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THE STATE OF MEDITERRANEAN AND BLACK SEA FISHERIES 2018

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Foreword

The Mediterranean and the Black Sea represent a unique convergence of complex ecological, economic and social features. For centuries, this region has offered coastal communities a bounty of marine living resources, which has propelled the development of the fishing industry and has helped forge the identity of many of the civilizations that constitute the cultural and social fabric of the area.

There are numerous reasons that explain why the Mediterranean Sea and the Black Sea play an intrinsic role in the development of the diverse nations bordering their shores. The exceptional location of both basins and their semi-enclosed nature has made it possible for marine trade to thrive. Fish products have traditionally been among the most important commodities traded in this region, and fish consumption has always been an integral part of people's diet. However, with the rapidly increasing demand for seafood – dramatic in recent decades – Mediterranean and Black Sea marine living resources have become more vulnerable. Some of the most iconic species found in the region and the marine ecosystems upon which they depend are facing extreme anthropogenic pressures; this may ultimately jeopardize the livelihoods of the coastal communities of the region, which, for so many years, have depended on these resources.

Human activities, which have an impact on marine living resources, such as fishing, require a concerted approach by riparian countries. As early as 1949, the Food and Agriculture Organization of the United Nations (FAO) called for the establishment of a regional body as an effective response for the common management of these resources and in 1952 the General Fisheries Commission for the Mediterranean (GFCM) was established. Like other organizations created in different regions of the world, the GFCM was first conceived as a body without management powers. This is arguably because living marine resources were still considered to be plentiful – if not inexhaustible – and the situation at the time did not command stringent measures. Advances in science showed a very different picture, and management eventually became the key function of the GFCM, as was also the case for other regional fishery management organizations. However, it should not be forgotten that all management efforts begin with knowledge.

Two years ago, the GFCM published a comprehensive assessment of the status of marine living resources in its area of application, *The State of Mediterranean and Black Sea Fisheries* (SoMFi), highlighting the sector's role, its characteristics, impacts and contributions as well as governance in the region. The success of this publication, the first to provide a complete outlook on Mediterranean and Black Sea fisheries, compelled the GFCM to continue along this path. The 2018 edition of the SoMFi is the fruit of our continued efforts in collecting, analysing and disseminating relevant information to the broadest possible audience. It provides a timely opportunity to strengthen the initial analysis, study developments, and improve knowledge towards the defining common rules.

SoMFi brings together the most exhaustive, up-to-date and reliable data and indicators, providing a comprehensive overview of regional and subregional trends in Mediterranean and Black Sea fisheries, with a view to supporting decision-making. Similar to the FAO global reference series, *The State of World Fisheries and Aquaculture* (SOFIA), SoMFi is a tool for measuring progress in meeting the targets set by the United Nations Sustainable Development

Goal (SDG) 14 on the conservation and sustainable use of oceans, seas and marine resources. In this regard, recent political commitments taken by Mediterranean and Black Sea countries are encouraging, since today, as reflected in the MedFish4Ever and the Sofia ministerial declarations, there is strong political will to take immediate action, for present and future generations that depend on the sector. The recently adopted Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) is also another step in this respect. Hence, the role of the GFCM in ensuring the proper management of marine living resources in the Mediterranean and the Black Sea, based on solid knowledge and sound advice, is ever so crucial.

We expect the 2018 edition of SoMFi to become an important reference for all stakeholders involved or interested in the sustainability of Mediterranean and Black Sea fisheries. I am confident that this publication will also be of interest to others around the world who may be keen on furthering their knowledge on the interactions between human activities and marine living resources. Here, they will find interesting insights on how we can contribute to the sustainable development of coastal communities while fostering inter-generational responsibility.

Abdellah Srour
Executive Secretary
General Fisheries Commission for the Mediterranean

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Abbreviations and acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
BlSAC	Black Sea Advisory Council
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoC	GFCM Compliance Committee
COFI	FAO Committee on Fisheries
CPCs	GFCM Contracting Parties and Cooperating non-Contracting Parties
CPUE	Catch per unit effort
CSO	Civil society organization
CWP	FAO Coordinating Working Party on Fishery Statistics
DCRF	GFCM Data Collection Reference Framework
EAF	Ecosystem approach to fisheries
EEZ	Exclusive economic zone
EFCA	European Fisheries Control Agency
EIA	Environmental Impact Assessment
EIFAAC	European Inland Fisheries and Aquaculture Advisory Commission
EFH	Essential fish habitat
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FRA	Fisheries restricted area
FTE	Full time equivalent
GCF	Gross cash flow
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GFCM-AVL	GFCM Authorized Vessel List
GSA	Geographical subarea
GT	Gross tonnage
ICES	International Council for the Exploration of the Sea
ILO	International Labour Organization
ISSCAAP	FAO International Standard Statistical Classification for Aquatic Animals and Plants
IUCN-Med	International Union for Conservation of Nature – Centre for Mediterranean Cooperation
IUU	Illegal, unreported and unregulated (fishing)
LIFE	Low Impact Fishers of Europe
LOA	Length overall
LSF	Large-scale fisheries
MCS	Monitoring, control and surveillance
MEDAC	Mediterranean Advisory Council
MedPAN	Network of Marine Protected Area Managers in the Mediterranean
mid-term strategy	mid-term strategy (2017-2020) towards the sustainability of Mediterranean and Black Sea fisheries
MPA	Marine protected area
MSE	Management Strategy Evaluation
nei	not elsewhere included
PSMA	Port State Measures Agreement
RFMO	Regional fisheries management organization
RPOA-SSF	Regional plan of action for small-scale fisheries in the Mediterranean and the Black Sea
SAC	GFCM Scientific Advisory Committee on Fisheries
SAF	Stock assessment forms
SDG	Sustainable Development Goals

SGSABS	GFCM Subregional Group on Stock Assessment in the Black Sea
SoMFi	The State of Mediterranean and Black Sea Fisheries
SOFIA	The State of World Fisheries and Aquaculture
SRC-AS	SAC Subregional Committee for the Adriatic Sea
SRC-CM	SAC Subregional Committee for the Central Mediterranean
SRC-EM	SAC Subregional Committee for the Eastern Mediterranean
SRC-WM	SAC Subregional Committee for the Western Mediterranean
SSB	Spawning stock biomass
SSF	Small-scale fisheries
SSF Guidelines	Voluntary Guidelines for Securing Small-scale Fisheries in the Context of Food Security and Poverty Eradication
SSF Symposium	First Regional Symposium on Sustainable Small-Scale Fisheries in the Mediterranean and Black Sea
TAC	Total allowable catch
UN Environment/MAP	United Nations Environment Programme – Mediterranean Action Plan
VME	Vulnerable marine ecosystems
VMS	Vessel Monitoring System
WGBS	GFCM Working Group on the Black Sea
WGEEL	Joint EIFAAC/ICES/GFCM Working Group on Eels
WGIUU	Working group on Illegal, Unreported and Unregulated IUU fishing
WGSAD	Working Group on Stock Assessment of Demersal Species
WGSASP	Working Group on Stock Assessment of Small Pelagic Species
WGSSF	Working Group on Small-Scale and Recreational Fisheries
WGVME	Working Group on Vulnerable Marine Ecosystems
WGVMS	Working Group on Vessel Monitoring Systems and related control systems
WKMSE	Workshop on the bioeconomic assessment of management measures
WWF	World Wildlife Fund for nature
XSA	Extended survivor analysis

Introduction and methodology

The Mediterranean and the Black Sea (FAO major fishing area 37) have sustained important fisheries activities since ancient times. Today, industrial, semi-industrial and small-scale fisheries coexist in the region, using a large variety of fishing gear. In contrast with other major fishing areas, Mediterranean and Black Sea fisheries generally lack large mono-specific stocks, and instead exploit a variety of benthic and pelagic stocks of fish, as well as molluscs and crustaceans. In addition, since the Mediterranean and the Black Sea are semi-enclosed seas, with an overall lack of exclusive economic zones (EEZs) and consequently with stocks that are often shared among fleets from different countries, the fishery sector has always played an important role in the region. In fact, despite its relatively low economic output compared to other economic activities in the region (e.g. tourism, oil and gas exploration), the annual production of roughly 1.22 million tonnes offers employment opportunities to several hundred thousand people, supplies seafood products for human consumption to local and regional markets, and creates many other indirect benefits, maintaining the social fabric of coastal communities. Fisheries are also an intrinsic part of the cultural landscape of Mediterranean and Black Sea countries.

However, the sustainability of Mediterranean and Black Sea fisheries is threatened in particular by the effects of increased pollution from human activities, habitat degradation, the introduction of non-indigenous species, overfishing and the impacts of climate-driven changes to the marine environment and ecosystems. The dramatic ecosystem changes that have recently occurred, especially in the Black Sea in the past few decades, are testimony to the need to account for these different processes and stressors when managing fisheries in the region, in line with an ecosystem approach to fisheries (EAF).

Recognizing the importance and peculiarities of fisheries in the Mediterranean and the Black Sea, and the need for strong regional cooperation, the GFCM was established to promote the development, conservation, rational management and best utilization of living marine resources in the region. Among its various responsibilities, the GFCM regularly reviews the state of fisheries, including the economic and social aspects of the fishing industry, as a basis for the formulation of scientific and management advice conducive to sustainable and responsible fisheries.

This report is the second issue of the GFCM biennial series *The State of Mediterranean and Black Sea Fisheries* (SoMFi). The first report – published in 2016 following a request by GFCM contracting parties – proved to be a reference for experts, scientists, policy-makers and stakeholders both from within and outside the region, seeking up-to-date and reliable information on the status of Mediterranean and Black Sea marine resources. It is a useful instrument for monitoring progress towards achieving GFCM objectives and thus supporting strategic decision-making. SoMFi can be seen as a magnifying glass on FAO major fishing area 37, and a complement to the FAO global reference series *The State of World Fisheries and Aquaculture* (SOFIA).

SoMFi 2018 is divided in two parts and consists of eight chapters. The first part provides an overview of status and trends, describing the current composition of the fishing fleet (Chapter 1), the overall capture fishery production (Chapter 2), the economic performance and socio-economic characteristics of capture fisheries (Chapter 3), bycatch (Chapter 4)

and an analysis of the status of the stocks (Chapter 5). The second part focuses on fisheries governance, with insights on small-scale fisheries, since they account for more than 80 percent of the Mediterranean and Black Sea fleet (Chapter 6) and fisheries management measures put in place by the GFCM to support the sustainability of fisheries (Chapter 7). It concludes with a summary of GFCM's contribution to the United Nations Sustainable Development Goals (SDGs) by reviewing progress in implementing the mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries (Chapter 8).

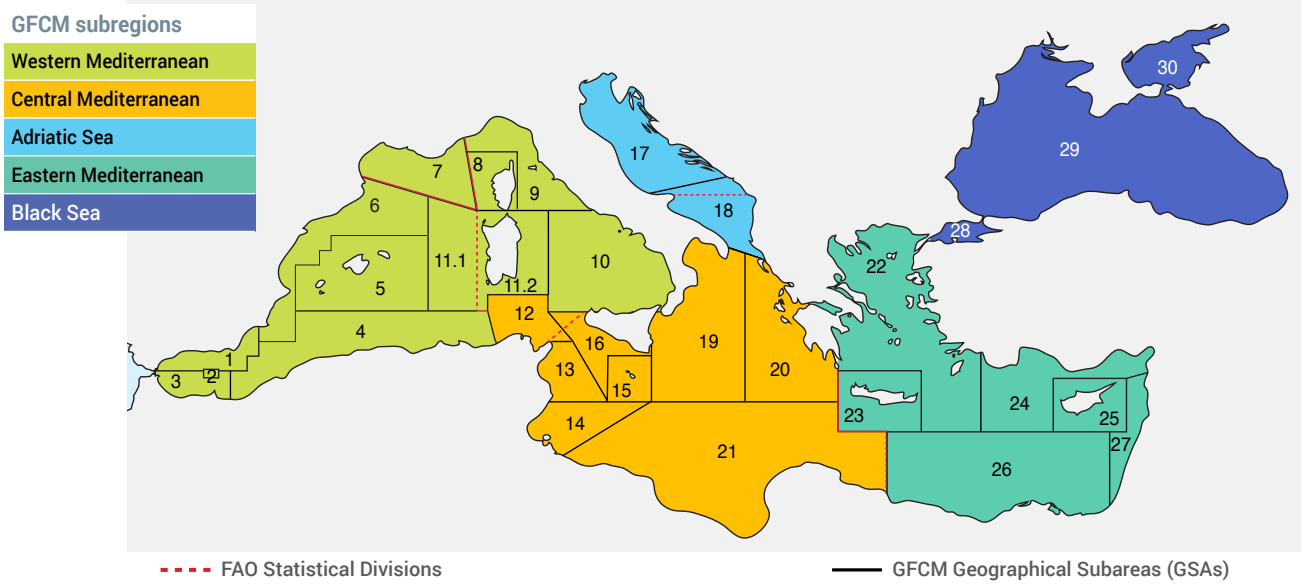
This report presents data and information mostly up to 2017. It is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions and through the online platform of the GFCM Data Collection Reference Framework (DCRF; Box 1), the GFCM Task 1 Statistical Matrix, FAO official fishery statistics (e.g. FAO fisheries commodities production and trade statistics), the GFCM database on stock assessment form metadata, the STATLANT system of questionnaires developed by the FAO Coordinating Working Party on Fishery Statistics (CWP) as well as other tools used within the GFCM to obtain information from countries (i.e. national reports to GFCM advisory bodies, ad hoc questionnaires, specific workshops and established working groups). In the absence of national reporting, estimates were made based on best available data obtained from other sources or through standard methodologies.

Data are analysed at different levels of aggregation, and particular attention is paid to address the main vessel categories and species (a list of the main species of commercial or conservation interest is available in Table 1). Information is provided at different spatial scales in order to facilitate analyses at the regional, subregional and national levels. At the regional scale, summaries are presented to provide a general overview of relevant aspects of fisheries in the entire GFCM area of application (the Mediterranean and the Black Sea). At the subregional level – using the subregions as defined in the DCRF (Figure 1) – the report provides a comparative analysis of the main characteristics in the western, central and eastern Mediterranean, the Adriatic Sea and the Black Sea. It also includes information for policy-makers at the level of states and relevant non-state actors. Finally, as appropriate and relevant, information is presented at a smaller aggregation level, i.e. geographical subareas, commonly used in the GFCM as the minimal management unit.

TABLE 1 – Main species of commercial or conservation interest in the GFCM area of application

Scientific name	Common name	Scientific name	Common name
Alosa immaculata	Pontic shad	*Pagellus erythrinus*	Common pandora
Anguilla anguilla	European eel	*Parapenaeus longirostris*	Deep-water rose shrimp
Aristaeomorpha foliacea	Giant red shrimp	*Prionace glauca*	Blue shark
Aristeus antennatus	Blue and red shrimp	*Pteroplatytrygon violacea*	Pelagic stingray
Boops boops	Bogue	*Raja asterias*	Mediterranean starry ray
Chamelea gallina	Striped venus	*Raja clavata*	Thornback ray
Corallium rubrum	Red coral	*Raja miraletus*	Brown ray
Coryphaena hippurus	Common dolphinfish	*Rapana venosa*	Rapa whelk
Dalatias licha	Kitefin shark	*Sarda sarda*	Atlantic bonito
Diplodus annularis	Annular seabream	*Sardina pilchardus*	European pilchard (=sardine)
Dipturus oxyrinchus	Longnosed skate	*Sardinella aurita*	Round sardinella
Eledone cirrhosa	Horned octopus	*Saurida lessepsianus*	Lizardfish
Eledone moschata	Musky octopus	*Saurida undosquamis*	Brushtooth lizardfish
Engraulis encrasicolus	European anchovy	*Scomber japonicus*	Pacific chub mackerel
Etmopterus spinax	Velvet belly	*Scomber scombrus*	Atlantic mackerel
Fistularia commersonii	Bluespotted cornetfish	*Scomberomorus commerson*	Narrow-barred Spanish mackerel
Galeus melastomus	Blackmouth catshark	*Scophthalmus maximus*	Turbot
Hexanchus griseus	Bluntnose sixgill shark	*Scyliorhinus canicula*	Small-spotted catshark
Lagocephalus sceleratus	Silver-cheeked toadfish	*Scyliorhinus stellaris*	Nursehound
Lophius budegassa	Blackbellied angler	*Sepia officinalis*	Common cuttlefish
Marsupenaeus japonicus	Kuruma prawn	*Siganus luridus*	Dusky spinefoot
Merlangius merlangus	Whiting	*Siganus rivulatus*	Marbled spinefoot
Merluccius merluccius	European hake	*Solea vulgaris*	Common sole
Metapenaeus stebbingi	Peregrine shrimp	*Sphyraena sphyraena*	European barracuda
Micromesistius poutassou	Southern blue whiting	*Spicara smaris*	Picarel
Mullus barbatus	Red mullet	*Sprattus sprattus*	European sprat
Mullus surmuletus	Surmullet	*Squalus acanthias*	Piked dogfish
Mustelus asterias	Starry smooth-hound	*Squalus blainville*	Longnose spurdog
Mustelus mustelus	Smooth-hound	*Squilla mantis*	Spottail mantis squillid
Mustelus punctulatus	Blackspotted smooth-hound	*Torpedo marmorata*	Marbled electric ray
Myliobatis aquila	Common eagle ray	*Torpedo torpedo*	Common torpedo
Nephrops norvegicus	Norway lobster	*Trachurus mediterraneus*	Mediterranean horse mackerel
Octopus vulgaris	Common octopus	*Trachurus picturatus*	Blue jack mackerel
Pagellus bogaraveo	Blackspot seabream	*Trachurus trachurus*	Atlantic horse mackerel

Source: DCRF (GFCM, 2018b).



GFCM GSAs

01 - Northern Alboran Sea	07 - Gulf of Lion	13 - Gulf of Hammamet	19 - Western Ionian Sea	25 - Cyprus
02 - Alboran Island	08 - Corsica	14 - Gulf of Gabes	20 - Eastern Ionian Sea	26 - South Levant
03 - Southern Alboran Sea	09 - Ligurian Sea and Northern Tyrrhenian Sea	15 - Malta	21 - Southern Ionian Sea	27 - Eastern Levant Sea
04 - Algeria	10 - South and Central Tyrrhenian Sea	16 - South of Sicily	22 - Aegean Sea	28 - Marmara Sea
05 - Balearic Islands	11.1 - Sardinia (west) 11.2 - Sardinia (east)	17 - Northern Adriatic Sea	23 - Crete	29 - Black Sea
06 - Northern Spain	12 - Northern Tunisia	18 - Southern Adriatic Sea	24 - North Levant Sea	30 - Azov Sea

Source: GFCM 2018.

FIGURE 1 – GFCM area of application, subregions and geographical subareas

BOX 1 – GFCM Data Collection Reference Framework

The GFCM Data Collection Reference Framework (DCRF) is the first GFCM framework for the collection and submission of fisheries-related data in the GFCM area of application. It underpins the formulation of sound scientific advice by relevant GFCM subsidiary bodies (i.e. the Scientific Advisory Committee on Fisheries and the Working Group for the Black Sea), ultimately supporting the GFCM decision-making process towards sustainable Mediterranean and Black Sea fisheries.

Formalized in 2017, the DCRF is an instrument to support GFCM contracting parties and cooperating non-contracting parties (CPCs) in complying with binding recommendations in place for the collection and submission of fisheries data. It covers, in a standardized and optimized way: catch (landing and catch per species); incidental catch of vulnerable species; fishing fleet (fleet register, authorized vessels, vessels operating in the GFCM fisheries restricted areas); fishing effort (per fleet segment, fishing gear, catch per unit effort [CPUE]); socio-economics (economic and social data, operating costs, species value); and biological information (stock assessment, length, size at first maturity, maturity data, dolphinfish, red coral, European eel).

CPCs are equipped with dynamic tools to facilitate the collection and submission of data:

a) The DCRF manual encompasses all necessary indications for CPCs to collect relevant national data in a standardized way in order to provide the GFCM with the minimum set of data needed to support the formulation of advice and decision-making.

b) The DCRF online platform provides CPCs with online tools for the official submission of national fisheries data in line with the requirements outlined in GFCM recommendations.

The DCRF is conceived as a flexible tool, which should be regularly reviewed in light of possible new GFCM requirements, including newly adopted recommendations. The DCRF is instrumental in achieving a more efficient data collection programme across the whole Mediterranean and Black Sea region and in better integrating data collection and subregional multiannual management plans towards sound fisheries management.

Executive summary

The second edition of *The State of Mediterranean and Black Sea Fisheries* is divided in two parts and consists of eight chapters. The first part provides an overview of status and trends, including fishing fleet, capture fishery production, socio-economic variables, bycatch and an analysis of the status of the stocks. The second part focuses on fisheries governance, with insights on small-scale fisheries and a review of management measures in place to achieve the sustainability of fisheries, concluding with the contribution of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries ("mid-term strategy") implemented by the GFCM.

The report is largely based on the most up-to-date data available, including data up to 2017, on stock status, national catches, fleet and socio-economic aspects, as submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions or obtained from other sources. Information is presented at the regional (GFCM area of application as a whole, and Mediterranean and Black Sea separately), subregional (western, central and eastern Mediterranean and Adriatic Sea) and country levels.

The main highlights of SoMFi 2018 are summarized in the paragraphs below.

FISHING FLEET

The officially reported fishing fleet operating in the Mediterranean and the Black Sea in 2017 comprises around 86 500 vessels, 6 200 units less than the 2014 value reported in SoMFi 2016. The fishing fleet is unevenly distributed in the GFCM area of application, with the eastern Mediterranean accounting for the largest share of vessels (30.6 percent), followed by the central Mediterranean (26.4 percent), the western Mediterranean (17.3 percent), the Black Sea (13.4 percent) and the Adriatic Sea (12.3 percent). Turkey, Italy, Egypt and Tunisia are, in decreasing order of importance, the countries with the highest fishing capacity in gross tonnage (GT), accounting for 60 percent of the total.

Polyvalent vessels constitute the dominant vessel group, representing 77.8 percent of all vessels in the Mediterranean Sea and 91.3 percent in the Black Sea. Other vessel groups of regional relevance in terms of numbers are trawlers over 6 m length overall (LOA) in the Mediterranean Sea (8.6 percent) and the group of purse seiners and pelagic trawlers over 6 m LOA in the Black Sea (4.7 percent).

The available information also highlights that the fishing fleet of Turkey, the largest in the GFCM area of application, is one of the youngest in the region (22 years old, on average), and that Albania's, one of the smallest fleets, is the oldest (43 years old, on average).

CAPTURE FISHERIES PRODUCTION

Overall, total capture fisheries production in the Mediterranean and the Black Sea continues to show the trends observed in SoMFi 2016. Total landings in the Mediterranean and the Black Sea increased irregularly from about one million tonnes in 1970 to almost two million tonnes in 1982. They remained relatively stable during most of the 1980s before declining abruptly in 1989 and 1990, largely due to the collapse of pelagic fisheries in the Black Sea. In the Mediterranean, landings continued to increase until 1994, reaching 1 087 000 tonnes, and subsequently declined irregularly to 850 000 in 2016, with production apparently levelling out

in the last three years. In the Black Sea, landings have varied considerably from one year to the next since 1990, showing a generally increasing trend. In 2016, the total reported landings in the Black Sea were 390 000 tonnes.

The combined landings for the Mediterranean and the Black Sea averaged between 2014–2016 amount to 1 220 000 tonnes (827 000 in the Mediterranean and 396 000 in the Black Sea). This value is slightly higher (5 percent) than the catches in 2013 but remains 17 percent lower than the average over the 2000–2013 period reported in SoMFi 2016.

Across the GFCM area of application, the ranking of capture fisheries production in 2014–2016 continues to be dominated by Turkey (321 800 tonnes and 26 percent of total landings versus 31 percent previously reported), followed by Italy (185 300 tonnes and 16 percent, similar to the percentage previously reported). Algeria (96 300 tonnes and 8 percent) and Greece (65 700 tonnes and 5 percent) also maintain the same percentages in landing contribution. Both Tunisia (185 300 tonnes) and Croatia (74 400 tonnes) show an increase compared to SoMFi 2016 (from 7 to 9 percent for Tunisia and from 3 to 6 percent for Greece). Total landings for Spain decreased (78 200 tonnes, decreasing from 8.5 percent to 7 percent of the total).

Catches are dominated by small pelagics (herrings, sardines, anchovies), representing nearly 49 percent of the catches (versus 51 percent reported in SoMFi 2016), mainly European anchovy and sardine (22 and 16 percent respectively, compared to 26 and 12 percent reported in SoMFi 2016).

Among areas and using the 2014–2016 average, the western Mediterranean continues to dominate the capture fisheries production in the Mediterranean (265 100 tonnes and 22 percent of the total landings in the GFCM area of application, compared to 24 percent reported in SoMFi 2016), followed by the Adriatic Sea and the central and eastern Mediterranean (193 500, 184 500 and 180 800 tonnes respectively, representing 16, 15 and 15 percent of the total). The average production in the Black Sea over the last three years has reached 396 000 tonnes, accounting for 32 percent, similar to the percentage reported in SoMFi 2016.

SOCIO-ECONOMIC CHARACTERISTICS

Marine capture fisheries in the Mediterranean and Black Sea produce an estimated annual revenue of USD 2.8 billion and directly employ just under a quarter of a million people (248 000) onboard fishing vessels. In comparison with the information reported in SoMFi 2016, total revenue has decreased by USD 300 million (around 10 percent) and total employment has increased by 26 000 people (around 10 percent). Revenue calculations, based on official data on value at first sale, represent only a small part of the total economic impact of fisheries, which is estimated to be at least 2.6 times larger (approximately USD 7.3 billion). Furthermore, the changes in revenue and employment reported here may indicate an improvement in the data collection rather than a real change in the sector.

Of the main vessel groups, trawlers and purse seiners together represent 64 percent of total revenue; however, they provide only 34 percent of employment in fisheries. In contrast, the situation of the polyvalent vessel group is reversed: it represents 26 percent of total revenue, but provides employment to 59 percent of all fishers in the region. Preliminary data show that remuneration within the vessel groups that provide the most employment opportunities (primarily the polyvalent vessel group) is approximately 50 percent less that of other groups, such as trawlers and purse seiners.

Trade of fish products continues to be important for the region. Most Mediterranean and Black Sea riparian states are net importers of fish products and only eight countries are net exporters (Morocco, the Russian Federation, Turkey, Tunisia, Croatia, Malta, Albania and Greece). Also, three countries depend almost entirely on imports of fish products (Montenegro, Lebanon and the Syrian Arab Republic).

BYCATCH: DISCARDS AND INCIDENTAL CATCH OF VULNERABLE SPECIES

The volume of fishery discards amounts to around 230 000 tonnes per year in the Mediterranean (around 18 percent of total catch) and is estimated at about 45 000 tonnes in the Black Sea (around 10–15 percent of total catch).

In the Mediterranean, bottom trawlers are responsible for the bulk of discards (generally more than 40 percent), whereas discard rates for pelagic trawlers and purse seiners are generally lower (mostly less than 15 percent and between 2 and 15 percent of total catch, respectively). Information on discards for small-scale fisheries is relatively scarce, but available data report a discard ratio lower than 10 percent for all different types of gear (i.e. trammel, gillnets and small longliners). Demersal longliners produce minimal discards (less than 15 percent), whereas pelagic longliners still may produce high values of both discards (more than 15 percent) and incidental catch of vulnerable species.

In the Black Sea, discard rates, by fishery, are: between 25 and 45 percent for trawl fisheries; 15 percent for small-scale fisheries; approximately 5 percent for midwater trawlers targeting small pelagic species; 1–5 percent for purse seiners; and around 11 percent for sea snail dredge fisheries.

Generally, in all subregions, the most commonly discarded groups of species are benthic invertebrates (e.g. gastropods, porifers, cnidarians, echinoderms), elasmobranch species with no commercial value, but also non-commercial individuals of target fish, crustaceans and cephalopods species.

Annual absolute values of incidental catches of vulnerable species are not available, therefore this report collects information on the relative importance of different types of fishing gear and the main species affected. Sharks, rays and skates, which occur in the shallow coastal shelves of the Mediterranean, are mainly affected by bottom trawlers targeting demersal fish and invertebrate species. Longlines (both pelagic and demersal) have a significant impact on sharks, sea turtles and seabirds. Static nets also incidentally catch a conspicuous number of sea turtles. In the Black Sea, the turbot gillnet fishery is associated with high rates of incidental catches of demersal sharks (e.g. piked dogfish) and dolphins.

Data from literature indicate that sea turtles (around 80 percent) and elasmobranchs (around 16 percent) show the highest percentages of reported incidental catch among the vulnerable groups. Seabirds and marine mammals, on the contrary, are apparently the groups with the lowest number of incidental catch events (around 4 percent of the total).

STATUS OF FISHERY RESOURCES

The quality and coverage of scientific advice on the status of fishery resources have continued to increase, reaching around 50 percent of the catches and providing a 40 percent coverage of management units for priority species across the Mediterranean and Black Sea. Coverage in the Adriatic Sea and the Black Sea continues to improve, whereas in the southwestern Mediterranean, the Ionian Sea and the eastern Mediterranean, it continues to be fragmented.

About 78 percent of Mediterranean and Black Sea stocks assessed are currently fished at biologically unsustainable levels,[1] although the percentage has slightly decreased since 2014 (88 percent).

In terms of biomass, 42 percent of Mediterranean stocks are considered to show low biomass, while the rest of stocks are considered to have intermediate or high biomass. In the Black Sea, advice in relation to biomass is generally lacking, although piked dogfish, and to a lesser extent, turbot are considered to be depleted, showing some signs of improvement for the latter.

Demersal stocks continue to experience higher fishing mortality rates, while small pelagic stocks show average fishing mortality rates close to the target. The average overexploitation rate for priority species across management units ranges from a minimum of 1.4 to a maximum of 5.8 (European hake) times the target exploitation rate. In terms of trends, all priority species except for sardine and European anchovy in the Mediterranean and sprat in the Black Sea show a decreasing overexploitation index in the recent years. An increasing trend in biomass is also observed for turbot in the Black Sea.

INSIGHTS INTO SMALL-SCALE AND RECREATIONAL FISHERIES

Artisanal or small-scale fisheries (SSF) in the Mediterranean and the Black Sea play a significant social and economic role: they represent 84 percent of the fishing fleet (70 000 vessels), 26 percent of total revenue (USD 633 million) and 60 percent of total employment (150 000 people). The SSF fleet has decreased by approximately 4 000 vessels (5 percent), whereas employment and annual revenue in SSF has increased by approximately 15 000 persons (9 percent) and USD 45.3 million (7 percent) compared with data reported in SoMFi 2016. Data submissions on SSF have become more complete and accurate; the changes seen may therefore, in part, be due to improved data collection.

Despite anecdotal evidence suggesting that marine recreational fisheries constitute significant fishing activity in the Mediterranean and the Black Sea, data collection for this sector is currently limited and fragmentary, and varies between countries.

FISHERIES MANAGEMENT MEASURES

The GFCM recently has adopted four multiannual management plans in the Mediterranean (small pelagic fisheries in the Adriatic Sea, demersal fisheries in the Strait of Sicily and two management plans for deep-water red shrimps in the central and eastern Mediterranean) and one multiannual management plan in the Black Sea (turbot), as well as two regional multiannual management plans in the Mediterranean (red coral and European eel). These include a wide variety of management measures, such as minimum landing size, catch limits, ad hoc spatial and temporal closures to allow the recovery of the stock and to create refugia zones, reduction of the fishing effort, monitoring, control and surveillance and other measures. In addition, the GFCM adopts spatial management measures; fisheries restricted areas (FRAs) are the main spatial protection tool currently in place. Up to 2018, eight well-delimited FRAs have been established to protect essential fish habitats (EFH) and/or vulnerable marine ecosystems (VMEs), from the significant adverse impact of fishing activities. The total surface of the marine area included in the FRAs is around 22 500 km^2. Moreover, a larger deep-sea FRA of slightly over 1 700 000 km^2 (about 59 percent of the GFCM area of

1 Based on the FAO classification on the status of stocks, biologically unsustainable levels imply that either fishing mortality is higher than the target fishing mortality, or that biomass is lower than the target biomass level.

application) protecting all sea bottom below 1 000 m across both basins has been in place since 2005, to protect poorly known and fragile deep-sea ecosystems from bottom-contact fishing gear. Finally, GFCM spatial fishing restrictions addressing coastal areas have also been implemented.

Management strategy evaluation (MSE) frameworks have been developed to assess management measures for the two multiannual management plans in the Mediterranean and the one in the Black Sea. In all cases, the outcomes show that protracting the current fishing mortality regimes ("the status quo") would lead the three fisheries to collapse. However, the implementation of adequate management measures is expected to facilitate the recovery of stocks, in some cases allowing catches to return to levels observed in the past. The challenge for the next years will be to translate hypothetical changes in fishing mortality and biomass into implementable measures.

MID-TERM STRATEGY TOWARDS THE SUSTAINABILITY OF MEDITERRANEAN AND BLACK SEA FISHERIES

The mid-term strategy was launched in order to define a course of decisive action aimed at reversing the alarming trend in the status of commercially exploited stocks. Aligned with the United Nations Sustainable Development Goals (SDGs), the mid-term strategy seeks to improve Mediterranean and Black Sea fisheries and contribute to the sustainable development of coastal states. In 2018, all mid-term strategy activities are launched and are, to a varying extent, either in progress, well-advanced or, in some cases, concluded. In particular, harmonized methodologies were produced to support regional data collection for discards and incidental catches of vulnerable species and recreational fisheries, as well as for surveys-at-sea. Also, a technical cooperation project (the BlackSea4Fish project) was launched to support Black Sea work, and the first GFCM subregional technical unit was established in Bulgaria. The Regional Plan of Action to Combat Illegal, Unreported and Unregulated Fishing in the GFCM area of application (RPOA-IUU) and the Regional Plan of Action for Sustainable Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) were adopted, with activities launched during 2018 for the former and expected to be launched from 2019 for the latter.

Replicability, scaling-up and continuation of successful initiatives will be sought, in line with the international and regional contexts, as well as renewed commitments by countries and partner organizations, when defining the post-2020 framework for sustainable fisheries in the Mediterranean and the Black Sea.

PART 1
OVERVIEW OF THE STATUS AND TRENDS OF MEDITERRANEAN AND BLACK SEA FISHERIES

FISHING FLEET

1

1. Fishing fleet

1.1. INTRODUCTION AND SOURCES OF INFORMATION

This chapter provides an overview of the most up-to-date information on fishing fleet operating in the GFCM area of application. The analysis takes into consideration key aspects of fishing vessels in the Mediterranean and the Black Sea, including size, capacity and engine power as well as the composition of fleet segments. Furthermore, characteristics of the fishing fleet in the context of current GFCM management plans (small pelagic fisheries in the Adriatic Sea, demersal fisheries in the Strait of Sicily, and turbot fisheries in the Black Sea) and of FRAs are also reported in this chapter.

The data and information used in this chapter mainly derive from binding recommendations that require GFCM contracting parties and cooperating non-contracting parties (CPCs) to regularly submit their national data according to the specifications set out in these decisions. These data-related recommendations can be grouped as follows.

The first set of decisions consists in Recommendations GFCM/33/2009/5 on the establishment of the GFCM regional fleet register and GFCM/33/2009/6 concerning the establishment of a GFCM record on vessels over 15 metres length overall (LOA) authorized to operate in the GFCM area of application (GFCM-AVL[1]). The data as transmitted by CPCs are stored into the GFCM vessel records database (containing data on fleet register, including authorized vessels list and operating fleet in FRAs). This database alone does not always provide an accurate picture of the actual fishing capacity of the fleet in the GFCM area of application, as not all the recorded vessels are actually in operation and in some countries, the national fleet register does not contain data on small-scale vessels.

The second group of GFCM decisions consists in Recommendations GFCM/33/2009/3 on the implementation of the GFCM Task 1 statistical matrix, GFCM/40/2016/2 on the progressive implementation of data submission in line with the Data Collection Reference Framework (DCRF) and GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application. The first recommendation was in force for eight years until 2017; the second was transitory and thus valid in 2017 only; and the third became binding in 2018[2] for all CPCs. These decisions requested various types of information on the operations of national fishing fleets in the GFCM area of application, including the number and capacity of vessels, catch, fishing effort and socio-economics characteristics of the different fleet segments, as well as specific biological characteristics of the catch for these fleet segments. This comprehensive characterization of the fleet provides the most accurate picture of the fishing fleets operating in the area at an aggregated level, namely the GFCM fleet segments, based on the size of the vessels, propulsion and dominant fishing gear (Box 2 and Box 3).

The last set of decisions, which serve a source of information for fishing fleet data in the context of GFCM fishery management plans, consists in Recommendations GFCM/37/2013/1 on a multiannual management plan for fisheries on small pelagic stocks in geographical subarea 17 (northern Adriatic Sea), and GFCM/40/2016/3 establishing further emergency

1 According to this recommendation, vessels longer than 15 m not entered in the record are deemed not to be authorized to fish for, retain on board, transship or land species covered by the Commission.

2 Recommendation GFCM/41/2017/6 is the result of the progressive implementation of the DCRF, and it repealed Recommendation GFCM/33/2009/3 (on the implementation of the GFCM Task 1 statistical matrix).

measures in 2017 and 2018 for small pelagic stocks in the Adriatic Sea (GSA 17 and GSA 18); GFCM/39/2015/3 on the establishment of a set of measures to prevent, deter and eliminate illegal, unreported and unregulated fishing in turbot fisheries in the Black Sea (GSA 29); GFCM/39/2015/2 on the establishment of asset of minimum standards for bottom trawling fisheries of demersal stocks in the Strait of Sicily, pending the development and adoption of a multiannual management plan; and GFCM/40/2016/4 establishing a multiannual management plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (GSAs 12 to 16)[3].

Finally, in addition to the above listed GFCM decisions, the following complementary data sources are used to provide the most updated figures on the size of the fleet in the Mediterranean and the Black Sea: the national reports to the Scientific Advisory Committee on Fisheries (SAC), questionnaires, or any other information submitted by countries to the GFCM.

1.2. SIZE OF THE FISHING FLEET

The fishing fleet in operation in the Mediterranean and the Black Sea consisted in around 86 500 vessels, with a gross tonnage (GT) of around 888 000, engine power of 5 435 000 kW and total landings of around 1 263 000 tonnes (Table 2 and Chapter 2 for landings). Despite the increased quantity of data submissions by CPCs to the GFCM in recent years, this total number of vessels should be considered an underestimate of the real size of the fleet, given the lack of data on some parts of the fleet, especially small-scale fleets, from some Mediterranean and Black Sea riparian states or non-state actors. Around 63 percent of the total reported number is represented by four countries only: Turkey (17.8 percent), Greece (17.3 percent), Tunisia (15.1 percent) and Italy (13 percent).

TABLE 2 – Number of operating fishing vessels per GFCM contracting party, cooperating non-contracting party, non-contracting party or relevant non-state actor in the Mediterranean and the Black Sea

Country	Operating vessels		Capacity (GT)	Landing (tonnes)	Engine power	Reference year
	Number	Percentage of the total (%)				
Albania*	571	0.66	6 955	6 282	79 642	2017
Algeria*	3 437	3.98	62 653	89 200	507 614	2017
Bulgaria*	1 295	1.50	4 958	8 513	41 160	2017
Croatia*	6 042	6.99	34 509	68 815	262 142	2017
Cyprus*	786	0.91	3 462	1 775	36 782	2017
Egypt*	3 087	3.57	121 953	53 964	340 526	2016
France*	1 489	1.72	15 927	18 706	144 476	2017
Georgia*	54	0.06	10 795	57 650	63 226	2016
Greece*	14 987	17.33	71 085	49 308	427 418	2017
Israel***	400	0.46	N/A	1 544	N/A	2015
Italy*	11 255	13.02	143 535	179 409	918 885	2017
Japan**	0		-	-	-	2017

▶▶

3 In addition to the information emanating from management plans used in this chapter, a number of recommendations were adopted in 2018 that also require the submission of information on fleet (e.g. management plan for European eel and deep-water red shrimps – see Chapter 7). Information emanating from these decisions will be available after their entry into force in 2019 and will be included in future SoMFi editions.

▶ TABLE 2 (Continued)

Country	Operating vessels		Capacity (GT)	Landing (tonnes)	Engine power	Reference year
	Number	Percentage of the total (%)				
Lebanon*	2 193	2.54	6 663	3 536	58 666	2017
Libya****	2 957	3.42	35 150	30 002	231 128	2016
Malta*	792	0.92	5 500	2 149	61 937	2017
Monaco	na		-	-	-	
Montenegro*	153	0.18	889	932	8 404	2017
Morocco*	2 981	3.45	20 922	24 925	107 112	2017
Palestine*	608	0.70	N/A	3 838	22 482	2016
Portugal*	2	0.01	391	116	915	2017
Romania*	135	0.16	1 377	9 553	6 104	2017
Russian Federation***	33	0.04	N/A	95 692	N/A	2013
Slovenia*	79	0.09	339	128	4 787	2017
Spain*	2 397	2.77	61 538	79 263	318 801	2017
Syrian Arab Republic*	1 950	2.26	N/A	1 900	N/A	2017
Tunisia*	13 124	15.18	104 535	108 419	596 060	2017
Turkey*	15 406	17.82	174 700	322 173	1 197 548	2017
Ukraine*	247	0.29	N/A	44 506	N/A	2017
Total	**86 460**	**100**	**887 836**	**1 262 299**	**5 435 815**	

Source of data:

* GFCM Task 1 and DCRF.

** GFCM vessel records (fleet register and authorized vessel list).

*** Other GFCM sources (e.g. questionnaires) or combination of previous sources.

na = not applicable (no fishing vessels).

N/A = data not available (data either not reported or not transmitted to the GFCM).

Japan = although Japan has 199 fishing vessels authorized to fish in the Mediterranean Sea, none of them operates in the area.

**** The reported values for the Libyan fleet (number of vessels, capacity and engine power) were estimated taking into account the most recent data (fleet register) as officially transmitted by Libya to the GFCM and applying a conversion ratio of small-scale fisheries in similar national fleets.

1.3. FISHING CAPACITY

According to the most up-to-date information reported to the GFCM (Table 2), the capacity of operating fishing vessels in the Mediterranean and the Black Sea accounted for around 888 000 GT and 5 450 000 kilowatts (kW), as shown in Figure 2. Although these data were not available for some countries or non-state actors, it is possible to affirm that four countries only represent around 60 percent of the total fishing capacity (in GT) in the GFCM area of application: Turkey (19.7 percent), Italy (16.2 percent), Egypt (13.7 percent) and Tunisia (11.8 percent). Although Japan is also relevant in terms of capacity, its fishing fleet is not currently operating in the area and therefore is not considered in the analysis: indeed, its 199 vessels are authorized to carry out fishing operations in the Mediterranean Sea, but they are not fishing in this area. Other national fleets of substantial capacity (more than 50 000 GT) are those of Greece, Algeria and Spain.

The distribution of fishing fleet in the Mediterranean and the Black Sea is shown in Figure 3. The three main geographical subareas (GSA) in terms of number of operating vessels are

GSA 22 (Aegean Sea, 16.8 percent), GSA 29 (Black Sea, 10.5 percent) and GSA 17 (northern Adriatic Sea, 10.4 percent).

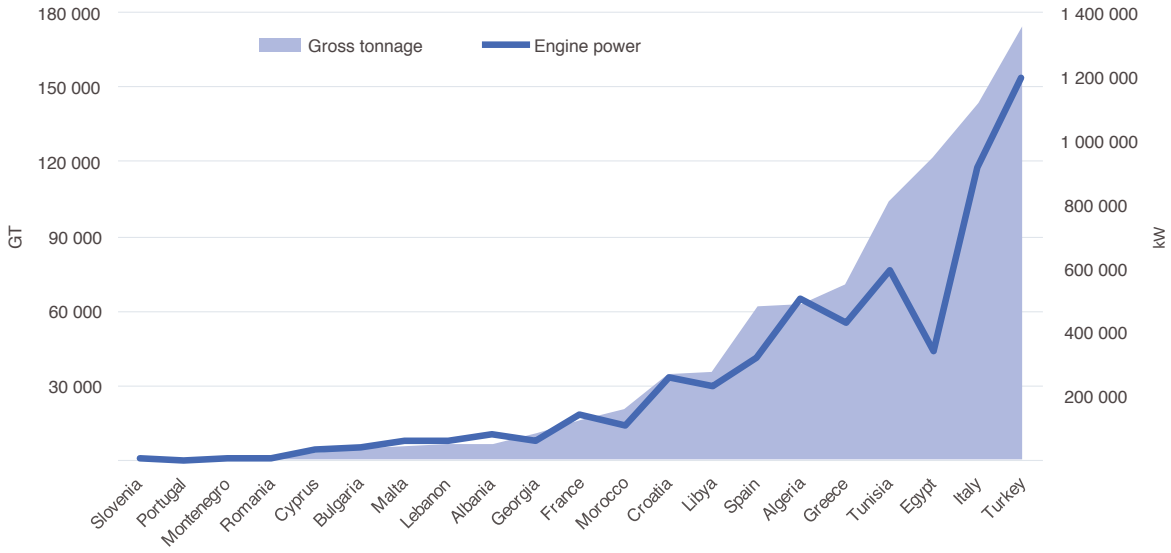


FIGURE 2 – Fishing capacity (GT and engine power) of GFCM contracting parties, cooperating non-contracting parties and non-contracting parties operating in the Mediterranean and the Black Sea

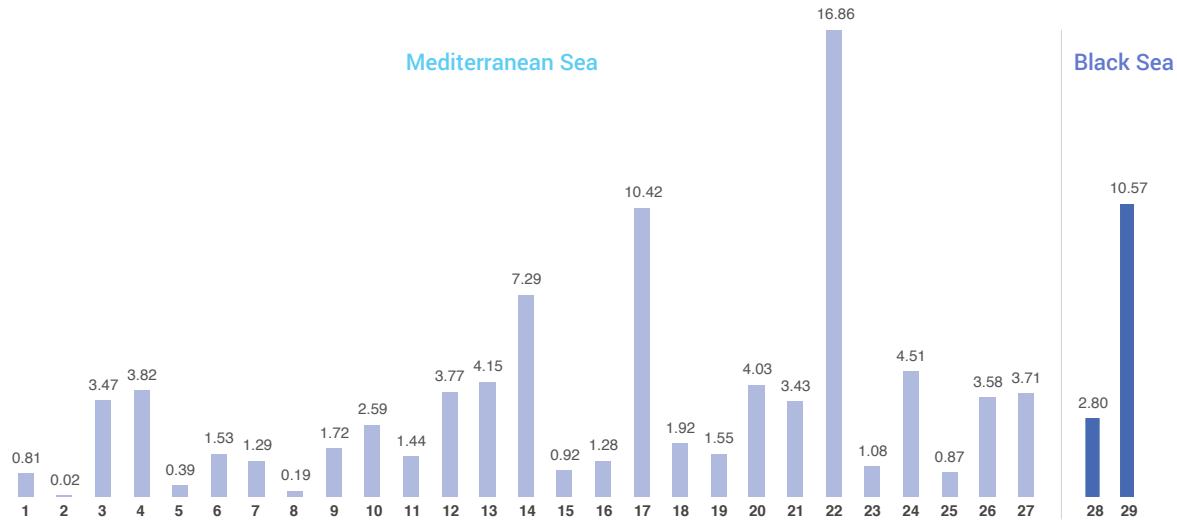


FIGURE 3 – Percentage of operating fishing vessels by geographical subarea

The largest share of operating vessels is present in the eastern and central Mediterranean subregions, with 30.6 and 26.4 percent respectively (Figure 4).

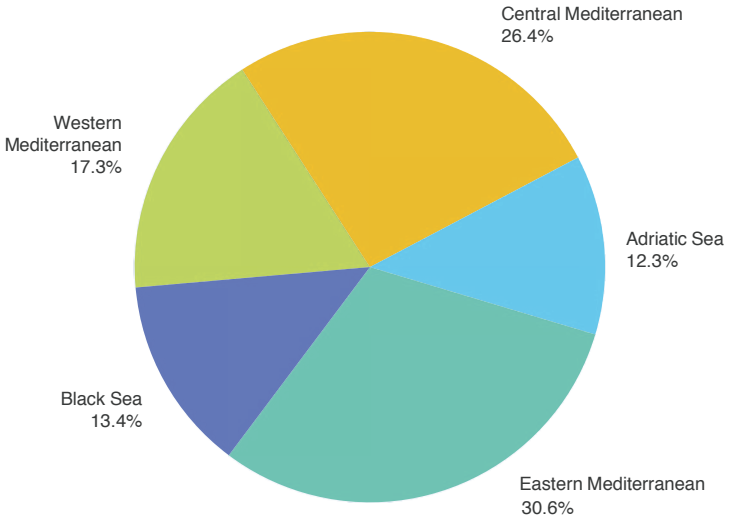


FIGURE 4 – Percentage of operating fishing vessels by GFCM subregion

BOX 2 – Fishing fleet in the context of GFCM management plans

In accordance with relevant GFCM recommendations related to the management of fisheries at the subregional level, the GFCM gathers information on fishing vessels authorized to operate in geographically defined areas and targeting specific species. The following is the most up-to-date information on fishing vessels reported to the GFCM:

Small pelagics in the Adriatic Sea (Albania, Croatia, Italy, Montenegro and Slovenia)
Recommendation GFCM/37/2013/1

1 461 vessels (around 55 000 GT) are operating. Fishing vessels are single and pair trawlers, purse seiners and surrounding nets without purse line, authorized to fish for small pelagic stocks and either registered at harbours located in GSAs 17 and 18 or registered at harbours located in other GSAs but operating in GSA 17 and/or 18. Croatia and Italy account each for around 47 percent of the fleet (95 percent of the fleet altogether).

Demersal fisheries in the Strait of Sicily (Cyprus, Italy, Malta, Spain and Tunisia)
Recommendation GFCM/39/2015/2

808 vessels (around 58 000 GT) are operating. Fishing vessels are bottom trawling vessels that are authorized for demersal fisheries in the Strait of Sicily (GSA 12 to 16). Italy and Tunisia account for around 80 percent and 18 percent of the total, respectively.

Turbot fishery in the Black Sea (Bulgaria, Romania, Russian Federation, Turkey)
Recommendation GFCM/39/2015/3

1 099 vessels (around 33 000 GT) are operating. Fishing vessels are those using bottom-set gillnets that are authorized to fish for turbot in GSA 29. Turkey accounts for around 80 percent of the total.

Red coral (Croatia, Italy, Malta and Tunisia)
Recommendation GFCM/41/2017/5

108 vessels (around 800 GT) are operating. Fishing vessels are those authorized to harvest red coral in the Mediterranean Sea. Croatia accounts for around 48 percent, followed by Tunisia and France, which account for around 24 and 19 percent, respectively.

BOX 3 – Fishing fleet in the context of GFCM fisheries restricted areas

In accordance with relevant GFCM recommendations, GFCM gathers information on fishing vessels authorized to operate in existing GFCM Fisheries restricted areas (FRAs). An FRA is a geographically defined area in which some specific fishing activities are temporarily banned or restricted in order to improve the exploitation and conservation of specific stocks (see chapter 8 for further information). The following is the most updated information on fishing vessels reported to the GFCM:

Jabuka/Pomo Pit (Croatia and Italy)
Recommendation GFCM/41/2017/3

The Jabuka/Pomo Pit FRA in the Adriatic Sea was established to improve the protection of VMEs and important EFHs for demersal stocks such as European hake and Norway lobster. It has one no-take zone and two zones where fishing is restricted to licensed vessels. **106 vessels** are currently operating (51 Croatian vessels and 55 Italian vessels) in the area where restricted fishing is allowed.

Gulf of Lion (France and Spain)
Recommendation GFCM/33/2009/1

29 vessels are operating in the FRA of the eastern Gulf of Lion. France accounts for around 70 percent of the total.

1.4. AGE OF THE FISHING FLEET

The average construction year of fishing vessels in each state or relevant non-state actor, as recorded in the GFCM vessel records (fleet register and authorized vessel list) database, is reported in Table 3. Although information on the year of construction is not always available for all the countries, it emerges that, on average, Romania has the youngest fleet (12 years old), followed by Portugal (19 years old), Algeria (19 years old) and Turkey (22 years old). By contrast, the oldest fishing vessels are in Albania (43 years old), Slovenia (39 years old), Croatia (38 years old) and Greece (37 years old). The ageing of the fleet in the latter countries may be a matter of concern for safety, while the substitution of ageing vessels can also represent a problem for the increase in fishing capacity if no rules are in place to regulate the entry of new vessels in the fishery.

TABLE 3 – Average year of construction and age of fishing vessels in the GFCM vessel records (fleet register and authorized vessel list) database

Country	Average		Data coverage (%)*
	Year of construction	Age	
Albania	1975	43	89
Algeria	1999	19	99
Bulgaria	1996	22	100
Croatia	1982	36	99
Cyprus	1991	27	100
Egypt	N/A	-	-
France	1984	34	100
Georgia	N/A	-	-
Greece	1981	37	100
Israel	N/A	-	-
Italy	1984	34	100

▶▶

▶ TABLE 3 (Continued)

Country	Average		Data coverage (%)*
	Year of construction	Age	
Japan	1996	22	100
Lebanon	1988	30	42
Libya	1997	21	7
Malta	1988	30	100
Monaco	Na	-	-
Montenegro	1981	37	14
Morocco	1994	24	91
Palestine	N/A	-	-
Portugal	1999	19	100
Romania	2006	12	100
Russian Federation	N/A	-	-
Slovenia	1979	39	100
Spain	1985	33	100
Syrian Arab Republic	N/A	-	-
Tunisia	1990	28	24
Turkey	1996	22	99
Ukraine	1983	35	97
Average	**1989**	**29**	**82**

* Coverage indicates the percentage of data records with information on the construction year of the fishing vessel.
na = not applicable (no fishing vessels).
N/A = data not available (either data not reported or data not transmitted to the GFCM).

According to the available information, a comparison between the total number of fishing vessels by country (Table 2) and the average of age (Table 3) highlights two opposite cases: Turkey, the largest fleet in the GFCM area of application (17.8 percent of the total), is one of the youngest of the region (22 years old, on average), whereas the oldest fishing vessels belong to Albania, which is one of the smallest fleets.

Half of the fishing fleet operating in the Mediterranean and the Black Sea is over 35 years old and around 30 percent of fishing vessels are under 30 years old (Figure 5).

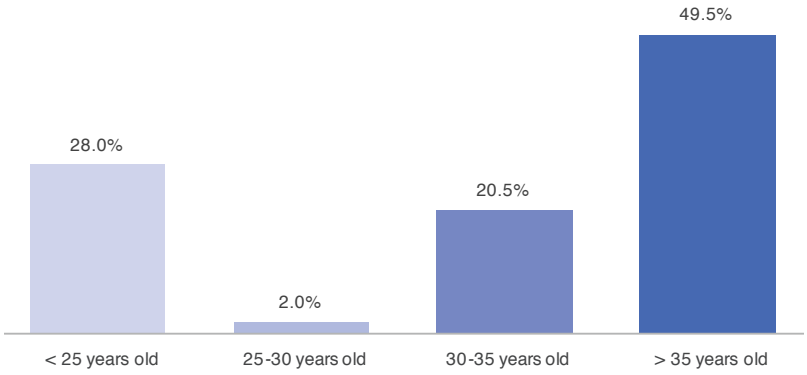


FIGURE 5 – Average age of fishing fleet in the Mediterranean and the Black Sea

1.5. FISHING FLEET SEGMENTS

In the period 2017-2018, the total number of fleet segments, given by the combination of vessel groups with length classes (Box 4), which was communicated by CPCs to the GFCM, accounted for a total of 51. The analysis of this information revealed an heterogeneous situation among countries, where a comparative analysis is not always straightforward: in fact, different CPCs have aggregated their data and then communicated them to the GFCM by combining same vessel groups with different length classes; consequently, the length range of some fleets segments overlap (e.g. "Purse seiners between 12–24 m" and "Purse seiners above 12 m").

BOX 4 – GFCM fleet segments, as defined by Recommendation GFCM/41/2017/6

Recommendations GFCM/40/2016/2 on the progressive implementation of data submission in line with the DCRF and GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application introduced the concept of flexibility of fleet segments. Following the specific guidance set in the DCRF manual, CPCs have the possibility of combining all the predefined vessel groups with all the length classes. Any proposal for aggregation of fleet segments should be brought to the attention of the relevant GFCM subsidiary bodies, mentioning the rationale and corresponding references (e.g. available scientific studies), which in turn should confirm the similarity/homogeneity of the combined cells.

Proposed fleet segments (combination of vessel group and length class) for data reporting purposes (Annex 2 of Recommendation GFCM/41/2017/6)

Vessel groups			Length classes (LOA)			
			< 6 m	6–12 m	12–24 m	> 24 m
Polyvalent	**P**	Small-scale vessels without engine using passive gear	**P-01**	**P-02**	**P-03**	**P-04**
			P-13			
		Small-scale vessels with engine using passive gear	**P-05**	**P-06**	**P-07**	**P-08**
		Polyvalent vessels	**P-09**	**P-10**	**P-11**	**P-12**
					P-14	
Seiners	**S**	Purse seiners	**S-01**	**S-02**	**S-03**	**S-04**
					S-09	
		Tuna seiners	**S-05**	**S-06**	**S-07**	**S-08**
					S-10	
Dredgers	**D**	Dredgers	**D-01**	**D-02**	**D-03**	**D-04**
				D-05		
Trawlers	**T**	Beam trawlers	**T-01**	**T-02**	**T-03**	**T-04**
		Pelagic trawlers	**T-05**	**T-06**	**T-07**	**T-08**
				T-13		
		Trawlers	**T-09**	**T-10**	**T-11**	**T-12**
Longliners	**L**	Longliners	**L-01**	**L-02**	**L-03**	**L-04**
				L-05		

Notes:

- In orange some potential combinations are proposed (e.g. reporting together small-scale vessels without engine smaller than 6 m and between 6–12 m).
- A vessel is assigned to a group on the basis of the dominant gear used in terms of percentage of time: more than 50 percent of the time at sea using the same fishing gear during the year.
- "Polyvalent vessels" are defined as all the vessels using more than one gear, with a combination of passive and active gear, none of which exceed more than 50 percent of the time at sea during the year.
- A vessel is considered "active" when it executes at least one fishing operation during the reference year in the GFCM area of application.

