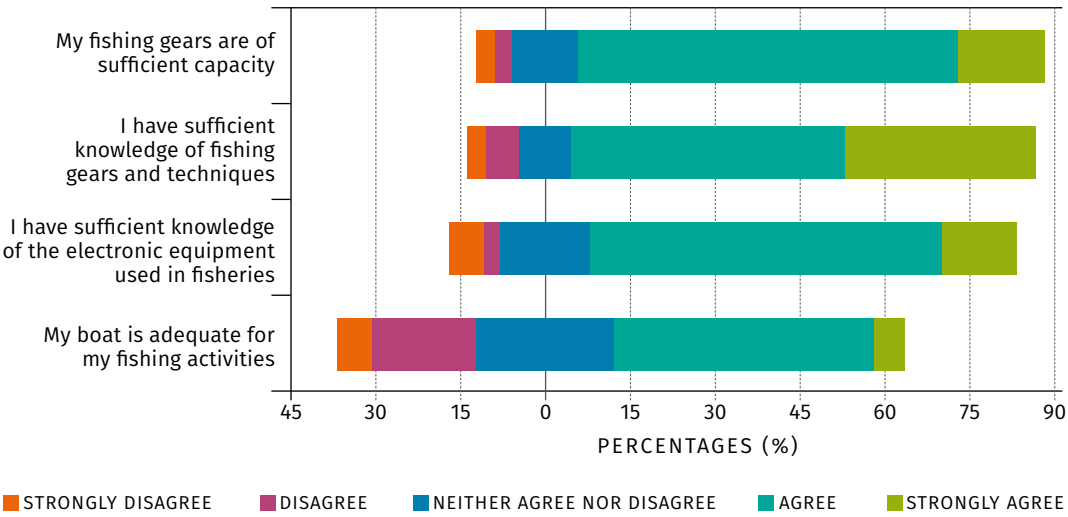
Figure 30. Fishers' economical dependency on fishing



Source: Authors' own elaboration, 2021.

More than half of the fishers (58 percent) reported they had no problem in finding crew required for fishing activities, but 42 percent stated that it was not easy to find crew and they have difficulties in this regard. Due to this, and also not to have to pay extra for help, 30 percent of the fishers prefer to work with one of their family members as crew members. Most of the fishers find their boats and fishing gears sufficient for fishing and state that they have sufficient knowledge and experience about the electronic devices, the fishing gear and equipment they use on their boats (Figure 31).

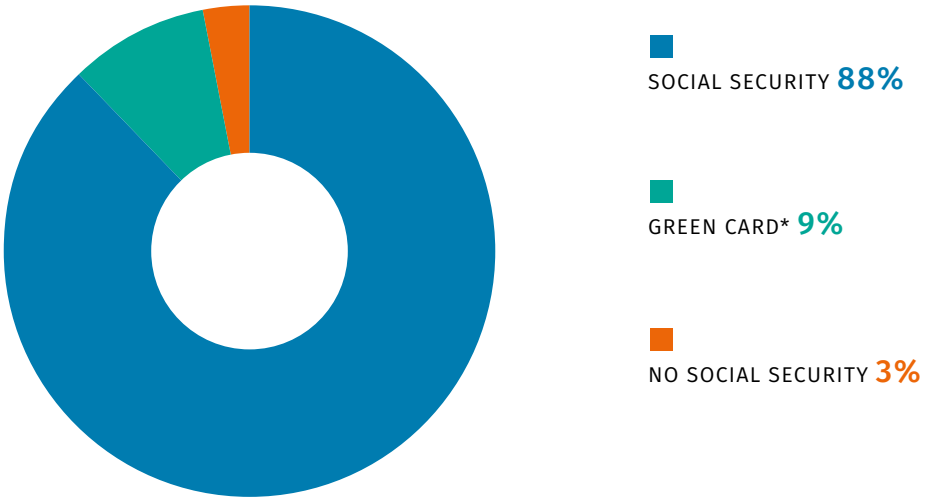
Figure 31. Proficiency of fishers in fishing gear, boats and electronics



Source: Authors' own elaboration, 2021.

The rate of fishers who have social security among the Gökçeada fishers is 88 percent. While 3 percent of the fishers do not have any social security, and 9 percent have a green card (Figure 32).

Figure 32. Social security status of fishers

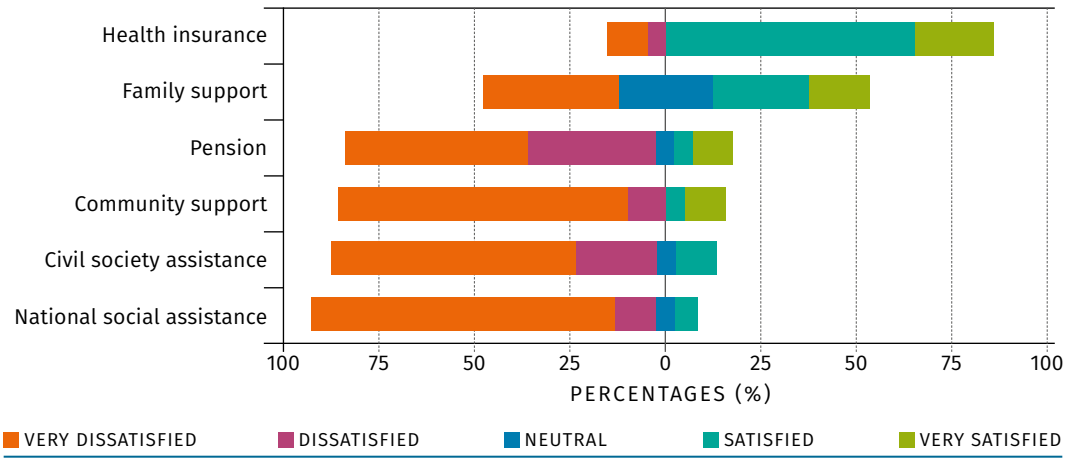


* A green card is provided to poor and uninsured citizens in order to provide them health services without payment. The state directly pays for the costs of medical care services for the poorest families.

Source: Authors' own elaboration, 2021.

Among the fishers of Gökçeada, there are also retired fishers, and 81 percent of these retired fishers report that they continue to fish to help supplement their pensions, which are not adequate. Most fishers are not satisfed with the assistance received from the state, non-governmental organizations or the cooperatives to which they belong (Figure 33).

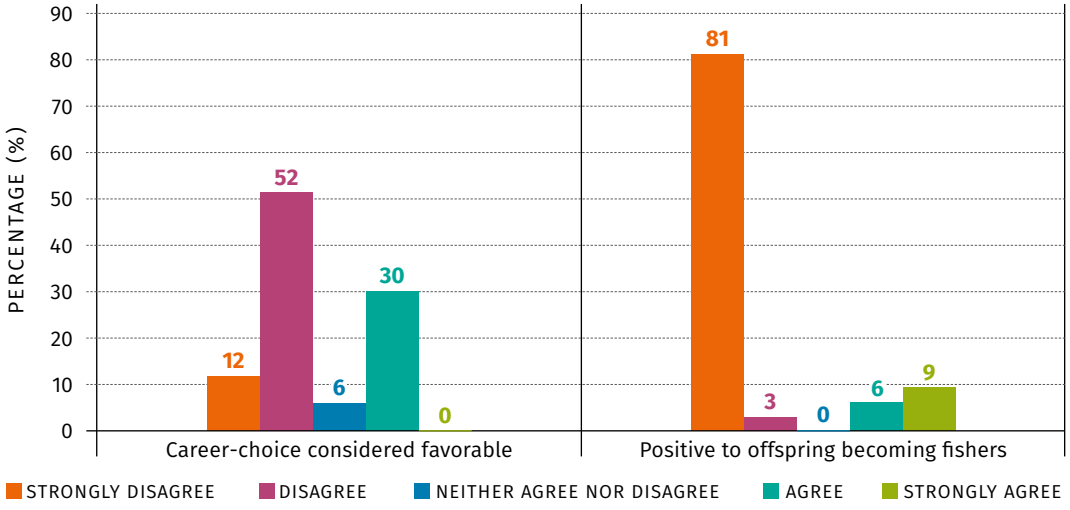
Figure 33. Level of satisfaction of fishers with social security and support



Source: Authors' own elaboration, 2021.

The ratio of fishers who think that their career-choice is of favorable status in society is 30 percent. Most however, (64 percent) think that fishing does not have a positive image in society. The ratio of fishers who want their children to become fishers is only 15 percent (Figure 34).

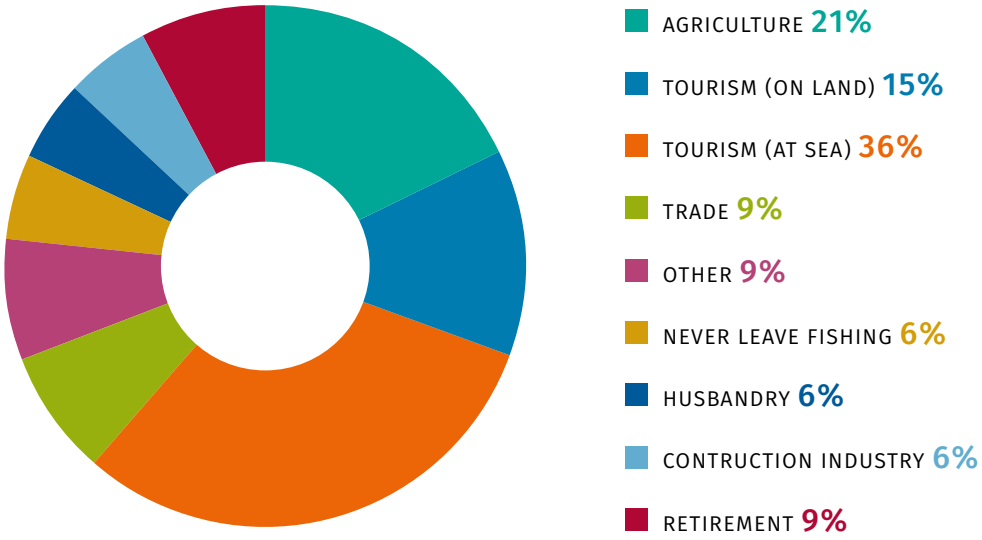
Figure 34. Fishers' opinion regarding their professional image in society



Source: Authors' own elaboration, 2021.

Fishers stated that if they had to quit fishing for any reason, they mostly wanted to work in the tourism sector (36 percent) at sea, which is followed by agriculture (21 percent), land tourism (15 percent), commerce (9 percent) and other sectors (Figure 35).

Figure 35. Sectors that are stated to be preferred in case of quitting fishing



Source: Authors' own elaboration, 2021.

Three quarters (75 percent) of fishers from Gökçeada are interested in fishing tourism (pesca-tourism). Fishing tourism stands out as one of the most frequently stated business types that would be preferred in case of exiting the fishing industry for any reason. Land tourism (hotel or apartment management, etc.) and agriculture rank second and third, respectively, among other preferred sectors. Fishers did not express an interest in aquaculture and think that Gökçeada conditions are not suitable for this practice. On the other hand, 6 percent of the interviewed fishers stated that they would never stop fishing no matter what.

2.9 The importance of fishing for the local / national / regional economy

Gökçeada has a wide range of economic potential with its agriculture, animal husbandry, fishing and various tourism activities provided by its natural geography (Kahraman, 2005). In a study conducted in 1973, it was stated that fishing on the island was not yet developed then as only 5 tonnes of fish were caught annually and sent to Istanbul (Aziz, 1973). Gökçeada fishing started to develop after 1984. In 1984, 125 people consisting of 25 fishermen families from Samsun, Trabzon, Ordu and Giresun provinces of the Black Sea region settled in Gökçeada Yeni Bademli (Kahraman, 2005). Most of today's fishers on the island are relatives of these families.

The contribution of Gökçeada fisheries along with its animal and plant production to the economy of Çanakkale is around one percent compared to the other 11 regional districts in the province. The share of Gökçeada within these 12 districts in the total fisheries production value is 3 percent. Thus fishing does not substantially contibute to the economy of the province, but it does hold more value for the island in the context of food provision, coastal employment and input for tourism (Table 8).

Table 8. Total agricultural production in Çanakkale Province and the share of Gökçeada District (TOB, 2020b)

Districts	Total Animal Production (USD)	Total Vegetative Production (USD)	Total Fisheries Production (USD)	Total Production Values in 2019 (USD)	Distribution (%)
Merkez	13 643 244	105 944 194	719 298	120 331 452	9.6
Ayvacık	12 258 911	67 043 955	18 743 632	98 046 498	7.9
Bayramiç	20 347 189	119 328 469	227 307	139 902 966	11.2
Biga	99 598 624	199 159 978	3 878 947	302 637 549	24.2
Bozcaada	130 300	6 856 009	83 900	7 070 209	0.6
Çan	35 913 404	29 579 545	42 614	65 535 564	5.2
Eceabat	2 166 475	27 955 294	8 640	30 130 410	2.4
Ezine	25 925 491	76 874 092	7 985 105	110 784 689	8.9
Gelibolu	12 379 085	79 546 732	2 060 316	93 986 133	7.5
Gökçeada	5 354 040	6 956 729	1 233 091	13 543 861	1.1
Lapseki	14 481 579	94 639 144	6 080 930	115 201 653	9.2
Yenice	44 917 597	107 453 615	1 772	152 372 984	12.2
Province Total	**287 115 942**	**921 337 756**	**41 065 552**	**1 249 543 968**	**100.00**

Table 9 compares the economic performance of the fishing fleet in Gökçeada for 2019, with vessels grouped in three categories which have been created considering the days at sea of fishing boats.Except for only one boat, all of the boats in the Gökçeada fishing fleet generated positive net revenue. The majority of the fleet (84.4 percent) shows a positive economic performance in terms of gross cash flow (GCF) when repair-maintenance costs and crews shares/salaries besides the running costs are taken into account. However, if the wages of family members are factored into total costs, then the GCF of 10 boats in total, 2 in Group I, 5 in Group II and 3 in Group III, becomes negative. In this case, it is seen that only 68.8 percent of Gökçeada fishing fleet has GCF that can cover the total expenses (except depreciation and opportunity costs of capital) (Table 9).

In the meantime, it should be highlighted that five of the boats in Group II, result in negative GCF, and were not included in the average here as other negative results were also not considered in groups I and III. Therefore, these explanations should not be overlooked when examining Table 9 which provides an overall picture for the year 2019 regarding the economic results of Gökçeada fishing boats.

Table 9. Economic activity results of Gökçeada fishing fleet (for 2019), grouped according to the total number of days at sea

Economic Results of the fishing fleet Fishing vessel/Year (USD)	**Group 1** Days at sea <100 days (n=9) (Mean ± SD)	**Group 2** Days at sea 100–149 days (n=16) (Mean ± SD)	**Group 3** Days at sea >150 days (n=7) (Mean ± SD)	**All fleet** (N=32) (Mean ± SD)
Revenue	8 900 ± 3 200	13 800 ± 5 600	12 200 ± 3 900	12 100 ± 5 000
Running costs	1 600 ± 1 100	4 000 ± 3 400	5 100 ± 2 200	3 600 ± 3 000
■ Fuel	1 200 ± 800	3 100 ± 2 800	2 700 ± 1 500	2 500 ± 2 300
■ Bait	200 ± 500	400 ± 600	700 ± 600	400 ± 600
■ Ice + food	300 ± 100	800 ± 600	1 700 ± 700	800 ± 700
Vessel fixed costs	1 200 ± 600	1 700 ± 1 800	1 800 ± 900	1 600 ± 1 400
■ Vessel repairing and maintenance costs	400 ± 200	700 ± 700	600 ± 700	600 ± 600
■ Engine repairing and maintenance costs	400 ± 200	300 ± 300	400 ± 200	400 ± 300
■ Fishing gears repairing and maintenance costs	700 ± 600	900 ± 1 700	500 ± 400	800 ± 1300
Crew costs (including family members)	4 800 ± 2 300	7 100 ± 3 800	7 000 ± 3 300	6 500 ± 3 400
Crew costs (excluding family members)	1 500 ± 1 800	2 200 ± 2 400	1 300 ± 1 600	1800 ± 2 100
Net revenue*	7 500 ± 3 700	10 200 ± 5 300	7 000 ± 2 300	8 800 ± 4 500
Gross cash flow**	6 200 ± 2 700	8 800 ± 4 800	3 400 ± 2 900	6 600 ± 4 400

* Net revenue was calculated by deducting running costs from total fishing revenue.
** Gross cash flow was calculated by subtracting running costs, vessel fixed costs and crew costs from the total fishing revenue.

Since not all the fishing boats generated positive GCF in Gökçeada, it was estimated GCF margin (percentage) only for those show positive GCF. According to the surveyed data, GCF constituted 54 percent of total revenue in the Gökçeada fishing fleet. This was higher than the 40 percent reported by Pinello *et al.* (2020) for the Turkish small-scale fishing fleet in 2016. This can be considered well enough for the survival of the fishing activity of these fishing boats in the short-term. This indicates that the majority of the fishing fleet (84.4 percent) in Gökçeada perform profitable fishing operations. However considering the labor costs of family-based crews, two-third of the fleet shows positive economic performance that mean can continue fishing activity under the existing conditions.

2.10 Current information on the status of fishing resources

Brief biology of the major species in the area

According to the latest information, the Aegean Sea hosts a rich and highly diverse fish fauna that includes a total of 449 species (Bilecenoğlu *et al.*, 2014). Consequently, the fishery of Gökçeada Island is a typical small scale multispecies fishery employing multiple types of fishing gear, quite similar to many other places in the Mediterranean, and exploiting an ample number of marine species. Some of the target species are caught more often than others, regardless of the season, while others are caught less frequently, or their availability is affected by seasonal change. Members of the families Sparidae, Serranidae, Carangidae, Mullidae, Merlucciidae and Xiphiidae are the most important and most targeted fish species in Gökçeada. Several other demersal and pelagic fish species from various families, including Mugilidae, Pomatomidae, Scombridae, Soleidae, Scophthalmidae, Scorpaenidae, Phycidae, Triglidae, and Zeidae, are also targeted or landed as bycatch. Some invertebrate species that are important for island's fisheries include cephalopod molluscs and decapod crustaceans.

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 in the north to Angola in the south, around São Tomé and Príncipe and the Canary Islands. It is also present in the Mediterranean and Black Sea. In the Atlantic and the Mediterranean, spawning takes place from May to September. The breeding season in Izmir Bay (located in the central eastern Aegean Sea) is between June and October (Metin *et al.*, 2011). Common pandora can reach a maximum length of 60 cm but is most commonly caught at about 25 cm in length (Bauchot and Hureau, 1986). The largest individual found on the shores of Gökçeada was a male at 34.5 cm in length, 456 g in weight, and estimated to be 14 years old (Ayyıldız *et al.*, 2019). Common pandora are protogynous hermaphrodite fishes beginning their lives as females. Females turn into males starting at about 3 years in age, between 16 cm and 18 cm in length (Papaconstantinou *et al.*, 1986). Their first length of sexual maturity in Izmir Bay was 11.3 cm for females and 15.1 cm for males (Metin *et al.*, 2011). Body color is pinkish red with or without stripes. Common pandora is carnivorous, feeding on molluscs, crustaceans, worms, cephalopods and fish (Benli *et al.*, 2001; Šantić *et al.*, 2011; Froese and Pauly, 2021).

Gilthead seabream (*Sparus aurata*)

Gilthead seabream is distributed all over the eastern Atlantic coasts from Denmark to the Cape Verde Islands and Senegal, as well as in the Mediterranean Sea. It is also one of the most important cultivated species in the European aquaculture industry (Alarcón *et al.*, 2004). This sparid usually inhabits seagrass beds and sandy bottoms, mostly at depths of about 30 m, however, adults may occur down to a depth of 150 m (Bauchot and Hureau, 1986). It can reach a maximum length of 70 cm but is more commonly caught around 30–35 cm in length (Beauchot and Hureau, 1986; Froese and Pauly, 2021). The maximum lengths, weights and estimated ages reported for this species from different regions in the Mediterranean were 51.5 cm, 2 600 g and 7 years in the Aegean Sea (Akyol and Gamsız, 2011), 57.5 cm, 2 500 g and 12 years in the northern Adriatic (Kraljević and Dulčić, 1997), and 61 cm, 3 410 g and 7 years in Mellah Lagoon in northeastern Algeria (Chaoui *et al.*, 2006). It is a euryhaline species which can tolerate a wide range of changes in salinity. It is known to move in early spring to sheltered coastal waters in search of abundant food and warmer temperatures and returns to the open sea in late autumn (Sola *et al.*, 2007). The breeding season is between October and January in the Mediterranean (Chaoui *et al.*, 2006; Sola *et al.*, 2007). Gilthead seabream is a highly fecund mass spawning species. This sparid is also a protandrous hermaphrodite, i.e., they first mature as males and then turn to females. The sex of each fish is primarily determined by social factors. Existing evidence suggests that the sex ratio is balanced in adult fish groups (Brown *et al.*, 2005). Gilthead seabream is a carnivore, and its diet consists of a wide variety of organisms including crustaceans and especially molluscs such as gastropods and bivalves (Sola *et al.*, 2007; Taieb *et al.*, 2013; Froese and Pauly, 2021).

Red porgy (*Pagrus pagrus*)

Red porgy is distributed in temperate and tropical regions of both east and west of the Atlantic Ocean, and in the Mediterranean and Black Sea, and has been recorded down to 250 m in depth (Beauchot and Hureau, 1986; Robins and Ray, 1986; Pajuelo and Lorenzo, 1996). Adults mostly live in rocky, sandy habitats between 10–50 m in depth, while juveniles usually inhabit seagrass beds (Froese and Pauly, 2021). The species have a very high commercial value and can grow up to 90 cm; however, they are usually caught between 30–35 cm in length. In 2020, a large male specimen of 50 cm in length and 12–years of age was caught in Gökçeada (Ayyıldız *et al.*, 2020). Red porgy is also a hermaphrodite fish. Like common pandora, the first developing sex is female. At the end of its second year or early third year, it reaches its first reproductive maturity as a female and becomes a male at a later age. The reported lengths at first sexual maturity in the Canary Islands were 22.6 cm for females and 26.7 cm for males (Pajuelo and Lorenzo, 1996), and in the Eastern Mediterranean, the length at first maturity was found to be 31.3 cm for females (Vassilopoulou and Papaconstantinou, 1992).

The spawning season begins in December around the Canary Islands and lasts until May, peaking in February and March (Pajuelo and Lorenzo, 1996), and the season in the Eastern Mediterranean lasts from March until June (Vassilopoulou and Papaconstantinou, 1992). Red porgy is carnivorous and preys on fish and various benthic invertebrates (Beauchot and Hureau, 1986).