TABLE 4 – Groups of fleet segments used for the analysis of fleet composition

Group of fleet segments	Fleet segments
Polyvalent vessels (all lengths)	– Small-scale vessels without engine using passive gear (0–6, 0-12, 6–12) – Small-scale vessels with engine using passive gear (> 0, 0–6, 0–12, 0–24, 6–12, 12–24, > 24) – Polyvalent vessels (0–6, 0–12, 6–12, > 12, 12–24, > 24)
Trawlers (> 6 m LOA)	– Trawlers (> 6, 6–12, 6–24, > 12, 12–24, > 24) – Beam trawlers (> 6, 6–12, 6–24, > 12, 12–24, > 24)
Purse seiners and pelagic trawlers (> 6 m LOA)	– Purse seiners (> 6, 6–12, 6–24, > 12, 12–24, > 24) – Pelagic trawlers (> 6, > 12, 12–24, > 24)
Other fleet segments (all lengths)	– Longliners (all) – Tuna seiners (all) – Dredgers (all)

Although this heterogeneity prevents an in-depth comparison of all the fleet segments at the national level, by aggregating the information on larger groups available in all data submissions (Table 4) it is possible to note that, according to the available information,[4] around 80 percent of the total fishing vessels operating in the GFCM area of application (Mediterranean and Black Sea) belong to the fleet segments "Polyvalent vessels – all lengths",[5] followed by "Trawlers above 6 m" (7.9 percent) and "Purse seiners and pelagic trawlers above 6 m" (4.8 percent). The "Other fleet segment" groups 16 different fleet segments accounting, individually, for around 7.6 percent of the total. This category also includes "Longliners 6–12 m" (2.9 percent), "Longliners 0-6 m" (1.8 percent), "Longliners 0-6 m" (1.6 percent) and "Dredges 12-24 m" (0.9 percent) (Figure 6).

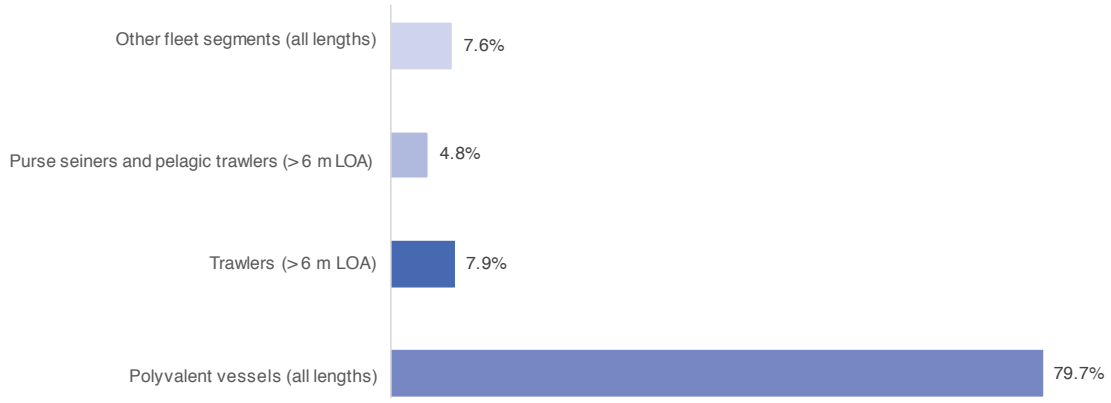


FIGURE 6 – Percentage of fleet segments operating in the GFCM area of application

4 Information on fleet segments for Georgia, Israel, Palestine, the Russian Federation and the Syrian Arab Republic is not available and thus not included in this analysis.

5 The group "Polyvalent vessels – all lengths" is composed of "Small-scale vessels w/ engine using passive gear 0–6 m" (16.2 percent), "Polyvalent vessels 6–12 m" (15.9 percent), "Small-scale vessels w/ engine using passive gear 0–12 m" (14.9 percent), "Small-scale vessels w/ engine using passive gear 6–12 m" (14.6 percent), "Small-scale vessels w/o engine using passive gear 0–12 m" (9.8 percent), "Polyvalent vessels 0–6 m" (3.2 percent), "Polyvalent vessels 12-24 m" (1.9 percent), "Small-scale vessels w/ engine using passive gear 12–24 m" (0.8 percent), "Small-scale vessels w/ engine using passive gear > 0 m" (0.8 percent), "Small-scale vessels w/ engine using passive gear 0–24 m" (0.7 percent) , "Polyvalent vessels 0-12 m" (0.5 percent), "Polyvalent vessels > 12 m" (0.1 percent), "Polyvalent vessels > 24 m" (0.1 percent), "Small-scale vessels w/ engine using passive gear > 24 m" (0.1 percent).

The breakdown of the available information highlights different scenarios in the Mediterranean and the Black Sea. Specifically, the two main groups of fleet segments "Polyvalent vessels (all lengths)" represent 91.3 percent in the Black Sea compared to 77.8 percent in the Mediterranean Sea. These data also show that the second relevant group of segments is "Purse seiners and pelagic trawlers over 6 m" (4.7 percent) in the Black Sea and "Trawlers over 6 m" (8.6 percent) in the Mediterranean Sea (Figure 7), with all other fleet segments aggregated under "Other fleet segments" group accounting for 0.4 percent in the Black sea and 8.8 percent in the Mediterranean.

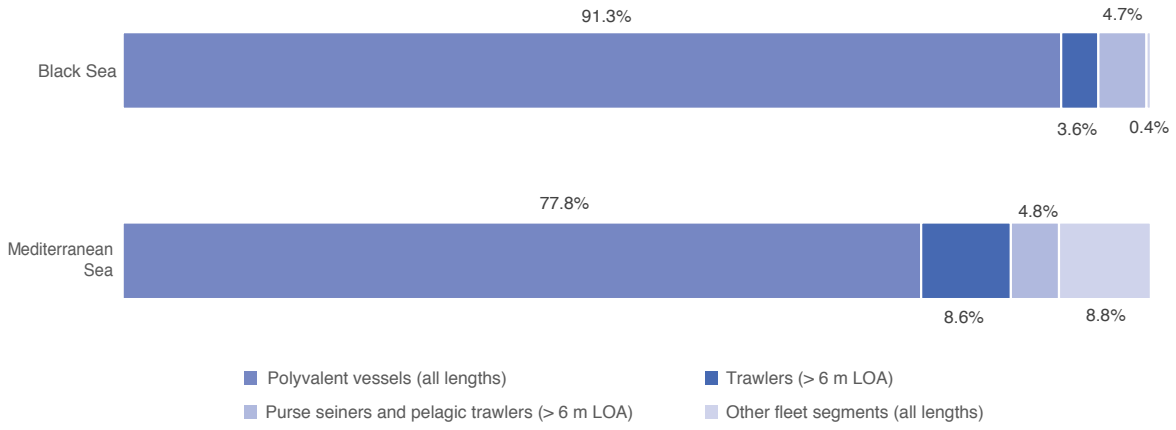


FIGURE 7 – Percentage of fleet segments operating in the Mediterranean and in the Black Sea

TABLE 5 – Number of operating fishing vessels, by group of fleet segments and by GFCM contracting party, cooperating non-contracting party, non-contracting party or relevant non-state actor in the Mediterranean and the Black Sea

Country	Group of fleet segments					Total
	Polyvalent vessels (all lengths)	Trawlers (> 6 m LOA)	Purse seiners and pelagic trawlers (> 6 m LOA)	Other fleet segments (all lengths)	Unallocated	
MEDITERRANEAN SEA						
Albania*	343	179	36	6		564
Algeria*	1 765	467	1 056	5		3 293
Croatia*	5 432	380	188	42		6 042
Cyprus*	772	12		2		786
Egypt*	628	1 043	249	1 167		3 087
France*	1 045	79	18	97		1 239
Greece*	10 724	246	238	3 779		**14 987**
Israel***					400	**400**
Italy*	7 794	2 243	309	870		**11 216**
Japan**						**0**
Lebanon*	2 106		87			**2 193**
Libya****	2 793	62	95	7		**2 957**
Malta*	715	11	6	60		**792**
Monaco						**0**

▶ TABLE 5 (Continued)

Country	Group of fleet segments					Total
	Polyvalent vessels (all lengths)	Trawlers (> 6 m LOA)	Purse seiners and pelagic trawlers (> 6 m LOA)	Other fleet segments (all lengths)	Unallocated	
Montenegro*	120	16	13	4		**153**
Morocco*	2 665	92	238	1		**2 996**
Palestine *					608	**608**
Portugal*	2					**2**
Slovenia*	64	8	1	3		**76**
Spain*	1 210	667	278	239		**2 394**
Syrian Arab Republic*					1 950	**1 950**
Tunisia*	12 123	467	507	27		**13 124**
Turkey*	5 574	211	104			**5 889**
Total	**55 895**	**6 183**	**3 423**	**6 309**	**2 958**	**74 748**
%	74.8	8.3	4.6	8.4	4.0	
BLACK SEA						
Bulgaria*	1 228	9	45	14		**1 296**
Georgia*					54	**54**
Romania*	96	30		9		**135**
Russian Federation***					33	**33**
Turkey*	8 894	362	495	23		**9 774**
Ukraine*	239	8				**247**
Total	**10 457**	**409**	**540**	**46**	**87**	**11 539**
%	90.6	3.5	4.7	0.4	0.8	

Source of data:

* GFCM Task 1 and DCRF.

** GFCM vessel records (fleet register and authorized vessel list).

*** Other GFCM sources (e.g. questionnaires) or combination of previous sources.

na = not applicable (no fishing vessels).

N/A = data not available (data either not reported or not transmitted to the GFCM).

**** The reported values for the Libyan fleet (number of vessels, capacity and engine power) have been estimated by taking into account the most recent data (fleet register) officially transmitted by Libya to the GFCM and applying a conversion ratio for small-scale fisheries in similar national fleets.

The available data clearly show that, out of six countries, four in the Mediterranean Sea (Lebanon, Turkey, Tunisia and Cyprus) and two in the Black Sea (Ukraine and Bulgaria), the polyvalent vessels (all lengths) segment represent more than 90 percent of the operating fishing fleet (Table 5; detailed discussion in Chapter 6 – SSF).

The subregional distribution of the main groups of fleet segments is shown in Table 6 and in Figures 8 to 10. Polyvalent vessels (all lengths) (Figure 8) are mainly present in the central Mediterranean (30.1 percent of the total), followed by the eastern Mediterranean (25.9 percent of the total). In the western Mediterranean, there is the highest distribution both of trawlers above 6 m, reaching 29 percent (Figure 9) and of purse seiners and pelagic trawlers above 6 m, with 43 percent of the fleet segments (Figure 10).

TABLE 6 – Group of fleet segments by GFCM subregion

Group of fleet segments	GFCM subregions				
	Western Mediterranean (%)	Central Mediterranean (%)	Adriatic Sea (%)	Eastern Mediterranean (%)	Black Sea (%)
Polyvalent vessels (all lengths)	72.6	87.5	74.6	73.2	91.3
Trawlers (> 6 m LOA)	13.0	5.1	15.0	6.3	3.6
Purse seiners and pelagic trawlers (> 6 m LOA)	11.6	3.0	3.4	2.7	4.7
Other fleet segments	2.8	4.3	7.0	17.7	0.4
Total %	100	100	100	100	100

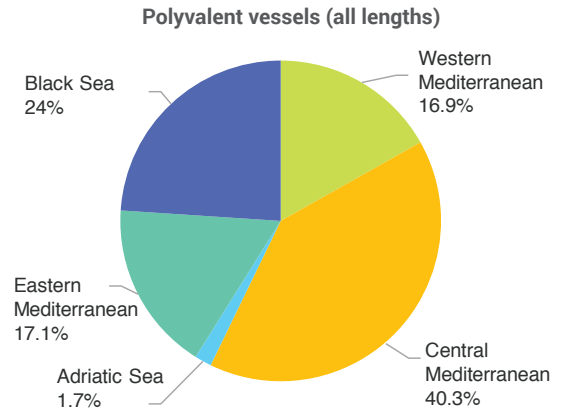


FIGURE 8 – Distribution of polyvalent vessels (all lengths) fleet segments by GFCM subregion

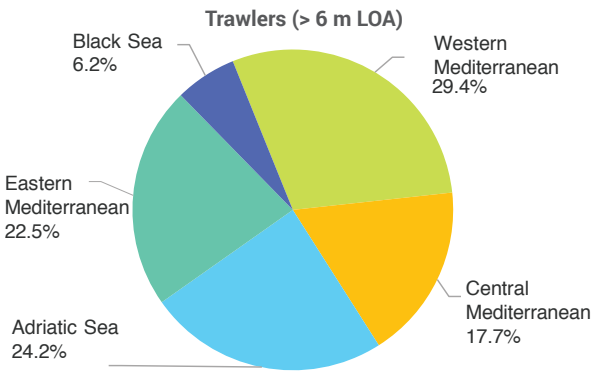


FIGURE 9 – Distribution of trawlers (> 6 m LOA) fleet segments by GFCM subregion

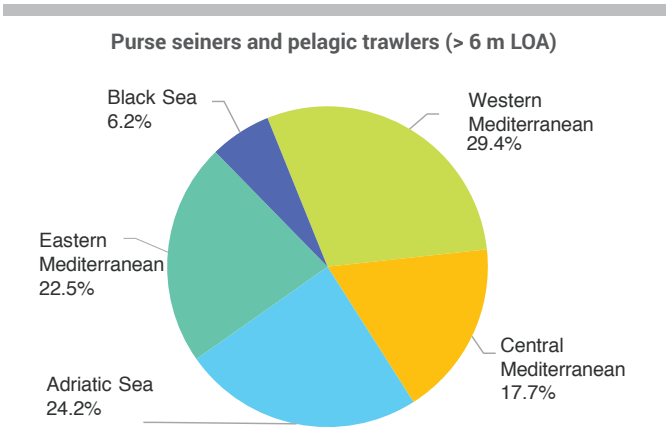


FIGURE 10 – Distribution of purse seiners and pelagic trawlers (> 6 m LOA) fleet segments by GFCM subregion

CAPTURE FISHERIES PRODUCTION

2

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2. Capture fisheries production

2.1. INTRODUCTION AND SOURCES OF INFORMATION

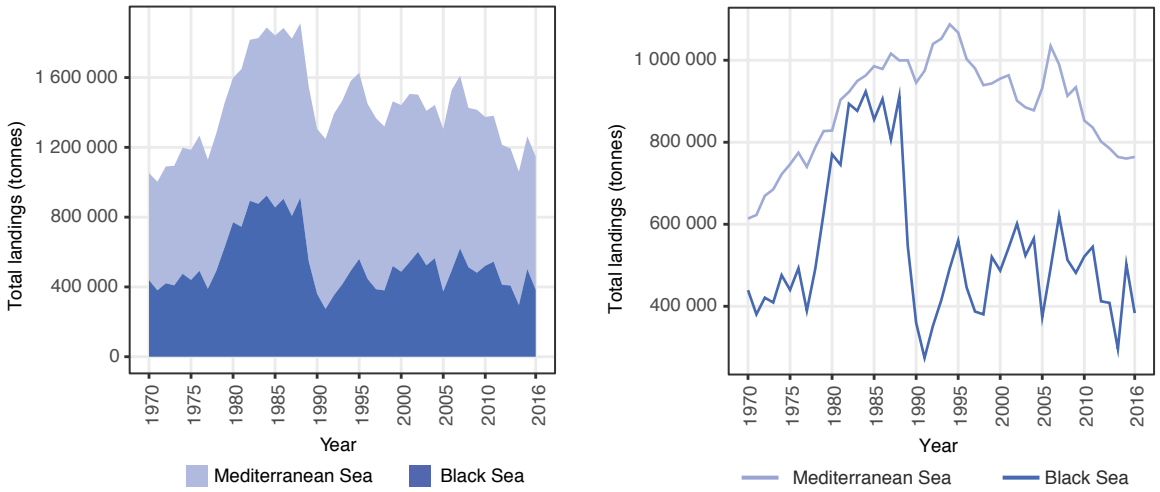
This chapter provides an overview of capture fisheries production (expressed in tonnes) in the GFCM area of application. It analyses historical trends of captures in the Mediterranean and the Black Sea (at the regional, subregional and national levels) and provides a summary of the main species and groups of species that contribute to catches in the Mediterranean and the Black Sea, taking into account the most up-to-date information, including 2016 data on landings.

The analysis is based on information from two different sources contained in the GFCM regional database on capture production. The primary source of information used is the data on annual captures by species and by subdivision that are reported by Mediterranean and Black Sea countries through the FAO/GFCM STATLANT 37A questionnaire. The STATLANT 37A questionnaire is developed by the FAO Coordinating Working Party on Fishery Statistics (CWP) and sent by the Organization on behalf of the GFCM to relevant national authorities; it covers the time series from 1970 to 2016. The second source of information is the national data that are officially submitted to the GFCM by its contracting parties and cooperating non-contracting parties (CPCs), in line with binding recommendations; these data cover the 2014–2016 time series.

2.2. HISTORICAL TRENDS AND CURRENT CAPTURE FISHERIES PRODUCTION

Overall, total capture fisheries production in the Mediterranean and the Black Sea continues to show the trends observed in SoMFi 2016. Total landings in the Mediterranean and the Black Sea increased irregularly from about one million tonnes in 1970 to almost two million tonnes in 1982. Total landings remained relatively stable during most of the 1980s before declining abruptly in 1989 and 1990, largely due to the collapse of pelagic fisheries in the Black Sea. In the Mediterranean, landings continued to increase until 1994, reaching 1 087 000 tonnes, and subsequently declined irregularly to 850 000 in 2016, with production apparently levelling out in the last three years. In the Black Sea, landings have varied considerably from one year to another since 1990, showing a generally increasing trend. In 2016, the total reported landings in the Black Sea were 390 000 tonnes (Figure 11).

The combined average landings for the Mediterranean and the Black Sea over the 2014–2016 period amount to 1 220 000 tonnes (827 000 in the Mediterranean and 396 000 in the Black Sea). This value is slightly higher (5 percent) than the catches in 2013 but remains 17 percent lower than the average over the 2000–2013 period reported in SoMFi 2016. The landings time series (1970–2016) of the largest producers, as well as of countries catching up to 150 000 tonnes and of countries catching up to 20 000 tonnes are reproduced in Figures 12 to 14 for reference.



Note: On the left, cumulative trends from both areas; on the right, trends by area.

FIGURE 11 – Trends in landings in the Mediterranean and the Black Sea, by year, 1970–2016

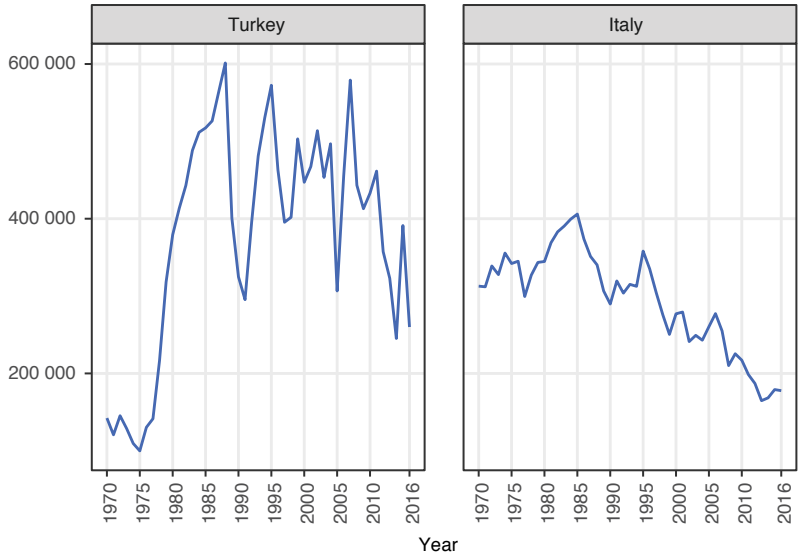


FIGURE 12 – Trends in landings of the largest producers (Turkey and Italy), 1970–2016

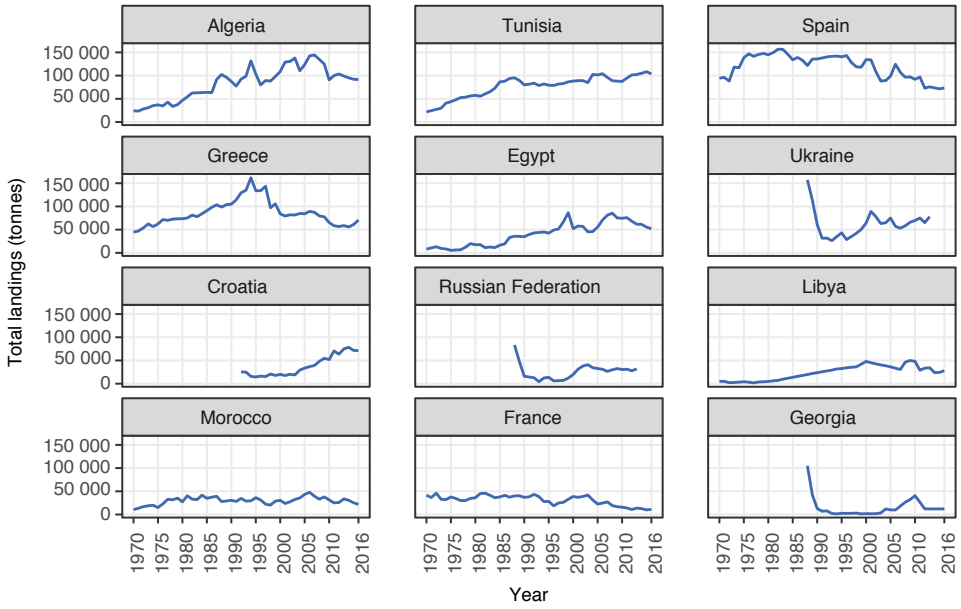


FIGURE 13 – Trends in landings by country (catching up to 150 000 tonnes), 1970–2016

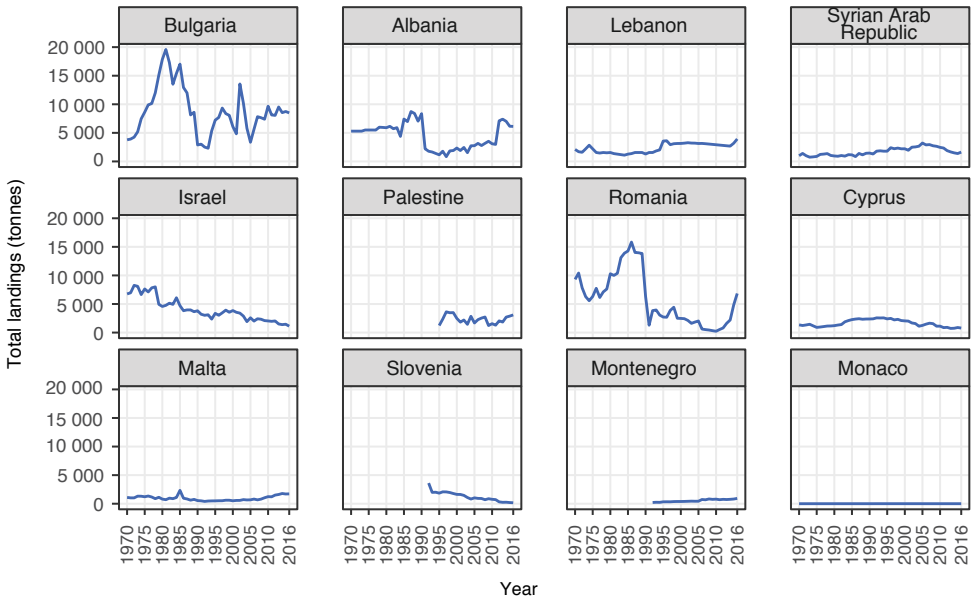


FIGURE 14 – Trends in landings by country (catching up to 20 000 tonnes), 1970–2016

TABLE 7 – Landings by country, 2014–2016

Country	Landings 2014 (tonnes)	Landings 2015 (tonnes)	Landings 2016 (tonnes)	Average 2014-2016 (tonnes)	% variation 2014-2015	% variation 2015-2016
Albania	7 061	6 232	6 204	6 500	-11.7	-0.45
Algeria	97 828	95 946	95 000	96 258	-1.9	-1.0
Bosnia and Herzegovina	5	5	5	5	--	--
Bulgaria	8 546	8 546	8 562	8 617	2.3	-2.1
Croatia	78 946	72 258	71 895	74 366	-8.5	-0.5
Cyprus	1 257	1 475	1 484	1 405	17.3	0.6
Egypt	62 747	57 603	53 965	58 105	-8.2	-6.3
France	15 063	12 742	14 337	14 047	-15.4	12.5
Georgia	12 050	12 050	12 050	12 050	0	0
Greece	58 505	63 763	74 733	65 667	9.0	17.2
Israel	1 475	1 544	1 207	1 409	4.7	-21.8
Italy	178 867	189 205	188 793	185 262	5.8	-0.2
Lebanon	2 978	3 618	4 271	3 622	21.5	18.0
Libya	25 004	26 002	30 002	27 003	4.0	15.4
Malta	2 404	2 438	2 418	2 420	1.4	-08
Monaco	--	--	--	--	--	--
Montenegro	787	825	933	848	4.7	13.1
Morocco	31 869	26 906	23 711	27 496	-15.6	-11.9
Palestine	2 854	3 227	3 306	3 129	13.1	2.4
Portugal	83	98	115	99	17.5	17.6
Romania	2 198	4 843	6 840	4 627	120.3	41.2
Russian Federation*	--	--	--	32 000	--	--
Slovenia	261	202	165	210	-22.6	-18.2
Spain	78 818	77 336	78 498	78 218	-1.9	1.5
Syrian Arab Republic	1 800	1700	2 000	1 833	-5.55	17.6
Tunisia	110 292	117 829	113 865	113 995	6.8	-3.4
Turkey	266 077	397 731	301 464	321 757	49.5	-24.2
Ukraine**	--	--	--	68 900	-	--

* Landing statistics relating to the period after 2013 are still being reviewed and compiled. Consequently, the average landing statistics between 2000– 2013, as already reported in SoMFi 2016, are used for the analysis.

** Landing statistics relating to the period after 2013 are still being reviewed and compiled. Consequently, the average landing statistics between 2000–2013, as already reported in SoMFi 2016, are used for the analysis.

Across the GFCM area of application, the ranking of capture fisheries production in 2014–2016 continues to be dominated by Turkey (321 800 tonnes and 26 percent of total landings versus 31 percent previously reported), followed by Italy, (185 300 tonnes and 16 percent, similar to the percentage previously reported) (Table 7 and Figure 15). Algeria (96 300 tonnes and 8 percent) and Greece (65 700 tonnes and 5 percent) also maintain the same percentages in landing contribution. Both Tunisia (185 300 tonnes) and Croatia (74 400 tonnes) show an increase compared to SoMFi 2016 (from 7 to 9 percent for Tunisia and from 3 to 6 percent for Croatia). Total landings for Spain decrease (78 200 tonnes and decreasing from 8.5 percent to 7 percent of the total).

In the Mediterranean, Italy is the main producer (22 percent). The other countries that contribute to at least 5 percent of total captures are Tunisia (14 percent), Algeria (12 percent), Spain (9 percent), Croatia (9 percent), Greece (8 percent), Turkey (8 percent) and Egypt (7 percent) (Figure 16).

In the Black Sea, Turkey dominates the catches (67 percent), followed by Ukraine (18 percent), Russian Federation (9 percent), Georgia (3 percent), Bulgaria (2 percent) and Romania (1 percent) (Figure 17).

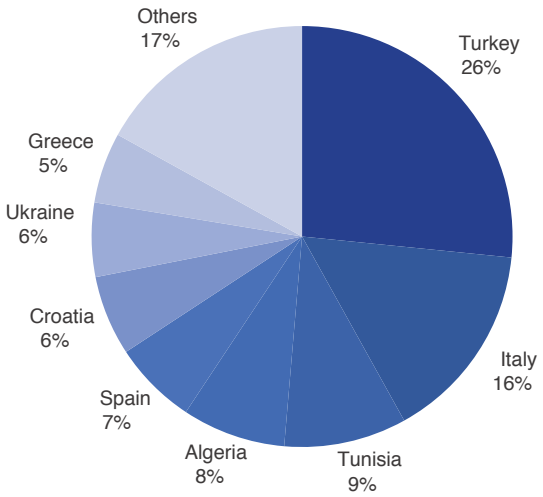


FIGURE 15 – Countries contributing to at least 5 percent of total captures in the GFCM area of application, average landings in 2014–2016

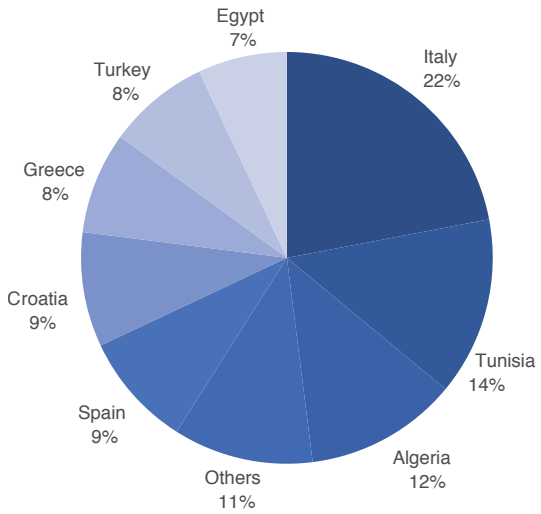


FIGURE 16 – Countries contributing to at least 5 percent of total captures in the Mediterranean Sea, average landings in 2014–2016

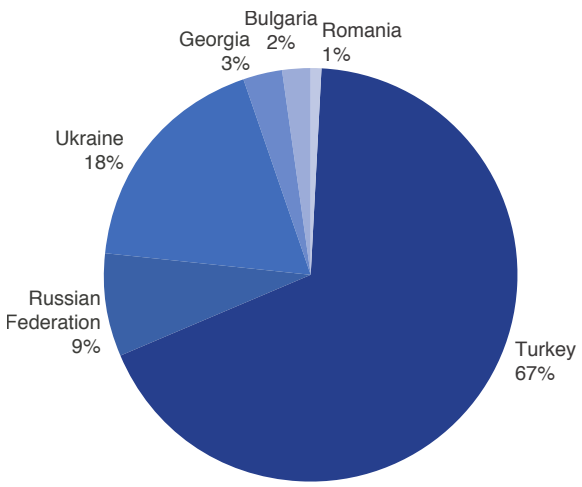


FIGURE 17 – Total captures by country in the Black Sea, average landings in 2014–2016

Taking into account the contribution of each fleet component to total landings, and using the fleet segments defined in Chapter 1, the group of "Purse seiners and pelagic trawlers above 6 m" is the segment responsible for the largest share of total landings (50.6 percent), followed by "Polyvalent vessels all lengths" with 22.6 percent and "Trawlers above 6 m" accounting for about 20.8 percent of the total (Figure 18). These percentages refer to 2013 data as reported in SoMFi 2016. Further analysis will be available when the newly established DCRF database of the GFCM is populated with complete data upon proper submissions by CPCs.

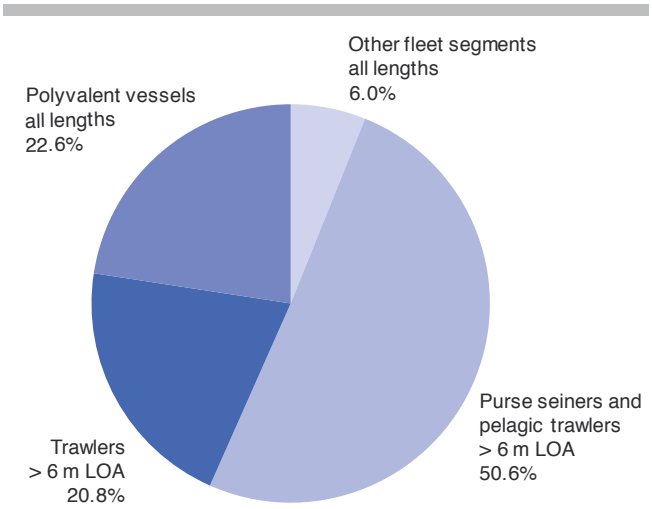


FIGURE 18 – Relative contribution (%) of the four groups of fleet segments in terms of landings

2.3. MAIN SPECIES AND GROUPS CONTRIBUTING TO CAPTURE FISHERIES PRODUCTION

In comparison with the average landings reported in SoMFi 2016, the main groups of species contributing at least to 1 percent of the catches remain stable: the only difference in composition is that the "Shark, rays and chimaeras" group is now included within the main groups contributing to the catch, while "Mussels" is excluded.

Three groups of species, namely "Herrings, sardines, anchovies" (596 200 tonnes), "Miscellaneous coastal fishes" (152 400 tonnes) and "Miscellaneous pelagic fishes" (81 200 tonnes), constitute around 68 percent of the total reported landings in the entire GFCM area of application (compared to 72 percent in SoMFi 2016). Six other groups of species contributing to more than 1 percent of the landings amount to 20 percent of the total landings, and the combination of all remaining species amount to approximatively 12 percent overall (Table 8 and Figure 19).

Compared with the whole GFCM area of application, the main groups of species contributing to landings in the Mediterranean only are very similar. Nonetheless, the contribution of small pelagic species (i.e. the combination of "Herrings, sardines, anchovies" and "Miscellaneous pelagic fishes") is slightly less important (48 percent of total landings) while the contribution of other groups of species is slightly higher (Figure 20).

Table 8 – Landings by major group of species, 2014–2016

Group of species	Landing (tonnes)			
	2014	2015	2016	% contribution (average values)
Herrings, sardines, anchovies	518 248	693 966	576 341	48.7
Miscellaneous coastal fishes	142 160	152 776	162 137	12.5
Miscellaneous pelagic fishes	84 482	78 503	80 487	6.6
Squids, cuttlefishes, octopuses	52 602	50 132	50 525	4.2
Clams, cockles, arkshells	40 963	56 808	43 413	3.8
Shrimps, prawns	39 810	44 664	44 407	3.5
Marine fishes not identified	51 875	38 537	34 273	3.4
Cods, hakes, haddocks	37 626	40 031	38 219	3.2
Shads	13 127	21 515	23 704	1.6
Others	136 312	137 861	183 583	12.5

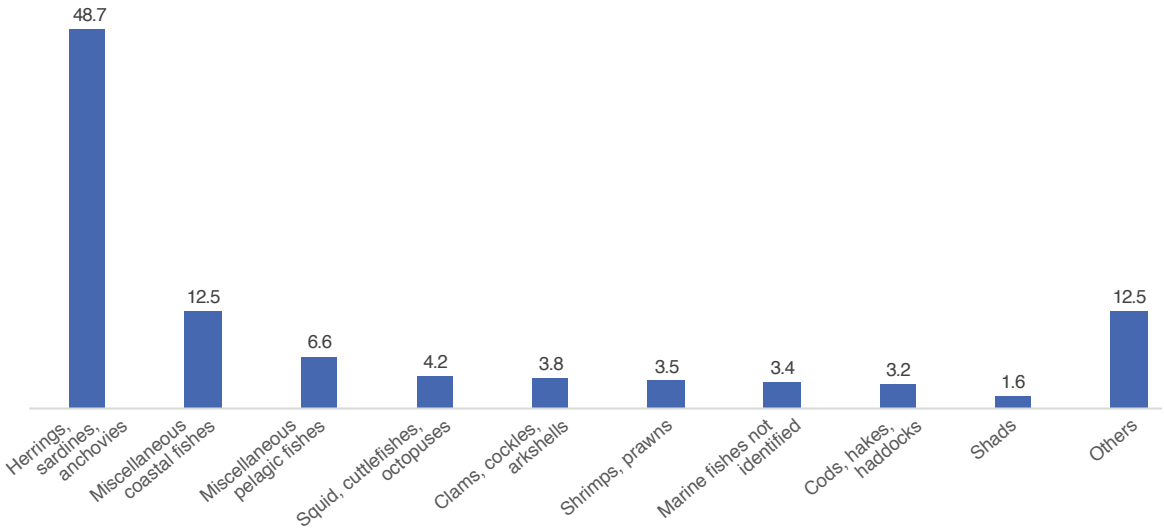


FIGURE 19 – Landings, by group of species (ISSCAAP) in the GFCM area of application, average values (percent) in 2014–2016

In the Black Sea, the situation is opposite, with a larger dominance of small pelagic species (in particular "Herrings, sardines, anchovies" with 65 percent) compared to the Mediterranean and a smaller contribution of other groups of species, reflecting the lower diversity of species in the catch (see subregional analysis below). Moreover, in comparison with the Mediterranean, "Clams, cockles, arkshells" are more relevant (third group in terms of importance representing 7 percent of the total catches), while shrimps and prawns represent a very low percentage of catches and are included in the "Others" group (Figure 21).

By species and in the whole GFCM area of application, European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) continue to be the main species landed (270 000 tonnes and 189 500 tonnes on average respectively), followed by European sprat (*Sprattus sprattus*) (82 000 tonnes). The only non-small pelagic species contributing more than 1 percent to

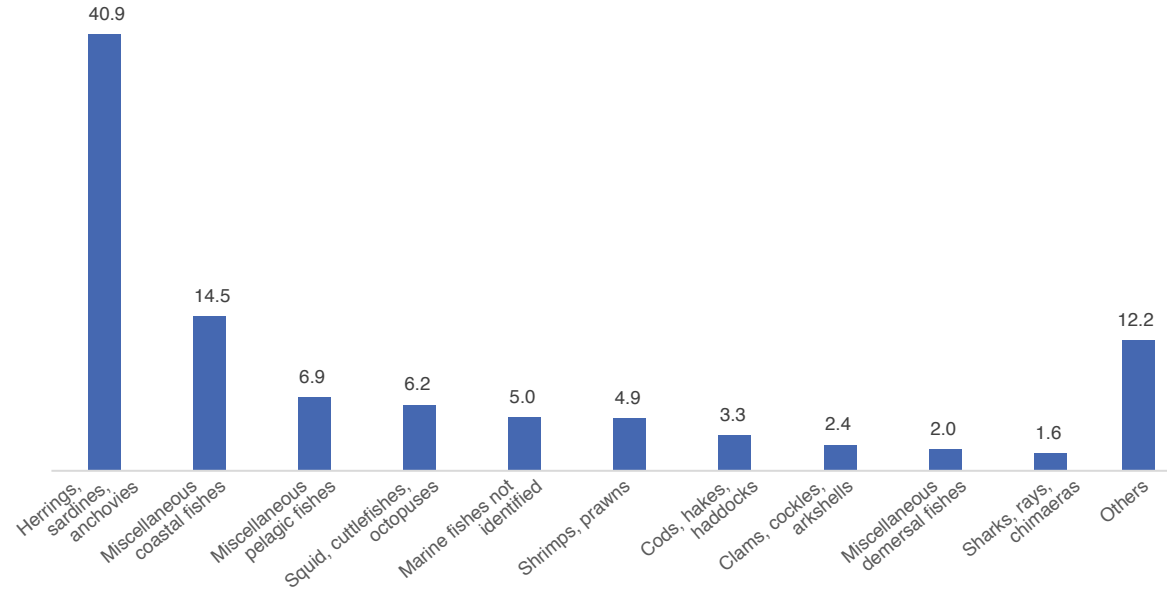


FIGURE 20 – Landings by group of species (ISSCAAP) in the Mediterranean Sea, average values (percent) in 2014–2016

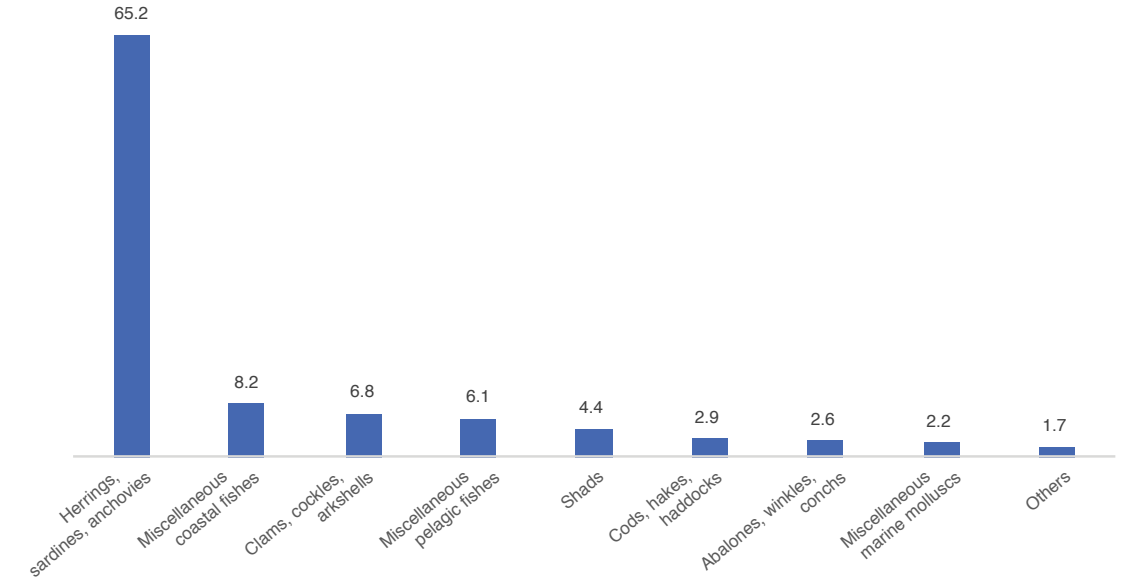


FIGURE 21 – Landings by group of species (ISSCAAP) in the Black Sea, average values (percent) in 2014–2016

the landings are one gasteropod (striped venus [*Chamelea gallina*]), a large pelagic (Atlantic bonito [*Sarda sarda*]) and six demersal species (bogue [*Boops boops*], European hake [*Merluccius merluccius*], gobies [Gobiidae], deep-water rose shrimp [*Parapenaeus longirostris*] and red mullet [*Mullus barbatus]*) (Table 9 and Figure 22). With the exception of striped venus, bogue and gobies, all other species are part of the GFCM list of main priority species (see Chapter 4).

TABLE 9 – Landings by main commercial species (more than 1 percent of total landings) in the GFCM area of application

Common name	Species (or group)	Landing (tonnes)			% contribution (2014–2016 average)
		2014	2015	2016	
European anchovy	*Engraulis encrasicolus*	210 431	345 840	254 260	22.1
European pilchard (=sardine)	*Sardina pilchardus*	195 443	184 759	188 431	15.5
European sprat	*Sprattus sprattus*	56 744	109 198	79 097	6.7
Marine fishes nei	Osteichthyes	51 905	38 537	34 302	3.4
Sardinella nei	*Sardinella* spp.	43 116	41 512	39 085	3.4
Striped venus	*Chamelea gallina*	36 096	52 173	37 345	3.4
Jack and horse mackerels nei	*Trachurus* spp.	24 511	19 509	20 643	1.8
Atlantic bonito	*Sarda sarda*	23 397	8 318	43 878	2.1
Bogue	*Boops boops*	21 105	20 006	20 746	1.7
European hake	*Merluccius merluccius*	20 998	20 307	19 736	1.7
Gobies	Gobiidae	18 638	28 408	29 999	2.1
Mediterranean horse mackerel	*Trachurus mediterraneus*	17 258	19 245	13 341	1.4
Deep-water rose shrimp	*Parapenaeus longirostris*	15 868	18 277	19 848	1.5
Red mullet	*Mullus barbatus*	14 788	15 310	16 006	1.3
	Others	366 907	393 394	420 371	32.2

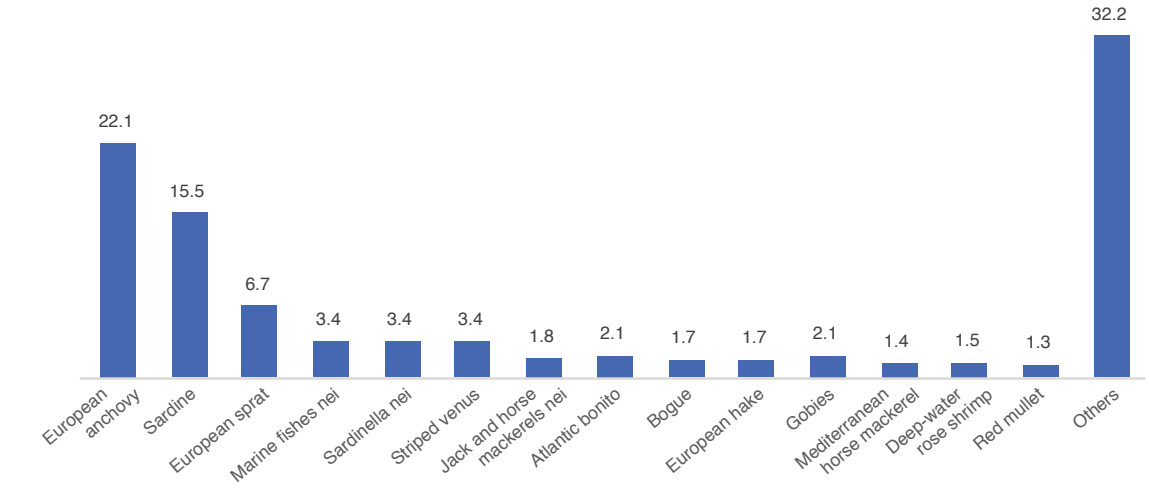


FIGURE 22 – Annual landings in the GFCM area of application, by species, average values (percent) in 2014–2016

By basin, there is a predominance of sardine and European anchovy in the Mediterranean, with a large diversity of species significantly contributing to the catches; in the Black Sea, sardine catches are very low and the dominance of European anchovy (Black Sea subspecies of European anchovy [*Engraulis encrasicolus ponticus*]) and European sprat is greater (Figures 23 and 24).

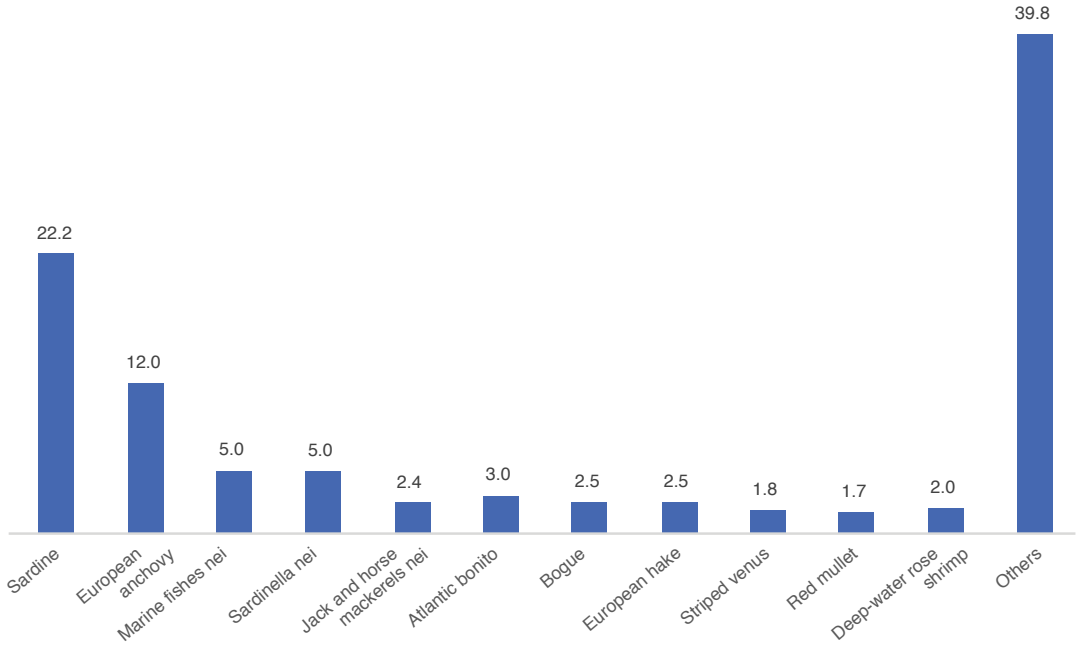


FIGURE 23 – Annual landings in the Mediterranean Sea, by species, average values (percent) in 2014–2016

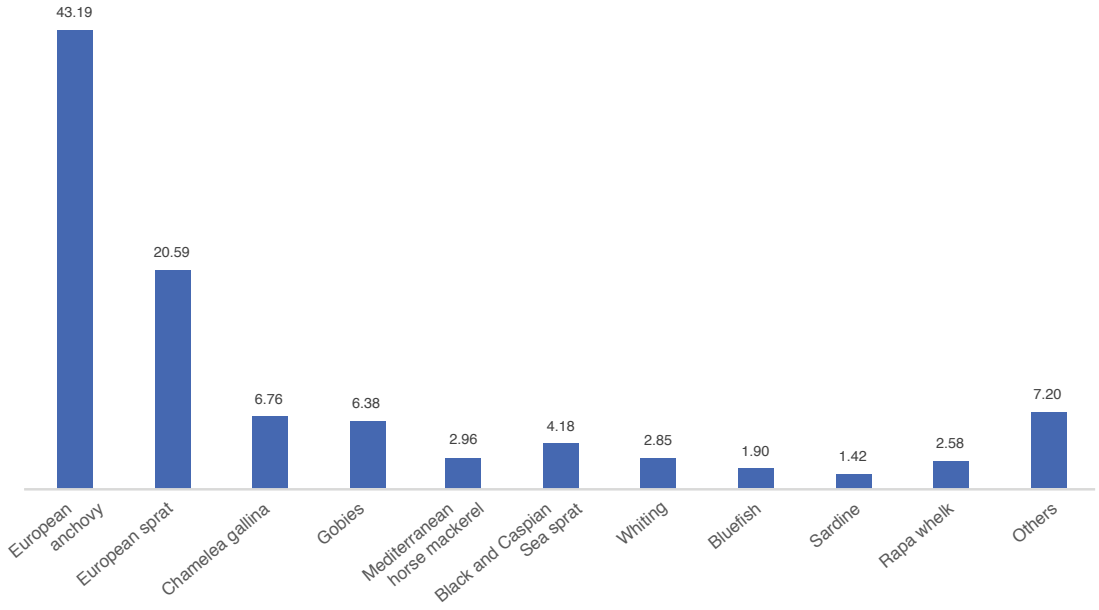


FIGURE 24 – Annual landings in the Black Sea, by species, average values (percent) in 2014–2016

2.4. CAPTURE FISHERIES PRODUCTION AT THE SUBREGIONAL LEVEL

An analysis of all GFCM subregions shows that, in the Mediterranean, the western Mediterranean is the subregion with the highest capture fishery production in weight, contributing to 22 percent of total landings (265 100 tonnes on average in 2014–2016), while the Adriatic Sea, and the central and eastern Mediterranean have similar productions (193 500, 184 500 and 180 800 tonnes respectively, accounting for 16, 15 and 15 percent of the landings respectively). The Black Sea has the highest capture fishery production in weight overall (32 percent with 396 000 tonnes) (Figure 25).

In general, the large majority of the catches in a given subregion are declared by countries belonging to this subregion; however, in some cases, fleets from countries outside the subregion contribute to a small percentage of the total catch.

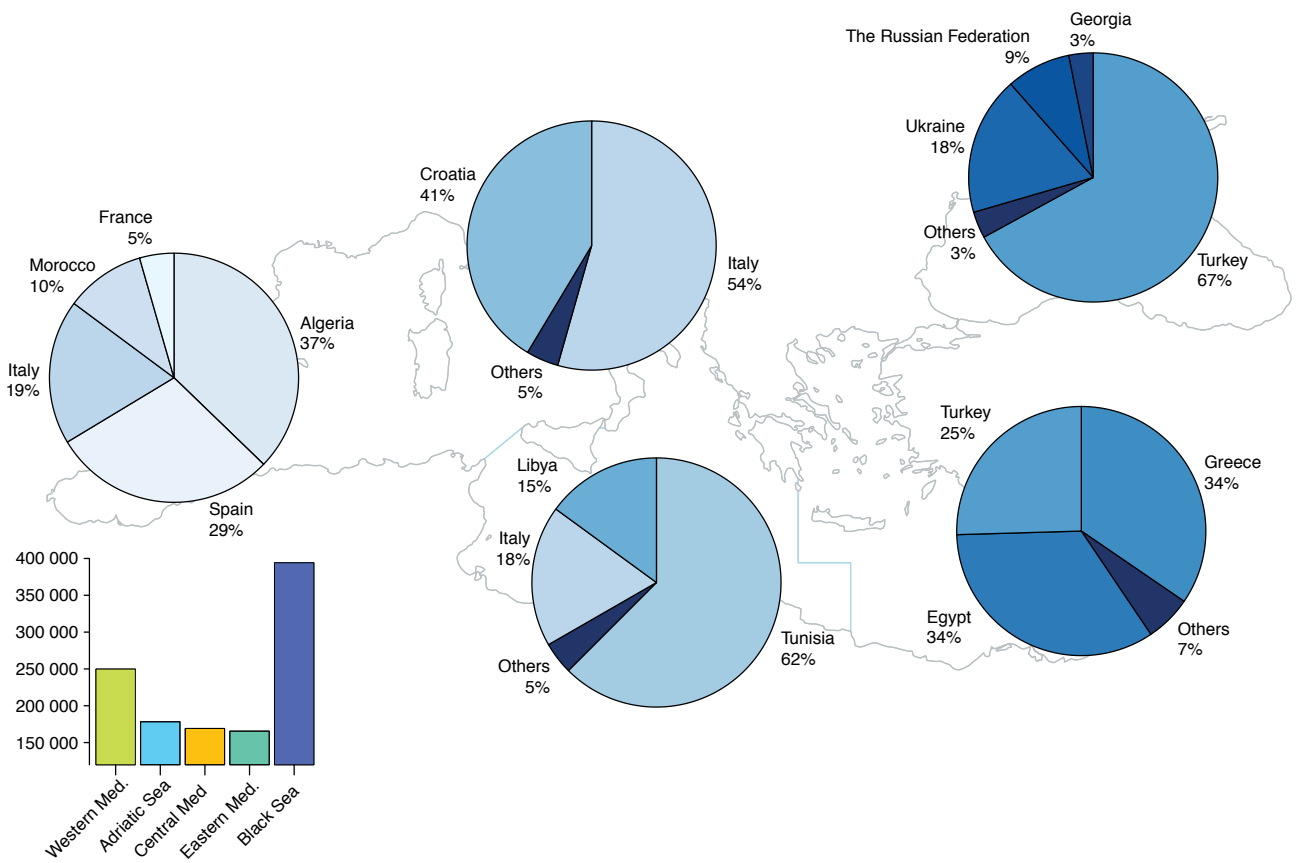
In the western Mediterranean, landings by weight are dominated by Algeria (37 percent), Spain (29 percent) and Italy (19 percent), which account for 85 percent of all landings in the subregion, followed by Morocco (10 percent) and France (5 percent).

In the Adriatic Sea, landings by weight are dominated by Italy (54 percent) and Croatia (41 percent) which account for 95 percent of all landings in the subregion, followed by Albania (around 4 percent), Montenegro (0.5 percent) and Slovenia (0.1 percent).

In the central Mediterranean, landings by weight are dominated by Tunisia (62 percent), followed by Italy (18 percent) and Libya (15 percent), which account for 95 percent of all landings in the subregion, followed by Greece (3 percent) and Malta (around 1 percent).

In the eastern Mediterranean, landings by weight are dominated by Greece (34 percent), Egypt (34 percent) and Turkey (25 percent), which account for 93 percent of all landings in the subregion, followed by Lebanon (around 2 percent), Palestine (around 2 percent), Syrian Arab Republic (1 percent), Israel (1 percent), and Cyprus (0.5 percent).

Finally, in the Black Sea, landings by weight are dominated by Turkey, which accounts for the overwhelming majority of landings by weight (67 percent), followed by Ukraine (18 percent) and the Russian Federation (9 percent), Georgia (3 percent), Bulgaria (2 percent) and Romania (1 percent).



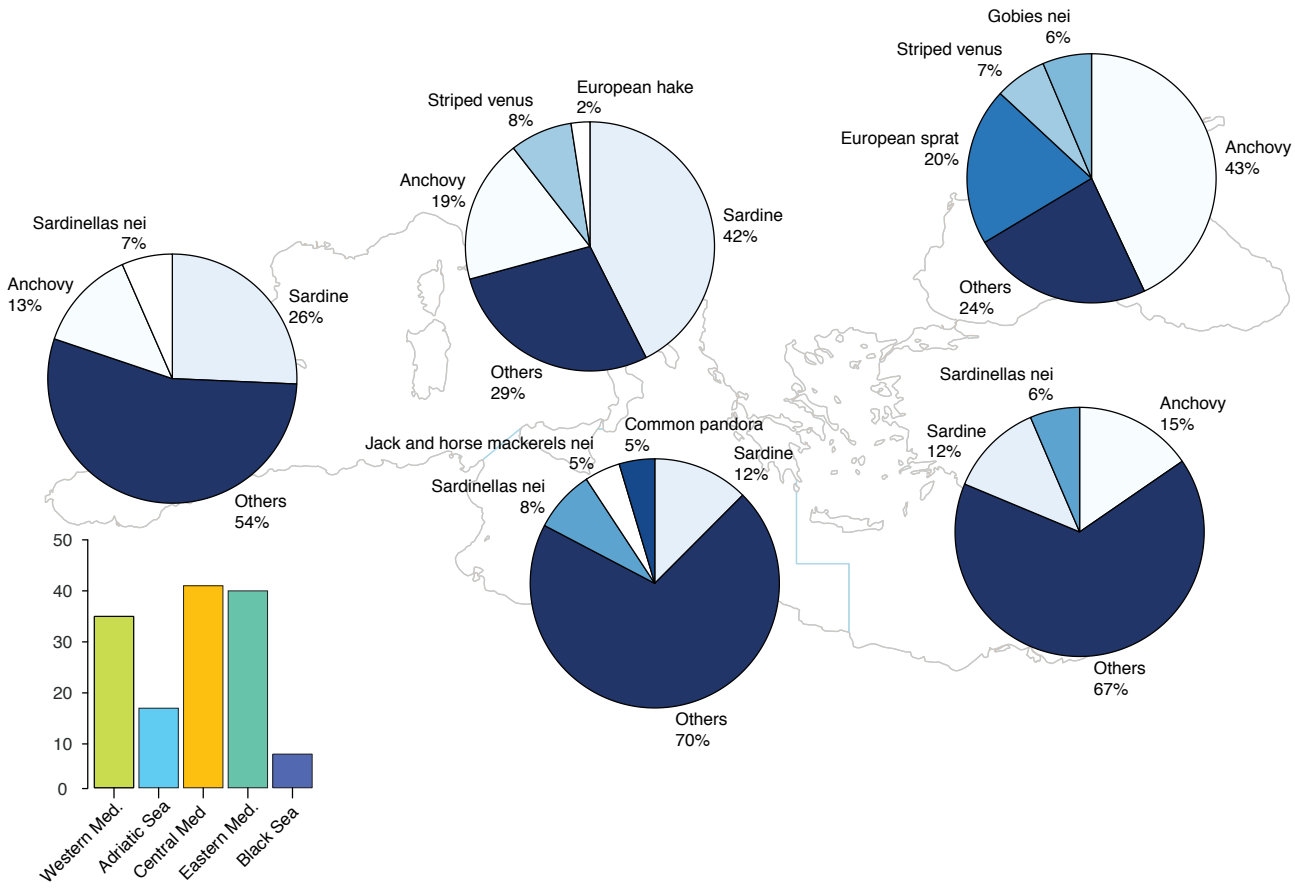
Note: Pie charts reflect the percentage of landings by country in the different GFCM subregions. The bar plot at the bottom-left represents absolute values of landings (tonnes) by GFCM subregion.