Common dentex (*Dentex dentex*)

Common dentex, is a littoral sparid species which lives on *Posidonia oceanica* sea meadows and rocky bottoms. Although common down to 50 m depth, it is also found at 100 m. It is a very valuable and highly sought-after fish in the Mediterranean region and other tropical regions. Common dentex inhabit the Mediterranean Sea most frequently south of 40° N, although it rarely occurs in the Black Sea. This species is also found in the Atlantic Ocean from Bay of Biscay in the north to Senegal in the south, including Madeira and the Canary Islands, but rarely around Great Britain and Northern Ireland. The abundance of this species in the Mediterranean varies by region. Whereas in the northern Mediterranean (e.g., Catalonia, France, the Ligurian Sea and the North Adriatic Sea) its occurrence is low, it is relatively abundant in the central and southern parts (Bauchot and Hureau, 1986; Marengo *et al.*, 2014). In the western Mediterranean, around the Balearic Islands, it occurs relatively frequently, being caught with bottom longlines between a depth of 30 and 60 m. Their juveniles are caught by trammel nets and surface trolling (Morales-Nin and Moranta, 1997). Catches are generally small because only juveniles school together; whereas adults tend to be solitary. The reproductive period of common dentex is relatively short between March and July (Beauchot and Hureau, 1986; Morales-Nin and Moranta, 1997). First sexual maturation takes place in the Balearic Islands between the second and fourth age classes: the lengths at first sexual maturity are 34.6 cm for females and 52 cm for males (Morales-Nin and Moranta, 1997). On the coasts of Tunisia, the length of first sexual maturity is much lower at about 23 cm (Marengo *et al.*, 2014). Common dentex can 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; Marengo *et al.*, 2014). 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 is a predatory fish and preys on a wide variety of fish species, most likely depending on their availability in the wild. Cephalopods are also sometimes included in the diet. Juveniles at small sizes consume crustaceans as well (Morales-Nin and Moranta, 1997; Marengo *et al.*, 2014).

Pink Dentex (*Dentex gibbosus*)

Pink dentex is a demersal fish that is distributed along the West African coast from Gibraltar to Angola, and around São Tomé and Príncipe and the Canary Islands. They also live off the coast of Portugal and in the Mediterranean (Pajuelo and Lorenzo, 1995; Alves and Vasconcelos, 2012). Young individuals (1–2-year age class) are found closer to the shore, often inhabiting estuaries, whereas adults tend to dwell in rocky areas in deeper waters up to the limit of the continental shelf. Pink dentex is a rapid growing sparid species that can grow up to 120 cm in length and 25 kg in weight. Breeding season of pink dentex living around the Canary Islands lasts from April to September, but their peak spawning months are June and July. The lengths at first sexual maturity were estimated as 34.7 cm for females and 38.6 cm for males (Pajuelo and Lorenzo, 1995). A carnivorous species, the pink dentex feeds on fishes, crustaceans and cephalopods (Katavic *et al.*, 2000).

White seabream (*Diplodus sargus*)

This sparid species is distributed in the Eastern Atlantic, from Brittany (France) in the north to Angola in the south, including Madeira and the Canary Islands. It is also native to and common in the Mediterranean and occurs also in the Marmara and the western Black Sea (Beauchot and Hureau, 1986; Froese and Pauly, 2021). White seabream is an ecologically and commercially important species preferring rocky areas and seagrass beds like other sparids. Juveniles enter estuaries in the spring, especially in the Mediterranean, and return to the sea by autumn. It is generally distributed between 0–50 m depths. This sparid can reach up to 45 cm in length, but it is most commonly caught between 20–25 cm in length (Beauchot and Hureau, 1986; Froese and Pauly, 2021). White seabream is a rudimentary hermaphrodite species featuring partial digynic protandry; it undergoes a bisexual gonadal phase during juvenile development. After this stage, the gonads may develop as either male or female at the first maturity. Male fish may become female by undergoing sex reversal at later ages (Giacalone *et al.*, 2018; Ayyıldız and Altın, 2020). The median length of first sexual maturity on the Algerian coast was found to be 20 cm for both sexes, and the spawning season extended from January to June, peaking in March and April (Benchalel and Kara, 2013). In the Gulf of Tunis, breeding takes place between March and June. In this region, the lengths at first sexual maturity were calculated to be 20.4 cm for females and 21.2 cm for males. This size corresponds to approximately the third year of age (Mouine *et al.*, 2012). Young white seabreams are omnivorous and feed on algae and small benthic invertebrates, whereas adults are carnivorous and prey on crustaceans, molluscs, echinoderms, small fish and worms (Beauchot and Hureau, 1986; Osman and Mahmoud, 2009).

Two-banded seabream (*Diplodus vulgaris*)

Two-banded seabream is a sparid species distributed along the coasts of the Mediterranean Sea and the eastern Atlantic Ocean from Bay of Biscay to Senegal. It lives on rocky and sandy bottoms, close to seagrass habitats formed by *Posidonia oceanica* or in lagoons (Arculeo *et al.*, 2003). It usually forms small schools and is disributed from very shallow waters to a depth of 150 m, but more commonly found in coastal areas of shallower than 30 m (Pajuelo and Lorenzo, 2003; Dulcic *et al.*, 2011). Hermaphroditism is not common in this sparid species (Dulcic *et al.*, 2011; İşmen *et al.,* 2019). The breeding season of two-banded seabreams lasts from September to March in the northern Aegean Sea, peaking in December. The lengths at first sexual maturity were found to be 18.3 cm for males and 20.4 cm for females (İşmen *et al.,* 2019). Two-banded seabream preys on small fish, various benthic invertebrates, crustaceans, worms and molluscs (Bauchot and Hureau, 1986; Altın *et al.*, 2015).

Salema (*Sarpa salpa*)

This sparid species is distributed along the eastern Atlantic Ocean, from Bay of Biscay to the shores of South Africa, including Madeira, Cape Verde and the Canary Islands. It inhabits a variety of habitats: rocky, sandy, muddy, algae and seagrass beds, down to depths of 70 m in the Mediterranean (Beauchot and Hureau, 1986; Froese and Pauly, 2021). In the Aegean Sea, salema may reach 43 cm in length and 1 kg in weight but is generally caught in the range of 25–30 cm in length (Bayhan and Kara, 2015). The largest specimen recorded from the shores of Gökçeada was 33 cm in length and 559 g in weight, and it was estimated to be 6 years old (Bektaş, 2017). Salema is a protandrous hermaphrodite species that first completes its sexual development as a male and then later turns into a female (Beauchot and Hureau, 1986; Criscoli *et al.*, 2006; Paiva *et al.*, 2016). Salema breeds in two separate seasons, spring and fall, on the west coast of Italy. In this region, the transformation of males into females begins at approximately 24 cm in length, and fish of both sexes up to 31 cm are encountered (Criscoli *et al.*, 2006). In the same region, the length at first maturity reported for males was 19.5 cm and all female fish above 26 cm caught during the breeding period were sexually mature (Criscoli *et al.*, 2006). According to the gonadosomatic index values, salema has two different spawning periods around Gökçeada, in spring and autumn, peaking in April and October (Bektaş, 2017). Studies conducted around the Canary Islands showed this species had a single spawning period extending from September to March and peaking in December–January (Villamil *et al.*, 2002). In the Canary Islands, male fish reach first sexual maturity at 2 years old and 22.6 cm in length, and females at 3 years old and 29.4 cm in length (Villamil *et al.*, 2002). On the Portuguese coast, a relatively shorter breeding season was observed from September to November (Paiva *et al.*, 2016). In this region, the length at first sexual maturity for males was found to be 24.5 cm and the age was 2 years. All females caught were sexually mature and the size of the smallest female was noted as 28.6 cm (Paiva *et al.*, 2016).

Salema is a herbivorous species which feeds on seagrasses, algae and epiphytes (Antolić *et al.*, 1994; Havelange *et al.*, 1997; Bektaş, 2017).

Bogue (*Boops boops*)

Bogue is a sparid species distributed along the eastern shores of the Atlantic Ocean, from Norway in the north to Angola in the south, around Cape Verde, São Tomé and Príncipe and the Canary Islands, and it is also present in the Mediterranean and Black Sea. It is a migratory demersal fish that can live in depths down to 300 m in sandy, muddy or rocky habitats. Bogue is more common in waters shallower than 150 m in the Mediterranean (Bauchot and Hureau, 1986; Monteiro *et al.*, 2006). It can reach a maximum length of 40 cm but is more commonly caught between 15 and 20 cm in length (Beauchot and Hureau, 1986; Froese and Pauly, 2021). The length at first sexual maturity length reported from Izmir Bay was 13 cm for females (Soykan *et al.*, 2015). Breeding season of bogue in this region starts in the end of winter and continues during the spring months (Soykan *et al.*, 2015). Similarly, another study conducted in Saros Bay stated that the spawning season of this fish lasts from March until May (Cengiz *et al.*, 2019). Being omnivorous, bogue feeds on algae as well as various benthic invertebrates and plankton (Bauchot and Hureau, 1986; Derbal and Kara, 2008).

Saddled seabream (*Oblada melanura*)

Saddled seabream is a sparid species distributed all around the Mediterranean, generally in habitats with rocky, algae and sea meadow beds down to 30 m in depth. It is rare in the Black Sea. The species also lives along the eastern Atlantic Ocean from Bay of Biscay to the shores of Angola, including Madeira, Cape Verde and the Canary Islands (Beauchot and Hureau, 1986; Froese and Pauly, 2021). Altought it can reach more than 35 cm in length and 570 g in weight in the Aegean Sea (Akyol *et al.*, 2014), the largest saddled seabream specimens observed on the shores of Gökçeada were 28–29 cm in length and 390 g in weight (Karakulak *et al.*, 2006; Cengiz, 2020). It is commonly caught at about 20 cm in length (Beauchot and Hureau, 1986; Froese and Pauly, 2021). Hermaphroditism is rarely observed in this sparid (Beauchot and Hureau, 1986; Daban *et al.*, 2020). Females tend to live longer than males and reach larger sizes (Pallaoro *et al.*, 1998; Daban *et al.*, 2020). While a 10-year-old male and an 11-year-old age class female fish were found in the Adriatic Sea (Pallaoro *et al.*, 1998), the oldest individual recorded from Egypt was 12 years old (Mahmoud, 2010). Beauchot and Hureau (1986) state that saddled seabream breeds throughout the Mediterranean from April to June. Daban *et al.* (2020) reported that the species spawned in the northern Aegean Sea from May until June. In the eastern Adriatic, on the other hand, the spawning period was observed to be in June–August months (Pallaoro *et al.*, 1998; Cetinić *et al.*, 2002). The estimated lengths at first sexual maturity for saddled seabream in northern Aegean were 18.8 cm for females and 18.9 cm for males (Daban *et al.*, 2020). First sexual maturity sizes recorded in the other parts of the Mediterranean are as

follows; 17.5 cm for females and 16.4 cm for males in the Adriatic Sea (Cetinić *et al.*, 2002), 15.7 cm for females and 13.9 cm for males on the Egyptian coast (Mahmoud, 2010), and 18.6 cm for females and 17.5 cm for males on the Libyan coast (Rafalah and El-Mor, 2018). Saddled seabream shows opportunistic prey choice behaviour depending on availability. While individuals of almost all sizes feed on zooplanktonic organisms such as copepods, preference for benthic organisms such as crustaceans, molluscs and worms in the diet increases as the fish grow (Pallaoro *et al.*, 2003; Pallaoro *et al.*, 2004).

Red mullet (*Mullus barbatus*)

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. Adults of this demersal species can inhabit depths down to 500 m. In the Mediterranean Sea, red mullet ranks among the most commercially important fish and is one of the main target species of the bottom trawl multispecies fishery in this region. Consequently, it is subjected to intense fishing pressure. Red mullet can reach a maximum length of 38 cm, but the largest sizes recorded from different regions of the Mediterranean are generally in the range of 22–30 cm (Filiz, 2011). The largest red mullet reported from Gökçeada was a female specimen with a length of 22.7 cm and a weight of 147 g, and it was estimated to be 7 years old (Tüzün *et al.*, 2019). The largest length and weight measurements recorded from Saros Bay in the North Aegean Sea was 24.1 cm and 120 g for males, and 23.6 cm and 177 g for females (Arslan and İşmen, 2014). The median sexual maturity values for females in red mullet populations across the Mediterranean show differences ranging from 11 cm to 14.4 cm in fork length (Kokokiris *et al.*, 2014). In Saros Bay, the spawning season is between March and September peaking in June, and the length at first sexual maturity was 11.9 cm for females and 12.1 cm for males (Arslan and İşmen, 2014). Red mullet reaches its sexual maturity at 1 year of age in Edremit Bay, and the observed spawning period starts in March and continues until the beginning of September with a peak in July (Çelik and Torcu, 2000). In Izmir Bay, the gonads of the females reach full maturity in May, and they are spawning capable. The length at first maturity was found to be 14.2 cm for females and 12.4 cm for males in this region (Metin, 2005). It feeds on small benthic crustaceans, polychaetes and molluscs (Hureau, 1986a; Çelik and Torcu, 2000; Arslan and İşmen, 2014).

Striped red mullet (*Mullus surmuletus*)

Like its very close relative red mullet, striped red mullet, in addition to the Mediterranean, Marmara and Black Seas, is distributed along the eastern coasts of the Atlantic Ocean, from the Scandinavian Peninsula in the north to Senegal in the south (Hureau, 1986a; Froese and Pauly, 2021). It inhabits sandy, muddy and rocky grounds. This demersal species may be encountered at depths of about 400 m, but is more commonly found at depths between 5–100 m. It may reach a total length of 40 cm but is generally caught at a

length range between 20 and 25 cm (Hureau, 1986a). Striped red mullet becomes sexually mature at 12–14 cm of length and 1–2 years of age across the Mediterranean Sea (Tsikliras and Stergiou, 2014; Froese and Pauly, 2021). Maximum spawning activity in Izmir Bay is observed in spring season when sea water temperatures begin to increase, especially in April and May (İlhan *et al.*, 2009). Its prey consists of small benthic fish and various invertebrates (Hureau, 1986a). Striped red mullet and red mullet are often mistaken for one another due to their quite similar appearance.

Tub gurnard (*Chelidonichthys lucerna*)

Tub gurnard is distributed in the eastern Atlantic Ocean from the coast of south-west Norway, including the British Isles in the north, to the coast of Sierra Leone in West Africa in the south. This valuable demersal fish species, which is also present in the Mediterranean, Marmara and Black Seas, generally inhabits sandy, sandy-muddy and rocky grounds between 20 and 300 m of depth (Hureau, 1986b; Froese and Pauly, 2021). Tub gurnard is the largest among other species of gurnards sharing the same habitat, and may exceed 76 cm in length (Papaconstantinou, 1984). Although a large specimen, 74 cm in length, has recently been caught from the middle Black Sea (Özdemir *et al.*, 2019), the largest gurnards recorded from other seas surrounding Turkey, such as the Marmara Sea, Edremit, İzmir and İskenderun Bays were 41, 36, 34 and 30 cm, respectively. (Eryılmaz and Meriç, 2005; Uçkun, 2005; Uçkun İlhan and Toğulga, 2007; İşmen *et al.*, 2004). Female gurnards live longer than males and attain larger sizes (Papaconstantinou, 1984). This trait is also reflected by the first sexual maturity lengths estimated in different regions for these fish. The spawning periods and median lengths at first maturity determined for gurnards in Turkish seas are between April and November, and 19 cm for females and 18.5 cm for males in the Marmara Sea, (Eryilmaz and Meriç, 2005), between December and April, and 19 cm for females and for 17.7 cm for males in Izmir Bay (Uçkun İlhan and Toğulga, 2007), between December and May, and 20 cm for females and 18 cm for males in Iskenderun Bay (İşmen *et al.*, 2004). Tub gurnard is an opportunistic carnivorous fish that preys on mainly demersal species including crustaceans, molluscs and fish. Prey selection shows variation with increasing size, larger gurnards tend to have higher preference for fish (Vallisneri *et al.*, 2011; Stagioni *et al.*, 2012; Montanini *et al.*, 2017; İlhan, 2019).

European hake (*Merluccius merluccius*)

European hake is a commercially very valuable species, and it is an important predator of deeper shelf–upper slope Mediterranean communities. It is a nektobenthic species distributed over a wide depth range (20 to 1 000 m) throughout the Mediterranean and northeast Atlantic regions (Carpentieri *et al.*, 2005; Lloris *et al.*, 2005). It is the most common bony fish species in the north of Gökçeada at the depth range of 500–1 000 m (Gönülal, 2016). The largest European hake ever recorded from the Atlantic Ocean had a length of 140 cm and weighed 15 kg. Hakes caught in the Mediterranean are smaller

in size: the common size of catch is around 45 cm (Lloris *et al.*, 2005). European hake is reproductively active throughout the year, but spawning seasons vary between populations. It spawns in the Mediterranean between December and June. Although there were specimens ready to spawn in December and May in Izmir Bay, April was the month when the most intensive spawning was observed (Soykan *et al.*, 2015). 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) (Recasens *et al.*, 1998). In terms of age, both sexes mature at the age of 3 to 3.5 years in the Gulf of Lion, 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 the age of 5 (Recasens *et al.*, 1998). The length at first maturity in Izmir Bay is 21.5 cm for females and 25.7 cm for males (Soykan *et al.*, 2015). Adult European hake mostly preys on fish, and juveniles generally feed on crustaceans (Bozzano *et al.*, 2005; Carpentieri *et al.*, 2005; Froese and Pauly, 2021).

Grey mullet (Mugilidae)

Several species of grey mullets are distributed in the region, and it is often difficult to distinguish between them. However, the flathead grey mullet *Mugil cephalus*, golden grey mullet *Chelon auratus*, leaping mullet *Chelon saliens* and thicklip grey mullet *Chelon labrosus* are among the more frequently occuring species. Grey mullets commonly inhabit tropical and warm temperate waters. Although these species have always spawn at sea, they are highly euryhaline and thrive in a wide range of salinity levels (Cardona, 2006). Adults are found in coastal waters, often entering estuaries, rivers, lagoons and hypersaline environments. They often form schools over sandy or muddy bottoms, between the surface and depths of up to 10 m. Grey mullets generally mature sexually at 3 to 4 years of age. These omnivorous fish are mainly diurnal and feed on detritus, macro algae and benthic organisms (Froese and Pauly, 2021).

Atlantic horse mackerel (*Trachurus trachurus*)

Atlantic horse mackerel is a schooling migratory species of high commercial importance. It is distributed from the continental shelf of the eastern Atlantic Ocean, from the Norwegian Sea, including Iceland and the British Isles in the north, to the coasts of Namibia (including Cape Verde and the Canary Islands) in the south, and also in the Mediterranean, Marmara and Black Seas (Smith-Vaniz, 1986; Abaunza *et al.*, 2003; Froese and Pauly, 2021). Atlantic horse mackerel is a long-lived fish that may attain an age of 40 years in the north-east Atlantic (Abaunza *et al.*, 2003). The oldest individual reported from the Turkish seas was 7 years old (Erdoğan *et al.*, 2016). It may reach lengths over 60 cm in the north-east Atlantic (Smith-Vaniz, 1986). The most recent largest size record from the Turkish seas was 26 cm and was reported from the Dardanelles (Güroy *et al.*, 2006). The largest Atlantic horse mackerel caught in the Saronikos Gulf in the western

Aegean Sea was 34 cm (Karlou-Riga and Sinis, 1997), and the largest specimen captured from the Adriatic Sea was 38 cm (Santić *et al*., 2011). The beginning and duration and of breeding period in the Atlantic Ocean varies according to region. It may begin in the middle of winter and last until the end of summer, and in some regions, it starts at the end of summer, and may extend more than eight months (Abaunza *et al*., 2003). Although the length at first maturity in the Atlantic varies between 16 and 25 cm, depending on regions, the most common length at first maturity is about 21 cm (Abaunza *et al*., 2003). Spawning seasons and estimated lengths at first maturity for different regions in the Mediterranean are between April and August, and 13 cm for Edremit Bay (Ulunehir Aydın and Erdoğan, 2018), between January and May, and 22 cm for the Saronikos Gulf (Karlou-Riga and Economidis, 1996), between November and June, and 18–20 cm for the southern Tyrrhenian, the Adriatic and the western Ionian Seas (Carbonara *et al*., 2012), between January and May, and 18 cm for the Algerian coast (Gherram *et al*., 2018). Horse macakerel of all sizes, both juveniles and adults feed on various zooplanktonic organisms. While juveniles prefer copepods, the portion of krill as main prey increases as they grow. Larger horse mackerel prey on small fish as well. Occasionally, cephalopods are also found in stomach contents (Jardas, *et al*., 2004; Šantić *et al*., 2005; Bayhan and Sever, 2009).

Mediterranean horse mackerel (*Trachurus mediterraneus*)

Mediterranean horse mackerel has a smaller area of distribution than its close relative, the Atlantic horse mackerel. This commercially important, schooling and migratory species is very common in the Mediterranean, Marmara and Black Seas. It is also distributed from Bay of Biscay to the shores of Mauritania in the eastern Atlantic Ocean (Smith-Vaniz, 1986; Froese and Pauly, 2021). The maximum age estimated for Mediterranean horse mackerel in the Mediterranean was 12 years (Karlou-Riga, 2000). The oldest individual found in Turkey was 6 years old and it was captured in the eastern Black Sea (Genç *et al*., 1998). Although Smith-Vaniz (1986) stated that Mediterranean horse mackerel might reach a maximum length greater than 50 cm; the largest size reported from the Turkish seas was only 27 cm and this specimen was captured in Gökçeada (Karakulak *et al*., 2006). The most recent largest size records for this species in the Mediterranean are from the Saronikos Gulf in the western Aegean Sea, and the eastern Adriatic Sea. Both measurements are slightly above 39 cm in length (Karlou-Riga, 2000; Santić *et al*., 2011). The spawning period for Mediterranean horse mackerel in the eastern Black Sea is between June and September, and the length of the smallest sexually mature fish in this region was 10.4 cm (Genç *et al*., 1998; Şahin *et al*., 2009). The spawning season in the Marmara Sea is from May to October with a peak between July and August. The length at first sexual maturity in the Marmara is 12.2 cm for females and 12.5 cm for males (Demirel and Yüksek, 2013). Spawning periods from other regions in the Mediterranean are as follows: between April and September in the Saronikos Gulf (Karlou-Riga, 2000), between May and August in the eastern Adriatic Sea (Šantić *et al*., 2006), and between May and August in Trieste Bay (Viette *et al*., 1997).

The median length at first sexual maturity in Trieste Bay was estimated to be 16 cm for both sexes (Viette *et al.*, 1997). Mediterranean horse mackerel feeds mainly on various zooplanktonic organisms such as Atlantic horse mackerel. Copepods constitute the main prey of juveniles, and they are followed by krill and fish eggs (Šantić *et al.*, 2013). Adults in the Aegean Sea, in addition to feeding on mainly copepods and various types of zooplankton, start to consume fish larvae and small fish as they grow in size (Bayhan *et al.*, 2013). Adult horse mackerel feeds similarly in the Adriatic Sea; however, the portion of krill in the zooplankton prey composition is greater (Šantić *et al.*, 2003). Although the dietary preferences of Mediterranean horse mackerel in the western Black Sea is similar to the Aegean and the Adriatic to a large extent, benthic invertebrates are predominantly consumed in this region, especially in spring and summer (Georgieva *et al.*, 2019). Atlantic horse mackerel and Mediterranean horse mackerel may be difficult to differentiate from each other due to their quite similar appearance.