FIGURE 25 – Landings by GFCM subregion and by country, average 2014–2016

2.5. SUBREGIONAL CAPTURES BY SPECIES

In terms of species contribution in the different subregions, the main captured species in the western Mediterranean is sardine (26 percent), followed by European anchovy (13 percent) and sardinella nei (*Sardinella* spp.) (7 percent); the remaining 54 percent corresponds to a large number of species contributing to the catch in this region. In the central Mediterranean, the main captured species is also sardine (12 percent), followed by sardinella nei (8 percent), jack and horse mackerel nei (*Trachurus* spp.) (5 percent) and common Pandora (*Pagellus erythrinus*) (5 percent). The sum of all other species contributing each one to less than 5 percent constitute the remaining 70 percent of the total. In the Adriatic Sea, the main captured species is sardine (42 percent), followed by European anchovy (19 percent), striped venus (8 percent) and European hake (2 percent), these four species adding to 71 percent of the landings. In the eastern Mediterranean, the main captured species is European anchovy (15 percent), followed by sardine (12 percent) and sardinella nei (6 percent), all the other species accounting for the remaining 67 percent. In the Black Sea, the main captured species is European anchovy (43 percent), followed by European sprat (20 percent), striped venus (7 percent), gobies (6 percent), with all the other species contributing to 24 percent of the total (Figure 26).

Overall, the diversity of species in the catches is much higher in the central Mediterranean and the eastern Mediterranean (nearly 40 species) while, in comparison, the number of species that account for 90 percent of the total catch in the Adriatic and the Black Sea is very low (more than 15 for the Adriatic and less than 10 for the Black Sea) (Figure 26).



Note: Pie charts reflect the percentage of landings by species in the different GFCM subregions. The bar plot at the bottom-left represents the number of species or groups of species that account for 90 percent of the total catch in the respective GFCM subregion.

FIGURE 26 – Landings by GFCM subregion and by species, average 2014–2016

SOCIO-ECONOMIC CHARACTERISTICS

3

3. Socio-economic characteristics

3.1. INTRODUCTION AND SOURCES OF INFORMATION

This chapter provides an overview of the latest information available on the economic performance and socio-economic characteristics of capture fisheries in the Mediterranean and the Black Sea. An analysis of revenue, costs, gross cash flow, employment, remuneration and trade data is presented, based on the most recent available information submitted to the GFCM, complemented with additional sources when appropriate (see description of data sources below). Attempts were also made to include, when available, data for cooperating non-contracting parties, and those non-contracting parties and relevant non-state actors that fish in the Mediterranean and the Black Sea. Where relevant, data were aggregated and analysed at both GFCM region-wide and subregional levels, as well as by major vessel groups.

Data presented are primarily based on official data submissions to the GFCM, stemming from binding recommendations requiring CPCs to regularly submit national data. In particular, recent recommendations[1] on the submission of data in line with the DCRF now require CPCs to submit new socio-economic variables that will facilitate more accurate and more complete analyses. As the data available for the present analysis stem from the transitional period of these recent recommendations, they represent a combination of information submitted through both the old Task 1 statistical matrix and the new DCRF online platform. The new data submission requirements allow for improved analyses of certain variables, such as revenue by species, costs and remuneration, and preliminary analyses are presented for these variables, despite data not yet being available for all CPCs. Data on trade are from FAO Fisheries Commodities Production and Trade statistics. All monetary values listed in this chapter have been adjusted for inflation and are listed as constant 2016 US dollars (USD) (World Bank, 2018a and World Bank, 2018b).

3.2. ECONOMIC PERFORMANCE

3.2.1 Revenue

Marine capture fisheries in the Mediterranean and the Black Sea region produce an estimated total revenue of USD 2.8 billion annually (USD 2.44 billion in the Mediterranean and USD 350 million in the Black Sea). This figure accounts for the value at first sale of fish from capture fisheries in FAO major fishing area 37, prior to any processing or value addition activities. Data on other revenue sources, such as income from the use of the vessel in other non-commercial fishing activities, are currently unavailable. It is estimated, however, that the wider economic impact of fisheries in the Mediterranean and the Black Sea, including the direct, indirect and induced economic effect of the fisheries sector, may be as much as 2.6 times the value at first sale (FAO, 2016), or approximately USD 7.3 billion. More complete data on total revenue are foreseen in the coming years as CPCs improve their data submissions in line with DCRF requirements.

Figure 27 presents a breakdown of landing value by CPC.[2,3,4] In line with the analysis presented in SoMFi 2016, the value of landings in Italy continues to be notable, accounting for

1 Recommendation GFCM/40/2016/2 on the progressive implementation of data submission in line with the Data Collection Reference Framework (DCRF) and Recommendation GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application.

2 Reference years: 2016 (Algeria, Bulgaria, Cyprus, Italy, Lebanon, Malta, Portugal, Romania, Slovenia, Tunisia, Turkey); 2015 (Egypt, Croatia, Morocco, Montenegro); 2014 (France, Greece, Spain); 2012 (Albania, Georgia, Russian Federation, Ukraine).

3 Data sources: Greece (OECD, 2018); Georgia, Russian Federation, Ukraine (FAO, 2016). All others are official GFCM data submissions (Task 1/DCRF).

4 Data were not reported for Bosnia and Herzegovina, Israel, the Republic of Moldova, Libya and the Syrian Arab Republic.

approximately 30 percent of total revenue in the region. Turkey, Egypt, Spain, Tunisia, Greece and Algeria, in addition to Italy, remain the countries producing the highest revenue from fisheries in the GFCM area of application.

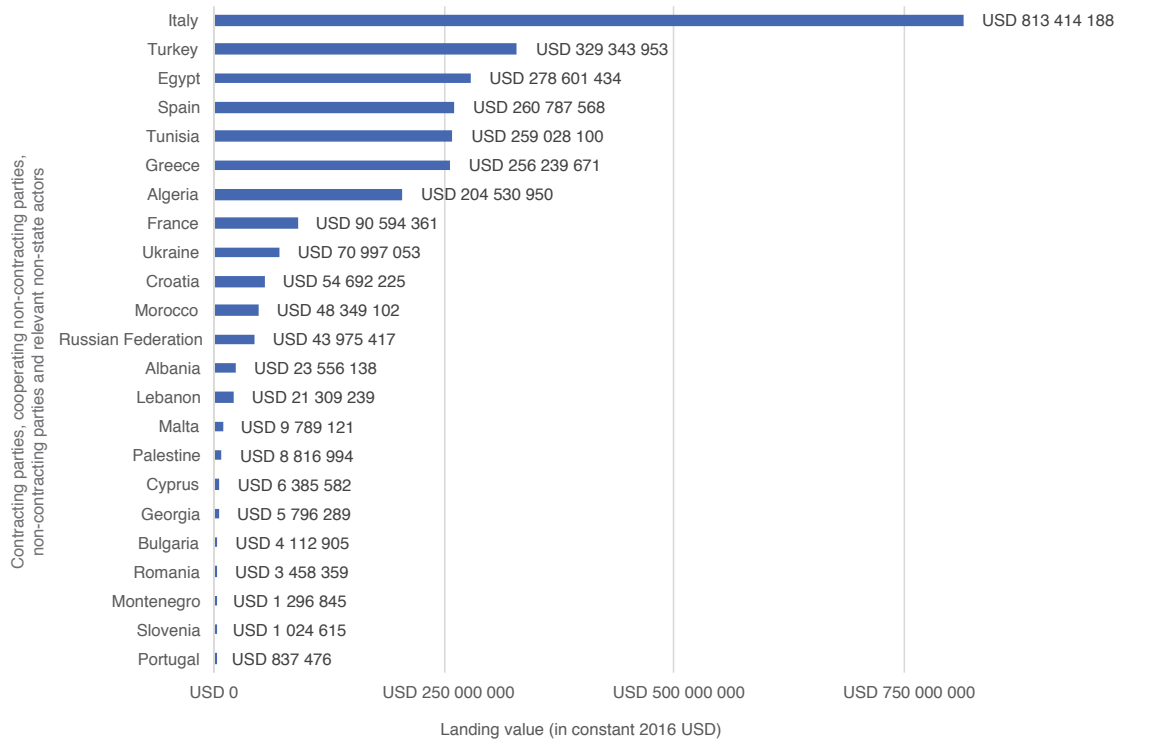


FIGURE 27 – Landing value at first sale by CPCs and relevant non-state actors

Landing values have also been aggregated by GFCM subregion (Figures 28 and 29). The western Mediterranean continues to account for the highest aggregate landing value (31 percent of total landing value), followed by the eastern Mediterranean (23 percent), the central Mediterranean (18 percent) and the Adriatic Sea (15 percent). The lowest aggregate landing value is seen in the Black Sea, accounting for 13 percent of the total regional landing value. This aggregation has been improved from SoMFi 2016 as a result of data submissions through the DCRF online platform, for which data are submitted by GSA, allowing for a more accurate subregional analysis. In Greece, for which data have not yet been submitted by subregion, the breakdown between the central Mediterranean and eastern Mediterranean subregions was estimated based on a ratio of landing weight per subregion.

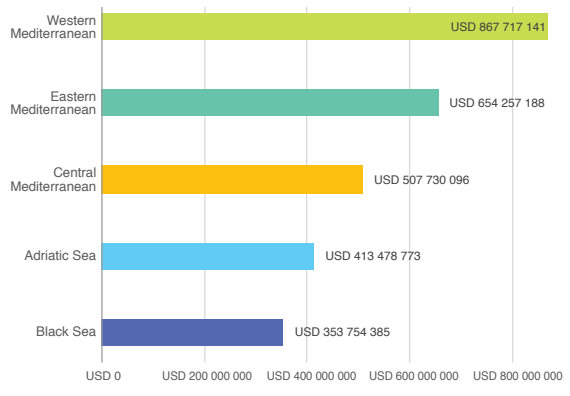


FIGURE 28 – Landing value by subregion

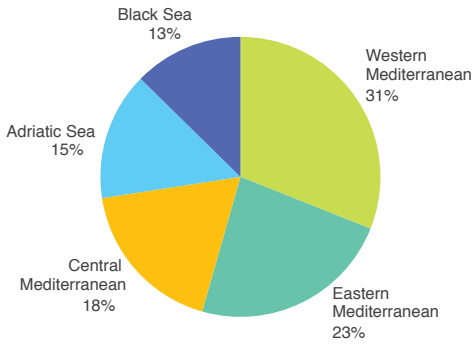


FIGURE 29 – Percentage of total landing value by subregion

Figures 30 and 31 provide the total landing value and the associated percentage per main vessel group,[5] aggregated across the entire GFCM area of application, offering insight into the economic contribution of each main vessel group. "Trawlers (above 6 m LOA)" is the vessel group with the highest revenue, accounting for 43 percent of total landing value. The next highest group is "Polyvalent vessels (all lengths)"; however, the total landing value of this group is only 60 percent of the value of "Trawlers (above 6 m LOA)" . Furthermore, major differences are observed between the landing value of main vessel groups in the Mediterranean and the Black Sea (Figures 32 and 33). Whereas in the Mediterranean, "Trawlers (above 6 m LOA)" account for 46 percent of landing value, in the Black Sea they account for only 9 percent. Instead, the revenue produced by "Polyvalent vessels (all lengths)" and "Purse seiners and pelagic trawlers (above 6 m LOA)" is much more significant in the Black Sea (49 percent and 41 percent, respectively).

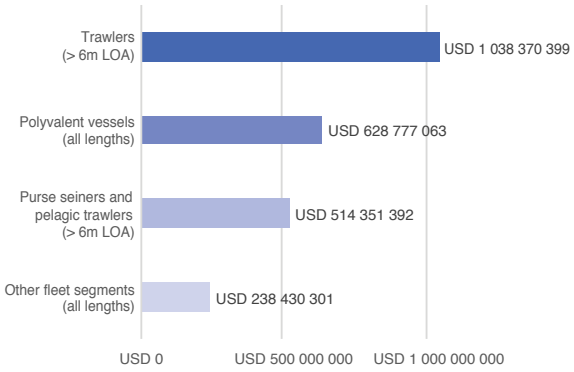


FIGURE 30 – Total landing value by vessel group

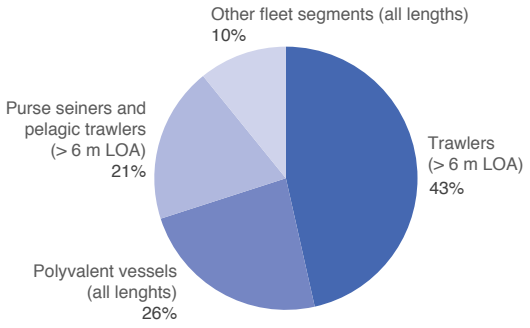


FIGURE 31 – Percentage of total landing value by vessel group in the GFCM area of application

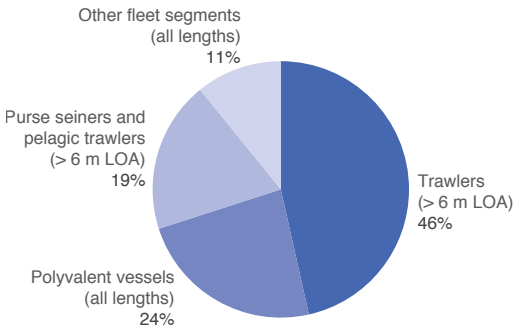


FIGURE 32 – Percentage of total landing value by vessel group: Mediterranean Sea

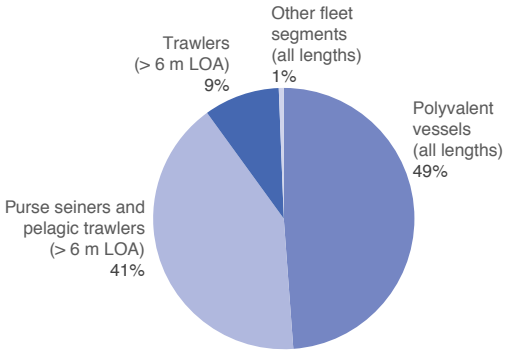


FIGURE 33 – Percentage of total landing value by vessel group: Black Sea

3.2.2 Revenue by species

New data submission requirements in line with the DCRF have facilitated the analysis of value per species. A preliminary analysis was carried out on official data transmitted to the GFCM and, after a quality control, data submissions from ten CPCs were included in this analysis (Albania, Bulgaria, Cyprus, Greece, Croatia, Italy, Lebanon, Malta, Romania and Slovenia). Disaggregated information from western and southern Mediterranean countries is unfortunately not available at the time of preparation of this report and is expected to be analysed in future issues of SoMFi.

5 For a full description of the fleet segment groupings, refer to section 1.6 of Chapter 1.

An analysis of landing values for main commercial species (see introduction and methodology, Table 1) for the ten CPCs noted above was carried out and the top 20 most important species by value from these groups are presented in Figure 34.

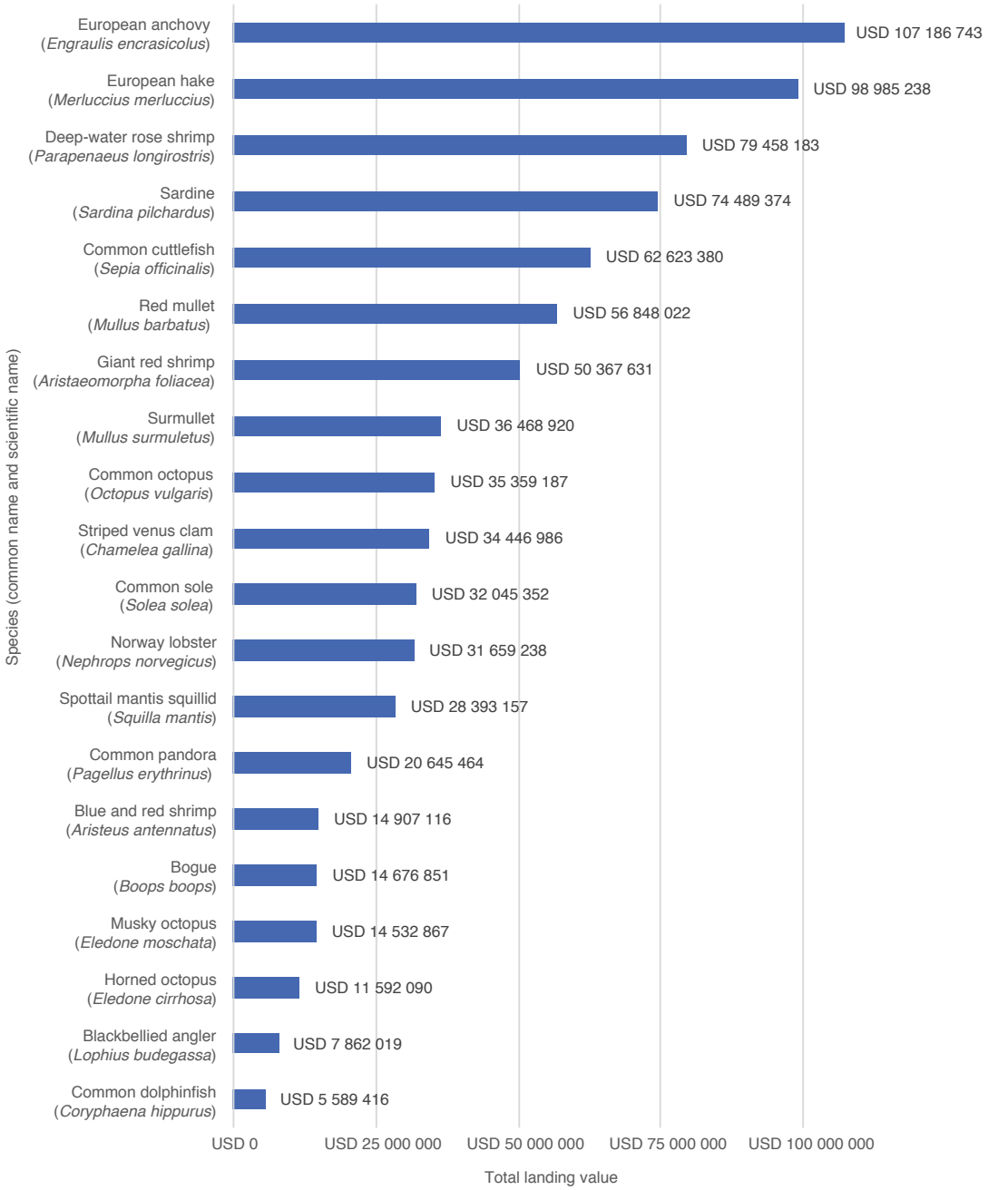


FIGURE 34 – Total value of landings for main commercial species

Over 60 percent of landing value comes from just seven species: European anchovy (*Engraulis encrasicolus* – 12 percent of total landing value), European hake (*Merluccius merluccius* – 12 percent of total landing value), deep-water rose shrimp (*Parapenaeus longirostris* – 9 percent of total landing value), sardine (*Sardina pilchardus* – 9 percent of total landing value), common cuttlefish (*Sepia officinalis* – 7 percent of total landing value), red mullet (*Mullus barbatus* – 7 percent of total landing value) and giant red shrimp (*Aristaeomorpha foliacea* – 6 percent of total landing value). When comparing these values with the volume of landings per species (see Table 9, Chapter 2), it is clear that demersal species have a larger contribution in value

than in volume; this is the case in particular for European hake (12.1 percent of value but only 1.7 percent of volume), deep-water rose shrimp (9.1 percent of value but only 1.5 percent of volume) and red mullet (6.9 percent of value but only 1.3 percent of volume). On the other hand, the opposite is the case for sardine (which accounts for 15.5 percent of volume but only 9.1 percent of value), and to a lesser extent for European anchovy (the species with the overall highest value and volume, however which accounts for 22.1 percent of volume but only 13.1 percent of value).

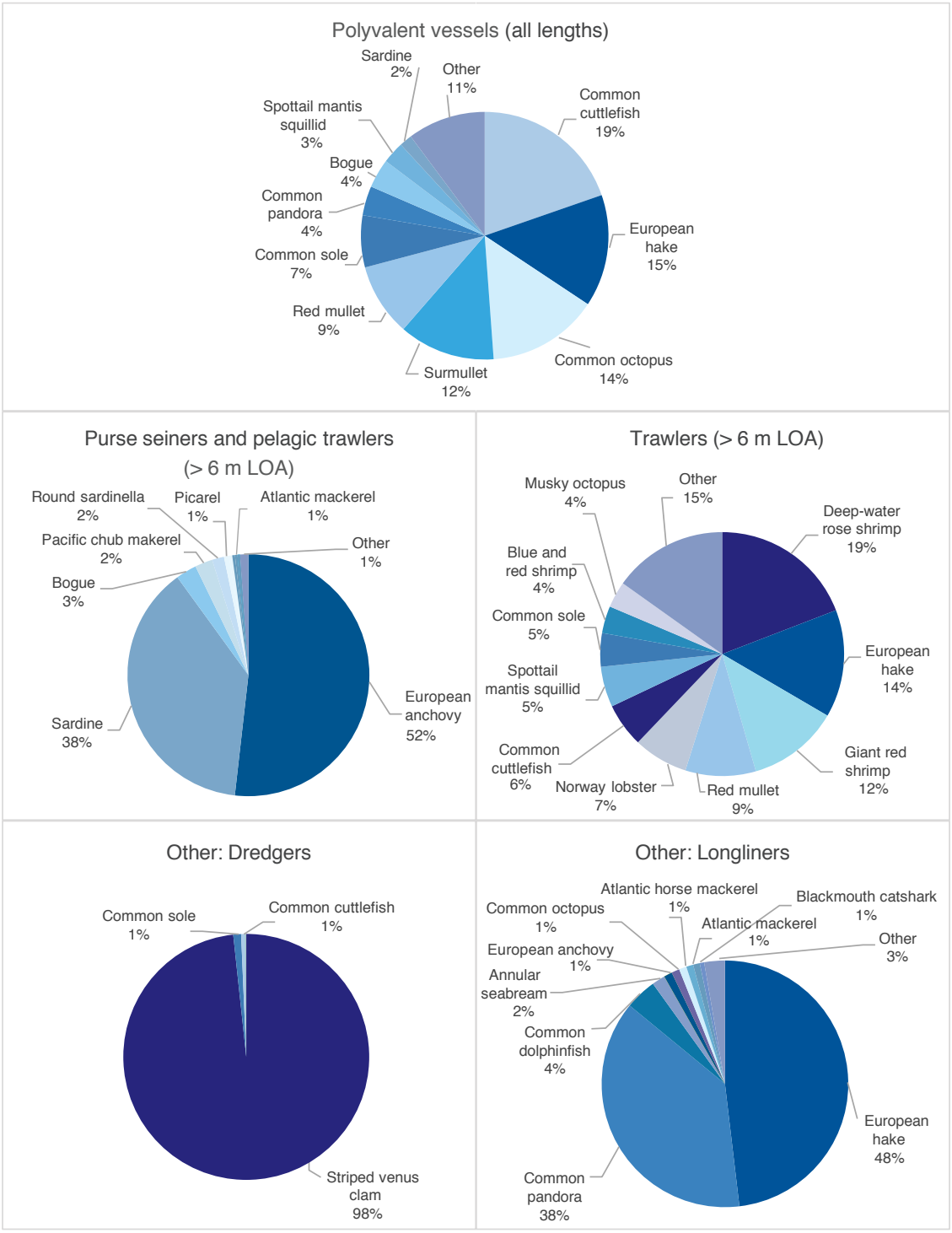


FIGURE 35 – Percentage of landing value by species for each main vessel group

An analysis of landing value for main commercial species (see Table 1, introduction and methodology), disaggregated by major vessel groups, provides further insight into the economic importance of different species (Figure 34). For a clearer analysis, the "Other fleet segments (all lengths)" vessel group was further broken down into "Dredgers" and "Longliners". Indeed, it is striking that, despite the wide variety of species caught in the Mediterranean and the Black Sea, for three vessel groups ("Purse seiners and pelagic trawlers [above 6 m LOA]", "Dredgers" and "Longliners"), over 90 percent of total landing value comes from less than three species. In the case of "Purse seiners and pelagic trawlers (above 6 m LOA)", 52 percent of landings by value come from European anchovy, 38 percent from sardine and 3 percent from bogue (*Boops boops*); for "Dredgers", 98 percent of all landings come from the striped venus clam (*Chamelea gallina*); and for "Longliners", 48 percent of landings by value come from European hake, 38 percent from common pandora (*Pagellus erythrinus*) and 4 percent from common dolphinfish (*Coryphaena hippurus*).

Instead, "Polyvalent vessels (all lengths)" and "Trawlers (above 6 m LOA)", which together account for 69 percent of total landings by value, have a much more multi-species nature. In the case of "Polyvalent vessels (all lengths)", over 75 percent of landings by value come from six species: 19 percent from common cuttlefish, 15 percent from European hake, 14 percent from common octopus (*Octopus vulgaris*), 12 percent from surmullet (*Mullus surmuletus*), 9 percent from red mullet and 7 percent from common sole (*Solea solea*). Also, in the case of "Trawlers (above 6 m LOA)", eight species make up approximately 77 percent of the landings by value: 19 percent from deep-water rose shrimp, 14 percent from European hake, 12 percent from giant red shrimp, 9 percent from red mullet, 7 percent from Norway lobster (*Nephrops norvegicus*), 6 percent from common cuttlefish, 5 percent from spottail mantis squillid (*Squilla mantis*) and 5 percent from common sole.

3.2.3 Operating costs

New data submission requirements have also now made possible the analysis of cost structures, including variable costs (personnel, energy, maintenance, commercial costs and other) as well as fixed costs and capital costs. Full data submissions through the DCRF online platform are currently not available for all CPCs; however a preliminary analysis has been presented here, based on current data submissions. After filtering data submission for quality control issues, the data from four CPCs were used for this preliminary analysis (Bulgaria, Italy, Lebanon and Slovenia). It is expected that the accuracy and completeness of this analysis will improve greatly in subsequent editions of SoMFi. In addition, this preliminary analysis, presented by main vessel groups provides initial indications (Figure 36). As in section 3.2.2 Revenue by species, the "Other fleet segments" vessel group was broken down into "Other: Dredgers" and "Other: Longliners" to better highlight the different cost structures of these different vessel types. In general, personnel/labour costs represent the most significant portion of total operating costs across all vessel groups. Labour costs are particularly significant for the "Polyvalent vessels (all lengths)" vessel group (48 percent of total operating costs), "Other: Dredgers" (43 percent) and "Purse seiners and pelagic trawlers (above 6 m LOA)" (38 percent). Fuel and other energy costs, instead, make up a significant portion of costs for trawlers (31 percent of total operating costs). Other variable costs also make up a significant portion of the operating costs of "Other: Longliners" (13 percent) where purchased inputs, such as bait, are important.

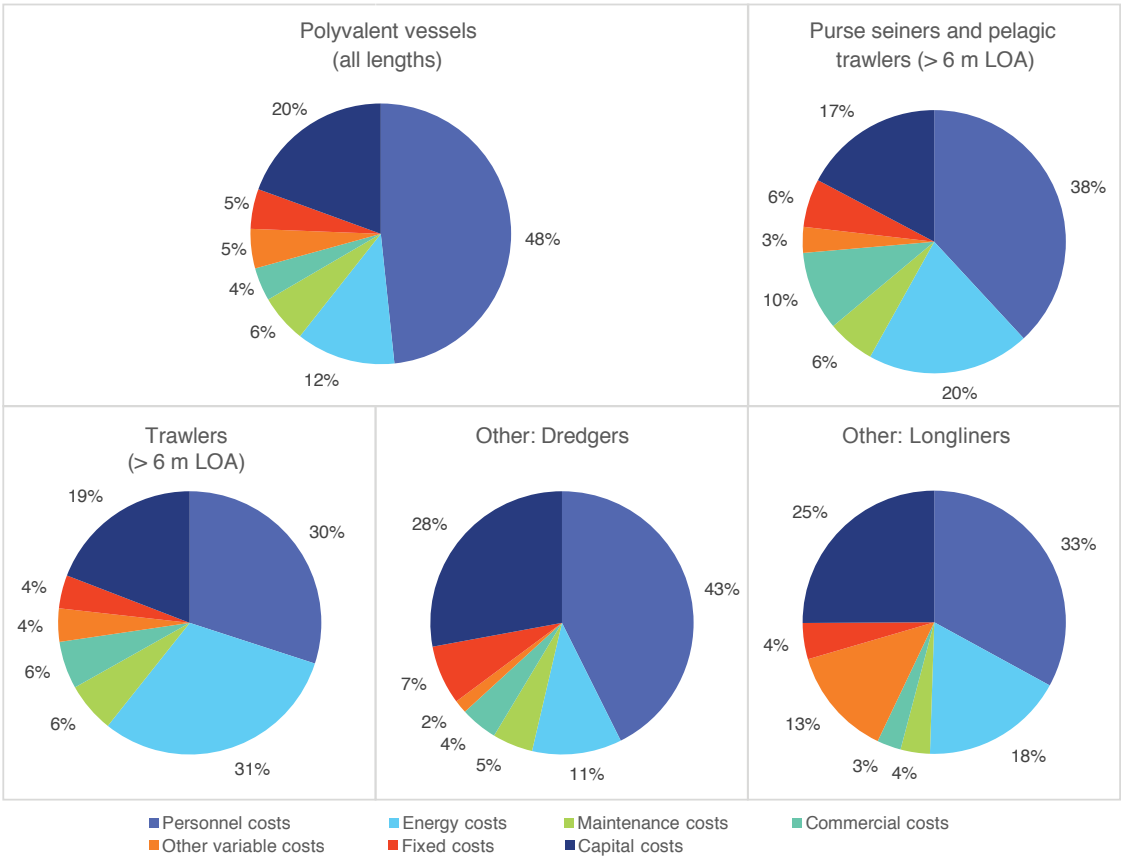


FIGURE 36 – Cost structure by main vessel groups

3.2.4 Gross cash flow

Data on operating costs have also facilitated a preliminary analysis of gross cash flow (GCF). GCF represents the total amount of cash generated each year, indicating the normal profitability of the fishing operation, and is calculated as revenue minus total operating costs.

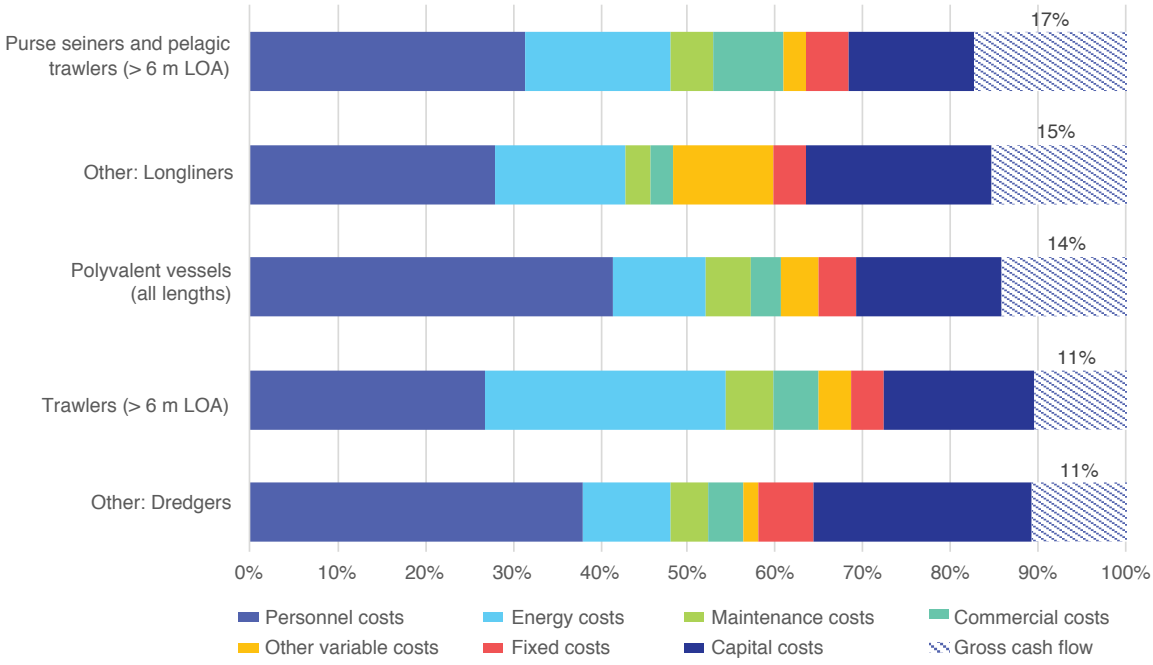


FIGURE 37 – Gross cash flow and cost structure (as a percentage of revenue) by vessel group

Based on the cost analysis presented in the previous section, the GCF for each main vessel group is presented in Figure 37. Based this preliminary analysis, "Purse seiners and pelagic trawlers (above 6 m LOA)" are the vessel group with the highest profitability, followed by "Other: Longliners" and "Polyvalent vessels (all lengths)". Again, it is important to note that this analysis is based on limited data submissions and the accuracy of this analysis is expected to improve in subsequent years as additional data are submitted through the DCRF online platform and quality controls are carried out.

3.3. EMPLOYMENT

According to official data submissions to the GFCM (Task 1 and DCRF), total employment onboard fishing vessels in the GFCM area of application is just under a quarter of a million people (248 000), with the Mediterranean accounting for approximately 227 250 jobs and the Black Sea accounting for 20 750 jobs.[6] These figures do not include pre- and post-harvest labour, gleaning activity or other in-kind labour, such as support from family members, which by some estimates may account for as much as half of total employment in the fisheries sector (Sauzade and Rousset, 2013). With respect to the SoMFi 2016, total employment has increased by approximately 10 percent (about 26 000 people). As many CPCs have been making efforts to improve their socio-economic data collection in recent years, this increase in employment, however, stems in part from an increase in the number of CPCs reporting employment data, as well as improved accuracy by certain CPCs of the data reported. Figure 38 presents employment data by CPCs and relevant non-state actors. [7,8] Four countries represent over 55 percent of all employment onboard fishing vessels in the GFCM area of application: Tunisia (19 percent of total employment), Turkey (13 percent of total employment), Algeria (12 percent of total employment) and Italy (10 percent of total employment).

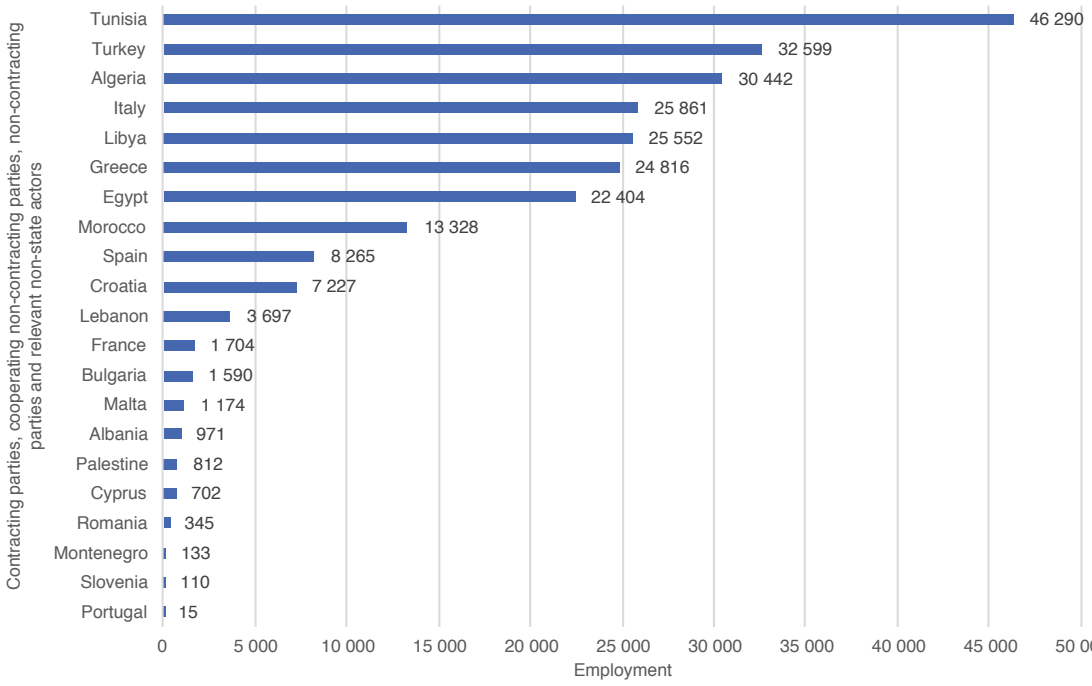


FIGURE 38 – Total employment onboard fishing vessels

6 Employment data are unavailable for Georgia, the Russian Federation and Ukraine.

7 Reference years: 2017 (Albania); 2016 (Bulgaria, Cyprus, France, Greece, Croatia, Italy, Lebanon, Malta, Montenegro, Portugal, Romania and Slovenia); 2015 (Egypt, Morocco and Spain); 2014 (Algeria, Libya and Turkey); 2013 (Tunisia); 2012 (Palestine). Data were not reported for Bosnia and Herzegovina, Israel, Georgia, the Republic of Moldova, Spain, the Syrian Arab Republic and Ukraine.

8 Spanish data has been calculated by averaging employment per vessel per fleet segment (data source: STECF, 2017) and applying this average to official fleet data submitted to the GFCM.

Employment data have been aggregated by subregion and are presented in Figures 39 and 40. The central, eastern and western Mediterranean subregions jointly represent 85 percent of all employment onboard fishing vessels in the GFCM area of application. With respect to the SoMFi 2016, the figures presented here are more accurate, facilitated by improved data submissions by GSA. In the case of Greece, for which data were unavailable by subregion, an estimate was made based on the percentage of production per subregion (see section 3.2.1). For Turkey, where employment data were also not available by subregion, the subregional breakdown was estimated based on a ratio of vessels per GSA.

An analysis of employment data by vessel group is also presented in Figure 41. "Polyvalent vessels (all lengths)" account for the predominant share of employment throughout the GFCM area of application (59 percent of total employment onboard fishing vessels). A disaggregated analysis by the two main basins (Figure 42) – the Mediterranean and the Black Sea – further illustrates the important role of polyvalent vessels for the Black Sea, where they account for 74 percent of employment. Figure 43 also presents an average number of employees per vessel group, based on initial data submitted through the DCRF online platform. Here, also, it is important to note the average of 1.9 fishers per polyvalent vessels (all lengths), underlining the small-scale nature of this vessel group.

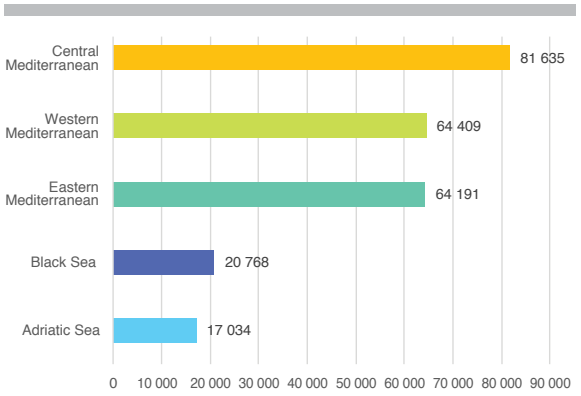


FIGURE 39 – Employment onboard fishing vessels by subregion

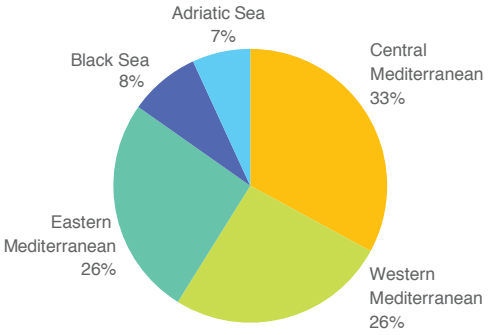


FIGURE 40 – Percentage employment onboard fishing vessels by subregion

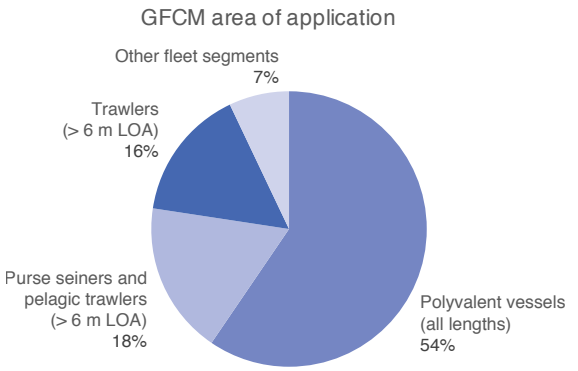


FIGURE 41 – Employment by vessel group

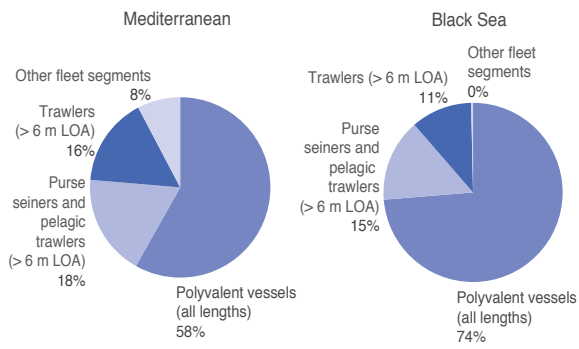


FIGURE 42 – Employment by vessel group by sea basin

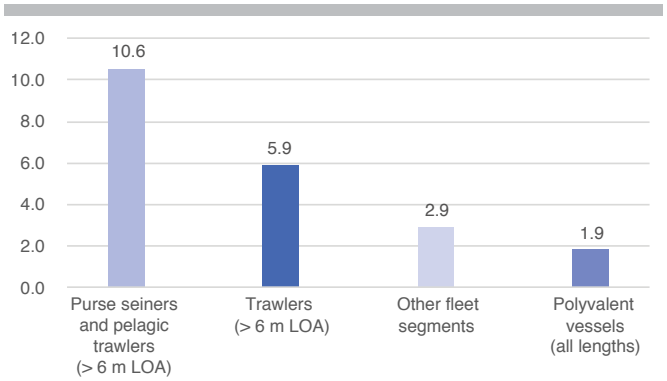


FIGURE 43 – Average employees per vessel by vessel group

3.3.1 Remuneration

As an indicator of productivity, the average production in terms of value at first sale for each fisher is presented, offering an indication of the efficiency of production. According to official data submissions to the GFCM, across the GFCM area of application, the average fisher produces approximately USD 14 000 in annual catch value. This indicator is presented below by CPC and by subregion (Figures 44 and 45, respectively). The landing values and employment data presented earlier in this chapter were used for this calculation.

Although useful as an indicator of productivity, landing value per employee provides a distorted view of remuneration per fisher as it does not consider part time employment and it does not account for costs. A better indicator is remuneration by full time equivalent (FTE). Full-time equivalent employment, which equals the number of full-time equivalent jobs, is defined as total hours worked divided by the average annual number of hours worked in full-time jobs (the commonly used international threshold is 2 000 hours per year). Through the new data submission requirements, CPCs now have the option of submitting FTE data, in addition to personnel costs. Although initial submissions are limited, a preliminary analysis of nine CPCs (Bulgaria, Croatia, Cyprus, Greece, Lebanon, Malta, Montenegro, Romania and Slovenia) has been carried out. On average, remuneration per FTE for these nine countries is USD 6 870 per FTE fisher, however, wide variation is seen across the different vessel groups (see Figure 46), with "Purse seiners and pelagic trawlers (above 6 m LOA)" and "Trawlers (above 6 m LOA)" providing the highest remuneration and "Polyvalent vessels (all lengths)" providing the lowest. A number of countries are improving their socio-economic data collection in order to submit these data, and it is foreseen that more complete and accurate calculations of this indicator will be available in coming years.

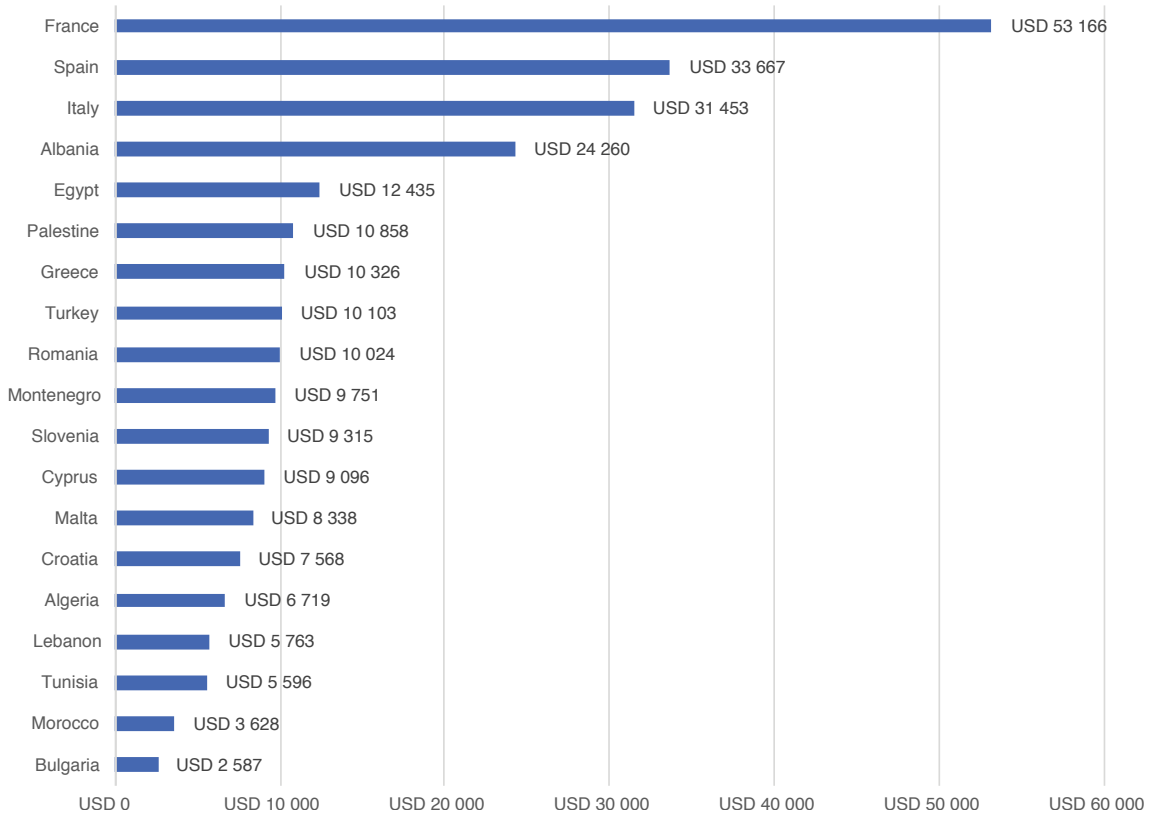


FIGURE 44 – Average annual landing value per employee

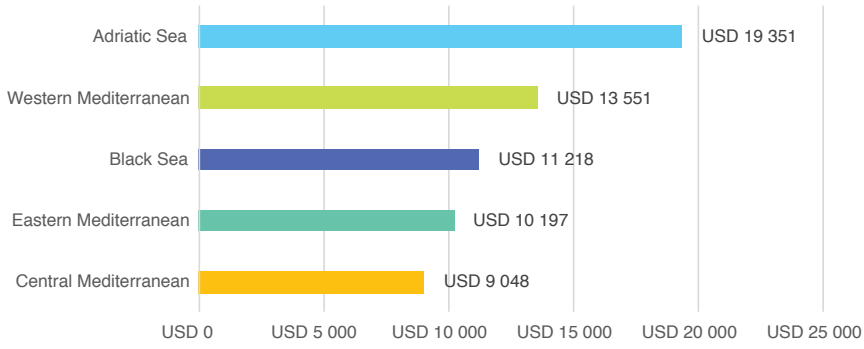


FIGURE 45 – Average landing value per employee by subregion

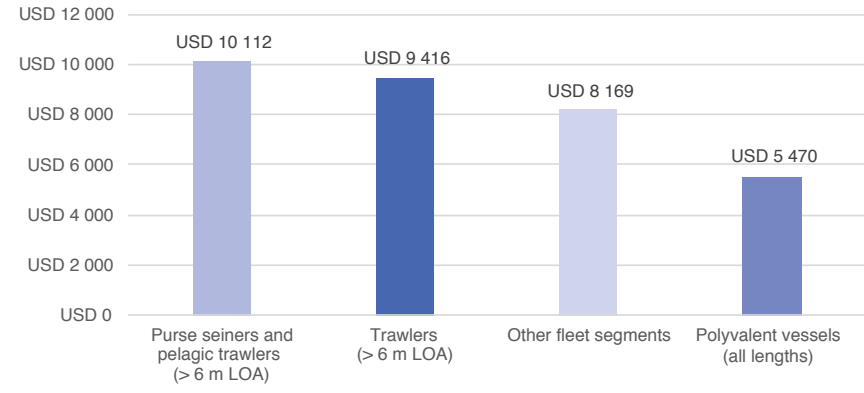


FIGURE 46 – Remuneration per full-time equivalent by fleet segment

3.4. TRADE

Fish trade is an increasingly important activity in the GFCM area of application. In particular, the trade relationships between the EU and non-EU CPCs are particularly important, often with high-value fish products being exported to the EU (Malvarosa and De Young, 2010). Trade data presented in this section are based on data from the FAO Fishery Commodities Global Production and Trade database for reference year 2016.

3.4.1 Standardized trade balance

The standardized trade balance (STB) is a useful indicator towards understanding if a country is a net importer or exporter of fishery products. It is calculated as a percent ratio between the simple balance (exports minus imports) and the total volume of trade (exports plus imports). An STB of negative one indicates 100 percent net imports and an STB of one indicates 100 percent net exports; a STB of zero indicates perfect balance between imports and exports. In the GFCM area of application, CPCs are generally net importers (Figure 47). In particular, Montenegro, Lebanon and the Syrian Arab Republic depend almost entirely on imports of fishery products, while Morocco has an important net export ratio. When data are analysed by subregion, the Black Sea results as the only subregion with net exports (Figure 48). Considering the importance of trade flows between southern and eastern Mediterranean countries and northern countries (such as EU countries) an analysis by geographic area (northern Mediterranean, southern Mediterranean, eastern Mediterranean and the Black Sea) was carried out (Figure 49). In this case, the data suggests that trade flows primarily from southern to northern Mediterranean countries.

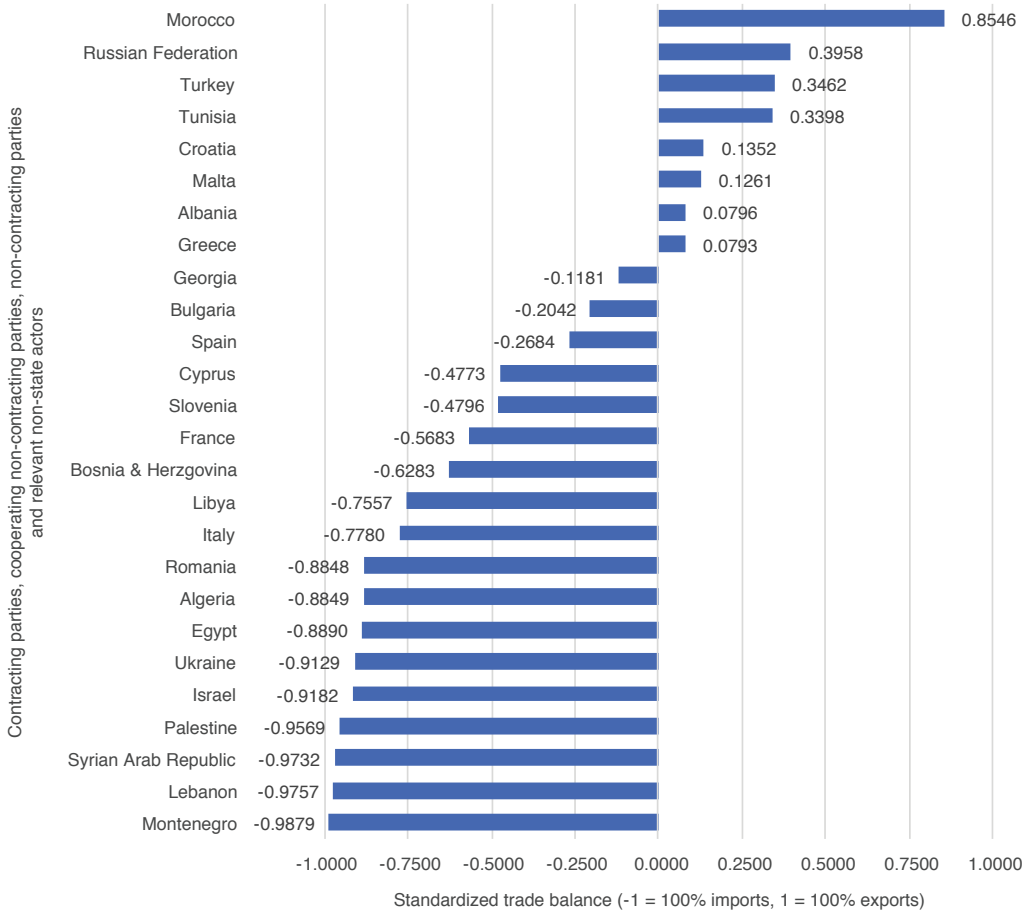


FIGURE 47 – Standardized trade balance

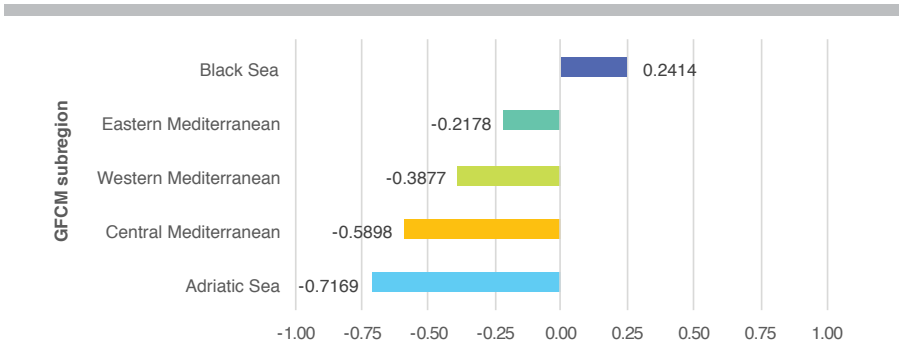


FIGURE 48 – Standardized trade balance by subregion

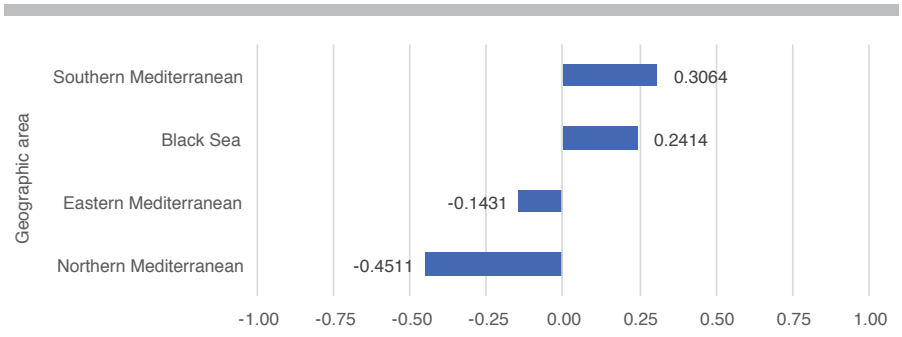


FIGURE 49 – Standardized trade balance by geographic area

3.4.2 Value of trade

In addition to trade balance, it is also important to understand the value of fishery trade in the region. The total value of traded fish product (imports plus exports) is provided for CPCs and relevant non-state actors in Figure 50. Total value of traded fish product from CPCs and relevant non-state actors is USD 40.5 billion, over 16 times the regional landing value at first sale. It is important to highlight that although these figures provide a snapshot of the value of traded fish products in the GFCM area of application, the available data are aggregated by country within the FAO Fishery commodities global production and trade database and they do not consist solely of fish products originating from capture fisheries in the GFCM area of application. As such, these data also include the value of traded fish products from aquaculture, from other FAO major fishing areas (especially in the case of Egypt, France, Morocco, the Russian Federation and Spain, which border multiple FAO fishing areas) as well as re-exports.

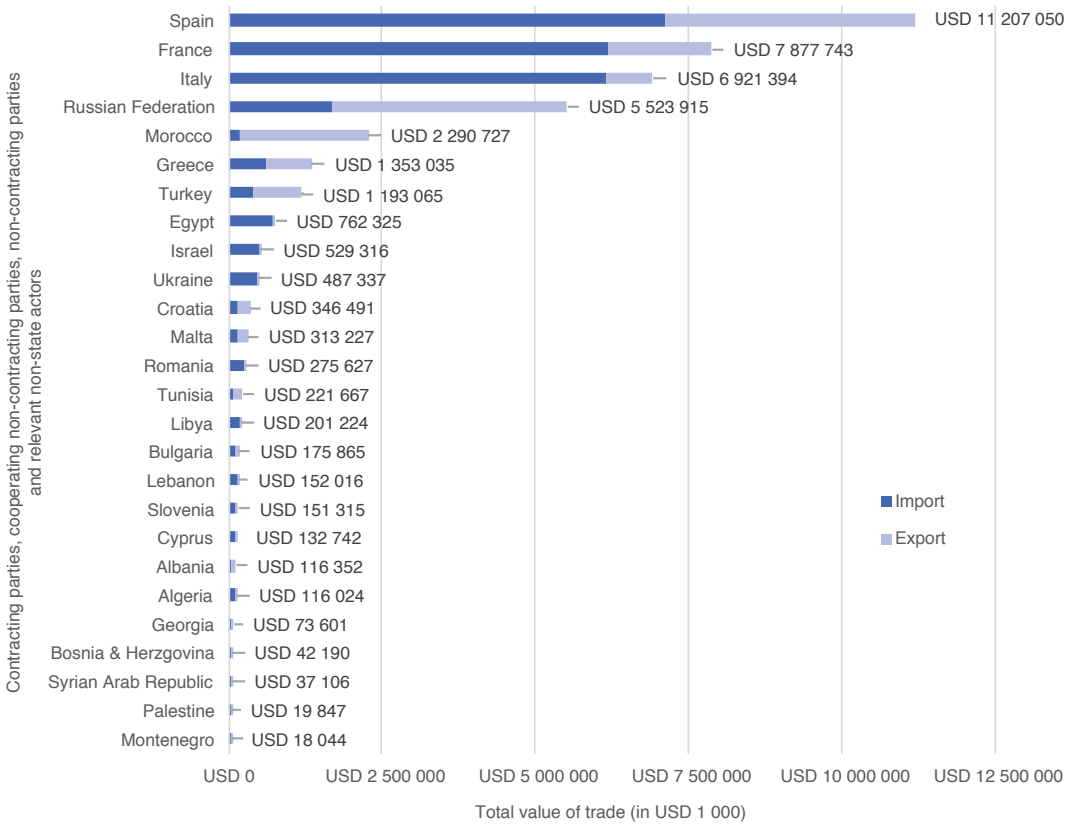


FIGURE 50 – Total value of traded fish product (imports and exports)

BYCATCH: DISCARDS AND INCIDENTAL CATCH OF VULNERABLE SPECIES

4

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4. Bycatch: Discards and incidental catch of vulnerable species

4.1. INTRODUCTION AND SOURCES OF INFORMATION

This chapter provides an overview of the characteristics of discards and incidental catches of vulnerable species, the main components of bycatch, in the Mediterranean and the Black Sea (both at the level of GSAs and GFCM subregions).

The term "bycatch" is widely used to refer to the part of the catch unintentionally captured during a fishing operation, in addition to target species. It consists of other commercial species (that may be secondary targets or may become target species if the market develops) and non-commercial species (returned to the sea or landed, in case of a discard ban) as well as incidental catches of vulnerable species, which may include species of commercial value or not, formally declared as "vulnerable" or "species at risk" as a result of natural or, more commonly, anthropogenic pressure, including fishing pressure (Figure 51).

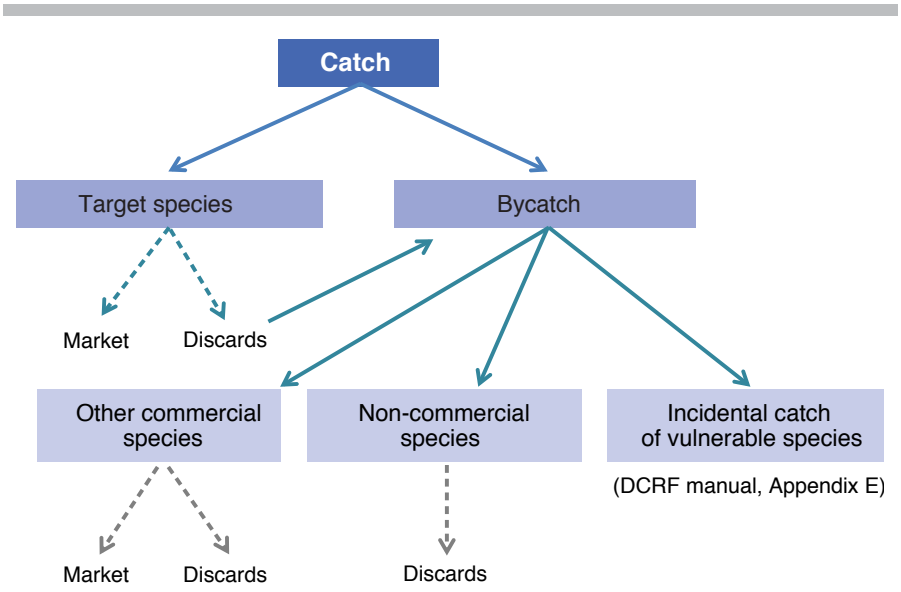


FIGURE 51 – Different components of the catch as defined by the GFCM Data Collection Reference Framework (GFCM, 2018b)

The effects of fisheries on the environment have been abundantly described and reviewed (Garcia *et al.*, 2003; Kelleher, 2005). Fisheries impact not only target resources (e.g. fish, crustaceans and cephalopods), but also many other species that are relevant to the functioning of the overall ecosystem (Jackson *et al.*, 2001; Kelleher, 2005), both directly (e.g. discards, vulnerable species, benthic species etc.) and indirectly (e.g. species occupying higher trophic levels that rely on target catch).

In 2016, recognizing the need to address this issue and to have better information, the GFCM brought back to the forefront monitoring programmes for discards and incidental catch of vulnerable species in the Mediterranean and the Black Sea. Assessing the impacts of bycatch on different fisheries activities was included as a priority in the mid-term strategy under Target 4 "Minimize and mitigate unwanted interactions between fisheries and marine ecosystems and

environment" (Output 4.1 "Reduced bycatch rates in Mediterranean and Black Sea fisheries") (see Chapter 8).

In general, bycatch studies (both on discards and on incidental catch of vulnerable species) do not address all fishing gear and countries, and most of these studies cover relatively short temporal and small spatial scales. This gap of knowledge highlights the need to expand bycatch surveys and to standardize practices in order to enable comparison among fisheries and the testing of potential methods and tools to mitigate bycatch. Actions aimed at gathering more robust data or better evidence are therefore crucial and analyses at the subregional level are of primary importance. Sharing existing information, standardizing approaches, establishing or expanding well-designed monitoring schemes and cooperation among countries are essential to develop a holistic approach of bycatch and thus contribute enhancing fisheries management in the region. In this view, the GFCM has developed two methodologies for the monitoring of discards and incidental catches of vulnerable species to be used as guidelines for relevant data collection activities (FAO, 2018d; FAO 2018e). The objective of these two documents is to provide a harmonized methodological framework for data collection that is applicable to the context of different countries and enables the comparison of data at the regional and subregional levels.

4.2. DISCARDS

Marine ecosystems are subject to a number of alterations of significant relevance to their functioning and resilience and to the goods and services they can provide (Garcia *et al.*, 2003). Discarding practices are one of the causes of these alterations. Discards are a part of bycatch; they represent the portion of the catch that is not retained on board during a fishing operation and that is discarded at sea (being the organisms dead or still alive) and may constitute a large portion of the total bycatch (Alverson *et al.*, 1994). Discards can also include the catch of target species or any other species (commercial and non-commercial) that is discarded at sea (GFCM, 2018) (Figure 51).

According to the most recent report on the global assessments of fisheries bycatch and discards release by the FAO (Kelleher, 2005), it is estimated that 7.3 million tonnes of fish (usually dead or dying) are discarded annually by marine fisheries throughout the world. The weighted discard rate, i.e. the proportion of the catch discarded at sea, is estimated at 8 percent.

In the Mediterranean, discards are estimated at around 230,000 tonnes (approximately 18 percent of the total catch) (Tsagarakis, Palialexis and Vassilopoulou, 2013). In the Black Sea, discards are estimated at around 45 000 tonnes (approximately 10–15 percent of the total catch). However, these studies only cover a small proportion of the total fishing activity, and there is a shortage of complete and up-to-date information (Sanchez *et al.*, 2007, Tzanatos *et al.*, 2007; Tsagarakis, Palialexis and Vassilopoulou, 2014; Sala *et al.*, 2015). This issue has been acknowledged as an important constraint, in particular for performing reliable stock assessments (Caddy, 2009; FAO, 2016). In European countries, discard has also been identified as a significant problem, both from an ecosystem and economic point of view, in the Common Fisheries Policy (CFP) (EU, 2013). In order to address this problem, the CFP introduces the obligation to land all catches and prohibits the discarding of species that are subject to catch and minimum size limitations (i.e. discard ban).

Despite the importance of discards, data collection and estimates of discard rates for several commercial species in Mediterranean and Black Sea waters are far from being complete, and the estimates generally have low precision.

This section presents a compilation and a review of available information on discard levels in different fisheries within the GFCM area of application. As a general approach, in order to compare discard practices between subregions and to draw an overall trend between GSAs, fisheries are divided into three broad categories depending on their discard rates: high discard fisheries (above 40 percent of total catch), medium discard fisheries (15–39 percent of total catch) and low discard fisheries (below 15 percent of total catch) (EU, 2011; FAO, 2016).

The information needed to produce this regional discard profile has been collected from the following sources: (i) review of the most recent regional reports mainly drawn from scientific publications and technical reports; (ii) regional databases (e.g. GFCM, FAO), and (iii) ad hoc questionnaire from a discard survey carried out in 2017 in Mediterranean and Black Sea countries (GFCM discard questionnaire, see Box 5). The purpose of the GFCM discard questionnaire was to obtain the viewpoint of country experts as well as qualitative assessments on the vessel groups for which discards activity is considered substantial and on the most important commercial and non-commercial species discarded. In order to facilitate a structured consultation process, the questionnaire was sent to the GFCM National Focal Point in each country (16 countries responded, representing 27 GSAs). After analysing all the information received, an approximate percentage of discarded catch was estimated for the major vessel groups by area (Appendix B of the DCRF; GFCM, 2018b). The landing composition was also reported for each vessel group and GFCM subregion (Appendix L of the DCRF; GFCM, 2018b).

BOX 5 – Survey on discards in Mediterranean and Black Sea countries

In 2017, in order to update the information presented in SoMFi 2016, a dedicated questionnaire was sent to Mediterranean and Black Sea riparian countries in order to obtain available information on a number of aspects related to discards, including: (i) monitoring systems/data collection in place; (ii) methodologies in place for the collection of discard data; (iii) vessel groups with substantial discards and occurrence and magnitude of discards; (iv) most important non-commercial discarded species; (v) reasons driving discard practices; (vi) mitigation measures in place, and (vii) main problems identified by countries in collecting discards data.

Furthermore, suggestions to facilitate the collection of discard data, were also requested. The information collected through this survey, together with information from other sources cited at the beginning of this chapter, were used to update the status of discards and incidental catches.

In addition, the following issues and suggestions to improve the collection of data on discard and incidental catches information were highlighted.

Main issues in discard data collection

- The quantification of discards can only be reliable through sampling from onboard observers. However, in order to take into account the variability in discard practices (e.g. type of vessels, fishery, seasons, area), a large number of samples needs to be obtained.
- There is a lack of staff/observers, mainly due to financial constraints, and capacity-building should be enhanced.
- The gaps, failures and difficulties in the collection of discard data by onboard observers are mainly related to:
  - The reluctance of fishers to receive observers on board;
  - Constraints in the number of person allowed to embark (especially on board small-vessels);
  - Spatial issues associated with a large number of landing ports dispersed along the coasts;
  - Workload on board.
- Other source of information are needed (e.g. questionnaires to share with fishers to obtain more accurate information; self-sampling; etc.). However, with these methods, discard data could be strongly influenced by subjective perceptions, as is the case for questionnaires/interviews.

BOX 5 (Continued)

- It is difficult to involve fishers in self-reporting and self-sampling of discards and the additional workload for fishers may induce considerable bias in the discard evaluation.
- In general, weak monitoring, control and surveillance systems lead to failure to collect discard data.
- Currently, the only way to collect discard data for in some countries is through the logbook. However, discard information in the logbook is only required if more than 50 kg per certain species are caught.
- In some countries, fishing prohibited species, undersize fish specimens (that can be easily landed/sold and not discarded) and in prohibited seasons could create overlaps between discards and IUU fishing.

Suggestions to facilitate discard data collection

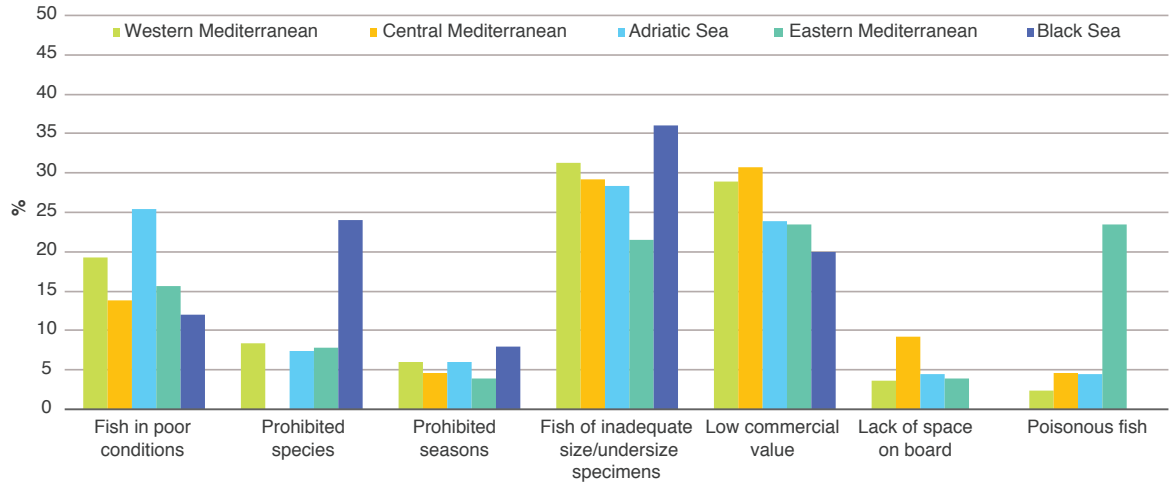
- Increase the involvement of fishers in monitoring catch data (landings and discards);
- Facilitate the boarding of scientific observers on commercial fishing vessels;
- Improve capacity-building;
- Train data collectors;
- Share knowledge (e.g. best practices, methodologies etc.) among countries;
- Support the implementation of a regional data collection system with a common methodology and common data processing in order to produce regional/subregional analysis and assessments;
- Develop a regional data collection protocol.

4.2.1 Reasons for discarding

Discarding can be due to a variety of reasons: low commercial value of species, individuals that are small and/or in poor conditions (e.g. due to prolonged time between capture and landing, or damaged by gear) (Kelleher, 2005), or as a result of fisheries management policies (Tsagarakis, Palialexis and Vassilopoulou, 2013; Bellido Millán *et al.*, 2014,). The lack of space on board can be a factor influencing discards: with a restricted storage capacity, the master of a vessel may prefer to retain only the most valuable species. The nutritional habits of the community could also affect fishing and discarding practices.

Other environmental, biological and behavioural factors can play an important role in discarding practices because they influence the composition of the catch (Crowder and Murawski, 1998; Hall *et al.*, 2000; Rochet and Trenkel, 2005). These factors include: season and area (e.g. temporal and/or spatial aggregation of species or sizes), rare species occurrence, species assemblages (e.g. predominance of smaller individuals in exploited populations), and state of the population (e.g. the association between target and non-target species). Fishing depth is also strongly related to discarding patterns due to the varying catch composition and to the relative biomass of target species in the different depth strata, although apparently there is no constant pattern related to the depth stratum for the whole basin. Increased discarding of some species has been reported during the recruitment period, when these species migrate from shallow waters to offshore areas and become therefore accessible to bottom trawling (Sala *et al.*, 2015).

These findings are also reflected in the results of the discard survey. Discarding is affected by a combination of factors: for a given species (especially for non-target species) discards are likely to fluctuate within a fishery and across seasons, years and subregions. A significant part of the discard fraction is represented by small and/or juveniles individuals and by species with very low market value (Figure 52).



Source: GFCM discard questionnaire.

FIGURE 52 – Main factors influencing discard behaviours in the GFCM subregions

4.2.2 Why is discarding a problem?

Discards have negative consequences on the environment and the ecosystems (Hall, 1996). Ethically, they constitute a waste of natural resources. From an ecological standpoint, they negatively affect the marine ecosystems, provoking changes in the overall structure of trophic webs and habitats, which in turn puts at risk the sustainability of current fisheries (Bellido *et al.*, 2011). Discards trigger changes in the food chain ecology: they generate increased levels of food through dead fish or fish that may not survive after release, altering the relative prey-predator abundance (Garthe and Scherp, 2003) and causing additional interactions between species (e.g. scavenging organisms on the sea floor, and feeding populations of sea birds, marine mammals, and sharks) (Votier *et al.*, 2004). Particularly, in deep-sea environments where food is scarce, the input of organic matter from discards increases the diversity of benthic communities in localized areas (Jennings and Kaiser, 1998). In contrast, species with a low discard mortality may increase in terms of abundance in areas of extensive fishing and alter relationships in the ecosystem (Rogers and Ellis, 2000).

The majority of specimens caught and discarded either dead or dying are usually small and sexually immature (Davis, 2002; CEC, 2002). This implies a reduction in future spawning stock biomass and reduced the potential for the stock to rebuild, which is currently one of the key parameters in fisheries management. Discarding results in the loss of valuable scientific information by complicating the stock assessment process since the real fishing mortality applied to fish stocks is not quantified (Diamond and Beukers-Stewart, 2011). Finally, discarding small specimens also lead to a reduction in future harvesting opportunities, thereby diminishing the growth potential of stocks as well as potential yields from the fishery, with obvious economic consequences. From a manager's perspective, the problem consists in simultaneously meeting socio-economic and biological objectives and developing suitable performance indicators to measure progress towards these objectives (Catchpole *et al.*, 2013); from a fishers' perspective, discarding is an extra cost both in labour and money (Pascoe, 1997).

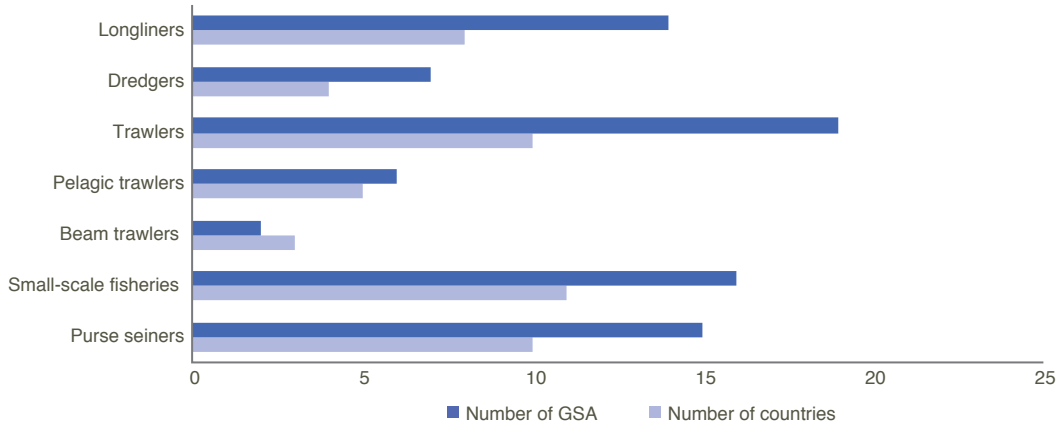
4.2.3 The need for discard data

Understanding discarding is of fundamental importance to clarify and avoid the detrimental impacts of fishing activities on the environment, particularly when these activities overexploit marine resources (Frid *et al.*, 2003). Discarding is not always taken into consideration in fish

stock assessments, even when it may account for a large proportion of fishing mortality, especially for younger individuals; this can lead to unrealistic and, in some cases, optimistic assessments. When discards form a substantial part of the catch for a given species, it is generally considered that accurate discard data should be included in order to improve fishing mortality and recruitment estimates. If the amount of discards is not considered in the assessment of the status of the stocks and in the implementation of relevant management plans, this can result in unsustainable fishing. In most cases, discards are not included due to a lack of data and systematic sampling, and the associated low precision. Accounting for discard data in stock assessments is therefore important in order to improve the estimates of removals from the population due to fisheries.

In addition, there is an increasing interest in using discard data to evaluate the effects of fishing activities on the wider ecosystems. Quantifying discards has become more important in recent years as fishery management objectives are moving towards the inclusion of an environmental perspective. This requires information about all catch components (landings, discards and catches of vulnerable species), and different sampling approaches may therefore be needed.

The GFCM survey on discarding practices highlighted that studies on discards are carried out routinely in few Mediterranean and Black Sea countries and cover a small portion of the total fishing activities (Figure 53). The survey has also identified major problems in collecting discards data and made suggestions for potential improvements (Box 5).



Source: GFCM discard questionnaire.

FIGURE 53 – Discard monitoring systems in place by vessel group in Mediterranean and Black Sea countries

4.3. OVERVIEW OF DISCARDS BY FISHERY

4.3.1 Bottom trawl fisheries

In the Mediterranean and the Black Sea, bottom trawl fisheries are the most important in terms of economic value of the catches and the second largest, after small pelagic fisheries, in terms of landings (Figures 30 and 31, Chapter 3; see also Damalas, 2015; FAO, 2016). Several trawl fisheries operate across the GFCM subregions and both catch composition (Table 10) and discards (Table 11) vary according to the species targeted and to the depth stratum where the fisheries operate. The high diversity of species in the catch (Sartor *et al.*, 2016) is also reflected in the discard fraction (Table 11).

TABLE 10 – Bottom trawl fishery landing composition by GFCM subregion

Bottom trawl landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
European hake *(Merluccius merluccius)*	8.00	Deep-water rose shrimp *(Parapenaeus longirostris)*	35.4	Red mullet *(Mullus barbatus)*	12.20	Bogue *(Boops boops)*	22.68	Sea snails *(Rapana* spp.*)*	48.6
Mediterranean horse mackerel *(Trachurus mediterraneus)*	7.07	Giant red shrimp *(Aristaeomorpha foliacea)*	13.0	Spottail mantis squillid *(Squilla mantis)*	11.95	Red mullet *(Mullus barbatus)*	16.44	Whiting *(Merlangius merlangus)*	13.2
Red mullet *(Mullus barbatus)*	6.03	European hake *(Merluccius merluccius)*	8.9	European hake *(Merluccius merluccius)*	11.85	Aristeid shrimps nei (Aristeidae)	13.78	Bluefish *(Pomatomus saltatrix)*	9.4
Deep-water rose shrimp *(Parapenaeus longirostris)*	5.27	Surmullet *(Mullus surmuletus)*	4.8	Musky octopus *(Eledone moschata)*	7.50	Mullets nei (Mugilidae)	12.79	Mediterranean horse mackerel *(Trachurus mediterraneus)*	6.8
Common octopus *(Octopus vulgaris)*	3.78	Blue and red shrimp *(Aristeus antennatus)*	3.0	Common cuttlefish *(Sepia officinalis)*	6.24	Deep-water rose shrimp *(Parapenaeus longirostris)*	7.27	European sprat *(Sprattus sprattus)*	6.4
European anchovy *(Engraulis encrasicolus)*	3.52	Musky octopus *(Eledone moschata)*	2.7	Deep-water rose shrimp *(Parapenaeus longirostris)*	5.08	Shads nei *(Alosa* spp.*)*	5.14	Surmullet *(Mullus surmuletus)*	4.1
Blue and red shrimp *(Aristeus antennatus)*	3.46	Silver scabbardfish *(Lepidopus caudatus)*	2.6	European squid *(Loligo vulgaris)*	4.26	Whiting *(Merlangius merlangus)*	4.32		
Broadtail shortfin squid *(Illex coindetii)*	3.36	Broadtail shortfin squid *(Illex coindetii)*	2.5	Caramote prawn *(Penaeus kerathurus)*	4.19	Mediterranean horse mackerel *(Trachurus mediterraneus)*	4.15		
Common pandora *(Pagellus erythrinus)*	3.11	Red mullet *(Mullus barbatus)*	2.2	Whiting *(Merlangius merlangus)*	3.22	Surmullet *(Mullus surmuletus)*	3.74		
Atlantic horse mackerel *(Trachurus trachurus)*	3.01	Norway lobster *(Nephrops norvegicus)*	2.2						
Bogue *(Boops boops)*	2.89	Common cuttlefish *(Sepia officinalis)*	1.7						
Horned octopus *(Eledone cirrhosa)*	2.85	Blackbellied angler *(Lophius budegassa)*	1.7						
Other species	47.7	Other species	19.4	Other species	33.5	Other species	9.7	Other species	11.5
Total (%)	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**
Total landing (tonnes)	**59 519**	**Total landing (tonnes)**	**16 799**	**Total landing (tonnes)**	**28 880**	**Total landing (tonnes)**	**2 013**	**Total landing (tonnes)**	**13 022**

Source: GFCM database.

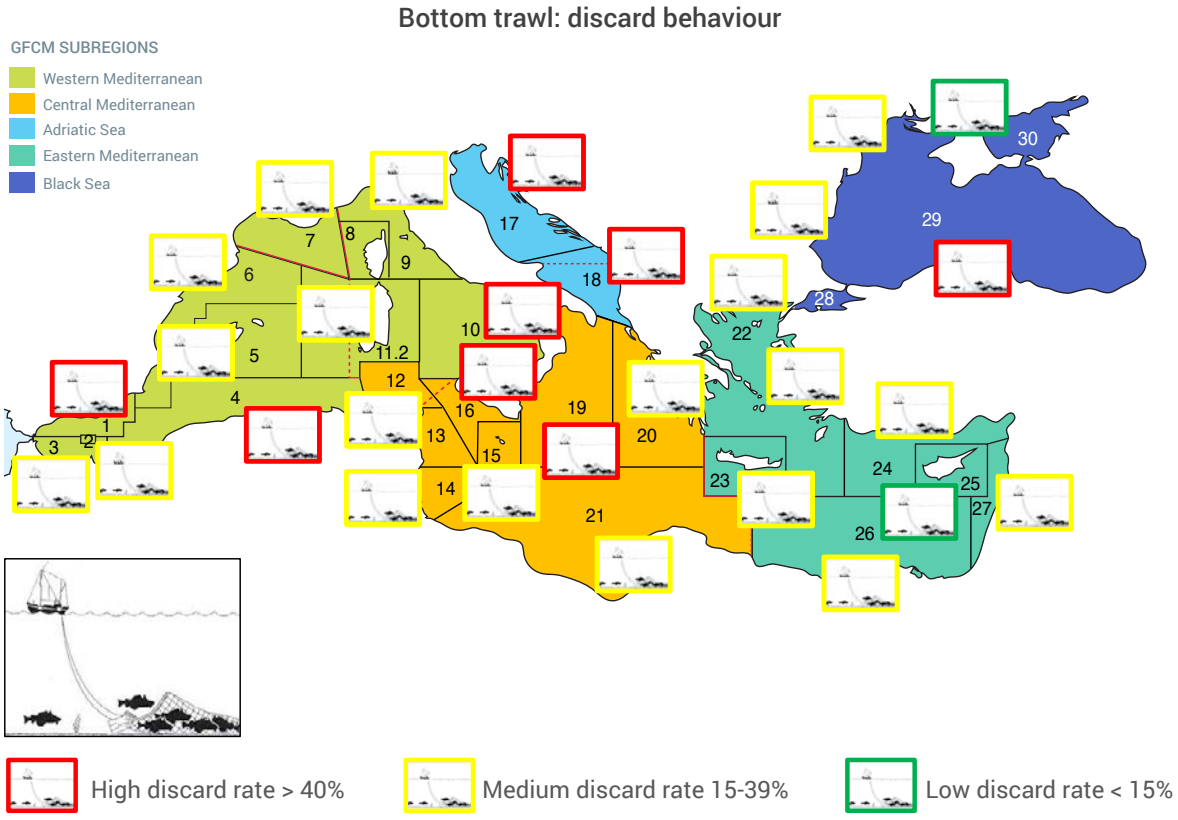
Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

Bottom trawl fisheries are generally responsible for the bulk of discards (Tsagarakis, Palialexis and Vassilopoulou, 2014) and are characterized by a wide range of discard ratios (Figure 54) in all the Mediterranean and Black Sea subregions (Edelist *et al.*, 2011; Guku, 2012; Damalas and Vassilopoulou, 2013; Damalas *et al.*, 2015; Gorelli *et al.*, 2016; Yildiz and Karakulak, 2017; Tsagarakis *et al.*, 2017). Apart from some exceptions, both Kelleher (2005), reporting discard values oscillating from 45–50 percent of the total catch, and Tsagarakis, Palialexis and Vassilopoulou (2014), reporting a mean discard value around 33 percent, confirm these results (Figure 54).

TABLE 11 – Main commercial and non-commercial species discarded by bottom trawl fisheries, by GFCM subregion

Bottom trawl: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	European common squid *(Allotheuthis subulata)*, Red gurnard *(Aspitrigla obscura)*, Bogue *(Boops boops)*, Spotted flounder *(Citharus linguatula)*, European conger *(Conger conger)*, Annular seabream *(Diplodus annularis)*, European anchovy *(Engraulis encrasicolus)*, Broadtail shortfin squid *(Illex coindetii)*, Thinlip grey mullet *(Liza ramada)*, European hake *(Merluccius merluccius)*, Red mullet (*Mullus barbatus)*, Common octopus *(Octopus vulgaris)*, Axillary seabream *(Pagellus acarne)*, Common pandora *(Pagellus erythrinus)*, Deep-water rose shrimp *(Parapaenaeus longirostris)*, White glass shrimp nei *(Pasiphaea* spp.*)*, Greater forkbeard *(Phycis blennoides)*, Sardine *(Sardina pilchardus)*, Pink cuttlefish *(Sepia orbignyana)*, Picarels nei (*Spicara* spp.), European sprat *(Sprattus sprattus)*, Jack and horse mackerels nei *(Trachurus* spp.*)*, Poor cod *(Trisopterus minutus capelanus)*	Ascidiacea, Echinoderms *(Astropecten irregularis, Holoturia tubulosa, Spatangus purpureus, Stichopus regalis, Trachythyone* spp.*)*, Boarfish *(Capros aper)*, Curled picarel *(Centracanthus cirrhus)*, Hollowsnout grenadier *(Coelorynchus caelorhyncus)*, Velvet belly *(Etmopterus spinax)*, Silvery pout *(Gadiculus argenteus)*, Blackmouth catshark *(Galeus melastomus)*, Gastropods *(Murex brandaris, Galeodea* spp.*)*, Smalltoothed argentine *(Glossanodon leioglossus)*, Mediterranean slimehead *(Hoplostethus mediterraneus)*, Jewel lanternfish *(Lampanyctus crocodilus)*, Silver scabbardfish *(Lepidopus caudatus)*, Liocarcinus swimcrabs nei *(Liocarcinus* spp.*)*, Longspine snipefish *(Macroramphosus scolopax)*, Demon-faced porter crab *(Medorippe lanata)*, Common atlantic grenadier *(Nezumia aequalis)*, Snake blenny *(Ophidion barbatum)*, Right-handed hermit crabs nei (Paguridae), Arrow shrimp *(Plesionika heterocarpus)*, Small-spotted catshark (*Scyliorhinus canicula)*, Brown comber (*Serranus hepatus*), Atlantic mud shrimp (*Solenocera membranacea*), Dark tonguefish *(Symphurus nigrescens)*, Marbled electric ray (*Torpedo marmorata*), Grenadier fishes *(Trachyrincus* spp.*)*
Central Mediterranean	Bogue *(Boops boops)*, Annular seabream *(Diplodus annularis)*, Broadtail shortfin squid *(Illex coindetii)*, European hake *(Merluccius merluccius)*, Red mullet *(Mullus barbatus)*, Common pandora *(Pagellus erythrinus)*, Blue swimming crab *(Portunus segnis)*, Deep-water rose shrimp *(Parapaenaeus longirostris)*, Mediterranean horse mackerel *(Trachurus mediterraneus)*, Atlantic horse mackerel *(Trachurus trachurus)*	Boarfish *(Capros aper)*, Shortnose greeneye *(Chlorophthalmus agassizi)*, Hollowsnout grenadier *(Coelorynchus caelorhyncus)*, Tall sea pen (*Funiculina quadrangularis)*, Silvery pout *(Gadiculus argenteus)*, Blackmouth catshark *(Galeus melastomus)*, Smalltoothed argentine *(Glossanodon leioglossus)*, Gobies nei *(Gobius* sp.*)*, Mediterranean slimehead *(Hoplostethus mediterraneus)*, Longspine snipefish *(Macroramphosus scolopax)*, Squat lobster *(Munida rutllanti)*, Spoon oyster *(Neopycnodonte cochlear)*, White glass shrimp *(Pasiphaea sivado)*, Arrow shrimp *(Plesionika heterocarpus)*, Small-spotted catshark *(Scyliorhinus canicula)*, Brown comber *(Serranus hepatus)*, Common tower shell *(Turritella communis)*
Adriatic Sea	Common pelican-foot *(Aporrhais pespelecani)*, European anchovy *(Engraulis encrasicolus)*, Broadtail shortfin squid *(Illex coindetii)*, European hake *(Merluccius merluccius)*, Red mullet *(Mullus barbatus)*, Smooth-hound *(Mustelus mustelus)*, Blue whiting *(Micromesistius poutassou)*, Common pandora *(Pagellus erythrinus)*, Deep-water rose shrimp *(Parapenaeus longirostris)*, Sardine *(Sardina pilchardus)*, Spottail mantis squillid *(Squilla mantis)*, Mediterranean horse mackerel *(Trachurus mediterraneus)*, Atlantic horse mackerel *(Trachurus trachurus)*, Poor cod *(Trisopterus minutus capelanus)*	Shortnose greeneye *(Chlorophthalmus agassizi)*, Grey gurnard *(Eutrigla gurnardus)*, Blackmouth catshark *(Galeus melastomus)*, Smalltoothed argentine *(Glossanodon leioglossus)*, Lobster krill *(Munida* spp.*)*, Blue-leg swimcrab *(Liocarcinus depurator)*, Common eagle ray *(Myliobatis aquila)*, Small-spotted catshark *(Scyliorhinus canicula)*, Brown comber *(Serranus hepatus)*
Eastern Mediterranean	Bogue *(Boops boops)*, Tub gurnard *(Chelidonichthys lucerna)*, Blackbelly rosefish *(Helicolenus dactylopterus)*, European hake *(Merluccius merluccius)*, Red mullet *(Mullus barbatus)*, Blackspot seabream *(Pagellus bogaraveo)*, Deep-water rose shrimp *(Parapenaeus longirostris)*, Mediterranean horse mackerel *(Trachurus mediterraneus)*, Atlantic horse mackerel *(Trachurus trachurus)*, Picarel *(Spicara smaris)*	Echinoderms, Klunzinger's ponyfish *(Equulites klunzingeri)*, Blackmouth catshark *(Galeus melastomus)*, Pufferishes nei *(Lagocephalus* spp.*)*, Jewel lanternfish *(Lampanyctus crocodilus)*, Large-scaled gurnard *(Lepidotrigla cavillone)*, Spiny gurnard *(Lepidotrigla dieuzeidei)*, Liocarcinus swimcrabs nei *(Liocarcinus* spp.*)*, Brown comber *(Serranus hepatus)*, Tunicate (Tunicata)
Black Sea	Whiting *(Merlangius merlangus)*, Red mullet *(Mullus barbatus)*, Turbot *(Scophthalmus maximus)*, Thornback ray *(Raja clavata)*, Picked dogfish *(Squalus acanthias)*	Butterfly blenny *(Blennius ocellaris)*, Dragonets nei (Callionymidae), Common stingray *(Dasyatis pastinaca)*, Black goby *(Gobius niger)*, Blue-leg swimcrab *(Liocarcinus depurator)*, Round goby *(Neogobius melanostomus)*, Combtooth blennies *(Parablennius* sp.*)*, Greater weever *(Trachinus draco)*

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 54 – Discard rates (in percentage) for bottom trawl fisheries operating in the different geographical subareas

Bottom trawl discard ratios may greatly vary across seasons or geographical areas due to natural conditions, market influence, and regulations (Eliasen *et al.*, 2014; Tsagarakis, Palialexis and Vassilopoulou, 2014; Gokce *et al.*, 2016; Milisenda *et al.*, 2017). The diversity of Mediterranean and Black Sea marine environments, the multi-species nature of the fisheries in the region as well as the cultural characteristics differentiate discarding patterns in the entire basin: discards ratios for trawlers are generally lower in the easternmost and southern basin.

4.3.2 Beam trawl fisheries

Beam trawlers are responsible for a high level of discards (over 15 percent) (Figure 55) in all locations where they are utilized (Tudela, 2004; EU, 2011; Tsagarakis, Palialexis and Vassilopoulou, 2014), regardless of whether they are targeting invertebrates or fish (Tables 12 and 13).

With this type of fishing gear, the impact on the seabed and benthos is mainly due to the hoop-like trawl heads, which give the vertical opening with their shoes/skates, and, to a lesser extent, to the beam. But, in general, problems are mostly related to the weight of the whole gear, which is towed on the bottom.

The most important beam trawl fisheries are located in the western Mediterranean, the Adriatic Sea (the "Rapido" trawl) (Pranovi *et al.*, 2001) and the Black Sea (Zengin and Akyol, 2009; Eryasar *et al.*, 2018).

TABLE 12 – Beam trawl fishery landing composition by GFCM subregion

Beam trawl landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
Scorpionfishes, redfishes nei (Scorpaenidae)	64.49	no beam trawl activity is reported		Common sole (*Solea solea*)	28.14	no beam trawl activity is reported		Sea snails (*Rapana* spp.)	89.38
Picarel (*Spicara smaris*)	24.51			Purple dye murex (*Bolinus brandaris*)	21.16			Whiting (*Merlangius merlangus*)	8.12
Common octopus (*Octopus vulgaris*)	2.07			Common cuttlefish (*Sepia officinalis*)	15.67			Surmullet (*Mullus surmuletus*)	1.75
				Murex (*Murex* spp.)	10.71				
				Scallops nei (Pectinidae)	5.97				
				Spottail mantis squillid (*Squilla mantis*)	4.69				
Other species	8.93			Other species	13.65			Other species	0.74
Total (%)	**100.0**			**Total (%)**	**100.0**			**Total (%)**	**100.0**
Total landing (tonnes)	**135**			**Total landing (tonnes)**	**3 694**			**Total landing (tonnes)**	**6 756**

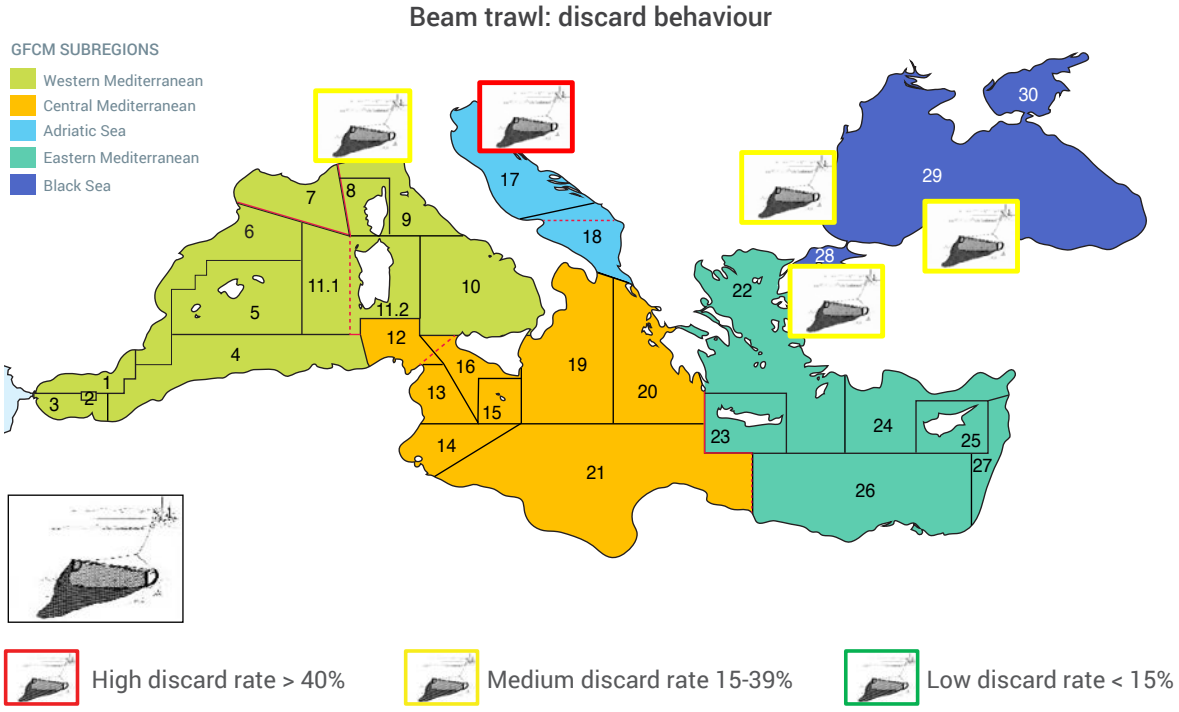
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 13 – Main commercial and non-commercial species discarded by beam trawl fisheries, by GFCM subregion

Beam trawl: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	Spottail mantis squillid *(Squilla mantis)*, Purple dye murex (*Bolinus brandaris*), Common sole *(Solea solea)*, Caramote prawn *(Penaeus kerathurus)*	Sand sea star (*Astropecten irregularis*), Benthic invertebrates, Bivalves, Purple dye murex (*Bolinus brandaris*), Tubular sea cucumber (*Holoturia tubulosa*), Smooth swimcrab *(Liocarcinus vernalis)*, Right-handed hermit crabs nei (Paguridae)
Central Mediterranean	**No beam trawl activity is reported**	
Adriatic Sea	Purple dye murex *(Murex brandaris)*, Mediterranean mussel *(Mytilus galloprovincialis)*, Banded dye-murex (*Hexaples trunculus*), Caramote prawn *(Penaeus kerathurus)*, Small-spotted catshark *(Scyliorhinus canicula)*, Common cuttlefish *(Sepia officinalis)*, Common sole *(Solea solea)*, Spottail mantis squillid *(Squilla mantis)*, Mediterranean horse mackerel *(Trachurus mediterraneus)*	Benthic invertebrates, Angular crab (*Goneplax rhomboides*), Hairy crab (*Medorippe lanata*), Echinoderms, Porifers
Eastern Mediterranean	**No beam trawl activity is reported**	
Black Sea	Ark clam *(Anadara kagoshimensis)*, Striped venus *(Chamelea gallina)*, Truncate donax *(Donax trunculus)*, Mediterranean mussel *(Mytilus galloprovincialis)*	Benthic invertebrates, Small-hermit crab *(Diogenes pugilator)*, Blue-leg swimcrab *(Liocarcinus depurator)*, Arch-fronted Swimming Crab (*Liocarcinus navigator*), Seahorses nei *(Hippocampus* sp.*)*

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 55 – Discard rates (in percentage) for beam trawl fisheries operating in the different geographical subareas

4.3.3 Longline fisheries

In all the GFCM subregions, longliners target both pelagic and demersal fish with the lines rigged and set at a position in the water column to catch different species (Tables 14 and 15). In comparison with other fishing methods, demersal longline is seen as more environmentally friendly fishing method as it has a relatively better size and species selectivity and it produces both minimal discards (below 15 percent) and incidental catch of vulnerable species (Stergiou, Moutopoulos and Erzini, 2002). In contrast, pelagic longline, although considered highly selective for the larger pelagic fish (swordfish *Xiphias gladius*, albacore *Thunnus alalunga* and bluefin tuna *Thunnus thynnus*), may still produce, in some areas, the highest value of discards and incidental catch of a large number of seabirds, sea turtles and marine mammals that are being caught or entangled by pelagic longlines (see section on incidental catches below; see also EU, 2011; Burgess *et al.*, 2010).

The highest discard values (reported in two Mediterranean areas, see Figure 56) mostly refer to large pelagic species that are discarded due to their size below the minimum landing size (e.g. swordfish and bluefin tuna) or to species with a low commercial value (e.g. rays) (Baez *et al.*, 2009; Garibaldi, 2015; Soykan and Tokaç, 2015; Gulsahin and Soykan, 2017).

TABLE 14 – Longline fishery landing composition by GFCM subregion

Longline landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
Swordfish *(Xiphias gladius)*	59.9	Swordfish *(Xiphias gladius)*	36.3	European hake *(Merluccius merluccius)*	49.9	Atlantic bluefin tuna *(Thunnus thynnus)*	67.4	Picked dogfish *(Squalus acanthias)*	100.0
Atlantic bluefin tuna (*Thunnus thynnus*)	23.8	Albacore *(Thunnus alalunga)*	28.6	Swordfish *(Xiphias gladius)*	9.7	Swordfish *(Xiphias gladius)*	18.7		
Little tunny *(Euthynnus alletteratus)*	1.9	Silver scabbardfish *(Lepidopus caudatus)*	10.6	European conger *(Conger conger)*	8.6	Albacore *(Thunnus alalunga)*	12.5		
European hake *(Merluccius merluccius)*	1.7	Atlantic bluefin tuna *(Thunnus thynnus)*	7.5	Blackbelly rosefish *(Helicolenus dactylopterus)*	8.0				
Common dolphinfish *(Coryphaena hippurus)*	1.5	Common dolphinfish *(Coryphaena hippurus)*	4.7	Atlantic chub mackerel *(Scomber colias)*	6.8				
Blackspot seabream *(Pagellus bogaraveo)*	1.4	European hake *(Merluccius merluccius)*	2.1	Tub gurnard *(Chelidonichthys lucerna)*	5.3				
European conger *(Conger conger)*	0.9			Common pandora *(Pagellus erythrinus)*	4.8				
Other species	8.9	Other species	10.1	Other species	6.9	Other species	1.5	Other species	0.0
Total (%)	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**
Total landing (tonnes)	**3 061**	**Total landing (tonnes)**	**3 415**	**Total landing (tonnes)**	**1 105**	**Total landing (tonnes)**	**86**	**Total landing (tonnes)**	**5**

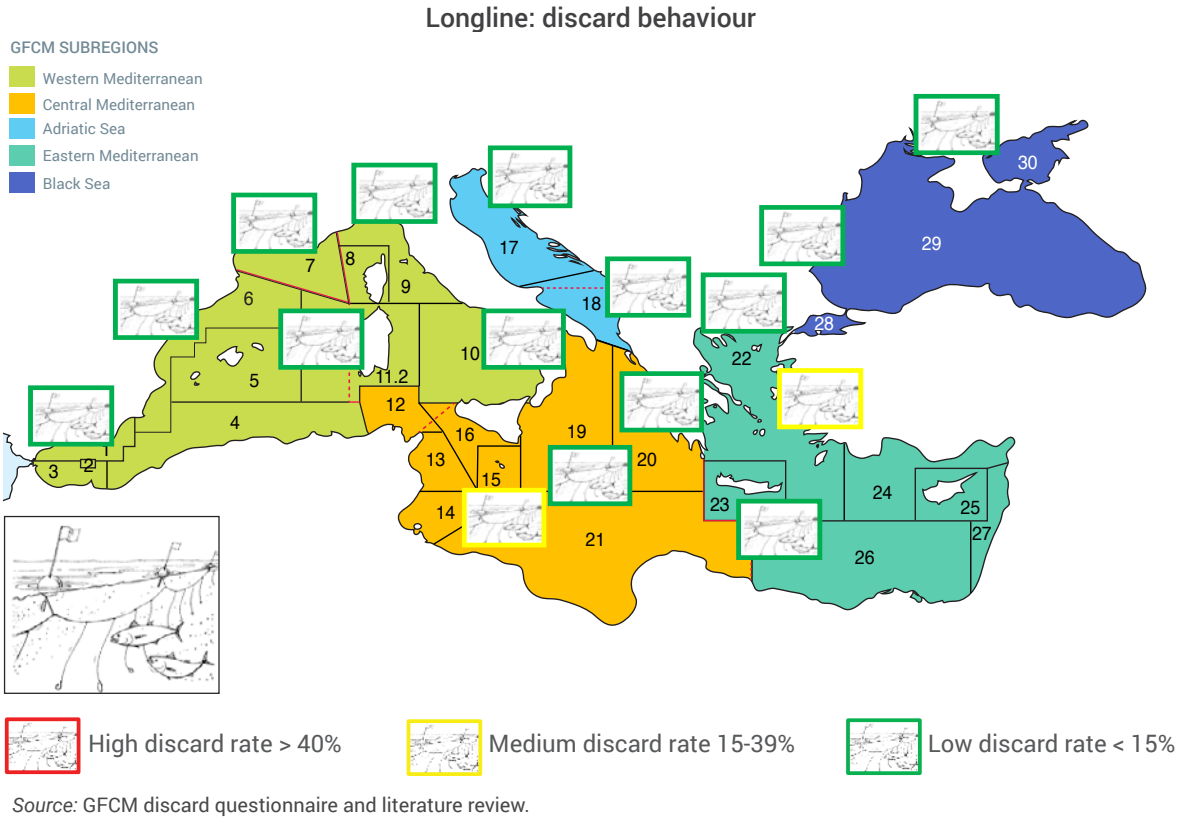
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 15 – Main commercial and non-commercial species discarded by longline fisheries, by GFCM subregion

Longline: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	European hake *(Merluccius merluccius)*	Thresher *(Alopias vulpinus)*, Common stingray *(Dasyatis pastinaca)*, Tope shark *(Galeorhinus galeus)*, Ocean sunfish *(Mola mola)*, Pelagic stingray (*Pteroplatytrygon violacea*), Barracudina *(Sudis hyalina)*, Mediterranean dealfish *(Trachipterus trachypterus)*, Scalloped ribbonfish *(Zu cristatus)*
Central Mediterranean	European hake *(Merluccius merluccius)*, Raja rays nei *(Raja spp.)*, Atlantic bluefin tuna *(Thunnus thynnus)*, Swordfish *(Xiphias gladius)*	Tope shark *(Galerhinus galeus)*, Pelagic stingray (*Pteroplatytrygon violacea*)
Adriatic Sea	European conger *(Conger conger)*, European hake *(Merluccius merluccius)*, Silver scabbardfish *(Lepidopus caudatus)*, Atlantic bluefin tuna *(Thunnus thynnus)*	Blackmouth catshark *(Galeus melastomus)*, Bluntnose sixgill shark *(Hexanchus griseus)*, Blue shark *(Prionace glauca)*, Pelagic stingray (*Pteroplatytrygon violacea*), Picked dogfish *(Squalus acanthias)*, Piper gurnard *(Trigla lyra)*
Eastern Mediterranean	Common dentex *(Dentex dentex)*, South American silver porgy *(Diplodus sp.)*, Pandoras nei *(Pagellus sp.)*, Thornback ray *(Raja clavata)*, Swordfish *(Xiphias gladius)*	Bandtooth conger *(Ariosoma balearicum)*, European conger *(Conger conger)*, Common stingray *(Dasyatis pastinaca)*, Silver-cheeked toadfish *(Lagocephalus sceleratus)*, Smooth-hound *(Mustelus mustelus)*, Mediterranean moray *(Muraena helena)*, Randall's threadfin bream *(Nemipterus randalli)*, Pelagic stingray *(Pteroplatytrygon violacea)*
Black Sea	No data reported	

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 56 – Discard rates (in percentage) for longline fisheries operating in the different geographical subareas

4.3.4 Purse seine fisheries

Purse seine is one of the most important fishing methods in the Mediterranean and the Black Sea in terms of catch volume. Target species (European anchovy, *Engraulis encrasicolus*, and sardine, *Sardina pilchardus*) usually represent more than 90 percent of the catch for this gear (Vassilopoulou, 2011). Current studies on purse seine fisheries indicate that the discard ratio is low (below 15 percent, Figure 57) because vessels target small pelagic fish that are all marketable and with a low diversity of species and sizes (Table 16) (Kelleher, 2005; Tsagarakis *et al.*, 2012; Sahin *et al.*, 2015; Soykan and Tokaç, 2015). However, the quantity, composition and market prices of the catch greatly affect the discarded portion, which can be higher at the local scale (Santojanni *et al.*, 2005). Kelleher (2005) reports that, although purse seine discards may be low as a percentage, the discarded quantities may still be high because purse seine catches can be large.

Discards for these fisheries mainly comprise damaged and small individuals of marketable species; for example, anchovies are discarded mainly during the recruitment period, in autumn, when juvenile fish dominate the population (Table 17).

TABLE 16 – Purse seine fishery landing composition by GFCM subregion

Purse seine landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
Sardine *(Sardina pilchardus)*	37.8	European anchovy *(Engraulis encrasicolus)*	41.8	European anchovy *(Engraulis encrasicolus)*	81.9	Sardine *(Sardina pilchardus)*	45.1	European anchovy *(Engraulis encrasicolus)*	60.7
European anchovy *(Engraulis encrasicolus)*	25.4	Sardine *(Sardina pilchardus)*	26.6	Sardine *(Sardina pilchardus)*	14.5	European anchovy *(Engraulis encrasicolus)*	31.0	European sprat *(Sprattus sprattus)*	17.1
Sardinellas nei *(Sardinella* spp.*)*	15.2	Pacific chub mackerel *(Scomber japonicus)*	13.1	Atlantic chub mackerel *(Scomber colias)*	1.0	Clupeoids nei (Clupeoidei)	6.8	Atlantic bonito *(Sarda sarda)*	10.5
Mediterranean horse mackerel *(Trachurus mediterraneus)*	5.3	Atlantic chub mackerel *(Scomber colias)*	4.3			Pacific chub mackerel *(Scomber japonicus)*	4.5	Mediterranean horse mackerel *(Trachurus mediterraneus)*	3.7
Bogue *(Boops boops)*	2.8	Atlantic mackerel *(Scomber scombrus)*	3.4			Atlantic horse mackerel *(Trachurus trachurus)*	2.7	Bluefish *(Pomatomus saltatrix)*	3.7
Atlantic mackerel *(Scomber scombrus)*	2.5	Round sardinella *(Sardinella aurita)*	2.0			Shads nei *(Alosa* spp.*)*	2.5	Sardine *(Sardina pilchardus)*	3.1
Round sardinella *(Sardinella aurita)*	2.4								
Other species	8.6	Other species	8.8	Other species	2.7	Other species	7.3	Other species	1.3
Total (%)	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**	**Total (%)**	100.0
Total landing (tonnes)	**111 043**	**Total landing (tonnes)**	**3 826**	**Total landing (tonnes)**	**7 593**	**Total landing (tonnes)**	**18 412**	**Total landing (tonnes)**	**73 601**

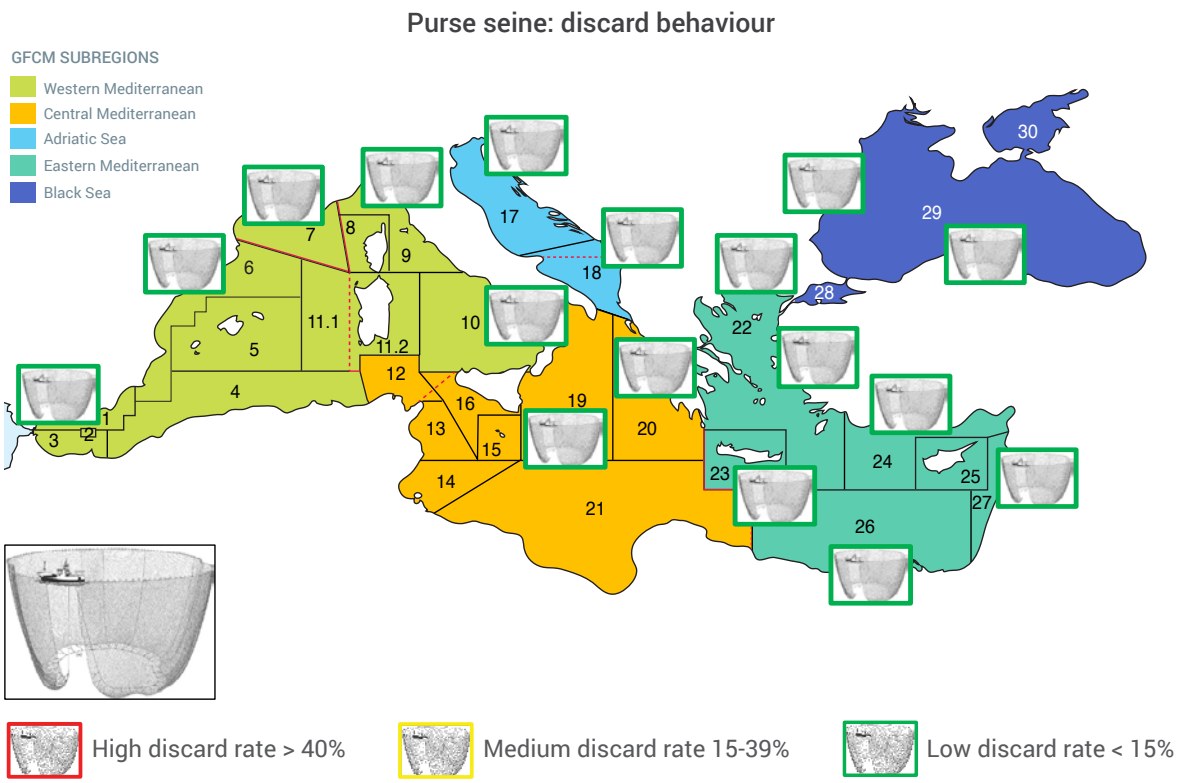
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 17 – Main commercial and non-commercial species discarded by purse seine fisheries, by GFCM subregion

Purse seine: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	European anchovy *(Engraulis encrasicolus)*, Sardine *(Sardina pilchardus)*	
Central Mediterranean	European anchovy *(Engraulis encrasicolus)*, Sardine *(Sardina pilchardus)*, Jack and horse mackerels nei *(Trachurus* spp.*)*	Damselfish *(Chromis chromis)*
Adriatic Sea	European anchovy *(Engraulis encrasicolus)*, Sardine *(Sardina pilchardus)*, Red bandfish *(Cepola macrophthalma)*	
Eastern Mediterranean	Bogue *(Boops boops)*, European anchovy *(Engraulis encrasicolus)*, Atlantic horse mackerel *(Trachurus trachurus)*, Sand steenbras *(Lithognathus mormyrus)*, Mullets nei (Mugilidae), Common pandora *(Pagellus erythrinus)*, Sardine *(Sardina pilchardus)*, Round sardinella *(Sardinella aurita)*, Picarel *(Spicara smaris)*, Jack and horse mackerels nei *(Trachurus* spp.*)*	Damselfish *(Chromis chromis)*, Black-barred halfbeak *(Hemiramphus far)*, Pufferfishes nei *(Lagocephalus* spp.*)*
Black Sea	European sprat *(Sprattus sprattus)*, Jack and horse mackerels nei *(Trachurus* spp.*)*	

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 57 – Discard rates (in percentage) for purse seine fisheries operating in the different geographical subareas

4.3.5 Dredge fisheries

Clams are an important seafood product across the Mediterranean and the Black Sea, but these fisheries (i.e. dredge fisheries) create a very high share of discards (over 15 percent), across almost all of the subregions it is operating (Figure 58). A large proportion of the discarded catch (Table 18) is mainly composed of undersized commercial individuals and non-commercial specimens of molluscs, decapods and echinoderms (Sala *et al.*, 2017; Urra *et al.*, 2017) (Table 19). Furthermore, a significant proportion of target species caught or left on the dredge path has damaged shells (with chipped margins, holed umbos, broken or smashed valves), which cause indirect fishing mortality and economic loss (Moschino, Deppieri and Marin, 2003).