Mediterranean chub mackerel (*Scomber colias*)

Mediterranean chub mackerel is a pelagic, schooling and migratory fish, which is distributed in the temperate waters of the Atlantic Ocean and the Mediterranean Sea down to depths of 200–300 m. This species grows fast and may reach and a maximum age of 13 years and a maximum length of 50 cm, but the more common capture size is below 30 cm (Collette, 1986; Froese and Pauly, 2021). Spawning periods in the Atlantic differ from north to south. In the north, spawning mainly occurs in winter and spring; however, along the coast of Spain and Portugal, and also in northwest Africa spawning begins earlier in fall. These differences are likely due to different water temperatures, oceanographic conditions (upwelling etc.) and nutrient availability (ICES, 2020). The length at first sexual maturity varies between 18 and 29 cm in different regions of the Atlantic Ocean (ICES, 2020). In the Mediterranean, the spawning season in the eastern Adriatic Sea is from May to August with a peak in June. The median lengths at first sexual maturity are estimated as 20.4 cm for males and 16.8 cm for females in this region (Cikeš Keč and Zorica, 2012). In Saros Bay in the north Aegean Sea, the spawning takes place between June and August, and the estimated lengths at first sexual maturity are same for both sexes and about 18 cm in this bay (Cengiz, 2012). Both juvenile and adult chub mackerel prey on zooplankton, but as they grow and become larger, the proportions of cephalopods, crustaceans and small pelagic fish in their diet increase (Castro and Del Pino, 1995; Sever *et al.*, 2006).

Bluefish (*Pomatomus saltatrix*)

Bluefish is a cosmopolitan, pelagic, schooling, migratory and predatory fish species with a high commercial value. It is distributed in the Black Sea, the Marmara Sea and the entire Mediterranean down to depths of 200 m. It is also found in tropical and subtropical zones of all oceans except the eastern and central Pacific Ocean (Tortonese, 1986; Froese and Pauly, 2021). Bluefish is called by different local names according to

its size in Turkey. Juvenile bluefish at a length not exceeding 10 cm are called "*defne yaprağı*". Those between 10–15 cm are named "*çinekop*". Bluefish between 15–20 cm in length and still sexually unmature are called "*sarı kanat*". Those larger than 20 cm in length are called "*lüfer*", and those larger than 35–40 cm in length are named "*kofana*". Bluefish can reach a maximum of 130 cm in length and 14 kg in weight (Froese and Pauly, 2021). The species spawns from June to September during the summer months on the Catalan coast in the northwestern Mediterranean and both sexes reach sexual maturity at between 36–38 cm in length (Villegas-Hernández *et al.*, 2015). In the Marmara Sea, the mean maturity age and length for females were 2 years and 25.4 cm, respectively. The spawning season starts in early spring in the Marmara Sea and peaks in June (Ceyhan *et al.*, 2007). The main prey of bluefish in the Turkish seas are various fish species such as horse mackerel, European anchovy, Atlantic mackerel, Mediterranean chub mackerel, European pilchard, red mullet and grey mullet. This species exhibits seasonal migration behavior following a route between the Black Sea and the Aegean Sea.

Atlantic bonito (*Sarda sarda*)

Atlantic bonito is a cosmopolitan, pelagic, schooling, migratory and predatory fish species that is distributed in the eastern Atlantic Ocean from Norway in the north to Port Elizabeth (South Africa) in the south, and in the western part of the Atlantic, from Nova Scotia (Canada) in the north to northern shores of Argentina in the south (Collette, 1986; Froese and Pauly, 2021). This commercially highly valuable species also lives in the Black Sea, the Marmara, and the Mediterranean and may inhabit the pelagic zone down to 200 m depth. It may reach 90 cm in length and 5 kg in weight. Atlantic bonito, like bluefish, is also known by different names according to its size in Turkey. The most common of these names are "*vonoz*" for juveniles at lengths not exceeding 10 cm, "*çingene palamutu*" between 10–25 cm, "*palamut*" between 25–35 cm, and "*torik*" between 35–60 cm. Larger specimens above 60 cm are called "*sivri*" or "*altı parmak*". Spawning usually occurs in the Black Sea and the Marmara between May and August with a peak in June and July. In this region, the length at first sexual maturity was estimated to be 36.8 cm for males and 42.5 cm for females (Kahraman *et al.*, 2014). Atlantic bonito generally preys on several fish species such as European anchovy, horse mackerel, European sprat, twaite shad, red mullet and whiting in the Marmara and Black Sea (Genç *et al.*, 2019). Atlantic bonito also exhibits seasonal migratory behavior like bluefish between the Black Sea and the Aegean Sea.

Swordfish (*Xiphias gladius*)

Swordfish is a cosmopolitan, pelagic, migratory, often solitary and predatory fish species that is generally encountered at depths between 0–550 m in the tropical and subtropical zones of the Atlantic, Indian and Pacific Oceans (Nakamura, 1986; Froese and Pauly, 2021). Swordfish has very high commercial importance and may reach a maximum length of 4.5 m and weigh up to 650 kg (Froese and Pauly, 2021). The largest fish caught in the

Aegean Sea had a lower jaw fork length of 242 cm and weighed 171 kg (Akyol and Ceyhan, 2013). The largest individual that was caught from Gökçeada was 5 years old, with a lower jaw fork length of 174 cm and a total weight of 69 kg (Alver *et al.*, 2016). Spawning in the Aegean Sea may occur in summertime (De Metrio *et al.*, 1989). In the Mediterranean Sea, it probably spawns from June to September (De la Serna *et al.*, 1996; Abid *et al.*, 2019). In a recent study (Abid *et al.*, 2019), in the Strait of Gibraltar, the lower jaw fork length at first sexual maturity was estimated to be 170 cm for females and 95 cm for males. In a previous study in the western Mediterranean, the median sexual maturity lower jaw fork length was reported as 142 cm for females (De la Serna *et al.*, 1996). In the north Atlantic, swordfish spawn all year round, with a peak in reproductive activity between December and June (Arocha and Lee, 1996). In this region, the lower jaw fork length at first sexual maturity was estimated to be 179 cm for females and 129 cm for males (Arocha and Lee, 1996). The spawning period in the Mediterranean is between June and September (Nakamura, 1986; Akyol and Ceyhan, 2013). Swordfish prey on small pelagic fish such as Atlantic mackerel, horse mackerel, European pilchard and cephalopods such as squid (Froese and Pauly, 2021).

Common octopus (*Octopus vulgaris*)

This cephalopod mollusc species with very high commercial value has worldwide distribution in the tropical, subtropical and temperate waters of the Atlantic, Indian and Pacific Oceans; it is also common in the Mediterranean Sea (Roper *et al.*, 1984). Common octopus 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 down to 200 m. In very shallow waters, the species occurs mostly in coral reefs or rocks, but in many regions of the Mediterranean, it is equally, or even more abundant, over sandy and muddy bottoms or in seagrass beds. Since the life of females ends shortly after spawning, the time to reach sexual maturity also determines their lifespan (Salman, 1995). The maximum life span is about 3–4 years in males and 2–3 years in females (Mangold, 1983).

Common cuttlefish (*Sepia officinalis*)

Common cuttlefish is a cephalopod mollusc species distributed in the Mediterranean, the North and Baltic Seas. The species has a high commercial value, and it generally inhabits a depth zone between 0–100 m but is also sometimes encountered at depths of 200 m (Salman, 1995; Cilasin *et al.*, 2015). Common cuttlefish has a relatively short life cycle, often up to 20–30 months (Salman, 1995). As in the case of other cephalopods, this species also grows very rapidly with a daily rate of 3–15 percent of its body weight, and therefore, having a quite high daily feeding rate, which can vary between 20–50 percent of its body weight (Domungues *et al.*, 2006). Cuttlefish prey on fish, crustaceans and molluscs, and the contribution of fish prey into their diet increases as they grow, whereas the portion of crustaceans decreases (Castro and Guerra, 1990).

Squid (*Loligo vulgaris*)

Squid is a commercially important cephalopod mollusc species that is distributed along the eastern shores of the Atlantic Ocean, from the North Sea in the north to the west African coasts in the south. It is also very common in the entire Mediterranean Sea (Roper *et al.*, 1984; Salman, 1995). This semi-pelagic cephalopod mostly prefers coastal waters at depths of 20–250 m (Gökçe *et al.*, 2005). Squid also plays an important role in the marine food web both as predator and prey to other taxa including fish, seabirds, and marine mammals. Male squids have a lifespan of 3 years, and females live up to 2 years. Female squid, like other cephalopods, dies soon after laying its eggs (Salman, 1995).

European lobster (*Homarus gammarus*)

European lobster is a highly valuable large crustacean species distributed along the coasts of eastern Atlantic Ocean, from the Lofoten Islands in northwestern Norway in the north to Morocco in the south including the British Isles and the Azores. The species is also native to the Mediterranean and Black Seas. Lobster prefers hard substrates, particularly rough and rocky grounds having holes or crevices to provide shelter. It is mostly a nocturnal animal emerging at night to feed. Males are territorial. It is usually found in shallow coastal waters between 20 m and 60 m deep. Lobsters may reach up to 60 cm in total length and weigh up to 6 kg, although specimens over 35 cm are rare. (Holthuis, 1991). Depending on the water temperature, they do not mature before the age of 5–8 years. Males reach sexual maturity earlier than females (Prodöhl *et al.*, 2006). Lobster feeds mainly on other benthic invertebrates such as other smaller crustaceans, echinoderms, molluscs and worms.

Common spiny lobster (*Palinurus elephas*)

This commercially highly valuable crustacean species is distributed in the eastern Atlantic Ocean from southwestern Norway to Morocco including south and west coasts of the British Isles, Madeira, the Azores and the Canary Islands. The species is also present in the Mediterranean, aside from the extreme eastern and southeastern coasts (Holthuis, 1991; Hunter, 1999; Goñi and Latrouite, 2005). Common spiny lobster inhabits depths between shore to 200 m, on rocky and coralligenous substrates where there are natural protective holes and micro-caves. Adults may be solitary, in pairs or in small groups. Like other lobsters, they are primarily active at night. Its total length and weight may reach up to 60 cm and 7 kg, respectively. The average size of functional maturity (ability to mate and lay eggs) varies regionally. According to a study from the Western Mediterranean, females attained physiological and functional maturity simultaneously at a carapace length of 76–77 mm (age 4); however, males became mature at a slightly larger size, at a carapace length of 82 mm (Goñi *et al.*, 2003). Spiny lobster is an omnivorous opportunistic feeder that adapts its prey preferences as a

function of the abundance of available benthic organisms. Its diet includes molluscs, sea urchins, other small crustaceans, brittle stars, bryozoans, worms, and red algae (Holthuis, 1991; Hunter, 1999; Goñi and Latrouite, 2005).

A table summarizing some of the key information from the preceding text in this subsection on the biology of the major species in the area can be found in Appendix 2.

Stock status

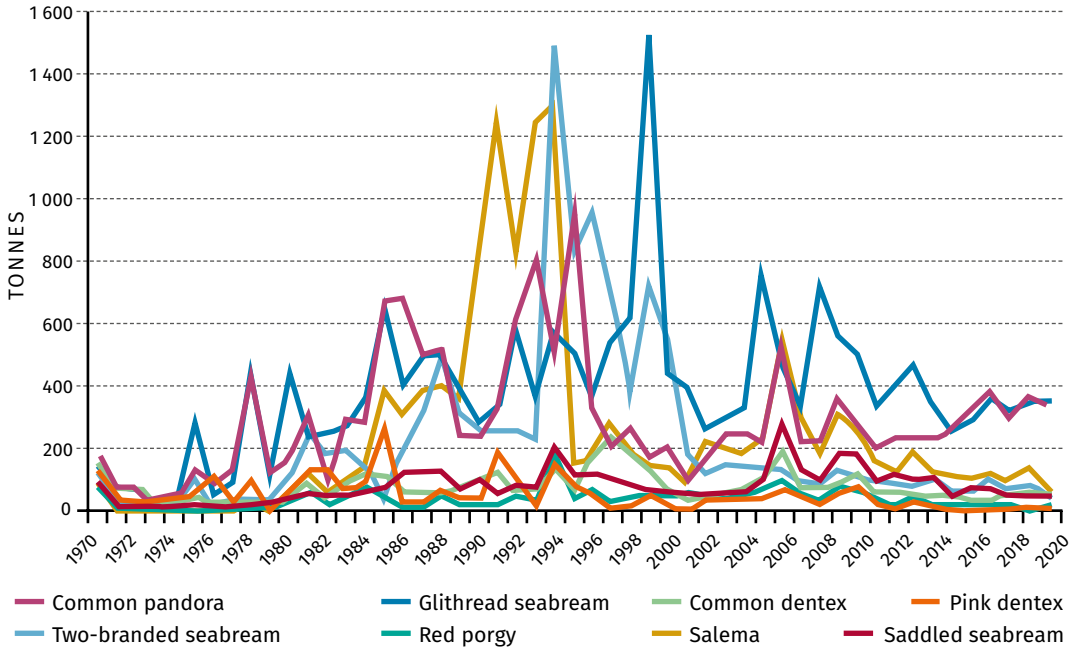
No assessments have been conducted for any of the fish or invertebrate stocks of the northeastern Aegean Sea where Gökçeada is located. Nor is any scientific or managerial information available for the boundaries of the stocks. The only primary and continuous source of information regarding the status of fisheries in Turkey is the official fishery statistics which are collected, compiled and published annually by the Turkish Statistical Institute (TUİK). Unfortunately, these statistics pool all the data collected in different regions of the Turkish Aegean 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 by scientists and representatives from the fisheries sector (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. Only one study attempted to assess the size of the unreported marine fisheries catches of in Turkey for the 1950–2010 time period and the total reconstructed catch for the whole time period (inclusive of the reported data) was approximately 30 million tonnes, about 63 percent more than the officially reported figure of 18.4 million tonnes (Ulman *et al.*, 2013).

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 deemed 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 still considered to be a useful index reflecting the overall variations in fisheries resources. Thus, the trends seen in Figures 36 to 44 presented below based on the official statistics, can be regarded as reasonably valid and reflecting the general status of stocks.

Figure 36 shows the annual total catch statistics in tonnes for the major commercial seabream species in the eastern Aegean Sea between 1970 and 2020. As shown here, the catches of almost all seabreams, very important species for the Gökçeada fisheries, have been declining since the beginning of the 2000s. Because the landings of two other important seabream species, bogue and picarel were much higher than the remainder of the other sparids, their annual catch statistics are shown separately in Figure 37 together with the horse mackerel species. Bogue seems one of the rare species showing an increasing trend in landings in the last decade; however, catches of both horse mackerel species and picarel declined in the same period. Since the historical catches of European hake, grey mullets and Mediterranean chub mackerel were much higher than the remainder of all other species, a separate graph (Figure 38) was prepared in order to ensure that the variations in the annual landings of this group would be more conspicuous. Grey mullets are a combined group including several distinct species distributed in the region. European hake once was the most abundant species in the demersal fisheries in the eastern Aegean Sea. The dominance of European hake in the demersal fish landings was more pronounced between 1992 and 2000, following the historical maximum catch in 1998, European hake landings began to decrease (Figure 38). Annual catches of three main commercial migratory fish species of the eastern Aegean Sea: Atlantic bonito, bluefish and leerfish, are presented in Figure 39. Landings of both Atlantic bonito and bluefish showed large year-to-year fluctuations. Red mullet was the second most abundant demersal fish species caught in the eastern Aegean Sea (Figure 40). After the historical maximum catch in 1994, landings of red mullet started to drop drastically down. In the last decade, however, the annual catches of both red mullet and striped red mullet showed very little variations and remained fairly stable (Figure 40). Annual catch statistics of swordfish, one of the most important target species around Gökçeada, are shown in Figure 42. They fluctuated considerably from one year to another (Figure 42). Landings of the commercially important invertebrates for Gökçeada fisheries are also presented in Figure 43 and 44.

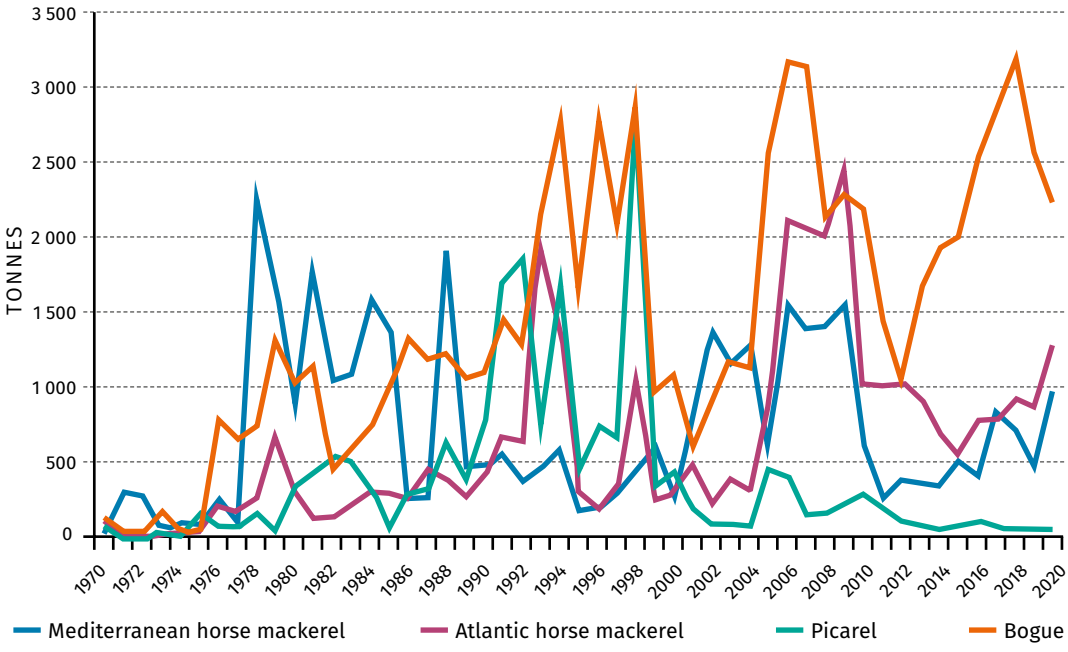
The common view expressed by Gökçeada fishers during the interviews was that, based on their traditional knowledge and experience, island's fisheries resources decreased drastically in the last decade, particularly in the course of last five years. Fishers' own assessment on the status of Gökçeada's fishery resources agree to a great extend with the trends observed in the above figures based on the TÜİK data. For example, the decline in the average daily catches of European lobster and spiny lobster in the island from 200–250 kg down to 10–15 kg during the last decade correspond rather well with the decreasing trends shown in Figure 44.

Figure 36. Annual total catch statistics in tonnes of major commercial species from the Sparidae family in the eastern Aegean Sea between 1970 and 2020



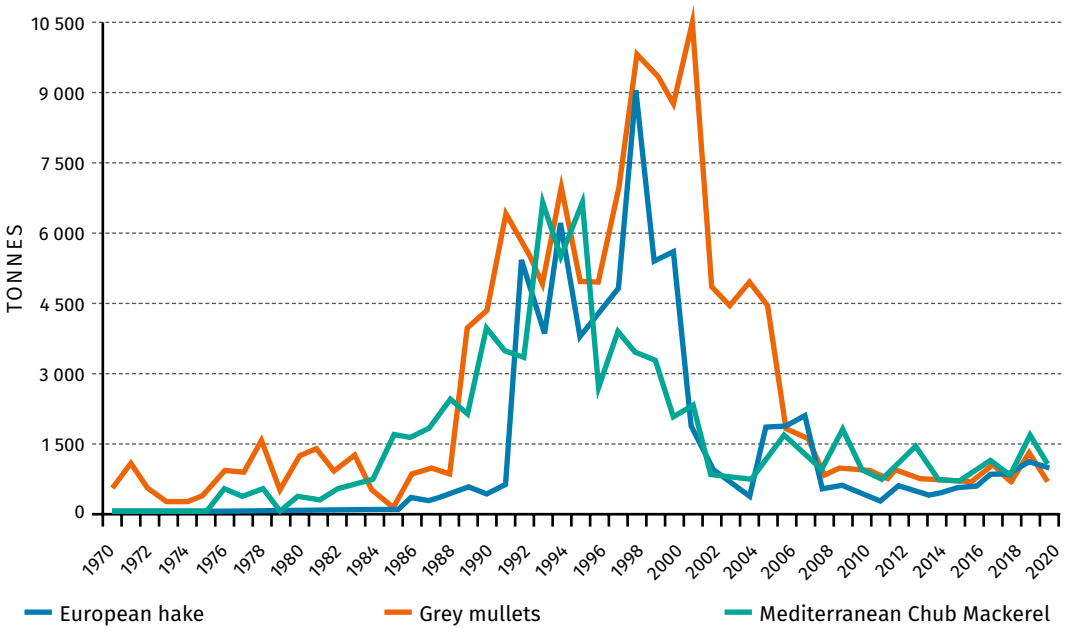
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 37. Annual total catch statistics in tonnes of horse mackerel, picarel and bogue, the main commercial fish species in the eastern Aegean Sea between 1970 and 2020



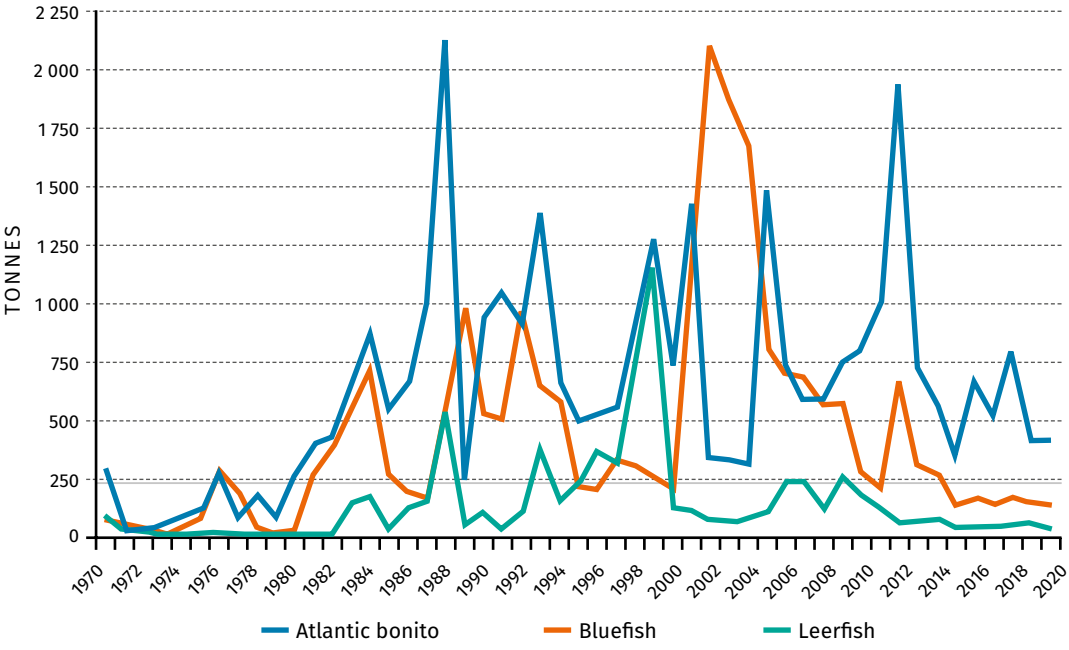
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 38. Annual total catch statistics in tonnes for European hake, grey mullet and Mediterranean chub mackerel in the eastern Aegean Sea between 1970 and 2020