In the northern Adriatic Sea, where this kind of fisheries are a common practice, discards are estimated at 50 percent of the total catch, of which 30 percent are undersized target species and 20 percent are other benthic invertebrates (Morello *et al.*, 2005). In the Black Sea, discards from hydraulic dredges targeting striped venus clams (*Chamelea gallina*), oscillate between 36 percent of the landed products along the Turkish coasts (Dalgıç and Ceylan, 2012) and below 15 percent in the rest of the subregion (Keskin *et al.*, 2015).

TABLE 18 – Dredge fishery landing composition by GFCM subregion

Dredge landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
Spiny cockle *(Acanthocardia tuberculata)*	68.40	no fishing activity reported		Striped venus *(Chamelea gallina)*	92.33	no fishing activity reported		Striped venus *(Chamelea gallina)*	100.0
Smooth callista *(Callista chione)*	12.94			*Smooth callista (Callista chione)*	6.66				
European razor clam *(Solen marginatus)*	11.11			European razor clam *(Solen marginatus)*	0.63				
Striped venus *(Chamelea gallina)*	4.56			Cockles nei (Cardiidae)	0.32				
Other species	3.0			Other species	0.1			Other species	0.0
Total (%)	**100.0**			**Total (%)**	**100.0**			**Total (%)**	**100.0**
Total landing (tonnes)	**1 296**			**Total landing (tonnes)**	**17 573**			**Total landing (tonnes)**	**18 838**

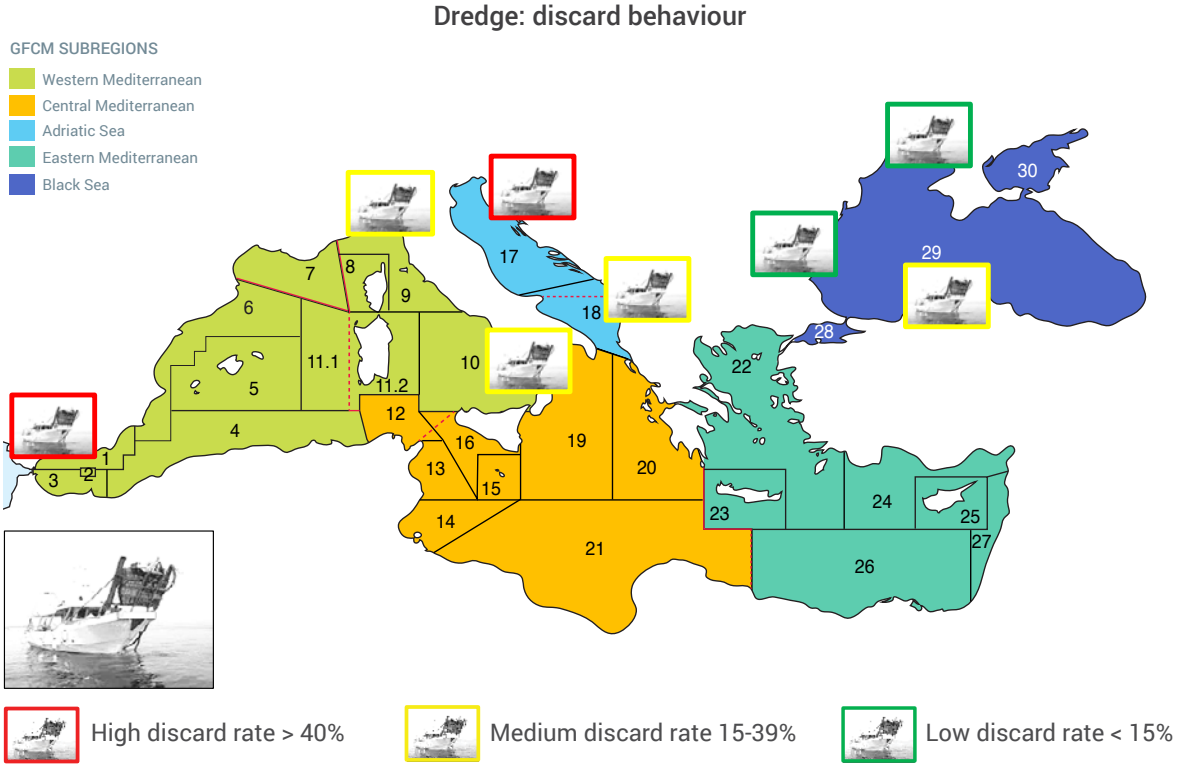
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 19– Main commercial and non-commercial species discarded by dredge fisheries, by GFCM subregion

Dredge: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	Truncate donax *(Donax trunculus)*	Benthic invertebrates
Central Mediterranean	No fishing activity reported	
Adriatic Sea	Striped venus *(Chamelea gallina)*	Benthic invertebrates
Eastern Mediterranean	No fishing activity reported	
Black Sea	Striped venus *(Chamelea gallina)*, Red mullet *(Mullus barbatus)*, Veined rapa whelk *(Rapana venosa)*, Turbot *(Scophthalmus maximus)*	Benthic invertebrates, Small hermit crab (*Diogenes pugilator)*, Nassarius snails (*Nassarius* sp.), Gobies nei (Gobidae)

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 58 – Discard rates (in percentage) for dredge fisheries operating in the different geographical subareas

4.3.6 Small-scale fisheries

Most of the Mediterranean and Black Sea fisheries could be considered as "small-scale", both in terms of employment (around 150 000 people and 70 300 vessels) and production (see Chapter 6; see also FAO, 2016; Damalas, 2017). Small-scale fishing boats are multi-species (Table 20), using a great variety of fishing gear (e.g. gillnets, trammel nets, longliners, traps, pots and other small-scale gear) and often switching among them during a fishing trip. This multi-specificity is also reflected in the discard composition (Table 21). Reasons for discarding are mainly due to low commercial value and damage at sea before the retrieval of the gear. Little information is currently available on total discards for SSF, and this information differs among gear and areas (Gonçalves *et al.*, 2007; Coll *et al.*, 2014; Uzer *et al.*, 2017; Catanese *et al.*, 2018). In a global review on discards in marine fisheries, Kelleher (2005) noted that SSF account for around 11 percent of the catch and have a weighted discard rate of 3.7 percent. The results obtained both from the replies to the GFCM discard questionnaire and the literature review show values that are generally lower than 15 percent in all the GFCM subregions, although higher discard rates are observed in some areas may due to fishing activity linked to specific gear (e.g. gillnets in the Adriatic Sea, GSA 17) (Figure 59).

TABLE 20 – Small-scale fishery landing composition by GFCM subregion

Small-scale fisheries landing composition: contribution (%) of the main commercial species per GFCM subregion									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
Common octopus *(Octopus vulgaris)*	9.46	Common cuttlefish *(Sepia officinalis)*	8.76	Common cuttlefish *(Sepia officinalis)*	16.66	Bogue *(Boops boops)*	24.96	Atlantic bonito *(Sarda sarda)*	31.87
Swordfish *(Xiphias gladius)*	6.40	European hake *(Merluccius merluccius)*	7.66	Gilthead seabream *(Sparus aurata)*	16.57	Mullets nei (Mugilidae)	8.50	Gobies nei (Gobiidae)	17.13
Gilthead seabream *(Sparus aurata)*	5.72	Blotched picarel *(Spicara maena)*	7.14	Common sole *(Solea solea)*	14.35	Red mullet *(Mullus barbatus)*	7.84	Whiting *(Merlangius merlangus)*	12.51
Mullets nei (Mugilidae)	4.94	Common octopus *(Octopus vulgaris)*	6.90	Changeable nassa *(Nassarius mutabilis)*	9.49	Aristeid shrimps nei (Aristeidae)	7.67	Sea snails *(Rapana* spp.*)*	6.58
Common cuttlefish *(Sepia officinalis)*	4.64	Swordfish *(Xiphias gladius)*	5.11	Mullets nei (Mugilidae)	8.95	Atlantic bonito *(Sarda sarda)*	6.20	Bluefish *(Pomatomus saltatrix)*	5.83
Sardine *(Sardina pilchardus)*	4.54	Bogue *(Boops boops)*	4.96	Spottail mantis squillid *(Squilla mantis)*	5.74	Surmullet *(Mullus surmuletus)*	4.36	Veined rapa whelk *(Rapana venosa)*	5.37
European hake *(Merluccius merluccius)*	3.50	Common dolphinfish *(Coryphaena hippurus)*	4.84	Thinlip grey mullet *(Liza ramada)*	3.54	Deep-water rose shrimp *(Parapenaeus longirostris)*	3.67	Mediterranean horse mackerel *(Trachurus mediterraneus)*	4.36
European eel *(Anguilla anguilla)*	2.96	Surmullet *(Mullus surmuletus)*	4.59	Silversides nei (Atherinidae)	2.72	Atlantic horse mackerel *(Trachurus trachurus)*	3.25	Striped venus *(Chamelea gallina)*	3.08
Surmullet *(Mullus surmuletus)*	2.67	Red scorpionfish *(Scorpaena scrofa)*	2.83	European seabass *(Dicentrarchus labrax)*	2.61	Axillary seabream *(Pagellus acarne)*	3.19	Surmullet *(Mullus surmuletus)*	2.86
Sardinellas nei *(Sardinella* spp.*)*	2.40	Atlantic bonito *(Sarda sarda)*	2.49	Common octopus *(Octopus vulgaris)*	1.79	Pacific chub mackerel *(Scomber japonicus)*	3.14	Black and Caspian Sea sprat *(Clupeonella cultriventris)*	2.58
Atlantic bonito *(Sarda sarda)*	2.37	Forkbeard *(Phycis phycis)*	2.17	Marine crabs nei (Brachyura)	1.66	Shads nei *(Alosa* spp.*)*	2.92		
Donax clams *(Donax* spp.*)*	2.35	Atlantic chub mackerel *(Scomber colias)*	1.99	European flounder *(Platichthys flesus)*	1.24	White seabream *(Diplodus sargus)*	2.84		
Common pandora *(Pagellus erythrinus)*	2.16	Red mullet *(Mullus barbatus)*	1.95	Purple dye murex *(Bolinus brandaris)*	1.24	Little tunny *(Euthynnus alletteratus)*	2.50		
Greater amberjack *(Seriola dumerili)*	2.08								
Other species	43.8	Other species	38.6	Other species	13.4	Other species	19.0	Other species	7.8
Total (%)	**100.0**	**Total (%)**		**Total (%)**	**100.0**	**Total (%)**		**Total (%)**	**100.0**
Total landing (tonnes)	**29 111**	**Total landing (tonnes)**	**6 467**	**Total landing (tonnes)**	**10 683**	**Total landing (tonnes)**	**8 876**	**Total landing (tonnes)**	**54 364**

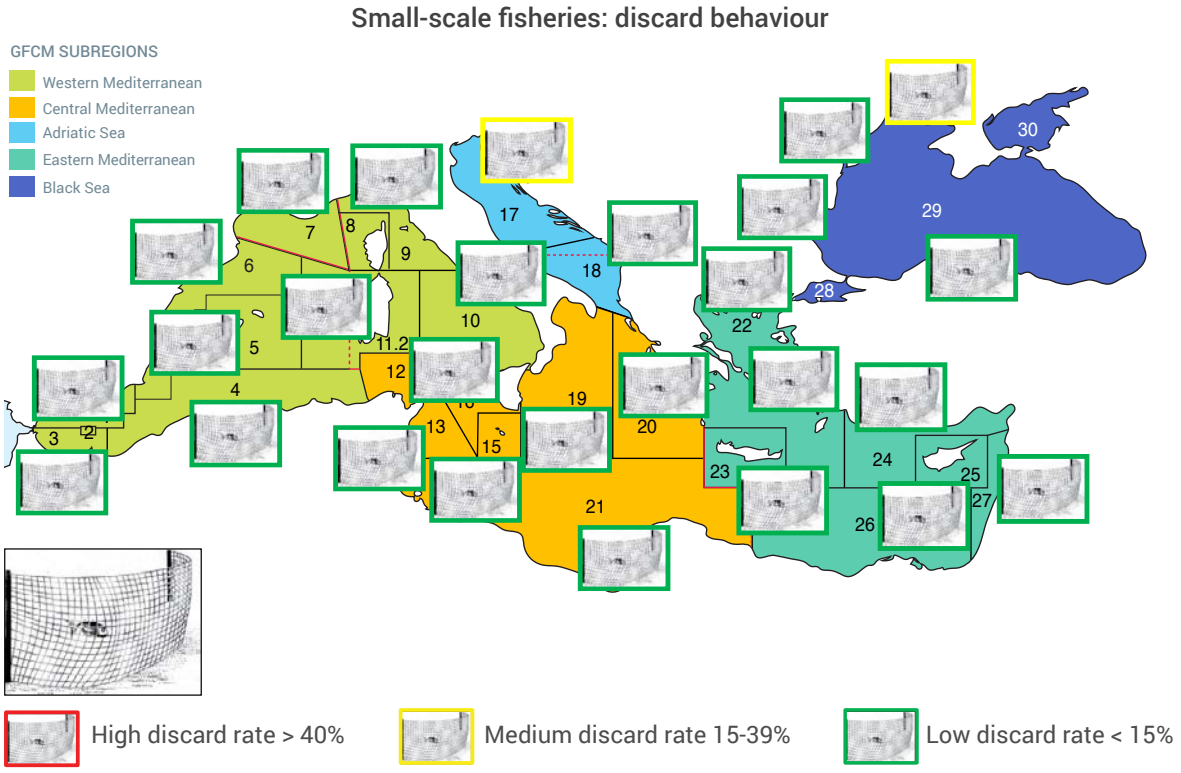
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 21 – Main commercial and non-commercial species discarded by small-scale fisheries, by GFCM subregion

Small-scale fisheries: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	Bogue (*Boops boops*), Sargo breams nei (*Diplodus* spp.), European hake *(Merluccius merluccius)*, (Mugilidae) Mullets nei, Red mullet *(Mullus barbatus)*, Surmullet *(Mullus surmuletus)*, Pandoras nei *(Pagellus* sp.*)*, Pargo breams nei *(Pagrus* spp.*)*, Sardine *(Sardina pilchardus)*, Scomber mackerels nei *(Scomber* spp.*)*, Comber *(Serranus cabrilla)*, Scorphionfishes *(Scorpaena* sp.*)*, Raja rays nei *(Raja* spp.*)*, Weevers nei *(Trachinus* sp.*)*	Sand sea star *(Astropecten irregularis)*, Purple dye murex *(Bolinus brandaris)*, Tubular sea cucumber *(Holoturia tubulosa)*, Spinous spider crab *(Maja squinado)*, Smooth swimcrab *(Liocarcinus vernalis)*, Right-handed hermit crabs nei (Paguridae), Torpedo rays (*Torpedo* spp.*)*
Central Mediterranean	Annular seabream *(Diplodus annularis)*, European hake *(Merluccius merluccius)*, Red mullet *(Mullus barbatus)*, Surmullet *(Mullus surmuletus)*, Pandoras nei *(Pagellus* sp.*)*, Scorpionfishes *(Scorpaena* sp.*)*, Gurnards, searobins nei (Triglidae)	Sand sea stars *(Astropecten* spp.*)*, Hermit crabs (*Dardanus* spp.), Gobies nei (Gobiidae), Sea cucumbers *(Holoturia* spp.*)*, Liocarcinus swimcrabs nei *(Liocarcinus* spp.*)*, Red lance urchin *(Stylocidaris affinis)*
Adriatic Sea	Marine crabs nei (Brachyura), Purple dye murex *(Bolinus brandaris)*, Sargo breams nei *(Diplodus* spp.*)*, Sand steenbras *(Lithognathus mormyrus)*, European hake *(Merluccius merluccius*), Red mullet *(Mullus barbatus)*, Common pandora *(Pagellus erythrinus)*, Common cuttlefish *(Sepia officinalis)*, Common sole *(Solea solea)*	Benthic invertebrates, Gobies nei (Gobiidae), Common eagle ray *(Myliobatis aquila)*
Eastern Mediterranean	Bogue *(Boops boops)*, Annular seabream *(Diplodus annularis)*, Common two-banded seabream *(Diplodus vulgaris)*, Mullets nei (Mugilidae), Pandoras nei *(Pagellus* sp.*)*, Pargo breams nei *(Pagrus* spp.*)*, Redcoat *(Sargocentron rubrum)*, Common cuttlefish *(Sepia officinalis)*, Scorpionfishes *(Scorpaena sp.)*, Dusky spinefoot *(Siganus luridus)*, Marbled spinefoot *(Siganus rivulatus)*, Picarels nei *(Spicara* spp.*)*, Atlantic lizardfish *(Synodus saurus)*, Gurnards, searobins nei (Triglidae)	Benthic invertebrates, Silver-cheeked toadfish *(Lagocephalus sceleratus)*, Pufferfishes nei *(Lagocephalus* spp.*)*, Wrasses nei *(Symphodus* sp.*)*
Black Sea	Sturgeons nei (*Acipenser* spp.), Shads nei *(Alosa* spp.*)*, Turbot *(Scophthalmus maximus)*, Picked dogfish *(Squalus acanthias)*	Benthic invertebrates, Liocarcinus swimcrabs nei *(Liocarcinus* spp.*)*

Source: GFCM questionnaire and bibliographic review.



Source: GFCM discard questionnaire and literature review.

FIGURE 59 – Discard rates (in percentage) for small-scale fisheries operating in the different geographical subareas

4.3.7 Pelagic trawl fisheries

In the GFCM subregions, these fisheries predominantly target European anchovy and sardine (Tables 22 and 23) with low levels of discards (Kelleher, 2005; FAO, 2016). The discard rate of pelagic trawl fisheries operating in different GSAs is generally below 15 percent of the total catch (Santojanni *et al.*, 2005; Ifremer, 2010; Keskin *et al.*, 2015) (Figure 60), and has little impact on bottom habitats.

However, in some areas, pelagic trawling can be seasonally responsible for discards due to high grading and minimum size restrictions. For example, in the Strait of Sicily (GSA 16), mid-water pelagic trawlers targeting European anchovy have variable discard rates which are high in winter, reaching over 50 percent of total catch, but lower in summer, at 10–15 percent. This difference is mainly due to the fact that juvenile areas are targeted in winter and therefore discarded species are mainly undersize European anchovy and sardine, other pelagic fish such as mackerel, and other species below the minimum landing size or of lower market value such as horse mackerel (EU, 2011).

TABLE 22 – Pelagic trawl fishery landing composition by GFCM subregion

Pelagic trawler landing composition: contribution (%) of the main commercial species per GFCM-sub region									
Western Mediterranean	**%**	**Central Mediterranean**	**%**	**Adriatic Sea**	**%**	**Eastern Mediterranean**	**%**	**Black Sea**	**%**
European anchovy *(Engraulis encrasicolus)*	99.27	European anchovy *(Engraulis encrasicolus)*	68.76	Sardine *(Sardina pilchardus)*	52.58	no fishing activity reported		European sprat *(Sprattus sprattus)*	46.39
Sardine *(Sardina pilchardus)*	0.29	Sardine *(Sardina pilchardus)*	30.96	European anchovy *(Engraulis encrasicolus)*	43.05			European anchovy *(Engraulis encrasicolus)*	38.16
European sprat *(Sprattus sprattus)*	0.14	Silver scabbardfish *(Lepidopus caudatus)*	0.27	Thinlip grey mullet *(Liza ramada)*	2.73			Atlantic bonito *(Sarda sarda)*	9.24
		Atlantic chub mackerel *(Scomber colias)*	0.01					Sea snails *(Rapana spp.)*	1.31
								Mediterranean horse mackerel *(Trachurus mediterraneus)*	1.30
Other species	0.3	Other species	0.0	Other species	1.6			Other species	3.6
Total (%)	**100.0**	**Total (%)**	**100.0**	**Total (%)**	**100.0**			**Total (%)**	**100.0**
Total landing (tonnes)	**203**	**Total landing (tonnes)**	**1 381**	**Total landing (tonnes)**	**44 557**			**Total landing (tonnes)**	**58 891**

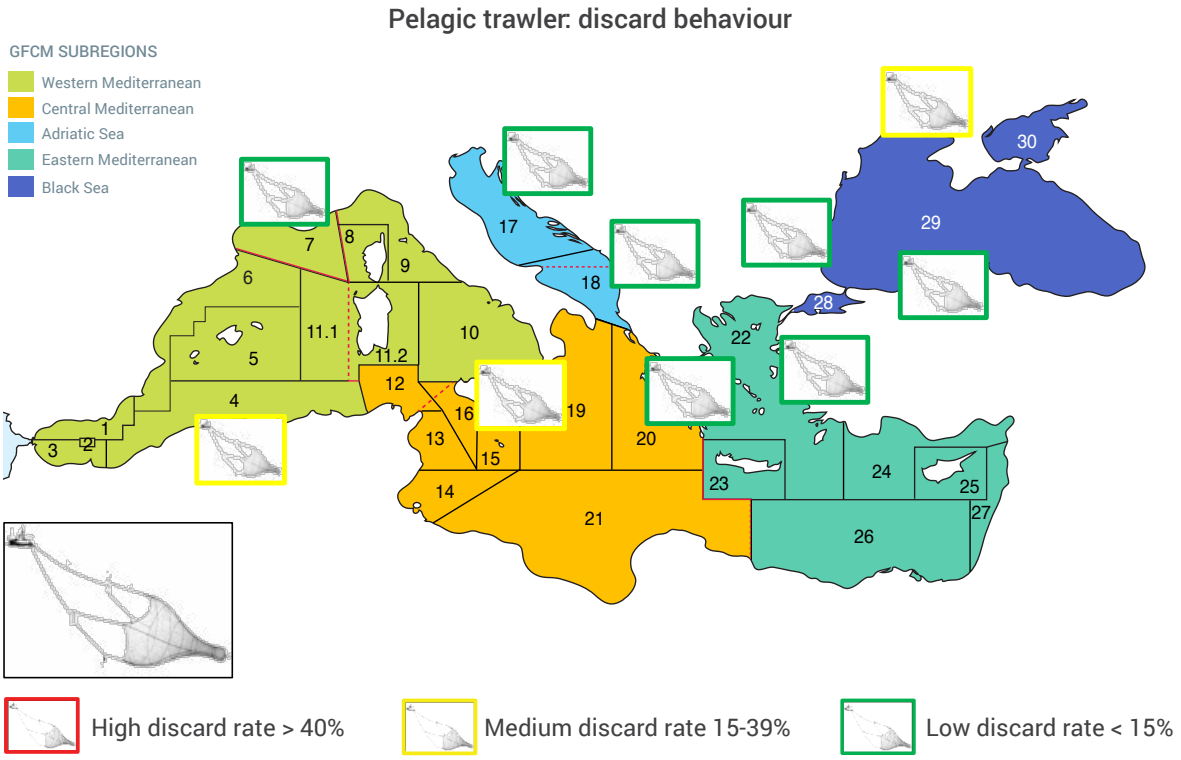
Source: GFCM database.

Note: For each subregion, the percent contribution of target species and total landings for all commercial species (in tonnes) are reported.

TABLE 23 – Main commercial and non-commercial species discarded by pelagic trawl fisheries, by GFCM subregion

Pelagic trawler: discards composition		
GFCM subregion	**Commercial species**	**Non-commercial species**
Western Mediterranean	European anchovy *(Engraulis encrasicolus)*, Sardine *(Sardina pilchardus)*, European sprat *(Sprattus sprattus)*	
Central Mediterranean	European anchovy *(Engraulis encrasicolus)*, Silver scabbardfish *(Lepidopus caudatus)*, Sardine *(Sardina pilchardus)*, European sprat *(Sprattus sprattus)*, Jack and horse mackerels nei *(Trachurus* spp.*)*	
Adriatic Sea	European anchovy (*Engraulis encrasicolus)*, Sardine (*Sardina pilchardus)*, European sprat *(Sprattus sprattus)*, Jack and horse mackerels nei *(Trachurus* spp.*)*	Common eagle ray *(Myliobatis aquila)*
Eastern Mediterranean	No fishing activity reported	
Black Sea	European anchovy *(Engraulis encrasicolus)*, Whiting *(Merlangius merlangus)*, European sprat *(Sprattus sprattus)*, Picked dogfish *(Squalus acanhias)*	Common jellyfish *(Aurelia aurita)*, Round goby *(Neogobius melanostomus)*

Source: GFCM discard questionnaire and literature review.



Source: GFCM discard questionnaire and literature review.

FIGURE 60 – Discard rates (in percentage) for pelagic trawl fisheries operating in the different geographical subareas

4.4. INCIDENTAL CATCH OF VULNERABLE SPECIES

Nowadays, the increasing exploitation of marine resources, the use and degradation of habitats and the diversification of pollution represent serious threats to the future of the Mediterranean and Black Sea environments (UN Environment/MAP-Plan Bleu, 2009). Healthy and productive marine ecosystems are important to support maximum sustainable yield and blue growth; however, fisheries and other anthropogenic threats (e.g. pollution, habitat pressure, climate change or the introduction of non-indigenous species) can have potentially negative effects on the marine environment and on marine ecosystems. If biological diversity is to be maintained, stringent criteria to minimize and mitigate the negative impacts of anthropogenic effects on marine biodiversity must be adopted in order to stay below at the lowest level of extinction risk, which is called "vulnerable". Vulnerable species are considered as all the species that have a 10 percent probability of extinction within 100 years (Shaffer, 1981).

In this context, the incidental capture and mortality of marine animals is considered as one of the main threats to the profitability and sustainability of fisheries, as well as a threat to wider marine biodiversity and the conservation and welfare of marine species (Lewison *et al.*, 2004; Soykan *et al.*, 2008, IUCN, 2012). Incidental catch of vulnerable species is defined here as a subset of bycatch (Figure 51), which includes species that, for some reason, are considered vulnerable (i.e. long-lived vertebrates with low reproductive rates such as marine mammals, but also sea turtles, seabirds and elasmobranchs).

In the Mediterranean and the Black Sea, bycatch mortality represents a particular conservation concern for large marine vertebrates (Tudela, 2004; Sacchi 2008) including sharks (Ferretti *et al.*, 2008; Dulvy *et al.*, 2106), cetaceans (Bearzi, 2002), sea turtles (Casale, 2011; Luschi and Casale, 2014), seabirds (Genovart *et al.*, 2016; Tarzia *et al.*, 2017) and monk seals (Karamanlidis

et al., 2008). The ecological impact of the incidental catch of vulnerable species greatly varies according to the group of species caught and to the different life history characteristics of the taxon concerned. The quantity and nature of the catch can also vary among different fisheries and regions. Data on incidental catch of vulnerable species are widely reported in most countries (as strandings and interviews), but there are no systematic monitoring and data collection systems: monitoring programmes are lacking for many fishing gear, countries or/and subregions, and most of the existing studies only cover small spatial scales. Although, in recent years, there has been an increase in the number of scientific papers published on the topic (Figure 61), these studies still cover a small portion of the total fishing activity in the Mediterranean and Black Sea subregions (Figure 62) and there are few quantitative estimates of incidental catch of vulnerable species (FAO, 2016).

Therefore, the collection of data (e.g. number, size, areas, fishing gear) on the incidental catch of vulnerable species is key to understanding the nature and extent of the issue and can be considered as a first step toward developing and implementing adequate management measures aimed at reducing interactions (Box 6).

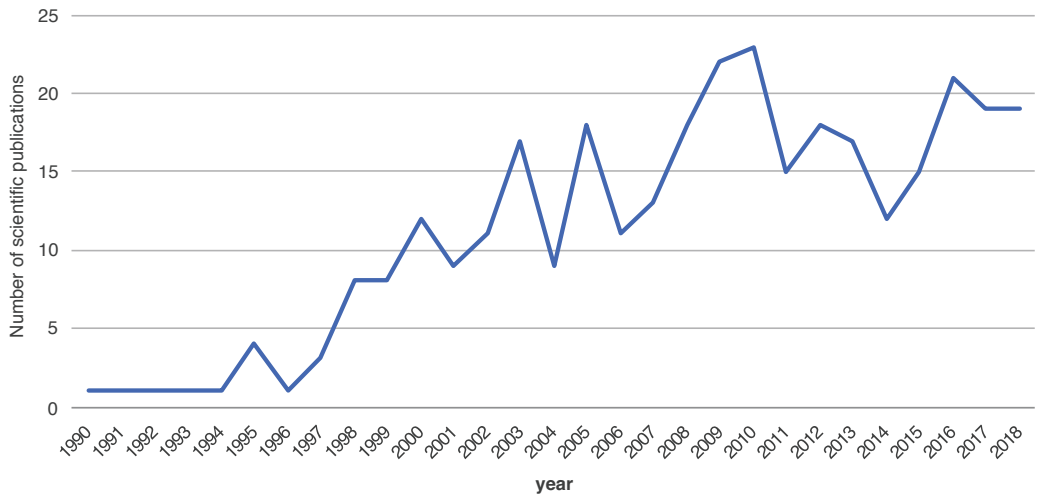


Figure 61 – Trends in scientific publications referring to the incidental catch of vulnerable species in the Mediterranean and the Black Sea produced from 1990 to 2018 (preliminary analysis)

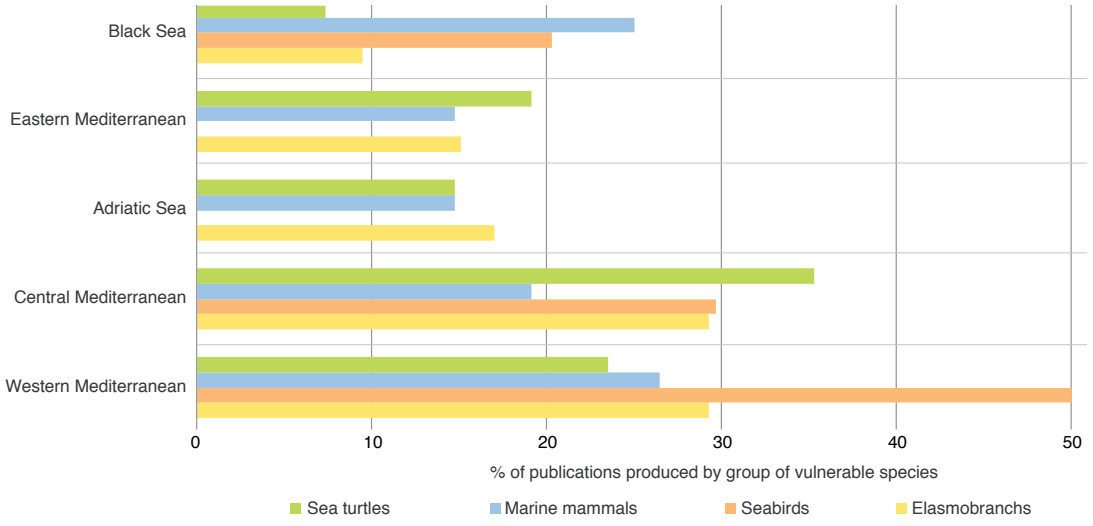


Figure 62 – Scientific publications produced (percentage) referring to the incidental catch of different groups of vulnerable species, by GFCM subregion (preliminary analysis)

In light of this, this section aims to provide a preliminary qualitative and quantitative assessment of the current situation regarding the impact of fisheries on vulnerable species in the Mediterranean and the Black Sea. This assessment is based on a critical literature review of regional and technical reports, scientific publications, outputs of GFCM working groups, and national and regional databases (e.g. MEDLEM, Serena *et al.*, 2009) relevant to the Mediterranean and Black Sea subregions. All the information collected and available for the four groups of vulnerable species considered (i.e. marine mammals, sea turtles, elasmobranchs and seabirds) have been stored and organized in a dataset (still preliminary and to be finalized). Available literature (around 400 titles) has been analysed and a first estimate – although probably an underestimation – based on all material produced can provide a preliminary status of the situation.

4.5. OVERVIEW OF INCIDENTAL CATCH OF VULNERABLE SPECIES

Sea turtles (around 80 percent) and elasmobranchs (around 16 percent) represent the highest share of reported incidental catches of vulnerable species among the total specimens caught. Seabirds and marine mammals, by contrast, are apparently the groups with the lowest amount of reported bycaught specimens (around 4 percent of the total) (Figure 63).

Most of the reported catch, for all groups of vulnerable species, is concentrated in the western Mediterranean (covered by 50 percent of available literature) (Figure 64). In other GFCM subregions, information is scattered and only refers to only a few groups of vulnerable species.

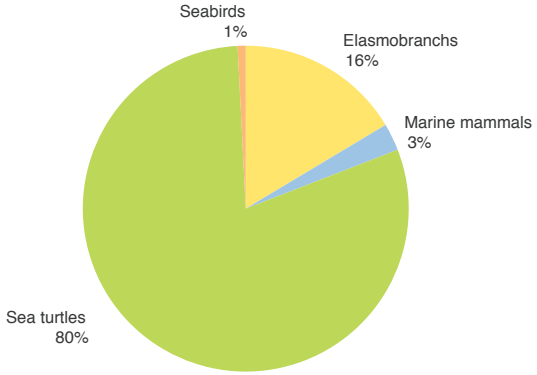


Figure 63 – Number of specimens (in percentage), by group of vulnerable species, reported as bycatch in scientific publications (preliminary analysis)

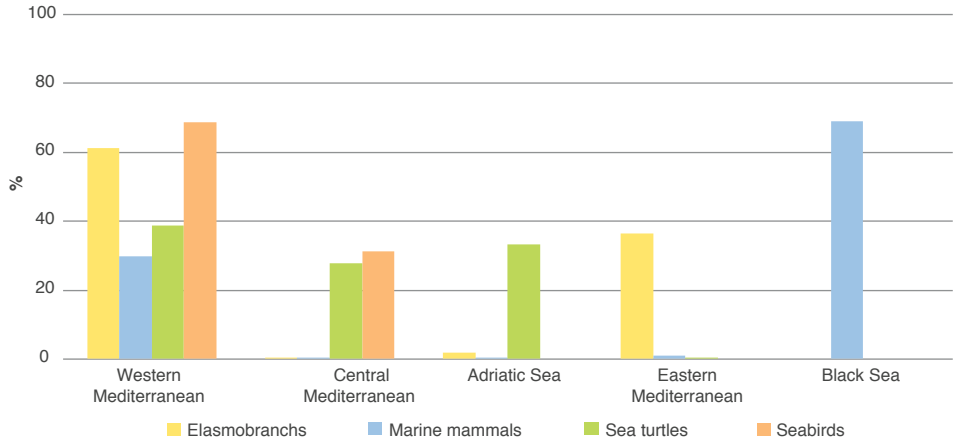


Figure 64 – Number of specimens (in percentage), by different group of vulnerable species and by GFCM subregion, reported as bycatch in the scientific publications analysed (preliminary analysis)

Concerning the information by vessel group (Table 24), longliners are responsible for most of the incidental catches of vulnerable species in all subregions; sea turtles, elasmobranchs and seabirds account for most of the incidental captures for this vessel group. The incidental catches of these groups of species are reported especially in the western and central basins where the fishing activity is more intense and where the monitoring measures are more constant and effective.

Trawlers (pelagic and demersal) are the vessel group for which most information is reported regarding the incidental catch of marine mammals (both in the central Mediterranean and the Adriatic Sea) and elasmobranchs (in the Adriatic Sea).

TABLE 24 – Relative impact by vessel group (in percentage) on different groups of vulnerable species in the GFCM subregions

	Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
	Elasmobranchs				
Seiners	0.1				
Trawlers			100	0.1	
Polyvalent	4.2			1.2	
Longliners	95.8	100		98.7	
	Marine mammals				
Seiners	0.5				8.2
Trawlers	1.3	40.0	100	100	1.4
Polyvalent	90.6	60.0			90.5
Longliners	7.6				
	Sea turtles				
Seiners	0.1				
Trawlers			76.0	61.4	
Polyvalent	3.3	0.3	23.3	2.7	
Longliners	96.7	99.7	0.8	35.9	
	Seabirds				
Seiners					
Trawlers					
Polyvalent		0.5			
Longliners	100	99.5			

Source: Literature review.

4.5.1 Marine mammals

Interactions between marine mammals and fisheries in the Mediterranean and the Black Sea mainly involve coastal fisheries and species such as: common bottlenose dolphin (*Tursiops truncatus*), typically found on the continental shelf; common dolphin (*Delphinus delphis*); harbour porpoise (*Phocoena phocoena*); and Mediterranean monk seal (*Monachus monachus*) (Guinet *et al.*, 2007; Bearzi *et al.*, 2008; Snape *et al.*, 2018). The striped dolphin (*Stenella coeruleoalba*),

by far the most abundant cetacean in the Mediterranean, has a pelagic distribution and largely feeds on non-commercial prey species (Notarbartolo di Sciara and Demma 1997; Notarbartolo di Sciara, 2002) and therefore rarely interacts with coastal fisheries, except on occasions when gear damage or time loss for fishers when the animals are entrapped in fishing gear have been reported (Bearzi, 2002).

Most fisheries, including towed net (e.g. pelagic and bottom trawl, purse seine) and static net (e.g. bottom-set gillnets, trammel nets and longlines) fisheries interact with marine mammals. Static nets, a mainstay gear used in SSF in the Mediterranean and the Black Sea, are prone to interactions with marine mammals, especially when they are set too close to critical areas for reproduction (Panou *et al.*, 1993; Cebrian, 1998). In particular, common bottlenose dolphin increasingly interacts with set nets across the region where, in addition to being caught, they depredate catch, damage gear, and may cause severe economic losses (Snape *et al.*, 2018).

In addition to incidental catches, interactions between fisheries and marine mammals can include cases where the fishing activity is negatively affected by the species behaviour. This is the case of the bottlenose dolphin, which affects static nets, and the killer whale (*Orcinus orca*), which affects tuna catches in the Strait of Gibraltar. Both mitigation measures to reduce incidental catches, as well as to reduce the negative interactions described above are currently being investigated, including through dedicated actions within the GFCM.

4.5.2 Sea turtles

Sea turtles interact with and are incidentally caught by different types of fisheries (Figure 62). Many authors report that most incidental catches of marine turtles occur in fisheries using longlines, bottom and pelagic trawlers as well as gillnets (FAO, 2004; Casale *et al.*, 2010; Fortuna *et al.*, 2010).

Coastal bottom gillnets are often set close to the shore or laid atop reef flats, a primary feeding area for sea turtles. Sea turtles that get entangled in the nets face a high risk of drowning (FAO, 2009a; Casale, 2011). They are also one of the most endangered groups of species subject to incidental catch by in some trawl fisheries. Fisheries that use bottom trawls in coastal waters and in other near-shore areas, particularly coastal trawl shrimp fisheries, can have a high impact on sea turtles (Hall, 2000).

Several attempts have been made to quantify the number of sea turtles incidentally caught in fishing operations every year. These studies usually apply to specific areas and fisheries and therefore are poorly suited to extrapolate global estimates; however, one comprehensive Mediterranean review suggests that several tens of thousands of sea turtles die annually in the Mediterranean Sea (Casale, 2011).

4.5.3 Seabirds

Mediterranean fisheries have been found to cause seabird bycatch in different areas (UN Environment/MAP-RAC/SPA, 2009, Menchero, 2010, ICES 2013), although many data gaps remain (Cooper *et al.*, 2003) (Figure 63). Generally, longline, trawl and gillnet fisheries are the three types of fisheries that are most commonly associated with the incidental catches of seabirds (Anderson *et al.*, 2011; Žydelis, Small and French, 2013). Moreover, in the Mediterranean and the Black Sea, incidental catch in longline fisheries is the main known source of seabird mortality (FAO, 2016), and it might be driving the decline of some seabird populations, as seems to be the case for the Balearic and Scopoli's shearwaters (Genovart *et al.* 2016, 2017). Longlines (and trawls) also pose a threat to Audouin's gull (*Larus audouinii*), a

Mediterranean endemic species (UN Environment/MAP-RAC/SPA, 2009). However, the information available on the impact of these fisheries on seabirds is still limited to a few regions (Dimech *et al*. 2009; García-Barcelona *et al*., 2010; Karris *et al*., 2013; Cortés, Arcos and González-Solís, 2017).

In the Mediterranean, compared to other areas of the world, the number of seabird species susceptible to be incidentally caught in gillnet fisheries is low, but it includes two of the most threatened seabirds in Europe: Balearic shearwater (*Puffinus mauretanicus*) and Yelkouan shearwater (*P. yelkouan*) (Žydelis *et al*., 2013). Mediterranean shag (*Phalacrocoraxaristotelis desmarestii*), a subspecies of the European shag, is caught in gillnets in the Balearic Islands, and it is thought that gillnetting can pose a significant threat to this subspecies (De Juana, 1984; Muntaner, 2004, Genovart *et al*., 2017). More data are therefore needed to properly assess their degree of impact. Incidental catches have also been documented with other gear used in Mediterranean fisheries, such as purse seines, traps and driftnets (ICES, 2008; FAO, 2016).

4.5.4 Elasmobranchs

In the past, fisheries targeting elasmobranch species were present in the Mediterranean and the Black Sea, but the local abundance of target populations largely decreased and could no longer sustain fisheries pressure (Abella and Serena, 2005; Cavanagh and Gibson, 2007; Dulvy *et al*., 2016). Nowadays, only few fisheries target one or a small number of shark species, but generally, most sharks are caught in multi-species fisheries where the fishers tend to target more highly valued teleost fish species (UN Environment/MAP-RAC/SPA, 2006). When incidentally caught, elasmobranchs are either discarded at sea or retained and landed to be sold (e.g. used for subsistence or bait), depending on the species. Gillnet, trammel net, longline and bottom trawl fisheries are considered a major threat for the survival of sharks and ray populations in the Mediterranean and the Black Sea (GFCM, 2014).

BOX 6 – Joint initiatives towards monitoring and mitigating interactions between vulnerable species and fisheries

In order to increase and improve available information on interactions between fishing activities and vulnerable species, including incidental catches of vulnerable species, the GFCM works in partnership with different organizations operating in its area of application as a means to join forces, resources and expertise. In this context, the GFCM launched two joint projects, funded by the MAVA Foundation, to address this key conservation issue and eventually contribute to identifying the necessary management measures towards the reduction of bycatch rates that are currently affecting the productivity and sustainable development of Mediterranean and Black Sea fisheries.

The project "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation: a collaborative approach" was launched at the end of 2017 for a three-year duration (until mid-2020) in partnership with the Agreement on the Conservation of Cetaceans in the Mediterranean and Black Sea and Contiguous Atlantic Area (ACCOBAMS), the Mediterranean Association to Save the Sea Turtles (MEDASSET), the Regional Activity Centre for Specially Protected Areas of the United Nations Environment/Mediterranean Action Plan (RAC/SPA) and the International Union for Conservation of Nature Centre for Mediterranean Cooperation (IUCN-Med).

The project focuses on ensuring a harmonized data collection on incidental catches of vulnerable species. It foresees the set-up of monitoring programmes with onboard observers in three Mediterranean countries (Morocco, Tunisia and Turkey) and for three different fishing gear (demersal trawls, gillnets and longlines), alongside training, awareness raising and testing of mitigation measures. The monitoring programmes are based on a standard multi-taxa data collection methodology developed by the GFCM, which allows to replicate the experience across the project area and eventually develop appropriate solutions for the whole region.

BOX 6 (Continued)

The project aims to provide support for the formulation of national/regional strategies for sustainable fisheries. The following outputs are expected:

- Regional review on existing information on incidental catches of vulnerable species.
- Standardized protocols for data collection of bycatch of vulnerable taxa, including self-reporting methods for fishers to be implemented across the Mediterranean as well as training of observers and fishers.
- Analysis of the impacts of the three identified fleet segments on the incidental catch of vulnerable species.
- Analysis of the spatial and temporal distribution of incidental catches for the selected fleet segments.
- Identification of the typology and quantitative assessment of current fishing practices pertaining to these fisheries leading to incidental catch (e.g. fishing area, seasonality, carrying capacity of the vessels, market).
- Estimation of the total number of vessels, total catch and effort deployed for the investigated fleet segments.
- Launch of awareness initiatives on the impact of the incidental catch of vulnerable species.
- Test of mitigation measures, including implementation and monitoring of possible measures in identified fisheries and countries.

The demonstrative project on "Necessary actions to reduce cetacean depredation in Morocco and Tunisia" was launched in January 2018 by ACCOBAMS and the GFCM as a continuation of the efforts carried out in the context of the previous collaboration aimed at mitigating interactions between vulnerable marine species and fishing activities. The project covers a three-year timeframe and its overarching objective is, in collaboration with relevant national institutes, to better assess and limit cetacean depredation in small pelagic fisheries, eventually producing technical recommendations to reduce the impacts of depredation and replicate best practices. This should be achieved by monitoring cetacean behaviour, analysing the characteristics of depredation phenomena, and experimenting targeted mitigation technologies in pilot sites.

STATUS OF FISHERY RESOURCES

5

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5. Status of fishery resources

5.1. INTRODUCTION AND SOURCES OF INFORMATION

Data for the assessment of stock status are currently collected through stock assessment forms (SAFs), which also contain information on reference points and outcomes of the assessment (e.g. estimates of fishing mortality, exploitation rate, spawning stock biomass and recruitment).[1] Although assessments have been presented to the SAC since its establishment in 1997, SAFs have been digitalized since 2007, and are stored in a database that incorporates metadata, which provide key information for the formulation of advice on stock status and input files from the stock assessment model. The analysis presented in this chapter is based on information contained in the SAF metadata database between 2006 and 2016 (stocks assessed in the years 2007 to 2017, based on information on fisheries from the previous year); only information pertaining to stocks validated by the SAC at the time of preparation of this report is used for this analysis, and only non-deprecated assessments (i.e. assessments no older than three years for small pelagic species and no older than five years for demersal species) are considered for each year. An overall analysis of stock status was carried out in relation to approved reference points. These are mainly linked to indicators of fishing mortality (F_{MSY} or proxies for F_{MSY}), since few stocks have agreed biomass reference points (B_{LIM} and B_{PA}). The terminology "within" or "outside" "biologically sustainable limits", agreed in the context of FAO (FAO, 2014), is used to describe the stocks for which indicators (fishing mortality, stock biomass) are inside or outside the limits established by the reference points. The fishing mortality indicators used herein are: (i) terminal fishing mortality (i.e. the fishing mortality estimated in the last year of the time series used for assessment) for small pelagic stocks and demersal stocks assessed with forward assessment methods (e.g. statistical catch-at-age methods); and (ii) the average fishing mortality of the last three years for demersal stocks assessed with backward methods (e.g. XSA). Special attention has been given to priority species agreed by the GFCM (see Box 7) and, whenever possible, information has been aggregated to provide a subregional and regional outline of the status of resources, using indicators derived by the GFCM (Box 8).

BOX 7 – GFCM priority species

The quality of advice has been improving significantly in recent years and, concurrently, the GFCM has advanced towards the regulation of fisheries in its area of application, with the introduction and adoption of multiannual management plans. However, advice in support of management measures still addresses only a percentage of exploited stocks, marine populations, ecosystems and areas. The purpose of Output 1.3 of the mid-term strategy (see Chapter 8) is to enhance science-based GFCM regulations on fisheries management; in this context, a number of activities are foreseen. Some of these activities include the implementation of a dedicated approach for the provision of advice that foresees actions for data limited stocks as well as for those stocks for which a validated analytical assessment exists. Within this approach, and without prejudice to addressing additional species, the GFCM has agreed on a list, by subregion, of priority commercial species for which advice should be produced. Priority species have been agreed in consultation with experts and managers, based on a combination of information, socio-economic importance and conservation concern.

▶▶

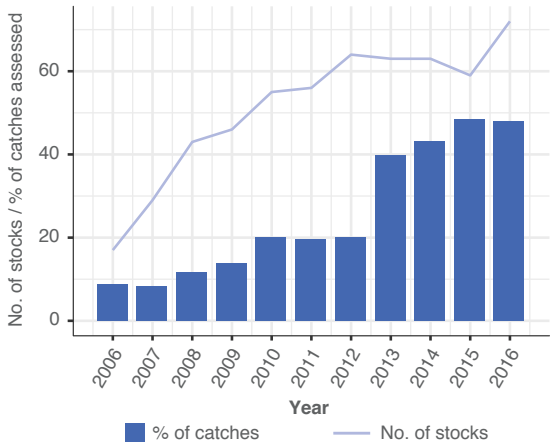
1 A description of indicators of stock status and reference points can be found in SoMFi 2016.

BOX 7 (Continued)

Type of species \ Area	Western Mediterranean	Central Mediterranean	Adriatic Sea	Eastern Mediterranean	Black Sea
Pelagic	European anchovy (*Engraulis encrasicolus*)	European anchovy (*Engraulis encrasicolus*)	European anchovy (*Engraulis encrasicolus*)	European anchovy (*Engraulis encrasicolus*)	European anchovy (*Engraulis encrasicolus*)
	Sardine (*Sardina pilchardus*)	Sardine (*Sardina pilchardus*)	Sardine (*Sardina pilchardus*)	Sardine (*Sardina pilchardus*)	Horse mackerel (*Trachurus mediterraneus*)
				Round sardinella (*Sardinella aurita*)	European sprat (*Sprattus sprattus*)
Demersal	Deep-water rose shrimp (*Parapenaeus longirostris*)	Deep-water rose shrimp (*Parapenaeus longirostris*)	Deep-water rose shrimp (*Parapenaeus longirostris*)	Red mullet (*Mullus barbatus*)	Withing (*Merlangius merlangus*)
	European hake (*Merluccius merluccius*)	European hake (*Merluccius merluccius*)	European hake (*Merluccius merluccius*)	Lizardfish (*Saurida lessepsianus*)	Turbot (*Scophthalmus maximus*)
	Blackspot seabream (*Pagellus bogaraveo*)	Red mullet (*Mullus barbatus*)	Red mullet (*Mullus barbatus*)	European hake (*Merluccius merluccius*)	
		Blue and red shrimp (*Aristeus antennatus*)	Norway lobster (*Nephrops norvegicus*)	Blue and red shrimp (*Aristeus antennatus*)	Rapa whelk (*Rapana venosa*)
		Giant red shrimp (*Aristaeomorpha foliacea*)	Common sole (*Solea solea*)	Giant red shrimp (*Aristaeomorpha foliacea*)	
			Common cuttlefish (*Sepia officinalis*)		
			Spottail mantis squillid (*Squilla mantis*)		
Regional importance	Common dolphinfish (*Coryphaena hippurus*)				
Conservation concern	European eel (*Anguilla anguilla*)				Piked dogfish (*Squalus acanthias*)
	Red coral (*Corallium rubrum*)				
Non-indigenous	Red lionfish (*Pterois miles*)				
	Silver-cheeked toadfish (*Lagocephalus sceleratus*)				

5.2. SPATIAL AND TEMPORAL COVERAGE OF ADVICE ON STOCK STATUS

The number of non-deprecated validated stocks progressively increased between 2006 and 2016, and peaked in 2016 (72). The percentage of catches assessed by the SAC more than doubled, from an average of 20 percent of catches assessed in 2010–2012, to 40 percent in 2013 (Figure 65). Since then, this percentage has further increased, and in 2015, advice was provided for stocks fetching just under 50 percent of total catches (Figure 65). This reflects both the increase in the number of stocks validated and the fact that stocks with significant catches (e.g. European anchovy in the Black Sea [*Engraulis encrasicolus ponticus*] whose catches fluctuate around 200 000 tonnes) are being currently assessed.



Note: Stock units are defined as a combination between species and management units. Only validated and non-deprecated assessments (e.g. less than three years old for small pelagic species or five years old for demersal species) are considered in this plot; stock units for which several assessments exist in a given year are only counted once.

FIGURE 65 – Number of stock units (blue line) and percentage of declared landings assessed in 2006–2016

There continue to be wide differences in the geographic distribution of validated assessments (Figure 66). Between 2009 and 2016, the Adriatic subregion and the Black Sea had, overall, the best coverage, while the coverage in the western and central Mediterranean subregions varied geographically within the subregions (Figure 66). The westernmost GSAs of both the western (GSAs 1–3, 5–7 and 9) and central (GSAs 12–16) subregions are well covered by stock assessments, while in certain GSAs, stocks have never (4, 8, 20 and 21) or sporadically (11, 19) been assessed (Figure 66). The eastern Mediterranean remains the subregion with the lowest number of validated assessments when considering the entire times series (Figure 66). Nevertheless, improvements are evident in this subregion, where the number of validated assessments increased, especially for GSA 22 in 2016. The Adriatic subregion and the Black Sea showed the greatest improvements over this time span (Figure 67).

Coverage in space varied for the different priority species. For European hake (*Merluccius merluccius*), recent assessments exist for most of the management units, while for other species such as giant red shrimp (*Aristaeomorpha foliacea*) and blackspot seabream (*Pagellus bogaraveo*), there are only assessments in a few management units (although the latter is only considered a priority species in the western subregion – see Table 25).

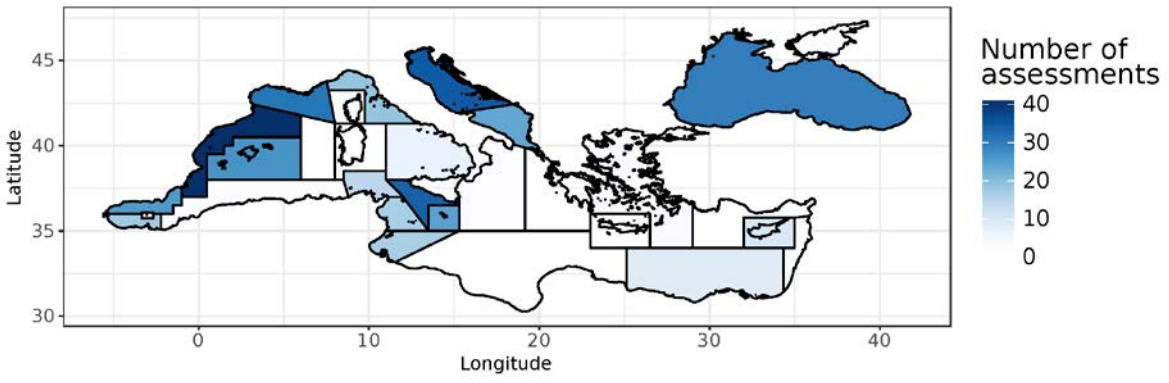


FIGURE 66 – Number of validated assessments in 2009–2016 by GSA

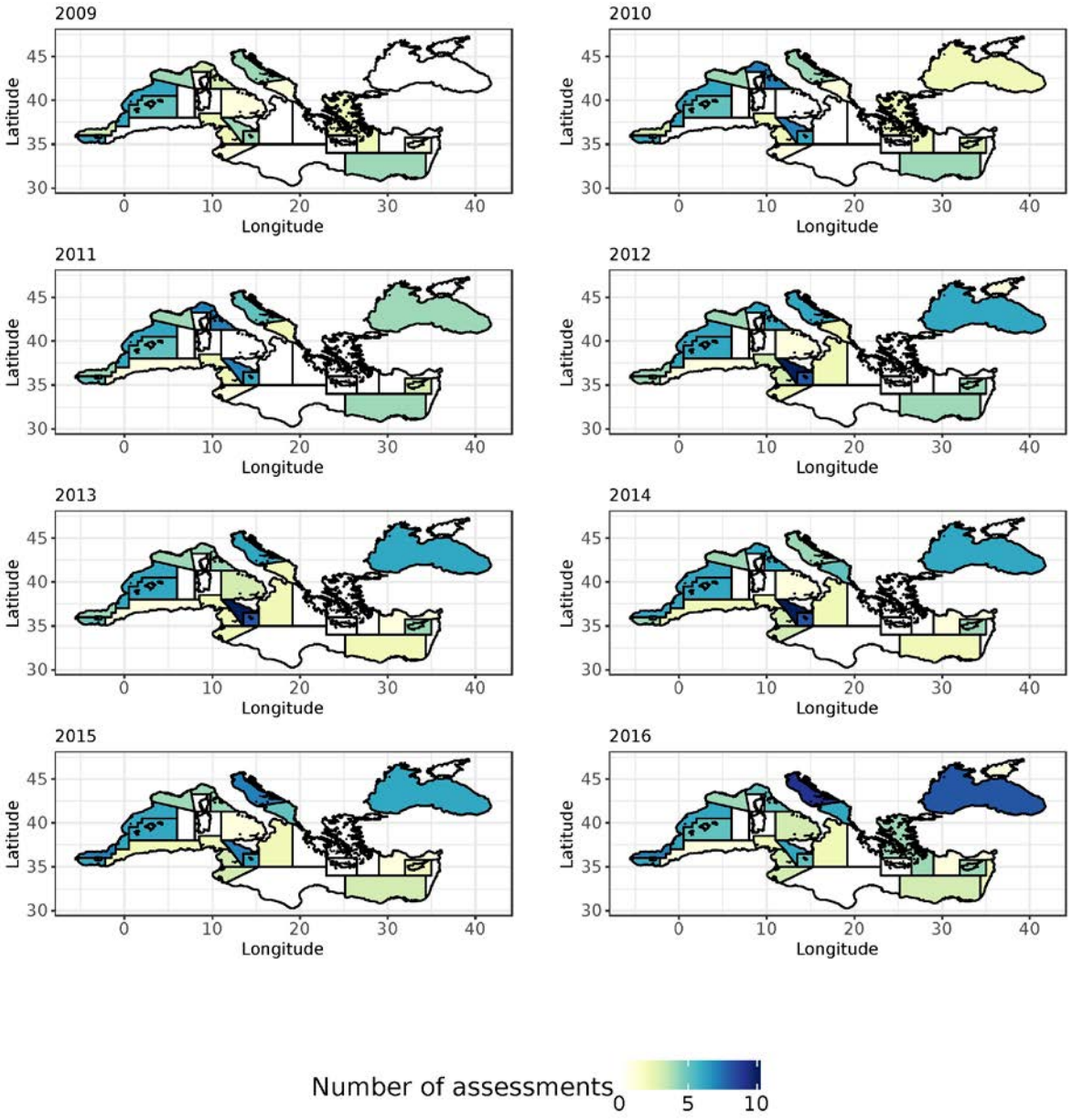


FIGURE 67 – Changes in the number of validated assessments in 2009–2016 by GSA

5.3. OVERVIEW OF THE STATUS OF MEDITERRANEAN AND BLACK SEA STOCKS

Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits (Figure 68). Nevertheless, the recent trend is a decreasing one, especially since 2014 when the percentage of overexploited stocks decreased from 88 percent to 78 percent in 2016 (Figure 68). Biomass reference points are not commonly available for assessed stocks; therefore, this percentage is mainly estimated from the level of fishing mortality in relation to the fishing mortality reference point.

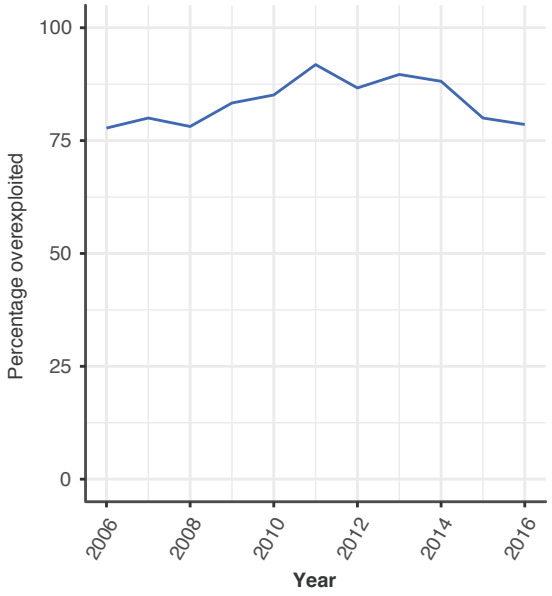


FIGURE 68 – Percentage of stocks in overexploitation since 2006

BOX 8 – Indicators of good environmental status

The ecosystem approach is a guiding principle within the United Nations Environment Programme – Mediterranean Action Plan (UN Environment/MAP) and the work carried out in the context of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention), with the ultimate objective of achieving the good environmental status (GES) of the Mediterranean sea and coast. In this framework and as part of the collaboration between the GFCM and UN Environment/MAP, a number of ecological objectives and associated indicators were developed. In particular, the GFCM was responsible for developing Ecological Objective 3 "Harvest of commercially exploited fish and shellfish" and identifying adequate indicators, which were based on previous experience on assessing fish populations. The first assessment of this Ecological Objective was based on the following fisheries indicators:

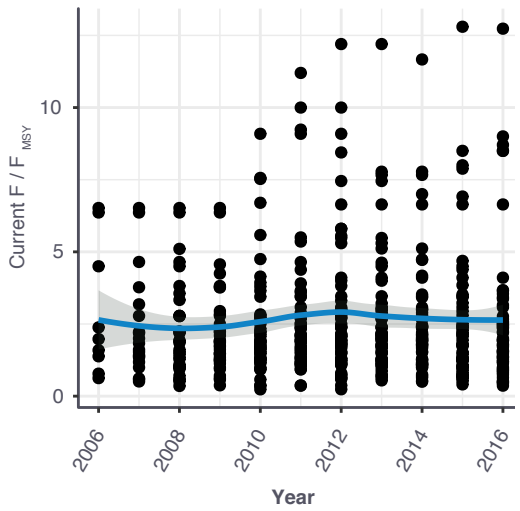
- spawning stock biomass (SSB)
- fishing mortality (F) and/or exploitation rate (E)
- total landings (TL)

Although these indicators are commonly used in the assessments provided by the SAC, work has been carried out to integrate the results at the regional and subregional levels. The outcomes of this work are included in the Mediterranean 2017 Quality Status Report (UN Environment/MAP, 2017) where the status of the various ecological objectives is evaluated and the methodology expanded and used to analyse the data within the report.

5.3.1 Overall status of stocks: Fishing mortality

Overall, fishing mortality for all species and management units combined is around 2.5 times higher than the reference point with no clear trend for the average overexploitation ratio since 2007 and a wide range of fishing mortality estimates around the average (Figure 69, Table 26). The highest values of overexploitation ratio are all related to European hake, whose current fishing mortality rates can be up to 12 times the target and five times greater on average (Table 26, Figure 69). If European hake is excluded, since 2012, there has been an overall decrease in the upper values of fishing mortality (Figure 69). In the Mediterranean, European hake is followed by red mullet (*Mullus barbatus*) and sardine (*Sardina pilchardus*) as second and third species showing higher overexploitation rates, while in the Black Sea horse

mackerel (*Trachurus mediterraneus ponticus*) has the highest average overexploitation ratio, closely followed by turbot (*Scophthalmus maximus*) (Table 26). Stocks fished within biologically sustainable limits mostly include small pelagic species (sardine, European anchovy [*Engraulis encrasicolus*] or sprat [*Sprattus sprattus*]), and some demersal stocks of red mullet and deep-water rose shrimp (*Parapenaeus longirostris*) in certain GSAs (Table 26).



Note: The solid line represents the average ratio, the shaded area represents the standard errors and dots represent the ratios for each given stock with valid and validated stock assessment in that year.

FIGURE 69 – Ratio of current fishing mortality to target fishing mortality for all species and management units, 2006–2016

5.3.2 Overall status of stocks: Biomass

Scientific advice on the status of stocks in relation to biomass is scarcer than on fishing mortality. This is mainly due to the lack of biomass reference points, which in turn reflects uncertainty in the absolute values of recruitment and/or biomass provided by some of the stock assessment models. In the case of the Mediterranean, recent advice on biomass was provided for a total of 62 stocks (mainly of priority species) by comparing current biomass with the time series of biomass emanating from the advice. For all demersal species (except European hake and red mullet in GSA 22 and common cuttlefish [*Sepia officinalis*] in GSA 17), biomass is classified as high, intermediate or low by comparing the current estimate with the 66th and 33rd percentiles of the available time series. For European hake and red mullet in GSA 22, and common cuttlefish in GSA 17 current biomass estimates were compared to the B_{MSY} reference point, while for small pelagics, the comparison was made with respect to the B_{PA} reference point (for both reference points biomass is considered high if higher than the relevant reference point and low if lower). Advice in relation to biomass in the Black Sea was only provided on a regular basis for turbot.

The analysis of the current biomass levels of Mediterranean stocks presents a less striking picture than for the case of fishing mortality, with 47 percent of the stocks having a low biomass, while 31 percent have an intermediate biomass and 23 percent have high biomass (Figure 70, Table 27).

By subregion, in the western and central Mediterranean, as well as in the Adriatic Sea, most stocks are at low or intermediate biomass levels, with a small representation of stocks having a high biomass. The coverage of eastern Mediterranean stocks is low (six stocks) half of which is at high biomass levels and half at low biomass levels (Figure 71, Table 27).

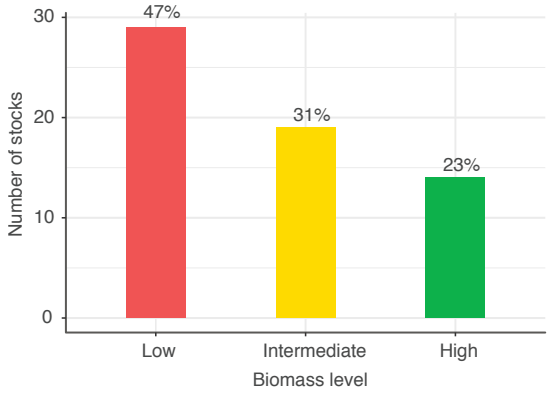


FIGURE 70 – Number of stocks (and percentage on top of the bars) at low, intermediate and high biomass levels in the Mediterranean Sea, based on information available for 62 stocks over a combination of 20 GSAs and 14 species (Table 27)

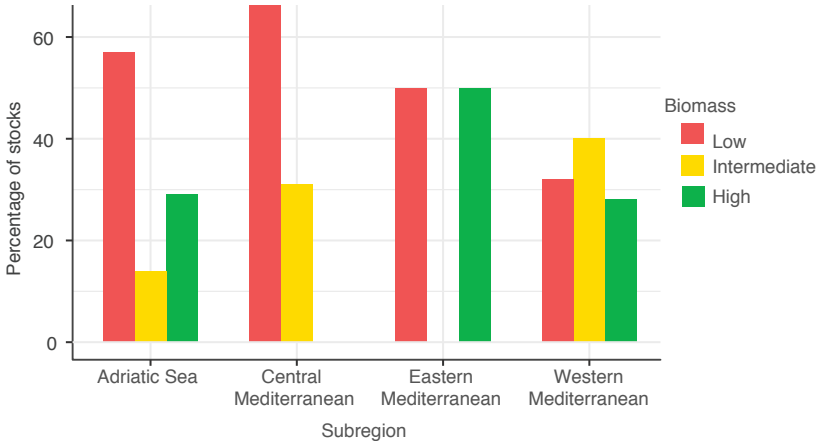


FIGURE 71 – Percentage of stocks in each Mediterranean subregion at low, intermediate and high biomass level, based on information available for 62 stocks (Table 27)

5.3.3 Status and trends of priority species

The mean overexploitation ratio (F/F_{MSY}) of all assessed priority species in the Mediterranean Sea (Figure 72) shows a stable trend since 2012, with a slight decrease between 2012 and 2014, despite the high mean values recorded for European hake (over 5.5) in all years. By species, European hake shows a stable trend, while deep-water rose shrimp, red mullet and, to some extent, blue and red shrimp (*Aristeus antennatus*) exhibit overall decreasing trends. Increasing trends are revealed for European anchovy and sardine (Figure 73). All priority species show an average overexploitation index greater than one, with demersal species being subject to higher exploitation, while small pelagic species show average fishing mortality rates closer to the target.

In terms of the status of biomass of single species stocks, the species with the highest number of validated assessments with estimated biomass indicators are European hake and red mullet (Table 27). None of European hake stocks have a high biomass status, while red mullet, giant red shrimp and blue and red shrimp stocks are more evenly distributed in terms of biomass status (Table 27). Most stocks of deep-water rose shrimp have low biomass status. The coverage of small pelagic species (sardine and European anchovy) is lower, and their status mostly intermediate to high, with the exception of European anchovy in GSA 7 (Table 27).

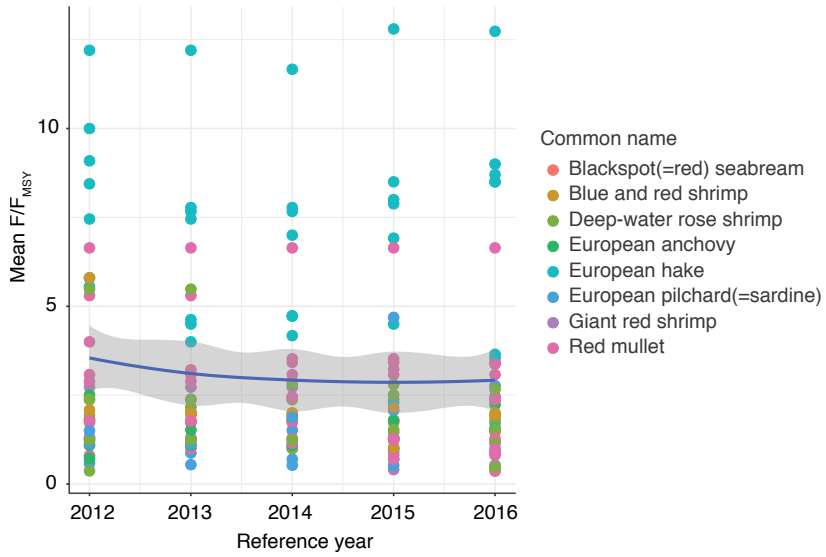


FIGURE 72 – Overall trend (Loess smoother) in the overexploitation index ($F_{current}/F_{MSY}$) of priority species in the Mediterranean Sea since 2012 averaged by assessed species over all assessed GSAs

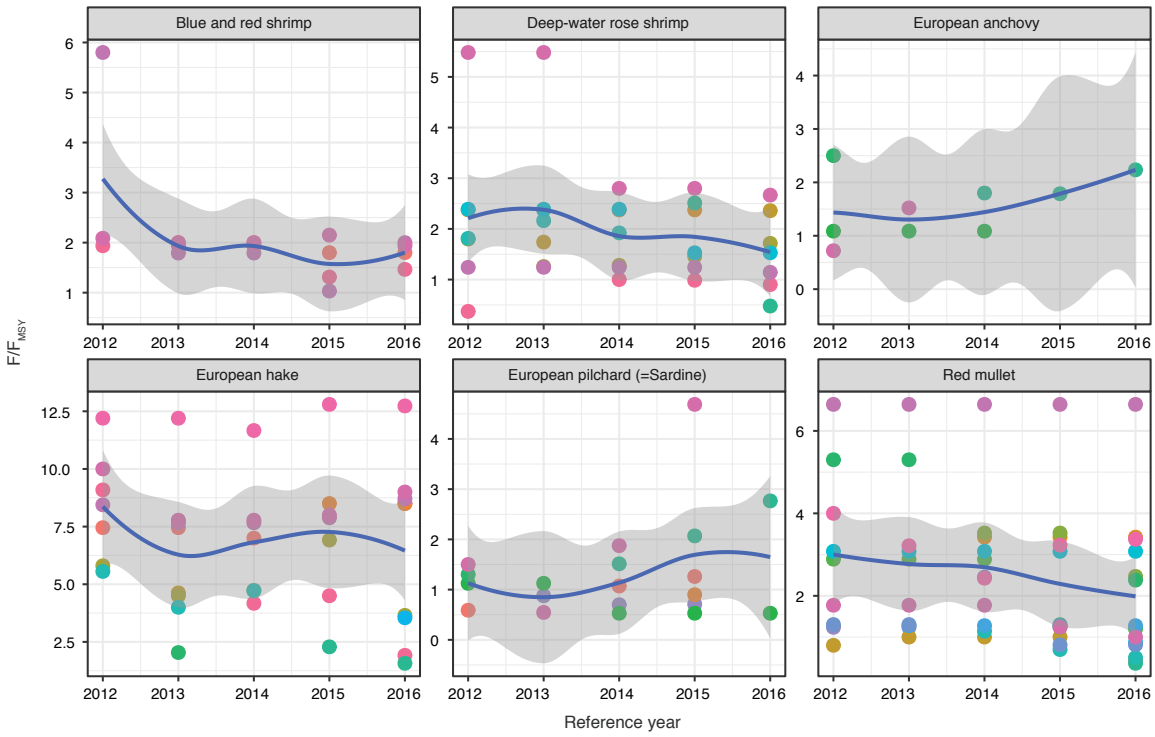


FIGURE 73 – Trend (Loess smoother) in the overexploitation index ($F_{current}/F_{MSY}$) of selected priority species in the Mediterranean Sea since 2013

TABLE 25 – Latest validated assessments by priority species and GSA

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
European hake	2016		2016		2016	2016	2016		2016	2013		2016	2016	2016	2016	2016	2016	2016				2016				2007				
Turbot																													2016	
Horse mackerel									2016	2016	2016																		2016	
Red mullet	2014		2014	2014	2012	2016	2016		2010	2016			2016	2016	2016	2016	2016	2016	2012			2016		2013	2015				2016	
Sardine	2016		2016			2016	2017									2014	2016	2016				2016								
Blue and red shrimp	2015				2016	2016			2016																					
Anchovy	2016					2016	2017									2012	2016	2016				2016							2016	2016
Deep-water rose shrimp	2011		2011	2011	2016	2016			2016	2016		2016	2016	2016	2016	2016	2016	2016	2015											
Giant red shrimp									2016						2010	2010														
European sprat																													2016	

TABLE 26 – Current exploitation rate by priority species and GSA with average value by species

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Average
European hake	8.50		8.50		8.71	9.00	12.73		1.92	4.62		3.65	3.65	3.65	3.65	3.65						3.55									**5.83**
Turbot																													3.15		**3.15**
Horse mackerel									2.43	2.43	2.43																		3.67		**2.85**
Red mullet	3.42		3.42	3.42	6.64	1.00	3.37			0.44			2.47	2.47	1.20	1.20	0.36	0.43	3.08			0.87		1.28	0.81						**2.11**
Sardine																0.53	2.77	2.77													**2.02**
Blue and red shrimp	1.80				2.00	1.94			1.47																						**1.80**
Anchovy																	2.23	2.23											1.35	0.95	**1.69**
Deep-water rose shrimp						2.67			0.90	2.36		1.71	1.71	1.71	1.71	1.71	0.48	0.48	1.53												**1.54**
Giant red shrimp									1.53																						**1.53**
European sprat																													1.38		**1.38**

Note: The final column shows the average value by species.

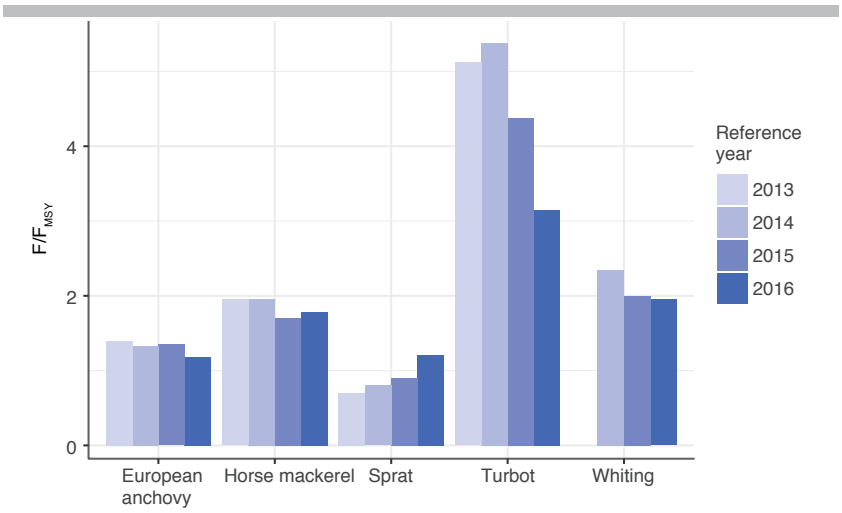
TABLE 27 – Stock status of each Mediterranean stock considered in the analysis of biomass indicators

Species	Western Mediterranean									Central Mediterranean						Adriatic Sea		Eastern Mediterranean		
	1	3	4	5	6	7	9	10	11	12	13	14	15	16	19	17	18	22	25	26
Anchovy (p)																				
Sardine (p)																				
Blue and red shrimp (d)																				
Common cuttlefish																(dm)				
Common sole (d)																				
Deep-water rose shrimp (d)																				
European hake (d)																		(dm)		
Giant red shrimp (d)																				
Lizardfish (d)																				
Mantis shrimp (d)																				
Peregrine shrimp (d)																				
Picarel (d)																				
Red mullet (d)																		(dm)		
Striped mullet (d)																				

Notes: Based on 62 validated stock assessments. Red indicates low biomass, yellow intermediate biomass, and green high biomass.

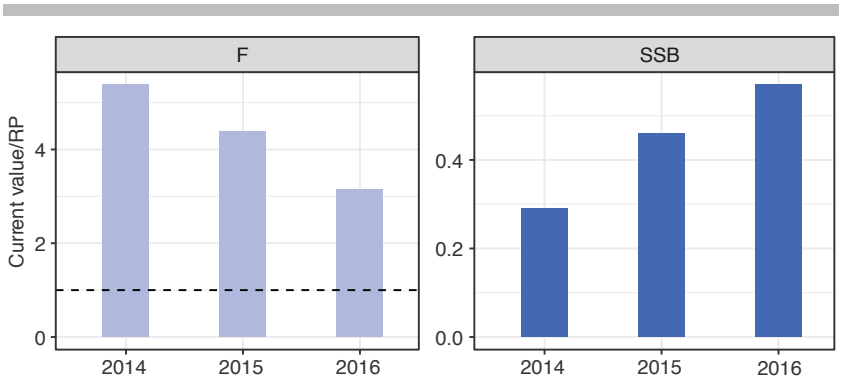
(p) pelagic species whose biomass level was decided based on the comparison between the current estimate and the reference point (low: $B_{curr} < B_{pa}$; intermediate: $B_{curr} > B_{pa}$); *(d)* demersal species whose biomass level was decided based on the comparison between the current estimate and the 33rd and 66th percentile of the time series (low: B_{curr} < 33rd percentile; intermediate: 66th percentile > B_{curr} > 33rd percentile; high: B_{curr} > 66th percentile); (*dm*): demersal species whose biomass level was decided based on the comparison between the current estimate and B_{MSY} (low: Bcurr < B_{MSY}; high: Bcurr > B_{MSY}).

The overexploitation ratio of Black Sea priority species for which fishing mortality estimates are available show a more encouraging trend with European anchovy, Black Sea horse mackerel, turbot and whiting (*Merlangius merlangus*), being characterized by more or less marked decreases since 2013 (Figure 74). The notable exception is sprat, whose F/F_{MSY} has steadily increased over the years, although it shows the lowest overexploitation rate (i.e. lower than 1 up to 2016). The situation of turbot seems particularly promising, with an evident decrease in F/F_{MSY} since 2013 and a specular increase in B/B_{MSY} since 2014 (Figure 75).



Note: The index of sprat for 2016 is an average of the two ratios obtained from two different stock assessment methodologies.

FIGURE 74 – Overexploitation index ($F_{current}/F_{MSY}$) of five Black Sea priority species since 2013



Note: The dashed line represents $F/F_{MSY} = 1$.

FIGURE 75 – Black Sea turbot: Yearly (reference year) progression in B/B_{MSY} (left) and F/F_{MSY} (right) since 2014 in GSA 29

5.4. FINAL REMARKS

The percentage of stocks with validated assessments has increased significantly over the years, particularly from 2012, as has the geographical coverage of assessments, but the most notable improvement is related to the percentage of catches being assessed, which has quadruplicated over a ten-year period. Nevertheless, significant efforts are still required to extend assessment coverage to all GSAs and priority species. While most stocks are still overexploited, the number of overexploited stocks has been decreasing and the overall temporal trajectory in overexploitation ratio has been stationary over the considered time span. Despite still fetching

high values, some species are showing evident decreases in overexploitation ratio over time, and this is particularly true for the Black Sea.

There are several ongoing initiatives within the GFCM aimed at improving coverage (spatial and temporal) of advice on stock status, so as to obtain a more comprehensive view of the status of Mediterranean and Black Sea stocks, as well as their temporal trend. A significant amount of work is also being carried out in assessing data-limited stocks. In addition, other initiatives to enhance data collection are in place within the framework of the mid-term strategy and of the BlackSea4Fish project in the Black Sea (see Chapter 8). Moreover, there has been a recent move towards enhancing the quality of advice through the establishment of a benchmarking process including an external review. There has also been an attempt to provide advice with a shorter time lag between data collection and its final formulation. It is foreseen that the result of these initiatives be reflected in future editions of SoMFi.

PART 2
MANAGEMENT OF MEDITERRANEAN AND BLACK SEA FISHERIES

INSIGHTS INTO SMALL-SCALE AND RECREATIONAL FISHERIES

6

6. Insights into small-scale and recreational fisheries

6.1. INTRODUCTION

Small-scale fisheries are deeply rooted in the fabric of Mediterranean and Black Sea fishing communities. Their significant role in this region is well known, despite, in some cases, limited available data for this sector. Since millennia, the small-scale fishing sector has supported livelihoods within coastal communities. The role it plays in sustaining economic activity and ensuring food security within vulnerable coastal communities is not to be overlooked, particularly in the current context of ever-increasing rural to urban migration. Furthermore, SSF play a key role in maintaining local traditions and culture, creating added value for other sectors, such as the restaurant and tourism industries.

Albeit different, recreational fisheries are another fishing subsector for which data are typically limited in the Mediterranean and the Black Sea. However, preliminary information points to a non-negligible impact of this sector, both in biological and economic terms. Here, too, the contribution of these fisheries to local tourism has enormous potential. This chapter seeks to review current available knowledge on SSF and recreational fisheries, and provides an overview of the actions being taken at the regional level to address these two important fishing subsectors. In the case of SSF, some of the data presented in this chapter were previously introduced in Chapter 1 (Fishing fleet) and Chapter 3 (Socio-economics). However, due to the importance of SSF within this region, specific analyses are presented in this chapter in order to highlight the distinctions between SSF and industrial or large-scale fisheries (LSF) in the Mediterranean and the Black Sea.

BOX 9 – Definition of small-scale fisheries

The definition of SSF has been regularly debated in various fora at global and regional level. Indeed, the *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (SSF Guidelines) recognize the great diversity of SSF and acknowledge that there is no single, agreed definition of the subsector, nor would such a definition be desirable for such a diverse and dynamic subsector. The SSF Guidelines therefore state that the identification and application of the term "small-scale" should be carried out at the regional, subregional or national level, taking into account local contexts. In particular, such an exercise should be carried out in a participatory fashion to ensure that all voices, including those of marginalized groups, are heard (FAO, 2015a, section 2.4).

The definition of SSF in the Mediterranean and the Black Sea has also been debated within the context of the GFCM. As noted within the proceedings of the First Regional Symposium on Sustainable Small-Scale Fisheries in the Mediterranean and the Black Sea (St. Julian's, Malta, 27–30 November 2013)(FAO, 2015b), as well as within SoMFi 2016 (FAO, 2016), SSF in the Mediterranean and the Black Sea are described as follows, although a clear and common definition is not agreed upon:

> At present, the terms "artisanal fisheries" and "small-scale fisheries" are often used interchangeably to refer broadly to a multi-faceted fisheries segment practised along coastal areas in the Mediterranean and the Black Sea, and indeed worldwide. Definitions vary between countries in the GFCM area of application. Small-scale fisheries are generally characterized by a large number of boats of low tonnage (between 1 and 4 tonnes), which are highly diversified and use low-impact fishing gear to target a wide variety of species. Fishers exploit areas that are usually close to the coast where they live and shelter their boats. Small-scale fisheries usually require low capital investment, in contrast to industrial fishing, but they are an important source of income and make a significant contribution to food security, especially in coastal communities. (FAO, 2016).

BOX 9 (Continued)

With a view to better defining SSF at the regional level, in 2017, in preparation for the first meeting of the Working Group on Small-Scale and Recreational Fisheries (WGSSF) (12–13 September 2017, FAO headquarters), CPCs were requested to complete a questionnaire on SSF. Among other topics, this questionnaire asked if there existed formal or informal definitions of SSF at the national level. Responses revealed that these definitions do exist in most countries and that common threads could be found, particularly regarding vessel length and gear types; however, these definitions were not universal across all CPCs. For example, two thirds of the definitions provided specified SSF as vessels less than 12 m LOA and using passive or not towed gear. Additional characteristics, such as ownership or gross tonnage are also used in certain cases. The WGSSF agreed, however, that a wide range of fishing activities fell within these length and gear parameters, including some activity with very high fishing effort (GFCM, 2017). It was therefore concluded that a more refined characterization of SSF was needed in the Mediterranean and the Black Sea (Box 10).

6.2. UPDATE ON MEDITERRANEAN AND BLACK SEA SMALL-SCALE FISHERIES

The compilation of timely and complete data on SSF has been historically limited because CPCs face a number of challenges in improving data collection for this subsector. In certain countries, there is still a need for complete and up-to-date fleet registers for the small-scale subsector. Furthermore, in many cases, SSF may lack dedicated infrastructure, and catches are landed at numerous remote landings sites along the coast, including informal sites such as beaches, hindering regular data collection and record keeping. The multi-gear and seasonal nature of SSF also contributes to a complex data collection scenario.

Nevertheless, the submission of data on SSF by CPCs has been improving in recent years, and data submission in line with the DCRF has facilitated improved analysis. A future challenge is the paucity of data on gleaning and post-harvest activities, which are not currently requested by the GFCM but which constitute an important share of SSF activity, as well as a principal contribution by women. Within the context of Target 2 of the mid-term strategy, work is underway to assist CPCs in further improving available data on SSF.

This section presents an overview of the latest available information on SSF in the GFCM area of application, including an analysis of the fleet characteristics, as well as socio-economic indicators such as revenue and employment.

6.2.1 Data sources

Data presented here are primarily based on official data submissions to the GFCM through the Task 1 statistical matrix and the DCRF online platform (for specific data sources and reference years, see Chapter 3). All monetary values have been adjusted for inflation and are listed as constant 2016 US dollars (USD).

Since there is currently no consensus on a precise definition of SSF in the GFCM area of application (Box 9), the analysis presented here calculates SSF as all polyvalent fleet segments ("Polyvalent vessels [all lengths]"), as well as longliners under 12 m (segments L-01, L-02 and L-07). This characterization of SSF also permits coherence between the fleet segmentation of data submissions in line with the DCRF and the fleet segmentation of data submissions in line with the Task 1 statistical matrix, since data for some countries are only available in the latter format. Calculating SSF in this way therefore also maintains consistency with SoMFi 2016. As work is currently underway to provide improved parameters for this subsector (Box 10), it is expected that future editions of this publication will provide a more precise characterization of SSF.

6.2.2 Small-scale fisheries: fleet

The small-scale fleet in the GFCM area of application represents 84 percent of the total regional fishing fleet – 83 percent of vessels in the Mediterranean and 91 percent of vessels in the Black Sea. A comparison between the SSF and large-scale fisheries (LSF) fleets is presented in Figure 76 and is further disaggregated by sea basin in Figure 78. The total small-scale fleet in the region is approximately 70 300 vessels[1] (approximately 59 800 vessels in the Mediterranean and 10 500 vessels in the Black Sea – Figure 79). A breakdown of the percentage of SSF vessels per national fleets is presented in Figure 77. In over half of the CPCs analysed, the small-scale fleet makes up over 90 percent of the total national fleet, accounting for the largest portion of national fleets in Cyprus, Ukraine, Lebanon, Greece, Bulgaria, Libya, Tunisia, Turkey, France and Malta.

A subregional breakdown of the small-scale fleet shows, in particular, the predominance of the small-scale fleet in the Black Sea and the central Mediterranean (Figure 80); in both subregions, the small-scale fleet accounts for 91 percent of the total fleet. In contrast, in the Adriatic Sea and the western Mediterranean, the small-scale segment accounts for only 75 and 73 percent of the total fleet, respectively.

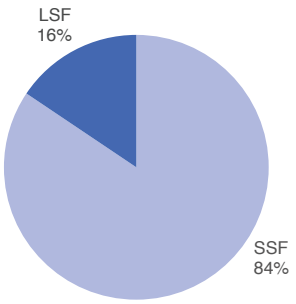


FIGURE 76 – Percentage of total fleet from large- and small-scale fleet segments

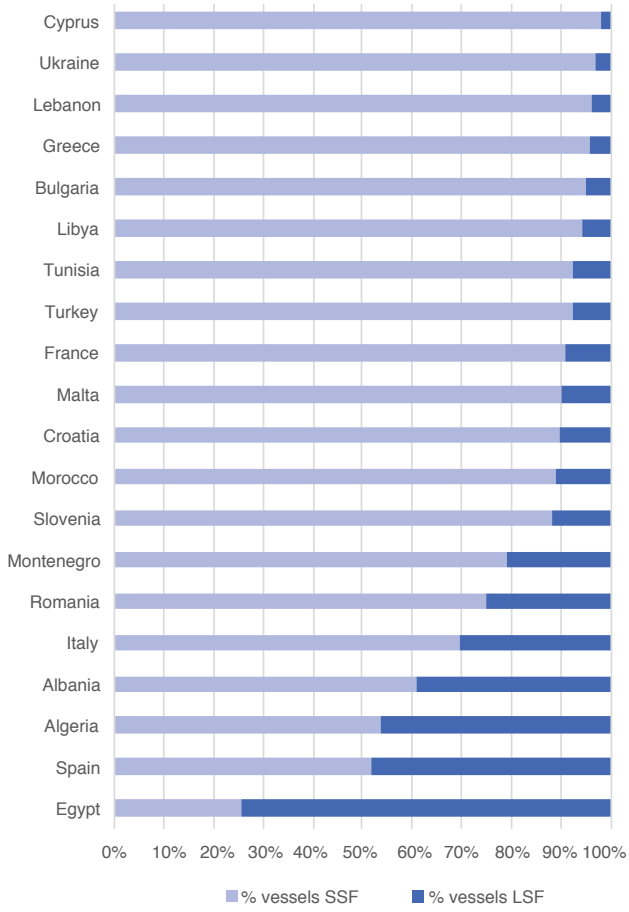


FIGURE 77 – Percentage of vessels from small-scale fisheries by contracting party and cooperating non-contracting party

1 See Chapter 1 for data sources and further fleet data. Vessel data for Georgia, Israel, Palestine, the Russian Federation and the Syrian Arab Republic were not allocated by fleet segment and therefore were not included in this analysis (see Table 5).

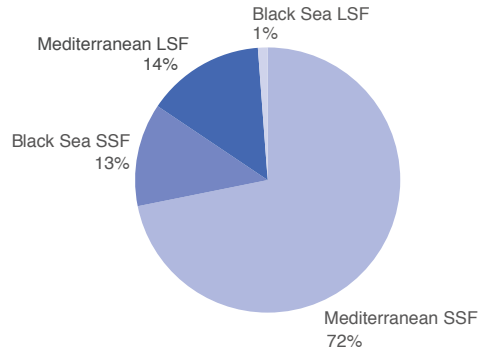


FIGURE 78 – Percentage of total fleet from large- and small-scale fleet segments in the Mediterranean and the Black Sea

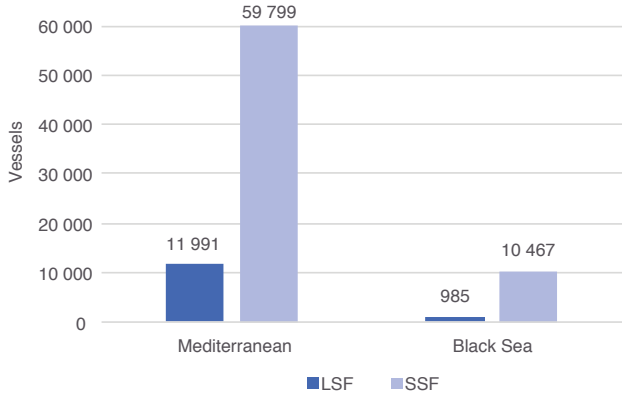


FIGURE 79 – Number of vessels from large- and small-scale fleet segments in the Mediterranean and the Black Sea

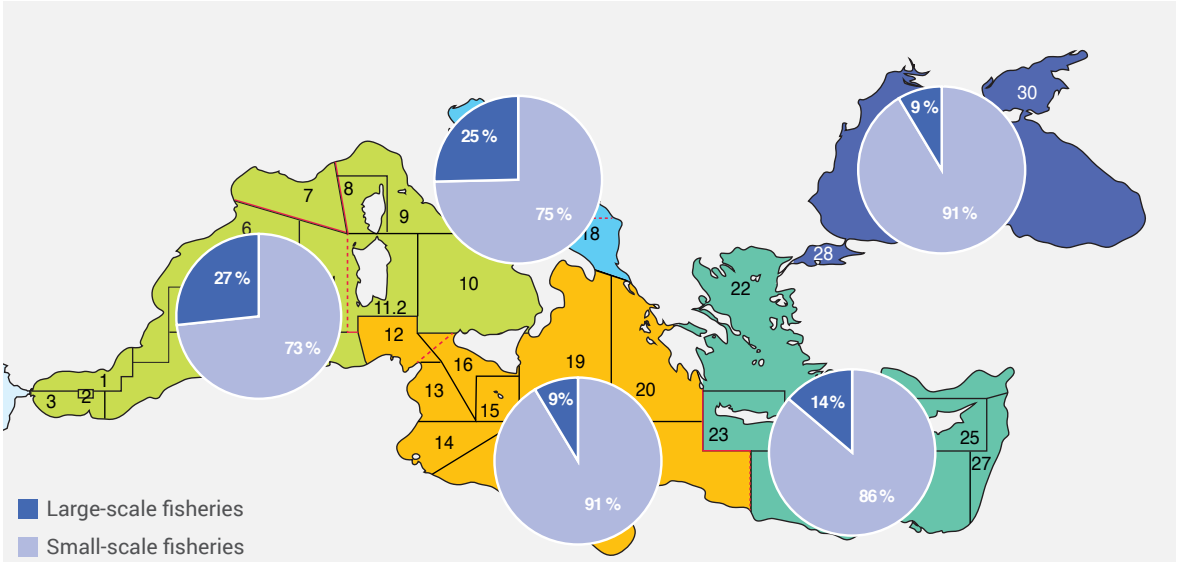


FIGURE 80 – Percentage of subregional fleets from small- and large-scale fisheries

6.2.3 Small-scale fisheries: value

Small-scale fisheries account for approximately 26 percent of total revenue in the GFCM area of application (Figure 81, further disaggregated by sea basin in Figure 83), or 24 percent of total revenue in the Mediterranean and 49 percent of total revenue in the Black Sea. This revenue amounts to approximately USD 633 million (USD 519 million in the Mediterranean and USD 114 million in the Black Sea – Figure 84). For a more complete analysis of revenue and costs across for the total Mediterranean and Black Sea fleet, see Chapter 3 (Socio-economics). A breakdown of the percentage of revenue from SSF by CPC is presented in Figure 82. These figures, however, only consider revenue from first sale of capture fishery products and do not include revenue from other uses of the vessel, such as pescatourism, which has been shown to have considerable economic potential for SSF (Piasecki *et al.*, 2016). Indeed, estimates suggest that the wider economic impact of SSF may be as much as 2.6 times the reported landing value (Dyck and Sumaila, 2010).

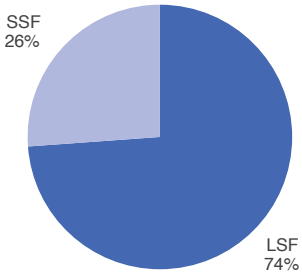


FIGURE 81 – Total revenue in the GFCM area of application by large- and small-scale fisheries

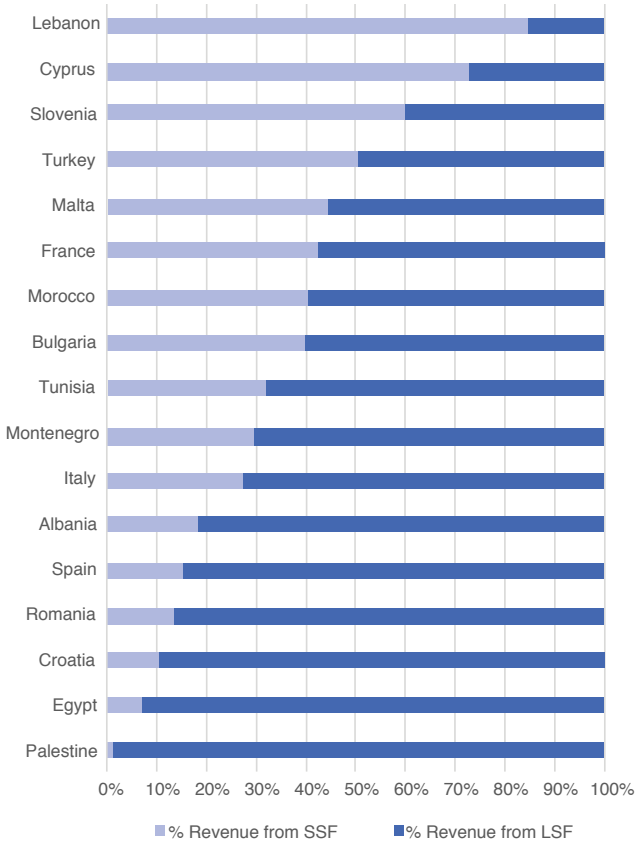


FIGURE 82 – Percentage of capture fishery production revenue from small-scale fisheries by contracting party and cooperating non-contracting partyand relevant non-state actor

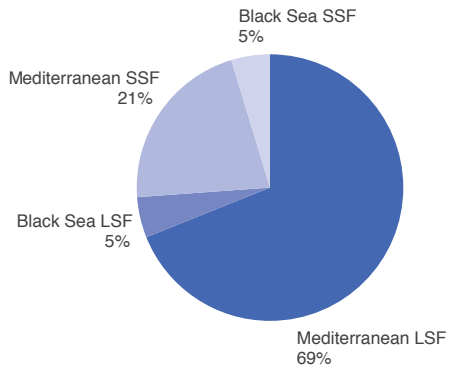


FIGURE 83 – Percentage of total revenue from large- and small-scale fisheries in the Mediterranean and the Black Sea

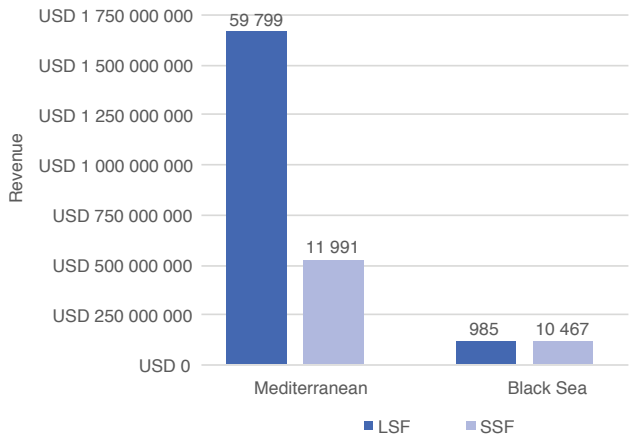


FIGURE 84 – Total revenue from large- and small-scale fisheries in the Mediterranean and the Black Sea

As seen in Figure 85, although revenue from SSF is significant throughout the region, it is particularly important to the fishing economy in certain subregions. In particular, in the Black Sea, SSF account for almost half of all revenue, whereas in the subregions that border the southern Mediterranean coast, namely the western, central and eastern Mediterranean, SSF contribute 25, 29 and 23 percent of revenue, respectively.

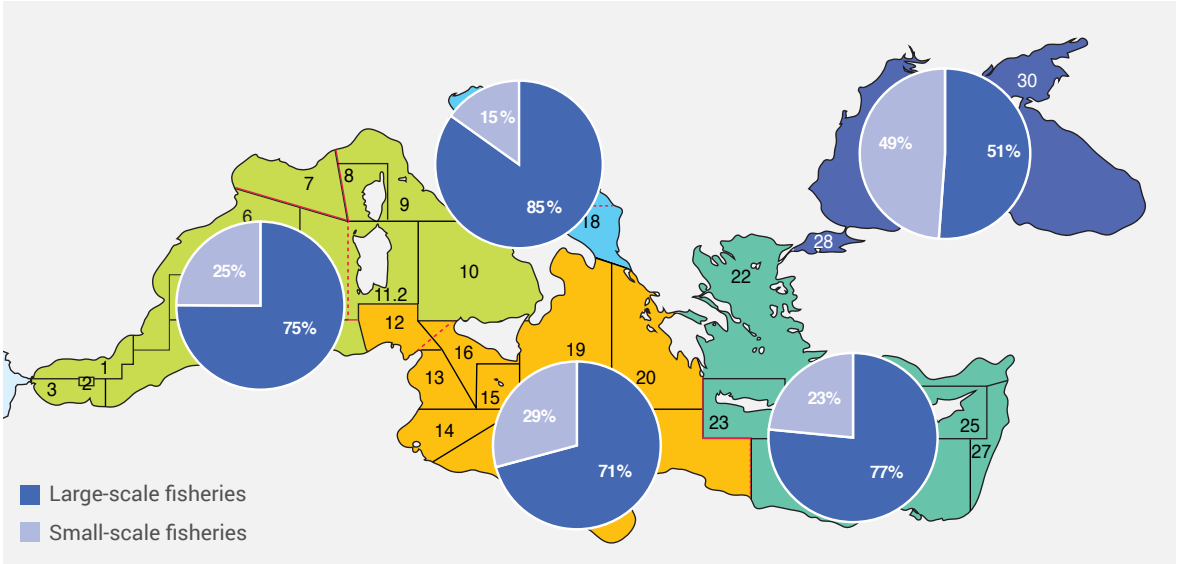


FIGURE 85 – Percentage of landing value from small- and large-scale fisheries by subregion

6.2.4 Small-scale fisheries: employment

The importance of SSF to coastal economies in the Mediterranean and Black Sea region is also illustrated by their important role in providing livelihoods, particularly in rural communities. Indeed, an analysis of employment data for SSF shows their crucial contribution to the region. Despite accounting for only 26 percent of revenue, SSF account for approximately 60 percent of total employment onboard fishing vessels in the GFCM area of application (Figure 86, further disaggregated by sea basin in Figure 88) – 59 percent of total employment in the Mediterranean and 74 percent of total employment in the Black Sea, which amounts to just under 150 000 people working onboard small-scale fishing vessels in the GFCM area of application (134 300 people in the Mediterranean and 15 300 people in the Black Sea; Figure 89). A breakdown of the percentage of onboard employment from SSF is presented by CPC in Figure 87 and by subregion in Figure 90. As noted above, a number of CPCs face difficulties in collecting accurate data on SSF and, as such, it is assumed that these figures are underestimated. In particular, these figures do not include pre- and post-harvest labour, gleaning activity or other in-kind labour, such as support from family members, which is particularly relevant and estimated to be considerable within the SSF subsector.

An analysis of employment in SSF by subregion reveals the important contribution of SSF to livelihoods within the fishing industry throughout the entire GFCM area of application. In particular, it is evident that the role of SSF as a source of employment is particularly crucial in the central Mediterranean and Black Sea subregions, where it represents 75 and 74 percent of all on-vessel employment, respectively. Note that in the case of the eastern Mediterranean, the data presented are undervalued, since Greek employment data are not available by GSA and thus are excluded from this analysis, while employment data are unavailable for certain Egyptian SSF segments (although data collection is currently underway to correct this gap). As such, in future analyses, it is foreseen that the percentage of on-vessel employment from SSF in the eastern Mediterranean will increase significantly.

Despite the important role of SSF in providing employment in the region's fishing sector, preliminary analyses have shown remuneration per FTE in LSF to be USD 9 800, compared to only USD 5 900 in SSF. Further data are needed, however, to improve this analysis.

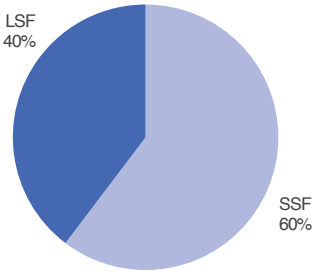


FIGURE 86 – Percentage of total employment from large- and small-scale fisheries in the Mediterranean and the Black Sea

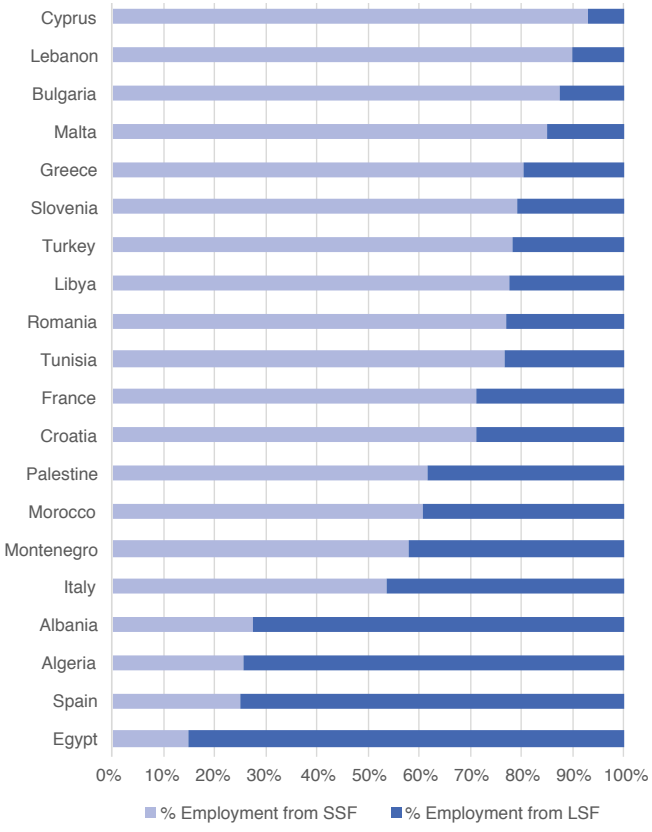


FIGURE 87 – Percentage of onboard employment from small-scale fisheries by contracting party and cooperating non-contracting party and relevant non-state actor

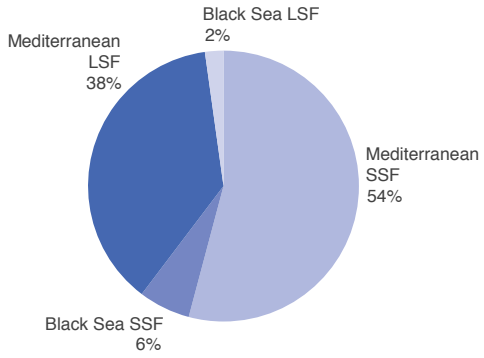


FIGURE 88 – Percentage of total employment from large- and small-scale fisheries in the Mediterranean and the Black Sea

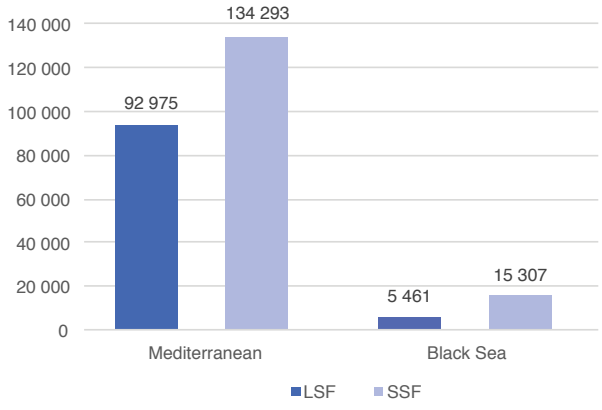


FIGURE 89 – Total employment in large- and small-scale fisheries in the Mediterranean and the Black Sea

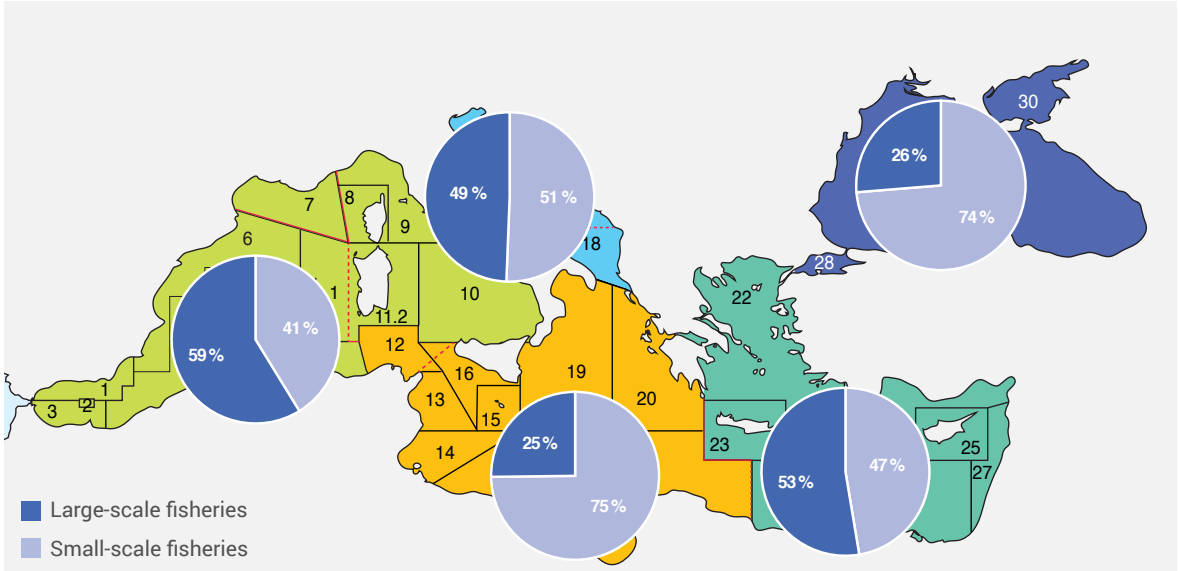


FIGURE 90 – Percentage of on-vessel employment from small- and large-scale fisheries by subregion

6.3. IMPROVING KNOWLEDGE ON RECREATIONAL FISHERIES

In addition to SSF, marine recreational and sport fisheries are another fishing subsector that forms an integral part of Mediterranean and Black Sea coastal life and communities, yet for which available data are limited. Recreational fisheries play an important cultural role and represent a significant economic component of coastal tourism, one of the main maritime sectors in terms of gross value added and employment. At the same time, recreational fishing has been shown to be an important component of fishing mortality across the globe (Hyder *et al.*, 2017), and a lack of estimates of catches for inclusion in stock assessment may lead to significant bias in the assessment results and the provision of incorrect advice on fisheries management.

These data limitations present a challenge to Mediterranean and Black Sea fisheries management. In order to better address recreational fisheries within the context of the GFCM, as a first step, a questionnaire on national marine recreational fisheries was circulated to all CPCs prior to the first meeting of the WGSSF in 2017. Information gathered through the questionnaires showed that data collection for this sector is limited, fragmentary and heterogeneous between countries. Indeed, 14 CPCs indicated having a licence system in force for recreational fishing, whereas the questionnaire results indicated that there were no licence systems in Bulgaria, France, Greece, Israel, Libya, Malta and Turkey, nor in three cooperating non-contracting parties (Bosnia and Herzegovina, Georgia and Ukraine[2]) (see Figure 91).

6.3.1 Towards a GFCM Handbook on recreational fisheries data collection in the Mediterranean and the Black Sea

To improve information on recreational fisheries, a handbook is being developed to provide a clear methodological framework for Mediterranean and Black Sea countries to adopt and/or implement suitably harmonized sampling and survey monitoring schemes for recreational fisheries. The estimation of catches and effort for this sector requires methodological approaches that are different from that of commercial fisheries. The general approach includes two key phases: identification and quantification of the total population/universe of fishers,

2 Since Republic of Moldova was not yet a cooperating non-contracting party when the questionnaire was carried out, it was not surveyed.

and subsequently, the selection of a representative sample to collect data on catch, effort, gear used and other needed information.

The identification of the population of fishers is easier and more efficient when information can be obtained from national marine recreational fishing licence systems and registration databases. Such is the case in 66 percent of CPCs, where different types of licence systems are already operational. Fishers can then be randomly sampled from the licence list with known probability. However, for countries that do not have a licensing system in place, the population of fishers could be identified by means of a fee-free online registration (e.g. Italy), which must be mandatory for every kind of marine recreational fishing technique (e.g. boat, shore and underwater fishing). An additional and more advanced option would be a probability-based nationwide survey of the population to estimate the numbers of people who fished recreationally during the year and to collect other demographic and avidity (frequency of fishing) information needed for subsequent analysis. An advanced version of such method has been used in New Zealand since 2011 and validated through trials and errors over a 20-year period (ICES, 2018). This method follows a two-phase sampling design: screening survey based on a national database on the location of all dwellings and a 12-month panel survey, allowing the selected recreational fishers to report their catch and effort on a regular basis. Regardless of the method used, once the population of recreational fishers is defined, the data collected on the random sample can be raised to the total national catch and effort. The draft handbook on recreational fisheries data collection in the Mediterranean and the Black Sea, which provides guidance on these data collection issues, is currently being tested through pilot studies in select countries and a forthcoming publication is foreseen pending the results of the studies.

6.3.2 Overview of the species targeted by recreational fishers in the Mediterranean and the Black Sea

Data collected through the GFCM questionnaire on national marine recreational fisheries shows that, in the Mediterranean and the Black Sea, this activity involves many different techniques (e.g. rod and line, spear gun, traps, longlines, hand-gathering), can be exerted from different locations (i.e. shore, boat, underwater) and targets a broad range of taxa (e.g. finfish, shellfish, crustaceans).

In the Black Sea, recreational fishers primarily target four taxa: Scombridae, Gobiidae, Mugilidae and Pomatomidae (primarily bluefish [*Pomatomus saltatrix*]). In the Mediterranean, however, the catch composition includes a higher number of taxa than in the Black Sea and slight variations in the target species are observed among the four GFCM Mediterranean subregions. The following are targeted in all Mediterranean subregions: bluefin tuna (*Thunnus thynnus*); small pelagics, particularly Scombridae such as Atlantic mackerel (*Scomber scombrus*) and Atlantic bonito (*Sarda sarda*); large pelagics, particularly Carangidae such as greater amberjack (*Seriola dumerili*) and leerfish (*Lichia amia*); Coryphaenidae, particularly dolphinfish (*Coryphaena hyppurus*); Sparidae, particularly gilthead seabream (*Sparus aurata*) and common dentex (*Dentex dentex*); and Cephalopoda, particularly European squid (*Loligo vulgaris*), common cuttlefish (*Sepia officinalis*) and common octopus (*Octopus vulgaris*).

As noted above, subregional variations occur, for example: Serranidae are mostly represented by different species of grouper, which are targeted along the western coast of the Adriatic Sea and on the rocky bottoms of the western, central and eastern Mediterranean; Mugilidae and bluefish are mainly exploited in the eastern Mediterranean and the Adriatic Sea; and Moronidae, which are represented exclusively by the European seabass (*Dicentrarchus labrax*),

are targeted in all countries bordering the Adriatic, as well as in Egypt, Libya, Spain and Turkey. A summary of the main nekton taxa targeted by recreational fisheries in the GFCM area of application is provided in Figure 91. CPCs for which national licence systems for marine recreational fisheries are in place are highlighted in dark grey.

FIGURE 91 – Distribution of the main nekton family and group of species targeted by recreational fisheries across the GFCM subregions

6.4. IMPROVING KNOWLEDGE OF SMALL-SCALE FISHERIES THROUGH ENHANCED REGIONAL COORDINATION

Mediterranean and Black Sea countries have increasingly recognized the importance of taking concerted action to improve available knowledge on these important subsectors, SSF and recreational fisheries. In addition to specific actions on data collection being carried out within the context of Target 2 of the mid-term strategy, work is underway to improve regional coordination on these topics.

6.4.1 Improving regional coordination

Acknowledging the growing interest of fisheries institutions, organizations and CPCs towards improving the situation of SSF and recognizing the increasing number of projects and activities being planned and carried out in the Mediterranean and the Black Sea, a number of organizations have come together to coordinate on SSF in the region. In addition to the

GFCM, this coordination group, "Friends of SSF", is currently composed of the World Wide Fund for Nature (WWF), the FAO Fisheries and Aquaculture Department, the Mediterranean Advisory Council (MEDAC), the Mediterranean Agronomic Institute of Bari (CIHEAM-IAM), the Low Impact Fishers of Europe (LIFE) and the Black Sea Advisory Council (BlSAC). In light of the multi-faceted and interdisciplinary nature of projects and interventions to support SSF, the coordination group seeks to promote synergies in ongoing work, also considering the expertise and comparative advantage of each organization. Furthermore, the group aims to support the realization of the mid-term strategy by addressing common issues, such as the characterization of SSF in the region.