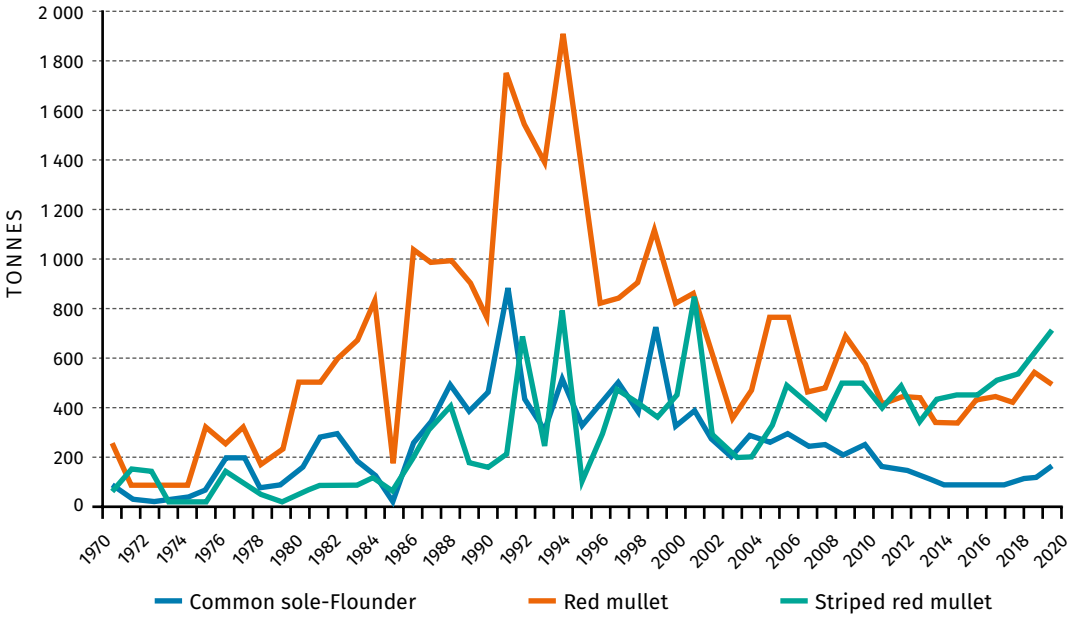
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 39. Annual total catch statistics in tonnes of Atlantic bonito, bluefish and leerfish in the eastern Aegean Sea between 1970 and 2020



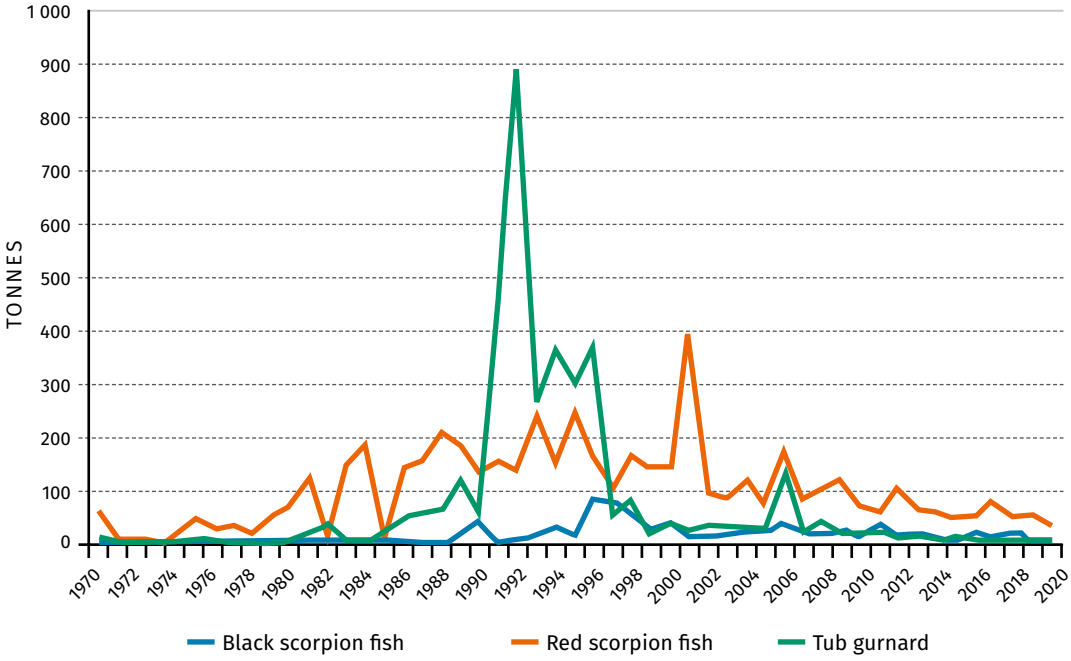
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 40. Annual total catch statistics in tonnes of common sole-flounder, red mullet and striped red mullet in the eastern Aegean Sea between 1970 and 2020



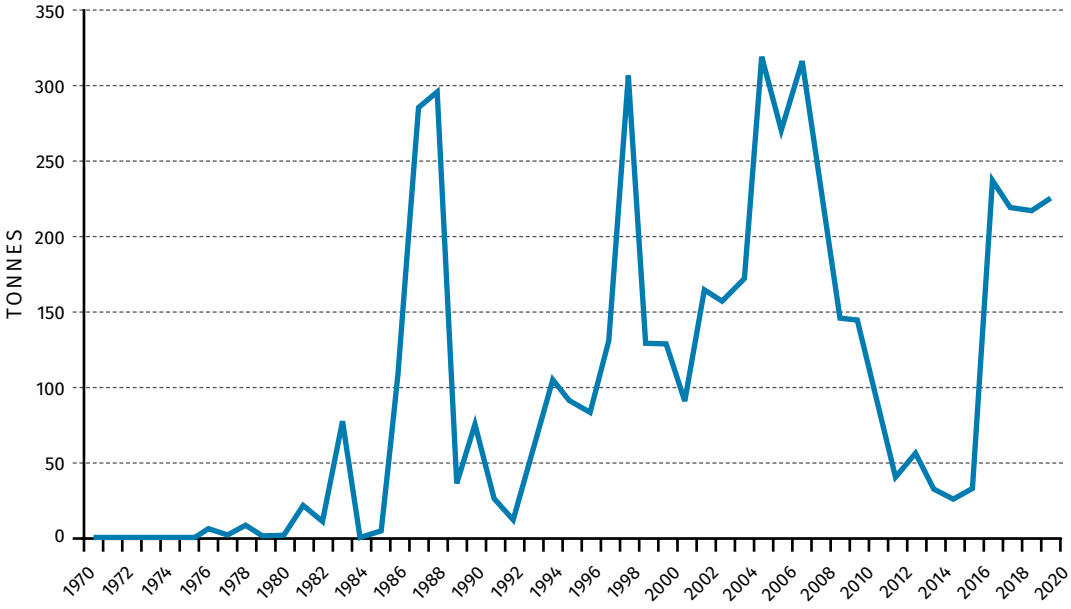
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 41. Annual total catch statistics in tonnes of common black scorpionfish, red scorpionfish and tub gurnard in the eastern Aegean Sea between 1970 and 2020



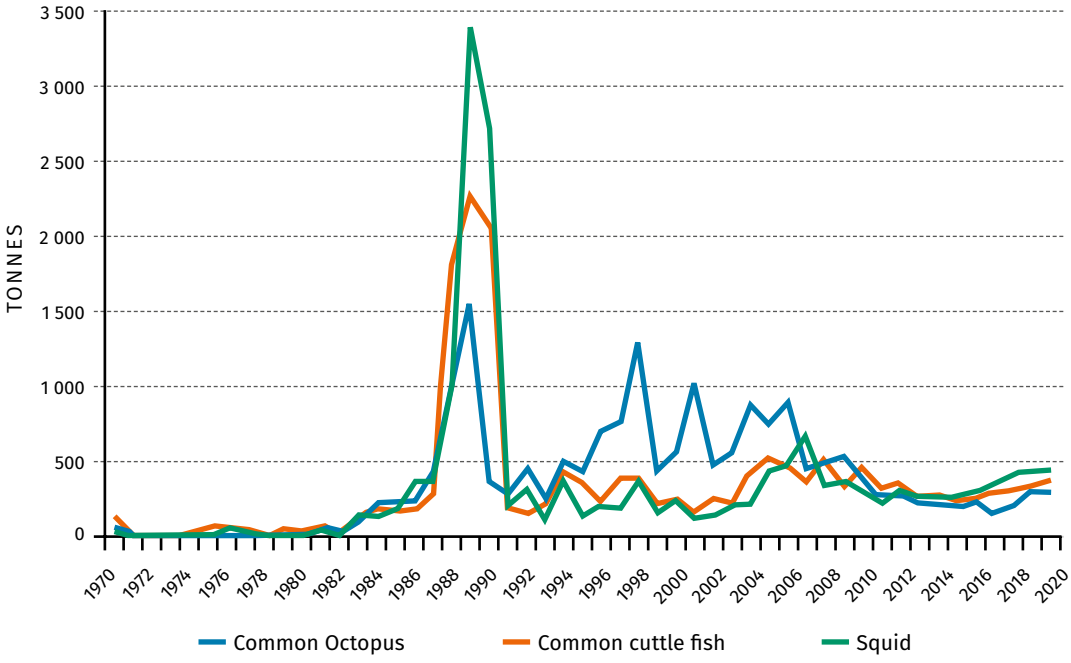
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 42. Annual catch statistics in tonnes for swordfish in the eastern Aegean Sea between 1970 and 2020



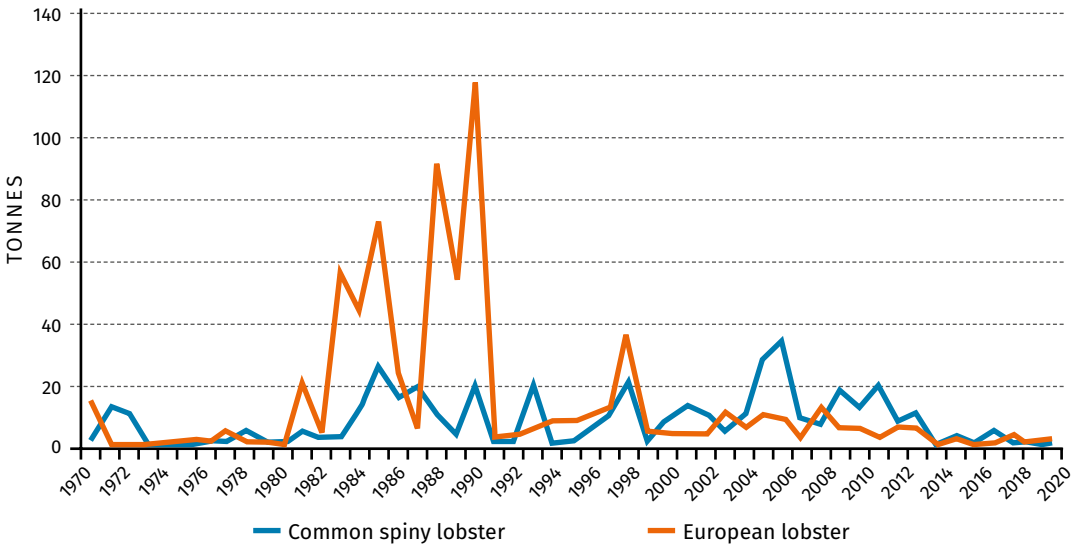
Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 43. Annual total catch statistics in tonnes for common octopus, common cuttlefish and squid, the main commercial cephalopod species of the eastern Aegean Sea between 1970 and 2020



Source: DİE (1970–2003) and TÜİK (2004–2021).

Figure 44. Annual total catch statistics in tonnes for European lobster and common spiny lobster, the main commercial crustacean species of the eastern Aegean Sea between 1970 and 2020



Source: DİE (1970–2003) and TÜİK (2004–2021).

2.11 Main stakeholders

In addition to the local fishers, the main stakeholders that emerged in line with the information obtained from field studies and face-to-face personal interviews are briefly summarized below.

Gökçeada Center, Kaleköy, Bademli, Uğurlu Fishery Cooperative

S.S. Gökçeada Center, Kaleköy, Bademli, Uğurlu Fishery Cooperative (Gökçeada Fishery Cooperative in short) was established in 2000, twenty-one years ago. The cooperative has a total of 41 partners, more than half (55 percent) of them have been partners for at least 15 years. However, around 10 fishers preferred not to be a cooperative partner. Among the partners of the cooperative there are three female fishers. The cooperative only has one employee receiving a salary. Even though, the cooperative membership rate is quite high at 80 percent (Figure 45), fishers are expected to have stronger solidarity in an isolated place like Gökçeada. Considering that around 35–40 recreational fishers, 30–40 trawlers, 15 purse-seiners, and around 30 small-scale fishers (especially those coming from Eceabat) also use Gökçeada's fishing grounds and sometimes even the fishing shelter, it should be questioned why the local fishers do not have more ownership of the island's

only cooperative. While all fishers who are not cooperative partners earn their living solely from fishing, it was observed that some of the cooperative member fishers have some additional income sources. Gökçeada Fishery Cooperative is a partner of Çanakkale Fishery Cooperatives Regional Union, but the head of the cooperative believes that they do not benefit from that partnership as they do not have any cooperation or solidarity with any other cooperatives in the region.

There is a fishing shelter that the cooperative rents/operates. The shelter in question has been rented by the municipality and transferred to the cooperative. The cooperative does not provide any marketing services. Marketing is carried out by middlemen (fishmongers) who buy from the fishers and sell to customers. The most important services provided by the cooperative are in providing warehouses for fishers to use, port services, boatyard and ice supply. According to the head of the cooperative, the cooperative has partially fulfilled its objectives, such as "protecting their rights by being a union, ensuring unity and solidarity among fishers". However, none of the aims such as maximizing the common interest, marketing the products of the partners at the best price, preventing illegal fishing, renting and operating the shelter have been successful. The head of the cooperative states that he, as well as all of the boards directors, or the cooperative employees did not attend any cooperative training course, and they do not even know who or which institution provides such training. According to the head of the cooperative, the most important characteristics (in order of importance) which are taken into account when evaluating the executive success of the cooperative are:

1. success in lobbying activities; and
2. degree of closeness with official institutions.

These factors are followed by

3. the manager's capabilities (planning, analysis ability, rational thinking, etc.);
4. achievement of meeting the objectives for the period;
5. partner satisfaction;
6. marketing success for obtaining high prices; and
7. the success of combating illegal fishing.

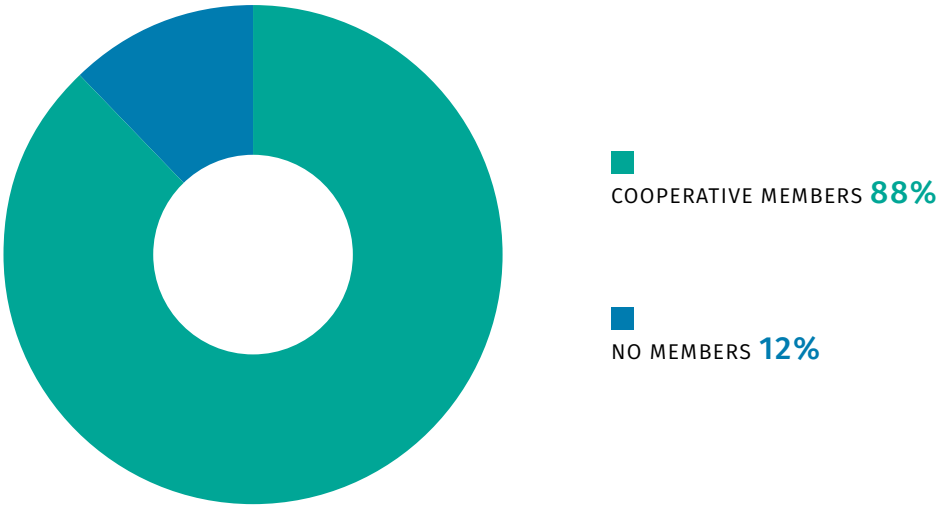
The president of the cooperative explained the selection criteria used for electing a chairman, or board members of the board of directors of this cooperative in Gökçeada. According to him experience, education and age of the manager are not important. Rather, their relationship with fishers, communication skills, followed by also being a fisher, having experience in fishing and being a reliable person are most important characteristics. According to the interviews made with the cooperative management, the issues that the cooperative sees regarding fishing are indicated in Table 10.

Table 10. Problems related to fisheries according to the Gökçeada Fishery Cooperative Management

NO PROBLEM!	PROBLEM!
Exotic Species (Pufferfish, lionfish etc.)	All kinds of illegal fishing; violation of space under the name of recreational, with trawls and purse seiners, etc.
The fishing grounds being a narrow and limited area	Current legal regulations on fisheries
Having no cooperatives training	Insufficient financial resources
Having no cooperatives building	Disputes and differences between fishers
The absence of an auction area	Not enough fish, overfishing
The absence of an icehouse	Increase in fishing power and capacity
Not having a boatyard with the desired features	Lack of a social facility
Tax issue	The shelter does not belong to the fishers
Sea pollution	Inability to produce enough projects
Aquaculture plants	Level of protection-control services
Not being able to provide marketing services; auction, retail, wholesale, etc.	Brokers / fish sellers and low prices
	Rules and regulations regarding fishing
	Climate change

Although the cooperative membership rate amongst fishers is quite high (88 percent) in Gökçeada (Figure 45), 41 percent of the fishers do not think that the cooperative is effective in achieving its goals. Only 21 percent of the members find the cooperative successful in this sense.

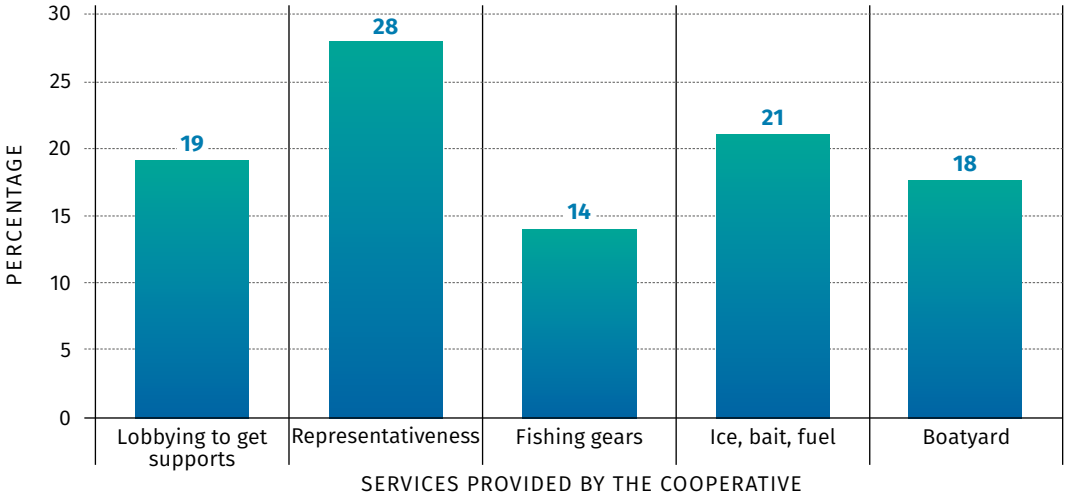
Figure 45. Percentage participation of fishes in the local Cooperative



Source: Authors' own elaboration, 2021.

Cooperative members rated the services received from the cooperative including representation in the eyes of public authority and negotiations for access to assistance and support, as well as facilitating access to fuel, fishing gears, ice, bait and boatyard. Figure 46 shows that 28 percent and 19 percent of surveyed fishers found the cooperative successful in terms of representativeness and lobbying to get supports, respectively (Figure 46).

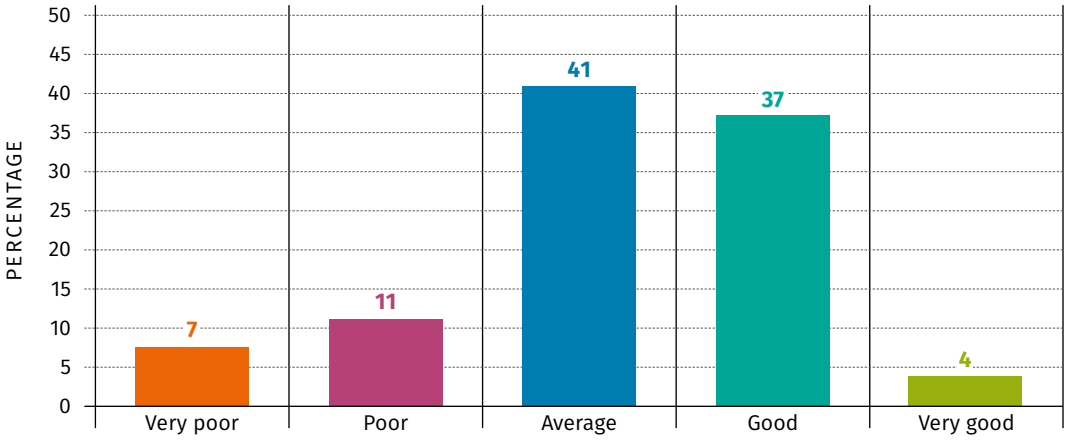
Figure 46. Percentage of fishers found cooperative successful in terms of services they received from the cooperative



Source: Authors' own elaboration, 2021.

The fishers in the cooperative generally rated the representation of their views by the cooperative at a moderate or positive level (Figure 47).

Figure 47. Perception of fishers regarding how effectively their own views are represented by their cooperative



Source: Authors' own elaboration, 2021.

Çanakkale PDAF- Gökçeada Fisheries and Aquaculture Branch Directorate (FABD)

With Law No. 1380 on Fisheries, enacted in 1971, the Ministry of Agriculture and Forestry (MoAF) was given the authority and responsibility to make legal arrangements with the aim of protecting fisheries resources and ensuring sustainable fisheries. The DG-Fish was established within the organizational structure of the Ministry. With the establishment of DG-Fish, FABD in 2015, the audit infrastructure has also started to develop rapidly. In this context, a fisheries control boat has been purchased and put into service. In addition, FABDs have been established in 43 provinces, including Çanakkale. In this context, a fishery engineer was employed in Gökçeda, which is located within the provincial borders of Çanakkale.

Within the scope of the "Clearing the Seas from Abandoned Fishing Gear Project" initiated by the institution as of 2014, scuba dives were made in the Dardanelles Strait and at the entrances of Marmara Sea and the Bosphorus Strait at depths between 0–39 m. Between 2016–2018, 37 sites were surveyed covering a total area of 484 700 m², and approximately 17 420 m² ghost nets were retrieved from the seas. It is important to stop these lost fishing nets from continuing to damage the ecosystem by continuing to fish. A Fisheries Control and Inspection Boat named "*KONTROL 17*" belonging to the Provincial Directorate was used to determine the coordinates of the ghost nets and to remove them from the sea.

In addition to routine and notification-based fisheries inspections, simultaneous and cross inspections are carried out with mobile inspection teams formed under the coordination of the directorate in the districts where fishing activities are intense. In addition, support is received from the Coast Guard Command, Gendarmerie and Police Forces authorized by the Fisheries Law No. 1380 in inspections, and joint inspections are also sometimes carried out. As a result of these inspections carried out in 2017, illegal fishing was detected for approximately 14 000 kg bivalves (grooved carpet shell, Mediterranean mussel, etc.), 5 020 kg sea cucumber, 1 200 kg miscellaneous fish, 25 kg octopus and 70 kg of other taxa totalling 20 340 kg in illegal fishery products. Also, 2 300 m of miscellaneous fishing nets, 15 fyke nets, 3 scoop nets, 1 diving compressor (with 100 m hose), 6 otter boards, 4 trawl nets, 2 inflatable boats (with oars), 5 diving suits, 2 pairs of flippers, 2 snorkels and 2 diving masks were confiscated.

MoAF-DG-Fish is a legal and important stakeholder, and the PDAF-FABD, which is its structure in the provinces, will be one of the most important stakeholders both in the process of the creation of an EAF-based fisheries management plan and in the implementation of the plan.

İstanbul University, Faculty of Aquatic Science, Gökçeada Marine Research Unit

Gökçeada Marine Research Unit, formerly Gökçeada Sponge Research Institute, affiliated with the Faculty of Water Sciences of Istanbul University, was established in 1971 under the request and recommendations of the National Security Council, under the Hydrobiology Research Institute of the Istanbul University Faculty of Science. In 1983, it was affiliated with the school established under the name of Istanbul University School of Fisheries.

Gökçeada Marine Research Unit, located on the coast of Kaleköy in the northwest of the island, consists of a 2-storey administrative building consisting of two laboratories, three offices, a seminar and conference hall, a 3-storey guest house with a 12-bed capacity, a workshop and 3 lodging buildings. In addition, there is an 11 m long wooden "*Fırtına IU*" boat and a 5 m fiber speedboat used for research. There are five personnel employed here also.

Sea sponge fishing and sponge cultivation studies started in 1972 and lasted until 1992 in Gökçeada, which was a very important place for the Aegean Sea sea sponges fishery, and provided an important contribution to the economy.

Some of the center's ongoing studies include fish and biodiversity sampling, and the creation of biological inventory, weekly oceanographic measurements (temperature, salinity and dissolved oxygen values), and sea-level measurements are conducted there at the mareograph station established in Kaleköy. Within the scope of the Meteorology and Oceanography Network of Excellence Pilot Project, the pollution ecosystem dynamics of the circulation, mixing and transport mechanisms of the seas and the atmosphere were monitored. In addition, the effects on biogeochemical processes, contributions to the physical climate system, and the effects that will allow continuous monitoring of regional climate variables were investigated. Establishment of a satellite and ground observation data assimilation station in Kaleköy Port, which provides up-to-date data, are only a few of the important contibutions carried out on the island.

The main coastal fishing activities carried out with the *Fırtına İÜ* vessel are as follows: the calculation of fishing efficiency of longlines was undertaken by using various sizes of hooks and studying discard rates. Also the use of cages were introduced instead of using lobster nets (a type of trammel net) which are harmful to the ecosystem in Gökçeada, which is the most important fishing area of lobsters in Turkey. In addition to these, trawl surveys were carried out around Gökçeada to determine changes in the catch composition and amounts of discards.

Çanakkale Onsekiz Mart University, Gökçeada College of Applied Science, Department of Fishing Technology

Located in Gökçeada, this scientific institution is one of the most important stakeholders in fisheries in Gökçeada, with important facilities, including a research vessel, experienced scientists with field knowledge on fisheries resources, and a range of relevant projects.

Gökçeada Diving Center

This center was established in 2009 and the owner and staff of the center are also engaged in recreational and professional fishing during the entire year. This diving center played a key role in introducing Turkey's first and only underwater national park to underwater lovers. All of its employees are locals who are experts in their field with unparalelled knowledge about the underwater habitats of Gökçeada. They conduct regular scuba diving trips around the entire island and some of the main dive sites are: Peynir Kayalıkları (Kaşkaval Cape), Pirinç Burnu, Şeytan Kayaları, İnce Burun, Gizli Liman, Akyarlar, Yüzen Kayalar, Kefaloz, and some sites in Gökçeada Marine Park (Mavi Koy, Mavi koy Tünel, Yıldız Taşları, Yelken Kaya).

Turkish Marine Research Foundation (TÜDAV)

TÜDAV was established in 1997 to conduct research on marine sciences in Turkey, to protect marine life, to carry and protect the maritime culture and help communicate the maritime love to the society, especially to future generations. Since its establishment, the foundation has published 56 books on marine issues, 38 of which are in English and 18 in Turkish.

The Foundation has been and continues to be carrying out many research and conservation projects supported by international organizations such as the United Nations Environment Program (UNEP) and United Nations Development Program (UNDP) and the European Union as well as private sectors. TÜDAV has also taken the title of observer of the Mediterranean Action Plan (MAP), the International Commission for the Conservation of Atlantic Tuna (ICCAT) and the United Nations (UN).

The Foundation also engages in training activities on the conservation of the seas through summer schools and seminars, has given marine conservation seminars to 10 000 students only during the 2003–2004 period, and distributed the book titled "Our Seas" to primary schools.

The Foundation conducts studies on sustainable fisheries, especially in the Turkish Straits region and the Black Sea. In addition, it strives for the implementation of

responsible fishing principles in Turkey by providing seminars. Cooperation is made with relevant institutions to prevent ship-based pollution and to develop the MARPOL 1973–78 convention.

The Foundation organizes workshops and courses and develops policies on many current issues such as pollution in the Turkish straits, marine biodiversity, sustainable fisheries, marine protected areas and maritime law.

TÜDAV played an important role in the establishment of Gökçeada Marine Park. The foundation had correspondence and negotiations with many institutions of that period (1997–1999), including the Ministry of Agriculture and Rural Affairs (now the Ministry of Agriculture and Forestry) and the Ministry of Environment (now the Ministry of Environment and Urbanization). After the necessary permissions were obtained, the foundation provided the establishment of Gökçeada Marine Park in the Official Gazette dated 21 February 1999 and numbered 23618.

In addition to the above-mentioned stakeholders, the following institutions are considered as importrant stakeholders: *Çanakkale Onsekiz Mart University-Faculty of Arts and Science, Department of Biology, Dokuz Eylül University-Institute of Marine Science and Technology*, and the *Ege University-Faculty of Fisheries*, which manages the EAF pilot project in Gökçeada.

2.12 Legal and administrative framework

Information on legal and administrative frameworks regarding fisheries is reported by two studies: "*Fisheries Management in Turkey*" (Ünal and Göncüoğlu, 2012) and "*Implementation of the ecosystem approach to fisheries for the small-scale fisheries in Gökova Bay, Turkey: baseline report*" (Ünal *et al.*, 2019). According to these studies:

> *Central fisheries management is implemented in Turkey. All fishing rules and guidelines are based on the Fisheries Law No. 1380, which came into effect in 1971. The law was amended with the law 3288 in 1986, 4950 in 2003 and 7191 in 2019. These basic laws constitute the legal basis for the regulation of fishing licenses, regulation of fishing gear, inspection and control, penalties, prohibitions, restrictions and obligations (MARA, 2009; Ünal and Göncüoğlu 2012).*
>
> *The current fisheries law and its predecessors form the necessary foundation for effective fisheries management. Today, DG-Fisheries is the main government agency responsible for fisheries management. It supervises the provisions of the fisheries regulations and carries out the duties of fishing conservation-control services,*

monitoring, supporting and providing technical assistance. However, responsibility for fisheries surveillance is shared among several other agencies such as the Coast Guard and the Gendarmerie.

The Ministry of Development selects an expert committee consisting of representatives of NGOs, fishery cooperatives, universities, the Coast Guard and other relevant institutions and stakeholders that determine the objectives of the fisheries management policy in Turkey. The overall goal is to manage fisheries resources in a sustainable way. Therefore, regionally-based pre-fisheries management plans (for the Black Sea, Marmara Sea and the Mediterranean) need to be designed, with sustainability at the forefront of the goal of rebuilding depleted stocks at a predetermined historical level. However, in practice, the sustainability of marine resources is not addressed by any concrete precaution. Management plans that try to counter severe resource depletion are therefore much needed at the genre, sectoral and regional levels, and these plans must be considered for implementation.

Thanks to Turkey's candidacy for EU membership, the most notable achievements in improving national maritime policy stemmed from the institutional twinning program in 2008, which promoted alignment with the EU acquis.

Biodiversity is rich in the Mediterranean region, but productivity is poor. The situation in the Black Sea is the reversed; biodiversity is very poor, but the remaining few pelagic stocks show high productivity, particularly anchovy and sprat, at least for the time-being. Therefore, different regions need different management practices to develop their respective fishing stocks. Unfortunately, to date, national fisheries management policies have not specifically designed different management systems to promote the diverse nature of ecosystems.

A management plan for European anchovy in the Black Sea was prepared after the completion of a five-year stock assessment project for the species. Until now, fisheries co-management has only been at the "consultative level" at the national scale. This means that the central management authority asks the opinion of the stakeholders but makes all decisions on its own. However, according to Ünal and Kızılkaya (2019) and Ünal and Ulman (2020), in the Gökova Marine Protected Area, six Closed Fishing Areas were established, especially by local fishers, NGOs, academics and other stakeholders. A strong co-management movement has developed since 2009 and 2010. During this period, fishers and other stakeholders were introduced to the concept of joint 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 No Fishing Areas. The facilitators of the co-management meetings were independent, experienced fishers and leaders with an influence among fishers stakeholders. In Gökova MPA, examples of joint management success stories from different parts of the world, especially Mediterranean countries with similar characteristics, were presented with the agreement and participation of almost all stakeholders. As a result, six areas were agreed and closed to fishing activities. Local fishery cooperatives made a decision by the board of directors, enabling DG-Fish to take this decision and put it into effect. In order to support the sustainability of fishing in Gökova Bay, the closure of six areas to fishing activities which were selected together with fishers, was published in the Official Gazette in 2010 and announced in the Notification on Commercial Fishing.*

Efforts to prepare and implement a Fisheries Management Plan (Gökova Marine Protected Area Small Scale Fisheries Management Plan) that takes into account the Ecosystem Approach in Fisheries for small-scale fisheries within the Gökova MPA in 2018 are very important initiatives undertaken within the legal and administrative framework of fisheries management. The new fisheries law, revised in 2019, is expected to support such initiatives in the example of Gökova and Gökçeada. In this direction, it is highly probable that studies on the preparation and implementation of regional or even local-small scale fisheries management plans that adopt the ecosystem approach to fisheries will increase.

2.13 Management measures

Notification on Commercial Fishing (Number 5/1)

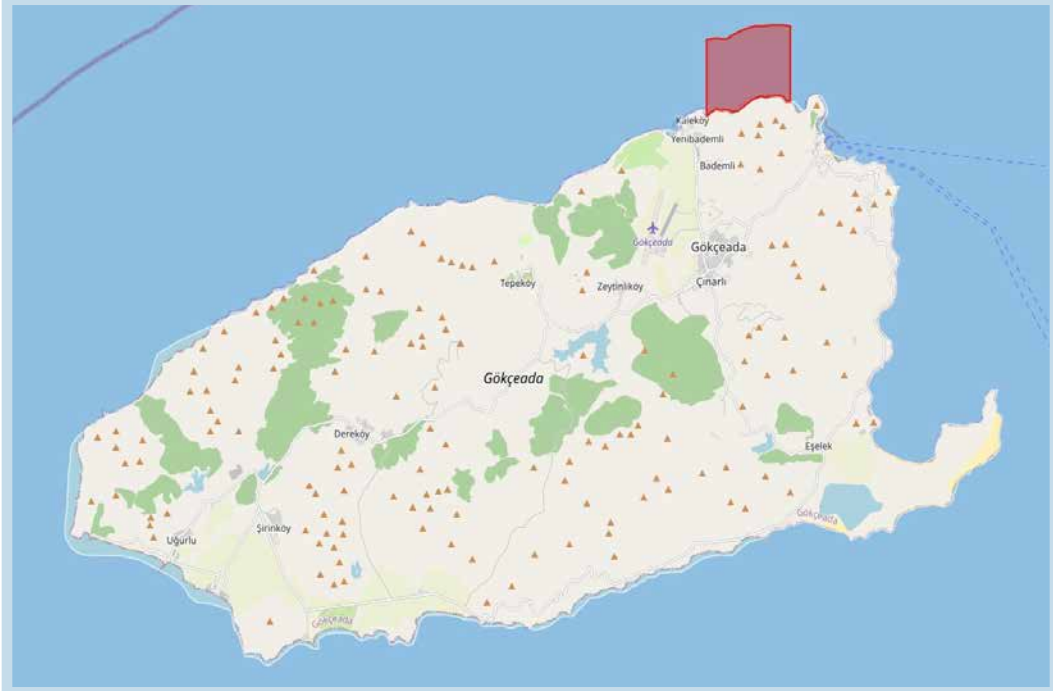
All types of rules and regulations regarding the management of Gökçeada fishing are included in the Notification Number 5/1 on Commercial Fishing (No. 2020/20; TOB, 2020a). These management measures concerning the fishers and fisheries of Gökçeada are given below in detail.

Article 5

(1) Spatial fishing bans in the Aegean Sea are as follows:

s) Fishing is forbidden in Çanakkale Province, Gökçeada District; in the area of 1 mile distance as from the coast between Yıldız Cove (40° 14.186´ N - 25° 54.230´ E) and Çiftlik Cove (40° 14.432´ N - 25° 56.112´ E) where **Gökçeada** Marine Park is located (Figure 48).

Figure 48. No fishing zone between Yıldız Bay and Çiftlik Bay where the Marine Park is located



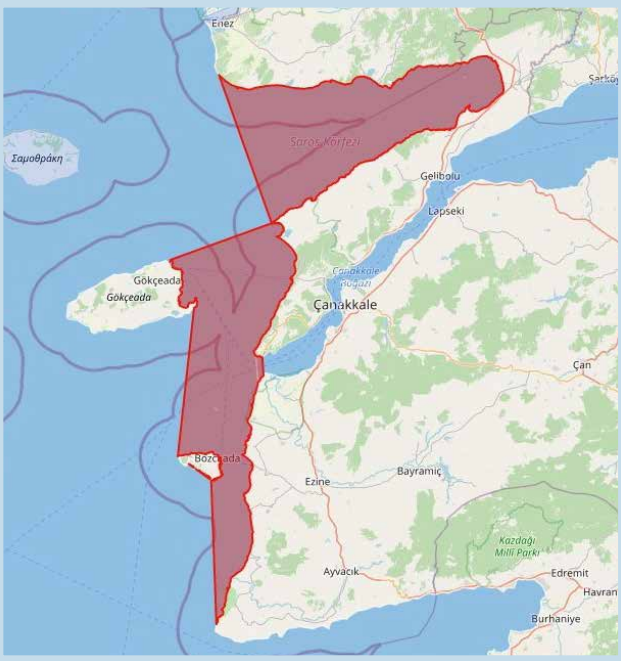
Source: TOB, 2020a.

Article 9

(3) In the Aegean Sea, fishing is prohibited in the folloing areas:

Trawling is prohibited in the area that is in the east of the line uniting Babakale (39° 28.772'N - 26° 04.013'E), Bozcaada Eskifener Cape (39° 47.319' N - 26° 03.137' E), Bozcaada West Cape (39° 50.259' N - 25° 57.754 'E), **Gökçeada** Aydıncık Cape (40° 09.801'N - 26° 00.554'E), Gökçeada Kaşkaval Cape (40°14.479'N-25°56.556'E), Büyük Kemikli Cape (40° 18.979'N - 26° 12.905'E), and Boztepe Cape (40° 37.140'N - 26° 04.403'E), (Figure 49)

Figure 49. Areas closed for demersal trawl fisheries in the region



Source: TOB, 2020a.

In the territorial waters north of latitude passing through Babakale (39 ° 28.772 'N), all types of trawling and fishing activities are prohibited between 20.00 and 05.00.

Article 10

(1) During the Notification period in addition to the places specified in Article 9, in all territorial waters open to trawl fishing, between April 15 and September 15 in the Mediterranean, and between April 15 and August 31 in our other seas, fishing by use of bottom trawl is prohibited.

(3) In the Aegean Sea:

ğ) In **Gökçeada**; in the north of the island, in the territorial waters between Kömür Cape (40° 09.524' N-25° 40.588 'E) and Kaşkaval Cape (40°14.479' N-25°56.556' E) in 1.5 mile distance from the coast, and in the other side of the island, in the area that is 3 miles inside, trawling is prohibited (Figure 50)

Figure 50. Areas with trawling prohibition around Gökçeada and along the Aegean coasts

Source: TOB, 2020a.

(5) For bottom trawler nets that are to be used in the Aegean Sea and Mediterranean Sea, for diamond meshed nets, the minimum mesh size is 44 mm, for square meshed nets, the minimum mesh size is 40 mm, and mesh size for the cover around the cod-end has to be at least double the mesh size.

(8) On bottom trawls, it is forbidden to use nets that have smaller meshes than the minimum mesh size and to have any net other than the cover or cod-end net in the pocket of the net.

(9) It is forbidden to use fishing line (one layer-fishing line) on pockets of bottom trawls.

(10) It is forbidden to have bottom trawls on board that are smaller than minimum mesh size and to tow the bottom trawl with more than one ship/boat.

(11) It is forbidden to fish with bottom trawls in waters deeper than 1 000 metres.

Article 12

(5) It is forbidden to use purse seines exceeding 164 metres (90 fathoms) of net depth. However, purse seines used for fishing tuna species [Atlantic bluefin tuna, skipjack tuna, bullet tuna, and albacore] are exempted.

(8) Issues related to encircling trammel net are listed below:

a) Fishing with encircling trammel nets are prohibited between April 15 and May 15.

b) The use of encircling trammel nets with a depth of more than 22 m (12 fathoms) for fishing is prohibited in the period when the use of encircling trammel net is permitted and the use of purse seiners is prohibited.

c) The use of encircling trammel nets in the area specified in item (b) of the second paragraph of this article is prohibited.

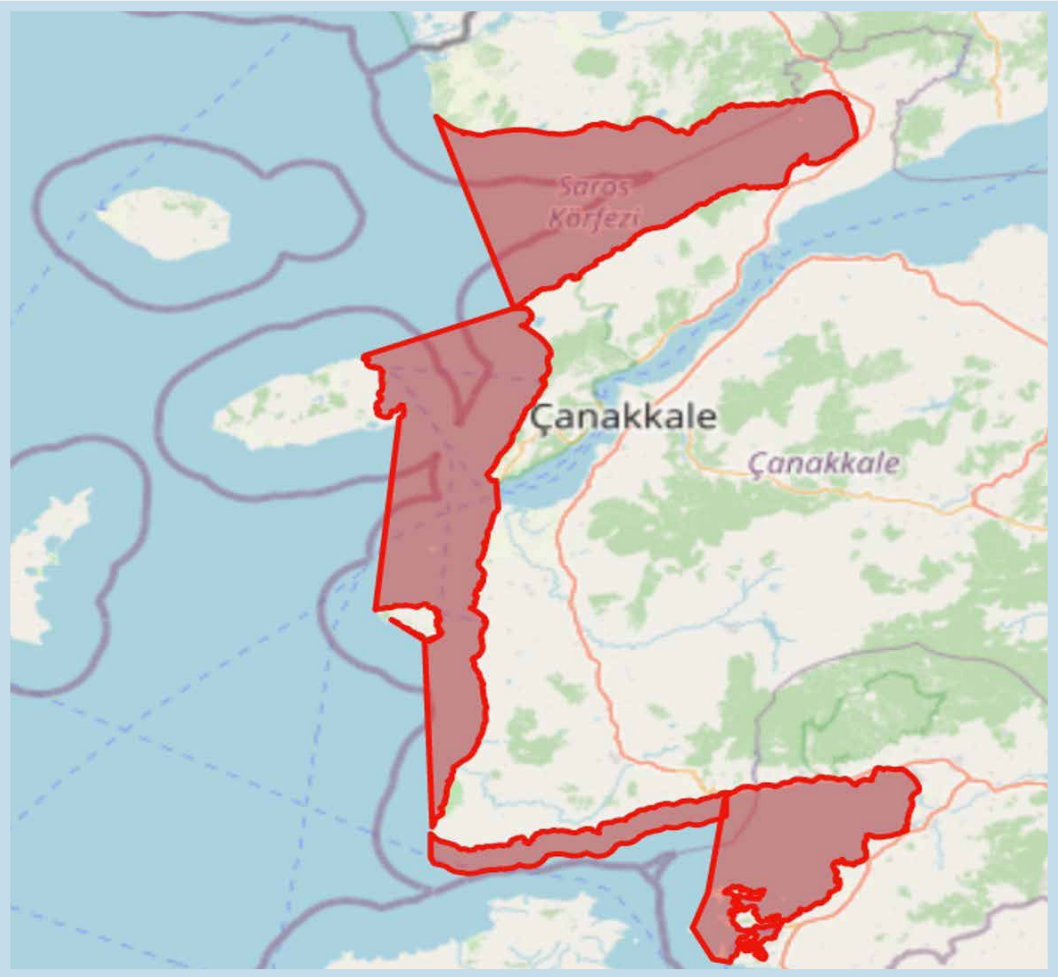
(9) Fishing is prohibited by covering a certain area with using encircling nets, diving into these nets and selectively collecting the product into a narrow area on the shore (a method called handling or elemination).

Article 13

(2) In the Aegean Sea:

f) It is forbidden to fish by light in the area to the east of the line connecting Babakale (39° 28.772' N- 26° 04.013' E), with Cape of Bozcaada Eskifener (39° 47.319' N - 26° 03.137' E), Bozcaada West Cape (39° 50.259' N - 25° 57.754' E), Gökçeada Cape of Aydıncık (40° 09.801' N - 26° 00.554' E), Gökçeada Cape of Kaşkaval (40° 14.479' N - 25° 56.556' E), Cape of Büyük Kemikli (40° 18.979' N - 26° 12.905' E) and Cape of Boztepe (40° 37.140' N -26° 04.403' E) (Map-46-7) (Figure 51)

Figure 51. Areas where fishing by light is prohibited in the region



Source: TOB, 2020a.