As a first step in improving regional coordination, a database of ongoing case studies by partner organizations has been compiled and the information has been incorporated within an interactive online data representation instrument. This online instrument maps ongoing case studies or projects by partner organizations, allowing users to visually identify potential duplication of efforts and/or synergies and gaps in coverage (see Figure 92[3]). The tool also visually identifies topics addressed by the case studies in order to promote synergies and highlight topics that may need to be addressed in the future. Work is underway to further refine this tool, ensuring it remains functional and up-to-date while incorporating additional case studies and projects to ensure it represents a comprehensive representation of work being carried out in the region.

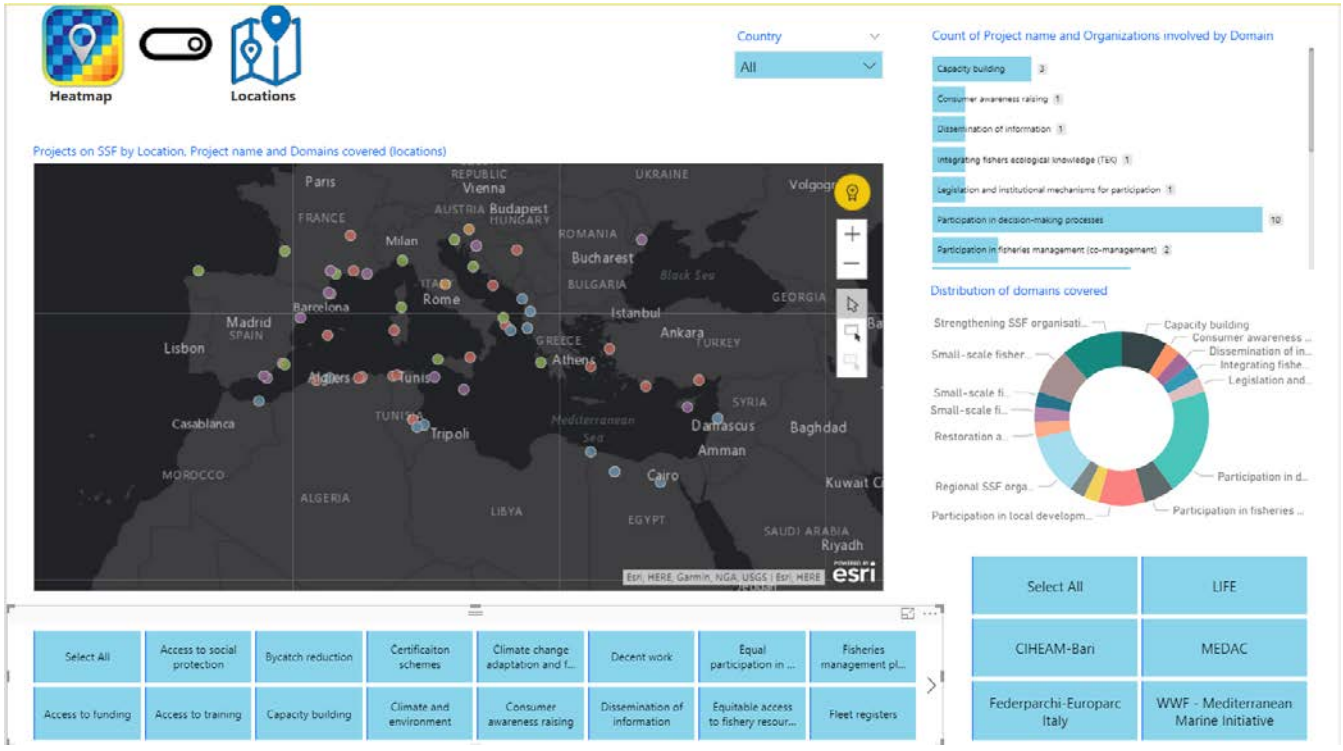


FIGURE 92 – Interactive online data representation instrument, mapping ongoing case studies and projects for small-scale fisheries in the Mediterranean and the Black Sea

3 Figure 92 is a proof of concept and may be modified in line with emerging needs and available technology.

6.4.2 Improving the characterization of small-scale fisheries

Although SSF are currently calculated as all polyvalent vessels and longliners under 12 m for data analysis purposes within the GFCM, the WGSSF noted that these categories comprised a wide range of small-scale activity. Considering this, and also considering the challenges in defining SSF (Box 9), the WGSSF advised that an improved characterization of SSF was needed for the Mediterranean and the Black Sea. This current definition for data analysis purposes captures technical characteristics of SSF, such as vessel length and gear type, however a more complete characterization should consider also biological characteristics such as target species, spatial characteristics such as depth and distance from shore of fishing activity and social and economic characteristics such as economic vulnerability to risks and shocks and demographic trends. In order to avoid any pernicious effects of eventual management measures to support livelihoods in SSF, the WGSSF recognized that in particular there was a need to better understand the biological, spatial and economic impacts of different types of SSF (GFCM, 2017).

Furthermore, it was agreed that there was a need to better distinguish between different types of SSF activity, as within the classification of vessels under 12 m using passive gear, fishing activity could range from very low-technology, low-impact activities, to fishing activity characterized by modern technology and high effort. To this end, building on work being carried out at a global level within FAO, a matrix for the characterization of fishing activities is being tested in the Mediterranean and the Black Sea (Box 10). As the characterization of SSF is a common topic to be addressed by the "Friends of SSF" platform (see section 6.4.1), the partner organizations participating in this group have contributed to discussions on refining this characterization matrix and have agreed to carry out a preliminary test of this matrix through their existing case studies of SSF. The socio-economic survey, being carried out in the Mediterranean and the Black Sea within the context of the mid-term strategy, is also collecting data in line with the matrix in order to perform a wide-scale application of the matrix at the regional level.

BOX 10 – Matrix for the characterization of fishing activities

In 2012, the World Bank published its Hidden harvest report on the global contribution of capture fisheries. In this report it was noted that, although generally large-scale fisheries were associated with high capital costs and sophisticated technology and SSF were associated with small vessels and labour intensive fishing techniques, in reality, modern fishing operations meant that even certain SSF could use very advanced technologies and have a high level of fishing effort (World Bank, 2012). The report noted that, from a policy and research perspective, it may be necessary to distinguish between true small-scale or artisanal activity and fishing activity that has small technical characteristics (i.e. under 12 m and using passive gear) but may use advanced technology and represent greater fishing effort.

With a view to supporting the implementation of the SSF Guidelines, as well as updating the Hidden harvest publication, the FAO Fisheries and Aquaculture Department developed a matrix which provides an objective, transparent and multidimensional approach for characterizing fishing activity. The application of the matrix is intended to aid in aggregating or segregating fishing activity (up to first landing) into different classifications of small- or large-scale operations. The matrix is designed to be inclusive and flexible enough to be applied to diverse fisheries throughout the world.

The matrix provides a tool to describe a fishing unit across multiple dimensions or characteristics of scale. In order to apply the matrix, a fishing unit is assigned values (from 0 to 3) according to its characteristics for 13 different topics (such as size of fishing vessel, mechanization, gear, ownership characteristics, disposal of catch, etc.). From these values an aggregate score is generated (between 0 and 39), placing it on a spectrum between highly artisanal, small-scale fishing (score of 0) and highly industrial large-scale fishing (score of 39). The matrix is currently in an early stage of testing at a global level, including in the Mediterranean and the Black Sea, and pending results of testing additional adjustments may need to be made.

▶▶

BOX 10 (Continued)

Matrix for the characterization of fishing activities

	0	1	2	3
Size of fishing vessel	No vessel	< 12 m, < 10 GT	≤ 24 m, < 50 GT	> 24 m, > 50 GT
Motorization	No engine	Outboard engine/ inboard engine ≤ 100 hp	Inboard engine < 400 hp	Inboard > 400 hp
Mechanization	No mechanization	Small power winch/hauler powered off engine	Independently powered gear deployment/ hauling	Fully mechanized gear deployment and hauling
Fishing gear	Labour-intensive gear	Passive gear	Gear with aggregating devices	Highly active gear
Refrigeration/ storage on board	No storage	Ice box (i.e. on deck)	Ice hold (i.e. below deck)	Refrigerated hold
Labour/crew	Individual and/or family members	Cooperative group	≤ 2 paid crew	> 2 paid crew
Ownership	Owner/operator	Leased arrangement	Owner	Corporate business
Time commitment	Occasional	Full-time, but seasonal	Part-time all year	Full time
Daily trip/multiday	< 6 hours	day trip (< 24 hours)	< 4 days	> 4 days
Fishing grounds/ zone/ distance from shore	< 100 m from shoreline/baselines/ high-water mark	< 10 km from shoreline	< 20 km	> 20 km from shoreline/ baselines
Disposal of catch	Household consumption/ barter (exchange for payment in goods or services)	Local direct sale (exchange for monetary payment)	Sale to traders	Onboard processing and/ or delivery to processors
Utilization of catch, value adding/ preservation	For direct human consumption	Chilled/locally processed/cured	Frozen	Frozen/chilled for factory processing (for human consumption or fishmeal)
Integration into economy and/ or management system	Informal, not integrated (no fees)	Integrated (registered, untaxed)	Formal integrated (licensed, landing fees)	Formal, integrated (licensed, taxed)

6.5. POLICY FRAMEWORK

6.5.1 Regional Conference on "Building a future for sustainable small-scale fisheries in the Mediterranean and the Black Sea"

Building on the results of the First Regional Symposium on Sustainable Small-Scale Fisheries in the Mediterranean and Black Sea (27–30 November 2013, Malta) (FAO, 2015b), the Regional Conference on "Building a future for sustainable small-scale fisheries in the Mediterranean and the Black Sea" was held on 7–9 March 2016 in Algeria (FAO, 2018f). This conference was conceived as a practical response to the outcomes of the SSF Symposium, seeking to

capitalize on the momentum generated and offer a tangible strategy for the future sustainable development of the sector. Concrete case studies on sustainable SSF practices were carried out by the several organizations involved in the regional conference, and the results were presented in a participatory format, allowing for robust discussion and comment to further explore the main themes already identified through the SSF Symposium.

As a result of the regional conference, conclusions were drawn for each of the five thematic areas (Box 11). Recognizing the importance of these conclusions, the GFCM, at its fortieth session, adopted Resolution GFCM/40/2016/3 on sustainable small-scale fisheries in the GFCM area of application, which directly underlined the importance of the regional conference conclusions, calling on national strategies to support SSF and for investment in co-management approaches for these important fisheries. Also at its fortieth session, the GFCM adopted the mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries as Resolution GFCM/40/2016/2; the discussions and conclusions drawn at the regional conference were used as the basis for the development of the actions within Target 2 of the mid-term strategy, "Support livelihoods for coastal communities through sustainable small-scale fisheries".

In general, the regional conference participants expressed widespread support for enhancing strategies to improve SSF. It was agreed that there was a need to build capacity within the SSF sector, including with regard to the implementation at the regional level of the SSF Guidelines and the enhancement of regional platforms for participatory processes. In particular, participants underlined the need to engage stakeholders through fisheries co-management processes and to develop synergies between SSF and other related sectors, such as tourism and recreational fisheries.

BOX 11 – Conclusions of the Regional Conference on "Building a future for sustainable small-scale fisheries in the Mediterranean and the Black Sea"

Panel 1 – Supporting the sustainable development of small-scale fisheries in the Mediterranean and the Black Sea under a Blue Growth perspective

Noting that Mediterranean and Black Sea fisheries are dominated by SSF, regional conference participants concluded that SSF should play an integral role in blue growth strategies. As such, the need to develop indicators to measure the economic and social impact of SSF both in quantitative and qualitative terms was highlighted, including the impact of SSF on coastal communities and the interaction between SSF and other marine industries (transportation, tourism, oil and gas, etc.). The need for a characterization of SSF was also discussed and was highlighted in the context of improving SSF data collection. Participants also called for a study on social protection programmes for small-scale fishers, recognizing the importance of these programmes in supporting management measures.

Panel 2 – Strengthening the role of stakeholders in the context of management and co-management schemes

Acknowledging the evidence that co-management can be an effective approach for both resolving conflicts and developing innovative solutions for the management of SSF, regional conference participants concluded that a priority action would be to identify institutional contexts that allow for the establishment of SSF co-management schemes, with a view to defining general rules for the engagement and compliance of small-scale fishers with these schemes. In addition, best practice guidelines for the enforcement of SSF co-management schemes in the Mediterranean and the Black Sea should be produced. The need to provide support to ongoing co-management processes in the Mediterranean and build commitment for their multiplication across the region was also highlighted. Participants also considered as regional priorities the need to secure tenure rights and access to the resources for small-scale fishers as well as the establishment of capacity-building programmes devoted to supporting stakeholder roles in SSF co-management.

▶▶

BOX 11 (Continued)

Panel 3 – Improving the efficiency of marine protected areas (MPAs) as fisheries management tools and benefits from involving the small-scale fisheries sector

Recognizing that the integration of the SSF sector into management decisions in and around MPAs is an important strategy for reconciling conservation and sustainability objectives, regional conference participants concluded that best practices should be replicated in existing and future MPAs. In particular, lessons can be learned from the experience of MPAs with no-take zones and regulated buffer zones that have been successful in involving fishers in management decisions and in processes that both safeguard wild resources while also preserving the livelihoods on which small-scale fishers depend. The participants also stressed the need to improve the management of MPAs, including multiple-use MPAs, by relying on the scientific and traditional knowledge of fishers, involving concerned users/stakeholders and using adaptive approaches. The setting up of cooperatives, through strategies that are integrated in development plans devised by local authorities and that provide a market edge in favour of responsible and sustainable fisheries practices, were also advocated as means to safeguard the SSF sector in MPAs.

Panel 4 – Enhancing small-scale fisheries value chains

Considering that the value chain of SSF is enhanced by a favourable environment where fishers are strongly connected with other local actors, including public and private institutions and even consumers, the regional conference participants proposed identifying best practices for value creation, especially in the fields of labelling, direct sale, processing, diversification, inter-sectoral integration and vertical coordination. Similarly, modelling successful value chains could allow for the identification of entry points for innovation and for an improved understanding of the scope for fisher cooperation in resource management and in product marketing. It was also proposed that a capacity-building programme be established to support stakeholder roles in: the creation of cooperatives; the formulation of agreements with public and private institutions; and the development of partnerships and projects for coastal development. The aim of the programme would also be to study and analyse issues related both to credit and financial institution support since access to formal finance is a crucial concern.

Panel 5 – Putting the principles of the SSF Guidelines into practice: The case of the Mediterranean and the Black Sea

Acknowledging that the SSF Guidelines constitute an important tool for supporting actions to secure sustainable SSF in the Mediterranean and the Black Sea, the regional conference participants explored the elements for operationalizing the principles of the SSF Guidelines within the regional context. They proposed the establishment of a GFCM Working Group on SSF in order to facilitate the implementation of the SSF Guidelines as well as to promote, without compromising environmental sustainability, the improvement of socio economic conditions within SSF, particularly through the promotion of livelihood diversification as appropriate, and the endorsement of the principle of decent work, as defined by the Work in Fishing Convention (C188) of the International Labour Organization (ILO). The need was also highlighted to promote the development of a forum for SSF associations of northern and southern Mediterranean riparian countries, particularly through specific projects financed by CPCs or by other international, governmental or non-governmental entities.

6.5.2 Establishment of the Working Group on Small-Scale and Recreational fisheries

Directly stemming from the conclusions of the regional conference, the fortieth session of the Commission established the WGSSF, whose first meeting was held on 12–13 September 2017 at the FAO headquarters in Rome, Italy (GFCM, 2017). The main objective of the working group is to coordinate activities, both technical and institutional, relating to small-scale and recreational fisheries, in order to fill the main data gaps relating to those sectors and to support their sustainable development within a Blue Growth perspective. The first meeting brought together relevant stakeholders – scientists, representatives of national administrations, civil society representatives and fishers – to review the state of the art and to discuss priorities for future work. It was agreed that separate working groups for SSF and recreational fisheries would be held in the future, with the possibility for joint sessions when necessary to discuss

common topics, and that technical work would be prioritized to better improve available knowledge and the characterization of these two sectors.

6.5.3 High-level conference on sustainable small-scale fisheries in the Mediterranean and the Black Sea

Representing the culmination of work carried out in recent years, the High-level conference on sustainable small-scale fisheries in the Mediterranean and the Black Sea was held in Malta on 25–26 September 2018. Recognizing that important progress had been made in the region, the conference sought to highlight best practices and discussed strategies for scaling up and expanding best practices throughout the region. Noting that such replication would take strong political will and coordinated action, a ministerial declaration was signed on a regional plan of action for small-scale fisheries in the Mediterranean and the Black Sea (RPOA-SSF). This RPOA-SSF elicits political support to ensure the long-term environmental, economic and social sustainability of SSF and sets forth specific actions to be implemented over the next ten years.

6.6. WAY FORWARD

6.6.1 Implementing the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea

With the adoption of the RPOA-SSF, concrete objectives, principles and actions have been set in motion to reinforce SSF in the Mediterranean and the Black Sea over the next decade (2018–2028) towards their long-term sustainability. In particular, the RPOA-SSF sets forth nine priority topics for which action should be taken in the course of implementing the RPOA-SSF.

a) Scientific research

The role of integrated research is underlined within the RPOA-SSF. Countries are called to, *inter alia*, take action to improve knowledge on the value and social role of SSF, to foster understanding of the interaction between SSF and the marine environment, and to study climate change adaptation strategies for SSF. Innovation to support the SSF sector is encouraged.

b) Small-scale fisheries data

In recognition of the gaps in available data to support research, advice and management of SSF, the RPOA-SSF calls for the development of information and data collection systems that involve small-scale fishers in the collection of regional-level data on fleets and fishing activities, including the recording of all catches. Furthermore, countries are encouraged to establish national fishing fleet registers that also include SSF vessels.

c) Small-scale fisheries management measures

The RPOA-SSF stresses the need for appropriate management of SSF, taking into account the particularities and vulnerabilities of the sector while also ensuring adequate resource management to ensure the long-term sustainability of SSF. Proposed measures to be promoted include, among many others: safeguarding SSF access to marine resources and ensuring appropriate landing facilities for SSF; investing in fishing technology to enhance fuel efficiency and promote selectivity; promoting the use of technology to reinforce safety at sea, traceability issues and monitoring, control and surveillance; and promoting co-management efforts, including within the context of combating illegal, unreported and unregulated (IUU) fishing.

d) Value chain of small-scale fisheries

The need for innovation within SSF value chains is a crucial component of the RPOA-SSF, with a view to improving efficiency and profitability of SSF. Fishing cooperatives are cited as playing a key role in improving market access and bargaining power of SSF. Further gains may be found through the creation of fish product labels and certified brands, by improving traceability of SSF products and by enhancing direct sale arrangements. Action to support fishers is called for; however, equally important are efforts to educate consumers on responsible consumption and the importance of purchasing local, high-quality and sustainable fish products.

e) Associating small-scale fisheries to the participative decision-making processes

A common thread throughout the RPOA-SSF is the reinforcement of participatory processes. Actions to support the SSF sector should be taken in consultation with stakeholders. To enhance the voice of small-scale fishers, their organization into associations should be supported and their representation in planning processes, including marine spatial planning, should be encouraged. Co-management is a model to be encouraged and replicated throughout the region.

f) Capacity-building

Recognizing that there is a need to build capacity to ensure that fishers can successfully participate in decision-making processes, the RPOA-SSF calls for concerted action to enhance regional SSF platforms, promote access to financial resources, and facilitate education and training opportunities. Particular attention should be paid to promoting such opportunities to women and youth who are active in SSF.

g) Promote decent work

In support of implementing the SSF Guidelines in the Mediterranean and the Black Sea, the RPOA-SSF recognizes the important topics of decent work and social protection for small-scale fishers. Specific actions are called for to foster understanding of the role of these issues in promoting the overall sustainability of SSF.

h) Role of women

The RPOA-SSF recognizes the important, but often unseen, contribution of women to SSF and underlines the need for their empowerment and equal participation in decision-making processes.

i) Climate and environment

Finally, the RPOA-SSF recognizes the role SSF may play in climate change adaptation and mitigation plans. In this context, the role SSF may play in a circular economy is highlighted, including in the collection of marine litter. Furthermore, the impact of invasive species is cited and action is called for to promote innovative solutions for their valorization.

The GFCM will necessarily play a critical role in the implementation of the RPOA-SSF over the coming decade, including through the provision of technical assistance to countries. A principal role of the GFCM will also be to steer, coordinate and monitor progress made. To this end, tools already developed within the GFCM, such as the online interactive mapping tool, have the potential to provide transparent and up-to-date information on the status of implementation, as well as to facilitate knowledge sharing and promote the replication of best practices within the region.

FISHERIES MANAGEMENT MEASURES

7

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7. Fisheries management measures

7.1. INTRODUCTION AND SOURCES OF INFORMATION

This chapter provides a summary of the main fisheries management measures adopted in recent years at the regional and subregional levels in the Mediterranean and the Black Sea. It focuses on multiannual management plans and on fisheries restricted areas (FRAs) as two of the main types of management actions used and summarizes adopted measures, especially those that provide additional support for the management of key fisheries and/or priority stocks (see Chapter 5). The chapter also presents the technical work carried out in support of the establishment of management plans, in particular through the use of management strategy evaluation (MSE) methods (Box 12), which allow to simulate expected responses of fisheries to alternative management measures.

The information used in this chapter mainly originates from the following sources: the Compendium of GFCM decisions (GFCM, 2018a); outcomes from the relevant GFCM expert meetings, in particular five workshops on the implementation of management measures in select case studies in the Mediterranean and the Black Sea held in 2014–2016, and five workshops on the assessment of management measures, organized in 2016–2018. In addition, a summary is provided on the technical work for the management of European eel (*Anguilla anguilla*) and red coral (*Corallium rubrum*) carried out through dedicated expert meetings.

7.2. FISHERIES MULTIANNUAL MANAGEMENT PLANS

Multiannual management plans constitute essential tools for fisheries management as they guide the implementation of management measures towards the overall objectives of achieving and maintaining the sustainable exploitation of fishery resources, counteracting and preventing overfishing, and ensuring high and long-term yields. This is typically addressed through the establishment of specific objectives, indicators and reference points, such as attaining and maintaining maximum sustainable yield (MSY) as gauged against target levels of fishing mortality (F_{MSY}) and/or stock biomass (e.g. precautionary biomass, B_{PA}, and limit biomass, B_{LIM} – see Chapter 5 for more indications of reference points and indicators). Accordingly, multiannual management plans include a number of management measures (e.g. spatio-temporal restrictions, effort and catch limitations, technical measures) and adaptive mechanisms to be implemented in order achieve objectives within a desired timeframe and maintain them (Table 29). It is important that management plans be drafted at least within a precautionary context and be adaptable to changing and evolving stocks, fisheries and environments.

The establishment of regional or subregional management plans is quite recent in the Mediterranean and the Black Sea: the first multiannual management plan was established for small pelagic fisheries in the Adriatic Sea in 2013. In the context of the GFCM, management plans are based on extensive technical work, such as the compilation of available scientific evidence useful for scientific advice, the identification of the management plan scope and objectives, and consultation with experts and national representatives on potential management measures to be established for particular fisheries. When detailed information from comprehensive scientific monitoring is available, management plans are based on quantitative objectives and scientific advice stemming from the simulation of potential effects of alternative management scenarios (Box 12). However, when information is scarce

or fragmented, management plans are based on precautionary principles that are agreed between experts and national representatives. In addition to these management plans, riparian countries and supranational entities such as the European Union also establish their own management plans, which should be compliant with the Agreement for the establishment of the General Fisheries Commission for the Mediterranean (GFCM Agreement) and in line with existing regional decisions.

This section summarizes the main regional or subregional management plans developed or in an advanced state of development for the Mediterranean and the Black Sea. When available, simulations of the potential effect of alternative management scenarios are presented as they provide insights on the response of fisheries to the decisions taken. Some information on the requirements for monitoring control and surveillance included in management decisions adopted is also provided in Box 13.

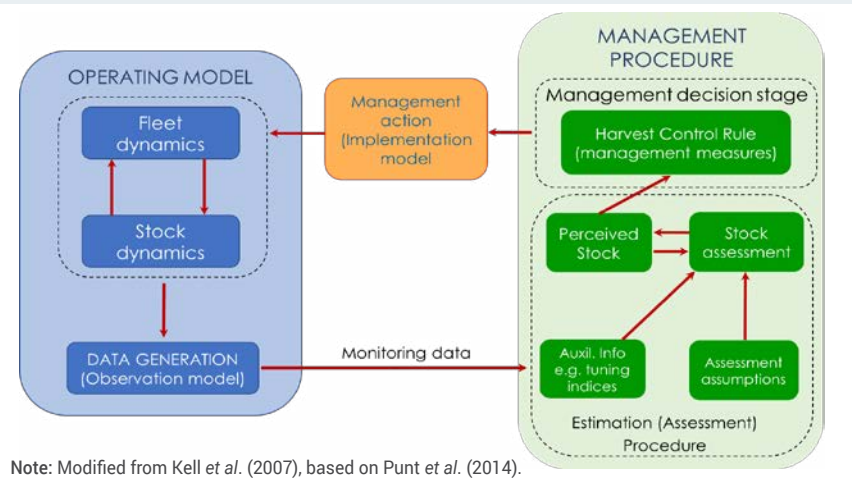
BOX 12 – Simulating the potential effects of alternative management scenarios through management strategy evaluation

Management strategy evaluation (MSE) is a statistical simulation framework developed to assess the outcomes of different management strategies with the aim of evaluating the trade-offs in their performance across a range of management objectives (Smith, 1994). MSE is currently recognized as the most appropriate and comprehensive means to compare management strategies and is widely applied worldwide.

The MSE framework comprises a number of interrelated components (Kell *et al.*, 2007; Rademeyer Plagányi and Butterworth, 2007; Punt *et al.*, 2014).

- Operating model (OM), which simulates the "true" system from fleet dynamics to stock dynamics, data collection and uncertainty. The OM is conditioned on data and generates new data when projected forward. The OM is often more complex than the assessment model, and there may or should be more than one OM to account for different versions of reality.
- Management procedure (MP), which represents the observed system, from data collection and estimation (assessment) to management implementation via predefined control rules. In the MP, the data generated by the OM are used in an assessment that generates an observed (or "perceived") stock, which is, in turn, fed into a harvest control rule resulting in a management action (e.g. a total allowable catch [TAC] or allowable fishing effort).
- Feedback loop: the management action resulting from the observed system (MP) then acts on the "true" system (OM) through a feedback loop. It is the presence of this feedback control that distinguishes MSE from risk analysis or projections.

MSE can also be used when stock assessments are not possible ("model-free" or empirical approaches), such as in data-poor situations, through the application of management actions directly from the data generated by the OM (Punt *et al.*, 2014).



Note: Modified from Kell *et al.* (2007), based on Punt *et al.* (2014).

Conceptual representation of the management strategy evaluation process

BOX 12 (Continued)

The development of an MSE should involve a strong interaction between scientists (analysts) and stakeholders/decision-makers (Smith, 1994; Smith, Sainsbury and Stevens, 1999; Punt *et al.*, 2014). Stakeholders/decision-makers must be involved in the identification of the general goals of the MSE (i.e. the management objectives) and of the management strategies to be simulated. The final results should be presented clearly, allowing decision-makers to take decisions on the final management strategy to be adopted and to make the policy call.

7.2.1 Small pelagic fisheries in the Adriatic Sea (geographical subareas 17–18)

The multiannual management plan for small pelagic fisheries in the Adriatic Sea[1] was adopted in 2013. It establishes management measures and harvest control rules for fisheries targeting sardine (*Sardina pilchardus*) and European anchovy (*Engraulis encrasicolus*) in the northern Adriatic Sea (GSA 17), and transitional conservation measures for small pelagic fisheries in the southern Adriatic Sea (GSA 18); further precautionary and emergency measures were established for 2015[2] and 2016[3]. Since then, additional recommendations have been adopted establishing supplementary precautionary and emergency measures for this fishery in both GSAs 17 and 18 for 2017–2018[4] and for 2019–2021.[5] The general objective is to ensure that the exploitation levels of small pelagics in the Adriatic Sea are at MSY by 2020. These recommendations (Table 29) provide for the reduction of fishing mortality in the Adriatic Sea, through the following measures:

- a limit on the number of fishing days per year, which in 2019, 2020 and 2021 must not exceed 180 fishing days per year, with a maximum of 144 fishing days targeting each species separately;
- a limit on fleet capacity at 2014 levels for trawlers and purse seiners actively fishing small pelagic stocks in 2019, 2020 and 2021;
- a limit on catch at 2014 levels for both species combined;
- spatio-temporal closures from 15 to 30 continuous days to protect nursery and spawning areas and covering the entire distribution of small pelagic stocks in the Adriatic Sea, during specific periods of the year (from 1 October to 31 March for sardine; from 1 April to 30 September for European anchovy);
- additional spatio-temporal closures for vessels over 12 m LOA for no less than seven months in 2019, eight months in 2020 and nine months in 2021, covering at least 30 percent of the areas previously identified as nursery areas or those that are important for the protection of early-age classes of fish (in territorial and inner seas).

An MSE for the small pelagic fishery in the Adriatic Sea has been under development since 2014 within the GFCM. It started from a qualitative appraisal of alternative management measures that was later developed into a full quantitative framework. Stakeholders, decision-makers, managers and scientific experts have been involved since the beginning of the process and

1 Recommendation GFCM/37/2013/1 on a multiannual management plan for fisheries exploiting small pelagic stocks in geographical subarea 17 (northern Adriatic Sea) and on transitional conservation measures for fisheries exploiting small pelagic stocks in geographical subarea 18 (southern Adriatic Sea).

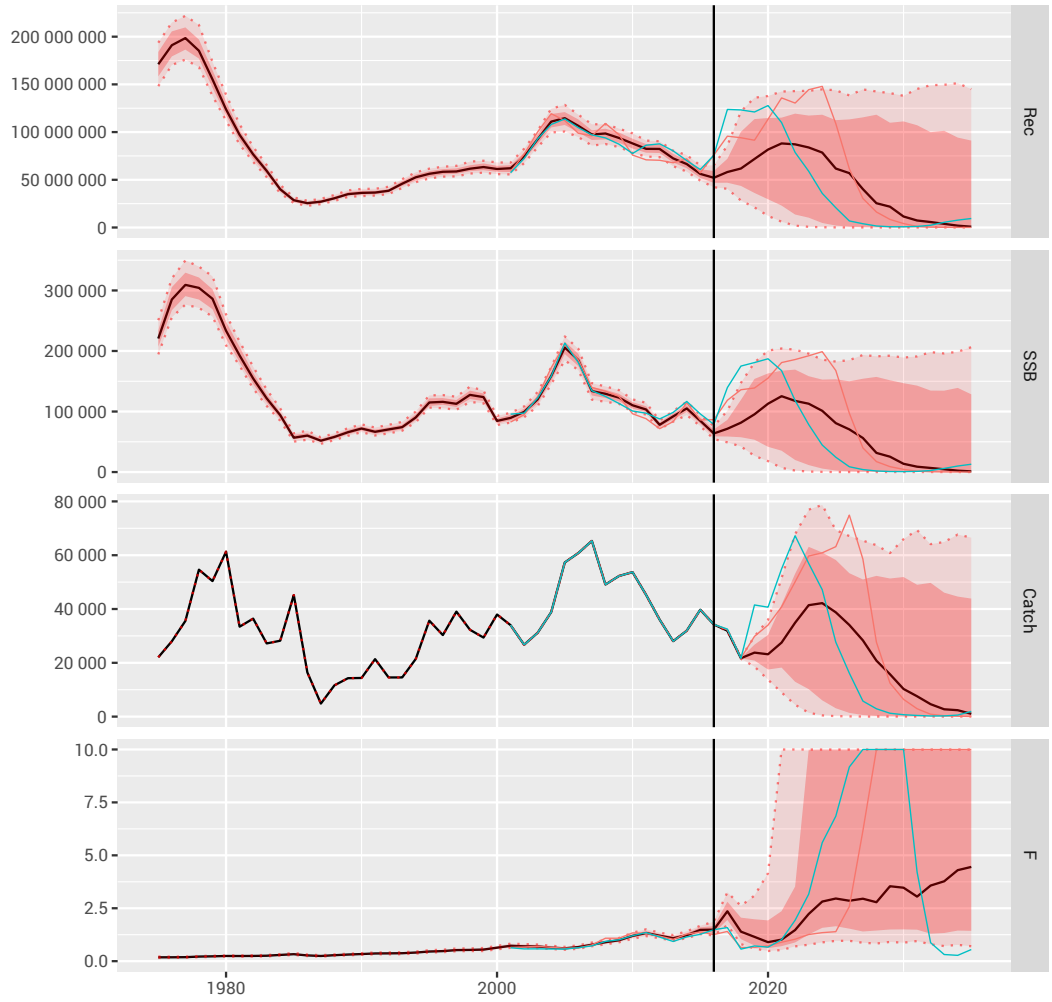
2 Recommendation GFCM/38/2014/1 on precautionary and emergency measures for 2015 on small pelagic stocks in geographical subarea 17 amending Recommendation GFCM/37/2013/1.

3 Recommendation GFCM/39/2015/1 establishing further precautionary and emergency measures in 2016 for small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18).

4 Recommendation GFCM/40/2016/3 establishing further emergency measures in 2017 and 2018 for small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18).

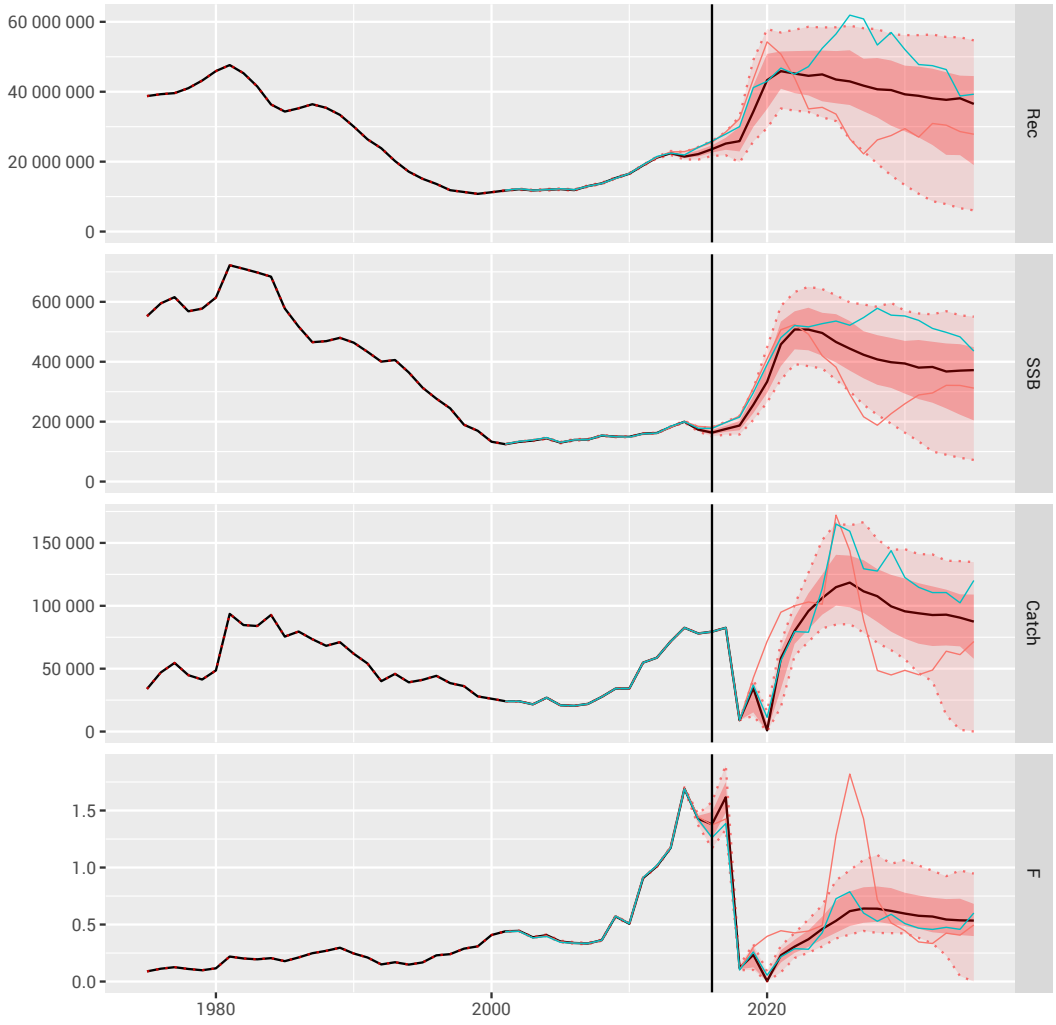
5 Recommendation GFCM/42/2018/8 on further emergency measures in 2019–2021 for small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18).

yearly meetings have been organized to agree on the management scenarios to be investigated. The most recent work, performed in 2018, included a revision of the methodology used in previous years. The MSE simulated the impacts of 18 different management scenarios in the future (up to 2036) including: the protraction of current fishing mortality (F status quo, F_{SQ}); the harvest control rule (HCR) contained in Recommendation GFCM/37/2013/1; a catch limit set at the catches of 2014 and other measures outlined above as well as contrast scenarios. The results obtained showed that, for both species, maintaining the status quo would result in a high risk of spawning stock biomass (SSB) falling below B_{LIM} in the short, medium and long term (example given in Figure 93 for European anchovy). They also showed that a recovery of the stock could be possible under a restricted number of scenarios with a low risk of dropping below B_{LIM}, at least in the medium term; for example, an effective implementation of the HCR foreseen under Recommendation GFCM/37/2013/1 would allow sardine SSB to recover with a low risk of dropping below B_{LIM} in the short and medium term (0 and 0.4 percent, respectively) and a relatively low risk (16.8 percent) in the longer term (Figure 94). In 2018, the MSE was, for the first time, integrated with a socio-economic component. It was considered premature to use these results for scientific advice but it is generally agreed that, in the future, such analyses would provide indications on the socio-economic impacts, in addition to biological impacts, of different management measures.



Note: The figure shows the median outcome of the simulations (black line) with associated uncertainty (pink shading) and two single iterations (blue and red) for recruitment (Rec, numbers), SSB (tonnes), catch (tonnes) and fishing mortality (F).

FIGURE 93 – Select outcomes of management strategy evaluation performed on small pelagic fisheries in the Adriatic Sea in 2017–2018 (based on reference year 2016): status quo scenario for European anchovy



Note: The figure shows the median outcome of the simulations (black line) with associated uncertainty (pink shading) and two single iterations (blue and red) for recruitment (Rec, numbers), SSB (tonnes), catch (tonnes) and fishing mortality (F).

FIGURE 94 – Select outcomes of management strategy evaluation performed on small pelagic fisheries in the Adriatic Sea in 2017–2018 (based on reference year 2016): harvest control rule of Recommendation GFCM/37/2013/1 for sardine

The results of this analysis, endorsed by the SAC, underline the need to minimize the risk of collapse and the importance of maintaining measures for a certain period of time (three years). These outcomes form the scientific basis of Recommendation GFCM/42/2018/8 on further emergency measures in 2019–2021 for small pelagic stocks in the Adriatic Sea. This recommendation includes, among other measures, a progressive annual 5 percent catch reduction (for CPCs with declared catches over 2 500 tonnes in 2014) until 2021, and the establishment of a voluntary observation and inspection programme.

7.2.2 European hake and deep-water rose shrimp in the Strait of Sicily (geographical subareas 12–16)

The Subregional technical workshop on fisheries multiannual management plans for the western, central and eastern Mediterranean (Tunisia, 2013) and the Follow-up on the implementation of management measures in selected case studies in the Mediterranean (Rome, 2015) drafted a detailed compendium of management measures applicable to the

management of bottom trawling fisheries for deep-water rose shrimp (*Parapenaeus longirostris*) and associated species in the Strait of Sicily (GSA 12–16). In response to this work, the GFCM adopted three recommendations for the management of demersal fisheries in the Strait of Sicily: a first recommendation (in 2015) setting minimum standards for bottom trawl fisheries in the area[6], pending the development and adoption of a multiannual management plan which was adopted as a recommendation the subsequent year[7]; both recommendations were repealed in 2018 by one encompassing all measures[8].

Recommendation GFCM/42/2018/5 on a multiannual management plan for bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (geographical subareas 12 to 16) applies the precautionary approach to fisheries management, ensuring that exploitation levels of European hake (*Merluccius merluccius*) and deep-water rose shrimp are at MSY by 2020 at the latest (Table 29). It includes the following measures:

- protection of nursery areas and essential fish habitats that are important for European hake and deep-water rose shrimp stocks in the Strait of Sicily through FRAs and temporal closures;
- gradual elimination of discards by avoiding and reducing, as far as possible, unwanted catches and progressively ensuring that catches are landed;
- implementation of specific measures to address illegal, unreported and unregulated (IUU) fishing activities (e.g. recording of catches, designation of landing ports, prohibition of transshipment, and establishment of an observation and inspection programme);
- measures to adjust the fishing capacity of the fleets to fishing mortality levels consistent with the MSY, so that fleets become economically viable without overexploiting marine biological resources.

In order to establish a mechanism investigating compliance with these provisions, two recommendations establishing an international joint inspection and surveillance scheme outside the waters under national jurisdiction in the Strait of Sicily (GSAs 12–16) were adopted in 2017 and 2018.[9]

As with small pelagics in the Adriatic Sea, a process towards building an MSE framework was initiated for this fishery whereby medium-term forecasts were carried out to explore the impacts of the different management measures adopted, including the effect of selection grids. This work still needs to be developed further and is also foreseen to investigate the effectiveness of FRAs. Furthermore, in 2018, enough socioeconomic data were collected to carry out a very preliminary analysis and are expected to be integrated in future MSE work.

6 Recommendation GFCM/39/2015/2 on the establishment of a set of minimum standards for bottom trawling fisheries exploiting demersal stocks in the Strait of Sicily, pending the development and adoption of a multiannual management plan.

7 Recommendation GFCM/40/2016/4 establishing a multiannual plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (geographical subareas 12 to 16).

8 Recommendation GFCM/42/2018/5 on a multiannual management plan for bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (geographical subareas 12 to 16), repealing Recommendations GFCM/39/2015/2 and GFCM/40/2016/4.

9 Recommendation GFCM/41/2017/8 on an international joint inspection and surveillance scheme outside the waters under national jurisdiction in the Strait of Sicily (geographical subareas 12 to 16); Recommendation GFCM/42/2018/6 on an international joint inspection and surveillance scheme outside the waters under national jurisdiction in the Strait of Sicily (geographical subareas 12 to 16), amending Recommendation GFCM/41/2017/8.

7.2.3 Black Sea turbot (geographical subarea 29)

Following the adoption of recommendations establishing minimum measures for bottom-set gillnet fisheries for turbot (*Scophthalmus maximus*) in the Black Sea[10] and on measures to prevent, deter and eliminate IUU fishing of turbot,[11] the GFCM adopted two additional recommendations regulating this fishery. Their purpose is to counteract turbot overfishing and restore the size of the Black Sea turbot stock in order to provide high long-term yields consistent with MSY. With Recommendation GFCM/40/2016/6 on the scientific monitoring, management and control of turbot fisheries in the Black Sea (GSA 29), a number of management measures were established (Table 29) to begin fishery management while gathering data and developing a full management plan. In particular, the recommendation establishes that, as of 2018, the average level of fishing opportunities (quotas) allocated in 2013–2015 should not be exceeded, or for the countries not applying a quota system, the average level of catches or of fishing effort deployed in 2013–2015 should be maintained. In addition, a yearly closure of at least two months during the spawning season of turbot (April–June) is required for each riparian country (Table 29).

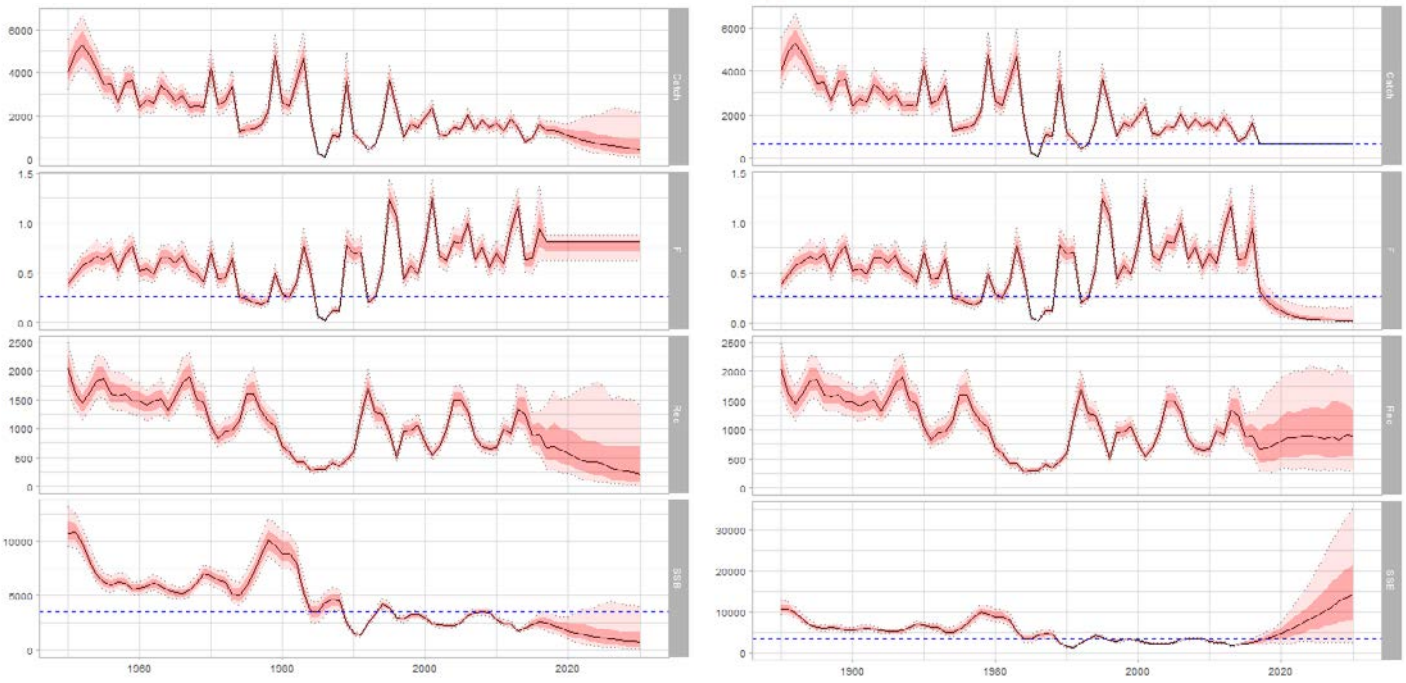
Recommendation GFCM/40/2016/6 also defines the work to be carried out to collate all available information for the formulation of a full management plan, including: a regular assessment of the stock; an evaluation of fishing effort; the assessment of possible management measures; the definition of adequate dimensions of bottom-set gillnets, and the proposal of minimum requirements for their marking and identification. Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (GSA 29) advances on previous work as it establishes that further transitional precautionary management measures must be implemented to reduce the risk of stock biomass level dropping below biologically sustainable levels (Table 29) while developing the full plan. Hence, all vessels fishing for turbot are required to have a special valid fishing authorization, and each riparian country must ensure that adequate mechanisms are in place for recording each fishing vessel in a national fleet register and recording catches and fishing effort both logbooks and remote sensing, as well as through catch and effort sampling surveys. In addition, fishing fleet capacity or fishing effort should be maintained at the levels authorized and applied in recent years. A total allowable catch (TAC) is set at 644 tonnes for 2018–2019, and each authorized vessel shall not exceed a maximum number of 180 fishing days per year. In addition, the status of the turbot stock must be regularly assessed and the level of current fishing mortality established in order to provide the GFCM with necessary elements for setting target reference points.

Furthermore, this recommendation foresees that the biological, economic and social implications of alternative management scenarios be assessed to inform the future revision of the contents of a management plan. Bearing this in mind, an MSE process was started in 2017 whereby a number of management scenarios agreed between stakeholders, managers and scientists were simulated and the outcomes evaluated with respect to the reference points determined for fishing mortality (F_{MSY}) and SSB (B_{LIM} and B_{PA}). In the case of Black Sea turbot, seven alternative management scenarios were tested, including F_{SQ}, the attainment of F_{MSY} and B_{PA} by 2020 and the application of a TAC as per Recommendation GFCM/41/2017/4. The results showed that, while Black Sea turbot stock is currently at very low levels of SSB and would be driven towards collapse should the situation of 2016 continue (F_{SQ}), (Figure 95, left),

10 Recommendation GFCM/37/2013/2 on the establishment of a set of minimum standards for bottom-set gillnet fisheries exploiting turbot and for the conservation of cetaceans in the Black Sea

11 Recommendation GFCM/39/2015/3 on the establishment of a set of measures to prevent, deter and eliminate illegal, unreported and unregulated fishing in turbot fisheries in the Black Sea

it is also responsive to decreases in catch and fishing mortality. Hence, the implementation of a TAC of 644 tonnes, assuming a 100 percent curb of IUU fishing, would allow the stock to quickly recover to large biomass values with a relatively low probability of SSB falling below B_{LIM} (11.6 percent in 2030) (Figure 95, right). These results provide grounds for the continuation of fishing activities at levels that are acceptable for both the population and the fishery, provided the adequate management measures are adopted.



Note: The figure shows the median outcome of the simulations (black line) with associated uncertainty (pink shading) for catch (tonnes), fishing mortality (F), recruitment (Rec, numbers) and SSB (tonnes); F_{MSY} and B_{LIM} are shown as dashed blue lines.

FIGURE 95 – Black Sea turbot management strategy evaluation: F_{SQ} scenario (left) and total allowable catch scenario (right)

7.2.4 Blackspot seabream in the Alboran Sea (geographical subareas 1–3)

As a result of the inclusion of blackspot seabream (*Pagellus bogaraveo*) in the list of priority species for the western Mediterranean subregion, and following the requirement to provide elements for the management of this species in the Strait of Gibraltar, the GFCM has started working towards providing advice in view of the drafting of a management plan. Following a first session in 2017 dedicated to blackspot seabream within the framework of the Subregional Committee for the Western Mediterranean and discussions held at the Working Group on Stock Assessment of Demersal Species (WGSAD) in the same year, the GFCM adopted Recommendation GFCM/41/2017/2 on the management of blackspot seabream fisheries in the Alboran Sea (GSAs 1 to 3) for a two-year transition period in 2017. This recommendation aims at improving the exploitation pattern as well as scientific, technical and socio-economic knowledge of blackspot seabream fisheries in GSAs 1–3, covering both commercial and recreational fishing vessels targeting the species. In line with the precautionary approach, the objective of the transitional measures set out in the recommendation is to start preparing the ground for a future management plan while reducing the risk that, in the absence of an assessment of the status of the stock, the biomass level of the stock could drop below undesirable values. Transitional measures include: maintaining fleet capacity or fishing effort at levels authorized and applied in recent years; establishing a mechanism to ensure that daily catches and bycatch are declared; recording or estimating catches from recreational

fishing; marking passive fishing gear; establishing a list of authorized vessels mounting a geolocalization system (e.g. VMS) on all vessels over 12 m LOA (Table 29). The recommendation foresees that collected information on the fishery at country level will allow for the provision of descriptive information and advice on: the characteristics of fishing gear (e.g. maximum length of longlines and fixed nets and number, type and size of hooks); deployed nominal fishing effort (e.g. number of fishing days per week times the relevant unit of activity, e.g. hooks) and overall catch levels by commercial fishing fleets; an estimate of recreational fisheries catches and their impacts; conservation and management reference points; socio-economic effects of alternative management scenarios; and possible spatiotemporal closures. In order to address the requirements of Recommendation GFCM/41/2017/2, and with the aim of providing technical advice on how to effectively implement it, the Subregional Committee for the Western Mediterranean discussed and proposed elements of a potential management plan, which were endorsed by the SAC in 2018. The scope, objectives, fisheries management measures and research priorities were thus reviewed, and a roadmap for the quantitative assessment of the species was proposed, including a data preparation meeting, followed by a benchmark assessment to determine and agree on the status of the stock.

7.2.5 Deep-water red shrimp fisheries in the eastern-central Mediterranean (geographical subareas 12–16; 19–27)

The deep-water red shrimp fishery in the eastern-central Mediterranean is one of the case studies selected to test the feasibility of the GFCM guidelines on management plans.[12] The feasibility phase ended with the compilation of a background technical document in support of the management plan for bottom trawl fisheries exploiting deep-water blue and red shrimp (*Aristeus antennatus*) and the giant red shrimp (*Aristaeomorpha foliacea*), in the eastern-central Mediterranean (GSAs 12–16; 19–27). This document summarized all available information on the fishery and the two target species. The forty-first session of the GFCM acknowledged the need to advance towards a management plan for the deep-water red shrimp fishery, and recommended that a technical session be organized to address this issue. As a result, the Subregional Committees for the eastern and for the central Mediterranean revised the existing background technical document and drafted specific technical elements for the management of the fishery. These elements outlined examples of management measures related to this fishery (Table 29) and they were later endorsed by the SAC, in 2018. Owing to the fragmentary information available on the fishery, the SAC stressed the need to provide precautionary advice while collecting data in order to perform a formal analytical assessment of the status of the stocks. The SAC thus endorsed a roadmap for the assessment of the two species and concurrently recommended to immediately establish management rules to ensure sustainable exploitation. In this respect, particular emphasis was placed on the importance of identifying the main fishing grounds and establishing the historical fishing footprint, which would also serve as the basis for the future implementation of exploratory fishing protocols, as suggested for deep-sea fisheries by the Working Group on Vulnerable Marine Ecosystems (WGVME). As a result, in 2018, the GFCM adopted two recommendations, one for the Levant Sea (referring to GSAs 24, 25, 26 and 27) and one for the Ionian Sea (referring to GSAs 19, 20 and 21), on multiannual management plans for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp.[13]

12 Decision GFCM/36/2012/1 on guidelines on a general management framework and the presentation of scientific information for multiannual management plans for sustainable fisheries in the GFCM area of application.

13 Recommendation GFCM/42/2018/3 on a multiannual management plan for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Levant Sea (geographical subareas 24, 25, 26 and 27); Recommendation GFCM/42/2018/4 on a multiannual management plan for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Ionian Sea (geographical subareas 19, 20 and 21).

These recommendations aim at ensuring that the stocks and the fisheries are kept at biologically sustainable levels while preparing for a future management plan. They provide for the implementation of the following transitional management measures:

- maintaining the fishing fleet capacity or fishing effort at the levels authorized and exerted during the years 2014–2017 for the exploitation of the two deep-water shrimp species in the Levant Sea and the Ionian Sea;
- establishing of a list of vessels authorized to fish for the two deep-water shrimp species with specific reporting (operating days and areas as well as catch) and landing obligations;
- designating of additional spatial/temporal restrictions to protect juvenile aggregations;
- ensuring specific measures are implemented to address IUU fishing activities;
- setting-up of an observation and inspection programme to ensure compliance with the conservation and management measures contained in the recommendations.

In addition, the recommendation foresees that the status of the stocks be regularly assessed and the biological reference points be set following the collection of relevant data through adequate scientific monitoring and in accordance with the precautionary principle. It also provides that the biological, economic and social implications of implementing several management scenarios be assessed.

7.2.6 European eel in the Mediterranean Sea

The importance of European eel (*Anguilla anguilla*) fisheries is acknowledged in coastal areas, lagoons and inland waters of most GFCM countries. As early as 2003, a possible concern for European eel in the Mediterranean area was raised, and its management has become a priority since the species was included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2009. At the GFCM level, the development of a management plan for European eel covering all Mediterranean subregions was recommended during a Transversal Workshop on European Eel, in 2010, and the species was then included as a special regional case study on the feasibility phase of the GFCM guidelines on management plans. The workshop also suggested the engagement of the GFCM in the Joint Working Group between the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) and the International Council for the Exploration of the Sea (ICES) on Eels; as a result, a Joint ICES/EIFAAC/GFCM Working Group on European eel was approved by the GFCM in 2012, and has been active since 2014. In 2013, the GFCM agreed to support an eel pilot action in order to contribute towards the participation of Mediterranean countries in actions regarding the eel stock at the global level. Within this pilot action, in 2015, the focus was initially placed on carrying out a first assessment of the European eel stock in the Mediterranean Sea. Subsequently, in 2016 and 2017, there were two liaison actions to enhance coordination and participation of GFCM countries in the Working Group focusing on, respectively, drafting terms of reference for a Mediterranean management plan and improving the framework for the collection of European eel fisheries data, also in line with the DCRF. In 2017, the forty-first session of the GFCM further acknowledged the critical status of European eel in the Mediterranean, recommending to hold a meeting on the management of the species. In response to this, the Workshop on the management of eel was organized in 2018 with the objective of reviewing previous work, identifying management priorities, and providing advice on the implementation of management measures to ensure the recovery of the stock and the future sustainability of the fishery. As a result, technical elements for the management of European eel in the Mediterranean Sea, proposing both immediately applicable precautionary measures and other adaptive measures based on future advice on the evolution of the state of resource and the fishery were drafted and then endorsed by the SAC

(Table 29). These technical elements include examples of management measures specific to this fishery such as spatial measures (e.g. establishment of closed areas, reduction of the area available to fishing in lagoons and lakes, closure of fisheries in specific inland water habitats) and temporal measures (e.g. closed seasons, by life stage, including a minimum of three months for the different life stages), gear restrictions (e.g. restriction of authorized gear types by life stage, specific regulations on the characteristics of traps and static nets, longlines and fish barriers), participatory restrictions (e.g. fishing authorizations with requirements such as the type of gear used and specific requirements such as the number of cod-ends, and criteria for their allocation) and catch and restocking restrictions, as well as reporting obligations (on catches, location of landing points and origin and destination of catches) (Table 29). On the basis of this advice, the GFCM adopted Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel (*Anguilla anguilla*) in the Mediterranean, which establishes transitional precautionary management measures while preparing the grounds for a future management plan. The transitional measures include: effort and catch reductions, temporal and spatial fishing closures (FRAs), measures to fight IUU fishing (e.g. catch registration, traceability, control); and the requirement to communicate existing national management plans and national management measures and to implement a minimum set of measures (Table 29). The recommendation also foresees the collection of all available data, including on recreational fishing and restocking activities, as well as the launch of a research programme and the establishment of a working group to examine management measures for eel (Table 29).