(6) Fishing vessels that fish with lights can only use one ship as a light ship. They cannot use another ship as a light ship, except for the light ship specified in the permits.

(7) Service boats on purse seiners can also be used as light boats. If the service boat of the fishing vessel is used as a light boat, another vessel cannot be used as a light boat.

(8) It is mandatory to have personnel in the light boats and to have a distance of at least 200 m between the light boats of two separate sets.

(9) It is forbidden for the vessels that do not have a light fishing permit to illuminate the sea surface with more than 100 watts of illumination to support fishing vessels that fish with purse seiners.

(10) For fishing vessels that will fish with light, it is obligatory to apply to one of the provincial directorates where they intend to fish and obtain the fishing "Permit Certificate" stated in Annex-2. Except for the sixteenth paragraph of this article, fishing vessels that do not have a purse-seine net are not permitted to fish with light, and without these nets, fishing activities with light cannot be carried out.

(11) The use of illumination power up to 100 watts in fishing does not require any permit. Light enhancement to be used in areas where fishing with light is allowed; including main boat, auxiliary and carrier boats may not exceed 8000 watts in total.

(12) The light sources to illuminate the ship deck must be fixed without any mobility.

(13) Fishing with light is only permitted with illumination above water surface.

(14) Lighting is prohibited in waters shallower than 30 m and closer than 300 m to the cages of fish farms.

(15) In fishing with purse seine nets, a single 12 or 24 volt lamp less than 100 watts, which is lit and extinguished for a short time to prevent the fishes from escaping from the mouth of the net, is not considered as a light source.

(16) The procedures and principles regarding squid fishing to be performed by using light on the vessel with mechanized fishing rods in areas where fishing with light is allowed shall be determined by the Ministry.

(17) Light sources less than 50 watts or a 1 LPG source lamp named as "*Lüks*" can be used as a light source in fishing vessels under 12 m.

(18) Vessels without a light fishing permit cannot be equipped with light fishing equipment.

(19) The use of white light as a light source in fisheries is prohibited.

Article 15

(1) It is obligatory that the longlines left in the sea are marked with a pennant (buoy) during the day and with a lighted buoy at night.

(2) It is forbidden to use hooks smaller than 7.2 mm in size (mouth opening) in fisheries fishing with longlines.

(3) It is forbidden to use hooks with a size (mouth opening) smaller than 2.8 cm in longlines used in swordfish fishing.

Article 16

(1) The species listed in Table 11 are prohibited from fishing, landing, retaining on boats, transporting and selling in all waters, including inland waters. Exceptions given by international conventions to which we are a party are excluded from this regulation.

Table 11. Prohibited species

Turkish names of species	Scientific names of species
Büyük camgöz (kum) köpek balığı	*Carcharhinus plumbeus*
Güneşlenen köpekbalığı	*Cetorhinus maximus*
Köpek balıkları	*Galeorhinus galeus, Prionace glauca, Alopias superciliosus, Carcharhinus longimanus, Carcharhinus falciformis, Sphyrna zygaena*
Dikburun köpek balığı	*Lamna nasus*
Mahmuzlu camgöz	*Squalus acanthias*
Deniz kaplumbağaları	*Caretta caretta*
	Chelonia mydas
	Dermochelys coriacea
	Trionyx triunguis
Deniz çayırları	*Posidonia oceanica*
	Zostera noltei
Orfoz	*Epinephelus marginatus*
Köpek balıkları (Kıkırdaklı Balıklar ve Yassı Köpek Balıkları)	*Squatina oculata, Squatina squatina, Squatina aculeata, Rhinobatos rhinobatos, Rhinobatos cemiculus, Oxynotus centrina, Alopias vulpinus, Isurus oxyrnchus, Raja clavata, Squalus blainville*
Mantalar	*Mobulinae (Mobula mobular, Mobula japonica)*
Kırmızı yıldız	*Asterina pancerii*
Kırmızı mercan	*Corallium rubrum*
Siyah mercan	*Savalia savaglia*
Deniz atı	*Hippocampus hippocampus*
Minare	*Cerithium vulgatum*
Şeytan minaresi	*Gourmya yulgata*
Deniz kulağı	*Haliotis tuberculata lamellosa*
Pina	*Pinna nobilis*
Mühreler	*Lamellaridae*
Maya	*Maja squinado*
Akdeniz foku	*Monachus monachus*
Yunus ve Balinalar	*Cetacea*
Yağlı balık	*Garra rufa*
Yağ balığı	*Pseudophoxinus* sp.

Article 17

(1) It is forbidden to fish, retain onboard, land, transport and sell fishery products whose minimum fishing length and weight are specified in Table 12 below.

Table 12. Minimum landing size and and minimum landing weight restrictions for commercial species

Turkish names of species	Scientific names of species	Minimum landing size (cm)	Minimum landing weight (kg)
Ahtapot	*Octopus vulgaris*	-	0.75
Akya	*Lichia amia*	40	
Bakalyaro (Berlam)	*Merluccius merluccius*	20	
Barbunya	*Mullus barbatus*	13	
Çipura	*Sparus aurata*	20	
Deniz böceği	*Palinurus vulgaris*	25	
Dil	*Solea solea*	20	
Eşkina	*Sciana umbra*	35	
Hamsi	*Engraulis encrasicolus*	9	
İstakoz	*Homarus gammarus*	25	
İstavrit İstavrit (Karagöz İstavrit)	*Trachurus trachurus* *Trachurus mediterraneus*	13	
İstiridye	*Ostrea edulis*	6	
Karagöz	*Diplodus vulgaris*	18	
Kefal (Diğer kefaller)	*Mugil (Oedalechius) labeo* *Chelon labrosus* *Liza ramada* *Liza saliens*	20	
Kefal (Has kefal)	*Mugil cephalus*	30	
Kefal (Sarıkulak kefal)	*Liza aurata*	30	
Kılıç	*Xiphias gladius*	125*	-
Kırlangıç	*Chelidonichthys lucerna*	18	
Kırma (Kırmızı) mercan	*Pagellus erythrinus*	15	
Kidonya	*Venus verrucosa*	3	
Kolyoz	*Scomber japonicus*	18	
Kum şirlanı (Tellina)	*Donax trunculus*	2.5	
Lagos	*Epinephelus aeneus*	50	
Levrek	*Dicentrarchus labrax*	25	
Lipsöz	*Scorpaena scrofa*	15	
Lüfer	*Pomatomus saltatrix*	18	
Mavi yengeç	*Callinectes sapidus*	13	
Mavi yüzgeçli ton (Orkinos)**	*Thunnus thynnus*	115*	30
Mezgit	*Merlangius merlangus*	13	

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Turkish names of species	Scientific names of species	Minimum landing size (cm)	Minimum landing weight (kg)
Midye (Beyaz kum midyesi)	*Chamelea gallina*	1.7	
Minekop (Kötek, Karakulak)	*Umbrina cirrosa*	45	
Palamut	*Sarda sarda*	25	
Pisi	*Pleuronectes* spp.	20	
Sardalya	*Sardina pilchardus* *Sardinella aurita*	11	
Sargos	*Diplodus sargos*	21	
Sarıağız (Halili, Muskar, Grenyüz)	*Argyrosomus regius*	25	
Sarıkuyruk	*Seriola dumerili*	30	
Sinagrit	*Dentex dentex*	35	
Tekir	*Mullus surmuletus*	11	
Uskumru	*Scomber scombrus*	20	
Yazılı orkinos	*Euthynus alletteratus*	45	

* Fork Length.
**One of the measures brought for height and weight is taken as a basis.

(2) Of the species whose minimum height and weight are specified for fishing: small sizes are exempted at 15 percent by weight for European anchovies, European pilchard and horse mackerel, and 5 percent by weight for other fishery products. For Atlantic bluefin tuna fish weighing between 8–30 kg or 75–115 cm, an exception is at most 5 percent. The determination of exceptions is based on the product amount in Atlantic bluefin tuna and the amount of products controlled in other species.

(3) In sea fishing, up to 5 percent by weight of the total fishery products caught incidentally (unintentionally) as by-catch, excluding the species whose fishing is prohibited by article 16, is allowed.

Fishing puffer fish species (*Lagocephalus sceleratus, Lagocephalus spadiceus, Lagocephalus suezensis, Lagocephalus guentheri, Lagocephalus lagocephalus, Sphoeroides pachygaster, Tylerius spinosissimus, Torquigener flavimaculosus*) are subject to the permission from the Ministry and the procedures and principles regarding fishing them are determined by the Ministry.

(5) It is forbidden to fish, land and sell ocean sunfish (*Mola mola*).

Article 19

(1) In all our territorial waters, between 1 April and 31 August, Atlantic bonito and larger sizes of Atlantic bonito fishing is prohibited by any type of fishing gear, including stationary uncovered pound nets. However, Atlantic bonito fishing by multi-hooked line is allowed between August 15–31.

Article 23

(1) Between 15 April and 15 May, leerfish and greater amberjack fishing is prohibited.

(3) Between 1 January – 14 August, common dolphinfish fishing by all means of fishing is prohibited.

Article 24

(1) It is forbidden to fish swordfish and keep the catch onboard or transfer to another ship, or land between 15 February – 15 March and 1 October – 30 November.

(2) It is obligatory to obtain the fishing "Permit Certificate" in Annex-2 from the provincial directorate for which the license is issued for the vessels that will engage in swordfish-fishing.

(3) The Ministry may impose a partial or general ban on swordfish fishing and activities of permitted fishing vessels pursued under the International Commission for the Conservation of Atlantic Tuna (ICCAT) of which we are a member.

(4) Bottom trawl nets, otter boards and winch, and bottom fish cannot be kept in swordfish fishing vessels during these activities.

(5) The use of drift-nets in swordfish fishing is prohibited.

Article 28

3) The Aegean Sea and Mediterranean:

ç) For fishing vessels to be used in sea snail fishing, it is obligatory to obtain the fishing "Permit Certificate" in Annex-2 from the provincial directorate, where the vessel license has been issued, and fishing must be carried out between 05.00 and 20.00 hours.

d) It is forbidden to have harpoons on fishing vessels engaged in sea snail fishing.

e) During the period when the beam trawl fishery is prohibited, in the fishing vessels that are permitted to catch sea snail by diving; it is obligatory for towing boom, crane, steel rope and davit to be sealed.

f) Fishing species other than the target species is prohibited in sea snail fishing with beam trawl. In case of violation, the fishing permit is canceled. A new permit is not issued for the fishing period in which the canceled permit is valid.

Article 29

(1) European lobster and spiny lobster fishing is prohibited in all territorial waters, except for the period between 15 April and 1 September. However, this temporal prohibition is not imposed for fishing Norway lobster (*Nephrops norvegicus*).

(2) European lobster and spiny lobster fishing is forbidden in our territorial waters between Cape of Kömür (40°14.479' N - 25°56.556' E) and Cape of Kaşkaval on the North Side of **Gökçeada** within 1.5 miles from the shore; and within 3 miles from the shore on other sides of the Island (Map-40-9).

Article 30

(1) Octopus fishing is prohibited between 1 April and 31 October.

(2) Octopus fishing by diving using tanks, hookahs and similar artificial air sources are prohibited.

Article 48

(1) It is obligatory that the license number that is issued for the vessel is written on a plate which can be seen from the right, left and top of the boat.

(10) Owners/equippers of fishing vessels with a length of 12> m who are licensed to engage in fishing have to keep a logbook of the records of their fishing activities and the species they fish. It is obligatory to keep the logbook according to the principles to be determined by the Ministry, pursuant to Article 28 of Law No. 1380. Logbooks will be taken from the provincial directorates. It is obligatory to provide the logbook to the Ministry. If required by the Ministry, it may be obligatory to keep a logbook for smaller fishing vessels too.

(12) Commercial fishing underwater by diving with a tank, hookah, mask, harpoon, using a snorkel, and pneumatic spearguns is prohibited. Those who will collect aquatic products other than fish by diving must have their diving certificate obtained within the scope of the Turkish Underwater Sports Federation Regulations published in the Official Gazette dated 2/9/1997 and numbered 23098.

Notification on Recreational Fishing (Number 5/2)

When it comes to the measures, rules and regulations regarding the management of Gökçeada fishing, the Notification Number 5/2 on Recreational Fishing (No. 2020/21; TOB, 2020c) should also be taken into account. In this context, these management measures regarding recreational fishing, which concern fishers and fisheries in Gökçeada, are detailed below.

Article 3

(1) In this Notification:

b) Recreational fisher: means the real person in the recreational fishing activity,

c) Recreational fishing: means fishing activity in which the caught product is not sold, non profited, and caught for sports or recreational purposes.

ç) Recreational fishing competition: means fishing competition organized to encourage and develop recreational fishing among recreational fishers, in accordance with the rules set forth in this notification. Fishing competition organized by public organizations, recreational fishing associations or federations with or without a prize,

d) Recreational underwater fisher: means the person who dives from sunrise to sunset, in our territorial waters, where it is not prohibited within the scope of this notification and for security reasons; diving without using an additional air source other than his/her own breathing and fishing using a speargun and auxiliary equipment,

l) Recreational fishing: means the activity carried out in the sea, lagoons, rivers, dam lakes, lakes and regulated areas where people participate voluntarily for recreation, entertainment and sports purposes,

m) Sport fishing: Refers to the individual fishing activity that includes basic principles such as not harming the caught fish, returning it to the water healthy and alive, based on the rules set by the sport fishing federations.

Table 13. Bait fish species

Bait Fish	Scientific Name	Bait Fish	Scientific Name
European sprat	*Sprattus sprattus*	Tubenose goby	*Proterorhinus marmoratus*
Blenny	*Blennius* sp.	Twaite shad	*Alosa fallax nilotica*
Bleak	*Alburnus alburnus*	Round sardinella European pilchard	*Sardinella aurita*
Horse mackerel	*Trachurus* spp.		*Sardina pilcardus*
Blotched picarel	*Spicara maena*	Mossul bleak	*Chalcalburnus mossulensis*
Big-scale sand smelt	*Atherina boyeri*		*Alburnus mossulensis*

Article 7

It is free to catch the bait fish in Table 13 with the bait fish net in recreational fishing.

(3) A recreational fisher can keep at most 30 bait fishes of the species listed in Table 13 in the fish net or bait bucket.

(4) Bait fish can be caught in the period when the fishing of the targeted species is free.

(5) Bait fish length is maximum 12 cm and sizes larger than this are considered as fishable fish.

(6) Marine and freshwater fish within the legal number and size restrictions can be used for bait purposes.

Article 8

(1) It is forbidden to sell, transport and transfer to other water resources of all kinds of fishery products caught by recreational fishing.

(4) It is forbidden to keep the prohibited fishing gear and equipment in the fishing area.

(8) It is forbidden to use any kind of light for fishing purposes in recreational fishing. However, in terms of life and property safety, the light used for illumination in the boat and on the shore, provided that it does not exceed 50 watts, is not considered within this scope.

(10) Technical delegation and other diving officers of the candidate staff for the National Team of Spearfishing that determined by the Turkish Underwater Sports Federation, may be allowed to dive in accordance with the principles to be determined by the Ministry for their training activities during the camp season.

(11) National athletes of the countries invited by the Turkish Underwater Sports Federation to make joint camping within the scope of bilateral or multiple cooperation with the federations of countries affiliated to the World Underwater Activities Confederation (CMAS), may engage in fishing activities within the scope of the provisions of the tenth paragraph during the camp period.

(12) In this notification, the number of fishing gears that can be used per person cannot be more than one per person for other free-to-use fishing gears.

Article 15

(1) It is forbidden to retain and catch smaller fishery products beyond the limits of minimum size and allowable quantity specified in Table 14. The species for which a temporal ban is established within a date range, cannot be fished during the prohibited period. Species with kg shown in Maximum Allowable Catch have a 5 kg daily catch limit.

Table 14. List of marine species permitted for recreational fishing, daily limits and size, weight and temporal restrictions

English names of species	Scientific names of species	Minimum landing size (cm) /weight limit (g)	Bag limits	Temporal ban
Common octopus	*Octopus vulgaris*	750 gr	1 piece	15 April–31 Oct.
Leerfish	*Lichia amia*	40 cm	1 piece	15 April–15 May
Red mullet	*Mullus barbatus*	13 cm	Kg	-
Gilthead seabream	*Sparus aurata*	20 cm	Kg	-
Common spiny lobster	*Palinurus elephas*	25 cm	1 piece	-
Brown meagre	*Sciana umbra*	35 cm	3 piece	-
Atlantic horse mackerel	*Trachurus trachurus*	13 cm	Kg	-
Europan lobster	*Homarus gammarus*	25 cm	1 piece	-
Turbot	*Scopthalmus maximus*	45 cm	1 piece	15 April–15 June
Two-banded seabream	*Diplodus vulgaris*	18 cm	Kg	-
Grey mullet	*Muglidae*	20 cm	Kg	-
Swordfish	*Xiphias gladius*	125 cm	1 piece	15 Febr.–15 March 1 Oct.–30 Nov.
Common pandora	*Pagellus erythrinus*	15 cm	Kg	-
Atlantic chub mackerel	*Scomber colias*	18 cm	Kg	-
White grouper	*Epinephelus aeneus*	50 cm	1 piece	1 June–31 Aug.

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English names of species	Scientific names of species	Minimum landing size (cm) /weight limit (g)	Bag limits	Temporal ban
Common Dolphinfish	*Coryphaena hippurus*	50 cm	1 piece	1 Jan. – 14 Aug.
European seabass	*Dicentrarchus labrax*	25 cm	Kg	-
Bluefish	*Pomatomus saltatrix*	18 cm	Kg	-
Atlantic blufin tuna*	*Thunnus thynnus*	115 cm	1 piece	15 Oct.– 15 June
Blue crab	*Callinectes sapidus*	13 cm	Kg	-
Whiting	*Merlangius merlangus*	13 cm	Kg	-
Atlantic bonito	*Sarda sarda*	25 cm	Kg	1 April – 14 Aug.
Common dab	*Limanda*	20 cm	Kg	-
White seabream	*Diplodus sargus*	21 cm	Kg	-
Greater amberjack	*Seriola dumerili*	30 cm	1 piece	15 April – 15 May
Common dentex	*Dentex dentex*	35 cm	Kg	-
Striped red mullet	*Mullus surmuletus*	11 cm	Kg	-
Atlantic mackerel	*Scomber scombrus*	20 cm	Kg	-
Skipjack tuna	*Euthynnus alletteratus*	45 cm	2 piece	-
Other species	-	Non	Kg	-

* Each year 0.5% of the country's quota is allocated for recreational Atlantic bluefin tuna fishing. It is obligatory to have a Atlantic Bluefin Tuna Catch Document (e-BCD) issued by the Provincial/District Directorates for the Atlantic bluefin tuna that are caught. Information on the current quota amount is available on the Ministry's website (www.tarimorman.gov.tr/BSGM).

(2) For the species whose size limits are specified in Table 14, an exception is made for 5 percent smaller sizes.

(3) Limits in kg are not taken into consideration for the species with a number limit.

(4) For the species that are given a limit in terms of kg, the total catch cannot exceed 5 kg, whether single or mixed. In species with restrictions in terms of kg, if a single individual exceeds 5 kg, this individual is accepted within legal limits. In the case of the largest fish being excluded, if the total weight of the remaining fishes do not exceed 4 kg, the fish caught are accepted within the retained amount.

(5) The amount that can be detained is not the amount in which each species can be detained separately, but is the total amount of fish that an recreational fisher can take with, regardless of the number of fishing days. In cases where more than one species is caught are subject to the quantity restriction, and the fishes that are caught are considered as one species. In this case, provided that none of the fished species is more than the allowed number, the total number of fish to be detained cannot exceed 3.

(6) In cases where the species subject to number and weight limitations are caught in a mixed manner, provided that the species subject to the number limitation is not more than the number that can be detained, the total weight of the remaining fish, excluding the largest fish caught, cannot exceed 4 kg.

Article 16

(1) Except for the species with a time prohibition in Table 14, recreational fishing in the seas is not subject to time prohibition. There is no limit to fishing time during the day.

(2) The fishing gear that can be used in recreational fishing in the seas and the matters related to prohibited substances are stated below.

a) Recreational fishing in the seas can be done with all types of fishing gear such as cast nets, bait set nets, handline and speargun, excluding handline with triple-grip hook, longline, fyke net and pots.

b) It is prohibited to use or keep on board of vessels or in fishery areas all types of fishing nets, traps and explosives, lethal, anaesthetic, narcotic, stimulant, calcium carbide, quicklime, fish poison or similar substances for fishing other than those permitted by specifying their features in this notification.

c) The cast net to be used cannot exceed 3 m in height from the ground when closed, and the mesh opening cannot be < 28 mm.

(3) A recreational fisher can use a maximum of 4 fishing handlines. The number of hooks in the handlines cannot exceed 10 in multi-hooked lines and 6 in handlines.

(4) Regulations related to speargun fishing are as follows:

a) Speargun fishing is not permitted in the seas from sunset to sunrise.

b) Except a light source and snorkel, no artificial air source, air tank, hookah, any kind of breathing apparatus or spare air source can be used in fishing with spearguns.

c) It is obligatory for those who dive with spearguns or harpoons to use a buoy indicating their location.

(6) In the fishing of fishery products other than those whose fishing is completely prohibited, it is permitted to use all kinds of natural baits, manufactured natural baits and artificial baits for fishing in the sea.

Article 17

(1) Spatial (locations) prohibitions and restrictions for recreational fishing and scuba diving in the seas are as follows:

j) In Çanakkale Province, Gökçeada District; in the area 1 mile distance from the coast between Yıldız Cove where Gökçeada Marine Park is located (40° 14.186´ N - 25° 54.230´ E) and Çiftlik Cove (40° 14.432´ N - 25° 56.112´ E). (Figure 52)

Figure 52. Spatial bans included in the recreational fishing notification

Source: TOB, 2020c.

(2) It is forbidden to dive by any means, swimming or entering through any sea, waiting at cave entrances, anchoring, fishing, or the use of light in coastal caves either with underwater or above water entrances where the Mediterranean monk seals live.

(3) In order to protect cultural and natural assets; the map and coordinate list for diving areas in the Black Sea was updated and determined by the Presidential Decree dated 9/12/2018 and numbered 435, and by the President Decision No. 2339 and dated 1/4/2020 regarding the areas that are forbidden to dive in the Aegean Sea. In addition, diving and fishing for fishery products are prohibited in the regions whose coordinates have been declared in the Decree on the Implementation of Diving Prohibition in Regions Where Cultural and Natural Properties are Required to be Protected Under Water, which was put into effect with the Decree of the Council of Ministers dated 5/4/2016 and numbered

2016/8743.

(4) Fishing for fishery products by diving in ports, fishers's shelters, shelters and boatyards is prohibited.

Article 19

(1) In determining whether violations pertain to commercial or recreational sectors are made by those in charge of conservation and control; the following violations are considered commercial violations:

a) Three times or more product than the amount allowed to be retained in recreational fishery fishing,

b) The possession of more than one product by species or number of species whose fishing is completely prohibited,

c) Two times or more the allowable amount allowed in recreational fishery fishing for these species having a temporal ban,

ç) Two times or more than the number of fishing gears (excluding the number of hooks) permitted to be used in recreational fishing,

d) All kinds of barrier nets, set nets, towed nets, encircling nets and similar nets and other fishing gear permitted to be used in commercial fisheries, except for the bait set nets,

e) More than one type fishing gear whose use is prohibited in recreational fishing,

f) All kinds of explosives, lethal, stunners, narcotics, chemical substances, quicklime, electroshock and similar misdemeanors are considered within the scope of violation of fishing activities for commercial purposes, and the sanctions listed in the Law No. 1380 for these misdemeanors are applied.

3 Threats to Fisheries Sustainability

3.1 Threats to ecological wellbeing

Gökçeada is still a rather pristine island surrounded by rich marine biodiversity, which has not suffered any deterioration of its terrestrial, coastal or marine environments due to excessive construction or population impacts since most of its coasts are free from human settlement. However, this once pristinene island is coming under threat from various human stressors.

The “Maritime Strategy Framework Directive (MSFD)” was developed by the member states of the European Union. Presently, the Turkish Ministry of Environment and Urbanization are working to adapt and facilitate the framework to ensure its compatibility with Turkish national legislation. These efforts, aiming to define the Good Environmental Status (GES) of a given sea area by simultaneously evaluating many criteria (a total of 11 qualitative descriptors), represent a much more detailed and broader approach than before. According to the MSFD, meeting only some of the objectives does not grant a sea area GES status. The absence of chemical and biological pollution or protection against such polluting factors is paramount but not sufficient for determining the GES status or for establishing the ecological well-being of a marine environment. The MSFD requires that several other important descriptors be considered and evaluates the GES of a marine area only based on their combined assessment. These include biodiversity conservation, the health of commercial fish populations, the maintenance of food webs to ensure long-term abundance and reproduction and preservation of seafloor integrity to ensure optimal functioning of the ecosystem. When considering Gökçeada in particular, the fact that the marine environment surrounding the island is free of biological and chemical waste is important in the context of the MSFD, but insufficient for a GES determination. In order to conclude on its ecological well-being and GES, other crucial criteria of MSFD must also be met. The sea area surrounding the island must be surveyed to ascertain that the biodiversity is maintained, the populations of commercial fish species are healthy, the elements of food webs fit enough to ensure long-term abundance and reproduction and that the integrity of the sea floor is such that it ensures a satisfactory functioning of the ecosystem. Failure to meet any one of these criteria will result in failure to achieve or maintain a GES status. The MSFD maintains that the health and well-being of commercial fish populations can be assured through sustainable, responsible, and precautionary

fishing. It proposes that fishing pressure should be regulated in such a way as to maintain a balanced population structure including not only very young individuals, but also a high proportion of old and large individuals, and to prevent recruitment overfishing, i.e., keeping the number of spawning capable mature fish in the population within safe limits. Various anthropogenic threats to ecological wellbeing will also be evaluated within this framework in order to determine GES status.

A bonafide potential threat to the ecological wellbeing of Gökçeada however, is the absence of specific assessments of the major fish or invertebrate stocks of the northeastern Aegean Sea where Gökçeada is located as well as the lack of basic biological and fisheries data (i.e. catch composition, length distributions of targeted species, discards, landings, effort etc) from the island's fisheries.

In Gökçeada, small-scale fishing is the norm, as there is only one bottom trawler operating in the area and this trawler joined the fleet recently in 2020. Because no licensing system is required for recreational fishers on the island, the exact number and impacts of recreational fishers is unknown. This situation is the same for the rest of the country and for many other Mediterranean countries as well. This sector is as such currently poorly managed, aside from the few rules previously stated that are applicable to them. In 2010, The GFCM organized a workshop on "Monitoring Recreational Fishing in GFCM Areas" in Palma de Mallorca. The importance of recreational fisheries management for member countries was emphasized in that workshop (GFCM, 2010).

Other human activities affecting marine ecological wellbeing are anchoring, dredging, pressure from invasive alien species and other terrestrial activities that cause dramatic habitat degradation. Essential fish habitats such as spawning, and recruitment areas are also under threat as well as fishing regions. In addition, fishing activities leave some ecological footprints such as ghost fishing nets which can continue to fish in the sea over the long-term (Ayaz *et al.*, 2010). Ayaz *et al.* (2010) conducted a survey study to determine the amount of lost fishing gears and the reasons for their loss. Poor weather conditions, bottom structure, conflicts with other fishing gears, vandalism, large fish species and marine mammals are the main factors causing the loss of fishing gears. Approximately 82 000 m of main longline lines, 220 m of multifilament (cloth) trammel nets, 100 m of monofilament fishing line and 35 m of multifilament (cloth) gillnets were collected from an area of 22 600 m^2 underwater. As a result, within the scope of the "ghost fishing net fishers" project, 7 000 m monofilament main longline lines and approximately 600 m fishing nets were detected and removed from the seas in 2013. The ghost fishing problem is one of the biggest causes of economic and ecological losses.

Invasive species have a significant impact on local species and habitats (Sala *et al.*, 2011). Although there are studies on prey and predator relationships of these species,

it is still not possible to predict the long-term effects of alien species on native species. This is because the numbers of invasive alien species are increasing every year as a result of human activities and global warming. As the water temperatures in the Mediterranean increase, the number of native fish species adapted to relatively lower water temperatures naturally decrease, and alien fish species from warmer seas proliferate (Hidalgo *et al*., 2018). Gönülal (2021), studying the sea water temperature measurements recorded in Gökçeada between 1972 and 2018, revealed that the surface water temperature had increased by approximately 1.6 °C during this period. It is clear that the continuation of this upward trend will lead to inevitable alterations in the entire fauna and flora composition of the island, including the fish. Climate change is one of the important threats to the ecological wellbeing, even if it is solely considered in the context of the change or loss of the island's marine biodiversity.

In parallel with climate change, in recent years, the invasive *Lagocephalus sceleratus* (pufferfish) originating from the Indo-Pacific region has had numerous negative effects on human health, local biodiversity, and the socio-economic wellbeing of fishers in the Eastern Mediterranean. The fishing of this species, which is deadly for humans and other species due to the high doses of tetrodotoxin it contains, was regulated by fisheries notifications (e.g. TOB, 2020a) prohibiting its catch and landing; however, the MoAF has recently published a bounty reward system for the collection of this species and other pufferfish species from 2021 to 2023 (TOB, 2020d). Ünal *et al.* (2015b) conducted face-to-face interviews with a total of 261 fishermen from Izmir in the central Aegean region to Hatay in the eastern Mediterranean, including the Gökova MPA, to identify problems arising from the presence of pufferfish. In these interviews, the economic losses caused by the pufferfish during 2011 were evaluated. There was then no pressure on this invasive species, and pufferfish significantly damaged both the fishing gear and catch of the fishers. 91 percent of the fishers interviewed agreed that the pufferfish was a big problem; in addition, 82 percent believed it negatively affected biological diversity and 89 percent thought it reduced fishing productivity. Presence of the pufferfish species *L. sceleratus* has not yet been reported in Gökçeada, but unfortunately its occurrence has already been reported in Edremit and Saros Bays, and even in the Marmara and Black Seas (Akyol and Ünal, 2017).

Another pufferfish species registered in Saros Bay in the Northern Aegean Sea is the *Sphoeroides pachygaster*, originating from the Atlantic Ocean (Eryılmaz *et al*., 2003). Encountered for the first time in 2020, it is now found in almost every trawl hauled from a depth of 100 m around Gökçeada (Personal communication, Cem Dalyan).

Recently, two specimens of another Indo-Pacific species, the possibly invasive *Champsodon nudivittis* (Dalyan *et al*., 2021), was landed by a trawler fishing at depths of 100–120 m north of Gökçeada. It is alarming that this species, which was first seen

in Iskenderun Bay in the eastern Mediterranean in 2009 (Çiçek and Bilecenoğlu, 2009), has already spread to the northern Aegean. The three alien species mentioned above in relation to Gökçeada are all carnivorous predatory fish that prey on other fish and cephalopods. When they establish a presence around the island, proliferate, and spread, they will put additional pressure on native species, affecting ecological wellbeing negatively. The socio-economic welfare of Gökçeada fishers will also be adversely affected, as the native fisheries may decline as a result.

Although the Coast Guard and other responsible institutions put great emphasis on combating illegal fishing, this is one of the most important threats to Gökçeada's fisheries resources. Decline in fishing income and increasing illegal spear-fishing targeting high-value species are the most important problems facing local fishers.

As an effort to increase surveillance in the area, the entire island needs an efficicient system of MCS for IUU (Illegal, Unreported and Unregulated) activities. To help combat IUU and support the future EAFM in Gökçeada, a patrol system that the Mediterranean Conservation Society initiated and successfully implemented in Gökova Bay in 2013 (Ünal *et al*., 2019) can be launched on the island. Training and properly equipping patrol boats and marine rangers are very important for successful patrolling. Although the rangers are unable to personally penalize illegal activities, they provide competent support for criminal proceedings by recording any illegal incident with a camera and transmitting the evidence to the relevant authorities.

In the early spring of 2021, a mass of marine mucilage started to bloom in the Marmara Sea. The so-called sea snot – a thick, slimy substance made up of compounds released by various marine organisms (see Appendix 3 for detailed information) had by June 2021 spread far and wide and had drawn great public attention as it was floating on the surface waters and blanketing the coasts of Istanbul, Çanakkale (including Gökçeada) and other urban centers surrounding the Marmara Sea (Figure 53, 54). Mucilage in the Marmara Sea had happened before, as early as in 2007 (Aktan *et al*., 2008a), but the 2021 outbreak was unprecedented in scale and severity, posing a serious threat to the marine ecosystem and the fishing industry in the area (Öztürk and Şeker, 2021). Marmara fishers saw their engines rendered inoperable by the sludge and the substance collected in their nets made them so heavy that they often broke or got lost. The ones that made it back were often empty as the strings coated with mucilage made the nets visible to the fish. The Gökçeada fishers, having witnessed their Marmara colleagues' struggle, now worry that their livelihood may also soon be under threat. The formation of such a mass mucilage in the sea area surrounding the island would certainly place both the ecological wellbeing and the socio-economic welfare of the Gökçeada fishers in grave peril.

However, as explained in Appendix 3, the formation of marine mucilage depends on the simultaneous occurrence of many complex environmental conditions, and it is very unlikely that this will happen in the vicinity of Gökçeada. Neither is Gokçeada considered potentially vulnerable to another mass mucilage phenomenon in the Marmara Sea in the future. Although the mucilage from the Marmara in January–July 2021 was able to partially reach Saros Bay and even Gökçeada via currents passing through the Dardanelles in layers (Aslan *et al.*, 2021), the slime was in a state of disintegration upon arrival due to the dynamics of the open sea. Consequently, it quickly disappeared. Although it is improbable that mucilage may constitute a significant threat for the ecological wellbeing of Gökçeada, any occurrence of this phenomenon in the vicinity of the island is still worth monitoring because it may indicate a possible human induced external impact. The recent mucilage outbreak had already an unfavourable impact on fish demand and prices in the Marmara region and neighbouring areas. Therefore, even though the Gökçeada marine ecosystem is unlikely be affected by any future mucilage phenomenon that may occur in the Marmara Sea, it seems that the island's fishers will be adversely affected due to low fish prices.

Figure 53. Blanket mucilage type in Yıldız Bay, Gökçeada, Çanakkale

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Figure 54. Blanket mucilage type in Seddülbahir, Çanakkale

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3.2 Threats to community (human) wellbeing

Small-scale fishing boats used in coastal fishing in Gökçeada are concentrated between 6–10 m in length, locally built and made of wood. Usually each boat is operated by one or two fishers. 49 of the 50 resident fishers on the island engage in small-scale fishing. Fishers who use longlines, various set nets, encircling trammel nets and special harpoons for swordfish fishing, usually go to the fishing areas in the evening, cast their nets or longlines and then return to the harbor. In the morning, they return to the fishing areas to collect their gear and catches. There are also some fishers who go out to fish a few days at a time before returning to the harbor, or live on their boats and spend all their time either at sea or in the port.

Although the average amount of catch varies depending on many factors, especially such as season and fishing experience, catches are between 5–25 kg per day for set nets and 10–40 kg for longlines. Fishers often want to sell all their catches themselves in order to maximize their income. They also generally take home some low-valued species for household consumption. Although the average amount of catch varies depending on

many factors, especially such as season and fishing experience, catches are between 5–25 kg per day for set nets and 10–40 kg for longlines. Fishers often want to sell all their catches themselves in order to maximize their income. They also generally take home some low-valued species for household consumption. According to the estimations based on the survey data, the fishers of Gökçeada achieved monthly net revenue of USD 733 per boat in 2019. In the same year, Turkey's gross monthly minimum wage was USD 430 while the net monthly minimum wage was the USD 339.6. Considering that fishers in Gökçeada generally prefer to work alone or with a member of the household, it can be pointed out that this income is well above the minimum national wage in Turkey.

The majority of fishers (85 percent) have fishing as their main profession, which is closely related to the lack of other employment opportunities on the island where they live.

The average age of fishers in Gökçeada was found to be 52.6, significantly above Turkey's average. The oldest fisher is 75 years old and the youngest is 35 years old. This may be related to the fact that young people do not see fishing as a desirable career, and that fishing is currently not attractive in terms of economic or social status. Undoubtedly, fishers motivated by their passion for the sea to stay in their professions do exist. But today, small-scale fishing has evolved to become complementary or part-time job along the coastal countryside, where people with low education, lacking other employment options conduct fishing to support their livelihoods (Ünal *et al.*, 2015a). Considering the ratio of fishers among the total working population along the coasts, it can be concluded that people, especially today's younger generations, do not prefer to commence careers as fishers.

According to Göncüoğlu (2011), small-scale fishing can be considered as a family business in the Aegean Region and there are a significant number of women engaged in fishing as their main employment type. Göncüoğlu and Ünal (2011) report that there are 427 female fishers in the Aegean region. In the Gökçeada fishery cooperative there are three female fishers. In addition there are four female fishers that occasionally go out to sea with their husbands.

Conflicts between different user groups in Gökçeada are another threat. Small-scale fishing competes with large-scale fishing on one hand and recreational fishing on the other. Recreational fishers are another stakeholder group that definitely need monitoring and management. Recreational fishing can be a hobby that includes spending time at sea, but it is also an important fisheries sector itself. Although the Notification Number 5/2 on Recreational Fisheries contains detailed rules and regulations, a comprehensive fisheries management plan cannot be carried out unless some key factors are first known such as the number of fishers engaged in this activity by land, boat, and diving, in addition to their fishing days and catches such target species, size, quantity, seasonal fisheries,

etc. (GFCM, 2010; Ünal *et al*., 2010). Although there is a license system for recreational fishing, fishers are not under any obligation to obtain licenses. This sector has never been monitored and its impact can only be estimated from some pilot studies (Ünal, 2014). In order to contribute to the sustainable use of marine resources, recreational charter boat fishing completed by commercial, recreational and daily tour boats, could be managed with effective measures that could help benefit tourism (Lew and Larson, 2015; Öndes *et al*., 2020).

FAO (2012b) defines the basic elements for the management of recreational fishing. An important first step is to collect data and better understand this type of fishing. The most important problem regarding this issue is expressed as the ability to change the behavior of recreational fishers. In this sense, the problems, the work to be done and the ways to be followed are clear, and many studies, reports and guides clarify the subject. It is strictly forbidden to sell fish caught by recreational fishing in most of the world, including Turkey. This sector has a negative economic impact on other fishing sectors. The amount of catch taken by recreational fishers is unknown, although they share the same resources as commercial fishers. Therefore, a recreational fishing effect should also be taken into account in Gökçeada fishing. Illegal situations such as fish sales by this sector have been reported, and in some cases punished accordingly, but such activities still pose a threat to both the marine environment and the fishers whose livelihoods depend on the fisheries. These types of threats are also compounded by field violations of some trawlers coming from other regions to fish around the island, overfishing by large numbers of purse seiners, and an uncontrollable and dynamic fishing fleet and fishing capacity. The fact that twice as many as Gökçeada fishers, large and small-scale fishers fish in the waters around the island threatens the marine ecosystem and jeopardizes the economic sustainability of the local fishers of the island. Additionally, the island is surrounded by Samothraki in the northwest and Limnos in the southwest, and strong winds in the region largely prevent local fishers from fishing in international waters. In addition, there is information that some of the 50 recreational fishers residing on the island engaged in “part-time commercial fishing” under the guise of “recreational” fishing. In addition to these, factors such as lack of personnel to control or monitor fishing in Gökçeada (as there is only one fisheries officer), workload, and harsh climate of the island prevent the implementation of controls on fishing at the desired level which threatens the livelihoods of fishers in Gökçeada.

Another major threat to be considered or awaiting resolution is the inability to scientifically monitor fish stocks and variations in their populations over time, and to lack means to measure the amount of extra fishing effort exerted around the island by non-resident vessels. These impediments make rational management of the fisheries impossible. This situation poses significant threats to the fishers in Gökçeada as well

as the communities whose livelihoods are directly or indirectly dependant on fishing or even the seas (for example, local diving center employees, diving lovers, fish restaurants and their staff, etc.).

3.3 Ability to achieve (including external factors)

Management of living marine resources is under the responsibility of the MoAF. Ünal and Göncüoğlu (2012) briefly report the duties of the DG-Fish, which is within the ministry and ministerial structuring, as follows:

- developing and implementing fisheries policy;
- allocating fishing licenses to fishing boats;
- taking measures to prevent or minimize marine pollution;
- provision of aid services such as loans and other similar initiatives;
- implementing a training program for fishers;
- encouraging and supporting fishery cooperatives;
- cooperating with academic experts from universities, research institutes etc., in order to develop improved management advice for fisheries improvement;
- defining and determining the features and limits required for fishing gears;
- determining the rules and requirements for leasing fisher shelters and fish production areas;
- to take measures regarding the management of fisheries resources;
- to collect and assess the fisheries data;
- to evaluate aquaculture projects and to ensure that they are environmentally and economically feasible; and
- to conduct investigations and research in field of fisheries.

However, both the ministry and the official institutions it collaborates with, also have some other stakeholders who do not have an official status while performing these duties. There are successful examples of this in the ongoing fishing activities and management within the Gökova Bay Marine Protected Area (Ünal and Kızılkaya, 2019; Ünal *et al.*, 2019). As stated in section 2.11 of this report, the MoAF, Coast Guard Command and Gendarmerie General Command are the main decision-makers and law enforcement

authorities for fisheries management, spatial management and surveillance in Gökçeada. It is an advantage that these institutions communicate and cooperate with each other. This harmony and cooperation are also expected between provincial organizations. In fact, these institutions need to cooperate directly with non-formal but locally important directly related actors (e.g., fishery cooperatives) and develop a culture of collaboration. Without this cooperation, bureaucratic overlap or problems arise in the functioning and sustainability of the sector (Ünal *et al.*, 2019).

Consistency among the relevant institutions and organizations is a very important issue. This is a basic approach that has the potential for ensuring the permanence of established and well-implemented solutions for long-term planning. As it is known, the ministry is responsible for building and implementing their regulations for both commercial and recreational fishing at sea and inland waters. The Ministry reviews and revises the regulation every four years with the help of related faculties from universities or other institutions and stakeholders. Although there is an effort to create cooperation, there may be unwillingness to cooperate, share responsibility and authority or act together among these different units. This situation is due to the lack of multi-disciplinary scientific studies and also the lack of participatory approach and collaborative work culture. Understanding the needs of the community is as important as understanding the ecological needs. To achieve this, all stakeholders that affect resources or are affected by regulations must be involved in different management steps. In this way, ownership will be created for communities and the sustainability of conservation measures will be ensured (Ünal *et al.*, 2019).

A bottom-up approach should be applied to further planning and management strategies. Although there are some gaps in the institutionalization of the approach (cooperatives, clubs, associations, etc.), a bottom-up approach should be encouraged in order to better manage the fisheries sector in Turkey (Ünal *et al.*, 2009; Ünal *et al.*, 2019). In the Project Introduction Meeting held within the scope of "Transition to Ecosystem Approach Fisheries Management and Preparation of a Fisheries Management Plan Project in Gökçeada" and in the field studies, it was observed that there is a culture of cooperation, acting together, solidarity and interdependence in Gökçeada.

4 Conclusions

Gökçeada is a unique island with a small population of only around ten thousand people. Sectors such as tourism, agriculture and fishing are very important here, and projects and developments related to these sectors are actively continuing. The island's fishing ports and boats are the most important assets for both the tourism and fishing sectors. Gökçeada is also home to Gökçeada Marine Park, the only marine park in Turkey, founded in 1999 and consisting of various conservation zones. In addition, the waters surrounding the island boast a rich variety of fish. The presence of a diving center further contributes to a great public interest in the underwater realm and this provides job opportunities for many fishers, most of whom are organized under the umbrella of Gökçeada fishery cooperative. The invaluable biodiversity of the island and its fish stocks are in need of protection and further research. However, the fact that the fishers in the area strongly depend on fishing for their livelihoods require a multi-faceted (environmental, biological, socioeconomic) management approach to island fishing. It is also important to ensure that the famous and traditional practice of swordfish hunting with harpoon is being conducted appropriately and the interest shown by many outside fishing boats in the island's fishing areas also warrants consideration. It is clear that there is a great need for the establishment of a thorough fisheries management system in Gökçeada. That the island is relatively isolated may be considered an advantage when it comes to developing and implementing an EAF compliant fisheries management plan. However, the fishers from the island itself are far from alone in terms of wanting to exploit the fishery resources around the island. Indeed they find themselves competing with fishers from other regions of Turkey and from Greece as well. This merits a wider cooperation effort during both the planning and managing stages. The "Gökova Marine Protected Area Small Scale Fisheries Management Plan" prepared in 2018 may serve as a valuable guide for this work. Under the leadership of scientists and the FAO, with the approval and support of MoAF-DG-Fish and provincial organizations and with the contribution and cooperation of the fishery cooperative, diving center, TÜDAV, SÜR-KOOP and all other stakeholders, an initiative has emerged with the aim of preparing a fisheries management plan to guide fisheries management decisions in the area. Undoubtedly, this goal can be achieved with the joint willingness and determination of all stakeholders, especially the official institutions and the fishery cooperative.

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Appendix 1
List of species

Turkish (local), English and scientific names of vertebrate and invertebrate marine organisms mentioned in various places in the report. After these species are divided into general groups, they are listed alphabetically in the list. The reason why there is no equivalent in the scientific name part of some species is that, in the places mentioned, there is more than a specific species, but the genus is used when a few species are closely related to each other.