7.2.7 Red coral in the Mediterranean Sea

Red coral (*Corallium rubrum*) is a precious coral that belongs to the phylum Cnidaria, Octocorallia subclass and Coralliidae family. Red coral is exploited in Mediterranean waters for its skeleton of calcium carbonate (or limestone), whose skeletal axis is used as a gemstone to make ornaments and jewelry. However, only a few countries have a history of red coral harvesting in the Mediterranean Sea. In Albania, Malta and Monaco, harvesting red coral is prohibited, while in Croatia, France, Italy, Montenegro, Spain and Tunisia, red coral is exploited under different national regulation frameworks (including the implementation of multiannual closures to allow for the recovery of exploited red coral banks). In Algeria, Greece and Morocco, red coral fisheries are temporarily closed.

Considering the high vulnerability of red coral to fishing activities (i.e. harvesting of a sessile animal with slow growth), since the 1980s, the GFCM has always included red coral in its programme of work and discussed measures to ensure the sustainable harvesting of red coral; in this view, GFCM has organized several meetings on the topic, following a participatory approach as to involve all stakeholders in discussions. As result of these consultations, four recommendations addressing red coral harvesting have been adopted by the GFCM since 2011, with the most recent regional adaptive management plan adopted in 2017[14] (main measures are included in Table 29).

The full implementation of the GFCM measures including the newly established management plan is expected to counteract or prevent overfishing, in order to ensure long-term yields while maintaining the size of red coral populations within biologically sustainable levels. According to the new management plan, and in addition to the measures implemented before 2017, CPCs should establish an individual system of daily and/or annual catch limitation, maintain fishing effort at the levels authorized and applied in recent years for the exploitation

14 Recommendation GFCM/41/2017/5 on the establishment of a regional adaptive management plan for the exploitation of red coral in the Mediterranean Sea.

of red coral, and temporarily close the area concerned to any red coral fishing activity when undersized specimens of red coral (i.e. colonies whose basal diameter is lower than 7 mm) exceeds 25 percent of the total catch harvested from a given red coral bank for a given year. Furthermore, countries actively harvesting red coral should introduce national closures for the protection of red coral on the basis of available scientific advice.

In addition to this, the GFCM continues to work on actions to eliminate IUU fishing of red coral. Discussions are ongoing on potential traceability mechanisms to trace red coral from the time it is landed and sold as a raw material to the manufactures until when it reaches the retailer as a finished product. These mechanisms would allow to certify that red coral is collected in compliance with GFCM or national regulations, which would also be effective in eradicating IUU fishing of red coral. Moreover, the need to carry out scientific research on red coral has long been acknowledged by the GFCM, due to the fact that only small areas of red coral populations in Italy, France and Spain have been studied over the last three decades. Data such as biomass, recruitment and mortality rate, that are necessary to construct a population dynamics model to estimate future resources and landings, are almost non-existent, and growth rate has only been studied in a few "shallow" populations. During the last Workshop on red coral organized by the GFCM in 2017, experts remarked the urgency to launch a Mediterranean scientific project in order to fill several knowledge gaps on the different traits of red coral life history, as this is essential to support any red coral management measure. In line with the provisions of Recommendation GFCM/41/2017/5, the GFCM is about to launch a Mediterranean research programme on red coral to support the provision of scientific advice for the management of this fishery.

BOX 13 – Monitoring control and surveillance of management measures

Monitoring, control and surveillance (MCS) measures are now fully integrated in the context of multiannual management plans, with the objective to fight against IUU fishing. These measures are more and more systematically included in the provisions of the binding decisions that are adopted to restore commercially exploited stocks in the Mediterranean and the Black Sea, in particular the obligation for authorized vessels to have a functioning vessel monitoring system (VMS) onboard. The original requirements on the establishment of a VMS were adopted around ten years ago under Recommendation GFCM/33/2009/7, whereby CPCs were requested to equip vessels over 15 m with satellite transponders. VMS is now an integral part of all multiannual management plans, either in place or under discussion. Another MCS measure currently included or foreseen in such plans is the obligation to list the ports or landing points where fishing catch can be landed, thereby allowing effective inspections and better data collection.

In addition, MCS measures within multiannual management plans call upon CPCs to cooperate in sharing information relating to cases of IUU fishing. This is achieved through the set- up of an assessment system whereby a working group evaluates the effectiveness of the established MCS measures in deterring IUU fishing. At the same time, international pilot projects establishing inspection schemes in select areas – carried out by the European Fisheries Control Agency (EFCA) in close cooperation with the GFCM Secretariat – are also included in these plans. These projects will help the GFCM in further evolving in addressing critical areas such as inspections at sea, procedures for the effective investigation of IUU fishing infringements and observer programmes.

The Compliance Committee (CoC) and its Working Groups on IUU fishing and on VMS and control systems oversee the progress made by CPCs in the implementation of MCS measures on an annual basis. This is complemented with the provision of technical assistance by the GFCM Secretariat in the field of MCS, when countries need to build their control capacity. It is expected that further advances will be achieved by the GFCM thanks to the launching of a regional pilot VMS and control systems that will serve the purpose of harmonizing MCS measures at the national level.

7.3. SPATIAL-MANAGEMENT MEASURES (FISHERIES RESTRICTED AREAS)

In the Mediterranean Sea, similarly to most coastal ecosystems across the world, marine protected areas (MPAs) have become a primary tool for *in situ* habitat and biodiversity conservation, with more than 1 000 MPAs established in the area (Rodríguez-Rodríguez *et al.*, 2016). Although there is a growing consensus that MPAs protect the structure and function of ecosystems and rebuild and sustain fisheries, particularly small-scale fisheries, the real potential of MPA networks in protecting most of the marine biodiversity from multiple threats is still unknown (Coll *et al.*, 2012). In addition, traditional MPAs are concentrated in coastal zones, but there is a need to start addressing the protection of deep-sea areas. Nonetheless, MPAs remain the main global tool for the conservation of marine biodiversity (FAO, 2011; Coll *et al.*, 2012; Rodríguez-Rodríguez *et al.*, 2016).

Considering MPAs *sensu latu* as a tool in support of fisheries management (FAO, 2011), the GFCM has been promoting the establishment of fisheries restrictions within well-delimited areas of the Mediterranean and the Black Sea (GFCM, 2012; GFCM, 2013; GFCM 2015), especially in the deep sea. In 2018, nine FRAs were established by the GFCM to protect essential fish habitats (EFHs) and/or deep-sea sensitive habitats of high ecological value, such as vulnerable marine ecosystems (VMEs), from significant adverse impacts of fishing activities (FAO, 2009b); moreover the possible implementation of two additional FRAs is under discussion. In addition, GFCM spatial fishing restrictions addressing coastal areas were also implemented (Table 28 and Figure 96). With the adoption of several fisheries multiannual management plans, the GFCM indirectly delegated its CPCs to establish additional temporal or permanent FRAs in their territorial waters as a measure to contribute to reversing the overfishing status of select pelagic or demersal stocks.

The existing FRAs are introduced and briefly described below, categorized by their main conservation objective.

7.3.1 Deep-water fisheries restricted area

In 2005, Recommendation GFCM/29/2005/1[15] prohibited the use of towed dredges and trawl nets at depths greater than 1 000 m. The preamble to this recommendation notes that this aims mainly to protect fish stocks and to halt the expansion of fisheries into deeper waters when the stock status is unknown, as a precautionary measure. However, in 2004, the SAC also made reference to the protection of vulnerable habitats and strongly advised to:

> *"refrain expanding deep water fishing operations beyond the limit of 1 000 m, in view of scientific considerations on the presence both of unmapped sensitive habitats (deep water coral banks, sea vents, sea mounts, etc.), and of the fragile nature of deep water fish assemblages as well as the presence of juveniles of different crustacean species at such depths"*.

This precautionary decision addresses both the management of deep-sea bottom fisheries and the protection of deep-sea benthic ecosystems. The area below 1 000 m covers slightly over 1 700 000 km^2 (approximately 59 percent of the GFCM area of application).

15 GFCM/29/2005/1 on the management of certain fisheries exploiting demersal and deep-water species and the establishment of a fisheries restricted area below 1 000 m.

7.3.2 Fisheries restricted areas protecting deep-sea sensitive habitats

In 2006, Recommendation GFCM/30/2006/3[16] established three FRAs in which fishing activities with towed dredges and bottom trawl nets are permanently prohibited, with the aim of protecting deep-sea vulnerable habitats.

The Nile Delta area cold hydrocarbon seeps FRA (4 378 km^2) is located in Egypt (GSA 26), in the south-eastern corner of the Mediterranean Sea, in waters between 300 and 800 m deep off the continental slope. The area hosts an exceptionally high concentration of cold hydrocarbon seeps supporting unique living communities of presumably chemosynthetic organisms such as polychaetes and bivalves (GFCM, 2005; Dupré *et al.*, 2007).

The Eratosthenes Seamount FRA (10 306 km^2) is located in the eastern Mediterranean Sea, about 100 km south of Cyprus (GSA 25), between the Levantine platform to the south and the Cyprus margin to the north, near the subduction zone of the African plate. This flat-topped seamount measures approximately 120 km in diameter at the base and rises 1 500 m above the adjacent bathyal plain, with a summit 756 m below sea level. Studies carried out in the area reveal a rich and diverse ecosystem (Varnavas, Papaioannou and Catani, 1988; Galil and Zibrowius, 1998), notably composed of two species of scleractinian corals (*Caryophyllia calveri* and *Desmophyllum cristagalli*); these were the first records of these species from the Levant basin, and significantly extended their known depth range), a rare deep-water sponge (*Hamacantha implicans,* previously known from a canyon in the western Mediterranean Sea), a remarkably dense population of the deep-water actinarian (*Kadophellia bathyalis*), and unidentified zoantharians and antipatharians. The high faunal diversity and density indicate a uniquely rich environment in the Levant basin, possibly an isolated refuge for relict populations of species that have disappeared from the adjacent continental slope. This area likely represents one the most pristine environments found in the Mediterranean Sea, and therefore its protection from fishing activities is considered a priority (GFCM, 2005).

The Lophelia reef off Capo Santa Maria di Leuca FRA (1 005 km^2) is located off the Italian coast in the Ionian Sea (GSA 19) at depths between 350 and 1 100 m. Many studies demonstrate the presence of a unique ecosystem of white coldwater corals (Tursi *et al.* 2004; Taviani *et al.* 2005) dominated by two colonial scleractinians (*Lophelia pertusa* and *Madrepora oculata*) and by two solitary corals (*Desmophyllum cristagalli* and *Stenocyathus vermiformis*). The coral colonies consist of bioconstructed buildups mostly located on muddy mounds widespread in the study area. Other important taxa (Foraminifera, Porifera, Brachiopoda, Anellida, etc.) were identified and classified as characteristic species, associated species, accompanying species and co-occurring species (Tursi *et al.*, 2004). These species also contribute to the complexity of the Lophelia reef community, with the presence of many suspension feeders and a complex trophic system.

7.3.3 Fisheries restricted areas protecting essential fish habitats

In 2009, Recommendation GFCM/33/2009/1[17] established the Eastern Gulf of Lion FRA (2 018 km^2) in GSA 7, where important spawning aggregations of various demersal species (European hake, monkfish, lobsters, etc.) are reported to occur. The FRA is located in international waters in the north-western Mediterranean Sea, between Spain and France,

16 Recommendation GFCM/30/2006/3 on the establishment of fisheries restricted areas to protect the deep sea sensitive habitats.

17 Recommendation GFCM/33/2009/1 on the establishment of a fisheries restricted area in the Gulf of Lion to protect spawning aggregations and deep sea sensitive habitats.

on the eastern part of the continental slope of the Gulf of Lion, and it hosts the Estaque, Grand-Rhône and Petit-Rhône submarine canyons, as well as a small part of Marti canyon. To protect spawning aggregations of fish, the area is protected from possible increase of fishing pressure; fishing effort on demersal stocks by vessels using towed nets, bottom and mid-water longlines, and bottom-set nets must be kept at its 2008 level. When the recommendation entered into force, relevant CPCs were asked to submit to the GFCM Secretariat the lists of authorized vessels fishing in the area at that time and were required to prohibit new vessels from fishing in the FRA so as not to increase the overall fishing effort. No studies of deep-sea ecosystems in the area were available at the time, but the presence of rare deep-water corals such as *Lophelia pertusa* and *Madrepora oculata* was considered possible, given their recorded presence in similar areas in the western part of the Gulf of Lion (GFCM, 2008).

In 2016, Recommendation GFCM/40/2016/4[18] established, among other relevant management measures addressing demersal fisheries, three FRAs across the Strait of Sicily: the East of Adventure Bank FRA, the West of Gela Basin FRA, and the East of Malta Bank FRA. Fishing activity with bottom trawlers is prohibited in these FRAs in order to the conserve and manage demersal stocks, including European hake and deep-water rose shrimp. The three FRAs cover a total area of 1 698 km^2 (on average 566 km each with a mean depth of 280 m, ranging from 20 to more than 1 700 m). The proposed areas were selected on the basis of the extensive scientific knowledge on the importance and stability of the nursery areas found, on the ecological and biological particularity of the areas for critical life history stages of commercial stocks, and on the long history of overfishing of demersal resources in the northern sector of the Strait of Sicily.

In 2017, Recommendation GFCM/41/2017/3[19] established the Jabuka/Pomo Pit FRA in the central Adriatic Sea (GSA 17), between Italy and Croatia, where any fishing activity with bottom-set nets, bottom trawls, set longlines and traps is permanently prohibited in the core area (zone A) and is temporary prohibited from 1 September to 31 October each year in the buffer area (zone B). Vessels authorized to fish in zone B are subject to fishing effort restrictions. The entire FRA covers an area of 3 143 km^2. The area has been clearly identified as a site with unique physical features influencing the dynamics of waters circulation in the entire Mediterranean basin, in which one of the most important essential fish habitat for European hake and other valuable species such as horned octopus (*Eledone cirrhosa*), monkfish (*Lophius budegassa*) and Norway lobster (*Nephrops norvegicus*) are reported to occur. The area is also known for the regular presence of cetaceans, sea turtles and seabirds, and it hosts vulnerable benthic ecosystems that could be significantly impacted by bottom trawling.

7.3.4 Other coastal fishing restrictions

In 2012, Recommendation GFCM/36/2012/3[20] prohibited fishing with trawl nets within 3 nm off the coast in the entire GFCM area of application, provided that the 50 m isobath is not reached, or within the 50 m isobath where this depth is reached at a shorter distance from the coast, in order to protect coastal sharks and rays and coastal benthic communities (e.g. *Posidonia oceanica* meadows).

18 Recommendation GFCM/40/2016/4 establishing a multiannual plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (GSAs 12 to 16).

19 Recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea.

20 Also included in Recommendation GFCM/42/2018/2 on fisheries management measures for the conservation of sharks and rays in the GFCM area of application, amending Recommendation GFCM/36/2012/3.

In 2016, Recommendation GFCM/40/2016/4 also established a temporal closure to bottom trawlers in GSA 14 (Gulf of Gabès, Tunisia), where bottom trawling is not allowed between the coast and the 200 m depth isobath from 1 July until 31 September each year.

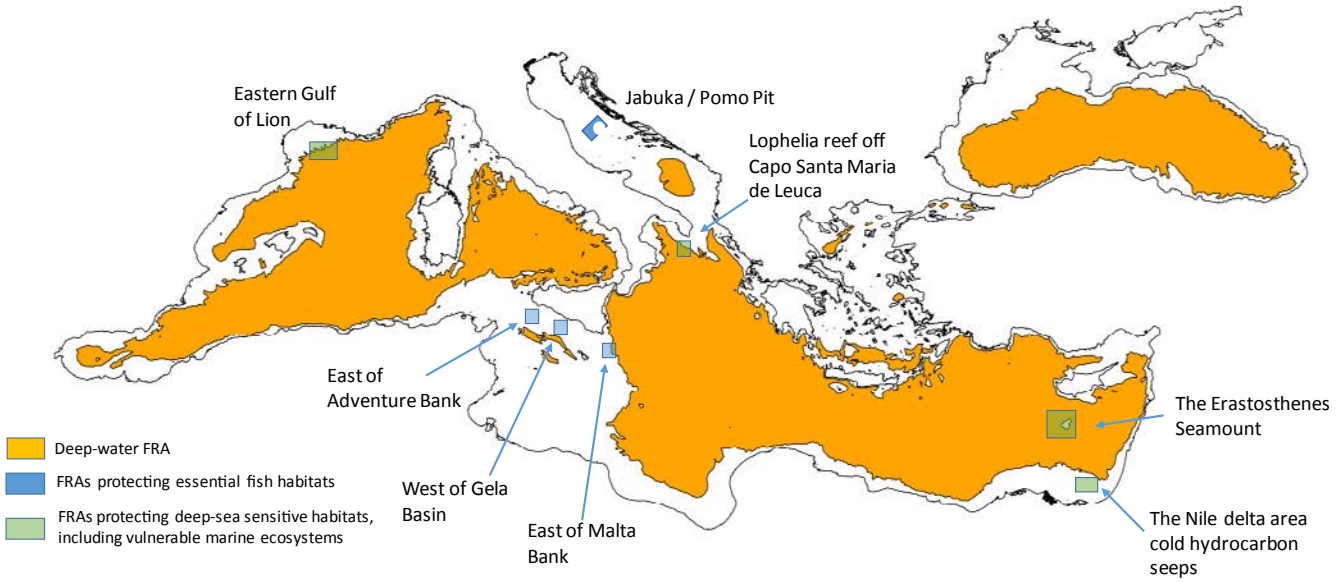


FIGURE 96 – Map of the GFCM fisheries restricted areas

TABLE 28 – GFCM fisheries restricted areas established from 2005 to 2017

N.	Name	GSA	Type of restriction	Year	Conservation objective	Fishing gear
1	**Deep-water FRA** (> 1 000 m)	Multiple	Permanent closure	2005[15]	To protect unknown fish stocks and deep-sea fish habitats below 1 000 m	Towed dredges and trawl nets
2	**Nile Delta area cold hydrocarbon seeps FRA**	26	Permanent closure	2006[16]	To protect deep-sea sensitive habitats	Towed dredges and trawl nets
3	**Eratosthenes Seamount FRA**	25	Permanent closure	2006[16]	To protect deep-sea sensitive habitats	Towed dredges and trawl nets
4	**Lophelia reef off Capo Santa Maria di Leuca FRA**	19	Permanent closure	2006[16]	To protect deep-sea sensitive habitats	Towed dredges and trawl nets
5	**Eastern Gulf of Lion FRA**	7	Fishing effort limit	2009[17]	To protect important essential fish habitats of demersal stocks	Towed nets, bottom and mid-water longlines, bottom-set nets
6	**East of Adventure Bank FRA**	16	Permanent closure	2016[18]	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawl
7	**West of Gela Basin FRA**	16	Permanent closure	2016[18]	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawl
8	**East of Malta Bank FRA**	15	Permanent closure	2016[18]	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawl
9	**Jabuka/Pomo Pit FRA**	17	Permanent closure	2017[19]	To protect important essential fish habitats of demersal stocks (European hake and Norway lobster)	Bottom-set nets, bottom trawls, set longlines and traps
	Coastal fishing restrictions					
1	**Coastal trawl ban** (less than 50 m)	Multiple	Permanent closure	2012[20]	To conserve sharks, rays and coastal habitats	Trawl nets
2	**Gulf of Gabès** (less than 200 m)	14	Temporal closure	2016[18]	To protect important essential fish habitats of demersal stocks	Bottom trawl

Table 29 – Summary of the management measures contained in GFCM recommendations and in technical elements for management

Measures		Recommendations									Proposed in technical elements	
Type of measure	Measure	Small pelagics GSAs 17–18	Demersal resources GSAs 17–18	Demersal resources GSAs 12–16	Turbot GSA 29	Piked dogfish GSA 29	Blackspot seabream GSAs 1–3	Deep-water red shrimps GSAs 19–21; 24–27	European eel Mediterranean Sea	Red coral Mediterranean Sea	Deep-water red shrimps GSAs 12–16; 19–27	Protection of vulnerable marine ecosystems and management of deep-sea fisheries
Spatial restrictions	Closures/FRA to protect EFH	38/2014/1 40/2016/3 42/2018/8	41/2017/3	39/2015/2 40/2016/4 42/2018/5	41/2017/4		41/2017/2	42/2018/3 42/2018/4	42/2018/1	41/2017/5	✓	
	FRA to protect VMEs		41/2017/3								✓	✓
	Depth restrictions		29/2005/1	29/2005/1		36/2012/3 42/2018/2		29/2005/1		35/2011/2	✓ (29/2005/1)	✓ (29/2005/1)
	Precautionary closures								42/2018/1	41/2017/5		
Temporal restrictions	Temporal closures	38/2014/1 39/2015/1 40/2016/3 42/2018/8		40/2016/4 42/2018/5	41/2017/4	36/2012/3	41/2017/2		42/2018/1	41/2017/5	✓	
	Authorized number of fishing days/ times	40/2016/3			41/2017/4							
Catch restrictions	Daily and/or annual catch limitation/TAC	40/2016/3			41/2017/4				42/2018/1	41/2017/5	✓	
	Habitat protection					36/2012/3					✓	
	Obligation to declare bycatch				41/2017/4			42/2018/3 42/2018/4				✓
	Elimination of discards			40/2016/4								
	Obligation to land all catches, including discards					39/2015/4						
Participatory restrictions	Register of fishing authorizations	37/2013/1 40/2016/3 42/2018/8		39/2015/2 40/2016/4 42/2018/5	41/2017/4		41/2017/2	42/2018/3 42/2018/4	42/2018/1	35/2011/2 36/2012/3	✓	
Effort restrictions	Fleet capacity	40/2016/3 42/2018/8		40/2016/4 42/2018/5			41/2017/2					
	Effort	40/2016/3 42/2018/8		40/2016/4 42/2018/5	41/2017/4		41/2017/2			41/2017/5		
Gear restrictions	Authorized gear types				37/2013/2				42/2018/1	35/2011/2	✓	
	Prohibited gear types				37/2013/2					35/2011/2		
	Gear characteristics				37/2013/2 41/2017/8 41/2017/4				42/2018/1		✓	
	Gear ID/marking				39/2015/3		41/2017/2					
Minimum reference conservation size		37/2013/1		39/2015/2 40/2016/4 42/2018/5		39/2015/4	42/2018/8			36/2012/1	✓	
Data collection obligations	Vessel characteristics	37/2013/1 40/2016/3		39/2015/2 40/2016/4 42/2018/5	41/2017/4	39/2015/4	41/2017/2				✓	✓
	Catch	37/2013/1		40/2016/4 42/2018/5	41/2017/4	36/2012/3 39/2015/4	41/2017/2	42/2018/3 42/2018/4	42/2018/1	35/2011/2 41/2017/5	✓	✓
	Effort	37/2013/1		39/2015/2 40/2016/4 42/2018/5	41/2017/4	39/2015/4	41/2017/2	42/2018/3 42/2018/4	42/2018/1	35/2011/2 41/2017/5	✓	✓

Table 29 (Continued)

Measures		Recommendations									Proposed in technical elements	
Type of measure	Measure	Small pelagics GSAs 17–18	Demersal resources GSAs 17–18	Demersal resources GSAs 12–16	Turbot GSA 29	Piked dogfish GSA 29	Blackspot seabream GSAs 1–3	Deep-water red shrimps GSAs 19–21; 24–27	European eel Mediterranean Sea	Red coral Mediterranean Sea	Deep-water red shrimps GSAs 12–16; 19–27	Protection of vulnerable marine ecosystems and management of deep-sea fisheries
Monitoring, control and surveillance	VMS (or other)			39/2015/2 40/2016/4 42/2018/5	40/2016/6		41/2017/2	42/2018/3 42/2018/4				✓
	Authorized ports/landing points			40/2016/4 42/2018/5	39/2015/3			42/2018/3 42/2018/4	42/2018/1	36/2012/1		
	Logbooks	37/2013/1			40/2016/6 41/2017/4			42/2018/3 42/2018/4	42/2018/1	35/2011/2		
	Transhipment prohibition			42/2018/5		29/2005/1	41/2017/2	42/2018/3 42/2018/4				
	National inspection plan	42/2018/8		42/2018/5	39/2015/3			42/2018/3 42/2018/4				✓
	International inspection plan	42/2018/8		41/2017/8 42/2018/5	41/2017/4			42/2018/3 42/2018/4				
Other	Harvest control rule	GFCM 37/2013/1										
	Scientific research								42/2018/1	41/2017/5		

8. The mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries

8

8. The mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries

8.1. INTRODUCTION AND SOURCES OF INFORMATION

This chapter provides an overview of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries ("mid-term strategy"), launched by the GFCM in 2016 in order to define a course of decisive action aimed at reverting the alarming trend in the status of commercially exploited stocks in its area of application. The rationale leading to the development of the mid-term strategy as well as its targets and objectives are presented, together with the progress achieved and the challenges and opportunities faced during the first phase of implementation.

The information presented here is mainly taken from the text of the mid-term strategy, adopted by CPCs as Resolution GFCM/40/2016/2 during the fortieth session of the GFCM in May 2016 as well as from the results of activities presented in the reports of the Scientific Advisory Committee on Fisheries (SAC), the Working Group on the Black Sea (WGBS) and their subsidiary bodies.

8.2. THE NEED FOR A STRATEGY

Thirteen years after the adoption of the Declaration of the Ministerial Conference for the Sustainable Development of Fisheries in the Mediterranean (2003 Venice Declaration), great strides have been made in promoting responsible fisheries practices. In particular, the role of the GFCM has been crucial in promoting common rules and strengthening regional cooperation in the Mediterranean and the Black Sea. However, fisheries in the region still face serious challenges: around 80 percent of scientifically assessed stocks in the region are considered to be fished outside safe biological limits (see Chapter 4). Such alarming trends not only negatively impact the fisheries sector, but also hinder attempts to ensure secure livelihoods and food security, through Blue Growth initiatives, for the coastal communities in the region.

Fishing has a tremendous cultural, social and economic importance in the Mediterranean and the Black Sea, providing an important source of food and livelihood for riparian countries, and sustaining the traditions and the way of life of many coastal communities. Against the backdrop of international commitments towards the sustainability of fisheries as a means to support the livelihood of coastal communities, Mediterranean and Black Sea fisheries needed tailor-made actions to be developed that would take into account the specificities of the region and the capacities of all actors involved.

The mid-term strategy is in line with the mandate of the GFCM as the regional fisheries management organization (RFMO) with competence over the Mediterranean and the Black Sea. It aims to capitalize on recent accomplishments in the region in fields such as stock assessment, fisheries management, marine environment and control, among others, while seeking to promote regional cooperation and capacity-building.

The development and implementation of the mid-term strategy are based on a unique interdisciplinary partnership that provides for a perfect opportunity to enhance cooperation in the region and maximize the probability of success. The mid-term strategy has been indeed discussed with relevant organizations having interest in different aspects related to fisheries and marine ecosystems, including organizations that have entered into cooperation agreements such as memoranda of understanding (MoUs) with the GFCM (currently totalling 14 international organizations).

8.2.1 Historical background

Since challenges facing fisheries management have evolved over the years, the GFCM has had to be adept at evolving. Since its establishment, the GFCM has undergone a series of amendments to its constitutive agreement, resulting namely in reinforcing its Scientific Advisory Committee on Fisheries (SAC), creating new subsidiary bodies, such as the Compliance Committee (CoC) and the Working Group on the Black Sea (WGBS), shifting to a subregional approach to fisheries management and developing a strong network of partner organizations.

As a result of the reforms, the GFCM is now a modern RFMO with the capability and expertise to take appropriate decisions based on the best available scientific advice and ensure their implementation. The positive impacts of the resolute actions stemming from the GFCM reform are increasingly evident. Since 2004 alone, some 50 decisions have been taken within the GFCM, including: binding recommendations underpinning a regional management system consisting of data collection and reporting schemes; assessments and evaluations of commercially exploited stocks; development of management measures, area-based management tools, and monitoring, control and surveillance (MCS) instruments.

8.2.2 International context

With the adoption of the 2030 Agenda for Sustainable Development at the United Nations Sustainable Development Summit (New York, September 2015), world leaders put forth 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030. SDG 14, "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" is of particular relevance to the management of Mediterranean and Black Sea fisheries, and sets forth ambitious targets that advocate for healthy and resilient marine ecosystems. Additional SDGs, including SDG 5 on gender equality, SDG 8 on decent work and economic growth, and SDG 13 on climate action, are also highly relevant in this context. Similarly, the Aichi Biodiversity Targets (ABT), in particular Target 6, also lays out specific objectives for the sustainable management of fisheries. Taken together, the relevant SDGs and ABT 6 can therefore be regarded as embodying comprehensive strategies calling for phased action at all levels of governance, including at the regional level.

As a United Nations specialized agency, FAO already contributes to the global implementation of the SDGs through a strategic framework, of which Strategic Objective 2 specifically aims to increase and improve the provision of goods and services from fisheries in a sustainable manner, addressing in particular multi-sectoral approaches for ecosystem management, capacity-building, governance frameworks and the like.

The mid-term strategy has therefore been developed as a comprehensive tool to support the achievement of United Nations targets (Figure 97), as well as the international obligations arising therefrom, including the FAO Strategic Objectives while addressing the specific needs and pressing issues facing fisheries management in the Mediterranean and the Black Sea region.

8.2.3 Regional context

Currently, the geopolitical situation in the Mediterranean and the Black Sea is complex. Recently, the Mediterranean has been experiencing significant instability due to ongoing conflicts and political turmoil in the region, which, in turn, has exacerbated the problem of migration across the sea. Moreover, the current gap in the level of development between the different subregions of the Mediterranean remains a top priority on the regional agenda. Similar considerations apply to the case of the Black Sea, although different issues are at stake. In light of the special characteristics of the Mediterranean and the Black Sea, it is all the more imperative to ensure the implementation of a sound strategy promoting sustainable development in the region.

The fisheries sector, in particular, has an important role to play in such a strategy, because it is crucial to livelihood protection, food security and sustainable long-term development in the Mediterranean and the Black Sea. Indeed, 80 percent of the region's fisheries are small-scale, underlining their role in sustaining coastal communities in the area. Although the value generated from the first sale of fish products from Mediterranean and Black Sea fisheries may seem relatively small compared with other sectors (representing less than 1 percent of regional gross domestic product [GDP]), the sector targets some of the most economically vulnerable communities in the region, making it a key player for sustainable development. In fact, the value at first sale as a percentage of GDP is six times greater in the developing countries of the southern Mediterranean than in the wealthier, northern Mediterranean countries. Furthermore, around 60 percent of employment in the region's fishing sector is found in the developing countries of the southern and eastern Mediterranean, indicating that most of the jobs provided by this sector are located precisely where jobs are needed.

8.3. MID-TERM STRATEGY TARGETS AND OBJECTIVES

The overall objective of the mid-term strategy is to improve, by 2020, the sustainability of Mediterranean and Black Sea fisheries, by achieving five targets and related outputs.

TARGET 1
Reverse the declining trend of fish stocks through strengthened scientific advice in support of management

This target aims at further reinforcing the GFCM as the international body in charge of adopting binding recommendations on Mediterranean and Black Sea fisheries through sound scientific advice that addresses all relevant aspects needed for decision-making. This includes: improving the sources of data available for stock assessment; increasing the percentage of fisheries that are the object of specific management measures; incorporating past and current socio-economic characteristics of the fisheries; and studying the potential socio-economic impacts of alternative management measures.

Consistent with SDG Targets 14.2, 14.4 and 14.7, commitment is needed to implement, by 2020, actions to increase scientific and socio-economic knowledge in support of fisheries management and to adopt science-based decisions to reverse the current overexploitation rates and reduce the percentage of stocks outside biologically safe limits.

Advice formulation should be reinforced by addressing gaps and weaknesses in available information. Accordingly, the creation of the GFCM Forum on Fisheries Science, the conducting of regional surveys-at-sea and the compilation of catalogues of fishing activities aim at enhancing the quantity and quality of data used for advice. A comprehensive regional

survey on the socio-economic characteristics of fisheries in the Mediterranean and the Black Sea is expected to help overcome a main barrier to the integration of socio-economic data in management advice by providing accurate, timely and complete socio-economic baseline data on fisheries in the region. The revision of existing management plans or the development of new ones is also considered necessary for main commercial fisheries as well as the fisheries that rely on or show a strong interaction with resources in need of urgent action.

TARGET 2
Support livelihoods for coastal communities through sustainable small-scale fisheries

This target recognizes the important role played by small-scale fisheries in the Mediterranean and the Black Sea in providing income and ensuring food security, particularly within economically vulnerable coastal communities. It also recognizes that collecting socio-economic data that are as complete, timely and accurate as possible helps develop coherent policies to ensure resource and market access for small-scale fishers.

Commitment is needed, by 2020, to support livelihoods within sustainable small-scale fisheries, consistent with SDG Targets 14.b and 14.7. This can be achieved through more robust and timely information on the impacts of small-scale fisheries and recreational fisheries on living marine resources and on their interactions with other human activities in coastal communities, as well as through an implementation of the FAO *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (SSF Guidelines) that is tailored to regional specificities.

With a view to mitigating potential detrimental socio-economic impacts of management measures, a regional survey on small-scale fisheries is expected to provide a snapshot of the ecological, social and economic impacts of small-scale fisheries in the region while improving the capacity to collect relevant data on small-scale fisheries, as requested through the DCRF. Complementarily, the establishment of permanent working groups on small-scale and recreational fisheries would foster knowledge-sharing among fishers for the dissemination of best practices, the development of indicators to monitor the socio-economic status of small-scale fisheries, and the consideration of best management measures to regulate these activities, while in parallel working on the assessment of the impacts of recreational fisheries. The development of national plans of action for the implementation of the SSF Guidelines and the establishment of regional platforms to engage and promote dialogue among small-scale fishing associations, together with the endorsement of the principle of decent work should encourage, without compromising environmental sustainability, the improvement of socio-economic conditions within small-scale fisheries, and the promotion of livelihood diversification.

TARGET 3
Curb illegal unreported and unregulated fishing, through a regional plan of action

The objective of this target is to underpin efforts towards sound fisheries management by taking into due account the impacts of illegal unreported and unregulated (IUU) fishing, which must be more thoroughly assessed and counteracted through a set of political and operational commitments. These commitments range from improving compliance with GFCM measures to reinforcing inspections and strengthening monitoring and control systems.

To effectively start reducing IUU fishing in the Mediterranean and the Black Sea by 2020, consistent with SDG Target 14.4, a holistic regional plan of action to fight IUU fishing must

be developed and eventually be transposed at the national level to achieve, among others, a regular quantification of IUU fishing, reinforced port state control and enhanced modular monitoring, control and surveillance (MCS) at the regional level.

Ongoing efforts to combat IUU fishing by improving knowledge of IUU activity and harmonizing existing counter-measures are foreseen to be sustained by an assessment of the quantity, magnitude and characteristics of IUU fishing as well as the evaluation and revision of the adequateness of national legislations relating to IUU fishing adopted by CPCs. Training of national inspectors and the establishment of a mutual assistance system would support the correct implementation of the FAO Port State Measures Agreement (PSMA) and the operationalization of a regional vessel monitoring system (VMS) and control system would enhance MCS capabilities in the Mediterranean and the Black Sea, including through harmonized control standards.

TARGET 4
Minimize and mitigate unwanted interactions between fisheries and marine ecosystems and environment

In order to support maximum sustainable yield and facilitate blue growth, this target first aims at monitoring given interactions between fisheries and marine ecosystems and the environment, including the potentially negative effects of other anthropogenic-driven phenomena such as climate change or the introduction of non-indigenous species. The aim is then devise necessary measures and develop appropriate adaptation strategies.

By 2020, consistent with SDG Targets 14.1, 14.2 and 14.5, measures should be taken to minimize the negative impacts of fisheries on marine biodiversity and ecosystems, especially in relation to vulnerable species and ecosystems, as well as to mitigate negative anthropogenic effects on fisheries, in close coordination with partner organizations. These measures should be implemented by reducing bycatch rates, and ensuring healthier marine ecosystems and more productive fisheries.

The implementation of a bycatch monitoring programme, covering both discards and incidental catches of vulnerable species through the use of observers on board, is expected to provide representative data to inform the adoption of required management measures, combined with targeted work on selectivity of fishing gear and a fully encompassing communication and awareness mechanism. The establishment of area-based management tools to protect vulnerable marine ecosystems and combat the combined effects of climate change as well as other direct and indirect anthropogenic impacts on the marine environment should be possible through the identification and establishment of FRAs, the adoption of a comprehensive regional management plan for red coral, the creation of adaptation strategies to cope with potential effects of non-indigenous species, climate change and marine litter on fisheries.

TARGET 5
Enhance capacity-building and cooperation

Considering the ambitious objectives of the mid-term strategy, this overarching target aims to promote increased scientific and technical cooperation among CPCs, relevant inter- and non-governmental organizations, and concerned stakeholders throughout the region. This aims to collectively ensure that foreseen outputs and related actions are made possible and correctly implemented at the regional, subregional and national levels.

Commitment is needed, by 2020, in line with SDG Target 14.7, to help level the playing field for developing countries and to ensure that socio-economic benefits are accrued from the sustainable management of fisheries by improving national capacity for the management of fishery resources, strengthening fisheries governance in the Black Sea, and increasing cooperation with relevant actors.

Relevant CPCs can be supported in meeting their obligations stemming from GFCM decisions through the provision of capacity-building, the implementation of a technical assistance mechanism, and the launch of a regional programme for education and training. This would to lay the foundation for a new generation of fisheries experts through mid- and long-term specialization curricula, in collaboration with regional and national research/training institutions. In addition, in order to build on ongoing cooperation and further strengthen fisheries governance in the Black Sea, the organization of a high-level conference and the launch of a regional, scientific and technical cooperation project for the Black Sea should contribute to further bridging gaps at the regional level. Finally, bolstering cooperation in the GFCM area of application, not only with the FAO Fisheries and Aquaculture Department and its regional projects for the Mediterranean, but also with partner organizations with which the GFCM has an MoU, is predicted to foster synergies, avoid duplications and promote comparative advantages.

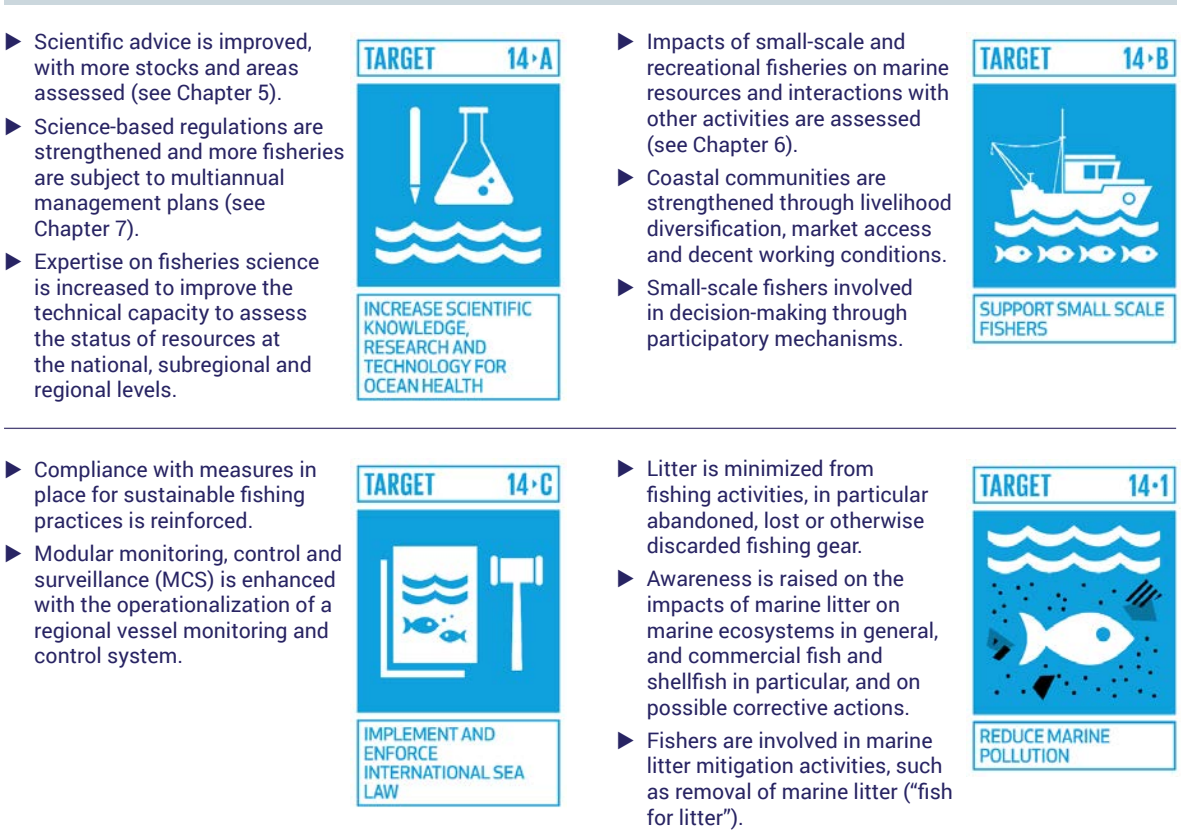


FIGURE 97 – The mid-term strategy's contribution to achieving SDG 14 targets

- Vulnerable marine ecosystems are protected from significant adverse impacts from fisheries, and any potentially harmful effect of fisheries on marine biodiversity and ecosystems is minimized through targeted measures.
- Bycatch of unwanted and vulnerable species is reduced through selected fishing gear.
- Combined effects of climate change and other direct and indirect anthropogenic impacts are mitigated through adaptation strategies.
- Species of conservation concern, such as European eel or red coral, are adequately managed at the Mediterranean level to ensure sustainability (see Chapter 7).

- Illegal, unreported and unregulated (IUU) fishing is curbed through reinforced inspections and a regular assessment of IUU activities.
- Fisheries are sustainably managed through an improved science-policy interface and science-based decisions (see Chapter 7).

- New fisheries restricted areas (FRAs) are identified and established to protect priority areas and ecosystems (see Chapter 7).
- Synergies are promoted with relevant international organizations to jointly work on conservation of key areas.

- Profitability of fisheries is secured through management plans based on robust biological and socio-economic information.
- Management strategy evaluation is systematically applied to assess the economic, social and biological implications of management scenarios (see Chapter 7).

FIGURE 97 (Continued)

8.4. LAUNCH AND FIRST PHASE OF THE MID-TERM STRATEGY: PROGRESS IN 2017–2018

The implementation of the mid-term strategy is planned to unfold in three phases: (i) the launch and first phase in 2017–2018; (ii) the consolidation and second phase in 2018-2019; and (iii) the finalization and third phase in 2019–2020, when a follow-up strategy will be set up to build upon results and capitalize on progress. Some activities are specifically defined in time and expected to take place *one time* in the context of the mid-term strategy, whereas others will be gradually implemented throughout the mid-term strategy period. In all cases, replicability, scaling-up and continuation of successful initiatives will be sought when defining the post-2020 framework for sustainable fisheries, in line with the international and regional contexts as well as renewed commitments by countries and partner organizations.

In 2018, all mid-term strategy activities were launched and, to a varying extent, in progress, well advanced or in some cases, concluded.

As part of the efforts to strengthen advice in support of management (Target 1), the effects and effectiveness of the management measures in place in the Adriatic (small pelagic species), the Strait of Sicily (demersal species) and the Black Sea (turbot fisheries) were studied by applying Management Strategy Evaluation and incorporating available socio-economic information into alternative management scenarios (see Chapter 8) (GFCM, 2018a, 2018b). Additionally, considerable work was carried out towards adopting new multiannual management plans for

deep-water red shrimps in the central-eastern Mediterranean[1] and blackspot seabream in the western Mediterranean (as in Appendix 7 of FAO, 2018c). In parallel, the harmonization of surveys-at-sea, one of the most complex actions included in the mid-term strategy, was set in motion, first by developing a technical handbook on the common implementation of demersal and acoustic surveys in the Mediterranean and the Black Sea (FAO, 2018a), and then by organizing comparable surveys in different subregions with the use of a similar gear, starting with Tunisia and Georgia in 2018, to be followed by other countries before the end of the mid-term strategy. Finally, the first GFCM Forum on Fisheries Science (FAO, 2018b) attracted the interest and collaboration of up to 30 organizations and over 400 participants, covering a wide range of crucial topics, and enhancing the network of experts and research institutions covering different domains of fisheries science.

In relation to the need to collect more socio-economic data in order to integration them into management advice, and with a view to supporting sustainable small-scale fisheries (Target 2) by obtaining information on their impact, the regional survey on socio-economic characteristics of fisheries, including small-scale fisheries, was launched in five countries (Egypt, Lebanon, Montenegro, Morocco and Ukraine) and it is expected that it will be expanded to three or four more during the second phase of the mid-term strategy. The Working Group on Small-scale Fisheries (WGSSF) was established, producing recommendations on a wide range of issues and kicking-off the testing of a characterization matrix for small-scale fisheries, launching a coordination group among partner organizations working on small-scale fisheries in the Mediterranean and providing inputs to the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and Black Sea (RPOA-SSF) (GFCM, 2017). The RPOA-SSF was signed in September 2018 at the High-level conference on sustainable small-scale fisheries in the Mediterranean and the Black Sea, setting forth concrete actions to be carried out over the next ten years, to 2028, to strengthen and support sustainable small-scale fisheries in the region. Specific attention was also dedicated to recreational fisheries with the production of a draft handbook for data collection, which is expected to be tested through pilot studies and revised at the next meeting of the newly established Working Group on Recreational Fisheries (WGRF). As part of GFCM's efforts to improve socio-economic conditions within small-scale fisheries, case studies on social protection schemes were carried out in all Mediterranean subregions (Albania, Egypt, Lebanon, Morocco and Tunisia), paving the way for further analysis and potential replication of best practices, in line with the RPOA-SSF.

In order to curb IUU fishing (Target 3), different actions were launched in the context of the CoC, following the adoption of the regional plan of action to combat illegal, unreported and unregulated fishing in the GFCM area of application (RPOA-IUU)[2], which allowed, inter alia, to establish the mutual assistance system, activated several times since the start of the mid-term strategy. A detailed work plan for IUU fishing assessment was developed together with the SAC and WGBS (see in Appendix 6 of FAO, 2018c), and the first two actions therein have been completed. An evaluation was undertaken of the adequateness of the national legislations of different CPCs, defining priority actions in the field, and the implementation of port state measures and MCS to support the fight against IUU fishing3 is advancing as a

1 Recommendation GFCM/42/2018/3 on a multiannual management plan for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Levant Sea (geographical subareas 24, 25, 26 and 27); Recommendation GFCM/42/2018/4 on a multiannual plan for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Ionian Sea (geographical subareas 19, 20 and 21).

2 Recommendation GFCM/41/2017/7 on a regional plan of action to combat illegal, unreported and unregulated fishing in the GFCM area of application.

3 Recommendation GFCM/41/2017/8 on an international joint inspection and surveillance scheme outside the waters under national jurisdiction in the Strait of Sicily (geographical subareas 12–16).

result of initiatives such as training of national inspectors, which was carried out in a number of countries in close cooperation with the European Fisheries Control Agency. Preliminary technical work was also completed towards a regional pilot VMS and controls system on enabling features such as the e-logbook, integration of EU FLUX Standards and creation of automatic alerts; preparatory steps in view of the next phase have started in relation to additional advances such as the collection and storage of control data, the use of electronic port inspections reports and the integration of technologies alternative to VMS.

The actions towards monitoring, mitigating and minimizing the interactions between fisheries and the environment and ecosystems (Target 4) could only be successfully implemented with the active collaboration of a number of partner organizations, in line with their specific mandates. Hence, considerable efforts were deployed to foster cooperation with these organizations by: updating MoU in place; establishing coordination mechanisms for relevant activities; promoting joint initiatives; and entering into wider partnerships for projects. As a result, harmonized methodologies for data collection on discards (FAO, 2018d) and incidental catches of vulnerable species (FAO, 2018e) were produced to support the implementation of the bycatch monitoring programme, which was first launched in seven countries (Algeria, Lebanon, Montenegro, Morocco, Tunisia, Turkey and Ukraine) and included training of onboard observers and, as appropriate, the development of awareness material. Considerable advances were also made in the field of marine spatial planning, with the establishment of a new FRA in the Jabuka/Pomo Pit[4] and two other proposals currently under discussion within the SAC, together with specific measures for the protection of vulnerable marine ecosystems. A regional management plan for red coral was also adopted,[5] and a research programme is expected to be launched in 2019 (see Chapter 8). Finally, preliminary work was carried out towards designing adaptation strategies to cope with the potential effects of non-indigenous species and climate change, by developing a methodology to assess the vulnerability of given fisheries to climate change (see in Appendix 8 of FAO, 2018c) and a monitoring programme for non-indigenous species (see in Appendix 9 of FAO, 2018c), which would be tested in select case studies in the western Mediterranean and the Black Sea, and in the eastern and central Mediterranean, respectively.

In implementing the mid-term strategy, the capacity of each country was duly taken into account, and technical assistance and training were provided, as appropriate, in order to level the playing field and bridge existing gaps. In particular, training was provided for observers on board and national teams involved in data collection in Algeria, Egypt, Lebanon, Morocco, Tunisia and Turkey, in line with the methodologies established for the bycatch monitoring programme and the socio-economic survey. In parallel, with the aim to strengthen fisheries governance in the Black Sea, a high-level conference was organized in Bulgaria in June 2018, which culminated in the adoption of a Ministerial Declaration, the Sofia Ministerial Declaration, and which aimed at fostering cooperation and technical work in the region. The BlackSea4Fish project was also launched and currently counts on a project coordinator, an established project steering committee, a fully encompassing project document,[6] a formalized network of national experts and focal points from all Black Sea riparian states, and specific communication material. The operationalization of the BlackSea4Fish project, together with the inauguration of the first GFCM Subregional Technical Unit (entirely dedicated to the

4 Recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea.

5 Recommendation GFCM/41/2017/5 on the establishment of a regional adaptive management plan for the exploitation of red coral in the Mediterranean Sea.

6 BlackSea4Fish Project Document.

Black Sea and situated in Burgas, Bulgaria), represented a considerable step forward in further supporting the WGBS, which can now count on dedicated support in the implementation of priority activities.

The next phase of implementation (2018–2019) of the mid-term strategy will see the launch of pending actions, including in other countries, the consolidation of activities launched and their expansion, as appropriate, to uncovered areas, the analysis of the data already collected, and based on related findings, the preliminary identification of measures that can be taken to improve the sustainability of Mediterranean and Black Sea fisheries.

8.5. MID-TERM STRATEGY IMPLEMENTATION: CHALLENGES AND OPPORTUNITIES

The adoption of the mid-term strategy represented a substantial commitment from CPCs and organizations involved, who acknowledged the need for a collective effort and strong involvement by stakeholders and institutions at the regional, subregional and national levels. They also acknowledged that a considerable amount of resources to be able to achieve fixed objectives through the realization of over 30 activities spanning across five interlinked but still relatively diverse targets. Notwithstanding evident progress, since almost all foreseen activities have started and some concluded, launching the mid-term strategy and setting in motion several strategic actions that had never before been carried out under the GFCM umbrella provided challenges and opportunities.

Kick-starting activities at the national level required a considerable coordination – with the central authorities first and subsequently, through the establishment of a network of focal points, with the institutes that would be involved in the process; this considerably delayed the actual beginning of various activities. The varying degree of technical and other inputs by countries to complement mid-term strategy activities also required time and resources for adjustment, while countries also had to adapt to an increased concentration of strategic activities taking place over a limited timeframe, in line with the commitments taken. However, the transfer to responsible institutions at the national level of the funds collected for mid-term strategy implementation also proved challenging due to administrative procedures and the need to devise specifically tailored solutions from country to country.

Nonetheless, formalizing a common umbrella for joint actions among the different Mediterranean and Black Sea actors helped foster positive synergies, pulling together expertise and resources of different organizations and other bodies, and renewed political momentum, and attracting new pilot projects and donors. In 2017, in order to underline their support to the mid-term strategy, 16 Mediterranean riparian countries signed the Malta MedFish4Ever Declaration, a pledge to save Mediterranean fish stocks and protect the region's ecological and economic wealth, which echoes the mid-term strategy targets. In 2018, the Sofia Ministerial Declaration was also signed to provide further endorsement to mid-term strategy objectives in the Black Sea. Complementarily, the formal adoption of two regional plans of actions – the RPOA-IUU and the RPOA-SSF – provided additional impetus for stakeholders' involvement in priority actions. Underpinning the mid-term strategy with strong political commitment has drawn interest to the work of the GFCM and especially to its area of application, which is increasingly sought after to test the applicability and efficacy of global initiatives at the regional level first. This was the case of several FAO projects, mainly linked to the application of the SSF Guidelines in the fields of SSF characterization and social protection work, which could be tested in select Mediterranean case studies that subsequently provided feedback on the application of the overall methodology. This momentum generated both an increased level

of funds from regular GFCM donors as well as an interest from new external donors that now strongly seek the partnership of GFCM in the projects they fund in the Mediterranean and the Black Sea. Finally, considering that one of the main purposes of the mid-term strategy is to foster an enabling environment for countries to thrive in improving fisheries sustainability, the first phase of implementation has allowed to develop a number of harmonized methodologies that, although currently being applied in select case studies, can be used at the regional level. It is also already providing opportunities to replicate best practices as a result of the technical assistance delivered. The next phase of the mid-term strategy is expected to overcome the challenges and make the most of these preliminary positive results, towards successfully achieving mid-term strategy objectives and safeguarding the Mediterranean and Black Sea fisheries.

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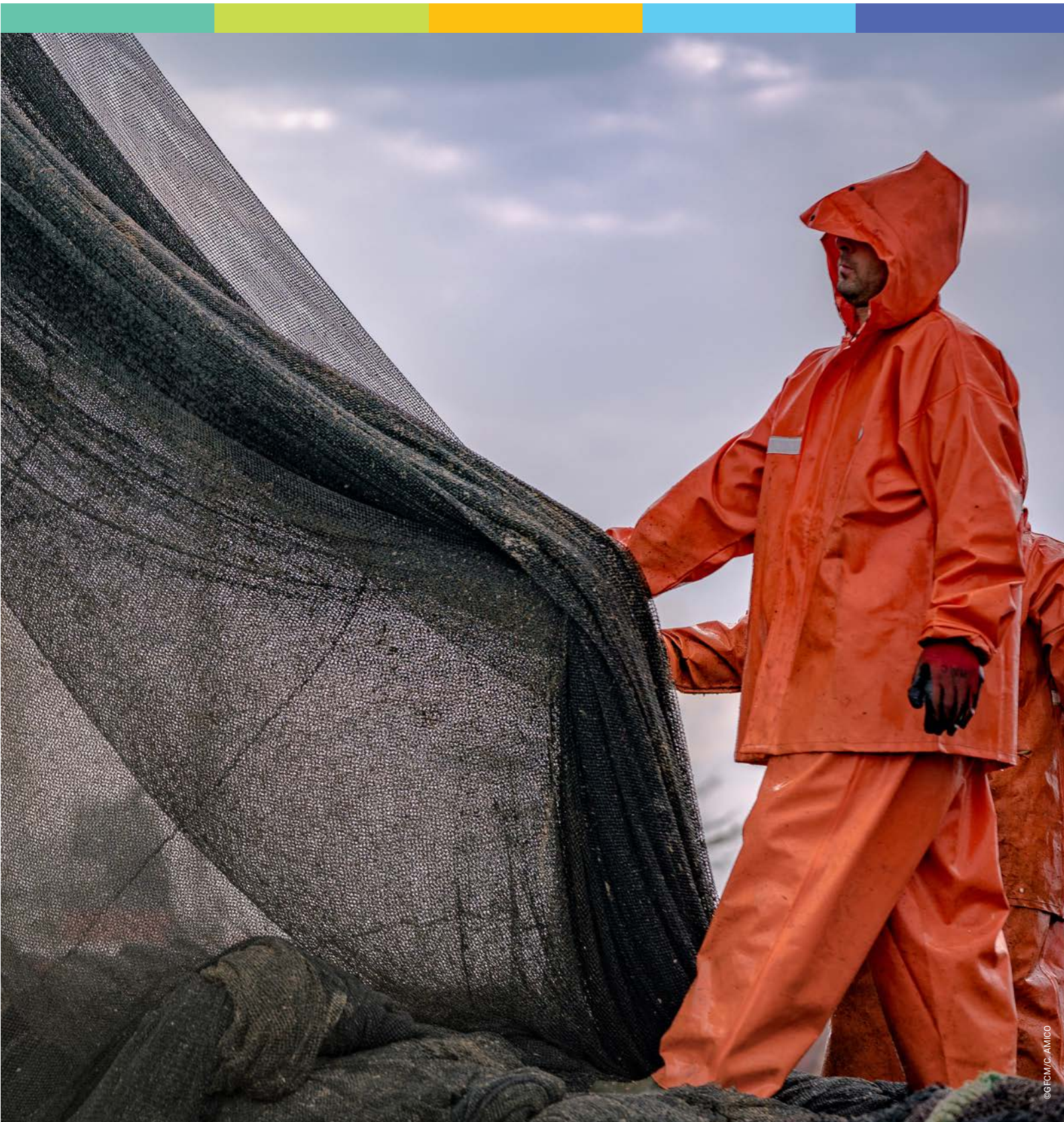

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The 2018 edition of *The State of Mediterranean and Black Sea Fisheries* (SoMFi 2018), the flagship publication of the GFCM, provides a comprehensive overview of regional and subregional trends in Mediterranean and Black Sea fisheries.

Bringing together data and indicators submitted by GFCM contracting parties and cooperating non-contracting parties on stock status, national catches, fleet and socio-economic aspects as well as information obtained from other sources, SoMFi 2018 aims to provide objective, reliable and up-to-date information to a wide audience and support decision-making in fisheries.

SoMFi 2018 is divided into eight chapters. The first analyses the current composition of the fishing fleet, including information on fleet capacity, vessel types and age classes. Next comes a detailed breakdown of overall capture fishery production with comparisons of the latest figures to data from previous years, highlighting significant changes and trends. The report then looks at what this means for regional economies and for the livelihoods of the people who depend on the fisheries sector. As small-scale fisheries make up a large majority of Mediterranean and Black Sea fisheries, they receive special focus.

SoMFi 2018 also provides the most detailed assessment yet of the state of fishery resources in the region. It shows the current status of the stocks, including those most at risk from overfishing, and looks at related issues like discards and incidental catches of vulnerable species. The report then highlights GFCM's strategic efforts to build long-term sustainability, as it works with its stakeholders to sustainably manage fisheries and improve coastal livelihoods across the region. Finally, SoMFi 2018 concludes with an overview of the important role fisheries have to play in achieving the United Nations Sustainable Development Goals, maintaining healthy ecosystems and productive fisheries.

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