Turkish names	English names	Scientific names
Mercanlar	**Corals**	
Kırmızı mercan	Red coral	*Corallium rubrum*
Yumuşakçalar	**Molluscs**	
Ahtapot	Common octopus	*Octopus vulgaris*
Akivades	Clam	*Ruditapes* spp.
Bülbül kalamar	Shortfin squid	*Illex coindetii*
Kalamar	Common squid	*Loligo vulgaris*
Kara midye	Mediterranean mussel	*Mytilus galloprovincialis*
Masko (ahtapot)	Musky octopus	*Elodone* spp.
Sübye	Common cuttlefish	*Sepia officinalis*
Kabuklular	**Crustaceans**	
Çimçim karides	Deep-water rose shrimp	*Parapenaeus longirostris*
Karides	Shrimp	Penaeidae
Istakoz	European lobster	*Homarus gammarus*
Böcek	Common spiny lobster	*Palinurus elephas*
Norveç ıstakozu (Deniz kereviti)	Norway lobster	*Nephrops norvegicus*

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Turkish names	English names	Scientific names
Kıkırdaklı balıklar	**Cartilaginous fish**	
Pamuk köpek balığı	Smooth-hound	*Mustelus mustelus*
Köpek (balığı)	Shark	Selachimorpha
İrina (Rina)	Common stingray	*Dasyatis pastinaca*
Elektrik balığı	Electric ray	*Torpedo* spp.
Keler	Angelshark	*Squatina* spp.
Vatoz	Skate	*Raja* spp.
Kemikli balıklar	**Bony fish**	
Akya	Leerfish	*Lichia amia*
Barbunya (Barbun)	Red mullet	*Mullus barbatus*
Benekli pisi balığı	Four-spot megrim	*Lepidorhombus boscii*
Berlam (Bakalyaro, mırlan)	European hake	*Merluccius merluccius*
Çaça	European sprat	*Sprattus sprattus*
Çarpan (balığı)	Greater weever	*Trachinus draco*
Derin deniz iskorpiti	Blackbelly rosefish	*Helicolenus dactylopterus*
Dil balığı	Common sole	*Solea solea*
Dülger (balığı)	John dory	*Zeus faber*
Eşkina	Brown meagre	*Sciaena umbra*
Fangri (mercan)	Red porgy	*Pagrus pagrus*
Fas sinariti	Morocco dentex	*Dentex maroccanus*
Fener (balığı)	Angler	*Lophius* spp.
Fener balığı (a)	Angler	*Lophius piscatorius*
Fener balığı (b)	Blackbellied angler	*Lophius budegassa*
Gelincik (Bülbül)	Greater forkbeard	*Phycis blennoides*
Gobene (Tombik)	Bullet tuna	*Auxis rochei*
Hanoz (Hani)	Comber	*Serranus cabrilla*
Iskatari	Black seabream	*Spondyliosoma cantharus*
İskorpit (Adabeyi)	Red scorpionfish	*Scorpaena scrofa*
İstavrit	Horse mackerel	Carangidae
İzmarit	Picarel	*Spicara* spp.
İzmarit (a)	Blotched picarel	*Spicara maena*

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Turkish names	English names	Scientific names
İzmarit (b)	Picarel	*Spicara flexuosa*
Kalkan	Turbot	*Scopthalmus maximus*
Karagöz	Two-banded seabream	*Diplodus vulgaris*
Karagöz istavrit	Atlantic horse mackerel	*Trachurus trachurus*
Kefal	Grey mullet	Mugilidae
Kılıç (balığı)	Swordfish	*Xiphias gladius*
Kırlangıç	Tub gurnard	*Chelidonichthys lucerna*
Kikla	Ballan wrasse	*Labrus bergylta*
Kolyoz	Atlantic chub mackerel	*Scomber colias*
Kupes (Kupez)	Bogue	*Boops boops*
Lahoz (Grida)	White grouper	*Epinephelus aeneus*
Lapin (Ot balığı)	Wrasse	Labridae
Lipsoz	Black scorpionfish	*Scorpaena porcus*
Lüfer (Çinekop, kofana)	Bluefish	*Pomatomus saltatrix*
Mandagöz mercan	Blackspot seabream	*Pagellus bogaraveo*
Mavi mezgit	Blue whiting	*Micromesistius poutassou*
Mazak	Streaked gurnard	*Chelidonichthys lastoviza*
Melanur (Melanurya)	Saddled seabream	*Oblada melanura*
Mercan (Kırma mercan, litrin)	Common pandora	*Pagellus erythrinus*
Mezgit	Whiting	*Merlangius merlangus*
Mıgri (Mıgrı)	European conger	*Conger conger*
Mırmır	Sand steenbras	*Lithognathus mormyrus*
Orfoz	Dusky grouper	*Epinephelus marginatus*
Orkinos (Ton balığı, Mavi yüzgeçli orkinos)	Atlantic bluefin tuna	*Thunnus thynnus*
Öksüz (balığı)	Piper gurnard	*Trigla lyra*
Palamut (Torik)	Atlantic bonito	*Sarda sarda*
Papaz	Damselfish	*Chromis chromis*
Pisi	European flounder	*Platichthys flesus*
Sardalye (Sardalya)	European pilchard	*Sardina pilchardus*
Sargoz	White seabream	*Diplodus sargus*
Sarıkuyruk istavrit	Mediterranean horse mackerel	*Trachurus mediterraneus*

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Turkish names	English names	Scientific names
Sarpa	Salema	*Sarpa salpa*
Sinarit	Common dentex	*Dentex dentex*
Sivriburun karagöz	Sharpsnout seabream	*Diplodus puntazzo*
Siyah lahoz	Grouper	Serranidae
Tekir	Striped red mullet	*Mullus surmuletus*
Tirsi	Twaite shad	*Alosa fallax*
Trança	Pink dentex	*Dentex gibbosus*
Turna (Iskarmoz)	European barracuda	*Sphyraena sphyraena*
Uskumru	Atlantic mackerel	*Scomber scombrus*
Uzun kanat orkinos (Tulina)	Albacore	*Thunnus alalunga*
Yabani mercan	Axillary seabream	*Pagellus acarne*
Yazılı orkinos	Skipjack tuna	*Katsuwonus pelamis*
Zargana	Garfish	*Belone belone*
Memeliler	**Mammals**	
Fok (Akdeniz Foku)	Mediterranean monk seal	*Monachus monachus*

Appendix 2

Summary of some key biological information of the major commercial fish and invertebrate species in Gökçeada Island

English and scientific name	Maximum size (cm)				Maximum age (years)			
	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic
Common pandora (*Pagellus erythrinus*)	60	60	60	60	14			
Gilthead seabream (*Sparus aurata*)	70	70	70	70	7		12	
Red porgy (*Pagrus pagrus*)	50	90	90	90	12			
Common dentex (*Dentex dentex*)	100	100	100	100	20			
Pink Dentex (*Dentex gibbosus*)	120	120	120	120				
White seabream (*Diplodus sargus*)	45	45	45	45				
Two-banded seabream (*Diplodus vulgaris*)	45	45	45	45				
Salema (*Sarpa salpa*)	33	46	46	46	6			
Bogue (*Boops boops*)	40	36	36	36				
Saddled seabream (*Oblada melanura*)	29	35	35	35	12			
Red mullet (*Mullus barbatus*)	24	38	38	38	7			
Striped red mullet (*Mullus surmuletus*)	40	40	40	40				
Tub gurnard (*Chelidonichthys lucerna*)	36	30	76	76				
European hake (*Merluccius merluccius*)	120	120	120	140				
Atlantic horse mackerel (*Trachurus trachurus*)	26/34*		38	60	7			40
Mediterranean horse mackerel (*Trachurus mediterraneus*)	27/39*		39	50	6	12	12	
Mediterranean chub mackerel (*Scomber colias*)	50	50	50	50	13			
Bluefish (*Pomatomus saltatrix*)	130	130	130	130				

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English and scientific name	Maximum size (cm)				Maximum age (years)			
	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic
Atlantic bonito (*Sarda sarda*)	90	90	90	90				
Swordfish (*Xiphias gladius*)	242			450	5			
Common octopus (*Octopus vulgaris*)					3–4 (males), 2–3 (females)			
Common cuttlefish (Sepia officinalis)					20–30 months			
Squid (*Loligo vulgaris*)					2 (females), 3 (males)			
European lobster (*Homarus gammarus*)	60	60	60	60				
Common spiny lobster (*Palinurus elephas*)	60	60	60					

English and scientific name	Maturity season			
	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic
Common pandora (*Pagellus erythrinus*)			May–September	
Gilthead seabream (*Sparus aurata*)		October–December	October–December	
Red porgy (*Pagrus pagrus*)		March–June		
Common dentex (*Dentex dentex*)			March–July	
Pink Dentex (*Dentex gibbosus*)			April–September	
White seabream (*Diplodus sargus*)		March–June		
Two-banded seabream (*Diplodus vulgaris*)	September–March			
Salema (*Sarpa salpa*)	Spring and fall (two times)	September–March/ September–November*		
Bogue (*Boops boops*)	Spring			
Saddled seabream (*Oblada melanura*)	April–June / May–June*			June–August
Red mullet (*Mullus barbatus*)	March–September			
Striped red mullet (*Mullus surmuletus*)	Spring			
Tub gurnard (*Chelidonichthys lucerna*)	April–November/ December–April/ December–May*			
European hake (*Merluccius merluccius*)	December–June	December–May		
Atlantic horse mackerel (*Trachurus trachurus*)	April–August	January–May	Mid winter–end of summer	

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English and scientific name	Maturity season			
	Aegean Sea	Eastern Mediterranean	Western Mediterranean	Atlantic
Mediterranean horse mackerel (*Trachurus mediterraneus*)	June–September	May–October	May–August	
Mediterranean chub mackerel (*Scomber colias*)	June–August		May–August	
Bluefish (*Pomatomus saltatrix*)	Early Spring, peaks in June		June–September	
Atlantic bonito (*Sarda sarda*)	May–August			
Swordfish (*Xiphias gladius*)	Summer		June–September	December–June
Common octopus (*Octopus vulgaris*)				
Common cuttlefish (Sepia officinalis)				
Squid (*Loligo vulgaris*)				
European lobster (*Homarus gammarus*)				
Common spiny lobster (*Palinurus elephas*)				

English and scientific name	Maturity size (cm)							
	Aegean Sea		Eastern Mediterranean		Western Mediterranean		Atlantic	
	Female	Male	Female	Male	Female	Male	Female	Male
Common pandora (*Pagellus erythrinus*)	11.3	15.1						
Gilthead seabream (*Sparus aurata*)								
Red porgy (*Pagrus pagrus*)					22.6	26.7		
Common dentex (*Dentex dentex*)					34.6	52		
Pink Dentex (*Dentex gibbosus*)					34.7	38.6		
White seabream (*Diplodus sargus*)			20.4	21.2				
Two-banded seabream (*Diplodus vulgaris*)	18.3	20.4						
Salema (*Sarpa salpa*)			29.4	22.6	26/28.6*	19.5/24.5*		
Bogue (*Boops boops*)	13							
Saddled seabream (*Oblada melanura*)	18.8	18.9	15.7/18.6*	13.9/17.5*	17.5	16.4		
Red mullet (*Mullus barbatus*)	11.9/14.2*	12.1/12.4*						
Striped red mullet (*Mullus surmuletus*)	12–14	12–14						

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English and scientific name	Maturity size (cm)							
	Aegean Sea		Eastern Mediterranean		Western Mediterranean		Atlantic	
	Female	Male	Female	Male	Female	Male	Female	Male
Tub gurnard (*Chelidonichthys lucerna*)	19/19/20*	18.5/17.7/18*						
European hake (*Merluccius merluccius*)	21.5	25.7					47–58	36–39
Atlantic horse mackerel (*Trachurus trachurus*)	13		22				16–25	
Mediterranean horse mackerel (*Trachurus mediterraneus*)	10.4/12.2*	10.4/12.5*			16	16		
Mediterranean chub mackerel (*Scomber colias*)	18	18					16.8	20.4
Bluefish (*Pomatomus saltatrix*)	25.4				36–38			
Atlantic bonito (*Sarda sarda*)	42.5	36.8						
Swordfish (*Xiphias gladius*)					142/170*	95	179	129
Common octopus (*Octopus vulgaris*)								
Common cuttlefish (Sepia officinalis)								
Squid (*Loligo vulgaris*)								
European lobster (*Homarus gammarus*)								
Common spiny lobster (*Palinurus elephas*)	76–77 mm	82 mm						

* / indicates different findings from different studies in the same region

Appendix 3

Mucilage: is it an ecological disaster?

Mucilage often referred to as sea saliva, sea snot, or marine slime, is a cry for help from a marine ecosystem that has been overwhelmed by pollution. It has been suggested that mucilage is simply a result of global warming and an increase in the amount of nitrogen and phosphorus in the sea. However, an increase in nitrogen and phosphorus in the environment, the presence of some pollution, or an increase in the temperature of the seawater does not automatically result in mucilage everywhere. Mucilage is relatively rare in many places and even if mucilage from one site was transplanted and poured into another, it would simply disperse and dissipate in a few days. There is as such no danger of mucilage accidentally being transported to and contaminating other seas.

Mucilage was first observed in 1729 in the Adriatic Sea, in the Gulf of Trieste and on the coasts of Istria. It continued to be seen periodically in the 19th century, but was little studied until the beginning of the 20th century (Fonda Umani *et al.*, 1989). Mucilage occurred in 1977 in the North Sea, mainly on the coasts of France, Belgium, the Netherlands and Germany (Lancelot, 1995); in the Gulf of Tasmania in New Zealand in 1981 (Bradstock and MacKenzie, 1981); in the summer of 1988 in the Adriatic (Rinaldi *et al.*, 1995); in 1991 in the Tyrrhenian Sea (Melley *et al.*, 1998); It was observed in the Ligurian Sea in 2003 (Schiaparelli *et al.*, 2007) and the Marmara Sea in 2007 (Aktan *et al.*, 2008a, 2008b). Fishers and locals in the Adriatic region called this sticky formation “mare sporco”, “onto de mar” and “ontisso de mar” meaning “dirty sea” because it causes clogging of and heavier than usual fishing nets (Fonda Umani *et al.*, 1989; Stachowitsch *et al.*, 1990). Since then the presence of massive marine mucilage events have been reported only sporadically, even though mucilage outbreaks have increased almost exponentially in the last two decades. Mucilage is not triggered by the existence of certain microplankton species. The microzooplankton species detected in the mucilage samples from both the Adriatic and the Marmara Seas, for example, nearly identical to those found in other seas and gulfs where there is no formation of mucilage. Dominant dinoflagellate and diatom species detected in studies conducted on mucilage contents are also not directly responsible for mucilage formation (Negro *et al.*, 2005). Neither *Gonyaulax hyalina* (Mackenzie *et al.*, 2002), which was extensively detected in mucilage in the Gulf of Tasmania, *Phaeocystis* sp. (Lancelot, 1995) nor the presence of *Gonyaulax fragilis* (Aktan *et al.*, 2008a,b) species seen in the Adriatic (Pompei *et al.*, 2003) and in the Marmara automatically cause mucilage.

The detection of some of the mucilage-forming and mucilage-secreting species in the slimy sticky mucilage body also does not mean that these species are responsible for the formation of large scale mucilage events. *Gonyaulax fragilis*, *Skeletonema costatum* and *Cylindrotheca closterium* etc. detected in mucilage (Marchetti, 1990; Mingazzini *et al.*, 1995; Najdek *et al.*, 2005; Urbani *et al.*, 2005) are all planktonic organisms commonly found in other regions of the world where no excessive mucilage has been detected. *Gonyaulax fragilis* species (Pistocchi *et al.*, 2005) secretes small amounts of microscale mucilage during the spring months, this naturally occurring secretion never reaching such a concentration that it forms clumps on the sea surface. Attributing mucilage to certain planktonic species (Negro *et al.*, 2005), to global warming or to the increase of nitrogen and phosphorus in the sea is simply wrong. Although bacteria may initiate the formation of mucilage, it is pollution that triggers large scale mucilage events. A case point is the huge oil spill in the Gulf of Mexico in April 2010. It lasted for 5 months and the disaster (Abbriano *et al.*, 2011) was followed by a massive mucilage formation (National Geographic, 2010; National Geographic News, 2010; Diercks, 2021).

The formation of mucilage is better described as a complex chain of events triggered first and foremost by pollution. Iron (Savun-Hekimoğlu and Gazioğlu, 2021) is for instance an element that exists in all kinds of poisonous compounds that flow into the sea by filtering from agricultural lands or through very polluted rivers and rainwaters from the land. When this iron reaches the sea, it binds to phosphate and sinks to the bottom. In this way, while iron accumulates on the seabed as a large iron reservoir, hardly any phosphate can be found in the first 30–40 m of the sea which therefore, deceptively looks pristine. Iron is an important compound which plays an essential role in chlorophyll biosynthesis and this enables phytoplanktonic organisms to perform photosynthesis by using the solar radiation in the sea. The iron stored at the bottom over time gets broken down by sulfide bacteria and becomes iron ions, which in turn rises to the surface seasonally and in this way participate in the cycle. However, even though the sea looks clean due to the phosphate-binding with iron and sinking to the bottom, the ecological balance is actually in a state of great disruption because of the enormous iron reservoir that has been accumulated. Bacteria in reaction start to multiply excessively, creating a temporary shelter in the sea. This proliferation, which starts at the bottom first, gradually reaches the surface and the micro-colloidal structure formed begins to thicken gradually (Fonda Umani *et al.*, 2005). Photosynthetic phytoplankton species are attracted to this colloidal structure. Diatom species continue their usual polysaccharide synthesis here as well (Baldi *et al.*, 1997; Mackenzie *et al.*, 2002). Larger species that like to feed on polysaccharide sugar are also drawn to this extraordinary formation. This beginning mucilage, started by bacteria and thickened over time by the participation of diatoms and dinoflagellates, is now a living space, a matrix, a coenose. It is extraordinary. Grazer ciliates come to notice this layer and dense teeming bacterial populations hide in attempting to avoid the ciliates cause a thickening of the matrix of this now labile habitat by means of the

gelatinous substances they secrete. Viruses also join en masse and kill many diatoms, dinoflagellates, and ciliates by infecting them (viral shunt) (Weinbauer and Peduzzi, 1995). All the dead ciliates, dinoflagellates, and diatom frustules are in turn trapped and become part of the mucilage layer that is forming. Due to bacteria such as *Escherichia coli* and *Vibrio harveyi* (Danovaro *et al.*, 2009) that proliferate in such a habitat the fish around and below the sticky layer begin to die. As there is more oxygen, chlorophyll-a, nutrients, and photosynthesis in the matrix than in the surrounding environment (Bongiorni *et al.*, 2007) with the thickening of the matrix, the light transmittance decreases, and light sensitive bacterial colonies begin to multiply and accumulate beneath it. The off-white mucilage layer on the spume surface is painted yellow by exposure to terrestrial pollen, mostly from pine. The color of the mucilage otherwise is green up to 30 m and brown deeper down. As this matrix clots, and thickens, it starts to smell foul due to the decomposition and breakdown of organic matter within it. The sun's rays dry and wrinkle the part of the top part of matrix surface. The dark green parts under the sea accumulate in large flocks near the bottom of the sea (Peduzzi and Weinbauer, 1993) and a false bottom is formed covering the sand and stone ground of the seabed. This dense colloidal substance continues to be enriched with photosynthetic algae, bacteria, and viruses, while covering all life, including the crabs and holes of dwellers at the bottom. After a few months, the mucilage breaks down due to bacteria and disappears by sinking to the bottom of the sea. Dead bacteria, diatoms, dinoflagellate parts, organic and inorganic substances, digested and undigested food in the mucilage slowly rain down onto the bottom and join the "marine snow" that is already on its way down (Giani *et al.*, 1992; Herndl and Peduzzi, 1988; Azam and Long, 2001). Since the structure of colloidal particles is larger however, the collapse is faster than that of sea snow (Alldredge *et al.*, 1988; Alldredge, 2000).

Ubiquitous marine snow content is essential for life at the bottom of the sea. Bacteria at the bottom consume all this falling material and break it down again. Both marine snow and mucilage are part of a natural cycle that has been around for millions of years. However, large scale events such as the recent mucilage calamity in the Marmara Sea are far from natural. In the Marmara Sea, it is the direct result of three decades worth heavy pollution of the sea. It is nothing sort of an environmental disaster (Tüfekçi *et al.*, 2010). The onset of mucilage in the Marmara Sea has generally been observed as forming during the summer months, and gradually withdrawing towards the winter months as a result of the winter rains. The mucilage which covered almost the entire Marmara between January–July, 2021 was able to reach Saros Bay via currents passing through the Dardanelles in layers. It has been seen as reaching as far as Gökçeada and Limni Island. There is no danger, however, of it passing through the Dardanelles and drifting with north or south with the currents. Neustonic slime shoals passing through the strait get carried into the open sea by currents, and then it disintegrates and disappears in a few weeks due to the dynamics of the open sea.

The mucilage phenomenon is very complex. A spreading of the Marmara Sea mucilage may be linked to climate-driven sea surface warming and could act as a controlling factor of microbial diversity across oceans and could have the potential to act as a carrier of specific marine plankton (Danovaro *et al.*, 2009). Some of the stages in its formation are still unknown. Clean up efforts limited to collecting the mucilage with pumps from the sea surface are vastly insufficient. Most of the danger lies out of sight, underwater in large macro flocs, stringers, cobwebs, ribbons, clouds, big creamy surface layers, gelatinous surface layers, and false bottoms (Stachowitsch *et al.*, 1990; Precali *et al.*, 2005). In areas where mucilage has progressed far enough to be visible to the layman, fishing is no longer possible and there are no fish left to catch. The sea cannot be used for leisure activities such as swimming and the mussels become inedible. Tourism is also negatively affected by it (Danovaro *et al.*, 2008). The pathogenic bacteria are harmful to human health (Danovaro *et al.*, 2005) as well as to that of fish. Attempts to obtain fresh water from the sea are hampered by mucilage clogging up expensive filters. As the situation progresses a hypoxic environment may occur when oxygen decreases to very low levels, and eventually an anoxic environment can be the result when oxygen has been completely depleted in the environment (Danovaro *et al.*, 2009). Because the sticky slimy structure clings to oceanographic measuring instruments and damages sensitive devices the researchers' work is obstructed. Instead of reactively trying to collect and destroy mucilage when it occurs, the focus should be on preventing pollution in the first place.

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The ecosystem approach to fisheries (EAF) was adopted by the FAO Committee on Fisheries as the appropriate and practical way to implement the FAO Code of Conduct for Responsible Fisheries. This technical paper presents a baseline report that was prepared under an EAF case study initiated for the small-scale fisheries of Gökçeada located in the northern Aegean Sea, the biggest island of Turkey. The baseline report was prepared in consultation with stakeholders to provide the necessary background information to support the subsequent steps of the EAF management planning process. The report documents essential information on the small-scale fisheries including the species and geographical areas covered in the case study, the socio-economic profile of the fisheries, the main threats to the sustainability of the fisheries and the institutional arrangements for their management.

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